Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E141	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E141	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E141	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E141	13-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R1-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R2-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R3-S-01D	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S3-S-01	E239.SO4	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S8-S-01	E239.SO4	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S9-S-01	E239.SO4	13-Sep-2022	23-Sep-2022	365 days	10 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S11-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S12-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S13-S-01D	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S14-S-01	E239.SO4	14-Sep-2022	23-Sep-2022	365 days	9 days	✓	24-Sep-2022	180 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration (Saturated Paste)	E293	657042	1	12	8.3	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	1	20	5.0	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	1	20	5.0	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	1	20	5.0	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	1	20	5.0	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	657043	1	12	8.3	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	657038	1	12	8.3	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	657041	1	12	8.3	5.0	✓
Loss On Ignition (550°C)	E205D	659685	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	657034	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	657033	1	18	5.5	5.0	✓
Moisture Content by Gravimetry	E144	657044	1	18	5.5	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	657037	1	12	8.3	5.0	✓
Particle Size Analysis - Hydrometer	E183	658748	1	12	8.3	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658747	1	12	8.3	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	1	20	5.0	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	657035	1	18	5.5	5.0	✓
pH by Meter (Saturated Paste)	E114	657040	1	12	8.3	5.0	✓
Saturation Percentage	E141	657039	1	12	8.3	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	657036	1	12	8.3	5.0	✓
Total Carbon by Combustion	E351	658686	1	20	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	658687	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration (Saturated Paste)	E293	657042	1	12	8.3	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	2	20	10.0	10.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	2	20	10.0	10.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	2	20	10.0	10.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	2	20	10.0	10.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	657043	2	12	16.6	10.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	657038	2	12	16.6	10.0	✓
Conductivity in Soil (Saturated Paste)	E102	657041	2	12	16.6	10.0	✓
Loss On Ignition (550°C)	E205D	659685	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	657034	2	12	16.6	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	657033	2	18	11.1	10.0	✓
Moisture Content by Gravimetry	E144	657044	1	18	5.5	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Nitrate by IC (Saturated Paste)	E239.NO3	657037	1	12	8.3	5.0	✓
Particle Size Analysis - Hydrometer	E183	658748	1	12	8.3	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658747	1	12	8.3	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	658746	1	12	8.3	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	2	20	10.0	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	657035	1	18	5.5	5.0	✓
pH by Meter (Saturated Paste)	E114	657040	2	12	16.6	10.0	✓
Saturation Percentage	E141	657039	2	12	16.6	10.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	657036	2	12	16.6	10.0	✓
Total Carbon by Combustion	E351	658686	2	20	10.0	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	2	20	10.0	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	2	19	10.5	10.0	✓
Total Nitrogen by Combustion	E366	658687	2	20	10.0	10.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration (Saturated Paste)	E293	657042	1	12	8.3	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	1	20	5.0	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	1	20	5.0	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	1	20	5.0	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	1	20	5.0	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	657043	1	12	8.3	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	657038	1	12	8.3	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	657041	1	12	8.3	5.0	✓
Loss On Ignition (550°C)	E205D	659685	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	657034	1	12	8.3	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	657033	1	18	5.5	5.0	✓
Moisture Content by Gravimetry	E144	657044	1	18	5.5	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	657037	1	12	8.3	5.0	✓
Saturation Percentage	E141	657039	1	12	8.3	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	657036	1	12	8.3	5.0	✓
Total Carbon by Combustion	E351	658686	1	20	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	1	20	5.0	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	658687	1	20	5.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (Saturated Paste)	E102 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)/AER D50	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a filtered extract from a soil sample prepared using the saturated paste procedure. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
pH by Meter (Saturated Paste)	E114 Vancouver - Environmental	Soil/Solid	Carter-CSSS / APHA 4500 H	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a soil produced by the saturated paste extraction procedure.
Saturation Percentage	E141 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/AER D50	Saturation Percentage (SP) is determined as the total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams), expressed as a percentage.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Loss On Ignition (550°C)	E205D Saskatoon - Environmental	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Chloride by IC (Saturated Paste)	E239.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste)	E239.NO3 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate by IC (Saturated Paste)	E239.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N Saskatoon - Environmental	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Alkalinity Species by Titration (Saturated Paste)	E293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Kjeldahl Nitrogen by Colourimetry	E319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by FIALab (Modified Kelowna)	E384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus is extracted from air dried soil using a fixed ratio Modified Kelowna extraction. Phosphorus is determined by colorimetry using an flow injection analyzer.
Available Potassium by flame photometry (Modified Kelowna)	E390 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available potassium is extracted from soil using modified Kelowna solution. Potassium is determined by flame emission at 770 nm.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium and Sodium by Collision/Reaction Cell ICPMS as per "Soil Sampling Methods of Analysis" By M Carter.
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available sulfate is determined by ICPOES. Soil is extracted using a 0.01M calcium chloride solution. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Sodium Adsorption Ratio (SAR) Saturated Paste	EC102 Vancouver - Environmental	Soil/Solid	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a sample is calculated from the Sodium, Calcium, and Magnesium concentrations from sediment paste extract.
Theoretical Gypsum Requirements (TGR) Saturated Paste	EC106 Vancouver - Environmental	Soil/Solid	J. Ashworth et al (1999)	Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chloride by IC (Saturated Paste) (mg/kg)	EC239A.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste) (mg/kg)	EC239A.NO3 Vancouver - Environmental	Soil/Solid	Calculation	Results are reported in mg/kg dry weight
Sulfate by IC (Saturated Paste) (mg/kg)	EC239A.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration (Saturated Paste) (mg/kg)	EC293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).
Ca, K, Mg, Na by ICPMS (Saturated Paste, mg/kg)	EC442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium, Sodium by ICPMS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2	EP108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.
Modified Kelowna Extraction for soil	EP384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus and potassium are extracted from the soil using fixed ratio Modified Kelowna solution.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind in Soil/Solid <60°C	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **VA22C2359**	Page	: 1 of 14
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686091	Issue Date	: 14-Oct-2022 17:14
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 12		
No. of samples analysed	: 12		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Quality Systems Coordinator	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Saskatoon Inorganics, Saskatoon, Saskatchewan
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Nancy Cruse	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Tracy Harley	Supervisor - Water Quality Instrumentation	Vancouver Inorganics, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 657035)											
VA22C2342-044	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	6.01	6.08	1.2%	5%	----
Physical Tests (QC Lot: 657044)											
VA22C2342-044	Anonymous	moisture	----	E144	0.25	%	67.0	67.3	0.542%	20%	----
Physical Tests (QC Lot: 659685)											
VA22C2359-001	22-S3-S-01	loss on ignition @ 550°C	----	E205D	1.0	%	9.0	8.8	0.2	Diff <2x LOR	----
Physical Tests (QC Lot: 660583)											
VA22C2359-006	22-R1-S-01	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.22	4.24	0.473%	10%	----
Particle Size (QC Lot: 658747)											
VA22C2359-001	22-S3-S-01	passing (0.05 mm)	----	E182	1.0	%	27.6	28.4	2.80%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	33.5	34.2	2.27%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	38.9	39.7	1.92%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	43.8	44.4	1.45%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	46.1	46.7	1.26%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	51.4	51.9	1.06%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	56.7	57.2	0.777%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	58.1	58.5	0.685%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	63.4	63.6	0.338%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	64.6	64.8	0.281%	15%	----
Particle Size (QC Lot: 658748)											
VA22C2359-001	22-S3-S-01	passing (0.002 mm)	----	E183	1.0	%	7.7	8.4	0.7	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	9.3	10.0	0.7	Diff <2x LOR	----
		passing (0.005 mm)	----	E183	1.0	%	10.3	11.0	6.86%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	17.3	18.6	7.30%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	21.9	22.7	3.39%	20%	----
Anions and Nutrients (QC Lot: 658687)											
VA22C2359-001	22-S3-S-01	nitrogen, total	7727-37-9	E366	0.020	%	0.269	0.260	3.40%	20%	----
Organic / Inorganic Carbon (QC Lot: 658686)											
VA22C2359-001	22-S3-S-01	carbon, total [TC]	----	E351	0.050	%	3.60	3.41	5.37%	20%	----
Organic / Inorganic Carbon (QC Lot: 662066)											
VA22C2359-001	22-S3-S-01	carbon, inorganic [IC]	----	E354	0.050	%	0.142	0.141	0.0009	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660552)											

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Plant Available Nutrients (QC Lot: 660552) - continued											
VA22C2359-004	22-R2-S-01	nitrate + nitrite, available (as N)	----	E269.N+N	2.5	mg/kg	<2.5	<2.5	2.5	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660553)											
VA22C2359-004	22-R2-S-01	sulfate, available (as S)	14808-79-8	E497.SO4	7.5	mg/kg	7.6	7.7	0.1	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660644)											
VA22C2364-006	Anonymous	phosphate, available (as P)	14265-44-2	E384	10.0	mg/kg	156	166	6.48%	30%	----
Plant Available Nutrients (QC Lot: 660645)											
VA22C2364-006	Anonymous	potassium, available	7440-09-7	E390	20	mg/kg	198	204	3.32%	30%	----
Saturated Paste Extractables (QC Lot: 657036)											
VA22C2359-001	22-S3-S-01	sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L	14.4	14.0	0.4	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657037)											
VA22C2359-001	22-S3-S-01	nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	<0.5	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657038)											
VA22C2359-001	22-S3-S-01	chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	<20	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657039)											
VA22C2359-001	22-S3-S-01	% saturation	----	E141	1.0	%	56.3	53.0	6.08%	20%	----
Saturated Paste Extractables (QC Lot: 657040)											
VA22C2359-001	22-S3-S-01	pH, saturated paste	----	E114	0.10	pH units	6.65	6.56	1.36%	5%	----
Saturated Paste Extractables (QC Lot: 657041)											
VA22C2359-001	22-S3-S-01	conductivity, saturated paste	----	E102	100	µS/cm	0.270 dS/m	168	102	Diff <2x LOR	RRQC
Saturated Paste Extractables (QC Lot: 657042)											
VA22C2359-001	22-S3-S-01	alkalinity, total (as CaCO3)	----	E293	50	mg/L	<50	<50	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 657043)											
VA22C2359-001	22-S3-S-01	calcium, soluble ion content	7440-70-2	E442	0.60	mg/L	16.1	15.6	3.00%	30%	----
		magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L	2.4	2.3	0.07	Diff <2x LOR	----
		potassium, soluble ion content	7440-09-7	E442	4.0	mg/L	4.3	4.2	0.08	Diff <2x LOR	----
		sodium, soluble ion content	17341-25-2	E442	2.0	mg/L	2.2	2.4	0.2	Diff <2x LOR	----
Metals (QC Lot: 657033)											
VA22C2342-044	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	10500	9780	7.17%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.76	1.10	37.4%	30%	DUP-H
		arsenic	7440-38-2	E440	0.10	mg/kg	16.7	12.0	32.9%	30%	DUP-H
		barium	7440-39-3	E440	0.50	mg/kg	94.4	93.8	0.706%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.20	0.20	0.004	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.212	0.192	9.74%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 657033) - continued											
VA22C2342-044	Anonymous	calcium	7440-70-2	E440	50	mg/kg	13400	12700	5.19%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	21.9	20.4	7.03%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	4.47	4.29	3.93%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	20.6	18.7	9.51%	30%	----
		iron	7439-89-6	E440	50	mg/kg	11100	9990	10.2%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	18.6	16.5	11.7%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	5.6	5.2	0.4	Diff <2x LOR	----
		magnesium	7439-95-4	E440	20	mg/kg	3300	3660	10.4%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	301	274	9.37%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	13.0	10.0	26.2%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	15.6	14.4	8.27%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	473	469	0.895%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	380	340	40	Diff <2x LOR	----
		selenium	7782-49-2	E440	0.20	mg/kg	1.16	1.19	0.03	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	277	267	3.66%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	72.4	69.4	4.18%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	3600	3400	300	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	0.050	<0.050	0.00006	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	386	402	3.88%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	1.26	1.07	0.19	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	1.00	0.946	5.73%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	43.8	42.1	4.00%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	57.5	50.0	13.9%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	2.4	1.9	0.5	Diff <2x LOR	----
Metals (QC Lot: 657034)											
VA22C2359-001	22-S3-S-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.199	0.174	13.6%	40%	----
Leachable Anions & Nutrients (QC Lot: 660214)											
VA22C2359-006	22-R1-S-01	Kjeldahl nitrogen, total [TKN]	----	E319	730	mg/kg	0.090 %	<730	900	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*
RRQC	*Refer to report comments for information regarding this QC result.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 657044)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 658687)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Organic / Inorganic Carbon (QCLot: 658686)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 662066)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Plant Available Nutrients (QCLot: 660552)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 660553)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 660644)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Plant Available Nutrients (QCLot: 660645)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Saturated Paste Extractables (QCLot: 657036)						
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	<5.0	----
Saturated Paste Extractables (QCLot: 657037)						
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	----
Saturated Paste Extractables (QCLot: 657038)						
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	----
Saturated Paste Extractables (QCLot: 657039)						
% saturation	----	E141	1	%	50.0	----
Saturated Paste Extractables (QCLot: 657041)						
conductivity, saturated paste	----	E102	10	µS/cm	<10	----
Saturated Paste Extractables (QCLot: 657042)						
alkalinity, total (as CaCO3)	----	E293	10	mg/L	<10	----
Saturated Paste Extractables (QCLot: 657043)						
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	<0.60	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	<1.0	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	<4.0	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	<2.0	----
Metals (QCLot: 657033)						

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 657033) - continued						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 657034)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Anions & Nutrients (QCLot: 660214)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 657035)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 657044)									
moisture	----	E144	0.25	%	50 %	101	90.0	110	----
Physical Tests (QCLot: 660583)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Anions and Nutrients (QCLot: 658687)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Organic / Inorganic Carbon (QCLot: 658686)									
carbon, total [TC]	----	E351	0.05	%	48 %	102	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662066)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	93.3	90.0	110	----
Plant Available Nutrients (QCLot: 660552)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	105	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.0	70.0	130	----
Saturated Paste Extractables (QCLot: 657036)									
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	100 mg/L	103	80.0	120	----
Saturated Paste Extractables (QCLot: 657037)									
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	2.5 mg/L	103	80.0	120	----
Saturated Paste Extractables (QCLot: 657038)									
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	100 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 657039)									
% saturation	----	E141	1	%	100 %	97.7	80.0	120	----
Saturated Paste Extractables (QCLot: 657040)									
pH, saturated paste	----	E114	----	pH units	6 pH units	99.8	95.0	105	----
Saturated Paste Extractables (QCLot: 657041)									

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Saturated Paste Extractables (QCLot: 657041) - continued									
conductivity, saturated paste	----	E102	10	µS/cm	146.9 µS/cm	102	80.0	120	----
Saturated Paste Extractables (QCLot: 657042)									
alkalinity, total (as CaCO3)	----	E293	10	mg/L	500 mg/L	107	85.0	115	----
Saturated Paste Extractables (QCLot: 657043)									
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	50 mg/L	110	80.0	120	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	50 mg/L	105	80.0	120	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	50 mg/L	110	80.0	120	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	50 mg/L	120	80.0	120	----
Metals (QCLot: 657033)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	106	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	114	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	102	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	96.4	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	102	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	90.3	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	99.5	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	95.2	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	101	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	101	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	98.8	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	95.5	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	103	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	104	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	98.9	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	98.9	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	93.0	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	101	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	92.5	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	100	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	105	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	106	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 657033) - continued									
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	96.9	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	97.0	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	98.0	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	107	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	97.4	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	95.1	80.0	120	----
Metals (QCLot: 657034)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	94.3	80.0	120	----
Leachable Anions & Nutrients (QCLot: 660214)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	81.0	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 659685)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	97.6	80.0	120	----
Physical Tests (QCLot: 660583)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Particle Size (QCLot: 658746)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Particle Size (QCLot: 658747)									
	RM	passing (0.05 mm)	----	E182	49.81 %	100	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	99.2	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	98.2	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	97.8	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	97.7	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	99.0	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.6	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.7	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.8	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.8	94.9	105	----
Particle Size (QCLot: 658748)									
	RM	passing (0.002 mm)	----	E183	21.14 %	92.0	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	96.4	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	98.9	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	98.7	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	100	88.0	112	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 658687)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	108	80.0	120	----
Organic / Inorganic Carbon (QCLot: 658686)									
	RM	carbon, total [TC]	----	E351	1.4 %	106	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662066)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	111	80.0	120	----
Plant Available Nutrients (QCLot: 660552)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	76.2	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	100	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	88.8	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	88.3	70.0	130	----
Saturated Paste Extractables (QCLot: 657036)									
	RM	sulfate, soluble ion content	14808-79-8	E239.SO4	1841 mg/L	106	70.0	130	----
Saturated Paste Extractables (QCLot: 657038)									
	RM	chloride, soluble ion content	16887-00-6	E239.Cl	1237 mg/L	102	70.0	130	----
Saturated Paste Extractables (QCLot: 657039)									
	RM	% saturation	----	E141	48.3 %	99.1	70.0	130	----
Saturated Paste Extractables (QCLot: 657040)									
	RM	pH, saturated paste	----	E114	7.59 pH units	96.8	95.0	105	----
Saturated Paste Extractables (QCLot: 657041)									
	RM	conductivity, saturated paste	----	E102	5970 µS/cm	106	70.0	130	----
Saturated Paste Extractables (QCLot: 657043)									
	RM	calcium, soluble ion content	7440-70-2	E442	776 mg/L	102	70.0	130	----
	RM	magnesium, soluble ion content	7439-95-4	E442	261 mg/L	103	70.0	130	----
	RM	potassium, soluble ion content	7440-09-7	E442	111 mg/L	103	70.0	130	----
	RM	sodium, soluble ion content	17341-25-2	E442	330 mg/L	97.0	70.0	130	----
Metals (QCLot: 657033)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	102	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	99.3	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	100	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	96.9	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Reference Material (RM) Report: Recovery (%) RM	Reference Material (RM) Report: Recovery Limits (%) Low	Reference Material (RM) Report: Recovery Limits (%) High	Reference Material (RM) Report: Qualifier
Metals (QCLot: 657033) - continued									
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	98.7	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	114	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	92.0	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	92.4	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	106	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	96.3	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	93.6	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	95.2	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	97.5	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	99.1	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	99.8	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	104	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	95.8	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	95.1	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	92.5	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	110	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	99.5	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	94.9	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	105	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	87.2	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	112	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	100	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	101	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	92.8	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	84.4	70.0	130	----
Metals (QCLot: 657034)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	102	70.0	130	----
Leachable Anions & Nutrients (QCLot: 660214)									
	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	84.4	80.0	120	----

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686091

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	~~604~~ 437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mount Polley Mining Corp
Contact:	gabriel.holmes@mountpolley.com

Project Information

ALS Account # / Quote #:	BR368337
Job #:	
PO / AFE:	5590008044
LSD:	
ALS Lab Work Order # (lab use only):	2359

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: melissa.paliouras@wsp.com
Email 2: samantha.lundquist@wsp.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact: Amber Springer	Sampler: Samantha Lundquist

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Organic Matter	TOC	Total N & Kjeldahl N	Available P, K, SO-4	Particle Size	Moisture	Conductivity	Sodium Absorption Ratio	pH (Ca Cl2)	Soluble Na, Cl, Ca, Mg	Soluble K, SO-4	Theoretical Gypsum Req	Total Metals	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-S3-S-01	13-Sep-22	15:30	Soil																3
	22-S9-S-01	"	13:00	"																"
	22-S8-S-01	"	14:15	"																"
	22-R2-S-01	14-Sep-22	8:50	"																"
	22-R3-S-01	"	10:00	"																"
	22-R1-S-01	"	11:00	"																"
	22-R3-S-01D	"	10:00	"																"
	22-S11-S-01	"	12:40	"																"
	22-S12-S-01	"	13:10	"																"
	22-S14-S-01	"	14:00	"																"
	22-S13-S-01	"	14:40	"																"
	22-S13-S-01D	"	14:40	"																"

Environmental Division
Vancouver
Work Order Reference
VA22C2359

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

...port by clicking on the drop-down list below
...C only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☑ | Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7°C (avg 6)		

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
S. Lundquist	Sept 17, 2022	14:30

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
JC	SEP 17 2022	14:40

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2364**	Page	: 1 of 10
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686092	Issue Date	: 30-Sep-2022 10:04
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Inorganics, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Jwan Abdalla	Laboratory Analyst	Sask Soils, Saskatoon, Saskatchewan
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
dS/m	decisiemens per metre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
pH units	pH units
t/ha	tonnes per hectare

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLIS	*Detection Limit Adjusted due to insufficient sample.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
DUPH	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		4.8	9.3	7.2	6.6	8.6
moisture	----	E144	0.25	%		3.90	7.41	5.86	5.67	4.76
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.54	6.35	6.44	6.31	5.90
pH (1:2 soil:water)	----	E108	0.10	pH units		7.10	6.99	6.93	6.93	6.50
ash content @ 550°C	----	E205D	1.0	%		95.2	90.7	92.8	93.4	91.4
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		90.3	92.3	93.4	90.5	94.8
passing (4.75 mm)	----	E181	1.0	%		78.6	84.5	82.2	78.4	85.8
passing (19 mm)	----	E181	1.0	%		100	100	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		59.3	67.6	62.4	58.0	64.0
passing (0.841 mm)	----	E182	1.0	%		58.1	66.6	61.4	56.9	62.9
passing (0.50 mm)	----	E182	1.0	%		52.7	62.2	56.7	52.0	58.1
passing (0.420 mm)	----	E182	1.0	%		51.4	61.1	55.6	50.7	57.0
passing (0.250 mm)	----	E182	1.0	%		46.0	56.8	50.5	45.7	52.0
passing (0.149 mm)	----	E182	1.0	%		41.3	52.6	45.3	40.9	47.2
passing (0.125 mm)	----	E182	1.0	%		39.3	50.7	43.2	39.0	45.1
passing (0.075 mm)	----	E182	1.0	%		35.3	47.0	38.6	34.9	40.8
passing (0.063 mm)	----	E182	1.0	%		32.2	42.8	34.7	31.9	36.8
passing (0.05 mm)	----	E182	1.0	%		28.8	38.3	30.5	28.7	32.4
passing (0.0312 mm)	----	E183	1.0	%		23.3	32.1	24.9	23.5	26.5
passing (0.020 mm)	----	E183	1.0	%		19.9	28.2	20.8	20.1	22.8
passing (0.005 mm)	----	E183	1.0	%		12.1	18.6	12.9	13.1	13.6
passing (0.004 mm)	----	E183	1.0	%		11.2	16.9	11.6	11.9	12.1
passing (0.002 mm)	----	E183	1.0	%		8.7	13.6	8.6	9.4	8.8
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Particle Size										
passing (2.0 mm)	----	E181	1.0	%		66.2	73.2	68.3	64.5	70.6
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.106	0.219	0.136	0.093	0.146
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		1.38	3.96	3.00	2.30	3.62
carbon, inorganic [IC]	----	E354	0.050	%		0.116	0.149	0.139	0.125	0.117
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		0.97	1.24	1.16	1.04	0.98
carbon, total organic [TOC]	----	EC356	0.050	%		1.26	3.81	2.86	2.18	3.50
organic matter	----	EC356	0.10	%		2.17	6.57	4.93	3.76	6.03
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		10.0	7.4	26.2	26.8	45.0
potassium, available	7440-09-7	E390	20	mg/kg		73	99	110	77	84
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		6.9	7.3	8.7	5.5	4.4
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	<1.0	<1.0	<1.0	<1.0
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.222	0.184	0.332	0.195	0.136
sodium adsorption ratio [SAR]	----	EC102	0.10	-		<0.10	<0.10	<0.10	<0.10	0.10
pH, saturated paste	----	E114	0.10	pH units		6.90	6.69	6.91	6.84	6.44
TGR (brine)	----	EC106	0.1	t/ha		Incalcuable	Incalcuable	----	----	----
TGR (brine)	----	EC106	0.10	t/ha		----	----	<0.10	<0.10	<0.10
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		47.4	55.0	52.6	52.8	49.0
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		16.7	15.4	29.8	17.3	12.0
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		35.3	28.1	56.6	32.7	24.6
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		1.75	1.38	2.37	1.80	1.62
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		3.7	2.5	4.5	3.4	3.3
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		<2.0	<2.2	3.2	<2.1	<2.0
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		<4.0	<4.0	6.0	<4.0	<4.0
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		<1.00	<1.10	1.16	<1.06	1.03
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		<2.0	<2.0	2.2	2.0	2.1
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<9.5	<11.0	<10.5	<10.6	<9.8

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		14.0	20.0	22.5	12.9	8.0
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		29.5	36.3	42.7	24.5	16.3
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		27.0	16.5	64.2	37.0	12.2
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		57	30	122	70	25
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<12.5 DLIS	<12.5 DLIS	<10.0 DLIS	<10.0 DLIS	<10.0 DLIS
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		27.0	16.5	64.2	37.0	12.2
alkalinity, total (as CaCO3)	----	E293	10	mg/L		57	30	122	70	25
Metals										
aluminum	7429-90-5	E440	50	mg/kg		17700	21200	15600	15500	13800
antimony	7440-36-0	E440	0.10	mg/kg		0.58	0.64	0.46	0.43	0.39
arsenic	7440-38-2	E440	0.10	mg/kg		10.0	13.9	9.23	9.86	8.11
barium	7440-39-3	E440	0.50	mg/kg		90.6	142	264	252	185
beryllium	7440-41-7	E440	0.10	mg/kg		0.57	0.72	0.48	0.47	0.37
bismuth	7440-69-9	E440	0.20	mg/kg		0.28	<0.20	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		6.0	6.2	9.5	<5.0	<5.0
cadmium	7440-43-9	E440	0.020	mg/kg		0.298	0.404	0.236	0.237	0.197
calcium	7440-70-2	E440	50	mg/kg		9950	11100	10500	10000	7190
chromium	7440-47-3	E440	0.50	mg/kg		33.2	31.6	25.8	26.9	28.1
cobalt	7440-48-4	E440	0.10	mg/kg		14.0	15.9	13.7	13.5	11.9
copper	7440-50-8	E440	0.50	mg/kg		254	703	642	324	191
iron	7439-89-6	E440	50	mg/kg		34100	35300	33300	33200	29400
lead	7439-92-1	E440	0.50	mg/kg		8.31	7.68	6.96	6.56	6.09
lithium	7439-93-2	E440	2.0	mg/kg		16.9	16.0	13.3	13.7	11.9
magnesium	7439-95-4	E440	20	mg/kg		7880	7760	6700	7120	5920
manganese	7439-96-5	E440	1.0	mg/kg		800	858	733	738	688
mercury	7439-97-6	E510	0.0050	mg/kg		0.274 DUPH	0.156	0.357	0.0647	0.0554
molybdenum	7439-98-7	E440	0.10	mg/kg		2.04	4.66	3.60	2.75	2.22

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-S-01	22-S16-S-01	22-S6-S-01	22-S5-S-01	22-S4-S-01
					Client sampling date / time	14-Sep-2022 16:15	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 09:10	15-Sep-2022 10:00
						VA22C2364-001	VA22C2364-002	VA22C2364-003	VA22C2364-004	VA22C2364-005
						Result	Result	Result	Result	Result
Metals										
nickel	7440-02-0	E440	0.50	mg/kg		21.1	19.8	17.7	17.1	17.4
phosphorus	7723-14-0	E440	50	mg/kg		1070	1010	914	988	910
potassium	7440-09-7	E440	100	mg/kg		1100	1500	1210	1020	990
selenium	7782-49-2	E440	0.20	mg/kg		0.35	0.98	0.79	0.45	0.36
silver	7440-22-4	E440	0.10	mg/kg		0.26	0.29	0.29	0.20	0.17
sodium	7440-23-5	E440	50	mg/kg		342	213	224	197	151
strontium	7440-24-6	E440	0.50	mg/kg		142	158	95.6	99.2	73.8
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	0.075	<0.050	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		1020	1060	1020	968	885
tungsten	7440-33-7	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.664	1.18	0.611	0.513	0.506
vanadium	7440-62-2	E440	0.20	mg/kg		110	114	107	103	89.8
zinc	7440-66-6	E440	2.0	mg/kg		75.1	92.5	65.2	69.3	64.3
zirconium	7440-67-7	E440	1.0	mg/kg		4.8	3.2	2.8	2.9	2.4
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.095	0.199	0.117	0.099	0.119

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		7.8	8.1	12.5	12.5	13.2
moisture	----	E144	0.25	%		8.65	7.67	9.97	11.3	14.1
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.44	6.29	4.86	4.89	5.75
pH (1:2 soil:water)	----	E108	0.10	pH units		7.03	6.85	5.55	5.59	6.28
ash content @ 550°C	----	E205D	1.0	%		92.2	91.8	87.5	87.4	86.8
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		86.2	90.7	77.8	68.6	94.5
passing (4.75 mm)	----	E181	1.0	%		72.4	77.4	59.1	44.8	81.5
passing (19 mm)	----	E181	1.0	%		100	100	97.6	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		50.3	54.7	39.4	24.1	58.3
passing (0.841 mm)	----	E182	1.0	%		49.1	53.6	38.5	23.2	56.9
passing (0.50 mm)	----	E182	1.0	%		44.5	49.0	35.3	20.2	51.5
passing (0.420 mm)	----	E182	1.0	%		43.3	47.8	34.5	19.5	50.2
passing (0.250 mm)	----	E182	1.0	%		39.2	43.6	31.5	17.1	44.7
passing (0.149 mm)	----	E182	1.0	%		35.5	39.6	28.8	15.3	39.6
passing (0.125 mm)	----	E182	1.0	%		34.1	37.7	27.7	14.6	37.6
passing (0.075 mm)	----	E182	1.0	%		31.0	33.9	25.3	13.2	33.5
passing (0.063 mm)	----	E182	1.0	%		27.3	28.6	22.6	11.9	28.6
passing (0.05 mm)	----	E182	1.0	%		23.4	22.9	19.6	10.4	23.3
passing (0.0312 mm)	----	E183	1.0	%		19.1	18.1	15.4	8.3	19.1
passing (0.020 mm)	----	E183	1.0	%		16.8	14.8	13.0	7.1	16.5
passing (0.005 mm)	----	E183	1.0	%		10.6	9.1	7.8	4.5	10.1
passing (0.004 mm)	----	E183	1.0	%		10.0	8.4	7.3	4.1	9.6
passing (0.002 mm)	----	E183	1.0	%		8.3	6.6	6.1	3.5	8.0
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
passing (2.0 mm)	----	E181	1.0	%		57.5	61.3	44.6	29.5	66.3

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.241	0.332	0.194	0.185	0.231
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		2.82	3.40	5.40	4.01	4.70
carbon, inorganic [IC]	----	E354	0.050	%		0.150	0.146	0.104	0.101	0.117
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		1.25	1.22	0.87	0.84	0.97
carbon, total organic [TOC]	----	EC356	0.050	%		2.67	3.25	5.30	3.91	4.58
organic matter	----	EC356	0.10	%		4.60	5.60	9.14	6.74	7.90
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		156	217	18.2	32.0	36.3
potassium, available	7440-09-7	E390	20	mg/kg		198	<20	225	159	251
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		5.5	4.1	<7.4 DLM	9.5	22.9
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		1.1	<1.0	<2.5 DLM	<2.5 DLM	<2.5 DLM
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.216	0.172	0.078	0.062	0.143
sodium adsorption ratio [SAR]	----	EC102	0.10	-		0.11	0.12	<0.10	<0.10	<0.10
pH, saturated paste	----	E114	0.10	pH units		6.95	6.84	5.62	5.65	6.29
TGR (brine)	----	EC106	0.1	t/ha		----	----	Incalcuable	Incalcuable	Incalcuable
TGR (brine)	----	EC106	0.10	t/ha		<0.10	<0.10	----	----	----
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		54.1	65.0	108	68.5	88.2
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		18.0	15.6	8.54	5.97	23.5
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		33.3	24.0	7.91	8.71	26.6
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		2.06	2.14	1.30	0.75	2.03
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		3.8	3.3	1.2	1.1	2.3
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		4.8	6.0	6.8	<2.7	9.8
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		8.8	9.2	6.3	<4.0	11.1
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		1.41	1.50	<2.16	<1.37	<1.76
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		2.6	2.3	<2.0	<2.0	<2.0
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<10.8	<13.0	<21.6	<13.7	<17.6
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		9.3	7.0	5.6	<3.4	7.3

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		17.2	10.7	5.2	<5.0	8.3
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.54	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		43.3	28.0	<2.0	<2.0	23.8
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		80	43	<10	<10	27
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<10.0 DLIS	<5.0	<5.0	<5.0	<5.0
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		43.3	28.0	<2.0	<2.0	23.8
alkalinity, total (as CaCO3)	----	E293	10	mg/L		80	43	<10	<10	27
Metals										
aluminum	7429-90-5	E440	50	mg/kg		18900	21100	22900	18500	14800
antimony	7440-36-0	E440	0.10	mg/kg		0.70	0.79	0.56	0.34	0.55
arsenic	7440-38-2	E440	0.10	mg/kg		12.5	13.2	13.7	11.6	8.59
barium	7440-39-3	E440	0.50	mg/kg		210	246	146	147	126
beryllium	7440-41-7	E440	0.10	mg/kg		0.61	0.63	0.61	0.71	0.50
bismuth	7440-69-9	E440	0.20	mg/kg		2.00	3.72	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		5.8	7.3	5.9	6.0	6.8
cadmium	7440-43-9	E440	0.020	mg/kg		0.545	0.578	0.590	0.561	0.382
calcium	7440-70-2	E440	50	mg/kg		14300	15800	5960	6540	7800
chromium	7440-47-3	E440	0.50	mg/kg		25.3	30.2	40.2	26.4	23.9
cobalt	7440-48-4	E440	0.10	mg/kg		15.6	16.5	16.7	12.2	11.1
copper	7440-50-8	E440	0.50	mg/kg		688	759	300	258	125
iron	7439-89-6	E440	50	mg/kg		37200	42500	45800	33900	34200
lead	7439-92-1	E440	0.50	mg/kg		12.5	17.4	13.6	16.8	10.2
lithium	7439-93-2	E440	2.0	mg/kg		15.2	15.8	23.4	22.6	17.4
magnesium	7439-95-4	E440	20	mg/kg		8020	9030	8600	5480	5320
manganese	7439-96-5	E440	1.0	mg/kg		978	950	1220	2000	1350
mercury	7439-97-6	E510	0.0050	mg/kg		0.200	0.280	1.98	0.104	0.0751
molybdenum	7439-98-7	E440	0.10	mg/kg		3.73	4.03	4.12	2.14	1.50
nickel	7440-02-0	E440	0.50	mg/kg		16.6	18.1	23.6	12.0	13.4
phosphorus	7723-14-0	E440	50	mg/kg		2320	3530	1260	1200	848

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-S-01	22-S1-S-01	22-R4-S-01	22-R5-S-01	22-R6-S-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:20	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 15:40
						VA22C2364-006	VA22C2364-007	VA22C2364-008	VA22C2364-009	VA22C2364-010
						Result	Result	Result	Result	Result
Metals										
potassium	7440-09-7	E440	100	mg/kg		1500	1700	1600	1240	1270
selenium	7782-49-2	E440	0.20	mg/kg		0.83	1.39	0.27	<0.20	<0.20
silver	7440-22-4	E440	0.10	mg/kg		0.60	0.90	0.50	0.36	0.35
sodium	7440-23-5	E440	50	mg/kg		422	388	216	109	118
strontium	7440-24-6	E440	0.50	mg/kg		188	182	78.7	77.1	87.4
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	0.064	0.072	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		3.8	6.9	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		701	839	1090	522	1140
tungsten	7440-33-7	E440	0.50	mg/kg		0.58	0.74	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.750	0.858	0.708	0.642	0.584
vanadium	7440-62-2	E440	0.20	mg/kg		114	127	160	125	130
zinc	7440-66-6	E440	2.0	mg/kg		158	201	168	154	116
zirconium	7440-67-7	E440	1.0	mg/kg		1.1	1.1	2.0	<1.0	4.5
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.252	0.362	0.169	0.213	0.214

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2364**	Page	: 1 of 40
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 30-Sep-2022 10:04
C-O-C number	: 17-686092		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	VA22C2364-001	22-S17-S-01	mercury	7439-97-6	E510	58.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R4-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S1-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S2-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S4-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S5-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S6-S-01	E366	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R5-S-01	E366	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-R6-S-01	E366	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S16-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S17-S-01	E366	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R4-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R5-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-R6-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S1-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S2-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S4-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S5-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S6-S-01	E319	15-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S16-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S17-S-01	E319	14-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	9 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R4-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R5-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-R6-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S1-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S2-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E510	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	11 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E510	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	12 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E510	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	12 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E440	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	11 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E440	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	12 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E440	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	12 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R4-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R5-S-01	E351	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-R6-S-01	E351	15-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S16-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S17-S-01	E351	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S1-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S2-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S4-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S5-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag 22-S6-S-01	E351	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R4-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R5-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-R6-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S16-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S17-S-01	E354	14-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S1-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S2-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S4-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S5-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S6-S-01	E354	15-Sep-2022	----	----	----		23-Sep-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R4-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R5-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-R6-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S16-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S17-S-01	E185	14-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S1-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S2-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S4-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S5-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S6-S-01	E185	15-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R4-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R5-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-R6-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S1-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S2-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S4-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S5-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S6-S-01	E183	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S16-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S17-S-01	E183	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R4-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R5-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-R6-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S1-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S2-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S4-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S5-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S6-S-01	E182	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S16-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S17-S-01	E182	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R4-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R5-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-R6-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S1-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S2-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S4-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S5-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S6-S-01	E181	15-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	6 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S16-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S17-S-01	E181	14-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R4-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R5-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-R6-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S1-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S2-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S4-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S5-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S6-S-01	E205D	15-Sep-2022	----	----	----		22-Sep-2022	365 days	7 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S16-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S17-S-01	E205D	14-Sep-2022	----	----	----		22-Sep-2022	365 days	8 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R4-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R5-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-R6-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S16-S-01	E144	14-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S17-S-01	E144	14-Sep-2022	----	----	----		25-Sep-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E144	15-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R4-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R5-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-R6-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag										
22-S16-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S17-S-01	E108B	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S1-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S2-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S4-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S5-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S6-S-01	E108B	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R4-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R5-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-R6-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E108	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	11 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E108	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	12 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E108	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	12 days	✓
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag										
22-R4-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag										
22-R5-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-R6-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S1-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S2-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S4-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S5-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S6-S-01	E269.N+N	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	8 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S16-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S17-S-01	E269.N+N	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	9 days	× EHTL

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R4-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R5-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-R6-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S1-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S2-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S4-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S5-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S6-S-01	E384	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S16-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S17-S-01	E384	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R4-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R5-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-R6-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S1-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S2-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S4-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S5-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S6-S-01	E390	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	8 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S16-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S17-S-01	E390	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R4-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R5-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-R6-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S16-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S17-S-01	E497.SO4	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S1-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-S2-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S4-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S5-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S6-S-01	E497.SO4	15-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E293	14-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E293	14-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E293	15-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E442	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E442	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E442	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E239.Cl	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E239.Cl	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E239.Cl	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E102	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E102	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E102	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E239.NO3	14-Sep-2022	26-Sep-2022	3 days	12 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E239.NO3	15-Sep-2022	26-Sep-2022	3 days	12 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E239.NO3	14-Sep-2022	26-Sep-2022	3 days	12 days	× EHTL	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E114	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	12 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E114	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	12 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E114	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	12 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E141	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E141	14-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E141	15-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R4-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R5-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-R6-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S1-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S2-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S4-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S5-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S16-S-01	E239.SO4	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S17-S-01	E239.SO4	14-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S6-S-01	E239.SO4	15-Sep-2022	26-Sep-2022	365 days	12 days	✓	27-Sep-2022	180 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	2	38	5.2	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	2	38	5.2	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	2	34	5.8	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	2	27	7.4	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659685	2	27	7.4	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	2	31	6.4	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	658686	2	40	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	2	39	5.1	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660516	1	10	10.0	5.0	✓
Total Nitrogen by Combustion	E366	658687	2	26	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	4	38	10.5	10.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	4	38	10.5	10.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	4	34	11.7	10.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	4	27	14.8	10.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	2	15	13.3	10.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	2	15	13.3	10.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	2	15	13.3	10.0	✓
Loss On Ignition (550°C)	E205D	659685	2	27	7.4	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	2	15	13.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	2	15	13.3	10.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	658741	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660583	4	31	12.9	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	2	15	13.3	10.0	✓
Saturation Percentage	E141	665003	2	15	13.3	10.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	2	15	13.3	10.0	✓
Total Carbon by Combustion	E351	658686	4	40	10.0	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	4	39	10.2	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660516	2	10	20.0	10.0	✓
Total Nitrogen by Combustion	E366	658687	4	26	15.3	10.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	660552	2	38	5.2	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	660644	2	38	5.2	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	660645	2	34	5.8	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	660553	2	27	7.4	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659685	2	27	7.4	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	658686	2	40	5.0	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662066	2	39	5.1	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660516	1	10	10.0	5.0	✓
Total Nitrogen by Combustion	E366	658687	2	26	7.6	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (Saturated Paste)	E102 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)/AER D50	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a filtered extract from a soil sample prepared using the saturated paste procedure. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
pH by Meter (Saturated Paste)	E114 Vancouver - Environmental	Soil/Solid	Carter-CSSS / APHA 4500 H	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a soil produced by the saturated paste extraction procedure.
Saturation Percentage	E141 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/AER D50	Saturation Percentage (SP) is determined as the total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams), expressed as a percentage.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Loss On Ignition (550°C)	E205D Saskatoon - Environmental	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Chloride by IC (Saturated Paste)	E239.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste)	E239.NO3 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate by IC (Saturated Paste)	E239.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N Saskatoon - Environmental	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Alkalinity Species by Titration (Saturated Paste)	E293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Kjeldahl Nitrogen by Colourimetry	E319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by FIALab (Modified Kelowna)	E384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus is extracted from air dried soil using a fixed ratio Modified Kelowna extraction. Phosphorus is determined by colorimetry using an flow injection analyzer.
Available Potassium by flame photometry (Modified Kelowna)	E390 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available potassium is extracted from soil using modified Kelowna solution. Potassium is determined by flame emission at 770 nm.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium and Sodium by Collision/Reaction Cell ICPMS as per "Soil Sampling Methods of Analysis" By M Carter.
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available sulfate is determined by ICPOES. Soil is extracted using a 0.01M calcium chloride solution. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Sodium Adsorption Ratio (SAR) Saturated Paste	EC102 Vancouver - Environmental	Soil/Solid	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a sample is calculated from the Sodium, Calcium, and Magnesium concentrations from sediment paste extract.
Theoretical Gypsum Requirements (TGR) Saturated Paste	EC106 Vancouver - Environmental	Soil/Solid	J. Ashworth et al (1999)	Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chloride by IC (Saturated Paste) (mg/kg)	EC239A.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste) (mg/kg)	EC239A.NO3 Vancouver - Environmental	Soil/Solid	Calculation	Results are reported in mg/kg dry weight
Sulfate by IC (Saturated Paste) (mg/kg)	EC239A.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration (Saturated Paste) (mg/kg)	EC293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).
Ca, K, Mg, Na by ICPMS (Saturated Paste, mg/kg)	EC442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium, Sodium by ICPMS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2	EP108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.
Modified Kelowna Extraction for soil	EP384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus and potassium are extracted from the soil using fixed ratio Modified Kelowna solution.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **VA22C2364**	Page	: 1 of 16
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686092	Issue Date	: 30-Sep-2022 10:04
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Vancouver Inorganics, Burnaby, British Columbia
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Nancy Cruse	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 659685)											
VA22C2359-001	Anonymous	loss on ignition @ 550°C	----	E205D	1.0	%	9.0	8.8	0.2	Diff <2x LOR	----
Physical Tests (QC Lot: 659686)											
VA22C2364-009	22-R5-S-01	loss on ignition @ 550°C	----	E205D	1.0	%	12.5	13.1	4.64%	20%	----
Physical Tests (QC Lot: 660583)											
VA22C2359-006	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.22	4.24	0.473%	10%	----
Physical Tests (QC Lot: 660592)											
VA22C2364-009	22-R5-S-01	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.89	4.91	0.408%	10%	----
Physical Tests (QC Lot: 664998)											
VA22C2364-001	22-S17-S-01	pH (1:2 soil:water)	----	E108	0.10	pH units	7.10	7.19	1.3%	5%	----
Physical Tests (QC Lot: 665008)											
VA22C2364-001	22-S17-S-01	moisture	----	E144	0.25	%	3.90	3.96	1.55%	20%	----
Particle Size (QC Lot: 658739)											
VA22C2364-001	22-S17-S-01	passing (0.002 mm)	----	E183	1.0	%	8.7	9.8	1.0	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	11.2	12.0	7.31%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	12.1	13.2	8.70%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	19.9	20.6	3.28%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	23.3	23.7	1.75%	20%	----
Particle Size (QC Lot: 658740)											
VA22C2364-001	22-S17-S-01	passing (0.05 mm)	----	E182	1.0	%	28.8	28.7	0.134%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	32.2	32.0	0.487%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	35.3	35.0	0.754%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	39.3	39.2	0.312%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	41.3	41.2	0.131%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	46.0	46.1	0.254%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	51.4	51.6	0.390%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	52.7	52.9	0.293%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	58.1	58.0	0.112%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	59.3	59.2	0.101%	15%	----
Anions and Nutrients (QC Lot: 658687)											
VA22C2359-001	Anonymous	nitrogen, total	7727-37-9	E366	0.020	%	0.269	0.260	3.40%	20%	----
Anions and Nutrients (QC Lot: 660320)											

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Anions and Nutrients (QC Lot: 660320) - continued											
FC2202271-006	Anonymous	nitrogen, total	7727-37-9	E366	0.020	%	0.110	0.095	0.015	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 658686)											
VA22C2359-001	Anonymous	carbon, total [TC]	----	E351	0.050	%	3.60	3.41	5.37%	20%	----
Organic / Inorganic Carbon (QC Lot: 660319)											
FC2202271-006	Anonymous	carbon, total [TC]	----	E351	0.050	%	1.26	1.22	3.14%	20%	----
Organic / Inorganic Carbon (QC Lot: 662066)											
VA22C2359-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	0.142	0.141	0.0009	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 662076)											
EO2207816-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	4.39	4.24	3.66%	20%	----
Plant Available Nutrients (QC Lot: 660552)											
VA22C2359-004	Anonymous	nitrate + nitrite, available (as N)	----	E269.N+N	2.5	mg/kg	<2.5	<2.5	2.5	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660553)											
VA22C2359-004	Anonymous	sulfate, available (as S)	14808-79-8	E497.SO4	7.5	mg/kg	7.6	7.7	0.1	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 660644)											
VA22C2364-006	22-S2-S-01	phosphate, available (as P)	14265-44-2	E384	10.0	mg/kg	156	166	6.48%	30%	----
Plant Available Nutrients (QC Lot: 660645)											
VA22C2364-006	22-S2-S-01	potassium, available	7440-09-7	E390	20	mg/kg	198	204	3.32%	30%	----
Plant Available Nutrients (QC Lot: 661785)											
YL2201594-002	Anonymous	nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg	1.4	1.7	0.3	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661786)											
VA22C2364-009	22-R5-S-01	sulfate, available (as S)	14808-79-8	E497.SO4	7.4	mg/kg	9.5	8.1	1.4	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661886)											
FC2202278-001	Anonymous	potassium, available	7440-09-7	E390	20	mg/kg	269	271	0.629%	30%	----
Plant Available Nutrients (QC Lot: 661887)											
FC2202278-001	Anonymous	phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665000)											
VA22C2364-001	22-S17-S-01	sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L	29.5	26.3	3.2	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665001)											
VA22C2364-001	22-S17-S-01	nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	<0.5	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665002)											
VA22C2364-001	22-S17-S-01	chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	<20	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665003)											
VA22C2364-001	22-S17-S-01	% saturation	----	E141	1.0	%	47.4	46.0	3.02%	20%	----
Saturated Paste Extractables (QC Lot: 665004)											
VA22C2364-001	22-S17-S-01	pH, saturated paste	----	E114	0.10	pH units	6.90	6.96	0.866%	5%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Saturated Paste Extractables (QC Lot: 665005)											
VA22C2364-001	22-S17-S-01	conductivity, saturated paste	----	E102	30	µS/cm	0.222 dS/m	230	8	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665006)											
VA22C2364-001	22-S17-S-01	alkalinity, total (as CaCO3)	----	E293	12	mg/L	57	58	1	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665007)											
VA22C2364-001	22-S17-S-01	calcium, soluble ion content	7440-70-2	E442	0.60	mg/L	35.3	34.8	1.63%	30%	----
		magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L	3.7	3.8	0.08	Diff <2x LOR	----
		potassium, soluble ion content	7440-09-7	E442	4.0	mg/L	<4.0	<4.0	0	Diff <2x LOR	----
		sodium, soluble ion content	17341-25-2	E442	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Metals (QC Lot: 664995)											
VA22C2364-001	22-S17-S-01	aluminum	7429-90-5	E440	50	mg/kg	17700	18300	3.11%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.58	0.47	0.10	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	10.0	10.4	4.08%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	90.6	88.0	2.86%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.57	0.57	0.0008	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	0.28	0.25	0.03	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	6.0	5.8	0.3	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.298	0.327	9.41%	30%	----
		calcium	7440-70-2	E440	50	mg/kg	9950	10800	8.69%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	33.2	36.2	8.47%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	14.0	15.4	9.71%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	254	243	4.49%	30%	----
		iron	7439-89-6	E440	50	mg/kg	34100	35300	3.49%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	8.31	8.22	1.09%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	16.9	17.7	4.68%	30%	----
		magnesium	7439-95-4	E440	20	mg/kg	7880	8760	10.6%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	800	832	3.83%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	2.04	2.00	1.88%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	21.1	26.4	22.2%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	1070	1120	4.01%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	1100	1070	3.23%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	0.35	0.33	0.02	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.26	0.25	0.006	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	342	390	13.0%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	142	144	1.24%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 664995) - continued											
VA22C2364-001	22-S17-S-01	thallium	7440-28-0	E440	0.050	mg/kg	<0.050	0.053	0.003	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	1020	1020	0.00286%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.664	0.808	19.5%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	110	118	6.69%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	75.1	75.4	0.360%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	4.8	4.9	0.2	Diff <2x LOR	----
Metals (QC Lot: 664996)											
VA22C2364-001	22-S17-S-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.274	0.150	58.6%	40%	DUP-H
Leachable Anions & Nutrients (QC Lot: 660516)											
VA22C2364-010	22-R6-S-01	Kjeldahl nitrogen, total [TKN]	----	E319	690	mg/kg	0.214 %	2140	1	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 665008)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 658687)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Anions and Nutrients (QCLot: 660320)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Organic / Inorganic Carbon (QCLot: 658686)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 660319)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 662066)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 662076)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Plant Available Nutrients (QCLot: 660552)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 660553)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 660644)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Plant Available Nutrients (QCLot: 660645)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Plant Available Nutrients (QCLot: 661785)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 661786)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 661886)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Plant Available Nutrients (QCLot: 661887)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Saturated Paste Extractables (QCLot: 665000)						
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	<5.0	----
Saturated Paste Extractables (QCLot: 665001)						
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Saturated Paste Extractables (QCLot: 665002)						
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	----
Saturated Paste Extractables (QCLot: 665003)						
% saturation	----	E141	1	%	50.0	----
Saturated Paste Extractables (QCLot: 665005)						
conductivity, saturated paste	----	E102	10	µS/cm	<10	----
Saturated Paste Extractables (QCLot: 665006)						
alkalinity, total (as CaCO3)	----	E293	10	mg/L	<10	----
Saturated Paste Extractables (QCLot: 665007)						
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	<0.60	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	<1.0	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	<4.0	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	<2.0	----
Metals (QCLot: 664995)						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 664995) - continued						
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 664996)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Leachable Anions & Nutrients (QCLot: 660516)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 660583)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 660592)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 664998)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 665008)									
moisture	----	E144	0.25	%	50 %	98.9	90.0	110	----
Anions and Nutrients (QCLot: 658687)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Anions and Nutrients (QCLot: 660320)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	99.7	90.0	110	----
Organic / Inorganic Carbon (QCLot: 658686)									
carbon, total [TC]	----	E351	0.05	%	48 %	102	90.0	110	----
Organic / Inorganic Carbon (QCLot: 660319)									
carbon, total [TC]	----	E351	0.05	%	48 %	101	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662066)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	93.3	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662076)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	95.2	90.0	110	----
Plant Available Nutrients (QCLot: 660552)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	104	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	105	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.0	70.0	130	----
Plant Available Nutrients (QCLot: 661785)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	111	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	106	70.0	130	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Plant Available Nutrients (QCLot: 661886)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.7	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	96.5	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	100 mg/L	104	80.0	120	----
Saturated Paste Extractables (QCLot: 665001)									
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	2.5 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665002)									
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	100 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665003)									
% saturation	----	E141	1	%	100 %	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665004)									
pH, saturated paste	----	E114	----	pH units	6 pH units	99.7	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									
conductivity, saturated paste	----	E102	10	µS/cm	146.9 µS/cm	105	80.0	120	----
Saturated Paste Extractables (QCLot: 665006)									
alkalinity, total (as CaCO3)	----	E293	10	mg/L	500 mg/L	108	85.0	115	----
Saturated Paste Extractables (QCLot: 665007)									
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	50 mg/L	107	80.0	120	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	50 mg/L	101	80.0	120	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	50 mg/L	101	80.0	120	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	50 mg/L	109	80.0	120	----
Metals (QCLot: 664995)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	92.9	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	100.0	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	92.4	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	88.4	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	88.4	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	83.5	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	94.2	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	90.2	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	95.9	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	94.1	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	92.8	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 664995) - continued									
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	99.2	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	91.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	85.7	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	95.2	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	95.2	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	100	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	92.5	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	100	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	95.9	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	97.3	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	89.5	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	96.4	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	94.0	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	88.2	80.0	120	----
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	95.6	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	90.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	93.4	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	96.2	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	97.6	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	95.3	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	106	80.0	120	----
Metals (QCLot: 664996)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	94.2	80.0	120	----
Leachable Anions & Nutrients (QCLot: 660516)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	80.6	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Physical Tests (QCLot: 659685)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	97.6	80.0	120	----
Physical Tests (QCLot: 659686)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	93.4	80.0	120	----
Physical Tests (QCLot: 660583)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Physical Tests (QCLot: 660592)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Particle Size (QCLot: 658739)									
	RM	passing (0.002 mm)	----	E183	21.14 %	105	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	102	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	102	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	105	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	106	88.0	112	----
Particle Size (QCLot: 658740)									
	RM	passing (0.05 mm)	----	E182	49.81 %	104	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	101	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	99.2	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	98.9	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	98.8	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.1	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.3	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.3	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.4	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.5	94.9	105	----
Particle Size (QCLot: 658741)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Particle Size (QCLot: 658741) - continued									
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Anions and Nutrients (QCLot: 658687)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	108	80.0	120	----
Anions and Nutrients (QCLot: 660320)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	109	80.0	120	----
Organic / Inorganic Carbon (QCLot: 658686)									
	RM	carbon, total [TC]	----	E351	1.4 %	106	80.0	120	----
Organic / Inorganic Carbon (QCLot: 660319)									
	RM	carbon, total [TC]	----	E351	1.4 %	106	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662066)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	111	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662076)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	109	80.0	120	----
Plant Available Nutrients (QCLot: 660552)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	76.2	70.0	130	----
Plant Available Nutrients (QCLot: 660553)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	100	70.0	130	----
Plant Available Nutrients (QCLot: 660644)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	88.8	80.0	120	----
Plant Available Nutrients (QCLot: 660645)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	88.3	70.0	130	----
Plant Available Nutrients (QCLot: 661785)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	78.0	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	99.0	70.0	130	----
Plant Available Nutrients (QCLot: 661886)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	98.0	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	91.6	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
	RM	sulfate, soluble ion content	14808-79-8	E239.SO4	1841 mg/L	99.9	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Saturated Paste Extractables (QCLot: 665002)									
	RM	chloride, soluble ion content	16887-00-6	E239.Cl	1237 mg/L	94.6	70.0	130	----
Saturated Paste Extractables (QCLot: 665003)									
	RM	% saturation	----	E141	48.3 %	102	70.0	130	----
Saturated Paste Extractables (QCLot: 665004)									
	RM	pH, saturated paste	----	E114	7.59 pH units	97.1	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									
	RM	conductivity, saturated paste	----	E102	5970 µS/cm	104	70.0	130	----
Saturated Paste Extractables (QCLot: 665007)									
	RM	calcium, soluble ion content	7440-70-2	E442	776 mg/L	95.3	70.0	130	----
	RM	magnesium, soluble ion content	7439-95-4	E442	261 mg/L	92.3	70.0	130	----
	RM	potassium, soluble ion content	7440-09-7	E442	111 mg/L	94.8	70.0	130	----
	RM	sodium, soluble ion content	17341-25-2	E442	330 mg/L	93.0	70.0	130	----
Metals (QCLot: 664995)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	95.0	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	99.8	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	98.2	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	89.8	70.0	130	----
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	94.2	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	97.7	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	88.1	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	90.3	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	101	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	95.6	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	92.4	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	97.3	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	87.5	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	91.2	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	95.7	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	97.9	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	93.8	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	94.3	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	91.7	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	103	70.0	130	----

Sub-Matrix:

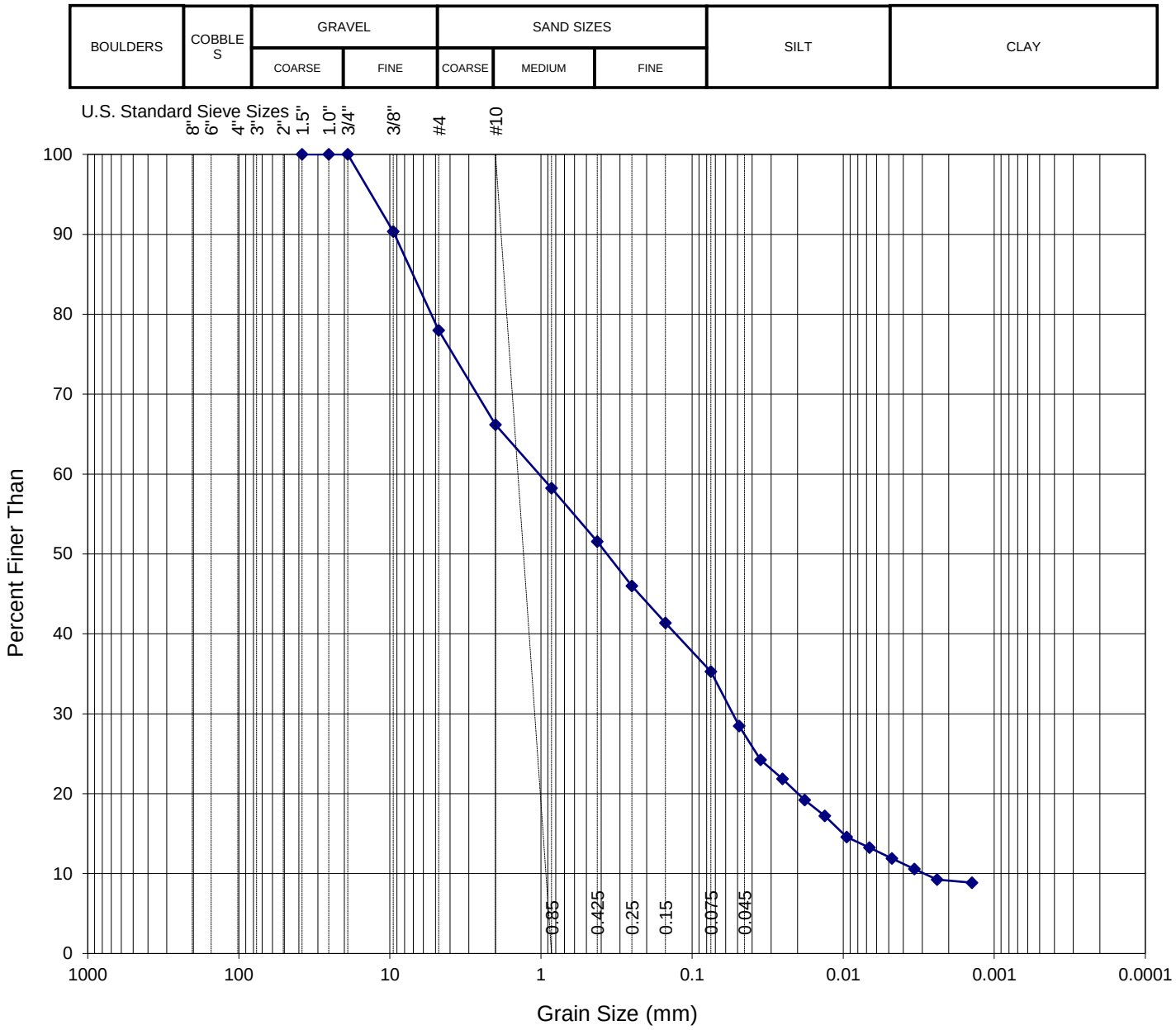
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 664995) - continued									
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	97.3	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	95.7	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	89.3	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	84.9	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	101	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	95.3	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	98.5	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	94.3	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	81.1	70.0	130	----
Metals (QCLot: 664996)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	97.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 660516)									
	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	85.1	80.0	120	----

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364001
Project Number:	
Client Sample ID	22-S17-S-01
Lab Sample ID	VA22C2364001
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

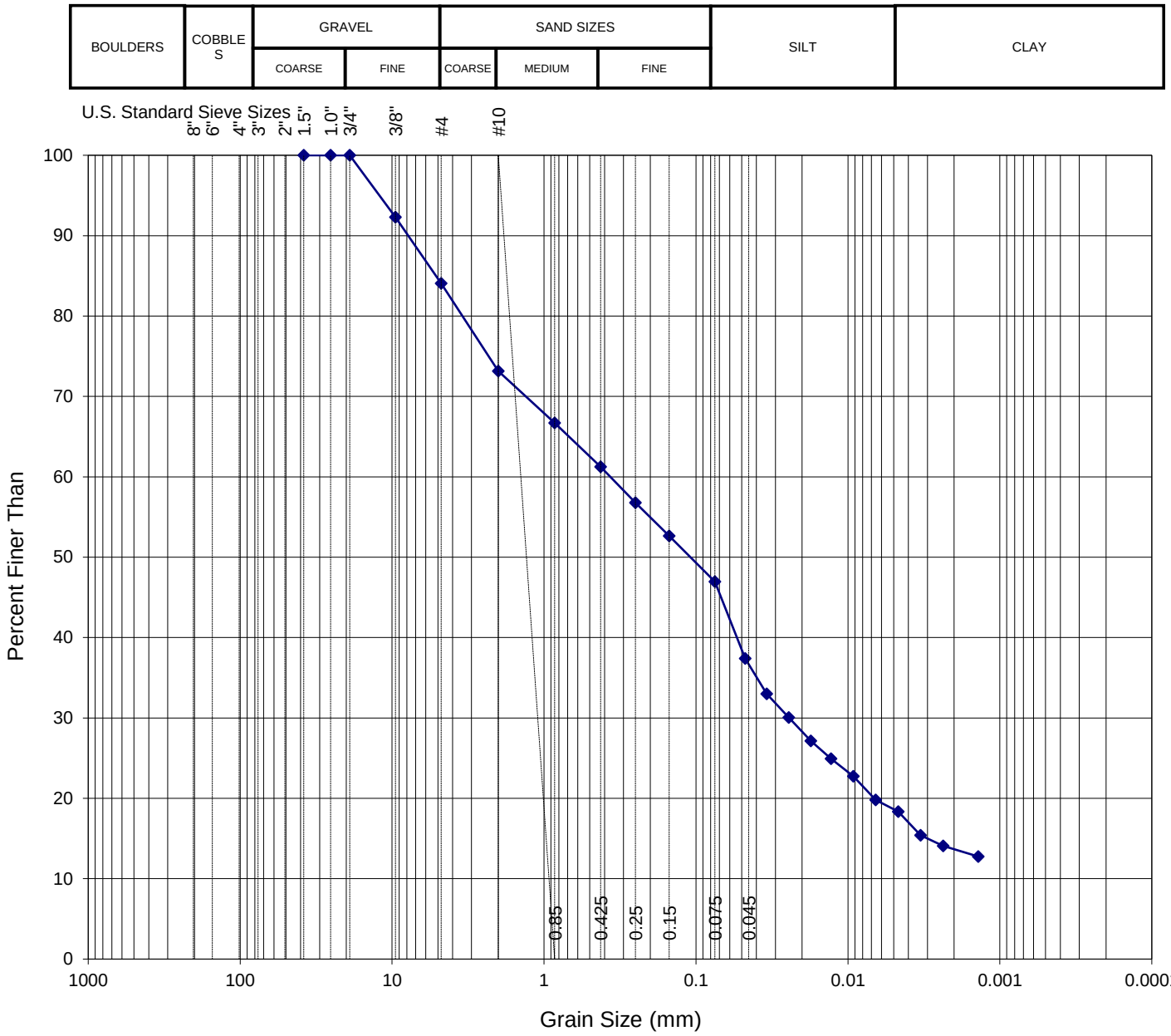
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	22.02	> 4.75
% COARSE SAND :	11.80	2.0 - 4.75
% MEDIUM SAND :	14.63	0.425 - 2.0
% FINE SAND :	16.26	0.075 - 0.425
% SILT :	23.18	0.075 - 0.005
% CLAY :	12.11	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364002
Project Number:	
Client Sample ID	22-S16-S-01
Lab Sample ID	VA22C2364002
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

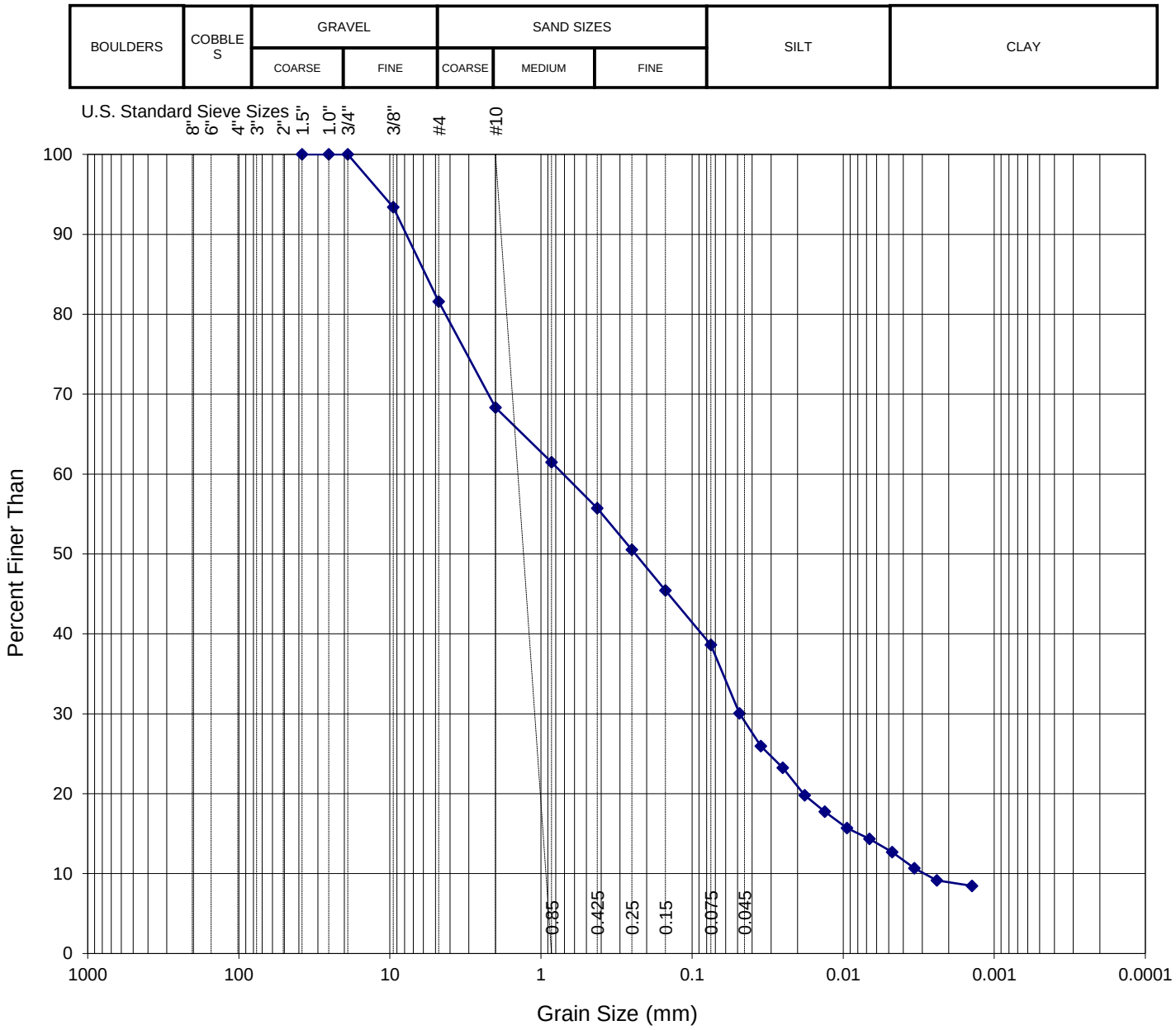
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	15.95	> 4.75
% COARSE SAND :	10.89	2.0 - 4.75
% MEDIUM SAND :	11.91	0.425 - 2.0
% FINE SAND :	14.29	0.075 - 0.425
% SILT :	28.33	0.075 - 0.005
% CLAY :	18.63	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364003
Project Number:	
Client Sample ID	22-S6-S-01
Lab Sample ID	VA22C2364003
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

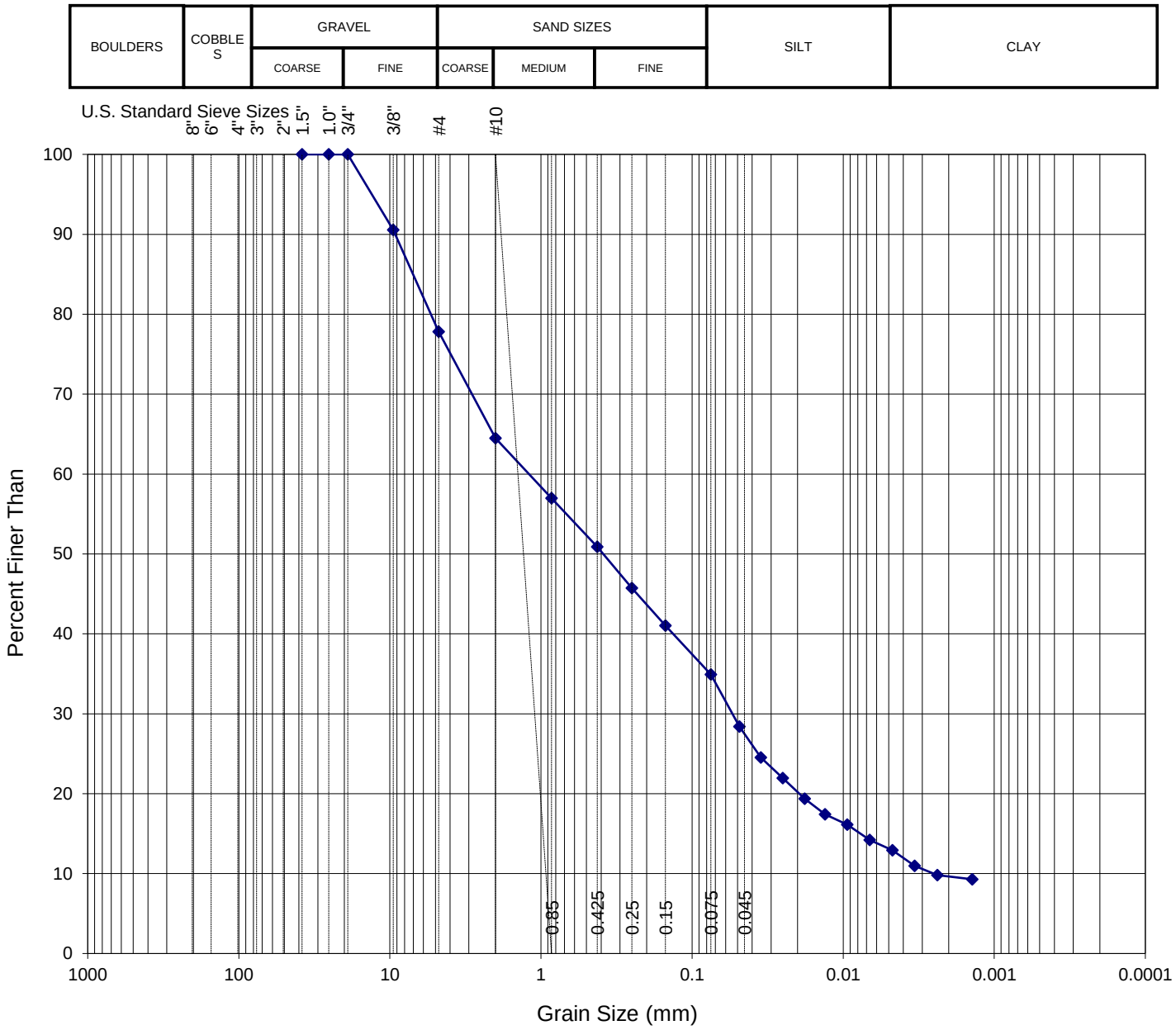
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	18.40	> 4.75
% COARSE SAND :	13.29	2.0 - 4.75
% MEDIUM SAND :	12.60	0.425 - 2.0
% FINE SAND :	17.10	0.075 - 0.425
% SILT :	25.65	0.075 - 0.005
% CLAY :	12.96	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2364004
Project Number:
Client Sample ID 22-S5-S-01
Lab Sample ID VA22C2364004
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH



METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

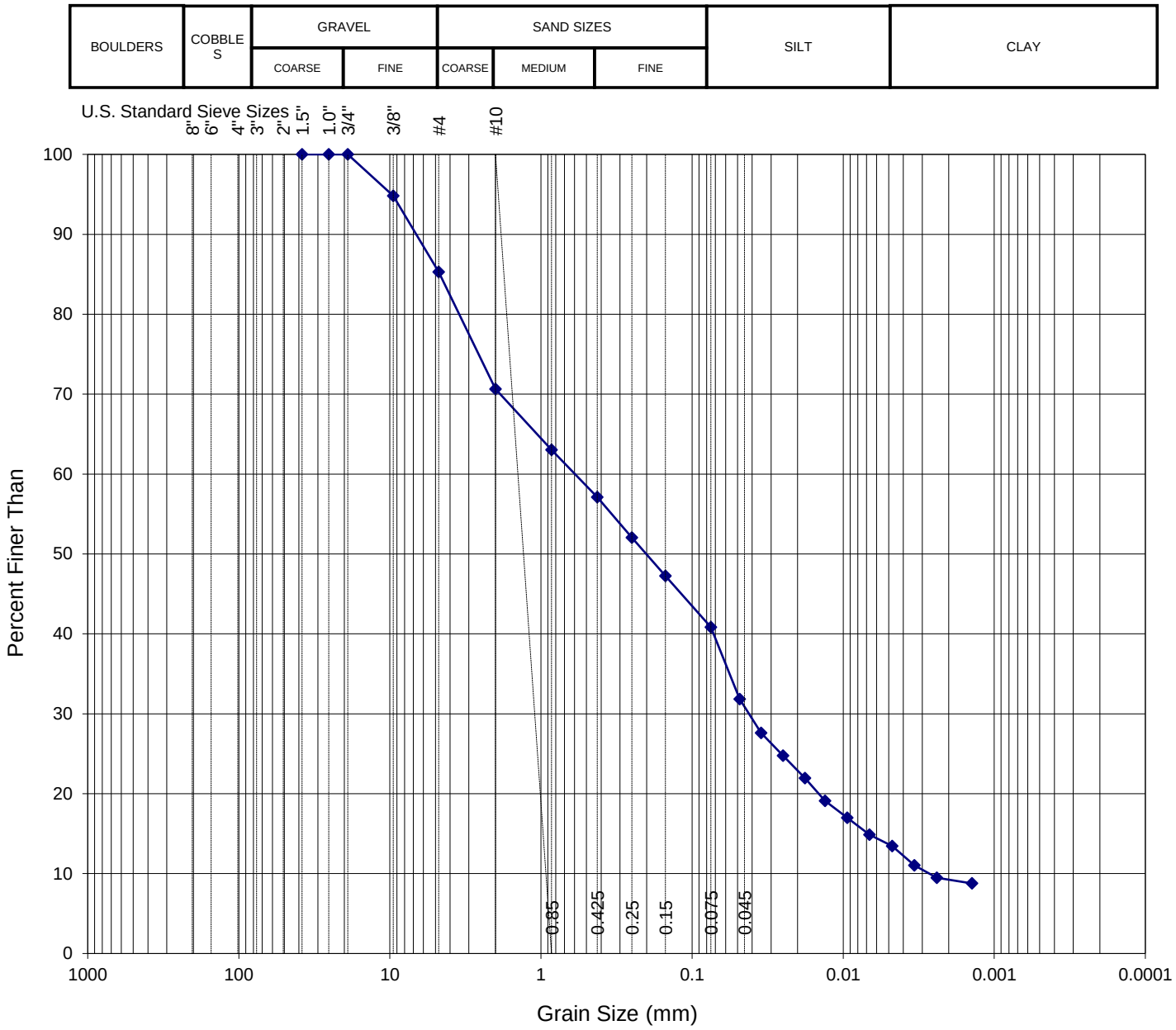
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	22.18	> 4.75
% COARSE SAND :	13.35	2.0 - 4.75
% MEDIUM SAND :	13.58	0.425 - 2.0
% FINE SAND :	15.98	0.075 - 0.425
% SILT :	21.79	0.075 - 0.005
% CLAY :	13.12	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364005
Project Number:	
Client Sample ID	22-S4-S-01
Lab Sample ID	VA22C2364005
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

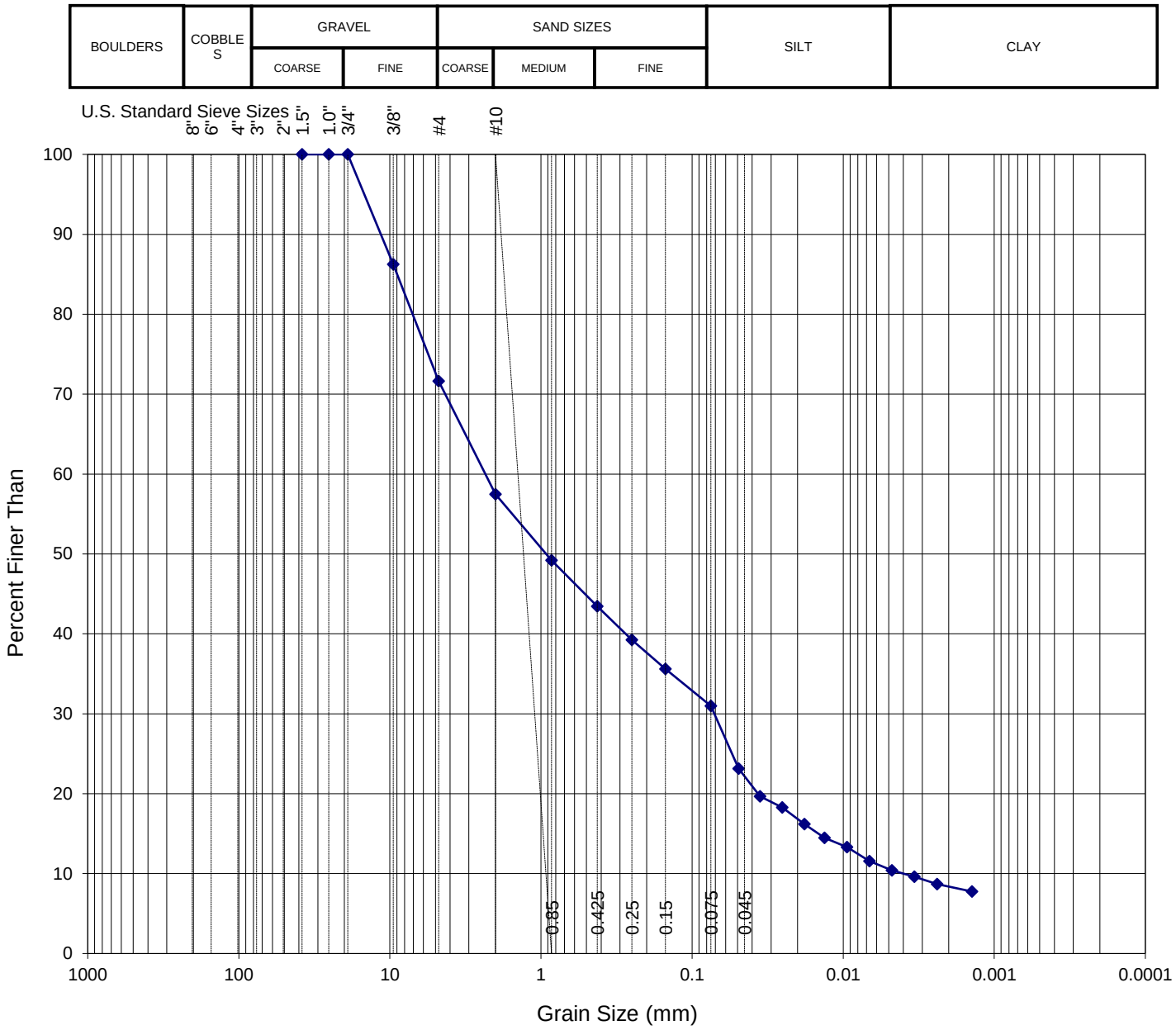
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	14.70	> 4.75
% COARSE SAND :	14.65	2.0 - 4.75
% MEDIUM SAND :	13.54	0.425 - 2.0
% FINE SAND :	16.26	0.075 - 0.425
% SILT :	27.18	0.075 - 0.005
% CLAY :	13.67	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364006
Project Number:	
Client Sample ID	22-S2-S-01
Lab Sample ID	VA22C2364006
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

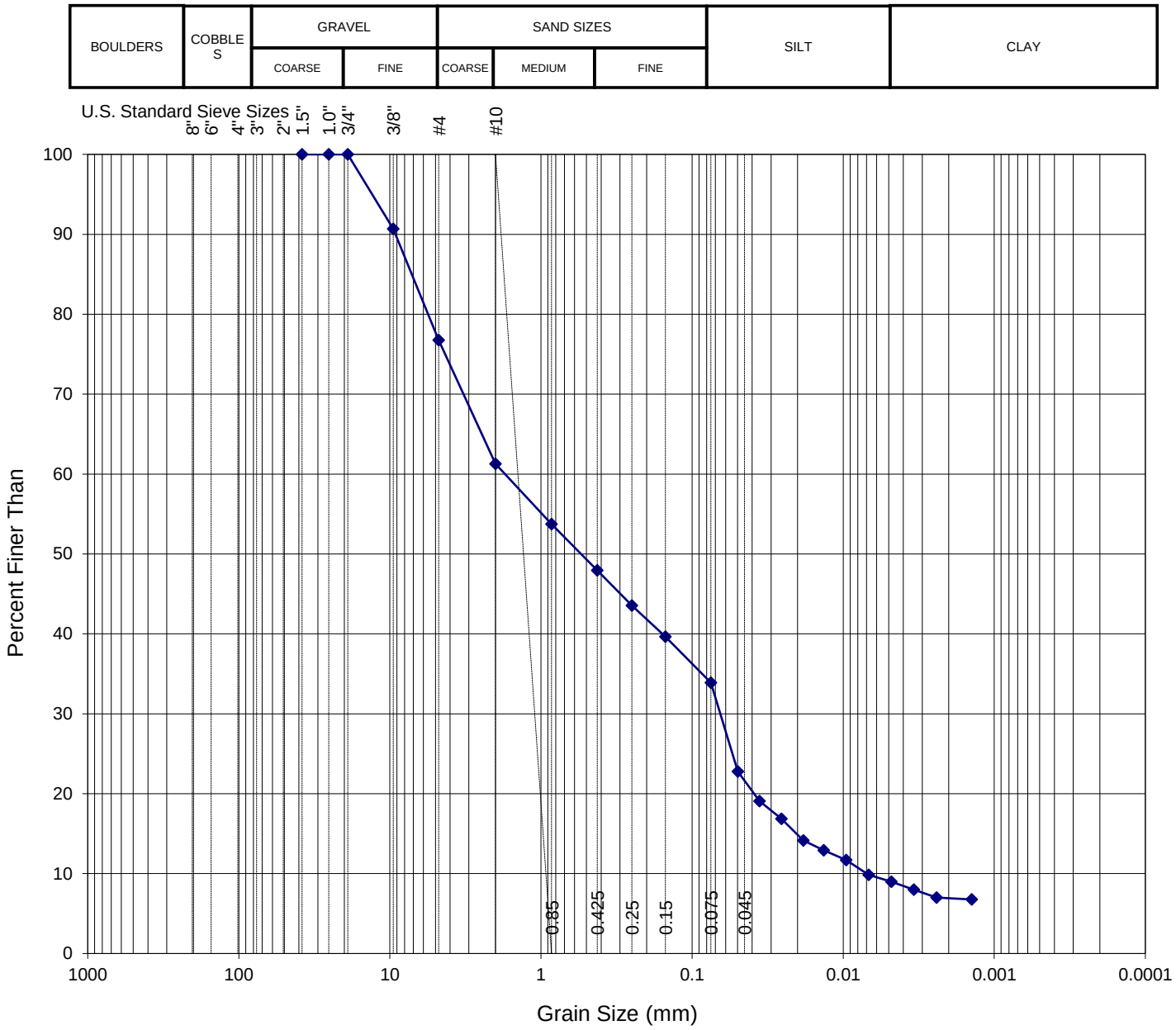
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	28.37	> 4.75
% COARSE SAND :	14.17	2.0 - 4.75
% MEDIUM SAND :	14.00	0.425 - 2.0
% FINE SAND :	12.48	0.075 - 0.425
% SILT :	20.39	0.075 - 0.005
% CLAY :	10.59	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364007
Project Number:	
Client Sample ID	22-S1-S-01
Lab Sample ID	VA22C2364007
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

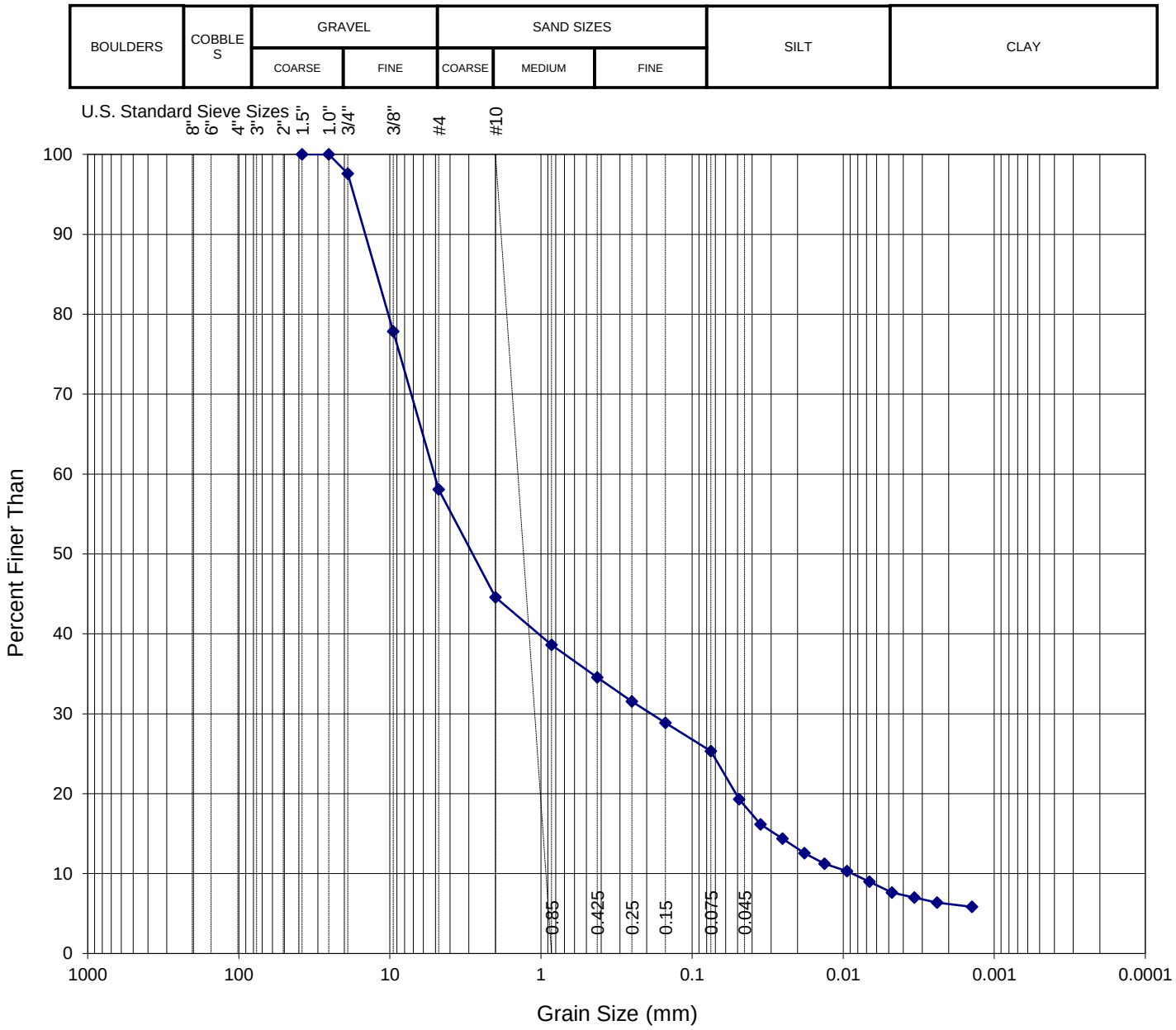
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	23.24	> 4.75
% COARSE SAND :	15.48	2.0 - 4.75
% MEDIUM SAND :	13.32	0.425 - 2.0
% FINE SAND :	14.07	0.075 - 0.425
% SILT :	24.80	0.075 - 0.005
% CLAY :	9.09	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2364008
Project Number:
Client Sample ID 22-R4-S-01
Lab Sample ID VA22C2364008
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH



METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

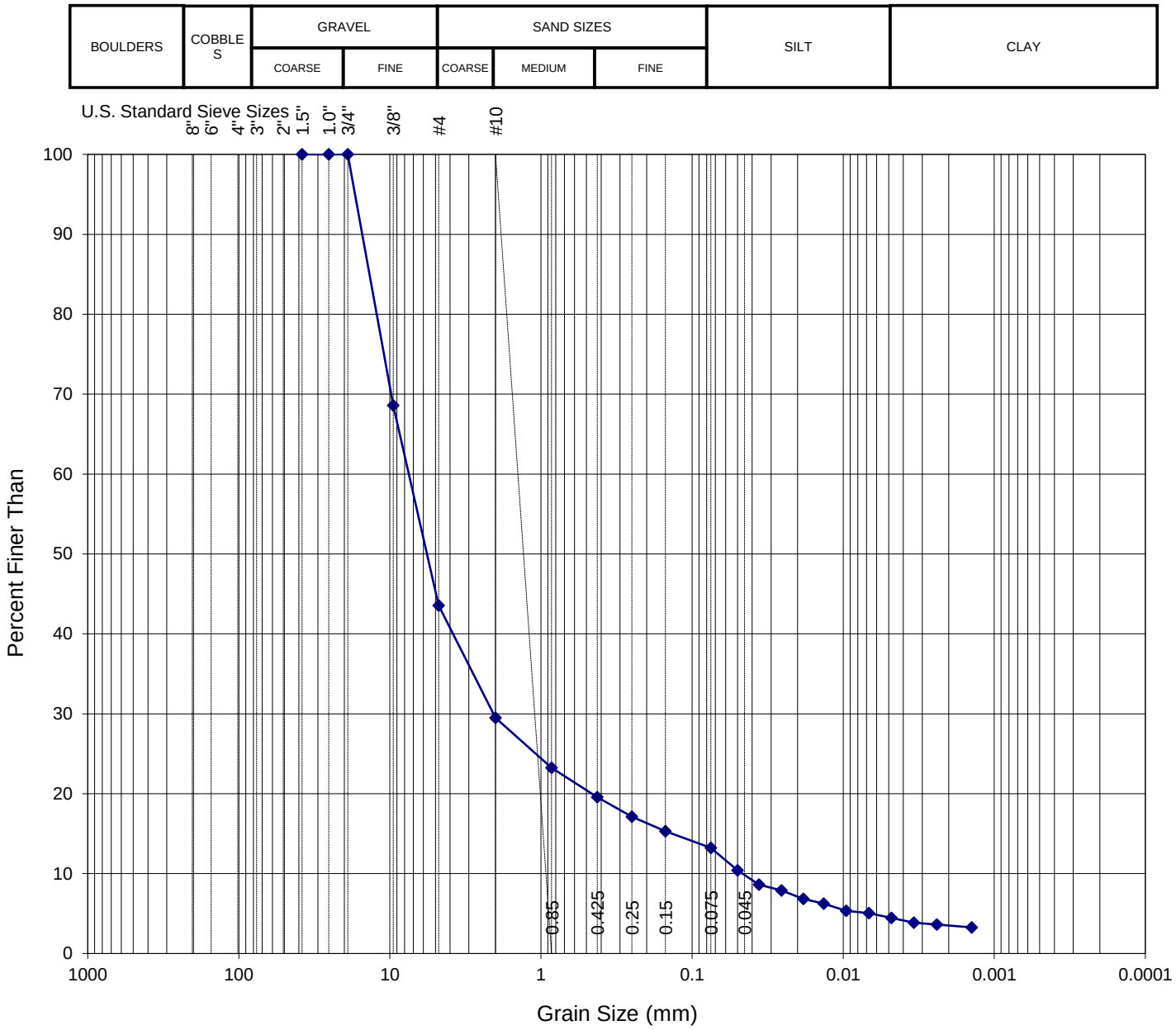
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	41.92	> 4.75
% COARSE SAND :	13.51	2.0 - 4.75
% MEDIUM SAND :	10.02	0.425 - 2.0
% FINE SAND :	9.24	0.075 - 0.425
% SILT :	17.49	0.075 - 0.005
% CLAY :	7.82	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364009
Project Number:	
Client Sample ID	22-R5-S-01
Lab Sample ID	VA22C2364009
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

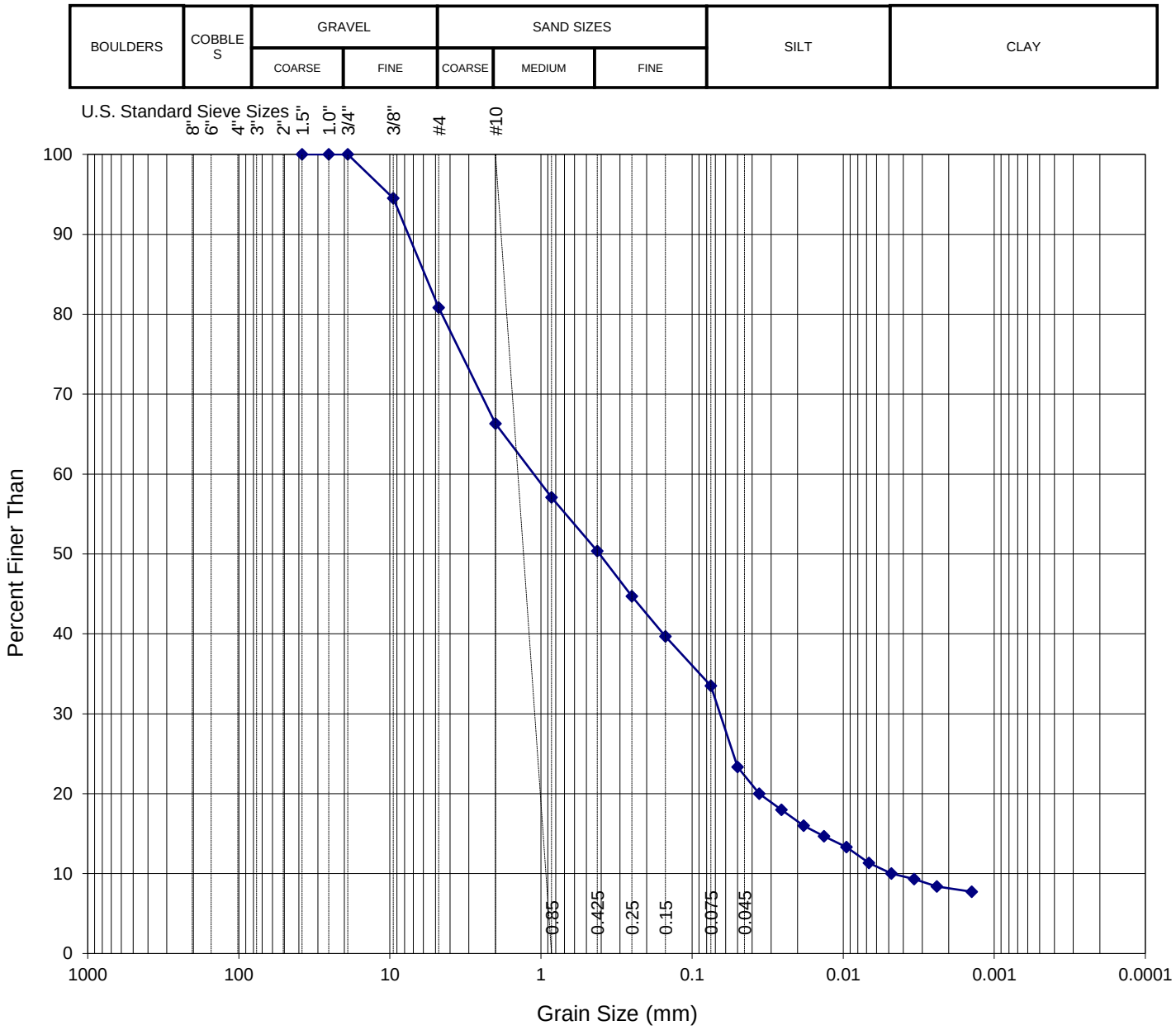
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	56.46	> 4.75
% COARSE SAND :	14.03	2.0 - 4.75
% MEDIUM SAND :	9.92	0.425 - 2.0
% FINE SAND :	6.35	0.075 - 0.425
% SILT :	8.70	0.075 - 0.005
% CLAY :	4.53	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2364010
Project Number:	
Client Sample ID	22-R6-S-01
Lab Sample ID	VA22C2364010
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	19.18	> 4.75
% COARSE SAND :	14.51	2.0 - 4.75
% MEDIUM SAND :	15.95	0.425 - 2.0
% FINE SAND :	16.86	0.075 - 0.425
% SILT :	23.33	0.075 - 0.005
% CLAY :	10.16	< 0.005

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686092

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [ ] EXCEL [X] EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lundquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	[X] Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days) 4 day [P4-20%]	[ ]
3 day [P3-25%]	[ ]
2 day [P2-50%]	[ ]
EMERGENCY 1 Business day [E-100%]	[ ]
Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	[ ]
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Invoice To		
	Same as Report To	YES [ ] NO [X]
	Copy of Invoice with Report	YES [ ] NO [ ]
Company:	Mount Polley Mining Corp	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008044
LSD:	

Oil and Gas Required Fields (client use)		
AFE/Cost Center:		PO#
Major/Minor Code:		Routing Code:
Requisitioner:		
Location:		

ALS Lab Work Order # (lab use only): 2364

ALS Contact: Amber Springer

Sampler: Samantha Lundquist

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Organic Matter	TOC	Total N & Kjeldahl N	Available P, K, SO4	Particle Size	Moisture	Conductivity	Sodium Absorption Ratio	pH (CaCl2)	Soluble Na, Cl, Ca, Mg	Soluble K, SO4	Theoretical Gypsum Req	Total Metals	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-S17-S-01	14-Sep-22	16:15	Soil																3
	22-S16-S-01	"	17:00	"																"
	22-S6-S-01	15-Sep-22	8:10	"																"
	22-S5-S-01	"	9:10	"																"
	22-S4-S-01	"	10:00	"																"
	22-S2-S-01	"	11:30	"																"
	22-S1-S-01	"	12:20	"																"
	22-R4-S-01	"	13:45	"																"
	22-R5-S-01	"	14:45	"																"
	22-R6-S-01	"	15:40	"																"

Environmental Division
Vancouver
Work Order Reference
VA22C2364

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? YES [ ] NO [X]

Are samples for human consumption/ use? YES [ ] NO [X]

report by clicking on the drop-down list below
COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]
Ice Packs [X] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]
Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
S. Lundquist	Sept 17, 2022	14:30				JC	17 Sep 22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2367**	Page	: 1 of 6
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686093	Issue Date	: 30-Sep-2022 10:05
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Caitlin Macey	Team Leader - Inorganics	Inorganics, Burnaby, British Columbia
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan
Hedy Lai	Team Leader - Inorganics	Sask Soils, Saskatoon, Saskatchewan
Janice Leung	Supervisor - Organics Instrumentation	Organics, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Nancy Cruse	Laboratory Assistant	Inorganics, Saskatoon, Saskatchewan
Nancy Cruse	Laboratory Assistant	Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances
LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
dS/m	decisiemens per metre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
pH units	pH units
t/ha	tonnes per hectare

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLIS	*Detection Limit Adjusted due to insufficient sample.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Physical Tests										
loss on ignition @ 550°C	----	E205D	1.0	%		9.2	8.3	6.3	6.1	5.3
moisture	----	E144	0.25	%		16.0	13.3	8.46	9.27	7.02
pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units		6.46	6.35	5.71	5.64	5.90
pH (1:2 soil:water)	----	E108	0.10	pH units		7.01	6.90	6.49	6.48	6.64
ash content @ 550°C	----	E205D	1.0	%		90.8	91.7	93.7	93.8	94.7
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		72.0	83.8	81.6	85.3	87.5
passing (4.75 mm)	----	E181	1.0	%		58.0	67.0	68.3	70.8	74.5
passing (19 mm)	----	E181	1.0	%		94.1	100	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		38.4	43.6	43.4	47.5	50.4
passing (0.841 mm)	----	E182	1.0	%		37.4	42.4	42.2	46.2	49.1
passing (0.50 mm)	----	E182	1.0	%		33.5	37.9	36.5	40.1	43.3
passing (0.420 mm)	----	E182	1.0	%		32.5	36.7	35.1	38.6	41.9
passing (0.250 mm)	----	E182	1.0	%		28.9	32.5	30.1	33.2	36.5
passing (0.149 mm)	----	E182	1.0	%		26.0	28.8	26.1	28.8	31.8
passing (0.125 mm)	----	E182	1.0	%		24.6	27.4	24.5	27.0	29.8
passing (0.075 mm)	----	E182	1.0	%		21.7	24.5	21.0	23.0	25.7
passing (0.063 mm)	----	E182	1.0	%		18.6	21.6	19.2	21.0	24.3
passing (0.05 mm)	----	E182	1.0	%		15.2	18.4	17.1	19.0	22.9
passing (0.0312 mm)	----	E183	1.0	%		12.1	13.8	15.0	16.2	19.7
passing (0.020 mm)	----	E183	1.0	%		10.1	12.0	13.0	14.4	17.4
passing (0.005 mm)	----	E183	1.0	%		6.3	7.8	7.7	9.6	11.3
passing (0.004 mm)	----	E183	1.0	%		6.0	7.1	7.3	8.9	10.5
passing (0.002 mm)	----	E183	1.0	%		5.6	6.5	6.1	7.3	9.1
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Particle Size										
passing (2.0 mm)	----	E181	1.0	%		44.4	50.6	50.3	55.3	58.4
Anions and Nutrients										
nitrogen, total	7727-37-9	E366	0.020	%		0.526	0.368	0.117	0.107	0.117
Organic / Inorganic Carbon										
carbon, total [TC]	----	E351	0.050	%		4.72	3.27	2.31	2.05	1.93
carbon, inorganic [IC]	----	E354	0.050	%		0.209	0.174	0.097	0.099	0.100
carbon, inorganic [IC], (as CaCO3 equivalent)	----	E354	0.40	%		1.74	1.45	0.81	0.83	0.84
carbon, total organic [TOC]	----	EC356	0.050	%		4.51	3.10	2.21	1.95	1.83
organic matter	----	EC356	0.10	%		7.78	5.34	3.81	3.36	3.15
Plant Available Nutrients										
phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg		222	247	12.5	11.7	10.3
potassium, available	7440-09-7	E390	20	mg/kg		197	221	86	82	102
sulfate, available (as S)	14808-79-8	E497.SO4	3.0	mg/kg		9.1	7.5	<3.0	<3.0	3.6
nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg		<1.0	1.2	<1.0	<1.0	<1.0
Saturated Paste Extractables										
conductivity, saturated paste	----	E102	0.030	dS/m		0.208	0.199	0.077	0.064	0.129
sodium adsorption ratio [SAR]	----	EC102	0.10	-		<0.10	0.15	<0.10	0.16	<0.10
pH, saturated paste	----	E114	0.10	pH units		7.06	6.85	6.18	6.19	6.37
TGR (brine)	----	EC106	0.1	t/ha		Incalcuable	----	Incalcuable	----	Incalcuable
TGR (brine)	----	EC106	0.10	t/ha		----	<0.10	----	<0.10	----
TGR (sodic)	----	EC106	0.10	t/ha		<0.10	<0.10	<0.10	<0.10	<0.10
% saturation	----	E141	1.0	%		66.4	66.1	43.1	48.1	40.4
calcium, soluble ion content	7440-70-2	EC442	0.30	mg/kg		21.0	17.0	4.65	4.62	7.60
calcium, soluble ion content	7440-70-2	E442	0.60	mg/L		31.7	25.8	10.8	9.61	18.8
magnesium, soluble ion content	7439-95-4	EC442	0.50	mg/kg		2.39	2.05	0.86	0.91	1.05
magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L		3.6	3.1	2.0	1.9	2.6
potassium, soluble ion content	7440-09-7	EC442	2.0	mg/kg		5.9	8.4	<2.0	<2.0	<2.0
potassium, soluble ion content	7440-09-7	E442	4.0	mg/L		8.9	12.7	<4.0	<4.0	<4.0
sodium, soluble ion content	17341-25-2	EC442	1.00	mg/kg		<1.33	1.98	<1.00	1.01	<1.00
sodium, soluble ion content	17341-25-2	E442	2.0	mg/L		<2.0	3.0	<2.0	2.1	<2.0
chloride, soluble ion content	16887-00-6	EC239A.Cl	1.0	mg/kg		<13.3	<13.2	<8.6	<9.6	<8.1

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Saturated Paste Extractables										
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L		<20	<20	<20	<20	<20
sulfate, soluble ion content	14808-79-8	EC239A.SO4	2.5	mg/kg		9.8	10.9	<2.5	<2.5	6.7
sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L		14.8	16.5	<5.0	<5.0	16.5
nitrate (as N), soluble ion content	14797-55-8	EC239A.NO3	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L		<0.5	<0.5	<0.5	<0.5	<0.5
alkalinity, bicarbonate (as CaCO3)	----	EC293	2.0	mg/kg		51.8	46.9	6.9	6.2	<2.0
alkalinity, bicarbonate (as CaCO3)	----	E293	10	mg/L		78	71	16	13	<25 DLIS
alkalinity, carbonate (as CaCO3)	----	EC293	2.0	mg/kg		<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, carbonate (as CaCO3)	----	E293	5.0	mg/L		<10.0 DLIS	<10.0 DLIS	<12.5 DLIS	<12.5 DLIS	<25.0 DLIS
alkalinity, total (as CaCO3)	----	EC293	2.0	mg/kg		51.8	46.9	6.9	6.2	<2.0
alkalinity, total (as CaCO3)	----	E293	10	mg/L		78	71	16	13	<25 DLIS
Metals										
aluminum	7429-90-5	E440	50	mg/kg		17400	16500	18100	15900	17200
antimony	7440-36-0	E440	0.10	mg/kg		0.80	0.74	1.22	1.01	0.87
arsenic	7440-38-2	E440	0.10	mg/kg		13.1	11.8	15.8	14.0	14.4
barium	7440-39-3	E440	0.50	mg/kg		230	223	136	135	152
beryllium	7440-41-7	E440	0.10	mg/kg		0.56	0.49	0.60	0.51	0.55
bismuth	7440-69-9	E440	0.20	mg/kg		6.25	5.15	<0.20	<0.20	<0.20
boron	7440-42-8	E440	5.0	mg/kg		8.0	7.0	6.5	6.0	7.2
cadmium	7440-43-9	E440	0.020	mg/kg		0.669	0.624	0.279	0.259	0.240
calcium	7440-70-2	E440	50	mg/kg		18000	15600	12000	10700	10600
chromium	7440-47-3	E440	0.50	mg/kg		22.8	23.2	25.8	22.1	26.2
cobalt	7440-48-4	E440	0.10	mg/kg		14.8	14.6	14.4	12.7	13.7
copper	7440-50-8	E440	0.50	mg/kg		713	633	479	410	372
iron	7439-89-6	E440	50	mg/kg		40000	37400	38200	34300	36400
lead	7439-92-1	E440	0.50	mg/kg		19.1	16.3	7.89	6.54	9.13
lithium	7439-93-2	E440	2.0	mg/kg		13.8	13.8	18.7	16.9	17.6
magnesium	7439-95-4	E440	20	mg/kg		8800	8720	8010	7540	7720
manganese	7439-96-5	E440	1.0	mg/kg		902	828	891	747	922
mercury	7439-97-6	E510	0.0050	mg/kg		0.334	0.255	0.114	0.0935	0.109
molybdenum	7439-98-7	E440	0.10	mg/kg		3.79	3.40	3.90	3.18	2.54

Analytical Results

Sub-Matrix: **Soil**
(Matrix: **Soil/Solid**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-S-01	22-A5-S-01	22-S15-S-01	22-S15-S-01D	22-S10-S-01
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 11:00
						VA22C2367-001	VA22C2367-002	VA22C2367-003	VA22C2367-004	VA22C2367-005
						Result	Result	Result	Result	Result
Metals										
nickel	7440-02-0	E440	0.50	mg/kg		14.6	13.1	15.5	14.1	15.0
phosphorus	7723-14-0	E440	50	mg/kg		3860	3350	1140	958	1090
potassium	7440-09-7	E440	100	mg/kg		1370	1430	1050	960	1150
selenium	7782-49-2	E440	0.20	mg/kg		1.52	1.18	0.27	0.24	0.28
silver	7440-22-4	E440	0.10	mg/kg		1.07	1.00	0.26	0.20	0.22
sodium	7440-23-5	E440	50	mg/kg		592	412	192	188	263
strontium	7440-24-6	E440	0.50	mg/kg		186	181	115	112	95.4
sulfur	7704-34-9	E440	1000	mg/kg		<1000	<1000	<1000	<1000	<1000
thallium	7440-28-0	E440	0.050	mg/kg		<0.050	<0.050	0.050	<0.050	<0.050
tin	7440-31-5	E440	2.0	mg/kg		6.4	5.4	<2.0	<2.0	<2.0
titanium	7440-32-6	E440	1.0	mg/kg		697	635	1170	1120	1030
tungsten	7440-33-7	E440	0.50	mg/kg		1.35	1.07	<0.50	<0.50	<0.50
uranium	7440-61-1	E440	0.050	mg/kg		0.704	0.610	1.10	0.881	0.766
vanadium	7440-62-2	E440	0.20	mg/kg		121	114	131	122	126
zinc	7440-66-6	E440	2.0	mg/kg		256	228	77.6	68.2	71.4
zirconium	7440-67-7	E440	1.0	mg/kg		1.1	1.1	3.8	3.6	3.6
Leachable Anions & Nutrients										
Kjeldahl nitrogen, total [TKN]	----	E319	0.020	%		0.446	0.455	0.118	<0.069 DLM	0.096

Please refer to the General Comments section for an explanation of any qualifiers detected.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2367**	Page	: 1 of 25
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 30-Sep-2022 10:05
C-O-C number	: 17-686093		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Duplicate outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Duplicate (DUP) RPDs								
Metals	Anonymous	Anonymous	mercury	7439-97-6	E510	58.6 % DUP-H	40%	Duplicate RPD does not meet the DQO for this test.

Result Qualifiers

Qualifier	Description
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-A4-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-A5-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S10-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S15-S-01	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Anions and Nutrients : Total Nitrogen by Combustion										
LDPE bag 22-S15-S-01D	E366	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	28 days	8 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-A4-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-A5-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S10-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S15-S-01	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Leachable Anions & Nutrients : Total Kjeldahl Nitrogen by Colourimetry										
LDPE bag 22-S15-S-01D	E319	16-Sep-2022	22-Sep-2022	----	----		23-Sep-2022	365 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-A4-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-A5-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S10-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S15-S-01	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Mercury in Soil/Solid by CVAAS										
Glass soil jar/Teflon lined cap 22-S15-S-01D	E510	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	28 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap 22-A4-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E440	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	180 days	10 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-A4-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-A5-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-S10-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-S15-S-01	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓
Organic / Inorganic Carbon : Total Carbon by Combustion										
LDPE bag										
22-S15-S-01D	E351	16-Sep-2022	24-Sep-2022	----	----		24-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-A4-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-A5-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S10-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S15-S-01	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Organic / Inorganic Carbon : Total Inorganic Carbon by Acetic Acid pH Standard Curve										
LDPE bag 22-S15-S-01D	E354	16-Sep-2022	----	----	----		23-Sep-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-A4-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-A5-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S10-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S15-S-01	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
LDPE bag 22-S15-S-01D	E185	16-Sep-2022	----	----	----		29-Sep-2022	365 days	----	
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-A4-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-A5-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S10-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S15-S-01	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
LDPE bag 22-S15-S-01D	E183	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-A4-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-A5-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S10-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S15-S-01	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
LDPE bag 22-S15-S-01D	E182	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-A4-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-A5-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S10-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S15-S-01	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
LDPE bag 22-S15-S-01D	E181	16-Sep-2022	21-Sep-2022	----	----		21-Sep-2022	365 days	5 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-A4-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-A5-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S10-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S15-S-01	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Loss On Ignition (550°C)										
LDPE bag 22-S15-S-01D	E205D	16-Sep-2022	----	----	----		22-Sep-2022	365 days	6 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-A4-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-A5-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S10-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S15-S-01	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap 22-S15-S-01D	E144	16-Sep-2022	----	----	----		25-Sep-2022	----	----	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-A4-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-A5-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S10-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S15-S-01	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)										
LDPE bag 22-S15-S-01D	E108B	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	30 days	0 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-A4-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-A5-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S10-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S15-S-01	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓
Physical Tests : pH by Meter (1:2 Soil:Water Extraction)										
Glass soil jar/Teflon lined cap 22-S15-S-01D	E108	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	30 days	10 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-A4-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-A5-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S10-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S15-S-01	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride										
LDPE bag 22-S15-S-01D	E269.N+N	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	3 days	7 days	× EHT
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-A4-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-A5-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S10-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S15-S-01	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Phosphorus by FIALab (Modified Kelowna)										
LDPE bag 22-S15-S-01D	E384	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-A4-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-A5-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S10-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S15-S-01	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Potassium by flame photometry (Modified Kelowna)										
LDPE bag 22-S15-S-01D	E390	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	7 days	✓
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-A4-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag 22-A5-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S10-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S15-S-01	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Plant Available Nutrients : Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)										
LDPE bag										
22-S15-S-01D	E497.SO4	16-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	----	0 days	
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Alkalinity Species by Titration (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E293	16-Sep-2022	26-Sep-2022	----	----		27-Sep-2022	14 days	1 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E442	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E442	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	0 days	✓
Saturated Paste Extractables : Chloride by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E239.Cl	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E102	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Conductivity in Soil (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E102	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	28 days	1 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	10 days	× EHT	27-Sep-2022	3 days	0 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Nitrate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E239.NO3	16-Sep-2022	26-Sep-2022	3 days	11 days	× EHT	27-Sep-2022	3 days	0 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	10 days	✓
Saturated Paste Extractables : pH by Meter (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E114	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	365 days	11 days	✓
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Saturation Percentage										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E141	16-Sep-2022	26-Sep-2022	----	----		26-Sep-2022	----	0 days	
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A5-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S10-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-S15-S-01D	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	10 days	✓	27-Sep-2022	180 days	0 days	✓
Saturated Paste Extractables : Sulfate by IC (Saturated Paste)										
Glass soil jar/Teflon lined cap										
22-A4-S-01	E239.SO4	16-Sep-2022	26-Sep-2022	365 days	11 days	✓	27-Sep-2022	180 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	661785	1	18	5.5	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	661887	1	18	5.5	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	661886	1	14	7.1	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	661786	1	7	14.2	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659686	1	7	14.2	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660592	1	11	9.0	5.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	664230	1	18	5.5	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662076	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	664231	1	18	5.5	5.0	✓
Laboratory Control Samples (LCS)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	661785	2	18	11.1	10.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	661887	2	18	11.1	10.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	661886	2	14	14.2	10.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	661786	2	7	28.5	10.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	2	15	13.3	10.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	2	15	13.3	10.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	2	15	13.3	10.0	✓
Loss On Ignition (550°C)	E205D	659686	1	7	14.2	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	2	15	13.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	2	15	13.3	10.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓

Matrix: **Soil/Solid**

Evaluation: × = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	658739	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	658740	1	15	6.6	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	658741	1	15	6.6	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B	660592	2	11	18.1	10.0	✓
pH by Meter (1:2 Soil:Water Extraction)	E108	664998	1	15	6.6	5.0	✓
pH by Meter (Saturated Paste)	E114	665004	2	15	13.3	10.0	✓
Saturation Percentage	E141	665003	2	15	13.3	10.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	2	15	13.3	10.0	✓
Total Carbon by Combustion	E351	664230	2	18	11.1	10.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662076	2	19	10.5	10.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	2	19	10.5	10.0	✓
Total Nitrogen by Combustion	E366	664231	2	18	11.1	10.0	✓
Method Blanks (MB)							
Alkalinity Species by Titration (Saturated Paste)	E293	665006	1	15	6.6	5.0	✓
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N	661785	1	18	5.5	5.0	✓
Available Phosphorus by FIALab (Modified Kelowna)	E384	661887	1	18	5.5	5.0	✓
Available Potassium by flame photometry (Modified Kelowna)	E390	661886	1	14	7.1	5.0	✓
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4	661786	1	7	14.2	5.0	✓
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442	665007	1	15	6.6	5.0	✓
Chloride by IC (Saturated Paste)	E239.Cl	665002	1	15	6.6	5.0	✓
Conductivity in Soil (Saturated Paste)	E102	665005	1	15	6.6	5.0	✓
Loss On Ignition (550°C)	E205D	659686	1	7	14.2	5.0	✓
Mercury in Soil/Solid by CVAAS	E510	664996	1	15	6.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS	E440	664995	1	15	6.6	5.0	✓
Moisture Content by Gravimetry	E144	665008	1	15	6.6	5.0	✓
Nitrate by IC (Saturated Paste)	E239.NO3	665001	1	15	6.6	5.0	✓
Saturation Percentage	E141	665003	1	15	6.6	5.0	✓
Sulfate by IC (Saturated Paste)	E239.SO4	665000	1	15	6.6	5.0	✓
Total Carbon by Combustion	E351	664230	1	18	5.5	5.0	✓
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354	662076	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Colourimetry	E319	660214	1	19	5.2	5.0	✓
Total Nitrogen by Combustion	E366	664231	1	18	5.5	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (Saturated Paste)	E102 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)/AER D50	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a filtered extract from a soil sample prepared using the saturated paste procedure. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter (1:2 Soil:Water Extraction)	E108 Vancouver - Environmental	Soil/Solid	BC Lab Manual	pH is determined by potentiometric measurement with a pH electrode at ambient laboratory temperature (normally 20 ± 5°C), and is carried out in accordance with procedures described in the BC Lab Manual (prescriptive method). The procedure involves mixing the dried (at <60 ºC) and sieved (10mesh/2mm) sample with ultra pure water at a 1:2 ratio of sediment to water. The pH is then measured by a standard pH probe.
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction)	E108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
pH by Meter (Saturated Paste)	E114 Vancouver - Environmental	Soil/Solid	Carter-CSSS / APHA 4500 H	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) on a soil produced by the saturated paste extraction procedure.
Saturation Percentage	E141 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/AER D50	Saturation Percentage (SP) is determined as the total volume of water present in a saturated paste (in mL) divided by the dry weight of the sample (in grams), expressed as a percentage.
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.
Loss On Ignition (550°C)	E205D Saskatoon - Environmental	Soil/Solid	CSSS (2008) 28.3 (mod)	Loss On Ignition (LOI) is determined by drying a portion of an air dried and ground sample at 105°C overnight, then igniting at 550°C for 16-20 hours. The weight loss after ignition is reported as % loss on ignition. LOI is reported on a dry weight basis. LOI at 550°C can be used as an estimation of Organic Matter (CSSS 2008).
Chloride by IC (Saturated Paste)	E239.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste)	E239.NO3 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate by IC (Saturated Paste)	E239.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Available Nitrate and Nitrite by Colourimetry (0.01M Calcium Chloride Ext.)	E269.N+N Saskatoon - Environmental	Soil/Solid	Alberta Agriculture/APHA 4500-NO3 I (mod)	Plant available nitrate and nitrite are analyzed by colourimetry using a flow injection analyzer on a soil sample extract that has been extracted using 0.01M Calcium Chloride, then shaken well and filtered prior to analysis.
Alkalinity Species by Titration (Saturated Paste)	E293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Kjeldahl Nitrogen by Colourimetry	E319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of $CuSO_4$ and K_2SO_4 catalysts. Ammonia in the soil extract is determined colrimetrically at 660 nm.
Total Carbon by Combustion	E351 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2 (mod)	Total Carbon is determined by the high temperature combustion method with measurement by an infrared detector.
Total Inorganic Carbon by Acetic Acid pH Standard Curve	E354 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 20.2	Total Inorganic Carbon is determined by acetic acid pH standard curve, where a known quantity of acetic acid is consumed by reaction with carbonates in the soil. The pH of the resulting solution is measured and compared against a standard curve relating pH to weight of carbonate.
Total Nitrogen by Combustion	E366 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.4	The sample is ignited in a combustion analyzer where nitrogen in the reduced nitrous oxide gas is determined using a thermal conductivity detector.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Available Phosphorus by FIALab (Modified Kelowna)	E384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus is extracted from air dried soil using a fixed ratio Modified Kelowna extraction. Phosphorus is determined by colorimetry using an flow injection analyzer.
Available Potassium by flame photometry (Modified Kelowna)	E390 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available potassium is extracted from soil using modified Kelowna solution. Potassium is determined by flame emission at 770 nm.
Metals in Soil/Solid by CRC ICPMS	E440 Vancouver - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Ca, K, Mg, and Na by CRC ICPMS (Saturated Paste, mg/L)	E442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium and Sodium by Collision/Reaction Cell ICPMS as per "Soil Sampling Methods of Analysis" By M Carter.
Available Sulfate by ICPOES (0.01M Calcium Chloride Ext.)	E497.SO4 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available sulfate is determined by ICPOES. Soil is extracted using a 0.01M calcium chloride solution. This extraction may also produce organic sulfur in the extracts when organic soils are analyzed.
Mercury in Soil/Solid by CVAAS	E510 Vancouver - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO3 and HCl, followed by CVAAS analysis.
Sodium Adsorption Ratio (SAR) Saturated Paste	EC102 Vancouver - Environmental	Soil/Solid	CCME Sodium Adsorption Ratio (SAR)	The Sodium Adsorption Ratio (SAR) for a sample is calculated from the Sodium, Calcium, and Magnesium concentrations from sediment paste extract.
Theoretical Gypsum Requirements (TGR) Saturated Paste	EC106 Vancouver - Environmental	Soil/Solid	J. Ashworth et al (1999)	Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chloride by IC (Saturated Paste) (mg/kg)	EC239A.Cl Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate by IC (Saturated Paste) (mg/kg)	EC239A.NO3 Vancouver - Environmental	Soil/Solid	Calculation	Results are reported in mg/kg dry weight
Sulfate by IC (Saturated Paste) (mg/kg)	EC239A.SO4 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/EPA 300.1 (mod)	Inorganic anions are analyzed by obtaining a soil extract produced by the saturated paste extraction procedure which is then analyzed by Ion Chromatography with conductivity and/or UV detection.
Alkalinity Species by Titration (Saturated Paste) (mg/kg)	EC293 Vancouver - Environmental	Soil/Solid	CSSS Ch. 15/APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint on an extract produced by the saturated paste procedure. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Total Organic Carbon (Calculated) in soil	EC356 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 21.2	Total Organic Carbon (TOC) is calculated by the difference between total carbon (TC) and total inorganic carbon (TIC).
Ca, K, Mg, Na by ICPMS (Saturated Paste, mg/kg)	EC442 Vancouver - Environmental	Soil/Solid	CSSS CH15/EPA 6020B (mod)	A soil extract produced by the saturated paste extraction procedure is analyzed for Calcium, Magnesium, Potassium, Sodium by ICPMS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Vancouver - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2	EP108B Saskatoon - Environmental	Soil/Solid	CSSS (2008) 16.3	A 10g portion of dried (<60°C) and ground (10 mesh/2 mm) sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Fixed ratio 0.01M Calcium Chloride extraction for plant available nutrients	EP269 Saskatoon - Environmental	Soil/Solid	Alberta Agriculture	Plant available nutrients (N&S) extracted using 0.01M calcium chloride, then shaken well and filtered prior to analysis.
Kjeldahl Digestion for soils	EP319 Saskatoon - Environmental	Soil/Solid	CSSS (2008) 22.2.3	The soil is digested with sulfuric acid in the presence of CuSO4 and K2SO4 catalysts.
Modified Kelowna Extraction for soil	EP384 Saskatoon - Environmental	Soil/Solid	Comm. Soil Sci. Plant Anal, 25 (5&6)	Plant available phosphorus and potassium are extracted from the soil using fixed ratio Modified Kelowna solution.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Digestion for Metals and Mercury	EP440 Vancouver - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are dried, then sieved through a 2 mm sieve, and digested with HNO_3 and HCl. This method is intended to liberate metals that may be environmentally available.
Dry and Grind	EPP442 Saskatoon - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

QUALITY CONTROL REPORT

Work Order	: **VA22C2367**	Page	: 1 of 14
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: 17-686093	Issue Date	: 30-Sep-2022 10:05
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 5		
No. of samples analysed	: 5		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
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Nancy Cruse	Laboratory Assistant	Saskatoon Sask Soils, Saskatoon, Saskatchewan
Qammar Almas	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 659686)											
VA22C2364-009	Anonymous	loss on ignition @ 550°C	----	E205D	1.0	%	12.5	13.1	4.64%	20%	----
Physical Tests (QC Lot: 660592)											
VA22C2364-009	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108B	0.10	pH units	4.89	4.91	0.408%	10%	----
Physical Tests (QC Lot: 664998)											
VA22C2364-001	Anonymous	pH (1:2 soil:water)	----	E108	0.10	pH units	7.10	7.19	1.3%	5%	----
Physical Tests (QC Lot: 665008)											
VA22C2364-001	Anonymous	moisture	----	E144	0.25	%	3.90	3.96	1.55%	20%	----
Particle Size (QC Lot: 658739)											
VA22C2364-001	Anonymous	passing (0.002 mm)	----	E183	1.0	%	8.7	9.8	1.0	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	11.2	12.0	7.31%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	12.1	13.2	8.70%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	19.9	20.6	3.28%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	23.3	23.7	1.75%	20%	----
Particle Size (QC Lot: 658740)											
VA22C2364-001	Anonymous	passing (0.05 mm)	----	E182	1.0	%	28.8	28.7	0.134%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	32.2	32.0	0.487%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	35.3	35.0	0.754%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	39.3	39.2	0.312%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	41.3	41.2	0.131%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	46.0	46.1	0.254%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	51.4	51.6	0.390%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	52.7	52.9	0.293%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	58.1	58.0	0.112%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	59.3	59.2	0.101%	15%	----
Anions and Nutrients (QC Lot: 664231)											
VA22C2367-002	22-A5-S-01	nitrogen, total	7727-37-9	E366	0.020	%	0.368	0.405	9.57%	20%	----
Organic / Inorganic Carbon (QC Lot: 662076)											
EO2207816-001	Anonymous	carbon, inorganic [IC]	----	E354	0.050	%	4.39	4.24	3.66%	20%	----
Organic / Inorganic Carbon (QC Lot: 664230)											
VA22C2367-002	22-A5-S-01	carbon, total [TC]	----	E351	0.050	%	3.27	3.56	8.70%	20%	----
Plant Available Nutrients (QC Lot: 661785)											

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Plant Available Nutrients (QC Lot: 661785) - continued											
YL2201594-002	Anonymous	nitrate + nitrite, available (as N)	----	E269.N+N	1.0	mg/kg	1.4	1.7	0.3	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661786)											
VA22C2364-009	Anonymous	sulfate, available (as S)	14808-79-8	E497.SO4	7.4	mg/kg	9.5	8.1	1.4	Diff <2x LOR	----
Plant Available Nutrients (QC Lot: 661886)											
FC2202278-001	Anonymous	potassium, available	7440-09-7	E390	20	mg/kg	269	271	0.629%	30%	----
Plant Available Nutrients (QC Lot: 661887)											
FC2202278-001	Anonymous	phosphate, available (as P)	14265-44-2	E384	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665000)											
VA22C2364-001	Anonymous	sulfate, soluble ion content	14808-79-8	E239.SO4	5.0	mg/L	29.5	26.3	3.2	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665001)											
VA22C2364-001	Anonymous	nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	<0.5	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665002)											
VA22C2364-001	Anonymous	chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	<20	0	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665003)											
VA22C2364-001	Anonymous	% saturation	----	E141	1.0	%	47.4	46.0	3.02%	20%	----
Saturated Paste Extractables (QC Lot: 665004)											
VA22C2364-001	Anonymous	pH, saturated paste	----	E114	0.10	pH units	6.90	6.96	0.866%	5%	----
Saturated Paste Extractables (QC Lot: 665005)											
VA22C2364-001	Anonymous	conductivity, saturated paste	----	E102	30	µS/cm	0.222 dS/m	230	8	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665006)											
VA22C2364-001	Anonymous	alkalinity, total (as CaCO3)	----	E293	12	mg/L	57	58	1	Diff <2x LOR	----
Saturated Paste Extractables (QC Lot: 665007)											
VA22C2364-001	Anonymous	calcium, soluble ion content	7440-70-2	E442	0.60	mg/L	35.3	34.8	1.63%	30%	----
		magnesium, soluble ion content	7439-95-4	E442	1.0	mg/L	3.7	3.8	0.08	Diff <2x LOR	----
		potassium, soluble ion content	7440-09-7	E442	4.0	mg/L	<4.0	<4.0	0	Diff <2x LOR	----
		sodium, soluble ion content	17341-25-2	E442	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Metals (QC Lot: 664995)											
VA22C2364-001	Anonymous	aluminum	7429-90-5	E440	50	mg/kg	17700	18300	3.11%	40%	----
		antimony	7440-36-0	E440	0.10	mg/kg	0.58	0.47	0.10	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.10	mg/kg	10.0	10.4	4.08%	30%	----
		barium	7440-39-3	E440	0.50	mg/kg	90.6	88.0	2.86%	40%	----
		beryllium	7440-41-7	E440	0.10	mg/kg	0.57	0.57	0.0008	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.20	mg/kg	0.28	0.25	0.03	Diff <2x LOR	----
		boron	7440-42-8	E440	5.0	mg/kg	6.0	5.8	0.3	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.020	mg/kg	0.298	0.327	9.41%	30%	----

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 664995) - continued											
VA22C2364-001	Anonymous	calcium	7440-70-2	E440	50	mg/kg	9950	10800	8.69%	30%	----
		chromium	7440-47-3	E440	0.50	mg/kg	33.2	36.2	8.47%	30%	----
		cobalt	7440-48-4	E440	0.10	mg/kg	14.0	15.4	9.71%	30%	----
		copper	7440-50-8	E440	0.50	mg/kg	254	243	4.49%	30%	----
		iron	7439-89-6	E440	50	mg/kg	34100	35300	3.49%	30%	----
		lead	7439-92-1	E440	0.50	mg/kg	8.31	8.22	1.09%	40%	----
		lithium	7439-93-2	E440	2.0	mg/kg	16.9	17.7	4.68%	30%	----
		magnesium	7439-95-4	E440	20	mg/kg	7880	8760	10.6%	30%	----
		manganese	7439-96-5	E440	1.0	mg/kg	800	832	3.83%	30%	----
		molybdenum	7439-98-7	E440	0.10	mg/kg	2.04	2.00	1.88%	40%	----
		nickel	7440-02-0	E440	0.50	mg/kg	21.1	26.4	22.2%	30%	----
		phosphorus	7723-14-0	E440	50	mg/kg	1070	1120	4.01%	30%	----
		potassium	7440-09-7	E440	100	mg/kg	1100	1070	3.23%	40%	----
		selenium	7782-49-2	E440	0.20	mg/kg	0.35	0.33	0.02	Diff <2x LOR	----
		silver	7440-22-4	E440	0.10	mg/kg	0.26	0.25	0.006	Diff <2x LOR	----
		sodium	7440-23-5	E440	50	mg/kg	342	390	13.0%	40%	----
		strontium	7440-24-6	E440	0.50	mg/kg	142	144	1.24%	40%	----
		sulfur	7704-34-9	E440	1000	mg/kg	<1000	<1000	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.050	mg/kg	<0.050	0.053	0.003	Diff <2x LOR	----
		tin	7440-31-5	E440	2.0	mg/kg	<2.0	<2.0	0	Diff <2x LOR	----
		titanium	7440-32-6	E440	1.0	mg/kg	1020	1020	0.00286%	40%	----
		tungsten	7440-33-7	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.050	mg/kg	0.664	0.808	19.5%	30%	----
		vanadium	7440-62-2	E440	0.20	mg/kg	110	118	6.69%	30%	----
		zinc	7440-66-6	E440	2.0	mg/kg	75.1	75.4	0.360%	30%	----
		zirconium	7440-67-7	E440	1.0	mg/kg	4.8	4.9	0.2	Diff <2x LOR	----
Metals (QC Lot: 664996)											
VA22C2364-001	Anonymous	mercury	7439-97-6	E510	0.0050	mg/kg	0.274	0.150	58.6%	40%	DUP-H
Leachable Anions & Nutrients (QC Lot: 660214)											
VA22C2359-006	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E319	730	mg/kg	0.090 %	<730	900	Diff <2x LOR	----

Qualifiers

Qualifier	*Description*
DUP-H	*Duplicate results outside ALS DQO, due to sample heterogeneity.*

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 665008)						
moisture	----	E144	0.25	%	<0.25	----
Anions and Nutrients (QCLot: 664231)						
nitrogen, total	7727-37-9	E366	0.02	%	<0.020	----
Organic / Inorganic Carbon (QCLot: 662076)						
carbon, inorganic [IC]	----	E354	0.05	%	<0.050	----
Organic / Inorganic Carbon (QCLot: 664230)						
carbon, total [TC]	----	E351	0.05	%	<0.050	----
Plant Available Nutrients (QCLot: 661785)						
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	<1.0	----
Plant Available Nutrients (QCLot: 661786)						
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	<3.0	----
Plant Available Nutrients (QCLot: 661886)						
potassium, available	7440-09-7	E390	20	mg/kg	<20	----
Plant Available Nutrients (QCLot: 661887)						
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	<2.0	----
Saturated Paste Extractables (QCLot: 665000)						
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	<5.0	----
Saturated Paste Extractables (QCLot: 665001)						
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	<0.5	----
Saturated Paste Extractables (QCLot: 665002)						
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	<20	----
Saturated Paste Extractables (QCLot: 665003)						
% saturation	----	E141	1	%	50.0	----
Saturated Paste Extractables (QCLot: 665005)						
conductivity, saturated paste	----	E102	10	µS/cm	<10	----
Saturated Paste Extractables (QCLot: 665006)						
alkalinity, total (as CaCO3)	----	E293	10	mg/L	<10	----
Saturated Paste Extractables (QCLot: 665007)						
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	<0.60	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	<1.0	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	<4.0	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	<2.0	----
Metals (QCLot: 664995)						

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 664995) - continued						
aluminum	7429-90-5	E440	50	mg/kg	<50	----
antimony	7440-36-0	E440	0.1	mg/kg	<0.10	----
arsenic	7440-38-2	E440	0.1	mg/kg	<0.10	----
barium	7440-39-3	E440	0.5	mg/kg	<0.50	----
beryllium	7440-41-7	E440	0.1	mg/kg	<0.10	----
bismuth	7440-69-9	E440	0.2	mg/kg	<0.20	----
boron	7440-42-8	E440	5	mg/kg	<5.0	----
cadmium	7440-43-9	E440	0.02	mg/kg	<0.020	----
calcium	7440-70-2	E440	50	mg/kg	<50	----
chromium	7440-47-3	E440	0.5	mg/kg	<0.50	----
cobalt	7440-48-4	E440	0.1	mg/kg	<0.10	----
copper	7440-50-8	E440	0.5	mg/kg	<0.50	----
iron	7439-89-6	E440	50	mg/kg	<50	----
lead	7439-92-1	E440	0.5	mg/kg	<0.50	----
lithium	7439-93-2	E440	2	mg/kg	<2.0	----
magnesium	7439-95-4	E440	20	mg/kg	<20	----
manganese	7439-96-5	E440	1	mg/kg	<1.0	----
molybdenum	7439-98-7	E440	0.1	mg/kg	<0.10	----
nickel	7440-02-0	E440	0.5	mg/kg	<0.50	----
phosphorus	7723-14-0	E440	50	mg/kg	<50	----
potassium	7440-09-7	E440	100	mg/kg	<100	----
selenium	7782-49-2	E440	0.2	mg/kg	<0.20	----
silver	7440-22-4	E440	0.1	mg/kg	<0.10	----
sodium	7440-23-5	E440	50	mg/kg	<50	----
strontium	7440-24-6	E440	0.5	mg/kg	<0.50	----
sulfur	7704-34-9	E440	1000	mg/kg	<1000	----
thallium	7440-28-0	E440	0.05	mg/kg	<0.050	----
tin	7440-31-5	E440	2	mg/kg	<2.0	----
titanium	7440-32-6	E440	1	mg/kg	<1.0	----
tungsten	7440-33-7	E440	0.5	mg/kg	<0.50	----
uranium	7440-61-1	E440	0.05	mg/kg	<0.050	----
vanadium	7440-62-2	E440	0.2	mg/kg	<0.20	----
zinc	7440-66-6	E440	2	mg/kg	<2.0	----
zirconium	7440-67-7	E440	1	mg/kg	<1.0	----
Metals (QCLot: 664996)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----

Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Leachable Anions & Nutrients (QCLot: 660214)						
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	<200	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 660592)									
pH (1:2 soil:CaCl2-aq)	----	E108B	----	pH units	6.86 pH units	100	97.0	103	----
Physical Tests (QCLot: 664998)									
pH (1:2 soil:water)	----	E108	----	pH units	6 pH units	99.7	95.0	105	----
Physical Tests (QCLot: 665008)									
moisture	----	E144	0.25	%	50 %	98.9	90.0	110	----
Anions and Nutrients (QCLot: 664231)									
nitrogen, total	7727-37-9	E366	0.02	%	22.37 %	101	90.0	110	----
Organic / Inorganic Carbon (QCLot: 662076)									
carbon, inorganic [IC]	----	E354	0.05	%	0.5 %	95.2	90.0	110	----
Organic / Inorganic Carbon (QCLot: 664230)									
carbon, total [TC]	----	E351	0.05	%	48 %	103	90.0	110	----
Plant Available Nutrients (QCLot: 661785)									
nitrate + nitrite, available (as N)	----	E269.N+N	1	mg/kg	40 mg/kg	111	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
sulfate, available (as S)	14808-79-8	E497.SO4	3	mg/kg	200 mg/kg	106	70.0	130	----
Plant Available Nutrients (QCLot: 661886)									
potassium, available	7440-09-7	E390	20	mg/kg	125 mg/kg	97.7	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
phosphate, available (as P)	14265-44-2	E384	2	mg/kg	12.5 mg/kg	96.5	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
sulfate, soluble ion content	14808-79-8	E239.SO4	5	mg/L	100 mg/L	104	80.0	120	----
Saturated Paste Extractables (QCLot: 665001)									
nitrate (as N), soluble ion content	14797-55-8	E239.NO3	0.5	mg/L	2.5 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665002)									
chloride, soluble ion content	16887-00-6	E239.Cl	20	mg/L	100 mg/L	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665003)									
% saturation	----	E141	1	%	100 %	102	80.0	120	----
Saturated Paste Extractables (QCLot: 665004)									
pH, saturated paste	----	E114	----	pH units	6 pH units	99.7	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Saturated Paste Extractables (QCLot: 665005) - continued									
conductivity, saturated paste	----	E102	10	µS/cm	146.9 µS/cm	105	80.0	120	----
Saturated Paste Extractables (QCLot: 665006)									
alkalinity, total (as CaCO3)	----	E293	10	mg/L	500 mg/L	108	85.0	115	----
Saturated Paste Extractables (QCLot: 665007)									
calcium, soluble ion content	7440-70-2	E442	0.6	mg/L	50 mg/L	107	80.0	120	----
magnesium, soluble ion content	7439-95-4	E442	1	mg/L	50 mg/L	101	80.0	120	----
potassium, soluble ion content	7440-09-7	E442	4	mg/L	50 mg/L	101	80.0	120	----
sodium, soluble ion content	17341-25-2	E442	2	mg/L	50 mg/L	109	80.0	120	----
Metals (QCLot: 664995)									
aluminum	7429-90-5	E440	50	mg/kg	200 mg/kg	92.9	80.0	120	----
antimony	7440-36-0	E440	0.1	mg/kg	100 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.1	mg/kg	100 mg/kg	100.0	80.0	120	----
barium	7440-39-3	E440	0.5	mg/kg	25 mg/kg	92.4	80.0	120	----
beryllium	7440-41-7	E440	0.1	mg/kg	10 mg/kg	88.4	80.0	120	----
bismuth	7440-69-9	E440	0.2	mg/kg	100 mg/kg	88.4	80.0	120	----
boron	7440-42-8	E440	5	mg/kg	100 mg/kg	83.5	80.0	120	----
cadmium	7440-43-9	E440	0.02	mg/kg	10 mg/kg	94.2	80.0	120	----
calcium	7440-70-2	E440	50	mg/kg	5000 mg/kg	90.2	80.0	120	----
chromium	7440-47-3	E440	0.5	mg/kg	25 mg/kg	95.9	80.0	120	----
cobalt	7440-48-4	E440	0.1	mg/kg	25 mg/kg	94.1	80.0	120	----
copper	7440-50-8	E440	0.5	mg/kg	25 mg/kg	92.8	80.0	120	----
iron	7439-89-6	E440	50	mg/kg	100 mg/kg	99.2	80.0	120	----
lead	7439-92-1	E440	0.5	mg/kg	50 mg/kg	91.4	80.0	120	----
lithium	7439-93-2	E440	2	mg/kg	25 mg/kg	85.7	80.0	120	----
magnesium	7439-95-4	E440	20	mg/kg	5000 mg/kg	95.2	80.0	120	----
manganese	7439-96-5	E440	1	mg/kg	25 mg/kg	95.2	80.0	120	----
molybdenum	7439-98-7	E440	0.1	mg/kg	25 mg/kg	100	80.0	120	----
nickel	7440-02-0	E440	0.5	mg/kg	50 mg/kg	92.5	80.0	120	----
phosphorus	7723-14-0	E440	50	mg/kg	1000 mg/kg	100	80.0	120	----
potassium	7440-09-7	E440	100	mg/kg	5000 mg/kg	95.9	80.0	120	----
selenium	7782-49-2	E440	0.2	mg/kg	100 mg/kg	97.3	80.0	120	----
silver	7440-22-4	E440	0.1	mg/kg	10 mg/kg	89.5	80.0	120	----
sodium	7440-23-5	E440	50	mg/kg	5000 mg/kg	96.4	80.0	120	----
strontium	7440-24-6	E440	0.5	mg/kg	25 mg/kg	103	80.0	120	----
sulfur	7704-34-9	E440	1000	mg/kg	5000 mg/kg	94.0	80.0	120	----
thallium	7440-28-0	E440	0.05	mg/kg	100 mg/kg	88.2	80.0	120	----

Sub-Matrix: **Soil/Solid**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 664995) - continued									
tin	7440-31-5	E440	2	mg/kg	50 mg/kg	95.6	80.0	120	----
titanium	7440-32-6	E440	1	mg/kg	25 mg/kg	90.6	80.0	120	----
tungsten	7440-33-7	E440	0.5	mg/kg	10 mg/kg	93.4	80.0	120	----
uranium	7440-61-1	E440	0.05	mg/kg	0.5 mg/kg	96.2	80.0	120	----
vanadium	7440-62-2	E440	0.2	mg/kg	50 mg/kg	97.6	80.0	120	----
zinc	7440-66-6	E440	2	mg/kg	50 mg/kg	95.3	80.0	120	----
zirconium	7440-67-7	E440	1	mg/kg	10 mg/kg	106	80.0	120	----
Metals (QCLot: 664996)									
mercury	7439-97-6	E510	0.005	mg/kg	0.1 mg/kg	94.2	80.0	120	----
Leachable Anions & Nutrients (QCLot: 660214)									
Kjeldahl nitrogen, total [TKN]	----	E319	200	mg/kg	1000 mg/kg	81.0	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Reference Material (RM) Report									
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method					Qualifier
Physical Tests (QCLot: 659686)									
	RM	loss on ignition @ 550°C	----	E205D	10.33 %	93.4	80.0	120	----
Physical Tests (QCLot: 660592)									
	RM	pH (1:2 soil:CaCl2-aq)	----	E108B	7.54 pH units	101	94.0	106	----
Particle Size (QCLot: 658739)									
	RM	passing (0.002 mm)	----	E183	21.14 %	105	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	102	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	102	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	105	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	106	88.0	112	----
Particle Size (QCLot: 658740)									
	RM	passing (0.05 mm)	----	E182	49.81 %	104	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	101	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	99.2	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	98.9	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	98.8	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.1	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.3	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.3	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.4	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.5	94.9	105	----
Particle Size (QCLot: 658741)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Anions and Nutrients (QCLot: 664231)									
	RM	nitrogen, total	7727-37-9	E366	0.11 %	107	80.0	120	----
Organic / Inorganic Carbon (QCLot: 662076)									
	RM	carbon, inorganic [IC]	----	E354	0.383 %	109	80.0	120	----
Organic / Inorganic Carbon (QCLot: 664230)									
	RM	carbon, total [TC]	----	E351	1.4 %	102	80.0	120	----
Plant Available Nutrients (QCLot: 661785)									
	RM	nitrate + nitrite, available (as N)	----	E269.N+N	18.9 mg/kg	78.0	70.0	130	----
Plant Available Nutrients (QCLot: 661786)									
	RM	sulfate, available (as S)	14808-79-8	E497.SO4	497 mg/kg	99.0	70.0	130	----
Plant Available Nutrients (QCLot: 661886)									
	RM	potassium, available	7440-09-7	E390	154 mg/kg	98.0	70.0	130	----
Plant Available Nutrients (QCLot: 661887)									
	RM	phosphate, available (as P)	14265-44-2	E384	10.47 mg/kg	91.6	80.0	120	----
Saturated Paste Extractables (QCLot: 665000)									
	RM	sulfate, soluble ion content	14808-79-8	E239.SO4	1841 mg/L	99.9	70.0	130	----
Saturated Paste Extractables (QCLot: 665002)									
	RM	chloride, soluble ion content	16887-00-6	E239.Cl	1237 mg/L	94.6	70.0	130	----
Saturated Paste Extractables (QCLot: 665003)									
	RM	% saturation	----	E141	48.3 %	102	70.0	130	----
Saturated Paste Extractables (QCLot: 665004)									
	RM	pH, saturated paste	----	E114	7.59 pH units	97.1	95.0	105	----
Saturated Paste Extractables (QCLot: 665005)									
	RM	conductivity, saturated paste	----	E102	5970 µS/cm	104	70.0	130	----
Saturated Paste Extractables (QCLot: 665007)									
	RM	calcium, soluble ion content	7440-70-2	E442	776 mg/L	95.3	70.0	130	----
	RM	magnesium, soluble ion content	7439-95-4	E442	261 mg/L	92.3	70.0	130	----
	RM	potassium, soluble ion content	7440-09-7	E442	111 mg/L	94.8	70.0	130	----
	RM	sodium, soluble ion content	17341-25-2	E442	330 mg/L	93.0	70.0	130	----
Metals (QCLot: 664995)									
	SCP SS-2	aluminum	7429-90-5	E440	9817 mg/kg	95.0	70.0	130	----
	SCP SS-2	antimony	7440-36-0	E440	3.99 mg/kg	99.8	70.0	130	----
	SCP SS-2	arsenic	7440-38-2	E440	3.73 mg/kg	98.2	70.0	130	----
	SCP SS-2	barium	7440-39-3	E440	105 mg/kg	89.8	70.0	130	----

Sub-Matrix:

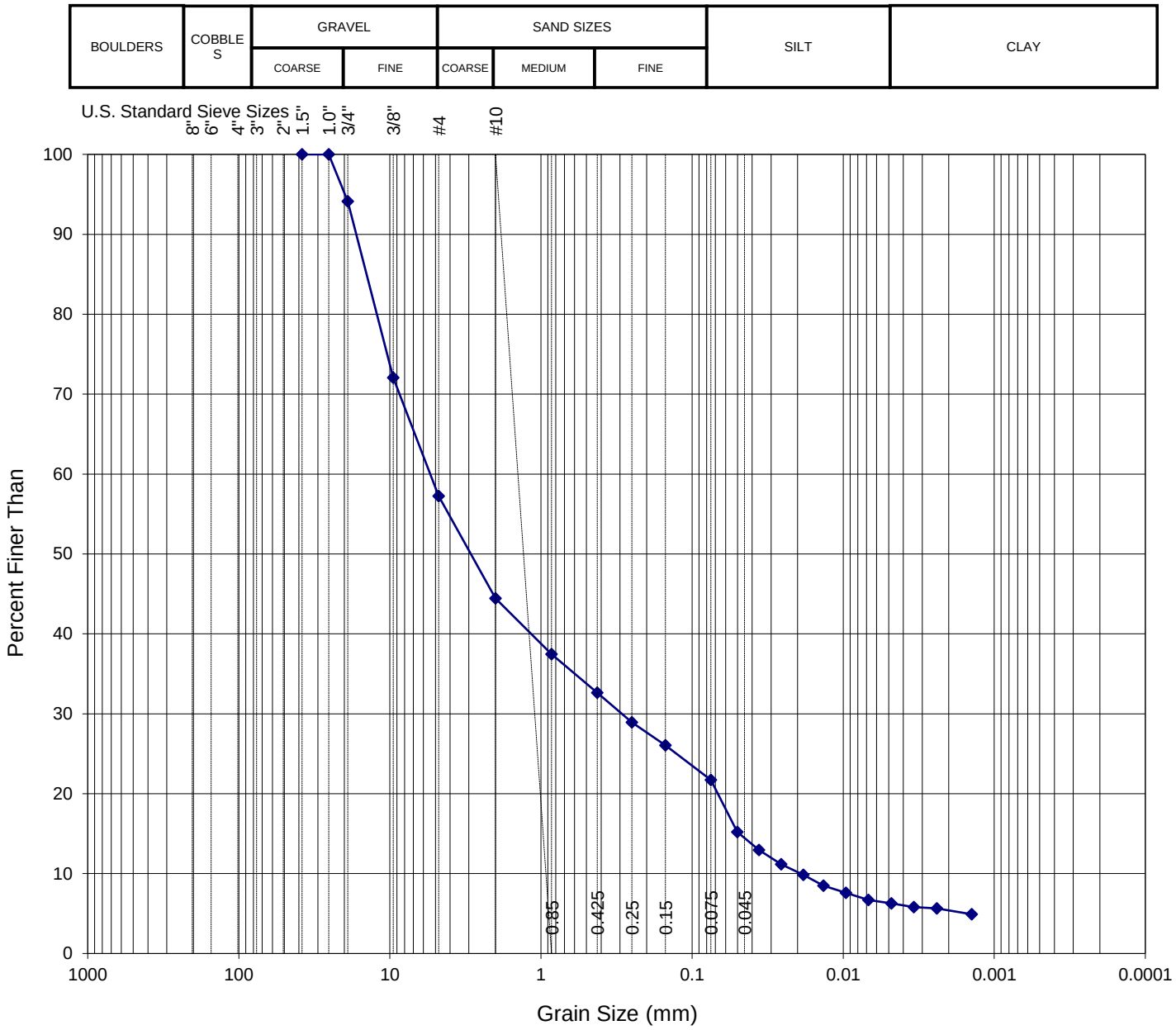
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Reference Material (RM) Report: Recovery (%) RM	Reference Material (RM) Report: Recovery Limits (%) Low	Reference Material (RM) Report: Recovery Limits (%) High	Reference Material (RM) Report: Qualifier
Metals (QCLot: 664995) - continued									
	SCP SS-2	beryllium	7440-41-7	E440	0.349 mg/kg	94.2	70.0	130	----
	SCP SS-2	boron	7440-42-8	E440	8.5 mg/kg	97.7	40.0	160	----
	SCP SS-2	cadmium	7440-43-9	E440	0.91 mg/kg	88.1	70.0	130	----
	SCP SS-2	calcium	7440-70-2	E440	31082 mg/kg	90.3	70.0	130	----
	SCP SS-2	chromium	7440-47-3	E440	101 mg/kg	101	70.0	130	----
	SCP SS-2	cobalt	7440-48-4	E440	6.9 mg/kg	95.6	70.0	130	----
	SCP SS-2	copper	7440-50-8	E440	123 mg/kg	92.4	70.0	130	----
	SCP SS-2	iron	7439-89-6	E440	23558 mg/kg	97.3	70.0	130	----
	SCP SS-2	lead	7439-92-1	E440	267 mg/kg	87.5	70.0	130	----
	SCP SS-2	lithium	7439-93-2	E440	9.5 mg/kg	91.2	70.0	130	----
	SCP SS-2	magnesium	7439-95-4	E440	5509 mg/kg	95.7	70.0	130	----
	SCP SS-2	manganese	7439-96-5	E440	269 mg/kg	97.9	70.0	130	----
	SCP SS-2	molybdenum	7439-98-7	E440	1.03 mg/kg	93.8	70.0	130	----
	SCP SS-2	nickel	7440-02-0	E440	26.7 mg/kg	94.3	70.0	130	----
	SCP SS-2	phosphorus	7723-14-0	E440	752 mg/kg	91.7	70.0	130	----
	SCP SS-2	potassium	7440-09-7	E440	1587 mg/kg	103	70.0	130	----
	SCP SS-2	sodium	7440-23-5	E440	797 mg/kg	97.3	70.0	130	----
	SCP SS-2	strontium	7440-24-6	E440	86.1 mg/kg	95.7	70.0	130	----
	SCP SS-2	thallium	7440-28-0	E440	0.0786 mg/kg	89.3	40.0	160	----
	SCP SS-2	tin	7440-31-5	E440	10.6 mg/kg	84.9	70.0	130	----
	SCP SS-2	titanium	7440-32-6	E440	839 mg/kg	101	70.0	130	----
	SCP SS-2	uranium	7440-61-1	E440	0.52 mg/kg	95.3	70.0	130	----
	SCP SS-2	vanadium	7440-62-2	E440	32.7 mg/kg	98.5	70.0	130	----
	SCP SS-2	zinc	7440-66-6	E440	297 mg/kg	94.3	70.0	130	----
	SCP SS-2	zirconium	7440-67-7	E440	5.73 mg/kg	81.1	70.0	130	----
Metals (QCLot: 664996)									
	SCP SS-2	mercury	7439-97-6	E510	0.059 mg/kg	97.1	70.0	130	----
Leachable Anions & Nutrients (QCLot: 660214)									
	RM	Kjeldahl nitrogen, total [TKN]	----	E319	1040 mg/kg	84.4	80.0	120	----

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2367001
Project Number:	
Client Sample ID	22-A4-S-01
Lab Sample ID	VA22C2367001
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

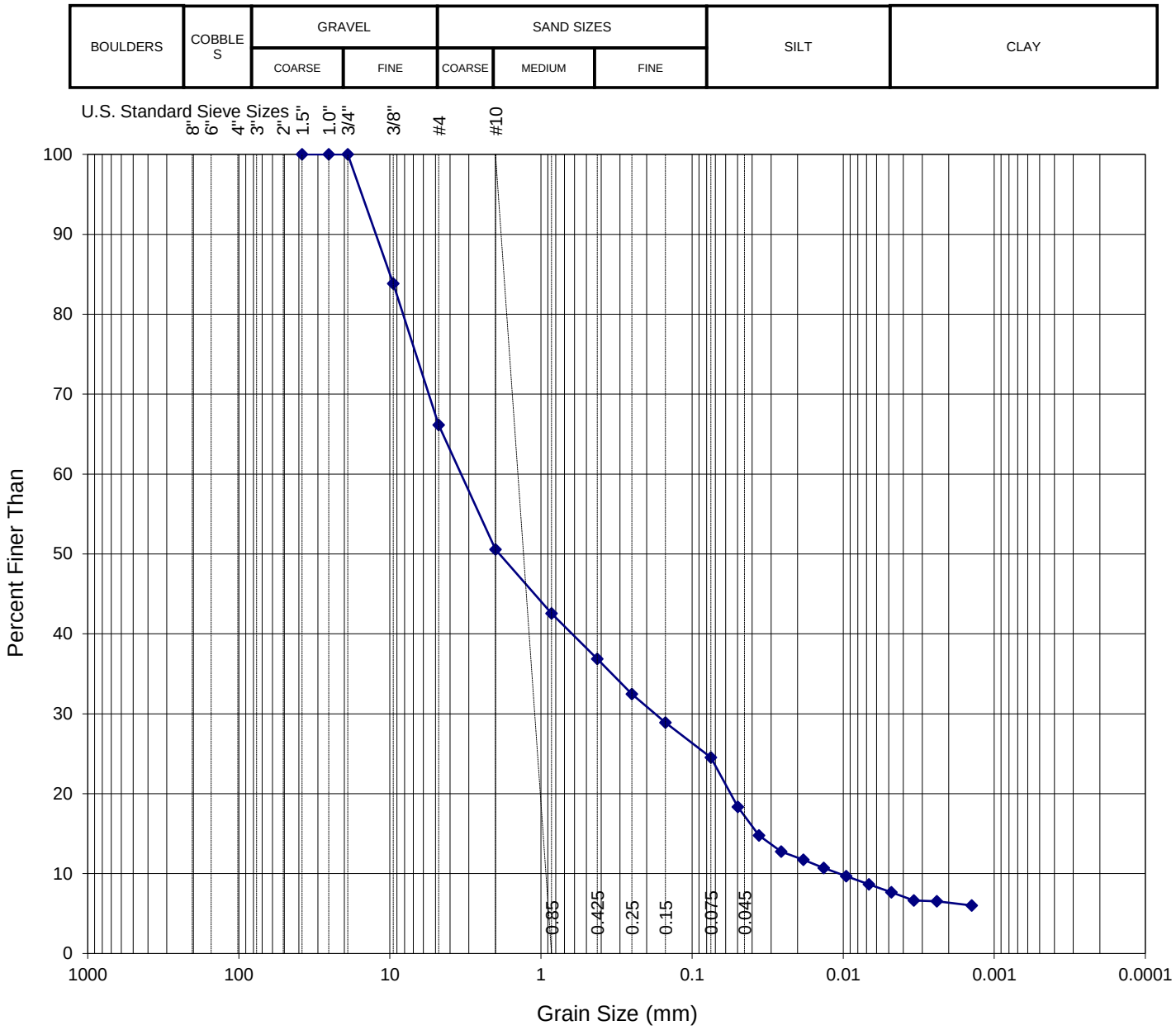
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	42.77	> 4.75
% COARSE SAND :	12.80	2.0 - 4.75
% MEDIUM SAND :	11.80	0.425 - 2.0
% FINE SAND :	10.92	0.075 - 0.425
% SILT :	15.41	0.075 - 0.005
% CLAY :	6.31	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2367002
Project Number:	
Client Sample ID	22-A5-S-01
Lab Sample ID	VA22C2367002
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

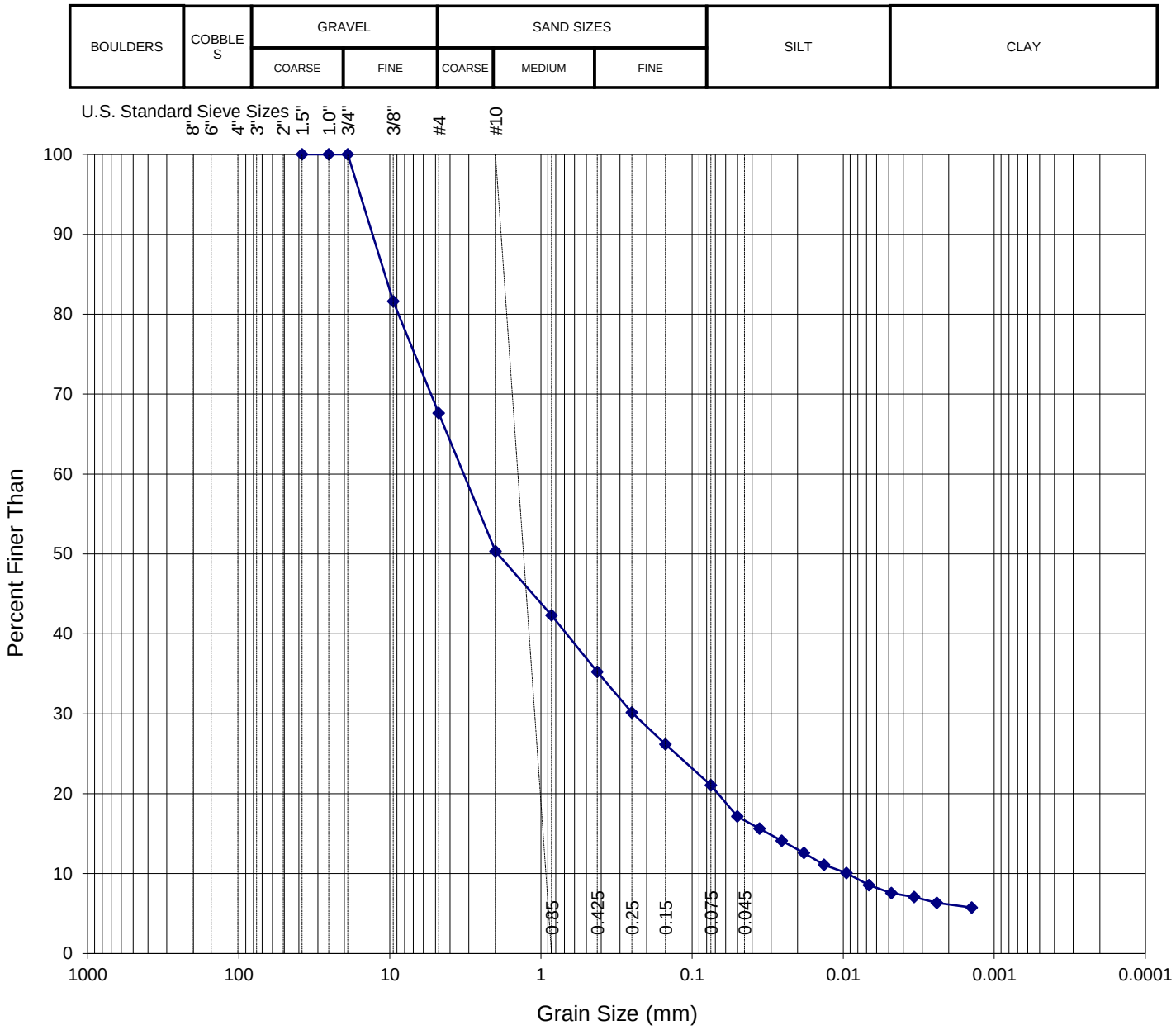
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	33.87	> 4.75
% COARSE SAND :	15.56	2.0 - 4.75
% MEDIUM SAND :	13.71	0.425 - 2.0
% FINE SAND :	12.34	0.075 - 0.425
% SILT :	16.75	0.075 - 0.005
% CLAY :	7.77	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2367003
Project Number:
Client Sample ID 22-S15-S-01
Lab Sample ID VA22C2367003
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH



METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

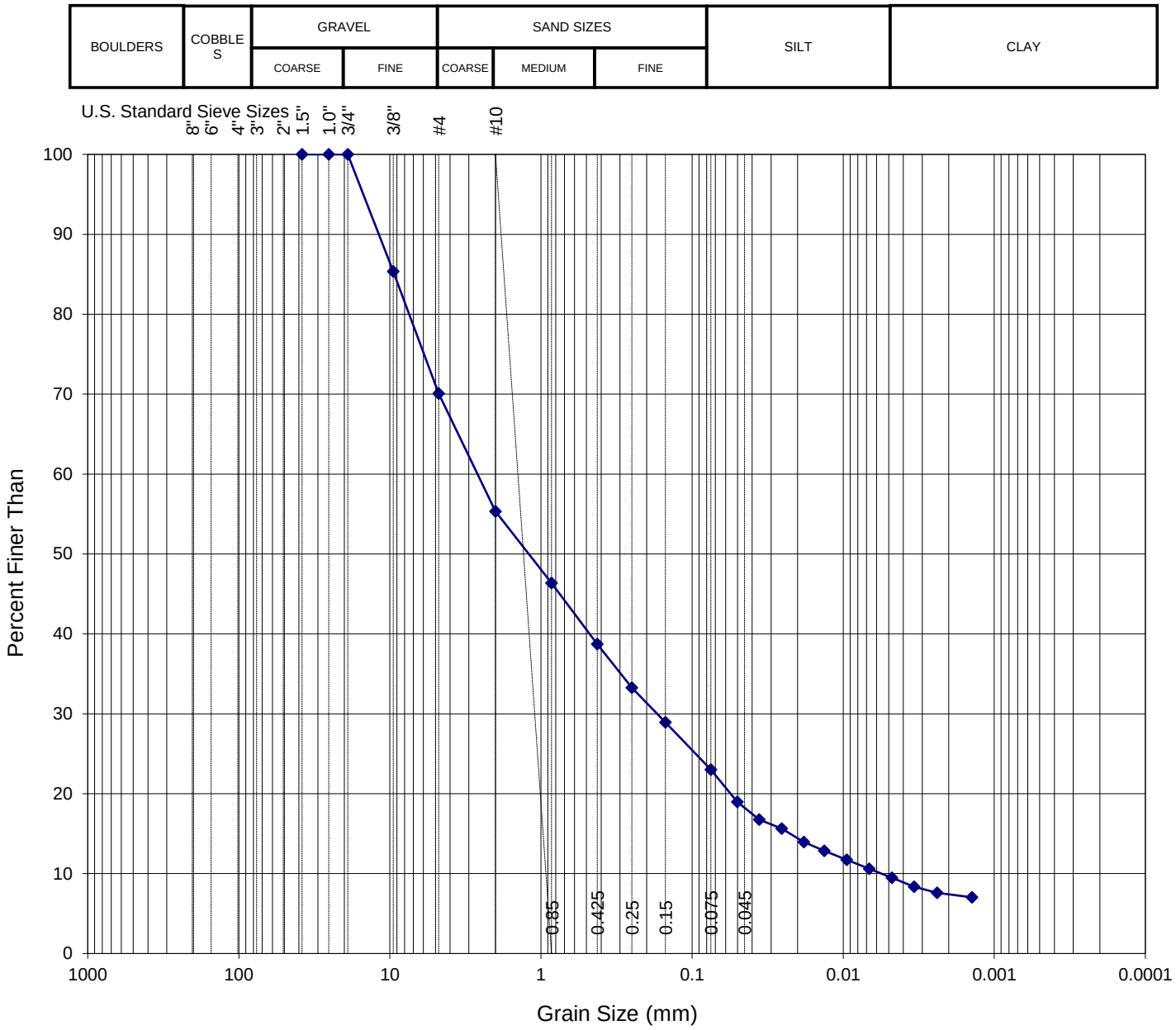
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	32.38	> 4.75
% COARSE SAND :	17.29	2.0 - 4.75
% MEDIUM SAND :	15.10	0.425 - 2.0
% FINE SAND :	14.18	0.075 - 0.425
% SILT :	13.37	0.075 - 0.005
% CLAY :	7.69	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: VA22C2367004
Project Number:
Client Sample ID 22-S15-S-01D
Lab Sample ID VA22C2367004
Date Sample Received 00-Jan-00
Test Completion Date: 29-Sep-22
Analyst: SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

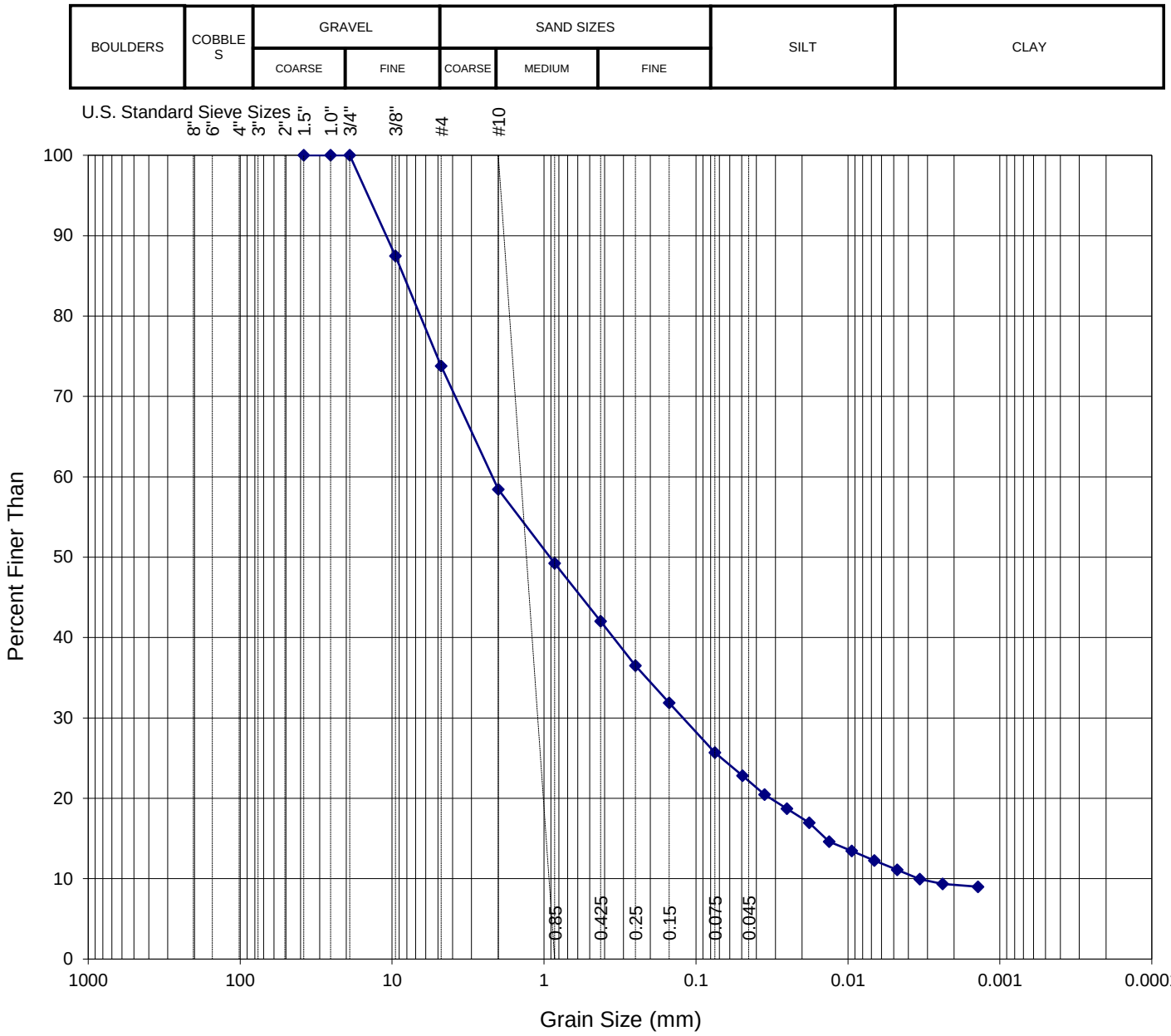
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	29.93	> 4.75
% COARSE SAND :	14.76	2.0 - 4.75
% MEDIUM SAND :	16.60	0.425 - 2.0
% FINE SAND :	15.72	0.075 - 0.425
% SILT :	13.35	0.075 - 0.005
% CLAY :	9.65	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	VA22C2367005
Project Number:	
Client Sample ID	22-S10-S-01
Lab Sample ID	VA22C2367005
Date Sample Received	00-Jan-00
Test Completion Date:	29-Sep-22
Analyst:	SIH



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	26.22	> 4.75
% COARSE SAND :	15.36	2.0 - 4.75
% MEDIUM SAND :	16.39	0.425 - 2.0
% FINE SAND :	16.33	0.075 - 0.425
% SILT :	14.41	0.075 - 0.005
% CLAY :	11.29	< 0.005

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686093

Page 1 of 1

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mount Polley Mining Corp
Contact:	Gabriel Holmes

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL | EDD (DIGITAL)
Quality Control (QC) Report with Report ☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: ☒ EMAIL | MAIL ☐ FAX
Email 1 or Fax: melissa.paliouras@wsp.com
Email 2: samantha.lundquist@wsp.com
Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax: gabriel.holmes@mountpolley.com
Email 2:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:
Job #:
PO / AFE: 5590008044
LSD:

Oil and Gas Required Fields (client use)

AFE/Cost Center: | PO#
Major/Minor Code: | Routing Code:
Requisitioner:
Location:

ALS Lab Work Order # (lab use only): 23647

ALS Contact: Amber Springer | Sampler: Samantha Lundquist

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Organic Matter	TOC	Total N & Kjeldahl N	Available P, K, SO4	Particle Size	Moisture	Conductivity	Sodium Absorption Ratio	pH (CaCl2)	Sorting Na, Cl, Ca, Mg	Soluble K, SO4	Theoretical Gypsum Requirement		Total Metals		SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-A4-S-01	16-Sep-22	8:15	Soil	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				3
	22-A5-S-01	"	9:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"
	22-S15-S-01	"	10:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"
	22-S16-S-01D	"	10:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"
	22-S10-S-01	"	11:00	"	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓				"

Environmental Division
Vancouver
Work Order Reference
VA22C2367

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client us

Are samples taken from a Regulated DW System?
☐ YES ☒ NO

Are samples for human consumption/ use?
☐ YES ☒ NO

to add on report by clicking on the drop-down list below
electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐
Ice Packs ☒ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: S. Lundquist	Date: Sept 17, 2022	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17 Sep 22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

ALS Canada Ltd.

CERTIFICATE OF ANALYSIS

Work Order	: **VA22C2369**	Page	: 1 of 83
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby BC Canada V5A 1W9
Telephone	: 604 298 6623	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 17-Oct-2022
C-O-C number	: 17-686095A-095M	Issue Date	: 03-Nov-2022 16:04
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 131		
No. of samples analysed	: 131		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Metals, Burnaby, British Columbia

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
%	percent
mg/kg	milligrams per kilogram
mg/kg wwt	milligrams per kilogram wet weight

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Qualifiers

Qualifier	*Description*
DLA	*Detection Limit adjusted for required dilution.*
DLI	*Detection Limit Raised: Dilution required to address Internal Standard response problems caused by matrix interference.*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S9-L-01	22-S9-L-02	22-S9-G-01	22-S9-L-03	22-S9-L-04
					Client sampling date / time	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00
						VA22C2369-001	VA22C2369-002	VA22C2369-003	VA22C2369-004	VA22C2369-005
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		50.2	66.6	39.8	53.5	62.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		92.6	310	394	230	178
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		46.1	103	237	107	66.7
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	0.012	0.012	0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0024	0.0041	0.0072	0.0047	0.0030
arsenic	7440-38-2	E440	0.020	mg/kg		0.108	0.268	0.339	6.11	0.158
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0540	0.0896	0.204	2.84	0.0594
barium	7440-39-3	E440	0.050	mg/kg		9.03	12.3	62.3	18.4	7.75
barium	7440-39-3	E440A	0.010	mg/kg wwt		4.49	4.10	37.5	8.56	2.90
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	0.010	0.012	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	0.0035	0.0072	0.0025	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		14.3	22.8	3.8	16.0	52.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		7.10	7.60	2.27	7.43	19.7
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0150 DLM	0.0672	0.147	0.0506	1.92
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0060 DLM	0.0224	0.0886	0.0235	0.719
calcium	7440-70-2	E440	20	mg/kg		11500	10500	9860	2640	21300
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5720	3500	5930	1230	7980
cesium	7440-46-2	E440	0.0050	mg/kg		0.598	0.104	0.0912	0.176	0.191
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.297	0.0348	0.0549	0.0816	0.0715
chromium	7440-47-3	E440	0.050	mg/kg		0.177	0.475	0.486	0.200	0.197
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.088	0.159	0.293	0.093	0.074
cobalt	7440-48-4	E440	0.020	mg/kg		0.244	0.305	0.343	0.297	0.604
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.122	0.102	0.206	0.138	0.226
copper	7440-50-8	E440	0.10	mg/kg		13.1	23.1	23.3	10.7	15.3
copper	7440-50-8	E440A	0.020	mg/kg wwt		6.53	7.72	14.0	4.99	5.73
iron	7439-89-6	E440	3.0	mg/kg		149	653	681	301	262

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S9-L-01	22-S9-L-02	22-S9-G-01	22-S9-L-03	22-S9-L-04
					Client sampling date / time	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00
						VA22C2369-001	VA22C2369-002	VA22C2369-003	VA22C2369-004	VA22C2369-005
						Result	Result	Result	Result	Result
Metals										
iron	7439-89-6	E440A	0.60	mg/kg wwt		74.3	218	410	140	98.1
lead	7439-92-1	E440	0.020	mg/kg		0.062	0.170	0.216	0.092	0.084
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0308	0.0569	0.130	0.0426	0.0315
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	0.54	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.12	0.32	<0.10	0.14
magnesium	7439-95-4	E440	2.0	mg/kg		1500	1940	617	983	2490
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		747	646	372	457	934
manganese	7439-96-5	E440	0.050	mg/kg		164	91.3	280	146	94.2
manganese	7439-96-5	E440A	0.010	mg/kg wwt		81.7	30.5	168	68.0	35.3
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0076	0.0084	0.0052	0.0055
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0022	0.0025	0.0050	0.0024	0.0020
molybdenum	7439-98-7	E440	0.020	mg/kg		18.6	1.35	10.4	0.562	5.28
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		9.24	0.450	6.25	0.261	1.98
nickel	7440-02-0	E440	0.20	mg/kg		0.28	0.75	0.38	0.22	0.42
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.140	0.249	0.226	0.100	0.159
phosphorus	7723-14-0	E440	10	mg/kg		2850	1100	711	1310	2020
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1420	366	428	611	758
potassium	7440-09-7	E440	20	mg/kg		10100	8170	4050	7170	11800
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5010	2730	2440	3340	4410
rubidium	7440-17-7	E440	0.050	mg/kg		20.9	8.82	3.35	8.64	10.4
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		10.4	2.94	2.02	4.02	3.89
selenium	7782-49-2	E440	0.050	mg/kg		1.28	4.32	3.63	1.19	3.26
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.636	1.44	2.19	0.556	1.22
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0135	0.0103	0.0296	0.0126	0.0140
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0067	0.0034	0.0178	0.0058	0.0052
sodium	7440-23-5	E440	20	mg/kg		39	64	94	23	45
sodium	7440-23-5	E440A	4.0	mg/kg wwt		19.3	21.2	56.8	10.7	16.7
strontium	7440-24-6	E440	0.050	mg/kg		33.2	32.7	41.6	21.8	51.6
strontium	7440-24-6	E440A	0.010	mg/kg wwt		16.5	10.9	25.0	10.1	19.3
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S9-L-01	22-S9-L-02	22-S9-G-01	22-S9-L-03	22-S9-L-04
					Client sampling date / time	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00	13-Sep-2022 13:00
						VA22C2369-001	VA22C2369-002	VA22C2369-003	VA22C2369-004	VA22C2369-005
						Result	Result	Result	Result	Result
Metals										
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0178	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00058	<0.00040	0.00120	0.00827	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.051	<0.020	0.027	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0024	0.0138	0.0154	0.0068	0.0046
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00120	0.00461	0.00930	0.00318	0.00174
vanadium	7440-62-2	E440	0.10	mg/kg		0.40	2.20	2.29	1.05	0.79
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.200	0.733	1.38	0.488	0.295
zinc	7440-66-6	E440	0.50	mg/kg		21.6	13.4	19.0	22.8	96.3
zinc	7440-66-6	E440A	0.10	mg/kg wwt		10.8	4.49	11.4	10.6	36.1
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	0.30	0.59	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	0.100	0.354	0.072	0.052

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S8-L-01	22-S8-G-01	22-S8-G-02	22-S8-L-02	22-S8-F-01
					Client sampling date / time	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15
						VA22C2369-006	VA22C2369-007	VA22C2369-008	VA22C2369-009	VA22C2369-010
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		61.4	41.3	29.6	58.5	81.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		97.0	41.7	55.1	67.9	51.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		37.4	24.5	38.8	28.2	9.76
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0022	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.077	0.056	0.061	2.87	0.066
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0298	0.0331	0.0433	1.19	0.0125
barium	7440-39-3	E440	0.050	mg/kg		2.66	6.08	9.96	25.5	5.04
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.03	3.57	7.02	10.6	0.959
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		14.5	3.7	3.3	20.8	33.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		5.60	2.16	2.32	8.66	6.31
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0568	0.0158	0.0235	0.0667	0.458
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0219	0.0093	0.0166	0.0277	0.0872
calcium	7440-70-2	E440	20	mg/kg		2440	3120	2250	3810	8940
calcium	7440-70-2	E440A	4.0	mg/kg wwt		941	1830	1590	1580	1700
cesium	7440-46-2	E440	0.0050	mg/kg		0.0512	0.0740	0.0210	0.106	0.530
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0198	0.0434	0.0148	0.0439	0.101
chromium	7440-47-3	E440	0.050	mg/kg		0.160	0.084	0.076	0.095	0.139
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.062	0.049	0.054	0.040	0.026
cobalt	7440-48-4	E440	0.020	mg/kg		0.142	0.051	0.047	0.087	0.083
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0549	0.0302	0.0331	0.0362	0.0157
copper	7440-50-8	E440	0.10	mg/kg		12.4	6.36	6.70	8.12	18.0
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.80	3.73	4.72	3.37	3.43
iron	7439-89-6	E440	3.0	mg/kg		187	80.8	78.2	130	129
iron	7439-89-6	E440A	0.60	mg/kg wwt		72.1	47.4	55.0	53.8	24.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S8-L-01	22-S8-G-01	22-S8-G-02	22-S8-L-02	22-S8-F-01
					Client sampling date / time	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15
						VA22C2369-006	VA22C2369-007	VA22C2369-008	VA22C2369-009	VA22C2369-010
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.042	0.027	0.038	0.035	0.032
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0163	0.0160	0.0266	0.0146	0.0061
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.60
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	0.11
magnesium	7439-95-4	E440	2.0	mg/kg		957	657	598	1260	3000
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		370	386	421	524	570
manganese	7439-96-5	E440	0.050	mg/kg		80.7	86.8	34.5	53.9	57.0
manganese	7439-96-5	E440A	0.010	mg/kg wwt		31.2	50.9	24.3	22.4	10.8
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0053	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0015	0.0016	0.0030	0.0022	<0.0010
molybdenum	7439-98-7	E440	0.020	mg/kg		3.02	2.09	3.01	3.25	4.90
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.17	1.23	2.12	1.35	0.932
nickel	7440-02-0	E440	0.20	mg/kg		1.60	0.33	<0.20	0.27	0.54
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.616	0.195	0.130	0.111	0.104
phosphorus	7723-14-0	E440	10	mg/kg		1510	1600	1600	2260	6300
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		582	940	1130	938	1200
potassium	7440-09-7	E440	20	mg/kg		5570	7650	5560	6780	51600
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2150	4490	3920	2810	9810
rubidium	7440-17-7	E440	0.050	mg/kg		3.17	7.56	3.58	5.46	47.4
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		1.22	4.44	2.52	2.27	9.03
selenium	7782-49-2	E440	0.050	mg/kg		0.342	0.241	0.183	0.358	10.3
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.132	0.141	0.129	0.149	1.96
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0498	0.0087	<0.0050	0.0165	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0192	0.0051	0.0027	0.0068	<0.0010
sodium	7440-23-5	E440	20	mg/kg		20	21	24	29	176
sodium	7440-23-5	E440A	4.0	mg/kg wwt		7.8	12.5	17.0	12.2	33.5
strontium	7440-24-6	E440	0.050	mg/kg		3.79	9.61	9.28	46.9	18.2
strontium	7440-24-6	E440A	0.010	mg/kg wwt		1.46	5.64	6.54	19.5	3.47
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S8-L-01	22-S8-G-01	22-S8-G-02	22-S8-L-02	22-S8-F-01
					Client sampling date / time	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15	13-Sep-2022 14:15
						VA22C2369-006	VA22C2369-007	VA22C2369-008	VA22C2369-009	VA22C2369-010
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0093	0.0033
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	0.00386	0.00063
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0038	<0.0020	<0.0020	0.0030	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00146	0.00088	0.00097	0.00123	<0.00040
vanadium	7440-62-2	E440	0.10	mg/kg		0.60	0.23	0.20	0.37	0.27
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.231	0.138	0.141	0.152	0.052
zinc	7440-66-6	E440	0.50	mg/kg		77.8	72.8	31.6	47.8	61.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		30.0	42.7	22.2	19.9	11.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.080 DLM	<0.080 DLM	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-G-01	22-S3-G-02	22-S3-L-01	22-S3-F-01	22-S3-L-02
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30
						VA22C2369-011	VA22C2369-012	VA22C2369-013	VA22C2369-014	VA22C2369-015
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		47.0	46.1	64.0	70.2	74.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		51.2	59.4	68.4	150	68.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		27.1	32.0	24.7	44.6	17.3
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0025	<0.0020	<0.0020	0.0023	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.159	0.066	0.050	0.149	0.151
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0841	0.0357	0.0182	0.0444	0.0381
barium	7440-39-3	E440	0.050	mg/kg		48.3	6.71	1.61	11.5	165
barium	7440-39-3	E440A	0.010	mg/kg wwt		25.6	3.62	0.582	3.43	41.7
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		9.3	7.8	12.6	36.7	82.0
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.94	4.18	4.55	10.9	20.7
cadmium	7440-43-9	E440	0.0050	mg/kg		0.254	<0.0050	0.0492	0.160	<0.0100 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.134	0.0021	0.0177	0.0476	<0.0020 DLM
calcium	7440-70-2	E440	20	mg/kg		8780	3210	2640	14800	25600
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4650	1730	950	4410	6460
cesium	7440-46-2	E440	0.0050	mg/kg		0.250	0.0553	0.108	0.208	0.181
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.132	0.0298	0.0388	0.0620	0.0456
chromium	7440-47-3	E440	0.050	mg/kg		0.170	0.074	0.084	0.158	0.116
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.090	0.040	0.030	0.047	0.029
cobalt	7440-48-4	E440	0.020	mg/kg		0.041	0.050	0.125	0.164	0.065
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0218	0.0271	0.0449	0.0489	0.0164
copper	7440-50-8	E440	0.10	mg/kg		8.28	6.05	6.68	23.2	6.96
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.39	3.26	2.41	6.89	1.75
iron	7439-89-6	E440	3.0	mg/kg		105	92.1	114	196	117
iron	7439-89-6	E440A	0.60	mg/kg wwt		55.6	49.6	41.3	58.5	29.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-G-01	22-S3-G-02	22-S3-L-01	22-S3-F-01	22-S3-L-02
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30
						VA22C2369-011	VA22C2369-012	VA22C2369-013	VA22C2369-014	VA22C2369-015
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.036	0.027	0.024	0.067	0.048
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0194	0.0148	0.0088	0.0200	0.0120
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		824	1360	1480	2400	3760
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		437	735	533	714	948
manganese	7439-96-5	E440	0.050	mg/kg		93.7	48.6	95.9	106	85.9
manganese	7439-96-5	E440A	0.010	mg/kg wwt		49.6	26.2	34.6	31.5	21.7
mercury	7439-97-6	E510	0.0050	mg/kg		0.0077	<0.0050	<0.0050	0.0069	0.0112
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0041	0.0020	0.0013	0.0020	0.0028
molybdenum	7439-98-7	E440	0.020	mg/kg		8.83	3.56	0.598	1.97	30.6
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		4.68	1.92	0.216	0.586	7.71
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.22	0.35	0.86	0.40
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.051	0.118	0.125	0.255	0.102
phosphorus	7723-14-0	E440	10	mg/kg		1010	2390	1580	5840	8110
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		536	1290	571	1740	2040
potassium	7440-09-7	E440	20	mg/kg		9440	8660	4100	24200	21800
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5000	4660	1480	7210	5490
rubidium	7440-17-7	E440	0.050	mg/kg		8.44	5.86	3.39	20.9	8.96
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.48	3.16	1.22	6.21	2.26
selenium	7782-49-2	E440	0.050	mg/kg		0.376	0.413	0.512	0.261	0.366
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.199	0.223	0.184	0.078	0.092
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0079	0.0055	0.0230	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0042	0.0030	0.0083	0.0012	<0.0010
sodium	7440-23-5	E440	20	mg/kg		45	<20	<20	61	53
sodium	7440-23-5	E440A	4.0	mg/kg wwt		24.0	8.6	6.1	18.2	13.5
strontium	7440-24-6	E440	0.050	mg/kg		35.0	12.2	5.90	38.1	95.0
strontium	7440-24-6	E440A	0.010	mg/kg wwt		18.6	6.55	2.12	11.3	24.0
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S3-G-01	22-S3-G-02	22-S3-L-01	22-S3-F-01	22-S3-L-02
					Client sampling date / time	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30	13-Sep-2022 15:30
						VA22C2369-011	VA22C2369-012	VA22C2369-013	VA22C2369-014	VA22C2369-015
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	0.0054
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00064	<0.00040	0.00137
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0033	0.0022
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00097	0.00071	0.00067	0.00098	0.00055
vanadium	7440-62-2	E440	0.10	mg/kg		0.31	0.24	0.32	0.59	1.72
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.164	0.129	0.117	0.175	0.435
zinc	7440-66-6	E440	0.50	mg/kg		38.6	60.1	42.3	57.4	25.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		20.5	32.4	15.2	17.1	6.40
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.089	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R2-L-01	22-R2-F-01	22-R2-L-02	22-R2-L-03	22-R3-L-01
					Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2369-016	VA22C2369-017	VA22C2369-018	VA22C2369-019	VA22C2369-020
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		61.6	83.9	57.0	62.7	60.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		63.5	147	118	260	146
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		24.4	23.7	50.8	97.0	57.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.013	0.011	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0057	0.0042	0.0027
arsenic	7440-38-2	E440	0.020	mg/kg		0.046	0.115	0.046	0.104	0.028
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0177	0.0185	0.0196	0.0387	0.0109
barium	7440-39-3	E440	0.050	mg/kg		26.1	16.6	43.2	5.80	84.0
barium	7440-39-3	E440A	0.010	mg/kg wwt		10.0	2.67	18.6	2.16	33.0
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		16.5	13.7	16.8	21.7	14.7
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.33	2.21	7.24	8.08	5.78
cadmium	7440-43-9	E440	0.0050	mg/kg		0.141	0.0605	0.0440	0.293	0.0991
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0540	0.0097	0.0189	0.109	0.0389
calcium	7440-70-2	E440	20	mg/kg		7440	5790	5150	4310	6750
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2860	932	2210	1610	2650
cesium	7440-46-2	E440	0.0050	mg/kg		0.0218	0.0410	0.0387	0.106	0.102
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0084	0.0066	0.0166	0.0394	0.0399
chromium	7440-47-3	E440	0.050	mg/kg		0.176	0.235	0.130	0.367	0.078
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.067	0.038	0.056	0.137	0.030
cobalt	7440-48-4	E440	0.020	mg/kg		0.079	0.124	0.122	0.173	0.161
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0305	0.0199	0.0525	0.0646	0.0634
copper	7440-50-8	E440	0.10	mg/kg		5.09	12.9	6.40	11.4	3.91
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.96	2.07	2.75	4.23	1.54
iron	7439-89-6	E440	3.0	mg/kg		136	315	138	317	80.2
iron	7439-89-6	E440A	0.60	mg/kg wwt		52.4	50.7	59.5	118	31.5

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R2-L-01	22-R2-F-01	22-R2-L-02	22-R2-L-03	22-R3-L-01
					Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2369-016	VA22C2369-017	VA22C2369-018	VA22C2369-019	VA22C2369-020
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.042	0.096	0.061	0.118	0.032
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0163	0.0155	0.0262	0.0441	0.0125
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	0.58	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	0.12	0.14	0.19
magnesium	7439-95-4	E440	2.0	mg/kg		1110	1410	899	1460	1490
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		425	226	387	543	586
manganese	7439-96-5	E440	0.050	mg/kg		94.4	42.3	340	438	663
manganese	7439-96-5	E440A	0.010	mg/kg wwt		36.2	6.81	146	163	260
mercury	7439-97-6	E510	0.0050	mg/kg		0.0112	0.0253	0.0171	0.0281	0.0111
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0043	0.0041	0.0073	0.0105	0.0044
molybdenum	7439-98-7	E440	0.020	mg/kg		0.674	0.234	0.669	0.080	0.077
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.259	0.0377	0.288	0.0296	0.0303
nickel	7440-02-0	E440	0.20	mg/kg		2.12	0.33	0.50	0.58	0.76
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.814	0.054	0.215	0.214	0.300
phosphorus	7723-14-0	E440	10	mg/kg		1200	3040	1550	1780	2070
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		462	489	666	664	813
potassium	7440-09-7	E440	20	mg/kg		6640	12800	7320	6350	7020
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2550	2070	3150	2370	2760
rubidium	7440-17-7	E440	0.050	mg/kg		6.22	10.6	6.44	5.57	13.1
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.39	1.71	2.77	2.08	5.16
selenium	7782-49-2	E440	0.050	mg/kg		0.063	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.024	<0.010	0.013	0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0050	0.0078	0.0235	0.0211	0.0087
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0019	0.0013	0.0101	0.0079	0.0034
sodium	7440-23-5	E440	20	mg/kg		49	164	62	80	76
sodium	7440-23-5	E440A	4.0	mg/kg wwt		19.0	26.4	26.8	29.6	29.9
strontium	7440-24-6	E440	0.050	mg/kg		90.1	24.4	29.0	9.22	38.0
strontium	7440-24-6	E440A	0.010	mg/kg wwt		34.6	3.94	12.5	3.43	14.9
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R2-L-01	22-R2-F-01	22-R2-L-02	22-R2-L-03	22-R3-L-01
					Client sampling date / time	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 08:50	14-Sep-2022 10:00
						VA22C2369-016	VA22C2369-017	VA22C2369-018	VA22C2369-019	VA22C2369-020
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0080	0.0084	0.0221
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00344	0.00312	0.00868
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.21	0.14	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.031	0.034	0.062	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0026	0.0057	0.0028	0.0070	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00098	0.00092	0.00121	0.00260	0.00064
vanadium	7440-62-2	E440	0.10	mg/kg		0.45	1.01	0.50	1.11	0.22
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.171	0.163	0.214	0.413	0.088
zinc	7440-66-6	E440	0.50	mg/kg		14.0	32.6	26.2	11.9	32.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		5.40	5.25	11.3	4.43	12.9
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	0.24	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	0.090	0.059

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00
						VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		59.0	62.5	63.9	65.7	63.3
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		198	65.8	48.4	510	372
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		81.0	24.7	17.4	175	136
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.037	0.027	0.028	0.025	0.055
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0152	0.0101	0.0101	0.0085	0.0203
barium	7440-39-3	E440	0.050	mg/kg		93.4	39.3	46.8	1.43	3.76
barium	7440-39-3	E440A	0.010	mg/kg wwt		38.3	14.7	16.9	0.491	1.38
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		0.0022	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		11.3	16.3	20.9	22.0	21.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.64	6.12	7.53	7.54	7.81
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0747	0.146	0.207	0.204	0.373
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0306	0.0549	0.0747	0.0700	0.137
calcium	7440-70-2	E440	20	mg/kg		7860	7250	7300	2980	3350
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3220	2720	2630	1020	1230
cesium	7440-46-2	E440	0.0050	mg/kg		0.0914	0.0233	0.0305	0.153	0.0727
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0374	0.0087	0.0110	0.0525	0.0267
chromium	7440-47-3	E440	0.050	mg/kg		0.138	0.111	0.081	0.093	0.114
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.057	0.042	0.029	0.032	0.042
cobalt	7440-48-4	E440	0.020	mg/kg		0.186	0.088	0.093	0.102	0.104
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0762	0.0331	0.0334	0.0351	0.0380
copper	7440-50-8	E440	0.10	mg/kg		5.08	4.43	4.92	6.74	8.86
copper	7440-50-8	E440A	0.020	mg/kg wwt		2.08	1.66	1.78	2.31	3.25
iron	7439-89-6	E440	3.0	mg/kg		119	93.7	89.0	84.3	152
iron	7439-89-6	E440A	0.60	mg/kg wwt		48.6	35.1	32.1	28.9	55.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00
						VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.047	0.027	<0.020	0.020	0.054
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0192	0.0100	0.0072	0.0069	0.0197
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.15	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		1660	1180	1380	1550	1300
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		680	443	499	532	479
manganese	7439-96-5	E440	0.050	mg/kg		564	236	292	1310	1280
manganese	7439-96-5	E440A	0.010	mg/kg wwt		231	88.5	105	451	470
mercury	7439-97-6	E510	0.0050	mg/kg		0.0172	0.0123	0.0089	0.0078	0.0114
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0070	0.0046	0.0032	0.0027	0.0042
molybdenum	7439-98-7	E440	0.020	mg/kg		0.098	1.04	1.16	0.416	0.152
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.0402	0.389	0.420	0.143	0.0557
nickel	7440-02-0	E440	0.20	mg/kg		0.85	2.92	3.80	0.23	0.29
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.348	1.10	1.37	0.078	0.105
phosphorus	7723-14-0	E440	10	mg/kg		1670	1550	1910	1880	1870
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		686	582	688	647	685
potassium	7440-09-7	E440	20	mg/kg		5630	8830	11500	7460	7200
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2300	3310	4160	2560	2640
rubidium	7440-17-7	E440	0.050	mg/kg		11.4	6.14	9.02	13.7	8.54
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.66	2.30	3.25	4.69	3.14
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0087	<0.0050	0.0051	0.0076	0.0117
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0036	0.0014	0.0018	0.0026	0.0043
sodium	7440-23-5	E440	20	mg/kg		62	<20	<20	30	42
sodium	7440-23-5	E440A	4.0	mg/kg wwt		25.4	6.6	7.0	10.3	15.6
strontium	7440-24-6	E440	0.050	mg/kg		48.9	61.8	64.8	3.31	6.35
strontium	7440-24-6	E440A	0.010	mg/kg wwt		20.0	23.2	23.4	1.14	2.33
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 10:00
						VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0271	<0.0020	<0.0020	0.0021	0.0043
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.0111	<0.00040	<0.00040	0.00074	0.00158
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.028	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0023	<0.0020	<0.0020	<0.0020	0.0028
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00095	0.00064	0.00055	<0.00040	0.00101
vanadium	7440-62-2	E440	0.10	mg/kg		0.38	0.34	0.26	0.17	0.43
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.155	0.128	0.092	0.058	0.159
zinc	7440-66-6	E440	0.50	mg/kg		33.9	15.5	16.8	9.46	11.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		13.9	5.83	6.06	3.24	4.11
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-F-01	22-R3-F-01D	22-R1-L-01	22-R1-L-02	22-R1-F-01
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 11:00	14-Sep-2022 11:00	14-Sep-2022 11:00
						VA22C2369-026	VA22C2369-027	VA22C2369-028	VA22C2369-029	VA22C2369-030
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		66.9	66.9	63.8	62.6	73.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		124	176	64.4	377	482
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		41.2	58.3	23.3	141	129
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0027	0.0027	0.0027
arsenic	7440-38-2	E440	0.020	mg/kg		0.053	0.038	0.045	0.113	0.093
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0174	0.0125	0.0162	0.0423	0.0248
barium	7440-39-3	E440	0.050	mg/kg		97.6	166	51.1	5.67	102
barium	7440-39-3	E440A	0.010	mg/kg wwt		32.2	54.8	18.5	2.12	27.2
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		11.2	11.7	21.0	27.3	54.9
boron	7440-42-8	E440A	0.20	mg/kg wwt		3.70	3.88	7.60	10.2	14.7
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0488	0.0819	0.125	0.127	0.0636
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0161	0.0271	0.0451	0.0474	0.0170
calcium	7440-70-2	E440	20	mg/kg		5480	8320	8510	3370	28100
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1810	2750	3080	1260	7530
cesium	7440-46-2	E440	0.0050	mg/kg		0.0863	0.0655	0.0140	0.0862	0.0285
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0285	0.0217	0.0051	0.0322	0.0076
chromium	7440-47-3	E440	0.050	mg/kg		0.113	0.115	0.120	0.213	0.370
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.037	0.038	0.043	0.080	0.099
cobalt	7440-48-4	E440	0.020	mg/kg		0.090	0.308	0.082	0.186	0.094
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0297	0.102	0.0295	0.0695	0.0252
copper	7440-50-8	E440	0.10	mg/kg		4.61	4.86	5.20	11.2	7.68
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.52	1.61	1.88	4.19	2.06
iron	7439-89-6	E440	3.0	mg/kg		56.9	69.3	116	324	219
iron	7439-89-6	E440A	0.60	mg/kg wwt		18.8	22.9	42.0	121	58.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-F-01	22-R3-F-01D	22-R1-L-01	22-R1-L-02	22-R1-F-01
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 11:00	14-Sep-2022 11:00	14-Sep-2022 11:00
						VA22C2369-026	VA22C2369-027	VA22C2369-028	VA22C2369-029	VA22C2369-030
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.023	0.029	0.028	0.119	0.076
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0076	0.0096	0.0100	0.0444	0.0203
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.56
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	0.10	0.15
magnesium	7439-95-4	E440	2.0	mg/kg		1890	2580	1340	1290	5850
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		626	852	487	483	1570
manganese	7439-96-5	E440	0.050	mg/kg		67.8	96.4	108	1250	105
manganese	7439-96-5	E440A	0.010	mg/kg wwt		22.4	31.9	39.3	466	28.0
mercury	7439-97-6	E510	0.0050	mg/kg		0.0175	0.0233	0.0127	0.0246	0.0100
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0058	0.0077	0.0046	0.0092	0.0027
molybdenum	7439-98-7	E440	0.020	mg/kg		0.119	0.094	0.443	0.228	0.250
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.0393	0.0312	0.160	0.0853	0.0671
nickel	7440-02-0	E440	0.20	mg/kg		0.52	0.83	1.62	0.40	0.44
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.171	0.275	0.586	0.152	0.117
phosphorus	7723-14-0	E440	10	mg/kg		1920	2380	1880	2650	4050
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		636	786	680	992	1090
potassium	7440-09-7	E440	20	mg/kg		14200	14900	8600	6530	13600
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4700	4920	3110	2440	3640
rubidium	7440-17-7	E440	0.050	mg/kg		16.6	15.0	5.99	6.80	8.73
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		5.49	4.98	2.17	2.54	2.34
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.075	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.012	0.025	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0050	0.0057	0.0145	0.0779
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0013	0.0016	0.0021	0.0054	0.0209
sodium	7440-23-5	E440	20	mg/kg		27	32	29	57	161
sodium	7440-23-5	E440A	4.0	mg/kg wwt		8.9	10.4	10.6	21.5	43.1
strontium	7440-24-6	E440	0.050	mg/kg		32.3	61.6	80.8	7.80	199
strontium	7440-24-6	E440A	0.010	mg/kg wwt		10.7	20.4	29.2	2.91	53.4
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R3-F-01	22-R3-F-01D	22-R1-L-01	22-R1-L-02	22-R1-F-01
					Client sampling date / time	14-Sep-2022 10:00	14-Sep-2022 10:00	14-Sep-2022 11:00	14-Sep-2022 11:00	14-Sep-2022 11:00
						VA22C2369-026	VA22C2369-027	VA22C2369-028	VA22C2369-029	VA22C2369-030
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0056	0.0058	<0.0020	0.0054	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00187	0.00193	<0.00040	0.00202	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	0.62
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	0.166
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0024	0.0057	0.0044
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00040	0.00087	0.00214	0.00119
vanadium	7440-62-2	E440	0.10	mg/kg		0.14	0.17	0.37	0.99	0.68
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.047	0.057	0.135	0.370	0.183
zinc	7440-66-6	E440	0.50	mg/kg		17.4	34.6	12.9	14.3	21.3
zinc	7440-66-6	E440A	0.10	mg/kg wwt		5.74	11.4	4.67	5.36	5.72
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.70 DLM
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	0.046	0.069	<0.170 DLM

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-L-03	22-S11-L-01	22-S11-G-01	22-S11-L-02	22-S11-L-03
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40
						VA22C2369-031	VA22C2369-032	VA22C2369-033	VA22C2369-034	VA22C2369-035
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		62.8	52.9	38.6	61.9	64.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		159	71.7	19.9	155	16.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		59.1	33.7	12.2	59.1	5.87
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.015	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0056	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.072	7.14	0.025	0.110	0.085
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0270	3.36	0.0152	0.0417	0.0306
barium	7440-39-3	E440	0.050	mg/kg		151	21.4	5.97	9.93	4.51
barium	7440-39-3	E440A	0.010	mg/kg wwt		56.1	10.1	3.66	3.78	1.62
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		20.3	16.9	4.4	46.4	49.1
boron	7440-42-8	E440A	0.20	mg/kg wwt		7.56	7.94	2.73	17.7	17.7
cadmium	7440-43-9	E440	0.0050	mg/kg		0.137	0.0389	<0.0050	0.0452	1.33
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0509	0.0183	<0.0025 DLM	0.0172	0.478
calcium	7440-70-2	E440	20	mg/kg		7540	4760	3640	16000	11700
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2800	2240	2230	6090	4220
cesium	7440-46-2	E440	0.0050	mg/kg		0.0341	0.0992	0.0150	0.0465	0.0662
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0127	0.0467	0.0092	0.0177	0.0238
chromium	7440-47-3	E440	0.050	mg/kg		0.112	0.066	0.071	0.264	<0.050
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.042	0.031	0.043	0.101	0.013
cobalt	7440-48-4	E440	0.020	mg/kg		0.125	0.150	0.030	0.126	0.717
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0466	0.0705	0.0186	0.0480	0.258
copper	7440-50-8	E440	0.10	mg/kg		8.95	6.05	3.05	8.88	6.02
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.33	2.85	1.87	3.38	2.17
iron	7439-89-6	E440	3.0	mg/kg		149	101	38.4	271	44.9
iron	7439-89-6	E440A	0.60	mg/kg wwt		55.6	47.3	23.6	103	16.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-L-03	22-S11-L-01	22-S11-G-01	22-S11-L-02	22-S11-L-03
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40
						VA22C2369-031	VA22C2369-032	VA22C2369-033	VA22C2369-034	VA22C2369-035
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.080	0.034	<0.020	0.090	<0.020
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0298	0.0160	0.0074	0.0342	<0.0040
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		1130	835	659	6210	4000
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		422	393	404	2370	1440
manganese	7439-96-5	E440	0.050	mg/kg		1200	171	41.7	101	79.6
manganese	7439-96-5	E440A	0.010	mg/kg wwt		446	80.3	25.6	38.5	28.7
mercury	7439-97-6	E510	0.0050	mg/kg		0.0307	0.0075	<0.0050	0.0097	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0114	0.0035	0.0021	0.0037	<0.0020 DLA
molybdenum	7439-98-7	E440	0.020	mg/kg		0.118	0.837	4.70	4.64	2.06
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.0439	0.394	2.88	1.77	0.740
nickel	7440-02-0	E440	0.20	mg/kg		0.70	<0.20	<0.20	0.22	0.24
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.259	0.065	0.059	0.083	0.086
phosphorus	7723-14-0	E440	10	mg/kg		2930	2000	1080	6530	2430
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1090	943	661	2490	876
potassium	7440-09-7	E440	20	mg/kg		7280	6480	6250	9040	8380
potassium	7440-09-7	E440A	4.0	mg/kg wwt		2710	3050	3830	3440	3020
rubidium	7440-17-7	E440	0.050	mg/kg		5.74	5.91	3.85	6.02	6.55
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.14	2.78	2.36	2.29	2.36
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.287	0.158	0.392	0.494
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	0.135	0.097	0.149	0.178
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0159	0.0211	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0059	0.0099	0.0014	0.0012	0.0015
sodium	7440-23-5	E440	20	mg/kg		69	26	<20	34	25
sodium	7440-23-5	E440A	4.0	mg/kg wwt		25.7	12.1	8.1	13.0	9.2
strontium	7440-24-6	E440	0.050	mg/kg		44.1	218	31.5	468	170
strontium	7440-24-6	E440A	0.010	mg/kg wwt		16.4	102	19.3	178	61.1
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	0.0045	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R1-L-03	22-S11-L-01	22-S11-G-01	22-S11-L-02	22-S11-L-03
					Client sampling date / time	14-Sep-2022 11:00	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40	14-Sep-2022 12:40
						VA22C2369-031	VA22C2369-032	VA22C2369-033	VA22C2369-034	VA22C2369-035
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0106	0.0162	<0.0020	0.0028	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00393	0.00763	<0.00040	0.00108	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	0.17	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.024	<0.020	0.065	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0032	0.0021	<0.0020	0.0061	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00121	0.00099	0.00046	0.00232	<0.00040
vanadium	7440-62-2	E440	0.10	mg/kg		0.46	0.25	<0.10	0.81	<0.10
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.172	0.118	0.057	0.310	0.027
zinc	7440-66-6	E440	0.50	mg/kg		64.9	37.2	13.8	18.1	147
zinc	7440-66-6	E440A	0.10	mg/kg wwt		24.1	17.5	8.47	6.91	53.0
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.070 DLM	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S11-F-01	22-S12-L-01	22-S12-G-01	22-S12-L-02	22-S12-F-01
					Client sampling date / time	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10
						VA22C2369-036	VA22C2369-037	VA22C2369-038	VA22C2369-039	VA22C2369-040
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		72.0	54.6	54.5	60.5	59.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		33.1	70.8	8.4	38.6	35.8
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		9.26	32.2	3.81	15.3	14.4
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0020	0.0027	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.037	0.062	<0.020	<0.020	0.026
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0104	0.0284	0.0060	0.0069	0.0104
barium	7440-39-3	E440	0.050	mg/kg		9.61	6.46	7.15	1.43	16.9
barium	7440-39-3	E440A	0.010	mg/kg wwt		2.69	2.93	3.26	0.565	6.81
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		16.4	46.4	7.1	8.8	13.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.59	21.1	3.24	3.47	5.45
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0200 DLM	0.0432	<0.0050	0.0254	<0.0100 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0050 DLM	0.0196	<0.0010	0.0100	<0.0030 DLM
calcium	7440-70-2	E440	20	mg/kg		18900	9200	5830	2030	30000
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5290	4180	2650	803	12000
cesium	7440-46-2	E440	0.0050	mg/kg		1.01	0.0385	0.0058	0.0266	0.240
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.283	0.0175	0.0026	0.0105	0.0967
chromium	7440-47-3	E440	0.050	mg/kg		0.134	1.21	<0.050	0.076	0.130
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.037	0.548	0.020	0.030	0.052
cobalt	7440-48-4	E440	0.020	mg/kg		0.416	0.079	<0.020	0.063	0.236
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.116	0.0359	0.0044	0.0250	0.0951
copper	7440-50-8	E440	0.10	mg/kg		15.0	7.58	2.82	6.52	13.4
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.19	3.44	1.28	2.58	5.37
iron	7439-89-6	E440	3.0	mg/kg		118	140	21.7	64.6	117
iron	7439-89-6	E440A	0.60	mg/kg wwt		32.9	63.7	9.87	25.5	46.9

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S11-F-01	22-S12-L-01	22-S12-G-01	22-S12-L-02	22-S12-F-01
					Client sampling date / time	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10
						VA22C2369-036	VA22C2369-037	VA22C2369-038	VA22C2369-039	VA22C2369-040
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.022	0.038	<0.020	<0.020	0.020
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0063	0.0175	0.0064	0.0054	0.0082
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		4240	4860	1030	832	5600
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1180	2210	467	329	2250
manganese	7439-96-5	E440	0.050	mg/kg		105	73.2	44.1	63.7	75.7
manganese	7439-96-5	E440A	0.010	mg/kg wwt		29.3	33.2	20.1	25.2	30.4
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0057	<0.0050	<0.0050	0.0062
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0012 DLI	0.0026	0.0015	0.0012	0.0025
molybdenum	7439-98-7	E440	0.020	mg/kg		36.5	1.34	1.05	2.17	12.7
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		10.2	0.610	0.477	0.858	5.11
nickel	7440-02-0	E440	0.20	mg/kg		0.35	0.43	<0.20	0.32	0.22
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.098	0.196	<0.040	0.127	0.089
phosphorus	7723-14-0	E440	10	mg/kg		2260	3320	1080	1370	2280
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		632	1500	492	543	919
potassium	7440-09-7	E440	20	mg/kg		18100	6910	7560	5230	11000
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5060	3140	3440	2070	4430
rubidium	7440-17-7	E440	0.050	mg/kg		32.4	4.19	2.50	2.90	13.9
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		9.07	1.90	1.14	1.14	5.58
selenium	7782-49-2	E440	0.050	mg/kg		0.345	0.143	0.057	0.063	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.097	0.065	0.026	0.025	0.019
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	0.0405	0.0062
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0011	<0.0010	<0.0010	0.0160	0.0025
sodium	7440-23-5	E440	20	mg/kg		50	61	22	<20	40
sodium	7440-23-5	E440A	4.0	mg/kg wwt		14.0	27.6	10.1	4.9	16.1
strontium	7440-24-6	E440	0.050	mg/kg		469	130	44.6	8.00	206
strontium	7440-24-6	E440A	0.010	mg/kg wwt		131	59.2	20.3	3.16	83.0
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S11-F-01	22-S12-L-01	22-S12-G-01	22-S12-L-02	22-S12-F-01
					Client sampling date / time	14-Sep-2022 12:40	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10	14-Sep-2022 13:10
						VA22C2369-036	VA22C2369-037	VA22C2369-038	VA22C2369-039	VA22C2369-040
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0029	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00042	0.00130	<0.00040	0.00041	0.00074
vanadium	7440-62-2	E440	0.10	mg/kg		0.17	0.31	<0.10	0.15	0.13
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.047	0.142	0.022	0.061	0.051
zinc	7440-66-6	E440	0.50	mg/kg		27.2	10.9	11.9	42.0	24.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		7.60	4.96	5.40	16.6	9.72
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S12-L-03	22-S14-F-01	22-S14-L-03	22-S14-L-02	22-S14-L-01
					Client sampling date / time	14-Sep-2022 13:10	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00
						VA22C2369-041	VA22C2369-042	VA22C2369-043	VA22C2369-044	VA22C2369-045
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		76.5	69.0	58.9	61.1	63.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		109	33.3	23.4	112	34.8
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		25.7	10.3	9.63	43.5	12.9
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0031	0.0024
arsenic	7440-38-2	E440	0.020	mg/kg		0.071	0.033	<0.020	0.071	0.039
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0168	0.0102	0.0076	0.0278	0.0145
barium	7440-39-3	E440	0.050	mg/kg		46.3	13.0	1.30	10.1	7.14
barium	7440-39-3	E440A	0.010	mg/kg wwt		10.9	4.04	0.537	3.92	2.64
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		65.0	14.0	9.3	33.3	32.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		15.3	4.36	3.81	13.0	11.9
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0100 DLM	<0.0200 DLM	0.0408	0.0137	0.842
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0020 DLM	<0.0060 DLM	0.0168	0.0053	0.312
calcium	7440-70-2	E440	20	mg/kg		12500	13700	2300	11600	14200
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2940	4270	947	4510	5260
cesium	7440-46-2	E440	0.0050	mg/kg		0.244	1.39	0.198	0.0353	0.559
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0573	0.432	0.0813	0.0137	0.207
chromium	7440-47-3	E440	0.050	mg/kg		0.230	0.179	0.176	0.318	0.258
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.054	0.056	0.072	0.124	0.095
cobalt	7440-48-4	E440	0.020	mg/kg		0.096	0.340	0.099	0.086	0.367
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0224	0.105	0.0408	0.0335	0.136
copper	7440-50-8	E440	0.10	mg/kg		8.47	10.6	12.3	8.03	9.08
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.99	3.29	5.05	3.12	3.36
iron	7439-89-6	E440	3.0	mg/kg		203	106	64.7	203	73.2
iron	7439-89-6	E440A	0.60	mg/kg wwt		47.6	32.8	26.6	78.8	27.1

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S12-L-03	22-S14-F-01	22-S14-L-03	22-S14-L-02	22-S14-L-01
					Client sampling date / time	14-Sep-2022 13:10	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00
						VA22C2369-041	VA22C2369-042	VA22C2369-043	VA22C2369-044	VA22C2369-045
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.044	0.023	<0.020	0.051	0.024
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0103	0.0071	0.0048	0.0198	0.0089
lithium	7439-93-2	E440	0.50	mg/kg		0.51	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.12	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		3670	2860	802	5000	3130
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		863	886	329	1940	1160
manganese	7439-96-5	E440	0.050	mg/kg		31.6	72.5	37.7	72.4	60.9
manganese	7439-96-5	E440A	0.010	mg/kg wwt		7.42	22.5	15.5	28.1	22.6
mercury	7439-97-6	E510	0.0050	mg/kg		0.0109	<0.0050	<0.0050	0.0097	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0026	<0.0012	0.0012	0.0038	0.0015
molybdenum	7439-98-7	E440	0.020	mg/kg		12.4	31.5	6.50	8.10	1.30
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		2.90	9.76	2.67	3.15	0.481
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.54	0.65	<0.20	0.34
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.043	0.167	0.266	0.077	0.126
phosphorus	7723-14-0	E440	10	mg/kg		7700	2100	1540	3730	2130
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1810	651	635	1450	790
potassium	7440-09-7	E440	20	mg/kg		26200	16800	3450	7320	8640
potassium	7440-09-7	E440A	4.0	mg/kg wwt		6160	5220	1420	2850	3200
rubidium	7440-17-7	E440	0.050	mg/kg		23.8	25.6	7.76	3.16	6.12
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		5.61	7.95	3.19	1.23	2.27
selenium	7782-49-2	E440	0.050	mg/kg		0.228	0.166	<0.050	0.208	0.362
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.054	0.051	0.013	0.081	0.134
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0069	<0.0050	0.0247	<0.0050	0.0069
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0016	<0.0010	0.0102	0.0013	0.0025
sodium	7440-23-5	E440	20	mg/kg		107	121	<20	56	33
sodium	7440-23-5	E440A	4.0	mg/kg wwt		25.2	37.6	4.4	21.6	12.3
strontium	7440-24-6	E440	0.050	mg/kg		335	404	34.2	141	616
strontium	7440-24-6	E440A	0.010	mg/kg wwt		78.6	125	14.1	55.0	228
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	0.0068

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S12-L-03	22-S14-F-01	22-S14-L-03	22-S14-L-02	22-S14-L-01
					Client sampling date / time	14-Sep-2022 13:10	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00	14-Sep-2022 14:00
						VA22C2369-041	VA22C2369-042	VA22C2369-043	VA22C2369-044	VA22C2369-045
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0058	<0.0020	<0.0020	0.0039	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00137	0.00046	0.00075	0.00152	0.00050
vanadium	7440-62-2	E440	0.10	mg/kg		0.49	0.18	0.14	0.56	0.15
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.114	0.056	0.056	0.218	0.056
zinc	7440-66-6	E440	0.50	mg/kg		18.1	26.6	40.4	11.6	69.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		4.26	8.26	16.6	4.52	25.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S14-G-01	22-S13-L-01	22-S13-L-02	22-S13-L-03	22-S13-F-01
					Client sampling date / time	14-Sep-2022 14:00	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-046	VA22C2369-047	VA22C2369-048	VA22C2369-049	VA22C2369-050
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		48.4	56.9	58.4	53.4	70.3
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		16.9	77.3	36.9	54.2	101
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		8.74	33.4	15.3	25.3	30.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0026	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		<0.020	0.038	0.061	8.45	0.076
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0094	0.0163	0.0253	3.94	0.0225
barium	7440-39-3	E440	0.050	mg/kg		3.68	2.41	5.98	17.1	11.1
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.90	1.04	2.49	7.98	3.30
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		3.5	8.6	39.5	8.4	18.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		1.82	3.71	16.4	3.94	5.48
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	0.0821	0.648	0.0145	<0.0150 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0022	0.0354	0.270	0.0067	<0.0050 DLM
calcium	7440-70-2	E440	20	mg/kg		3310	3000	10300	2160	15600
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1710	1290	4310	1010	4640
cesium	7440-46-2	E440	0.0050	mg/kg		0.0132	0.0175	0.0460	0.0260	0.550
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0068	0.0075	0.0191	0.0121	0.163
chromium	7440-47-3	E440	0.050	mg/kg		0.063	0.339	0.137	0.252	0.385
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.032	0.146	0.057	0.117	0.114
cobalt	7440-48-4	E440	0.020	mg/kg		0.023	0.187	0.319	0.065	0.585
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0117	0.0806	0.133	0.0304	0.173
copper	7440-50-8	E440	0.10	mg/kg		2.38	6.00	6.53	4.84	14.1
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.22	2.59	2.72	2.25	4.19
iron	7439-89-6	E440	3.0	mg/kg		33.5	112	63.4	104	248
iron	7439-89-6	E440A	0.60	mg/kg wwt		17.3	48.5	26.4	48.4	73.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S14-G-01	22-S13-L-01	22-S13-L-02	22-S13-L-03	22-S13-F-01
					Client sampling date / time	14-Sep-2022 14:00	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-046	VA22C2369-047	VA22C2369-048	VA22C2369-049	VA22C2369-050
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.027	0.024	0.032	0.046
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0070	0.0116	0.0100	0.0149	0.0136
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	0.11
magnesium	7439-95-4	E440	2.0	mg/kg		607	1530	3020	770	3780
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		313	662	1260	359	1120
manganese	7439-96-5	E440	0.050	mg/kg		41.6	76.6	31.6	147	96.6
manganese	7439-96-5	E440A	0.010	mg/kg wwt		21.5	33.0	13.1	68.5	28.6
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0013	<0.0011 DLI	0.0014	<0.0022 DLA	0.0012
molybdenum	7439-98-7	E440	0.020	mg/kg		2.14	1.63	1.60	2.47	38.0
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.10	0.704	0.667	1.15	11.3
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.21	<0.20	<0.20	0.74
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.050	0.090	0.077	0.066	0.220
phosphorus	7723-14-0	E440	10	mg/kg		850	1100	1580	1460	2830
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		438	475	656	678	838
potassium	7440-09-7	E440	20	mg/kg		5860	4400	5380	7960	23100
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3020	1900	2240	3710	6860
rubidium	7440-17-7	E440	0.050	mg/kg		3.54	2.58	5.39	5.98	38.7
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		1.83	1.11	2.24	2.78	11.5
selenium	7782-49-2	E440	0.050	mg/kg		0.054	<0.050	0.112	<0.050	0.105
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.028	0.015	0.046	0.022	0.031
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0305	0.0055	0.0097	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0131	0.0023	0.0045	<0.0010
sodium	7440-23-5	E440	20	mg/kg		<20	21	40	<20	116
sodium	7440-23-5	E440A	4.0	mg/kg wwt		9.7	9.0	16.5	8.7	34.4
strontium	7440-24-6	E440	0.050	mg/kg		34.9	24.4	324	44.5	330
strontium	7440-24-6	E440A	0.010	mg/kg wwt		18.0	10.5	135	20.7	98.0
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S14-G-01	22-S13-L-01	22-S13-L-02	22-S13-L-03	22-S13-F-01
					Client sampling date / time	14-Sep-2022 14:00	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-046	VA22C2369-047	VA22C2369-048	VA22C2369-049	VA22C2369-050
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	0.0031	<0.0020	0.0093	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	0.00133	<0.00040	0.00432	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0031	<0.0020	<0.0020	0.0034
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00133	0.00054	0.00080	0.00100
vanadium	7440-62-2	E440	0.10	mg/kg		<0.10	0.34	0.15	0.30	0.52
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.049	0.148	0.061	0.142	0.154
zinc	7440-66-6	E440	0.50	mg/kg		12.2	66.2	72.5	23.4	35.6
zinc	7440-66-6	E440A	0.10	mg/kg wwt		6.31	28.6	30.2	10.9	10.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S16-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00
						VA22C2369-051	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-055
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		35.9	57.5	62.5	62.4	31.3
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		69.2	20.1	45.4	60.7	38.1
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		44.3	8.53	17.0	22.8	26.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	0.011	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0028	0.0045	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.069	0.022	0.043	13.3	0.044
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0445	0.0094	0.0163	5.01	0.0306
barium	7440-39-3	E440	0.050	mg/kg		35.8	8.56	1.51	20.0	5.23
barium	7440-39-3	E440A	0.010	mg/kg wwt		22.9	3.64	0.565	7.51	3.59
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		3.3	41.1	16.3	17.8	2.3
boron	7440-42-8	E440A	0.20	mg/kg wwt		2.10	17.4	6.12	6.71	1.57
cadmium	7440-43-9	E440	0.0050	mg/kg		0.111	1.23	0.0363	0.0127	0.0117
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0714	0.525	0.0136	0.0048	0.0081
calcium	7440-70-2	E440	20	mg/kg		4060	15900	2840	3440	1610
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2600	6740	1070	1290	1110
cesium	7440-46-2	E440	0.0050	mg/kg		0.0427	0.259	0.0696	0.162	0.0161
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0274	0.110	0.0261	0.0611	0.0110
chromium	7440-47-3	E440	0.050	mg/kg		0.112	0.088	0.095	0.246	0.176
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.072	0.037	0.036	0.092	0.121
cobalt	7440-48-4	E440	0.020	mg/kg		0.058	0.370	0.086	0.114	0.046
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0370	0.157	0.0322	0.0427	0.0318
copper	7440-50-8	E440	0.10	mg/kg		4.94	6.39	5.05	5.12	3.18
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.17	2.72	1.89	1.93	2.18
iron	7439-89-6	E440	3.0	mg/kg		124	52.6	59.2	104	73.3
iron	7439-89-6	E440A	0.60	mg/kg wwt		79.5	22.3	22.2	39.1	50.3

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S16-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00
						VA22C2369-051	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-055
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.041	0.021	<0.020	0.026	0.028
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0264	0.0090	0.0052	0.0096	0.0195
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.15	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		510	2520	1140	1000	341
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		327	1070	427	378	234
manganese	7439-96-5	E440	0.050	mg/kg		64.6	38.3	91.4	94.1	43.5
manganese	7439-96-5	E440A	0.010	mg/kg wwt		41.4	16.3	34.3	35.4	29.9
mercury	7439-97-6	E510	0.0050	mg/kg		0.0073	0.0050	<0.0050	0.0061	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0047	0.0021	<0.0017 DLA	0.0023	<0.0018 DLA
molybdenum	7439-98-7	E440	0.020	mg/kg		10.4	1.32	1.67	1.87	1.02
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		6.68	0.561	0.627	0.702	0.704
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	<0.20	0.21	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.056	0.075	0.080	<0.040	0.050
phosphorus	7723-14-0	E440	10	mg/kg		774	1550	1420	1470	220
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		496	659	533	553	151
potassium	7440-09-7	E440	20	mg/kg		4690	8500	4230	5860	5400
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3010	3610	1580	2200	3710
rubidium	7440-17-7	E440	0.050	mg/kg		3.67	6.28	3.54	8.69	2.53
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.35	2.66	1.33	3.27	1.74
selenium	7782-49-2	E440	0.050	mg/kg		0.075	0.235	0.311	0.273	0.054
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.048	0.100	0.116	0.103	0.037
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0058	0.0270	0.0071	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0020	0.0024	0.0101	0.0027	<0.0010
sodium	7440-23-5	E440	20	mg/kg		31	52	35	22	<20
sodium	7440-23-5	E440A	4.0	mg/kg wwt		19.6	22.1	13.2	8.3	12.1
strontium	7440-24-6	E440	0.050	mg/kg		106	434	35.6	159	30.9
strontium	7440-24-6	E440A	0.010	mg/kg wwt		68.3	184	13.4	59.7	21.2
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	0.0042	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S16-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00	14-Sep-2022 17:00
						VA22C2369-051	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-055
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0026	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00042	0.00099	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0031	<0.0020	<0.0020	0.0032	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00199	0.00060	0.00050	0.00119	0.00120
vanadium	7440-62-2	E440	0.10	mg/kg		0.41	0.10	0.14	0.28	0.25
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.260	0.045	0.052	0.107	0.175
zinc	7440-66-6	E440	0.50	mg/kg		15.3	143	44.9	18.9	6.93
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.82	60.7	16.8	7.12	4.76
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.060	0.043	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S16-F-01	22-S6-L-01	22-S6-L-02	22-S6-G-01	22-S6-F-01
					Client sampling date / time	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10
						VA22C2369-056	VA22C2369-057	VA22C2369-058	VA22C2369-059	VA22C2369-060
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		69.9	62.9	67.3	43.7	70.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		61.7	107	17.4	22.0	33.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		18.6	39.6	5.71	12.4	10.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0022	0.0033	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.054	0.075	0.041	0.021	0.034
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0162	0.0278	0.0135	0.0120	0.0101
barium	7440-39-3	E440	0.050	mg/kg		12.3	23.8	10.1	9.13	24.5
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.70	8.80	3.30	5.14	7.32
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		19.8	34.1	40.2	3.6	13.3
boron	7440-42-8	E440A	0.20	mg/kg wwt		5.95	12.6	13.2	2.04	3.98
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0150 DLM	0.0623	0.437	<0.0050	0.0122
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0040 DLM	0.0231	0.143	0.0015	0.0036
calcium	7440-70-2	E440	20	mg/kg		19800	11200	15600	2440	18000
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5950	4150	5100	1370	5370
cesium	7440-46-2	E440	0.0050	mg/kg		0.618	0.0223	0.0812	0.0092	0.554
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.186	0.0083	0.0266	0.0052	0.165
chromium	7440-47-3	E440	0.050	mg/kg		0.228	0.350	0.072	0.144	0.130
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.068	0.130	0.024	0.081	0.039
cobalt	7440-48-4	E440	0.020	mg/kg		0.257	0.103	0.394	0.026	0.153
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0773	0.0380	0.129	0.0144	0.0455
copper	7440-50-8	E440	0.10	mg/kg		16.1	10.1	5.55	3.17	12.8
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.84	3.74	1.82	1.78	3.81
iron	7439-89-6	E440	3.0	mg/kg		143	211	48.7	45.7	108
iron	7439-89-6	E440A	0.60	mg/kg wwt		43.1	78.1	16.0	25.7	32.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S16-F-01	22-S6-L-01	22-S6-L-02	22-S6-G-01	22-S6-F-01
					Client sampling date / time	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10
						VA22C2369-056	VA22C2369-057	VA22C2369-058	VA22C2369-059	VA22C2369-060
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.039	0.060	0.023	<0.020	0.024
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0116	0.0222	0.0075	0.0084	0.0073
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.12	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		2990	5350	2020	594	2710
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		901	1980	661	334	809
manganese	7439-96-5	E440	0.050	mg/kg		62.5	225	21.1	42.2	70.1
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.8	83.5	6.91	23.7	20.9
mercury	7439-97-6	E510	0.0050	mg/kg		0.0054	0.0063	<0.0050	<0.0050	0.0056
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0022 DLA	0.0023	0.0016	0.0019	0.0017
molybdenum	7439-98-7	E440	0.020	mg/kg		20.1	2.69	2.90	1.96	4.40
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		6.05	0.996	0.950	1.10	1.31
nickel	7440-02-0	E440	0.20	mg/kg		0.26	0.69	0.21	0.22	0.76
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.077	0.257	0.070	0.122	0.226
phosphorus	7723-14-0	E440	10	mg/kg		1290	4540	2510	1460	1500
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		388	1680	822	820	448
potassium	7440-09-7	E440	20	mg/kg		18600	7370	12500	9590	17300
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5610	2730	4080	5400	5170
rubidium	7440-17-7	E440	0.050	mg/kg		24.8	3.47	8.11	5.40	22.7
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		7.47	1.29	2.66	3.04	6.78
selenium	7782-49-2	E440	0.050	mg/kg		0.181	0.065	0.116	<0.050	0.071
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.054	0.024	0.038	0.016	0.021
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0096	<0.0050	<0.0050	<0.0050	0.0084
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0029	<0.0010	0.0011	<0.0010	0.0025
sodium	7440-23-5	E440	20	mg/kg		79	100	36	21	36
sodium	7440-23-5	E440A	4.0	mg/kg wwt		23.9	37.2	11.7	11.7	10.8
strontium	7440-24-6	E440	0.050	mg/kg		557	43.0	55.6	11.7	71.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		168	15.9	18.2	6.60	21.3
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		0.0046	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S16-F-01	22-S6-L-01	22-S6-L-02	22-S6-G-01	22-S6-F-01
					Client sampling date / time	14-Sep-2022 17:00	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10	15-Sep-2022 08:10
						VA22C2369-056	VA22C2369-057	VA22C2369-058	VA22C2369-059	VA22C2369-060
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0032	0.0032	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00096	0.00120	<0.00040	<0.00040	<0.00040
vanadium	7440-62-2	E440	0.10	mg/kg		0.32	0.56	<0.10	0.10	0.22
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.096	0.207	0.030	0.059	0.065
zinc	7440-66-6	E440	0.50	mg/kg		18.9	20.7	28.0	19.4	26.6
zinc	7440-66-6	E440A	0.10	mg/kg wwt		5.68	7.66	9.16	10.9	7.94
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S6-G-02	22-S13-L-01D	22-S13-L-02D	22-S13-L-03D	22-S13-F-01D
					Client sampling date / time	15-Sep-2022 08:10	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-061	VA22C2369-062	VA22C2369-063	VA22C2369-064	VA22C2369-065
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		42.8	58.2	58.6	53.7	69.2
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		46.9	45.8	27.3	64.6	71.7
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		26.8	19.1	11.3	30.0	22.0
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0036	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.038	0.032	0.056	10.9	0.057
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0215	0.0134	0.0233	5.04	0.0176
barium	7440-39-3	E440	0.050	mg/kg		20.6	1.85	5.56	15.5	12.8
barium	7440-39-3	E440A	0.010	mg/kg wwt		11.8	0.775	2.30	7.18	3.95
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		2.3	7.9	36.6	8.0	15.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		1.33	3.29	15.2	3.72	4.76
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0066	0.0482	0.984	0.0140	<0.0225 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0038	0.0202	0.408	0.0065	<0.0065 DLM
calcium	7440-70-2	E440	20	mg/kg		2160	2440	11100	1940	11900
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1230	1020	4580	900	3660
cesium	7440-46-2	E440	0.0050	mg/kg		0.0080	0.0193	0.0628	0.0302	0.331
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0046	0.0080	0.0260	0.0140	0.102
chromium	7440-47-3	E440	0.050	mg/kg		0.143	0.109	0.116	0.080	1.51
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.082	0.046	0.048	0.037	0.464
cobalt	7440-48-4	E440	0.020	mg/kg		0.052	0.154	0.371	0.067	0.367
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0300	0.0645	0.154	0.0311	0.113
copper	7440-50-8	E440	0.10	mg/kg		3.94	6.12	5.64	5.23	13.1
copper	7440-50-8	E440A	0.020	mg/kg wwt		2.25	2.56	2.34	2.42	4.04
iron	7439-89-6	E440	3.0	mg/kg		76.4	97.0	75.9	112	180
iron	7439-89-6	E440A	0.60	mg/kg wwt		43.7	40.6	31.4	51.7	55.3

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S6-G-02	22-S13-L-01D	22-S13-L-02D	22-S13-L-03D	22-S13-F-01D
					Client sampling date / time	15-Sep-2022 08:10	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-061	VA22C2369-062	VA22C2369-063	VA22C2369-064	VA22C2369-065
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.031	0.025	0.073	0.028	0.039
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0176	0.0105	0.0302	0.0130	0.0119
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.71
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	0.22
magnesium	7439-95-4	E440	2.0	mg/kg		473	1300	3180	737	2930
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		271	544	1320	341	900
manganese	7439-96-5	E440	0.050	mg/kg		28.1	68.4	37.9	122	63.4
manganese	7439-96-5	E440A	0.010	mg/kg wwt		16.1	28.6	15.7	56.6	19.5
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0021	0.0014	0.0012	0.0023	<0.0022 DLA
molybdenum	7439-98-7	E440	0.020	mg/kg		3.74	2.35	2.09	2.58	37.3
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		2.14	0.984	0.866	1.20	11.5
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.21	<0.20	<0.20	0.58
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.068	0.089	0.064	0.048	0.180
phosphorus	7723-14-0	E440	10	mg/kg		565	973	1640	1550	3380
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		323	407	679	718	1040
potassium	7440-09-7	E440	20	mg/kg		3320	3840	7610	7360	24800
potassium	7440-09-7	E440A	4.0	mg/kg wwt		1900	1600	3150	3410	7620
rubidium	7440-17-7	E440	0.050	mg/kg		1.75	2.94	5.33	7.42	36.3
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		1.00	1.23	2.21	3.44	11.2
selenium	7782-49-2	E440	0.050	mg/kg		0.054	<0.050	0.184	<0.050	0.099
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.031	0.014	0.076	0.022	0.030
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0374	0.0054	0.0082	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0014	0.0156	0.0022	0.0038	<0.0010
sodium	7440-23-5	E440	20	mg/kg		33	<20	<20	<20	105
sodium	7440-23-5	E440A	4.0	mg/kg wwt		18.7	4.5	5.8	7.9	32.3
strontium	7440-24-6	E440	0.050	mg/kg		12.7	18.6	347	38.0	290
strontium	7440-24-6	E440A	0.010	mg/kg wwt		7.26	7.78	144	17.6	89.3
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S6-G-02	22-S13-L-01D	22-S13-L-02D	22-S13-L-03D	22-S13-F-01D
					Client sampling date / time	15-Sep-2022 08:10	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40	14-Sep-2022 14:40
						VA22C2369-061	VA22C2369-062	VA22C2369-063	VA22C2369-064	VA22C2369-065
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	0.0078	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	0.00048	<0.00040	0.00360	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0023	<0.0020	0.0021	0.0021
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00114	0.00096	<0.00040	0.00096	0.00066
vanadium	7440-62-2	E440	0.10	mg/kg		0.21	0.24	0.12	0.31	0.36
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.123	0.101	0.048	0.146	0.111
zinc	7440-66-6	E440	0.50	mg/kg		10.5	52.7	96.1	21.0	34.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		6.03	22.0	39.8	9.75	10.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01D	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-S17-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15
						VA22C2369-066	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-070
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		38.4	61.1	60.5	62.6	29.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		69.8	38.4	37.3	11.7	40.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		43.0	15.0	14.7	4.38	28.6
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0025	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.087	0.025	3.96	<0.020	0.071
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0535	0.0097	1.56	0.0050	0.0501
barium	7440-39-3	E440	0.050	mg/kg		47.8	1.65	12.3	3.32	30.0
barium	7440-39-3	E440A	0.010	mg/kg wwt		29.4	0.644	4.84	1.24	21.2
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		5.1	10.7	11.9	38.1	4.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		3.13	4.16	4.71	14.2	3.16
cadmium	7440-43-9	E440	0.0050	mg/kg		0.104	0.0516	0.0599	1.50	0.0642
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0642	0.0201	0.0237	0.562	0.0453
calcium	7440-70-2	E440	20	mg/kg		5790	3020	3190	10900	5390
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3560	1180	1260	4070	3800
cesium	7440-46-2	E440	0.0050	mg/kg		0.0429	0.110	0.111	0.489	0.140
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0264	0.0429	0.0437	0.183	0.0985
chromium	7440-47-3	E440	0.050	mg/kg		0.173	0.055	0.071	<0.050	0.100
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.107	0.021	0.028	<0.010	0.070
cobalt	7440-48-4	E440	0.020	mg/kg		0.060	0.118	0.123	0.476	0.036
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0372	0.0459	0.0485	0.178	0.0254
copper	7440-50-8	E440	0.10	mg/kg		5.26	4.53	3.53	6.03	4.69
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.24	1.76	1.39	2.25	3.31
iron	7439-89-6	E440	3.0	mg/kg		124	80.8	61.3	37.2	80.0
iron	7439-89-6	E440A	0.60	mg/kg wwt		76.3	31.5	24.2	13.9	56.4

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01D	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-S17-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15
						VA22C2369-066	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-070
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.041	0.022	<0.020	<0.020	0.031
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0251	0.0086	0.0063	0.0046	0.0221
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	0.71	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.14	<0.10	<0.10	0.26	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		708	1110	731	3360	414
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		436	431	289	1260	292
manganese	7439-96-5	E440	0.050	mg/kg		96.9	63.0	73.9	54.4	85.8
manganese	7439-96-5	E440A	0.010	mg/kg wwt		59.6	24.5	29.2	20.4	60.5
mercury	7439-97-6	E510	0.0050	mg/kg		0.0073	<0.0050	<0.0050	<0.0050	0.0065
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0045	0.0013	0.0018	0.0013	0.0046
molybdenum	7439-98-7	E440	0.020	mg/kg		19.6	2.67	0.749	1.84	4.86
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		12.0	1.04	0.296	0.688	3.43
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.32	<0.20	0.46	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.063	0.125	0.042	0.171	0.052
phosphorus	7723-14-0	E440	10	mg/kg		996	1110	1440	1880	579
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		613	432	570	705	408
potassium	7440-09-7	E440	20	mg/kg		5540	3760	6190	7520	4320
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3410	1460	2440	2810	3040
rubidium	7440-17-7	E440	0.050	mg/kg		4.26	3.28	4.84	5.82	3.40
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.62	1.28	1.91	2.17	2.40
selenium	7782-49-2	E440	0.050	mg/kg		0.093	0.063	0.098	0.816	0.056
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.057	0.024	0.039	0.305	0.040
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0086	0.0062	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0021	0.0034	0.0025	0.0014	0.0022
sodium	7440-23-5	E440	20	mg/kg		45	36	24	<20	23
sodium	7440-23-5	E440A	4.0	mg/kg wwt		27.7	14.1	9.3	7.1	16.0
strontium	7440-24-6	E440	0.050	mg/kg		146	49.4	121	469	112
strontium	7440-24-6	E440A	0.010	mg/kg wwt		90.2	19.2	47.9	175	78.9
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	0.0041	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S13-G-01D	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-S17-G-01
					Client sampling date / time	14-Sep-2022 14:40	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15	14-Sep-2022 16:15
						VA22C2369-066	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-070
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0037	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00146	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.022	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0030	<0.0020	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00182	0.00059	0.00058	0.00044	0.00109
vanadium	7440-62-2	E440	0.10	mg/kg		0.39	0.22	0.15	<0.10	0.24
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.242	0.085	0.058	0.021	0.172
zinc	7440-66-6	E440	0.50	mg/kg		15.1	44.4	20.6	82.1	15.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.30	17.3	8.13	30.7	11.2
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.056	<0.040	<0.040	<0.040	0.086

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-F-01	22-S5-L-01	22-S5-B-01	22-S5-G-01	22-S5-L-02
					Client sampling date / time	14-Sep-2022 16:15	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10
						VA22C2369-071	VA22C2369-072	VA22C2369-073	VA22C2369-074	VA22C2369-075
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		69.0	58.7	61.1	47.0	60.1
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		32.0	117	95.9	27.5	19.9
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		9.93	48.2	37.3	14.6	7.92
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0028	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.032	0.089	0.079	0.035	0.027
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0098	0.0368	0.0308	0.0184	0.0109
barium	7440-39-3	E440	0.050	mg/kg		9.72	15.5	9.23	6.64	4.67
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.02	6.41	3.59	3.52	1.86
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		20.8	29.8	23.2	3.9	39.4
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.44	12.3	9.00	2.06	15.7
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0200 DLM	0.0146	0.0180	<0.0050	0.220
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0060 DLM	0.0060	0.0070	<0.0020 DLM	0.0879
calcium	7440-70-2	E440	20	mg/kg		15600	10700	7660	2520	9960
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4830	4410	2980	1340	3970
cesium	7440-46-2	E440	0.0050	mg/kg		1.04	0.0480	0.111	0.0297	0.648
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.323	0.0198	0.0433	0.0157	0.258
chromium	7440-47-3	E440	0.050	mg/kg		0.077	0.280	0.097	0.095	0.061
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.024	0.115	0.038	0.050	0.024
cobalt	7440-48-4	E440	0.020	mg/kg		0.298	0.108	0.116	0.032	0.382
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0924	0.0447	0.0452	0.0171	0.152
copper	7440-50-8	E440	0.10	mg/kg		12.0	11.2	9.59	4.33	6.95
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.73	4.63	3.73	2.30	2.77
iron	7439-89-6	E440	3.0	mg/kg		106	194	154	48.7	50.1
iron	7439-89-6	E440A	0.60	mg/kg wwt		32.8	80.2	60.0	25.8	20.0

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-F-01	22-S5-L-01	22-S5-B-01	22-S5-G-01	22-S5-L-02
					Client sampling date / time	14-Sep-2022 16:15	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10
						VA22C2369-071	VA22C2369-072	VA22C2369-073	VA22C2369-074	VA22C2369-075
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.024	0.067	0.030	0.021	0.031
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0074	0.0276	0.0118	0.0110	0.0123
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.13	<0.10	<0.10	<0.10	0.12
magnesium	7439-95-4	E440	2.0	mg/kg		4320	3390	2410	633	2950
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1340	1400	938	336	1180
manganese	7439-96-5	E440	0.050	mg/kg		99.3	85.3	41.6	33.6	32.4
manganese	7439-96-5	E440A	0.010	mg/kg wwt		30.8	35.2	16.2	17.8	12.9
mercury	7439-97-6	E510	0.0050	mg/kg		0.0060	0.0068	<0.0050	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0018	0.0028	0.0013	0.0020	0.0015
molybdenum	7439-98-7	E440	0.020	mg/kg		27.4	2.11	1.72	4.42	2.95
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		8.50	0.872	0.668	2.34	1.18
nickel	7440-02-0	E440	0.20	mg/kg		0.69	0.40	0.43	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.215	0.167	0.167	0.083	0.077
phosphorus	7723-14-0	E440	10	mg/kg		1830	3970	3270	1350	2670
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		568	1640	1270	715	1060
potassium	7440-09-7	E440	20	mg/kg		15600	10100	12300	8410	12100
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4850	4190	4790	4450	4810
rubidium	7440-17-7	E440	0.050	mg/kg		27.1	6.60	12.6	6.06	10.8
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		8.40	2.72	4.88	3.21	4.31
selenium	7782-49-2	E440	0.050	mg/kg		0.124	0.163	0.273	0.081	1.21
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.039	0.067	0.106	0.043	0.484
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0013	0.0011	<0.0010	<0.0010
sodium	7440-23-5	E440	20	mg/kg		119	59	22	<20	57
sodium	7440-23-5	E440A	4.0	mg/kg wwt		37.0	24.5	8.7	10.6	22.7
strontium	7440-24-6	E440	0.050	mg/kg		409	40.9	30.4	10.9	38.7
strontium	7440-24-6	E440A	0.010	mg/kg wwt		127	16.9	11.8	5.79	15.4
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S17-F-01	22-S5-L-01	22-S5-B-01	22-S5-G-01	22-S5-L-02
					Client sampling date / time	14-Sep-2022 16:15	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10	15-Sep-2022 09:10
						VA22C2369-071	VA22C2369-072	VA22C2369-073	VA22C2369-074	VA22C2369-075
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	1.17	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	0.456	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0035	0.0023	<0.0020	0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00044	0.00144	0.00090	0.00050	0.00080
vanadium	7440-62-2	E440	0.10	mg/kg		0.18	0.54	0.41	0.13	<0.10
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.057	0.223	0.158	0.068	0.037
zinc	7440-66-6	E440	0.50	mg/kg		37.0	12.2	22.6	12.6	24.5
zinc	7440-66-6	E440A	0.10	mg/kg wwt		11.5	5.02	8.80	6.67	9.75
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S5-F-01	22-S4-L-02	22-S4-L-01	22-S4-G-01	22-S4-F-01
					Client sampling date / time	15-Sep-2022 09:10	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00
						VA22C2369-076	VA22C2369-077	VA22C2369-078	VA22C2369-079	VA22C2369-080
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		67.7	55.7	61.6	48.6	72.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		73.0	169	25.0	31.3	42.0
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		23.6	74.9	9.59	16.1	11.8
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0034	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.056	0.110	0.053	0.039	0.052
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0182	0.0486	0.0205	0.0199	0.0146
barium	7440-39-3	E440	0.050	mg/kg		29.7	22.6	9.11	12.9	23.4
barium	7440-39-3	E440A	0.010	mg/kg wwt		9.61	10.0	3.50	6.65	6.56
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	0.0023	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		14.5	38.1	35.7	4.7	19.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.68	16.9	13.7	2.41	5.48
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0100 DLM	0.0454	0.613	0.0069	<0.0125 DLM
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0030 DLM	0.0201	0.235	0.0035	<0.0035 DLM
calcium	7440-70-2	E440	20	mg/kg		21900	13800	12500	2710	25400
calcium	7440-70-2	E440A	4.0	mg/kg wwt		7100	6110	4820	1390	7110
cesium	7440-46-2	E440	0.0050	mg/kg		0.278	0.0538	0.254	0.0209	0.822
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0898	0.0238	0.0975	0.0107	0.230
chromium	7440-47-3	E440	0.050	mg/kg		0.092	0.223	0.052	<0.050	0.118
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.030	0.099	0.020	0.020	0.033
cobalt	7440-48-4	E440	0.020	mg/kg		0.257	0.128	0.207	0.032	0.226
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0831	0.0570	0.0796	0.0164	0.0633
copper	7440-50-8	E440	0.10	mg/kg		21.3	12.7	6.78	4.56	17.7
copper	7440-50-8	E440A	0.020	mg/kg wwt		6.90	5.62	2.60	2.34	4.95
iron	7439-89-6	E440	3.0	mg/kg		146	273	51.4	57.6	114
iron	7439-89-6	E440A	0.60	mg/kg wwt		47.2	121	19.7	29.6	32.0

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S5-F-01	22-S4-L-02	22-S4-L-01	22-S4-G-01	22-S4-F-01
					Client sampling date / time	15-Sep-2022 09:10	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00
						VA22C2369-076	VA22C2369-077	VA22C2369-078	VA22C2369-079	VA22C2369-080
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.032	0.070	<0.020	<0.020	0.029
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0103	0.0309	0.0060	0.0081	0.0081
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	0.52
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.16	0.13	<0.10	0.15
magnesium	7439-95-4	E440	2.0	mg/kg		4050	4910	2880	722	3590
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1310	2180	1100	371	1000
manganese	7439-96-5	E440	0.050	mg/kg		56.0	176	37.0	48.5	102
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.1	78.2	14.2	24.9	28.5
mercury	7439-97-6	E510	0.0050	mg/kg		0.0071	0.0082	<0.0050	<0.0050	0.0056
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0023	0.0036	0.0015	0.0014	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		10.5	3.86	2.18	1.40	15.9
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		3.40	1.71	0.838	0.722	4.45
nickel	7440-02-0	E440	0.20	mg/kg		0.33	0.43	0.41	0.21	0.35
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.107	0.190	0.159	0.107	0.098
phosphorus	7723-14-0	E440	10	mg/kg		2300	3890	1740	1730	2050
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		744	1720	667	887	575
potassium	7440-09-7	E440	20	mg/kg		13000	8100	7080	11800	18900
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4210	3590	2720	6090	5300
rubidium	7440-17-7	E440	0.050	mg/kg		15.3	4.92	7.95	8.22	24.9
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.95	2.18	3.05	4.22	6.96
selenium	7782-49-2	E440	0.050	mg/kg		0.576	0.475	0.670	0.101	1.10
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.186	0.210	0.257	0.052	0.307
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0104	<0.0050	<0.0050	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0034	0.0016	<0.0010	<0.0010	0.0011
sodium	7440-23-5	E440	20	mg/kg		72	117	34	31	170
sodium	7440-23-5	E440A	4.0	mg/kg wwt		23.5	52.0	13.1	15.8	47.7
strontium	7440-24-6	E440	0.050	mg/kg		84.1	45.8	45.6	11.1	73.8
strontium	7440-24-6	E440A	0.010	mg/kg wwt		27.2	20.3	17.5	5.70	20.7
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S5-F-01	22-S4-L-02	22-S4-L-01	22-S4-G-01	22-S4-F-01
					Client sampling date / time	15-Sep-2022 09:10	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00	15-Sep-2022 10:00
						VA22C2369-076	VA22C2369-077	VA22C2369-078	VA22C2369-079	VA22C2369-080
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0024	0.0063	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00077	0.00278	<0.00040	0.00053	0.00043
vanadium	7440-62-2	E440	0.10	mg/kg		0.33	0.74	0.14	0.16	0.21
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.106	0.331	0.053	0.084	0.059
zinc	7440-66-6	E440	0.50	mg/kg		28.1	15.2	31.0	20.8	30.9
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.09	6.74	11.9	10.7	8.65
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.060 DLM	<0.040	<0.050 DLM	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S4-B-01	22-S2-L-01	22-S2-L-02	22-S2-G-01	22-S2-G-02
					Client sampling date / time	15-Sep-2022 10:00	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30
						VA22C2369-081	VA22C2369-082	VA22C2369-083	VA22C2369-084	VA22C2369-085
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		27.6	73.6	60.7	40.2	40.8
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		81.6	126	122	75.3	80.2
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		59.1	33.2	47.7	45.1	47.5
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0028	0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.071	0.123	0.086	0.094	0.120
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0516	0.0324	0.0336	0.0561	0.0707
barium	7440-39-3	E440	0.050	mg/kg		9.45	67.4	2.33	4.19	41.3
barium	7440-39-3	E440A	0.010	mg/kg wwt		6.84	17.8	0.914	2.51	24.5
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		26.0	116	14.6	8.9	4.7
boron	7440-42-8	E440A	0.20	mg/kg wwt		18.8	30.6	5.73	5.32	2.77
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0190	<0.0100 DLM	0.0397	0.0085	0.0382
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0137	<0.0025 DLM	0.0156	0.0051	0.0226
calcium	7440-70-2	E440	20	mg/kg		7050	20900	3200	4210	4570
calcium	7440-70-2	E440A	4.0	mg/kg wwt		5110	5510	1250	2520	2700
cesium	7440-46-2	E440	0.0050	mg/kg		0.0881	0.212	0.132	0.0280	0.0634
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0638	0.0560	0.0518	0.0168	0.0375
chromium	7440-47-3	E440	0.050	mg/kg		0.105	0.151	0.165	0.096	0.120
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.076	0.040	0.065	0.057	0.071
cobalt	7440-48-4	E440	0.020	mg/kg		0.087	0.103	0.112	0.061	0.062
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0630	0.0271	0.0438	0.0363	0.0367
copper	7440-50-8	E440	0.10	mg/kg		8.87	10.2	9.45	7.69	7.07
copper	7440-50-8	E440A	0.020	mg/kg wwt		6.42	2.69	3.71	4.60	4.19
iron	7439-89-6	E440	3.0	mg/kg		130	228	199	102	142
iron	7439-89-6	E440A	0.60	mg/kg wwt		94.1	60.4	78.0	61.2	84.2

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S4-B-01	22-S2-L-01	22-S2-L-02	22-S2-G-01	22-S2-G-02
					Client sampling date / time	15-Sep-2022 10:00	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30
						VA22C2369-081	VA22C2369-082	VA22C2369-083	VA22C2369-084	VA22C2369-085
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.027	0.063	0.038	0.034	0.035
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0196	0.0167	0.0149	0.0205	0.0210
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.12	<0.10	<0.10	0.13
magnesium	7439-95-4	E440	2.0	mg/kg		2250	5030	1180	981	475
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1630	1330	463	587	281
manganese	7439-96-5	E440	0.050	mg/kg		26.8	22.5	100	41.8	58.1
manganese	7439-96-5	E440A	0.010	mg/kg wwt		19.4	5.95	39.3	25.0	34.4
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0125	<0.0050	<0.0050	0.0060
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0023	0.0033	0.0018	0.0029	0.0036
molybdenum	7439-98-7	E440	0.020	mg/kg		1.45	26.5	2.38	7.17	7.80
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.05	7.00	0.936	4.29	4.62
nickel	7440-02-0	E440	0.20	mg/kg		0.50	0.27	0.51	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.362	0.071	0.202	0.085	0.050
phosphorus	7723-14-0	E440	10	mg/kg		3040	6090	1600	1910	850
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		2200	1610	630	1140	503
potassium	7440-09-7	E440	20	mg/kg		8130	22500	5650	8020	5330
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5890	5950	2220	4800	3150
rubidium	7440-17-7	E440	0.050	mg/kg		10.6	10.7	4.10	3.71	2.62
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		7.65	2.84	1.61	2.22	1.55
selenium	7782-49-2	E440	0.050	mg/kg		0.326	0.368	0.300	0.227	0.151
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.236	0.097	0.118	0.136	0.089
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	0.0374	<0.0050	0.0107
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0020	<0.0010	0.0147	0.0017	0.0063
sodium	7440-23-5	E440	20	mg/kg		26	88	22	28	62
sodium	7440-23-5	E440A	4.0	mg/kg wwt		18.6	23.3	8.7	16.7	36.5
strontium	7440-24-6	E440	0.050	mg/kg		26.9	65.0	5.57	14.6	17.8
strontium	7440-24-6	E440A	0.010	mg/kg wwt		19.5	17.2	2.19	8.70	10.5
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S4-B-01	22-S2-L-01	22-S2-L-02	22-S2-G-01	22-S2-G-02
					Client sampling date / time	15-Sep-2022 10:00	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30	15-Sep-2022 11:30
						VA22C2369-081	VA22C2369-082	VA22C2369-083	VA22C2369-084	VA22C2369-085
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	0.00047	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		0.54	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.392	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0021	0.0038	0.0036	0.0023	0.0026
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00155	0.00100	0.00141	0.00137	0.00157
vanadium	7440-62-2	E440	0.10	mg/kg		0.34	1.67	0.61	0.30	0.48
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.243	0.441	0.241	0.176	0.286
zinc	7440-66-6	E440	0.50	mg/kg		24.2	24.2	43.6	46.3	33.0
zinc	7440-66-6	E440A	0.10	mg/kg wwt		17.5	6.39	17.1	27.7	19.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.045	<0.040	<0.040	<0.060 DLM	0.106

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-F-01	22-S1-L-01	22-S1-L-02	22-S1-G-02	22-S1-G-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30
						VA22C2369-086	VA22C2369-087	VA22C2369-088	VA22C2369-089	VA22C2369-090
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		60.9	77.3	67.0	42.9	41.4
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		79.2	127	475	78.2	219
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		31.0	28.8	157	44.6	128
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.016	<0.010	0.011
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0053	0.0024	0.0064
arsenic	7440-38-2	E440	0.020	mg/kg		0.083	0.095	0.350	0.078	0.179
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0326	0.0216	0.115	0.0446	0.105
barium	7440-39-3	E440	0.050	mg/kg		4.25	3.04	14.1	7.39	45.6
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.66	0.691	4.64	4.22	26.7
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	0.016	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0053	<0.0020	0.0040
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		11.8	13.4	28.5	6.0	5.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.64	3.03	9.41	3.43	3.30
cadmium	7440-43-9	E440	0.0050	mg/kg		0.572	0.0258	0.0981	0.0134	0.108
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.224	0.0059	0.0323	0.0077	0.0635
calcium	7440-70-2	E440	20	mg/kg		8430	2940	9720	3940	6180
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3300	669	3200	2250	3620
cesium	7440-46-2	E440	0.0050	mg/kg		0.529	0.277	0.0888	0.0382	0.155
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.207	0.0628	0.0293	0.0218	0.0910
chromium	7440-47-3	E440	0.050	mg/kg		0.114	0.129	0.501	0.106	0.280
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.044	0.029	0.165	0.060	0.164
cobalt	7440-48-4	E440	0.020	mg/kg		0.077	0.170	0.404	0.072	0.164
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0300	0.0387	0.133	0.0414	0.0964
copper	7440-50-8	E440	0.10	mg/kg		12.2	11.1	31.4	8.49	16.8
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.78	2.52	10.4	4.85	9.85
iron	7439-89-6	E440	3.0	mg/kg		138	256	1070	144	375
iron	7439-89-6	E440A	0.60	mg/kg wwt		54.0	58.2	353	82.0	220

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-F-01	22-S1-L-01	22-S1-L-02	22-S1-G-02	22-S1-G-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30
						VA22C2369-086	VA22C2369-087	VA22C2369-088	VA22C2369-089	VA22C2369-090
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.025	0.041	0.160	0.033	0.082
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0099	0.0094	0.0529	0.0187	0.0478
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	0.64	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	0.21	<0.10	0.14
magnesium	7439-95-4	E440	2.0	mg/kg		2740	984	5280	996	922
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		1070	223	1740	569	540
manganese	7439-96-5	E440	0.050	mg/kg		49.8	75.3	163	57.2	73.6
manganese	7439-96-5	E440A	0.010	mg/kg wwt		19.5	17.1	53.6	32.7	43.1
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	<0.0050	<0.0050	0.0052
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0012 DLA	<0.0010	0.0014	0.0024	0.0031
molybdenum	7439-98-7	E440	0.020	mg/kg		1.23	1.45	2.36	3.58	10.8
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.482	0.330	0.776	2.04	6.36
nickel	7440-02-0	E440	0.20	mg/kg		0.72	0.48	0.88	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.282	0.109	0.292	0.095	0.109
phosphorus	7723-14-0	E440	10	mg/kg		4050	1420	4920	2220	1010
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1580	324	1620	1270	590
potassium	7440-09-7	E440	20	mg/kg		17600	4620	14900	12800	5740
potassium	7440-09-7	E440A	4.0	mg/kg wwt		6890	1050	4920	7320	3370
rubidium	7440-17-7	E440	0.050	mg/kg		17.0	5.15	5.37	5.47	5.21
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		6.64	1.17	1.77	3.12	3.06
selenium	7782-49-2	E440	0.050	mg/kg		0.183	0.127	0.204	0.128	0.502
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.072	0.029	0.067	0.073	0.294
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0378	0.0080	0.0076	0.0072
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0086	0.0026	0.0044	0.0042
sodium	7440-23-5	E440	20	mg/kg		55	23	114	20	34
sodium	7440-23-5	E440A	4.0	mg/kg wwt		21.4	5.3	37.6	11.7	20.0
strontium	7440-24-6	E440	0.050	mg/kg		26.9	4.96	34.0	13.4	28.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		10.5	1.13	11.2	7.67	16.6
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S2-F-01	22-S1-L-01	22-S1-L-02	22-S1-G-02	22-S1-G-01
					Client sampling date / time	15-Sep-2022 11:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30	15-Sep-2022 12:30
						VA22C2369-086	VA22C2369-087	VA22C2369-088	VA22C2369-089	VA22C2369-090
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0043	0.0162	0.0022	0.0076
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00071	0.00097	0.00533	0.00124	0.00448
vanadium	7440-62-2	E440	0.10	mg/kg		0.33	0.89	3.69	0.46	1.37
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.131	0.203	1.22	0.265	0.802
zinc	7440-66-6	E440	0.50	mg/kg		52.0	68.9	63.6	55.7	33.8
zinc	7440-66-6	E440A	0.10	mg/kg wwt		20.3	15.6	21.0	31.8	19.8
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	0.32	<0.20	0.30
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		0.057	<0.040	0.104	0.046	0.175

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S1-F-01	22-R4-G-01	22-R4-L-01	22-R4-L-02	22-R4-L-03
					Client sampling date / time	15-Sep-2022 12:30	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45
						VA22C2369-091	VA22C2369-092	VA22C2369-093	VA22C2369-094	VA22C2369-095
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		71.7	59.4	58.6	62.0	60.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		134	88.3	59.4	53.7	246
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		37.8	35.8	24.6	20.4	96.9
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0028	0.0035	<0.0020	0.0023	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.102	0.108	0.024	0.036	0.039
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0289	0.0439	0.0101	0.0138	0.0154
barium	7440-39-3	E440	0.050	mg/kg		4.42	21.3	27.2	25.9	98.4
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.25	8.66	11.2	9.83	38.7
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0024	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		21.9	3.5	23.6	15.1	9.3
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.20	1.44	9.74	5.72	3.66
cadmium	7440-43-9	E440	0.0050	mg/kg		0.232	0.0335	0.0095	0.121	0.264
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0655	0.0136	0.0039	0.0459	0.104
calcium	7440-70-2	E440	20	mg/kg		7120	3610	11400	8110	5500
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2010	1460	4720	3080	2160
cesium	7440-46-2	E440	0.0050	mg/kg		0.693	0.0305	0.157	0.0107	0.0086
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.196	0.0124	0.0648	0.0041	0.0034
chromium	7440-47-3	E440	0.050	mg/kg		0.252	0.208	0.133	0.118	0.074
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.071	0.084	0.055	0.045	0.029
cobalt	7440-48-4	E440	0.020	mg/kg		0.141	0.097	0.307	0.075	0.136
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0398	0.0394	0.127	0.0283	0.0536
copper	7440-50-8	E440	0.10	mg/kg		18.1	7.90	12.2	4.86	6.85
copper	7440-50-8	E440A	0.020	mg/kg wwt		5.12	3.21	5.04	1.85	2.69
iron	7439-89-6	E440	3.0	mg/kg		207	183	108	111	134
iron	7439-89-6	E440A	0.60	mg/kg wwt		58.4	74.3	44.4	42.1	52.5

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S1-F-01	22-R4-G-01	22-R4-L-01	22-R4-L-02	22-R4-L-03
					Client sampling date / time	15-Sep-2022 12:30	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45
						VA22C2369-091	VA22C2369-092	VA22C2369-093	VA22C2369-094	VA22C2369-095
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.046	0.062	0.040	0.025	0.040
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0130	0.0251	0.0165	0.0095	0.0157
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.20	<0.10	<0.10	0.10
magnesium	7439-95-4	E440	2.0	mg/kg		2590	760	1380	1020	1170
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		731	309	572	387	460
manganese	7439-96-5	E440	0.050	mg/kg		64.3	797	202	174	363
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.2	324	83.3	66.3	143
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0071	0.0072	0.0075	0.0124
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0010	0.0029	0.0030	0.0028	0.0049
molybdenum	7439-98-7	E440	0.020	mg/kg		4.15	2.28	0.809	2.26	0.099
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.17	0.928	0.334	0.857	0.0388
nickel	7440-02-0	E440	0.20	mg/kg		0.32	0.44	1.22	2.14	1.09
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.091	0.178	0.505	0.811	0.428
phosphorus	7723-14-0	E440	10	mg/kg		5950	2250	1490	1960	2900
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1680	914	615	745	1140
potassium	7440-09-7	E440	20	mg/kg		27800	22900	5230	8880	9100
potassium	7440-09-7	E440A	4.0	mg/kg wwt		7850	9300	2160	3370	3570
rubidium	7440-17-7	E440	0.050	mg/kg		33.4	16.3	8.44	3.13	4.04
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		9.45	6.62	3.49	1.19	1.59
selenium	7782-49-2	E440	0.050	mg/kg		0.275	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.078	0.014	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0076	0.0152	<0.0050	0.0108
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0031	0.0063	0.0011	0.0042
sodium	7440-23-5	E440	20	mg/kg		73	152	54	52	39
sodium	7440-23-5	E440A	4.0	mg/kg wwt		20.8	61.7	22.2	19.8	15.4
strontium	7440-24-6	E440	0.050	mg/kg		16.3	19.8	39.3	45.9	19.6
strontium	7440-24-6	E440A	0.010	mg/kg wwt		4.60	8.02	16.2	17.4	7.69
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S1-F-01	22-R4-G-01	22-R4-L-01	22-R4-L-02	22-R4-L-03
					Client sampling date / time	15-Sep-2022 12:30	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45	15-Sep-2022 13:45
						VA22C2369-091	VA22C2369-092	VA22C2369-093	VA22C2369-094	VA22C2369-095
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0022	<0.0020	<0.0020	<0.0020	0.0044
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00064	<0.00040	<0.00040	<0.00040	0.00174
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.14	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.059	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0030	0.0031	<0.0020	0.0038	0.0022
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00086	0.00125	0.00062	0.00145	0.00086
vanadium	7440-62-2	E440	0.10	mg/kg		0.53	0.56	0.24	0.34	0.38
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.149	0.227	0.100	0.131	0.151
zinc	7440-66-6	E440	0.50	mg/kg		59.3	17.4	38.4	15.3	52.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		16.8	7.08	15.9	5.82	20.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	0.075	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R4-F-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R5-F-01
					Client sampling date / time	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45
						VA22C2369-096	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-100
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		83.7	55.6	61.4	63.8	70.0
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		249	50.2	102	56.4	86.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		40.6	22.3	39.2	20.4	25.9
antimony	7440-36-0	E440	0.010	mg/kg		0.013	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		0.0020	<0.0020	<0.0020	<0.0020	0.0026
arsenic	7440-38-2	E440	0.020	mg/kg		0.151	0.033	5.94	0.036	0.069
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0246	0.0145	2.29	0.0128	0.0208
barium	7440-39-3	E440	0.050	mg/kg		37.6	38.6	40.8	44.4	124
barium	7440-39-3	E440A	0.010	mg/kg wwt		6.12	17.1	15.7	16.0	37.1
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0045	0.0022
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		25.8	11.5	16.4	37.4	37.4
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.21	5.09	6.33	13.5	11.2
cadmium	7440-43-9	E440	0.0050	mg/kg		0.944	0.105	0.0158	2.56	2.29
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.154	0.0464	0.0061	0.927	0.686
calcium	7440-70-2	E440	20	mg/kg		17600	6660	2290	20700	13100
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2860	2960	884	7480	3930
cesium	7440-46-2	E440	0.0050	mg/kg		0.0872	0.0078	0.0444	0.0262	0.0837
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0142	0.0034	0.0171	0.0094	0.0251
chromium	7440-47-3	E440	0.050	mg/kg		0.782	0.068	0.063	0.122	0.198
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.127	0.030	0.024	0.044	0.059
cobalt	7440-48-4	E440	0.020	mg/kg		0.398	0.054	0.038	0.820	0.202
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0648	0.0242	0.0147	0.296	0.0605
copper	7440-50-8	E440	0.10	mg/kg		21.4	5.11	6.48	8.12	12.4
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.48	2.27	2.50	2.93	3.73
iron	7439-89-6	E440	3.0	mg/kg		361	107	56.1	80.2	166
iron	7439-89-6	E440A	0.60	mg/kg wwt		58.8	47.7	21.6	29.0	49.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R4-F-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R5-F-01
					Client sampling date / time	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45
						VA22C2369-096	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-100
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.102	0.028	<0.020	0.043	0.050
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0166	0.0126	0.0043	0.0157	0.0152
lithium	7439-93-2	E440	0.50	mg/kg		0.61	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		3740	931	1240	1980	1740
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		609	413	479	714	524
manganese	7439-96-5	E440	0.050	mg/kg		126	196	130	159	159
manganese	7439-96-5	E440A	0.010	mg/kg wwt		20.5	86.9	50.0	57.4	47.7
mercury	7439-97-6	E510	0.0050	mg/kg		0.0252	0.0078	0.0055	0.0064	0.0053
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0041	0.0035	0.0021	0.0023	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		1.95	0.827	0.045	0.202	2.26
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.317	0.367	0.0174	0.0730	0.678
nickel	7440-02-0	E440	0.20	mg/kg		0.49	1.58	1.26	0.42	1.42
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.080	0.700	0.484	0.154	0.427
phosphorus	7723-14-0	E440	10	mg/kg		5700	1570	2320	3150	3530
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		927	696	892	1140	1060
potassium	7440-09-7	E440	20	mg/kg		37700	9020	9390	9870	22600
potassium	7440-09-7	E440A	4.0	mg/kg wwt		6140	4000	3620	3560	6780
rubidium	7440-17-7	E440	0.050	mg/kg		33.1	2.30	5.22	4.82	18.5
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		5.39	1.02	2.01	1.74	5.56
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0286	0.0057	0.0285	0.0187	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0046	0.0025	0.0110	0.0068	<0.0010
sodium	7440-23-5	E440	20	mg/kg		212	<20	26	36	77
sodium	7440-23-5	E440A	4.0	mg/kg wwt		34.5	8.3	9.9	13.0	23.1
strontium	7440-24-6	E440	0.050	mg/kg		59.6	35.9	21.2	78.2	50.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		9.70	15.9	8.15	28.3	15.1
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R4-F-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R5-F-01
					Client sampling date / time	15-Sep-2022 13:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45	15-Sep-2022 14:45
						VA22C2369-096	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-100
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.039	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		0.0058	<0.0020	<0.0020	<0.0020	0.0028
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00094	0.00080	<0.00040	<0.00040	0.00083
vanadium	7440-62-2	E440	0.10	mg/kg		1.20	0.34	0.11	0.17	0.45
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.196	0.149	0.041	0.060	0.134
zinc	7440-66-6	E440	0.50	mg/kg		56.2	16.2	28.5	290	72.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		9.16	7.21	11.0	105	21.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-R6-L-01	22-R6-L-02
					Client sampling date / time	15-Sep-2022 14:45	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40
						VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-104	VA22C2369-105
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		74.9	73.0	86.9	60.4	60.5
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		62.2	376	176	65.7	116
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		15.6	102	23.0	26.0	45.7
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	0.011	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0024	<0.0020	0.0022	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.041	0.095	0.144	0.043	0.075
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0102	0.0257	0.0188	0.0171	0.0297
barium	7440-39-3	E440	0.050	mg/kg		14.3	161	408	29.4	87.1
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.59	43.4	53.3	11.6	34.4
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		34.9	38.1	21.7	18.5	22.2
boron	7440-42-8	E440A	0.20	mg/kg wwt		8.76	10.3	2.83	7.31	8.74
cadmium	7440-43-9	E440	0.0050	mg/kg		0.866	0.0385	0.797	0.0400	0.209
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.217	0.0104	0.104	0.0158	0.0826
calcium	7440-70-2	E440	20	mg/kg		7260	27600	21600	11400	6520
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1820	7450	2830	4520	2570
cesium	7440-46-2	E440	0.0050	mg/kg		0.0330	0.164	0.0747	0.0379	0.0229
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0083	0.0443	0.0098	0.0150	0.0090
chromium	7440-47-3	E440	0.050	mg/kg		0.145	0.267	0.328	0.092	0.121
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.036	0.072	0.043	0.036	0.048
cobalt	7440-48-4	E440	0.020	mg/kg		0.077	0.104	0.126	0.080	0.124
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0193	0.0281	0.0165	0.0316	0.0490
copper	7440-50-8	E440	0.10	mg/kg		20.8	8.15	10.9	5.48	8.24
copper	7440-50-8	E440A	0.020	mg/kg wwt		5.23	2.20	1.43	2.17	3.25
iron	7439-89-6	E440	3.0	mg/kg		147	266	329	144	194
iron	7439-89-6	E440A	0.60	mg/kg wwt		36.8	71.9	43.0	56.8	76.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-R6-L-01	22-R6-L-02
					Client sampling date / time	15-Sep-2022 14:45	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40
						VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-104	VA22C2369-105
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.031	0.118	0.099	0.036	0.044
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0078	0.0318	0.0129	0.0142	0.0173
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	0.13	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		1770	4830	2340	1510	1090
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		443	1310	306	597	432
manganese	7439-96-5	E440	0.050	mg/kg		72.3	94.5	131	127	1400
manganese	7439-96-5	E440A	0.010	mg/kg wwt		18.1	25.5	17.1	50.2	552
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	0.0121	0.0226	0.0132	0.0147
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0012	0.0033	0.0029	0.0052	0.0058
molybdenum	7439-98-7	E440	0.020	mg/kg		3.46	1.10	0.428	2.28	0.124
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.866	0.296	0.0559	0.902	0.0491
nickel	7440-02-0	E440	0.20	mg/kg		1.94	0.34	1.40	0.83	0.62
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.486	0.091	0.183	0.328	0.244
phosphorus	7723-14-0	E440	10	mg/kg		3720	2980	4620	1710	2660
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		933	804	604	676	1050
potassium	7440-09-7	E440	20	mg/kg		29800	13400	35300	8270	8630
potassium	7440-09-7	E440A	4.0	mg/kg wwt		7470	3610	4610	3270	3400
rubidium	7440-17-7	E440	0.050	mg/kg		12.2	13.3	28.8	6.93	5.84
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		3.06	3.60	3.76	2.74	2.30
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	<0.050	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	<0.010	<0.010	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	<0.0050	0.0170	0.0087	0.0060
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		<0.0010	0.0011	0.0022	0.0034	0.0024
sodium	7440-23-5	E440	20	mg/kg		94	52	133	94	48
sodium	7440-23-5	E440A	4.0	mg/kg wwt		23.7	14.0	17.4	37.3	19.2
strontium	7440-24-6	E440	0.050	mg/kg		14.4	218	188	86.8	24.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		3.61	58.9	24.6	34.4	9.60
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-R6-L-01	22-R6-L-02
					Client sampling date / time	15-Sep-2022 14:45	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40	16-Sep-2022 15:40
						VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-104	VA22C2369-105
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	0.0043
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	0.00171
tin	7440-31-5	E440	0.10	mg/kg		<0.10	0.26	0.36	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	0.070	0.047	<0.020	0.033
uranium	7440-61-1	E440	0.0020	mg/kg		0.0024	0.0048	0.0063	0.0028	0.0030
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00059	0.00131	0.00082	0.00112	0.00118
vanadium	7440-62-2	E440	0.10	mg/kg		0.37	0.90	1.07	0.46	0.62
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.093	0.244	0.140	0.180	0.247
zinc	7440-66-6	E440	0.50	mg/kg		44.3	17.5	13.0	16.5	47.0
zinc	7440-66-6	E440A	0.10	mg/kg wwt		11.1	4.74	1.70	6.55	18.6
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R6-B-01	22-A4-L-01	22-A4-L-02	22-A4-G-01	22-A4-F-01
					Client sampling date / time	16-Sep-2022 15:40	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15
						VA22C2369-106	VA22C2369-107	VA22C2369-108	VA22C2369-109	VA22C2369-110
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		60.5	61.0	61.3	55.4	76.7
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		28.8	105	19.8	14.6	73.7
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		11.4	40.8	7.65	6.51	17.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0023	<0.0020	<0.0020	0.0022
arsenic	7440-38-2	E440	0.020	mg/kg		0.047	0.086	0.054	0.064	0.081
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0186	0.0336	0.0207	0.0284	0.0188
barium	7440-39-3	E440	0.050	mg/kg		80.2	51.3	25.8	48.4	33.1
barium	7440-39-3	E440A	0.010	mg/kg wwt		31.7	20.0	9.97	21.6	7.73
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		7.0	23.8	37.9	6.4	13.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		2.76	9.28	14.7	2.85	3.17
cadmium	7440-43-9	E440	0.0050	mg/kg		0.466	0.464	0.590	0.0324	0.0186
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.184	0.181	0.228	0.0144	0.0043
calcium	7440-70-2	E440	20	mg/kg		2030	28600	23300	8750	19800
calcium	7440-70-2	E440A	4.0	mg/kg wwt		802	11100	9020	3900	4630
cesium	7440-46-2	E440	0.0050	mg/kg		0.0187	0.0446	0.0516	0.0513	1.69
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0074	0.0174	0.0200	0.0228	0.394
chromium	7440-47-3	E440	0.050	mg/kg		0.051	0.134	<0.050	0.062	0.120
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.020	0.052	0.018	0.028	0.028
cobalt	7440-48-4	E440	0.020	mg/kg		0.023	0.301	0.361	<0.020	0.456
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0091	0.117	0.139	0.0053	0.106
copper	7440-50-8	E440	0.10	mg/kg		2.99	11.6	8.18	4.31	17.1
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.18	4.54	3.16	1.92	3.99
iron	7439-89-6	E440	3.0	mg/kg		51.8	176	65.7	31.8	214
iron	7439-89-6	E440A	0.60	mg/kg wwt		20.4	68.7	25.4	14.2	49.9

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R6-B-01	22-A4-L-01	22-A4-L-02	22-A4-G-01	22-A4-F-01
					Client sampling date / time	16-Sep-2022 15:40	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15
						VA22C2369-106	VA22C2369-107	VA22C2369-108	VA22C2369-109	VA22C2369-110
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		<0.020	0.070	0.043	0.052	0.061
lead	7439-92-1	E440A	0.0040	mg/kg wwt		<0.0040	0.0272	0.0166	0.0231	0.0142
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		500	1570	2260	572	2410
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		198	610	874	255	562
manganese	7439-96-5	E440	0.050	mg/kg		12.2	56.9	59.8	108	164
manganese	7439-96-5	E440A	0.010	mg/kg wwt		4.84	22.2	23.1	48.0	38.2
mercury	7439-97-6	E510	0.0050	mg/kg		0.0065	0.0120	0.0077	0.0070	0.0059
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0026	0.0047	0.0030	0.0031	0.0014
molybdenum	7439-98-7	E440	0.020	mg/kg		0.678	0.704	1.80	11.3	10.6
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.268	0.274	0.698	5.02	2.47
nickel	7440-02-0	E440	0.20	mg/kg		0.54	0.22	0.25	<0.20	0.46
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.212	0.084	0.098	<0.040	0.107
phosphorus	7723-14-0	E440	10	mg/kg		1940	1970	2730	1170	2930
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		764	769	1060	520	683
potassium	7440-09-7	E440	20	mg/kg		11900	7250	8060	6800	17900
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4700	2820	3120	3030	4180
rubidium	7440-17-7	E440	0.050	mg/kg		15.4	4.95	5.18	3.56	31.3
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		6.09	1.93	2.00	1.58	7.30
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.395	1.29	0.193	0.881
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	0.154	0.497	0.086	0.206
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0239	0.0052	0.0056	<0.0050	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0094	0.0020	0.0022	0.0014	<0.0010
sodium	7440-23-5	E440	20	mg/kg		<20	36	41	74	57
sodium	7440-23-5	E440A	4.0	mg/kg wwt		6.5	14.2	15.8	32.8	13.2
strontium	7440-24-6	E440	0.050	mg/kg		20.5	114	119	26.8	118
strontium	7440-24-6	E440A	0.010	mg/kg wwt		8.10	44.4	46.0	11.9	27.5
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-R6-B-01	22-A4-L-01	22-A4-L-02	22-A4-G-01	22-A4-F-01
					Client sampling date / time	16-Sep-2022 15:40	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15	16-Sep-2022 08:15
						VA22C2369-106	VA22C2369-107	VA22C2369-108	VA22C2369-109	VA22C2369-110
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		1.50	<0.10	0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.592	<0.020	0.039	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0029	<0.0020	<0.0020	0.0025
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00113	0.00050	<0.00040	0.00059
vanadium	7440-62-2	E440	0.10	mg/kg		0.14	0.47	0.10	<0.10	0.39
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.057	0.182	0.040	0.034	0.091
zinc	7440-66-6	E440	0.50	mg/kg		5.95	202	149	32.9	54.5
zinc	7440-66-6	E440A	0.10	mg/kg wwt		2.35	78.7	57.7	14.6	12.7
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-G-02	22-A5-L-01	22-A5-G-01	22-A5-G-02	22-A5-G-03
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00
						VA22C2369-111	VA22C2369-112	VA22C2369-113	VA22C2369-114	VA22C2369-115
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		59.8	64.6	60.4	62.1	53.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		25.0	48.3	31.2	35.8	33.0
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		10.0	17.1	12.3	13.6	15.3
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0022	<0.0020	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.084	0.036	0.077	0.060	0.094
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0336	0.0127	0.0306	0.0226	0.0436
barium	7440-39-3	E440	0.050	mg/kg		10.2	1.93	8.15	5.39	58.3
barium	7440-39-3	E440A	0.010	mg/kg wwt		4.11	0.681	3.23	2.04	27.0
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		3.4	9.6	3.4	4.9	3.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		1.38	3.38	1.37	1.86	1.70
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0335	0.0777	0.0724	0.0117	0.0733
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0134	0.0275	0.0286	0.0044	0.0340
calcium	7440-70-2	E440	20	mg/kg		4130	2810	3990	3160	5700
calcium	7440-70-2	E440A	4.0	mg/kg wwt		1660	993	1580	1200	2640
cesium	7440-46-2	E440	0.0050	mg/kg		0.0511	0.0353	0.0843	0.0419	0.0595
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0205	0.0125	0.0334	0.0159	0.0276
chromium	7440-47-3	E440	0.050	mg/kg		0.072	0.074	0.106	0.105	0.123
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.029	0.026	0.042	0.040	0.057
cobalt	7440-48-4	E440	0.020	mg/kg		0.026	0.101	0.033	0.043	0.029
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0107	0.0356	0.0130	0.0163	0.0134
copper	7440-50-8	E440	0.10	mg/kg		4.88	6.37	8.38	5.35	6.56
copper	7440-50-8	E440A	0.020	mg/kg wwt		1.96	2.25	3.32	2.03	3.04
iron	7439-89-6	E440	3.0	mg/kg		49.4	100	62.7	66.0	70.2
iron	7439-89-6	E440A	0.60	mg/kg wwt		19.9	35.4	24.8	25.0	32.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-G-02	22-A5-L-01	22-A5-G-01	22-A5-G-02	22-A5-G-03
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00
						VA22C2369-111	VA22C2369-112	VA22C2369-113	VA22C2369-114	VA22C2369-115
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.051	0.033	0.053	0.047	0.058
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0206	0.0116	0.0211	0.0179	0.0267
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	0.18	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		554	867	511	766	471
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		223	307	202	290	219
manganese	7439-96-5	E440	0.050	mg/kg		40.8	76.1	74.4	33.5	58.5
manganese	7439-96-5	E440A	0.010	mg/kg wwt		16.4	26.9	29.4	12.7	27.2
mercury	7439-97-6	E510	0.0050	mg/kg		0.0058	<0.0050	0.0057	<0.0050	0.0086
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0023	0.0012	0.0022	0.0014	0.0040
molybdenum	7439-98-7	E440	0.020	mg/kg		7.00	4.01	3.26	2.38	5.50
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		2.81	1.42	1.29	0.903	2.55
nickel	7440-02-0	E440	0.20	mg/kg		<0.20	0.66	<0.20	<0.20	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		<0.040	0.235	0.044	0.063	<0.040
phosphorus	7723-14-0	E440	10	mg/kg		2140	1090	1510	1340	850
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		859	387	597	508	394
potassium	7440-09-7	E440	20	mg/kg		9000	4500	8330	7350	5080
potassium	7440-09-7	E440A	4.0	mg/kg wwt		3620	1590	3300	2780	2360
rubidium	7440-17-7	E440	0.050	mg/kg		5.72	4.36	6.14	5.88	2.67
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		2.30	1.54	2.43	2.23	1.24
selenium	7782-49-2	E440	0.050	mg/kg		0.237	0.062	0.131	0.129	0.168
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.095	0.022	0.052	0.049	0.078
silver	7440-22-4	E440.Ag	0.0050	mg/kg		<0.0050	0.0149	0.0124	0.0063	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0010	0.0053	0.0049	0.0024	0.0022
sodium	7440-23-5	E440	20	mg/kg		41	<20	43	39	55
sodium	7440-23-5	E440A	4.0	mg/kg wwt		16.6	6.1	17.1	14.7	25.7
strontium	7440-24-6	E440	0.050	mg/kg		15.9	5.06	12.0	10.6	24.3
strontium	7440-24-6	E440A	0.010	mg/kg wwt		6.40	1.79	4.76	4.01	11.2
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A4-G-02	22-A5-L-01	22-A5-G-01	22-A5-G-02	22-A5-G-03
					Client sampling date / time	16-Sep-2022 08:15	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00	16-Sep-2022 09:00
						VA22C2369-111	VA22C2369-112	VA22C2369-113	VA22C2369-114	VA22C2369-115
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		0.14	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		0.056	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0021	<0.0020	<0.0020	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00074	0.00050	0.00050	0.00060
vanadium	7440-62-2	E440	0.10	mg/kg		0.13	0.29	0.17	0.18	0.20
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.052	0.104	0.068	0.067	0.094
zinc	7440-66-6	E440	0.50	mg/kg		35.4	64.2	49.8	34.4	47.2
zinc	7440-66-6	E440A	0.10	mg/kg wwt		14.2	22.7	19.7	13.0	21.9
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A5-F-01	22-S15-L-01	22-S15-L-02	22-S15-L-03	22-S15-G-01
					Client sampling date / time	16-Sep-2022 08:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-116	VA22C2369-117	VA22C2369-118	VA22C2369-119	VA22C2369-120
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		80.5	63.4	59.9	60.8	55.9
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		40.4	93.8	130	369	45.0
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		7.89	34.4	52.0	144	19.8
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.020	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0033	0.0077	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.034	0.058	0.117	0.282	0.059
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0066	0.0212	0.0469	0.110	0.0262
barium	7440-39-3	E440	0.050	mg/kg		6.02	2.52	22.2	23.9	8.18
barium	7440-39-3	E440A	0.010	mg/kg wwt		1.18	0.923	8.92	9.36	3.61
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.012	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	0.0022	0.0048	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0030	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		18.5	13.3	41.0	63.1	4.5
boron	7440-42-8	E440A	0.20	mg/kg wwt		3.62	4.87	16.4	24.7	2.00
cadmium	7440-43-9	E440	0.0050	mg/kg		0.102	0.0965	1.54	0.0984	0.0087
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0200	0.0354	0.619	0.0385	0.0038
calcium	7440-70-2	E440	20	mg/kg		11900	2630	19000	13000	1690
calcium	7440-70-2	E440A	4.0	mg/kg wwt		2330	964	7620	5090	747
cesium	7440-46-2	E440	0.0050	mg/kg		0.251	0.0652	0.112	0.0528	0.0603
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0491	0.0239	0.0449	0.0207	0.0266
chromium	7440-47-3	E440	0.050	mg/kg		0.125	0.116	0.164	0.577	0.092
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.024	0.042	0.066	0.226	0.040
cobalt	7440-48-4	E440	0.020	mg/kg		0.060	0.117	0.590	0.297	0.049
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0118	0.0428	0.236	0.116	0.0217
copper	7440-50-8	E440	0.10	mg/kg		20.6	7.96	12.6	21.9	5.21
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.03	2.92	5.04	8.59	2.30
iron	7439-89-6	E440	3.0	mg/kg		124	175	246	838	101
iron	7439-89-6	E440A	0.60	mg/kg wwt		24.3	64.2	98.6	328	44.7

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A5-F-01	22-S15-L-01	22-S15-L-02	22-S15-L-03	22-S15-G-01
					Client sampling date / time	16-Sep-2022 08:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-116	VA22C2369-117	VA22C2369-118	VA22C2369-119	VA22C2369-120
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.089	0.054	0.101	0.221	0.046
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0174	0.0199	0.0404	0.0866	0.0202
lithium	7439-93-2	E440	0.50	mg/kg		0.96	<0.50	<0.50	0.68	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		0.19	<0.10	<0.10	0.27	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		2800	1320	3460	5150	459
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		547	485	1390	2020	202
manganese	7439-96-5	E440	0.050	mg/kg		26.4	93.2	140	242	74.3
manganese	7439-96-5	E440A	0.010	mg/kg wwt		5.15	34.1	56.2	94.6	32.8
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	0.0110	0.0138	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		<0.0010	0.0012	0.0044	0.0054	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		1.63	4.82	3.35	65.1	7.37
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		0.319	1.76	1.34	25.5	3.25
nickel	7440-02-0	E440	0.20	mg/kg		0.48	1.04	0.61	0.56	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.094	0.382	0.246	0.220	0.043
phosphorus	7723-14-0	E440	10	mg/kg		6000	1480	2080	4610	278
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		1170	541	836	1800	122
potassium	7440-09-7	E440	20	mg/kg		21900	4820	6270	7560	7670
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4270	1770	2510	2960	3380
rubidium	7440-17-7	E440	0.050	mg/kg		24.5	4.14	3.37	2.75	5.90
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.79	1.52	1.35	1.08	2.60
selenium	7782-49-2	E440	0.050	mg/kg		0.367	<0.050	0.133	<0.050	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		0.072	<0.010	0.053	0.016	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0074	0.0410	0.0237	0.0070	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0014	0.0150	0.0095	0.0028	0.0016
sodium	7440-23-5	E440	20	mg/kg		332	32	45	168	44
sodium	7440-23-5	E440A	4.0	mg/kg wwt		64.9	11.6	18.2	65.8	19.3
strontium	7440-24-6	E440	0.050	mg/kg		35.6	8.79	360	92.1	11.0
strontium	7440-24-6	E440A	0.010	mg/kg wwt		6.96	3.22	145	36.1	4.85
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-A5-F-01	22-S15-L-01	22-S15-L-02	22-S15-L-03	22-S15-G-01
					Client sampling date / time	16-Sep-2022 08:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-116	VA22C2369-117	VA22C2369-118	VA22C2369-119	VA22C2369-120
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		0.0152	<0.0020	0.0040	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		0.00298	0.00049	0.00163	0.00054	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	0.22	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	0.086	0.031	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0033	0.0053	0.0152	0.0024
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00120	0.00211	0.00594	0.00106
vanadium	7440-62-2	E440	0.10	mg/kg		0.23	0.56	0.73	2.91	0.34
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.044	0.205	0.293	1.14	0.150
zinc	7440-66-6	E440	0.50	mg/kg		80.1	60.2	261	23.3	10.4
zinc	7440-66-6	E440A	0.10	mg/kg wwt		15.6	22.0	105	9.13	4.59
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	0.050	0.069	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01	22-S15-L-01D	22-S15-L-02D	22-S15-L-03D	22-S15-G-01D
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-121	VA22C2369-122	VA22C2369-123	VA22C2369-124	VA22C2369-125
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		77.3	63.9	61.7	62.6	54.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		58.4	79.8	63.6	294	42.3
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		13.2	28.8	24.4	110	19.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	0.014	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0051	0.0026
arsenic	7440-38-2	E440	0.020	mg/kg		0.056	0.046	0.053	0.234	0.046
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0128	0.0164	0.0203	0.0876	0.0209
barium	7440-39-3	E440	0.050	mg/kg		22.5	2.02	13.5	21.0	6.73
barium	7440-39-3	E440A	0.010	mg/kg wwt		5.10	0.728	5.18	7.86	3.06
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	0.0033	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		26.8	14.4	31.0	58.9	2.7
boron	7440-42-8	E440A	0.20	mg/kg wwt		6.09	5.20	11.9	22.0	1.23
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0198	0.0726	1.16	0.134	<0.0050
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0045	0.0262	0.444	0.0500	<0.0030 DLM
calcium	7440-70-2	E440	20	mg/kg		17700	2410	11900	12600	1380
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4010	870	4560	4720	624
cesium	7440-46-2	E440	0.0050	mg/kg		0.519	0.0685	0.133	0.0672	0.0187
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.118	0.0247	0.0510	0.0252	0.0085
chromium	7440-47-3	E440	0.050	mg/kg		0.136	0.092	0.114	0.444	0.147
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.031	0.033	0.044	0.166	0.067
cobalt	7440-48-4	E440	0.020	mg/kg		0.188	0.092	0.430	0.244	0.043
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0428	0.0332	0.165	0.0914	0.0194
copper	7440-50-8	E440	0.10	mg/kg		18.8	6.49	8.94	17.1	3.76
copper	7440-50-8	E440A	0.020	mg/kg wwt		4.27	2.34	3.43	6.41	1.71
iron	7439-89-6	E440	3.0	mg/kg		170	139	118	583	85.1
iron	7439-89-6	E440A	0.60	mg/kg wwt		38.6	50.3	45.3	218	38.6

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01	22-S15-L-01D	22-S15-L-02D	22-S15-L-03D	22-S15-G-01D
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-121	VA22C2369-122	VA22C2369-123	VA22C2369-124	VA22C2369-125
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.092	0.039	0.062	0.176	0.051
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0209	0.0142	0.0236	0.0658	0.0230
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	<0.10	<0.10	0.14	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		3280	1150	3120	4730	452
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		745	416	1200	1770	205
manganese	7439-96-5	E440	0.050	mg/kg		60.7	93.0	79.7	204	48.7
manganese	7439-96-5	E440A	0.010	mg/kg wwt		13.8	33.6	30.5	76.3	22.1
mercury	7439-97-6	E510	0.0050	mg/kg		<0.0050	<0.0050	0.0080	0.0130	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0010	0.0015	0.0031	0.0048	0.0016
molybdenum	7439-98-7	E440	0.020	mg/kg		7.99	5.63	2.15	29.8	8.14
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.81	2.03	0.826	11.2	3.70
nickel	7440-02-0	E440	0.20	mg/kg		1.07	0.96	0.63	0.58	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.243	0.346	0.240	0.215	0.081
phosphorus	7723-14-0	E440	10	mg/kg		1940	1360	1860	3330	568
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		439	491	713	1240	258
potassium	7440-09-7	E440	20	mg/kg		20200	4530	5200	6310	6160
potassium	7440-09-7	E440A	4.0	mg/kg wwt		4580	1640	1990	2360	2800
rubidium	7440-17-7	E440	0.050	mg/kg		20.0	3.94	2.82	3.38	3.91
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.54	1.42	1.08	1.26	1.77
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	<0.050	0.073	0.053	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	<0.010	0.028	0.020	<0.010
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0154	0.0479	0.0148	0.0062	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0035	0.0173	0.0057	0.0023	0.0017
sodium	7440-23-5	E440	20	mg/kg		115	27	49	64	36
sodium	7440-23-5	E440A	4.0	mg/kg wwt		26.1	9.9	18.7	23.8	16.4
strontium	7440-24-6	E440	0.050	mg/kg		247	8.13	235	138	8.02
strontium	7440-24-6	E440A	0.010	mg/kg wwt		56.1	2.93	89.9	51.6	3.64
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01	22-S15-L-01D	22-S15-L-02D	22-S15-L-03D	22-S15-G-01D
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00	16-Sep-2022 10:00
						VA22C2369-121	VA22C2369-122	VA22C2369-123	VA22C2369-124	VA22C2369-125
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	0.0021	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	0.00082	0.00055	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	0.032
uranium	7440-61-1	E440	0.0020	mg/kg		0.0029	0.0027	0.0026	0.0111	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		0.00066	0.00099	0.00100	0.00414	0.00067
vanadium	7440-62-2	E440	0.10	mg/kg		0.44	0.42	0.31	1.99	0.27
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.099	0.153	0.118	0.745	0.123
zinc	7440-66-6	E440	0.50	mg/kg		31.6	49.7	129	21.9	8.77
zinc	7440-66-6	E440A	0.10	mg/kg wwt		7.17	17.9	49.3	8.20	3.98
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01D	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S10-G-01
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00
						VA22C2369-126	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-130
						Result	Result	Result	Result	Result
Physical Tests										
moisture	----	E144	0.50	%		77.1	61.3	64.8	63.9	52.6
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		36.1	52.6	97.5	66.7	42.6
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		8.27	20.3	34.4	24.1	20.2
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	0.0025	0.0027	<0.0020	<0.0020
arsenic	7440-38-2	E440	0.020	mg/kg		0.046	0.108	0.110	0.041	0.039
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0105	0.0420	0.0387	0.0148	0.0187
barium	7440-39-3	E440	0.050	mg/kg		29.1	19.6	41.4	2.24	7.44
barium	7440-39-3	E440A	0.010	mg/kg wwt		6.65	7.58	14.6	0.811	3.53
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	7440-42-8	E440	1.0	mg/kg		31.5	53.6	62.9	15.4	4.6
boron	7440-42-8	E440A	0.20	mg/kg wwt		7.21	20.8	22.2	5.56	2.18
cadmium	7440-43-9	E440	0.0050	mg/kg		0.0162	1.03	0.180	0.0468	0.0053
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		0.0037	0.398	0.0633	0.0169	0.0025
calcium	7440-70-2	E440	20	mg/kg		21200	20100	11500	2730	1240
calcium	7440-70-2	E440A	4.0	mg/kg wwt		4860	7770	4040	986	586
cesium	7440-46-2	E440	0.0050	mg/kg		0.475	0.276	0.107	0.0538	0.0232
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.109	0.107	0.0379	0.0194	0.0110
chromium	7440-47-3	E440	0.050	mg/kg		0.086	0.098	0.164	0.068	0.082
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.020	0.038	0.058	0.024	0.039
cobalt	7440-48-4	E440	0.020	mg/kg		0.161	0.771	0.169	0.150	0.043
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0368	0.298	0.0596	0.0543	0.0206
copper	7440-50-8	E440	0.10	mg/kg		17.2	5.92	11.3	5.64	3.82
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.95	2.29	3.97	2.04	1.81
iron	7439-89-6	E440	3.0	mg/kg		129	98.9	236	108	86.1
iron	7439-89-6	E440A	0.60	mg/kg wwt		29.6	38.2	83.4	39.0	40.8

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01D	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S10-G-01
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00
						VA22C2369-126	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-130
						Result	Result	Result	Result	Result
Metals										
lead	7439-92-1	E440	0.020	mg/kg		0.051	0.090	0.143	0.032	0.044
lead	7439-92-1	E440A	0.0040	mg/kg wwt		0.0117	0.0349	0.0503	0.0117	0.0211
lithium	7439-93-2	E440	0.50	mg/kg		<0.50	<0.50	<0.50	<0.50	<0.50
lithium	7439-93-2	E440A	0.10	mg/kg wwt		<0.10	0.14	<0.10	<0.10	<0.10
magnesium	7439-95-4	E440	2.0	mg/kg		4030	2700	2560	1230	455
magnesium	7439-95-4	E440A	0.40	mg/kg wwt		922	1040	902	445	216
manganese	7439-96-5	E440	0.050	mg/kg		76.2	75.2	153	99.8	51.8
manganese	7439-96-5	E440A	0.010	mg/kg wwt		17.4	29.1	54.0	36.1	24.6
mercury	7439-97-6	E510	0.0050	mg/kg		0.0053	0.0072	0.0074	<0.0050	<0.0050
mercury	7439-97-6	E510A	0.0010	mg/kg wwt		0.0012	0.0028	0.0026	0.0012	0.0012
molybdenum	7439-98-7	E440	0.020	mg/kg		8.42	1.10	1.33	2.98	2.32
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt		1.93	0.426	0.467	1.08	1.10
nickel	7440-02-0	E440	0.20	mg/kg		1.42	0.22	0.63	0.48	<0.20
nickel	7440-02-0	E440A	0.040	mg/kg wwt		0.326	0.087	0.223	0.175	0.059
phosphorus	7723-14-0	E440	10	mg/kg		2090	1380	2540	1300	784
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt		479	535	896	470	372
potassium	7440-09-7	E440	20	mg/kg		23600	5580	6790	4520	6320
potassium	7440-09-7	E440A	4.0	mg/kg wwt		5400	2160	2390	1630	3000
rubidium	7440-17-7	E440	0.050	mg/kg		20.8	2.33	3.88	2.56	4.01
rubidium	7440-17-7	E440A	0.010	mg/kg wwt		4.77	0.901	1.37	0.926	1.90
selenium	7782-49-2	E440	0.050	mg/kg		<0.050	0.163	0.320	0.090	<0.050
selenium	7782-49-2	E440A	0.010	mg/kg wwt		<0.010	0.063	0.113	0.032	0.012
silver	7440-22-4	E440.Ag	0.0050	mg/kg		0.0125	<0.0050	0.0152	0.0358	<0.0050
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt		0.0029	0.0014	0.0053	0.0130	<0.0010
sodium	7440-23-5	E440	20	mg/kg		52	27	38	48	52
sodium	7440-23-5	E440A	4.0	mg/kg wwt		11.8	10.5	13.6	17.4	24.8
strontium	7440-24-6	E440	0.050	mg/kg		233	126	73.2	8.94	7.86
strontium	7440-24-6	E440A	0.010	mg/kg wwt		53.3	48.6	25.8	3.23	3.73
tellurium	13494-80-9	E440	0.020	mg/kg		<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt		<0.0040	<0.0040	<0.0040	<0.0040	<0.0040

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S15-F-01D	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S10-G-01
					Client sampling date / time	16-Sep-2022 10:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00	16-Sep-2022 11:00
						VA22C2369-126	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-130
						Result	Result	Result	Result	Result
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg		<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	7440-28-0	E440A	0.00040	mg/kg wwt		<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	7440-31-5	E440	0.10	mg/kg		<0.10	<0.10	<0.10	<0.10	<0.10
tin	7440-31-5	E440A	0.020	mg/kg wwt		<0.020	<0.020	<0.020	<0.020	<0.020
uranium	7440-61-1	E440	0.0020	mg/kg		<0.0020	0.0031	0.0042	0.0021	<0.0020
uranium	7440-61-1	E440A	0.00040	mg/kg wwt		<0.00040	0.00122	0.00149	0.00077	0.00077
vanadium	7440-62-2	E440	0.10	mg/kg		0.24	0.27	0.75	0.30	0.30
vanadium	7440-62-2	E440A	0.020	mg/kg wwt		0.055	0.106	0.265	0.108	0.142
zinc	7440-66-6	E440	0.50	mg/kg		35.6	79.0	102	46.6	9.75
zinc	7440-66-6	E440A	0.10	mg/kg wwt		8.16	30.6	36.0	16.8	4.62
zirconium	7440-67-7	E440	0.20	mg/kg		<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	7440-67-7	E440A	0.040	mg/kg wwt		<0.040	<0.040	<0.040	<0.040	<0.040

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: **Tissue**
(Matrix: **Biota**)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	22-S10-F-01	----	----	----	----
					Client sampling date / time	16-Sep-2022 11:00	----	----	----	----
					VA22C2369-131	--------	--------	--------	--------	--------
					Result	----	----	----	----	----
Physical Tests										
moisture	----	E144	0.50	%		80.5	----	----	----	----
Metals										
aluminum	7429-90-5	E440	2.0	mg/kg		26.6	----	----	----	----
aluminum	7429-90-5	E440A	0.40	mg/kg wwt		5.18	----	----	----	----
antimony	7440-36-0	E440	0.010	mg/kg		<0.010	----	----	----	----
antimony	7440-36-0	E440A	0.0020	mg/kg wwt		<0.0020	----	----	----	----
arsenic	7440-38-2	E440	0.020	mg/kg		0.031	----	----	----	----
arsenic	7440-38-2	E440A	0.0040	mg/kg wwt		0.0060	----	----	----	----
barium	7440-39-3	E440	0.050	mg/kg		20.1	----	----	----	----
barium	7440-39-3	E440A	0.010	mg/kg wwt		3.92	----	----	----	----
beryllium	7440-41-7	E440	0.010	mg/kg		<0.010	----	----	----	----
beryllium	7440-41-7	E440A	0.0020	mg/kg wwt		<0.0020	----	----	----	----
bismuth	7440-69-9	E440	0.010	mg/kg		<0.010	----	----	----	----
bismuth	7440-69-9	E440A	0.0020	mg/kg wwt		<0.0020	----	----	----	----
boron	7440-42-8	E440	1.0	mg/kg		20.9	----	----	----	----
boron	7440-42-8	E440A	0.20	mg/kg wwt		4.08	----	----	----	----
cadmium	7440-43-9	E440	0.0050	mg/kg		<0.0050	----	----	----	----
cadmium	7440-43-9	E440A	0.0010	mg/kg wwt		<0.0010	----	----	----	----
calcium	7440-70-2	E440	20	mg/kg		15400	----	----	----	----
calcium	7440-70-2	E440A	4.0	mg/kg wwt		3000	----	----	----	----
cesium	7440-46-2	E440	0.0050	mg/kg		0.153	----	----	----	----
cesium	7440-46-2	E440A	0.0010	mg/kg wwt		0.0299	----	----	----	----
chromium	7440-47-3	E440	0.050	mg/kg		0.070	----	----	----	----
chromium	7440-47-3	E440A	0.010	mg/kg wwt		0.014	----	----	----	----
cobalt	7440-48-4	E440	0.020	mg/kg		0.180	----	----	----	----
cobalt	7440-48-4	E440A	0.0040	mg/kg wwt		0.0351	----	----	----	----
copper	7440-50-8	E440	0.10	mg/kg		17.4	----	----	----	----
copper	7440-50-8	E440A	0.020	mg/kg wwt		3.39	----	----	----	----
iron	7439-89-6	E440	3.0	mg/kg		112	----	----	----	----
iron	7439-89-6	E440A	0.60	mg/kg wwt		21.8	----	----	----	----

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	22-S10-F-01	----	----	----	----
					Client sampling date / time	16-Sep-2022 11:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22C2369-131	--------	--------	--------	--------	
					Result	----	----	----	----	
Metals										
lead	7439-92-1	E440	0.020	mg/kg	0.064	----	----	----	----	
lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0126	----	----	----	----	
lithium	7439-93-2	E440	0.50	mg/kg	<0.50	----	----	----	----	
lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	----	----	----	----	
magnesium	7439-95-4	E440	2.0	mg/kg	2840	----	----	----	----	
magnesium	7439-95-4	E440A	0.40	mg/kg wwt	554	----	----	----	----	
manganese	7439-96-5	E440	0.050	mg/kg	43.8	----	----	----	----	
manganese	7439-96-5	E440A	0.010	mg/kg wwt	8.54	----	----	----	----	
mercury	7439-97-6	E510	0.0050	mg/kg	0.0051	----	----	----	----	
mercury	7439-97-6	E510A	0.0010	mg/kg wwt	<0.0010	----	----	----	----	
molybdenum	7439-98-7	E440	0.020	mg/kg	1.43	----	----	----	----	
molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	0.279	----	----	----	----	
nickel	7440-02-0	E440	0.20	mg/kg	0.42	----	----	----	----	
nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.082	----	----	----	----	
phosphorus	7723-14-0	E440	10	mg/kg	2730	----	----	----	----	
phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	533	----	----	----	----	
potassium	7440-09-7	E440	20	mg/kg	27700	----	----	----	----	
potassium	7440-09-7	E440A	4.0	mg/kg wwt	5410	----	----	----	----	
rubidium	7440-17-7	E440	0.050	mg/kg	17.2	----	----	----	----	
rubidium	7440-17-7	E440A	0.010	mg/kg wwt	3.36	----	----	----	----	
selenium	7782-49-2	E440	0.050	mg/kg	<0.050	----	----	----	----	
selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	----	----	----	----	
silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0119	----	----	----	----	
silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0023	----	----	----	----	
sodium	7440-23-5	E440	20	mg/kg	133	----	----	----	----	
sodium	7440-23-5	E440A	4.0	mg/kg wwt	25.9	----	----	----	----	
strontium	7440-24-6	E440	0.050	mg/kg	56.5	----	----	----	----	
strontium	7440-24-6	E440A	0.010	mg/kg wwt	11.0	----	----	----	----	
tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	----	----	----	----	
tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	----	----	----	----	

Analytical Results

Sub-Matrix: Tissue (Matrix: Biota)					Client sample ID	22-S10-F-01	----	----	----	----
					Client sampling date / time	16-Sep-2022 11:00	----	----	----	----
Analyte	CAS Number	Method	LOR	Unit	VA22C2369-131	--------	--------	--------	--------	
					Result	----	----	----	----	
Metals										
thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	----	----	----	----	
thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	----	----	----	----	
tin	7440-31-5	E440	0.10	mg/kg	<0.10	----	----	----	----	
tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	----	----	----	----	
uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	----	----	----	----	
uranium	7440-61-1	E440A	0.00040	mg/kg wwt	<0.00040	----	----	----	----	
vanadium	7440-62-2	E440	0.10	mg/kg	0.17	----	----	----	----	
vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.033	----	----	----	----	
zinc	7440-66-6	E440	0.50	mg/kg	29.5	----	----	----	----	
zinc	7440-66-6	E440A	0.10	mg/kg wwt	5.76	----	----	----	----	
zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	----	----	----	----	
zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	----	----	----	----	

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **VA22C2369**	Page	: 1 of 109
Client	: **Golder Associates Ltd.**	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: 200-2920 Virtual Way Vancouver BC Canada V5M 0C4	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	: ----	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Issue Date	: 03-Nov-2022 16:04
C-O-C number	: 17-686095A-095M		
Sampler	: SL		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 131		
No. of samples analysed	: 131		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Method Blank value outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Biota**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Metals	QC-MRG6-7231200 01	----	zinc	7440-66-6	E440	0.66 mg/kg B	0.5 mg/kg	Blank result exceeds permitted value
Metals	QC-MRG6-7231200 01	----	zinc	7440-66-6	E440A	0.13 mg/kg wwt B	0.1 mg/kg wwt	Blank result exceeds permitted value

Result Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Reference Material (RM) Sample								
Metals	QC-MRG6-7231100 03	----	chromium	7440-47-3	E440	134 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7154750 03	----	lead	7439-92-1	E440	132 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7231100 03	----	lead	7439-92-1	E440	134 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7231100 03	----	chromium	7440-47-3	E440A	134 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7154750 03	----	lead	7439-92-1	E440A	132 % MES	70.0-130%	Recovery greater than upper control limit
Metals	QC-MRG6-7231100 03	----	lead	7439-92-1	E440A	134 % MES	70.0-130%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-F-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-G-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-L-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-L-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-F-01	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-F-02	E510	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-F-03	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-L-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-L-02	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-F-02	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-L-03	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-G-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-G-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-G-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-L-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-L-02	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-F-01	E510	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-F-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-G-03	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-F-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-G-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-L-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-L-02	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S10-L-03	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-F-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-F-01D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-G-01	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-01D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-02D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-03	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-03D	E510	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-G-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A4-L-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-G-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-A5-G-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-B-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-L-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R6-L-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-G-01D	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-01	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
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Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S15-L-02	E510	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-G-02	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-L-01	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-L-02	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S4-B-01	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-B-01	E510	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-G-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-L-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S5-L-02	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-F-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-G-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-G-02	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-L-01	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S6-L-02	E510	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-F-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-L-02	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R1-L-03	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R2-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-F-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-02D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R3-L-03D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-G-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R4-L-03	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-L-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-R5-L-02	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-G-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-L-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S11-L-03	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S12-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-F-01D	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-G-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-01D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-02D	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S13-L-03D	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S14-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-L-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-L-02	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S16-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-F-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-G-01	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-L-01	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-L-02	E510	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S17-L-03	E510	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-G-02	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-L-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S1-L-02	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S2-F-01	E510	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-F-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-G-01	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-G-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-L-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S3-L-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-F-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-G-01	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-G-02	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-L-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S8-L-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-G-01	E510	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-01	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-02	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-03	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (DRY units, Routine)										
LDPE bag 22-S9-L-04	E510	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-F-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-G-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-L-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-L-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-F-01	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-F-02	E510A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	42 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-F-03	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-L-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-L-02	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-F-02	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-L-03	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-G-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-G-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-G-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-L-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-L-02	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-F-01	E510A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	365 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-F-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-G-03	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-F-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-G-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-L-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-L-02	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S10-L-03	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-F-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-F-01D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-G-01	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-01D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-02D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-03	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-03D	E510A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	46 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-G-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A4-L-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-G-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-A5-G-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-B-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-L-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R6-L-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-G-01D	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-01	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S15-L-02	E510A	16-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-G-02	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-L-01	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-L-02	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S4-B-01	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-B-01	E510A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-G-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-L-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S5-L-02	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-F-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-G-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-G-02	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-L-01	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S6-L-02	E510A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	47 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-F-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-L-02	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R1-L-03	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R2-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-F-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-02D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R3-L-03D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-G-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R4-L-03	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-L-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-R5-L-02	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-G-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-L-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S11-L-03	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S12-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-F-01D	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-G-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-01D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-02D	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S13-L-03D	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S14-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-L-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-L-02	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S16-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-F-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-G-01	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-L-01	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-L-02	E510A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S17-L-03	E510A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-G-02	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-L-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S1-L-02	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S2-F-01	E510A	15-Sep-2022	01-Nov-2022	----	----		02-Nov-2022	365 days	48 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-F-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-G-01	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-G-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-L-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S3-L-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-F-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-G-01	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-G-02	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-L-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S8-L-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-G-01	E510A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-01	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-02	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-03	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Mercury in Biota by CVAAS (WET units, Routine)										
LDPE bag 22-S9-L-04	E510A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	365 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-F-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-L-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-01	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-02	E440	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-F-03	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-02	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-02	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-03	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-G-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-02	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-F-01	E440	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-F-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-03	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-B-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-F-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-G-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-02	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-03	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
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LDPE bag 22-S15-G-01D	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
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LDPE bag 22-S15-L-01	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
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LDPE bag 22-S15-L-01D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02	E440	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03D	E440	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-G-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-03	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-F-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-01	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-02	E440	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
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LDPE bag 22-S5-G-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
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LDPE bag 22-S5-L-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-L-02	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-F-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-02	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-01	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-02	E440	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-F-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-02	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-03	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03D	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-G-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-03	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
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LDPE bag 22-S12-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01D	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
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Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-G-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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LDPE bag 22-S14-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-G-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-02	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-F-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-G-01	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-01	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-02	E440	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-03	E440	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-F-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-01	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-F-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-01	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-02	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-G-01	E440	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-01	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-02	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-03	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-04	E440	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-F-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-L-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-01	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-02	E440A	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-F-03	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-02	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-02	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-03	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-G-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-02	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-F-01	E440A	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-F-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-03	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-B-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-F-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-G-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-02	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-03	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01D	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02	E440A	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03D	E440A	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-G-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-03	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-F-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-02	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-B-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-B-01	E440A	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-G-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-02	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-F-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-02	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-01	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-02	E440A	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-F-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-02	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-03	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-G-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-03	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01D	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02D	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03D	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-02	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-F-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-G-01	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-01	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-02	E440A	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-03	E440A	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-F-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-01	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-F-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-01	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-02	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-G-01	E440A	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-01	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-02	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-03	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Metals in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-04	E440A	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-F-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-L-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-01	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-F-02	E440.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-F-03	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-02	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-F-02	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-03	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-G-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-L-02	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-F-01	E440.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-G-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A4-L-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-F-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-A5-G-03	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-B-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R6-L-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-F-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-G-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-02	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S10-L-03	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-F-01D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-G-01D	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-01	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-01D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02	E440.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-02D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S15-L-03D	E440.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-G-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R4-L-03	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R5-L-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-G-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S1-L-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-F-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-G-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S2-L-02	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S4-B-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-B-01	E440.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-G-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-L-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S5-L-02	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-F-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-G-02	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-01	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S6-L-02	E440.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-F-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-02	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R1-L-03	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R2-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-F-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-02D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-R3-L-03D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-G-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S11-L-03	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S12-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-F-01D	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-G-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-01D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-02D	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S13-L-03D	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

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Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S14-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-02	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S16-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-F-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-G-01	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-01	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-02	E440.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S17-L-03	E440.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-F-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-01	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-G-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S3-L-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-F-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-01	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-G-02	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S8-L-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-G-01	E440.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-01	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-02	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-03	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (DRY units, Routine)										
LDPE bag 22-S9-L-04	E440.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-F-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-L-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-01	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-F-02	E440A.Ag	16-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	42 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-F-03	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-02	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-F-02	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-03	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-G-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-L-02	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-F-01	E440A.Ag	15-Sep-2022	28-Oct-2022	----	----		28-Oct-2022	730 days	43 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-G-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A4-L-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-F-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-A5-G-03	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-B-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R6-L-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-F-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-G-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-02	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S10-L-03	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-F-01D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-G-01D	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-01D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02	E440A.Ag	16-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-02D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S15-L-03D	E440A.Ag	16-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	46 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-G-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R4-L-03	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R5-L-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-G-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S1-L-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-F-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-G-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓

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Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S2-L-02	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S4-B-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-B-01	E440A.Ag	15-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-G-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S5-L-02	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-F-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-G-02	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-01	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S6-L-02	E440A.Ag	15-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	47 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-F-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-02	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R1-L-03	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R2-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-F-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-02D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-R3-L-03D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-G-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S11-L-03	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S12-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-F-01D	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-G-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-01D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-02D	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S13-L-03D	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S14-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-02	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S16-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-F-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-G-01	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-01	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-02	E440A.Ag	14-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S17-L-03	E440A.Ag	14-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	48 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-F-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-01	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-G-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S3-L-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-F-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-01	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-G-02	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S8-L-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-G-01	E440A.Ag	13-Sep-2022	01-Nov-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-01	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-02	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-03	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Metals : Silver in Biota by CRC ICPMS (WET units, Routine)										
LDPE bag 22-S9-L-04	E440A.Ag	13-Sep-2022	31-Oct-2022	----	----		01-Nov-2022	730 days	49 days	✓
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-F-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-G-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-G-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A4-L-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-F-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-G-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-G-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-G-03	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-A5-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R1-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R2-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-F-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-02D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R3-L-03D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-F-03	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-G-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-L-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R4-L-03	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-F-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R5-L-03	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-B-01	E144	16-Sep-2022	----	----	----		20-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-F-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-F-02	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-L-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-R6-L-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-F-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-G-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-L-02	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S10-L-03	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S11-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S12-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-F-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-G-01D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-01D	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-02D	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S13-L-03D	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-F-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-L-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-L-02	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S14-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-F-01	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-F-01D	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-G-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-G-01D	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-01	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-01D	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-02	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-02D	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-03	E144	16-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S15-L-03D	E144	16-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-G-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-L-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-L-02	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S16-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-F-01	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-G-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-L-01	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-L-02	E144	14-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S17-L-03	E144	14-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-G-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-G-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-L-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S1-L-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-G-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-G-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S2-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-F-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-G-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-G-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-L-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S3-L-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-B-01	E144	15-Sep-2022	----	----	----		20-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-F-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-G-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S4-L-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-B-01	E144	15-Sep-2022	----	----	----		20-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-F-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-G-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-L-01	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S5-L-02	E144	15-Sep-2022	----	----	----		17-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-F-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-G-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-G-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-L-01	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S6-L-02	E144	15-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-F-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-G-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-G-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-L-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S8-L-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-G-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-L-01	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-L-02	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	
Physical Tests : Moisture Content by Gravimetry										
LDPE bag 22-S9-L-03	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	

Matrix: **Biota**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Moisture Content by Gravimetry										
LDPE bag										
22-S9-L-04	E144	13-Sep-2022	----	----	----		19-Oct-2022	----	----	

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Biota**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Mercury in Biota by CVAAS (DRY units, Routine)	E510	715477	7	131	5.3	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	715476	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	715479	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A	715478	7	131	5.3	5.0	✓
Moisture Content by Gravimetry	E144	699199	8	131	6.1	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	715480	7	131	5.3	5.0	✓
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag	715475	7	131	5.3	5.0	✓
Laboratory Control Samples (LCS)							
Mercury in Biota by CVAAS (DRY units, Routine)	E510	715477	14	131	10.6	10.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	715476	14	131	10.6	10.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	715479	14	131	10.6	10.0	✓
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A	715478	14	131	10.6	10.0	✓
Moisture Content by Gravimetry	E144	699199	8	131	6.1	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	715480	14	131	10.6	10.0	✓
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag	715475	14	131	10.6	10.0	✓
Method Blanks (MB)							
Mercury in Biota by CVAAS (DRY units, Routine)	E510	715477	7	131	5.3	5.0	✓
Mercury in Biota by CVAAS (WET units, Routine)	E510A	715476	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440	715479	7	131	5.3	5.0	✓
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A	715478	7	131	5.3	5.0	✓
Moisture Content by Gravimetry	E144	699199	8	131	6.1	5.0	✓
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag	715480	7	131	5.3	5.0	✓
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag	715475	7	131	5.3	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Moisture Content by Gravimetry	E144 Vancouver - Environmental	Biota	Puget Sound Water Quality Authority/CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Metals in Biota by CRC ICPMS (DRY units, Routine)	E440 Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (DRY units, Routine)	E440.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Metals in Biota by CRC ICPMS (WET units, Routine)	E440A Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Silver in Biota by CRC ICPMS (WET units, Routine)	E440A.Ag Vancouver - Environmental	Biota	EPA 200.3/6020B (mod)	Tissue samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by Collision/Reaction Cell ICPMS. Method Limitation: This method employs a strong acid/peroxide digestion, and is intended to provide a conservative estimate of bio-available metals. Near complete recoveries are achieved for most toxicologically important metals, but elements associated with recalcitrant minerals may be only partially recovered.
Mercury in Biota by CVAAS (DRY units, Routine)	E510 Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.
Mercury in Biota by CVAAS (WET units, Routine)	E510A Vancouver - Environmental	Biota	EPA 200.3/1631 Appendix (mod)	Samples are homogenized and sub-sampled prior to hotblock digestion with HNO3, HCl, and H2O2. Analysis is by CVAAS.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals and Mercury Biota Digestion	EP440 Vancouver - Environmental	Biota	EPA 200.3	This method uses a heated strong acid digestion with HNO_3, HCl, and H_2O_2 and is intended to provide a conservative estimate of bio-available metals.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **VA22C2369**	Page	: 1 of 65
Client	: Golder Associates Ltd.	Laboratory	: Vancouver - Environmental
Contact	: Samantha Lundquist	Account Manager	: Amber Springer
Address	: PO Box 12 Likely BC Canada V0L 1N0	Address	: 8081 Lougheed Highway Burnaby, British Columbia Canada V5A 1W9
Telephone	:	Telephone	: +1 604 253 4188
Project	: 22514095/42200/42213	Date Samples Received	: 17-Sep-2022 14:40
PO	: 5590008044	Date Analysis Commenced	: 17-Oct-2022
C-O-C number	: 17-686095A-095M	Issue Date	: 03-Nov-2022 16:05
Sampler	: SL ----		
Site	: ----		
Quote number	: Golder/Mt. Polley (VA22-MPMC100-007)		
No. of samples received	: 131		
No. of samples analysed	: 131		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Alex Thornton	Analyst	Vancouver Metals, Burnaby, British Columbia
Dan Gebert	Laboratory Analyst	Vancouver Metals, Burnaby, British Columbia
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Parnian Sane	Analyst	Vancouver Metals, Burnaby, British Columbia
Salimah Khimani	Lab Assistant	Vancouver Metals, Burnaby, British Columbia

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 699199)											
VA22C2369-094	22-R4-L-02	moisture	----	E144	0.50	%	62.0	61.7	0.457%	20%	----
Physical Tests (QC Lot: 699290)											
VA22C2369-107	22-A4-L-01	moisture	----	E144	0.50	%	61.0	59.8	2.12%	20%	----
Physical Tests (QC Lot: 703846)											
VA22C2369-041	22-S12-L-03	moisture	----	E144	0.50	%	76.5	75.4	1.40%	20%	----
Physical Tests (QC Lot: 703855)											
VA22C2369-001	22-S9-L-01	moisture	----	E144	0.50	%	50.2	47.8	5.04%	20%	----
Physical Tests (QC Lot: 703865)											
VA22C2369-021	22-R3-L-01D	moisture	----	E144	0.50	%	59.0	58.2	1.33%	20%	----
Physical Tests (QC Lot: 703872)											
VA22C2369-069	22-S17-L-03	moisture	----	E144	0.50	%	62.6	63.0	0.553%	20%	----
Physical Tests (QC Lot: 703880)											
VA22C2369-118	22-S15-L-02	moisture	----	E144	0.50	%	59.9	61.2	2.08%	20%	----
Physical Tests (QC Lot: 705539)											
VA22C2369-073	22-S5-B-01	moisture	----	E144	0.50	%	61.1	59.7	2.36%	20%	----
Metals (QC Lot: 715475)											
VA22C2369-014	22-S3-F-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0012	<0.0010	0.0002	Diff <2x LOR	----
Metals (QC Lot: 715476)											
VA22C2369-014	22-S3-F-01	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0020	0.0026	0.0005	Diff <2x LOR	----
Metals (QC Lot: 715477)											
VA22C2369-014	22-S3-F-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.0069	0.0087	0.0018	Diff <2x LOR	----
Metals (QC Lot: 715478)											
VA22C2369-014	22-S3-F-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	44.6	44.6	0.0694%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	0.0023	0.0020	0.0002	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0444	0.0364	19.7%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	3.43	3.46	0.755%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	10.9	11.3	3.16%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0476	0.0485	1.82%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 715478) - continued											
VA22C2369-014	22-S3-F-01	calcium	7440-70-2	E440A	4.0	mg/kg wwt	4410	4550	3.27%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0620	0.0634	2.27%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.047	0.043	0.004	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0489	0.0478	2.20%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	6.89	7.15	3.73%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	58.5	49.8	15.9%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0200	0.0212	5.89%	40%	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	714	736	3.08%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	31.5	33.4	5.76%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	0.586	0.614	4.66%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.255	0.262	2.73%	40%	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	1740	1800	3.40%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	7210	7380	2.33%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	6.21	6.36	2.28%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.078	0.088	12.6%	40%	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	18.2	16.7	1.4	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	11.3	11.2	1.10%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00098	0.00093	0.00004	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.175	0.163	6.98%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	17.1	18.1	5.67%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 715479)											
VA22C2369-014	22-S3-F-01	aluminum	7429-90-5	E440	2.0	mg/kg	150	150	0.0694%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.149	0.122	19.7%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	11.5	11.6	0.755%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	36.7	37.9	3.16%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.160	0.163	1.82%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 715479) - continued											
VA22C2369-014	22-S3-F-01	calcium	7440-70-2	E440	20	mg/kg	14800	15300	3.27%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.208	0.213	2.27%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.158	0.144	0.013	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.164	0.161	2.20%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	23.2	24.0	3.73%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	196	168	15.9%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.067	0.071	0.004	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	2400	2470	3.08%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	106	112	5.76%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	1.97	2.06	4.66%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	0.86	0.88	0.02	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	5840	6040	3.40%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	24200	24800	2.33%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	20.9	21.4	2.28%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	0.261	0.296	12.6%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	61	56	5	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	38.1	37.7	1.10%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0033	0.0031	0.0002	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.59	0.55	6.98%	40%	----
		zinc	7440-66-6	E440	0.50	mg/kg	57.4	60.8	5.67%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 715480)											
VA22C2369-014	22-S3-F-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 716122)											
VA22C2369-049	22-S13-L-03	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	25.3	24.3	3.98%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	3.94	5.38	31.0%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	7.98	8.56	7.02%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716122) - continued											
VA22C2369-049	22-S13-L-03	boron	7440-42-8	E440A	0.20	mg/kg wwt	3.94	4.04	2.57%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0067	0.0070	3.74%	40%	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	1010	1050	4.08%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0121	0.0122	0.879%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.117	0.119	1.54%	40%	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0304	0.0312	2.41%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	2.25	2.32	2.72%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	48.4	45.3	6.62%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0149	0.0124	0.0024	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	359	378	5.03%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	68.5	67.4	1.64%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	1.15	1.20	4.15%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.066	0.069	0.003	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	678	704	3.68%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	3710	3900	5.14%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	2.78	2.98	6.89%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.022	0.022	0.0003	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	8.7	7.7	1.0	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	20.7	21.0	1.26%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	0.00432	0.00460	6.22%	40%	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00080	0.00074	0.00005	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.142	0.130	8.89%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	10.9	11.6	6.04%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 716123)											
VA22C2369-049	22-S13-L-03	aluminum	7429-90-5	E440	2.0	mg/kg	54.2	52.1	3.98%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	8.45	11.6	31.0%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	17.1	18.4	7.02%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716123) - continued											
VA22C2369-049	22-S13-L-03	boron	7440-42-8	E440	1.0	mg/kg	8.4	8.7	2.57%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.0145	0.0150	0.0006	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	2160	2250	4.08%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0260	0.0262	0.879%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.252	0.255	1.54%	40%	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.065	0.067	0.002	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	4.84	4.97	2.72%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	104	97.3	6.62%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.032	0.027	0.005	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	770	810	5.03%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	147	144	1.64%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	2.47	2.57	4.15%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	1460	1510	3.68%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	7960	8380	5.14%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	5.98	6.40	6.89%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	20	mg/kg	<20	<20	0	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	44.5	45.1	1.26%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	0.0093	0.0099	0.0006	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.30	0.28	0.03	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	23.4	24.8	6.04%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 716124)											
VA22C2369-049	22-S13-L-03	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0045	0.0044	0.0002	Diff <2x LOR	----
Metals (QC Lot: 716125)											
VA22C2369-049	22-S13-L-03	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0097	0.0094	0.0004	Diff <2x LOR	----
Metals (QC Lot: 716126)											
VA22C2369-049	22-S13-L-03	mercury	7439-97-6	E510A	0.0022	mg/kg wwt	<0.0022	<0.0022	0.0000008	Diff <2x LOR	----
Metals (QC Lot: 716127)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716127) - continued											
VA22C2369-049	22-S13-L-03	mercury	7439-97-6	E510	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 716145)											
VA22C2369-076	22-S5-F-01	mercury	7439-97-6	E510A	0.0014	mg/kg wwt	0.0023	0.0020	0.0003	Diff <2x LOR	----
Metals (QC Lot: 716146)											
VA22C2369-076	22-S5-F-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.0071	0.0061	0.0010	Diff <2x LOR	----
Metals (QC Lot: 716147)											
VA22C2369-076	22-S5-F-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	23.6	22.7	3.69%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0182	0.0173	0.0009	Diff <2x LOR	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	9.61	9.62	0.114%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	4.68	4.82	2.88%	40%	----
		cadmium	7440-43-9	E440A	0.0030	mg/kg wwt	<0.0030	<0.0030	0	Diff <2x LOR	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	7100	6790	4.39%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0898	0.0904	0.594%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.030	0.030	0.0002	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0831	0.0818	1.52%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	6.90	7.08	2.48%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	47.2	45.5	3.61%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0103	0.0142	0.0039	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	1310	1310	0.124%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	18.1	17.1	5.71%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	3.40	3.54	3.89%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.107	0.113	0.006	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	744	765	2.79%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	4210	4430	5.14%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.95	5.23	5.44%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.186	0.189	1.43%	40%	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	23.5	20.4	13.9%	40%	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	27.2	27.6	1.60%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716147) - continued											
VA22C2369-076	22-S5-F-01	tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00077	0.00076	0.000004	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.106	0.104	1.86%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	9.09	8.87	2.50%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 716148)											
VA22C2369-076	22-S5-F-01	aluminum	7429-90-5	E440	2.0	mg/kg	73.0	70.3	3.69%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.056	0.053	0.003	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	29.7	29.7	0.114%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	14.5	14.9	2.88%	40%	----
		cadmium	7440-43-9	E440	0.0100	mg/kg	<0.0100	<0.0100	0	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	21900	21000	4.39%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.278	0.280	0.594%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.092	0.092	0.0007	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.257	0.253	1.52%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	21.3	21.9	2.48%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	146	141	3.61%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.032	0.044	0.012	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	4050	4060	0.124%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	56.0	52.9	5.71%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	10.5	10.9	3.89%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	0.33	0.35	0.02	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	2300	2370	2.79%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	13000	13700	5.14%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	15.3	16.2	5.44%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	0.576	0.584	1.43%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	72	63	9	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	84.1	85.4	1.60%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 716148) - continued											
VA22C2369-076	22-S5-F-01	tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0024	0.0024	0.00001	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.33	0.32	0.006	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	28.1	27.4	2.50%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 716149)											
VA22C2369-076	22-S5-F-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0034	0.0032	0.0002	Diff <2x LOR	----
Metals (QC Lot: 716150)											
VA22C2369-076	22-S5-F-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0104	0.0099	0.0005	Diff <2x LOR	----
Metals (QC Lot: 720236)											
VA22C2369-121	22-S15-F-01	aluminum	7429-90-5	E440	2.0	mg/kg	58.4	57.8	1.02%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.056	0.058	0.002	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	22.5	22.8	1.58%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	26.8	26.2	2.59%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.0198	0.0211	0.0013	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	17700	18100	2.42%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.519	0.529	1.77%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.136	0.168	0.032	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.188	0.194	3.15%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	18.8	20.0	5.95%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	170	165	3.18%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.092	0.098	0.006	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	3280	3430	4.32%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	60.7	69.1	12.9%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	7.99	7.74	3.16%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	1.07	1.18	9.39%	40%	----
		phosphorus	7723-14-0	E440	10	mg/kg	1940	2120	9.28%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	20200	20000	0.892%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	20.0	20.4	1.95%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720236) - continued											
VA22C2369-121	22-S15-F-01	sodium	7440-23-5	E440	20	mg/kg	115	127	9.86%	40%	----
		strontium	7440-24-6	E440	0.050	mg/kg	247	240	2.94%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	0.0029	0.0025	0.0004	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.44	0.38	0.05	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	31.6	34.5	8.76%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 720237)											
VA22C2369-121	22-S15-F-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0154	0.0183	0.0030	Diff <2x LOR	----
Metals (QC Lot: 720238)											
VA22C2369-121	22-S15-F-01	mercury	7439-97-6	E510A	0.0012	mg/kg wwt	0.0010	0.0012	0.0002	Diff <2x LOR	----
Metals (QC Lot: 720239)											
VA22C2369-121	22-S15-F-01	mercury	7439-97-6	E510	0.0050	mg/kg	<0.0050	0.0055	0.0005	Diff <2x LOR	----
Metals (QC Lot: 720240)											
VA22C2369-121	22-S15-F-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	13.2	13.1	1.02%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	0.0020	0.00002	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0128	0.0133	0.0005	Diff <2x LOR	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	5.10	5.18	1.58%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	6.09	5.93	2.59%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0045	0.0048	0.0003	Diff <2x LOR	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	4010	4110	2.42%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.118	0.120	1.77%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.031	0.038	0.007	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0428	0.0441	3.15%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	4.27	4.53	5.95%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	38.6	37.4	3.18%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0209	0.0222	6.10%	40%	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	745	777	4.32%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	13.8	15.7	12.9%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720240) - continued											
VA22C2369-121	22-S15-F-01	molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	1.81	1.76	3.16%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.243	0.267	9.39%	40%	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	439	482	9.28%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	4580	4540	0.892%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.54	4.63	1.95%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	<0.010	0	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	26.1	28.8	9.86%	40%	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	56.1	54.5	2.94%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	0.021	0.001	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00066	0.00057	0.00008	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.099	0.087	0.012	Diff <2x LOR	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	7.17	7.82	8.76%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 720241)											
VA22C2369-121	22-S15-F-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0035	0.0042	0.0007	Diff <2x LOR	----
Metals (QC Lot: 720263)											
VA22C2369-024	22-R3-L-03	aluminum	7429-90-5	E440	2.0	mg/kg	510	585	13.6%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.025	0.028	0.003	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	1.43	1.66	14.7%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	22.0	26.2	17.4%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.204	0.235	14.0%	40%	----
		calcium	7440-70-2	E440	20	mg/kg	2980	3480	15.5%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.153	0.176	13.9%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.093	0.123	0.029	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.102	0.119	15.3%	40%	----
		copper	7440-50-8	E440	0.10	mg/kg	6.74	7.84	15.0%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	84.3	95.8	12.7%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.020	0.024	0.003	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720263) - continued											
VA22C2369-024	22-R3-L-03	magnesium	7439-95-4	E440	2.0	mg/kg	1550	1810	15.2%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	1310	1550	16.7%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	0.416	0.482	14.5%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	0.23	0.27	0.04	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	1880	2160	13.6%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	7460	8590	14.1%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	13.7	16.0	15.5%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	20	mg/kg	30	38	8	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	3.31	3.86	15.2%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	0.0021	0.0026	0.0004	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.17	0.18	0.01	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	9.46	10.7	12.2%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 720264)											
VA22C2369-024	22-R3-L-03	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0026	0.0035	0.0009	Diff <2x LOR	----
Metals (QC Lot: 720265)											
VA22C2369-024	22-R3-L-03	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0076	0.0101	0.0026	Diff <2x LOR	----
Metals (QC Lot: 720266)											
VA22C2369-024	22-R3-L-03	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0027	0.0024	0.0003	Diff <2x LOR	----
Metals (QC Lot: 720267)											
VA22C2369-024	22-R3-L-03	mercury	7439-97-6	E510	0.0050	mg/kg	0.0078	0.0070	0.0008	Diff <2x LOR	----
Metals (QC Lot: 720268)											
VA22C2369-024	22-R3-L-03	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	175	201	13.6%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0085	0.0096	0.0011	Diff <2x LOR	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	0.491	0.568	14.7%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	7.54	8.98	17.4%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.0700	0.0806	14.0%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 720268) - continued											
VA22C2369-024	22-R3-L-03	calcium	7440-70-2	E440A	4.0	mg/kg wwt	1020	1190	15.5%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0525	0.0604	13.9%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.032	0.042	0.010	Diff <2x LOR	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0351	0.0409	15.3%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	2.31	2.69	15.0%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	28.9	32.8	12.7%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0069	0.0081	0.0012	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	532	620	15.2%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	451	533	16.7%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	0.143	0.165	14.5%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.078	0.093	0.015	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	647	741	13.6%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	2560	2950	14.1%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.69	5.48	15.5%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	<0.010	0	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	10.3	13.1	2.8	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	1.14	1.32	15.2%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	0.00074	0.00089	0.00015	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	<0.00040	0.00042	0.00002	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.058	0.062	0.004	Diff <2x LOR	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	3.24	3.66	12.2%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 723110)											
VA22C2369-011	22-S3-G-01	aluminum	7429-90-5	E440	2.0	mg/kg	51.2	57.2	11.0%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.159	0.164	3.19%	40%	----
		barium	7440-39-3	E440	0.050	mg/kg	48.3	52.2	7.58%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	9.3	9.6	2.85%	40%	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	0.254	0.266	4.76%	40%	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723110) - continued											
VA22C2369-011	22-S3-G-01	calcium	7440-70-2	E440	20	mg/kg	8780	9190	4.62%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.250	0.260	4.00%	40%	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.170	0.167	0.003	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.041	0.042	0.0005	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	8.28	8.32	0.438%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	105	112	6.64%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.036	0.038	0.001	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	824	859	4.16%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	93.7	98.7	5.25%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	8.83	9.29	5.00%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	1010	1050	3.82%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	9440	10000	6.07%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	8.44	8.83	4.47%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	0.376	0.389	3.54%	40%	----
		sodium	7440-23-5	E440	20	mg/kg	45	50	4	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	35.0	36.3	3.67%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		vanadium	7440-62-2	E440	0.10	mg/kg	0.31	0.33	0.02	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	38.6	37.8	2.18%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 723111)											
VA22C2369-011	22-S3-G-01	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0042	0.0044	0.0002	Diff <2x LOR	----
Metals (QC Lot: 723112)											
VA22C2369-011	22-S3-G-01	silver	7440-22-4	E440.Ag	0.0050	mg/kg	0.0079	0.0083	0.0004	Diff <2x LOR	----
Metals (QC Lot: 723113)											
VA22C2369-011	22-S3-G-01	mercury	7439-97-6	E510A	0.0018	mg/kg wwt	0.0041	0.0041	0.00005	Diff <2x LOR	----
Metals (QC Lot: 723114)											
VA22C2369-011	22-S3-G-01	mercury	7439-97-6	E510	0.0050	mg/kg	0.0077	0.0078	0.00010	Diff <2x LOR	----
Metals (QC Lot: 723115)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723115) - continued											
VA22C2369-011	22-S3-G-01	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	27.1	30.3	11.0%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	0.0025	0.0020	0.0005	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0841	0.0868	3.19%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	25.6	27.6	7.58%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	4.94	5.08	2.85%	40%	----
		cadmium	7440-43-9	E440A	0.0010	mg/kg wwt	0.134	0.141	4.76%	40%	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	4650	4870	4.62%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.132	0.138	4.00%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.090	0.089	1.55%	40%	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0218	0.0220	1.28%	40%	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	4.39	4.41	0.438%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	55.6	59.5	6.64%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0194	0.0200	0.0006	Diff <2x LOR	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	0.10	0.002	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	437	455	4.16%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	49.6	52.3	5.25%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	4.68	4.92	5.00%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.051	0.050	0.0007	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	536	557	3.82%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	5000	5320	6.07%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	4.48	4.68	4.47%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	0.199	0.206	3.54%	40%	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	24.0	26.2	8.77%	40%	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	18.6	19.2	3.67%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	<0.020	<0.020	0	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00097	0.00105	0.00008	Diff <2x LOR	----
		vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.164	0.175	6.36%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	20.5	20.0	2.18%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	0.089	0.078	0.011	Diff <2x LOR	----
Metals (QC Lot: 723120)											

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723120) - continued											
VA22C2369-125	22-S15-G-01D	mercury	7439-97-6	E510A	0.0010	mg/kg wwt	0.0016	0.0015	0.0001	Diff <2x LOR	----
Metals (QC Lot: 723121)											
VA22C2369-125	22-S15-G-01D	mercury	7439-97-6	E510	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
Metals (QC Lot: 723122)											
VA22C2369-125	22-S15-G-01D	aluminum	7429-90-5	E440A	0.40	mg/kg wwt	19.2	17.6	8.78%	40%	----
		antimony	7440-36-0	E440A	0.0020	mg/kg wwt	0.0026	<0.0020	0.0006	Diff <2x LOR	----
		arsenic	7440-38-2	E440A	0.0040	mg/kg wwt	0.0209	0.0192	8.66%	40%	----
		barium	7440-39-3	E440A	0.010	mg/kg wwt	3.06	2.78	9.68%	40%	----
		beryllium	7440-41-7	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440A	0.0020	mg/kg wwt	<0.0020	<0.0020	0	Diff <2x LOR	----
		boron	7440-42-8	E440A	0.20	mg/kg wwt	1.23	1.21	2.06%	40%	----
		cadmium	7440-43-9	E440A	0.0030	mg/kg wwt	<0.0030	<0.0030	0	Diff <2x LOR	----
		calcium	7440-70-2	E440A	4.0	mg/kg wwt	624	599	4.10%	60%	----
		cesium	7440-46-2	E440A	0.0010	mg/kg wwt	0.0085	0.0086	0.731%	40%	----
		chromium	7440-47-3	E440A	0.010	mg/kg wwt	0.067	0.056	17.9%	40%	----
		cobalt	7440-48-4	E440A	0.0040	mg/kg wwt	0.0194	0.0187	0.0008	Diff <2x LOR	----
		copper	7440-50-8	E440A	0.020	mg/kg wwt	1.71	1.63	4.73%	40%	----
		iron	7439-89-6	E440A	0.60	mg/kg wwt	38.6	38.3	0.917%	40%	----
		lead	7439-92-1	E440A	0.0040	mg/kg wwt	0.0230	0.0282	20.1%	40%	----
		lithium	7439-93-2	E440A	0.10	mg/kg wwt	<0.10	<0.10	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440A	0.40	mg/kg wwt	205	196	4.81%	40%	----
		manganese	7439-96-5	E440A	0.010	mg/kg wwt	22.1	21.1	4.74%	40%	----
		molybdenum	7439-98-7	E440A	0.0040	mg/kg wwt	3.70	3.60	2.52%	40%	----
		nickel	7440-02-0	E440A	0.040	mg/kg wwt	0.081	0.071	0.009	Diff <2x LOR	----
		phosphorus	7723-14-0	E440A	2.0	mg/kg wwt	258	243	6.05%	40%	----
		potassium	7440-09-7	E440A	4.0	mg/kg wwt	2800	2710	3.08%	40%	----
		rubidium	7440-17-7	E440A	0.010	mg/kg wwt	1.77	1.69	4.63%	40%	----
		selenium	7782-49-2	E440A	0.010	mg/kg wwt	<0.010	<0.010	0	Diff <2x LOR	----
		sodium	7440-23-5	E440A	4.0	mg/kg wwt	16.4	15.8	0.5	Diff <2x LOR	----
		strontium	7440-24-6	E440A	0.010	mg/kg wwt	3.64	3.67	0.826%	60%	----
		tellurium	13494-80-9	E440A	0.0040	mg/kg wwt	<0.0040	<0.0040	0	Diff <2x LOR	----
		thallium	7440-28-0	E440A	0.00040	mg/kg wwt	<0.00040	<0.00040	0	Diff <2x LOR	----
		tin	7440-31-5	E440A	0.020	mg/kg wwt	0.032	<0.020	0.012	Diff <2x LOR	----
		uranium	7440-61-1	E440A	0.00040	mg/kg wwt	0.00067	0.00068	0.000009	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723122) - continued											
VA22C2369-125	22-S15-G-01D	vanadium	7440-62-2	E440A	0.020	mg/kg wwt	0.123	0.112	9.05%	40%	----
		zinc	7440-66-6	E440A	0.10	mg/kg wwt	3.98	3.70	7.20%	40%	----
		zirconium	7440-67-7	E440A	0.040	mg/kg wwt	<0.040	<0.040	0	Diff <2x LOR	----
Metals (QC Lot: 723123)											
VA22C2369-125	22-S15-G-01D	aluminum	7429-90-5	E440	2.0	mg/kg	42.3	38.8	8.78%	40%	----
		antimony	7440-36-0	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		arsenic	7440-38-2	E440	0.020	mg/kg	0.046	0.042	0.004	Diff <2x LOR	----
		barium	7440-39-3	E440	0.050	mg/kg	6.73	6.11	9.68%	40%	----
		beryllium	7440-41-7	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		bismuth	7440-69-9	E440	0.010	mg/kg	<0.010	<0.010	0	Diff <2x LOR	----
		boron	7440-42-8	E440	1.0	mg/kg	2.7	2.6	0.06	Diff <2x LOR	----
		cadmium	7440-43-9	E440	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		calcium	7440-70-2	E440	20	mg/kg	1380	1320	4.10%	60%	----
		cesium	7440-46-2	E440	0.0050	mg/kg	0.0187	0.0189	0.0001	Diff <2x LOR	----
		chromium	7440-47-3	E440	0.050	mg/kg	0.147	0.122	0.024	Diff <2x LOR	----
		cobalt	7440-48-4	E440	0.020	mg/kg	0.043	0.041	0.002	Diff <2x LOR	----
		copper	7440-50-8	E440	0.10	mg/kg	3.76	3.58	4.73%	40%	----
		iron	7439-89-6	E440	3.0	mg/kg	85.1	84.3	0.917%	40%	----
		lead	7439-92-1	E440	0.020	mg/kg	0.051	0.062	0.011	Diff <2x LOR	----
		lithium	7439-93-2	E440	0.50	mg/kg	<0.50	<0.50	0	Diff <2x LOR	----
		magnesium	7439-95-4	E440	2.0	mg/kg	452	431	4.81%	40%	----
		manganese	7439-96-5	E440	0.050	mg/kg	48.7	46.5	4.74%	40%	----
		molybdenum	7439-98-7	E440	0.020	mg/kg	8.14	7.94	2.52%	40%	----
		nickel	7440-02-0	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		phosphorus	7723-14-0	E440	10	mg/kg	568	535	6.05%	40%	----
		potassium	7440-09-7	E440	20	mg/kg	6160	5980	3.08%	40%	----
		rubidium	7440-17-7	E440	0.050	mg/kg	3.91	3.73	4.63%	40%	----
		selenium	7782-49-2	E440	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		sodium	7440-23-5	E440	20	mg/kg	36	35	1	Diff <2x LOR	----
		strontium	7440-24-6	E440	0.050	mg/kg	8.02	8.09	0.826%	60%	----
		tellurium	13494-80-9	E440	0.020	mg/kg	<0.020	<0.020	0	Diff <2x LOR	----
		thallium	7440-28-0	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----
		tin	7440-31-5	E440	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		uranium	7440-61-1	E440	0.0020	mg/kg	<0.0020	<0.0020	0	Diff <2x LOR	----

Sub-Matrix: **Biota**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Metals (QC Lot: 723123) - continued											
VA22C2369-125	22-S15-G-01D	vanadium	7440-62-2	E440	0.10	mg/kg	0.27	0.25	0.02	Diff <2x LOR	----
		zinc	7440-66-6	E440	0.50	mg/kg	8.77	8.16	7.20%	40%	----
		zirconium	7440-67-7	E440	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
Metals (QC Lot: 723124)											
VA22C2369-125	22-S15-G-01D	silver	7440-22-4	E440A.Ag	0.0010	mg/kg wwt	0.0017	0.0014	0.0003	Diff <2x LOR	----
Metals (QC Lot: 723125)											
VA22C2369-125	22-S15-G-01D	silver	7440-22-4	E440.Ag	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 699199)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 699290)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703846)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703855)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703865)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703872)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 703880)						
moisture	----	E144	0.5	%	<0.50	----
Physical Tests (QCLot: 705539)						
moisture	----	E144	0.5	%	<0.50	----
Metals (QCLot: 715475)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 715476)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 715477)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 715478)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 715478) - continued						
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 715479)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 715479) - continued						
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 715480)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716122)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716122) - continued						
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 716123)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716123) - continued						
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 716124)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716125)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716126)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716127)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716145)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716146)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 716147)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716147) - continued						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 716148)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716148) - continued						
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 716149)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 716150)						

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 716150) - continued						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720236)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720237)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720238)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720239)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720240)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720240) - continued						
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 720241)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720263)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720263) - continued						
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 720264)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720265)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720266)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 720267)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 720268)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 720268) - continued						
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 723110)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723110) - continued						
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	<0.50	----
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 723111)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723112)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----
Metals (QCLot: 723113)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723114)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 723115)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723115) - continued						
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	<0.10	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 723120)						
mercury	7439-97-6	E510A	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723121)						
mercury	7439-97-6	E510	0.005	mg/kg	<0.0050	----
Metals (QCLot: 723122)						
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	<0.40	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	<0.0020	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	<0.0040	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	<0.010	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	<0.0020	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	<0.0020	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	<0.20	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	<0.0010	----
calcium	7440-70-2	E440A	4	mg/kg wwt	<4.0	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	<0.0010	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	<0.010	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	<0.0040	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723122) - continued						
copper	7440-50-8	E440A	0.02	mg/kg wwt	<0.020	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	<0.60	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	<0.0040	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	<0.10	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	<0.40	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	<0.010	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	<0.0040	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	<0.040	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	<2.0	----
potassium	7440-09-7	E440A	4	mg/kg wwt	<4.0	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	<0.010	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	<0.010	----
sodium	7440-23-5	E440A	4	mg/kg wwt	<4.0	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	<0.010	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	<0.0040	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	<0.00040	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	<0.020	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	<0.00040	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	<0.020	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	# 0.13	B
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	<0.040	----
Metals (QCLot: 723123)						
aluminum	7429-90-5	E440	2	mg/kg	<2.0	----
antimony	7440-36-0	E440	0.01	mg/kg	<0.010	----
arsenic	7440-38-2	E440	0.02	mg/kg	<0.020	----
barium	7440-39-3	E440	0.05	mg/kg	<0.050	----
beryllium	7440-41-7	E440	0.01	mg/kg	<0.010	----
bismuth	7440-69-9	E440	0.01	mg/kg	<0.010	----
boron	7440-42-8	E440	1	mg/kg	<1.0	----
cadmium	7440-43-9	E440	0.005	mg/kg	<0.0050	----
calcium	7440-70-2	E440	20	mg/kg	<20	----
cesium	7440-46-2	E440	0.005	mg/kg	<0.0050	----
chromium	7440-47-3	E440	0.05	mg/kg	<0.050	----
cobalt	7440-48-4	E440	0.02	mg/kg	<0.020	----
copper	7440-50-8	E440	0.1	mg/kg	<0.10	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 723123) - continued						
iron	7439-89-6	E440	3	mg/kg	<3.0	----
lead	7439-92-1	E440	0.02	mg/kg	<0.020	----
lithium	7439-93-2	E440	0.5	mg/kg	<0.50	----
magnesium	7439-95-4	E440	2	mg/kg	<2.0	----
manganese	7439-96-5	E440	0.05	mg/kg	<0.050	----
molybdenum	7439-98-7	E440	0.02	mg/kg	<0.020	----
nickel	7440-02-0	E440	0.2	mg/kg	<0.20	----
phosphorus	7723-14-0	E440	10	mg/kg	<10	----
potassium	7440-09-7	E440	20	mg/kg	<20	----
rubidium	7440-17-7	E440	0.05	mg/kg	<0.050	----
selenium	7782-49-2	E440	0.05	mg/kg	<0.050	----
sodium	7440-23-5	E440	20	mg/kg	<20	----
strontium	7440-24-6	E440	0.05	mg/kg	<0.050	----
tellurium	13494-80-9	E440	0.02	mg/kg	<0.020	----
thallium	7440-28-0	E440	0.002	mg/kg	<0.0020	----
tin	7440-31-5	E440	0.1	mg/kg	<0.10	----
uranium	7440-61-1	E440	0.002	mg/kg	<0.0020	----
vanadium	7440-62-2	E440	0.1	mg/kg	<0.10	----
zinc	7440-66-6	E440	0.5	mg/kg	# 0.66	B
zirconium	7440-67-7	E440	0.2	mg/kg	<0.20	----
Metals (QCLot: 723124)						
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	<0.0010	----
Metals (QCLot: 723125)						
silver	7440-22-4	E440.Ag	0.005	mg/kg	<0.0050	----

Qualifiers

Qualifier	Description
B	*Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.*

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 699199)									
moisture	----	E144	0.5	%	50 %	99.7	90.0	110	----
Physical Tests (QCLot: 699290)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 703846)									
moisture	----	E144	0.5	%	50 %	99.4	90.0	110	----
Physical Tests (QCLot: 703855)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Physical Tests (QCLot: 703865)									
moisture	----	E144	0.5	%	50 %	98.8	90.0	110	----
Physical Tests (QCLot: 703872)									
moisture	----	E144	0.5	%	50 %	99.8	90.0	110	----
Physical Tests (QCLot: 703880)									
moisture	----	E144	0.5	%	50 %	95.8	90.0	110	----
Physical Tests (QCLot: 705539)									
moisture	----	E144	0.5	%	50 %	100	90.0	110	----
Metals (QCLot: 715475)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	93.5	80.0	120	----
Metals (QCLot: 715476)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	96.4	80.0	120	----
Metals (QCLot: 715477)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	96.4	80.0	120	----
Metals (QCLot: 715478)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	106	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	96.4	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	99.9	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 715478) - continued									
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	104	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	97.7	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	110	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	104	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	100.0	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	107	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	101	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	112	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	100	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	103	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	109	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	101	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	103	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	95.4	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	101	80.0	120	----
Metals (QCLot: 715479)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	106	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	104	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	105	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	96.4	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	99.9	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	104	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 715479) - continued									
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	100	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	97.7	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	110	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	104	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	100.0	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	107	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	112	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	100	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	109	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	101	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	95.4	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	101	80.0	120	----
Metals (QCLot: 715480)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	93.5	80.0	120	----
Metals (QCLot: 716122)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	104	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	107	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	97.6	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	105	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716122) - continued									
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	97.3	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	106	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	107	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	100.0	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	110	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	99.9	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	103	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	108	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	106	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	96.0	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	103	80.0	120	----
Metals (QCLot: 716123)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	104	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	108	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	106	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	104	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	107	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	101	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	97.6	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	105	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	102	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	97.3	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716123) - continued									
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	105	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	106	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	108	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	107	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	108	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	100.0	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	110	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	99.9	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	103	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	103	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	108	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	104	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	106	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	96.0	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	103	80.0	120	----
Metals (QCLot: 716124)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	94.5	80.0	120	----
Metals (QCLot: 716125)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	94.5	80.0	120	----
Metals (QCLot: 716126)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	100	80.0	120	----
Metals (QCLot: 716127)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	100	80.0	120	----
Metals (QCLot: 716145)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	97.2	80.0	120	----
Metals (QCLot: 716146)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	97.2	80.0	120	----
Metals (QCLot: 716147)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	108	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	107	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716147) - continued									
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	99.8	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	99.6	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	107	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	102	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	105	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	105	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	101	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	111	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	104	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	106	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	112	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	103	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	102	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	106	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	99.1	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	98.8	80.0	120	----
Metals (QCLot: 716148)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	108	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	107	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	104	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 716148) - continued									
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	99.8	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	99.6	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	102	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	107	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	102	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	100	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	106	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	105	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	101	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	111	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	104	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	106	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	106	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	112	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	102	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	105	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	103	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	102	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	106	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	99.1	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	98.8	80.0	120	----
Metals (QCLot: 716149)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	90.2	80.0	120	----
Metals (QCLot: 716150)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	90.2	80.0	120	----
Metals (QCLot: 720236)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	104	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	106	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	105	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720236) - continued									
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	99.7	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	103	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	96.3	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	96.7	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	100	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	101	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	98.9	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	96.0	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	102	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	104	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	106	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	99.6	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	98.4	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	98.2	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	98.3	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	103	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	105	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	100	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	99.1	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	101	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	92.6	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	94.3	80.0	120	----
Metals (QCLot: 720237)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	90.4	80.0	120	----
Metals (QCLot: 720238)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	100	80.0	120	----
Metals (QCLot: 720239)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	100	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720240)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	104	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	106	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	99.7	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	96.3	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	96.7	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	100	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	101	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	98.9	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	96.0	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	102	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	106	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	105	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	99.6	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	98.4	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	108	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	98.2	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	98.3	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	105	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	100	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	99.1	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	101	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	92.6	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	94.3	80.0	120	----
Metals (QCLot: 720241)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	90.4	80.0	120	----
Metals (QCLot: 720263)									

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720263) - continued									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	104	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	108	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	102	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	102	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	105	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	102	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	98.4	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	101	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	101	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	98.6	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	105	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	102	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	105	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	104	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	109	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	105	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	108	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	101	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	104	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	101	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	102	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	103	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	97.4	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	102	80.0	120	----
Metals (QCLot: 720264)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	90.5	80.0	120	----
Metals (QCLot: 720265)									

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720265) - continued									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	90.5	80.0	120	----
Metals (QCLot: 720266)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	98.4	80.0	120	----
Metals (QCLot: 720267)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	98.4	80.0	120	----
Metals (QCLot: 720268)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	105	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	102	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	98.4	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	101	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	98.6	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	105	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	109	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	105	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	101	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 720268) - continued									
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	97.4	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
Metals (QCLot: 723110)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	105	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	99.4	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	107	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	105	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	98.3	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	103	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	100.0	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	104	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	98.4	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	97.0	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	103	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	102	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	108	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	106	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	105	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	103	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	104	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	99.2	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	102	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	109	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	102	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	105	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	108	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	103	80.0	120	----
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	97.1	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	105	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	99.3	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	109	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	104	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	99.3	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723110) - continued									
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	98.5	80.0	120	----
Metals (QCLot: 723111)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	87.7	80.0	120	----
Metals (QCLot: 723112)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	87.7	80.0	120	----
Metals (QCLot: 723113)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	94.0	80.0	120	----
Metals (QCLot: 723114)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	94.0	80.0	120	----
Metals (QCLot: 723115)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	105	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	99.4	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	107	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	98.3	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	100.0	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	104	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	98.4	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	97.0	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	102	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	108	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	106	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	105	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	103	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	104	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	99.2	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	102	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	109	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	102	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	108	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	103	80.0	120	----

Sub-Matrix: **Biota**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723115) - continued									
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	97.1	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	105	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	99.3	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	109	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	104	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	99.3	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	98.5	80.0	120	----
Metals (QCLot: 723120)									
mercury	7439-97-6	E510A	0.001	mg/kg wwt	0.02 mg/kg wwt	93.6	80.0	120	----
Metals (QCLot: 723121)									
mercury	7439-97-6	E510	0.005	mg/kg	0.02 mg/kg	93.6	80.0	120	----
Metals (QCLot: 723122)									
aluminum	7429-90-5	E440A	0.4	mg/kg wwt	20 mg/kg wwt	98.8	80.0	120	----
antimony	7440-36-0	E440A	0.002	mg/kg wwt	10 mg/kg wwt	95.3	80.0	120	----
arsenic	7440-38-2	E440A	0.004	mg/kg wwt	10 mg/kg wwt	103	80.0	120	----
barium	7440-39-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	97.8	80.0	120	----
beryllium	7440-41-7	E440A	0.002	mg/kg wwt	1 mg/kg wwt	100	80.0	120	----
bismuth	7440-69-9	E440A	0.002	mg/kg wwt	10 mg/kg wwt	95.3	80.0	120	----
boron	7440-42-8	E440A	0.2	mg/kg wwt	10 mg/kg wwt	94.7	80.0	120	----
cadmium	7440-43-9	E440A	0.001	mg/kg wwt	1 mg/kg wwt	100	80.0	120	----
calcium	7440-70-2	E440A	4	mg/kg wwt	500 mg/kg wwt	100	80.0	120	----
cesium	7440-46-2	E440A	0.001	mg/kg wwt	0.5 mg/kg wwt	95.5	80.0	120	----
chromium	7440-47-3	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	100	80.0	120	----
cobalt	7440-48-4	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	99.8	80.0	120	----
copper	7440-50-8	E440A	0.02	mg/kg wwt	2.5 mg/kg wwt	99.0	80.0	120	----
iron	7439-89-6	E440A	0.6	mg/kg wwt	10 mg/kg wwt	104	80.0	120	----
lead	7439-92-1	E440A	0.004	mg/kg wwt	5 mg/kg wwt	98.6	80.0	120	----
lithium	7439-93-2	E440A	0.1	mg/kg wwt	2.5 mg/kg wwt	107	80.0	120	----
magnesium	7439-95-4	E440A	0.4	mg/kg wwt	500 mg/kg wwt	101	80.0	120	----
manganese	7439-96-5	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	99.1	80.0	120	----
molybdenum	7439-98-7	E440A	0.004	mg/kg wwt	2.5 mg/kg wwt	97.2	80.0	120	----
nickel	7440-02-0	E440A	0.04	mg/kg wwt	5 mg/kg wwt	98.2	80.0	120	----
phosphorus	7723-14-0	E440A	2	mg/kg wwt	100 mg/kg wwt	108	80.0	120	----
potassium	7440-09-7	E440A	4	mg/kg wwt	500 mg/kg wwt	97.4	80.0	120	----
rubidium	7440-17-7	E440A	0.01	mg/kg wwt	1 mg/kg wwt	99.2	80.0	120	----
selenium	7782-49-2	E440A	0.01	mg/kg wwt	10 mg/kg wwt	99.8	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723122) - continued									
sodium	7440-23-5	E440A	4	mg/kg wwt	500 mg/kg wwt	102	80.0	120	----
strontium	7440-24-6	E440A	0.01	mg/kg wwt	2.5 mg/kg wwt	101	80.0	120	----
tellurium	13494-80-9	E440A	0.004	mg/kg wwt	1 mg/kg wwt	95.6	80.0	120	----
thallium	7440-28-0	E440A	0.0004	mg/kg wwt	10 mg/kg wwt	96.4	80.0	120	----
tin	7440-31-5	E440A	0.02	mg/kg wwt	5 mg/kg wwt	97.3	80.0	120	----
uranium	7440-61-1	E440A	0.0004	mg/kg wwt	0.05 mg/kg wwt	103	80.0	120	----
vanadium	7440-62-2	E440A	0.02	mg/kg wwt	5 mg/kg wwt	100	80.0	120	----
zinc	7440-66-6	E440A	0.1	mg/kg wwt	5 mg/kg wwt	101	80.0	120	----
zirconium	7440-67-7	E440A	0.04	mg/kg wwt	1 mg/kg wwt	96.7	80.0	120	----
Metals (QCLot: 723123)									
aluminum	7429-90-5	E440	2	mg/kg	20 mg/kg	98.8	80.0	120	----
antimony	7440-36-0	E440	0.01	mg/kg	10 mg/kg	95.3	80.0	120	----
arsenic	7440-38-2	E440	0.02	mg/kg	10 mg/kg	103	80.0	120	----
barium	7440-39-3	E440	0.05	mg/kg	2.5 mg/kg	97.8	80.0	120	----
beryllium	7440-41-7	E440	0.01	mg/kg	1 mg/kg	100	80.0	120	----
bismuth	7440-69-9	E440	0.01	mg/kg	10 mg/kg	95.3	80.0	120	----
boron	7440-42-8	E440	1	mg/kg	10 mg/kg	94.7	80.0	120	----
cadmium	7440-43-9	E440	0.005	mg/kg	1 mg/kg	100	80.0	120	----
calcium	7440-70-2	E440	20	mg/kg	500 mg/kg	100	80.0	120	----
cesium	7440-46-2	E440	0.005	mg/kg	0.5 mg/kg	95.5	80.0	120	----
chromium	7440-47-3	E440	0.05	mg/kg	2.5 mg/kg	100	80.0	120	----
cobalt	7440-48-4	E440	0.02	mg/kg	2.5 mg/kg	99.8	80.0	120	----
copper	7440-50-8	E440	0.1	mg/kg	2.5 mg/kg	99.0	80.0	120	----
iron	7439-89-6	E440	3	mg/kg	10 mg/kg	104	80.0	120	----
lead	7439-92-1	E440	0.02	mg/kg	5 mg/kg	98.6	80.0	120	----
lithium	7439-93-2	E440	0.5	mg/kg	2.5 mg/kg	107	80.0	120	----
magnesium	7439-95-4	E440	2	mg/kg	500 mg/kg	101	80.0	120	----
manganese	7439-96-5	E440	0.05	mg/kg	2.5 mg/kg	99.1	80.0	120	----
molybdenum	7439-98-7	E440	0.02	mg/kg	2.5 mg/kg	97.2	80.0	120	----
nickel	7440-02-0	E440	0.2	mg/kg	5 mg/kg	98.2	80.0	120	----
phosphorus	7723-14-0	E440	10	mg/kg	100 mg/kg	108	80.0	120	----
potassium	7440-09-7	E440	20	mg/kg	500 mg/kg	97.4	80.0	120	----
rubidium	7440-17-7	E440	0.05	mg/kg	1 mg/kg	99.2	80.0	120	----
selenium	7782-49-2	E440	0.05	mg/kg	10 mg/kg	99.8	80.0	120	----
sodium	7440-23-5	E440	20	mg/kg	500 mg/kg	102	80.0	120	----
strontium	7440-24-6	E440	0.05	mg/kg	2.5 mg/kg	101	80.0	120	----

Sub-Matrix: **Biota**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 723123) - continued									
tellurium	13494-80-9	E440	0.02	mg/kg	1 mg/kg	95.6	80.0	120	----
thallium	7440-28-0	E440	0.002	mg/kg	10 mg/kg	96.4	80.0	120	----
tin	7440-31-5	E440	0.1	mg/kg	5 mg/kg	97.3	80.0	120	----
uranium	7440-61-1	E440	0.002	mg/kg	0.05 mg/kg	103	80.0	120	----
vanadium	7440-62-2	E440	0.1	mg/kg	5 mg/kg	100	80.0	120	----
zinc	7440-66-6	E440	0.5	mg/kg	5 mg/kg	101	80.0	120	----
zirconium	7440-67-7	E440	0.2	mg/kg	1 mg/kg	96.7	80.0	120	----
Metals (QCLot: 723124)									
silver	7440-22-4	E440A.Ag	0.001	mg/kg wwt	1 mg/kg wwt	86.5	80.0	120	----
Metals (QCLot: 723125)									
silver	7440-22-4	E440.Ag	0.005	mg/kg	1 mg/kg	86.5	80.0	120	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 715475)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	93.2	70.0	130	----
Metals (QCLot: 715476)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	113	70.0	130	----
Metals (QCLot: 715477)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	113	70.0	130	----
Metals (QCLot: 715478)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	88.7	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	97.4	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	117	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	94.2	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	95.8	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	97.1	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	108	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	92.8	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	96.1	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	97.0	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	# 132	70.0	130	MES
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	101	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	96.6	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	99.1	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	123	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	100	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	94.7	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	96.6	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	100.0	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	95.3	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	94.8	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 715478) - continued									
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	88.0	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	100	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	96.6	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	95.0	70.0	130	----
Metals (QCLot: 715479)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	88.7	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	97.4	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	117	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	94.2	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	95.8	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	97.1	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	108	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	92.8	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	96.1	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.0	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	# 132	70.0	130	MES
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	96.6	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	99.1	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	123	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	94.7	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	96.6	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	100.0	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	95.3	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	94.8	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	88.0	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	100	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	96.6	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	95.0	70.0	130	----
Metals (QCLot: 715480)									

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 715480) - continued									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	93.2	70.0	130	----
Metals (QCLot: 716122)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	106	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	97.8	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	91.9	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	91.9	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	98.9	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	101	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	108	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	95.9	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	95.0	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	97.0	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	95.0	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	101	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	97.4	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	98.2	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	95.2	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	96.8	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	95.9	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	97.8	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	98.2	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	95.7	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	97.4	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	86.6	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	106	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	98.7	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	95.5	70.0	130	----
Metals (QCLot: 716123)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	106	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	97.8	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 716123) - continued									
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	91.9	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	91.9	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	98.9	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	101	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	108	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	95.9	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	95.0	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.0	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	95.0	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	97.4	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	98.2	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	95.2	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	96.8	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	95.9	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	97.8	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	98.2	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	95.7	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	97.4	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	86.6	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	106	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	98.7	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	95.5	70.0	130	----
Metals (QCLot: 716124)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	95.9	70.0	130	----
Metals (QCLot: 716125)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	95.9	70.0	130	----
Metals (QCLot: 716126)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	111	70.0	130	----
Metals (QCLot: 716127)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	111	70.0	130	----
Metals (QCLot: 716145)									

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 716145) - continued									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	112	70.0	130	----
Metals (QCLot: 716146)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	112	70.0	130	----
Metals (QCLot: 716147)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	94.5	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	102	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	73.6	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	95.8	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	100	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	93.8	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	116	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	100	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	99.7	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	103	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	99.8	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	102	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	95.8	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	97.8	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	102	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	101	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	100.0	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	105	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	106	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	92.1	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	85.6	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	100	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	98.0	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	99.9	70.0	130	----
Metals (QCLot: 716148)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	94.5	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 716148) - continued									
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	102	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	73.6	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	95.8	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	100	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	93.8	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	116	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	100	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	99.7	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	103	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	99.8	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	102	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	95.8	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	97.8	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	102	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	101	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	100.0	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	105	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	106	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	92.1	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	85.6	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	100	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	98.0	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	99.9	70.0	130	----
Metals (QCLot: 716149)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	89.8	70.0	130	----
Metals (QCLot: 716150)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	89.8	70.0	130	----
Metals (QCLot: 720236)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	117	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	97.7	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	97.7	60.0	140	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 720236) - continued									
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	93.0	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	88.0	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	89.5	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	104	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	94.1	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	95.6	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	97.9	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	88.6	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	104	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	95.8	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	91.2	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	104	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	100	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	94.4	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	95.1	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	98.9	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	96.5	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	88.1	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	81.2	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	99.6	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	95.9	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	93.7	70.0	130	----
Metals (QCLot: 720237)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	89.0	70.0	130	----
Metals (QCLot: 720238)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	112	70.0	130	----
Metals (QCLot: 720239)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	112	70.0	130	----
Metals (QCLot: 720240)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	117	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	97.7	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 720240) - continued									
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	97.7	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	93.0	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	88.0	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	89.5	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	104	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	94.1	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	95.6	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	97.9	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	88.6	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	104	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	95.8	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	91.2	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	104	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	100	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	94.4	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	95.1	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	98.9	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	96.5	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	88.1	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	81.2	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	99.6	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	95.9	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	93.7	70.0	130	----
Metals (QCLot: 720241)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	89.0	70.0	130	----
Metals (QCLot: 720263)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	105	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	96.5	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	113	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	90.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 720263) - continued									
	RM	calcium	7440-70-2	E440	550 mg/kg	97.5	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	97.4	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	97.1	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	94.8	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	95.5	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	96.0	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	101	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	95.9	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	95.1	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	109	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	97.2	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	94.9	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	96.3	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	101	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	94.8	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	94.9	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	98.2	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	101	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	95.8	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	96.3	70.0	130	----
Metals (QCLot: 720264)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	93.9	70.0	130	----
Metals (QCLot: 720265)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	93.9	70.0	130	----
Metals (QCLot: 720266)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	111	70.0	130	----
Metals (QCLot: 720267)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	111	70.0	130	----
Metals (QCLot: 720268)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	105	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	96.5	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 720268) - continued									
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	113	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	90.2	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	97.5	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	97.4	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	97.1	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	94.8	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	95.5	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	96.0	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	101	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	95.9	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	95.1	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	109	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	97.2	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	94.9	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	96.3	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	101	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	94.8	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	94.9	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	98.2	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	101	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	95.8	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	96.3	70.0	130	----
Metals (QCLot: 723110)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	99.6	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	99.8	70.0	130	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	97.1	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	93.0	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	94.7	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	# 134	70.0	130	MES
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	98.0	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 723110) - continued									
	RM	copper	7440-50-8	E440	35 mg/kg	100	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	103	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	# 134	70.0	130	MES
	RM	magnesium	7439-95-4	E440	940 mg/kg	102	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	99.7	70.0	130	----
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	99.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	105	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	99.6	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	99.2	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	101	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	102	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	94.3	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	89.1	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	105	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	98.9	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	97.8	70.0	130	----
Metals (QCLot: 723111)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	91.1	70.0	130	----
Metals (QCLot: 723112)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	91.1	70.0	130	----
Metals (QCLot: 723113)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	104	70.0	130	----
Metals (QCLot: 723114)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	104	70.0	130	----
Metals (QCLot: 723115)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	99.6	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	99.8	70.0	130	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	97.1	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	93.0	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	94.7	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	# 134	70.0	130	MES

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Metals (QCLot: 723115) - continued									
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	98.0	70.0	130	----
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	100	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	103	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	# 134	70.0	130	MES
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	102	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	99.7	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	99.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	105	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	99.6	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	99.2	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	101	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	102	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	94.3	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	89.1	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	105	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	98.9	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	97.8	70.0	130	----
Metals (QCLot: 723120)									
	RM	mercury	7439-97-6	E510A	0.331 mg/kg wwt	106	70.0	130	----
Metals (QCLot: 723121)									
	RM	mercury	7439-97-6	E510	0.331 mg/kg	106	70.0	130	----
Metals (QCLot: 723122)									
	RM	aluminum	7429-90-5	E440A	11.2 mg/kg wwt	114	70.0	130	----
	RM	arsenic	7440-38-2	E440A	34.6 mg/kg wwt	99.3	70.0	130	----
	RM	bismuth	7440-69-9	E440A	0.0247 mg/kg wwt	83.7	60.0	140	----
	RM	cadmium	7440-43-9	E440A	14.5 mg/kg wwt	96.4	70.0	130	----
	RM	calcium	7440-70-2	E440A	550 mg/kg wwt	91.7	70.0	130	----
	RM	cesium	7440-46-2	E440A	0.0712 mg/kg wwt	86.1	70.0	130	----
	RM	chromium	7440-47-3	E440A	1.96 mg/kg wwt	120	70.0	130	----
	RM	cobalt	7440-48-4	E440A	0.267 mg/kg wwt	96.2	70.0	130	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Metals (QCLot: 723122) - continued									
	RM	copper	7440-50-8	E440A	35 mg/kg wwt	98.7	70.0	130	----
	RM	iron	7439-89-6	E440A	1070 mg/kg wwt	98.3	70.0	130	----
	RM	lead	7439-92-1	E440A	0.162 mg/kg wwt	108	70.0	130	----
	RM	magnesium	7439-95-4	E440A	940 mg/kg wwt	102	70.0	130	----
	RM	manganese	7439-96-5	E440A	8.91 mg/kg wwt	98.0	70.0	130	----
	RM	molybdenum	7439-98-7	E440A	1.41 mg/kg wwt	85.7	70.0	130	----
	RM	nickel	7440-02-0	E440A	1.57 mg/kg wwt	92.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440A	11500 mg/kg wwt	103	70.0	130	----
	RM	potassium	7440-09-7	E440A	14400 mg/kg wwt	98.5	70.0	130	----
	RM	rubidium	7440-17-7	E440A	5.11 mg/kg wwt	94.6	70.0	130	----
	RM	selenium	7782-49-2	E440A	8 mg/kg wwt	97.5	70.0	130	----
	RM	sodium	7440-23-5	E440A	10673 mg/kg wwt	100	70.0	130	----
	RM	strontium	7440-24-6	E440A	3.92 mg/kg wwt	87.2	70.0	130	----
	RM	thallium	7440-28-0	E440A	0.013 mg/kg wwt	80.6	70.0	130	----
	RM	uranium	7440-61-1	E440A	0.0786 mg/kg wwt	95.8	70.0	130	----
	RM	vanadium	7440-62-2	E440A	0.51 mg/kg wwt	96.8	70.0	130	----
	RM	zinc	7440-66-6	E440A	105.3 mg/kg wwt	102	70.0	130	----
Metals (QCLot: 723123)									
	RM	aluminum	7429-90-5	E440	11.2 mg/kg	114	70.0	130	----
	RM	arsenic	7440-38-2	E440	34.6 mg/kg	99.3	70.0	130	----
	RM	bismuth	7440-69-9	E440	0.0247 mg/kg	83.7	60.0	140	----
	RM	cadmium	7440-43-9	E440	14.5 mg/kg	96.4	70.0	130	----
	RM	calcium	7440-70-2	E440	550 mg/kg	91.7	70.0	130	----
	RM	cesium	7440-46-2	E440	0.0712 mg/kg	86.1	70.0	130	----
	RM	chromium	7440-47-3	E440	1.96 mg/kg	120	70.0	130	----
	RM	cobalt	7440-48-4	E440	0.267 mg/kg	96.2	70.0	130	----
	RM	copper	7440-50-8	E440	35 mg/kg	98.7	70.0	130	----
	RM	iron	7439-89-6	E440	1070 mg/kg	98.3	70.0	130	----
	RM	lead	7439-92-1	E440	0.162 mg/kg	108	70.0	130	----
	RM	magnesium	7439-95-4	E440	940 mg/kg	102	70.0	130	----
	RM	manganese	7439-96-5	E440	8.91 mg/kg	98.0	70.0	130	----

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Metals (QCLot: 723123) - continued									
	RM	molybdenum	7439-98-7	E440	1.41 mg/kg	85.7	70.0	130	----
	RM	nickel	7440-02-0	E440	1.57 mg/kg	92.6	70.0	130	----
	RM	phosphorus	7723-14-0	E440	11500 mg/kg	103	70.0	130	----
	RM	potassium	7440-09-7	E440	14400 mg/kg	98.5	70.0	130	----
	RM	rubidium	7440-17-7	E440	5.11 mg/kg	94.6	70.0	130	----
	RM	selenium	7782-49-2	E440	8 mg/kg	97.5	70.0	130	----
	RM	sodium	7440-23-5	E440	10673 mg/kg	100	70.0	130	----
	RM	strontium	7440-24-6	E440	3.92 mg/kg	87.2	70.0	130	----
	RM	thallium	7440-28-0	E440	0.013 mg/kg	80.6	70.0	130	----
	RM	uranium	7440-61-1	E440	0.0786 mg/kg	95.8	70.0	130	----
	RM	vanadium	7440-62-2	E440	0.51 mg/kg	96.8	70.0	130	----
	RM	zinc	7440-66-6	E440	105.3 mg/kg	102	70.0	130	----
Metals (QCLot: 723124)									
	RM	silver	7440-22-4	E440A.Ag	2.05 mg/kg wwt	83.1	70.0	130	----
Metals (QCLot: 723125)									
	RM	silver	7440-22-4	E440.Ag	2.05 mg/kg	83.1	70.0	130	----

Qualifiers

Qualifier	Description
MES	*Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).*

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095A

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Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa Pallouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437 - 332 - 5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200%] (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Street:	2920 Virtual way # 200	Email 1 or Fax melissa.pallouras@wsp.com	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
Postal Code:	V5M 0C4	Email 3	

Invoice To		Invoice Distribution	Analysis Request
	Same as Report To ☐ YES ☒ NO		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Company:	Mount Polley Mining Corp	Email 1 or Fax gabriel.homes@mountpolley.com	
Contact:	Gabriel Homes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	2369	ALS Contact: Amber Springer	Sampler: D. Sales

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22 - SG - L - 01	13 SEP 22	13:00	veg	X	X			1
	22 - SG - L - 02	"	"	"	X	X			"
	22 - SG - G - 01	"	"	"	X	X			"
	22 - SG - L - 03	"	"	"	X	X			"
	22 - SG - L - 04	"	"	"	X	X			"
	22 - SB - L - 01	13sep 22	14:15	veg	X	X			"
	22 - SB - G - 01	"	"	"	X	X			"
	22 - SB - G - 02	"	"	"	X	X			"
	22 - SB - L - 02	"	"	"	X	X			"
10	22 - SB - F - 01	"	"	"	X	X			"

Environmental Division
Vancouver
Work Order Reference
VA22C2369

Telephone : +1 604 253 4188

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)	SAMPLE CONDITION AS RECEIVED (lab use only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO		Frozen ☐ SIF Observations Yes ☐ No ☐
Are samples for human consumption/ use? ☐ YES ☒ NO		Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
		Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C	
				7°C (avg 6)	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17 Sep 2022	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17 Sep 22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
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Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 6860951 3

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Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437 - 332 - 5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mt. Polley Mining Corp.
Contact:	Gabriel Homes

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008044
LSD:	
ALS Lab Work Order # (lab use only):	

Report Format / Distribution

Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☒ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: melissa.paliouras@wsp.com

Email 2: samantha.lundquist@wsp.com

Email 3:

Invoice Distribution

Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: gabriel.homes@mountainpolley.com

Email 2:

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Contact: Amber Springer Sampler: D. Sales

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
	22-S3-G-01	13-SEP-22	15:30	Veg	X	X			1
	22-S3-G-02	"	"	"	X	X			"
	22-S3-L-01	"	"	"	X	X			"
	22-S3-F-01	"	"	"	X	X			"
	22-S3-L-02	"	"	"	X	X			"
	22-R2-L-01	14-SEP-22	8:50	Veg	X	X			"
	22-R2-F-01	"	"	"	X	X			"
	22-R2-L-02	"	"	"	X	X			"
19	22-R2-L-03	"	"	"	X	X			"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
Debo Sales	17 Sep 22	14:30

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
JC	17/9/22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 C

Page 3 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lindquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E-100%] ☐ | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Invoice To	Same as Report To ☐ YES ☒ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	Mt. Polley Mining Corp
Contact:	Gabriel Homes

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.homes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	6590008044
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
20	22-R3-L-01	14SEP22	10:00	veg	✓	✓			1
	22-R3-L-01D	"	"	"	✓	✓			"
	22-R3-L-02	"	"	"	✓	✓			"
	22-R3-L-02D	"	"	"	✓	✓			"
	22-R3-L-03	"	"	"	✓	✓			"
	22-R3-L-03D	"	"	"	✓	✓			"
	22-R3-F-01	"	"	"	✓	✓			"
	22-R3-F-01D	"	"	"	✓	✓			"
	22-R1-L-01	14SEP22	11:00	veg	✓	✓			"
	22-R1-L-02	"	"	"	✓	✓			"
	22-R1-F-01	"	"	"	✓	✓			"
32.31	22-R1-L-03	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☒ NO

Are samples for human consumption/ use? ☐ YES ☒ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☒ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)		
Released by: Deb Sales	Date: 17Sep2022	Time: 14:30

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by: JC	Date: 17/9/22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 D

Page 4 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [ ] EXCEL [X] EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lindquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	[X] Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days): 4 day [P4-20%]	[ ]
3 day [P3-25%]	[ ]
2 day [P2-50%]	[ ]
EMERGENCY: 1 Business day [E-100%]	[ ]
Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	[ ]
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Invoice To		
	Same as Report To	YES [ ] NO [X]
	Copy of Invoice with Report	YES [ ] NO [ ]
Company:	Mt Polley Mining Corp.	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
3	22-S11-L-01	14sep22	12:40	Veg	✓	✓			1
	22-S11-G-01	"	"	"	✓	✓			1
	22-S11-L-02	"	"	"	✓	✓			1
	22-S11-L-03	"	"	"	✓	✓			1
	22-S11-F-01	"	"	"	✓	✓			1
	22-S12-L-01	14sep22	13:10	Veg	✓	✓			1
	22-S12-G-01	"	"	"	✓	✓			1
	22-S12-L-02	"	"	"	✓	✓			1
	22-S12-F-01	"	"	"	✓	✓			1
4	22-S12-L-03	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES [ ] NO [X]	
Are samples for human consumption/ use? YES [ ] NO [X]	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] SIF Observations Yes [ ] No [ ]

Ice Packs [X] Ice Cubes [ ] Custody seal intact Yes [ ] No [ ]

Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7 C (avg 6)		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095E

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	☐ PDF ☒ EXCEL | EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL | MAIL ☐ FAX
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lindquist@wsp.com
Email 3	

Invoice To		
	Same as Report To	☐ YES ☒ NO
	Copy of Invoice with Report	☐ YES ☐ NO
Company:	Mt Polley Mining Corp.	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days)		EMERGENCY	
4 day [P4-20%]	☐	1 Business day [E-100%]	☐
3 day [P3-25%]	☐	Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	☐
2 day [P2-50%]	☐		

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
4248	22-S14-F-01	14 Sep 22	14:00	veg	✓	✓			1
	22-S14-L-03	"	"	"	✓	✓			1
	22-S14-L-02	"	"	"	✓	✓			1
	22-S14-L-01	"	"	"	✓	✓			1
	22-S14-G-01	"	"	"	✓	✓			1
	22-S13-L-01	14 Sep 22	14:40	veg	✓	✓			1
	22-S13-L-02	"	"	"	✓	✓			1
	22-S13-L-03	"	"	"	✓	✓			1
	22-S13-F-01	"	"	"	✓	✓			1
4252	22-S13-G-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				1°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: Sep 17, 2022	Time: 1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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JULY 2017 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095G

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa. Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2920 Virtual Way # 200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 Samantha.lundquist@wsp.com	
Postal Code:	V6M 0C4	Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☐ YES ☐ NO		
Company:	Mt. Polley Mining Corp	Email 1 or Fax galenel.holmes@mountpolley.com	
Contact:	Galenel Holmes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590000844	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
62 63	22-S16-L-01	14sep22	17:00	Veg	✓	✓			1
	22-S16-L-02	"	"	"	✓	✓			"
	22-S16-L-03	"	"	"	✓	✓			"
	22-S16-G-01	"	"	"	✓	✓			"
	22-S16-F-01	"	"	"	✓	✓			"
	22-S5-L-01	15sep22	8:10	Veg	✓	✓			"
	22-S6-L-02	"	"	"	✓	✓			"
	22-S6-G-01	"	"	"	✓	✓			"
	22-S6-F-01	"	"	"	✓	✓			"
71 72	22-S6-G-02	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	☐	SIF Observations	Yes ☐	No ☐
Ice Packs	☑	Ice Cubes ☐	Custody seal intact	Yes ☐ No ☐
Cooling Initiated	☐			

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	7°C (avg 6)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Deb Sales	17sep22	14:32				JC	17 Sep 22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION — WHITE - LABORATORY COPY — YELLOW - CLIENT COPY — JULY 2017 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 F

Page 6 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	melissa. Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 virtual way #200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	☐ PDF ☒ EXCEL | EDD (DIGITAL)
Quality Control (QC) Report with Report	☒ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☒ EMAIL | MAIL ☐ FAX
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lundquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Regular [R]	☒ Standard TAT if received by 3 pm - business days - no surcharges apply		
PRIORITY (Business Days)	4 day [P4-20%] ☐	EMERGENCY	1 Business day [E-100%] ☐
	3 day [P3-25%] ☐		Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	2 day [P2-50%] ☐		
Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm	
For tests that can not be performed according to the service level selected, you will be contacted.			

Invoice To		
	Same as Report To	☐ YES ☒ NO
	Copy of Invoice with Report	☐ YES ☐ NO
Company:	Mt. Polley Mining Corp	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	☒ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008044
LSD:	
ALS Lab Work Order # (lab use only):	

Oil and Gas Required Fields (client use)		
AFE/Cost Center:		PO#
Major/Minor Code:		Routing Code:
Requisitioner:		
Location:		
ALS Contact:	Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
S254	22-S13-L-01D	14sep22	14:40	veg	✓	✓			1
	22-S13-L-02D	"	"	"	✓	✓			1
	22-S13-L-03D	"	"	"	✓	✓			1
	22-S13-F-01D	"	"	"	✓	✓			1
	22-S13-G-01D	"	"	"	✓	✓			1
	22-S17-L-01	14sep22	16:15	veg	✓	✓			1
	22-S17-L-02	"	"	"	✓	✓			1
	22-S17-L-03	"	"	"	✓	✓			1
	22-S17-G-01	"	"	"	✓	✓			1
61 62	22-S17-F-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☒ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)		
Released by:	Date:	Time:
Deb Sales	17Sep22	14:30

INITIAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)		
Received by:	Date:	Time:
JC	Sep 17/22	1440

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095H

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-352-5990
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [X] EXCEL [ ] EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	melissa.paliouras@wsp.com
Email 2	samantha.lundquist@wsp.com
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)	
Regular [R]	[X] Standard TAT if received by 3 pm - business days - no surcharges apply
PRIORITY (Business Days) 4 day [P4-20%]	[ ]
PRIORITY (Business Days) 3 day [P3-25%]	[ ]
PRIORITY (Business Days) 2 day [P2-50%]	[ ]
EMERGENCY 1 Business day [E-100%]	[ ]
EMERGENCY Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)]	[ ]
Date and Time Required for all E&P TATs:	dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.	

Invoice To		
	Same as Report To	YES [ ] NO [X]
	Copy of Invoice with Report	YES [ ] NO [ ]
Company:	M.T. Polley Mining Corp.	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountainpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590006044
LSD:	
ALS Lab Work Order # (lab use only):	

Oil and Gas Required Fields (client use)		
AFE/Cost Center:		PO#:
Major/Minor Code:		Routing Code:
Requisitioner:		
Location:		
ALS Contact:	Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
7L78	22-S5-L-01	15Sep22	09:10	veg	✓	✓			1
	22-S5-B-01	"	"	"	✓	✓			1
	22-S5-G-01	"	"	"	✓	✓			1
	22-S5-L-02	"	"	"	✓	✓			1
	22-S5-F-01	"	"	"	✓	✓			1
	22-S4-L-02	15Sep22	10:00	veg	✓	✓			1
	22-S4-L-01	"	"	"	✓	✓			1
	22-S4-G-01	"	"	"	✓	✓			1
	22-S4-F-01	"	"	"	✓	✓			1
8L82	22-S4-B-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES [ ] NO [X]	
Are samples for human consumption/ use? YES [ ] NO [X]	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	[ ]	SIF Observations	Yes [ ]	No	[ ]
Ice Packs	[✓]	Ice Cubes [ ]	Custody seal intact	Yes [ ]	No [ ]
Cooling Initiated	[ ]				

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C (avg 6)			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2pm
Deb Sales	17Sep22	14:30						

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 I

Page 9 of 13

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa.Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2920 Virtual Way # 200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	
Postal Code:	V5M 0C4	Email 3	

Invoice To		Invoice Distribution
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX
	Copy of Invoice with Report ☐ YES ☐ NO	
Company:	Mt Polley Mining Corp	Email 1 or Fax gabriel.holmes@mountpolley.com
Contact:	Gabriel Holmes	Email 2

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
					☒	☒			
82 83	22-S2-L-01	15Sep22	11:30	Veg	✓	✓			1
	22-S2-L-02	"	"	"	✓	✓			"
	22-S2-G-01	"	"	"	✓	✓			"
	22-S2-G-02	"	"	"	✓	✓			"
	22-S2-F-01	"	"	"	✓	✓			"
	22-S1-L-01	15Sep22	12:30	Veg	✓	✓			"
	22-S1-L-02	"	"	"	✓	✓			"
	22-S1-G-02	"	"	"	✓	✓			"
	22-S1-G-01	"	"	"	✓	✓			"
91 92	22-S1-F-01	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	7°C (avg 6)

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Deb Sales	Date: 17Sep22	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095 J

Page 10 of 13

Report To	Contact and company name below will appear on the final report
Company:	WSP Golder
Contact:	Melissa Paliouras
Phone:	437-332-5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4

Report Format / Distribution	
Select Report Format:	PDF [ ] EXCEL [X] | EDD (DIGITAL) [ ]
Quality Control (QC) Report with Report	YES [X] NO [ ]
Compare Results to Criteria on Report - provide details below if box checked	[ ]
Select Distribution:	EMAIL [X] | MAIL [ ] FAX [ ]
Email 1 or Fax	
Email 2	
Email 3	

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Regular [R]	[X]	Standard TAT if received by 3 pm - business days - no surcharges apply	
PRIORITY (Business Days)	4 day [P4-20%]	[ ]	EMERGENCY: 1 Business day [E-100%] [ ]
	3 day [P3-25%]	[ ]	Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] [ ]
	2 day [P2-50%]	[ ]	
Date and Time Required for all E&P TATs:			dd-mmm-yy hh:mm
For tests that can not be performed according to the service level selected, you will be contacted.			

Invoice To		
	Same as Report To	YES [ ] NO [X]
	Copy of Invoice with Report	YES [ ] NO [ ]
Company:	Mt. Polley Mining Corp	
Contact:	Gabriel Holmes	

Invoice Distribution	
Select Invoice Distribution:	EMAIL [X] MAIL [ ] FAX [ ]
Email 1 or Fax	gabriel.holmes@mountpolley.com
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008844
LSD:	

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact: Amber Springer

Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
92	22-R4-G-01	15Sep22	13:45	Veg	✓	✓			1
	22-R4-L-01	"	"	"	✓	✓			"
	22-R4-L-02	"	"	"	✓	✓			"
	22-R4-L-03	"	"	"	✓	✓			"
	22-R4-F-03	"	"	"	✓	✓			"
	22-R5-L-01	15Sep22	14:45	Veg	✓	✓			"
	22-R5-L-02	"	"	"	✓	✓			"
	22-R5-L-03	"	"	"	✓	✓			"
	22-R5-F-01	"	"	"	✓	✓			"
101	22-R5-F-02	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? YES [ ] NO [X]	
Are samples for human consumption/ use? YES [ ] NO [X]	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen	[ ]	SIF Observations	Yes [ ]	No [ ]	
Ice Packs	[ ]	Ice Cubes [ ]	Custody seal intact	Yes [ ]	No [ ]
Cooling Initiated	[ ]				

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7°C (avg 6)		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
D. Sales	Sept 17, 2022	14:30				SC	17/9/22	2pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

ALS Environmental
www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095K

Page 11 of 13

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	Wsp Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa. Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2920 Virtual Way # 200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	
Postal Code:	V5M 0C4	Email 3	

Invoice To		Invoice Distribution	
	Same as Report To ☐ YES ☒ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
	Copy of Invoice with Report ☐ YES ☐ NO		
Company:	Mt Polley Mining Corp.	Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:	Gabriel Holmes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Spenger	Sampler: Delo Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture Content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
102 ~~103~~	22-R6-F-01	15Sep 01	15:40	veg	✓	✓			1
	22-R6-F-02	"	"	"	✓	✓			"
	22-R6-L-01	"	"	"	✓	✓			"
	22-R6-L-02	"	"	"	✓	✓			"
	22-R6-B-01	"	"	"	✓	✓			"
	22-A4-L-01	16Sep22	08:15	veg	✓	✓			"
	22-A4-L-02	"	"	"	✓	✓			"
	22-A4-G-01	"	"	"	✓	✓			"
	22-A4-F-01	"	"	"	✓	✓			"
111 ~~112~~	22-A4-G-02	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐	SIF Observations: Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐	Custody seal intact: Yes ☐ No ☐
Cooling Initiated ☐	

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				7°C	(Cava 6)		

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Dr. Sales	Date: Sept 17, 2022	Time: 14:30	Received by:	Date:	Time:	Received by: JC	Date: 17/9/22	Time: 2 pm

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095L

Page 12 of 13

Report To	Contact and company name below will appear on the final report	Report Format / Distribution	Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)
Company:	WSP Golder	Select Report Format: ☐ PDF ☒ EXCEL ☐ EDD (DIGITAL)	Regular [R] ☒ Standard TAT if received by 3 pm - business days - no surcharges apply
Contact:	Melissa Paliouras	Quality Control (QC) Report with Report ☒ YES ☐ NO	PRIORITY (Business Days): 4 day [P4-20%] ☐ / 3 day [P3-25%] ☐ / 2 day [P2-50%] ☐
Phone:	437-332-5490	☐ Compare Results to Criteria on Report - provide details below if box checked	EMERGENCY: 1 Business day [E-100%] ☐ / Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] ☐
	Company address below will appear on the final report	Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm
Street:	2420 Virtual Way #200	Email 1 or Fax melissa.paliouras@wsp.com	For tests that can not be performed according to the service level selected, you will be contacted.
City/Province:	Vancouver	Email 2 samantha.lundquist@wsp.com	
Postal Code:	V5M 0C4	Email 3	
Invoice To	Same as Report To ☐ YES ☒ NO	Invoice Distribution	
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX	
Company:	Mt. Polley Mining Corp.	Email 1 or Fax gabriel.holmes@mountpolley.com	
Contact:	Gabriel Holmes	Email 2	

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#:
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:	5590008044	Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):		ALS Contact: Amber Springer	Sampler: D. Sales

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
112 1/3	22-A5-L-01	16Sep22	09:00	veg	✓	✓			1
	22-A5-G-01	"	"	"	✓	✓			1
	22-A5-G-02	"	"	"	✓	✓			1
	22-A5-G-03	"	"	"	✓	✓			1
	22-A5-F-01	"	"	"	✓	✓			1
	22-S15-L-01	16Sep22	10:00	veg	✓	✓			1
	22-S15-L-02	"	"	"	✓	✓			1
	22-S15-L-03	"	"	"	✓	✓			1
	22-S15-G-01	"	"	"	✓	✓			1
121 1/2	22-S15-F-01	"	"	"	✓	✓			1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☒ NO	
Are samples for human consumption/ use? ☐ YES ☒ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐
Ice Packs ☑ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐
Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C			FINAL COOLER TEMPERATURES °C		
			7°C	Cava	6

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Deb Sales	17Sep 22	14:30				JC	17/9/22	2pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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JULY 2017 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 - 686095M

Report To	Contact and company name below will appear on the final report
Company:	WSP. Golder
Contact:	Melissa Paliouras
Phone:	437 332 5490
	Company address below will appear on the final report
Street:	2920 Virtual Way # 200
City/Province:	Vancouver
Postal Code:	V5M 0C4
Invoice To	Same as Report To: NO
	Copy of Invoice with Report: NO
Company:	Mt. Polley Mining Corp.
Contact:	Gabriel Holmes

Report Format / Distribution

Select Report Format: PDF [X] EXCEL | EDD (DIGITAL)
Quality Control (QC) Report with Report [X] YES [ ] NO
[ ] Compare Results to Criteria on Report - provide details below if box checked
Select Distribution: [X] EMAIL | MAIL | FAX
Email 1 or Fax: melissa.paliouras
Email 2:
Email 3:

Invoice Distribution

Select Invoice Distribution: [X] EMAIL [ ] MAIL [ ] FAX
Email 1 or Fax:
Email 2:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R]: [X] Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] [ ] | 3 day [P3-25%] [ ] | 2 day [P2-50%] [ ]

EMERGENCY: 1 Business day [E-100%] [ ] | Same Day, Weekend or Statutory holiday [E2-200% (Laboratory opening fees may apply)] [ ]

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	5590008044
LSD:	

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	

ALS Lab Work Order # (lab use only):

ALS Contact:

Sampler: D. Sales

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Total Metal	Moisture content	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
122	22-S15-L-01 D	16Sep22	10:00	veg	✓	✓			1
124	22-S15-L-02 D	"	"	"	✓	✓			"
125	22-S15-L-03 D	"	"	"	✓	✓			"
X	~~22-S15-L-03~~				~~✓~~	~~✓~~			"
	22-S15-G-01 D	"	"	"	✓	✓			"
	22-S15-F-01 D	"	"	"	✓	✓			"
	22-S10-L-01	16 Sep 22	11:00	veg	✓	✓			"
	22-S10-L-02	"	"	"	✓	✓			"
	22-S10-L-03	"	"	"	✓	✓			"
	22-S10-G-01	"	"	"	✓	✓			"
131	22-S10-F-01	"	"	"	✓	✓			"

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? [ ] YES [X] NO

Are samples for human consumption/ use? [ ] YES [X] NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ] | SIF Observations: Yes [ ] No [ ]
Ice Packs [✓] Ice Cubes [ ] | Custody seal intact: Yes [ ] No [ ]
Cooling Initiated [ ]

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	7.6 (Cavity) 6.2

SHIPMENT RELEASE (client use)

Released by:	Date:	Time:
Deb Sales	17Sep22	14:30

INITIAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:

FINAL SHIPMENT RECEPTION (lab use only)

Received by:	Date:	Time:
SC	17/9/22	2pm

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JULY 2017 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

APPENDIX D

Soil Screening Results

Table D-1:
Soil Screening Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID					22-R1-S-01	22-R2-S-01	22-R3-S-01	22-R3-S-01D	22-R4-S-01	22-R5-S-01	22-R6-S-01	22-S1-S-01	22-S2-S-01	22-S3-S-01	22-S4-S-01	22-S5-S-01	22-S6-S-01	22-S8-S-01	22-S9-S-01	22-S10-S-01	22-S11-S-01	22-S12-S-01	22-S13-S-01	22-S13-S-01D	22-S14-S-01	22-S15-S-01	22-S15-S-01D	22-S16-S-01	22-S17-S-01	22-A4-S-01	22-A5-S-01
Date Sampled					14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022
Time Sampled					11:00	08:50	10:00	10:00	13:45	14:45	15:40	12:20	11:30	15:30	10:00	09:10	08:10	14:15	13:00	10:00	12:40	13:10	14:40	14:40	14:00	10:00	10:00	17:00	16:15	08:15	09:00
ALS Sample ID					VA22C2359-006	VA22C2359-004	VA22C2359-005	VA22C2359-007	VA22C2364-008	VA22C2364-009	VA22C2364-010	VA22C2364-007	VA22C2364-006	VA22C2359-001	VA22C2364-005	VA22C2364-004	VA22C2364-003	VA22C2359-003	VA22C2359-002	VA22C2367-005	VA22C2359-008	VA22C2359-009	VA22C2359-011	VA22C2359-012	VA22C2359-010	VA22C2367-003	VA22C2367-004	VA22C2364-002	VA22C2364-001	VA22C2367-001	VA22C2367-002
QAQC							FDA	FD															FDA	FD		FDA	FD				
Analyte	Lowest Detection Limit	Units	Wildlife Screening Criteria (BC ENV)	Notes	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Physical Tests																															
loss on ignition @ 550°C	1.0	%	-	-	7.8	53.5	8.4	8.4	12.5	12.5	13.2	8.1	7.8	9	8.6	6.6	7.2	9.6	1.9	5.3	5.9	6.9	4.2	4.2	5.3	6.3	6.1	9.3	4.8	9.2	8.3
moisture	0.25	%	-	-	9.4	19	9	9.59	9.97	11.3	14.1	7.67	8.65	7.51	4.76	5.67	5.86	9.69	5.11	7.02	6.78	9.39	5.48	5.56	6.78	8.46	9.27	7.41	3.9	16	13.3
pH (1:2 soil:CaCl2-aq)	0.1	pH units	-	-	4.2	4.3	4.2	4.2	4.9	4.9	5.8	6.3	6.4	6.2	5.9	6.3	6.4	7.3	7.2	5.9	6.7	6.6	7.0	7.1	7.0	5.7	5.6	6.4	6.5	6.5	6.4
pH (1:2 soil:water)	0.1	pH units	-	-	4.94	4.98	4.82	4.93	5.55	5.59	6.28	6.85	7.03	6.6	6.5	6.93	6.93	6.78	8.33	6.64	7.52	7.12	7.63	7.57	7.6	6.49	6.48	6.99	7.1	7.01	6.9
ash content @ 550°C	1.0	%	-	-	92.1	46.5	91.6	91.6	87.5	87.4	86.4	91.8	92.2	91	91.4	93.4	92.8	90.4	98	94.7	94.1	93.1	95.8	95.8	94.7	93.7	93.8	90.7	95.2	90.8	91.7
Particle Size																															
grain size curve		-	-	-	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached	See Attached
passing (0.0312 mm)	1.0	%	-	-	20.6	21.5	19	19.7	15.4	8.3	19.1	18.1	19.1	21.9	26.5	23.5	24.9	21.9	29	19.7	31.3	38.4	33.2	34	36.6	15	16.2	32.1	23.3	12.1	13.8
passing (9.5 mm)	1.0	%	-	-	82.2	92.2	80.6	84.3	77.8	68.6	94.5	90.7	86.2	95.5	94.8	90.5	93.4	95.8	91.8	87.5	91.4	93.4	94.7	93.9	92.6	81.6	85.3	92.3	90.3	72	83.8
passing (0.020 mm)	1.0	%	-	-	17.2	18	14.5	14.6	13	7.1	16.5	14.8	16.8	17.3	22.8	20.1	20.8	19.1	25.1	17.4	26.8	33.7	29.3	29.9	31.9	13	14.4	28.2	19.9	10.1	12
passing (1.0 mm)	1.0	%	-	-	51.8	64	55.4	58.6	39.4	24.1	58.3	54.7	50.3	64.6	64	58	62.4	63.7	57.9	50.4	66.5	71.4	69.8	69	71.1	43.4	47.5	67.6	59.3	38.4	43.6
passing (4.75 mm)	1.0	%	-	-	68.4	82.9	71.2	74.4	59.1	44.8	81.5	77.4	72.4	85.4	85.8	78.4	82.2	84.8	79.3	74.5	83.3	86.5	87.2	85.5	86.5	68.3	70.8	84.5	78.6	58	67
passing (0.005 mm)	1.0	%	-	-	8.9	10.3	8.3	8	7.8	4.5	10.1	9.1	10.6	10.3	13.6	13.1	12.9	12.3	16.6	11.3	17.2	22.9	18.6	19.2	21.2	7.7	9.6	18.6	12.1	6.3	7.8
passing (0.841 mm)	1.0	%	-	-	51	62.8	54.3	57.5	38.5	23.2	56.9	53.6	49.1	63.4	62.9	56.9	61.4	62.4	56.7	49.1	65.4	70.4	68.8	67.9	69.9	42.2	46.2	66.6	58.1	37.4	42.4
passing (19 mm)	1.0	%	-	-	100	100	100	96.2	97.6	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	94.1	100
passing (0.004 mm)	1.0	%	-	-	8	9.3	7.4	7.2	7.3	4.1	9.6	8.4	10	9.3	12.1	11.9	11.6	11.4	15	10.5	16.1	21.2	17.3	17.9	19.5	7.3	8.9	16.9	11.2	6	7.1
passing (0.50 mm)	1.0	%	-	-	47.5	58.8	50.3	53.5	35.3	20.2	51.5	49	44.5	58.1	58.1	52	56.7	57	51.3	43.3	60.4	65.9	63.5	62.6	64.9	36.5	40.1	62.2	52.7	33.5	37.9
passing (25.4 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.002 mm)	1.0	%	-	-	6.8	7.9	5.6	5.7	6.1	3.5	8	6.6	8.3	7.7	8.8	9.4	8.6	9.3	12.1	9.1	13.4	17.3	14	14.2	16.1	6.1	7.3	13.6	8.7	5.6	6.5
passing (0.420 mm)	1.0	%	-	-	46.6	57.8	49.3	52.5	34.5	19.5	50.2	47.8	43.3	56.7	57	50.7	55.6	55.6	50	41.9	59.1	64.8	62.1	61.2	63.6	35.1	38.6	61.1	51.4	32.5	36.7
passing (38.1 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.250 mm)	1.0	%	-	-	43	53.9	45.3	48.2	31.5	17.1	44.7	43.6	39.2	51.4	52	45.7	50.5	50.4	44.6	36.5	54	59.9	56.3	55.5	58.5	30.1	33.2	56.8	46	28.9	32.5
passing (50.8 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.149 mm)	1.0	%	-	-	39.2	50.4	41.1	43.9	28.8	15.3	39.6	39.6	35.5	46.1	47.2	40.9	45.3	45.4	39.6	31.8	48.8	54.8	50.5	49.6	53.4	26.1	28.8	52.6	41.3	26	28.8
passing (76.2 mm)	1.0	%	-	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
passing (0.125 mm)	1.0	%	-	-	37.6	48.5	39.4	42.1	27.7	14.6	37.6	37.7	34.1	43.8	45.1	39	43.2	43.2	37.8	29.8	46.9	52.8	48.2	47.4	51.3	24.5	27	50.7	39.3	24.6	27.4
passing (2.0 mm)	1.0	%	-	-	56.9	71.1	62.2	65.6	44.6	29.5	66.3	61.3	57.5	71.7	70.6	64.5	68.3	70.9	65.3	58.4	73	77.1	76.2	75.6	78	50.3	55.3	73.2	66.2	44.4	50.6
passing (0.075 mm)	1.0	%	-	-	34.4	44.5	35.9	38.3	25.3	13.2	33.5	33.9	31	38.9	40.8	34.9	38.6	38.6	34	25.7	43	48.6	43.5	43	47	21	23	47	35.3	21.7	24.5
passing (0.063 mm)	1.0	%	-	-	30.4	36.4	30.5	32.4	22.6	11.9	28.6	28.6	27.3	33.5	36.8	31.9	34.7	32.8	33.1	24.3	39.9	46	40.7	40.4	44.6	19.2	21	42.8	32.2	18.6	21.6
passing (0.05 mm)	1.0	%	-	-	26.2	27.7	24.6	26	19.6	10.4	23.3	22.9	23.4	27.6	32.4	28.7	30.5	26.5	32.2	22.9	36.4	43.2	37.6	37.6	42	17.1	19	38.3	28.8	15.2	18.4
Anions and Nutrients																															
nitrogen, total	0.020	%	-	-	0.117	0.347	0.129	0.112	0.194	0.185	0.231	0.332	0.241	0.269	0.146	0.093	0.136	0.485	0.021	0.117	0.125	0.171	0.056	0.076	0.127	0.117	0.107	0.219	0.106	0.526	0.368
Organic / Inorganic Carbon																															
carbon, inorganic [IC]	0.050	%	-	-	0.067	0.132	0.06	0.062	0.104	0.101	0.117	0.146	0.15	0.142	0.117	0.125	0.139	0.149	0.167	0.1	0.135	0.151	0.112	0.108	0.131	0.097	0.099	0.149	0.116	0.209	0.174
carbon, total [TC]	0.050	%	-	-	2.86	15.5	3.28	3.16	5.4	4.01	4.7	3.4	2.82	3.6	3.62	2.3	3	4.32	0.28	1.93	2.02	2.71	1.1	1.24	1.69	2.31	2.05	3.96	1.38	4.72	3.27
carbon, total organic [TOC]	0.050	%	-	-	2.79	15.4	3.22	3.1	5.3	3.91	4.58	3.25	2.67	3.46	3.5	2.18	2.86	4.17	0.113	1.83	1.88	2.56	0.988	1.13	1.56	2.21	1.95	3.81	1.26	4.51	3.1
carbon, inorganic [IC], (as CaCO3 equivalent)	0.40	%	-	-	0.56	1.1	0.5	0.52	0.87	0.84	0.97	1.22	1.25	1.18	0.98	1.04	1.16	1.24	1.39	0.84	1.13	1.26	0.93	0.9	1.09	0.81	0.83	1.24	0.97	1.74	1.45
organic matter	0.10	%	-	-	4.81	26.5	5.55	5.34	9.14	6.74	7.9	5.6	4.6	5.96	6.03	3.76	4.93	7.19	0.19	3.15	3.24	4.41	1.7	1.95	2.69	3.81	3.36	6.57	2.17	7.78	5.34
Plant Available Nutrients																															
nitrate + nitrite, available (as N)	1.0	mg/kg	-	-	<1.0	<2.5	<1.0	<1.0	<2.5	<2.5	<2.5	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.3	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2
phosphate, available (as P)	2.0	mg/kg	-	-	82.2	37.7	64.4	54.7	18.2	32	36.3	217	156	159	45	26.8	26.2	212	11	10.3	15.1	13.9	14.4	14.5	12.5	12.5	11.7	7.4	10	222	247
potassium, available	20.0	mg/kg	-	-	102	193	76	67	225	159	251	<20	198	138	84	77	110	207	<20	102	136	118	127	119	97	86	82	99	73	197	221
sulfate, available (as S)	3.0	mg/kg	-	-	<3.0	7.6	<3.0	3.6	<7.4	9.5	22.9	4.1	5.5	4.2	4.4	5.5	8.7	5.6	3.3	3.6	4	8	3.4	3.4	5.9	<3.0	<3.0	7.3	6.9	9.1	7.5
Saturated Paste Extractables																															
calcium, soluble ion content	0.30	mg/kg	-	-	4.06	27.3	6.49	6.36	8.54	5.97	23.5	15.6	18	9.06	12	17.3	29.8	15.8	13.7	7.6	22.4	15.8	27.1	24.8	16.2	4.65	4.62	15.4	16.7	21	17
magnesium, soluble ion content	0.50	mg/kg	-	-	0.78	3.13	0.9	0.91	1.3	0.75	2.03	2.14	2.06	1.35	1.62	1.8	2.37	2.72	1.1	1.05	2.04	1.56	3.43	3.4	2.08	0.86	0.91	1.38	1.75	2.39	2.05
potassium, soluble ion content	2.0	mg/kg	-	-	2.9	15.1	<2.0	<2.0	6.8	<2.7	9.8	6	4.8	2.4	<2.0	<2.1	3.2	5.7	<2.0	<2.0	2.6	<2.0	2.1	2	<2.0	<2.0	<2.0	<2.2	<2.0	5.9	8.4
sodium, soluble ion content	1.0	mg/kg	**200**	WL_{eff}-T	<1.00	<3.49	1.06	1.06	<2.16	<1.37	<1.76	1.5	1.41	1.24	1.03	<1.06	1.16	<1.47	1.14	<1.00	1.26	<1.00	1.26	1.22	<1.00	1.01	<1.10	<1.00	<1.33	1.98
% saturation	1.0	%	-	-	48.8	174	50.3	50.5	108	68.5	88.2	65	54.1	56.3	49	52.8	52.6	73.6	40.7	40.4	48.6	47.4	48.3	48.6	43.4	43.1	48.1	55	47.4	66.4	66.1
TGR (brine)	0.10	t/ha	-	-	Incalculable	Incalculable	<0.10	<0.10	Incalculable	Incalculable	Incalculable	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	Incalculable	<0.10	Incalculable	<0.10	Incalculable	<0.10	<0.10	<0.10	Incalculable	Incalculable	Incalculable	Incalculable	Incalculable	<0.10
TGR (sodic)	0.10	t/ha	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
alkalinity, total (as CaCO3)	10.0	mg/L	-	-	<12	<10	<12	<12	<10	<10	27	43	80	<50	25	70	122	22	54	<25	65	<25	113	120	51	16	13	30	57	78	71
alkalinity, total (as CaCO3)	2.0	mg/kg	-	-	<5.8	<17.4	<6.0	<6.0	<2.0	<2.0	23.8	28	43.3	<28.1	12.2	37	64.2	16.2	22	<2.0	31.6	<11.8	54.6	58.3	22.1	6.9	6.2	16.5	27	51.8	46.9
chloride, soluble ion content	1.0	mg/kg	**350**	WL_{eff}-T	<9.8	<34.9	<10.1	<10.1	<21.6	<13.7	<17.6	<13.0	<10.8	<11.2	<9.8	<10.6	<10.5	<14.7	<9.1	<9.1	<9.7	<9.5	<9.6	<9.7	<8.7	<8.6	<9.6	<11.0	<9.5	<13.3	<13.2
conductivity, saturated paste	0.030	dS/m	-	-	0.056	0.071	0.068	0.065	0.078	0.062	0.143	0.172	0.216	0.27	0.136	0.195	0.332	0.148	0.21	0.129	0.176	0.164	0.291	0.282	0.192	0.077	0.064	0.184	0.222	0.208	0.199
nitrate (as N), soluble ion content	0.50	mg/L	-	-	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
nitrate (as N), soluble ion content	0.50	mg/kg	-	-	<0.50	<0.87	<0.50	<0.50	<0.54	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
pH, saturated paste	0.10	pH units	-	-	4.96	5.06	4.88	4.88	5.62	5.65	6.29	6.84	6.95	6.65	6.44	6.84	6.91	6.74	7.97	6.37	7.34	6.83	7.67	7.44	7.37	6.18	6.19	6.69	6.9	7.06	6.85
sodium adsorption ratio [SAR]	0.10		-	-	<0.10	<0.10	0.14	0.15	<0.10	<0.10	<0.10	<0.10	0.11	0.14	0.1	<0.10	<0.10	<0.10	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.16	<0.10	<0.10	<0.10	0.15
sulfate, soluble ion content	5.0	mg/L	-	-	<5.0	<5.0	5.1	5.3	5.2	<5.0	8.3	10.7	17.2	14.4	16.3	24.5	42.7	24.2	22.5	16.5	20.8	53	10.2	9.7	32.8	<5.0	<5.0	36.3	29.5	14.8	16.5
sulfate, soluble ion content	2.50	mg/kg	-	-	<2.5	<8.7	2.6	2.7	5.6	<3.4	7.3	7	9.3	8.1	8	12.9	22.5	17.8	9.2	6.7	10.1	25.1	4.9	4.7	14.2	<2.5	<2.5	20	14	9.8	10.9
chloride, soluble ion content	20.0	mg/L	-	-	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20	<20
alkalinity, bicarbonate (as CaCO3)	10.0	mg/L	-	-	<12	<10	<12	<12	<10	<10	27	43	80	<10	25	70	122	22	54	<25	65	<25	113	120	51	16	13	30	57	78	71
alkalinity, carbonate (as CaCO3)	5.0	mg/L	-	-	<12.5	<5.0	<12.5	<12.5	<5.0	<5.0	<5.0	<5.0	<5.0	<10.0	<5.0	<10.0	<10.0	<10.0	<5.0	<12.5	<25.0	<10.0	<25.0	<25.0	<12.5	<10.0	<12.5	<12.5	<12.5	<12.5	<10.0	<10.0
alkalinity, carbonate (as CaCO3)	2.0	mg/kg	-	-	<6.1	<8.7	<6.3	<6.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.8	<2.0	<2.0	<2.0	<3.7	<2.0	<5.1	<2.0	<4.9	<11.8	<12.1	<6.1	<4.3	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
alkalinity, bicarbonate (as CaCO3)	2.0	mg/kg	-	-	<5.8	<17.4	<6.0	<6.0	<2.0	<2.0	23.8	28	43.3	<5.6	12.2	37	64.2	16.2	22	<2.0	31.6	<11.8	54.6	58.3	22.1	6.9	6.2	16.5	27	51.8	46.9
sodium, soluble ion content	2.0	mg/L	-	-	<2.0	<2.0	2.1	2.1	<2.0	<2.0	<2.0	2.3	2.6	2.2	2.1	2	2.2	<2.0	2.8	<2.0	2.6	<2.0	2.6	2.5	2.2	<2.0	2.1	<2.0	<2.0	<2.0	3
potassium, soluble ion content	4.0	mg/L	-	-	6	8.7	<4.0	<4.0	6.3	<4.0	11.1	9.2	8.8	4.3	<4.0	<4.0	6	7.8	<4.0	<4.0	5.4	<4.0	4.3	4.2	<4.0	<4.0	<4.0	<4.0	<4.0	8.9	12.7
magnesium, soluble ion content	1.0	mg/L	-	-	1.6	1.8	1.8	1.8	1.2	1.1	2.3	3.3	3.8	2.4	3.3	3.4	4.5	3.7	2.7	2.6	4.2	3.3	7.1	7	4.8	2	1.9	2.5	3.7	3.6	3.1
calcium, soluble ion content	0.60	mg/L	-	-	8.33	15.7	12.9	12.6	7.91	8.71	26.6	24	33.3	16.1	24.6	32.7	56.6	21.5	33.7	18.8	46	33.3	56.2	51.1	37.4	10.8	9.61	28.1	35.3	31.7	25.8
Metals																															
aluminum	50	mg/kg	-	-	13800	13000	12200	13300	22900	18500	14800	21100	18900	21200	13800	15500	15600	18100	19800	17200	23300	26400	19300	17600	21600	18100	15900	21200	17700	17400	16500
antimony	0.10	mg/kg	**20**	WL_{eff}-G	0.36	0.25	0.26	0.28	0.56	0.34	0.55	0.79	0.7	0.72	0.39	0.43	0.46	0.9	0.6	0.87	0.69	0.74	0.61	0.55	0.55	1.22	1.01	0.64	0.58	0.8	0.74
arsenic	0.10	mg/kg	**25**	WL_{eff}-T	5.38	4.37	5.3	4.89	13.7	11.6	8.59	13.2	12.5	11.5	8.11	9.86	9.23	12.1	14.1	14.4	14.5	15.1	13.1	12.4	12	15.8	14	13.9	10	13.1	11.8
barium	0.50	mg/kg	**700**	WL_{eff}-T	133	150	99.5	106	146	147	126	246	210	224	185	252	264	231	206	152	167	173	134	136	140	136	135	142	90.6	230	223
beryllium	0.10	mg/kg	**150**	WL_{eff}-T	0.25	0.28	0.29	0.26	0.61	0.71	0.5	0.63	0.61	0.63	0.37	0.47	0.48	0.55	0.67	0.55	0.84	0.92	0.62	0.54	0.66	0.6	0.51	0.72	0.57	0.56	0.49
bismuth	0.20	mg/kg	-	-	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	3.72	2	2.13	<0.20	<0.20	<0.20	10.8	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.28	6.25	5.15
boron	5.0	mg/kg	-	-	<5.0	<5.0	<5.0	<5.0	5.9	6	6.8	7.3	5.8	7.4	<5.0	<5.0	9.5	8.3	9.7	7.2	12.1	9	8	6.9	6.2	6.5	6	6.2	6	8	7
cadmium	0.020	mg/kg	**30**	WL_{eff}-T	0.379	0.527	0.39	0.392	0.59	0.561	0.382	0.578	0.545	0.479	0.197	0.237	0.236	0.811	0.437	0.24	0.322	0.372	0.29	0.275	0.298	0.279	0.259	0.404	0.298	0.669	0.624
calcium	50.0	mg/kg	-	-	3140	6240	4060	3860	5960	6540	7800	15800	14300	14100	7190	10000	10500	16400	19400	10600	15600	14200	14900	12700	11600	12000	10700	11100	9950	18000	15600
chromium	0.50	mg/kg	**200**	WL_{eff}-T	34	26.4	29.6	30.6	40.2	26.4	23.9	30.2	25.3	29.7	28.1	26.9	25.8	27.9	20.6	26.2	30.1	38.9	38.7	30	34.9	25.8	22.1	31.6	33.2	22.8	23.2
cobalt	0.10	mg/kg	**45**	WL_{eff}-T	8.32	7.57	6.81	7.54	16.7	12.2	11.1	16.5	15.6	14.9	11.9	13.5	13.7	15	17	13.7	17.2	19	18.7	16.4	16.4	14.4	12.7	15.9	14	14.8	14.6
copper	0.50	mg/kg	**150**	WL_{eff}-T	22.7	59.5	18.5	18.1	**300**	**258**	125	**759**	**688**	**619**	**191**	**324**	**642**	**716**	**635**	**372**	**830**	**761**	**269**	**243**	**595**	**479**	**410**	**703**	**254**	**713**	**633**
iron	50.0	mg/kg	-	-	25200	21400	24200	24600	45800	33900	34200	42500	37200	37500	29400	33200	33300	38400	38200	36400	37800	41200	37700	33400	34600	38200	34300	35300	34100	40000	37400
lead	0.50	mg/kg	**550**	WL_{eff}-T	6.2	8.03	7.36	6.77	13.6	16.8	10.2	17.4	12.5	13.7	6.09	6.56	6.96	16.2	10.5	9.13	8.76	10.2	9.53	8.74	8.99	7.89	6.54	7.68	8.31	19.1	16.3
lithium	2.0	mg/kg	-	-	13.5	10.1	11.8	12.2	23.4	22.6	17.4	15.8	15.2	15.5	11.9	13.7	13.3	15.4	19	17.

Table D-2:
Soil Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R3-S-01	22-R3-S-01D				22-S13-S-01	22-S13-S-01D				22-S15-S-01	22-S15-S-01D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled			10:00	10:00				14:40	14:40				10:00	10:00			
ALS Sample ID	Lowest Detection Limit	Units	VA22C2359-005	VA22C2359-007	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2359-011	VA22C2359-012	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2367-003	VA22C2367-004	Mean	Relative Percent Difference (%)	Difference Factor
QAQC			FDA	FD				FDA	FD				FDA	FD			
Analyte			Soil	Soil				Soil	Soil				Soil	Soil			
Physical Tests																	
loss on ignition @ 550°C	1	%	8.4	8.4	8.4	0	NC	4.2	4.2	4.2	NC	0	6.3	6.1	6.2	3	NC
moisture	0.25	%	9	9.59	9.295	6	NC	5.48	5.56	5.52	1	NC	8.46	9.27	8.865	9	NC
pH (1:2 soil:CaCl2-aq)	0.1	pH units	4.18	4.17	4.175	0	NC	7.03	7.1	7.065	1	NC	5.71	5.64	5.675	1	NC
pH (1:2 soil:water)	0.1	pH units	4.82	4.93	4.875	2	NC	7.63	7.57	7.6	1	NC	6.49	6.48	6.485	0	NC
ash content @ 550°C	1	%	91.6	91.6	91.6	0	NC	95.8	95.8	95.8	0	NC	93.7	93.8	93.75	0	NC
Particle Size																	
grain size curve			See Attached	See Attached	-	-	NC	See Attached	See Attached	-	-	NC	See Attached	See Attached	-	-	NC
passing (0.0312 mm)	1	%	19	19.7	19.35	4	NC	33.2	34	33.6	2	NC	15	16.2	15.6	8	NC
passing (9.5 mm)	1	%	80.6	84.3	82.45	4	NC	94.7	93.9	94.3	1	NC	81.6	85.3	83.45	4	NC
passing (0.020 mm)	1	%	14.5	14.6	14.55	1	NC	29.3	29.9	29.6	2	NC	13	14.4	13.7	10	NC
passing (1.0 mm)	1	%	55.4	58.6	57	6	NC	69.8	69	69.4	1	NC	43.4	47.5	45.45	9	NC
passing (4.75 mm)	1	%	71.2	74.4	72.8	4	NC	87.2	85.5	86.35	2	NC	68.3	70.8	69.55	4	NC
passing (0.005 mm)	1	%	8.3	8	8.15	4	NC	18.6	19.2	18.9	3	NC	7.7	9.6	8.65	22	NC
passing (0.841 mm)	1	%	54.3	57.5	55.9	6	NC	68.8	67.9	68.35	1	NC	42.2	46.2	44.2	9	NC
passing (19 mm)	1	%	100	96.2	98.1	4	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.004 mm)	1	%	7.4	7.2	7.3	3	NC	17.3	17.9	17.6	3	NC	7.3	8.9	8.1	20	NC
passing (0.50 mm)	1	%	50.3	53.5	51.9	6	NC	63.5	62.6	63.05	1	NC	36.5	40.1	38.3	9	NC
passing (25.4 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.002 mm)	1	%	5.6	5.7	5.65	2	NC	14	14.2	14.1	1	NC	6.1	7.3	6.7	18	NC
passing (0.420 mm)	1	%	49.3	52.5	50.9	6	NC	62.1	61.2	61.65	1	NC	35.1	38.6	36.85	9	NC
passing (38.1 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.250 mm)	1	%	45.3	48.2	46.75	6	NC	56.3	55.5	55.9	1	NC	30.1	33.2	31.65	10	NC
passing (50.8 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.149 mm)	1	%	41.1	43.9	42.5	7	NC	50.5	49.6	50.05	2	NC	26.1	28.8	27.45	10	NC
passing (76.2 mm)	1	%	100	100	100	0	NC	100	100	100	0	NC	100	100	100	0	NC
passing (0.125 mm)	1	%	39.4	42.1	40.75	7	NC	48.2	47.4	47.8	2	NC	24.5	27	25.75	10	NC
passing (2.0 mm)	1	%	62.2	65.6	63.9	5	NC	76.2	75.6	75.9	1	NC	50.3	55.3	52.8	9	NC
passing (0.075 mm)	1	%	35.9	38.3	37.1	6	NC	43.5	43	43.25	1	NC	21	23	22	9	NC
passing (0.063 mm)	1	%	30.5	32.4	31.45	6	NC	40.7	40.4	40.55	1	NC	19.2	21	20.1	9	NC
passing (0.05 mm)	1	%	24.6	26	25.3	6	NC	37.6	37.6	37.6	0	NC	17.1	19	18.05	11	NC
Anions and Nutrients																	
nitrogen, total	0.02	%	0.129	0.112	0.1205	14	NC	0.056	0.076	0.066	NC	1	0.117	0.107	0.112	9	NC
Organic / Inorganic Carbon																	
carbon, inorganic [IC]	0.05	%	0.06	0.062	0.061	NC	0	0.112	0.108	0.11	NC	0	0.097	0.099	0.098	NC	0
carbon, total [TC]	0.05	%	3.28	3.16	3.22	4	NC	1.1	1.24	1.17	12	NC	2.31	2.05	2.18	12	NC
carbon, total organic [TOC]	0.05	%	3.22	3.1	3.16	4	NC	0.988	1.13	1.059	13	NC	2.21	1.95	2.08	13	NC
carbon, inorganic [IC], (as CaCO3 equivalent)	0.4	%	0.5	0.52	0.51	NC	0	0.93	0.9	0.915	NC	0	0.81	0.83	0.82	NC	0
organic matter	0.1	%	5.55	5.34	5.445	4	NC	1.7	1.95	1.825	14	NC	3.81	3.36	3.585	13	NC
Plant Available Nutrients																	
nitrate + nitrite, available (as N)	1	mg/kg	<1.0	<1.0	1	NC	0	<1.0	<1.0	1	NC	0	<1.0	<1.0	1	NC	0
phosphate, available (as P)	2	mg/kg	64.4	54.7	59.55	16	NC	14.4	14.5	14.45	1	NC	12.5	11.7	12.1	7	NC
potassium, available	20	mg/kg	76	67	71.5	NC	0	127	119	123	7	NC	86	82	84	NC	0
sulfate, available (as S)	3	mg/kg	<3.0	3.6	3.3	NC	0	3.4	3.4	3.4	NC	0	<3.0	<3.0	3	NC	0
Saturated Paste Extractables																	
calcium, soluble ion content	0.3	mg/kg	6.49	6.36	6.425	2	NC	27.1	24.8	25.95	9	NC	4.65	4.62	4.635	1	NC
magnesium, soluble ion content	0.5	mg/kg	0.9	0.91	0.905	NC	0	3.43	3.4	3.415	1	NC	0.86	0.91	0.885	NC	0
potassium, soluble ion content	2	mg/kg	<2.0	<2.0	2	NC	0	2.1	2	2.05	NC	0	<2.0	<2.0	2	NC	0
sodium, soluble ion content	1	mg/kg	1.06	1.06	1.06	NC	0	1.26	1.22	1.24	NC	0	<1.00	1.01	1.005	NC	0
% saturation	1	%	50.3	50.5	50.4	0	NC	48.3	48.6	48.45	1	NC	43.1	48.1	45.6	11	NC
TGR (brine)	0.1	t/ha	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	Incalcuable	<0.10	0.10	NC	NC
TGR (sodic)	0.1	t/ha	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
alkalinity, total (as CaCO3)	10	mg/L	<12	<12	12	NC	0	113	120	116.5	6	NC	16	13	14.5	NC	0
alkalinity, total (as CaCO3)	2	mg/kg	<6.0	<6.0	6	NC	0	54.6	58.3	56.45	7	NC	6.9	6.2	6.55	NC	0
chloride, soluble ion content	1	mg/kg	<10.1	<10.1	10.1	0	NC	<9.6	<9.7	9.65	1	NC	<8.6	<9.6	9.1	11	NC
conductivity, saturated paste	0.03	dS/m	0.068	0.065	0.0665	NC	0	0.291	0.282	0.2865	3	NC	0.077	0.064	0.0705	NC	0
nitrate (as N), soluble ion content	0.5	mg/L	<0.5	<0.5	0.5	NC	0	<0.5	<0.5	0.5	NC	0	<0.5	<0.5	0.5	NC	0
nitrate (as N), soluble ion content	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
pH, saturated paste	0.1	pH units	4.88	4.88	4.88	0	NC	7.67	7.44	7.555	3	NC	6.18	6.19	6.185	0	NC
sodium adsorption ratio [SAR]	0.1		0.14	0.15	0.145	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	0.16	0.13	NC	1

Table D-2:
Soil Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R3-S-01	22-R3-S-01D				22-S13-S-01	22-S13-S-01D				22-S15-S-01	22-S15-S-01D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled			10:00	10:00				14:40	14:40				10:00	10:00			
ALS Sample ID	Lowest Detection Limit	Units	VA22C2359-005	VA22C2359-007	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2359-011	VA22C2359-012	Mean	Relative Percent Difference (%)	Difference Factor	VA22C2367-003	VA22C2367-004	Mean	Relative Percent Difference (%)	Difference Factor
QAQC			FDA	FD				FDA	FD				FDA	FD			
Analyte			Soil	Soil				Soil	Soil				Soil	Soil			
sulfate, soluble ion content	5	mg/L	5.1	5.3	5.2	NC	0	10.2	9.7	9.95	NC	0	<5.0	<5.0	5	NC	0
sulfate, soluble ion content	2.5	mg/kg	2.6	2.7	2.65	NC	0	4.9	4.7	4.8	NC	0	<2.5	<2.5	2.5	NC	0
chloride, soluble ion content	20	mg/L	<20	<20	20	NC	0	<20	<20	20	NC	0	<20	<20	20	NC	0
alkalinity, bicarbonate (as CaCO3)	10	mg/L	<12	<12	12	NC	0	113	120	116.5	6	NC	16	13	14.5	NC	0
alkalinity, carbonate (as CaCO3)	5	mg/L	<12.5	<12.5	12.5	NC	0	<25.0	<12.5	18.75	NC	3	<12.5	<12.5	12.5	NC	0
alkalinity, carbonate (as CaCO3)	2	mg/kg	<6.3	<6.3	6.3	NC	0	<12.1	<6.1	9.1	**66**	NC	<2.0	<2.0	2	NC	0
alkalinity, bicarbonate (as CaCO3)	2	mg/kg	<6.0	<6.0	6	NC	0	54.6	58.3	56.45	7	NC	6.9	6.2	6.55	NC	0
sodium, soluble ion content	2	mg/L	2.1	2.1	2.1	NC	0	2.6	2.5	2.55	NC	0	<2.0	2.1	2.05	NC	0
potassium, soluble ion content	4	mg/L	<4.0	<4.0	4	NC	0	4.3	4.2	4.25	NC	0	<4.0	<4.0	4	NC	0
magnesium, soluble ion content	1	mg/L	1.8	1.8	1.8	NC	0	7.1	7	7.05	1	NC	2	1.9	1.95	NC	0
calcium, soluble ion content	0.6	mg/L	12.9	12.6	12.75	2	NC	56.2	51.1	53.65	10	NC	10.8	9.61	10.205	12	NC
Metals																	
aluminum	50	mg/kg	12200	13300	12750	9	NC	19300	17600	18450	9	NC	18100	15900	17000	13	NC
antimony	0.1	mg/kg	0.26	0.28	0.27	NC	0	0.61	0.55	0.58	10	NC	1.22	1.01	1.115	19	NC
arsenic	0.1	mg/kg	5.3	4.89	5.095	8	NC	13.1	12.4	12.75	5	NC	15.8	14	14.9	12	NC
barium	0.5	mg/kg	99.5	106	102.75	6	NC	134	136	135	1	NC	136	135	135.5	1	NC
beryllium	0.1	mg/kg	0.29	0.26	0.275	NC	0	0.62	0.54	0.58	14	NC	0.6	0.51	0.555	16	NC
bismuth	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
boron	5	mg/kg	<5.0	<5.0	5	NC	0	8	6.9	7.45	NC	0	6.5	6	6.25	NC	0
cadmium	0.02	mg/kg	0.39	0.392	0.391	1	NC	0.29	0.275	0.2825	5	NC	0.279	0.259	0.269	7	NC
calcium	50	mg/kg	4060	3860	3960	5	NC	14900	12700	13800	16	NC	12000	10700	11350	11	NC
chromium	0.5	mg/kg	29.6	30.6	30.1	3	NC	38.7	30	34.35	25	NC	25.8	22.1	23.95	15	NC
cobalt	0.1	mg/kg	6.81	7.54	7.175	10	NC	18.7	16.4	17.55	13	NC	14.4	12.7	13.55	13	NC
copper	0.5	mg/kg	18.5	18.1	18.3	2	NC	269	243	256	10	NC	479	410	444.5	16	NC
iron	50	mg/kg	24200	24600	24400	2	NC	37700	33400	35550	12	NC	38200	34300	36250	11	NC
lead	0.5	mg/kg	7.36	6.77	7.065	8	NC	9.53	8.74	9.135	9	NC	7.89	6.54	7.215	19	NC
lithium	2	mg/kg	11.8	12.2	12	3	NC	16.8	14.4	15.6	15	NC	18.7	16.9	17.8	10	NC
magnesium	20	mg/kg	2910	2900	2905	0	NC	9060	8440	8750	7	NC	8010	7540	7775	6	NC
manganese	1	mg/kg	570	630	600	10	NC	905	862	883.5	5	NC	891	747	819	18	NC
mercury	0.005	mg/kg	0.0355	0.0334	0.03445	6	NC	0.0847	0.0776	0.08115	9	NC	0.114	0.0935	0.10375	20	NC
molybdenum	0.1	mg/kg	0.9	0.8	0.85	12	NC	2.45	2.23	2.34	9	NC	3.9	3.18	3.54	20	NC
nickel	0.5	mg/kg	10.5	11.1	10.8	6	NC	18.5	15.6	17.05	17	NC	15.5	14.1	14.8	9	NC
phosphorus	50	mg/kg	1080	1020	1050	6	NC	1190	1120	1155	6	NC	1140	958	1049	17	NC
potassium	100	mg/kg	610	650	630	6	NC	1510	1390	1450	8	NC	1050	960	1005	9	NC
selenium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	0.55	0.45	0.5	NC	1	0.27	0.24	0.255	NC	0
silver	0.1	mg/kg	0.14	0.12	0.13	NC	0	0.19	0.18	0.185	NC	0	0.26	0.2	0.23	NC	1
sodium	50	mg/kg	88	100	94	NC	0	251	221	236	13	NC	192	188	190	NC	0
strontium	0.5	mg/kg	60.7	63.8	62.25	5	NC	208	188	198	10	NC	115	112	113.5	3	NC
sulfur	1000	mg/kg	<1000	<1000	1000	NC	0	<1000	<1000	1000	NC	0	<1000	<1000	1000	NC	0
thallium	0.05	mg/kg	<0.050	0.05	0.05	NC	0	0.064	0.06	0.062	NC	0	0.05	<0.050	0.05	NC	0
tin	2	mg/kg	<2.0	<2.0	2	NC	0	<2.0	<2.0	2	NC	0	<2.0	<2.0	2	NC	0
titanium	1	mg/kg	800	897	848.5	11	NC	1330	1200	1265	10	NC	1170	1120	1145	4	NC
tungsten	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
uranium	0.05	mg/kg	0.331	0.384	0.3575	15	NC	0.687	0.666	0.6765	3	NC	1.1	0.881	0.9905	22	NC
vanadium	0.2	mg/kg	71.7	74.3	73	4	NC	132	113	122.5	16	NC	131	122	126.5	7	NC
zinc	2	mg/kg	94.2	98.5	96.35	4	NC	92.5	84.5	88.5	9	NC	77.6	68.2	72.9	13	NC
zirconium	1	mg/kg	1.7	1.8	1.75	NC	0	5	4.7	4.85	NC	0	3.8	3.6	3.7	NC	0
Leachable Anions & Nutrients																	
Kjeldahl nitrogen, total [TKN]	0.02	%	0.091	0.099	0.095	NC	0	0.175	<0.071	0.123	**85**	NC	0.118	<0.069	0.0935	**52**	NC

Notes:
Value = RPD is greater than 35%

BC ENV = British Columbia Ministry of Environment and Climate Change Strategy; dS/m = deciSiemens per metre; FDA = field duplicate available; FD = field duplicate; G = generic; mg/kg = milligram per kilogram; mg/L = milligram per liter; QAQC = quality assurance quality control sample type; T = toxicity to soil invertebrates and plants; t/ha = tonnes per hectare; WLR = wildlands reverted; % = percent; < = indicates parameter was below laboratory equipment detection limit.

APPENDIX E

Vegetation Screening Results

Table E-1: List of identified vegetation species at Mt. Polley (13-16 September 2022)

Common Name	Scientific Name
Trees	
black cottonwood	*Populus trichocarpa*
lodgepole pine	*Pinus contorta* var. *latifolia*
Rocky Mountain Douglas-fir	*Pseudotsuga menziesii* var. *glauca*
Sitka alder	*Alnus alnobetula* ssp. *Sinuate*
trembling aspen	*Populus tremuloides*
western hemlock	*Tsuga heterophylla*
western redcedar	*Thuja plicata*
Shrubs (Berries)	
black elderberry	*Sambucus racemosa* var. *melanocarpa*
red raspberry	*Rubus idaeus* ssp. *Strigosus*
soopolallie	*Shepherdia canadensis*
Forbs	
bunchberry	*Cornus canadensi*
dandelion	*Taraxacum* sp.
false Solomon's-seal	*Maianthemum racemosum* ssp. *Amplexicaule*
Lindley's aster	*Symphyotrichum ciliolatum*
Loesel's tumble-mustard	*Sisymbrium loeselii*
pearly everlasting	*Anaphalis margaritacea*
pink wintergreen	*Pyrola asarifolia* ssp. *asarifoli*
red clover	*Trifolium pratense*
wild chamomile	*matricaria chamomilla*
yarrow	*Achillea millefolium*
yellow salsify	*Tragopogon dubius*
rattlesnake-plantain	*Goodyera oblongifoli*
Graminoid	
common timothy	*Phleum pratense* ssp. *pratense*
mountain brome	*Bromus carinatus* var. *marginatus*
nodding trisetum	*Trisetum cernuum*
slender wheatgrass	*Elymus trachycaulus* ssp. *Trachycaulus*

Note: see Appendix B – Photo Log for Site photographs.

Table E-2:
Grass Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R4-G-01	22-S1-G-02	22-S1-G-01	22-S2-G-02	22-S2-G-02	22-S3-G-01	22-S3-G-02	22-S4-G-01	22-S5-G-01	22-S6-G-01	22-S6-G-02	22-S8-G-01	22-S8-G-02	22-S9-G-01	22-S10-G-01	22-S11-G-01	22-S12-G-01	22-S13-G-01	22-S13-G-01D	22-S14-G-01	22-S15-G-01	22-S15-G-01D	22-S16-G-01	22-S17-G-01	22-A4-G-01	22-A4-G-02	22-A5-G-01	22-A5-G-02	22-A5-G-03
Date Sampled			15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022
Time Sampled	Lowest Detection Limit	Units	13:45	12:30	12:30	11:30	11:30	15:30	15:30	15:30	10:00	09:10	08:10	14:15	14:15	13:00	11:00	12:40	13:10	14:40	14:40	14:00	10:00	10:00	17:00	16:15	08:15	08:15	09:00	09:00	09:00
ALS Sample ID			VA22C2369-092	VA22C2369-089	VA22C2369-090	VA22C2369-084	VA22C2369-085	VA22C2369-011	VA22C2369-012	VA22C2369-079	VA22C2369-074	VA22C2369-059	VA22C2369-061	VA22C2369-007	VA22C2369-008	VA22C2369-003	VA22C2369-130	VA22C2369-033	VA22C2369-038	VA22C2369-051	VA22C2369-066	VA22C2369-046	VA22C2369-120	VA22C2369-125	VA22C2369-055	VA22C2369-070	VA22C2369-109	VA22C2369-111	VA22C2369-113	VA22C2369-114	VA22C2369-115
QAQC																				FDA	FD		FDA	FD							
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																														
moisture	0.50	%	59.4	42.9	41.4	40.2	40.8	47	46.1	48.6	47	43.7	42.8	41.3	29.6	39.8	52.6	38.6	54.5	35.9	38.4	48.4	55.9	54.6	31.3	29.5	55.4	59.8	60.4	62.1	53.6
Metals																															
aluminum	2.0	mg/kg	88.3	78.2	219	75.3	80.2	51.2	59.4	31.3	27.5	22	46.9	41.7	55.1	394	42.6	19.9	8.4	69.2	69.8	16.9	45	42.3	38.1	40.6	14.6	25	31.2	35.8	33
aluminum	0.40	mg/kg wwt	35.8	44.6	128	45.1	47.5	27.1	32	16.1	14.6	12.4	26.8	24.5	38.8	237	20.2	12.2	3.81	44.3	43	8.74	19.8	19.2	26.2	28.6	6.51	10	12.3	13.6	15.3
antimony	0.010	mg/kg	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	0.0035	0.0024	0.0064	0.0028	0.002	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	0.0072	<0.0020	<0.0020	<0.0020	0.0028	0.0025	<0.0020	0.0026	<0.0020	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.108	0.078	0.179	0.094	0.12	0.159	0.066	0.039	0.035	0.021	0.038	0.056	0.061	0.339	0.039	0.025	<0.020	0.069	0.087	<0.020	0.059	0.046	0.044	0.071	0.064	0.084	0.077	0.06	0.094
arsenic	0.0040	mg/kg wwt	0.0439	0.0446	0.105	0.0561	0.0707	0.0841	0.0357	0.0199	0.0184	0.012	0.0215	0.0331	0.0433	0.204	0.0187	0.0152	0.006	0.0445	0.0535	0.0094	0.0262	0.0209	0.0306	0.0501	0.0284	0.0336	0.0306	0.0226	0.0436
barium	0.050	mg/kg	21.3	7.39	45.6	4.19	41.3	48.3	6.71	12.9	6.64	9.13	20.6	6.08	9.96	62.3	7.44	5.97	7.15	35.8	47.8	3.68	8.18	6.73	5.23	30	48.4	10.2	8.15	5.39	58.3
barium	0.010	mg/kg wwt	8.66	4.22	26.7	2.51	24.5	25.6	3.62	6.65	3.52	5.14	11.8	3.57	7.02	37.5	3.53	3.66	3.26	22.9	29.4	1.9	3.61	3.06	3.59	21.2	21.6	4.11	3.23	2.04	27
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	0.004	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0072	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	3.5	6	5.6	8.9	4.7	9.3	7.8	4.7	3.9	3.6	2.3	3.7	3.3	3.8	4.6	4.4	7.1	3.3	5.1	3.5	4.5	2.7	2.3	4.5	6.4	3.4	3.4	4.9	3.6
boron	0.20	mg/kg wwt	1.44	3.43	3.3	5.32	2.77	4.94	4.18	2.41	2.06	2.04	1.33	2.16	2.32	2.27	2.18	2.73	3.24	2.1	3.13	1.82	2	1.23	1.57	3.16	2.85	1.38	1.37	1.86	1.7
cadmium	0.0050	mg/kg	0.0335	0.0134	0.108	0.0085	0.0382	0.254	<0.0050	0.0069	<0.0050	<0.0050	0.0066	0.0158	0.0235	0.147	0.0053	<0.0050	<0.0050	0.111	0.104	<0.0050	0.0087	<0.0050	0.0117	0.0642	0.0324	0.0335	0.0724	0.0117	0.0733
cadmium	0.0010	mg/kg wwt	0.0136	0.0077	0.0635	0.0051	0.0226	0.134	0.0021	0.0035	<0.0020	0.0015	0.0038	0.0093	0.0166	0.0886	0.0025	<0.0010	0.0027	0.0714	0.0642	0.0022	0.0038	<0.0030	0.0081	0.0453	0.0144	0.0134	0.0286	0.0044	0.034
calcium	20	mg/kg	3610	3940	6180	4210	4570	8780	3210	2710	2520	2440	2160	3120	2250	9860	1240	3640	5830	4060	5790	3310	1690	1380	1610	5390	8750	4130	3990	3160	5700
calcium	4.0	mg/kg wwt	1460	2250	3620	2520	2700	4650	1730	1390	1340	1370	1230	1830	1590	5930	586	2230	2650	2600	3560	1710	747	624	1110	3800	3900	1660	1580	1200	2640
cesium	0.0050	mg/kg	0.0305	0.0382	0.155	0.028	0.0634	0.25	0.0553	0.0209	0.0297	0.0092	0.008	0.0074	0.021	0.0912	0.0232	0.015	0.0058	0.0427	0.0429	0.0132	0.0603	0.0187	0.0161	0.14	0.0513	0.0511	0.0843	0.0419	0.0595
cesium	0.0010	mg/kg wwt	0.0124	0.0218	0.091	0.0168	0.0375	0.132	0.0298	0.0107	0.0157	0.0052	0.0046	0.0434	0.0148	0.0549	0.011	0.0092	0.0026	0.0274	0.0264	0.0068	0.0266	0.0085	0.011	0.0985	0.0228	0.0205	0.0334	0.0159	0.0276
chromium	0.050	mg/kg	0.208	0.106	0.28	0.096	0.12	0.17	0.074	<0.050	0.095	0.144	0.143	0.084	0.076	0.486	0.082	0.071	<0.050	0.112	0.173	0.063	0.092	0.147	0.176	0.1	0.062	0.072	0.106	0.105	0.123
chromium	0.010	mg/kg wwt	0.084	0.06	0.164	0.057	0.071	0.09	0.04	0.02	0.05	0.081	0.082	0.049	0.054	0.293	0.039	0.043	0.02	0.072	0.107	0.032	0.04	0.067	0.121	0.07	0.028	0.029	0.042	0.04	0.057
cobalt	0.020	mg/kg	0.097	0.072	0.164	0.061	0.062	0.041	0.05	0.032	0.032	0.026	0.052	0.051	0.047	0.343	0.043	0.03	<0.020	0.058	0.06	0.023	0.049	0.043	0.046	0.036	<0.020	0.026	0.033	0.043	0.029
cobalt	0.0040	mg/kg wwt	0.0394	0.0414	0.0964	0.0363	0.0367	0.0218	0.0271	0.0164	0.0171	0.0144	0.03	0.0302	0.0331	0.206	0.0206	0.0186	0.0044	0.037	0.0372	0.0117	0.0217	0.0194	0.0318	0.0254	0.0053	0.0107	0.013	0.0163	0.0134
copper	0.10	mg/kg	7.9	8.49	16.8	7.69	7.07	8.28	6.05	4.56	4.33	3.17	3.94	6.36	6.7	23.3	3.82	3.05	2.82	4.94	5.26	2.38	5.21	3.76	3.18	4.69	4.31	4.88	8.38	5.35	6.56
copper	0.020	mg/kg wwt	3.21	4.85	9.85	4.6	4.19	4.39	3.26	2.34	2.3	1.78	2.25	3.73	4.72	14	1.81	1.87	1.28	3.17	3.24	1.22	2.3	1.71	2.18	3.31	1.92	1.96	3.32	2.03	3.04
iron	3.0	mg/kg	183	144	375	102	142	105	92.1	57.6	48.7	45.7	76.4	80.8	78.2	681	86.1	38.4	21.7	124	124	33.5	101	85.1	73.3	80	31.8	49.4	62.7	66	70.2
iron	0.60	mg/kg wwt	74.3	82	220	61.2	84.2	55.6	49.6	29.6	25.8	25.7	43.7	47.4	55	410	40.8	23.6	9.87	79.5	76.3	17.3	44.7	38.6	50.3	56.4	14.2	19.9	24.8	25	32.6
lead	0.020	mg/kg	0.062	0.033	0.082	0.034	0.035	0.036	0.027	<0.020	0.021	<0.020	0.031	0.027	0.038	0.216	0.044	<0.020	<0.020	0.041	0.041	<0.020	0.046	0.051	0.028	0.031	0.052	0.051	0.053	0.047	0.058
lead	0.0040	mg/kg wwt	0.0251	0.0187	0.0478	0.0205	0.021	0.0194	0.0148	0.0081	0.011	0.0084	0.0176	0.016	0.0266	0.13	0.0211	0.0074	0.0064	0.0264	0.0251	0.007	0.0202	0.023	0.0195	0.0221	0.0231	0.0206	0.0211	0.0179	0.0267
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.54	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	0.2	<0.10	0.14	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.32	<0.10	<0.10	<0.10	0.15	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.18	<0.10	<0.10
magnesium	2.0	mg/kg	760	996	922	981	475	824	1360	722	633	594	473	657	598	617	455	659	1030	510	708	607	459	452	341	414	572	554	511	766	471
magnesium	0.40	mg/kg wwt	309	569	540	587	281	437	735	371	336	334	271	386	421	372	216	404	467	327	436	313	202	205	234	292	255	223	202	290	219
manganese	0.050	mg/kg	797	57.2	73.6	41.8	58.1	93.7	48.6	48.5	33.6	42.2	28.1	86.8	34.5	280	51.8	41.7	44.1	64.6	96.9	41.6	74.3	48.7	43.5	85.8	108	40.8	74.4	33.5	58.5
manganese	0.010	mg/kg wwt	324	32.7	43.1	25	34.4	49.6	26.2	24.9	17.8	23.7	16.1	50.9	24.3	168	24.6	25.6	20.1	41.4	59.6	21.5	32.8	22.1	29.9	60.5	48	16.4	29.4	12.7	27.2
mercury	0.0050	mg/kg	0.0071	<0.0050	0.0052	<0.0050	0.006	0.0077	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0084	<0.0050	<0.0050	<0.0050	0.0073	0.0073	<0.0050	<0.0050	<0.0050	<0.0050	0.0065	0.007	0.0058	0.0057	<0.0050	0.0086
mercury	0.0010	mg/kg wwt	0.0029	0.0024	0.0031	0.0029	0.0036	0.0041	0.002	0.0014	0.002	0.0019	0.0021	0.0016	0.003	0.005	0.0012	0.0021	0.0015	0.0047	0.0045	0.0013	0.0016	0.0016	<0.0018	0.0046	0.0031	0.0023	0.0022	0.0014	0.004
molybdenum	0.020	mg/kg	2.28	3.58	10.8	7.17	7.8	8.83	3.56	1.4	4.42	1.96	3.74	2.09	3.01	10.4	2.32	4.7	1.05	3.04	19.6	2.14	7.37	8.14	1.02	4.86	11.3	7	3.26	2.38	5.5
molybdenum	0.0040	mg/kg wwt	0.928	2.04	6.36	4.29	4.62	4.68	1.92	0.722	2.34	1.1	2.14	1.23	2.12	6.25	1.1	2.88	0.477	6.68	12	1.1	3.25	3.7	0.704	3.43	5.02	2.81	1.29	0.903	2.55
nickel	0.20	mg/kg	0.44	<0.20	<0.20	<0.20	<0.20	<0.20	0.22	0.21	<0.20	0.22	<0.20	0.33	<0.20	0.38	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
nickel	0.040	mg/kg wwt	0.178	0.095	0.109	0.085	0.05	0.051	0.118	0.107	0.083	0.122	0.068	0.195	0.13	0.226	0.059	0.059	<0.040	0.056	0.063	0.05	0.043	0.081	0.05	0.052	<0.040	<0.040	0.044	0.063	<0.040
phosphorus	10	mg/kg	2250	2220	1010	1910	850	1010	2390	1730	1350	1460	565	1600	1600	1710	1080	1080	784	996	996	850	278	568	220	579	1170	2140	1510	1340	850
phosphorus	2.0	mg/kg wwt	914	1270	590	1140	503	536	1290	887	715	820	323	940	1130	428	372	661	492	496	613	438	122	258	151	408	520	859	597	508	394
potassium	20	mg/kg	22900	12800	5740	8020	5330	9440	8660	11800	8410	9590	3320	7650	5560	4050	6320	6250	7560	4690	5540	5860	7670	6160	5400	4320	6800	9000	8330	7350	5080
potassium	4.0	mg/kg wwt	9300	7320	3370	4800	3150	5000	4660	6090	4450	5400	1900	4490	3920	2440	3000	3830	3440	3010	3410	3020	3380	2800	3710	3040	3030	3620	3300	2780	2360
rubidium	0.050	mg/kg	16.3	5.47	5.21	3.71	2.62	8.44	5.86	8.22	6.06	5.4	1.75	7.56	3.58	3.35	4.01	3.85	2.5	3.67	4.26	3.54	5.9	3.91	2.53	3.4	3.56	6.72	6.14	5.88	2.67
rubidium	0.010	mg/kg wwt	6.62	3.12	3.06	2.22	1.55	4.48	3.16	4.22	3.21	3.04	1	4.44	2.52	2.02	1.9	2.36	1.14	2.35	2.62	1.83	2.6	1.77	1.74	2.4	1.58	2.3	2.43	2.23	1.24
selenium	0.050	mg/kg	<0.050	0.128	0.502	0.227	0.151	0.376	0.413	0.101	0.081	<0.050	0.054	0.241	0.183	3.63	<0.050	0.158	0.057	0.075	0.093	0.054	<0.050	<0.050	0.054	0.056	0.193	0.237	0.131	0.129	0.168
selenium	0.010	mg/kg wwt	0.014	0.073	0.294	0.136	0.088	0.199	0.223	0.052	0.043	0.016	0.031	0.141	0.129	2.19	0.012	0.097	0.026	0.048	0.057	0.028	<0.010	<0.010	0.037	0.04	0.086	0.095	0.052	0.049	0.078
silver	0.0050	mg/kg	0.0076	0.0076	0.0072	<0.0050	0.0107	0.0079	0.0055	<0.0050	<0.0050	<0.0050	<0.0050	0.0087	<0.0050	0.0296	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0124	0.0063	<0.0050
silver	0.0010	mg/kg wwt	0.0031	0.0044	0.0042	0.0017	0.0063	0.0042	0.003	<0.0010	<0.0010	<0.0010	0.0014	0.0051	0.0027	0.0178	<0.0010	0.0014	<0.0010	0.002	0.0021	<0.0010	0.0016	0.0017	<0.0010	0.0022	0.0014	0.001	0.0049	0.0024	0.0022
sodium	20	mg/kg	152	20	34	28	62	45	<20	31	<20	21	33	21	24	94	52	<20	22	31	45	<20	44	36	<20	23	74	41	43	39	55
sodium	4.0	mg/kg wwt	61.7	11.7	20	16.7	36.5	24	8.6	15.8	10.6	11.7	18.7	12.5	17	56.8	24.8	8.1	10.1	19.6	27.7	9.7	19.3	16.4	12.1	16	32.8	16.6	17.1	14.7	25.7
strontium	0.050	mg/kg	19.8	13.4	28.3	14.6	17.8	35	12.2	11.1	10.9	11.7	12.7	9.61	9.28	41.6	7.86	31.5	44.6	106	146	34.9	11	8.02	30.9	112	26.8	15.9	12	10.6	24.3
strontium	0.010	mg/kg wwt	8.02	7.67	16.6	8.7	10.5	18.6	6.55	5.7	5.79	6.6	7.26	5.64	6.54	25	3.73	19.3	20.3	68.3	90.2	18	4.85	3.64	21.2	78.9	11.9	6.4	4.76	4.01	11.2
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.0012	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040
tin	0.10	mg/kg	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	0.059	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.027	<0.020	<0.020	<0.020	<0.020	0.022	<0.020	<0.020	0.032	<0.020	<0.020	<0.020	0.056	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0031	0.0022	0.0076	0.0023	0.0026	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0154	<0.0020	<0.0020	<0.0020	0.0031	0.003	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
uranium	0.00040	mg/kg wwt	0.00125	0.00124	0.00448	0.00137	0.00157	0.00097	0.00071	0.00053	0.0005	<0.00040	0.00114	0.00088	0.00097	0.0093	0.00077	0.00046	<0.00040	0.00199	0.00182	<0.00040	0.00106	0.00067	0.0012	0.00109	<0.00040	<0.00040	0.0005	0.0005	0.0006
vanadium	0.10	mg/kg	0.56	0.46	1.37	0.3	0.48	0.31	0.24	0.16	0.13	0.1	0.21	0.23	0.2	2.29	0.3	<0.10	<0.10	0.41	0.39	<0.10	0.34	0.27	0.25	0.24	<0.10	0.13	0.17	0.18	0.2
vanadium	0.020	mg/kg wwt	0.227	0.265	0.802	0.176	0.286	0.164	0.129	0.084	0.068	0.059	0.123	0.138	0.141	1.38	0.142	0.057	0.022	0.26	0.242	0.049	0.15	0.123	0.175	0.172	0.034	0.052	0.068	0.067	0.094
zinc	0.50	mg/kg	17.4	55.7	33.8	46.3	33	38.6	60.1	20.8	12.6	19.4	10.5	72.8	31.6	19	9.75	13.8	11.9	15.3	15.1	12.2	10.4	8.77	6.93	15.8	32.9	35.4	49.8	34.4	47.2
zinc	0.10	mg/kg wwt	7.08	31.8	19.8	27.7	19.6	20.5	32.4	10.7	6.67	10.9	6.03	42.7	22.2	11.4	4.62	8.47	5.4	9.82	9.3	6.31	4.59	3.98	4.76	11.2	14.6	14.2	19.7	13	21.9
zirconium	0.20	mg/kg	<0.20	<0.20	0.3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.59	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	0.075	0.046	0.175	<0.060	0.106	0.089	<0.040	<0.050	<0.040	<0.040	<0.040	<0.080	<0.080	0.354	<0.040	<0.040	<0.040	0.06	0.056	<0.040	<0.040	<0.040	<0.040	0.086	<0.040	<0.040	<0.040	<0.040	0.04

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R1-L-01	22-R1-L-02	22-R1-L-03	22-R2-L-01	22-R2-L-02	22-R2-L-03	22-R3-L-01	22-R3-L-01D	22-R3-L-02	22-R3-L-02D	22-R3-L-03	22-R3-L-03D	22-R4-L-01	22-R4-L-02	22-R4-L-03	22-R5-L-01	22-R5-L-02	22-R5-L-03	22-R6-L-01	22-R6-L-02	22-S1-L-01	22-S1-L-02	22-S2-L-01
Date Sampled			14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	16-Sep-2022	16-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022
Time Sampled	Lowest Detection Limit	Units	11:00	11:00	11:00	08:50	08:50	08:50	10:00	10:00	10:00	10:00	10:00	10:00	13:45	13:45	13:45	14:45	14:45	14:45	15:40	15:40	12:30	12:30	11:30
ALS Sample ID			VA22C2369-028	VA22C2369-029	VA22C2369-031	VA22C2369-016	VA22C2369-018	VA22C2369-019	VA22C2369-020	VA22C2369-021	VA22C2369-022	VA22C2369-023	VA22C2369-024	VA22C2369-025	VA22C2369-093	VA22C2369-094	VA22C2369-095	VA22C2369-097	VA22C2369-098	VA22C2369-099	VA22C2369-104	VA22C2369-105	VA22C2369-087	VA22C2369-088	VA22C2369-082
QAQC									FDA	FD	FDA	FD	FDA	FD											
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																									
moisture	0.50	%	63.8	62.6	62.8	61.6	57	62.7	60.7	59	62.5	63.9	65.7	63.3	58.6	62	60.7	55.6	61.4	63.8	60.4	60.5	77.3	67	73.6
Metals																									
aluminum	2.0	mg/kg	64.4	377	159	63.5	118	260	146	198	65.8	48.4	510	372	59.4	53.7	246	50.2	102	56.4	65.7	116	127	475	126
aluminum	0.40	mg/kg wwt	23.3	141	59.1	24.4	50.8	97	57.2	81	24.7	17.4	175	136	24.6	20.4	96.9	22.3	39.2	20.4	26	45.7	28.8	157	33.2
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	0.013	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.016	<0.010
antimony	0.0020	mg/kg wwt	0.0027	0.0027	<0.0020	<0.0020	0.0057	0.0042	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	0.0053	<0.0020
arsenic	0.020	mg/kg	0.045	0.113	0.072	0.046	0.046	0.104	0.028	0.037	0.027	0.028	0.025	0.055	0.024	0.036	0.039	0.033	5.94	0.036	0.043	0.075	0.095	0.35	0.123
arsenic	0.0040	mg/kg wwt	0.0162	0.0423	0.027	0.0177	0.0196	0.0387	0.0109	0.0152	0.0101	0.0101	0.0085	0.0203	0.0101	0.0138	0.0154	0.0145	2.29	0.0128	0.0171	0.0297	0.0216	0.115	0.0324
barium	0.050	mg/kg	51.1	5.67	151	26.1	43.2	5.8	84	93.4	39.3	46.8	1.43	3.76	27.2	25.9	98.4	38.6	40.8	44.4	29.4	87.1	3.04	14.1	67.4
barium	0.010	mg/kg wwt	18.5	2.12	56.1	10	18.6	2.16	33	38.3	14.7	16.9	0.491	1.38	11.2	9.83	38.7	17.1	15.7	16	11.6	34.4	0.691	4.64	17.8
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	0.016	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	0.0045	<0.0020	<0.0020	<0.0020	0.0053	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	21	27.3	20.3	16.5	16.8	21.7	14.7	11.3	16.3	20.9	22	21.2	23.6	15.1	9.3	11.5	16.4	37.4	18.5	22.2	13.4	28.5	116
boron	0.20	mg/kg wwt	7.6	10.2	7.56	6.33	7.24	8.08	5.78	4.64	6.12	7.53	7.54	7.81	9.74	5.72	3.66	5.09	6.33	13.5	7.31	8.74	3.03	9.41	30.6
cadmium	0.0050	mg/kg	0.125	0.127	0.137	0.141	0.044	0.293	0.0991	0.0747	0.146	0.207	0.204	0.373	0.0095	0.121	0.264	0.105	0.0158	2.56	0.04	0.209	0.0258	0.0981	<0.0100
cadmium	0.0010	mg/kg wwt	0.0451	0.0474	0.0509	0.054	0.0189	0.109	0.0389	0.0306	0.0549	0.0747	0.07	0.137	0.0039	0.0459	0.104	0.0464	0.0061	0.927	0.0158	0.0826	0.0059	0.0323	<0.0025
calcium	20	mg/kg	8510	3370	7540	7440	5150	4310	6750	7860	7250	7300	2980	3350	11400	8110	5500	6660	2290	20700	11400	6520	2940	9720	20900
calcium	4.0	mg/kg wwt	3080	1260	2800	2860	2210	1610	2650	3220	2720	2630	1020	1230	4720	3080	2160	2960	884	7480	4520	2570	669	3200	5510
cesium	0.0050	mg/kg	0.014	0.0862	0.0341	0.0218	0.0387	0.106	0.102	0.0914	0.0233	0.0305	0.153	0.0727	0.157	0.0107	0.0086	0.0078	0.0444	0.0262	0.0379	0.0229	0.277	0.0888	0.212
cesium	0.0010	mg/kg wwt	0.0051	0.0322	0.0127	0.0084	0.0166	0.0394	0.0399	0.0374	0.0087	0.011	0.0525	0.0267	0.0648	0.0041	0.0034	0.0034	0.0171	0.0094	0.015	0.009	0.0628	0.0293	0.056
chromium	0.050	mg/kg	0.12	0.213	0.112	0.176	0.13	0.367	0.078	0.138	0.111	0.081	0.093	0.114	0.133	0.118	0.074	0.068	0.063	0.122	0.092	0.121	0.129	0.501	0.151
chromium	0.010	mg/kg wwt	0.043	0.08	0.042	0.067	0.056	0.137	0.03	0.057	0.042	0.029	0.032	0.042	0.055	0.045	0.029	0.03	0.024	0.044	0.036	0.048	0.029	0.165	0.04
cobalt	0.020	mg/kg	0.082	0.186	0.125	0.079	0.122	0.173	0.161	0.186	0.088	0.093	0.102	0.104	0.307	0.075	0.136	0.054	0.038	0.82	0.08	0.124	0.17	0.404	0.103
cobalt	0.0040	mg/kg wwt	0.0295	0.0695	0.0466	0.0305	0.0525	0.0646	0.0634	0.0762	0.0331	0.0334	0.0351	0.038	0.127	0.0283	0.0536	0.0242	0.0147	0.296	0.0316	0.049	0.0387	0.133	0.0271
copper	0.10	mg/kg	5.2	11.2	8.95	5.09	6.4	11.4	3.91	5.08	4.43	4.92	6.74	8.86	12.2	4.86	6.85	5.11	6.48	8.12	5.48	8.24	11.1	31.4	10.2
copper	0.020	mg/kg wwt	1.88	4.19	3.33	1.96	2.75	4.23	1.54	2.08	1.66	1.78	2.31	3.25	5.04	1.85	2.69	2.27	2.5	2.93	2.17	3.25	2.52	10.4	2.69
iron	3.0	mg/kg	116	324	149	136	138	317	80.2	119	93.7	89	84.3	152	108	111	134	107	56.1	80.2	144	194	256	1070	228
iron	0.60	mg/kg wwt	42	121	55.6	52.4	59.5	118	31.5	48.6	35.1	32.1	28.9	55.8	44.4	42.1	52.5	47.7	21.6	29	56.8	76.6	58.2	353	60.4
lead	0.020	mg/kg	0.028	0.119	0.08	0.042	0.061	0.118	0.032	0.047	0.027	<0.020	0.02	0.054	0.04	0.025	0.04	0.028	<0.020	0.043	0.036	0.044	0.041	0.16	0.063
lead	0.0040	mg/kg wwt	0.01	0.0444	0.0298	0.0163	0.0262	0.0441	0.0125	0.0192	0.01	0.0072	0.0069	0.0197	0.0165	0.0095	0.0157	0.0126	0.0043	0.0157	0.0142	0.0173	0.0094	0.0529	0.0167
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.64	<0.50
lithium	0.10	mg/kg wwt	<0.10	0.1	<0.10	<0.10	0.12	0.14	0.19	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	0.13	<0.10	<0.10	0.21	0.12
magnesium	2.0	mg/kg	1340	1290	1130	1110	899	1460	1490	1660	1180	1380	1550	1300	1380	1020	1170	931	1240	1980	1510	1090	984	5280	5030
magnesium	0.40	mg/kg wwt	487	483	422	425	387	543	586	680	443	499	532	479	572	387	460	413	479	714	597	432	223	1740	1330
manganese	0.050	mg/kg	108	1250	1200	94.4	340	438	663	564	236	292	1310	1280	202	174	363	196	130	159	127	1400	75.3	163	22.5
manganese	0.010	mg/kg wwt	39.3	466	446	36.2	146	163	260	231	88.5	105	451	470	83.3	66.3	143	86.9	50	57.4	50.2	552	17.1	53.6	5.95
mercury	0.0050	mg/kg	0.0127	0.0246	0.0307	0.0112	0.0171	0.0281	0.0111	0.0172	0.0123	0.0089	0.0078	0.0114	0.0072	0.0075	0.0124	0.0078	0.0055	0.0064	0.0132	0.0147	<0.0050	<0.0050	0.0125
mercury	0.0010	mg/kg wwt	0.0046	0.0092	0.0114	0.0043	0.0073	0.0105	0.0044	0.007	0.0046	0.0032	0.0027	0.0042	0.003	0.0028	0.0049	0.0035	0.0021	0.0023	0.0052	0.0058	<0.0010	0.0014	0.0033
molybdenum	0.020	mg/kg	0.443	0.228	0.118	0.674	0.669	0.08	0.077	0.098	1.04	1.16	0.416	0.152	0.809	2.26	0.099	0.827	0.045	0.202	2.28	0.124	1.45	2.36	26.5
molybdenum	0.0040	mg/kg wwt	0.16	0.0853	0.0439	0.259	0.288	0.0296	0.0303	0.0402	0.389	0.42	0.143	0.0557	0.334	0.857	0.0388	0.367	0.0174	0.073	0.902	0.0491	0.33	0.776	7
nickel	0.20	mg/kg	1.62	0.4	0.7	2.12	0.5	0.58	0.76	0.85	2.92	3.8	0.23	0.29	1.22	2.14	1.09	1.58	1.26	0.42	0.83	0.62	0.48	0.88	0.27
nickel	0.040	mg/kg wwt	0.586	0.152	0.259	0.814	0.215	0.214	0.3	0.348	1.1	1.37	0.078	0.105	0.505	0.811	0.428	0.7	0.484	0.154	0.328	0.244	0.109	0.292	0.071
phosphorus	10	mg/kg	1880	2650	2930	1200	1550	1780	2070	1670	1550	1910	1880	1870	1490	1960	2900	1570	2320	3150	1710	2660	1420	4920	6090
phosphorus	2.0	mg/kg wwt	680	992	1090	462	666	664	813	686	582	688	647	685	615	745	1140	696	892	1140	676	1050	324	1620	1610
potassium	20	mg/kg	8600	6530	7280	6640	7320	6350	7020	5630	8830	11500	7460	7200	5230	8880	9100	9020	9390	9870	8270	8630	4620	14900	22500
potassium	4.0	mg/kg wwt	3110	2440	2710	2550	3150	2370	2760	2300	3310	4160	2560	2640	2160	3370	3570	4000	3620	3560	3270	3400	1050	4920	5950
rubidium	0.050	mg/kg	5.99	6.8	5.74	6.22	6.44	5.57	13.1	11.4	6.14	9.02	13.7	8.54	8.44	3.13	4.04	2.3	5.22	4.82	6.93	5.84	5.15	5.37	10.7
rubidium	0.010	mg/kg wwt	2.17	2.54	2.14	2.39	2.77	2.08	5.16	4.66	2.3	3.25	4.69	3.14	3.49	1.19	1.59	1.02	2.01	1.74	2.74	2.3	1.17	1.77	2.84
selenium	0.050	mg/kg	<0.050	<0.050	<0.050	0.063	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.127	0.204	0.368
selenium	0.010	mg/kg wwt	<0.010	<0.010	<0.010	0.024	0.013	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.029	0.067	0.097
silver	0.0050	mg/kg	0.0057	0.0145	0.0159	0.005	0.0235	0.0211	0.0087	0.0087	<0.0050	0.0051	0.0076	0.0117	0.0152	<0.0050	0.0108	0.0057	0.0285	0.0187	0.0087	0.006	0.0378	0.008	<0.0050
silver	0.0010	mg/kg wwt	0.0021	0.0054	0.0059	0.0019	0.0101	0.0079	0.0034	0.0036	0.0014	0.0018	0.0026	0.0043	0.0063	0.0011	0.0042	0.0025	0.011	0.0068	0.0034	0.0024	0.0086	0.0026	<0.0010
sodium	20	mg/kg	29	57	69	49	62	80	76	62	<20	<20	30	42	54	52	39	<20	26	36	94	48	23	114	88
sodium	4.0	mg/kg wwt	10.6	21.5	25.7	19	26.8	29.6	29.9	25.4	6.6	7	10.3	15.6	22.2	19.8	15.4	8.3	9.9	13	37.3	19.2	5.3	37.6	23.3
strontium	0.050	mg/kg	80.8	7.8	44.1	90.1	29	9.22	38	48.9	61.8	64.8	3.31	6.35	39.3	45.9	19.6	35.9	21.2	78.2	86.8	24.3	4.96	34	65
strontium	0.010	mg/kg wwt	29.2	2.91	16.4	34.6	12.5	3.43	14.9	20	23.2	23.4	1.14	2.33	16.2	17.4	7.69	15.9	8.15	28.3	34.4	9.6	1.13	11.2	17.2
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	0.0054	0.0106	<0.0020	0.008	0.0084	0.0221	0.0271	<0.0020	<0.0020	0.0021	0.0043	<0.0020	<0.0020	0.0044	<0.0020	<0.0020	<0.0020	<0.0020	0.0043	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	0.00202	0.00393	<0.00040	0.00344	0.00312	0.00868	0.0111	<0.00040	<0.00040	0.00074	0.00158	<0.00040	<0.00040	0.00174	<0.00040	<0.00040	<0.00040	<0.00040	0.00171	<0.00040	<0.00040	0.00047
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	0.031	0.062	<0.020	<0.020	0.028	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.039	<0.020	<0.020	<0.020	0.033	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0024	0.0057	0.0032	0.0026	0.0028	0.007	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	0.0028	<0.0020	0.0038	0.0022	<0.0020	<0.0020	<0.0020	0.0028	0.003	0.0043	0.0162	0.0038
uranium	0.00040	mg/kg wwt	0.00087	0.00214	0.00121	0.00098	0.00121	0.0026	0.00064	0.00095	0.00064	0.00055	<0.00040	0.00101	0.00062	0.00145	0.00086	0.0008	<0.00040	<0.00040	0.00112	0.00118	0.00097	0.00533	0.001
vanadium	0.10	mg/kg	0.37	0.99	0.46	0.45	0.5	1.11	0.22	0.38	0.34	0.26	0.17	0.43	0.24	0.34	0.38	0.34	0.11	0.17	0.46	0.62	0.89	3.69	1.67
vanadium	0.020	mg/kg wwt	0.135	0.37	0.172	0.171	0.214	0.413	0.088	0.155	0.128	0.092	0.058	0.159	0.1	0.131	0.151	0.149	0.041	0.06	0.18	0.247	0.203	1.22	0.441
zinc	0.50	mg/kg	12.9	14.3	64.9	14	26.2	11.9	32.8	33.9	15.5	16.8	9.46	11.2	38.4	15.3	52.4	16.2	28.5	290	16.5	47	68.9	63.6	24.2
zinc	0.10	mg/kg wwt	4.67	5.36	24.1	5.4	11.3	4.43	12.9	13.9	5.83	6.06	3.24	4.11	15.9	5.82	20.6	7.21	11	105	6.55	18.6	15.6	21	6.39
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	0.24	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.32	<0.20
zirconium	0.040	mg/kg wwt	0.046	0.069	<0.070	<0.040	<0.040	0.09	0.059	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.104	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S2-L-02	22-S3-L-01	22-S3-L-02	22-S4-L-02	22-S4-L-01	22-S5-L-01	22-S5-L-02	22-S6-L-01	22-S6-L-02	22-S8-L-01	22-S8-L-02	22-S9-L-01	22-S9-L-02	22-S9-L-03	22-S9-L-04	22-S10-L-01	22-S10-L-02	22-S10-L-03	22-S11-L-01	22-S11-L-02	22-S11-L-03	22-S12-L-01	22-S12-L-02
Date Sampled			15-Sep-2022	13-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	13-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022
Time Sampled	Lowest Detection Limit	Units	11:30	15:30	15:30	10:00	10:00	09:10	09:10	08:10	08:10	14:15	14:15	13:00	13:00	13:00	13:00	11:00	11:00	11:00	12:40	12:40	12:40	13:10	13:10
ALS Sample ID			VA22C2369-083	VA22C2369-013	VA22C2369-015	VA22C2369-077	VA22C2369-078	VA22C2369-072	VA22C2369-075	VA22C2369-057	VA22C2369-058	VA22C2369-006	VA22C2369-009	VA22C2369-001	VA22C2369-002	VA22C2369-004	VA22C2369-005	VA22C2369-127	VA22C2369-128	VA22C2369-129	VA22C2369-032	VA22C2369-034	VA22C2369-035	VA22C2369-037	VA22C2369-039
QAQC																									
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																									
moisture	0.50	%	60.7	64	74.8	55.7	61.6	58.7	60.1	62.9	67.3	61.4	58.5	50.2	66.6	53.5	62.5	61.3	64.8	63.9	52.9	61.9	64	54.6	60.5
Metals																									
aluminum	2.0	mg/kg	122	68.4	68.6	169	25	117	19.9	107	17.4	97	67.9	92.6	310	230	178	52.6	97.5	66.7	71.7	155	16.3	70.8	38.6
aluminum	0.40	mg/kg wwt	47.7	24.7	17.3	74.9	9.59	48.2	7.92	39.6	5.71	37.4	28.2	46.1	103	107	66.7	20.3	34.4	24.1	33.7	59.1	5.87	32.2	15.3
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	0.015	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0034	<0.0020	0.0028	<0.0020	0.0033	<0.0020	<0.0020	<0.0020	0.0024	0.0041	0.0047	0.003	0.0025	0.0027	<0.0020	<0.0020	0.0056	<0.0020	0.0027	<0.0020
arsenic	0.020	mg/kg	0.086	0.05	0.151	0.11	0.053	0.089	0.027	0.075	0.041	0.077	2.87	0.108	0.268	6.11	0.158	0.108	0.11	0.041	7.14	0.11	0.085	0.062	<0.020
arsenic	0.0040	mg/kg wwt	0.0336	0.0182	0.0381	0.0486	0.0205	0.0368	0.0109	0.0278	0.0135	0.0298	1.19	0.054	0.0896	2.84	0.0594	0.042	0.0387	0.0148	3.36	0.0417	0.0306	0.0284	0.0069
barium	0.050	mg/kg	2.33	1.61	165	22.6	9.11	15.5	4.67	23.8	10.1	2.66	25.5	9.03	12.3	18.4	7.75	19.6	41.4	2.24	21.4	9.93	4.51	6.46	1.43
barium	0.010	mg/kg wwt	0.914	0.582	41.7	10	3.5	6.41	1.86	8.8	3.3	1.03	10.6	4.49	4.1	8.56	2.9	7.58	14.6	0.811	10.1	3.78	1.62	2.93	0.565
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0035	0.0025	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	14.6	12.6	82	38.1	35.7	29.8	39.4	34.1	40.2	14.5	20.8	14.3	22.8	16	52.5	53.6	62.9	15.4	16.9	46.4	49.1	46.4	8.8
boron	0.20	mg/kg wwt	5.73	4.55	20.7	16.9	13.7	12.3	15.7	12.6	13.2	5.6	8.66	7.1	7.6	7.43	19.7	20.8	22.2	5.56	7.94	17.7	17.7	21.1	3.47
cadmium	0.0050	mg/kg	0.0397	0.0492	<0.0100	0.0454	0.613	0.0146	0.22	0.0623	0.437	0.0568	0.0667	<0.0150	0.0672	0.0506	1.92	1.03	0.18	0.0468	0.0389	0.0452	1.33	0.0432	0.0254
cadmium	0.0010	mg/kg wwt	0.0156	0.0177	<0.0020	0.0201	0.235	0.006	0.0879	0.0231	0.143	0.0219	0.0277	<0.0060	0.0224	0.0235	0.719	0.398	0.0633	0.0169	0.0183	0.0172	0.478	0.0196	0.01
calcium	20	mg/kg	3200	2640	25600	13800	12500	10700	9960	11200	15600	2440	3810	11500	10500	2640	21300	20100	11500	2730	4760	16000	11700	9200	2030
calcium	4.0	mg/kg wwt	1250	950	6460	6110	4820	4410	3970	4150	5100	941	1580	5720	3500	1230	7980	7770	4040	986	2240	6090	4220	4180	803
cesium	0.0050	mg/kg	0.132	0.108	0.181	0.0538	0.254	0.048	0.648	0.0223	0.0812	0.0512	0.106	0.598	0.104	0.176	0.191	0.276	0.107	0.0538	0.0992	0.0465	0.0662	0.0385	0.0266
cesium	0.0010	mg/kg wwt	0.0518	0.0388	0.0456	0.0238	0.0975	0.0198	0.258	0.0083	0.0266	0.0198	0.0439	0.297	0.0348	0.0816	0.0715	0.107	0.0379	0.0194	0.0467	0.0177	0.0238	0.0175	0.0105
chromium	0.050	mg/kg	0.165	0.084	0.116	0.223	0.052	0.28	0.061	0.35	0.072	0.16	0.095	0.177	0.475	0.2	0.197	0.098	0.164	0.068	0.066	0.264	<0.050	1.21	0.076
chromium	0.010	mg/kg wwt	0.065	0.03	0.029	0.099	0.02	0.115	0.024	0.13	0.024	0.062	0.04	0.088	0.159	0.093	0.074	0.038	0.058	0.024	0.031	0.101	0.013	0.548	0.03
cobalt	0.020	mg/kg	0.112	0.125	0.065	0.128	0.207	0.108	0.382	0.103	0.394	0.142	0.087	0.244	0.305	0.297	0.604	0.771	0.169	0.15	0.15	0.126	0.717	0.079	0.063
cobalt	0.0040	mg/kg wwt	0.0438	0.0449	0.0164	0.057	0.0796	0.0447	0.152	0.038	0.129	0.0549	0.0362	0.122	0.102	0.138	0.226	0.298	0.0596	0.0543	0.0705	0.048	0.258	0.0359	0.025
copper	0.10	mg/kg	9.45	6.68	6.96	12.7	6.78	11.2	6.95	10.1	5.55	12.4	8.12	13.1	23.1	10.7	15.3	5.92	11.3	5.64	6.05	8.88	6.02	7.58	6.52
copper	0.020	mg/kg wwt	3.71	2.41	1.75	5.62	2.6	4.63	2.77	3.74	1.82	4.8	3.37	6.53	7.72	4.99	5.73	2.29	3.97	2.04	2.85	3.38	2.17	3.44	2.58
iron	3.0	mg/kg	199	114	117	273	51.4	194	50.1	211	48.7	187	130	149	653	301	262	98.9	236	108	101	271	44.9	140	64.6
iron	0.60	mg/kg wwt	78	41.3	29.4	121	19.7	80.2	20	78.1	16	72.1	53.8	74.3	218	140	98.1	38.2	83.4	39	47.3	103	16.2	63.7	25.5
lead	0.020	mg/kg	0.038	0.024	0.048	0.07	<0.020	0.067	0.031	0.06	0.023	0.042	0.035	0.062	0.17	0.092	0.084	0.09	0.143	0.032	0.034	0.09	<0.020	0.038	<0.020
lead	0.0040	mg/kg wwt	0.0149	0.0088	0.012	0.0309	0.006	0.0276	0.0123	0.0222	0.0075	0.0163	0.0146	0.0308	0.0569	0.0426	0.0315	0.0349	0.0503	0.0117	0.016	0.0342	<0.0040	0.0175	0.0054
lithium	0.50	mg/kg	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10	0.16	0.13	<0.10	0.12	0.12	<0.10	<0.10	<0.10	<0.10	0.12	<0.10	0.14	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	1180	1480	3760	4910	2880	3390	2950	5350	2020	957	1260	1500	1940	983	2490	2700	2560	1230	835	6210	4000	4860	832
magnesium	0.40	mg/kg wwt	463	533	948	2180	1100	1400	1180	1980	661	370	524	747	646	457	934	1040	902	445	393	2370	1440	2210	329
manganese	0.050	mg/kg	100	95.9	85.9	176	37	85.3	32.4	225	21.1	80.7	53.9	164	91.3	146	94.2	75.2	153	99.8	171	101	79.6	73.2	63.7
manganese	0.010	mg/kg wwt	39.3	34.6	21.7	78.2	14.2	35.2	12.9	83.5	6.91	31.2	22.4	81.7	30.5	68	35.3	29.1	54	36.1	80.3	38.5	28.7	33.2	25.2
mercury	0.0050	mg/kg	<0.0050	<0.0050	0.0112	0.0082	<0.0050	0.0068	<0.0050	0.0063	<0.0050	<0.0050	0.0053	<0.0050	0.0076	0.0052	0.0055	0.0072	0.0074	<0.0050	0.0075	0.0097	<0.0050	0.0057	<0.0050
mercury	0.0010	mg/kg wwt	0.0018	0.0013	0.0028	0.0036	0.0015	0.0028	0.0015	0.0023	0.0016	0.0015	0.0022	0.0022	0.0025	0.0024	0.002	0.0028	0.0026	0.0012	0.0035	0.0037	<0.0020	0.0026	0.0012
molybdenum	0.020	mg/kg	2.38	0.598	30.6	3.86	2.18	2.11	2.95	2.69	2.9	3.02	3.25	18.6	1.35	0.562	5.28	1.1	1.33	2.98	0.837	4.64	2.06	1.34	2.17
molybdenum	0.0040	mg/kg wwt	0.936	0.216	7.71	1.71	0.838	0.872	1.18	0.996	0.95	1.17	1.35	9.24	0.45	0.261	1.98	0.426	0.467	1.08	0.394	1.77	0.74	0.61	0.858
nickel	0.20	mg/kg	0.51	0.35	0.4	0.43	0.41	0.4	<0.20	0.69	0.21	1.6	0.27	0.28	0.75	0.22	0.42	0.22	0.63	0.48	<0.20	0.22	0.24	0.43	0.32
nickel	0.040	mg/kg wwt	0.202	0.125	0.102	0.19	0.159	0.167	0.077	0.257	0.07	0.616	0.111	0.14	0.249	0.1	0.159	0.087	0.223	0.175	0.065	0.083	0.086	0.196	0.127
phosphorus	10	mg/kg	1600	1580	8110	3890	1740	3970	2670	4540	2510	1510	2260	2850	1100	1310	2020	1380	2540	1300	2000	6530	2430	3320	1370
phosphorus	2.0	mg/kg wwt	630	571	2040	1720	667	1640	1060	1680	822	582	938	1420	366	611	758	535	896	470	943	2490	876	1500	543
potassium	20	mg/kg	5650	4100	21800	8100	7080	10100	12100	7370	12500	5570	6780	10100	8170	7170	11800	5580	6790	4520	6480	9040	8380	6910	5230
potassium	4.0	mg/kg wwt	2220	1480	5490	3590	2720	4190	4810	2730	4080	2150	2810	5010	2730	3340	4410	2160	2390	1630	3050	3440	3020	3140	2070
rubidium	0.050	mg/kg	4.1	3.39	8.96	4.92	7.95	6.6	10.8	3.47	8.11	3.17	5.46	20.9	8.82	8.64	10.4	2.33	3.88	2.56	5.91	6.02	6.55	4.19	2.9
rubidium	0.010	mg/kg wwt	1.61	1.22	2.26	2.18	3.05	2.72	4.31	1.29	2.66	1.22	2.27	10.4	2.94	4.02	3.89	0.901	1.37	0.926	2.78	2.29	2.36	1.9	1.14
selenium	0.050	mg/kg	0.3	0.512	0.366	0.475	0.67	0.163	1.21	0.065	0.116	0.342	0.358	1.28	4.32	1.19	3.26	0.163	0.32	0.09	0.287	0.392	0.494	0.143	0.063
selenium	0.010	mg/kg wwt	0.118	0.184	0.092	0.21	0.257	0.067	0.484	0.024	0.038	0.132	0.149	0.636	1.44	0.556	1.22	0.063	0.113	0.032	0.135	0.149	0.178	0.065	0.025
silver	0.0050	mg/kg	0.0374	0.023	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0498	0.0165	0.0135	0.0103	0.0126	0.014	<0.0050	0.0152	0.0358	0.0211	<0.0050	<0.0050	<0.0050	0.0405
silver	0.0010	mg/kg wwt	0.0147	0.0083	<0.0010	0.0016	<0.0010	0.0013	<0.0010	<0.0010	0.0011	0.0192	0.0068	0.0067	0.0034	0.0058	0.0052	0.0014	0.0053	0.013	0.0099	0.0012	0.0015	<0.0010	0.016
sodium	20	mg/kg	22	<20	53	117	34	59	57	100	36	20	29	39	64	23	45	27	38	48	26	34	25	61	<20
sodium	4.0	mg/kg wwt	8.7	6.1	13.5	52	13.1	24.5	22.7	37.2	11.7	7.8	12.2	19.3	21.2	10.7	16.7	10.5	13.6	17.4	12.1	13	9.2	27.6	4.9
strontium	0.050	mg/kg	5.57	5.9	95	45.8	45.6	40.9	38.7	43	55.6	3.79	46.9	33.2	32.7	21.8	51.6	126	73.2	8.94	218	468	170	130	8
strontium	0.010	mg/kg wwt	2.19	2.12	24	20.3	17.5	16.9	15.4	15.9	18.2	1.46	19.5	16.5	10.9	10.1	19.3	48.6	25.8	3.23	102	178	61.1	59.2	3.16
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0045	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	0.0054	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0093	<0.0020	<0.0020	0.0178	<0.0020	<0.0020	<0.0020	<0.0020	0.0162	0.0028	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	0.00064	0.00137	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00386	0.00058	<0.00040	0.00827	<0.00040	<0.00040	<0.00040	<0.00040	0.00763	0.00108	<0.00040	<0.00040	<0.00040
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.17	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.051	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.024	0.065	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0036	<0.0020	0.0022	0.0063	<0.0020	0.0035	0.002	0.0032	<0.0020	0.0038	0.003	0.0024	0.0138	0.0068	0.0046	0.0031	0.0042	0.0021	0.0021	0.0061	<0.0020	0.0029	<0.0020
uranium	0.00040	mg/kg wwt	0.00141	0.00067	0.00055	0.00278	<0.00040	0.00144	0.0008	0.0012	<0.00040	0.00146	0.00123	0.0012	0.00461	0.00318	0.00174	0.00122	0.00149	0.00077	0.00099	0.00232	<0.00040	0.0013	0.00041
vanadium	0.10	mg/kg	0.61	0.32	1.72	0.74	0.14	0.54	<0.10	0.56	<0.10	0.6	0.37	0.4	2.2	1.05	0.79	0.27	0.75	0.3	0.25	0.81	<0.10	0.31	0.15
vanadium	0.020	mg/kg wwt	0.241	0.117	0.435	0.331	0.053	0.223	0.037	0.207	0.03	0.231	0.152	0.2	0.733	0.488	0.295	0.106	0.265	0.108	0.118	0.31	0.027	0.142	0.061
zinc	0.50	mg/kg	43.6	42.3	25.4	15.2	31	12.2	24.5	20.7	28	77.8	47.8	21.6	13.4	22.8	96.3	79	102	46.6	37.2	18.1	147	10.9	42
zinc	0.10	mg/kg wwt	17.1	15.2	6.4	6.74	11.9	5.02	9.75	7.66	9.16	30	19.9	10.8	4.49	10.6	36.1	30.6	36	16.8	17.5	6.91	53	4.96	16.6
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	0.3	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.060	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.1	0.072	0.052	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S12-L-03	22-S13-L-01	22-S13-L-01D	22-S13-L-02	22-S13-L-02D	22-S13-L-03	22-S13-L-03D	22-S14-L-03	22-S14-L-02	22-S14-L-01	22-S15-L-01	22-S15-L-01D	22-S15-L-02	22-S15-L-02D	22-S15-L-03	22-S15-L-03D	22-S16-L-01	22-S16-L-02	22-S16-L-03	22-S17-L-01	22-S17-L-02	22-S17-L-03	22-A4-L-01
Date Sampled			14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022
Time Sampled	Lowest Detection Limit	Units	13:10	14:40	14:40	14:40	14:40	14:40	14:40	14:00	14:00	14:00	10:00	10:00	10:00	10:00	10:00	10:00	17:00	17:00	17:00	16:15	16:15	16:15	08:15
ALS Sample ID			VA22C2369-041	VA22C2369-047	VA22C2369-062	VA22C2369-048	VA22C2369-063	VA22C2369-049	VA22C2369-064	VA22C2369-043	VA22C2369-044	VA22C2369-045	VA22C2369-117	VA22C2369-122	VA22C2369-118	VA22C2369-123	VA22C2369-119	VA22C2369-124	VA22C2369-052	VA22C2369-053	VA22C2369-054	VA22C2369-067	VA22C2369-068	VA22C2369-069	VA22C2369-107
QAQC				FDA	FD	FDA	FD	FDA	FD				FDA	FD	FDA	FD	FDA	FD							
Analyte			Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																									
moisture	0.50	%	76.5	56.9	58.2	58.4	58.6	53.4	53.7	58.9	61.1	63	63.4	63.9	59.9	61.7	60.8	62.6	57.5	62.5	62.4	61.1	60.5	62.6	61
Metals																									
aluminum	2.0	mg/kg	109	77.3	45.8	36.9	27.3	54.2	64.6	23.4	112	34.8	93.8	79.8	130	63.6	369	294	20.1	45.4	60.7	38.4	37.3	11.7	105
aluminum	0.40	mg/kg wwt	25.7	33.4	19.1	15.3	11.3	25.3	30	9.63	43.5	12.9	34.4	28.8	52	24.4	144	110	8.53	17	22.8	15	14.7	4.38	40.8
antimony	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.02	0.014	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	0.0026	<0.0020	<0.0020	0.0036	<0.0020	<0.0020	<0.0020	0.0031	0.0024	<0.0020	<0.0020	0.0033	<0.0020	0.0077	0.0051	0.0045	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0023
arsenic	0.020	mg/kg	0.071	0.038	0.032	0.061	0.056	8.45	10.9	<0.020	0.071	0.039	0.058	0.046	0.117	0.053	0.282	0.234	0.022	0.043	13.3	0.025	3.96	<0.020	0.086
arsenic	0.0040	mg/kg wwt	0.0168	0.0163	0.0134	0.0253	0.0233	3.94	5.04	0.0076	0.0278	0.0145	0.0212	0.0164	0.0469	0.0203	0.11	0.0876	0.0094	0.0163	5.01	0.0097	1.56	0.005	0.0336
barium	0.050	mg/kg	46.3	2.41	1.85	5.98	5.56	17.1	15.5	1.3	10.1	7.14	2.52	2.02	22.2	13.5	23.9	21	8.56	1.51	20	1.65	12.3	3.32	51.3
barium	0.010	mg/kg wwt	10.9	1.04	0.775	2.49	2.3	7.98	7.18	0.537	3.92	2.64	0.923	0.728	8.92	5.18	9.36	7.86	3.64	0.565	7.51	0.644	4.84	1.24	20
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0048	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.003	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	65	8.6	7.9	39.5	36.6	8.4	8	9.3	33.3	32.2	13.3	14.4	41	31	63.1	58.9	41.1	16.3	17.8	10.7	11.9	38.1	23.8
boron	0.20	mg/kg wwt	15.3	3.71	3.29	16.4	15.2	3.94	3.72	3.81	13	11.9	4.87	5.2	16.4	11.9	24.7	22	17.4	6.12	6.71	4.16	4.71	14.2	9.28
cadmium	0.0050	mg/kg	<0.0100	0.0821	0.0482	0.648	0.984	0.0145	0.014	0.0408	0.0137	0.842	0.0965	0.0726	1.54	1.16	0.0984	0.134	1.23	0.0363	0.0127	0.0516	0.0599	1.5	0.464
cadmium	0.0010	mg/kg wwt	<0.0020	0.0354	0.0202	0.27	0.408	0.0067	0.0065	0.0168	0.0053	0.312	0.0354	0.0262	0.619	0.444	0.0385	0.05	0.525	0.0136	0.0048	0.0201	0.0237	0.562	0.181
calcium	20	mg/kg	12500	3000	2440	10300	11100	2160	1940	2300	11600	14200	2630	2410	19000	11900	13000	12600	15900	2840	3440	3020	3190	10900	28600
calcium	4.0	mg/kg wwt	2940	1290	1020	4310	4580	1010	900	947	4510	5260	964	870	7620	4560	5090	4720	6740	1070	1290	1180	1260	4070	11100
cesium	0.0050	mg/kg	0.244	0.0175	0.0193	0.046	0.0628	0.026	0.0302	0.198	0.0353	0.559	0.0652	0.0685	0.112	0.133	0.0528	0.0672	0.259	0.0696	0.162	0.11	0.111	0.489	0.0446
cesium	0.0010	mg/kg wwt	0.0573	0.0075	0.008	0.0191	0.026	0.0121	0.014	0.0813	0.0137	0.207	0.0239	0.0247	0.0449	0.051	0.0207	0.0252	0.11	0.0261	0.0611	0.0429	0.0437	0.183	0.0174
chromium	0.050	mg/kg	0.23	0.339	0.109	0.137	0.116	0.252	0.08	0.176	0.318	0.258	0.116	0.092	0.164	0.114	0.577	0.444	0.088	0.095	0.246	0.055	0.071	<0.050	0.134
chromium	0.010	mg/kg wwt	0.054	0.146	0.046	0.057	0.048	0.117	0.037	0.072	0.124	0.095	0.042	0.033	0.066	0.044	0.226	0.166	0.037	0.036	0.092	0.021	0.028	<0.010	0.052
cobalt	0.020	mg/kg	0.096	0.187	0.154	0.319	0.371	0.065	0.067	0.099	0.086	0.367	0.117	0.092	0.59	0.43	0.297	0.244	0.37	0.086	0.114	0.118	0.123	0.476	0.301
cobalt	0.0040	mg/kg wwt	0.0224	0.0806	0.0645	0.133	0.154	0.0304	0.0311	0.0408	0.0335	0.136	0.0428	0.0332	0.236	0.165	0.116	0.0914	0.157	0.0322	0.0427	0.0459	0.0485	0.178	0.117
copper	0.10	mg/kg	8.47	6	6.12	6.53	5.64	4.84	5.23	12.3	8.03	9.08	7.96	6.49	12.6	8.94	21.9	17.1	6.39	5.05	5.12	4.53	3.53	6.03	11.6
copper	0.020	mg/kg wwt	1.99	2.59	2.56	2.72	2.34	2.25	2.42	5.05	3.12	3.36	2.92	2.34	5.04	3.43	8.59	6.41	2.72	1.89	1.93	1.76	1.39	2.25	4.54
iron	3.0	mg/kg	203	112	97	63.4	75.9	104	112	64.7	203	73.2	175	139	246	118	838	583	52.6	59.2	104	80.8	61.3	37.2	176
iron	0.60	mg/kg wwt	47.6	48.5	40.6	26.4	31.4	48.4	51.7	26.6	78.8	27.1	64.2	50.3	98.6	45.3	328	218	22.3	22.2	39.1	31.5	24.2	13.9	68.7
lead	0.020	mg/kg	0.044	0.027	0.025	0.024	0.073	0.032	0.028	<0.020	0.051	0.024	0.054	0.039	0.101	0.062	0.221	0.176	0.021	<0.020	0.026	0.022	<0.020	<0.020	0.07
lead	0.0040	mg/kg wwt	0.0103	0.0116	0.0105	0.01	0.0302	0.0149	0.013	0.0048	0.0198	0.0089	0.0199	0.0142	0.0404	0.0236	0.0866	0.0658	0.009	0.0052	0.0096	0.0086	0.0063	0.0046	0.0272
lithium	0.50	mg/kg	0.51	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.68	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.71	<0.50
lithium	0.10	mg/kg wwt	0.12	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.27	0.14	<0.10	<0.10	<0.10	<0.10	<0.10	0.26	<0.10
magnesium	2.0	mg/kg	3670	1530	1300	3020	3180	770	737	802	5000	3130	1320	1150	3460	3120	5150	4730	2520	1140	1000	1110	731	3360	1570
magnesium	0.40	mg/kg wwt	863	662	544	1260	1320	359	341	329	1940	1160	485	416	1390	1200	2020	1770	1070	427	378	431	289	1260	610
manganese	0.050	mg/kg	31.6	76.6	68.4	31.6	37.9	147	122	37.7	72.4	60.9	93.2	93	140	79.7	242	204	38.3	91.4	94.1	63	73.9	54.4	56.9
manganese	0.010	mg/kg wwt	7.42	33	28.6	13.1	15.7	68.5	56.6	15.5	28.1	22.6	34.1	33.6	56.2	30.5	94.6	76.3	16.3	34.3	35.4	24.5	29.2	20.4	22.2
mercury	0.0050	mg/kg	0.0109	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0097	<0.0050	<0.0050	<0.0050	0.011	0.008	0.0138	0.013	0.005	<0.0050	0.0061	<0.0050	<0.0050	<0.0050	0.012
mercury	0.0010	mg/kg wwt	0.0026	<0.0011	0.0014	0.0014	0.0012	<0.0022	0.0023	0.0012	0.0038	0.0015	0.0012	0.0015	0.0044	0.0031	0.0054	0.0048	0.0021	<0.0017	0.0023	0.0013	0.0018	0.0013	0.0047
molybdenum	0.020	mg/kg	12.4	1.63	2.35	1.6	2.09	2.47	2.58	6.5	8.1	1.3	4.82	5.63	3.35	2.15	65.1	29.8	1.32	1.67	1.87	2.67	0.749	1.84	0.704
molybdenum	0.0040	mg/kg wwt	2.9	0.704	0.984	0.667	0.866	1.15	1.2	2.67	3.15	0.481	1.76	2.03	1.34	0.826	25.5	11.2	0.561	0.627	0.702	1.04	0.296	0.688	0.274
nickel	0.20	mg/kg	<0.20	0.21	0.21	<0.20	<0.20	<0.20	<0.20	0.65	<0.20	0.34	1.04	0.96	0.61	0.63	0.56	0.58	<0.20	0.21	<0.20	0.32	<0.20	0.46	0.22
nickel	0.040	mg/kg wwt	0.043	0.09	0.089	0.077	0.064	0.066	0.048	0.266	0.077	0.126	0.382	0.346	0.246	0.24	0.22	0.215	0.075	0.08	<0.040	0.125	0.042	0.171	0.084
phosphorus	10	mg/kg	7700	1100	973	1580	1640	1460	1550	1540	3730	2130	1480	1360	2080	1860	4610	3330	1550	1420	1470	1110	1440	1880	1970
phosphorus	2.0	mg/kg wwt	1810	475	407	656	679	678	718	635	1450	790	541	491	836	713	1800	1240	659	533	553	432	570	705	769
potassium	20	mg/kg	26200	4400	3840	5380	7610	7960	7360	3450	7320	8640	4820	4530	6270	5200	7560	6310	8500	4230	5860	3760	6190	7520	7250
potassium	4.0	mg/kg wwt	6160	1900	1600	2240	3150	3710	3410	1420	2850	3200	1770	1640	2510	1990	2960	2360	3610	1580	2200	1460	2440	2810	2820
rubidium	0.050	mg/kg	23.8	2.58	2.94	5.39	5.33	5.98	7.42	7.76	3.16	6.12	4.14	3.94	3.37	2.82	2.75	3.38	6.28	3.54	8.69	3.28	4.84	5.82	4.95
rubidium	0.010	mg/kg wwt	5.61	1.11	1.23	2.24	2.21	2.78	3.44	3.19	1.23	2.27	1.52	1.42	1.35	1.08	1.08	1.26	2.66	1.33	3.27	1.28	1.91	2.17	1.93
selenium	0.050	mg/kg	0.228	<0.050	<0.050	0.112	0.184	<0.050	<0.050	<0.050	0.208	0.362	<0.050	<0.050	0.133	0.073	<0.050	0.053	0.235	0.311	0.273	0.063	0.098	0.816	0.395
selenium	0.010	mg/kg wwt	0.054	0.015	0.014	0.046	0.076	0.022	0.022	0.013	0.081	0.134	<0.010	<0.010	0.053	0.028	0.016	0.02	0.1	0.116	0.103	0.024	0.039	0.305	0.154
silver	0.0050	mg/kg	0.0069	0.0305	0.0374	0.0055	0.0054	0.0097	0.0082	0.0247	<0.0050	0.0069	0.041	0.0479	0.0237	0.0148	0.007	0.0062	0.0058	0.027	0.0071	0.0086	0.0062	<0.0050	0.0052
silver	0.0010	mg/kg wwt	0.0016	0.0131	0.0156	0.0023	0.0022	0.0045	0.0038	0.0102	0.0013	0.0025	0.015	0.0173	0.0095	0.0057	0.0028	0.0023	0.0024	0.0101	0.0027	0.0034	0.0025	0.0014	0.002
sodium	20	mg/kg	107	21	<20	40	<20	<20	<20	<20	56	33	32	27	45	49	168	64	52	35	22	36	24	<20	36
sodium	4.0	mg/kg wwt	25.2	9	4.5	16.5	5.8	8.7	7.9	4.4	21.6	12.3	11.6	9.9	18.2	18.7	65.8	23.8	22.1	13.2	8.3	14.1	9.3	7.1	14.2
strontium	0.050	mg/kg	335	24.4	18.6	324	347	44.5	38	34.2	141	616	8.79	8.13	360	235	92.1	138	434	35.6	159	49.4	121	469	114
strontium	0.010	mg/kg wwt	78.6	10.5	7.78	135	144	20.7	17.6	14.1	55	228	3.22	2.93	145	89.9	36.1	51.6	184	13.4	59.7	19.2	47.9	175	44.4
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0068	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0042	<0.0040	<0.0040	<0.0040	<0.0040	0.0041	<0.0040
thallium	0.0020	mg/kg	<0.0020	0.0031	<0.0020	<0.0020	<0.0020	0.0093	0.0078	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.004	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	<0.0020	0.0037	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	0.00133	0.00048	<0.00040	<0.00040	0.00432	0.0036	<0.00040	<0.00040	<0.00040	0.00049	<0.00040	0.00163	0.00082	0.00054	0.00055	<0.00040	0.00042	0.00099	<0.00040	0.00146	<0.00040	<0.00040
tin	0.10	mg/kg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.22	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	0.086	<0.020	0.031	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0058	0.0031	0.0023	<0.0020	<0.0020	<0.0020	0.0021	<0.0020	0.0039	<0.0020	0.0033	0.0027	0.0053	0.0026	0.0152	0.0111	<0.0020	<0.0020	0.0032	<0.0020	<0.0020	<0.0020	0.0029
uranium	0.00040	mg/kg wwt	0.00137	0.00133	0.00096	0.00054	<0.00040	0.0008	0.00096	0.00075	0.00152	0.0005	0.0012	0.00099	0.00211	0.001	0.00594	0.00414	0.0006	0.0005	0.00119	0.00059	0.00058	0.00044	0.00113
vanadium	0.10	mg/kg	0.49	0.34	0.24	0.15	0.12	0.3	0.31	0.14	0.56	0.15	0.56	0.42	0.73	0.31	2.91	1.99	0.1	0.14	0.28	0.22	0.15	<0.10	0.47
vanadium	0.020	mg/kg wwt	0.114	0.148	0.101	0.061	0.048	0.142	0.146	0.056	0.218	0.056	0.205	0.153	0.293	0.118	1.14	0.745	0.045	0.052	0.107	0.085	0.058	0.021	0.182
zinc	0.50	mg/kg	18.1	66.2	52.7	72.5	96.1	23.4	21	40.4	11.6	69.4	60.2	49.7	261	129	23.3	21.9	143	44.9	18.9	44.4	20.6	82.1	202
zinc	0.10	mg/kg wwt	4.26	28.6	22	30.2	39.8	10.9	9.75	16.6	4.52	25.7	22	17.9	105	49.3	9.13	8.2	60.7	16.8	7.12	17.3	8.13	30.7	78.7
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.05	<0.040	0.069	<0.040	0.043	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-3:
Leaf Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-A4-L-02	22-A5-L-01
Date Sampled			16-Sep-2022	16-Sep-2022
Time Sampled			08:15	09:00
ALS Sample ID	Lowest Detection Limit	Units	VA22C2369-108	VA22C2369-112
QAQC				
Analyte			Tissue	Tissue
Physical Tests				
moisture	0.50	%	61.3	64.6
Metals				
aluminum	2.0	mg/kg	19.8	48.3
aluminum	0.40	mg/kg wwt	7.65	17.1
antimony	0.010	mg/kg	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	0.0022
arsenic	0.020	mg/kg	0.054	0.036
arsenic	0.0040	mg/kg wwt	0.0207	0.0127
barium	0.050	mg/kg	25.8	1.93
barium	0.010	mg/kg wwt	9.97	0.681
beryllium	0.010	mg/kg	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020
boron	1.0	mg/kg	37.9	9.6
boron	0.20	mg/kg wwt	14.7	3.38
cadmium	0.0050	mg/kg	0.59	0.0777
cadmium	0.0010	mg/kg wwt	0.228	0.0275
calcium	20	mg/kg	23300	2810
calcium	4.0	mg/kg wwt	9020	993
cesium	0.0050	mg/kg	0.0516	0.0353
cesium	0.0010	mg/kg wwt	0.02	0.0125
chromium	0.050	mg/kg	<0.050	0.074
chromium	0.010	mg/kg wwt	0.018	0.026
cobalt	0.020	mg/kg	0.361	0.101
cobalt	0.0040	mg/kg wwt	0.139	0.0356
copper	0.10	mg/kg	8.18	6.37
copper	0.020	mg/kg wwt	3.16	2.25
iron	3.0	mg/kg	65.7	100
iron	0.60	mg/kg wwt	25.4	35.4
lead	0.020	mg/kg	0.043	0.033
lead	0.0040	mg/kg wwt	0.0166	0.0116
lithium	0.50	mg/kg	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10
magnesium	2.0	mg/kg	2260	867
magnesium	0.40	mg/kg wwt	874	307
manganese	0.050	mg/kg	59.8	76.1
manganese	0.010	mg/kg wwt	23.1	26.9
mercury	0.0050	mg/kg	0.0077	<0.0050
mercury	0.0010	mg/kg wwt	0.003	0.0012
molybdenum	0.020	mg/kg	1.8	4.01
molybdenum	0.0040	mg/kg wwt	0.698	1.42
nickel	0.20	mg/kg	0.25	0.66
nickel	0.040	mg/kg wwt	0.098	0.235
phosphorus	10	mg/kg	2730	1090
phosphorus	2.0	mg/kg wwt	1060	387
potassium	20	mg/kg	8060	4500
potassium	4.0	mg/kg wwt	3120	1590
rubidium	0.050	mg/kg	5.18	4.36
rubidium	0.010	mg/kg wwt	2	1.54
selenium	0.050	mg/kg	1.29	0.062
selenium	0.010	mg/kg wwt	0.497	0.022
silver	0.0050	mg/kg	0.0056	0.0149
silver	0.0010	mg/kg wwt	0.0022	0.0053
sodium	20	mg/kg	41	<20
sodium	4.0	mg/kg wwt	15.8	6.1
strontium	0.050	mg/kg	119	5.06
strontium	0.010	mg/kg wwt	46	1.79
tellurium	0.020	mg/kg	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040
tin	0.10	mg/kg	0.1	<0.10
tin	0.020	mg/kg wwt	0.039	<0.020
uranium	0.0020	mg/kg	<0.0020	0.0021
uranium	0.00040	mg/kg wwt	0.0005	0.00074
vanadium	0.10	mg/kg	0.1	0.29
vanadium	0.020	mg/kg wwt	0.04	0.104
zinc	0.50	mg/kg	149	64.2
zinc	0.10	mg/kg wwt	57.7	22.7
zirconium	0.20	mg/kg	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-4:
Forb Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R1-F-01	22-R2-F-01	22-R3-F-01	22-R3-F-01D	22-R4-F-03	22-R5-F-01	22-R5-F-02	22-R6-F-01	22-R6-F-02	22-S1-F-01	22-S2-F-01	22-S3-F-01	22-S4-F-01	22-S5-F-01	22-S6-F-01	22-S8-F-01	22-S10-F-01	22-S11-F-01	22-S12-F-01	22-S13-F-01	22-S13-F-01D	22-S14-F-01	22-S15-F-01	22-S15-F-01D	22-S16-F-01	22-S17-F-01	22-A4-F-01	22-A5-F-01
Date Sampled			14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	16-Sep-2022	16-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	15-Sep-2022	15-Sep-2022	15-Sep-2022	13-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	14-Sep-2022	14-Sep-2022	16-Sep-2022	16-Sep-2022
Time Sampled			11:00	08:50	10:00	10:00	13:45	14:45	14:45	15:40	15:40	12:30	11:30	15:30	10:00	09:10	08:10	14:15	11:00	12:40	13:10	14:40	14:40	14:00	10:00	10:00	17:00	16:15	08:15	08:00
ALS Sample ID			VA22C2369-030	VA22C2369-017	VA22C2369-026	VA22C2369-027	VA22C2369-096	VA22C2369-100	VA22C2369-101	VA22C2369-102	VA22C2369-103	VA22C2369-091	VA22C2369-086	VA22C2369-014	VA22C2369-080	VA22C2369-076	VA22C2369-060	VA22C2369-010	VA22C2369-131	VA22C2369-036	VA22C2369-040	VA22C2369-050	VA22C2369-065	VA22C2369-042	VA22C2369-121	VA22C2369-126	VA22C2369-056	VA22C2369-071	VA22C2369-110	VA22C2369-116
QAQC					FDA	FD																FDA	FD		FDA	FD				
Analyte	Lowest Detection Limit	Units	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue	Tissue
Physical Tests																														
moisture	0.50	%	73.2	83.9	66.9	66.9	83.7	70	74.9	73	86.9	71.7	60.9	70.2	72	67.7	70.2	81	80.5	72	59.8	70.3	69.2	69	77.3	77.1	69.9	69	76.7	80.5
Metals																														
aluminum	2.0	mg/kg	482	147	124	176	249	86.3	62.2	376	176	134	79.2	150	42	73	33.6	51.3	26.6	33.1	35.8	101	71.7	33.3	58.4	36.1	61.7	32	73.7	40.4
aluminum	0.40	mg/kg wwt	129	23.7	41.2	58.3	40.6	25.9	15.6	102	23	37.8	31	44.6	11.8	23.6	10	9.76	5.18	9.26	14.4	30	22	10.3	13.2	8.27	18.6	9.93	17.2	7.89
antimony	0.010	mg/kg	0.01	<0.010	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	0.0027	<0.0020	<0.0020	<0.0020	0.002	0.0026	<0.0020	0.0024	<0.0020	0.0028	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.0022	<0.0020
arsenic	0.020	mg/kg	0.093	0.115	0.053	0.038	0.151	0.069	0.041	0.095	0.144	0.102	0.083	0.149	0.052	0.056	0.034	0.066	0.031	0.037	0.026	0.076	0.057	0.033	0.056	0.046	0.054	0.032	0.081	0.034
arsenic	0.0040	mg/kg wwt	0.0248	0.0185	0.0174	0.0125	0.0246	0.0208	0.0102	0.0257	0.0188	0.0289	0.0326	0.0444	0.0146	0.0182	0.0101	0.0125	0.006	0.0104	0.0104	0.0225	0.0176	0.0102	0.0128	0.0105	0.0162	0.0098	0.0188	0.0066
barium	0.050	mg/kg	102	16.6	97.6	166	37.6	124	14.3	161	408	4.42	4.25	11.5	23.4	29.7	24.5	5.04	20.1	9.61	16.9	11.1	12.8	13	22.5	29.1	12.3	9.72	33.1	6.02
barium	0.010	mg/kg wwt	27.2	2.67	32.2	54.8	6.12	37.1	3.59	43.4	53.3	1.25	1.66	3.43	6.56	9.61	7.32	0.959	3.92	2.69	6.81	3.3	3.95	4.04	5.1	6.65	3.7	3.02	7.73	1.18
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	0.002	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	54.9	13.7	11.2	11.7	25.8	37.4	34.9	38.1	21.7	21.9	11.8	36.7	19.6	14.5	13.3	33.2	20.9	16.4	13.5	18.5	15.5	14	26.8	31.5	19.8	20.8	13.6	18.5
boron	0.20	mg/kg wwt	14.7	2.21	3.7	3.88	4.21	11.2	8.76	10.3	2.83	6.2	4.64	10.9	5.48	4.68	3.98	6.31	4.08	4.59	5.45	5.48	4.76	4.36	6.09	7.21	5.95	6.44	3.17	3.62
cadmium	0.0050	mg/kg	0.0636	0.0605	0.0488	0.0819	0.944	2.29	0.866	0.0385	0.797	0.232	0.572	0.16	<0.0125	<0.0100	0.0122	0.458	<0.0050	<0.0200	<0.0100	<0.0150	<0.0225	<0.0200	0.0198	0.0162	<0.0150	<0.0200	0.0186	0.102
cadmium	0.0010	mg/kg wwt	0.017	0.0097	0.0161	0.0271	0.154	0.686	0.217	0.0104	0.104	0.0655	0.224	0.0476	<0.0035	<0.0030	0.0036	0.0872	<0.0010	<0.0050	<0.0030	<0.0050	<0.0065	<0.0060	0.0045	0.0037	<0.0040	<0.0060	0.0043	0.02
calcium	20	mg/kg	28100	5790	5480	8320	17600	13100	7260	27600	21600	7120	8430	14800	25400	21900	18000	8940	15400	18900	30000	15600	11900	13700	17700	21200	19800	15600	19800	11900
calcium	4.0	mg/kg wwt	7530	932	1810	2750	2860	3930	1820	7450	2830	2010	3300	4410	7110	7100	5370	1700	3000	5290	12000	4640	3660	4270	4010	4860	5950	4830	4630	2330
cesium	0.0050	mg/kg	0.0285	0.041	0.0863	0.0655	0.0872	0.0837	0.033	0.164	0.0747	0.693	0.529	0.208	0.822	0.278	0.554	0.53	0.153	1.01	0.24	0.55	0.331	1.39	0.519	0.475	0.618	1.04	1.69	0.251
cesium	0.0010	mg/kg wwt	0.0076	0.0066	0.0285	0.0217	0.0142	0.0251	0.0083	0.0443	0.0098	0.196	0.207	0.062	0.23	0.0898	0.165	0.101	0.0299	0.283	0.0967	0.163	0.102	0.432	0.118	0.109	0.186	0.323	0.394	0.0491
chromium	0.050	mg/kg	0.37	0.235	0.113	0.115	0.782	0.198	0.145	0.267	0.328	0.252	0.114	0.158	0.118	0.092	0.13	0.139	0.07	0.134	0.13	0.385	1.51	0.179	0.136	0.086	0.228	0.077	0.12	0.125
chromium	0.010	mg/kg wwt	0.099	0.038	0.037	0.038	0.127	0.059	0.036	0.072	0.043	0.071	0.044	0.047	0.033	0.03	0.039	0.026	0.014	0.037	0.052	0.114	0.464	0.056	0.031	0.02	0.068	0.024	0.028	0.024
cobalt	0.020	mg/kg	0.094	0.124	0.09	0.308	0.398	0.202	0.077	0.104	0.126	0.141	0.077	0.164	0.226	0.257	0.153	0.083	0.18	0.416	0.236	0.585	0.367	0.34	0.188	0.161	0.257	0.298	0.456	0.06
cobalt	0.0040	mg/kg wwt	0.0252	0.0199	0.0297	0.102	0.0648	0.0605	0.0193	0.0281	0.0165	0.0398	0.03	0.0489	0.0633	0.0831	0.0455	0.0157	0.0351	0.116	0.0951	0.173	0.113	0.105	0.0428	0.0368	0.0773	0.0924	0.106	0.0118
copper	0.10	mg/kg	7.68	12.9	4.61	4.86	21.4	12.4	20.8	8.15	10.9	18.1	12.2	23.2	17.7	21.3	12.8	18	17.4	15	13.4	14.1	13.1	10.6	18.8	17.2	16.1	12	17.1	20.6
copper	0.020	mg/kg wwt	2.06	2.07	1.52	1.61	3.48	3.73	5.23	2.2	1.43	5.12	4.78	6.89	4.95	6.9	3.81	3.43	3.39	4.19	5.37	4.19	4.04	3.29	4.27	3.95	4.84	3.73	3.99	4.03
iron	3.0	mg/kg	219	315	56.9	69.3	361	166	147	266	329	207	138	196	114	146	108	129	112	118	117	248	180	106	170	129	143	106	214	124
iron	0.60	mg/kg wwt	58.7	50.7	18.8	22.9	58.8	49.7	36.8	71.9	43	58.4	54	58.5	32	47.2	32.2	24.6	21.8	32.9	46.9	73.6	55.3	32.8	38.6	29.6	43.1	32.8	49.9	24.3
lead	0.020	mg/kg	0.076	0.096	0.023	0.029	0.102	0.05	0.031	0.118	0.099	0.046	0.025	0.067	0.029	0.032	0.024	0.032	0.064	0.022	0.02	0.046	0.039	0.023	0.092	0.051	0.039	0.024	0.061	0.089
lead	0.0040	mg/kg wwt	0.0203	0.0155	0.0076	0.0096	0.0166	0.0152	0.0078	0.0318	0.0129	0.013	0.0099	0.02	0.0081	0.0103	0.0073	0.0061	0.0126	0.0063	0.0082	0.0136	0.0119	0.0071	0.0209	0.0117	0.0116	0.0074	0.0142	0.0174
lithium	0.50	mg/kg	0.56	0.58	<0.50	<0.50	0.61	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.52	<0.50	<0.50	0.6	<0.50	<0.50	<0.50	<0.50	0.71	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	0.96
lithium	0.10	mg/kg wwt	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.15	<0.10	<0.10	0.11	<0.10	<0.10	<0.10	0.11	0.22	<0.10	<0.10	<0.10	<0.10	0.13	<0.10	0.19
magnesium	2.0	mg/kg	5850	1410	1890	2580	3740	1740	1770	4830	2340	2590	2740	2400	3590	4050	2710	3000	2840	4240	5600	3780	2930	2860	3280	4030	2990	4320	2410	2800
magnesium	0.40	mg/kg wwt	1570	226	626	852	609	524	443	1310	306	731	1070	714	1000	1310	809	570	554	1180	2250	1120	900	886	745	922	901	1340	562	547
manganese	0.050	mg/kg	105	42.3	67.8	96.4	126	159	72.3	94.5	131	64.3	49.8	106	102	56	70.1	57	43.8	105	75.7	96.6	63.4	72.5	60.7	76.2	62.5	99.3	164	26.4
manganese	0.010	mg/kg wwt	28	6.81	22.4	31.9	20.5	47.7	18.1	25.5	17.1	18.2	19.5	31.5	28.5	18.1	20.9	10.8	8.54	29.3	30.4	28.6	19.5	22.5	13.8	17.4	18.8	30.8	38.2	5.15
mercury	0.0050	mg/kg	0.01	0.0253	0.0175	0.0233	0.0252	0.0053	<0.0050	0.0121	0.0226	<0.0050	<0.0050	0.0069	0.0056	0.0071	0.0056	<0.0050	0.0051	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0053	0.0054	0.006	0.0059	<0.0050
mercury	0.0010	mg/kg wwt	0.0027	0.0041	0.0058	0.0077	0.0041	0.0016	0.0012	0.0033	0.0029	<0.0010	<0.0012	0.002	0.0016	0.0023	0.0017	<0.0010	<0.0010	<0.0012	0.0025	0.0012	<0.0022	<0.0012	0.001	0.0012	0.0058	<0.0022	0.0018	0.0014	<0.0010
molybdenum	0.020	mg/kg	0.25	0.234	0.119	0.094	1.95	2.26	3.46	1.1	0.428	4.15	1.23	1.97	15.9	10.5	4.4	4.9	1.43	36.5	12.7	38	37.3	31.5	7.99	8.42	20.1	27.4	10.6	1.63
molybdenum	0.0040	mg/kg wwt	0.0671	0.0377	0.0393	0.0312	0.317	0.678	0.866	0.296	0.0559	1.17	0.482	0.586	4.45	3.4	1.31	0.932	0.279	10.2	5.11	11.3	11.5	9.76	1.81	1.93	6.05	8.5	2.47	0.319
nickel	0.20	mg/kg	0.44	0.33	0.52	0.83	0.49	1.42	1.94	0.34	1.4	0.32	0.72	0.86	0.35	0.33	0.76	0.54	0.42	0.35	0.22	0.74	0.58	0.54	1.07	1.42	0.26	0.69	0.46	0.48
nickel	0.040	mg/kg wwt	0.117	0.054	0.171	0.275	0.098	0.427	0.486	0.091	0.183	0.091	0.282	0.255	0.098	0.107	0.082	0.104	0.082	0.098	0.089	0.22	0.18	0.167	0.243	0.226	0.077	0.215	0.107	0.094
phosphorus	10	mg/kg	4050	3040	1920	2380	5700	3530	3720	2980	4620	5950	4050	5840	2050	2300	1500	6300	2730	2260	2280	2830	3380	2100	1940	2090	1290	1830	2930	6000
phosphorus	2.0	mg/kg wwt	1090	489	636	786	927	1060	933	804	604	1680	1580	1740	575	744	448	1200	533	632	919	838	1040	651	439	479	388	568	683	1170
potassium	20	mg/kg	13600	12800	14200	14900	37700	22600	29800	13400	35300	27800	17600	24200	18900	13000	17300	51600	27700	18100	11000	23100	24800	16800	20200	23600	18600	15600	17900	21900
potassium	4.0	mg/kg wwt	3640	2070	4700	4920	6140	6780	7470	3610	4610	7850	6890	7210	5300	4210	5170	9810	5410	5060	4430	6860	7620	5220	4580	5400	5610	4850	4180	4270
rubidium	0.050	mg/kg	8.73	10.6	16.6	15	33.1	18.5	12.2	13.3	28.8	33.4	17	20.9	24.9	15.3	22.7	47.4	17.2	32.4	22.7	38.7	36.3	25.6	20	20.8	24.8	27.1	31.3	24.5
rubidium	0.010	mg/kg wwt	2.34	1.71	5.49	4.98	5.39	5.56	3.06	3.6	3.76	9.45	6.64	6.21	6.96	4.95	6.78	9.03	3.36	9.07	5.58	11.5	11.2	7.95	4.54	4.77	7.47	8.4	7.3	4.79
selenium	0.050	mg/kg	<0.050	<0.050	<0.050	0.075	<0.050	<0.050	<0.050	<0.050	<0.050	0.275	0.183	0.261	1.1	0.576	0.071	10.3	<0.050	0.345	<0.050	0.105	0.099	0.166	<0.050	<0.050	0.181	0.124	0.881	0.367
selenium	0.010	mg/kg wwt	<0.010	<0.010	0.012	0.025	<0.010	<0.010	<0.010	<0.010	<0.010	0.078	0.072	0.078	0.307	0.186	0.021	1.96	<0.010	0.097	0.019	0.031	0.03	0.051	<0.010	<0.010	0.054	0.039	0.206	0.072
silver	0.0050	mg/kg	0.0779	0.0078	<0.0050	0.005	0.0286	<0.0050	<0.0050	<0.0050	0.017	<0.0050	<0.0050	<0.0050	<0.0050	0.0104	0.0084	<0.0050	0.0119	<0.0050	0.0062	<0.0050	<0.0050	<0.0050	0.0154	0.0125	0.0096	<0.0050	<0.0050	0.0074
silver	0.0010	mg/kg wwt	0.0209	0.0013	0.0013	0.0016	0.0046	<0.0010	<0.0010	0.0011	0.0022	<0.0010	<0.0010	0.0012	0.0011	0.0034	0.0025	<0.0010	0.0023	0.0011	0.0025	<0.0010	<0.0010	<0.0010	0.0035	0.0029	0.0029	<0.0010	<0.0010	0.0014
sodium	20	mg/kg	161	164	27	32	212	77	94	52	133	73	55	61	170	72	36	176	133	50	40	116	105	121	115	52	79	119	57	332
sodium	4.0	mg/kg wwt	43.1	26.4	8.9	10.4	34.5	23.1	23.7	14	17.4	20.8	21.4	18.2	47.7	23.5	10.8	33.5	25.9	14	16.1	34.4	32.3	37.6	26.1	11.8	23.9	37	13.2	64.9
strontium	0.050	mg/kg	199	24.4	32.3	61.6	59.6	50.3	14.4	218	188	16.3	26.9	38.1	73.8	84.1	71.3	18.2	56.5	469	206	330	290	404	247	233	557	409	118	35.6
strontium	0.010	mg/kg wwt	53.4	3.94	10.7	20.4	9.7	15.1	3.61	58.9	24.6	4.6	10.5	11.3	20.7	27.2	21.3	3.47	11	131	83	98	89.3	125	56.1	53.3	168	127	27.5	6.96
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	0.0046	<0.0040	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	0.0056	0.0058	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0033	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0152
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040	0.00187	0.00193	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00064	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00063	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	<0.00040	0.00298
tin	0.10	mg/kg	0.62	0.21	<0.10	<0.10	<0.10	<0.10	<0.10	0.26	0.36	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
tin	0.020	mg/kg wwt	0.166	0.034	<0.020	<0.020	<0.020	<0.020	<0.020	0.07	0.047	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
uranium	0.0020	mg/kg	0.0044	0.0057	<0.0020	<0.0020	0.0058	0.0028	0.0024	0.0048	0.0063	0.003	<0.0020	0.0033	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0021	<0.0020	0.0029	<0.0020	0.0032	<0.0020	0.0025	<0.0020
uranium	0.00040	mg/kg wwt	0.00119	0.00092	<0.00040	0.0004	0.00094	0.00083	0.00059	0.00131	0.00082	0.00086	0.00071	0.00098	0.00043	0.00077	<0.00040	<0.00040	<0.00040	0.00042	0.00074	0.001	0.00066	0.00046	0.00066	<0.00040	0.00096	0.00044	0.00059	<0.00040
vanadium	0.10	mg/kg	0.68	1.01	0.14	0.17	1.2	0.45	0.37	0.9	1.07	0.53	0.33	0.59	0.21	0.33	0.22	0.27	0.17	0.17	0.13	0.52	0.36	0.18	0.44	0.24	0.32	0.18	0.39	0.23
vanadium	0.020	mg/kg wwt	0.183	0.163	0.047	0.057	0.196	0.134	0.093	0.244	0.14	0.149	0.131	0.175	0.059	0.106	0.065	0.052	0.033	0.047	0.051	0.154	0.111	0.056	0.099	0.055	0.096	0.057	0.091	0.044
zinc	0.50	mg/kg	21.3	32.6	17.4	34.6	56.2	72.4	44.3	17.5	13	59.3	52	57.4	30.9	28.1	26.6	61.2	29.5	27.2	24.2	35.6	34.8	26.6	31.6	35.6	18.9	37	54.5	80.1
zinc	0.10	mg/kg wwt	5.72	5.25	5.74	11.4	9.16	21.7	11.1	4.74	1.7	16.8	20.3	17.1	8.65	9.09	7.94	11.6	5.76	7.6	9.72	10.6	10.7	8.26	7.17	8.16	5.68	11.5	12.7	15.6
zirconium	0.20	mg/kg	<0.70	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.170	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	0.057	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040	<0.040

Notes:

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-5:
Berry Tissue Analytical Results
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R6-B-01	22-S4-B-01	22-S5-B-01
Date Sampled			16-Sep-2022	15-Sep-2022	15-Sep-2022
Time Sampled	Lowest Detection Limit	Units	15:40	10:00	09:10
ALS Sample ID			VA22C2369-106	VA22C2369-081	VA22C2369-073
QAQC					
Analyte			Tissue	Tissue	Tissue
Physical Tests					
moisture	0.50	%	60.5	27.6	61.1
Metals					
aluminum	2.0	mg/kg	28.8	81.6	95.9
aluminum	0.40	mg/kg wwt	11.4	59.1	37.3
antimony	0.010	mg/kg	<0.010	<0.010	<0.010
antimony	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020
arsenic	0.020	mg/kg	0.047	0.071	0.079
arsenic	0.0040	mg/kg wwt	0.0186	0.0516	0.0308
barium	0.050	mg/kg	80.2	9.45	9.23
barium	0.010	mg/kg wwt	31.7	6.84	3.59
beryllium	0.010	mg/kg	<0.010	<0.010	<0.010
beryllium	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020
bismuth	0.010	mg/kg	<0.010	<0.010	<0.010
bismuth	0.0020	mg/kg wwt	<0.0020	<0.0020	<0.0020
boron	1.0	mg/kg	7	26	23.2
boron	0.20	mg/kg wwt	2.76	18.8	9
cadmium	0.0050	mg/kg	0.466	0.019	0.018
cadmium	0.0010	mg/kg wwt	0.184	0.0137	0.007
calcium	20	mg/kg	2030	7050	7660
calcium	4.0	mg/kg wwt	802	5110	2980
cesium	0.0050	mg/kg	0.0187	0.0881	0.111
cesium	0.0010	mg/kg wwt	0.0074	0.0638	0.0433
chromium	0.050	mg/kg	0.051	0.105	0.097
chromium	0.010	mg/kg wwt	0.02	0.076	0.038
cobalt	0.020	mg/kg	0.023	0.087	0.116
cobalt	0.0040	mg/kg wwt	0.0091	0.063	0.0452
copper	0.10	mg/kg	2.99	8.87	9.59
copper	0.020	mg/kg wwt	1.18	6.42	3.73
iron	3.0	mg/kg	51.8	130	154
iron	0.60	mg/kg wwt	20.4	94.1	60
lead	0.020	mg/kg	<0.020	0.027	0.03
lead	0.0040	mg/kg wwt	<0.0040	0.0196	0.0118
lithium	0.50	mg/kg	<0.50	<0.50	<0.50
lithium	0.10	mg/kg wwt	<0.10	<0.10	<0.10
magnesium	2.0	mg/kg	500	2250	2410
magnesium	0.40	mg/kg wwt	198	1630	938
manganese	0.050	mg/kg	12.2	26.8	41.6
manganese	0.010	mg/kg wwt	4.84	19.4	16.2
mercury	0.0050	mg/kg	0.0065	<0.0050	<0.0050
mercury	0.0010	mg/kg wwt	0.0026	0.0023	0.0013
molybdenum	0.020	mg/kg	0.678	1.45	1.72
molybdenum	0.0040	mg/kg wwt	0.268	1.05	0.668
nickel	0.20	mg/kg	0.54	0.5	0.43
nickel	0.040	mg/kg wwt	0.212	0.362	0.167
phosphorus	10	mg/kg	1940	3040	3270
phosphorus	2.0	mg/kg wwt	764	2200	1270
potassium	20	mg/kg	11900	8130	12300
potassium	4.0	mg/kg wwt	4700	5890	4790
rubidium	0.050	mg/kg	15.4	10.6	12.6
rubidium	0.010	mg/kg wwt	6.09	7.65	4.88
selenium	0.050	mg/kg	<0.050	0.326	0.273
selenium	0.010	mg/kg wwt	<0.010	0.236	0.106
silver	0.0050	mg/kg	0.0239	<0.0050	<0.0050
silver	0.0010	mg/kg wwt	0.0094	0.002	0.0011
sodium	20	mg/kg	<20	26	22
sodium	4.0	mg/kg wwt	6.5	18.6	8.7
strontium	0.050	mg/kg	20.5	26.9	30.4
strontium	0.010	mg/kg wwt	8.1	19.5	11.8
tellurium	0.020	mg/kg	<0.020	<0.020	<0.020
tellurium	0.0040	mg/kg wwt	<0.0040	<0.0040	<0.0040
thallium	0.0020	mg/kg	<0.0020	<0.0020	<0.0020
thallium	0.00040	mg/kg wwt	<0.00040	<0.00040	<0.00040
tin	0.10	mg/kg	1.5	0.54	1.17
tin	0.020	mg/kg wwt	0.592	0.392	0.456
uranium	0.0020	mg/kg	<0.0020	0.0021	0.0023
uranium	0.00040	mg/kg wwt	<0.00040	0.00155	0.0009
vanadium	0.10	mg/kg	0.14	0.34	0.41
vanadium	0.020	mg/kg wwt	0.057	0.243	0.158
zinc	0.50	mg/kg	5.95	24.2	22.6
zinc	0.10	mg/kg wwt	2.35	17.5	8.8
zirconium	0.20	mg/kg	<0.20	<0.20	<0.20
zirconium	0.040	mg/kg wwt	<0.040	0.045	<0.040

Notes:
FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-6:
Vegetation Tissue Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-R3-L-01	22-R3-L-01D				22-R3-L-02	22-R3-L-02D				22-R3-L-03	22-R3-L-03D				22-R3-F-01	22-R3-F-01D				22-S13-L-01	22-S13-L-01D				22-S13-L-02	22-S13-L-02D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022			
Time Sampled	Lowest Detection Limit	Units	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor
ALS Sample ID			VA22C2369-020	VA22C2369-021				VA22C2369-022	VA22C2369-023				VA22C2369-024	VA22C2369-025				VA22C2369-026	VA22C2369-027				VA22C2369-047	VA22C2369-062				VA22C2369-048	VA22C2369-063			
QAQC			FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD			
Analyte			Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue			
Physical Tests																																
moisture	0.5	%	60.7	59	59.85	3	NC	62.5	63.9	63.2	2	NC	65.7	63.3	64.5	4	NC	66.9	66.9	66.9	0	NC	56.9	58.2	57.55	2	NC	58.4	58.6	58.5	0	NC
Metals																																
aluminum	2	mg/kg	146	198	172	30	NC	65.8	48.4	57.1	30	NC	510	372	441	31	NC	124	176	150	35	NC	77.3	45.8	61.55	**51**	NC	36.9	27.3	32.1	30	NC
aluminum	0.4	mg/kg wwt	57.2	81	69.1	34	NC	24.7	17.4	21.05	35	NC	175	136	155.5	25	NC	41.2	58.3	49.75	34	NC	33.4	19.1	26.25	**54**	NC	15.3	11.3	13.3	30	NC
antimony	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
antimony	0.002	mg/kg wwt	0.0027	<0.0020	0.00235	NC	0.35	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.0026	<0.0020	0.0023	NC	0.3	<0.0020	0.0036	0.0028	NC	0.8
arsenic	0.02	mg/kg	0.028	0.037	0.0325	NC	0.45	0.027	0.028	0.0275	NC	0.05	0.025	0.055	0.04	NC	1.5	0.053	0.038	0.0455	NC	0.75	0.038	0.032	0.035	NC	0.3	0.061	0.056	0.0585	NC	0.25
arsenic	0.004	mg/kg wwt	0.0109	0.0152	0.01305	NC	1.075	0.0101	0.0101	0.0101	NC	0	0.0085	0.0203	0.0144	**82**	NC	0.0174	0.0125	0.01495	NC	1.225	0.0163	0.0134	0.01485	NC	0.725	0.0253	0.0233	0.0243	8	NC
barium	0.05	mg/kg	84	93.4	88.7	11	NC	39.3	46.8	43.05	17	NC	1.43	3.76	2.595	**90**	NC	97.6	166	131.8	**52**	NC	2.41	1.85	2.13	26	NC	5.98	5.56	5.77	7	NC
barium	0.01	mg/kg wwt	33	38.3	35.65	15	NC	14.7	16.9	15.8	14	NC	0.491	1.38	0.9355	**95**	NC	32.2	54.8	43.5	**52**	NC	1.04	0.775	0.9075	29	NC	2.49	2.3	2.395	8	NC
beryllium	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
beryllium	0.002	mg/kg wwt	<0.0020	0.0022	0.0021	NC	0.1	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
bismuth	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
boron	1	mg/kg	14.7	11.3	13	26	NC	16.3	20.9	18.6	25	NC	22	21.2	21.6	4	NC	11.2	11.7	11.45	4	NC	8.6	7.9	8.25	8	NC	39.5	36.6	38.05	8	NC
boron	0.2	mg/kg wwt	5.78	4.64	5.21	22	NC	6.12	7.53	6.825	21	NC	7.54	7.81	7.675	4	NC	3.7	3.88	3.79	5	NC	3.71	3.29	3.5	12	NC	16.4	15.2	15.8	8	NC
cadmium	0.005	mg/kg	0.0991	0.0747	0.0869	28	NC	0.146	0.207	0.1765	35	NC	0.204	0.373	0.2885	**59**	NC	0.0488	0.0819	0.06535	**51**	NC	0.0821	0.0482	0.06515	**52**	NC	0.648	0.984	0.816	41	NC
cadmium	0.001	mg/kg wwt	0.0389	0.0306	0.03475	24	NC	0.0549	0.0747	0.0648	31	NC	0.07	0.137	0.1035	**65**	NC	0.0161	0.0271	0.0216	**51**	NC	0.0354	0.0202	0.0278	**55**	NC	0.27	0.408	0.339	41	NC
calcium	20	mg/kg	6750	7860	7305	15	NC	7250	7300	7275	1	NC	2980	3350	3165	12	NC	5480	8320	6900	41	NC	3000	2440	2720	21	NC	10300	11100	10700	7	NC
calcium	4	mg/kg wwt	2650	3220	2935	19	NC	2720	2630	2675	3	NC	1020	1230	1125	19	NC	1810	2750	2280	41	NC	1290	1020	1155	23	NC	4310	4580	4445	6	NC
cesium	0.005	mg/kg	0.102	0.0914	0.0967	11	NC	0.0233	0.0305	0.0269	27	NC	0.153	0.0727	0.11285	**71**	NC	0.0863	0.0655	0.0759	27	NC	0.0175	0.0193	0.0184	NC	0.36	0.046	0.0628	0.0544	31	NC
cesium	0.001	mg/kg wwt	0.0399	0.0374	0.03865	6	NC	0.0087	0.011	0.00985	23	NC	0.0525	0.0267	0.0396	**65**	NC	0.0285	0.0217	0.0251	27	NC	0.0075	0.008	0.00775	6	NC	0.0191	0.026	0.02255	31	NC
chromium	0.05	mg/kg	0.078	0.138	0.108	NC	1.2	0.111	0.081	0.096	NC	0.6	0.093	0.114	0.1035	NC	0.42	0.113	0.115	0.114	NC	0.04	0.339	0.109	0.224	**103**	NC	0.137	0.116	0.1265	NC	0.42
chromium	0.01	mg/kg wwt	0.03	0.057	0.0435	**62**	NC	0.042	0.029	0.0355	NC	1.3	0.032	0.042	0.037	NC	1	0.037	0.038	0.0375	NC	0.1	0.146	0.046	0.096	**104**	NC	0.057	0.048	0.0525	17	NC
cobalt	0.02	mg/kg	0.161	0.186	0.1735	14	NC	0.088	0.093	0.0905	NC	0.25	0.102	0.104	0.103	2	NC	0.09	0.308	0.199	**110**	NC	0.187	0.154	0.1705	19	NC	0.319	0.371	0.345	15	NC
cobalt	0.004	mg/kg wwt	0.0634	0.0762	0.0698	18	NC	0.0331	0.0334	0.03325	1	NC	0.0351	0.038	0.03655	8	NC	0.0297	0.102	0.06585	**110**	NC	0.0806	0.0645	0.07255	22	NC	0.133	0.154	0.1435	15	NC
copper	0.1	mg/kg	3.91	5.08	4.495	26	NC	4.43	4.92	4.675	10	NC	6.74	8.86	7.8	27	NC	4.61	4.86	4.735	5	NC	6	6.12	6.06	2	NC	6.53	5.64	6.085	15	NC
copper	0.02	mg/kg wwt	1.54	2.08	1.81	30	NC	1.66	1.78	1.72	7	NC	2.31	3.25	2.78	34	NC	1.52	1.61	1.565	6	NC	2.59	2.56	2.575	1	NC	2.72	2.34	2.53	15	NC
iron	3	mg/kg	80.2	119	99.6	39	NC	93.7	89	91.35	5	NC	84.3	152	118.15	**57**	NC	56.9	69.3	63.1	20	NC	112	97	104.5	14	NC	63.4	75.9	69.65	18	NC
iron	0.6	mg/kg wwt	31.5	48.6	40.05	43	NC	35.1	32.1	33.6	9	NC	28.9	55.8	42.35	**64**	NC	18.8	22.9	20.85	20	NC	48.5	40.6	44.55	18	NC	26.4	31.4	28.9	17	NC
lead	0.02	mg/kg	0.032	0.047	0.0395	NC	0.75	0.027	<0.020	0.0235	NC	0.35	0.02	0.054	0.037	NC	1.7	0.023	0.029	0.026	NC	0.3	0.027	0.025	0.026	NC	0.1	0.024	0.073	0.0485	NC	2.45
lead	0.004	mg/kg wwt	0.0125	0.0192	0.01585	NC	1.675	0.01	0.0072	0.0086	NC	0.7	0.0069	0.0197	0.0133	NC	3.2	0.0076	0.0096	0.0086	NC	0.5	0.0116	0.0105	0.01105	NC	0.275	0.01	0.0302	0.0201	**100**	NC
lithium	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
lithium	0.1	mg/kg wwt	0.19	0.15	0.17	NC	0.4	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
magnesium	2	mg/kg	1490	1660	1575	11	NC	1180	1380	1280	16	NC	1550	1300	1425	18	NC	1890	2580	2235	31	NC	1530	1300	1415	16	NC	3020	3180	3100	5	NC
magnesium	0.4	mg/kg wwt	586	680	633	15	NC	443	499	471	12	NC	532	479	505.5	10	NC	626	852	739	31	NC	662	544	603	20	NC	1260	1320	1290	5	NC
manganese	0.05	mg/kg	663	564	613.5	16	NC	236	292	264	21	NC	1310	1280	1295	2	NC	67.8	96.4	82.1	35	NC	76.6	68.4	72.5	11	NC	31.6	37.9	34.75	18	NC
manganese	0.01	mg/kg wwt	260	231	245.5	12	NC	88.5	105	96.75	17	NC	451	470	460.5	4	NC	22.4	31.9	27.15	35	NC	33	28.6	30.8	14	NC	13.1	15.7	14.4	18	NC
mercury	0.005	mg/kg	0.0111	0.0172	0.01415	NC	1.22	0.0123	0.0089	0.0106	NC	0.68	0.0078	0.0114	0.0096	NC	0.72	0.0175	0.0233	0.0204	NC	1.16	<0.0050	<0.0050	0.005	NC	0	<0.0050	<0.0050	0.005	NC	0
mercury	0.001	mg/kg wwt	0.0044	0.007	0.0057	46	NC	0.0046	0.0032	0.0039	NC	1.4	0.0027	0.0042	0.00345	NC	1.5	0.0058	0.0077	0.00675	28	NC	<0.0011	0.0014	0.00125	NC	0.3	0.0014	0.0012	0.0013	NC	0.2
molybdenum	0.02	mg/kg	0.077	0.098	0.0875	NC	1.05	1.04	1.16	1.1	11	NC	0.416	0.152	0.284	**93**	NC	0.119	0.094	0.1065	23	NC	1.63	2.35	1.99	36	NC	1.6	2.09	1.845	27	NC
molybdenum	0.004	mg/kg wwt	0.0303	0.0402	0.03525	28	NC	0.389	0.42	0.4045	8	NC	0.143	0.0557	0.09935	**88**	NC	0.0393	0.0312	0.03525	23	NC	0.704	0.984	0.844	33	NC	0.667	0.866	0.7665	26	NC
nickel	0.2	mg/kg	0.76	0.85	0.805	NC	0.45	2.92	3.8	3.36	26	NC	0.23	0.29	0.26	NC	0.3	0.52	0.83	0.675	NC	1.55	0.21	0.21	0.21	NC	0	<0.20	<0.20	0.2	NC	0
nickel	0.04	mg/kg wwt	0.3	0.348	0.324	15	NC	1.1	1.37	1.235	22	NC	0.078	0.105	0.0915	NC	0.675	0.171	0.275	0.223	47	NC	0.09	0.089	0.0895	NC	0.025	0.077	0.064	0.0705	NC	0.325
phosphorus	10	mg/kg	2070	1670	1870	21	NC	1550	1910	1730	21	NC	1880	1870	1875	1	NC	1920	2380	2150	21	NC	1100	973	1036.5	12	NC	1580	1640	1610	4	NC
phosphorus	2	mg/kg wwt	813	686	749.5	17	NC	582	688	635	17	NC	647	685	666	6	NC	636	786	711	21	NC	475	407	441	15	NC	656	679	667.5	3	NC
potassium	20	mg/kg	7020	5630	6325	22	NC	8830	11500	10165	26	NC	7460	7200	7330	4	NC	14200	14900	14550	5	NC	4400	3840	4120	14	NC	5380	7610	6495	34	NC
potassium	4	mg/kg wwt	2760	2300	2530	18	NC	3310	4160	3735	23	NC	2560	2640	2600	3	NC	4700	4920	4810	5	NC	1900	1600	1750	17	NC	2240	3150	2695	34	NC
rubidium	0.05	mg/kg	13.1	11.4	12.25	14	NC	6.14	9.02	7.58	38	NC	13.7	8.54	11.12	46	NC	16.6	15	15.8	10	NC	2.58	2.94	2.76	13	NC	5.39	5.33	5.36	1	NC
rubidium	0.01	mg/kg wwt	5.16	4.66	4.91	10	NC	2.3	3.25	2.775	34	NC	4.69	3.14	3.915	40	NC	5.49	4.98	5.235	10	NC	1.11	1.23	1.17	10	NC	2.24	2.21	2.225	1	NC
selenium	0.05	mg/kg	<0.050	<0.050	0.05	NC	0	<0.050	<0.050	0.05	NC	0	<0.050	<0.050	0.05	NC	0	<0.050	0.075	0.0625	NC	0.5	<0.050	<0.050	0.05	NC	0	0.112	0.184	0.148	NC	1.44
selenium	0.01	mg/kg wwt	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	0.012	0.025	0.0185	NC	1.3	0.015	0.014	0.0145	NC	0.1	0.046	0.076	0.061	49	NC
silver	0.005	mg/kg	0.0087	0.0087	0.0087	NC	0	<0.0050	0.0051	0.00505	NC	0.02	0.0076	0.0117	0.00965	NC	0.82	<0.0050	0.005	0.005	NC	0	0.0305	0.0374	0.03395	20	NC	0.0055	0.0054	0.00545	NC	0.02
silver	0.001	mg/kg wwt	0.0034	0.0036	0.0035	NC	0.2	0.0014	0.0018	0.0016	NC	0.4	0.0026	0.0043	0.00345	NC	1.7	0.0013	0.0016	0.00145	NC	0.3	0.0131	0.0156	0.01435	17	NC	0.0023	0.0022	0.00225	NC	0.1
sodium	20	mg/kg	76	62	69	NC	0.7	<20	<20	20	NC	0	30	42	36	NC	0.6	27	32	29.5	NC	0.25	21	<20	20.5	NC	0.05	40	<20	30	NC	1
sodium	4	mg/kg wwt	29.9	25.4	27.65	16	NC	6.6	7	6.8	NC	0.1	10.3	15.6	12.95	NC	1.325	8.9	10.4	9.65	NC	0.375	9	4.5	6.75	NC	1.125	16.5	5.8	11.15	NC	2.675
strontium	0.05	mg/kg	38	48.9	43.45	25	NC	61.8	64.8	63.3	5	NC	3.31	6.35	4.83	**63**	NC	32.3	61.6	46.95	**62**	NC	24.4	18.6	21.5	27	NC	324	347	335.5	7	NC
strontium	0.01	mg/kg wwt	14.9	20	17.45	29	NC	23.2	23.4	23.3	1	NC	1.14	2.33	1.735	**69**	NC	10.7	20.4	15.55	**62**	NC	10.5	7.78	9.14	30	NC	135	144	139.5	6	NC
tellurium	0.02	mg/kg	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0
thallium	0.002	mg/kg	0.0221	0.0271	0.0246	20	NC	<0.0020	<0.0020	0.002	NC	0	0.0021	0.0043	0.0032	NC	1.1	0.0056	0.0058	0.0057	NC	0.1	0.0031	<0.0020	0.00255	NC	0.55	<0.0020	<0.0020	0.002	NC	0
thallium	0.0004	mg/kg wwt	0.00868	0.0111	0.00989	24	NC	<0.00040	<0.00040	0.0004	NC	0	0.00074	0.00158	0.00116	NC	2.1	0.00187	0.00193	0.0019	NC	0.15	0.00133	0.00048	0.000905	NC	2.125	<0.00040	<0.00040	0.0004	NC	0
tin	0.1	mg/kg	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
tin	0.02	mg/kg wwt	<0.020	0.028	0.024	NC	0.4	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
uranium	0.002	mg/kg	<0.0020	0.0023	0.002215	NC	0.15	<0.0020	<0.0020	0.002	NC	0	<0.0020	0.0028	0.0024	NC	0.4	<0.0020	<0.0020	0.002	NC	0	0.0031	0.0023	0.0027	NC	0.4	<0.0020	<0.0020	0.002	NC	0
uranium	0.0004	mg/kg wwt	0.00064	0.00095	0.000795	NC	0.775	0.00064	0.00055	0.000595	NC	0.225	<0.00040	0.00101	0.000705	NC	1.525	<0.00040	0.0004	0.0004	NC	0	0.00133	0.00096	0.001145	NC	0.925	0.00054	<0.00040	0.00047	NC	0.35
vanadium	0.1	mg/kg	0.22	0.38	0.3	NC	1.6	0.34	0.26	0.3	NC	0.8	0.17	0.43	0.3	NC	2.6	0.14	0.17	0.155	NC	0.3	0.34	0.24	0.29	NC	1	0.15	0.12	0.135	NC	0.3
vanadium	0.02	mg/kg wwt	0.088	0.155	0.1215	**55**	NC	0.128	0.092	0.11	33	NC	0.058	0.159	0.1085	**93**	NC	0.047	0.057	0.052	NC	0.5	0.148	0.101	0.1245	38	NC	0.061	0.048	0.0545	NC	0.65
zinc	0.5	mg/kg	32.8	33.9	33.35	3	NC	15.5	16.8	16.15	8	NC	9.46	11.2	10.33	17	NC	17.4	34.6	26	**66**	NC	66.2	52.7	59.45	23	NC	72.5	96.1	84.3	28	NC
zinc	0.1	mg/kg wwt	12.9	13.9	13.4	7	NC	5.83	6.06	5.945	4	NC	3.24	4.11	3.675	24	NC	5.74	11.4	8.57	**66**	NC	28.6	22	25.3	26	NC	30.2	39.8	35	27	NC
zirconium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
zirconium	0.04	mg/kg wwt	0.059	<0.040	0.0495	NC	0.475	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0

Notes:
Value = RPD is greater than 50%

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-6:
Vegetation Tissue Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S13-L-03	22-S13-L-03D				22-S13-F-01	22-S13-F-01D				22-S13-G-01	22-S13-G-01D				22-S15-L-01	22-S15-L-01D				22-S15-L-02	22-S15-L-02D				22-S15-L-03	22-S15-L-03D			
Date Sampled			14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				14-Sep-2022	14-Sep-2022				16-Sep-2022	16-Sep-2022				16-Sep-2022	16-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled	Lowest Detection Limit	Units	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	14:40	14:40	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor
ALS Sample ID			VA22C2369-049	VA22C2369-064				VA22C2369-050	VA22C2369-065				VA22C2369-051	VA22C2369-066				VA22C2369-117	VA22C2369-122				VA22C2369-118	VA22C2369-123				VA22C2369-119	VA22C2369-124			
QAQC			FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD				FDA	FD			
Analyte			Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue				Tissue	Tissue			
Physical Tests																																
moisture	0.5	%	53.4	53.7	53.55	1	NC	70.3	69.2	69.75	2	NC	35.9	38.4	37.15	7	NC	63.4	63.9	63.65	1	NC	59.9	61.7	60.8	3	NC	60.8	62.6	61.7	3	NC
Metals																																
aluminum	2	mg/kg	54.2	64.6	59.4	18	NC	101	71.7	86.35	34	NC	69.2	69.8	69.5	1	NC	93.8	79.8	86.8	16	NC	130	63.6	96.8	**69**	NC	369	294	331.5	23	NC
aluminum	0.4	mg/kg wwt	25.3	30	27.65	17	NC	30	22	26	31	NC	44.3	43	43.65	3	NC	34.4	28.8	31.6	18	NC	52	24.4	38.2	**72**	NC	144	110	127	27	NC
antimony	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	0.02	0.014	0.017	NC	0.6
antimony	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.0028	0.0025	0.00265	NC	0.15	<0.0020	<0.0020	0.002	NC	0	0.0033	<0.0020	0.00265	NC	0.65	0.0077	0.0051	0.0064	NC	1.3
arsenic	0.02	mg/kg	8.45	10.9	9.675	25	NC	0.076	0.057	0.0665	NC	0.95	0.069	0.087	0.078	NC	0.9	0.058	0.046	0.052	NC	0.6	0.117	0.053	0.085	**75**	NC	0.282	0.234	0.258	19	NC
arsenic	0.004	mg/kg wwt	3.94	5.04	4.49	24	NC	0.0225	0.0176	0.02005	24	NC	0.0445	0.0535	0.049	18	NC	0.0212	0.0164	0.0188	26	NC	0.0469	0.0203	0.0336	**79**	NC	0.11	0.0876	0.0988	23	NC
barium	0.05	mg/kg	17.1	15.5	16.3	10	NC	11.1	12.8	11.95	14	NC	35.8	47.8	41.8	29	NC	2.52	2.02	2.27	22	NC	22.2	13.5	17.85	49	NC	23.9	21	22.45	13	NC
barium	0.01	mg/kg wwt	7.98	7.18	7.58	11	NC	3.3	3.95	3.625	18	NC	22.9	29.4	26.15	25	NC	0.923	0.728	0.8255	24	NC	8.92	5.18	7.05	**53**	NC	9.36	7.86	8.61	17	NC
beryllium	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	0.012	<0.010	0.011	NC	0.2
beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.0022	<0.0020	0.0021	NC	0.1	0.0048	0.0033	0.00405	NC	0.75
bismuth	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.003	<0.0020	0.0025	NC	0.5
boron	1	mg/kg	8.4	8	8.2	5	NC	18.5	15.5	17	18	NC	3.3	5.1	4.2	43	NC	13.3	14.4	13.85	8	NC	41	31	36	28	NC	63.1	58.9	61	7	NC
boron	0.2	mg/kg wwt	3.94	3.72	3.83	6	NC	5.48	4.76	5.12	14	NC	2.1	3.13	2.615	39	NC	4.87	5.2	5.035	7	NC	16.4	11.9	14.15	32	NC	24.7	22	23.35	12	NC
cadmium	0.005	mg/kg	0.0145	0.014	0.01425	NC	0.1	<0.0150	<0.0225	0.01875	NC	1.5	0.111	0.104	0.1075	7	NC	0.0965	0.0726	0.08455	28	NC	1.54	1.16	1.35	28	NC	0.0984	0.134	0.1162	31	NC
cadmium	0.001	mg/kg wwt	0.0067	0.0065	0.0066	3	NC	<0.0050	<0.0065	0.00575	26	NC	0.0714	0.0642	0.0678	11	NC	0.0354	0.0262	0.0308	30	NC	0.619	0.444	0.5315	33	NC	0.0385	0.05	0.04425	26	NC
calcium	20	mg/kg	2160	1940	2050	11	NC	15600	11900	13750	27	NC	4060	5790	4925	35	NC	2630	2410	2520	9	NC	19000	11900	15450	46	NC	13000	12600	12800	3	NC
calcium	4	mg/kg wwt	1010	900	955	12	NC	4640	3660	4150	24	NC	2600	3560	3080	31	NC	964	870	917	10	NC	7620	4560	6090	**50**	NC	5090	4720	4905	8	NC
cesium	0.005	mg/kg	0.026	0.0302	0.0281	15	NC	0.55	0.331	0.4405	50	NC	0.0427	0.0429	0.0428	0	NC	0.0652	0.0685	0.06685	5	NC	0.112	0.133	0.1225	17	NC	0.0528	0.0672	0.06	24	NC
cesium	0.001	mg/kg wwt	0.0121	0.014	0.01305	15	NC	0.163	0.102	0.1325	46	NC	0.0274	0.0264	0.0269	4	NC	0.0239	0.0247	0.0243	3	NC	0.0449	0.051	0.04795	13	NC	0.0207	0.0252	0.02295	20	NC
chromium	0.05	mg/kg	0.252	0.08	0.166	**104**	NC	0.385	1.51	0.9475	**119**	NC	0.112	0.173	0.1425	NC	1.22	0.116	0.092	0.104	NC	0.48	0.164	0.114	0.139	NC	1	0.577	0.444	0.5105	26	NC
chromium	0.01	mg/kg wwt	0.117	0.037	0.077	**104**	NC	0.114	0.464	0.289	**121**	NC	0.072	0.107	0.0895	39	NC	0.042	0.033	0.0375	NC	0.9	0.066	0.044	0.055	40	NC	0.226	0.166	0.196	31	NC
cobalt	0.02	mg/kg	0.065	0.067	0.066	NC	0.1	0.585	0.367	0.476	46	NC	0.058	0.06	0.059	NC	0.1	0.117	0.092	0.1045	24	NC	0.59	0.43	0.51	31	NC	0.297	0.244	0.2705	20	NC
cobalt	0.004	mg/kg wwt	0.0304	0.0311	0.03075	2	NC	0.173	0.113	0.143	42	NC	0.037	0.0372	0.0371	1	NC	0.0428	0.0332	0.038	25	NC	0.236	0.165	0.2005	35	NC	0.116	0.0914	0.1037	24	NC
copper	0.1	mg/kg	4.84	5.23	5.035	8	NC	14.1	13.1	13.6	7	NC	4.94	5.26	5.1	6	NC	7.96	6.49	7.225	20	NC	12.6	8.94	10.77	34	NC	21.9	17.1	19.5	25	NC
copper	0.02	mg/kg wwt	2.25	2.42	2.335	7	NC	4.19	4.04	4.115	4	NC	3.17	3.24	3.205	2	NC	2.92	2.34	2.63	22	NC	5.04	3.43	4.235	38	NC	8.59	6.41	7.5	29	NC
iron	3	mg/kg	104	112	108	7	NC	248	180	214	32	NC	124	124	124	0	NC	175	139	157	23	NC	246	118	182	**70**	NC	838	583	710.5	36	NC
iron	0.6	mg/kg wwt	48.4	51.7	50.05	7	NC	73.6	55.3	64.45	28	NC	79.5	76.3	77.9	4	NC	64.2	50.3	57.25	24	NC	98.6	45.3	71.95	**74**	NC	328	218	273	40	NC
lead	0.02	mg/kg	0.032	0.028	0.03	NC	0.2	0.046	0.039	0.0425	NC	0.35	0.041	0.041	0.041	NC	0	0.054	0.039	0.0465	NC	0.75	0.101	0.062	0.0815	48	NC	0.221	0.176	0.1985	23	NC
lead	0.004	mg/kg wwt	0.0149	0.013	0.01395	NC	0.475	0.0136	0.0119	0.01275	NC	0.425	0.0264	0.0251	0.02575	5	NC	0.0199	0.0142	0.01705	NC	1.425	0.0404	0.0236	0.032	**53**	NC	0.0866	0.0658	0.0762	27	NC
lithium	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	0.71	0.605	NC	0.42	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0	0.68	<0.50	0.59	NC	0.36
lithium	0.1	mg/kg wwt	<0.10	<0.10	0.1	NC	0	0.11	0.22	0.165	NC	1.1	0.15	0.14	0.145	NC	0.1	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	0.27	0.14	0.205	NC	1.3
magnesium	2	mg/kg	770	737	753.5	4	NC	3780	2930	3355	25	NC	510	708	609	33	NC	1320	1150	1235	14	NC	3460	3120	3290	10	NC	5150	4730	4940	9	NC
magnesium	0.4	mg/kg wwt	359	341	350	5	NC	1120	900	1010	22	NC	327	436	381.5	29	NC	485	416	450.5	15	NC	1390	1200	1295	15	NC	2020	1770	1895	13	NC
manganese	0.05	mg/kg	147	122	134.5	19	NC	96.6	63.4	80	42	NC	64.6	96.9	80.75	40	NC	93.2	93	93.1	0	NC	140	79.7	109.85	**55**	NC	242	204	223	17	NC
manganese	0.01	mg/kg wwt	68.5	56.6	62.55	19	NC	28.6	19.5	24.05	38	NC	41.4	59.6	50.5	36	NC	34.1	33.6	33.85	1	NC	56.2	30.5	43.35	**59**	NC	94.6	76.3	85.45	21	NC
mercury	0.005	mg/kg	<0.0050	<0.0050	0.005	NC	0	<0.0050	<0.0050	0.005	NC	0	0.0073	0.0073	0.0073	NC	0	<0.0050	<0.0050	0.005	NC	0	0.011	0.008	0.0095	NC	0.6	0.0138	0.013	0.0134	NC	0.16
mercury	0.001	mg/kg wwt	<0.0022	0.0023	0.00225	NC	0.1	0.0012	<0.0022	0.0017	NC	1	0.0047	0.0045	0.0046	NC	0.2	0.0012	0.0015	0.00135	NC	0.3	0.0044	0.0031	0.00375	NC	1.3	0.0054	0.0048	0.0051	12	NC
molybdenum	0.02	mg/kg	2.47	2.58	2.525	4	NC	38	37.3	37.65	2	NC	10.4	19.6	15	**61**	NC	4.82	5.63	5.225	16	NC	3.35	2.15	2.75	44	NC	65.1	29.8	47.45	**74**	NC
molybdenum	0.004	mg/kg wwt	1.15	1.2	1.175	4	NC	11.3	11.5	11.4	2	NC	6.68	12	9.34	**57**	NC	1.76	2.03	1.895	14	NC	1.34	0.826	1.083	47	NC	25.5	11.2	18.35	**78**	NC
nickel	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	0.74	0.58	0.66	NC	0.8	<0.20	<0.20	0.2	NC	0	1.04	0.96	1	8	NC	0.61	0.63	0.62	NC	0.1	0.56	0.58	0.57	NC	0.1
nickel	0.04	mg/kg wwt	0.066	0.048	0.057	NC	0.45	0.22	0.18	0.2	20	NC	0.056	0.063	0.0595	NC	0.175	0.382	0.346	0.364	10	NC	0.246	0.24	0.243	2	NC	0.22	0.215	0.2175	2	NC
phosphorus	10	mg/kg	1460	1550	1505	6	NC	2830	3380	3105	18	NC	774	996	885	25	NC	1480	1360	1420	8	NC	2080	1860	1970	11	NC	4610	3330	3970	32	NC
phosphorus	2	mg/kg wwt	678	718	698	6	NC	838	1040	939	22	NC	496	613	554.5	21	NC	541	491	516	10	NC	836	713	774.5	16	NC	1800	1240	1520	37	NC
potassium	20	mg/kg	7960	7360	7660	8	NC	23100	24800	23950	7	NC	4690	5540	5115	17	NC	4820	4530	4675	6	NC	6270	5200	5735	19	NC	7560	6310	6935	18	NC
potassium	4	mg/kg wwt	3710	3410	3560	8	NC	6860	7620	7240	10	NC	3010	3410	3210	12	NC	1770	1640	1705	8	NC	2510	1990	2250	23	NC	2960	2360	2660	23	NC
rubidium	0.05	mg/kg	5.98	7.42	6.7	21	NC	38.7	36.3	37.5	6	NC	3.67	4.26	3.965	15	NC	4.14	3.94	4.04	5	NC	3.37	2.82	3.095	18	NC	2.75	3.38	3.065	21	NC
rubidium	0.01	mg/kg wwt	2.78	3.44	3.11	21	NC	11.5	11.2	11.35	3	NC	2.35	2.62	2.485	11	NC	1.52	1.42	1.47	7	NC	1.35	1.08	1.215	22	NC	1.08	1.26	1.17	15	NC
selenium	0.05	mg/kg	<0.050	<0.050	0.05	NC	0	0.105	0.099	0.102	NC	0.12	0.075	0.093	0.084	NC	0.36	<0.050	<0.050	0.05	NC	0	0.133	0.073	0.103	NC	1.2	<0.050	0.053	0.0515	NC	0.06
selenium	0.01	mg/kg wwt	0.022	0.022	0.022	NC	0	0.031	0.03	0.0305	NC	0.1	0.048	0.057	0.0525	17	NC	<0.010	<0.010	0.01	NC	0	0.053	0.028	0.0405	**62**	NC	0.016	0.02	0.018	NC	0.4
silver	0.005	mg/kg	0.0097	0.0082	0.00895	NC	0.3	<0.0050	<0.0050	0.005	NC	0	<0.0050	<0.0050	0.005	NC	0	0.041	0.0479	0.04445	16	NC	0.0237	0.0148	0.01925	NC	1.78	0.007	0.0062	0.0066	NC	0.16
silver	0.001	mg/kg wwt	0.0045	0.0038	0.00415	NC	0.7	<0.0010	<0.0010	0.001	NC	0	0.002	0.0021	0.00205	NC	0.1	0.015	0.0173	0.01615	14	NC	0.0095	0.0057	0.0076	50	NC	0.0028	0.0023	0.00255	NC	0.5
sodium	20	mg/kg	<20	<20	20	NC	0	116	105	110.5	10	NC	31	45	38	NC	0.7	32	27	29.5	NC	0.25	45	49	47	NC	0.2	168	64	116	**90**	NC
sodium	4	mg/kg wwt	8.7	7.9	8.3	NC	0.2	34.4	32.3	33.35	6	NC	19.6	27.7	23.65	34	NC	11.6	9.9	10.75	NC	0.425	18.2	18.7	18.45	NC	0.125	65.8	23.8	44.8	**94**	NC
strontium	0.05	mg/kg	44.5	38	41.25	16	NC	330	290	310	13	NC	106	146	126	32	NC	8.79	8.13	8.46	8	NC	360	235	297.5	42	NC	92.1	138	115.05	40	NC
strontium	0.01	mg/kg wwt	20.7	17.6	19.15	16	NC	98	89.3	93.65	9	NC	68.3	90.2	79.25	28	NC	3.22	2.93	3.075	9	NC	145	89.9	117.45	47	NC	36.1	51.6	43.85	35	NC
tellurium	0.02	mg/kg	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0
thallium	0.002	mg/kg	0.0093	0.0078	0.00855	NC	0.75	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0	0.004	0.0021	0.00305	NC	0.95	<0.0020	<0.0020	0.002	NC	0
thallium	0.0004	mg/kg wwt	0.00432	0.0036	0.00396	18	NC	<0.00040	<0.00040	0.0004	NC	0	<0.00040	<0.00040	0.0004	NC	0	0.00049	<0.00040	0.000445	NC	0.225	0.00163	0.00082	0.001225	NC	2.025	0.00054	0.00055	0.000545	NC	0.025
tin	0.1	mg/kg	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0	0.22	<0.10	0.16	NC	1.2	<0.10	<0.10	0.1	NC	0
tin	0.02	mg/kg wwt	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0	<0.020	0.022	0.021	NC	0.1	<0.020	<0.020	0.02	NC	0	0.086	<0.020	0.053	NC	3.3	0.031	<0.020	0.0255	NC	0.55
uranium	0.002	mg/kg	<0.0020	0.0021	0.00205	NC	0.05	0.0034	0.0021	0.00275	NC	0.65	0.0031	0.003	0.00305	NC	0.05	0.0033	0.0027	0.003	NC	0.3	0.0053	0.0026	0.00395	NC	1.35	0.0152	0.0111	0.01315	31	NC
uranium	0.0004	mg/kg wwt	0.0008	0.00096	0.00088	NC	0.4	0.001	0.00066	0.00083	NC	0.85	0.00199	0.00182	0.001905	NC	0.425	0.0012	0.00099	0.001095	NC	0.525	0.00211	0.001	0.001555	**71**	NC	0.00594	0.00414	0.00504	36	NC
vanadium	0.1	mg/kg	0.3	0.31	0.305	NC	0.1	0.52	0.36	0.44	36	NC	0.41	0.39	0.4	NC	0.2	0.56	0.42	0.49	29	NC	0.73	0.31	0.52	**81**	NC	2.91	1.99	2.45	38	NC
vanadium	0.02	mg/kg wwt	0.142	0.146	0.144	3	NC	0.154	0.111	0.1325	32	NC	0.26	0.242	0.251	7	NC	0.205	0.153	0.179	29	NC	0.293	0.118	0.2055	**85**	NC	1.14	0.745	0.9425	42	NC
zinc	0.5	mg/kg	23.4	21	22.2	11	NC	35.6	34.8	35.2	2	NC	15.3	15.1	15.2	1	NC	60.2	49.7	54.95	19	NC	261	129	195	**68**	NC	23.3	21.9	22.6	6	NC
zinc	0.1	mg/kg wwt	10.9	9.75	10.325	11	NC	10.6	10.7	10.65	1	NC	9.82	9.3	9.56	5	NC	22	17.9	19.95	21	NC	105	49.3	77.15	**72**	NC	9.13	8.2	8.665	11	NC
zirconium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
zirconium	0.04	mg/kg wwt	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0	0.06	0.056	0.058	NC	0.1	<0.040	<0.040	0.04	NC	0	0.05	<0.040	0.045	NC	0.25	0.069	<0.040	0.0545	NC	0.725

Notes:
Value = RPD is greater than 50%

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

Table E-6:
Vegetation Tissue Quality Assurance Quality Control
Ecological Risk Assessment
Mount Polley Mine, British Columbia

Client Sample ID			22-S15-G-01	22-S15-G-01D				22-S15-F-01	22-S15-F-01D			
Date Sampled			16-Sep-2022	16-Sep-2022				16-Sep-2022	16-Sep-2022			
Time Sampled	Lowest Detection Limit	Units	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor	10:00	10:00	Mean	Relative Percent Difference (%)	Difference Factor
ALS Sample ID			VA22C2369-120	VA22C2369-125				VA22C2369-121	VA22C2369-126			
QAQC			FDA	FD				FDA	FD			
Analyte			Tissue	Tissue				Tissue	Tissue			
Physical Tests												
moisture	0.5	%	55.9	54.6	55.25	2	NC	77.3	77.1	77.2	0	NC
Metals												
aluminum	2	mg/kg	45	42.3	43.65	6	NC	58.4	36.1	47.25	47	NC
aluminum	0.4	mg/kg wwt	19.8	19.2	19.5	3	NC	13.2	8.27	10.735	46	NC
antimony	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
antimony	0.002	mg/kg wwt	<0.0020	0.0026	0.0023	NC	0.3	<0.0020	<0.0020	0.002	NC	0
arsenic	0.02	mg/kg	0.059	0.046	0.0525	NC	0.65	0.056	0.046	0.051	NC	0.5
arsenic	0.004	mg/kg wwt	0.0262	0.0209	0.02355	23	NC	0.0128	0.0105	0.01165	NC	0.575
barium	0.05	mg/kg	8.18	6.73	7.455	19	NC	22.5	29.1	25.8	26	NC
barium	0.01	mg/kg wwt	3.61	3.06	3.335	16	NC	5.1	6.65	5.875	26	NC
beryllium	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
beryllium	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
bismuth	0.01	mg/kg	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
bismuth	0.002	mg/kg wwt	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
boron	1	mg/kg	4.5	2.7	3.6	NC	1.8	26.8	31.5	29.15	16	NC
boron	0.2	mg/kg wwt	2	1.23	1.615	48	NC	6.09	7.21	6.65	17	NC
cadmium	0.005	mg/kg	0.0087	<0.0050	0.00685	NC	0.74	0.0198	0.0162	0.018	NC	0.72
cadmium	0.001	mg/kg wwt	0.0038	<0.0030	0.0034	NC	0.8	0.0045	0.0037	0.0041	NC	0.8
calcium	20	mg/kg	1690	1380	1535	20	NC	17700	21200	19450	18	NC
calcium	4	mg/kg wwt	747	624	685.5	18	NC	4010	4860	4435	19	NC
cesium	0.005	mg/kg	0.0603	0.0187	0.0395	**105**	NC	0.519	0.475	0.497	9	NC
cesium	0.001	mg/kg wwt	0.0266	0.0085	0.01755	**103**	NC	0.118	0.109	0.1135	8	NC
chromium	0.05	mg/kg	0.092	0.147	0.1195	NC	1.1	0.136	0.086	0.111	NC	1
chromium	0.01	mg/kg wwt	0.04	0.067	0.0535	**50**	NC	0.031	0.02	0.0255	NC	1.1
cobalt	0.02	mg/kg	0.049	0.043	0.046	NC	0.3	0.188	0.161	0.1745	15	NC
cobalt	0.004	mg/kg wwt	0.0217	0.0194	0.02055	11	NC	0.0428	0.0368	0.0398	15	NC
copper	0.1	mg/kg	5.21	3.76	4.485	32	NC	18.8	17.2	18	9	NC
copper	0.02	mg/kg wwt	2.3	1.71	2.005	29	NC	4.27	3.95	4.11	8	NC
iron	3	mg/kg	101	85.1	93.05	17	NC	170	129	149.5	27	NC
iron	0.6	mg/kg wwt	44.7	38.6	41.65	15	NC	38.6	29.6	34.1	26	NC
lead	0.02	mg/kg	0.046	0.051	0.0485	NC	0.25	0.092	0.051	0.0715	NC	2.05
lead	0.004	mg/kg wwt	0.0202	0.023	0.0216	13	NC	0.0209	0.0117	0.0163	**56**	NC
lithium	0.5	mg/kg	<0.50	<0.50	0.5	NC	0	<0.50	<0.50	0.5	NC	0
lithium	0.1	mg/kg wwt	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
magnesium	2	mg/kg	459	452	455.5	2	NC	3280	4030	3655	21	NC
magnesium	0.4	mg/kg wwt	202	205	203.5	1	NC	745	922	833.5	21	NC
manganese	0.05	mg/kg	74.3	48.7	61.5	42	NC	60.7	76.2	68.45	23	NC
manganese	0.01	mg/kg wwt	32.8	22.1	27.45	39	NC	13.8	17.4	15.6	23	NC
mercury	0.005	mg/kg	<0.0050	<0.0050	0.005	NC	0	<0.0050	0.0053	0.00515	NC	0.06
mercury	0.001	mg/kg wwt	0.0016	0.0016	0.0016	NC	0	0.001	0.0012	0.0011	NC	0.2
molybdenum	0.02	mg/kg	7.37	8.14	7.755	10	NC	7.99	8.42	8.205	5	NC
molybdenum	0.004	mg/kg wwt	3.25	3.7	3.475	13	NC	1.81	1.93	1.87	6	NC
nickel	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	1.07	1.42	1.245	28	NC
nickel	0.04	mg/kg wwt	0.043	0.081	0.062	NC	0.95	0.243	0.326	0.2845	29	NC
phosphorus	10	mg/kg	278	568	423	**69**	NC	1940	2090	2015	7	NC
phosphorus	2	mg/kg wwt	122	258	190	**72**	NC	439	479	459	9	NC
potassium	20	mg/kg	7670	6160	6915	22	NC	20200	23600	21900	16	NC
potassium	4	mg/kg wwt	3380	2800	3090	19	NC	4580	5400	4990	16	NC
rubidium	0.05	mg/kg	5.9	3.91	4.905	41	NC	20	20.8	20.4	4	NC
rubidium	0.01	mg/kg wwt	2.6	1.77	2.185	38	NC	4.54	4.77	4.655	5	NC
selenium	0.05	mg/kg	<0.050	<0.050	0.05	NC	0	<0.050	<0.050	0.05	NC	0
selenium	0.01	mg/kg wwt	<0.010	<0.010	0.01	NC	0	<0.010	<0.010	0.01	NC	0
silver	0.005	mg/kg	<0.0050	<0.0050	0.005	NC	0	0.0154	0.0125	0.01395	NC	0.58
silver	0.001	mg/kg wwt	0.0016	0.0017	0.00165	NC	0.1	0.0035	0.0029	0.0032	NC	0.6
sodium	20	mg/kg	44	36	40	NC	0.4	115	52	83.5	**75**	NC
sodium	4	mg/kg wwt	19.3	16.4	17.85	NC	0.725	26.1	11.8	18.95	**75**	NC
strontium	0.05	mg/kg	11	8.02	9.51	31	NC	247	233	240	6	NC
strontium	0.01	mg/kg wwt	4.85	3.64	4.245	29	NC	56.1	53.3	54.7	5	NC
tellurium	0.02	mg/kg	<0.020	<0.020	0.02	NC	0	<0.020	<0.020	0.02	NC	0
tellurium	0.004	mg/kg wwt	<0.0040	<0.0040	0.004	NC	0	<0.0040	<0.0040	0.004	NC	0
thallium	0.002	mg/kg	<0.0020	<0.0020	0.002	NC	0	<0.0020	<0.0020	0.002	NC	0
thallium	0.0004	mg/kg wwt	<0.00040	<0.00040	0.0004	NC	0	<0.00040	<0.00040	0.0004	NC	0
tin	0.1	mg/kg	<0.10	<0.10	0.1	NC	0	<0.10	<0.10	0.1	NC	0
tin	0.02	mg/kg wwt	<0.020	0.032	0.026	NC	0.6	<0.020	<0.020	0.02	NC	0
uranium	0.002	mg/kg	0.0024	<0.0020	0.0022	NC	0.2	0.0029	<0.0020	0.00245	NC	0.45
uranium	0.0004	mg/kg wwt	0.00106	0.00067	0.000865	NC	0.975	0.00066	<0.00040	0.00053	NC	0.65
vanadium	0.1	mg/kg	0.34	0.27	0.305	NC	0.7	0.44	0.24	0.34	NC	2
vanadium	0.02	mg/kg wwt	0.15	0.123	0.1365	20	NC	0.099	0.055	0.077	NC	2.2
zinc	0.5	mg/kg	10.4	8.77	9.585	17	NC	31.6	35.6	33.6	12	NC
zinc	0.1	mg/kg wwt	4.59	3.98	4.285	14	NC	7.17	8.16	7.665	13	NC
zirconium	0.2	mg/kg	<0.20	<0.20	0.2	NC	0	<0.20	<0.20	0.2	NC	0
zirconium	0.04	mg/kg wwt	<0.040	<0.040	0.04	NC	0	<0.040	<0.040	0.04	NC	0

Notes:
Value = RPD is greater than 50%

FDA = field duplicate available; FD = field duplicate; mg/kg = milligrams per kilogram; QAQC = quality assurance quality control sample type; wt wwt = wet weight; % = percent; < = indicates parameter was below laboratory equipment detection limit.

APPENDIX F

Sample Calculations

SOIL AND FOOD INGESTION BY SMALL MAMMALS AND BIRDS

Exposure equations used to estimate the daily dose of copper to mammals and birds are based on CCME (2020), as presented below:

Estimated Dose via Ingestion of Soil

Soil dose (mg/kg bw/day) = SIR x C_s (Equation 1)

Where:

- SIR = soil ingestion rate (kg dw/kg bw/day)
- C_s = measured concentration of POPC in soil (mg/kg dw)
- mg = milligram
- kg = kilogram
- dw = dry weight concentration
- bw = body weight of receptor

Estimated Dose via Ingestion of Food

Food dose (mg/kg bw/day) = FIR x $\sum_1^j (C_{Fj} \times P_{Fj})$ (Equation 2)

Where:

- FIR = food ingestion rate (kg dw/kg bw/day)
- C_{Fj} = measured concentration of POPC in food item j in the diet of the receptor (mg/kg dw)
- p_{Fj} = proportion of food item j in the diet of the receptor (unitless)
- mg = milligram
- kg = kilogram
- dw = dry weight concentration
- bw = body weight of receptor

Total Dose

Total dose = Soil dose + Food dose* (Equation 3)

*The dose from water is not considered in this ERA.

Sample calculations

Sample calculations are provided below for the meadow vole (herbivore) exposure to **copper:**

STEP 1: CALCULATE DOSE VIA SOIL INGESTION

The dose from soil ingestion is calculated as follow:

$$Soil\ dose\ (mg/kg\ bw/day) = SIR \times C_s \qquad \text{(Equation 1)}$$

The input values are as follows:

Parameter	Value	Units	Source
SIR	3.2E-03	kg dw/kg bw/day	FCSAP, 2012
C_s	830	mg/kg	Maximum concentration measured in soil on-site (from Station S-11)

Based on the above parameter, the dose via soil ingestion:
2.6E+00

STEP 2: CALCULATE DOSE VIA FOOD INGESTION

The dose from food ingestion (comprised of plants) is calculated as follow:

$$Food\ dose\ (mg/kg\ bw/day) = FIR \times \sum_1^j (C_{Fj} \times P_{Fj}) \qquad \text{(Equation 2)}$$

The input values are as follows:

Parameter	Value	Units	Source
FIR	1.3E-01	kg dw/kg bw/day	FCSAP, 2012
C_{Fj}	2.3E+01	mg/kg dw	Maximum concentration of copper measured in plant tissue on-site (red raspberry leaves at S-1)
P_{Fj}	1.0	unitless	FCSAP, 2012 (Diet is assumed to be 100% plants)

Based on the above parameters, the dose from food ingestion (diet comprised exclusively of plants) is:
3.1E+00

STEP 3: CALCULATE THE TOTAL DAILY DOSE

The unadjusted total dose is calculated as follow:

$$Total\ dose^* = Soil\ dose + Food\ dose \qquad \text{(Equation 3)}$$

The input values are as follows:

Parameter	Value	Units	Source
Food dose	3.1E+00	mg/kg bw/day	Step 2
Soil dose	2.6E+00	mg/kg bw/day	Step 1

Based on the above parameters, the total daily dose is:
5.7E+00



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Appendix O
2017 Invasive Plant Management Plan

Mount Polley Mining Corporation
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Environmental Management Plan:

Invasive Plant Management Plan

Last Update: March 29, 2017

Document Review and Revision Control

Rev. No.	Review/Revision	Date	Author
0	Original	January 2014	GH
1	Update of site specific components and plans	July 9, 2015	KM
2	Update of site specific components and plans; updated to reflect current government regulations/documents; added document tracking and formatting to be consistent with other MPMC EMPs	March 29, 2016	KM
3	Annual Review	Dec. 2020	GH

1 Introduction

The BC Ministry of Forest, Lands and Natural Resource Operations (as per the British Columbia [BC] Inter-Ministry Invasive Plant Working Group) defines invasive plants as “non-native (alien) plants whose introduction into BC cause, or are likely to cause, economic or environmental damage, or harm to human health” (MFLNRO, 2014). The Invasive Species Council of BC has a similar definition, and notes that invasive plants can establish quickly and easily on both disturbed and un-disturbed sites, causing widespread negative economic, social, and environmental impacts (ISCBC, 2015).

Mining operations result in disturbed areas, which can be susceptible to invasion of invasive plants. Such invasions have the potential to hinder reclamation efforts or interfere with regional invasive plant management programs. To manage this risk, Mount Polley Mining Corporation (MPMC) has developed this Invasive Plant Management Plan (the “Plan”). The purpose of the Plan is to outline procedures for the prevention and, if necessary, control (mitigation) of the establishment of invasive plants or noxious weeds in the Mount Polley Mine (the “Mine”) area throughout the Mine project life, including closure.

1.1 Regulatory Framework

The BC *Weed Control Act* (RSBC, 1996) requires owners or occupiers of crown and private lands in BC (excluding those under federal jurisdiction) to control listed noxious weeds. As such, MPMC is under legal obligation to control these species. At the time of last update of this Plan, the BC Proposed Prohibited Noxious Weeds List (MFLNRO, 2016) was the most up to date applicable listing.

As per the BC *Mines Act* Section 10.7, mine land surfaces must be reclaimed to an approved end land use at closure, excluding lands that are not to be reclaimed, and the average land capability should be equal to or greater than the average land capability present prior to mining. While these requirements do not specifically mention invasive plants, they are inherently included; given the undesirable nature of invasive plants, their associated negative environmental and economic impacts, and the fact that invasive plants are non-native, such species are likely inconsistent with closure revegetation objectives and could result in a mining company not meeting their closure revegetation targets.

In addition, under MPMC’s *Mines Act* Permit M-200, the following additional specific conditions apply to invasive species management at the site:

- The Permittee shall manage and control invasive species that establish on the site and shall take reasonable efforts to ensure that invasive species do not move from the site to adjacent areas.
- The Permittee shall ensure that all seed mixes are certified as weed-free.
- Revegetation species shall be selected based on the principles of ecological succession and traditional use and cultural significance, including all reasonable efforts to use only native species unless short-lived agronomic species are required to temporarily control erosion or prevent ingress of invasive species.

While not associated with regulatory requirements, the Cariboo Chilcotin Coast Invasive Plant Council (CCCIPC) is a non-profit organization that coordinates the invasive plant management efforts of government agencies, individuals, communities and industry sectors, and promotes awareness and education about invasive plants in the region. Each year, the CCCIPC produces an Annual Strategic Plan (http://cccipc.ca/index.php/S=0/resources/regional-strategic-plans/) which incorporates provincial requirements (e.g., noxious weeds listings) and is to be used as a guide for invasive plant management activities and resource allocation in region.

2 Objectives

As described above, the purpose of the Plan is to outline procedures for the prevention and, if necessary, mitigation of the establishment of invasive plants or noxious weeds in the Mount Polley Mine area throughout the Mine project life and closure. The specific objectives are to:

- Control invasive plant establishment on the site, such that reclamation objectives are achieved. Reclamation objectives include establishing self-sustaining vegetative covers on disturbed areas at the Mine site with native vegetation this is appropriate to the target site series and consequently promotes the target end land use(s); and
- Implement invasive plant control measures consistent with the Regional Strategic Plan and the BC Proposed Prohibited Noxious Weeds List.

This Plan applies to the operations footprint of the Mine as well as areas being rehabilitated following the tailings dam embankment breach. However, only the Mine site is regulated under the BC *Mines Act* and associated items (e.g., permit requirements and land capability requirements) do not apply to breach rehabilitation areas. Instead, reclamation revegetation objectives for the breach area will be defined by the Remediation Plan due for submission in the third quarter of 2017.

The Plan follows the Plan, Do, Check, and Act cycle developed by the International Standards Organization guidelines. The cycle is described as follows:

- **PLAN** - identifies potential sources of invasive plant ingress that may challenge achieving the objectives of the program;
- **DO** - documents the prevention and control management practices in place at the Mine;
- **CHECK** - describes the monitoring procedures and methods for evaluating monitoring results against the objectives; and
- **ACT** - describes review of the management program and update of procedures based on monitoring results in order to promote its continuous improvement and mitigate identified deficiencies.

3 Plan: Identification of Potential Sources of Invasive Plant Ingress

Mining activities can facilitate the introduction or spread of invasive plants by removing native vegetation, which decreases competition for weedy plants, and creating exposed soil in disturbed areas. Exposed areas create a soil bed which may allow invasive plants to establish. These areas include:

- Soil stockpiles and areas from which the soil was salvaged;
- Soil applied to reclamation areas;
- Road and powerline construction and maintenance activities; and
- Exposed areas around the Mill site, maintenance areas and other associated infrastructure.

Table 1 provides an overview of potential sources of invasive plant ingress to the site. Each potential source is classified into if control is possible or not. If control is not possible, for example the movement of wildlife or wind transport of seed, only prevention methods (and, if necessary, mitigation measures) are applicable to management.

Table 1 Potential sources of invasive plant ingress and/or spread at the Mount Polley Mine site

Category	Source	Control Method Possible
Animals	Livestock	×
	Wildlife	×
Natural spread	Wind (long-distance)	×
	Rhizome spread or seed drop (short-distance)	✓ (within Mine site only)
Human-mediated spread	People – on-site (e.g., employees, and contractors)	✓
	People – off-site (e.g., tourists and recreationists; spread to areas immediately adjacent to site)	×
	Vehicles and equipment – on-site	✓
	Vehicles and equipment – off-site (spread to areas immediately adjacent to site)	×
Reclamation Activities	Application of soil from contaminated soil stockpiles	✓
	Use of contaminated seed or soil amendments	✓
	Use of contaminated soil amendments	✓

4 Do: Prevention and Control Measures

4.1 Preventative Measures

The primary goal involved in managing invasive plant infestations in the project area is to carry out mining activities in a manner that prevents the introduction or spread of invasive plants and supports the ability to establish desired species during site reclamation activities.

MPMC is to implement the following best management practices for preventing invasive plant establishment on disturbed areas at the Mine, which are to minimize disturbance during all phases of the mining operation in order to limit the availability of exposed, un-vegetated ground to invasive plant seed deposition; and establish a vegetative cover as soon as possible after ground disturbance. Specifics for establishing ground cover vegetation are as follows:

- Seed ground disturbed due to construction or mining activity with a rapidly establishing seed mix for erosion protection and invasive plant control if reclamation of the area is not imminent. Active areas (e.g., open pits or areas without appropriate substrates for vegetation growth) at the Mine do not require invasive plant control as vegetation does not have a chance to become established;
- Seed soil stockpiles; water management features such as ditches and sediment pond berms; borrow pits; road edges; powerline access roads and power pole installation sites; inactive sections of mill site areas, storage and equipment yards; and generally any disturbed ground where invasive plant establishment is possible;
- Use only high quality grade seed in the reclamation and interim invasive plant control seed mixtures. Low quality grade seed may contain a higher portion of weed seed in the seed lot. At minimum, ensure that the seed used for revegetation is of the grade Common #1 Forage Mixture or Canada No. 1 Ground Cover Mixture.
- Assess soil amendments that may contain invasive plant seeds or propagules. This is currently only applicable to biosolids, and MPMC's supplier (Metro Vancouver) tests the material to verify that invasive plant seeds are not present.

MPMC typically conducts a seeding program annually in the spring and/or fall, and any disturbed areas (as described above) or areas that were previously seeded but lack appropriate native vegetative cover, should be added to the list of areas to be seeded.

4.2 Control Measures

If monitoring results (Section 5) show areas of invasive species infestation that are not consistent with the objectives of this Plan (Section 2), available control or mitigation options for managing established invasive plants include mechanical, biological, and chemical methods.

Mechanical methods include:

- Hand weeding or pulling (if plants are hand-pulled, propagules are to be removed from the site and disposed of in a way that does not allow the spread of seeds. i.e., burned, not composted);
- Mowing or cutting; and
- Burning.

Biological control agents are natural organisms that are another option for reducing invasive species populations. Typically, they are insects, nematodes, fungi or viruses that infect or invade the invasive plants and weaken the target species by decreasing seed production and reducing density. Biological control is only an option for select invasive species

Chemical control through application of herbicides will be the method of last resort because applications are limited by proximity to watercourses and can potentially have detrimental effects on native vegetation.

In addition to these mitigation methods, contingency control programs that could be reviewed for feasibility and implemented are:

- Inspection and/or cleaning of vehicles or equipment coming from offsite or moving from an infested area to an uninfested area within the site;
- Refraining from driving through areas infested with invasive plants;
- Limiting road maintenance to the road surface to retain vegetation along the roadsides;
- Keeping equipment yards and vehicle storage facilities free of invasive plants; and
- Training personnel on preventing invasive plant spread by checking and removing seeds from clothing and equipment.

It is important to note that majority of the invasive plants observed at the Mine are designated in the CCCIPC Regional Strategic Plans as “established” or are designated as non-native species (not invasive species), and management options are not implemented regionally because control of these species is not currently feasible. As such, MPMC does not actively manage these species, unless they are directly impeding reclamation efforts. These aforementioned control measures are listed as options for future use, as required, and are currently not a routine component of MPMC’s invasive plant management activities, as the Plan objectives are being met without their use.

Mitigation measures will focus on the “new invaders” and “containment” categories, as well as any “established” species if they are directly impeding reclamation efforts. Consistent with the Regional Strategic Plan, the treatment goal for “new invaders” is eradication (elimination of all individuals and their propagules), while the treatment objective for species listed for “containment” is prevention of invasive

plants from spreading to uninfested areas. For species that are impeding reclamation revegetation, but are regionally listed under “containment” or “established” categories, the primary option will be suppression (reduction in plant population size and abundance). These control measures generally follow the following process, based on the level of infestation:

1. Prevent new infestations from becoming established;
2. Eradicate small or isolated “satellite” infestations;
3. Contain the perimeter of large “core” infestations; and
4. Suppress the interior of large “core” infestations.

If control measures area applied in the future, any sites that have treatments applied will be monitored through the established methods (described in Section 5) in subsequent years to assess if treatment measures have been successful.

5 Check: Monitoring Program

The MPMC invasive plant monitoring program includes visual surveys conducted in combination with routine assessments of progressive reclamation sites and annual soil stockpiles inspections; invasive plant species present and their percent cover are documented and compiled with revegetation results.

In addition, more formal invasive plant inventories are to be conducted routinely at the Mine site. These inventories should encompass disturbed areas, including any that are undergoing reclamation, as well as adjacent undisturbed areas from which invasive plants could ingress. Inventories may be conducted by MPMC Environmental Department staff with sufficient expertise or an external consultant. Each inventory should include the following items, with the results presented in a report:

- Surveying and mapping of infestation locations, with a focus on reclamation areas and soil stockpiles;
- Identification of invasive plant species present;
- Assessment of the degree of invasive plant growth, distribution, and density present at infestation sites;
- Assessment of success of any prevention and control measures that were previously implemented;
- Recommendations for any prevention and control measures that should be implemented; and
- Recommendations for when the next inventory should be conducted.

Where possible, all assessments and inventories should take place in the late spring/early summer so that eradication measures can be undertaken prior to seed dispersal in late summer/early fall. Alternatively, assessments and inventories can be conducted in mid to late summer, when plants are readily identifiable, with interpretation of results to take place over winter and management applications to be implemented early the following growing season.

6 Act: Program Review and Continuous Improvement

Each year, the results of invasive species monitoring should be reviewed with respect to the objectives outlined in Section 2, and the Plan and associated site invasive plant management activities should be updated accordingly. Specific items that should be reviewed and associated actions are listed in Table 2. When the Plan is updated, it is to be submitted to the Ministry of Energy and Mine with the Annual Environmental and Reclamation Report. In addition, an update on invasive plant monitoring, prevention

and control activities at the Mine (including any pertinent results from progressive reclamation and soil stockpile inspections, and site invasive plant inventory reports) is to be included in the Annual Environmental and Reclamation Report each year.

Table 2 Invasive plant management program review process

Item to Review	Associated Actions
Verify that all seed mixes used were certified weed-free (i.e., comply with Canadian Food Inspection Agency standards).	If seed utilized is not certified weed-free (or invasive plants were suspected to be present in the seed mixtures used): • Change seed suppliers and/or seed mixtures.
Verify that all soil amendments (where appropriate) were tested to confirm they did not contain invasive plant propagules or seeds.	If soil amendments were not tested: • Conduct post-application assessments for any soil amendments not tested; • Discontinue use of any soil amendments not tested until appropriate testing has been completed; and • Plan appropriately to test all amendments prior to use in the future.
Verify that no invasive plants identified in monitoring are on provincial noxious weed lists.	If any noxious weeds are identified: • Implement appropriate control measures (Section 4.2), with the objective of eradication; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that all invasive plants identified in monitoring are being managed according to the most recent CCCIPC Annual Strategic Plan.	If invasive plant management is inconsistent with the Regional Strategic Plan: • Implement prevention and/or control actions (Section 4) until management actions are consistent with the Regional Strategic Plan; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that results from reclamation revegetation assessments are consistent with closure objectives (with respect to species composition and/or functional groups). If results are not consistent, verify that invasive plants are not a constraining factor. The prioritization matrix in Figure 1 can be used to aid in separating innocuous from disruptive species in reclamation areas and prioritize management actions accordingly.	If invasive plants are identified as a constraint to meeting revegetation objectives: • Delineate the specific species and areas of concern; • Implement prevention and/or control actions (Section 4) appropriate for the level of infestation, the life history of the identified invasive plants, and available control options; and • Ensure that measures taken and target native reclamation species are monitored in the identified reclamation areas as per the program in Section 5.

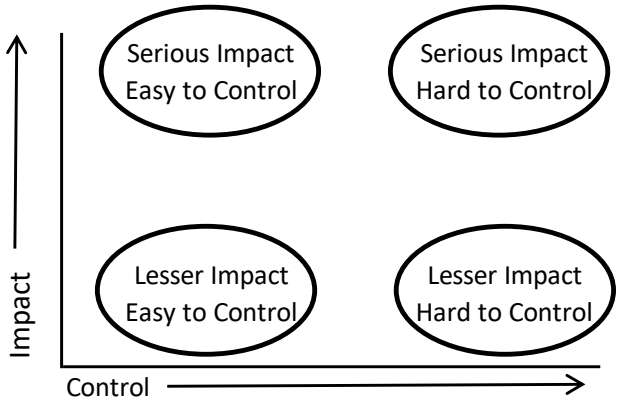


Figure 1 Invasive plant management prioritization matrix (adapted from USFWS, 2009)

7 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Supervisor):

- Be knowledgeable of, adhere to, and coordinate implementation of all aspects of this Plan;
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan;
- Ensure this Plan and monitoring data are reviewed annually and updated accordingly, with updates submitted in the Annual Environmental and Reclamation Report and appropriate management actions implemented;
- Be aware of high level mine planning to ensure that seeding of disturbed areas can be done in a timely manner and transport of soil is appropriately managed;
- Review updates to the MPMC *Mines Act* Permit 11678, BC *Mines* Act, CCCIPC Regional Strategic Plan and provincial noxious weed lists and regulations;
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including monitoring programs and reporting;
- Plan and budget for necessary invasive plant control measures;
- Obtain and permits or authorizations required for control measures that are implemented; and
- Ensure that individuals conducting monitoring, data interpretation, reporting, and planning and implantation of prevention and control measures have appropriate training.

Qualified individual conducting monitoring and reporting (e.g., Environmental Technician, contractor):

- Be knowledgeable of and adhere to all aspects of this Plan;
- Conduct assigned activities, such that all requirements of this Plan (at minimum) are met; and
- Have appropriate training and expertise for assigned components of this Plan.

Staff or contractors conducting control measures

- Have appropriate training and expertise for prevention and control actions they are implementing.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances and any transport of soil materials;
- Where possible, minimize the disturbance of vegetated areas; and
- Transmit relevant information related to the aforementioned points to the Mine Operations Supervisors.

Mine Operations Supervisors:

- Supervise operators such that new disturbances and soil handling are conducted as planned.

8 References

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Appendix P
Dust Management Plan

Mount Polley Mining Corporation

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Dust Management Plan

Submitted to:

BC Ministry of Environment and Climate Change Strategy
Environmental Protection Division
South Interior Region – Cariboo

Prepared by:

Mount Polley Mining Corporation
Environmental Department

Box 12, Likely BC
V0L 1N0

(250) 790-2215

Date: February 27, 2020

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1 INTRODUCTION

The following describes the Dust Management Plan (the Plan) for the Mount Polley Mine (the Facility), which is located approximately 100 km northeast of the city of Williams Lake, British Columbia (BC), near the town of Likely, BC.

The purpose of the Plan is to:

- identify the sources of fugitive dust emissions associated with the Mount Polley Mine;
- describe how fugitive dust can be controlled from each significant source and describe the best management practices in place and planned for at the Mount Polley Mine;
- describe how the Plan will be implemented, including the training of personnel;
- describe inspection and maintenance procedures; and,
- describe methods of monitoring and appropriate actions/response framework to feedback into refining management actions, as needed, based on monitoring and inspection results (i.e., Act component described below).

The Plan is structured as follows:

- Section 2 provides an overview of the Facility;
- Section 3 provides an overview of the existing meteorological conditions;
- Section 4 provides an overview of the dust monitoring programs;
- Section 5 identifies the responsibilities for each employment level as they relate to the Plan; and,
- Section 6 describes the fugitive dust control measures that are implemented at the Facility. This section follows the Plan, Do, Check, and Act (PDCA) cycle according to the International Standards Organization guidelines. The PDCA cycle is described below:
    - Section 6.1 **PLAN** - identifies the emission sources at the Facility;
    - Section 6.2 **DO** - documents the schedule for implementation of the management practices;
    - Section 6.3 **CHECK** - describes the monitoring procedures and a record keeping system; and
    - Section 6.4 **ACT** - describes the management practice review and update procedures in order to promote its continuous improvement.

According to Section 2.5 of the BC Ministry of Environment (MoE) PA-15087, the Permittee (Mount Polley Mine) shall supress fugitive dust created within the operations area. This plan is an update to the *Fugitive Dust Management Plan Mount Polley* (Golder 2015a) for the tailings storage facility (TSF) submitted by Golder Associates Ltd. (Golder) on May 26, 2015 to the BC MoE. This update includes the entire site of Mount Polley Mine.

2 FACILITY DESCRIPTION

As shown in Figure 2.1, the Mount Polley Mine can be separated into:

- the TSF and surrounding areas (including Polley Flats);
- the crusher and mill processing site; and,
- operations areas (open pits, waste rock dumps, stockpiles, roads, etc.) and surrounding areas.

The Mount Polley mine has been in Care and Maintenance since May 31, 2019. Care and Maintenance operations are focussed on general site maintenance, predominantly ensuring that all pumps, sumps and water management systems are functioning properly. Eleven full time employees work in 4 shifts including day shifts and night shifts.

All environmental monitoring and samplings as per all permits and Comprehensive Monitoring Plan (CEMP) will be followed during this temporary care and maintenance period.

2.1 TSF AND SURROUNDING AREAS

The TSF at Mount Polley Mine consists of tailings material and a single embankment made up of three dams: the Main Embankment, the Perimeter Embankment, and the South Embankment. During the TSF dam failure which occurred on August 4, 2014, water (both supernatant and interstitial) was released from the TSF, resulting in much of the tailings within the TSF being exposed to the elements (i.e., no longer submerged).

The breach of the Mount Polley TSF resulted in the deposition of tailings between Polley Lake and Hazeltine Creek (known as the Polley Flats). Polley Flats covers an approximately 900 m long section of Hazeltine Creek south of Polley Lake. Prior to the breach, the area immediately south of Polley Lake included a wetland. The materials deposited in the Polley Flats are observed to include the following:

- tailings (sandy silt or silty sand, and clay-textured material);
- dam construction materials (gravel, rock fill and till);
- organic matter transported by the tailings flow (including trees and wood debris); and,
- re-worked organic and inorganic materials from the wetland.

Under current conditions, the exposed tailings are retaining moisture, particularly at depth, though the exposed tailings surface will dry in the summer. Dried and exposed tailings combined with high winds could cause the particulates to become airborne, which may potentially affect onsite and offsite air quality.

In addition to the exposed tailings in the TSF and those deposited in the Polley Flats, other identified potential sources for fugitive dust emissions at the Facility are construction emissions related to the disturbance of waste rock during TSF construction and Hazeltine Creek remediation activities. Planting of alder and conifer species has been conducted in the upper and lower Hazeltine Creek areas from 2016 to 2018, resulting in improved vegetation cover and therefore, reduced risk of airborne particulate in the area since the breach.

2.2 CRUSHER AND MILL PROCESSING SITE

The crusher and mill area includes the crusher and mill building, the coarse ore pile, the tertiary pile, the fine ore (mill feed) pile, and the pebble pile (Figure 2.1). No crushing operations are conducted during Care and Maintenance period.

2.3 PITS AND SURROUNDING AREAS

No mining activities are being conducted during Care and Maintenance period. Open pits include Cariboo and Springer Pits and waste rock dumps include the Temporary NW PAG Stockpile, North East Zone (NEZ) Rock Dump and the South East Rock Dump (SERD). Potential sources for fugitive dust include road dust. (Figure 2.1)

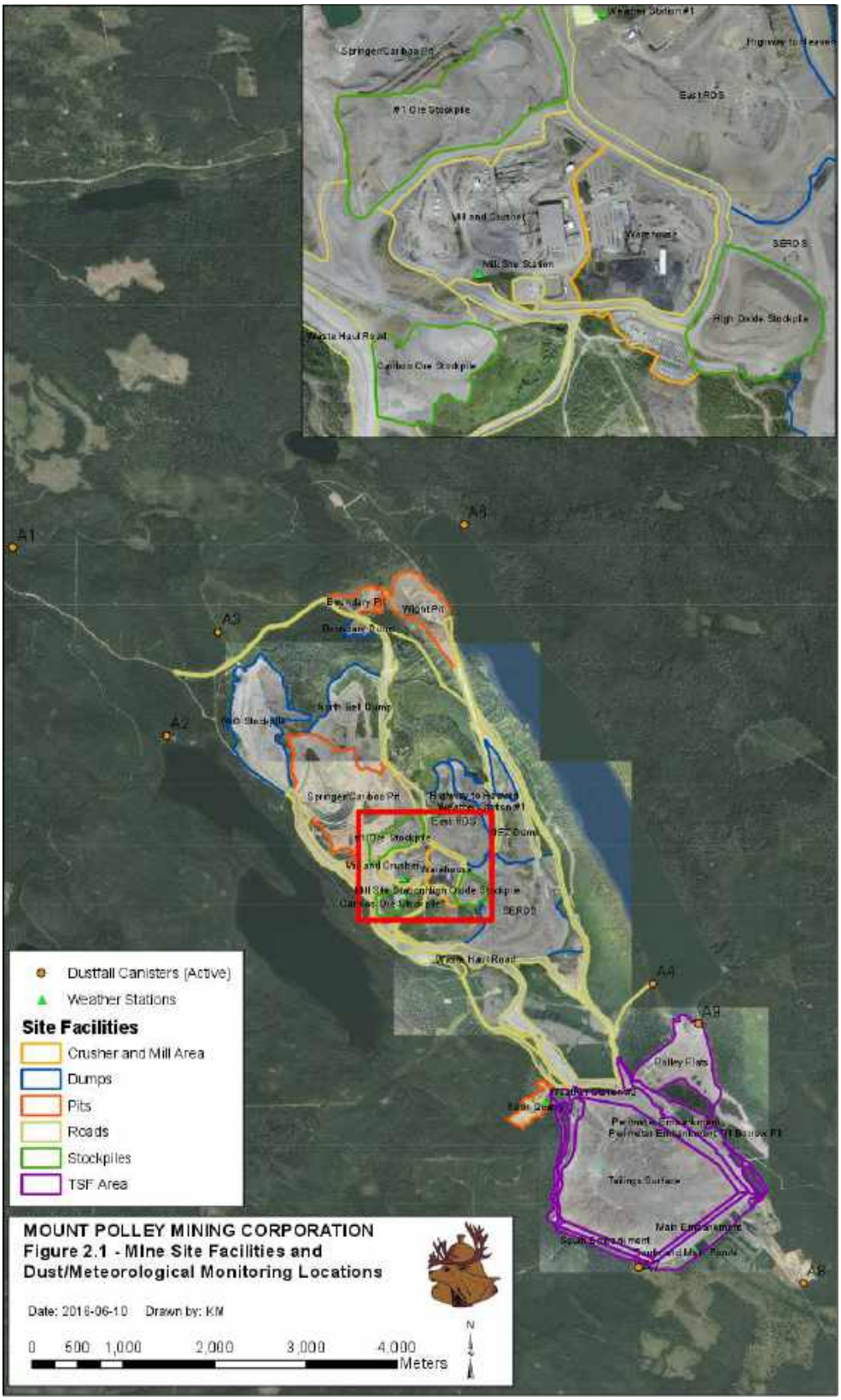


Figure 2.1. Mine Site Facilities and Dust/Meteorological Monitoring Locations

3 METEOROLOGY

Mount Polley Mine has two meteorological monitoring stations on site that have been operating since 2012 (see Figure 2.1). The first station (Station #1) is located southwest of the Polley Mountain summit, at an elevation of 1,171 metres above sea level (masl) near the Mill Site. The second station (Station #2) is located northwest of the TSF, along the access road to the old rock quarry. Station #2 is located atop a topographical rise at an elevation of 964 masl. The two stations are approximately 3.5 km apart, with an elevation difference of approximately 200 m. These stations monitor and record rainfall, temperature, relative humidity, wind speed, wind direction, and solar radiation every 30 minutes. From 1995 to 2012, a single meteorological station located beside the crusher building, northwest of the TSF, was in operation. This station monitored rainfall and temperature only. See Section 2.1 in *Fugitive Dust Management Plan Mount Polley* (Golder 2015a) for data from the three stations.

4 DUST MONITORING

4.1 DUSTFALL MONITORING

Five airborne particulate stations monitored dustfall at the Mount Polley Mine from November 2011 to December 2019; one was added in 2013 and three were added in June 2015. The station A5 was discontinued in August 2014. Station names and locations are presented in Table 4.1 and are shown in Figure 2.1. These air quality monitoring stations provided the fixed, volatile, and total dustfall measured in milligrams per decimetre squared per day (mg/dm^2/d) over a monthly period.

Table 4.1. Airborne Particulate Station Description

Station Name and Description	Easting (m)	Northing (m)	Years Active
A1 – by W12 (6km Creek water monitoring station)	588,221	5,826,043	2011-2019
A2 – at cabin on Bootjack Lake	589,906	5,823,978	2011-2019
A3 – near New Access Road	590,471	5,825,114	2011-2019
A4 – Polley Lake Boat Launch	595,241	5,821,259	2011-2019
A5 – by W7 (Hazeltine Creek water monitoring station)	597,010	5,819,075	2011-2014
A6 – Polley Lake Cabin	593,170	5,826,290	2013-2019
A7 – by Corner 3 (southwest) of TSF	592,969	5,818,320	2015-2019
A8 – southeast of TSF	596,911	5,817,991	2015-2019
A9 – Polley Flats (northeast of TSF)	596,020	5,821,407	2015-2019

The technical memorandum titled *Dustfall Monitoring and Pollution Control Objectives* written by the Air Quality Section of the MoE (2016), states that the Air Quality Section considers dustfall monitoring to be an outdated methodology and no longer recommends its use. For protection of human health, the Air Quality Section recommends particulate monitoring, specifically, monitoring of particulates with a diameter of 10 µm or less and 2.5 µm or less, be conducted instead of dustfall monitoring (MoE 2016; Appendix A). As such, dustfall monitoring will no longer be collected at the Mount Polley Mine. Particulate monitoring at the mine site in discussed in Section 4.2.

4.2 PARTICULATE MONITORING

Particulate matter is generally defined into three size fractions:

- Particulates of all size classes are referred to as total suspended particulate (TSP);
- Particulates with a diameter of 10 µm or less are referred to as PM_{10}; and
- Particulates with a diameter of 2.5 µm or less are referred to as $PM_{2.5}$.

Exposure to respirable (PM_{10}) and fine particulate matter ($PM_{2.5}$) may aggravate a number of respiratory illnesses. Smaller particles are generally thought to be of greater concern to human health than larger particles (US EPA 2016).

The deposition of TSP is generally considered dustfall. Deposition of PM_{10} and $PM_{2.5}$ are limited relative to TSP and these smaller particles can generally travel farther distances than TSP. Currently, there is no monitoring of TSP, PM_{10}, and $PM_{2.5}$ at the Facility, but these parameters were continuously monitored from July to October 2015 at four locations around the TSF and Polley Flats. The monitoring for TSP, PM_{10}, and $PM_{2.5}$ was discontinued based on the monitored results. Of the 82 days that were monitored, only three days had PM_{10} and $PM_{2.5}$ concentrations greater than the AAQO; however, these exceedances were most likely attributable to local and regional forest fires (Golder 2015b). Also, despite August 2015 being a dry month when compared to historical averages, particulate concentration data showed fugitive dust control measures were effective in the TSF and Plug area. For more information see *Continuous Particulate Monitoring at Mount Polley September 17 to 29, 2015: Summary of Particulate Monitoring July 7 to September 29, 2015* (Golder 2015b).

4.3 RECEPTORS

Table 4.3 summarizes offsite sensitive receptors near the Facility, arranged by the least distance from the Facility, which may be affected by fugitive dust (Golder 2015a). There are a number of recreational areas within 10 km of the Facility and the nearest town site is the community of Likely located 12 km northeast of the TSF and 9.5 km northeast of the Mount Polley Mine mill site.

Table 4.2. Sensitive Receptor Locations

Receptor Description	Receptor Name	Easting (m)	Northing (m)	Direction from Facility
Recreation	Polley Lake Campsite	596,031	5,821,197	North
Recreation	Polley Lake	595,508	5821,029	North
Recreation	Bootjack Lake	592,240	5,820,738	Northwest
Recreation	Raft Creek Campsite	601,094	5,818,449	East
Recreation	Bootjack Mountain	589,454	5,820,753	West northwest
Recreation	Quesnel Lake	599,055	5,823,901	Northeast
Recreation	Campsite at Bootjack Lake	590,183	5,823,874	Northwest
Residence	Cedar Creek Rd Residences by Quesnel Lake	599,755	5,826,365	Northeast
Residence	Cabins at Polley Lake	593,105	5,826,547	North northwest

Receptor Description	Receptor Name	Easting (m)	Northing (m)	Direction from Facility
Residence	Residential Dwelling	592,076	5,826,365	North northwest
Recreation	Cedar Point Provincial Park	598,954	5,826,215	Northeast
Recreation	Gavin Lake	587,195	5,816,268	Southwest
Recreation	Mount Jacobie	586,318	5,821,558	Northwest
Residence	Likely Road Residences by Quesnel Lake	598,207	5,829,330	Northeast
Recreation	Jacobie Lake	584,757	5,822,835	Northwest
Town Site	Community of Likely	596,739	5,830,494	Northeast
Recreation	Morehead Lake	586,301	5,826,856	Northwest
Recreation	Prior Lake	589,673	5,829,819	North northwest
Recreation	Little Lake	586,936	5,830,106	Northwest
Residence	Dwelling by Little Lake	586,878	5,830,576	Northwest
Recreation	Morehead Lake Cabins and Campsite	586,824	5,828,888	Northwest

5 RESPONSIBILITIES

The following sections detail the responsibilities held by each of the employment levels at the Facility as they pertain to this Plan.

5.1 SENIOR MANAGEMENT REPRESENTATIVE: MINE MANAGER

The Senior Management Representative, or designate, is responsible for:

- ensuring the required resources are in place to execute the Plan.

5.2 ACCOUNTABLE FACILITY REPRESENTATIVE: ACTING GENERAL MANAGER

The Accountable Facility Representative, or designate, is responsible for:

- reviewing the effectiveness of the current dust control measures at the Facility;
- scheduling and coordinating the implementation of fugitive dust control measures; and,
- training of site personnel and contractors on the Plan and best management practices to be implemented.

5.3 OPERATIONS SUPERVISOR: GENERAL FOREMAN

The Operations Supervisor, or designate, are responsible for:

- reviewing the effectiveness of the current dust control measures at the Facility;
- maintaining documentation of schedules and logs;
- implementing fugitive dust control measures;
- forwarding dust observation reports from site personnel to the Accountable Facility Representative; and,

- completing daily dustfall observations of the TSF and surrounding area as part of the daily Water Management Inspection Manual checklist (Appendix B).

5.4 FACILITY PERSONNEL AND CONTRACTORS

All Facility Personnel and Contractors are responsible for:

- following the dust control procedures that are currently in place; and,
- reporting dust observations to appropriate supervisor.

5.5 TECHNICAL SERVICES SUPERINTENDENT

The Technical Services Superintendent is responsible for:

- providing feedback on the effectiveness of the current dust control measures at the Facility;
- conducting internal audits of the dust control measures at the Facility;
- coordinating external audits of the dust control measures at the Facility;
- coordinating dust sampling programs; and,
- reporting results to regulatory authorities.

6 FUGITIVE DUST EMISSIONS MANAGEMENT

This section describes the fugitive dust control measures that are implemented at the Facility. This section follows the PDCA cycle as described below:

- Section 6.1 **PLAN** - identifies the emission sources at the Facility.
- Section 6.2 **DO** - documents the schedule for implementation of the management practice(s).
- Section 6.3 **CHECK** - describes the monitoring procedures and a record keeping system.
- Section 6.4 **ACT** - describes the management practice review and updating procedures in order to promote its continuous improvement.

6.1 PLAN – IDENTIFICATION AND CLASSIFICATION OF FUGITIVE DUST EMISSIONS

6.1.1 Identification of the Sources of Fugitive Dust Emissions

Fugitive dust emissions occur due to mechanical disturbances of granular materials exposed to the air. Dust generated from these open sources is termed "fugitive" as it is not discharged to the atmosphere in a confined flow stream, such as through an exhaust pipe or stack (US EPA 1995).

Mechanical disturbances are often created from activities such as vehicle movement, crushing and material transfer activities, but can also be created from wind action, which promotes lifting of fine particles from sources such as open fields and stockpiles. Therefore, some fugitive dust emissions occur, or are intensified during, certain operations and/or by natural means (e.g., wind action).

Factors that would affect the quantity of fugitive dust emitted from a source include the material's particulate size distribution, moisture content, and frequency of the mechanical and natural disturbances. Precipitation and evaporation conditions can affect the moisture content of the material being disturbed

and have an influence on the amount of fugitive dust emitted. Precipitation acts to prevent emissions through cohesive bonding of small particles, while evaporation elevates the potential for dust emissions.

Once dust is emitted (suspended in air), it will disperse from the source according to various factors such as wind speed and direction, precipitation rates, and particle size distribution (OMoE 2005). Higher wind speeds increase the potential distance travelled by the particulates, while precipitation can facilitate particulate deposition (wet deposition). Particles that are less than 2.5 µm in diameter can travel further before settling and are of higher concern as they have the potential to present a health problem to humans if inhaled.

Main sources of activities which contribute to fugitive dust emissions from the Facility are summarized in Table 6.1.

Table 6.1: Main Sources and Factors Contributing to Fugitive Dust

Process/Activity	Causes	Factors that may Produce Fugitive Dust Emissions
TSF	• Wind erosion off of surface of TSF from dried material	• Fines content of tailings • Surface moisture content of tailings • Wind speed and direction • Precipitation and snow cover (natural control measures) • Vegetation cover – control measures • Sprinklers – control measures • Pond volume – control measure
Polley Flats	• Wind erosion off of surface of Polley Flats from dried material	• Fines content of tailings • Surface moisture content of tailings • Wind speed and direction • Precipitation and snow cover (natural control measures) • Vegetation cover – control measures • Surface treatment – control measures
Material Handling (Limited)	• Disturbance of material (waste rock, ore and stockpiles) caused by loading/unloading (dumping into haul trucks and dumping onto stockpiles/dumps/gyratory crusher) • Wind erosion of material from material being handled	• Drop height of loading/unloading activities • Moisture content of material • Fines content of material • Wind speed
Ore Processing (No Activity)	• Processing of material (waste rock and ore) through crusher • Wind erosion off of stockpiles	• Drop height of loading/unloading activities • Moisture content of material • Fines content of material • Wind speed
Dozing Activity (Limited)	• Disturbance of material (waste rock, ore and stockpiles) caused by machinery • Wind erosion of material from material being dozed	• Height of material being dozed • Fines content in material handled • Moisture content in the material • Vehicle weight and speed • Wind speed
Grading (Limited)	• Disturbance of surface material caused by grading machinery	• Surface fines content • Surface material moisture content • Vehicle weight and speed
Hauling/Access Road Traffic	• Disturbance of granular material on the road surface caused by motion of vehicles • Wind erosion on the road surface	• Surface fines content • Surface material moisture content • Wind speed

(Light Vehicles Only)		• Vehicle weight and speed

6.1.2 Fugitive Dust Management Practices

Control measures to reduce fugitive dust emissions should take into account the sources of the dust emission, the dispersion conditions and the location of sensitive areas in order to avoid significant impacts of dust emissions on receptors. Control measures tend to impact one or more factors affecting the generation and/or dispersion of fugitive dust emissions. These control measures can be classified as follows:

- **Preventative Procedure**: Measure pertaining to the design and installation of structures and the operating procedures which are implemented on a regular basis in order to prevent the generation of dust and/or the dispersion of dust generated from reaching sensitive areas.
- **Reactive Control Measures**: Measures which are implemented in the event of unexpected circumstances which can lead to the generation of dust and/or the dispersion of dust generated reaching sensitive areas.

Table 6.2 provides a description of the preventative procedures and control measures at the Facility.

Table 6.2: Description of Preventative Procedures and Control Measures for Fugitive Dust Emissions

Preventative Procedure/ Control Measure	Emission Source Effected	Description	Application Frequency
Visual Inspection	TSF and Polley Flats	Daily visual inspections of the TSF and Polley Flats	Daily during non-frozen periods. If inspection indicates potential for dust emissions another follow up inspection will be conducted later that day
Wet Suppression	TSF and unpaved site roads	Fugitive dust generated from the TSF and unpaved site roads are controlled by using water	Daily observations (water management inspections, when wind speeds measured over 3.6 m/s are observed, and/or incidents)
Progressive Reclamation	TSF and Polley Flats	Growth media and vegetation applied progressively as either planting, broadcast seeding, heli-seeding or natural re-vegetation	One-time event, with ongoing planting, as required
Use of Dedicated Routes/Areas	Unpaved Site Roads (excluding the Mine and Ore Stockpile Area)	Haul traffic has designated routes. Have a procedure that all vehicles comply with these routes. Regular application of appropriate dust suppression (e.g. water, flocc, CaCl)	When necessary
Controlled Loading and Unloading Techniques	Dust from Material Handling	Trucks are loaded/unloaded in a slow and controlled manner to minimize drop height and avoid spillage	When necessary based on daily observations, inspections, and/or incidents

Fugitive dust may be emitted from the TSF and Polley Flats under strong wind conditions (wind speeds >5.4 m/s) (Golder 2015a). If wind erosion from the TSF is observed, it can be controlled by stabilizing the affected surfaces by use of chemical suppressants or regular watering. Control measures that have been implemented to reduce wind erosion from the TSF include:

- Installation of 5 water sprayers along the Main Embankment of the TSF. Each sprayer has a spray radius of 40-70 m and are adjacent to each other. Water is being pumped from the Main Embankment Seepage Collection Pond below the Main Embankment to a sprinkler line connected to all other sprinklers.
- Pond volume size parameters take into account dust management in regards to amount of surface area exposed.

Winter temperatures, below freezing, will prohibit the use of water as a dust suppressant; however, snow cover will act as dust suppressant in the winter months. Based on weather data presented in Golder (2015a), the average temperature is below freezing from November to March, where there is snow cover present.

Table 6.3 summarizes the fugitives dust emission activities and processes along with the proactive and reactive mitigation practices that can be implemented to control fugitive dust.

Table 6.3: Summary Table of Mitigation

Source	Proactive Mitigation Practices	Reactive Mitigation Practices
TSF	• Sprinklers as a dust suppressant on TSF • Rain/snow cover as a natural dust suppressant during winter • Interim seeding	• Wet suppression • Visual inspection of nearby sensitive receptor locations (<2 km) during dust events
Polley Flats	• Rain/snow cover as a natural dust suppressant during winter • Progressive reclamation (including ongoing removal and/or capping of tailings)	• Wet suppression • Visual inspection of nearby sensitive receptor locations (<2 km) during dust events
Crusher Building/Stockpiles (No or very limited activity during care and maintenance)	• Sprayers located on conveyers, transfer chutes, screens, and at the top of stockpiles • Dust control scrubber system for crusher building • Turbomister installed by crusher stockpiles	• Wet suppression • Removal of dust emissions from building
Road Dust	• Use of water trucks to wet roads	• Wet suppression

The effectiveness of watering practices for the TSF and Polley Flats are expected to be the same as for stockpiles. From Environment Canada (2014), wet suppression effectiveness rates are a function of the amount of water applied and range between 50-95% efficiency (Table 6.4).

Table 6.4: Wet Suppression Efficiency (Environment Canada 2014)

Efficiency (%)	Application Rate (L/m^2)
50	1.591
60	2.232
70	3.172
80	4.748
85	6.077
90	8.306
95	13.337

It is expected that there are 151 days during the year where there are either subfreezing ground conditions, based on average monthly temperature in Golder (2015a), or days where there is at least 1 cm of snow on the ground (Horsefly Lake Gruhs Lake Environment Canada Climate normal) which would act as a natural dust control measure. Furthermore, it is expected that during the non-freezing period there are approximately 98 days where there is at least 0.254 mm of rainfall (Station #1 and Station #2). Therefore, using the precipitation adjustment factor published by Environment Canada (2014) for stockpiles, it is expected that precipitation and snow cover would have approximately 68% percent effectiveness at controlling fugitive dust on an annual basis.

The effectiveness of vegetation covers to control fugitive dust has been observed to vary with the type and amount of cover. In the southwest regions of the United States, vegetation cover, which were sparse, resulted in dust control effectiveness of 25%; whereas, dense vegetation cover can result in dust control effectiveness of up to 100% (US EPA 1984). Visual inspections can be undertaken at receptor locations near (within 2 km of the Facility) during dust events (i.e., wind events >5.4 m/s).

6.2 DO – Implementation of the Dust Management Plan

Dust generating activities performed on-site should meet the requirements of this Plan.

6.3 CHECK – Inspection, Maintenance and Documentation

Routine inspections at the Facility should be performed to firstly check that the proactive and reactive mitigation measures are being implemented, and secondly, confirm that the mitigation practices are effectively reducing fugitive dust emissions. Daily inspections of the TSF and surrounding area are incorporated into MPMC's Water Management Inspection Manual checklist. Outstanding or overdue inspection findings are reviewed monthly by the Joint Occupational Health Safety and Environment Committee.

Routine reviews of results are also performed by MPMC's Environmental Department. This includes review of the documented observations to confirm that that mitigation (control) measures were implemented to reflect the observations recorded.

It is expected that all deficiencies identified in inspections will be addressed. Reasonable corrective action will be undertaken and documented. Reviews of the non-conformance should be done quarterly as a

method for continual improvement. The Operations Supervisor should be responsible for recordkeeping the information listed above.

The annual and monthly wind roses for Station #2 (the station with representative winds at the TSF and Polley Flats) demonstrates that the predominant wind directions during the summer months are from the north and south (with more southerly winds).

6.4 ACT – DUST MANAGEMENT PLAN REVIEW AND CONTINUOUS IMPROVEMENT

Inspections and monitoring procedures will assist MPMC personnel with the maintenance of an effective Dust Management Plan. The Dust Management Plan should be monitored and updated, as follows:

- when there are significant changes in the fugitive dust emissions sources;
- periodically, every five (5) years (minimum);
- when there are verified grievances associated with fugitive dust emissions from the Facility; and,
- when there are visible dust emissions occurring more frequently and/or at a higher rate (excluding seasonal conditions).

Review of the Plan is intended to evaluate the effectiveness of the proactive and reactive dust control practices and focus on the identification of improvement opportunities that can reduce the risk of complaints or health concerns related to fugitive dust emissions.

6.4.1 Contingency Measures

Possible contingency measures to be implemented at a later date, if required, include:

- Application of calcium chloride on Bootjack Forest Service Road.
- Installation of additional turbomisters, sprayers and sprinklers to periodically wet the TSF, thereby increasing the moisture content of the surface material which will result in greater surface cohesion and a reduction from fugitive windblown dust.

7 REFERENCES

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Appendix A

Dustfall Monitoring and Pollution Control Objectives Technical Memorandum

BRITISH COLUMBIA

Memorandum

Air Quality Section

Monitoring, Assessment and Stewardship

Date: January 21, 2016 **File: 21610-00\Dustfall**

To: Robyn Roome, Director, Monitoring, Assessment & Stewardship

Re: Dustfall Monitoring and Pollution Control Objectives

The Air Quality Section has recently reviewed the use of dustfall monitoring in mining assessments and EMA authorizations/permits. Based on the review, the Air Quality Section considers dustfall monitoring and the dustfall Pollution Control Objectives as outdated methodology/criteria and, with the exception of specific limited circumstances, is no longer recommending or supporting their use based on the following reasons:

- The BC dustfall objectives were originally developed under the old BC Pollution Control Objectives (PCOs) back in 1979 as a 'soiling index' or method of assessing the "dustiness" of an area from an aesthetic or nuisance perspective. Their effectiveness for determining impacts on human or environmental health (soil, water, vegetation) is extremely limited.
- The PCOs were rescinded in 2006, although the dustfall objectives were retained on the BC air quality website "for reference purposes".
- Dustfall sampling methodology (passive open canister exposure) does not perform well (severely underestimates) during high wind events (often associated with fugitive dust).
- Dustfall monitoring is often used around mining projects with the stated intention of tracking metals impacts associated with fugitive dust. However, results are poor indicators for metals effects monitoring as there is no indication of the bioavailability of any metal contained in the samples and no established relationship between deposition rates and protection of soil, water or vegetation health.
- Dustfall results cannot be used for dust episode management actions as the 30-day sample periods (and subsequent laboratory analyses) are too long to be of any use for this purpose.
- While dispersion modelling may assist with determining the possible affected areas from fugitive dust generated during mining operations, the modelled concentrations are highly uncertain due to the poor quality of the model inputs, namely simplistic emission factors, added to the inherent uncertainties and limitations in modelling dust dispersion and deposition. This is particularly the case with road dust.

Based on the rationale above, it is suggested that before requiring dustfall as a component of any assessment process or inclusion within a regulatory authorization, that the objectives of the monitoring and/or dust management plans be clearly defined. Some possible considerations:

- If the concern is simply one of an aesthetic or nuisance nature, the use of dustfall monitoring and the objectives may be justified, with careful selection of the appropriate criteria, e.g.
    - 'residential/parkland' PCO (1.75mg/dm^2/day),
    - 'industrial/other' PCO (2.90mg/dm^2/day), or
    - facility/site specific deposition rate.
- If the objective is to protect of human health (i.e. nearby human receptors), monitoring of $PM_{2.5}$/PM_{10} would be more appropriate, including compliance with associated Ambient Air Quality Objectives.
- If the objective is to the protect the soil/water/vegetation and/or tracking accumulation of metals or other contaminants in the environment, including impacts to 'country foods', sampling of the specific media of concern would be more appropriate and specialists from the related disciplines should be involved in the development of baseline and on-going monitoring programs and determination of protective criteria.
- For episode management of fugitive dust, continuous monitoring of TSP or PM_{10} would provide more timely information for triggering actions under a dust mitigation plan.
- If there are concerns regarding other emission sources and possible impacts to ambient air quality and the environment, the emissions/impacts should be characterized, assessed and the appropriate monitoring determined.

When dispersion modelling is used in an assessment, the BC modelling guidelines recommend that a modelling plan be developed with input and subsequent sign-off from an Air Quality Meteorologist; it is recommended that a similar approach be used when developing baseline monitoring plans used to support assessments, compliance monitoring programs, or permit monitoring clauses. Proponents and permitting staff should consult with Air Quality Meteorologists to determine the contaminant(s) of concern, the monitoring methods, sampling locations and air quality criteria to be used.

Sincerely,



Arvind Saraswat, P.Eng.
Air Quality Section Head (Assessments)

Appendix B

The Daily Water Management Inspection Checklist

Daily Water Management Inspection Checklist

*(Controlled Document – **DO NOT COPY**: please ask Environment Department for print out)*

Inspector: _____ Date: _____

Shift: (Crew, D or N) _____ Weather Conditions: (ex. hot, windy, sunny): _____

	Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes / Comments
1	Junction Zone Seepage Sump		GOOD / ISSUE	
2	9K Sump # Starts _____ Op hrs_____		RED YELLOW BLACK	
3	CWTS (Wetland)		GOOD / ISSUE	
4	NW PAG Sump Starter 1: # Starts _____ Op hrs_____ Starter 2: # Starts _____ Op hrs_____		RED YELLOW BLACK	
5	Mine Drainage Creek Sump		RED YELLOW BLACK	
6	West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
7	Booster Station		GOOD / ISSUE	
8	Bootjack Creek Sump – Upstream side		GOOD / ISSUE	
9	Corner 1 Buttress Culverts/Ditch		GOOD / ISSUE	
10	TSF Barge		GOOD / ISSUE	
11	Dredge Outflow Pipe		GOOD / ISSUE	Location:
12	South Seepage Collection Pond		RED YELLOW BLACK	
13	Main Seepage Collection Pond		RED YELLOW BLACK	Percent Full ____%
14	Fish fence at outlet to Quesnel Lake		GOOD / ISSUE	
15	Fish Fences above Gavin Lake Bridge		GOOD / ISSUE	Cleaned? Y / N
16	WTP Well		(m)	
17	WTP Slurry Line		GOOD / ISSUE	
18	Perimeter Embankment Till Borrow Pond		RED YELLOW BLACK	
19	Breach Sump/COW Drain/Upstream Drain		GOOD / ISSUE	
20	CCS		GOOD / ISSUE	
21	Long Ditch Outflow Pipes		GOOD / ISSUE	
22	Long Ditch Sump (Lower)		RED YELLOW BLACK	
23	Long Ditch Sump (Upper)		RED YELLOW BLACK	
24	SERDS Sump		RED YELLOW BLACK	
25	Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
26	**NEZ Seep Sump**		GOOD / ISSUE	
27	Wight Pit Water Level		(m)	
28	Joe's Creek Pipe		GOOD / ISSUE	
29	**Leachpad LCRS**		(m)	Pumped? Y / N
30	West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
31	Bootjack Creek Sump		RED YELLOW BLACK	
32	Mill Site Sump		Pump Hours	

Updated Feb 16, 2019

Is the TSF Generating Dust?

No Minor Moderate Major | Corner 1 Corner 2 Corner 3 Corner 4 Corner 5

Is the Polley Lake Plug Generating Dust?

No Minor Moderate Major

REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING IN FREEZING CONDITIONS

ADDITIONAL COMMENTS/OBSERVATIONS (EX. EROSION):

NOTE* - Please clean up and report all spills of hydrocarbons or chemicals

WILDLIFE OBSERVATIONS (include locations):

Appendix Q
2015 Contaminated Sites Assessment Procedure

September 30, 2015 Reference No. 1411734-085-L-Rev0-15000-6000

Katie McMahen
Mount Polley Mining Corporation
Box 12
Likely, BC V0L 1N0

CONTAMINATED SITE ASSESSMENT PLAN

Dear Ms. McMahen:

This letter provides an outline of the conceptual contaminated sites assessment (CSA) plan for closure of the Mount Polley Mine ("the Site") required by the BC Ministry of Energy and Mines in a permit amendment issued to Mount Polley Mining Corporation on July 9, 2015. Specifically, the CSA plan to address potential contamination on closure of the mine will follow the technical guidance and protocols outlined in the Contaminated Sites Regulation (http://www2.gov.bc.ca/gov/content/environment/air-land-water/site-remediation/laws-regulations-compliance), and tailored to the conditions of the Site. The CSA work will be conducted in consultation with a Contaminated Sites Approved Professional

Stage I Preliminary Site Investigation

MPMC has identified the activities or areas of potential environmental concern (APECs) associated with mining operations and the contaminants of potential concern (COPC) associated with these APECs (Table 1, Figure 1). On closure of the mine, or areas of the mine, each of the APECs will be inspected for visual signs of contamination. Photos of each APEC will be taken to include in documentation. Interviews will be held with MPMC personnel familiar with the APECs to determine standard practice for each APEC and records of spills or other historical activities that could have resulted in contamination. This process is consistent with a Stage I Preliminary Site Investigation. MPMC will track each APEC recording site inspections, interviews and photos of those closed, such that documentation can be supplied, if requested. The estimated costs associated with the Stage I PSI are outlined in Table 2.

Stage II Preliminary Site Investigation and Detailed Site Investigation

If there is evidence of contamination associated with the APEC, soil will be sampled and analyzed for the COPCs associated with the APEC in accordance with the guidelines and protocols for a Stage II Preliminary Investigation (Stage II PSI). If contamination is found, step out soil samples will be collected to delineate soil contamination in a Detailed Site Investigation (DSI). Depending on the extent of soil contamination found, an investigation of groundwater quality may be needed. If the COPCs are listed on Schedule 11 of the CSR, it may be necessary to conduct an investigation of soil vapour. The estimated costs associated with a Detailed Site Investigation are dependent on the results of the PSI, and are therefore difficult to predict. For planning purposes, an estimate is provided in Table 3.

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Using Site Knowledge

MPMC has conducted many detailed site investigations related to contamination, contaminant fate and transport, as well as restoration work including site-specific assessments of geochemistry and contaminant toxicity as part of their exploration work and work related to the tailings dam failure. Reclamation plans have been developed for both terrestrial and aquatic areas surrounding the mine. This work should be consulted if contamination is found related to the mine APECs, as this work provides valuable context for data interpretation.

Following delineation of contamination, a remediation plan will be developed to address contamination such that it meets the requirements of the BC *Environmental Management Act*. It is anticipated that the remediation plan will build off of studies conducted and lessons learned and successes from the remediation and restoration work conducted for the tailings dam failure.

The plan provides an outline of the CSA plan required in the July 9, 2015 permit amendment issued to MPMC. The cost associated with the stages of investigation are difficult to determine as it will depend the extent of contamination encountered. For planning purposes, MPMC should expect the costs to be similar to those estimated in this report. As APECs are investigated and closed, the costs should be updated such that they provide a meaningful budgeting tool moving forward.

Yours very truly,

GOLDER ASSOCIATES LTD.





Reidar Zapf-Gilje, Ph.D., P.Eng.
Contaminated Sites Expert

Trish Miller, M.Sc., R.P.Bio.
Principal, Senior Environmental Scientist

RZG/TAM/ch

Attachments: Table 1: Areas of Potential Environmental Concern (APECs) and Contaminants of Potential Concern (COPC) for the Operational Areas of the Mount Polley Mine
Table 2: Stage 1 PSI Scope and Cost
Table 3: Scope of Work and Estimated Costs for a Stage II Preliminary Site Investigation (Stage II PSI) and Detailed Site Investigation (DSI) for Budget Planning Purposes

Figure 1 – CSR Conceptual Plan APECs

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Area	~Size(m^2)	Material(s) Stored/Used	COPC(s)
Fuel Island (light vehicle)	170	Diesel, gasoline	Hydrocarbons
Waste Disposal Area (adjacent to light vehicle fuel island)	90	Batteries, hydrocarbon contaminated waste, used paint, plastic jug recycling	Glass cleaner (Isopropyl alcohol; propoxy propanol; cipropylene glycol; monomethyl ether; monobutyl ether; ammonia),washer fluid (methanol), hydrocarbons, acid batteries (lead; lead sulphate; figer glass separator, ABS), aerosol paint cans/paint cans (liquified petroleum gas; acetone; toluene; limestone; xylene; titanium dioxide; aliphatic hydrocarbon; talc; naphtha, petrolume hydrogreated light; ethylbenzne; barium sulfate; mineral spirits; aliphatic hydrocarbon, and similar)
Fuel Island	1,600	Diesel	Hydrocarbons
Outside maintenance shop + wash bay	8,200	**Lube Products**, **Welding Products,** diesel	See list below
Maintenance laydown	17,700	**Lube Products**, diesel	See list below
Light vehicle maintenance shop + weld barn	1,100	**Lube Products**, **Welding Products,** diesel	See list below
Warehouse	1,400	waste hydrocarbons/contained hydrocarbon products, mill reagents, cleaning products, lube products	See lists below
Crusher Yard	6,500	**Lube Products**, diesel	See list below
Crusher Area	38,400	Ore	Metals (copper, sulphur, iron, silica, aluminua); liquid heat (diethylene glycol; non-hazardous ingredients held as trade secret); belt dressing and conditioner (N-hexane; petroleum gases, liquified, sweetened; polybutylene resin), Nordbak products (aluminum oxide, fibrous; epoxy resin; silicon carbide; silicon dioxide; magnesium oxide; treated fumed silica; neopentyl glycol diglycidyl ether; silicon carbine; aliphatic amines; amine adduct; amine reacted fatty acid; alkyl phenol; triethylenetetramine; lisane derivative; quartz; calcium carbonate epichlorohydrin-4-4'isopropylidene diphenol resin, butyl 2,3-epoxypropyl ether; triphenyl phosphite
Temporary PAG Stockpile	428,400	Potentially acid generating rock	Metals
#1 Ore Stockpile	55,500	Ore	Metals
Cariboo Ore Stockpile	39000	Ore	Metals
Sulphur Pile	5,200	Sulphur compounds	Sulphur compounds
Heap Leach (test facility)	24,000	Sulphur compounds	Metals, sulphur compounds
Underground Operation and Maintenance Area	6,000	Blasting products	?
Magnetite Plant	33,600	Magnetite	Metals (iron oxide)
Concentrate Sheds	2,600	Ore, magnetite	Metals (copper, sulphur, iron, silica, alumiuna)
Orica Site	14,400	Blasting products	Fortan Extra System (Dry product: Ammonium nitrate; petrolium distillates, hydrotreated light; mineral oil. Wet product: ammonium nitrate; diesel fuel; mineral oil)

Cleaning Products	Hazardous Constituents (from MSDS)
ACTION DSC	Didecyl Dimethyl Ammonium Chloride; sodium carbonate; ethyl acoho
ALL PURPOSE WASHROOM CLEANER	Organic acid salt
AQUARESS HAND & BODY SHAMPOO	Water, Sodium Laureth Sulfate, Cocamide DEA, Sodium Chloride, Citric Acid, Diazolidinyl Urea, Glycol Distearate, Tetrasodium EDTA, Fragrance, Cocamide MEA, Laureth-10, Magnesium Nitrate, Methylchloroisothiazolinone, Magnesium Chloride, Methylisothiazolinone, Blue 1 (CI 42090
BLEACH-SODIUM HYPOCHLORITE	Sodium Hypochlorite
BORAXO POWDERED HAND SOAP	Sodium Borate Decahydrate (Borax); sodium soap
CITRUS AIR	Ethanol; D-Limonene; propylene glycol; isobutane; propane
CITRUSOLV-HF	Distillates (petroleum), hydrotreated light; (R)-p-mentha-1,8-diene
CLEAN SPRAY	Ethylene glycol mono butyl ether; tetrapotassium pyrophosphate; tetrasodium salt of ethylenediaminetetraacetic acid
COMPARE	No hazardous ingredients listed on MSDS
COMET DISINFECTANT CLEANER WITH CHLORINOL	Dipropylene glycol N-butyl ether; citric acid
ENGINE DEGREASER	Diethylene gloycol monoethyl ether; ethanol; propane; butane; citrus terpenes; ethanol
FAST ORANGE PUMICE CLEANER	Pumic; ethoxylated C11-C16 alcohol; D-limonene
FLOOR SWEEP-CANOLA OIL BASED	No hazardous ingredients listed on MSDS
GLASS CLEANER WITH AMMONIA	Isopropyl alcohol; propoxy propanol; cipropylene glycol; monomethyl ether; monobutyl ether; ammonia
KLINGER BOWL CLEANER	Citric acid
KRYSTAL GREEN	Ethylene glycol mono butyl ether; monoethanolamine
LEMINEE 23 CLEANER-DISINF.	Alcohols, C12-15, ethoxylated; soda ash; alkyl dimethylbenzylammonium chloride; alkyl dimethyl ethylbenzylammonium chloride; ethyl alcohol
LIQUID HAND SOAP-6000	No hazardous ingredients listed on MSDS
MULTI-KLEEN	2-propanol; 2-propanol; Alcohol Ethoxylate; caustic potash (45%); sodium metasilicate; sodium tripolyphosphate
MULTI-KLEEN-INDUSTRIAL	Sodium metasilicates; 2-butoxyethanol; Alcohol Ethoxylated; sodium tripolyphosphates
NEUTRAL FLOOR CLEANER	Sodium lauriminodipropionate; alcohols C12-C13 ethoxylated; dipropylene glycol monomethyl ether; alcohol ethoxylate (C9-C11)
ORDERLY-DISINFECTAND	Di-(C8-10)-alkyl dimethyl ammonium chlorides; alkyl dimethyl benzyl ammonium chlorides; ethanol; alcohol ethoxylate
PINOSAN	Alkyl dimethyl ammonium chlorides; Didecyl dimethyl ammonium chloride
PLEDGE	Hydrocarbons, C16-C20, n-alkanes, isoalkanes, cyclics,<2% aromatics; white mineral oil (petroleum)
SHOWER SHINE	Phosphoric acid; ethoxylated nonionic detergent; lauryl dimethylamine oxide
STAIN REMOVER AND DEODORIZER-SR (unbelievable)	No hazardous ingredients listed on MSDS
STRATE FLUSH	Hydrochloric acid
SUNLIGHT DISH SOAP	Magnesium oxide; ethyl alcohol; dodecylbenzene sulfonic acid
SUPER-CLEAN DEGREASER (DETERGENT)	Sodium metasilicate; sodium hydroxide; surfactant, glycol blend
SUPER 90 FLOOR FINISH	No hazardous ingredients listed on MSDS
TOUGH GUY LAUNDRY DETERGENT	Sodium carbonate
TOUGH GUY NEUTRAL CLEANER	No hazardous ingredients listed on MSDS
TRISODIUM PHOSPHATE-TSP	Trisodium phosphate dodecahydrate
URINAL BLOCKS	1,4-Dichlorobenzene
VELVA SHEEN	1,8-p-menthadiene; isoparaffinic hydrocarbon; propane/N-butane

Lube Products	Hazardous Constituents (from MSDS)
2-CYCLE MOTOR OIL	Distillates, petroleum, solvent-refined heavy paraffinic; petroleum distillates, hydrotreated light
ANTIFREEZE/COOLANT 50/50	CH_2OHCH_2OH
ANTIFREEZE/COOLANT HEAVY DUTY	CH_2OHCH_2OH
ANTIFREEZE/COOLANT-UNIVERSAL	CH_2OHCH_2OH
ANTIFREEZE - AIR BREAK	CH_3OH
ATF-SUPER	Distillates, petroleum, hydrotreated heavy paraffinic; distillates, petroleum, hydrotreated light paraffinic
ATF-TYPE F	Distillates, petroleum, hydrotreated heavy paraffinic; N-Phenyl-1-naphthylamine
BATTERY CLEANER	2-butyloxyethanol; sodium bicarbonate; detergent; liquefied petroleum gas
BEARING MOUNTS FOR CLOSE FITS	Methacrylate monomer; 2-hydroxyethyl methylate; coumarone-indene resin (mixture); poly(ethyl methacrylate); dimethylbenzyl hydroperoxide
BREAK CLEAN	Heptane; methanol; 2-propane
BREAK FLUID DOT 3 HEAVY DUTY	http://armoredautogroup.com/pdf/STP/STP-Heavy-Duty-Brake-Fluid,-DOT-3-(1-2011).pdf
COMPRESSOR OIL	Hydrotreated light paraffinic distillates, petroleum
FUEL-DIESEL	Diesel; distillates (petroleum), hydrotreated middle; distillates, hydrotreated light (may contain: alkyl nitrate, polyisobutenyl succinic anhydride nitrogen functionalized dispersant, and mixed cyclic amines)
FUEL-GASOLINE	Gasoline, toluene, ethanol, benzene
FULL SYNTHETIC MITOR OIL-KENDALL	Distillates, petroleum, hydrotreated heavy paraffinic
FULL SYNTHETIC MITOR OIL-HIGH PERFORMANCE	Distillates, petroleum, hydrotreated heavy paraffinic
GEAR LUBE-EXTRA DUTY	Residual oils, petroleum, solvent-refined; distillates, petroleum, solvent-dewaxed heavy paraffinic; residual oils, petroleum, solvent-dewaxed; distillates, petroleum, hydrotreated heavy paraffinic; residuum resins
GEAR LUBE-MOLYLUBE SF 100 SEMI-SYN. LIGHT	Graphite, hydrotreated light distillates (petroleum); carbon black; Stoddard solvent; silica, crystalline, quartz; mineral oil; molybdenum compounds; trymethylbenzne
GEAR LUBE- MOLYLUBE SF 100 SEMI-SYN ARCTIC	Distillates (petroleum), hydrotreated heavy naphthenic; distillates (petroleum), hydrotreated heavy paraffinic; distillates (petroleum), solvent-refined heavy paraffinic; hydrotreated light distillates (petroleum); Stoddard solvent
GEAR LUBE-MP	Lubricant base oil (light)
GEAR LUBE- TRITON SYN	1-Decene, homopolymer, hydrogenated
GEAR SHIELD NC	Bitumen; distillates (petroleum), hydrotreated light; distillates (petroleum), hydrotreated middle; zinc compounds
GEAR SHIELD-HEAVY	Heavy hydrotreated naphthenic distillates (petroleum); petroleum hydrocarbon; residual oils (petroleum), solvent dewaxed; petroleum asphalt; zinc oxide; 12 hydroxystearic acid; carbon black; inedible animal grease; lithium hydroxide monohydrate
GUARDOL ECT-MOTOR OIL (TITANIUM)	Lubricant base oil (petroleum); proprietary additives
GUARDOL QLT-MOTOR OIL	Distillates, petroleum, hydrotreated heavy paraffinic
HT/4 FLUID	Distillates, petroleum, hydrotreated heavy paraffinic; distillates, petroleum, solvent-refined heavy paraffinic; residual oils, petroleum, solvent-dewaxed; distillates, petroleum, solvent-dewaxed heavy paraffinic
HYDRAULIC/TRACTOR FLUID	Distillates, petroleum, hydrotreated heavy paraffinic; distillates, petroleum, solvent-dewaxed heavy paraffinic
HYDRAULIC OIL-MEGAFLOW AW	Distillates, petroleum, hydrotreated heavy paraffinic;
HYDRAULIC OIL-SUPER	Zinc compounds; lubricant base oil (petroleum)
KOPR-KOTE	Talc; graphite; copper; molybdenum disulphide
LUBRIPLATE CHAIN AND CABLE FLUID	Heavy and light hydrotreated naphthenic distillates (petroleum); carbon dioxide; 2-butoxyethanol; light distillate; aliphatic petroleum distillate
MAROK-ROCK DRILL OIL	Distillates, petroleum, hydrotreated light naphthenic
MEGAPLEX XD3	Lubricant base oil (petroleum); molybdenum disulfide; carbonic acid, calcium salt
MEGAPLEX XD5	Lubricant base oil (petroleum); molybdenum disulfide; zinc dialkyl dithiophosphate
MOLY LOW TEMP	Distillates, petroleum, hydrotreated light naphthenic; distillates, petroleum, hydrotreated heavy naphthenic; molybdenum (IV) sulfide
MULTIPLEX-RED	Phosphorodithioic acid, O,O-di-C1-14-alkyl esters, zinc salts; lubricating oils (petroleum), hydrotreated solvent-refined bright stock-based; alkyl Imidazoline; lubricant base (petroleum)
OMNIGUARD	Lubricant base (petroleum); calcium carbonate
OSBORN BLUE LAYOUT FLUID	Acetone; methyl ethyl ketone; liquified petroleum gas; ethyl acetate; xylene; butyl acetate; isopropyl alcohol; nitrocellulose
POLYTAC EP	Distillates, petroleum, hydrotreated heavy naphthenic; distillates, petroleum, solvent-refined heavy paraffinic; N-Phenyl-1-naphthylamine
PYROSHIELD 9011	Amines, C12-14-alkyl, reaction products
QUIK PENETRATING SOLVENT	Mineral spirits; white mineral oil; propane
REDTAC	Naphthenic acids, zinc salts; lubricating oils (petroleum)
SKF GREASE (LGEP 2)	Phosphorodithioic acid, O,O-di-C1-14-alkyl esters, zinc salts; lubricating oils (petroleum), hydrotreated solvent-refined bright stock-based
SOLVENT	Stoddard solvent
SUPER MOTOR OIL	Distillates, petroleum, hydrotreated heavy paraffinic
SUPER SYNTHETIC BLEND MOTOR OIL	Distillates, petroleum, hydrotreated heavy paraffinic
TRANSFORMER OIL	Distillates, petroleum, hydrotreated light naphthenic
TRITON 220	Synthetic lubricant base oil
UNIMIX 2-CYCLE OIL	Lubricant base oil (petroleum); hydrotreated distillate, light C9-C16
UNOBA EP	Lubricant base oil (petroleum); calcium carbonate; proprietary additives
VICTAULIC LUBRICANT	Fatty acids, tall-oil, potassium salts; 1,2-Propylene glycol; mica
WASHER FLUID	Methanol
WHITE LITHIUM GREASE	Hexane isomers; n-hexane; heavy napthenic petroleum distillates; liquefied petrolum gas

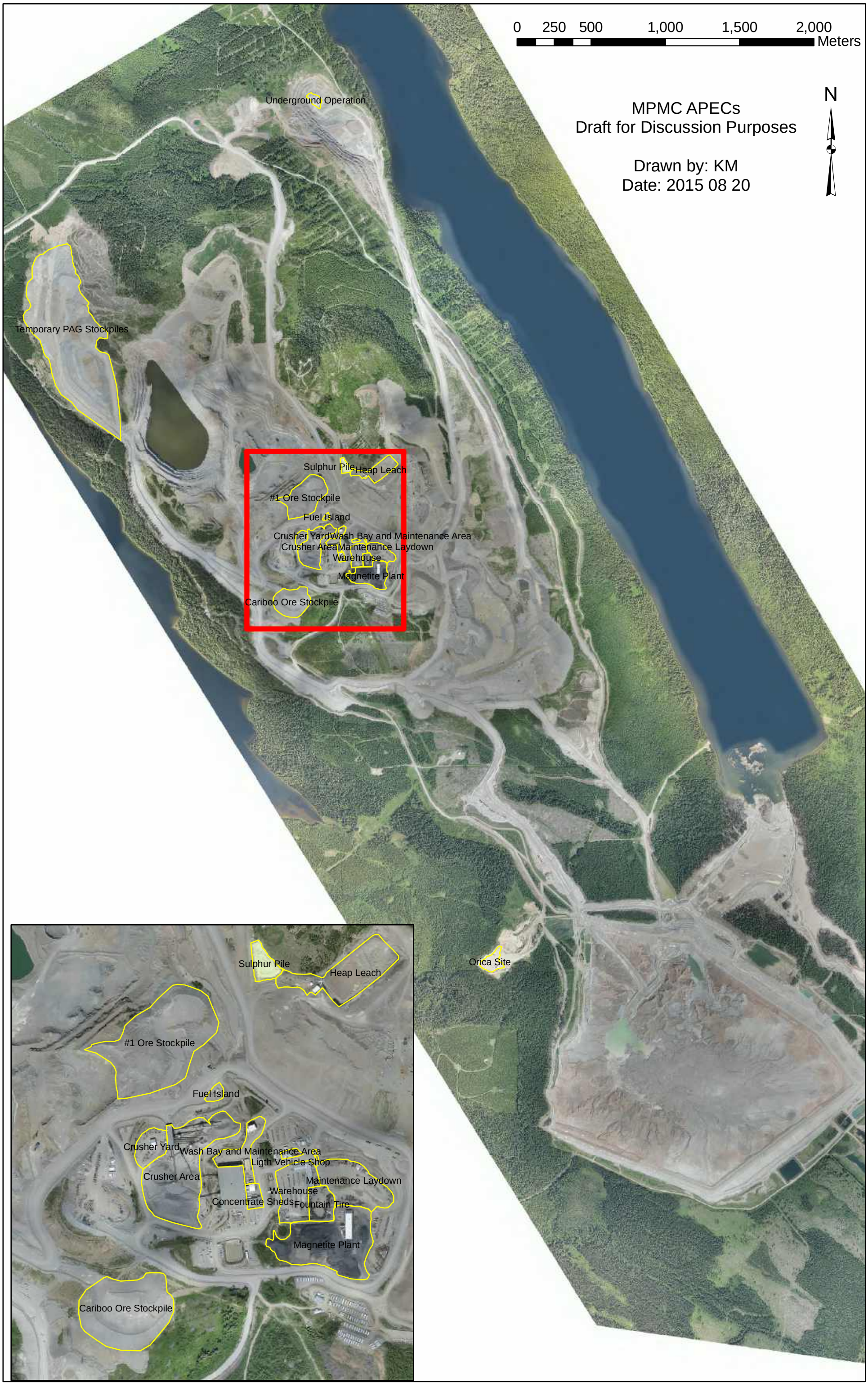
Chemial Products	Hazardous Constituents (from MSDS)
AERO 208 PROMOTER	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium salt, phosphorodithioic acid, o,o-diethyl ester, sodium salt, sodium hydroxide
AERO 3477 PROMOTER	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium hydroxide
AERO 7048 PROMOTER	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium salt, carbamothioic acid, 2-propenyl-, O-(2-methylpropyl) ester, isobutanol, sec-butyl alcohol, sodium hydroxide
AERO 7279 PROMOTER (DISCONTINUED)	carbamothioic acid, 2-propenyl-, O-(2-methylpropyl) ester, isobutanol, phosphorodithioic acid, O,O-bis(2-methylpropyl) ester, sodium salt, nonylphenol ethoxylate, sec-butyl alcohol
AERO 5100 PROMOTER	modified thionocarbamate #1, sec-butyl alcohol, isobutanol, modified thionocarbamate #2
DANAFLOAT 262	carbamothioic acid, ethyl-, *O*-(1-methylethyl) ester, isopropanol
DANAFLOAT 262T (unavailable)	carbamothioic acid, ethyl-, O-(1-methylethyl) ester, isopropanol, 1-dodecanethiol
DANAFLOAT 468	phosphorodithioic acid, O,O-bis(methylpropyl) ester, sodium salt, phosphorodithioic acid, o,o-diethyl ester, sodium salt, sodium hydroxide
CARBON DIOXIDE	carbon dioxide
HELIUM	helium
HIGHT CALCIUM QUICKLIME	calcium oxide, crystalline silica quartz
IPAC 6832	no hazardous ingredents listed on MSDS
IRON CHIP ACCELERATOR	iron; iron oxide dust
LECOCEL II and II HP	tungsten, tin
LECOSORB	non-fibrous silicate
LIQUID HEAT	diethylene glycol; non-hazardous ingredients held as trade secret
MAGNETITE	iron oxide
MIBC	methyl isobutyl carbinol
POLYCLEAR 2529	anionic water-soluble polymer
POLYCLEAR 2528	anionic water-soluble polymer
POLYCLEAR 2532	long-chain polymer
POLYCLEAR 2530	long-chain polymer
POLYFROTH W22C FROTHER	polyoxyalkylene alkyl ether, methyl isobutyl carbinol
POTASSIUM AMYL XANTHATE 85%	potassium amyl xanthate
POTASSIUM AMYL XANTHATE 90%	potassium amyl xanthate
SODIUM HYDROSULFIDE 36% SOLUTION	sodium hydrosulfide, sodium carbonate, sodium sulfide, nonahydrate
SODIUM HYDROXIDE SOLUTIONS	sodium hydroxide
SULPHUR	sulphur
TMT 15	1,3,5-triazine-2,4,6(1H,3H,5H)-trithione, triosodium salt
VULTREX-TOOL JOINT COMPOUND-	zinc, talc, mixture of severely hydrotreated and hydrocracked base oil (petroleum

Welding Products	Hazardous Constituents (from MSDS)
Arcair Electrodes	Iron; manganese; copper; chromium; iron; molybdenum; nickel; silicon; niobium
Arcair Slice Cutting Rod	Nicel; steel
Hardfacing allyed electrode	Titanium dioxide; nickel; silicon dioxide; calcium fluride
ER70S2	Iron; carbon; copper; manganese; phosphorus; molybdenum; silicon; titanium; zirconium
Carbon ring	Sulfur dioxide; nitrogen
Welding rods	Iron; chromium; nickel; maganese; silicon; molybdenum; columbium; titanium dioxide; sodium fluoride; talc; calcium fluoride; crystalline silica respirable; silicon; molybdenum; titanium; cobalt; copper
Welding wire	Iron; manganese; titanium dioxide; nickel; calcium flouride
WIA Fabshield 4 Hobart	Metals (numberous)
Wearsheild BU	Iron; limestone and/or calcium carbonate; silicates; fluorides; silicon and/or silicon alloys and compounds; manganese and/or manganese alloys and compounds; chromium and chromium alloys and/or compounds; quartz; cellulose and other carbohydrates; iron oxides; carbon steel core wire
Wearhshield ME	Chromium and chromium alloys or compounds; titanium dioxides; mineral silicates; silicates; limestone and/or calcium carbonate; magnesite; fluride; cellulose and other carbohydrates; iron; silicon and/or silicon alloys and compounds; quartz
Acetylene	Acetylene
Blueshield	Argon

Stage 1 Preliminary Site Investigation Scope and Estimated Costs for Budget Planning Purposes

Task	Scope	Cost
Baseline report	MCMC collects information on all APECs, prepare working tables, figures and photos. Golder organizes report in CSR format and checks information in the field and through meetings with MCMC.	$25,000
Update reports	The Stage 1 PSI is updated when an APEC is decommissioned or at 5 year intervals. Estimated cost of $2,500/update	$25,000
Total		$50,000

Area	~Size(m^2)	Material(s) Stored/Used	Characteristics	Scope	Cost
Fuel Island (light vehicle)	170	Diesel, gasoline	AST with spill protection. No observed or reported spills. Likelihood of contamination is low.	> Limited soil sampling using hand dug pits or excavator test pits > no groundwater sampling > Reporting	$ 5,000
Waste Disposal Area (adjacent to light vehicle fuel island)	90	Batteries, hydrocarbon contaminated waste, used paint, plastic jug recycling	Potential for surface spills	> Soil sampling using hand dug test pits > No groundwater sampling > Reporting	$ 5,000
Fuel Island	1,600	Diesel	AST with spill protection. No observed or reported spills. Likelihood of contamination is low to moderate.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 25,000
Outside maintenance shop + wash bay	8,200	**Lube Products**, **Welding Products,** diesel	Potential for surface spills	> Soil sampling using excavator test pits > Limited shallow groundwater sampling > Reporting	$ 25,000
Maintenance laydown	17,700	**Lube Products**, diesel	Potential for surface spills	> Soil sampling using excavator test pits > Limited shallow groundwater sampling > Reporting	$ 25,000
Light vehicle maintenance shop + weld barn	1,100	**Lube Products**, **Welding Products,** diesel	Potential for surface spills	> Soil sampling using excavator test pits > Limited shallow groundwater sampling > Reporting	$ 10,000
Warehouse	1,400	waste hydrocarbons contained hydrocarbon products, mill reagents, cleaning products, lube products	Indoor storage on concrete floor. Liklihood of contamination is neglible.	No sampling	$ -
Crusher Yard	6,500	**Lube Products**, diesel	Potential for surface spills	> Limited soil sampling using hand dug pits or excavator test pits > no groundwater sampling > Reporting	$ 25,000
Crusher Area	38,400	Ore	Potential for residual contamination of soil and shallow groundwater	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 35,000
Temporary PAG Stockpile	428,400	Potentially acid generating rock	Potential for residual contamination of surface soil and groundwater after PAG stockpile has been backfilled into Springer Pit	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 50,000
#1 Ore Stockpile	55,500	Ore	Potential for residual contamination of surface soil and groundwater after ore stockpile has been removed.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 35,000
Cariboo Ore Stockpile	39000	Ore	Potential for residual contamination of surface soil and groundwater after ore stockpile has been removed.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 35,000
Sulphur Pile	5,200	Sulphur compounds	Potential for residual contamination of surface soil and groundwater after sulphur pile has been removed.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 25,000
Heap Leach (test facility)	24,000	Sulphur compounds	Potential for residual contamination of surface soil and groundwater after sulphur has been removed.	> Soil sampling using excavator test pits > Groundwater sampling > Reporting	$ 35,000
Underground Operation and Maintenance Area	6,000	Blasting products	Potential for residual contamination of surface soil and shallow groundwater.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 15,000
Magnetite Plant	33,600	Magnetite	Potential for residual contamination of surface soil and shallow groundwater.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 35,000
Concentrate Sheds	2,600	Ore, magnetite	Indoor storage on concrete floor. Liklihood of contamination is neglible.	No sampling	$ -
Orica Site	14,400	Blasting products	Potential for residual contamination of surface soil and shallow groundwater.	> Limited soil sampling using hand dug pits or excavator test pits > limited shallow groundwater sampling > Reporting	$ 25,000
					$ 410,000


0 250 500 1,000 1,500 2,000
Meters
N
MPMC APECs
Draft for Discussion Purposes
Drawn by: KM
Date: 2015 08 20
Underground Operation
Temporary PAG Stockpiles
Sulphur Pile
Heap Leach
#1 Ore Stockpile
Fuel Island
Crusher Yard
Wash Bay and Maintenance Area
Crusher Area
Maintenance Laydown
Warehouse
Magnetite Plant
Cariboo Ore Stockpile
Orica Site
Sulphur Pile
Heap Leach
#1 Ore Stockpile
Fuel Island
Crusher Yard
Wash Bay and Maintenance Area
Ligth Vehicle Shop
Crusher Area
Maintenance Laydown
Warehouse
Concentrate Sheds
Fountain Tire
Magnetite Plant
Cariboo Ore Stockpile

Appendix R
2015 Spillway Design

TECHNICAL MEMORANDUM

DATE October 30, 2015 **REFERENCE No.** 1411734-095-TM-Rev0-15000

TO Katie McMahen
Mount Polley Mining Corporation

CC Luke Moger, Art Frye

FROM James Ogilvie and Allan Bronsro **EMAIL** jogilvie@golder.com; abronsro@golder.com

SPRINGER PIT SPILLWAY CONCEPTUAL DESIGN

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) has retained Golder Associates Ltd. (Golder) to develop a conceptual-level spillway design for the Springer Pit. The Springer Pit is located in the northwest part of the Mount Polley Mine site. The spillway is intended to operate after closure of the Springer Pit. The function of the spillway will be to safely discharge overflow from the Springer Pit caused by storm water runoff and other inflows from the surrounding catchment. This document reflects ultimate pit conditions following completion of the restricted operations and a return to full operations over a combined period of approximately four (4) years.

This document presents the data that Golder used to develop the spillway design.

2.0 DATA FOR DESIGN

2.1 Design Flows

Precipitation depths used to estimate inflows to Springer Pit for various return periods are presented in Table 1.

Table 1: 24-Hour Precipitation Depths

Return Period	Depth (mm)
2-year	34.2
10-year	46.8
25-year	52.5
100-year	60.7
200-year	64.7
1000-year	73.8
Probable Maximum Precipitation	188.1

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The total catchment area draining to the Springer Pit spillway is estimated to be 1.1 km^2. The design event for the Springer Pit was selected as the 1-in-200-year 24-hour rainfall plus the 1-in-2-year snowmelt. The flows to Springer Pit were calculated using Hydrologic Engineering Centre Hydrologic Modelling System (HEC-HMS) software (USACE 2010), and are presented below in Table 2. The Soil Conservation Service (SCS) curve number (CN) method (USDA 1986) was used to calculate catchment losses. A CN value of 95 and a lag time of 15 minutes were used for the HEC-HMS calculations.

The peak outflow was estimated by routing the inflow through the pit.

Table 2: Design Event Flows

Description	Flow (m^3/s)
Peak rainfall inflow	3.64
Peak snowmelt inflow	0.17
Peak combined inflow	3.81
Peak outflow	0.52

2.2 Design Elevations

Elevations used for the design are presented below in Table 3. All elevations are in MPMC's mine grid.

Table 3: Design Elevations

Description	Value (masl)
Spillway crest elevation	1050.0
Top of spillway channel	1050.5

3.0 DESIGN SUMMARY

A summary of the conceptual spillway design for the Springer Pit is provided in this section. The spillway design consists of a weir crest and a rock-lined, 40 m-long channel to convey flows, as shown on Drawings 100 through 300 in Attachment A.

The channel dimensions are shown below in Table 4.

Table 4: Spillway Channel Dimensions

Description	Value	Comment
Design flow depth	0.16 m	Calculated
Channel depth	0.5 m	Provides freeboard
Bottom width	3.0 m	Allows for vehicle passage across channel
Side slope	10H:1V	Allows for vehicle passage across channel

The spillway channel has been sized with constructability and vehicle passage along the existing haul road as main considerations. The wide channel base and gradually-sloped banks allow for vehicles using the existing haul road to cross the spillway channel safely when no water is flowing. The spillway channel has been sloped towards the Springer Pit to eliminate the risk of normal runoff from the haul road discharging into the environment. Additional design information is presented in the drawing package that was provided with this memorandum.

The outlet channel design does not include a specific termination point and is only intended to convey flows beyond the Springer Pit area. Golder recommends that the final discharge location for the spillway channel be confirmed at a later date and based on site conditions existing at the anticipated time of construction (i.e., water quality and closure scenario).

Golder understands that there are several scenarios that could apply for the closure of Springer Pit.

There are two potential discharge options for the case of permanent closure: Bootjack Lake or a temporary storage location (i.e., the Tailings Storage Facility (TSF) or the Perimeter Embankment Till Borrow Pit). The water quality in Springer Pit is an important factor in selecting one of these locations. If the water quality in Springer Pit, perhaps following enhancement with a passive treatment system, is suitable, the water could be discharged into Bootjack Lake. If it is not feasible to meet water quality targets, the water could be conveyed to and retained in a temporary storage location, where it would be treated and eventually discharged to Quesnel Lake.

If the closure of Springer Pit is temporary, the preferred option would be to pump the water into the West Ditch, which conveys water to the Central Collection Sump.

4.0 CLOSURE

We trust this document meets your present requirements. Please direct any questions, comments, or concerns to the undersigned.





James Ogilvie, P.Eng.
Water Resources Engineer

Allan Bronsro, MCIP, P.Eng.
Associate, Senior Water Resources Engineer

JMO/AB/pn
Attachments: A: Conceptual Design Drawings 100, 200, 300 Rev 2

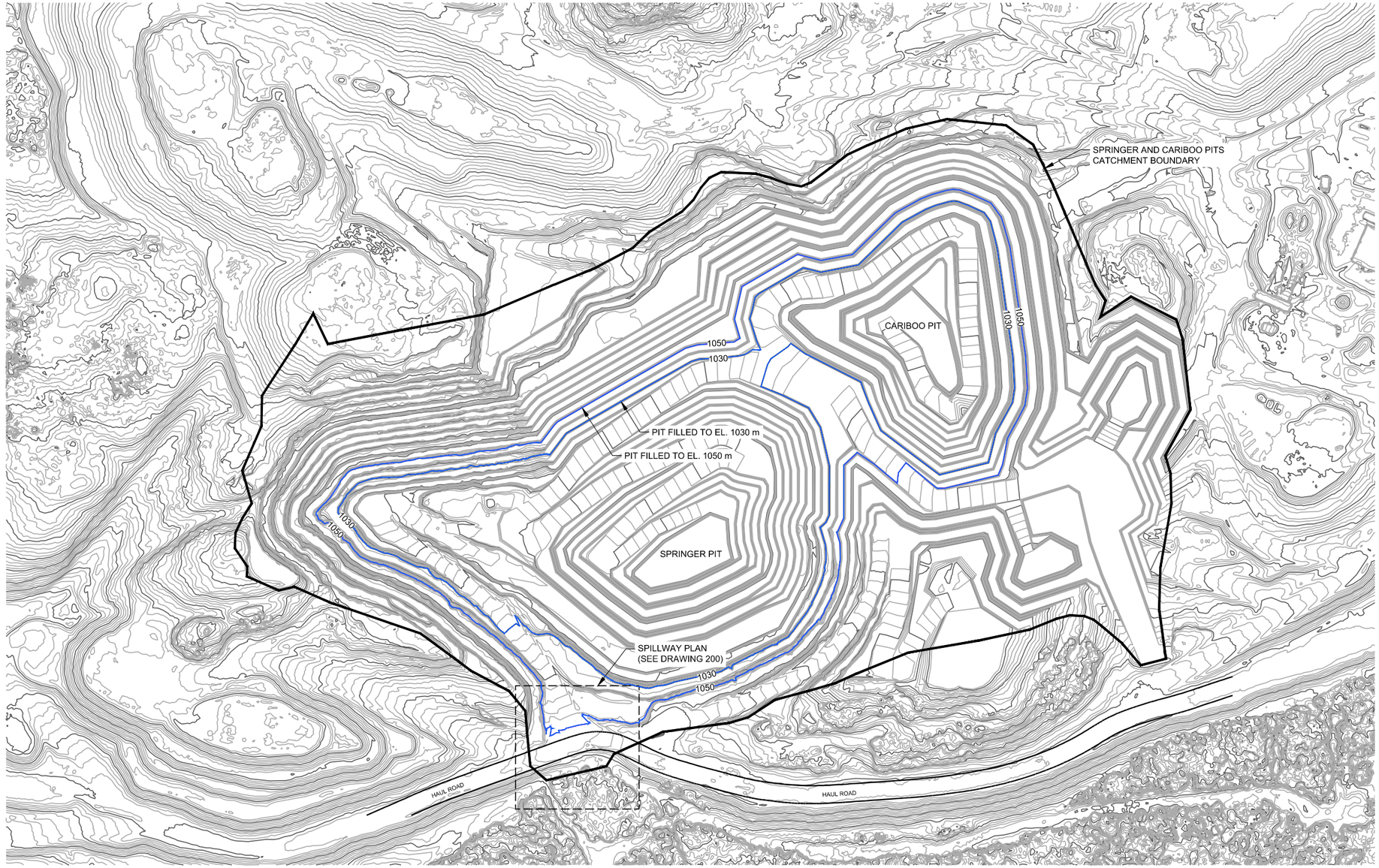
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Golder (Golder Associates Ltd.). 2015. *Site Wide Water Balance.* Prepared for Mount Polley Mining Corporation. Submitted May 29, 2015. Vancouver, BC. Ref. #1411734-031-R-Rev0-12000.

USACE (US Army Corps of Engineers). 2010. *Hydrologic Modeling System HEC-HMS*. Version 3.5, released August 2010.

USDA-SCS (United States Department of Agriculture- Soil Conservation Service). 1986. *Urban Hydrology for Small Watersheds*. TR-55, 164 p.



NOTES

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL 2 m MINOR AND 10 m MAJOR CONTOURS.

PLAN
SCALE 1:7500

NOT FOR CONSTRUCTION

CONCEPT ONLY

0 125 250
1:7,500 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
2	2015-10-30	ISSUED FOR USE	BC	SH	JO	AB
1	2015-09-24	ISSUED FOR USE	BC	SH	JO	AB

SEAL

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PROJECT
SPRINGER PIT SPILLWAY
CONCEPTUAL DESIGN

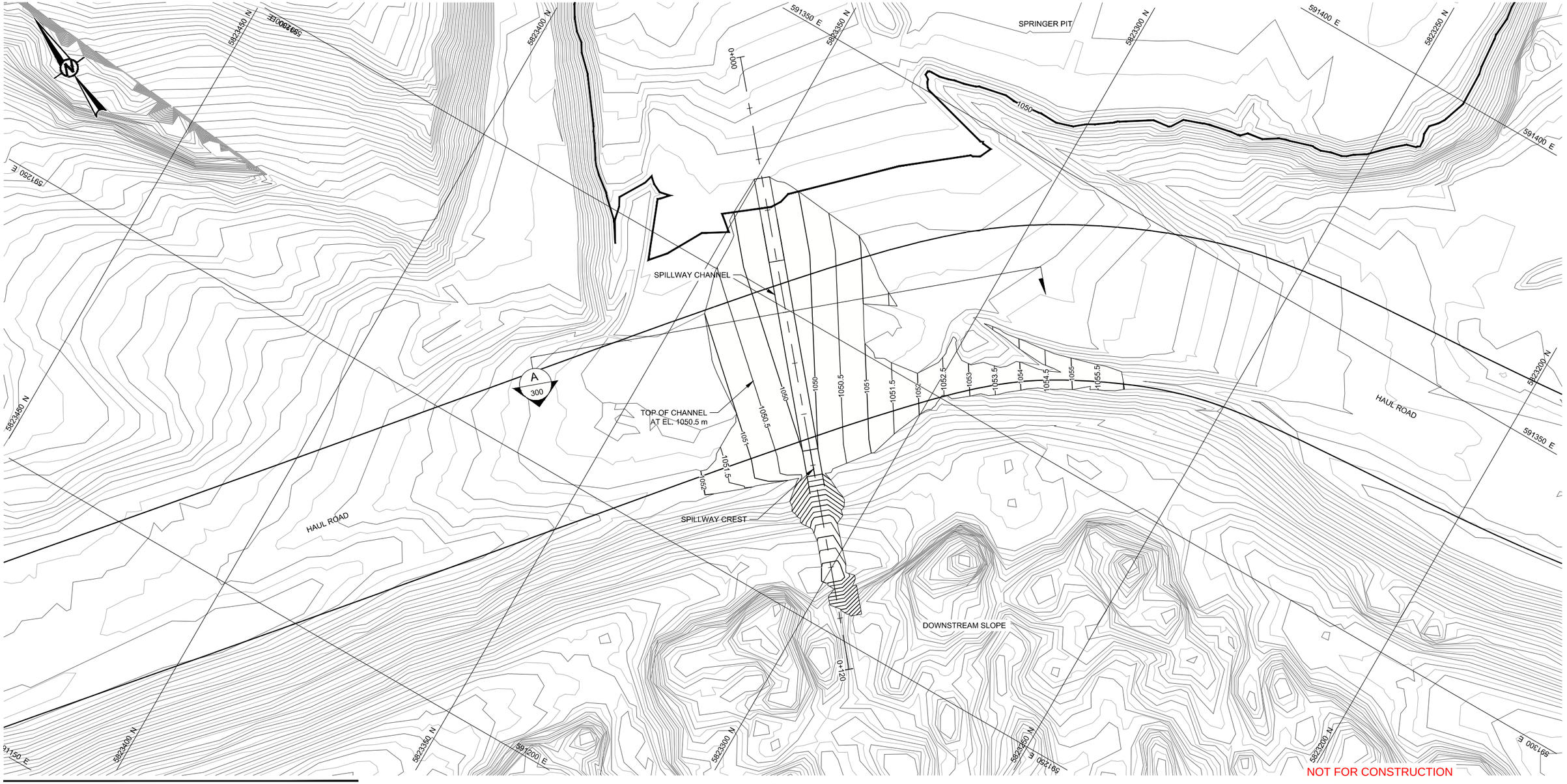
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm



NOTES

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL 0.5 m MINOR AND 1 m MAJOR CONTOURS.

PLAN
SCALE 1:750

NOT FOR CONSTRUCTION

CONCEPT ONLY

0 12.5 25
1:750 METRES

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
2	2015-10-30	ISSUED FOR USE	BC	SH	JO	AB
1	2015-09-24	ISSUED FOR USE	BC	SH	JO	AB

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PROJECT
SPRINGER PIT SPILLWAY
CONCEPTUAL DESIGN

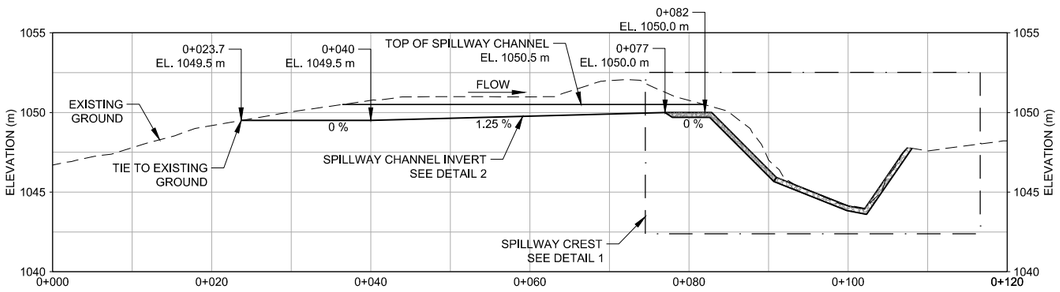
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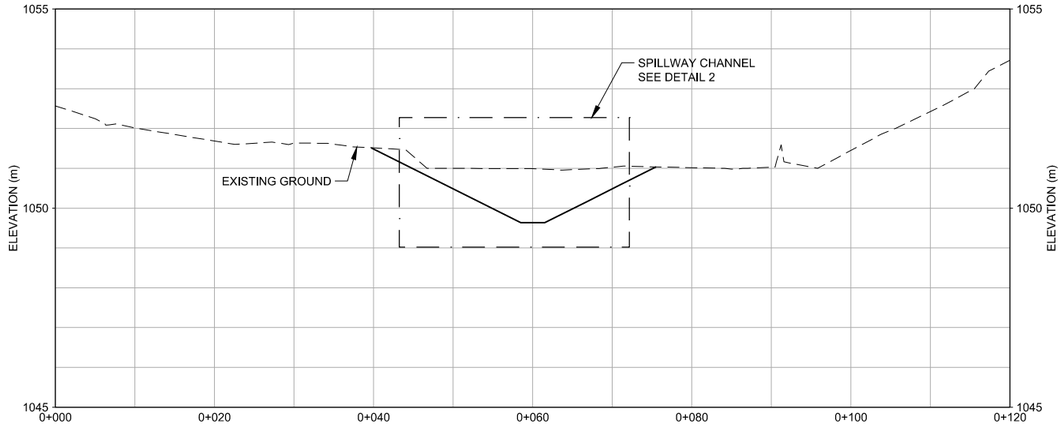
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SPILLWAY PROFILE

SCALE 1:750
VERT. SCALE 1:375

0 12.5 25
1:750 METRES

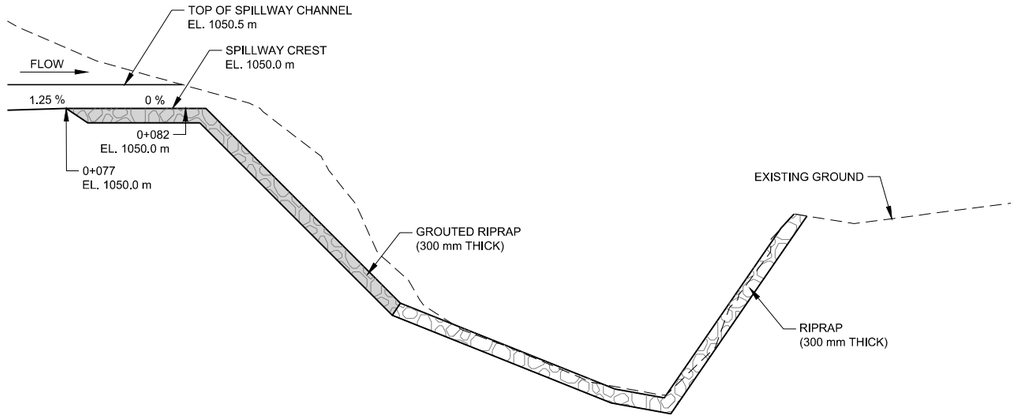


SCALE 1:750
VERT. SCALE 1:150

A 200

SPILLWAY CHANNEL SECTION

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1:750 METRES

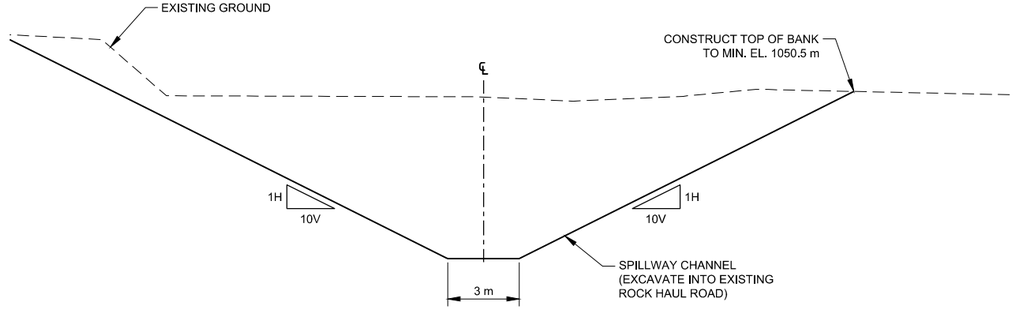


SCALE 1:250
VERT. SCALE 1:125

1

SPILLWAY CREST DETAIL

0 5 10
1:250 METRES



SCALE 1:250
VERT. SCALE 1:50

2

SPILLWAY CHANNEL TYPICAL DETAIL

0 5 10
1:250 METRES

NOTES

1. ALL UNITS IN METERS UNLESS OTHERWISE NOTED.
2. SPILLWAY CHANNEL SLOPED TO PROVIDE DRAINAGE BACK TO SPRINGER PIT.

NOT FOR CONSTRUCTION

CONCEPT ONLY

Rev.	YYYY-MM-DD	DESCRIPTION	PREPARED	DESIGN	REVIEW	APPROVED
2	2015-10-30	ISSUED FOR USE	BC	SH	JO	AB
1	2015-09-24	ISSUED FOR USE	BC	SH	JO	AB

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PROJECT
SPRINGER PIT SPILLWAY
CONCEPTUAL DESIGN

TITLE
PROFILE, SECTIONS, AND DETAILS

PROJECT No.	PHASE	Rev.		DRAWING
1411734	15000	2	3 of 3	300

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

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Appendix S
2021 Pit Slope and Rock Disposal Site (RDS) Stability

GOLDER
MEMBER OF WSP

REPORT

2021 Pit Slope and Waste Rock Dump Slope Stability Review

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Attention: Mathieu O'Leary

Submitted by:

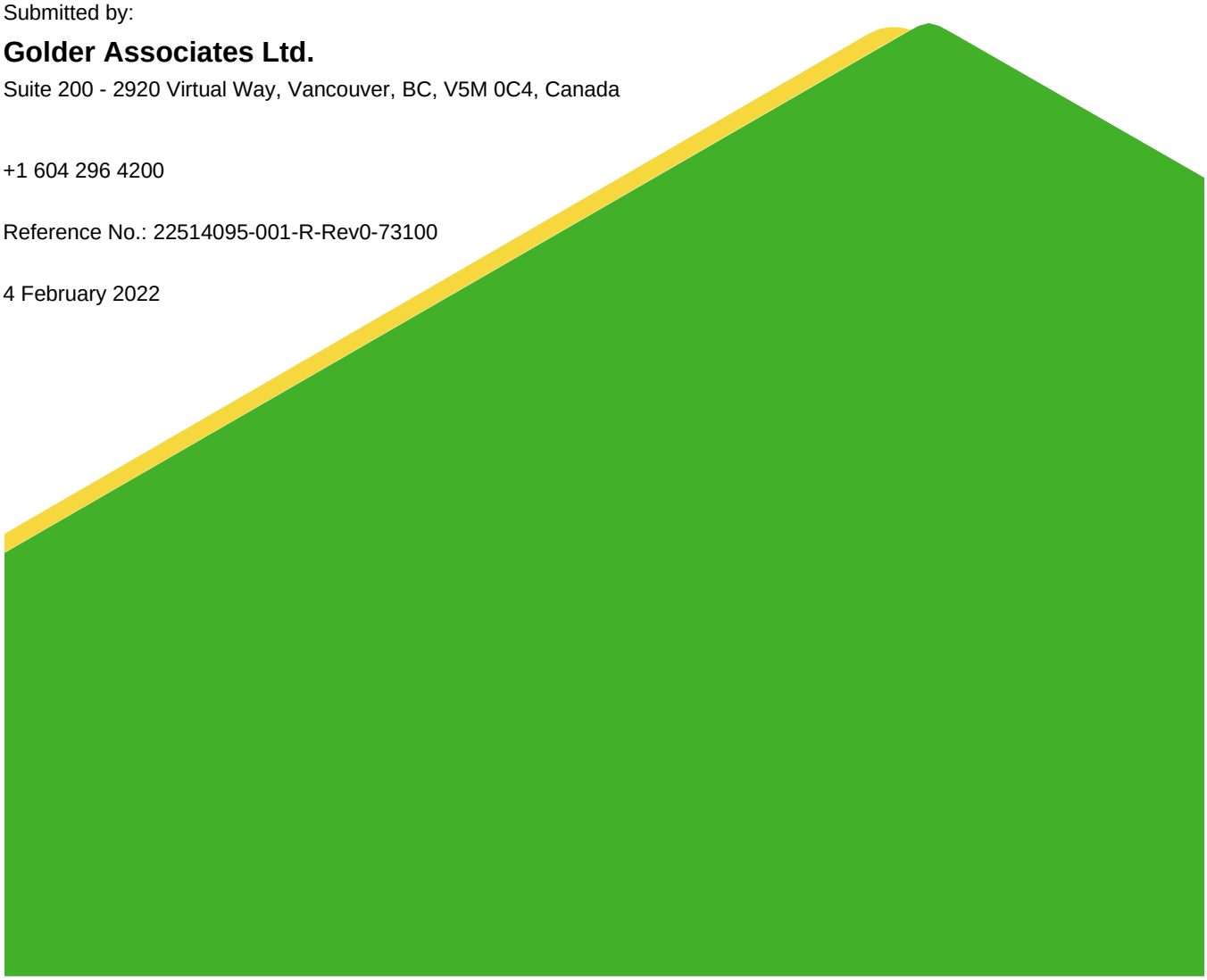
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Reference No.: 22514095-001-R-Rev0-73100

4 February 2022



Executive Summary

This report presents a summary of the observations that were made and the discussions that were held with Mount Polley Mining Corporation (MPMC) staff during Golder Associates Ltd.'s (Golder) annual pit slope and waste rock dump slope stability review at the Mount Polley Mine. The report provides the following:

- a description of the engineering geology of Mount Polley Mine
- a description of the existing and proposed open pit mine and waste rock dump operations
- a summary of the slope stability performance of the existing pit slopes and waste rock dumps at the time of the 2021 review
- a discussion of the pit slope and waste rock dump monitoring data
- geotechnical recommendations for the pit slopes and the waste rock dumps, and the geotechnical monitoring program

The following mine areas were included in the review:

- the Cariboo Pit
- the Springer Pit
- the Wight Pit
- the Northwest Potentially Acid Generating (PAG) Dump
- the Southeast Rock Disposal Site (SERDS)
- the Northeast Non-acid Generating (NAG) Rock Dump (inactive)
- the Tailings Road

This slope stability review covers the time between October 2020 and October 2021.

The recommendations following the 2021 review are summarized in Table E-1. The ID column has a unique number for each recommendation, prefixed with the year the recommendation was originally made. New recommendations and comments from 2021 are marked with *italic text.*

Table E-1: Summary of Recommendations for 2021 Review

Area	ID	Recommendation	Timeline
Cariboo Pit	2019-03	If access is needed below the east wall on the haul road switchback or mining resumes, a rock rollout berm should be built and maintained below the east wall unload zone.	If access is needed or mining resumes, immediately.
	2020-01	Install three new prisms on the unload zone.	*Completed in fall 2020; however, the new prisms failed over the winter. These prisms should be replaced in Q2 2022, before monitoring resumes.*
		Replace broken head on existing prism.	*Completed in 2021; however, prism head broke again. Replace in Q2 2022 and install a cover to protect the prisms on the east wall from the elements. The cover could be made of plywood or metal.*
	2021-01	*Rock rollout berm in front of wedge instability along haul ramp and below C2 Pit due to limited catchment available.*	*Q2 2022 – personnel enter the Cariboo Pit to access the pumping infrastructure and a rollout berm should be in place to protect the pump equipment and personnel.*
Springer Pit	*2021-01*	*Remove boulders from haul ramp on west wall and establish a rock rollout berm in front of overhang in bench.*	*Q2 2022 – personnel enter the Springer Pit to access the pumping infrastructure.*
Wight Pit	2018-02	Clean catch ditch along east wall below Rusty Fault.	Once per year or as required
	2020-02	Install two to four additional prisms along the west wall, between Prisms 595 and 543.	*Complete – two prisms were installed on the west wall in early 2021.*
	2020-03	Move the location of the monitoring base station farther back from the crest of the east wall.	*Incomplete – a new station was installed that monitors the existing base station for movement.*
Tailings Road	2019-06	Remediate failure scarp area.	*Incomplete in 2020 and 2021. Divert water away from the Tailings Road to limit ponding in the area of the scarp area until it is remediated.*
All areas – prism monitoring data	2019-07	Collect slope distance measurements.	*Incomplete – Q2 2022*

Study Limitations

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1.0 INTRODUCTION

This report presents a summary of the observations that were made and the discussions that were held with Mount Polley Mining Corporation (MPMC) staff during Golder Associates Ltd.'s (Golder) annual pit slope and waste rock dump slope stability review at the Mount Polley Mine. The review was carried out on 20 October 2021 by Ms. Alannah Gray Hubbard, P.Eng., and Mr. Caleb Lee, P.Geo., of Golder, in the accompaniment of Mr. Mathieu O'Leary and Mr. Chad Cameron of MPMC. The report provides the following:

- a description of the engineering geology of Mount Polley Mine
- a description of the existing and proposed open pit mine and waste rock dump operations
- a summary of the slope stability performance of the existing pit slopes and waste rock dumps at the time of the 2021 review
- a discussion of the pit slope and waste rock dump monitoring data
- geotechnical recommendations for the pit slopes, waste rock dumps, and geotechnical monitoring program

The following mine areas were included in the review and are shown in Figure 1:

- the Cariboo Pit
- the Springer Pit
- the Wight Pit
- the Northwest Potentially Acid Generating (PAG) Dump
- the Southeast Rock Disposal Site (SERDS)
- the Northeast Non-acid Generating (NAG) Rock Dump (inactive)
- the Tailings Road

This slope stability review covers the time between October 2020 and October 2021.

All coordinates presented in this report are in mine grid coordinates, and elevations are relative to a local mine site datum.

2.0 MOUNT POLLEY MINE ENGINEERING GEOLOGY

The Mount Polley deposits are located within an alkalic intrusive complex within the northwest–southeast trending Quesnel Trough, a 35 km wide, northwest trending volcanic sedimentary belt. The copper and gold mineralization is contained predominately within north–south trending, elongated intrusive breccia stocks that have intruded late-phase diorites and monzonite porphyries. Later-stage north–south trending dykes have been intruded along the regional structural trend.

In general, the rocks in the Cariboo Pit consist of monzonite intrusion breccias that have intruded the host monzonite rocks. Monzonite is exposed in the majority of the pit walls, while breccias are exposed in the centre of the pit. However, localized blocks of diorite are exposed in the northeast wall – northwest segment and the east wall, while plagioclase porphyry is exposed along the southeast wall.

The mineralized hydrothermal breccia in the Springer Pit occurs along a north-northwest–south-southeast trend. To the west, the mineralized breccia zone is bounded by a “mix” of breccia and intrusive rocks, which are then bounded by monzonite rocks. Monzonite rocks are the dominant rock type along the south side of the Springer Pit. Intrusive diorite rocks bound the mineralized breccia to the north and northeast. Finally, a series of younger north–south trending augite porphyry dykes are interpreted to occur throughout the proposed pit area. These dykes are often chlorite and calcite-altered and commonly faulted. These younger dykes intersect the different rock types and the major faults.

For further discussion of the site geology and major geological structures at the Mount Polley Mine, refer to the 2016 Cariboo and Springer Pit design report (Golder 2016a).

The dyke and fault models for the Springer and Cariboo Pits are shown in Figures 2 and 3, together with the October 2019 topography. At the time of the 2021 review, the topography had not changed since LiDAR collection in October 2019; therefore, all figures within this report use the 2019 topography.

3.0 MOUNT POLLEY CURRENT MINE STATUS

A plan of the Mount Polley Mine and the locations of the existing pits and waste rock dumps at the time of the October 2021 review are shown in Figure 1. The review photographs are presented in Appendix A. The following sections provide an overview of the status of the pits and waste rock dumps at the Mount Polley Mine at the time of the 2021 review.

3.1 Open Pit Development and Status

3.1.1 Cariboo Pit

The status of the Cariboo Pit at the time of the 2021 review is shown in Figures 1 and 4. The Cariboo Pit is located between 2,800 N and 3,550 N, and 1,160 E and 1,990 E, to the southeast of the Springer Pit. Mining operations in the Cariboo Pit were carried out from 1996 to 2001 and, upon completion, the pit was backfilled with waste rock from other pits. Mining activities in the Cariboo Pit resumed in 2015, until the mine went into care and maintenance in May 2019. At the time of the 2021 review, the Cariboo Pit was flooded to approximately elev. 1,020 m.

Four walls have been excavated in the Cariboo Pit. These walls are labelled in Figure 4 and in Appendix A, Photograph A-2. A haul ramp enters the pit from the south, descends along the southeast wall, and wraps around the east, northeast, and west walls to the pit bottom on the east side (Figure 4). Six benches have been excavated on either side of the haul ramp that enters the pit from the south. The Cariboo Pit crest at its highest point is at approximately elev. 1,181 m on the east wall, and the pit floor was at elev. 921 m; however, the pit bottom was flooded and was not visible at the time of the review.

The northeast wall of the Cariboo Pit is an approximately 900 m long southwest-facing wall that includes three segments: the northwest, central, and southeast wall segments (Figure 4). The northwest segment includes about seven single benches that have been excavated to the elev. 1,894 m platform between the Cariboo and Springer Pits. The central segment of the northeast wall includes a waste rock rehandle slope and has a large catch-bench area at elev. 988 m (not visible at the time of the 2021 review). There are about six single benches excavated in the rehandle slope. On the southeast segment there is a nose that notches into the east wall. The crest of the northeast wall is at approximately elev. 1,168 m, and at the base of the wall is a haul road ramp at elev. 952 m. From the crest of the rehandle slope to the catch-bench area below the northwest segment of the northeast wall is about 180 m high, and the overall slope height from the crest to the pit bottom is 247 m.

The east wall experienced deep-seated toppling instability in April 2017 and unloading of the area was completed in 2018. The wall is currently stable. The crest of the unload zone is located at elev. 1,181 m. The wall is approximately 247 m high.

On the southeast side of the pit, the east wall curves and changes orientation from southwest-facing (east wall), through west-facing, and becomes northwest-facing (southeast wall). The southeast wall is approximately 380 m long. The crest of the southeast wall is located at elev. 1,146 m, and the toe of the wall was at the pit bottom (elev. 921 m). There are three double benches below the haul road ramp into the pit on the southeast wall and one single bench. The southeast wall is approximately 225 m high.

A saddle exists between the Springer and Cariboo Pits, and its elevation has remained unchanged since the 2019 review; the south side of the saddle is at elev. 1,096 m and at elev. 1,084 m on the north side. The saddle on the southwest side forms the west wall in the Cariboo Pit. The wall is approximately 163 m high.

3.1.2 WX Pit

The WX Pit is an east-facing alcove that was excavated into a ridge located to the south of the Springer Pit (Figures 1 and 4). The crest of the ridge is located at approximately elev. 1,156 m, and the floor of the WX Pit is located at elev. 1,053 m. Three double benches were excavated to form a maximum wall height in the alcove of approximately 80 m. Three single benches have been mined beneath the WX Pit to elev. 1,030 m as a continuation of the west wall on the west side of the haul ramp. The WX Pit has been excavated to its ultimate configuration.

3.1.3 C2 Pit

The C2 Pit is a west-facing alcove that is located at the southwest end of the Cariboo Pit (Figures 1 and 4). The crest of the wall is at elev. 1,159 m, and the pit floor is located at elev. 1,062 m. Three to four double benches have been excavated in the C2 Pit, to form a maximum wall height in the alcove of approximately 90 m. The C2 Pit has been excavated to its ultimate configuration.

3.1.4 Springer Pit

The Springer Pit is located to the northwest of the Cariboo Pit and to the southwest of the mined-out and backfilled Bell Pit (Figures 1 and 4). The Springer Pit is pear shaped and is approximately 1,000 m long and approximately 600 m wide. The pit floor at the south end of the pit is excavated to approximately elev. 940 m. In 2015 and 2016 tailings were discharged as slurry into Springer Pit from the saddle between the Cariboo and Springer Pits. Approximately ⅓ of the tailings have been dredged from Springer Pit and pumped as slurry to the tailings storage facility between March 2016 and October 2019. Approximately 3.5 Mt of tailings remain in the Springer Pit. The tailings had a free water cover (approximately elev. 986 m) at the time of the 2021 review and the water was actively being pumped. The long-term mine plan includes continued dewatering, removal of the tailings, and an expansion of the Springer Pit to merge with the Cariboo Pit.

3.1.5 Wight Pit

The Wight Pit is located at the northeast end of the mine property along the northwest shore of Polley Lake between 5,150 N and 5,820 N, and 2,380 E and 3,025 E (Figure 1). Mining of the open pit was completed in 2009 and underground operations were carried out via an adit that was driven into the base of the northwest wall of the pit. Underground operations ceased in 2018.

The Wight Pit trends northwest–southeast, and the entrance is located at the south end of the pit. The pit floor was initially mined down to elev. 804 m and was backfilled by 2016 to approximately elev. 875 m at the north end of the pit and approximately elev. 911 m at the south end of the pit. The west wall of the pit has a maximum crest of elev. 1,020 m, and approximately seven double benches have been excavated on this wall, of which six were visible above the backfill during the 2021 review. The west wall is approximately 146 m high. The east wall has a maximum crest of elev. 964 m and an approximate maximum wall height of 116 m. Approximately five double benches have been excavated on the east wall. The north wall has a maximum crest of elev. 996 m and a wall height of approximately 120 m. Approximately seven double benches have been excavated on the north wall, of which six were visible above the backfill during the 2021 review.

The south end of the Wight Pit was backfilled with waste rock in 2009 and used to access the underground portal located at the bottom of the north wall. The waste rock backfill extends approximately 140 m north from the mined-out south wall, and the top of the fill has a maximum elevation of elev. 911 m.

3.2 Waste Rock Dump Development and Status

3.2.1 Northwest Potentially Acid Generating Dump

The Northwest PAG Dump is located at the northwest end of the mine property to the west of the Springer Pit between 3,600 N and 4,630 N, and 470 E and 1,150 E (Figure 1). A layer of NAG rock was placed on the bottom lift, and PAG rock was end-dumped on top of the NAG lift in four lifts from the bottom up. No activities were occurring on the Northwest PAG Dump at the time of the 2021 review and there was no change in the dump configuration since the 2020 review. The dump at the north end of the upper platform is at elev. 1,140 m. The toe of the dump is located at approximately elev. 1,020 m, and the dump is approximately 120 m high.

Ultimately, the PAG material will be transferred into the open pits during mine closure.

3.2.2 Southeast Rock Disposal Site

The SERDS, previously referred to as the Southeast NAG Dump (Golder 2021) and the Life of Mine NAG Dump (Golder 2016b), is located at the southeast end of the mine property and covers the old Sandwich Dump, the Southeast Zone Pit, and the Pond Zone Pit (Figure 1). The SERDS is located between approximately 1,300 N and 2,500 N, and 3,100 E and 4,420 E. It is a southward extension of the existing Northeast NAG Dump. The top lift of the SERDS is at elev. 1,110 m and no additional dumping has occurred since the 2020 review.

3.2.3 Northeast Non-acid Generating Dump

The Northeast NAG Dump is located to the north of the SERDS and to the northeast of the East Waste Dump between 2,500 N and 4,200 N, along the west side of Polley Lake (Figure 1). Waste rock from the Wight Pit was consigned to the dump, and this dump has been inactive for several years.

4.0 REVIEW OF OPEN PIT SLOPE STABILITY PERFORMANCE

The following sections summarize open pit slope stability performance observations that were made during the 2021 review.

4.1 Cariboo Pit Slope Stability Performance

With the exception of localized zones within and adjacent to the Polley Fault causing bench-scale planar failure, overall rock mass quality in the Cariboo Pit is generally good. Slope stability continues to be favourable, and the pit walls have not exhibited any signs of large, multi-bench instability since the 2020 review. Bench-scale stability continues to be favourable and, in general, there is adequate catchment on the slopes. An overview of the Cariboo Pit is shown in Appendix A, Photograph A-2. The Cariboo Pit walls are labelled in Figure 4. The slope stability performance exhibited by the walls is presented in the following sections.

4.1.1 Northeast Wall – Northwest Segment

An overview of the northeast wall of the Cariboo Pit is shown in Figure 4 and in Appendix A, Photograph A-2. The northwest segment of the northeast wall is adjacent to the Springer Pit Phase 3 pushback. The two pit areas are separated by the Polley Fault (Appendix A, Photograph A-3). This area has not changed since the 2020 review.

Approximately seven single benches have been excavated along the northwest segment of the northeast wall of the Cariboo Pit. The wall was in good condition with no signs of overall wall instability at the time of the 2021 review. The majority of the major geological structures are favourably oriented with respect to the northwest segment of the northeast wall (Figure 2), and the benches were exhibiting good stability performance. North–south trending augite porphyry dykes are exposed in the wall and dip favourably to the east at steep angles (Appendix A, Photograph A-3). Moderately dipping features are evident on the northwest side of this segment where benches have broken back to these features (Appendix A, Photograph A-3). Catchment is still adequate in these areas where localized back-break has occurred.

The Polley Fault and adjacent faults trend at approximately 350 degrees and dip to the east-northeast at approximately 70 degrees (Figure 3 and Appendix A, Photograph A-3). The north-northwest–south-southeast striking regional trend intersects the northeast wall at an oblique angle. Ravel debris continues to accumulate at the base of fault traces on individual benches; however, adequate catchment has been maintained on the wall.

4.1.2 Northeast Wall – Central Segment

An overview of the central segment of the northeast wall of the Cariboo Pit is shown in Figure 4 and in Appendix A, Photograph A-4. A rehandle slope excavated in waste rock is located in the upper central portion of the northeast wall of the Cariboo Pit. Approximately six single benches have been excavated in the waste rock rehandle slope. The lower benches in the rehandle material have been re-sloped to reduce the bench face angles. This area has not changed since the 2020 review. The rehandle slope is exhibiting good overall slope stability with no signs of bulging or instability in the face of the slope and no cracking behind the crest of the slope.

Seven single benches have been excavated in rock down to elev. 998 m, below the waste rock rehandle slope. South-southeasterly dipping structures strike sub-parallel to the central segment of the northeast wall, and the bench faces are breaking back to these moderately dipping structures (Appendix A, Photograph A-4). These structures exhibit a dip on the order of 55 to 65 degrees, and a dip direction of 200 degrees true azimuth. The catch-benches range from 8 to 11 m in width. They currently have adequate catchment to contain the ongoing ravel material.

4.1.3 Northeast Wall – Southeast Segment

An overview of the southeast segment of the northeast wall of the Cariboo Pit is shown in Figure 4 and in Appendix A, Photograph A-5. This area has not changed since the 2020 review and was exhibiting good stability performance at the time of the 2021 review. The double bench faces on the wall are breaking back to moderately to steeply south-southeasterly dipping joints, and some localized raveling has occurred (Appendix A, Photograph A-5). The ravel debris was confined to localized areas of the benches, and adequate catchment is being maintained on the overall slope. There are some fault exposures on the northwest side of the wall segment around about mid-wall height (Appendix A, Photograph A-5). Minor ongoing raveling appears to be occurring along these faults; however, the overall wall catchment is adequate. The East Cariboo Fault is exposed in the upper northeast corner of the southeast wall segment (Appendix A, Photograph A-5).

4.1.4 East Wall

An overview of the east wall is shown in Figure 4 and Appendix A, Photograph A-6. The East Cariboo Fault intersects the southeast segment of the northeast wall (Figure 3) and forms the boundary between the southeast segment of the northeast wall and the east wall. The East Cariboo Fault generally follows an orientation trend similar to the Polley Fault; it strikes northwest–southeast and dips steeply to the northeast at approximately 60 degrees.

In previous years, multi-bench-scale toppling instability developed in the hangingwall of the East Cariboo Fault, at the top of the slope between approximately elev. 1,108 and 1,160 m and was being monitored with geotechnical visual reviews and prism monitoring. Toppling displacement began to accelerate in the spring of 2017, and the upper three to four benches failed on 7 April 2017. The slope was well monitored prior to the instability. A rockfall berm was constructed below the failure zone, based on the results of rockfall and runout analyses. The rockfall berm contained the failure debris. It was recommended that the crest of the east wall be mined down to elev. 1,120 m to remove failure debris that could continue to ravel. The crest of the east wall was unloaded by mining five single benches to elev. 1,120 m and this was completed in 2018 (Golder 2019). At the time of the 2021 review, the unload area and single benches were exhibiting good stability performance (Appendix A, Photograph A-6).

Appropriate ditching has been implemented around the unload zone to intercept and conduct water away from the east wall on the south side of the unload area. There is one area of wall seepage that was noted during the 2019 review on the unload area north of the interception ditch and was again observed during the 2021 review (Appendix A, Photographs A-6 and A-7). The source of the water could be due to a geologic structure in the wall that extends to higher ground to the northeast. The water is infiltrating into the fill material on the unload zone. The benches below the seepage zone are dry and there are no signs of increased raveling or instability (Appendix A, Photograph A-6). At the time of the 2021 review there were no concerns related to slope stability due to the seepage area. The unloaded area should continue to be inspected during routine visual inspections for excess seepage and raveling.

The benches below the unload zone are partially infilled with failure debris; however, there is adequate catchment below the two benches that are filled (Appendix A, Photograph A-6). A wide bench was excavated at the toe of the east wall beside the haul road ramp into the pit; however, at the time of the 2021 review, the wide bench was under water.

4.1.5 Southeast Wall

The status of the Cariboo Pit southeast wall at the time of the 2021 review is shown in Figure 4 and in Appendix A, Photograph A-8. One single bench and nine double benches (six double benches above the haul ramp and three double benches below the ramp) have been excavated in the southeast wall. The in-pit reservoir was at elev. 1,020 m at the time of the 2021 review; therefore, the lower southeast wall was not visible (Appendix A, Photograph A-8). The southeast wall continues to exhibit adequate slope stability performance. There are bench-scale wedge failures that continue to ravel on the north side of the southeast wall (Appendix A, Photograph A-8). The areas should be monitored for increased ravel debris. Once access is required into Cariboo Pit along the haul ramp on this wall as water is removed, maintain the rock rollout berm along the haul ramp to contain potential rockfall and to protect light vehicles or equipment that may need to enter the pit to access the pit lake or pumping equipment. Benches on the south end of the southeast wall have bench faces breaking back to moderate dipping, planar, continuous joints that dip toward the northwest (Appendix A, Photograph A-8).

Overall, the southeast wall is exhibiting adequate stability performance. Adequate catchment remains along the majority of the wall, and the benches have not been significantly infilled by ravel debris. The degree of available catchment along this wall should continue to be monitored, particularly if access is required to the in-pit reservoir as pumping continues.

4.1.6 West Wall

A saddle has been developed between the southeast side of the Springer Pit and the west side of the Cariboo Pit (Appendix A, Photograph A-9). The crest of the saddle is located at elev. 1,084 m, and the west wall of the Cariboo Pit has been mined down to elev. 921 m. At the time of the 2021 review, the bottom of the west wall was not visible due to the in-pit reservoir (Appendix A, Photograph A-9).

The Polley Fault is a broad zone of deformation 60 to 80 m wide that is exposed in the west wall. The fault zone strikes approximately north-northwest–south-southeast and dips steeply to the east. Bench-scale planar failure continues to be observed along a shallow easterly dipping fault within the Polley Fault Zone and in the immediate hangingwall. The degree of catchment and bench infilling along the portion of the west wall where the Polley Fault is exposed should continue to be monitored (Appendix A, Photograph A-9). If the in-pit reservoir is lowered and mining resumes, it may be necessary to increase catch-bench widths or construct rollout berms along the working bench along the west wall if rockfall hazards become a concern.

Bench stability performance is better outside of the Polley Fault Zone in the west wall. The rock along the upper south side of the wall and on the lower north side of the wall below the Polley Fault Zone exhibits good rock quality and favourable geological structure orientations.

4.1.7 Haul Ramp

The haul ramp into Cariboo Pit enters from the south heading north then wraps around the pit from the southeast, east, northeast, and west walls to the pit bottom (Figure 1). The haul ramp has pumping infrastructure that is located on the east side of the ramp to the in-pit reservoir's edge at elev. 1,020 m. There is a wedge instability that has continued to ravel over the years on the east side of the haul ramp entrance before the C2 Pit (Appendix A, Photograph A-10). Material has accumulated at the toe of the instability. There is a risk of rock rollout that could damage the pipe infrastructure for dewatering, and the ramp is going to be used for long-term access into the Springer Pit once mining activities reach this elevation. A berm should be constructed in front of the instability area. The ravel material could be used to cover the pipe for protection and a rock rollout berm should be constructed at the toe of the wedge instability. The berm should be inspected and cleaned annually while the haul ramp is actively being used by light and heavy traffic.

4.2 C2 Pit Slope Stability Performance

The C2 Pit is a small pit that was mined out immediately southeast of the Cariboo Pit (Appendix A, Photograph A-11). The C2 Pit has an in-pit reservoir (elev. 1,077 m) and only two double benches were visible above the water level. The benches appear to be in adequate condition and exhibiting good stability performance. There are five benches below the C2 Pit above the haul ramp in and out of the Cariboo Pit. The catch-benches are infilled and there is limited catchment available. A rock rollout berm should be established and maintained along the haul ramp to protect operations as well as the pumping infrastructure along the haul ramp (Appendix A, Photograph A-12).

4.3 WX Pit Slope Stability Performance

The WX Pit is a small pit that was mined out immediately west of the C2 Pit and southwest of the Cariboo Pit. The WX Pit has three double benches excavated. The benches in the west wall of the WX Pit have limited catchment available and the benches to the south appear to have more catchment available. As mining resumes on the saddle between the Springer and Cariboo Pits, overspill could infill these benches and potentially cause a rockfall risk to traffic along the haul ramp into Cariboo Pit. Limit the amount of overspill onto the catch-benches from new mining activities at the crest of the wall. If the catch-benches continue to become infilled, install a rockfall rollout berm at the base of wall to reduce the risk of rockfall to light vehicles and personnel (Appendix A, Photograph A-13).

4.4 Springer Pit Slope Stability Performance

The status of the Springer Pit at the time of the 2021 review is shown in Appendix A, Photograph A-14, and the pit walls are labelled in Figure 4. The pit has been partially backfilled with tailings and water, and mining has not been carried out in the Springer Pit for a few years. The inundation of the Springer Pit has not adversely impacted the overall slope stability performance of the pit slopes. Slope stability analyses to assess the impact of dewatering the Springer Pit slopes as the tailings are dredged from the pit have been carried out, and the results are presented in a separate document (Golder 2017). The analyses assessed a scenario where the backfill materials in the pit are removed and where high water tables remain in the pit slopes. The stability analyses indicated factors of safety between 1.7 and 2.0 for the southwest and northeast walls of the Springer Pit, respectively. Consequently, the removal of the tailings and water from the Springer Pit is not expected to adversely impact the overall pit slope stability of the Springer Pit. When mining resumes in the Springer Pit the walls should be monitored for seepage, particularly in the east and south walls where seepage has been noted previously (Golder 2016b). No dredging activities have been carried out in the Springer Pit since 2019 and dewatering was ongoing. The water level in the pit was at approximately elev. 986 m (Appendix A, Photograph A-14).

The overall rock mass quality in the Springer Pit is good, and the slopes continue to exhibit favourable overall and bench-scale slope stability. The slope stability performance exhibited by the walls at the time of the 2021 review is presented in the following sections.

4.4.1 North Wall

The north wall is continuing to exhibit favourable stability performance and there has been very little change to the wall since the 2020 review (Appendix A, Photograph A-14). Large-scale geological structures are favourably oriented with respect to the north wall (Figure 3). The catch-benches have some ravel infilling in areas where the Springer and Wishbone Faults are exposed in the wall (Appendix A, Photograph A-15).

4.4.2 East Wall

The east wall has not changed significantly over the last few years. The benches are infilled with old mining overspill (Appendix A, Photographs A-16). There is too much material on the elev. 1,000 m bench to safely clean and re-establish the catch-bench. Depending on the mine plan there are two options to proceed with mining (Figure 5 and Appendix A, Photograph A-16):

1) If MPMC plan to only mine along the saddle between the Springer and Cariboo Pits, there are no concerns with leaving the elev. 1,000 m bench as is.

2) If MPMC plan to mine concurrently at the Springer Pit bottom and along the saddle between the Springer and Cariboo Pits, additional catchment may be required below the current Springer Pit bottom. Once the Springer Pit is dewatered, the available catchment on the benches below the elev. 1,000 m catch-bench should be inspected. If adequate catchment is not available, a wider catch-bench will be required with a rock rollout berm.

4.4.3 South Wall

The south wall is exhibiting adequate stability performance, and some benches have broken back to moderately dipping joints over about three single benches mid-wall (Appendix A, Photograph A-17). There are some steeply dipping dykes in the south wall that are causing minor bench-scale raveling (Appendix A, Photograph A-17). Adequate catchment remains along the wider geotechnical bench at elev. 1,000 m to contain any ravel debris.

Preparations for mining activities were underway at the time of the 2021 review (Appendix A, Photograph A-18). When mining resumes, every effort should be made to limit overspill into the WX, Cariboo, and Springer Pits. Depending on the amount of overspill from mining activities a rock rollout berm may be required on the west side of the access ramp into Cariboo Pit (Appendix A, Photograph A-13).

4.4.4 West Wall

The west wall is continuing to exhibit favourable slope stability performance and there has been very little change to the wall since the 2020 review (Appendix A, Photograph A-19). Some large geological structures are visible in the west wall, and they are favourably oriented with no large-scale instability apparent (Figure 4). The catch-benches have some ravel infilling in localized areas, but there continues to be adequate catchment along the majority of the west wall. At the time of the 2021 review there had been a minor rock rollout on the ramp to the pumping equipment in the Springer Pit along the west wall (Appendix A, Photograph A-20). The boulders should be removed, and the area should be monitored. A rock rollout berm should be constructed in the area where the overhanging material is still visible since vehicles continue to utilize the ramp.

During the 2020 review, reduced catchment was identified on the north side of the west wall below the north nose where equipment was being stored. A rock rollout berm was established along the toe of the wall (Appendix A, Photographs A-21 and A-22). Continue to keep equipment and personnel at least 10 m from the wall to reduce the risk of rockfall.

4.5 Wight Pit Slope Stability Performance

The status of the Wight Pit at the time of the 2021 review is shown in Figure 1 and in Appendix A, Photograph A-23. With the exception of the rock within the Rusty Fault on the northeast side of the pit, and within the Green Dykes that bound the south side of the west wall toppling zone, overall rock mass quality in the Wight Pit is generally good. The slope stability performance exhibited by the various walls at the time of the 2021 review is presented in the following sections.

4.5.1 West Wall

An overview of the west wall of the Wight Pit is shown in Appendix A, Photographs A-23 and A-24. In 2007, toppling instability developed in the middle of west wall along the steeply dipping, north–south striking joints and faults. A steep west-northwest–east-southeast striking dyke swarm that intersects the middle of the west wall formed release structures for the south side of the toppling zone. The highest deformation rates occurred immediately adjacent to the north side of the dyke swarm, and deformation rates decrease toward the north and away from the dyke swarm. Ongoing monitoring data and visual observations have indicated that the portion of the west wall on the south side of the dyke swarm has not exhibited any deformation.

The toppling deformation to the north of the dykes decelerated after unloading of the crest was carried out and mining of the pit was completed. The toe of the south side of the west wall toppling zone has been buttressed with waste rockfill (Appendix A, Photograph A-24). The crest of the west wall was inspected during the 2021 review. The unloaded area appears to be in similar condition to what was observed in 2020 review, with some ongoing displacement and raveling caused by deformation and creep from within toppling zone (Appendix A, Photograph A-25). The cracks behind the crest of the west wall were in similar condition to the 2020 review, with some ongoing year-over-year displacement (Appendix A, Photograph A-26). This displacement trend is also indicated by the prism monitoring data and discussed further in Section 4.6.3.1. Prism monitoring and visual review of the cracks should continue to assess areas that exhibit ongoing creep displacements and to monitor for any sudden accelerations in the toppling zone.

The rockfill buttress in the bottom of the pit provides a very large catch-bench for the majority of rockfall from the toppling zone (Appendix A, Photograph A-27). To the north of the backfill, a rockfall ditch and berm was constructed several years ago along the toe of the west wall to keep the pit floor free of raveling rocks from the north side of the topple zone. This ditch and berm have been effective, as rockfalls have not been observed beyond the berm. An inactive wellhouse is located near the base of the north side of the west wall, and there was limited catchment on the bench immediately above (Appendix A, Photograph A-27). If the wellhouse is reactivated, the condition of the berm should be reviewed and, if required, cleaned out to provide sufficient catchment and rockfall protection to personnel accessing the wellhouse. Catchment along the west wall should continue to be monitored. There is sufficient room to expand the size and height of the catchment berm at the base of the north end of the west wall, if required.

4.5.2 North Wall

The status of the north wall at the time of the review is shown in Appendix A, Photograph A-28. The slopes along the northwest and north sides of the pit continue to remain stable and have only exhibited raveling along fault intersections, particularly in the northwest and northeast corners of the wall. This ravel material is infilling the catch-benches; however, there is adequate rockfall protection below the slope at the pit bottom (Appendix A, Photograph A-28).

4.5.3 East Wall

The status of the east wall at the time of the 2021 review is shown in Appendix A, Photograph A-29. The benches on the east wall are infilled with ravel debris. As well, ongoing raveling is occurring along the Rusty Fault in the northeast corner of the east wall (Appendix A, Photograph A-29). A talus slope has developed at the toe of the Rusty Fault, and ravel debris is continuing to accumulate at the base of the wall. A rockfall catch ditch and berm have been constructed along the toe of the east wall, and there is adequate rockfall protection on the pit floor (Appendix A, Photograph A-29). If access to the bottom of the pit is required, the degree of available catchment in the ditch should be inspected at least twice a year and, if the ditch becomes filled, it should be cleaned out with an excavator so that personnel working at the base of the wall remain protected from rockfall.

There is a potential undaylighted wedge developing at the north end of the east wall that was first observed in 2018 and has been inspected annually since (Appendix A, Photograph A-29). The undaylighted wedge is formed by the intersection of the Rusty Fault and a fault that dips toward the north-northwest. The line of intersection of the Rusty Fault and the fault that dips toward the north-northwest does not appear to be daylighted, but displacement could be occurring along the wedge between the two faults. Additional prisms were installed in 2019 and 2020. The prism monitoring data and locations are discussed further in Section 4.6.3.3.

Toppling deformation has previously occurred along the crest of the east wall; however, the toppling slowed and stopped after mining of the pit was completed. The cracks associated with the toppling deformation in the till at the crest of the east wall were inspected during the 2021 review (Appendix A, Photograph A-30). The cracks in the till behind the east wall are rounded and it appears that there has been little to no movement on the east wall.

A perimeter ditch was re-established around the north and east wall of the Wight Pit in 2021 (Appendix A, Photograph A-31). After the large storm event that occurred in 2020, the perimeter ditch was re-established to convey water around the Wight Pit. At the time of the 2021 review, the ditch was in good condition. The ditch should be inspected at least twice per year (in the fall and after freshet) and if any repairs are required, they should be completed.

4.6 Review of Pit Slope Stability Monitoring Data

Prisms are an integral part of the monitoring system for walls of the open pits at Mount Polley Mine. Long-term deformations can be detected in the prism data, and displacement vectors can be calculated to assist in determining failure mechanisms. Diligence and care should continue to be applied to the monitoring accuracy and frequency. The MPMC survey staff achieve a good level of accuracy in the prism monitoring surveys.

Monitoring data up to 31 October 2021 for the Cariboo, Springer, and Wight Pits have been provided by MPMC. The locations of the monitoring prisms in the Cariboo, Springer, and Wight Pits are presented in Appendix B, Figures B-1, B-11, and B-18. Monitoring prism plots are presented in Appendix B. All of the prisms were not read between December 2020 and May 2021 due to winter conditions.

Slope distance is not being recorded in the monitoring data spreadsheets. Every effort should be made to record slope distance as this is an integral component of the data review to understand apparent movement of the prisms relative to the base station.

As prisms are reset or moved, the prism maps should be updated. The inactive prisms should be clearly marked in the data collection spreadsheets.

Continue to measure the prisms in all the pits on a monthly basis (excluding winter months between December and May) and review the data for changes in the magnitude and rate of displacement.

4.6.1 Monitoring Prism Data – Cariboo Pit

Several prisms area located in the Cariboo Pit (Appendix B, Figure B-1). Since mining ceased in 2019, the trends in the prism data have been steady, with little indication of movement with the exception of ongoing slow-moving relaxation of the pit walls. The following sections provide a review of the prism readings from October 2019 to October 2020 for the Cariboo Pit. Due to the in-pit water reservoir increasing in elevation from elev. 1,000 m to elev. 1,020 m throughout 2021, several of the prisms on the lower benches of the pit were not read during the reporting period.

4.6.1.1 Northeast Wall – Northwest Segment

The Cariboo Pit northeast wall – northwest segment has five 700 series and seven 800 series prisms installed (Appendix B, Figure B-1). The prisms are showing small displacements that are within the accuracy of the system. A typical 700 series prism plot is shown in Appendix B, Figure B-2, and a typical 800 series prism plot is shown in Appendix B, Figure B-3.

The 700 series prisms show little movement, with total displacements of 10 mm or less over the reporting period. The 700 series prisms indicate a small upward vertical displacement within the accuracy of the system (unlikely that the base station is settling) and the horizontal displacement is generally to the south-southeast (out of the pit wall). The 700 series prisms are exhibiting low velocities and no indication of acceleration.

The 800 series prism show about 20 mm or less of total displacement over the reporting period. The prisms indicate downward vertical displacement and movement out of the pit wall to the south-southwest. The 800 series prisms are exhibiting very low velocities and no indication of acceleration.

Overall, the monitoring prism data indicate the wall appears to be stable, and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.2 Northeast Wall – Central Segment

There are 10 prisms installed on the northeast wall – central segment (Appendix B, Figure B-1). Four of these prisms are on the waste rock rehandle slope (two on the upper benches, two on the lower benches) and six on the bedrock below the rehandle slope.

All the prisms on the rehandle slope show similar movement out of the slope into the Cariboo Pit (south-southeast). Prisms 814 and 815 on the upper benches of the waste rock rehandle slope indicate between 7 and 15 mm of total displacement over the reporting period. A typical prism plot on the upper slopes of the waste rock rehandle slope is presented in Appendix B, Figure B-4. These prisms are exhibiting very low velocities and no indication of acceleration. These displacements are typical for long-term settlement of a waste rock slope and are not a concern.

Prisms 828 and 829 are on the lower benches of the waste rock rehandle slope. A typical prism plot on the lower slopes of the waste rock rehandle slope is presented in Appendix B, Figure B-5. The prisms indicate less than 15 mm of total displacement over the reporting period. Prism 828 is moving to the northeast whereas Prism 829 is moving to the west. Both prisms are exhibiting very low velocities with no indication of acceleration. Again, these trends are typical for long-term settlement of a waste rock slope and are not a concern.

The prisms on the bedrock benches below the waste rock rehandle slope that were visible during the 2021 reporting period are showing total displacements of less than 15 mm over the reporting period. A typical plot for the bedrock below the waste rock rehandle slope is shown in Appendix B, Figure B-6. All prisms are showing movement out of the pit wall.

Overall, the wall appears to be stable and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.3 Northeast Wall – Southeast Segment

There are 10 prisms installed on the Cariboo Pit northeast wall – southeast segment (Appendix B, Figure B-1). A typical plot of a prism on the upper benches of the northeast wall – southeast segment is presented in Appendix B, Figure B-7. The prisms located on the upper benches of the wall are all moving out of the pit wall to the south-southwest and exhibit total displacements of less than 7 mm over the reporting period.
The displacements are within the accuracy of the system and there is no indication of acceleration.

A typical plot of a prism on the lower benches of the northeast wall – southeast segment is presented in Appendix B, Figure B-8. The prisms on the lower benches of the wall are all moving out of the pit wall to the south-southwest and indicate total displacements of less than 5 mm (very little movement) over the reporting period.

Overall, the wall appears to be stable and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.4 East Wall

There are 10 prisms installed on the east wall of the Cariboo Pit (Appendix B, Figure B-1). The majority of the prisms were moved in 2017 due to the April 2017 toppling failure and subsequent unloading in the area.
The prisms installed on the single benches above the unload zone are all showing total displacements of less than 15 mm over the reporting period. The movement is out of the pit wall to the west. There is no indication of acceleration or large incremental velocities. A typical plot of a prism on the east wall on the benches above the unload zone is presented in Appendix B, Figure B-9.

Prism 844 is on the elev. 1,084 m bench below the unload zone. The prism is also moving out of the pit wall towards the southwest and the total displacement is about 5 mm over the reporting period.

Three additional prisms should be installed along the crest of the east wall unload zone and recommended locations for the additional prisms are shown in Figure 6. The prisms on the east wall continue to freeze and break over the winter months. Covers could be manufactured for these specific prisms to protect the prisms from the elements and water infiltration. The covers could be made of plywood or metal.

Overall, the wall appears to be stable and there is no indication or large incremental velocities or acceleration in the prism readings.

4.6.1.5 Southeast Wall

The southeast wall of the Cariboo Pit has 11 prisms installed. Prisms 821 and 823 are no longer reading. The prisms that are being monitored on the southeast wall exhibit total displacements between 2 and 10 mm over the reporting period. The prisms are all generally moving to the west-northwest out of the pit wall. There is no indication of acceleration or large incremental velocities. A typical prism plot for the southeast wall is shown in Appendix B, Figure B-10.

Overall, the wall appears to be stable and there is no indication of large incremental velocities or acceleration in the prism readings.

4.6.1.6 Elevation 1,013 m Bench (All Pit Walls)

There are eight prisms installed on the elev. 1,013 m bench in the Cariboo Pit from the north wall notch to the haul ramp into the pit. The prisms have been read since May 2018; however, readings ceased in 2021 due to the in-pit reservoir elevation increasing above this bench height. When Cariboo Pit is dewatered, the prisms on the elev. 1,013 m bench should be re-shot and re-established if safe to do so.

4.6.2 Monitoring Prism Data – Springer Pit

The Springer Pit monitoring prism locations are shown in Appendix B, Figure B-11. Since mining ceased in 2014, the trends in the Springer Pit prism data have been steady, with ongoing relaxation of the pit walls occurring. MPMC began reading the majority of the prisms in the Springer Pit in 2010 in the upper benches, with a select few in 2011 and 2012 in the lower benches. The following sections provide a review of the prism readings from October 2020 to October 2021 for the Springer Pit.

4.6.2.1 East Wall

The prisms on north end of the east wall indicate between 2 and 10 mm of total displacement over the reporting period. The wander plots generally indicate movement out of the pit wall to the southwest. There is no increase in incremental velocity or indication of acceleration. Representative plots are shown in Appendix B, Figures B-12 and B-13.

4.6.2.2 North Wall / North Nose Area

The prisms on the north wall / north nose area are exhibiting small total displacements between 0 and 15 mm over the reporting period. Wander plots generally indicate the movement is out of the pit wall to the south. There is no increase in incremental velocity or indication of acceleration. Typical plots for the north wall / north nose area are shown in Appendix B, Figure B-14 and B-15.

4.6.2.3 West Wall

The prisms on the west wall indicate small total displacements between 2 and 10 mm over the reporting period. The wander plots generally indicate the movement is out of the pit wall to the south-southeast. There is no increase in incremental velocity or indication of acceleration. Representative plots are presented in Appendix B, Figures B-16 and B-17.

4.6.3 Monitoring Prism Data – Wight Pit

The Wight Pit monitoring prism locations are shown in Appendix B, Figure B-18. Since mining ceased in 2009 and the pit was backfilled, the movement within the pit walls has continued to exhibit similar displacement trends to previous years, indicating ongoing relaxation of the pit walls as well as ongoing toppling in the west wall.

The base station was reset in June 2020; therefore, the majority of the prisms in the Wight Pit show a jump in total displacement of approximately 50 mm at this time. The base station on the east wall (at Prism 587) is located on the south side of the east wall within about a metre of the wall crest, and evidence of erosion was visible on the slope below in 2020 (Golder 2021). It was recommended that the survey base station be re-installed farther back from the crest of the east wall to reduce the risk to survey personnel. Rather than move the base station, MPMC installed a new station (WP13) that monitors movement of the existing base station. The station indicates less than 10 mm of total displacement between October 2020 and June 2021. No further readings were available for

the station. Continue to collect readings at WP13 and Prism 587 at the same frequency that readings are taken in the Wight Pit to monitor movement of the base station. Use caution when working near the edge of the east wall.

The following sections provide a review of the prism readings from October 2020 to October 2021 for the Wight Pit.

4.6.3.1 West Wall

The prisms located at the crest of the west wall toppling instability have indicated a steady trend of toppling displacements over the years and prisms in this area continue to show ongoing displacements. Visual observations of the tension cracks were made during the 2021 review and there appears to be little change visually. The prisms above the unload area indicate, on average, 40 mm of total displacement over the reporting period downward in the vertical component and out of the pit wall to the northeast. There is no increase in incremental velocity or indication of acceleration. A representative plot of the prisms above the unload area is shown in Appendix B, Figure B-19. Prisms 530 and 523 show similar trends in total displacement; however, the movement is in the downward vertical component and to the southwest. The direction of movement is isolated to these two prisms and appears to have begun after the base station was reset. Prism 528 stopped being read in 2020.

The prisms at the crest of the unloaded area indicate between 30 and 80 mm of total displacement during the reporting period. The movement trend indicates ongoing settlement on the unload crest towards the north-northeast. There is no increase in incremental velocity or indication of acceleration. This movement is indicative that the cracks in the unload area are continuing to develop and that the wall continues to gradually deform. Representative plots for the west wall unload are shown in Appendix B, Figures B-20 to B-21. Prisms 594 and 595 were installed in September 2020 on the unload area crest. If prisms are lost on the unload area, replace these prisms when safe to do so and with good sightlines to the base station.

The prisms on the north end of the west wall (outside of the unload area) indicate between 30 and 90 mm of total displacement over the reporting period in the downward vertical component and out of the pit wall to the east-southeast. There is no increase in incremental velocity or indication of acceleration. A representative plot of the prisms north of the unload area on the west wall is shown in Appendix B, Figure B-22.

4.6.3.2 North Wall

The prisms on the north wall indicate between 27 and 41 mm of total displacement over the reporting period in the downward vertical component and movement out to the southeast. There is no increase in incremental velocity or indication of acceleration. Typical plots for the north wall are shown in Appendix B, Figures B-23 and B-24.

4.6.3.3 East Wall

As recommended by Golder in 2019 (Golder 2020), prisms have been installed on the east wall, and during the 2020 review, three additional prisms were installed along the crest of the east wall. The prisms on the east wall indicate between 90 and 192 mm of total displacements (120 mm average total displacement) over the reporting period with movement generally in the downward vertical component and towards the southeast to southwest. There is no increase in incremental velocity or indication of acceleration. A typical plot for the east wall is shown in Appendix B, Figure B-25. During the 2021 review it was observed that some of the prisms get knocked over by wildlife (Appendix A, Photograph A-30). These prisms need to be reset and re-shot by the base station as soon as damage is discovered, and these prism resets reduce the accuracy of the long-term monitoring data that are being collected along the east wall. It would be beneficial to determine a more permanent prism installation that cannot be knocked over by wildlife.

5.0 STABILITY CONSIDERATIONS FOR CARIBOO AND SPRINGER PITS

5.1 Slope Stability Considerations for Cariboo Pit

The Cariboo Pit continues to exhibit overall good slope stability performance with the exception of minor localized areas of displacement. The current pit slope design recommendations are still considered to be appropriate based on the current performance of the Cariboo Pit. The existing pit slope design criteria for the Cariboo Pit are presented in Table 1.

Table 1: Summary of Cariboo Pit Recommended Pit Slope Design Criteria

Wall Dip Direction Azimuth (degrees)	Pit Design Sector Azimuth (degrees)	Bench Height (m)	Bench Face Angle (degrees)	Inter-ramp Angle (degrees)	Bench Width (m)	Rationale
000	180	24	65	46	12	Use a double bench configuration with a 65 degree BFA.
030	210	24/12	65/70	46/43	12/8.5	Use a single bench configuration with a 70 degree BFA in the Polley Fault. Otherwise, use a double bench configuration with a 65 degree BFA.
060 to 090	240 to 270	24/12	70	49/43	12/8.5	Use a single bench configuration with a 70 degree BFA in the Polley Fault. Otherwise, use a double bench configuration with a 65 degree BFA.
120	300	24/12	65/70	46/43	12/8.5	Use a single bench configuration with a 70 degree BFA in the Polley Fault. Otherwise, use a double bench configuration with a 65 degree BFA
150	330	24	65	46	12	No slope stability controls.
180 to 240	000 to 060	24	70	49	12.13	No slope stability controls.
270	090	12	70	43	8.5	Current design is a single bench configuration due to toppling along East Cariboo Fault.
300	120	24	70	49	12.13	No slope stability controls.
330	150	24	65	46	12	Use a double bench configuration with a 65 degree BFA.

Source: Golder 2016a.

BFA = bench face angle.

The catch-bench widths for the double benches range from 11.5 to 12 m. The effective catch-bench width is likely to exceed the regulatory 8 m minimum requirement, after accounting for bench crest back-break and the accumulation of ravel debris on the benches. There is little concern over the availability of catchment on the double benched slopes. The design catch-bench width for single benches is 8.5 m. After bench crest back-break and the accumulation of ravel debris on the benches, the effective catch-bench widths may be less than 8 m on walls where single benches are recommended. Effective catch-bench widths can be maximized by ensuring that benches are scaled and cleaned prior to drilling and blasting the next bench. Standard Operating Procedures related to slope stability performance monitoring can be used to identify areas where available catchment is insufficient and where rockfall is creating a hazard to mining operations. A single wide catch-bench or a series of slightly wider catch-benches can be used in areas where rockfall becomes a safety issue.

With the exception of localized areas where the available catch-bench width has been lost due to failures or overspill from mining activities above, the majority of the pit slopes in the Cariboo Pit are achieving the intended design objectives.

If mining resumes, the following potential remedial measures should be considered in the Cariboo Pit:

- When the Cariboo Pit is dewatered, the area below the east wall unload zone should be visually inspected and a rollout berm in the east corner of the haul ramp switchback should be built and maintained to capture any potential ravel debris from the east wall toppling area.
- When the Cariboo Pit is dewatered, the west wall below the Polley Fault should be visually inspected. A rollout berm may be required below the west wall where planar failure is occurring within the Polley Fault Zone and the immediate hangingwall. If catchment decreases along the wall, a wider geotechnical catch-bench may be required when mining proceeds.

5.2 Slope Stability Considerations for Springer Pit

The Springer Pit is currently being used as temporary storage for tailings. During 2015 and 2016 tailings were discharged as slurry into Springer Pit from the saddle between the Cariboo and Springer Pits. Approximately ⅓ of the tailings were dredged from Springer Pit and pumped as slurry to the tailings storage facility between March 2016 and October 2019. Approximately 3.5 Mt of tailings remain in the Springer Pit. The tailings had a free water cover (approximately elev. 986 m) at the time of the 2021 review and the water was actively being pumped. The long-term mine plan includes continued dewatering, removal of the tailings, and an expansion of the Springer Pit to merge with the Cariboo Pit.

Overall, the walls are performing adequately, with the exception of overspill on the east wall. The current pit slope design recommendations are still considered to be appropriate based on the current performance of the Springer Pit. When mining resumes in the Springer Pit, the elev. 1,000 m bench should be cleaned or, alternatively, a new 12 m catch-bench should be excavated below the elev. 1,000 m bench (Figure 5). The existing pit slope design recommendations for the Springer Pit are presented in Table 2.

Table 2: Summary of Springer Pit Recommended Pit Slope Design Criteria

	Pit Design Sector Azimuth (degrees)	Bench Height (m)	Bench Face Angle (degrees)	Inter-ramp Angle (degrees)	Bench Width (m)	Rationale
000	180	12	70	43	8.5	Single bench due to the shallowest dipping structures within Set 3 in the south wall, which dip at angles that are less than the design bench face angle and undercut the current benches. These structures are shown in Appendix A, Photograph A-17.
030	210	24	70	50	11.5	No slope stability controls.
060 to 180	240 to 000	24	65	46.5	11.5	No slope stability controls.
210 to 240	030 to 060	12	70	43	8.5	Single bench through Polley and Springer Faults.
270	090	12	70	43	8.5	Single bench through Polley and Springer Faults. Single bench due to shallow, westerly dipping structures at the bottom of east wall.
300 to 330	120 to 150	12	70	43	8.5	Single bench due to the shallowest dipping structures within Set 3 in the south wall, which dip at angles that are less than the design bench face angle and undercut the current benches. These structures are shown in Appendix A, Photograph A-17.

Source: Golder 2016a.

6.0 REVIEW OF WASTE ROCK DUMP STABILITY PERFORMANCE

The waste rock dumps status at the time of the 2021 review is shown in Figure 1 and the photographs of the waste rock dumps taken during the review are presented in Appendix A. The following sections summarize the waste rock dump slope stability performance observations that were made during the 2021 review.

6.1 Northwest Potentially Acid Generating Dump Stability Performance

The Northwest PAG Dump was exhibiting good stability performance at the time of the 2021 review and there had been little change since the 2020 review (Appendix A, Photograph A-32). The upper PAG lifts were not exhibiting any signs of overall instability or deep-seated instability (Appendix A, Photograph A-33). No signs of dump face bulging or deformation were observed. There was no evidence of ponding or significant cracking on the dump platform (Appendix A, Photograph A-33). Continue to monitor any settlement cracks that could develop, and doze to mitigate the infiltration of water into the dump.

The haul road along the north end of the Northwest PAG Dump has previously shown evidence of water erosion. At the time of the 2021 review, the haul road was in adequate condition and ditching was controlling the flow of water (Appendix A, Photograph A-34).

The lower lifts of the Northwest PAG Dump are exhibiting good overall stability performance. All of the dump faces are at angle of repose and the lifts consist of good, coarse material (Appendix A, Photograph A-35). The berm at the toe of the lower lifts on the inside of the light vehicle road is performing adequately and no rock rollout was visible on the road. There is evidence of ponding in some areas on the lower lifts (Appendix A, Photograph A-36). The ponding water on the lower lifts should be drained, filled, and graded such that water will no longer pool on the lift (particularly near the crest edge) (Appendix A, Photograph A-37). There is also evidence of water ponding below one of the ramps to the lower lifts and fine-grained material has accumulated in this area (Appendix A, Photograph A-37). Water should be diverted away from the area and controlled down the haul ramp.

At the toe of the Northwest PAG Dump there are no signs of foundation failure or deformation observed along the toe of the dump (Appendix A, Photograph A-38). Future construction will progress the dump to the west and north. Construction of the expansion will be bottom-up starting with NAG material at the base and PAG material on top. The thickness of NAG material required in this area should be confirmed with the MPMC environmental team. The foundation soils for areas of the expansion that are on original ground are colluvium and till with localized depressions of saturated soils (Golder 2013). As previously recommended, the foundation materials should be loaded slowly with the initial NAG lift to preload the foundation. This has been achieved to date with the previous initial construction of the Northwest PAG Dump and can continue to be achieved by preloading the foundation with the NAG lift. Once the remaining foundation of the dump has been preloaded with NAG material, the PAG lifts can be advanced from south to north over the NAG material (Golder 2013).

6.2 Southeast Rock Disposal Site Stability Performance

Since the 2020 review, there has been no change to the SERDS (Appendix A, Photograph A-39). The dump platform is properly graded, no ponding was visible, and there were very few settlement cracks observed on the platform (Appendix A, Photograph A-40). The upper and lower dump faces are at angle of repose, with no signs of deformation or bulging in the face or in the foundation soils (Appendix A, Photographs A-41 to A-43). The dump height is relatively low, and the dump is continuing to exhibit adequate stability performance.

6.3 Northeast Non-acid Generating Rock Dump

The Northeast NAG Dump has been inactive for several years. The areas of the dump that were visible during the 2021 review were exhibiting good stability performance and there was no indication of deformation of the waste dump or the foundation (Appendix A, Photograph A-44). The platform has lots of vegetation growing and the berms in place around the perimeter of the platform are not showing any signs of deformation. As well, the lower slopes have good vegetation growth and there is no indication of foundation deformation (Appendix A, Photograph A-45).

6.4 Tailings Road

A minor instability of the Tailings Road occurred prior to the 2019 review. The instability and runout was likely due to flowing water over the road caused by runoff and the water infiltrating the fill material. This subsequently led to the instability.

The instability area was inspected by Golder during the 2021 review and has remained relatively unchanged since the instability occurred (Appendix A, Photograph A-46). The crest area is bermed off and there is no access at the toe of the slope. There is evidence of ponding water on the platform of the Tailings Road (Appendix A, Photograph A-47). Water needs to be redirected using appropriate ditching above the Tailings Road such that water doesn't flow past the berm at the entrance and onto the platform. If water continues to pond on the platform after appropriate ditching has been implemented above the Tailings Road, the platform may need to be regraded. Visual reviews should be carried out of the instability to check for changes to the instability area, backscarp, and toe of the slope.

When the Tailings Road construction restarts, it is possible that the road may be constructed over fine-grained foundation materials. The road may need to be constructed from south to north with smaller lift heights to control pore pressures in the foundation materials and loading rates. Using a dozer to pre-load the foundation materials, the Tailings Road construction could begin off the S-curve in the current road to the east with a lower lift height. The lower lift could be advanced north and south from this access road along the alignment of the proposed Tailings Road (Figure 10). Once the lower lift is advanced to the toe of the current Tailings Road fill, it would be tied into the failed area. The instability area should be remediated with good-quality, coarse-grained material that is dumped short and pushed into the instability area by a dozer to help tie the Tailings Road together.

6.5 Review of Waste Rock Dump Stability Monitoring Data

Prisms are an integral part of the monitoring system for the waste rock dumps at Mount Polley Mine. Long-term deformations and settlement of the dumps can be detected in the prism data, and displacement vectors can be calculated to assist in determining failure mechanisms. Diligence and care should continue to be applied to the monitoring accuracy and frequency. The MPMC survey staff achieve a good level of accuracy in the prism monitoring surveys.

The Northwest PAG Dump is the only dump on site that is currently being monitored by prisms. The location of the monitoring prisms on the Northwest PAG Dump are shown in Appendix B, Figure B-26. Monitoring prism plots are presented in Appendix B.

6.5.1 Northeast Potentially Acid Generating Dump Monitoring Prism Data

There are 27 prisms that were actively monitored on the Northwest PAG Dump through the reporting period (Appendix B, Figure B-26). The 100 series prisms were read six times between October 2020 and October 2021, and the 700 series prisms, Prisms 776 through 779, were read 14 times within the data review period.

The 100 series prisms are located on various lifts of the Northeast PAG Dump. On the north end of the dump, the 100 series prisms show approximately 0 to 20 mm of total displacement over the reporting period with both a vertical and horizontal component, which is consistent with ongoing settlement. The wander plots show that the movement is generally to the northwest, which is out of the dump slope. The incremental velocity is low and there is no indication of acceleration for any of the 100 series prisms on the north end of the dump. Typical prism plots for the 100 series on the north end of the Northwest PAG Dump are shown in Appendix B, Figures B-27 and B-28. Prism 106 on the lower lift of the north end of the dump shows 170 mm of total displacement in readings between June and July 2021. The majority of the movement is in the horizontal component with about 40 mm in the vertical component downward. The wander plot indicates that the movement is to the south. The readings after July 2021 are constant and there is little indication of movement. It is possible that the prism was knocked over. The area should be inspected after freshet and the prism monitoring data that are collected after freshet should be reviewed to understand if the movement is the dump or potentially the prism being knocked over. The prism plot for Prism 106 is shown in Appendix B, Figure B-29.

The 100 series prisms located on the south end of the dump show between 0 and 25 mm of total displacement over the reporting period with both a vertical and horizontal component, which is consistent with ongoing settlement. The wander plots show that the movement is generally to the southeast with some variability between prisms. The incremental velocity is low and there is no indication of acceleration for any of the 100 series prisms on the south end of the dump. A typical prism plot for the south end of the dump is shown in Appendix B, Figures B-30 and B-31. Prisms 103, 119, 120, 121, and 122 all have a sudden increase or decrease in total displacement (movement is in the horizontal and vertical components) that appears to revert back to normal readings between May and June 2021. Prism 119 is shown in Appendix B, Figure B-32. It is possible that there was an issue with the reading taken in June 2021 or that a backsight was not corrected for properly. Readings after June 2021 appear to follow the typical trend of a waste dump settling.

The 700 series prisms are all located on the southwest access road crest edge to the Northwest PAG Dump. The prisms all show approximately 30 mm to 65 mm of total displacement over the reporting period with both a vertical and horizontal component, which is consistent with ongoing settlement. The wander plots show that the movement is to the southwest, which is out of the dump at an angle approximately perpendicular to the crest. The incremental velocity is low and there is no indication of acceleration for any of the 700 series prisms. A representative prism plot for the 700 series is shown in Appendix B, Figure B-33.

7.0 WASTE ROCK DUMP DESIGN CONSIDERATIONS

The proposed ultimate design of the Northwest PAG Dump has been updated since the slope stability review in 2020 and will include an expansion to increase the lift height of the northern portion of the dump to elev. 1,150 m and extend the dump to the west and north (Figure 7). Overall, the dump will be approximately 140 m high.

During the 2021 review, Golder discussed with MPMC staff how the extension should be progressed from the lower lifts of the Northwest PAG Dump towards the west then to the north (Appendix A, Photograph A-38). Future construction will progress the dump to the west and north. Construction of the expansion will be bottom-up, starting with NAG material at the base and PAG material on top. The thickness of NAG material required in this area should be confirmed with the MPMC environmental team. The foundation soils for areas of the expansion that are on original ground are colluvium and till with localized depressions of saturated soils (Golder 2013). As previously recommended (Golder 2013), the foundation materials should be loaded slowly with the initial NAG lift to preload the foundation. This has been achieved to date with the previous initial construction of the Northwest PAG Dump and can continue to be achieved by preloading the foundation with the NAG lift. Once the remaining foundation of the dump has been preloaded with NAG material, the PAG lifts can be advanced from south to north over the NAG material (Golder 2013).

The proposed ultimate design of the SERDS is currently under review as a co-disposal site. The detailed design will be complete in 2022.

8.0 SUMMARY OF GEOTECHNICAL CONSIDERATIONS

Slope stability monitoring and surface water management will be key to maintaining the stability of the existing pit slopes and waste rock dump slopes. The following sections describe the recommended actions.

8.1 Pit Slope Stability Performance Monitoring

The stability of the pit slopes is being monitored by survey prisms that are installed on benches in the Cariboo, Springer, and Wight Pits as well as by visual inspections. The prisms should be measured by the MPMC survey team on approximately a monthly basis. Readings are not required in winter when the prisms are covered in snow and the slopes are frozen. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements, as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceed a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data. The current system is functioning adequately and is being used to monitor pit slope displacements. The following general guidelines should be used in collecting and interpreting the monitoring data:

- Slope distance should be recorded in the prism monitoring spreadsheets.
  - Slope distance data should be used with caution. It is possible for a portion of the slope to move a significant distance perpendicular to the line of sight with very little change in the slope distance measurement. Therefore, the 3D displacements must also be reviewed for signs of long-term displacement.
- Velocity threshold criteria have been established for pit walls based on previous experience. However, these data must also be reviewed for signs of acceleration. If a prism is showing acceleration—regardless of the measured velocity—personnel should be told to avoid the area and the source of the displacement should be investigated. Displacement trend guidelines for the pit wall prisms are illustrated in Figure 8.
- If prisms are moved or reset, the prism should be renamed and a new data collection sheet should be completed. The old prism should become inactive in the data collection sheet.

A major part of the slope stability monitoring program will be the regular visual inspections of the bench faces and crest areas for early evidence of slope instability. Regular pit inspections should be carried out quarterly, and areas of instability should be inspected monthly. After a major rainfall event, an inspection of the pit walls should be completed to check for any adverse conditions after the event. These inspections should ideally be carried out by the same individual to maintain continuity of the observations. The observations should be recorded in a diary so that a record of the stability performance is available should it be required in the event of instability.

8.2 Waste Rock Dump Stability Performance Monitoring

Similar to the pit slopes, the stability of the waste rock dump slopes is being monitored by survey prisms and visual inspections. The prisms should be measured by the MPMC survey team on approximately a quarterly basis when the dumps are not active. Readings are not required in winter when the prisms are covered in snow and the slopes are frozen. Survey personnel should continue to ensure consistency in readings and use the same setup and monitoring procedures for each set of measurements. This will improve the ability to detect localized and short-term displacements as well as develop more accurate interpretations of long-term settlement trends. If any significant storm events occur that exceeds a five-year return period or daily maximum precipitation, the prisms should be read. Daily temperature and barometric pressure corrections should be applied to the monitoring data, as rapid changes in temperature or barometric pressure can have a significant impact on the day-to-day accuracy of the data. The current system is functioning adequately and is being used to monitor waste rock dump slope displacements. The following general guidelines should be used in collecting and interpreting the monitoring data:

- Slope distance should be recorded in the waste rock dump monitoring spreadsheets.
  - Slope distance data should be used with caution. It is possible for a portion of the slope to move a significant distance perpendicular to the line of sight with very little change in the slope distance measurement. Therefore, the 3D displacements must also be reviewed for signs of long-term displacement.
- Velocity threshold criteria have been established for the waste rock dumps based on previous experience. However, these data must also be reviewed for signs of acceleration. If a prism is showing acceleration—regardless of the measured velocity—personnel should be told to avoid the area and the source of the displacement should be investigated (Figure 9).
- If prisms are moved or reset, the prism should be renamed and a new data collection sheet should be completed. The old prism should become inactive in the data collection sheet.

A major part of the slope stability monitoring program will be the regular visual inspections of the waste rock dump crests, platforms, and slope faces for early evidence of slope instability. The waste rock dumps should be inspected once per quarter and during periods of high precipitation that may cause additional infiltration into the dump or additional erosion. These regular inspections should ideally be carried out by the same individual to maintain continuity of the observations. The observations should be recorded so that a record of the stability performance is available should it be required in the event of instability.

The visual reviews should include the following:

- inspecting the crests for signs of cracking and localized settlement and ponding water
- inspecting the faces of the waste rock dumps for signs of over-steepening, bulging in the middle or at the toe of the face, seepage, and erosion
- inspecting the foundation, or toe of the waste rock dump, for signs of deformation

Visual observations should be documented on inspection forms.

8.3 Surface Water Management

Surface water management around the pits and waste rock dump areas is a key component of maintaining the stability of the slopes. The following areas should continue to be monitored and managed:

- The seepage area noted on the unload area of the east wall of the Cariboo Pit in 2019 should continue to be monitored as well as the benches below the seepage area within the unload zone.
- The Wight Pit perimeter ditch should be maintained to convey water around the pit.
- The platforms should be regraded to promote water draining away from the face of the dump if any ponding water is noted on the waste rock dumps.
- Appropriate ditching and/or water bars around the area of the Tailings Road failure should be maintained to promote water flowing away from the dump faces.

9.0 SUMMARY OF 2021 REVIEW RECOMMENDATIONS

The recommendations following the 2021 review are summarized in Table 3. The ID column has a unique number for each recommendation, prefixed with the year the recommendation was originally made. New recommendations and comments from 2021 are marked with *italic text.* Recommendations that were marked as complete in previous years are not included in the summary table.

Table 3: Summary of Recommendations for 2021 Review

Area	ID	Recommendation	Timeline
Cariboo Pit	2019-03	If access is needed below the east wall on the haul road switchback or mining resumes, a rock rollout berm should be built and maintained below the east wall unload zone.	If access is needed or mining resumes, immediately.
	2020-01	Install three new prisms on the unload zone.	*Completed in fall 2020; however, the new prisms failed over the winter. These prisms should be replaced in Q2 2022 before monitoring resumes.*
		Replace broken head on existing prism.	*Completed in 2021; however, the prism head broke again. Replace in Q2 2022 and install a cover to protect the prisms on the east wall from the elements. The cover could be made of plywood or metal.*
	2021-01	*Rock rollout berm in front of wedge instability along haul ramp and below C2 Pit due to limited catchment available.*	*Q2 2022 – personnel enter the Cariboo Pit to access the pumping infrastructure and a rollout berm should be in place to protect the pump equipment and personnel.*
Springer Pit	*2021-01*	*Remove boulders from haul ramp on west wall and establish a rock rollout berm in front of overhang in bench.*	*Q2 2022 – personnel enter the Springer Pit to access the pumping infrastructure.*
Wight Pit	2018-02	Clean catch ditch along east wall below Rusty Fault.	Once per year or as required.
	2020-02	Install two to four additional prisms along the west wall between Prisms 595 and 543.	*Complete – two prisms were installed on the west wall in early 2021.*
	2020-03	Move the location of the monitoring base station farther back from the crest of the east wall.	*Incomplete – a new station was installed that monitors the existing base station for movement.*
Tailings Road	2019-06	Remediate failure scarp area.	*Incomplete in 2020 and 2021. Divert water away from the Tailings Road to limit ponding in the area of the scarp area until it is remediated.*
All areas – prism monitoring data	2019-07	Collect slope distance measurements.	*Incomplete – Q2 2022*

10.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

Golder Associates Ltd.

4 February 2022

PROFESSIONAL ENGINEER
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https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/001-r-73114-2021 site visit report/rev0/22514095-001-r-rev0-73114_mount polley 2021 slope stability report-04feb_22.docx

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REFERENCES

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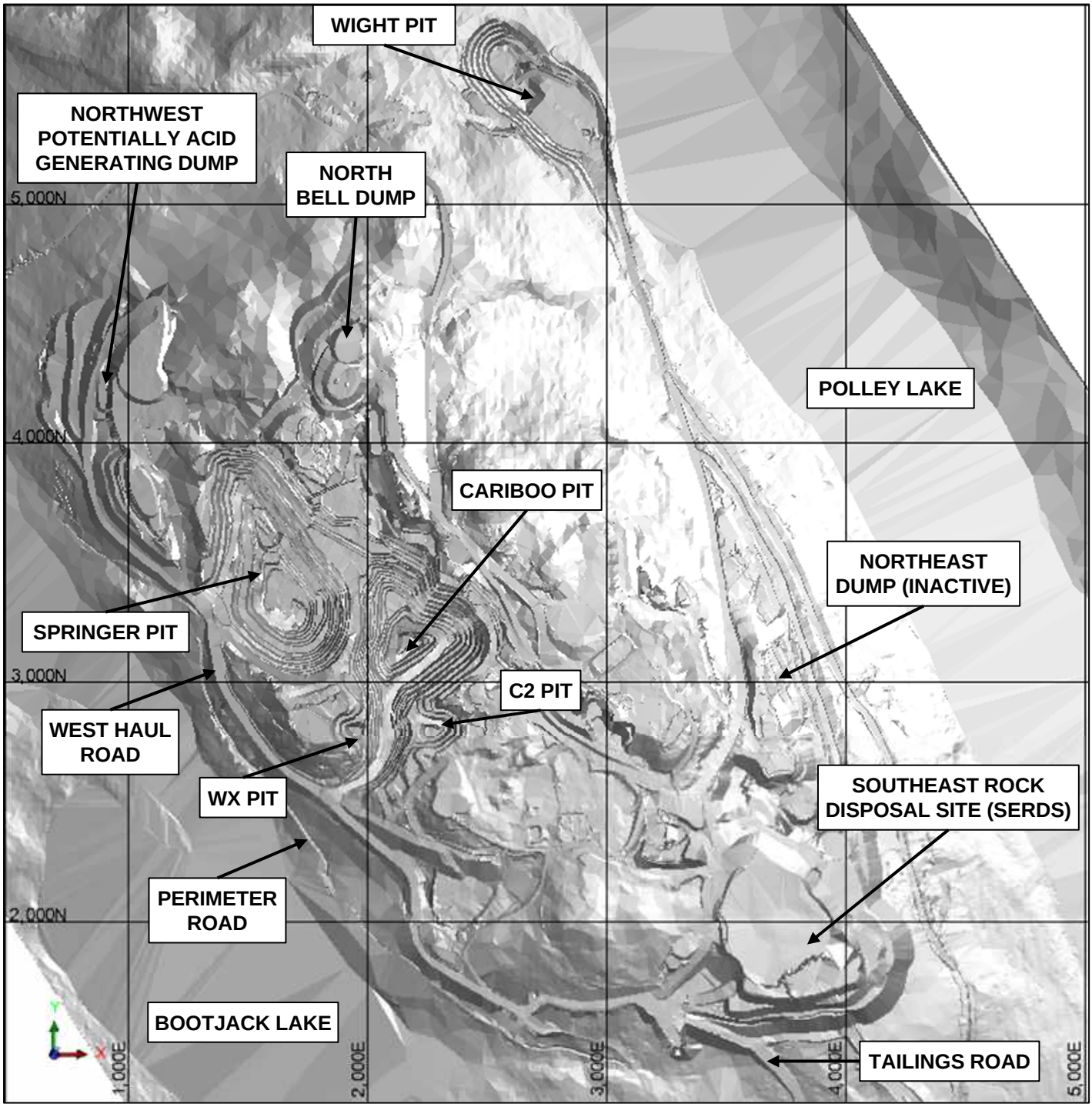
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REFERENCES AND NOTES

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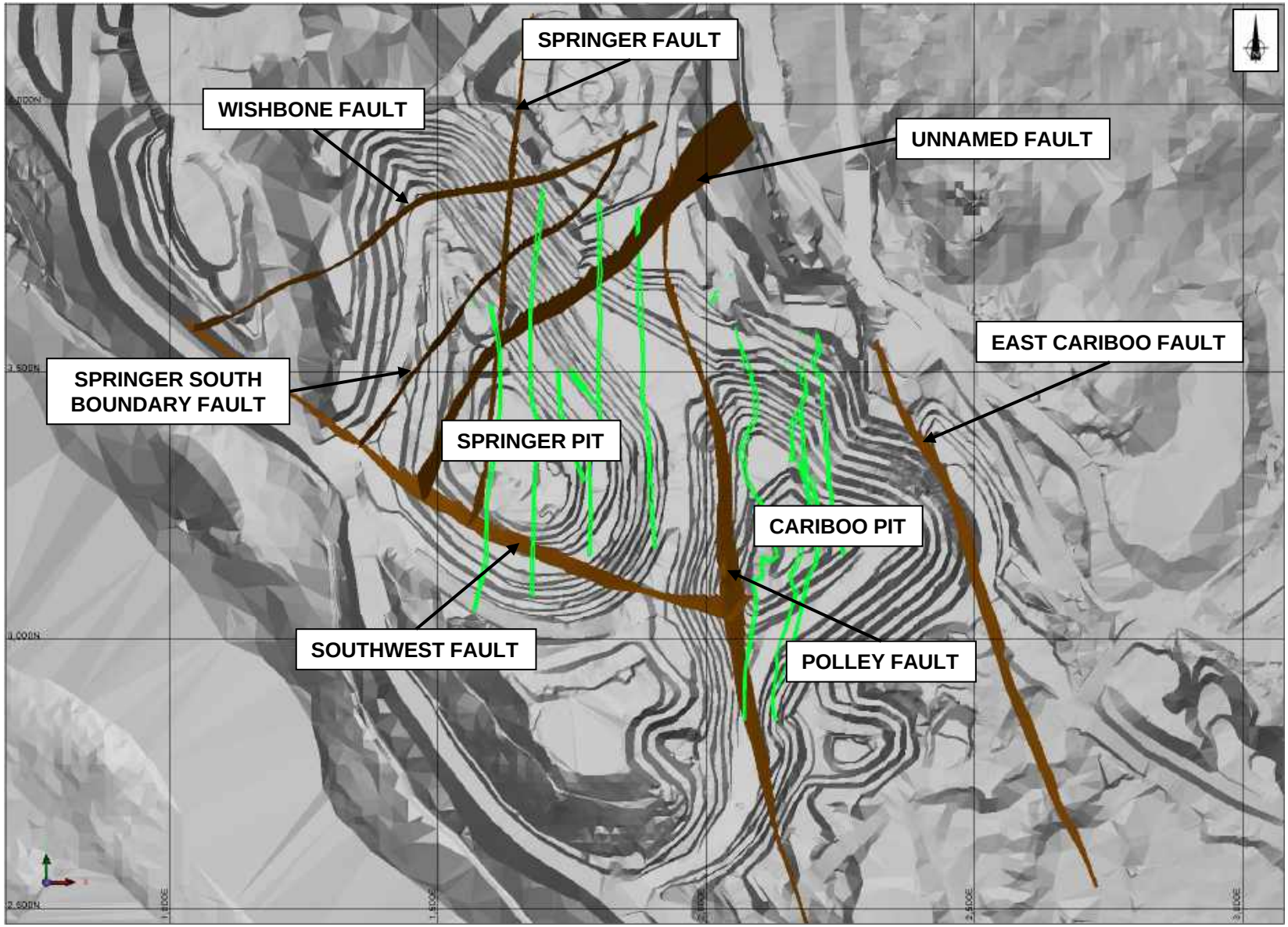
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MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
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PROJECT NO.	PHASE	REV.	FIGURE
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	FAULTS



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1. MT. POLLEY MINE SITE SURFACE PROVIDED BY MPMC, 7 OCTOBER 2019. FILENAME: Site – Oct 7,2019.dxf.
2. FAULT SURFACES PROVIDED BY MPMC, 3 SEPTEMBER 2015.
3. DYKE STRINGS PROVIDED BY MPMC, 7 DECEMBER 2011.

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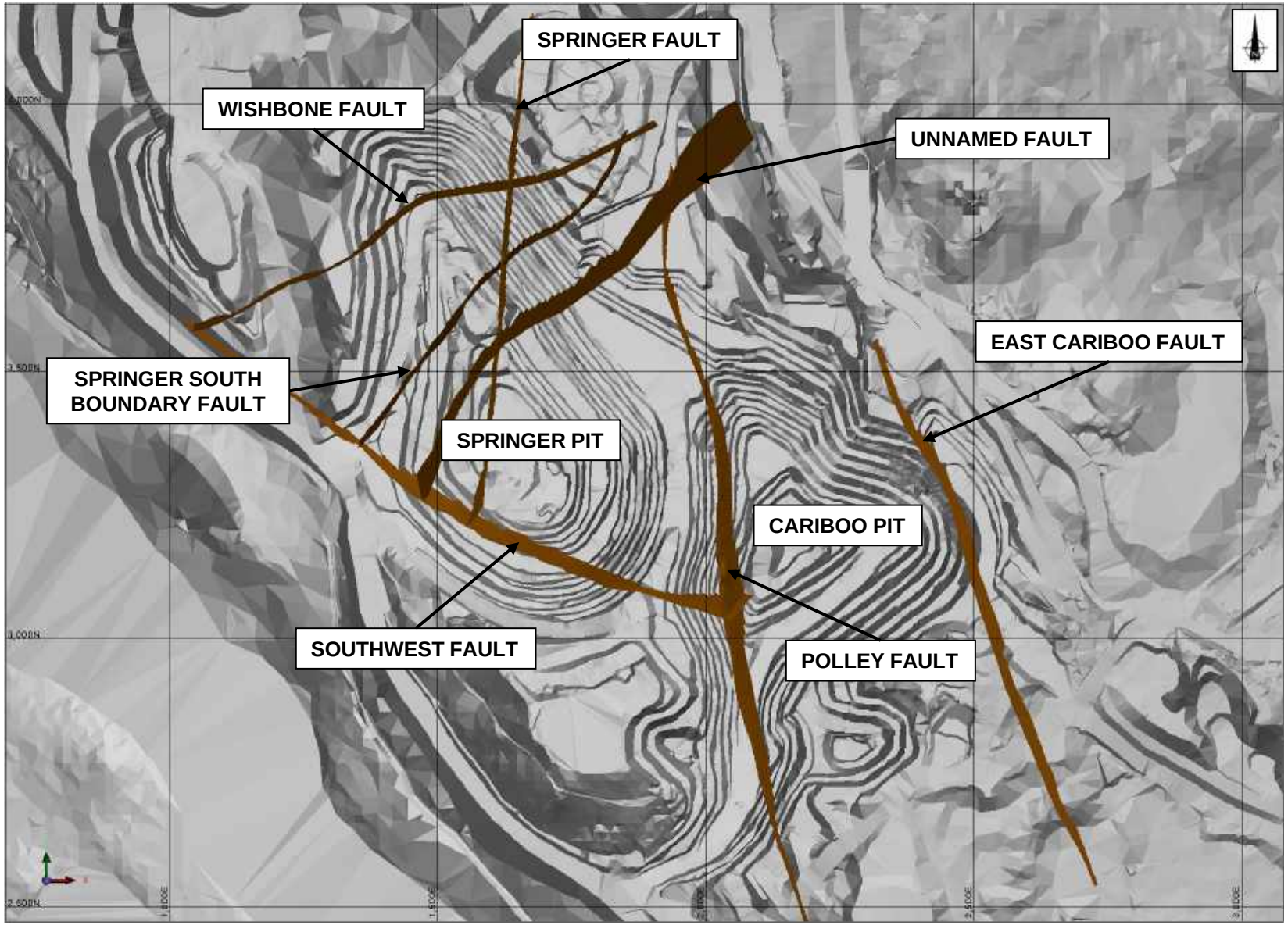
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CARIBOO AND SPRINGER PITS
MAJOR FAULTS AND DYKES
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI A
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LEGEND

FAULTS



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1. MT. POLLEY MINE SITE SURFACE PROVIDED BY MPMC, 7 OCTOBER 2019. FILENAME: Site – Oct 7,2019.dxf.
2. FAULT SURFACES PROVIDED BY MPMC, 3 SEPTEMBER 2015.

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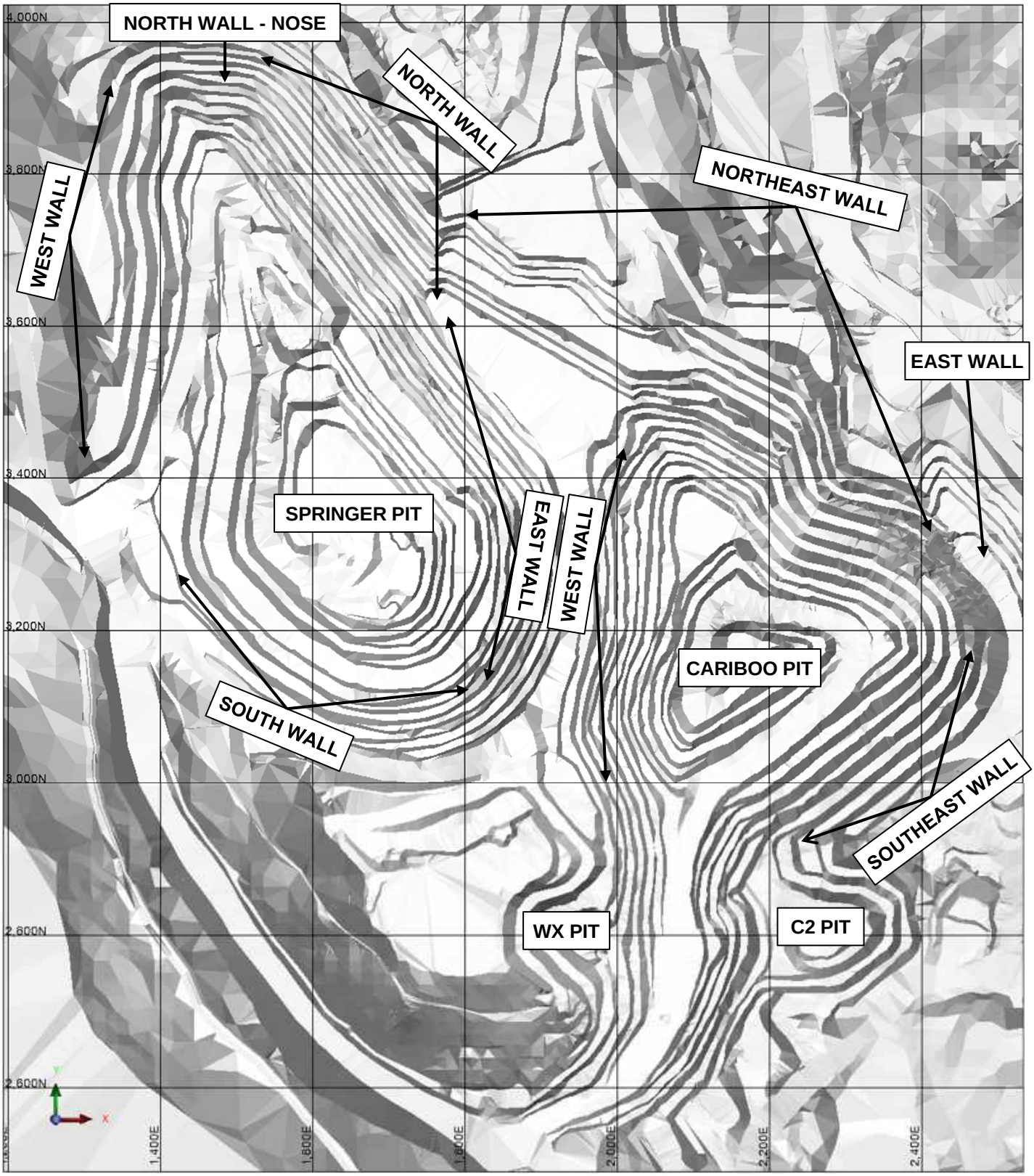
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MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
MAJOR FAULTS
PLAN VIEW

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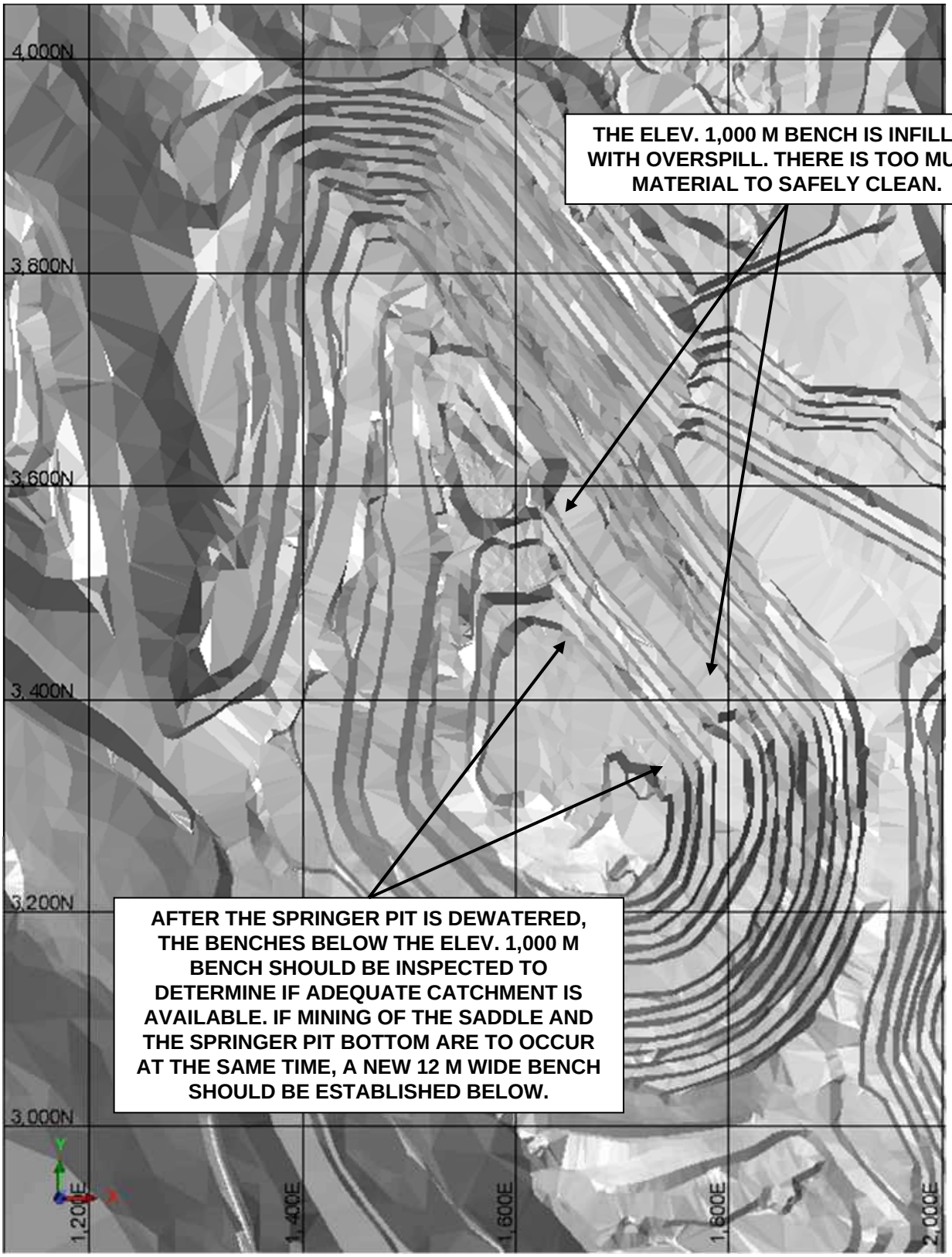
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2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
WALL LOCATIONS
PLAN VIEW

PROJECT NO.	PHASE	REV.	FIGURE
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1. MT. POLLEY MINE SITE SURFACE PROVIDED BY MPMC, 7 OCTOBER 2019. FILENAME: Site – Oct 7,2019.dxf.

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PROJECT
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2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT
ELEV. 1,000 m BENCH AND POTENTIAL STEP-OUT LOCATION

PROJECT NO.	PHASE	REV.	FIGURE
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INSTALLED PRISM **RECOMMENDED ADDITIONAL PRISMS**

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER 20 OCTOBER 2021.

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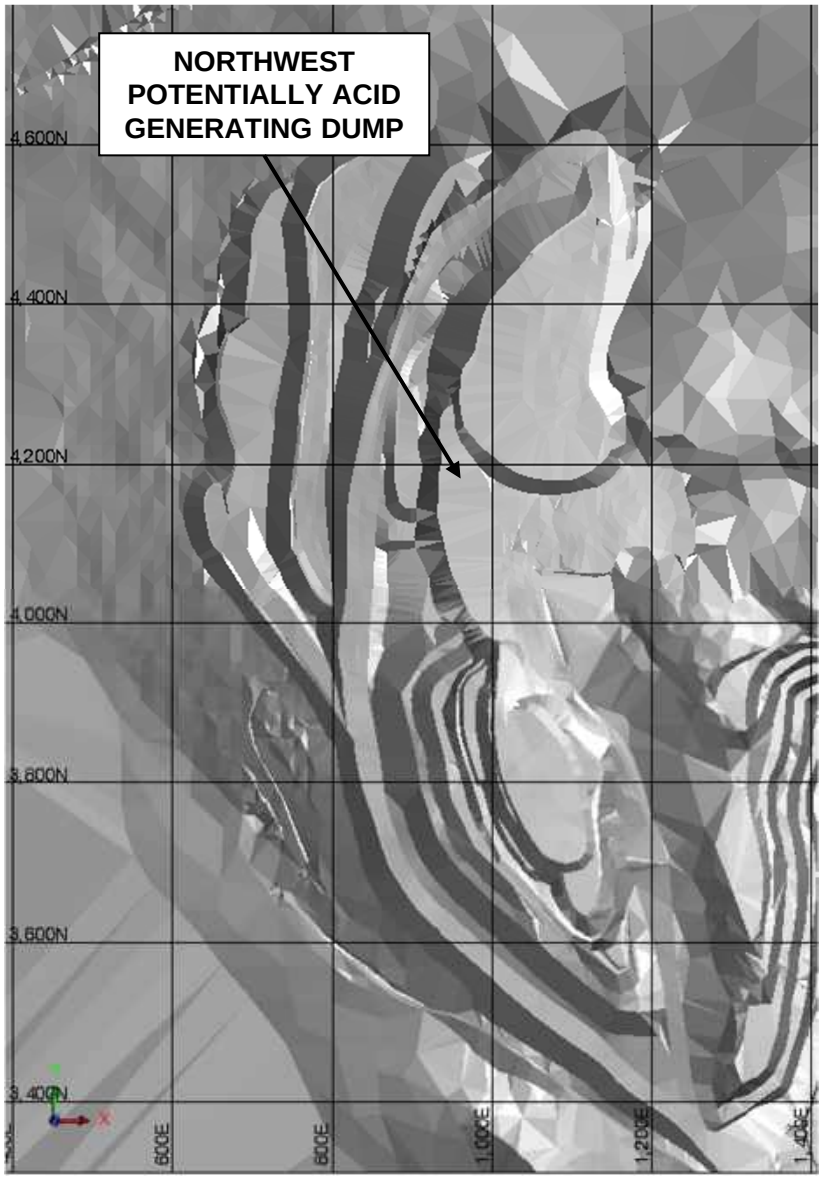
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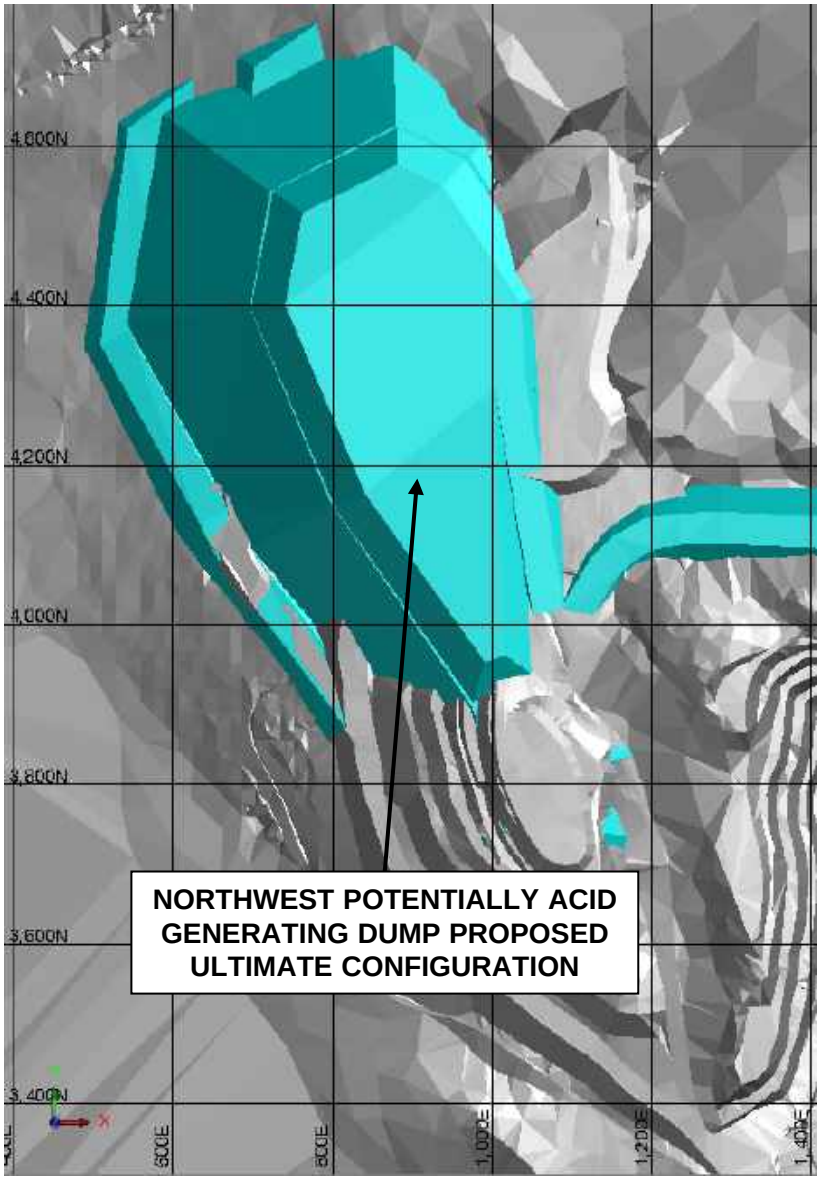
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT – EAST WALL UNLOAD ZONE
PRISM LOCATION RECOMMENDATIONS
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	FIGURE
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PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST POTENTIALLY ACID GENERATING DUMP PROPOSED ULTIMATE DESIGN CONFIGURATION

PROJECT NO.	PHASE	REV.	FIGURE
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Prism Data Interpretation Procedures

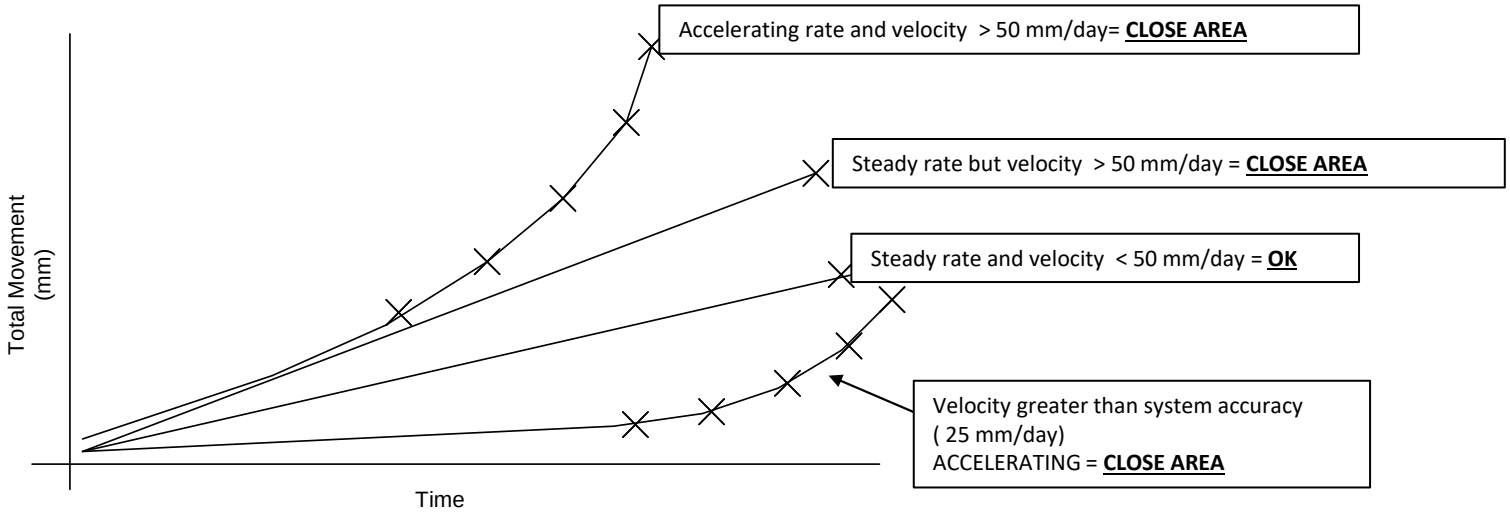
A) Daily displacement (mm)
(How many millimetres did it move? Was this less than or more than the monitoring system accuracy?)

B) Daily velocity (mm/day)
(How fast is it moving?)

C) Direction of movement (azimuth)
(Does the direction of movement make sense? Is it moving away from the wall, parallel to the wall, or into the wall?)

D) Direction of movement (vertical)
(Are all of the prisms moving upward? If so, is it possible that the base station or back-sight is settling?)

E) Total displacement graph
(Is it accelerating?)



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MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
PIT SLOPE PRISM MONITORING DATA INTERPRETATION CRITERIA

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**8**

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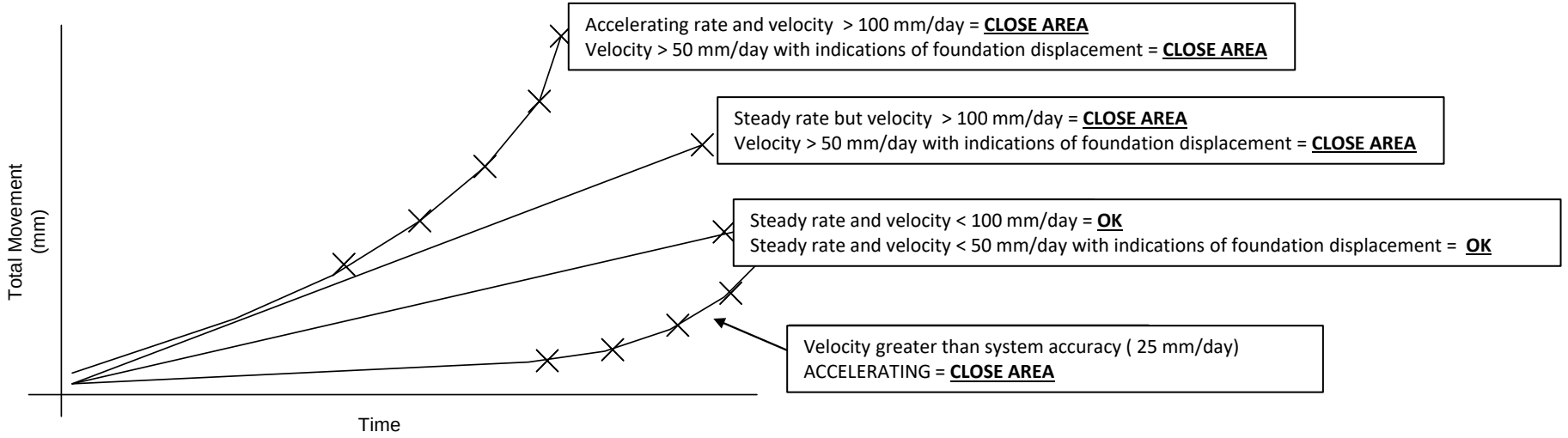
A) Daily displacement (mm)
(How many millimetres did it move? Was this less than or more than the monitoring system accuracy?)

B) Daily velocity (mm/day)
(How fast is it moving?)

C) Direction of movement (azimuth)
(Does the direction of movement make sense? Is it moving away from the wall, parallel to the wall, or into the wall?)

D) Direction of movement (vertical)
(Are all of the prisms moving upward? If so, is it possible that the base station or back-sight is settling?)

E) Total displacement graph
(Is it accelerating?)



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2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WASTE ROCK DUMP PRISM MONITORING DATA INTERPRETATION CRITERIA

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**9**

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REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

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DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
PROPOSED CONSTRUCTION OF THE TAILINGS ROAD DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	FIGURE
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APPENDIX A

Photographs



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO AND SPRINGER PITS
OVERVIEW
DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

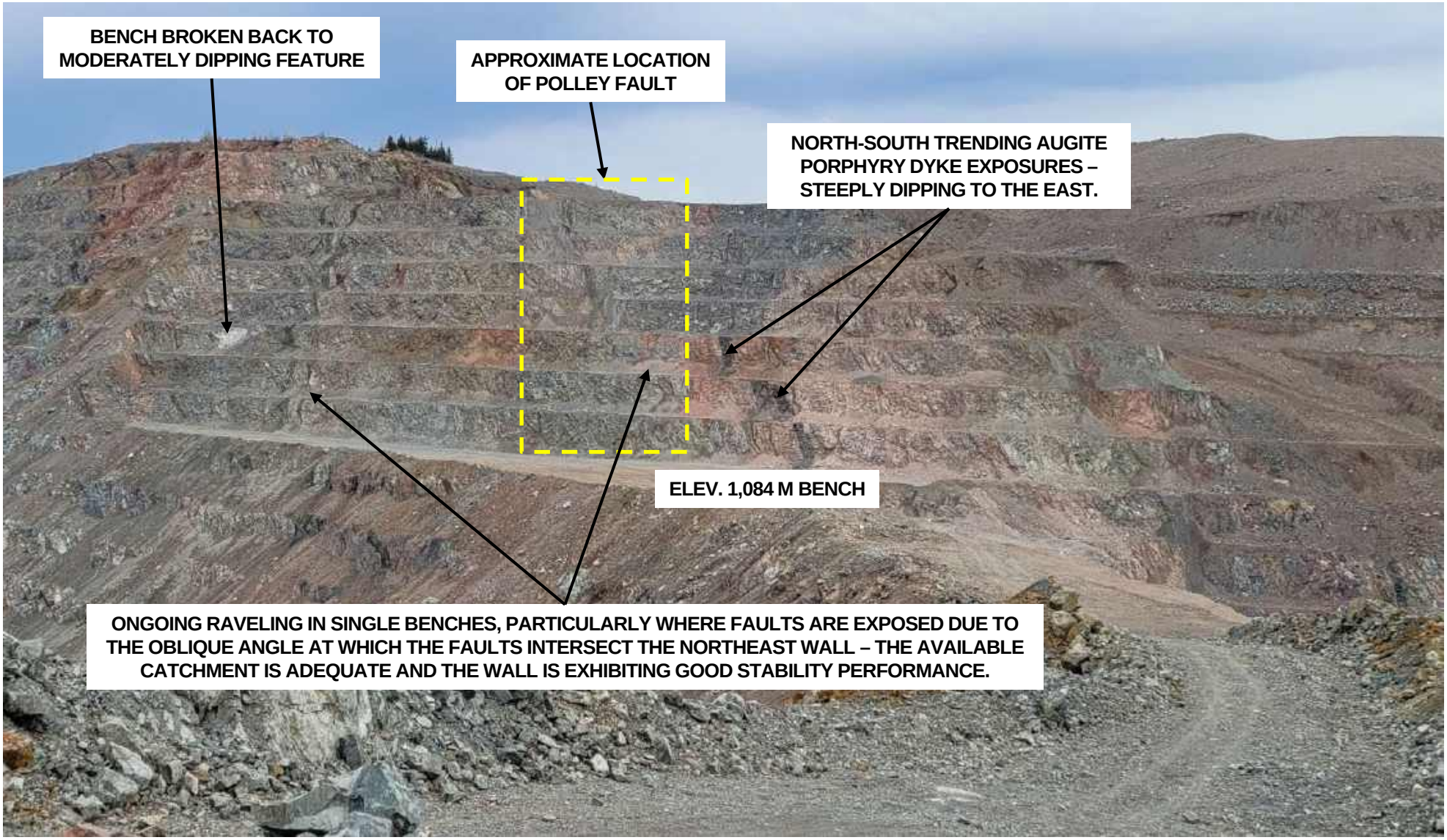
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT
OVERVIEW
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

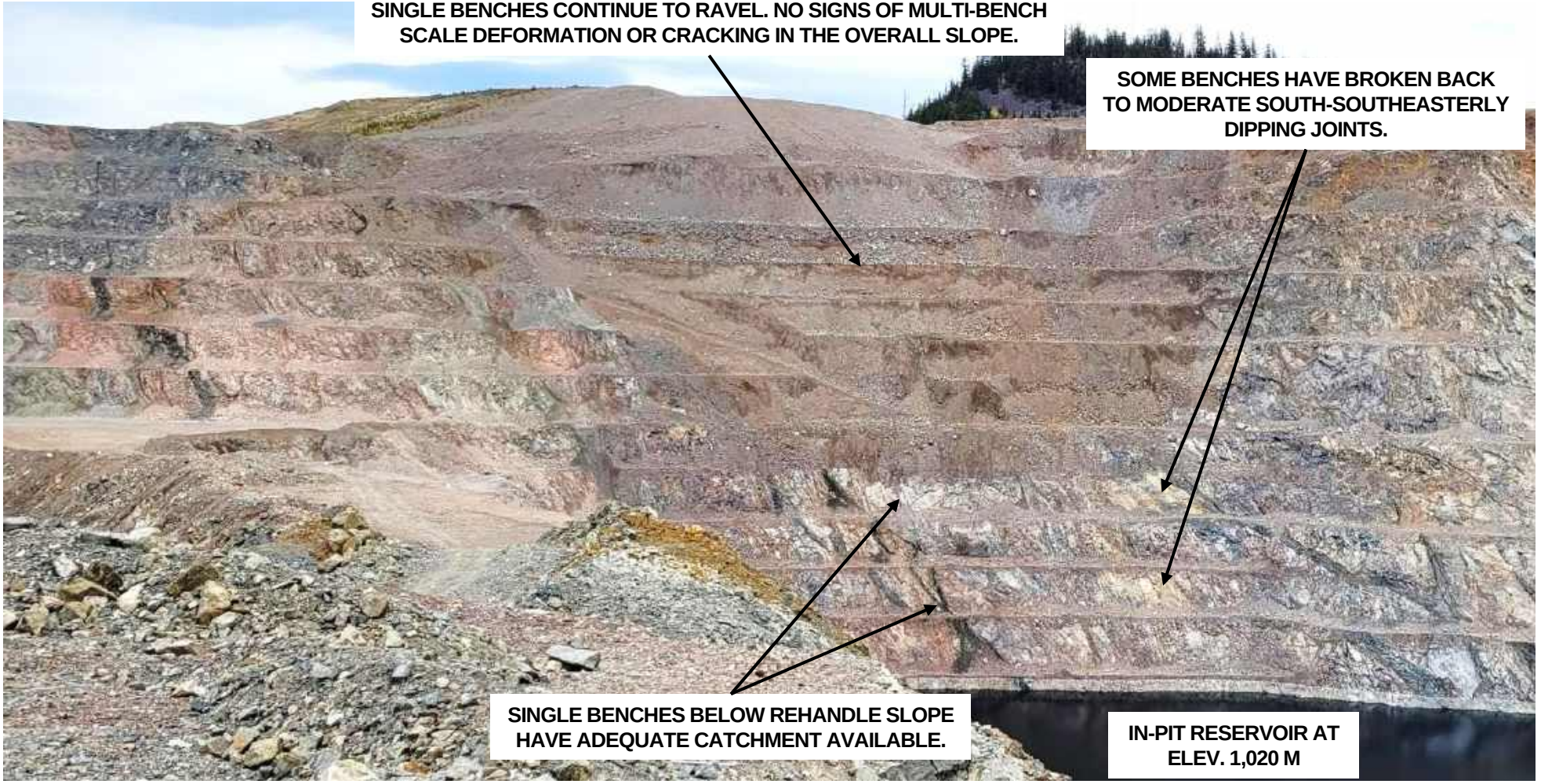
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER AND CARIBOO PITS NORTHEAST WALL NORTHWEST SEGMENT
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

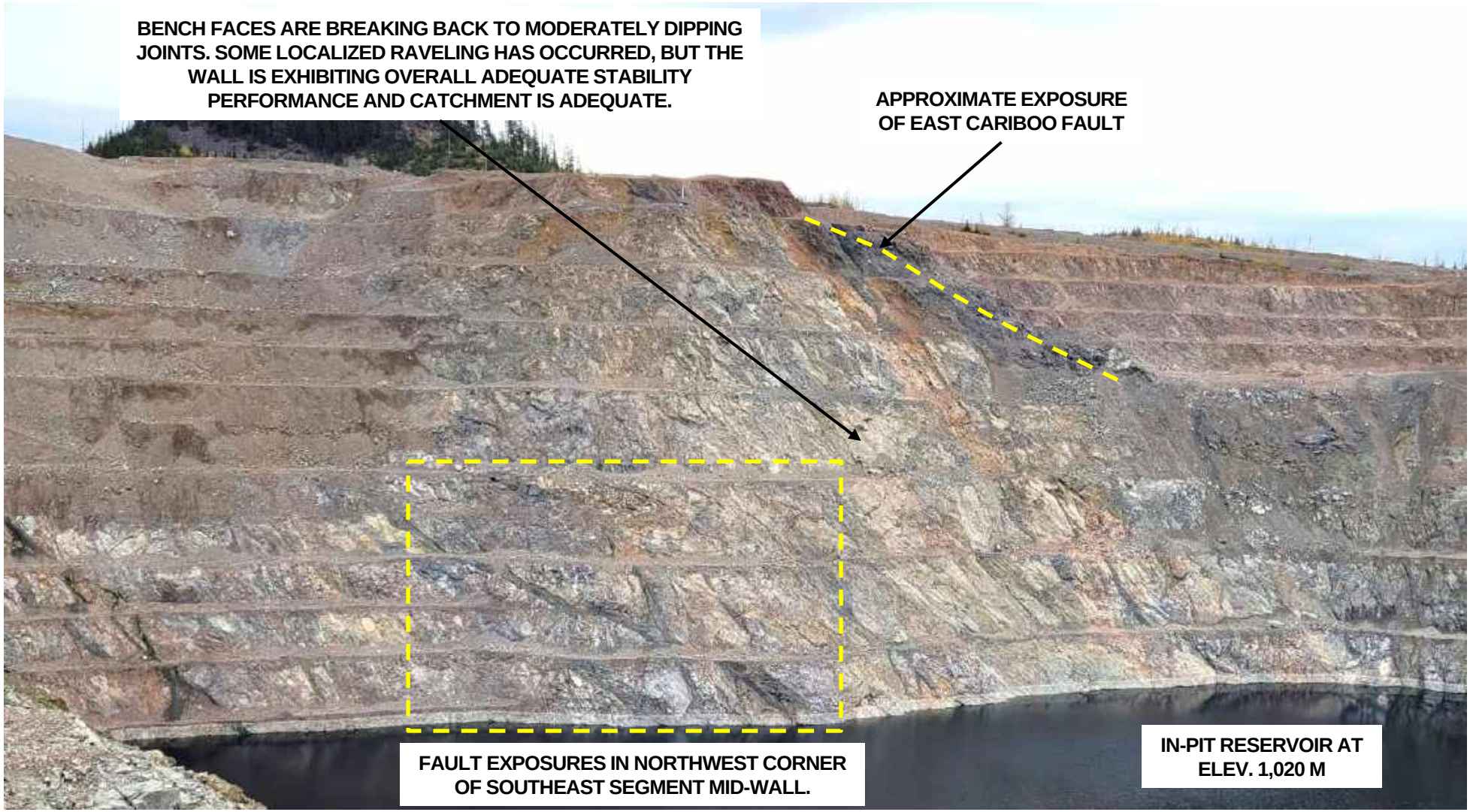
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL
CENTRAL SEGMENT
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

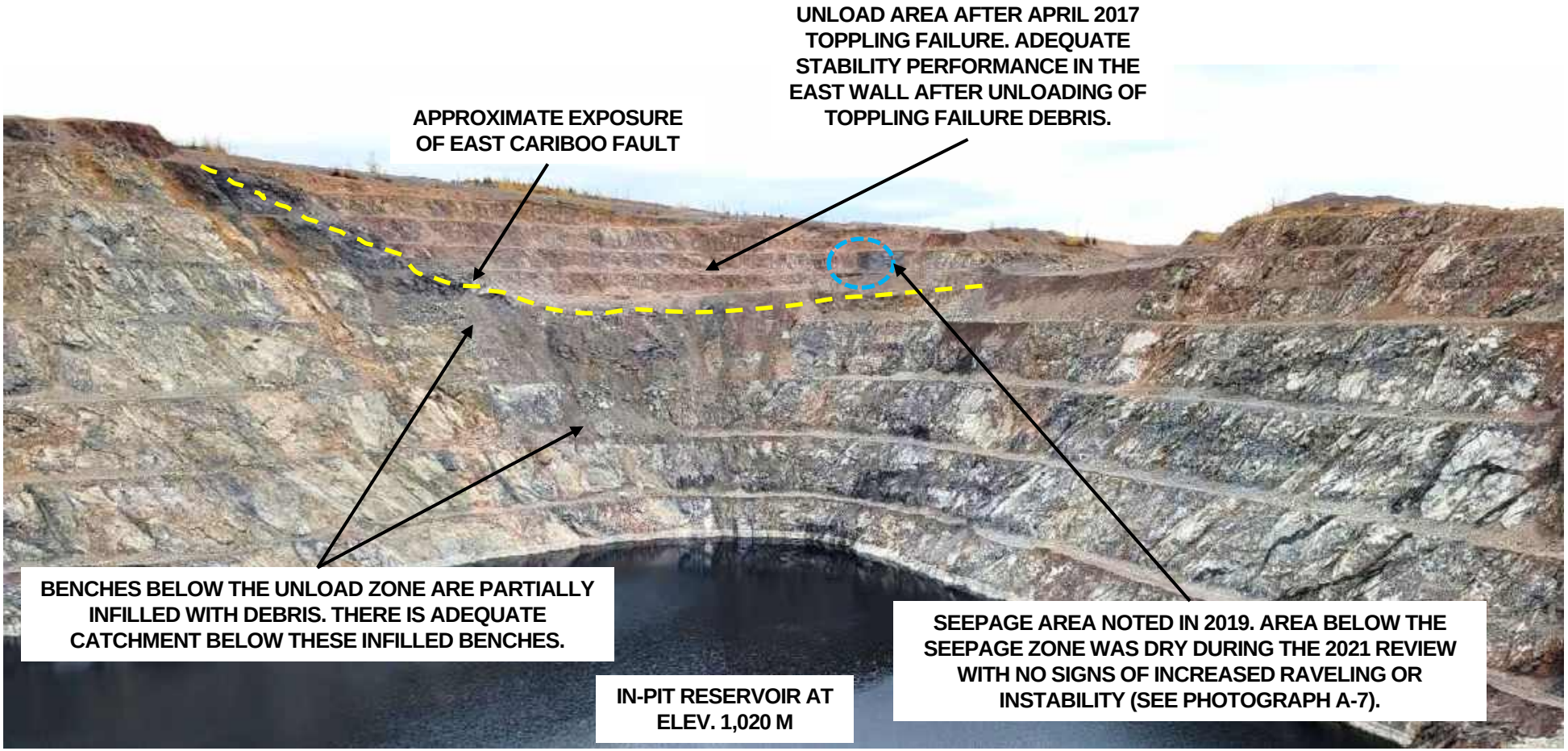
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL SOUTHEAST SEGMENT PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

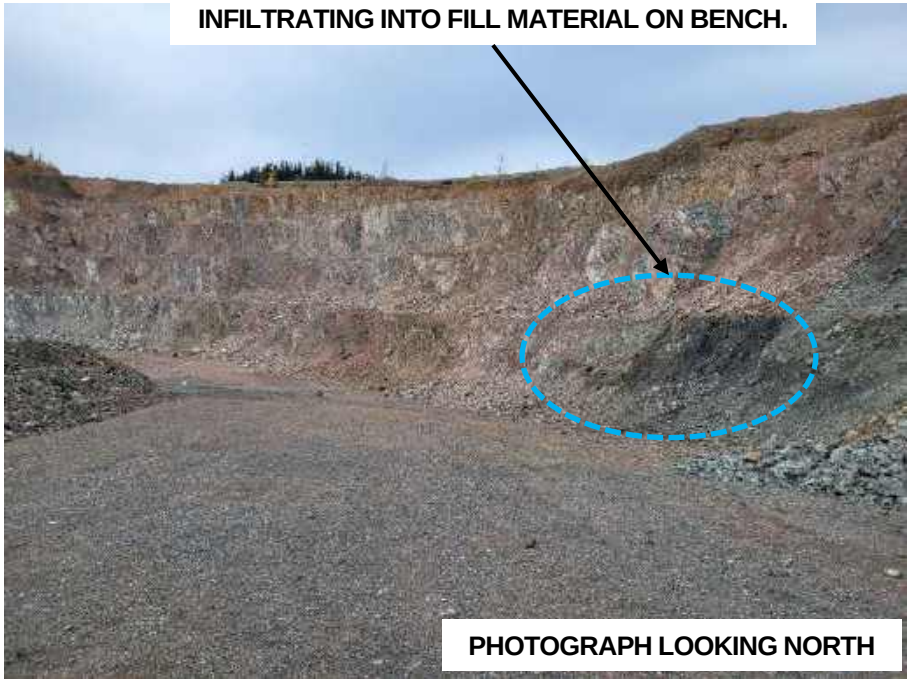
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT EAST WALL
UNLOAD AREA
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0





REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

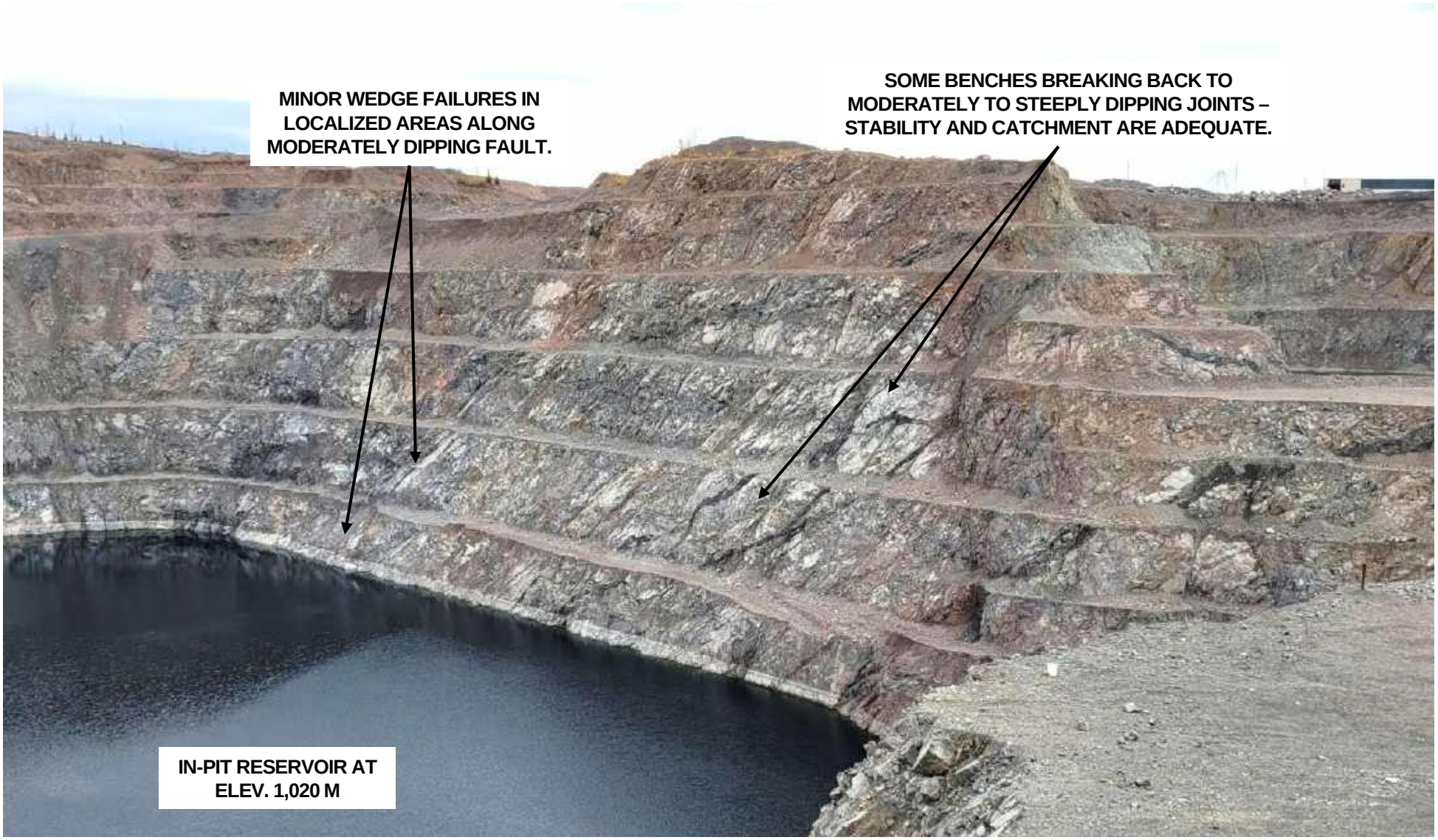
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT EAST WALL
UNLOAD AREA DITCHING AND SEEPAGE
PHOTOGRAPHS LOOKING SOUTH AND NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

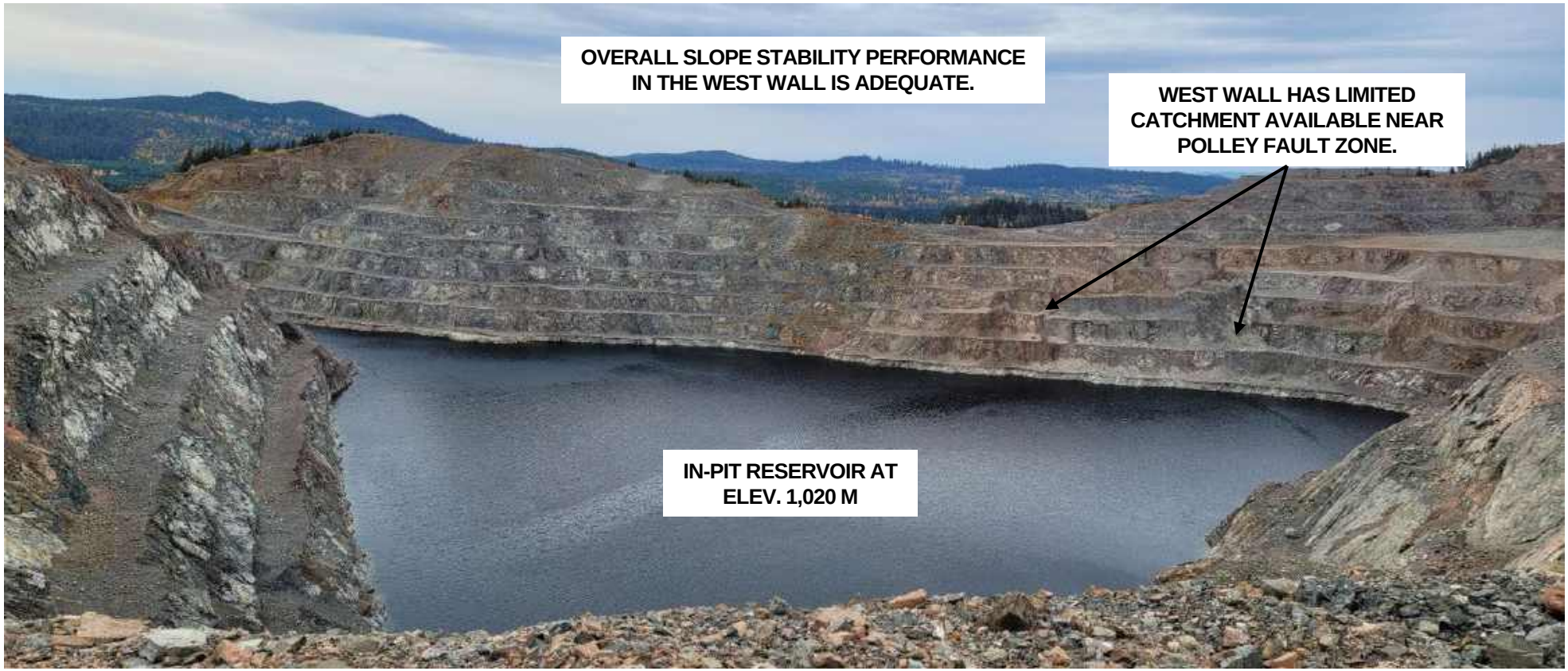
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT SOUTHEAST WALL
PHOTOGRAPH LOOKING EAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-8

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT WEST WALL
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT HAUL RAMP
PHOTOGRAPH LOOKING SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

BENCHES IN THE C2 PIT HAVE ADEQUATE CATCHMENT WITH MINOR AREAS WHERE BENCHES ARE INFILLED. SLOPE STABILITY PERFORMANCE IS GOOD.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
C2 PIT
OVERVIEW
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-11**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



THE CATCH-BENCHES ARE LARGELY INFILLED

C2 PIT

BENCHES BELOW THE C2 PIT ARE LARGELY INFILLED – A ROCK ROLLOUT BERM SHOULD BE CONSTRUCTED AND MAINTAINED ALONG THE HAUL RAMP TO PROTECT THE PUMPING INFRASTRUCTURE AND LIGHT VEHICLE TRAFFIC ACCESSING THE PUMP EQUIPMENT.

REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER IN SEPTEMBER 2020 AND ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

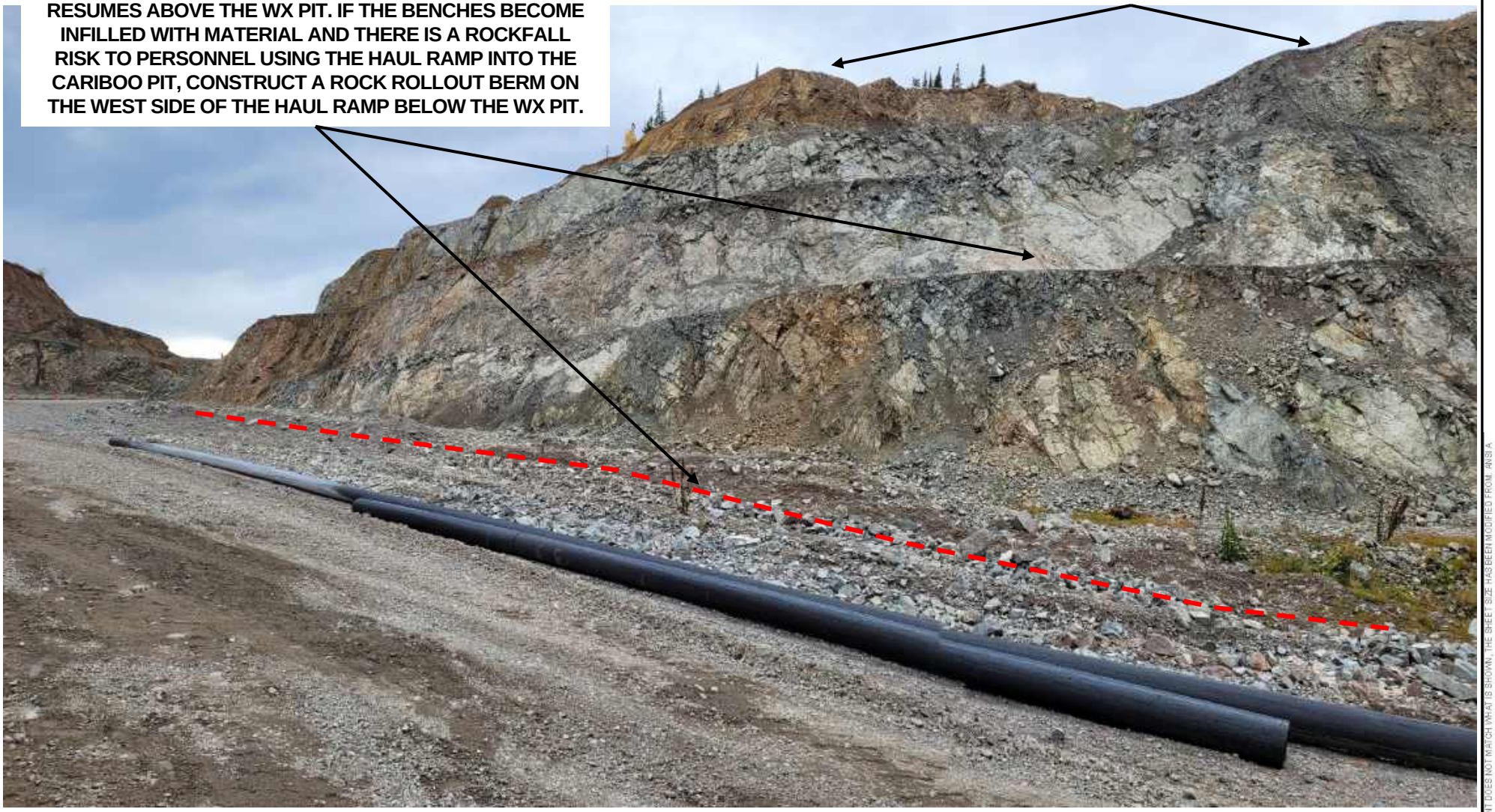
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
C2 PIT
BENCHES BELOW PIT
PHOTOGRAPHS LOOKING EAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-12

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

MONITOR BENCHES FOR OVERSPILL/INFILLING AS MINING RESUMES ABOVE THE WX PIT. IF THE BENCHES BECOME INFILLED WITH MATERIAL AND THERE IS A ROCKFALL RISK TO PERSONNEL USING THE HAUL RAMP INTO THE CARIBOO PIT, CONSTRUCT A ROCK ROLLOUT BERM ON THE WEST SIDE OF THE HAUL RAMP BELOW THE WX PIT.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

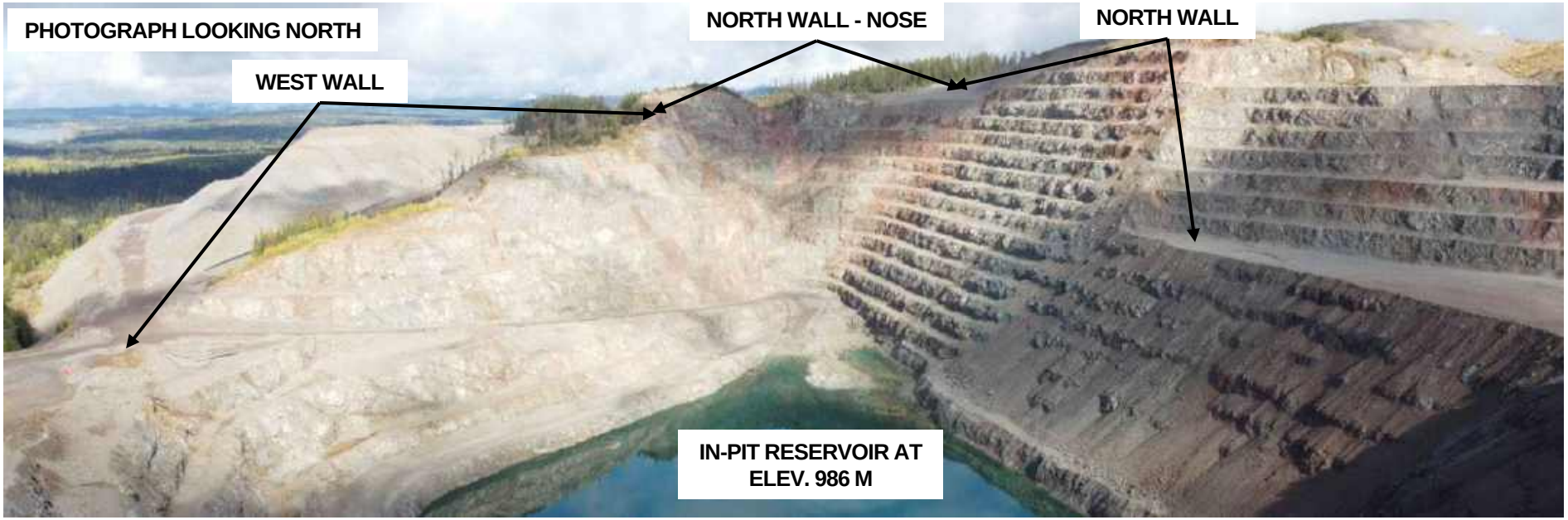
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

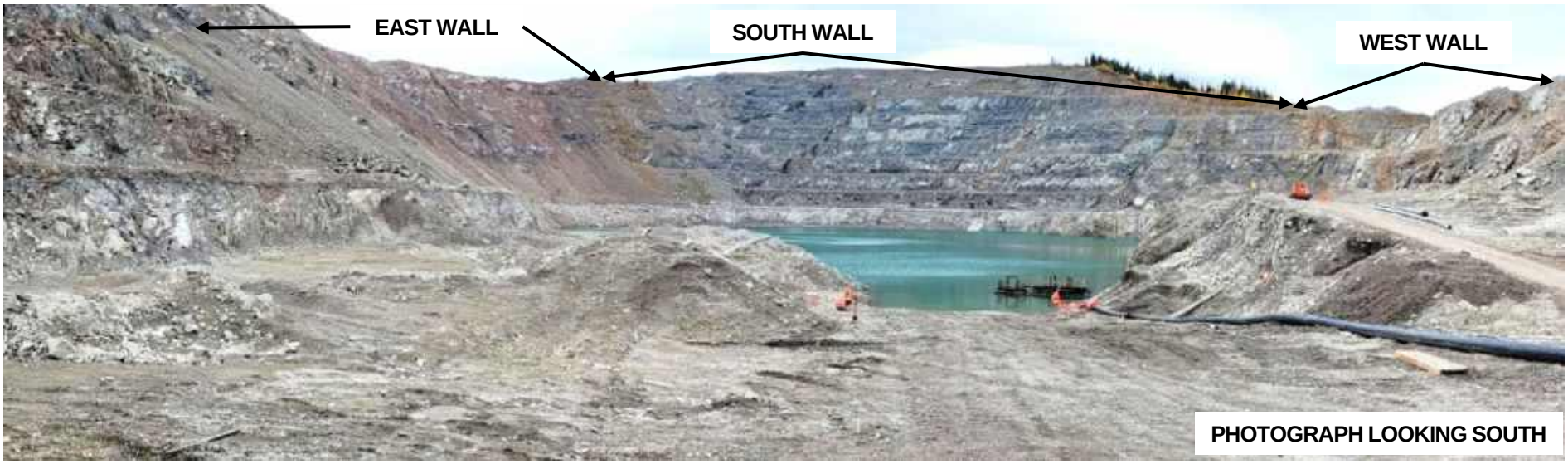
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WX PIT
BENCHES BELOW PIT
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm





REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021 AND BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT
OVERVIEW
PHOTOGRAPHS LOOKING NORTH AND SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-14

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



BENCHES ARE PERFORMING ADEQUATELY AND THERE IS LITTLE CHANGE SINCE THE 2020 REVIEW. BENCHES CONTINUE TO HAVE MINOR INFILLING ALONG FAULT EXPOSURES – CONTINUE TO MONITOR CATCHMENT IN AREAS WHERE FAULTS ARE EXPOSED AND RAVELING.

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT NORTH WALL – EAST SIDE PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-15

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

OVERSPILL HAS INFILLED BENCHES ON THE EAST WALL. LITTLE CHANGE SINCE THE 2020 REVIEW DUE TO NO MINING ACTIVITIES.



THERE IS TOO MUCH OVERSPILL TO SAFELY CLEAN THE ELEV. 1,000 M BENCH. ONCE THE SPRINGER PIT IS DEWATERED, THE BENCHES SHOULD BE ASSESSED AS TO WHETHER OR NOT THERE IS ADEQUATE CATCHMENT AVAILABLE IF MINING ACTIVITIES ARE TO OCCUR CONCURRENTLY ON THE SADDLE AND AT THE PIT BOTTOM. A NEW 12 M WIDE BENCH BELOW THE OVERSPILL MAY BE REQUIRED.

REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

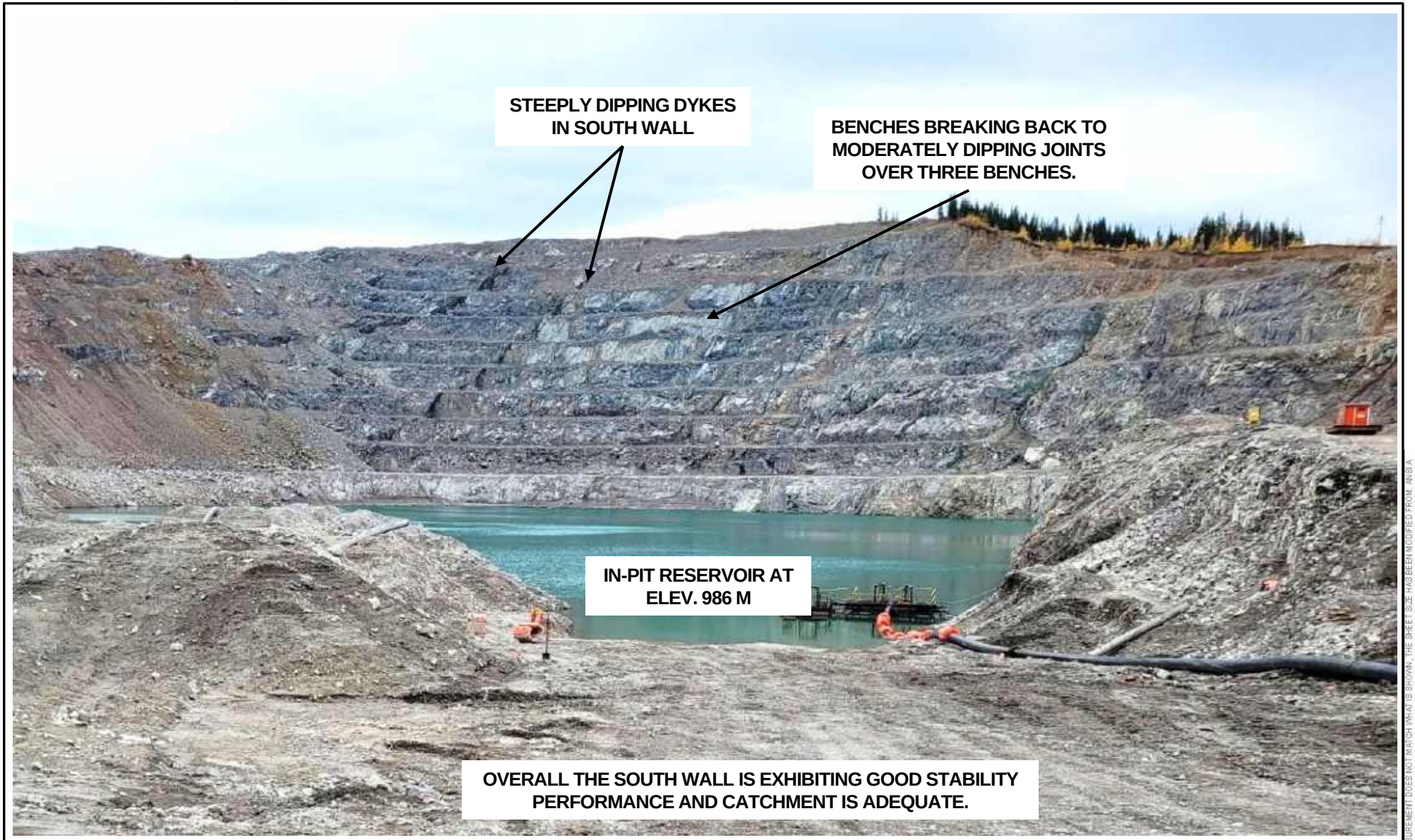
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT EAST WALL
DRONE PHOTOGRAPH IMAGERY LOOKING SOUTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT SOUTH WALL
PHOTOGRAPH LOOKING SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

PREPARATIONS FOR ACTIVE MINING UNDERWAY ON UPPER BENCHES OF THE SOUTH WALL/SADDLE BETWEEN SPRINGER AND CARIBOO PITS. AS MINING ADVANCES, LIMIT OVERSPILL PARTICULARLY INTO THE CARIBOO PIT TO THE SOUTH DUE TO THE HAUL RAMP BEING USED BY LIGHT VEHICLES FOR PUMP INFRASTRUCTURE INSPECTIONS.



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

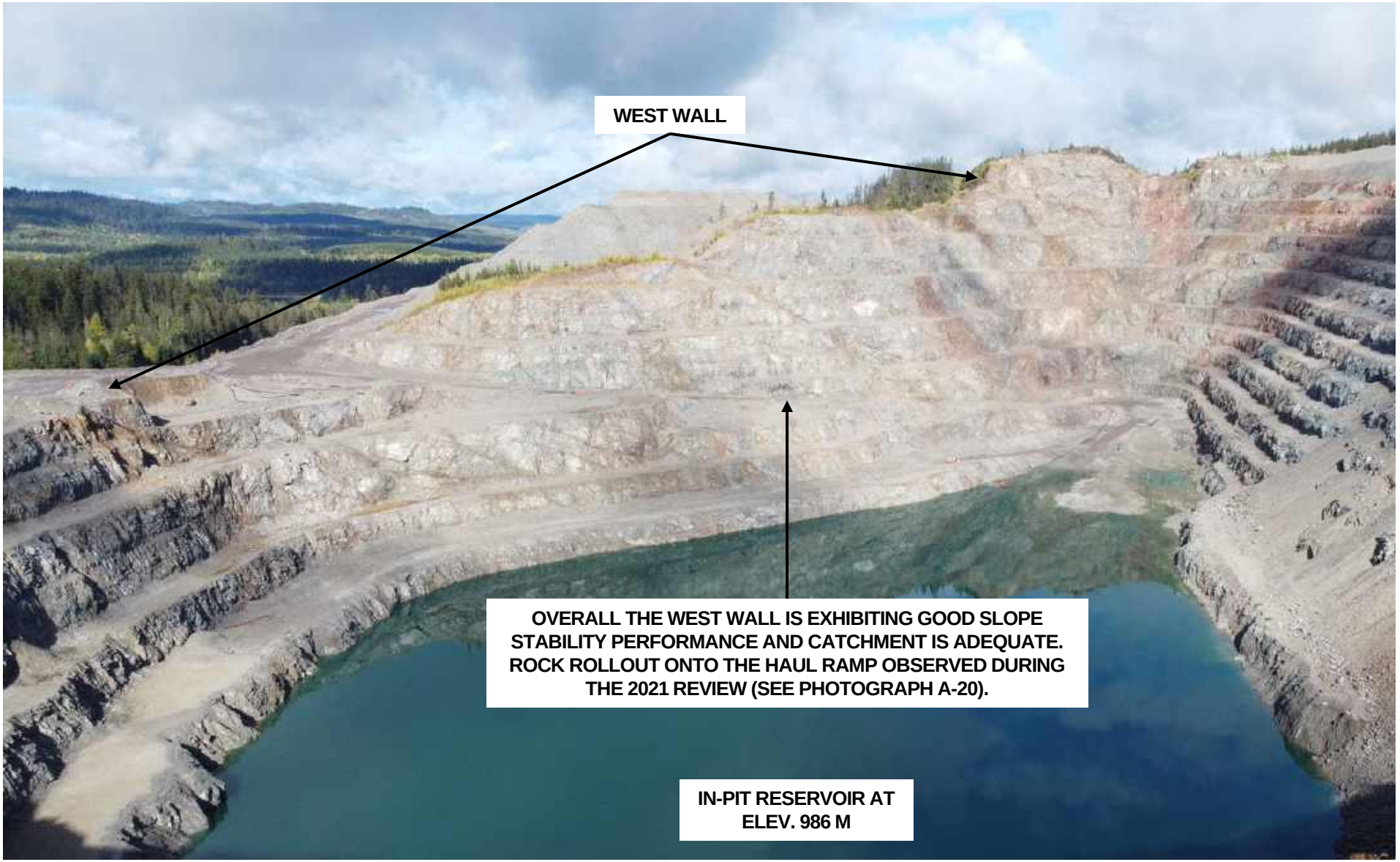
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT SOUTH WALL
UPPER BENCHES
DRONE PHOTOGRAPH IMAGERY LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
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REVIEWED	AGH
APPROVED	JKH

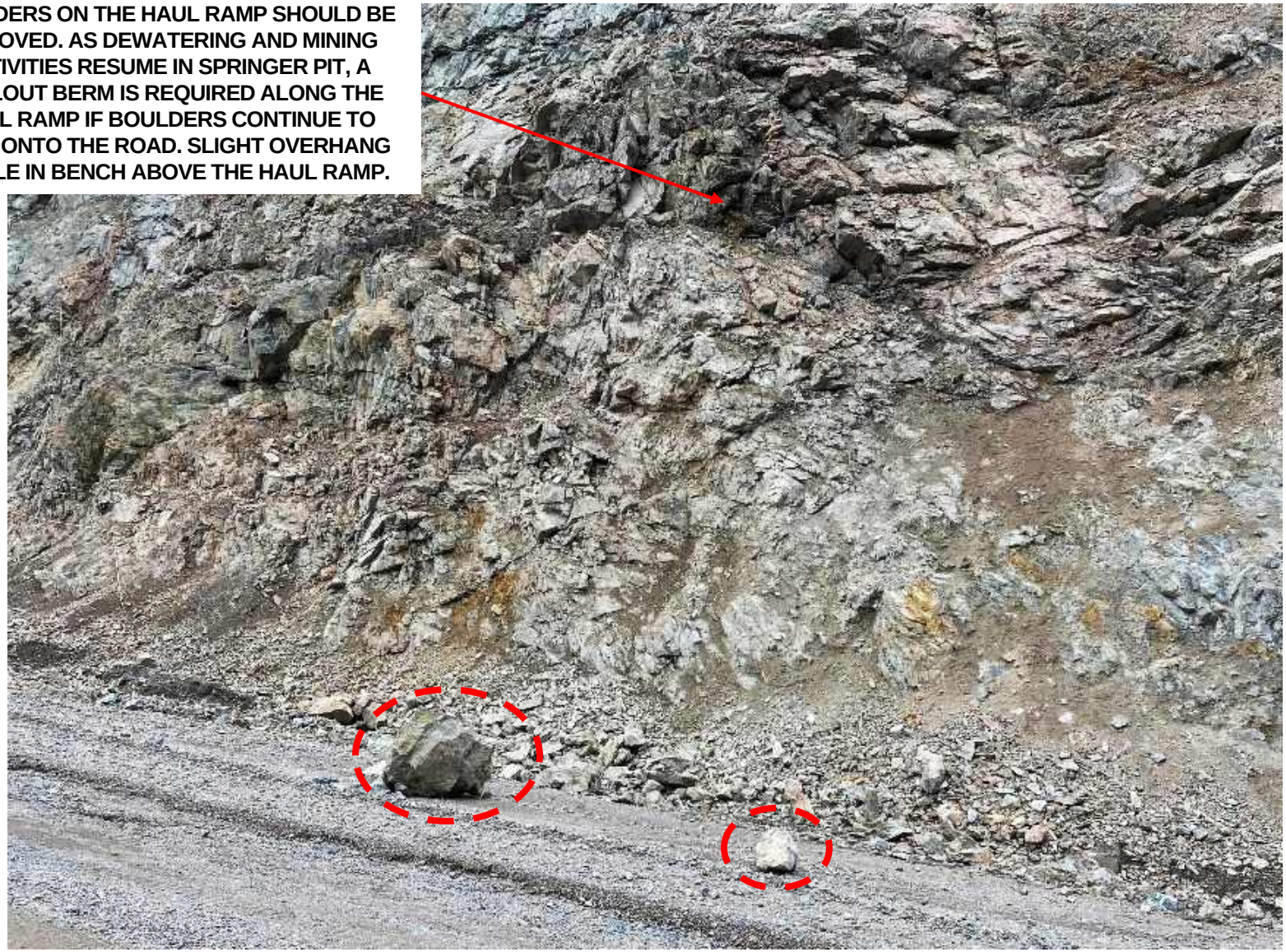
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL
DRONE PHOTOGRAPH IMAGERY LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-19**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

BOULDERS ON THE HAUL RAMP SHOULD BE REMOVED. AS DEWATERING AND MINING ACTIVITIES RESUME IN SPRINGER PIT, A ROLLOUT BERM IS REQUIRED ALONG THE HAUL RAMP IF BOULDERS CONTINUE TO ROLL ONTO THE ROAD. SLIGHT OVERHANG VISIBLE IN BENCH ABOVE THE HAUL RAMP.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL
HAUL RAMP ROCK ROLLOUT
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-20**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – NORTH SIDE NOSE LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-21**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

NOSE AREA IS EXHIBITING ADEQUATE SLOPE STABILITY, HOWEVER, LIMITED CATCHMENT IS AVAILABLE. A ROCK ROLLOUT BERM WAS CONSTRUCTED IN FRONT OF AN AREA OF THE NORTH WALL NOSE TO LIMIT POTENTIAL ROCK ROLLOUT. MONITOR THE BERM AND ANNUALLY CHECK IF THE BERM NEEDS TO BE CLEANED OF DEBRIS.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – NORTH SIDE NOSE ROLLOUT BERM
LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-22

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0
25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

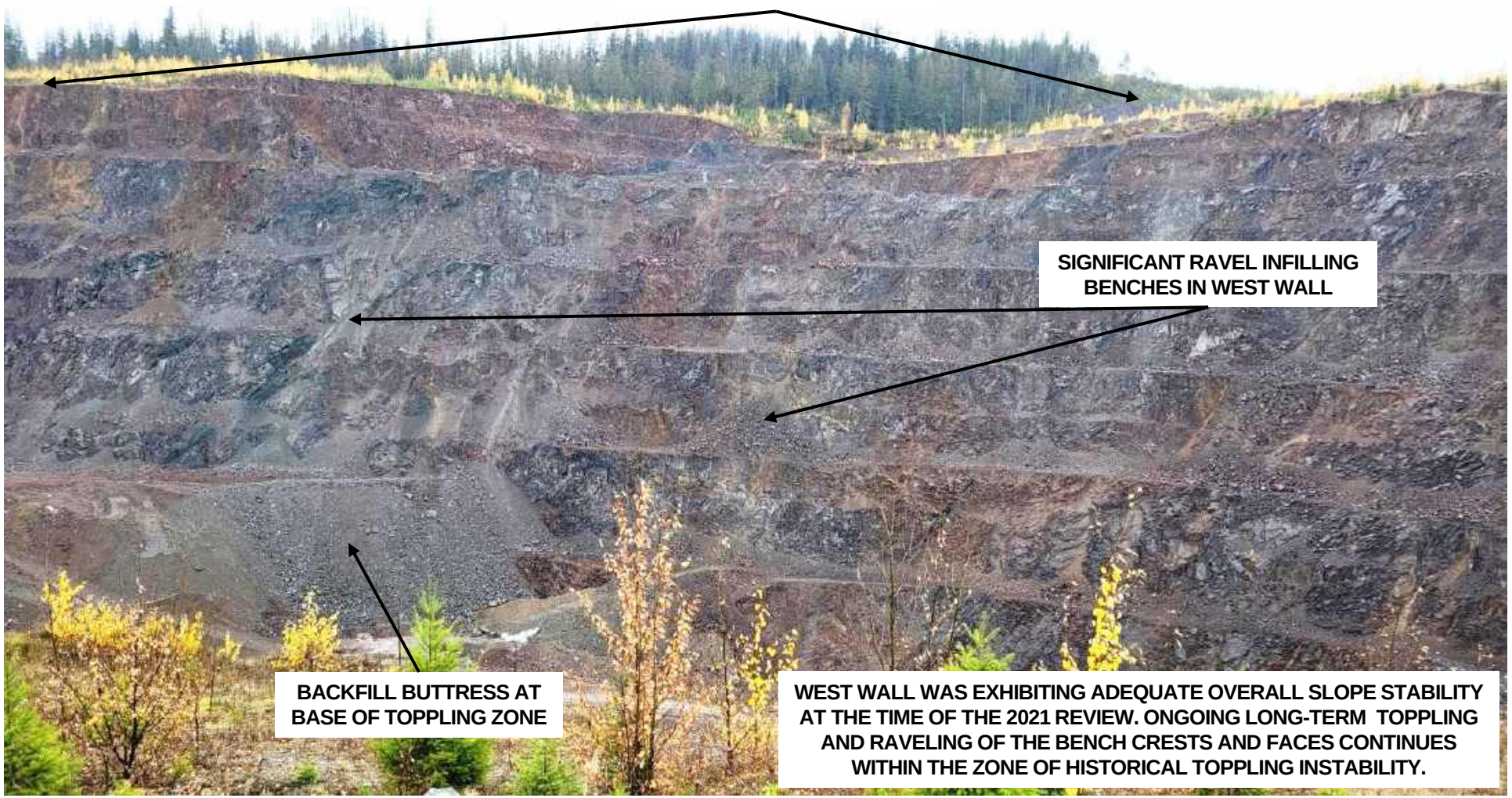
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT
OVERVIEW
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-24**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
UNLOAD AREA
PHOTOGRAPH LOOKING SOUTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-25

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

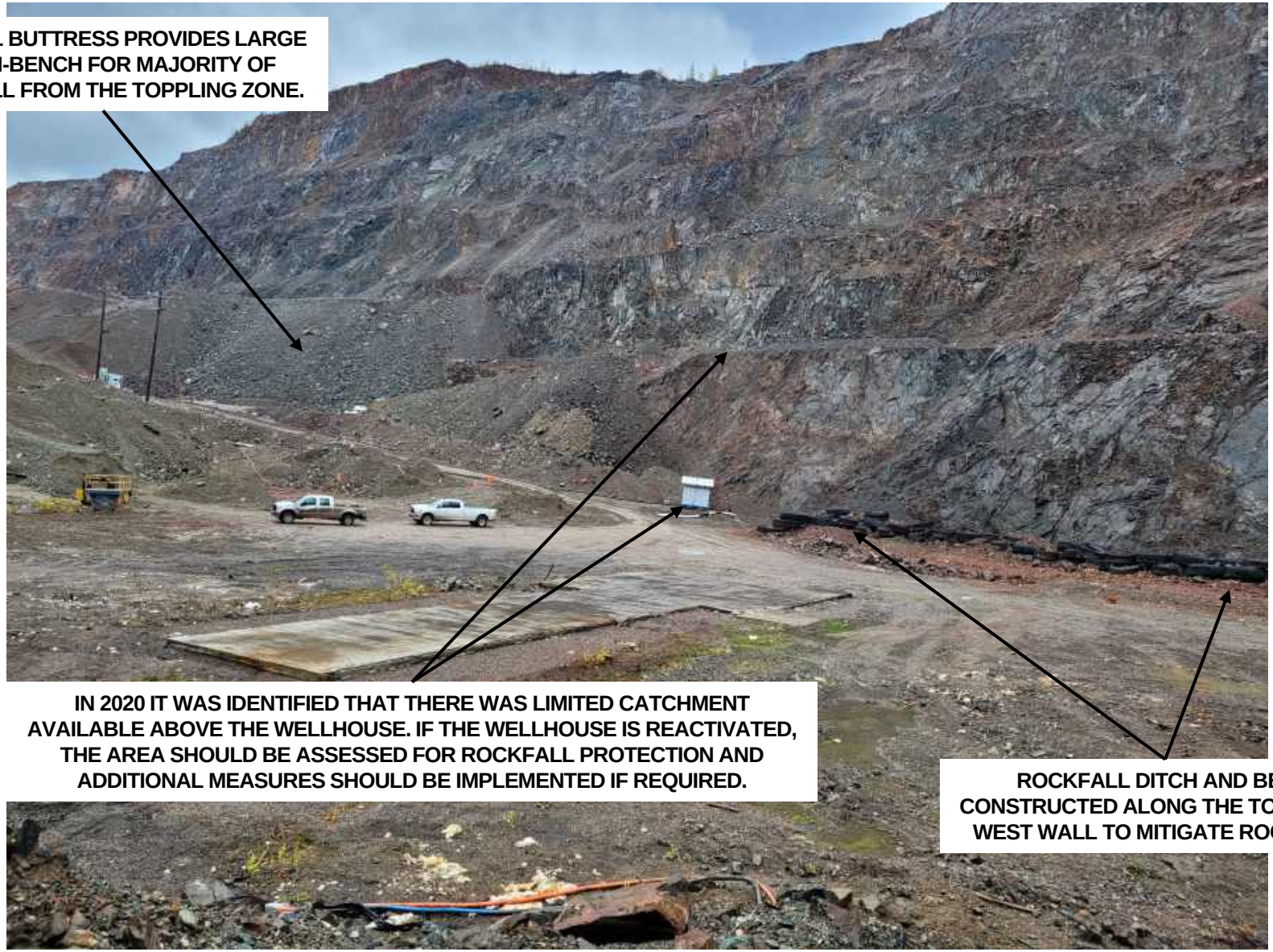
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
UNLOAD AREA CRACKS
PHOTOGRAPH LOOKING SOUTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-26**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm
0



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL
WELLHOUSE AND CATCHMENT
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-27

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0
25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

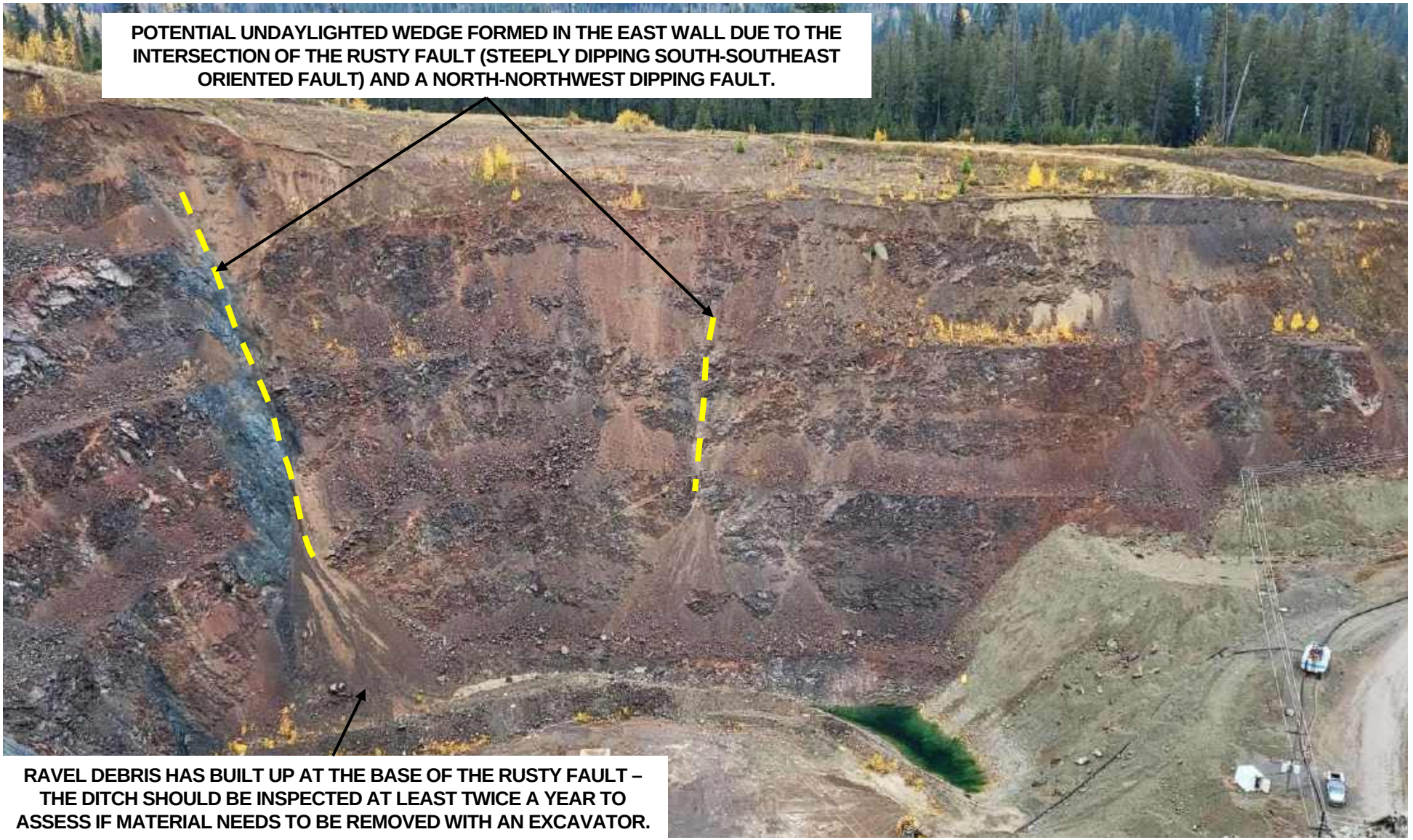
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT NORTH WALL
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-28

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-29**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
TILL OVERBURDEN AT CREST
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-30**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

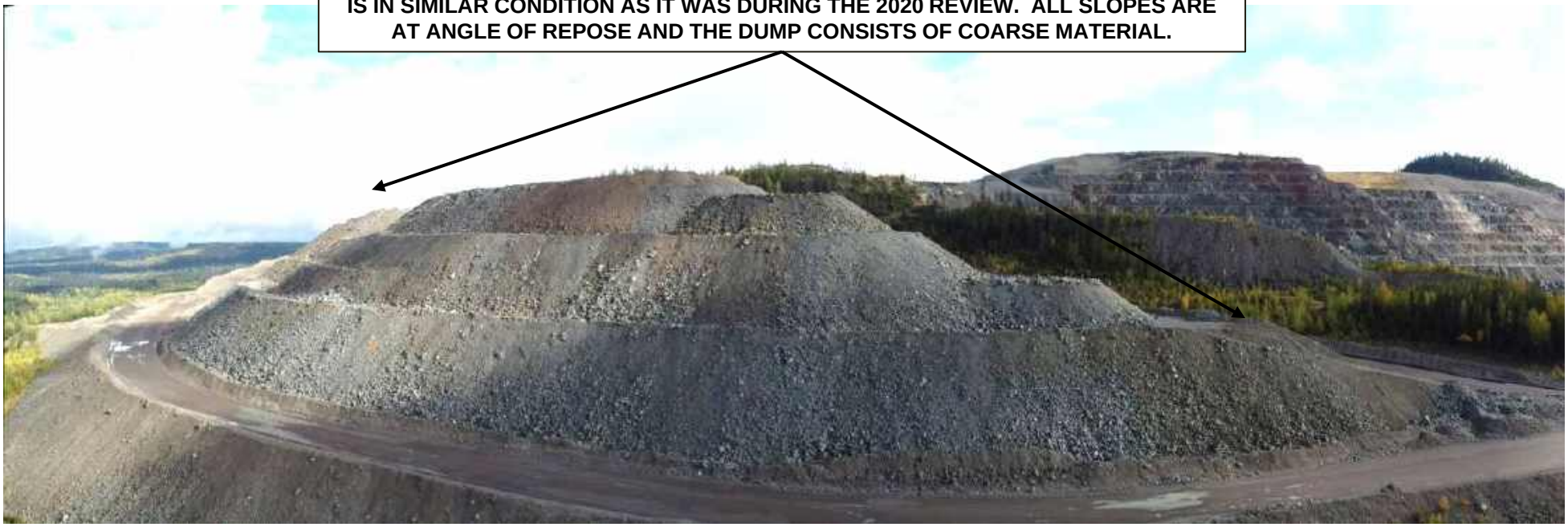
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
PERIMETER DITCHING
PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-31**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

NORTHWEST PAG DUMP EXHIBITS GOOD OVERALL STABILITY PERFORMANCE AND IS IN SIMILAR CONDITION AS IT WAS DURING THE 2020 REVIEW. ALL SLOPES ARE AT ANGLE OF REPOSE AND THE DUMP CONSISTS OF COARSE MATERIAL.



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
OVERVIEW
DRONE PHOTOGRAPH IMAGERY LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-32**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm





REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
UPPER LIFTS
PHOTOGRAPHS LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-33

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

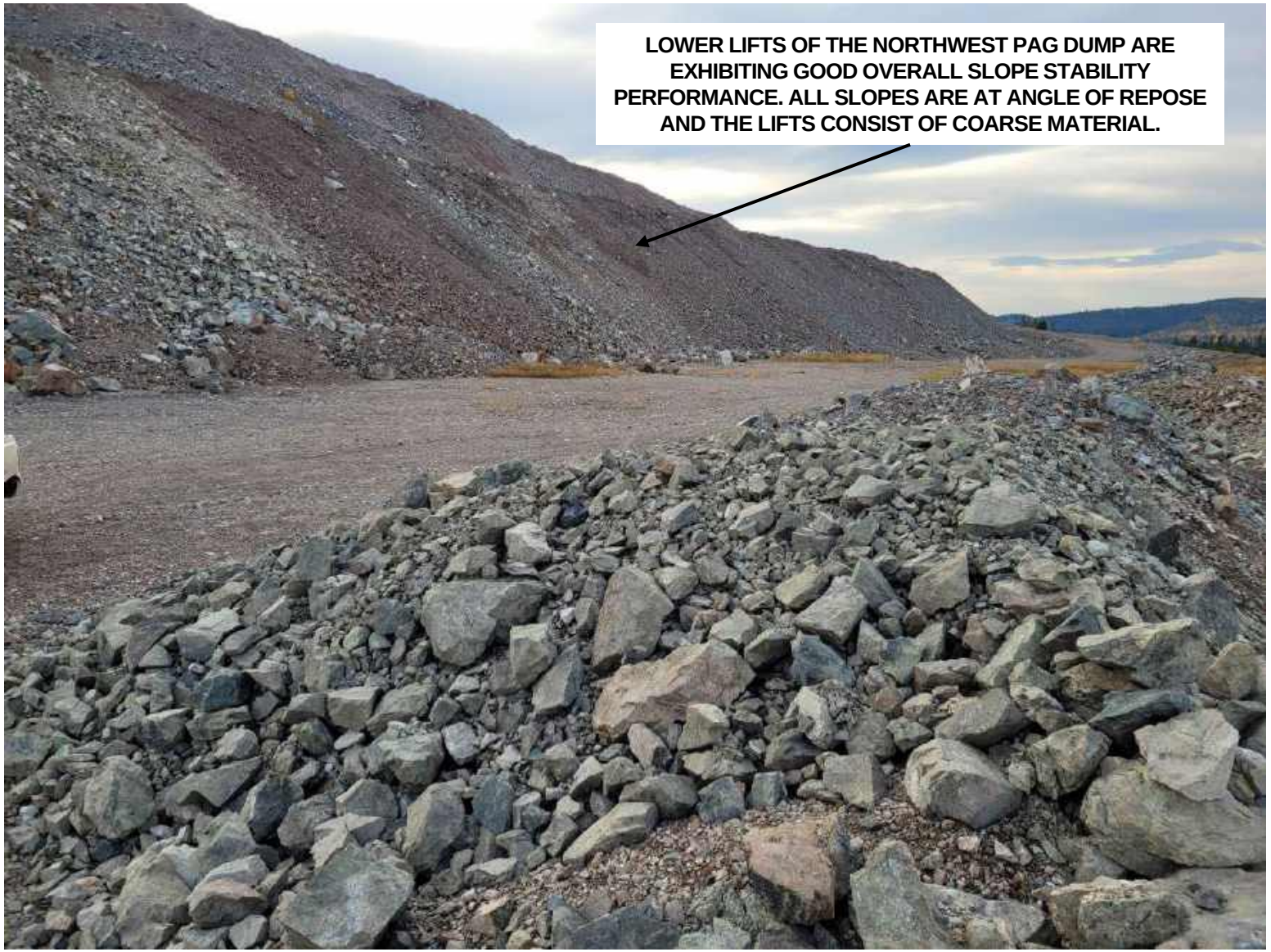
YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
HAUL RAMP
PHOTOGRAPHS LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-34**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
LOWER LIFTS
PHOTOGRAPHS LOOKING SOUTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-35

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



SOME EVIDENCE OF PONDING ALONG THE LOWER LIFTS, WHERE WATER IS COLLECTING ON THE OUTSIDE OF THE WASTE DUMP (SEE PHOTOGRAPH A-37).

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PONDING
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-36**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm





EVIDENCE OF WATER PONDING BELOW RAMP TO LOWER LIFT – FINE MATERIAL HAS ACCUMULATED IN THIS AREA. WATER SHOULD BE DIVERTED AWAY FROM THIS AREA SO THAT WATER DOES NOT POND.

REFERENCES AND NOTES

1. PHOTOGRAPHS TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PONDING ON LOWER LIFTS
PHOTOGRAPHS LOOKING SOUTHEAST AND EAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-37

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

FUTURE CONSTRUCTION WILL PROGRESS THE DUMP TO THE WEST THEN NORTH. AREAS TO THE WEST ARE DAMP. CONSTRUCTION OF THE EXPANSION WILL BE BOTTOM-UP CONSTRUCTION STARTING WITH NAG MATERIAL AT THE BASE WITH PAG MATERIAL ON TOP. THE NAG LIFT FOR SHOULD BE PROGRESSED FROM SOUTH TO NORTH AT A LOW LIFT HEIGHT (SIMILAR TO WHAT HAS BEEN DONE PREVIOUSLY FOR THE CONSTRUCTION OF THIS DUMP) TO PRELOAD THE DAMP AREAS.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

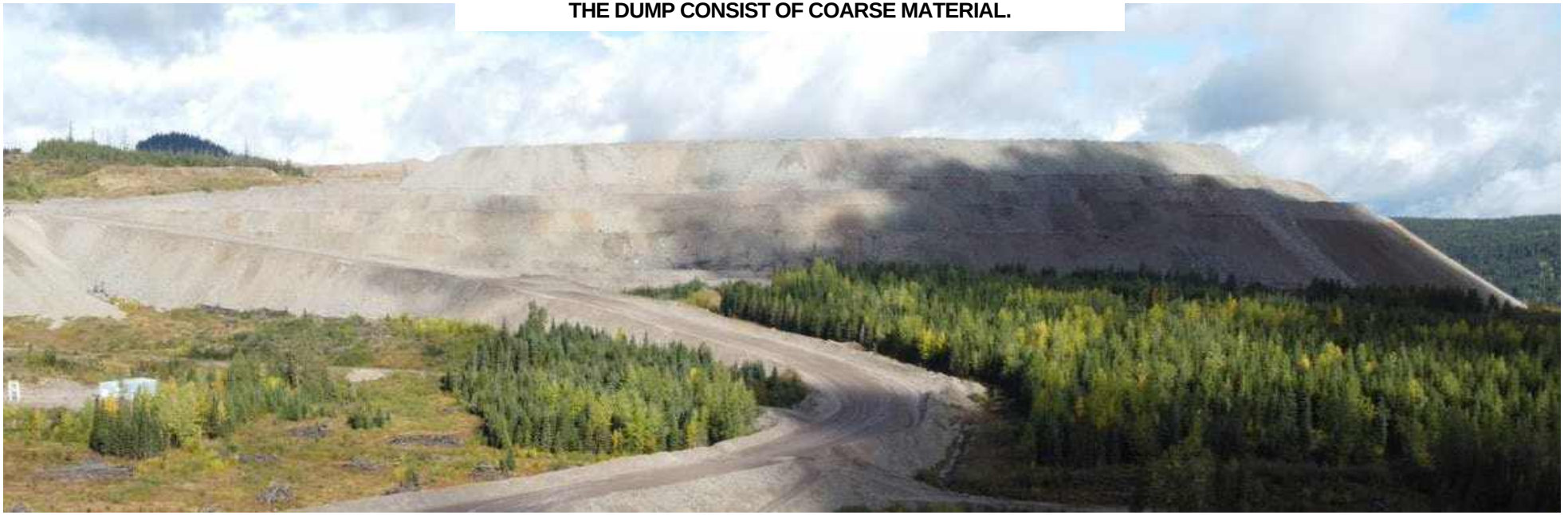
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
LOWER PLATFORM ADVANCE
PHOTOGRAPHS LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-38

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

THE SERDS IS EXHIBITING GOOD OVERALL SLOPE STABILITY PERFORMANCE. ALL SLOPES ARE AT ANGLE OF REPOSE AND THE DUMP CONSIST OF COARSE MATERIAL.



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
OVERVIEW
DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-39**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

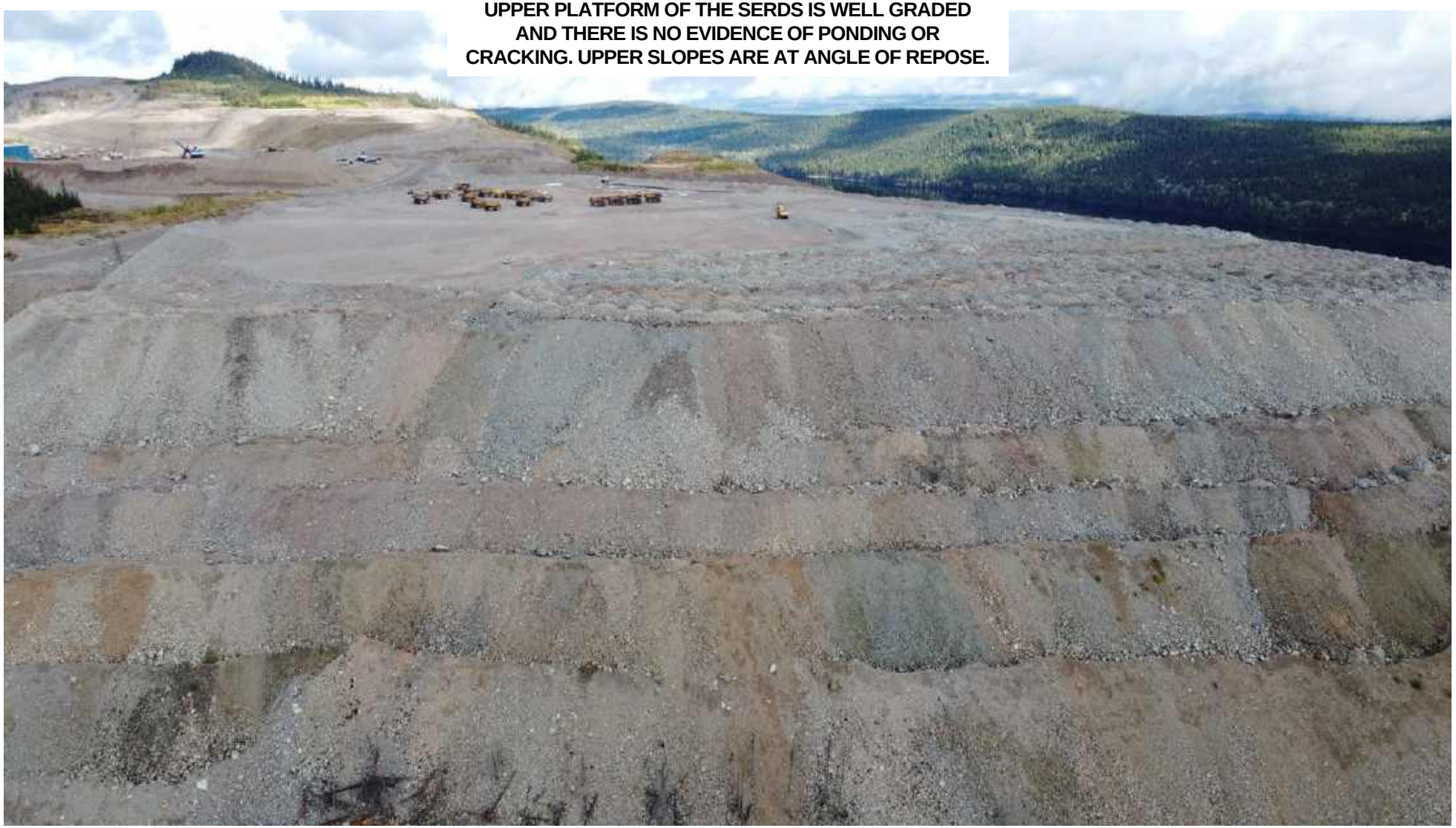
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
PLATFORM
PHOTOGRAPH LOOKING WEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-40**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

UPPER PLATFORM OF THE SERDS IS WELL GRADED AND THERE IS NO EVIDENCE OF PONDING OR CRACKING. UPPER SLOPES ARE AT ANGLE OF REPOSE.



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

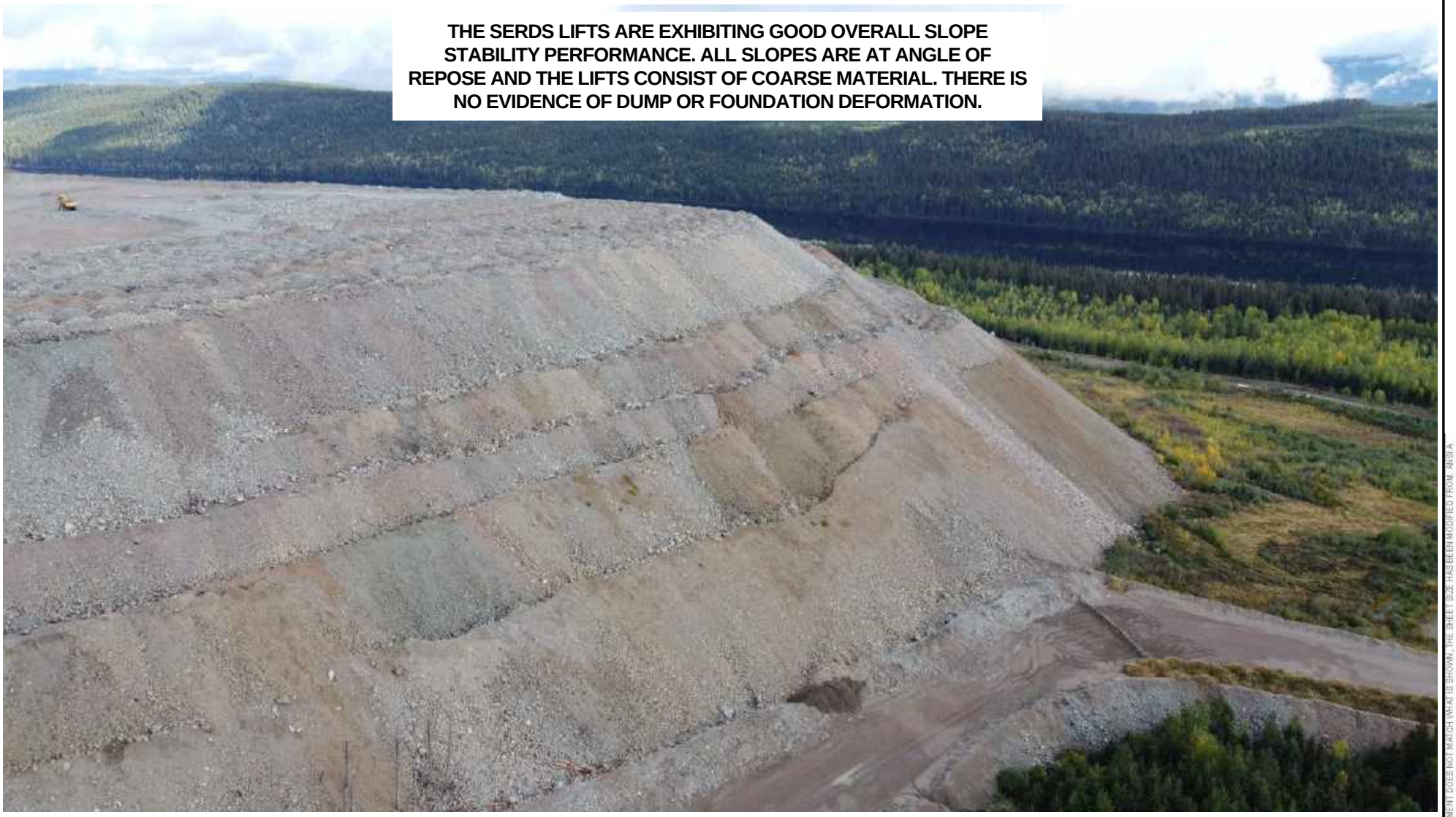
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
PLATFORM AND UPPER LIFTS
DRONE PHOTOGRAPH IMAGERY LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-41**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

THE SERDS LIFTS ARE EXHIBITING GOOD OVERALL SLOPE STABILITY PERFORMANCE. ALL SLOPES ARE AT ANGLE OF REPOSE AND THE LIFTS CONSIST OF COARSE MATERIAL. THERE IS NO EVIDENCE OF DUMP OR FOUNDATION DEFORMATION.



REFERENCES AND NOTES

1. DRONE PHOTOGRAPH TAKEN BY MR. LEE NIKL OF GOLDER ON 22 SEPTEMBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
UPPER LIFTS
DRONE PHOTOGRAPH IMAGERY LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-42**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



DUMP SLOPES ARE AT ANGLE OF REPOSE AND SLOPE STABILITY PERFORMANCE IS GOOD. THERE IS NO EVIDENCE OF DUMP OR FOUNDATION DEFORMATION.

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SOUTHEAST ROCK DISPOSAL SITE
LOWER LIFTS
PHOTOGRAPH LOOKING NORTH

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-43**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

INACTIVE NORTHEAST NAG DUMP EXHIBITING GOOD STABILITY PERFORMANCE. PLATFORM AND SLOPES ARE PARTIALLY VEGETATED AND IN GOOD CONDITION.



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHEAST NAG DUMP
OVERVIEW
PHOTOGRAPH LOOKING NORTHEAST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-44**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHEAST NAG DUMP
LOWER LIFTS
PHOTOGRAPH LOOKING SOUTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-45**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

MINOR INSTABILITY OF THE TAILINGS ROAD OCCURRED IN 2019. WATER IS STILL PONDING ON THE CREST OF THE TAILINGS ROAD (SEE PHOTOGRAPH A-47).



WHEN CONSTRUCTION OF THE TAILINGS ROAD IS RESTARTED, REMEDIATE THE FAILURE BY ADDING GOOD QUALITY, COARSE-GRAINED MATERIAL, AND DUMPING SHORT AND PUSHING TO FILL THE SCARP. DO NOT END DUMP MATERIAL DIRECTLY OVER THE SCARP.

REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
TAILINGS ROAD INSTABILITY AND RUNOUT PHOTOGRAPH LOOKING NORTHWEST

PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	**73100**	**0**	**A-46**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



REFERENCES AND NOTES

1. PHOTOGRAPH TAKEN BY GOLDER ON 20 OCTOBER 2021.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-15
PREPARED	AGH
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
TAILINGS ROAD
PLATFORM AND MITIGATION
PHOTOGRAPH LOOKING NORTHWEST

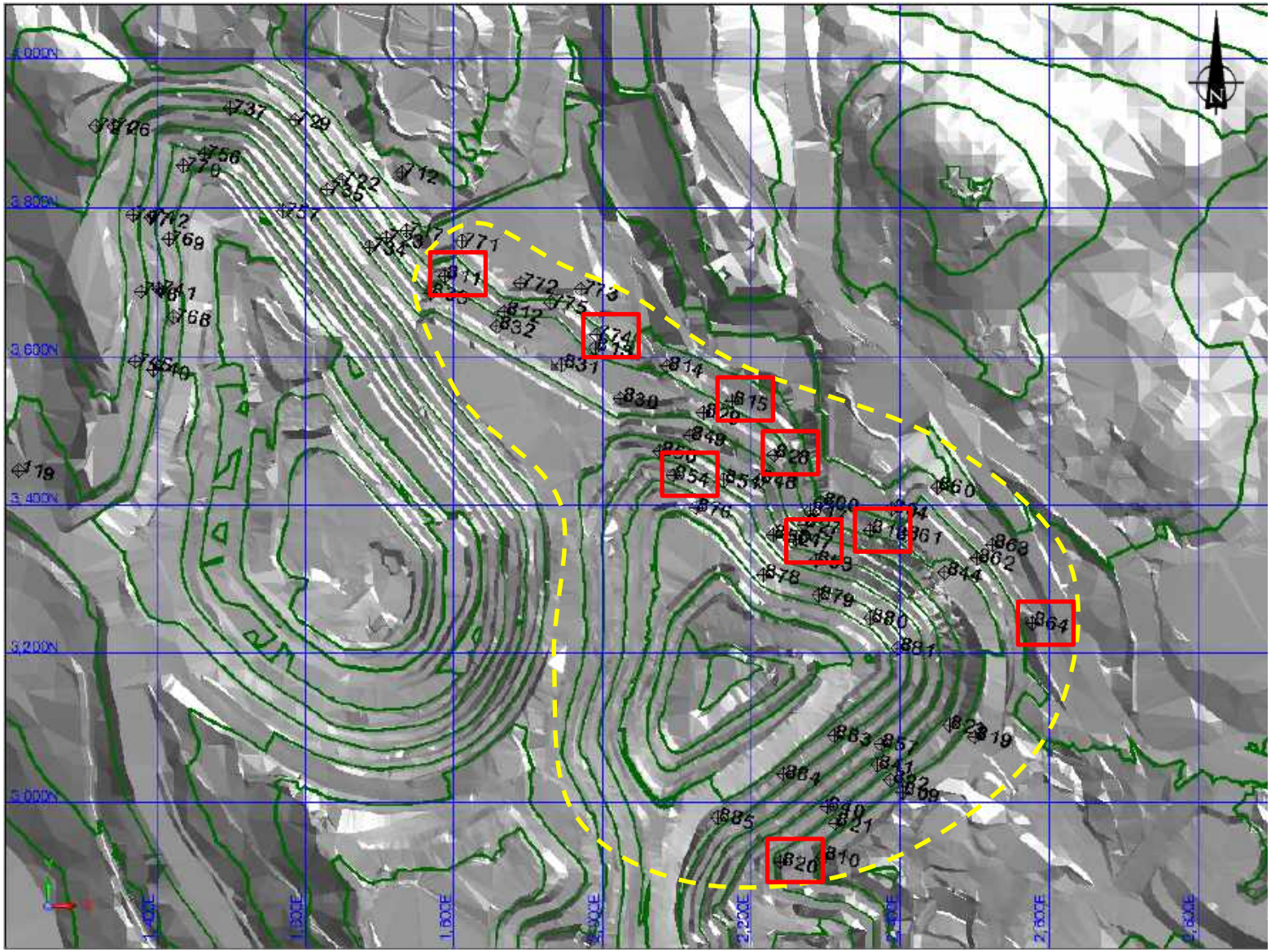
PROJECT NO.	PHASE	REV.	PHOTOGRAPH
21452039	73100	0	A-47

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

APPENDIX B

Prism Monitoring Data

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	



REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

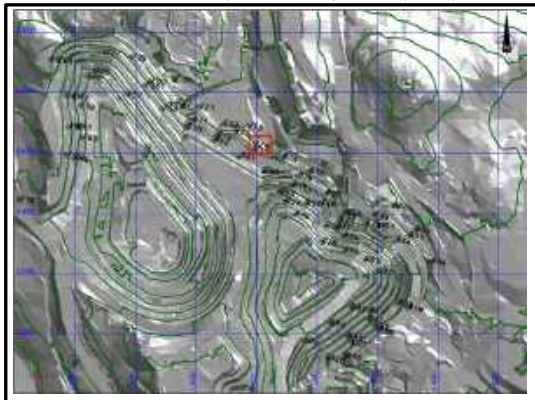
CONSULTANT
GOLDER
MEMBER OF WSP

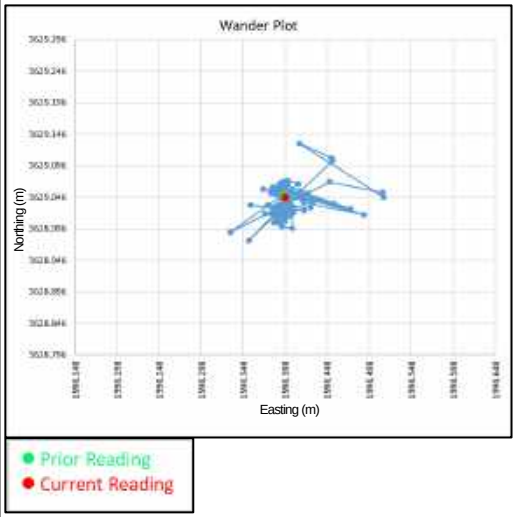
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

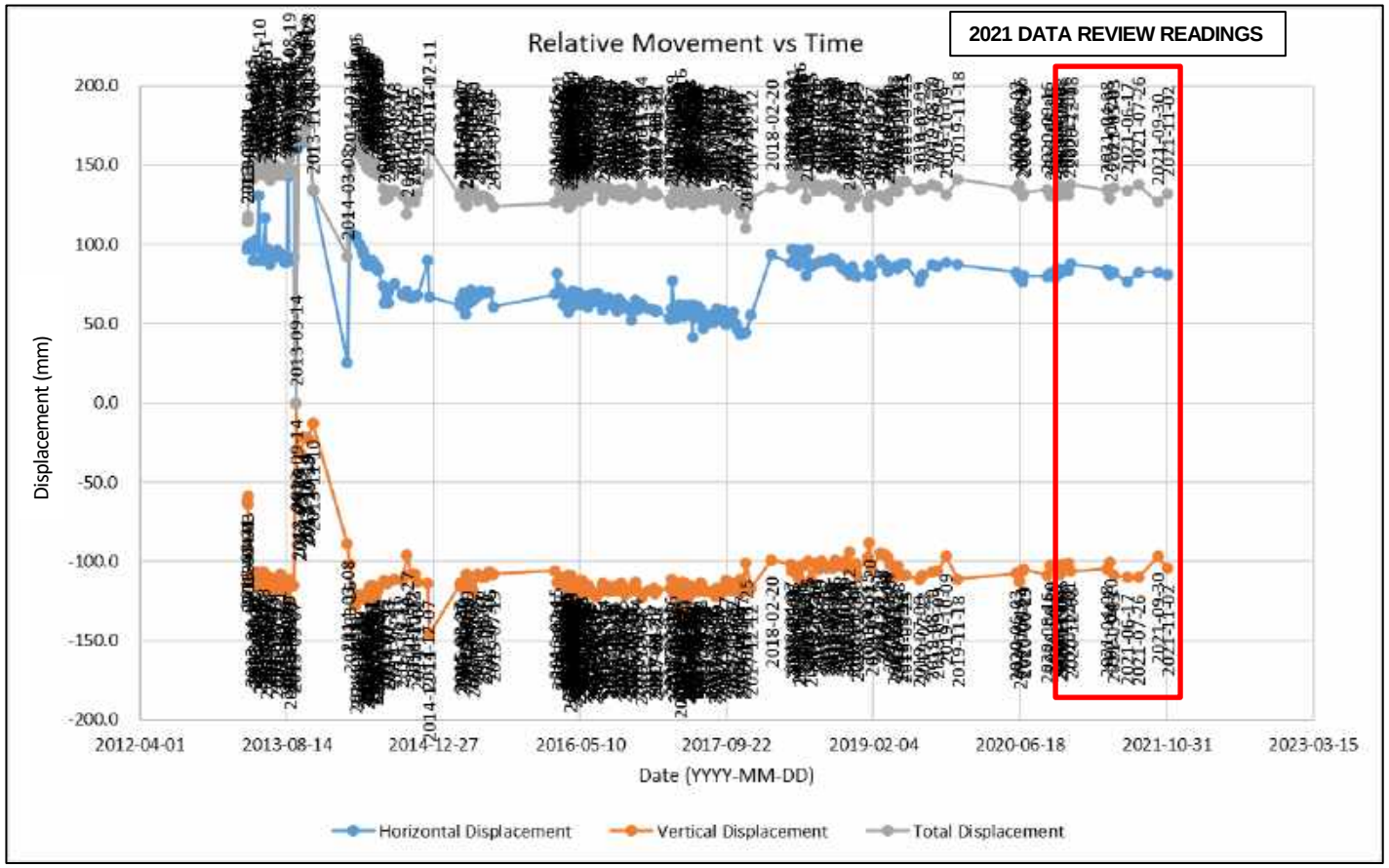
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-1**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

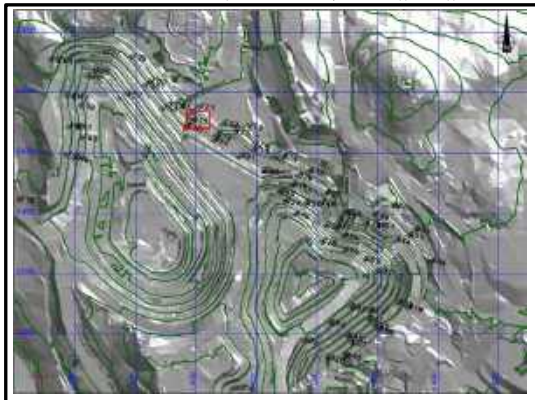
CONSULTANT
GOLDER
MEMBER OF WSP

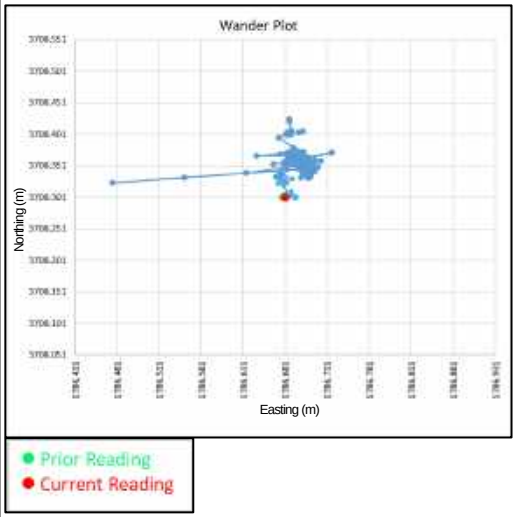
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

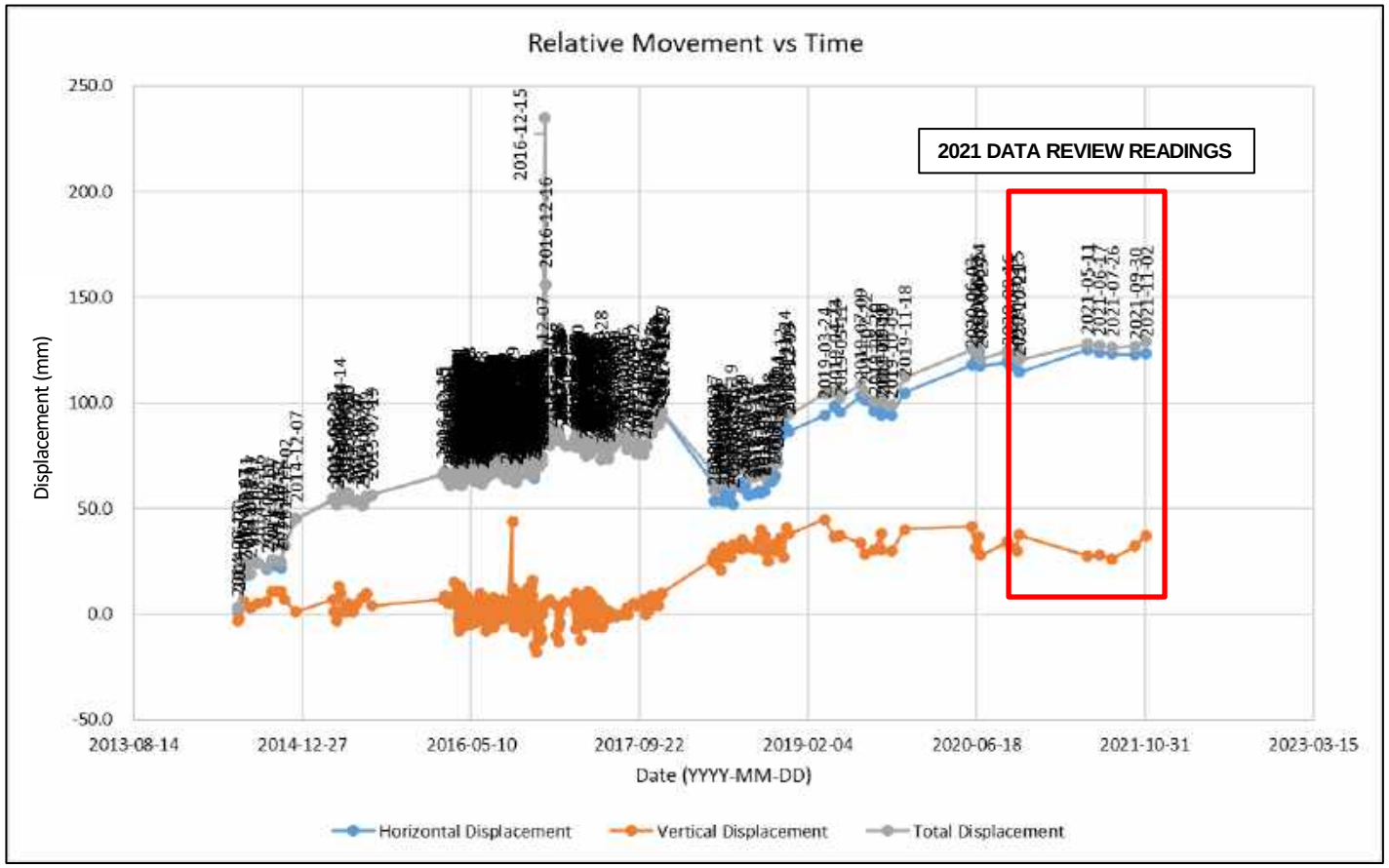
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – NORTHWEST SEGMENT PRISM 774

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-2**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

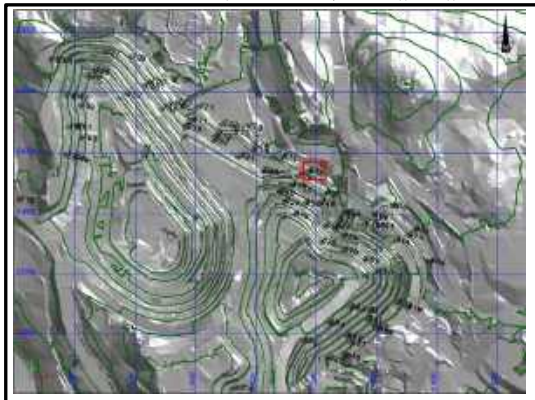
CONSULTANT
GOLDER
MEMBER OF WSP

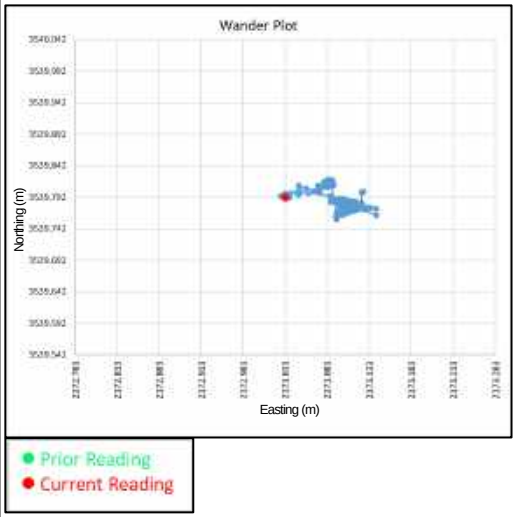
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

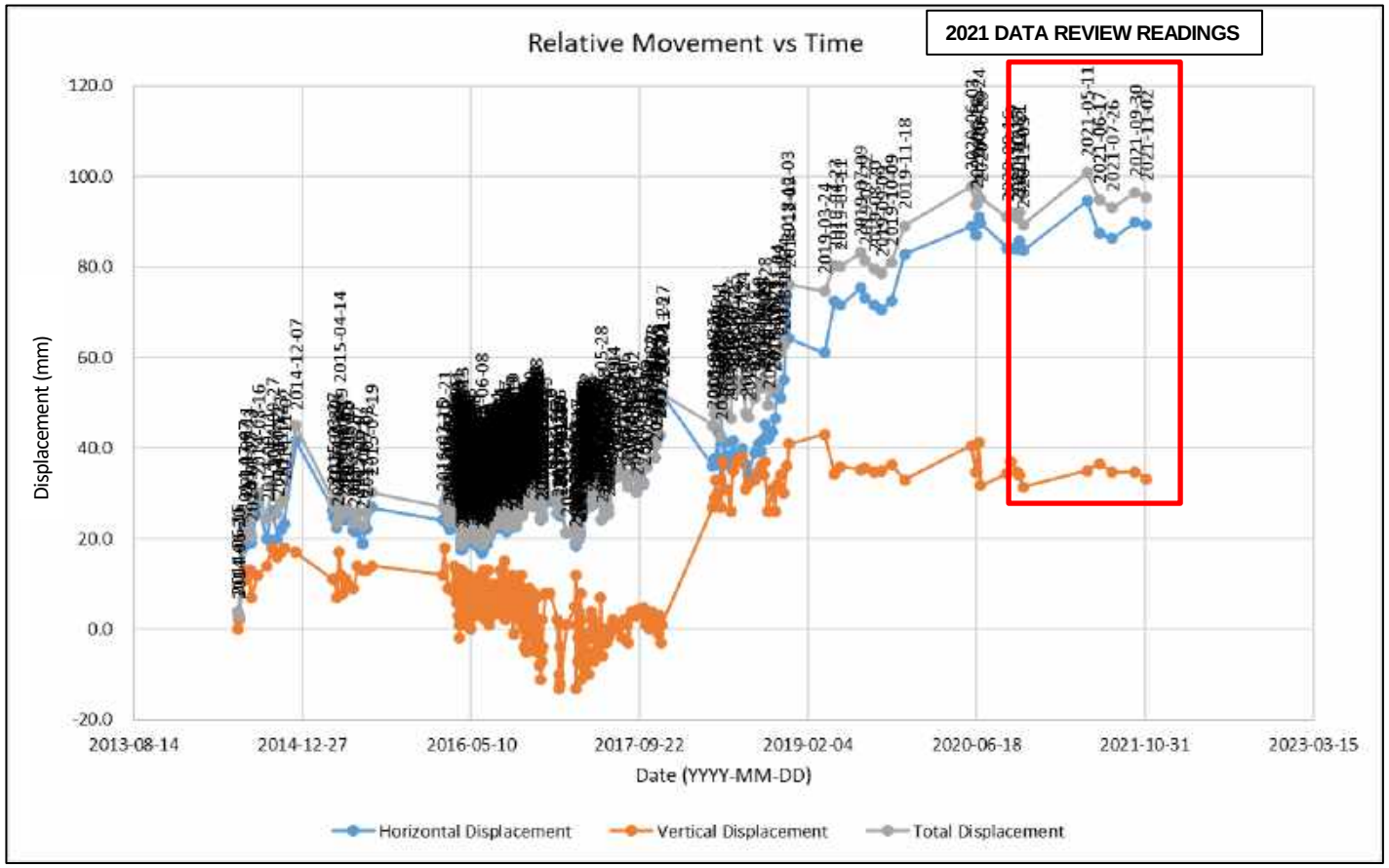
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – NORTHWEST SEGMENT PRISM 811

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-3**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

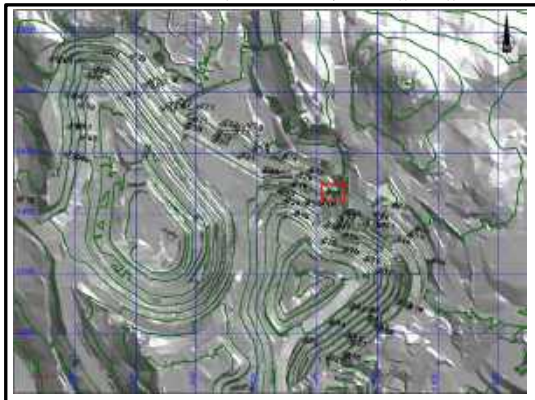
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

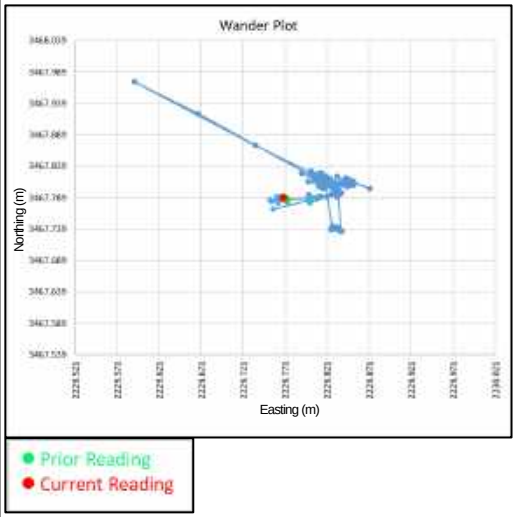
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

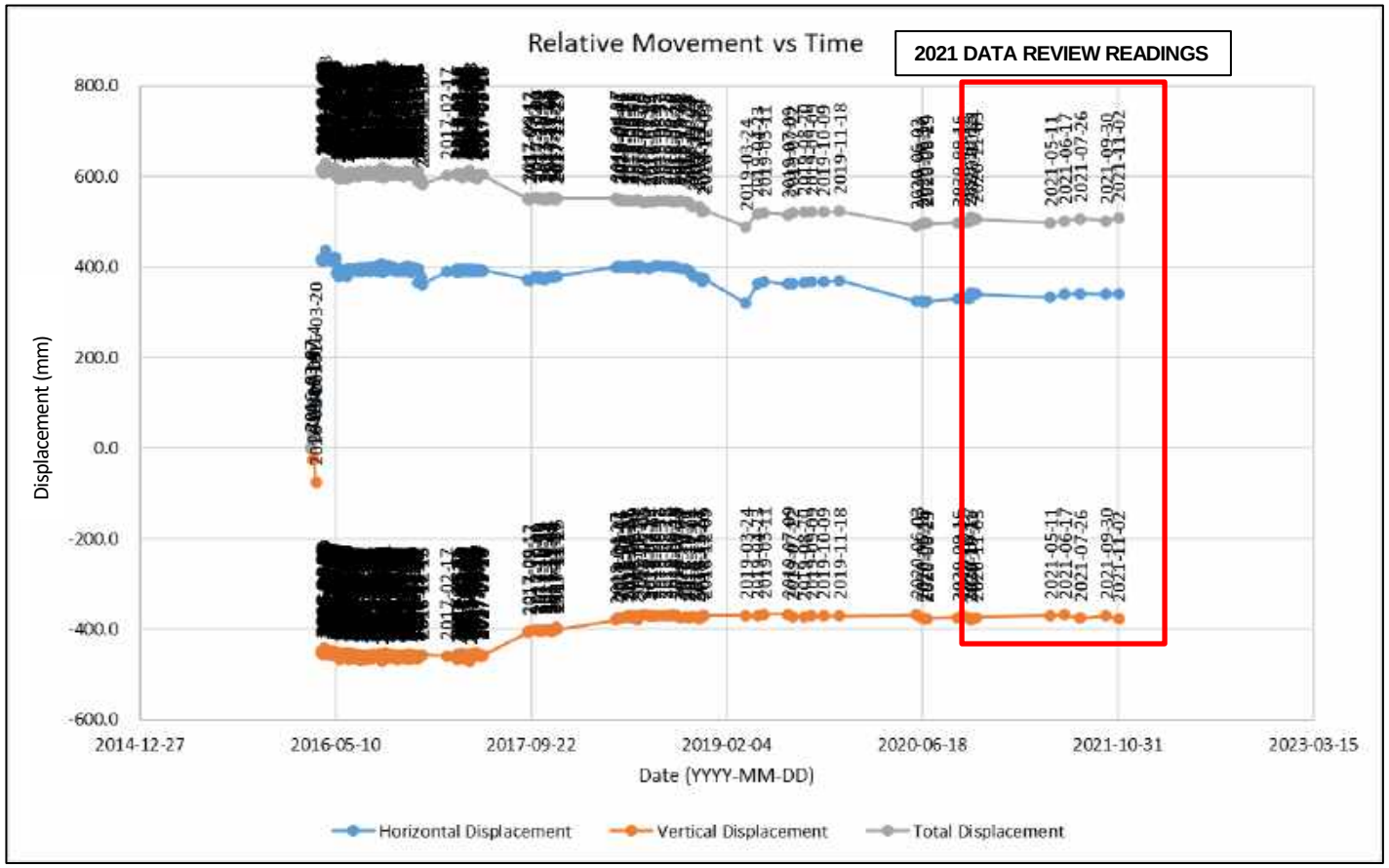
TITLE
CARIBOO PIT NORTHEAST WALL – CENTRAL SEGMENT
UPPER BENCHES OF WASTE ROCK REHANDLE SLOPE
PRISM 815

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

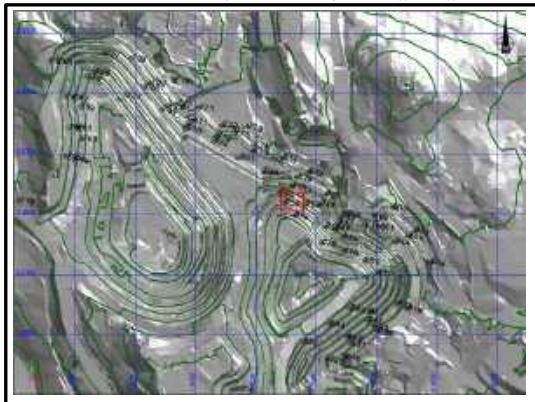
CONSULTANT
GOLDER
MEMBER OF WSP

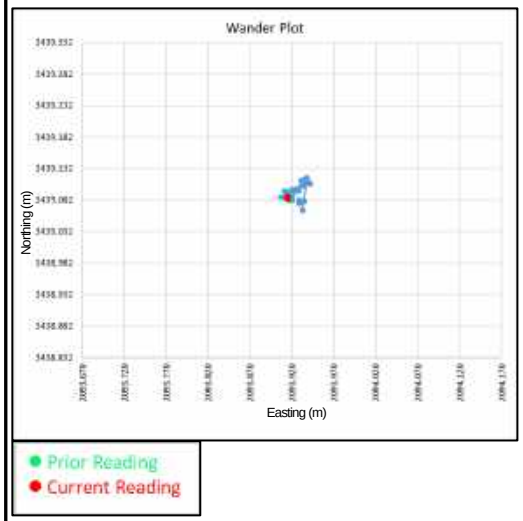
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

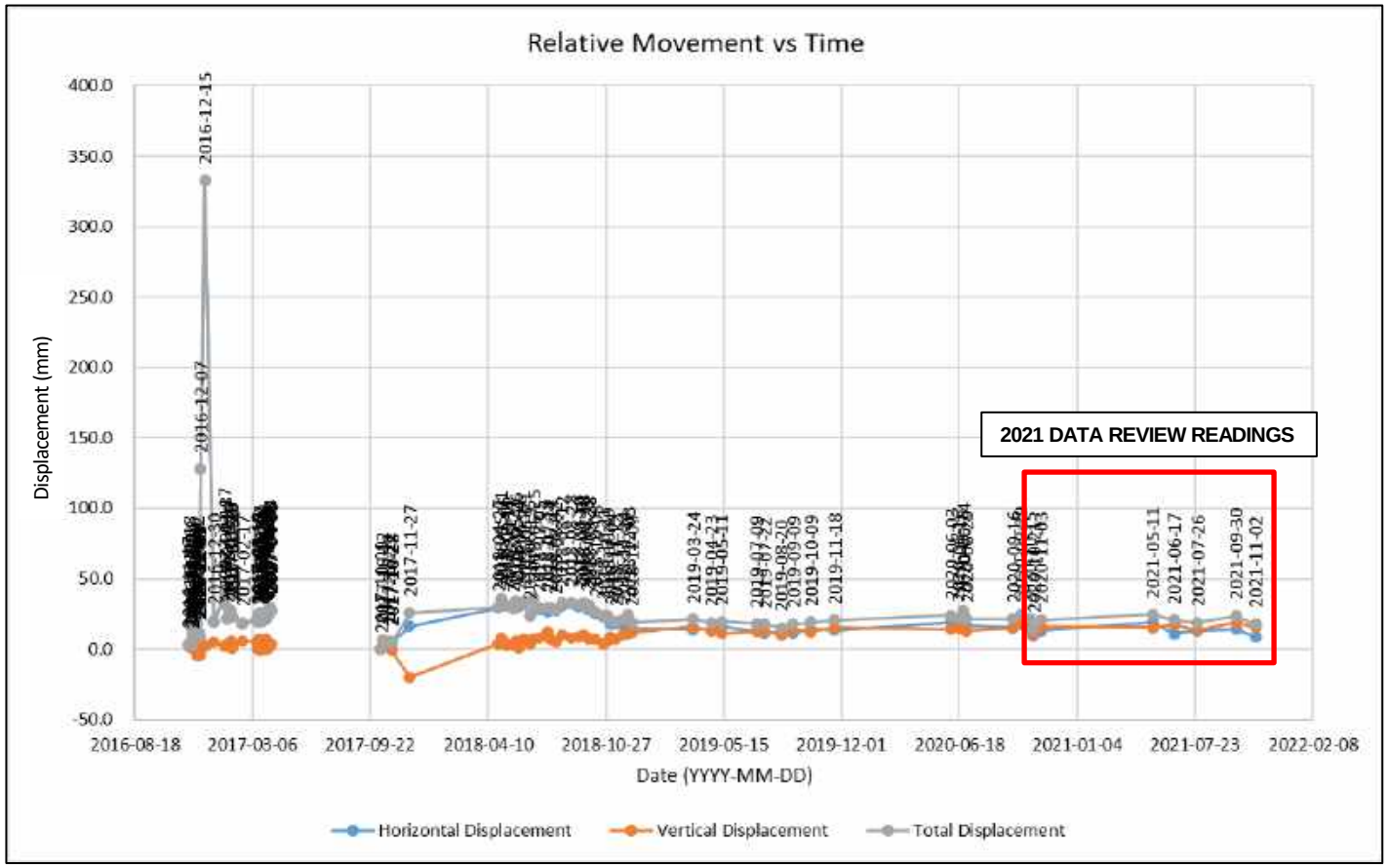
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – CENTRAL SEGMENT LOWER BENCHES OF WASTE ROCK REHANDLE SLOPE PRISM 828

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-5







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

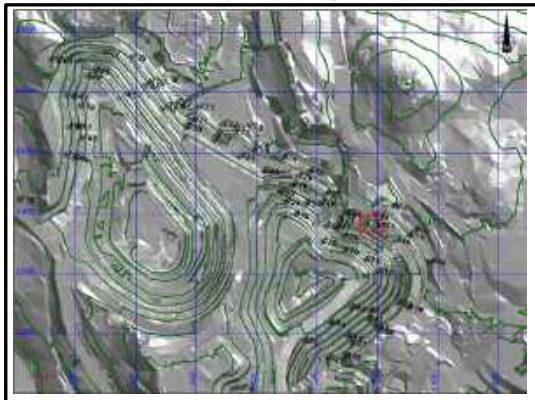
CONSULTANT
GOLDER
MEMBER OF WSP

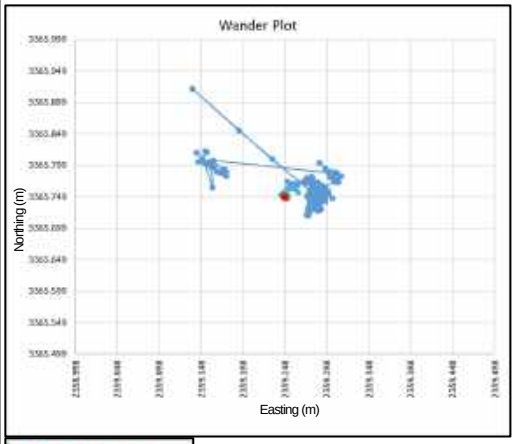
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

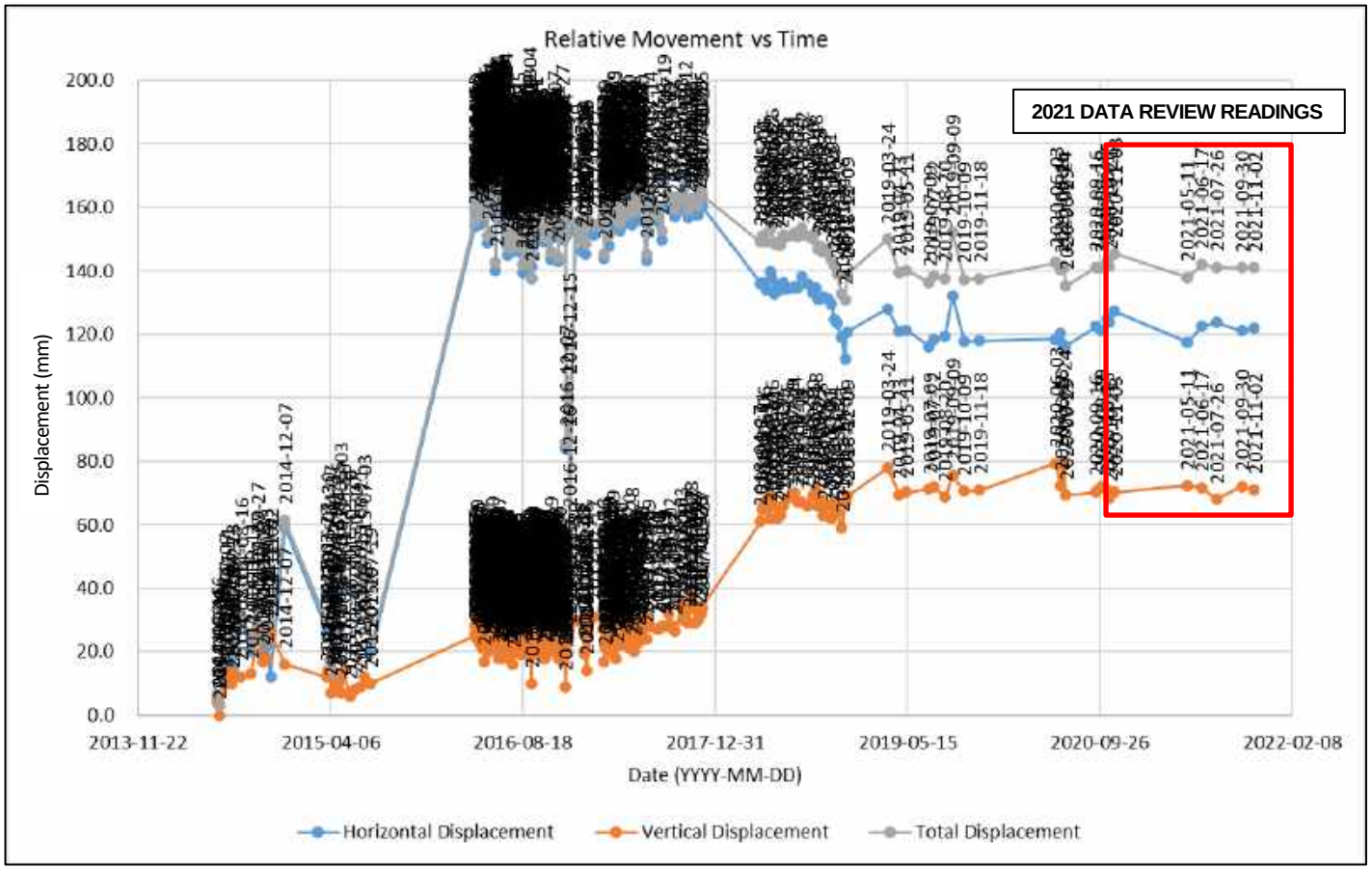
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – CENTRAL SEGMENT
BEDROCK BENCHES BELOW WASTE ROCK REHANDLE SLOPE
PRISM 854

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-6







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

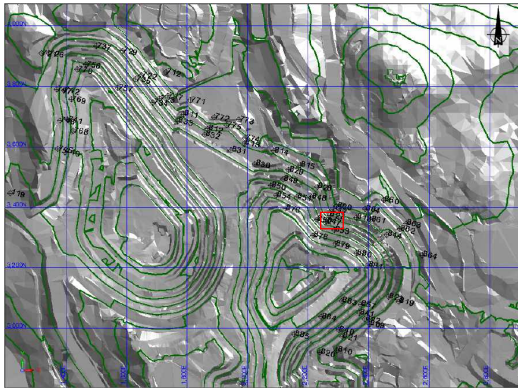
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

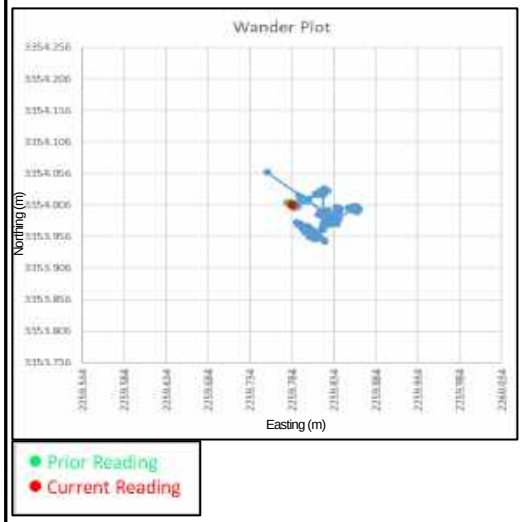
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

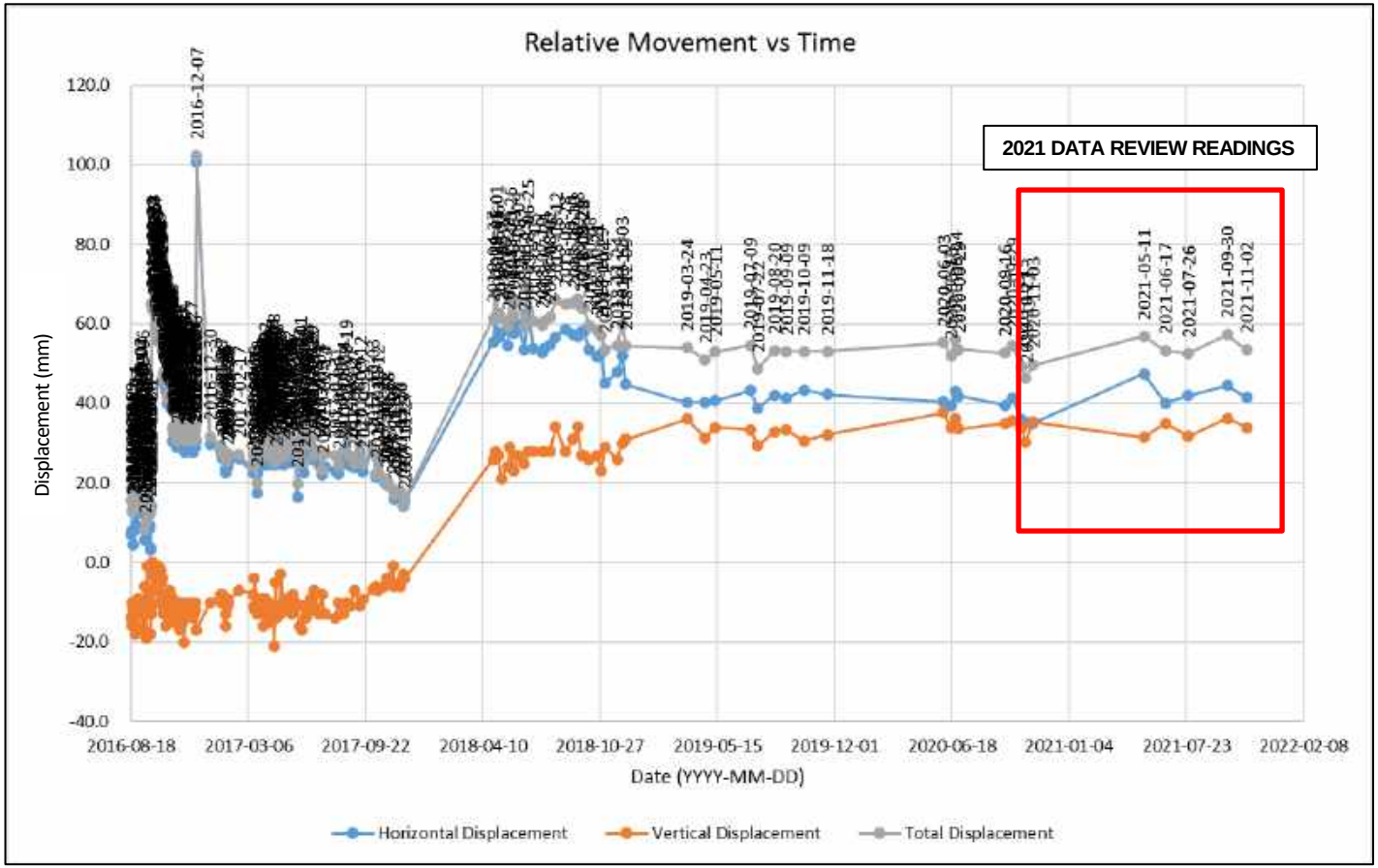
TITLE
CARIBOO PIT NORTHEAST WALL – SOUTHEAST SEGMENT UPPER BENCHES
PRISM 818

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

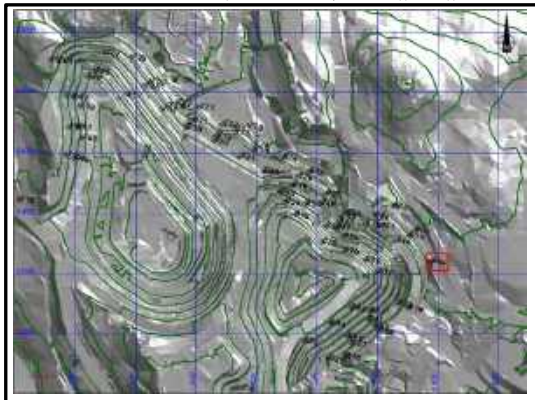
CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

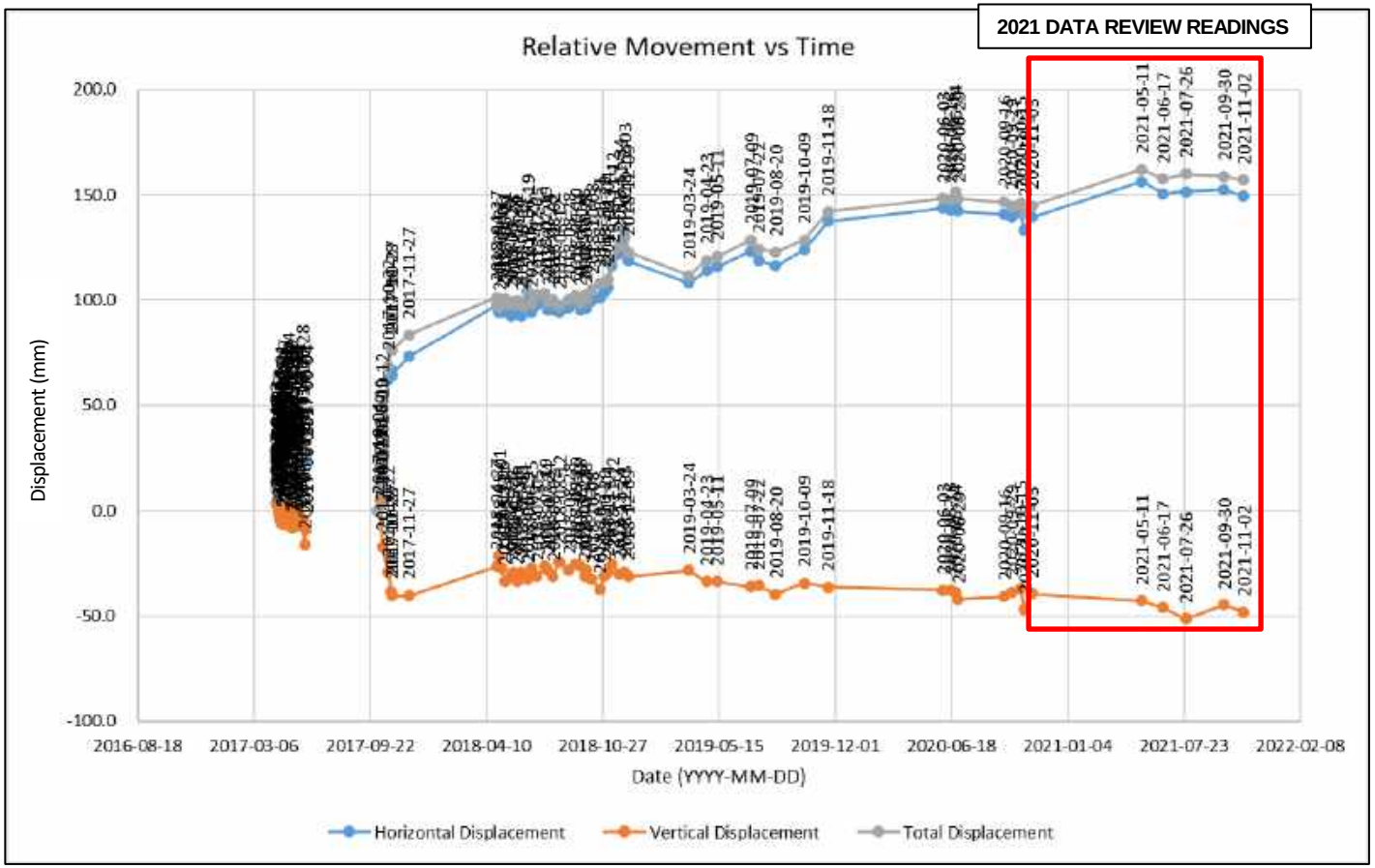
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT NORTHEAST WALL – SOUTHEAST SEGMENT LOWER BENCHES
PRISM 847

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-8**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

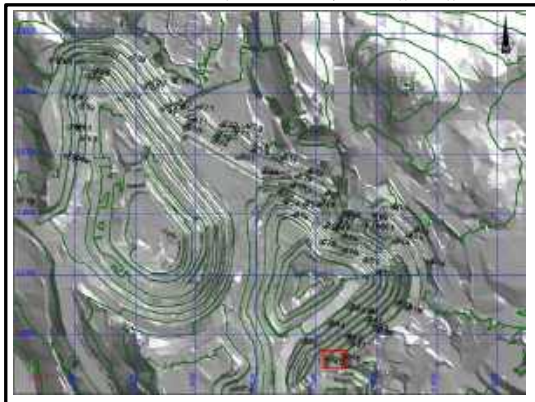
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

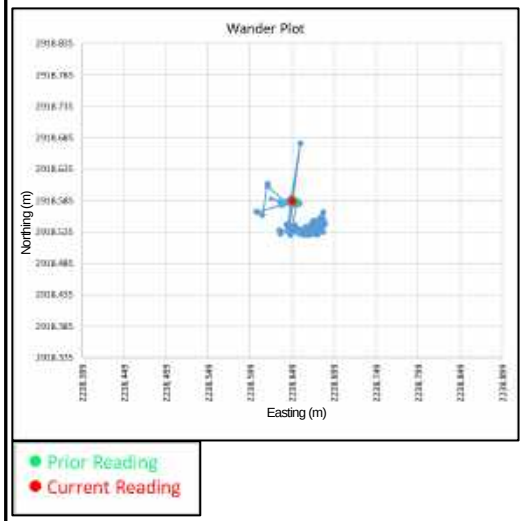
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

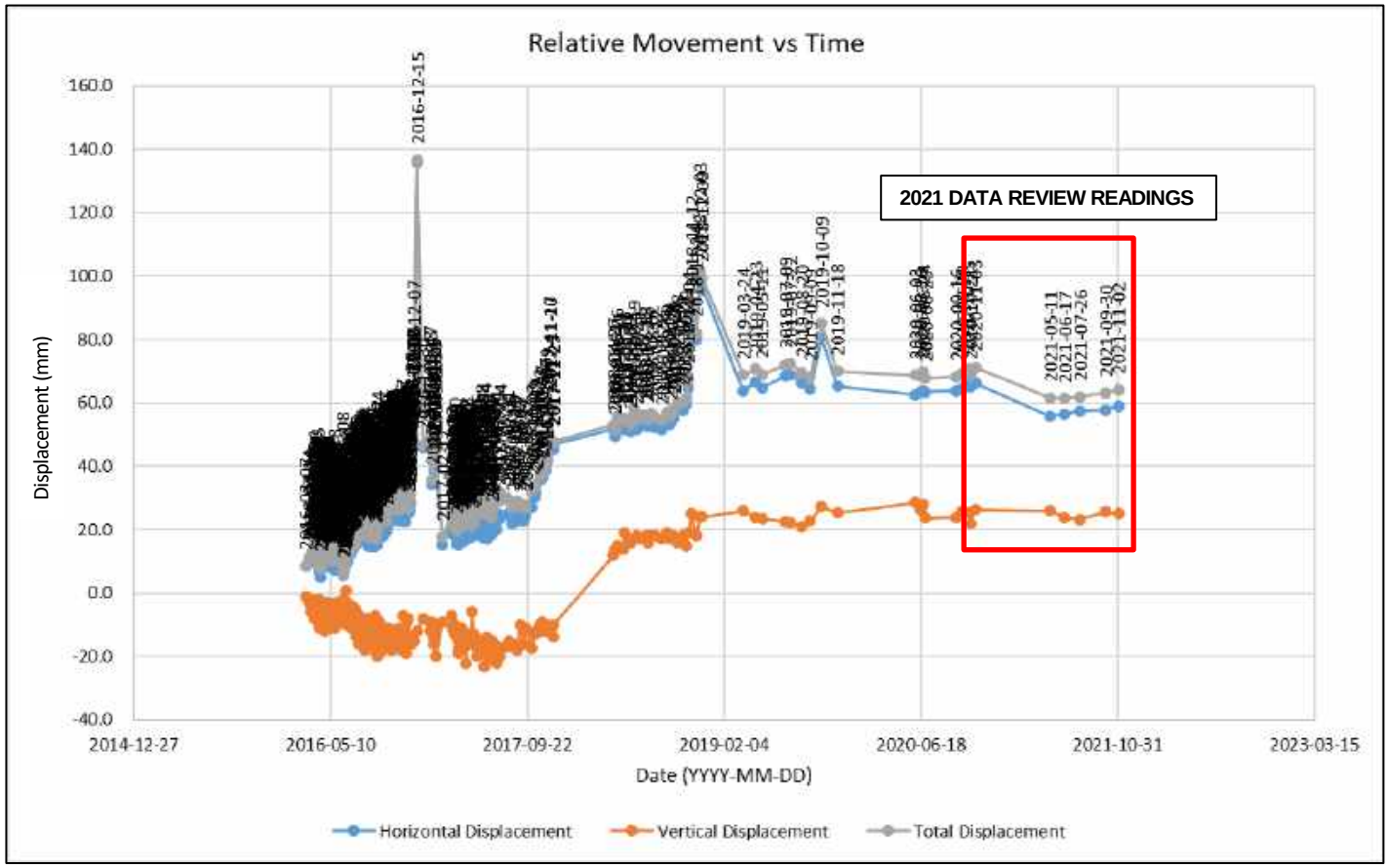
TITLE
CARIBOO PIT EAST WALL
PRISM 864

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

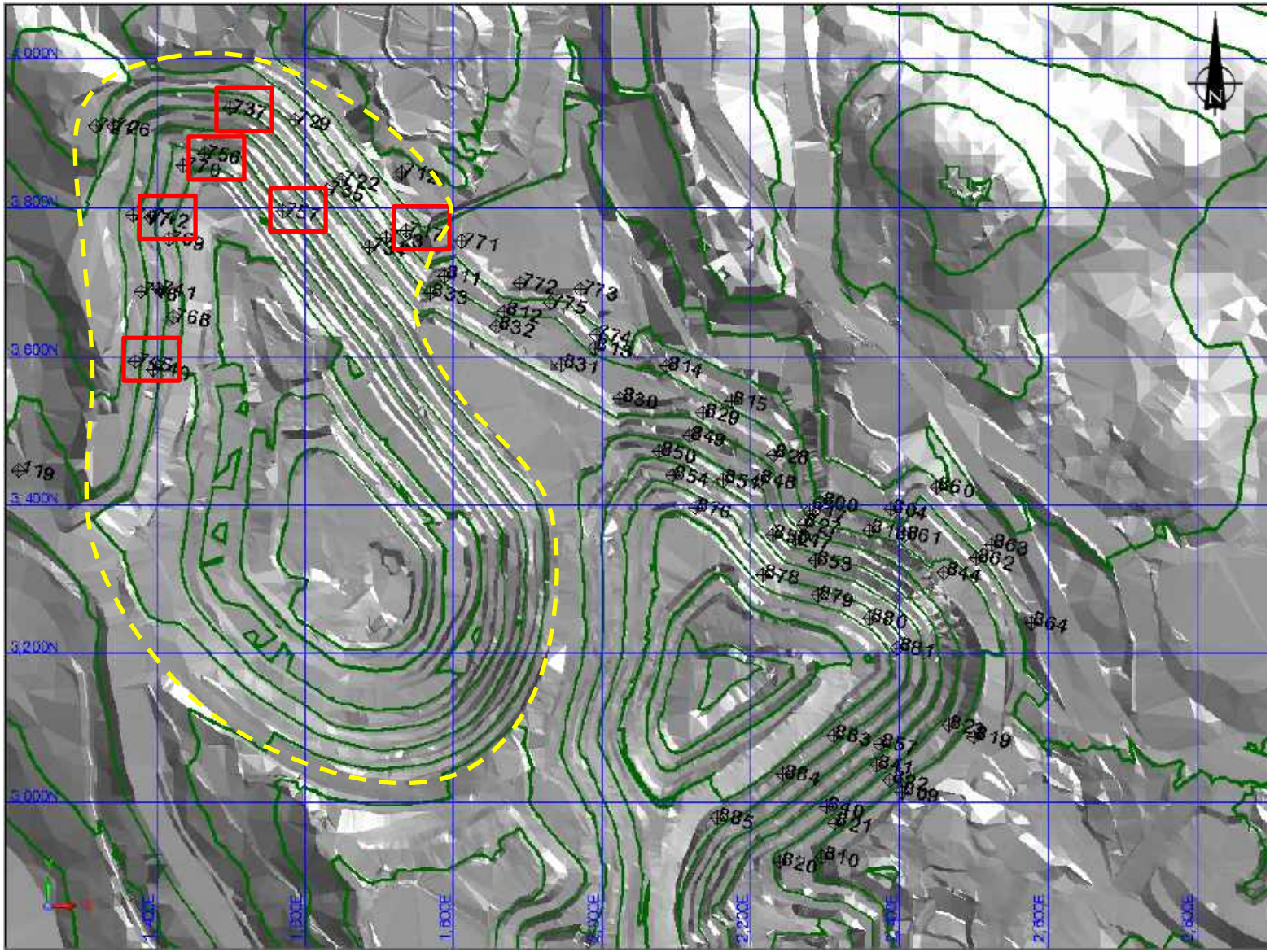
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
CARIBOO PIT SOUTHEAST WALL
PRISM 820

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-10

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	



REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

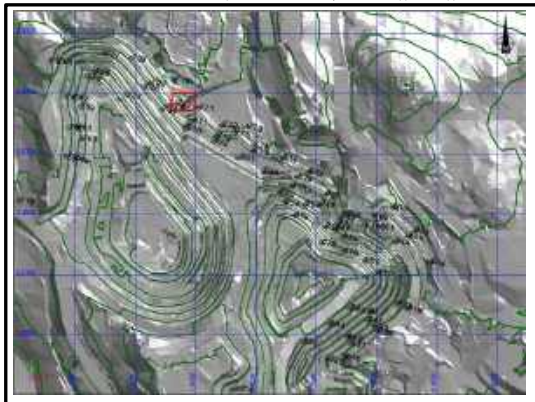
CONSULTANT
GOLDER
MEMBER OF WSP

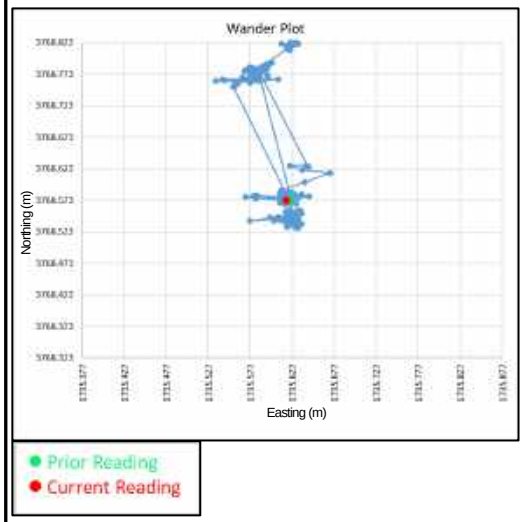
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

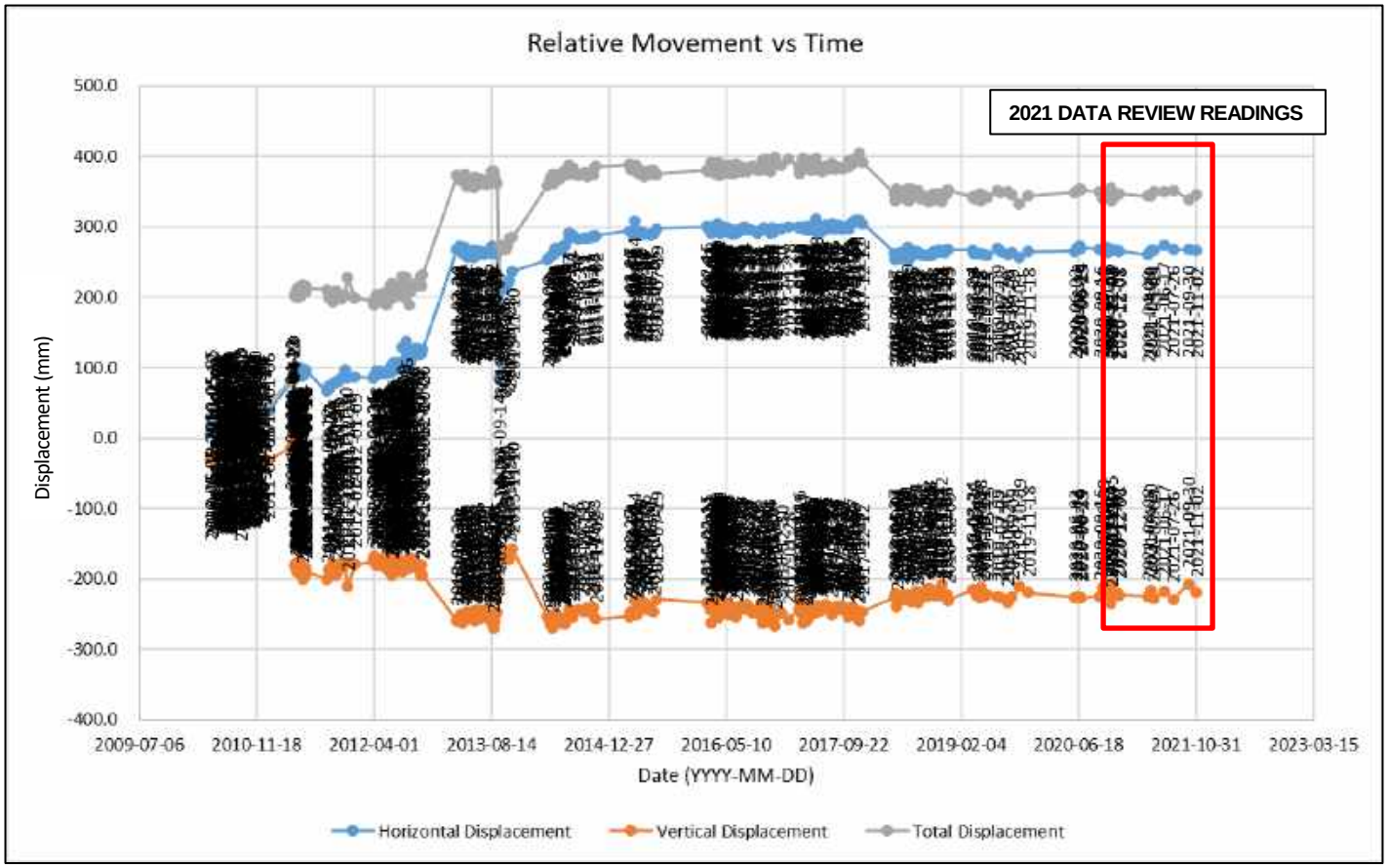
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-11**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

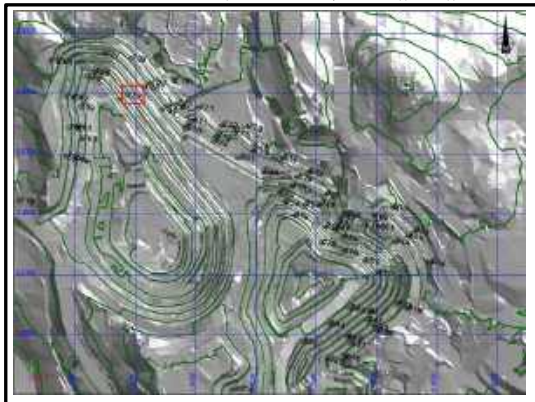
CONSULTANT
GOLDER
MEMBER OF WSP

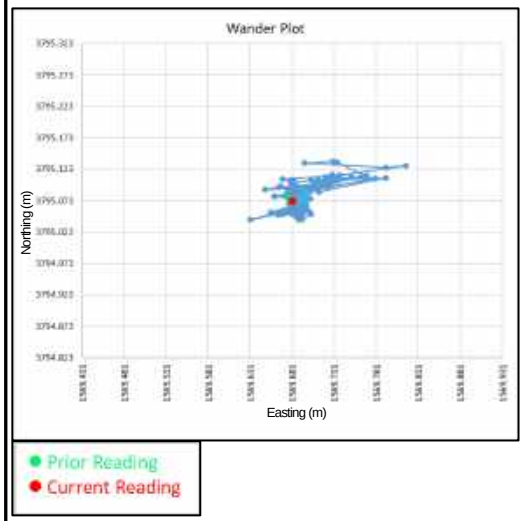
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

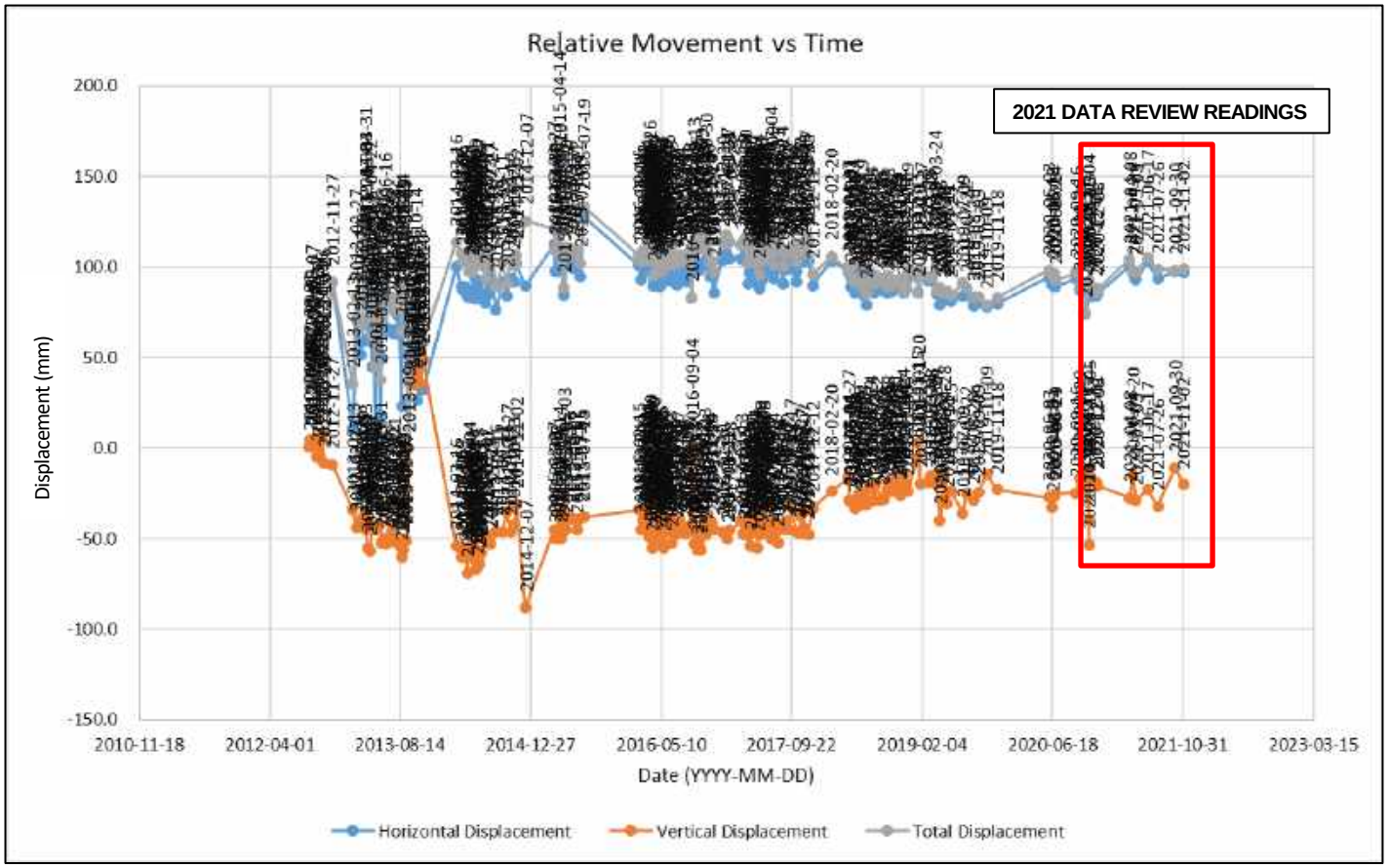
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT EAST WALL – CREST PRISM 717

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-12**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

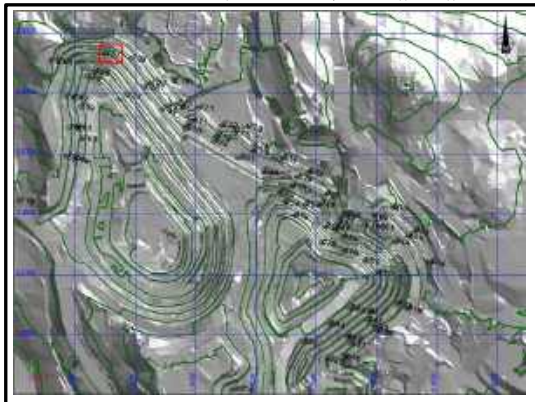
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

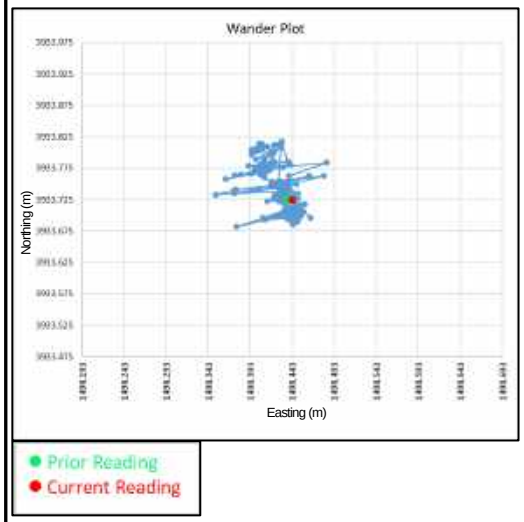
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

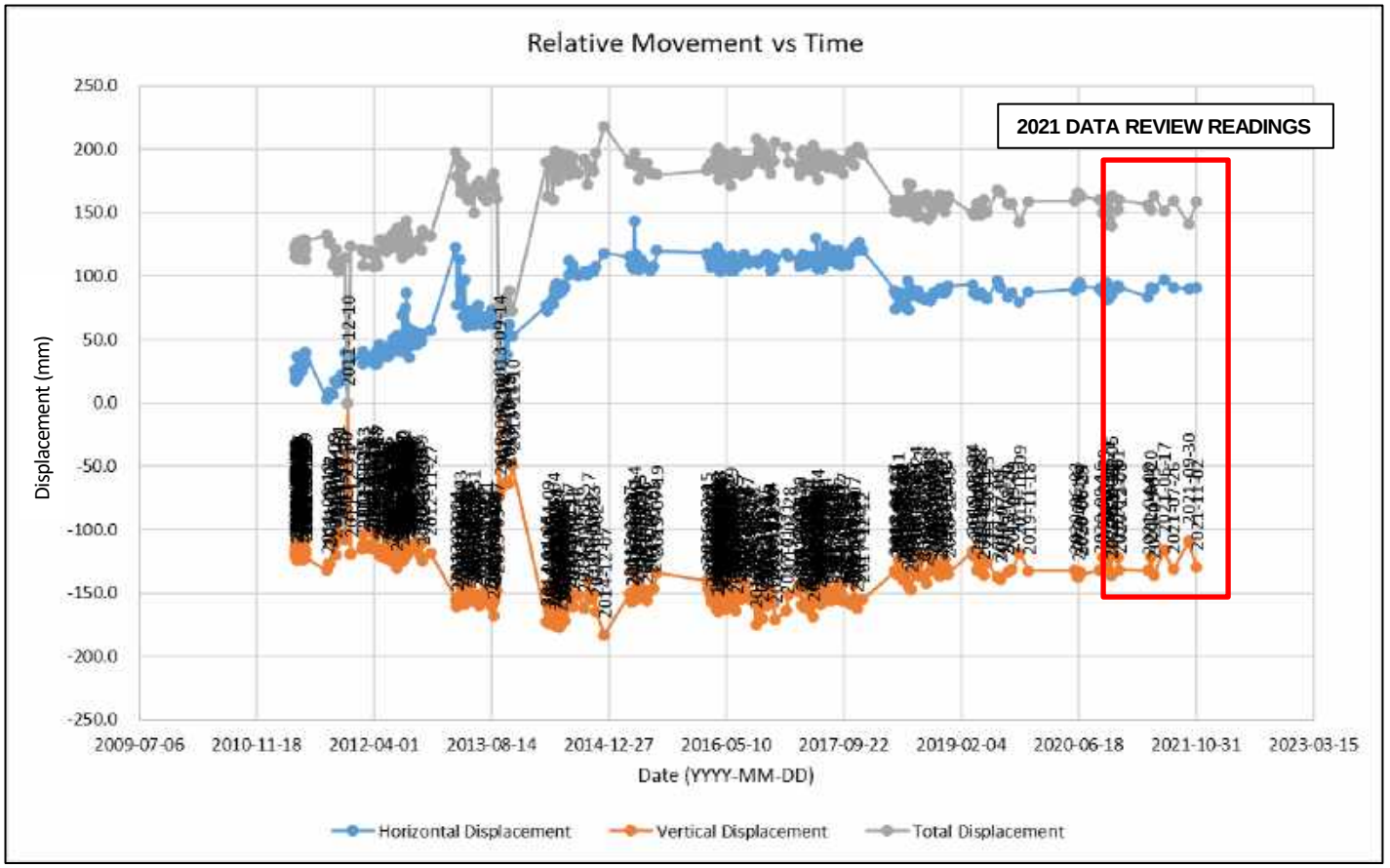
TITLE
SPRINGER PIT EAST WALL – LOWER PORTION
PRISM 757

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B
0 25 mm







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

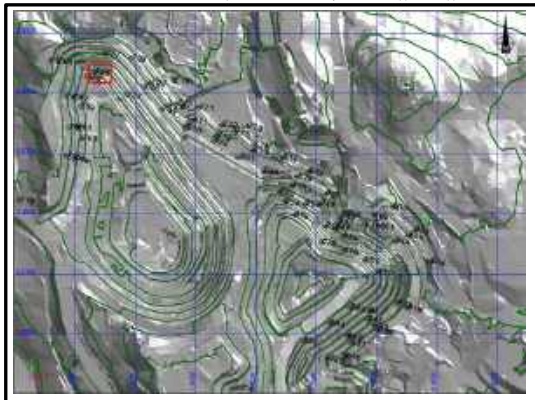
CONSULTANT
GOLDER
MEMBER OF WSP

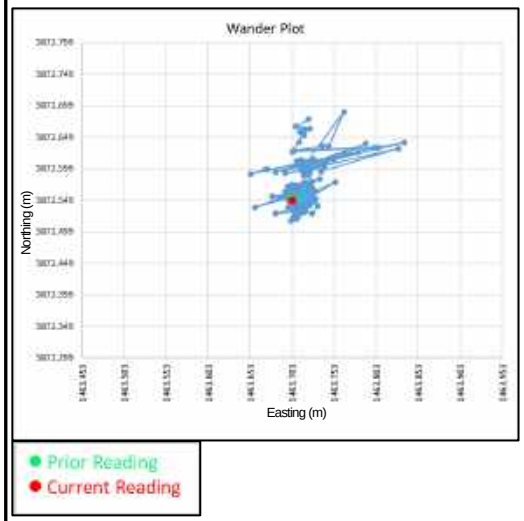
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

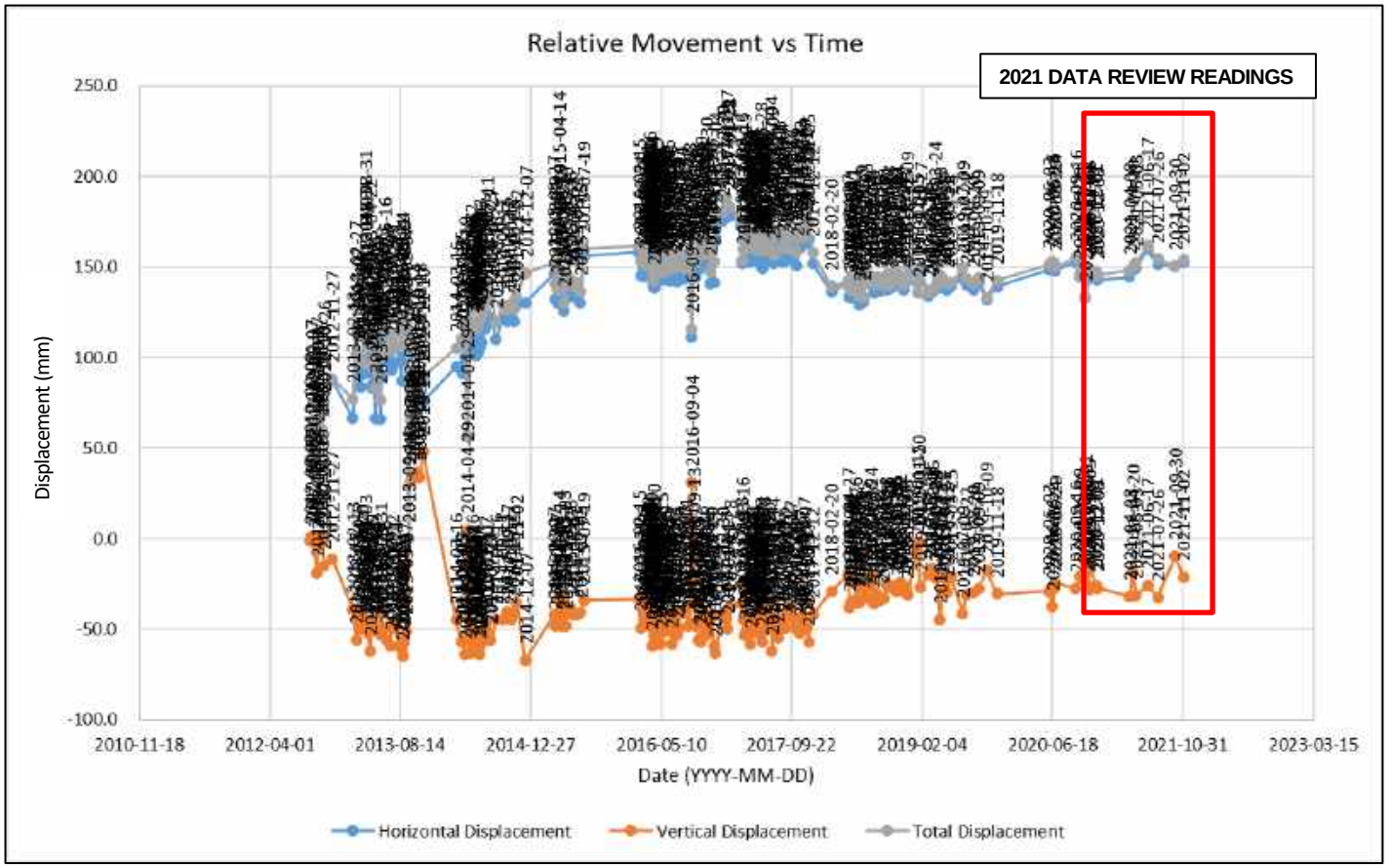
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT NORTH WALL – UPPER PORTION
PRISM 737

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-14







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

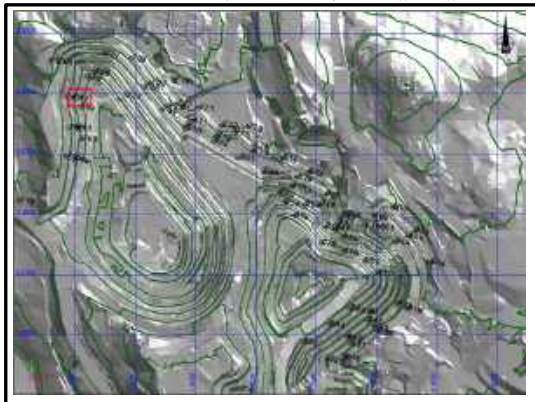
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

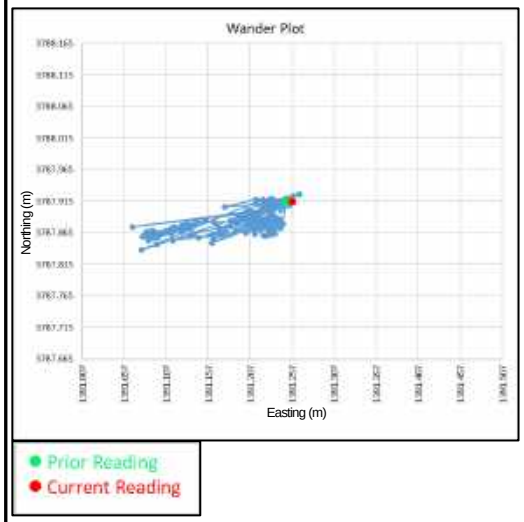
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

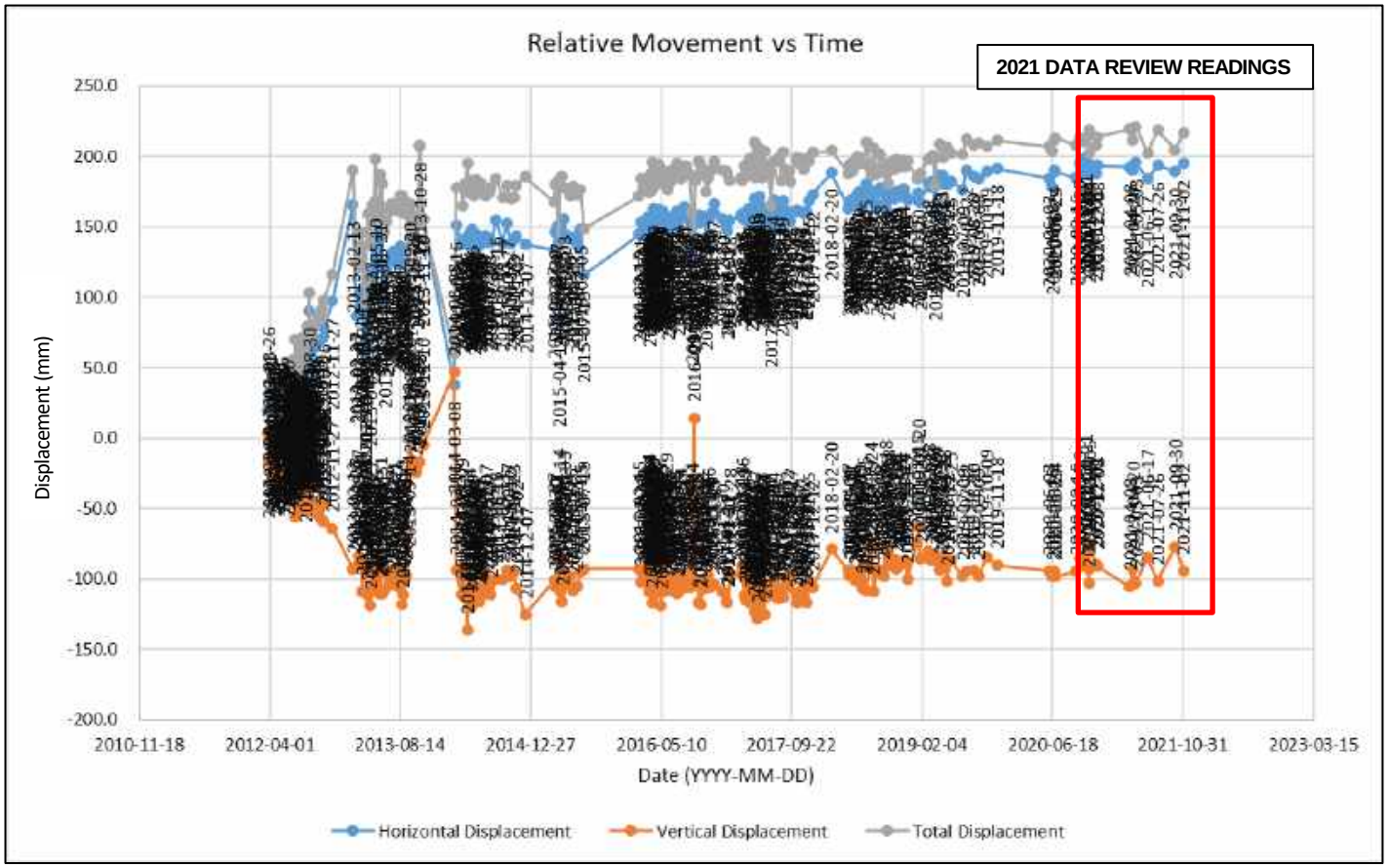
TITLE
SPRINGER PIT NORTH WALL – NOSE
PRISM 756

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

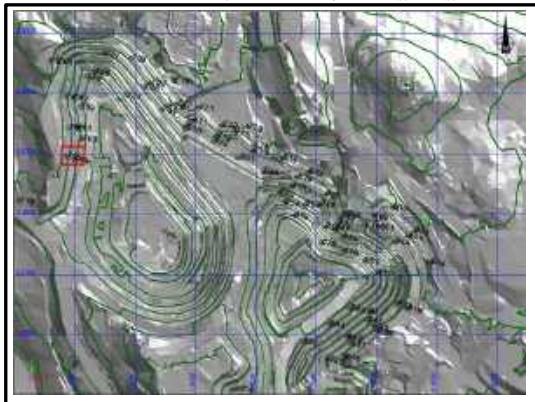
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

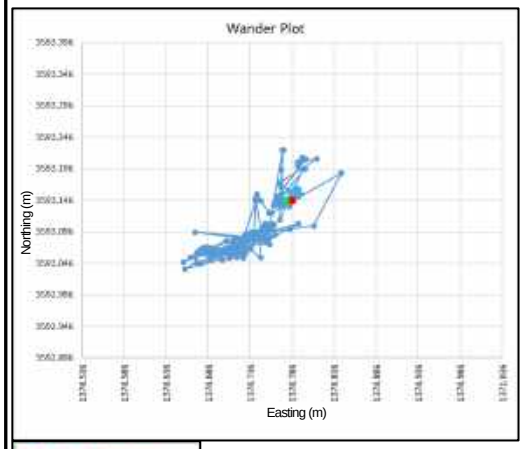
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

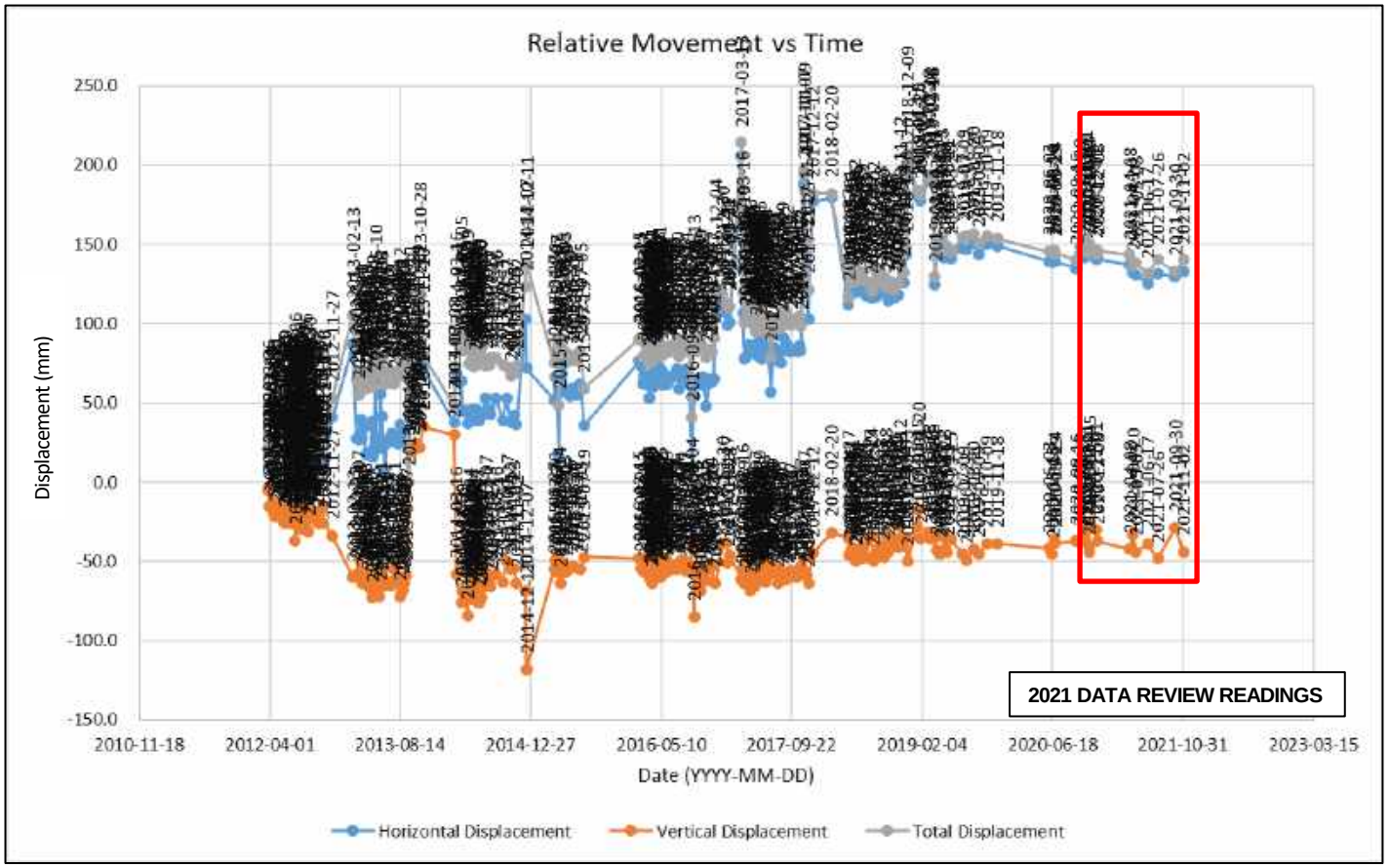
TITLE
SPRINGER PIT WEST WALL – MID WALL
PRISM 742

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

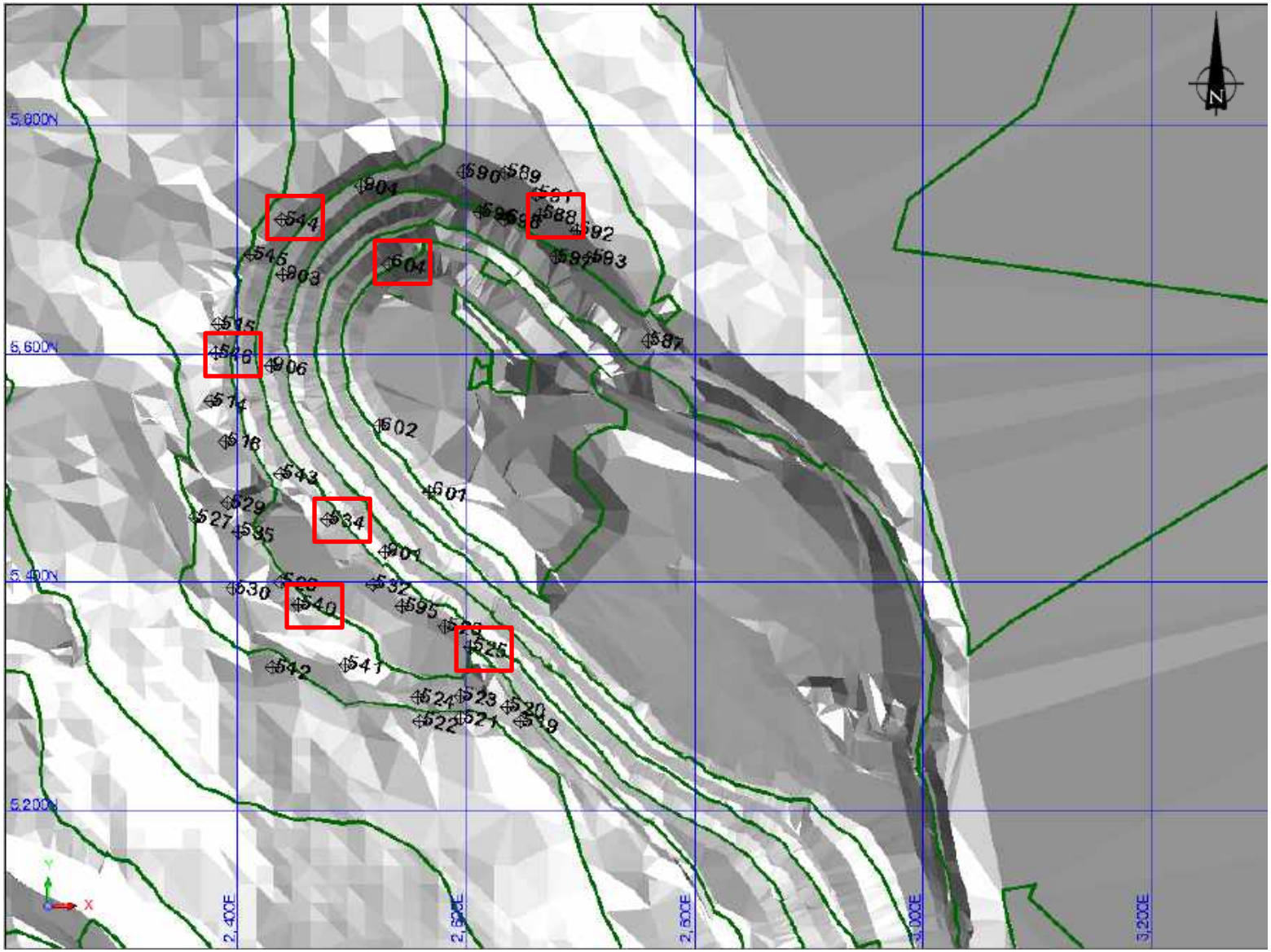
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
SPRINGER PIT WEST WALL – MID WALL
PRISM 745

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	



REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

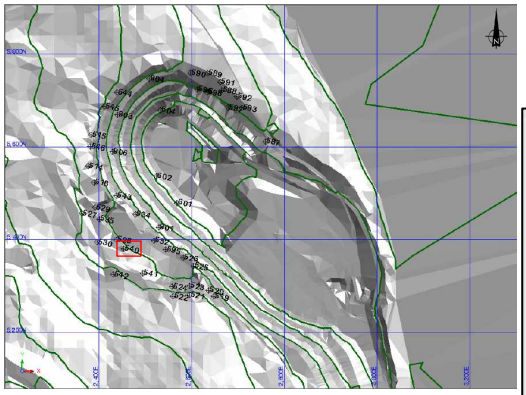
CONSULTANT
GOLDER
MEMBER OF WSP

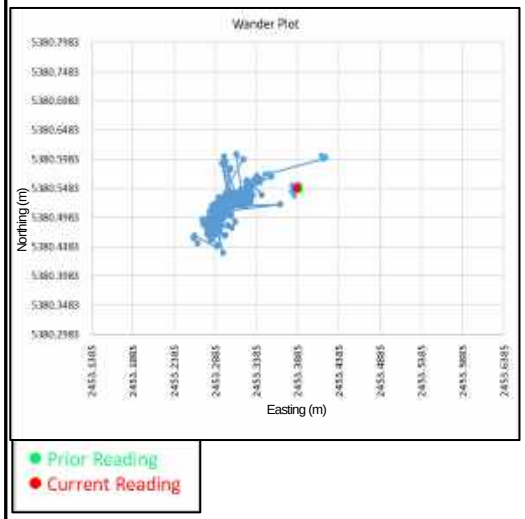
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

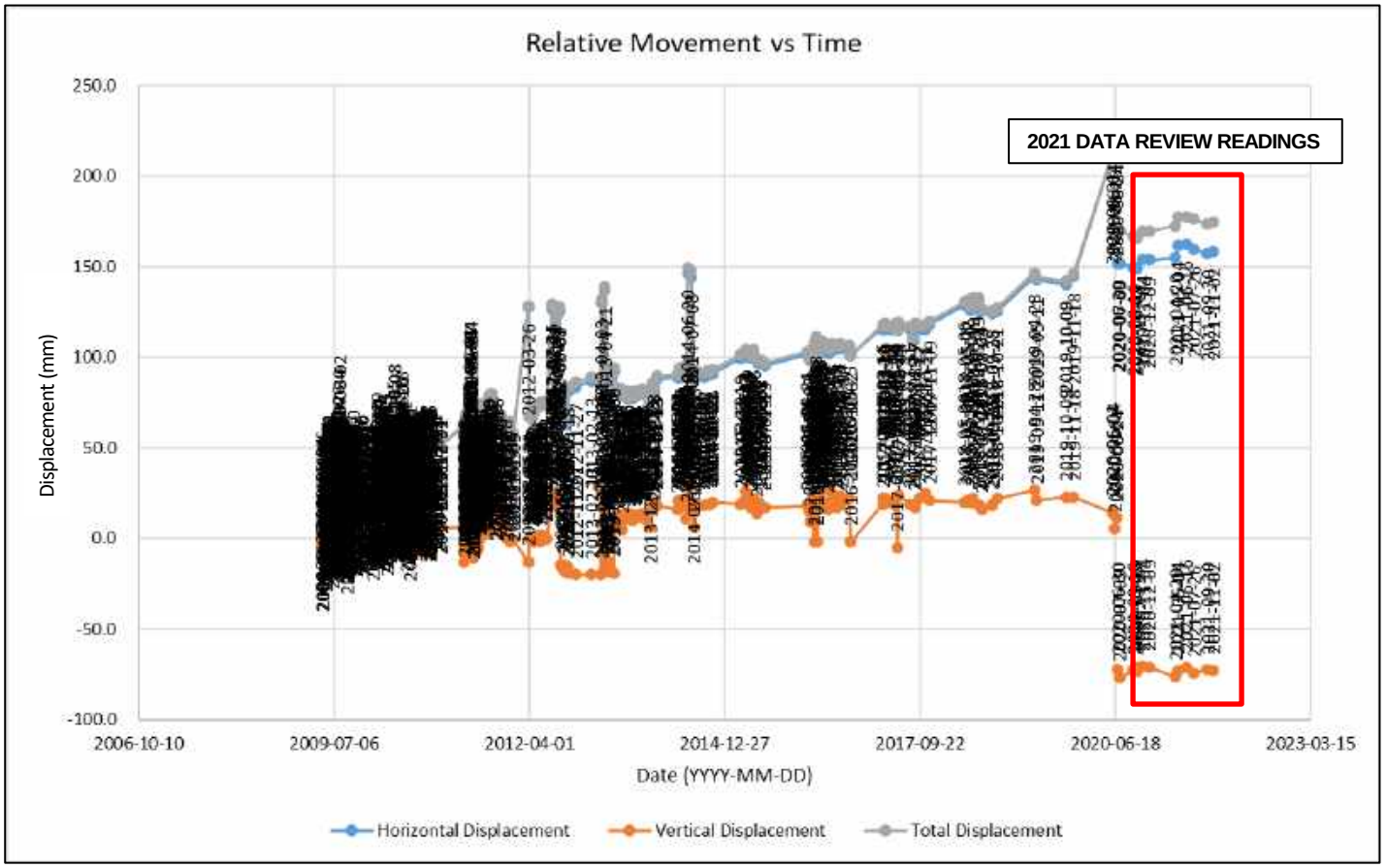
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-18**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

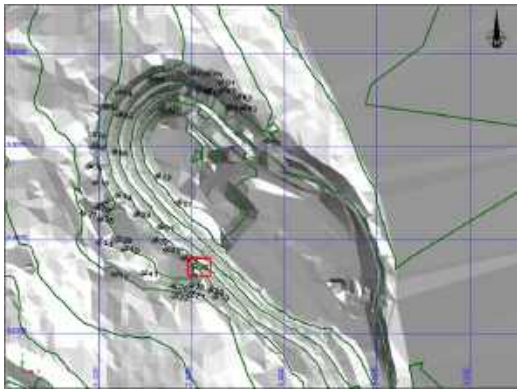
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

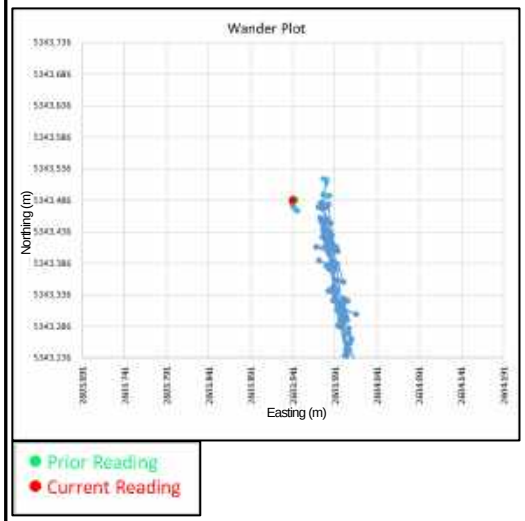
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

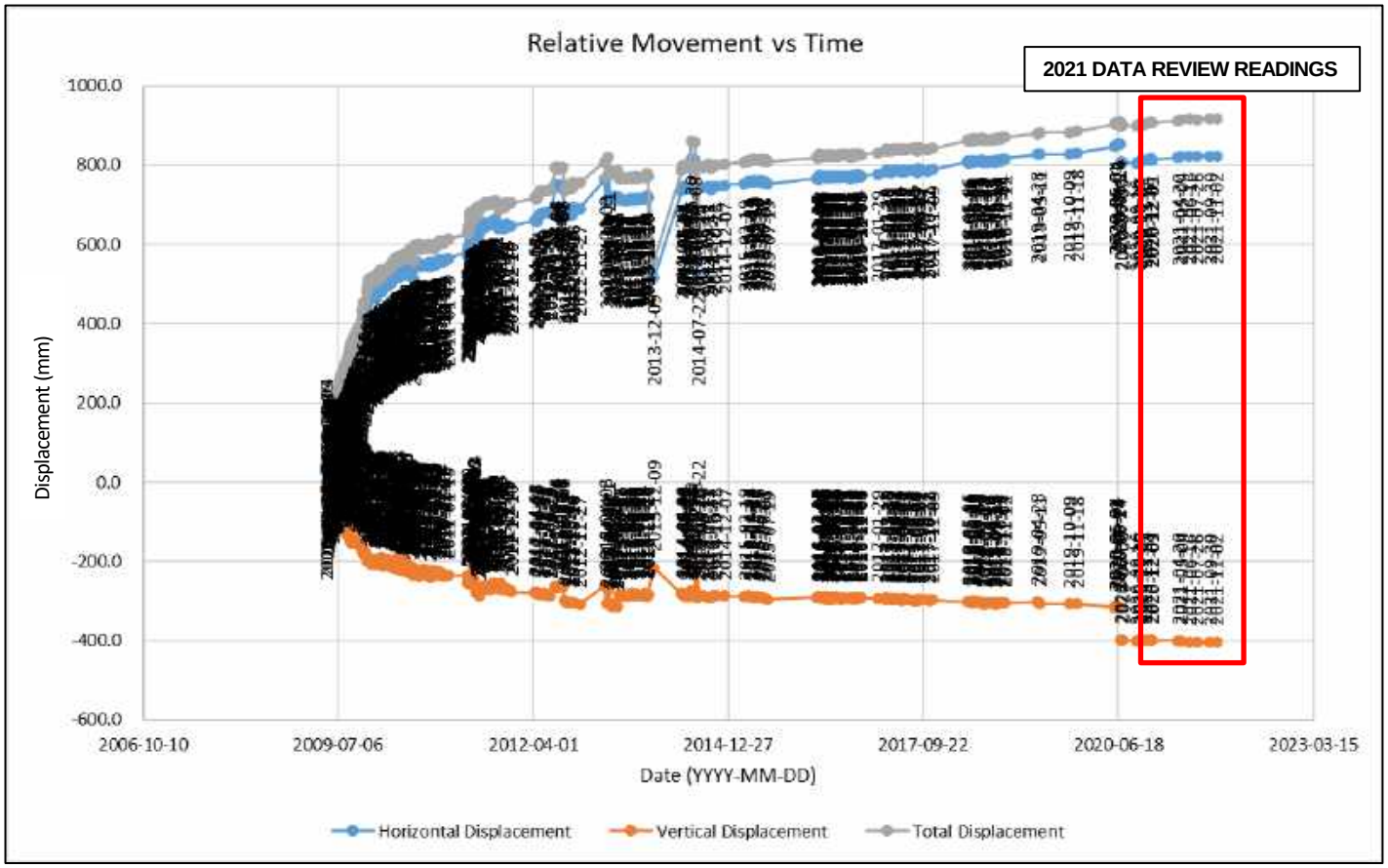
TITLE
WIGHT PIT WEST WALL ABOVE UNLOAD AREA
PRISM 540

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-19

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

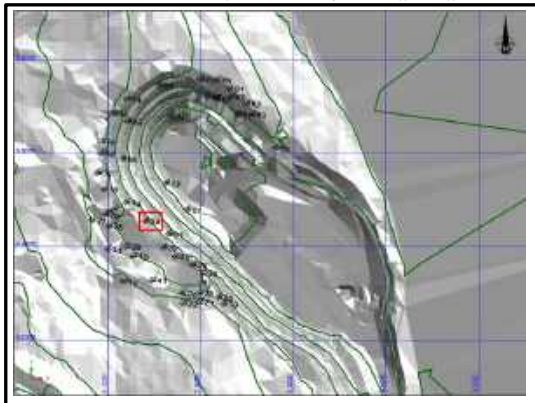
CONSULTANT
GOLDER
MEMBER OF WSP

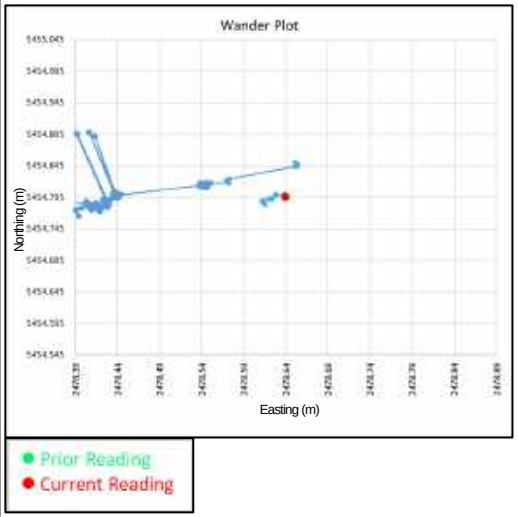
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

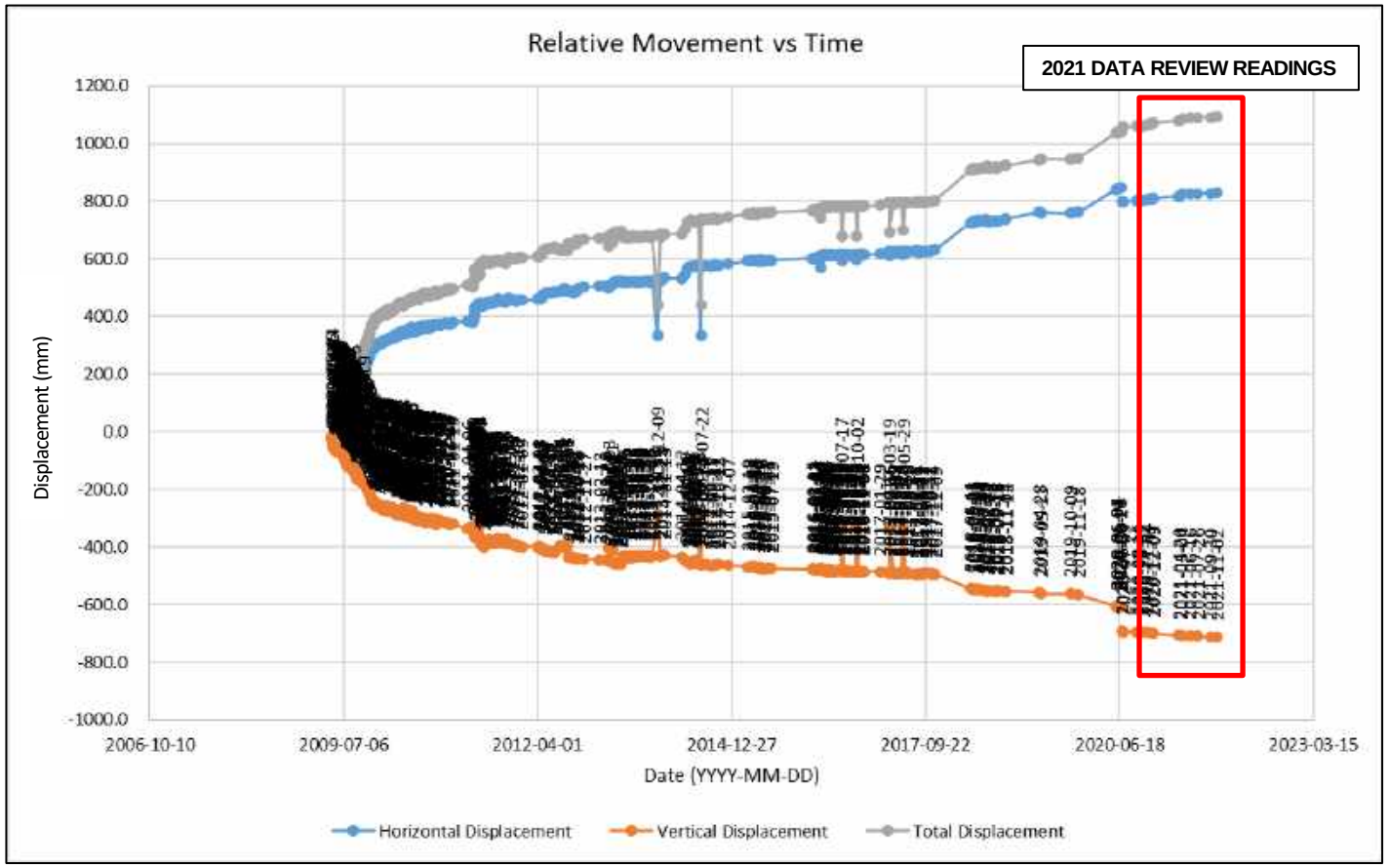
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL ON UNLOAD AREA CREST PRISM 525

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-20**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

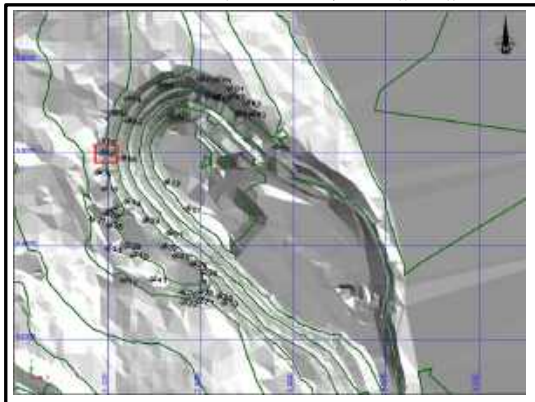
CONSULTANT
GOLDER
MEMBER OF WSP

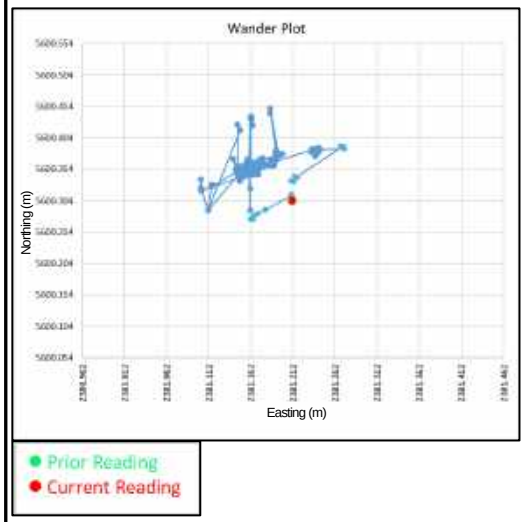
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

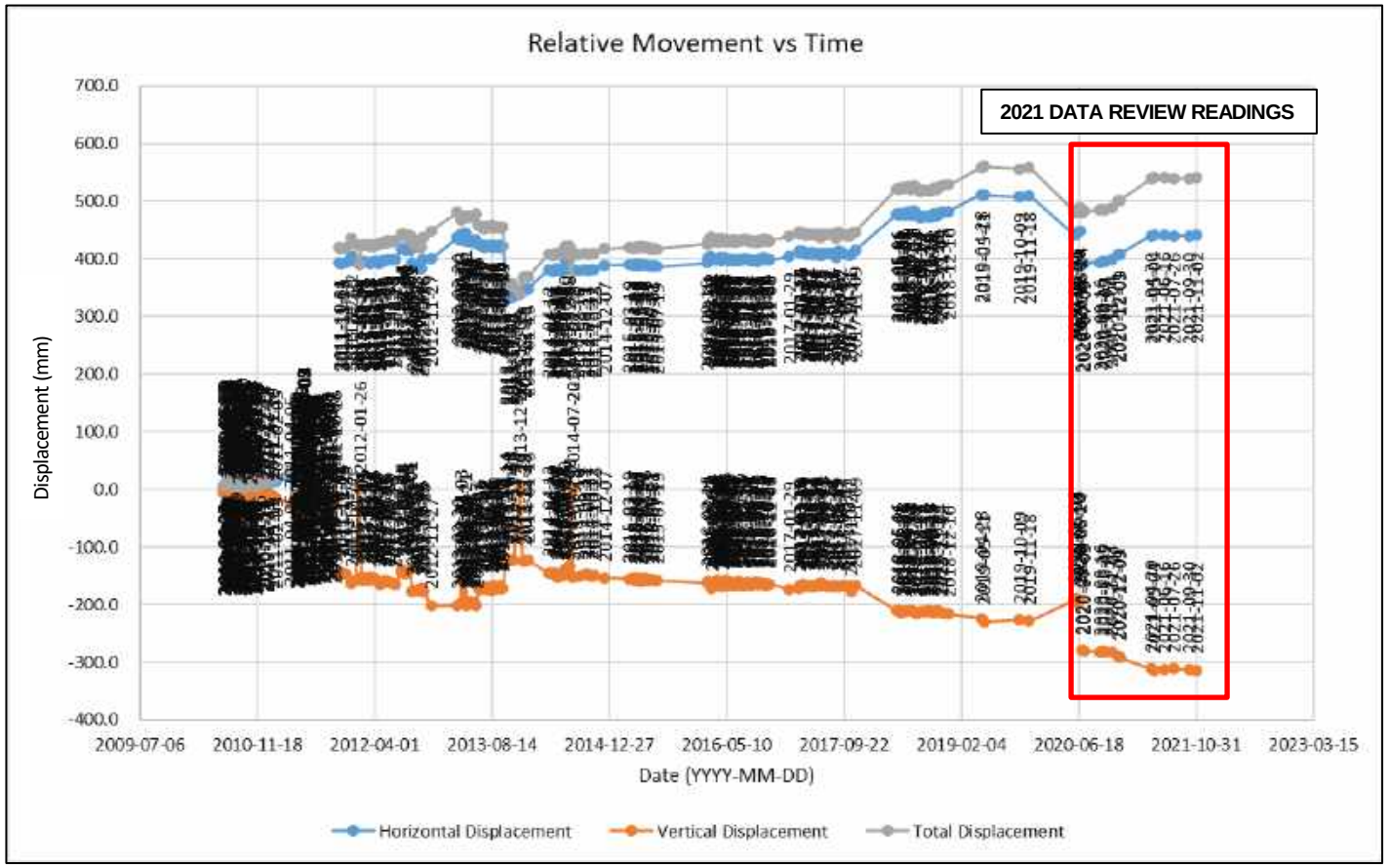
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT WEST WALL ON UNLOAD AREA CREST PRISM 534

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-21**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

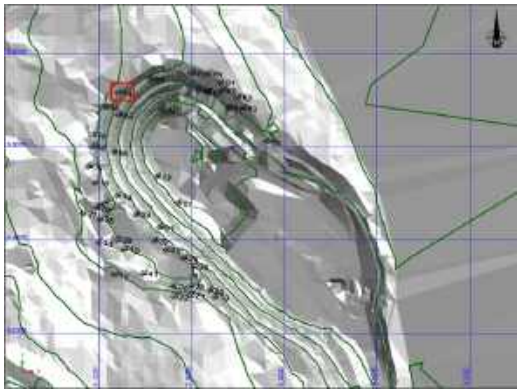
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

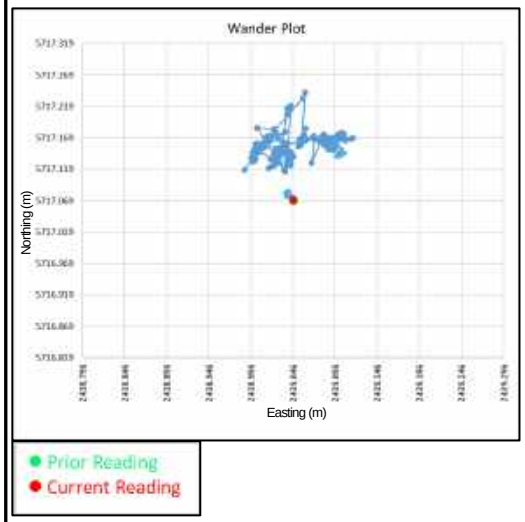
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

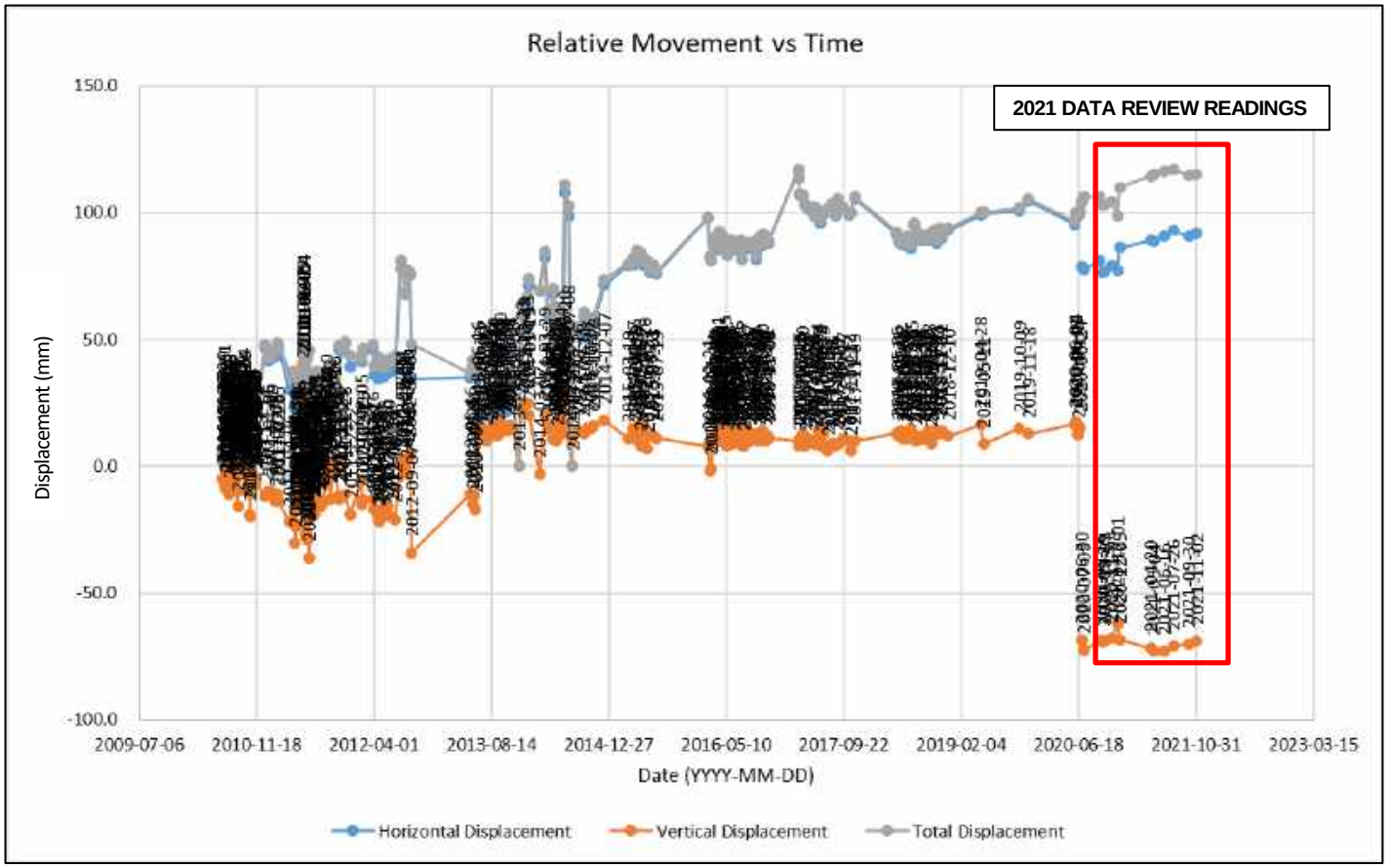
TITLE
WIGHT PIT WEST WALL
PRISM 546

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

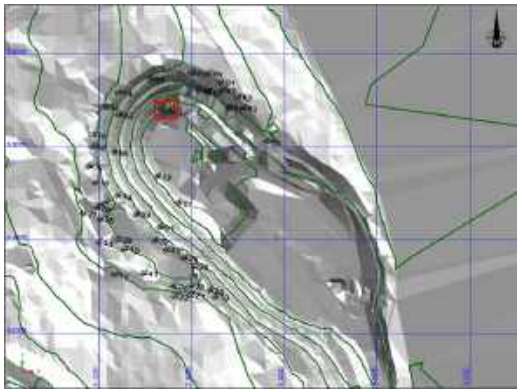
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

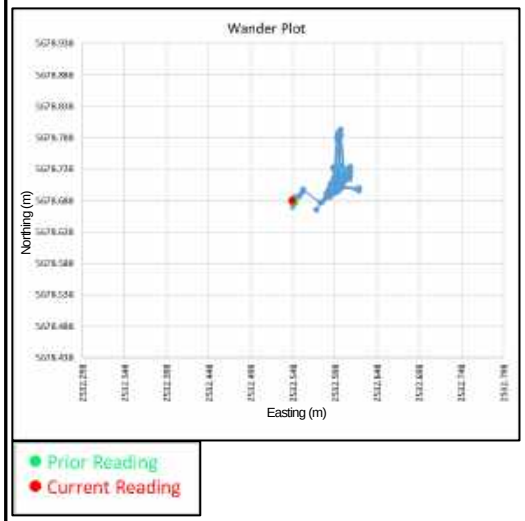
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

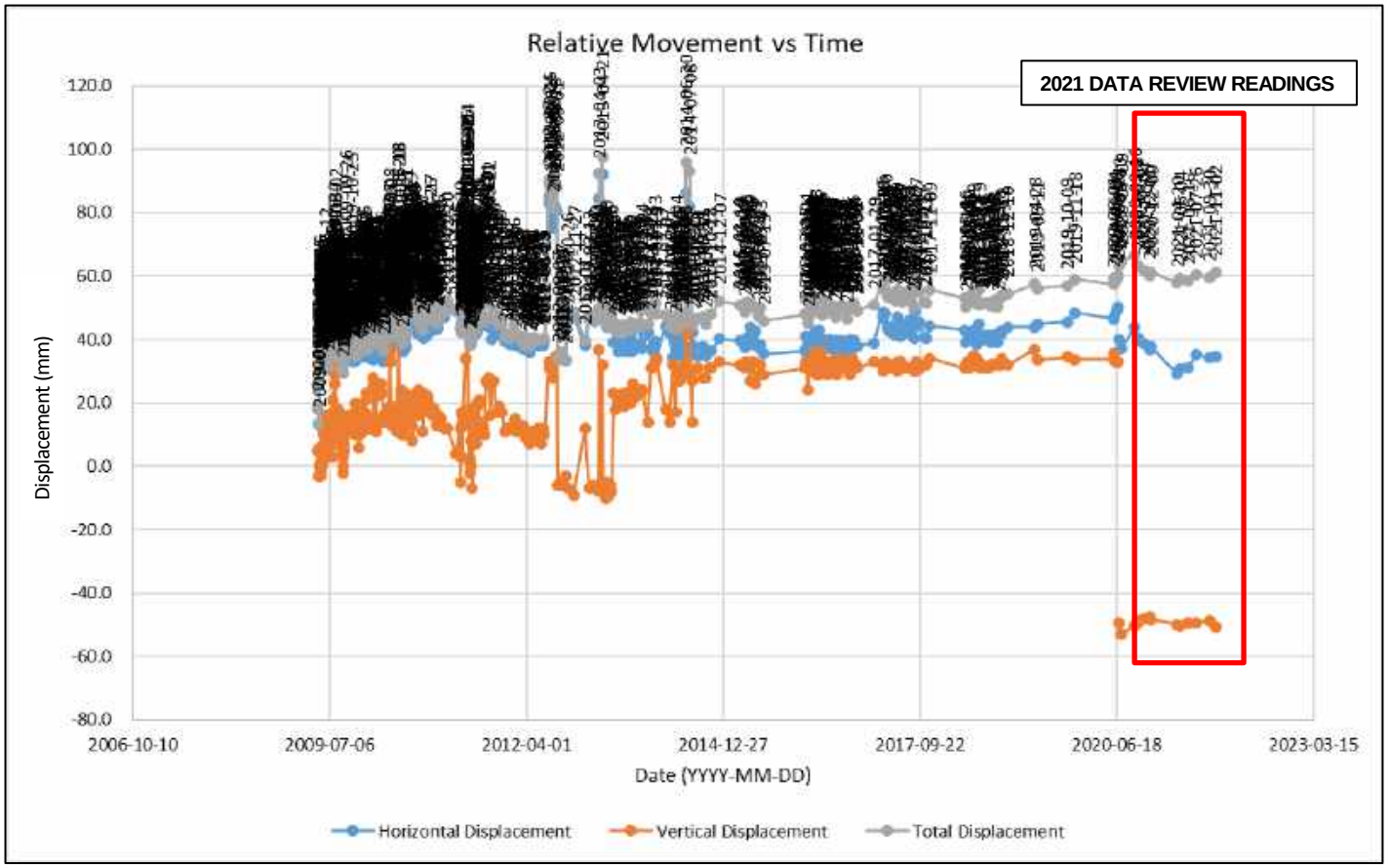
TITLE
WIGHT PIT NORTH WALL
PRISM 544

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B
0 25 mm







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

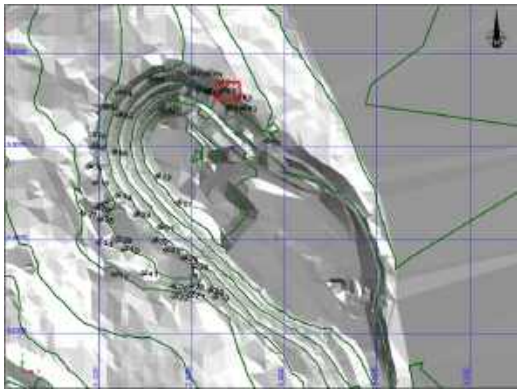
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

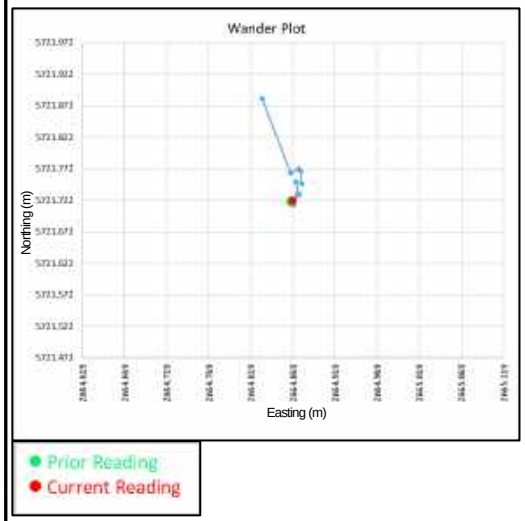
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

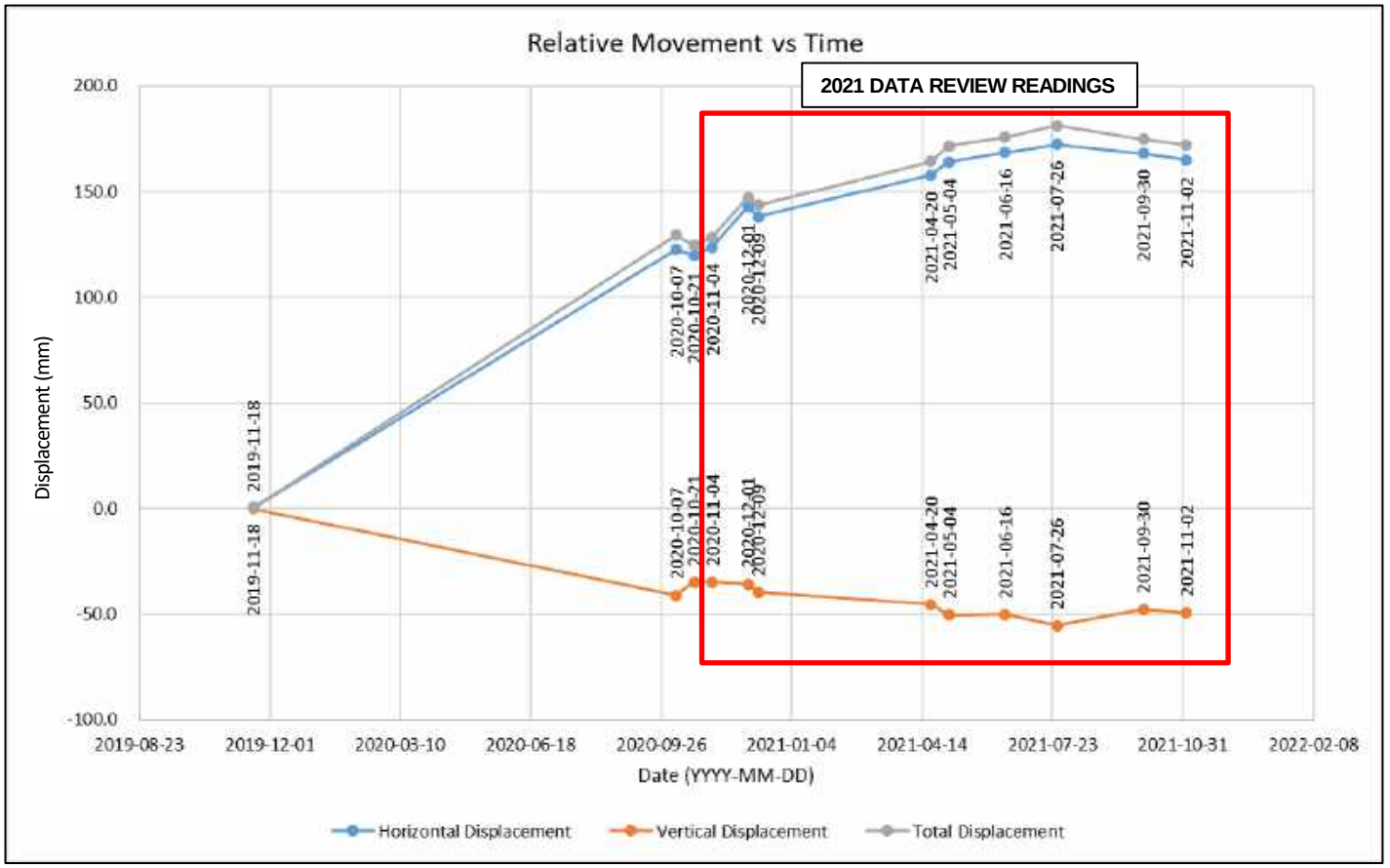
TITLE
WIGHT PIT NORTH WALL
PRISM 604

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-24**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B
0 25 mm







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

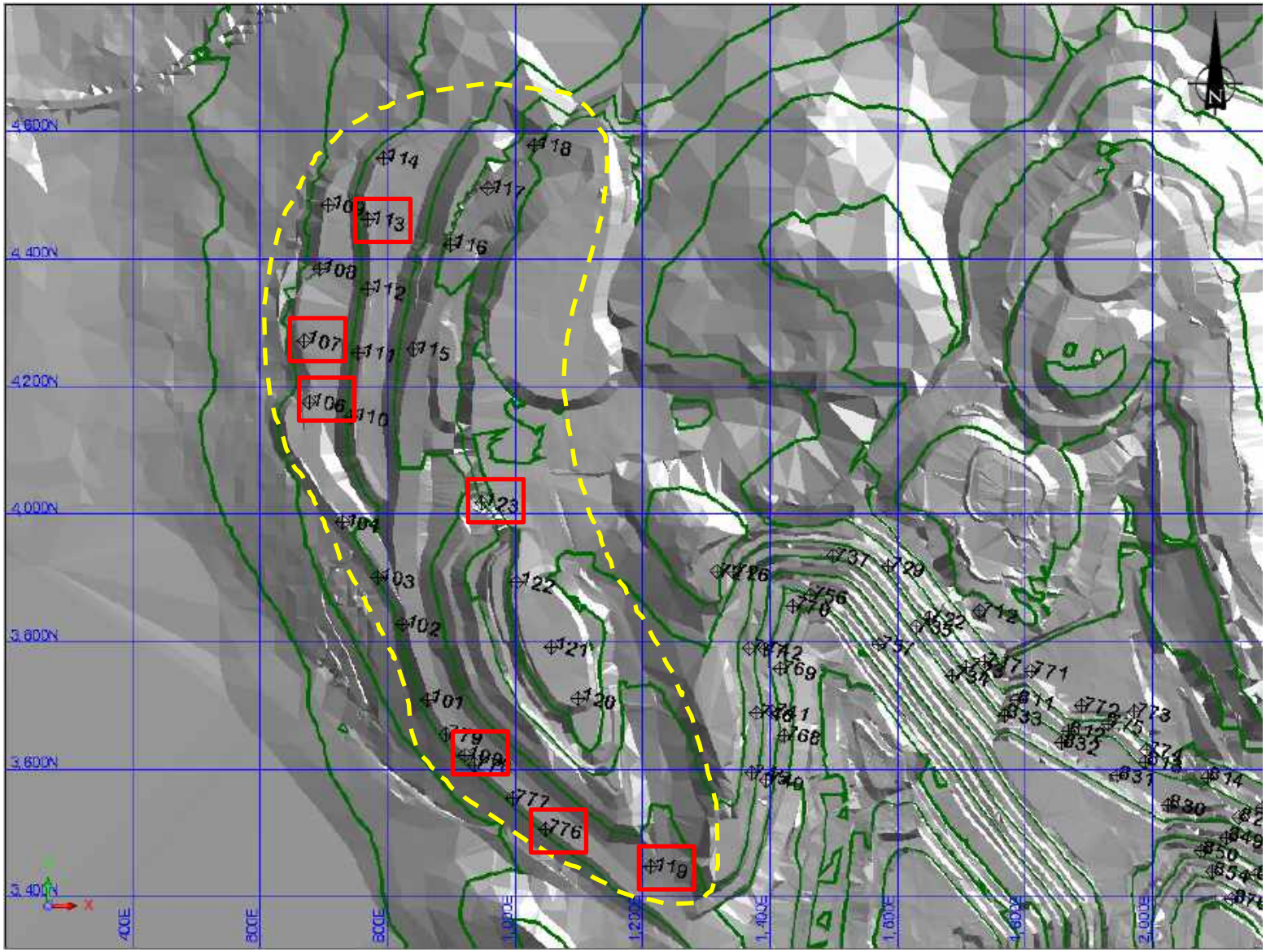
YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
WIGHT PIT EAST WALL
PRISM 588

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-25**

LEGEND	
PRISM DATA PRESENTED	
25 M CONTOUR	



REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

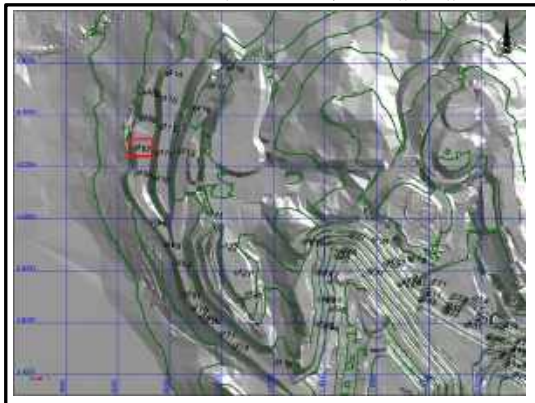
CONSULTANT
GOLDER
MEMBER OF WSP

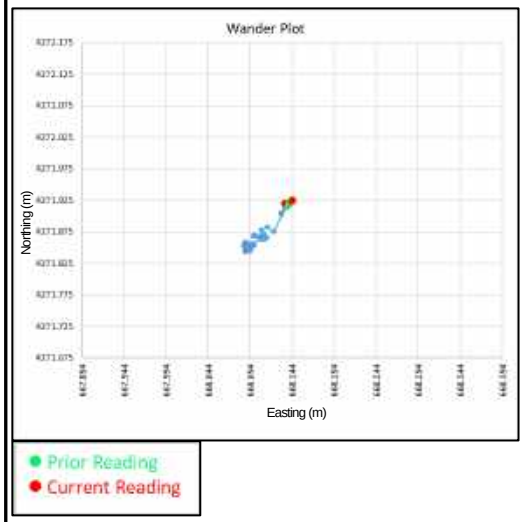
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REVIEWED	AGH
APPROVED	JKH

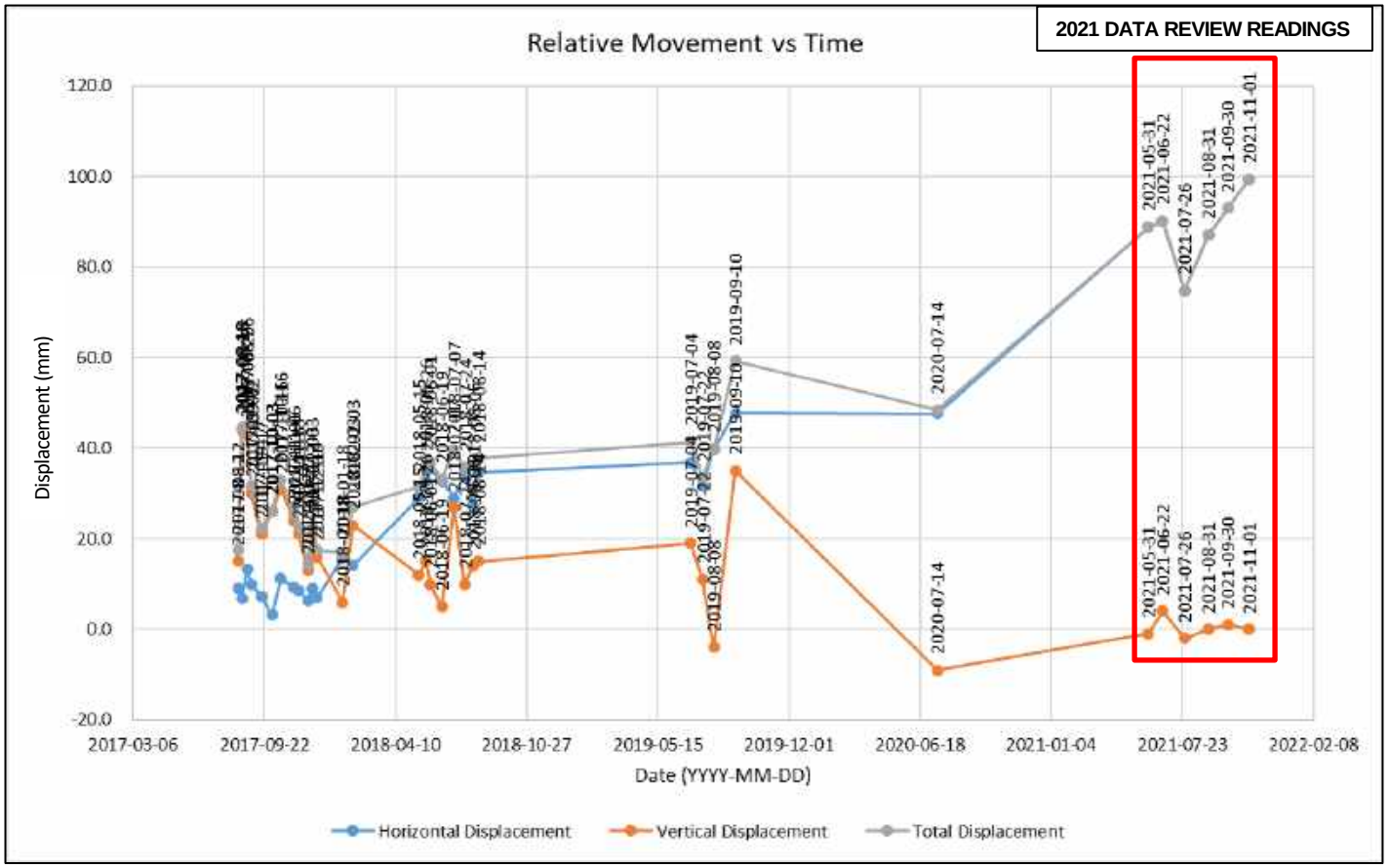
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP PRISM LOCATION PLAN

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-26**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
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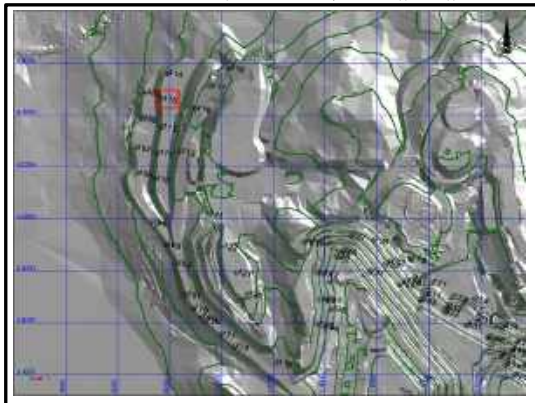
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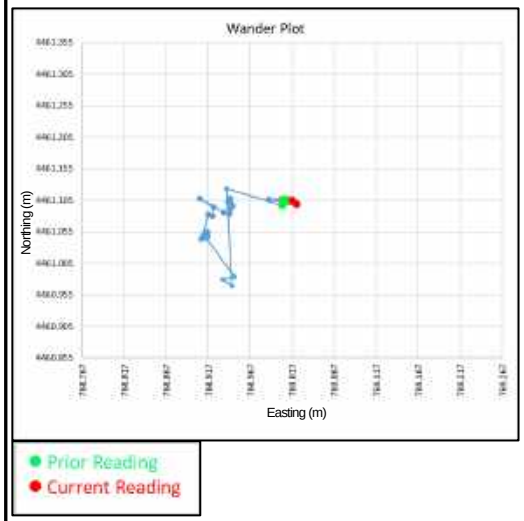
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

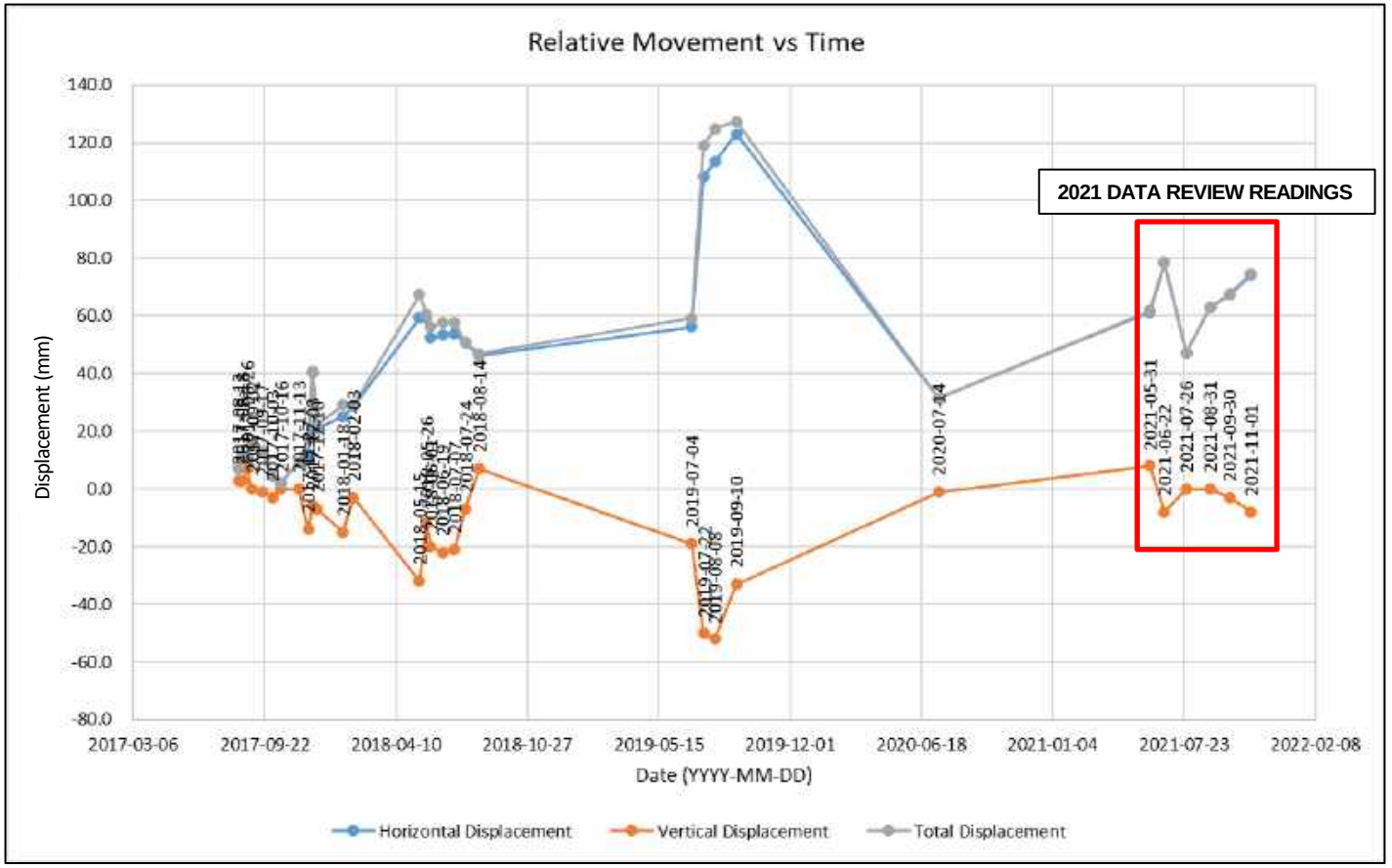
TITLE
NORTHWEST PAG DUMP
PRISM 107

PROJECT NO.	PHASE	REV.	FIGURE
21452039	73100	0	B-27

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REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
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IMPERIAL METALS CORPORATION
LIKELY, BC

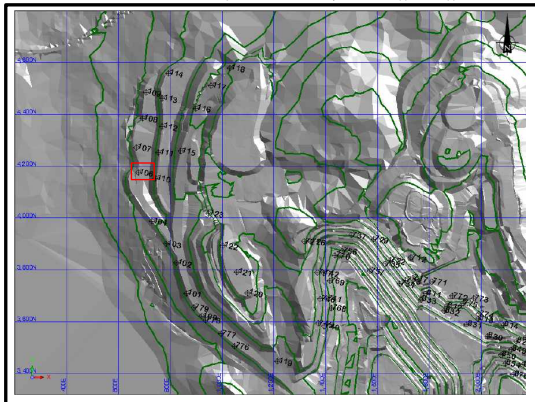
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MEMBER OF WSP

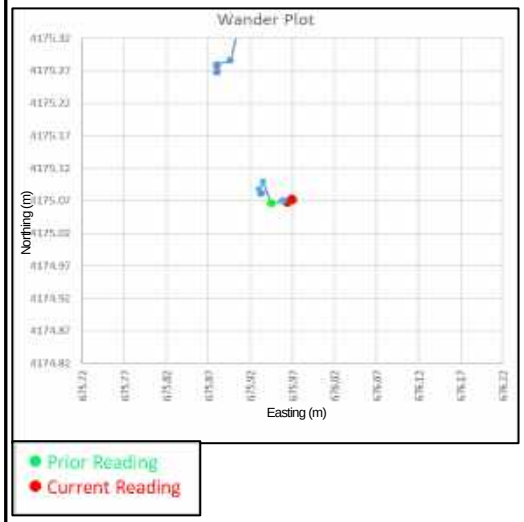
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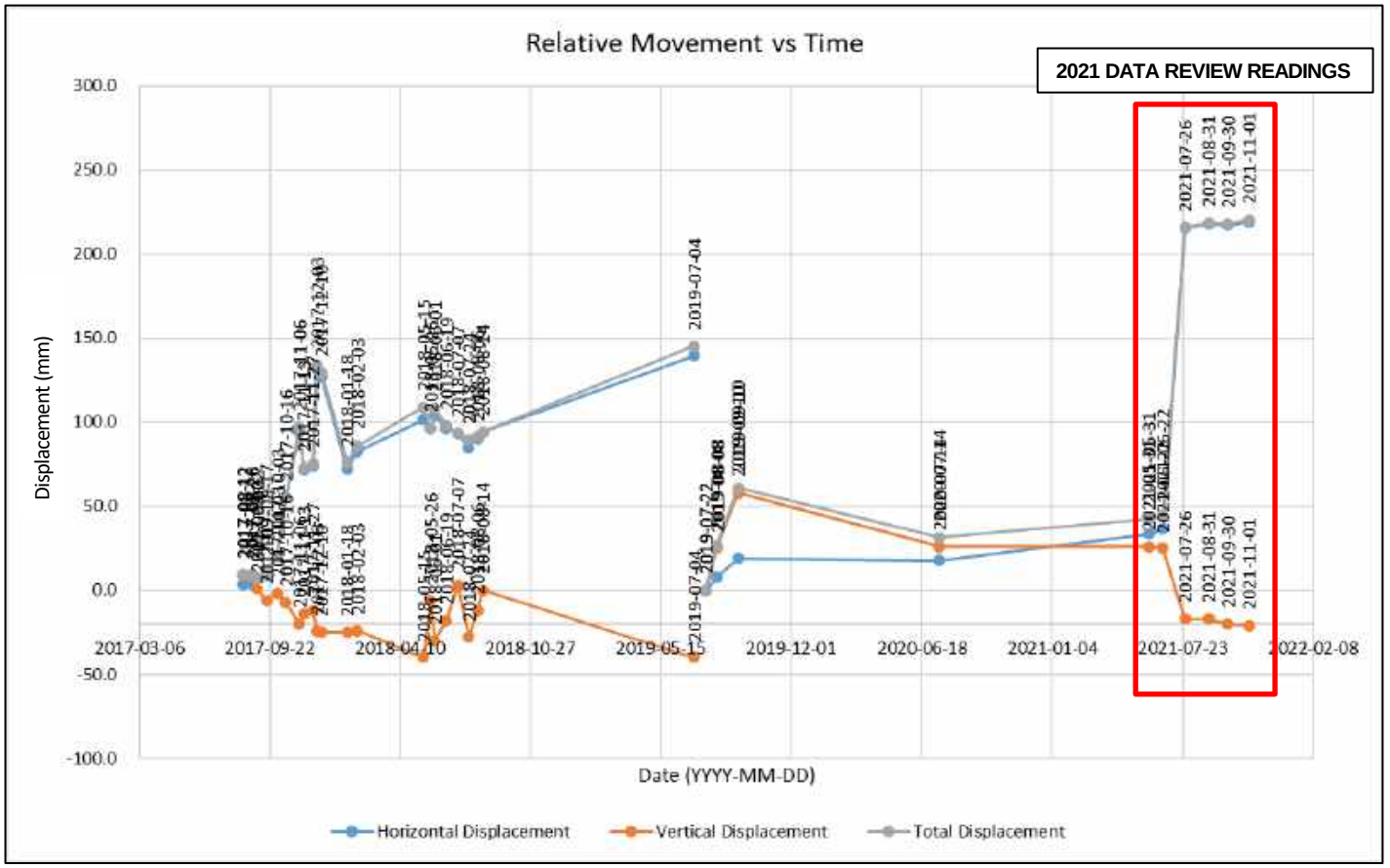
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 113

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-28**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

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GOLDER
MEMBER OF WSP

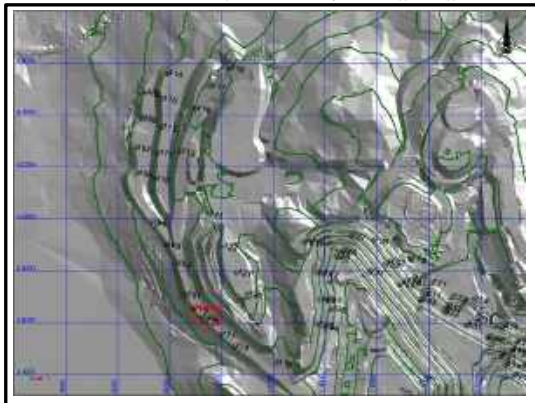
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APPROVED	JKH

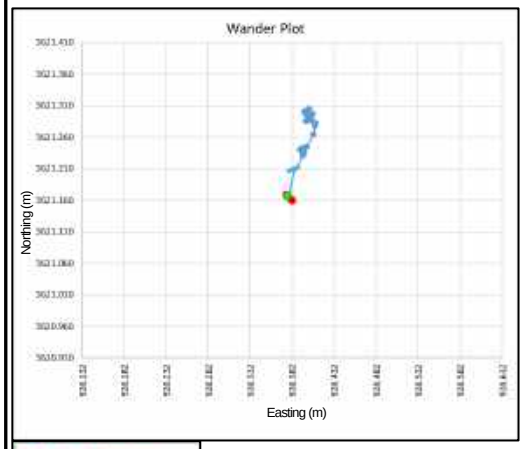
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

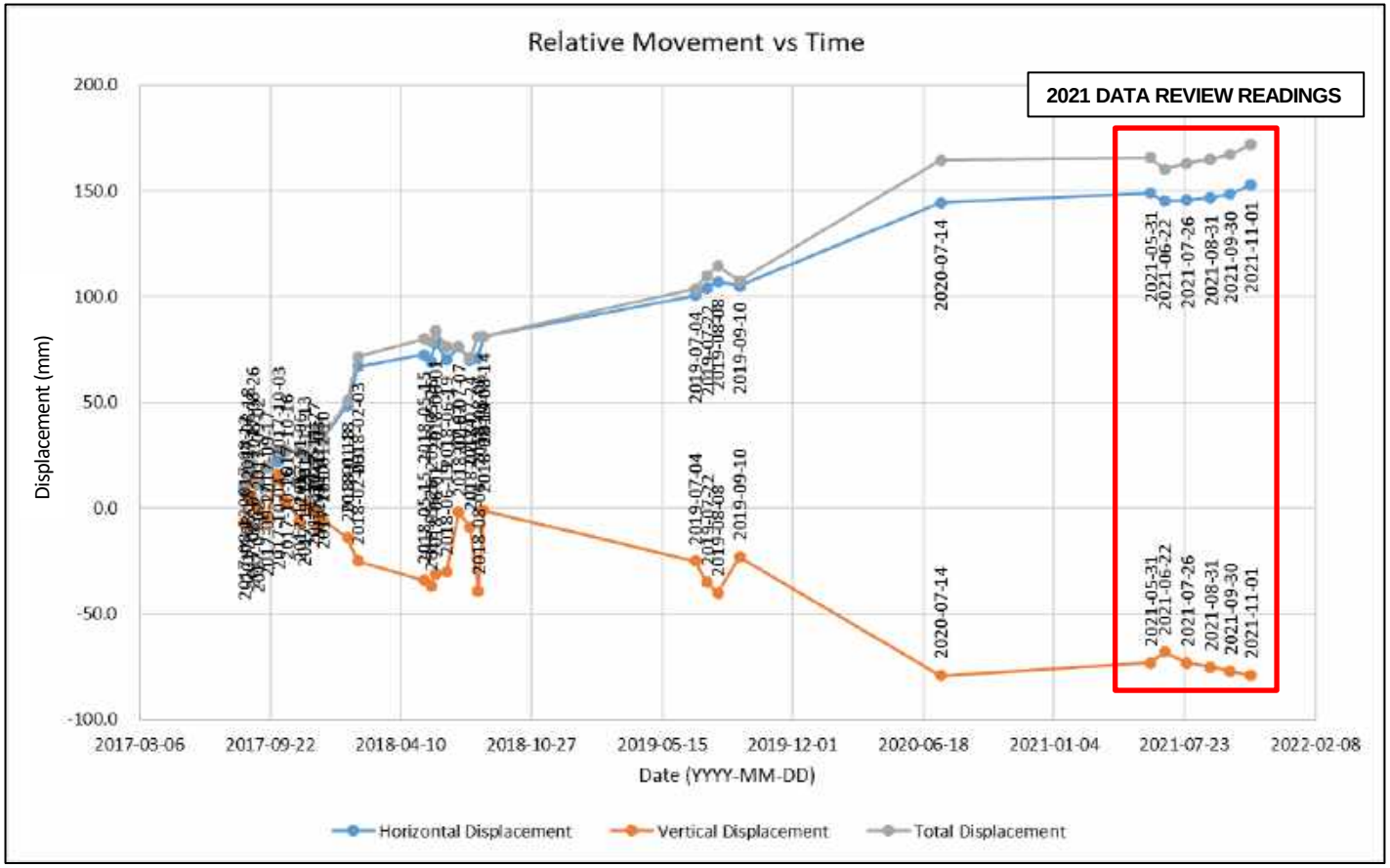
TITLE
NORTHWEST PAG DUMP
PRISM 106

PROJECT NO.	PHASE	REV.	FIGURE
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REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
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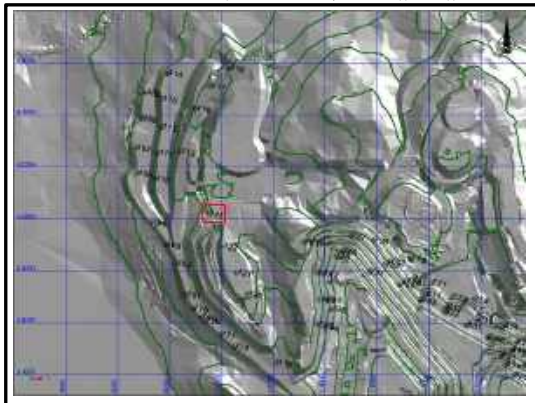
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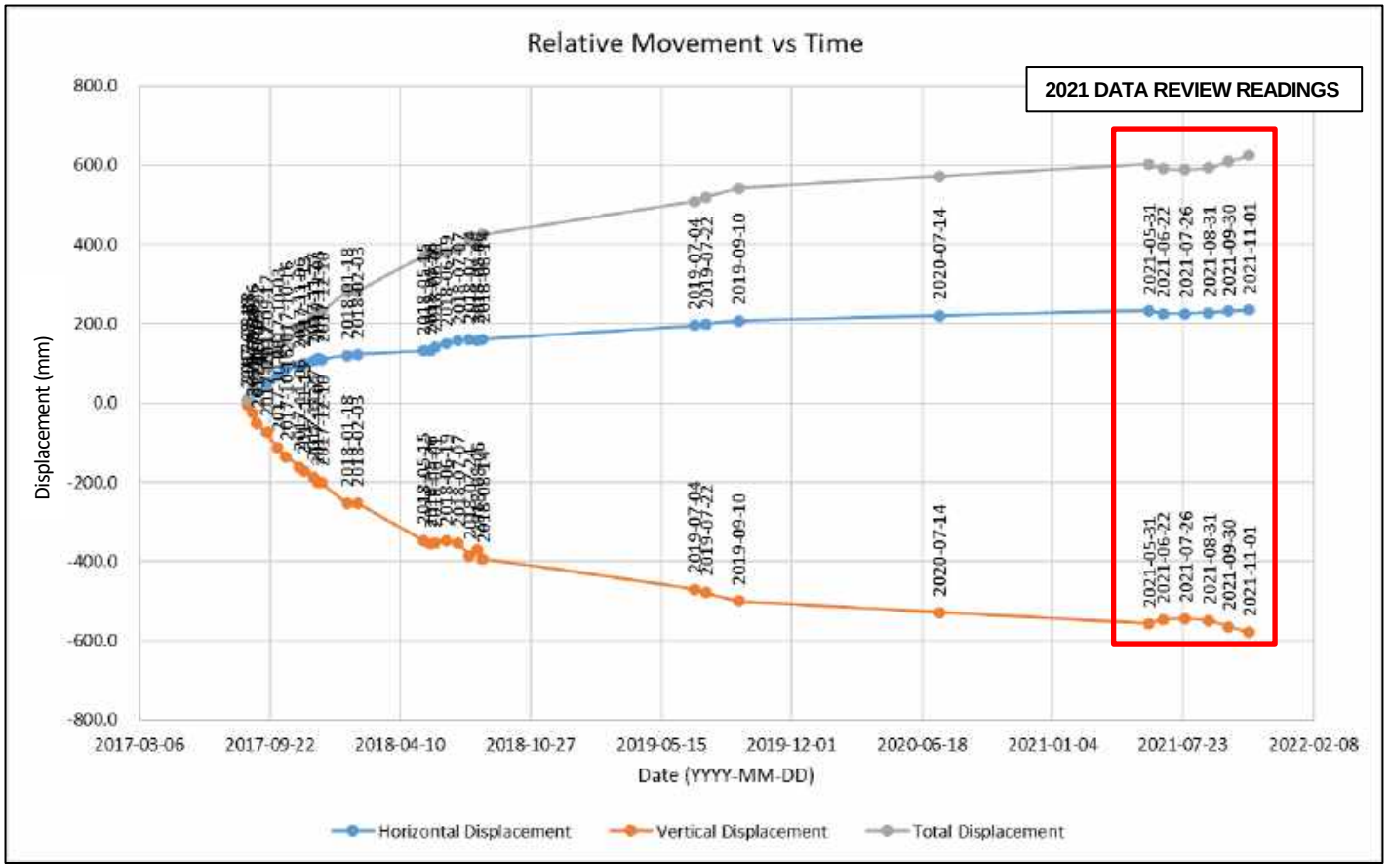
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 100

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-30**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

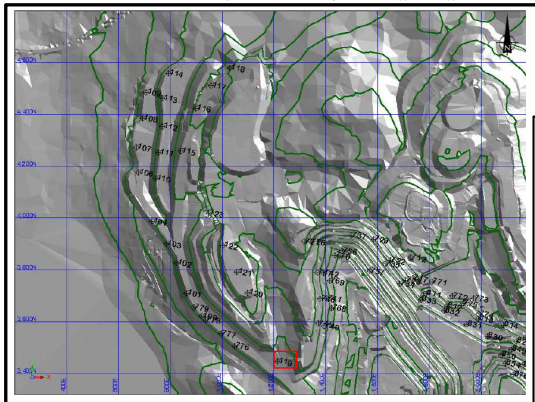
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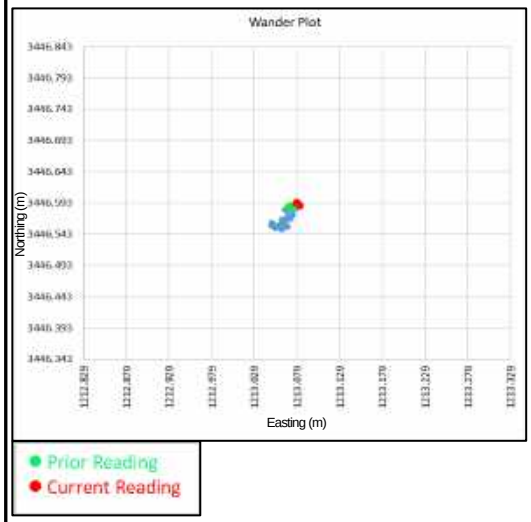
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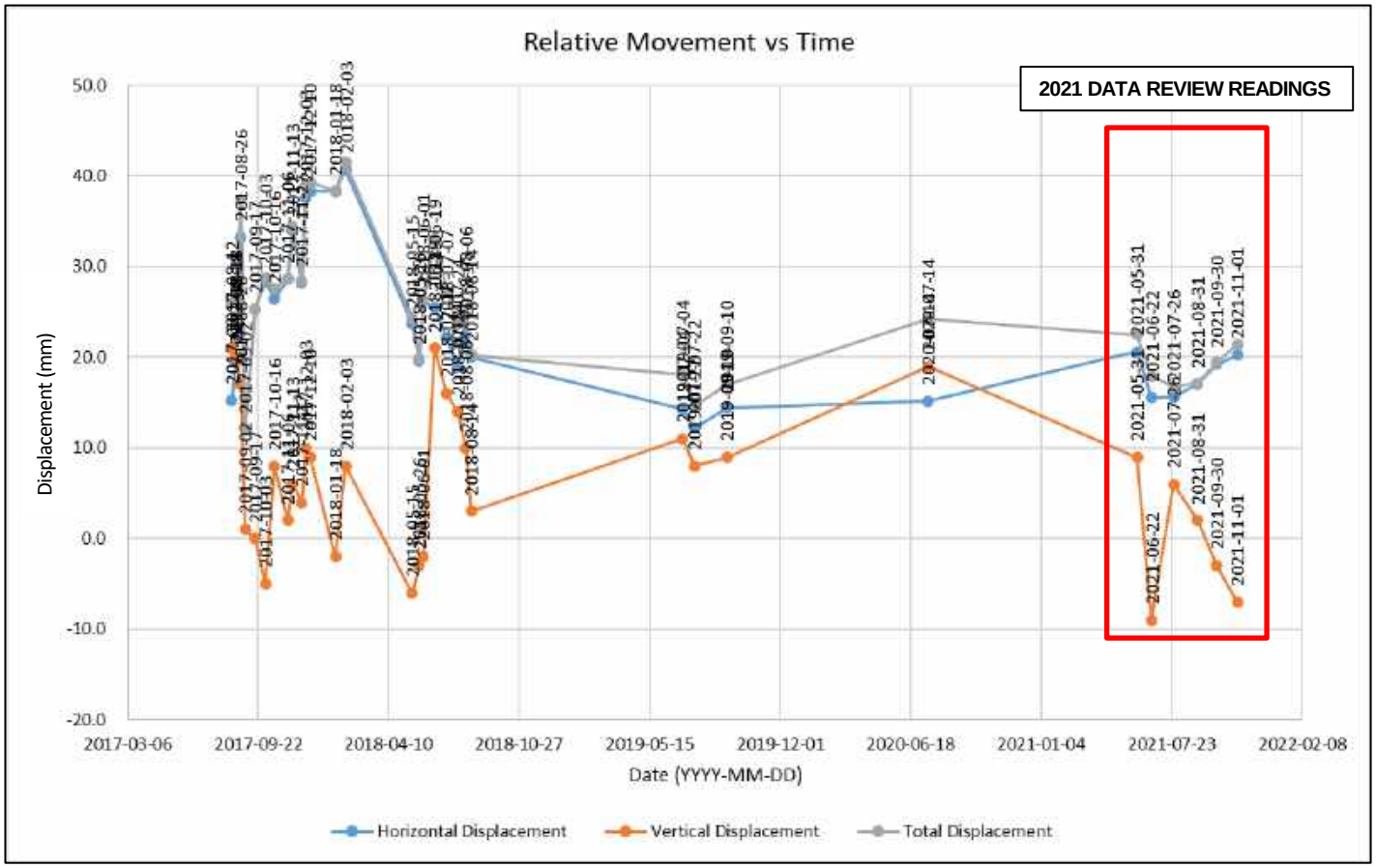
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 123

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-31**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

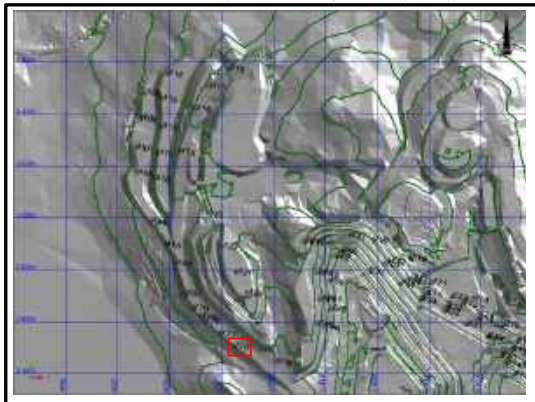
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GOLDER
MEMBER OF WSP

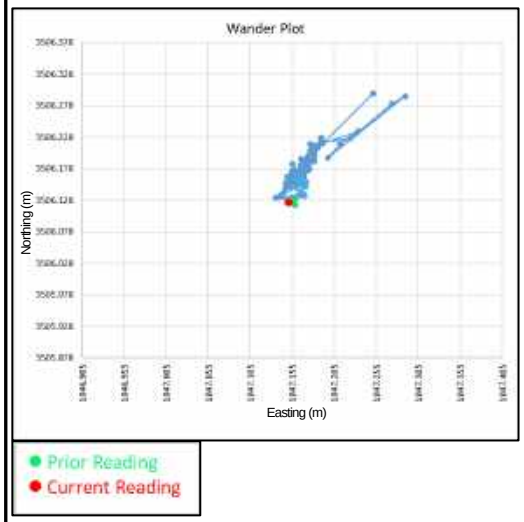
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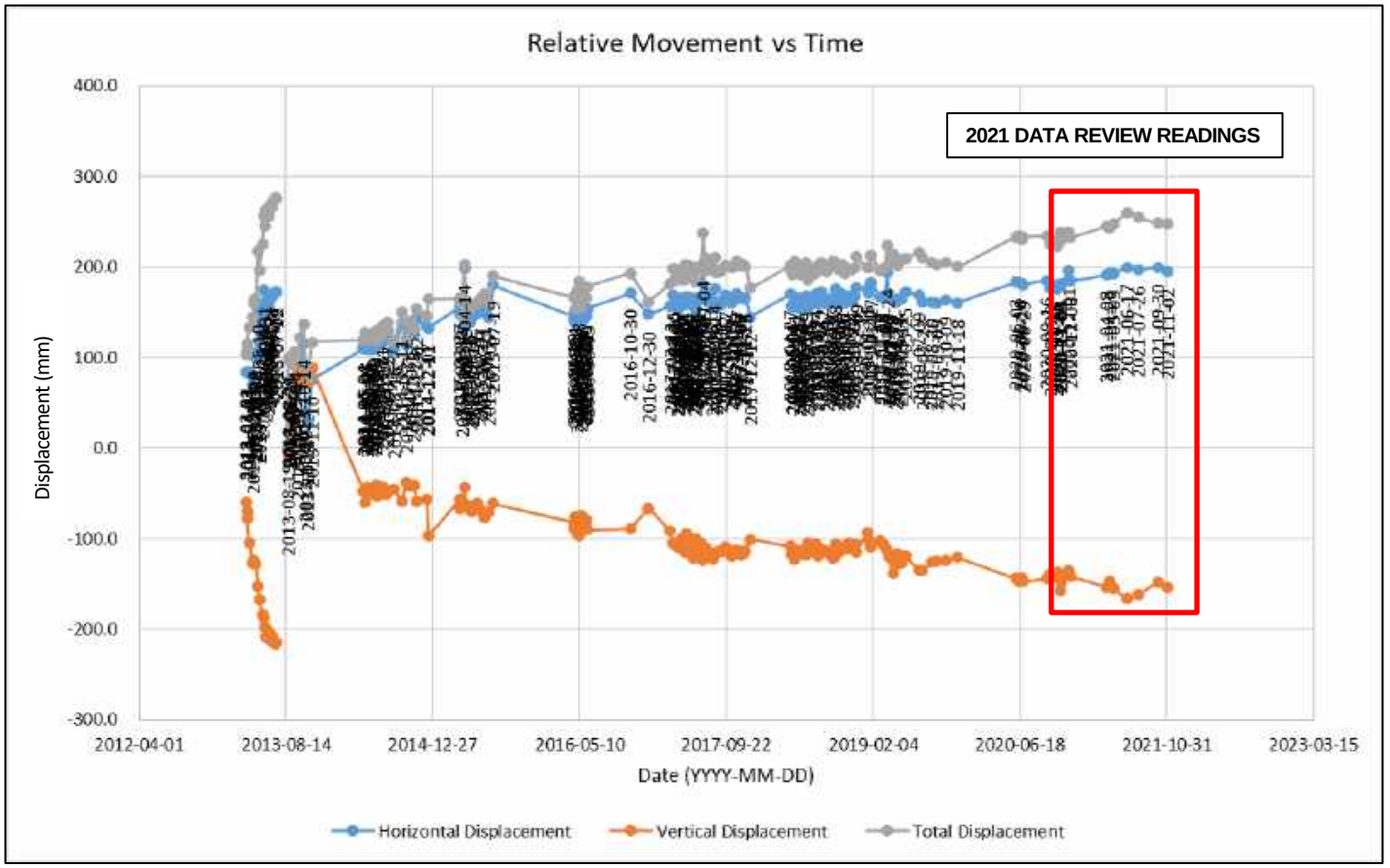
PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 119

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-32**







REFERENCES AND NOTES

1. PRISM LOCATIONS PROVIDED BY MPMC, 26 OCTOBER 2020.

CLIENT
MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION
LIKELY, BC

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-11-23
PREPARED	MVK
DESIGNED	AGH
REVIEWED	AGH
APPROVED	JKH

PROJECT
MOUNT POLLEY MINE
2021 ANNUAL PIT SLOPE AND WASTE DUMP STABILITY REVIEW

TITLE
NORTHWEST PAG DUMP
PRISM 776

PROJECT NO.	PHASE	REV.	FIGURE
21452039	**73100**	**0**	**B-33**



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Appendix T
2016 GW Wight Pit Predictions

TECHNICAL MEMORANDUM

DATE September 11, 2015 **PROJECT No.** 1411734-070-TM-Rev0-15000

TO Katie McMahen, P.Ag.
Mount Polley Mining Corporation

FROM Willy Zawadzki
Don Chorley

EMAIL wzawadzki@golder.com

PRELIMINARY PREDICTIONS OF GROUNDWATER SEEPAGE FOR THE WIGHT OPEN PIT AT CLOSURE – MOUNT POLLEY MINE

1.0 INTRODUCTION

This technical memorandum presents preliminary predictions of groundwater seepage for the Wight Pit Lake at closure at the Mount Polley Mine that is operated by the Mount Polley Mining Corporation (MPMC). These predictions were made in support of the Reclamation and Closure Plan that is currently being prepared for the site. This Plan assumes that the Wight Pit will be allowed to flood to a spillover elevation of approximately 926 m.

This memorandum documents preliminary predictions of groundwater seepage from the Wight Pit Lake at closure. It is understood that the Wight Pit Lake hydrology, quality of pit lake water and resulting seepage quality is assessed by the concurrent studies conducted by MPMC and Golder.

2.0 BACKGROUND

Surface mining of the Wight Pit occurred between 1999 and 2009. The pit floor reached an elevation of approximately 804 m; however, since the mining stopped the pit has been partially filled with waste rock with the pit bottom presently at an elevation of approximately 875 m in the northwest and approximately 912 m in the southeast, as presented on Figure 1. In the northwest, the pit crest is located at a distance of approximately 200 m from the Polley Lake shore and in the southeast this distance is about 80 m. At both locations the pit bottom is below the average level of Polley Lake of approximately 920 m.

Similar to the nearby Springer Pit, the majority of the Wight Pit walls were excavated in monzonite bedrock that was intruded by hydrothermal breccias. Three northwest-southeast striking faults intersect the pit, and these faults have been intruded by thick and presently weathered mafic dykes. In 2014, groundwater seepage was observed in the southeast corner of the pit along the east-west striking dyke that is exposed in the pit wall (Golder, 2014a).

The southeast corner of the pit also intersected a relatively thick sequence of overburden deposits of glacio-lacustrine and glacio-fluvial origin. In 2004, Golder conducted hydrogeological investigations in these deposits that included installation and testing of two pumping wells (Golder, 2004) and in 2005 Golder assisted in the installation and testing of two dewatering wells that became part of pit wall dewatering/depressurization system (Golder, 2005). The location of these wells is presented in Attachment 1. Interpretation of hydrogeological data collected during these investigations suggested that the overburden southeast from the pit is highly variable, ranging in texture from silt/clay to sand/gravel, with coarser sediments present at depth and directly overlying bedrock.

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MPMC provided information on the historical dewatering rates for the Wight Pit. In 2008, when the majority of the pit was mined out, MPMC estimated groundwater inflow to this pit to range between 950 m^3/day (175 USgpm) in winter and 1600 m^3/day (300 USgpm) during spring/summer. MPMC also indicated that in 2008 only one overburden dewatering well was operational; however, the dewatering records for this well are not available. In 2014, MPMC estimated that, during summer months, the groundwater inflow to the Wight Pit was approximately 1300 m^3/day (240 USgpm), and indicated that the dewatering wells were not active at this time.

3.0 PRELIMINARY ESTIMATES OF SEEPAGE AT CLOSURE

At present the hydrogeological data from the area of the Wight Pit is not sufficient for the development of a detailed hydrogeological model that could be used to estimate seepage near this pit during closure. Most importantly, current hydraulic head data from the overburden sediments and bedrock surrounding the dewatered pit are not available. However, the available information was considered sufficient for providing preliminary estimates of this seepage based primarily on the historical groundwater inflows to this pit and information from the nearby Springer Pit. These preliminary estimates relied on a simplified analytical model of groundwater seepage near the Wight Pit that was based on the following assumptions:

- Seepage in bedrock near the Wight Pit can be represented using the Thiem equation that describes radial flow of groundwater towards a circular sink under steady-state conditions. The portion of this seepage originating from the topographic high west of the pit was based on the effective radius to the inferred groundwater divide of approximately 700 m and hydraulic head near this divide of 1080 m elevation. The portion of this seepage originating from the east (i.e. from Polley Lake) was based on the effective radius to Polley Lake of 325 m and the Polley Lake level of 920 m;
- Seepage in the overburden along the southeast wall of the Wight Pit can be represented using Darcy's Law. The cross-sectional area for this seepage was estimated to be approximately 2000 m^2 based on Golder (2006) interpretation, and the effective distance between the seepage face along the pit wall and Polley Lake was assumed to be 80 m;
- Estimates of groundwater seepage to the Wight Pit in 2008 and 2014 ranging between 950 m^3/day (175 USgpm) and 1600 m^3/day (300 USgpm) were assumed to consist of 50% of inflow from bedrock and 50% inflow from the overburden, under the assumption that in 2008 only one dewatering well was operational (as indicated by MPMC) and that in 2014 the dewatering system was off. For the base case estimates of groundwater seepage, inflow to the dewatered pit originating from bedrock alone was thus assumed to be equal to 650 m^3/day (120 USgpm) or 50% of average inflow estimated in 2008 and 2014;
- Groundwater seepage from the overburden to the Wight Pit under dewatered conditions was assumed to be equivalent to the pumping rate of 1900 m^3/day (350 USgpm) that was utilized during testing of TW05-1 in 2005 (Golder, 2006).

The simplified analytical model was calibrated to the estimates of groundwater inflow during mining by adjusting hydraulic conductivity assigned to the overburden and bedrock. When these parameters for overburden and bedrock were set to 6×10^{-5} m/s and 2×10^{-7} m/s, respectively, the model calculated total inflow was 2,600 m^3/day (470 USgpm) and matched 700 m^3/day (120 USgpm) estimated to originate from bedrock and 1,900 m^3/day (350 USgpm) assumed to enter the pit from the overburden. The values of hydraulic conductivity adopted in the calibrated model are in good agreement with bulk hydraulic conductivity of bedrock estimated for the mine site (Golder, 2014b) and with results of overburden testing near the Wight Pit discussed in Golder (2004, 2006).

Following calibration, the simplified analytical model was used to predict groundwater seepage near the Wight Pit for the pit lake level ranging between 880 m (i.e. current pit bottom) to 926 m (i.e. spillover elevation). The results of these calculations are presented in Table 1. Groundwater inflow to the pit lake was predicted to gradually decrease as the pit lake level increases from approximately 2,600 m^3/day (470 USgpm) when the pit lake level is at 880 m elevation to about 600 m^3/day (100 USgpm) when the lake is at a spillover elevation of 926 m. Groundwater outflow from the pit lake was predicted to occur once the pit lake level is above the water level elevation of Polley Lake (i.e. approximately 920 m) and was calculated to reach approximately 500 m^3/day (90 USgpm) when the pit lake is at the spillover elevation. The majority of this outflow was calculated to occur via the overburden materials that are present in the southeast between the pit wall and Polley Lake.

Table 1: Predicted Groundwater Flows for Wight Pit Lake

Pit Lake Elevation (m)	Groundwater Flow (m^3/day)	
	Into the Lake	Out of the Lake
Base Case		
880	2600	0
900	2500	0
910	2100	0
920	800	0
926	600	500
Lower Reasonable Bound		
926	400	300
Upper Reasonable Bound		
926	700	800

Table 1 also presents a range of potential groundwater inflow and outflow from the Wight Pit Lake that could be expected considering the uncertainty in the understanding of hydrogeological conditions near the facility. This range was calculated by considering the estimated range of historical pit inflows and the results of testing conducted previously in the overburden. The analysis indicated that, for the pit lake level at spillover elevation, the groundwater inflow to the pit could range from 400 m^3/day to 700 m^3/day: whereas, the outflow from the pit towards Polley Lake could vary from 300 m^3/day to 800 m^3/day.

4.0 SUMMARY AND RECOMMENDATIONS

The simplified hydrogeological analysis that was carried out for the Wight Pit Lake indicates that groundwater inflow to this lake could range between approximately 2600 m^3/day (470 USgpm) when the pit lake level is at 880 m elevation and 600 m^3/day (110 USgpm) when the spillover elevation of 926 m is reached. Once the pit lake level is above the average water level in Polley Lake of 920 m, groundwater seepage from the pit lake towards Polley Lake would occur. When the Wight Pit Lake is at spillover elevation this outflow was calculated to be approximately 500 m^3/day (90 USgpm).

Due to limited hydrogeological data available for the Wight Pit, the above predictions should be considered only as preliminary estimates of actual groundwater fluxes that could occur at closure. At present there is lack of understanding of groundwater levels in the area surrounding the Wight Pit and the hydrogeological significance of faults intersecting the east pit wall. In the absence of this information more accurate predictions of these fluxes cannot be made. The following activities are recommended to address these data gaps so that the estimates of groundwater seepage could be refined:

- Borehole survey: During the 2004 and 2005 investigations, several boreholes and wells were completed between the crest of the Wight Pit and Polley Lake (Attachment 1). It is recommended that the condition of these boreholes be assessed for their suitability for hydraulic head monitoring and water quality sampling;
- Installation of monitoring wells: If the borehole survey finds that wells installed in 2004-2005 are no longer accessible and/or suitable for groundwater monitoring, two multi-level monitoring wells should be installed between the Wight Pit and Polley Lake. At each location the shallow piezometer should target the more permeable portion of the overburden and the deep piezometer should be completed in bedrock. One of the deeper installations should target the fault/dike structure that is present in the southeast corner of the pit;
- Seepage survey: A seepage survey, focusing on major structure identified along the pit walls, should be conducted. If practicable, quantitative measurements of groundwater seepage from the fault/dyke structure in the southeast corner of the pit (and other visible seepage) should be made to facilitate estimates of hydrogeological properties of this feature;
- Groundwater monitoring: Monitoring wells near the Wight Pit should be included in the groundwater monitoring program for the site. Hydraulic heads at these installations should be measured at least weekly and groundwater quality should be assessed on a quarterly basis. After one year of monitoring, the groundwater quality data should be assessed for seasonal variability and the monitoring frequency should be adjusted appropriately;
- The existing hydrogeological model should be expanded to include the Wight Pit and its calibration should be updated to include new data sources described above. The expanded model should be used to refine the predictions of groundwater seepage that could occur at closure.

5.0 CLOSURE

We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate contact the undersigned at 604-296-4200.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED AND SEALED

Willy Zawadzki, P.Geo.
Principal, Senior Hydrogeologist

ORIGINAL SIGNED

Don Chorley, P.Geo.
Principal, Senior Hydrogeologist

WZ/DWC/ch

Attachments: Figure 1: Site Plan
Attachment 1: Location of Pumping Wells Completed in the Overburden
Attachment 2: Study Limitations

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6.0 REFERENCES

Golder Associates Ltd. 2004. *Report on Hydrogeological Investigation – Proposed Wishbone Open Pit – Mt. Polley Mining Corporation, Likely, B.C*. submitted to MPMC on October 18, 2004.

Golder Associates Ltd. 2006. *Preliminary Review of 2005 Hydrogeological Program – Dewatering Wells DW-2 and DW-3, Wight Pit, Mount Polley Mine Site*. submitted to MPMC on January 24, 2006.

Golder Associates Ltd. 2014a. *Review of Boundary Zone Underground Mine Blasting Effects on Wight Pit Slope Stability.* submitted to MPMC on January 7, 2014.

Golder Associates Ltd. 2014b. *Updated Predictions of Pit Lake Formation for the Springer Open Pit – Mount Polley Mine*. submitted to Mount Polley Mining Corporation on December 16, 2014.

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CLIENT
MOUNT POLLEY MINING CORPORATION
LIKELY, BC

PROJECT
PRELIMINARY PREDICTIONS OF GROUNDWATER SEEPAGE FOR THE WIGHT OPEN PIT AT CLOSURE

CONSULTANT
Golder Associates

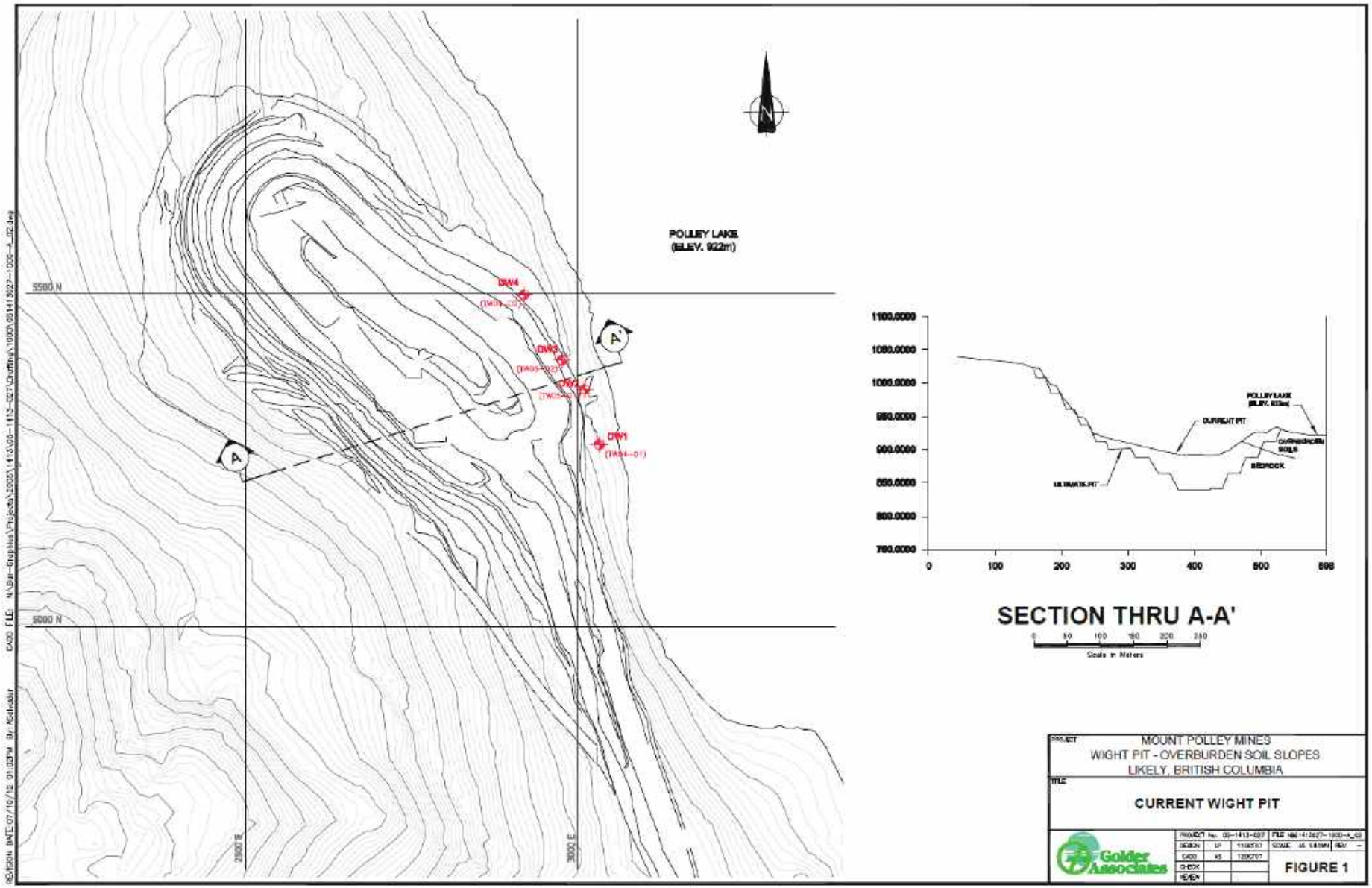
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PREPARED	WZ
DESIGN	WZ
REVIEW	DWC
APPROVED	DWC

TITLE
SITE PLAN

PROJECT No. **1411734** **15000** Rev. **0** **1**

ATTACHMENT 1

LOCATION OF PUMPING WELLS COMPLETED IN THE OVERBURDEN



Note: This figure is reproduced from Golder letter report to MPMC dated October 31, 2007.

ATTACHMENT 2
STUDY LIMITATIONS

Study Limitations

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The professional groundwater modelling services performed as described in this document were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the quantity and quality of available data, the time limits and financial and physical constraints applicable to the services. Unless otherwise specified, the results of previous or simultaneous work provided by sources other than Golder and quoted and/or used herein are considered as having been obtained according to recognised and accepted professional rules and practices, and therefore deemed valid. This model provides a predictive scientific tool to evaluate the impacts on a real groundwater system of specified hydrological stresses and/or to compare various scenarios in a decision-making process. However and despite the professional care taken during the construction of the model and in conducting the simulations, its accuracy is bound to the normal uncertainty associated to groundwater modelling and no warranty, expressed or implied, is made.

Appendix U
2016 Boundary Pit Seepage

TECHNICAL MEMORANDUM

DATE 17 October 2016 **REFERENCE No.** 1411734-152-TM-Rev0-16000

TO Dale Reimer, General Manager
Mount Polley Mining Corporation

FROM Willy Zawadzki and Don Chorley **EMAIL** Willy_Zawadzki@golder.com; Don_Chorley@golder.com

PRELIMINARY PREDICTIONS OF GROUNDWATER SEEPAGE FOR THE BOUNDARY PIT – MOUNT POLLEY MINE

1.0 INTRODUCTION

This technical memorandum presents preliminary predictions of groundwater seepage for the Boundary Pit Lake at closure at the Mount Polley Mine, which is operated by the Mount Polley Mining Corporation (MPMC). These predictions were made in support of water balance studies for the site. It is understood that the Boundary Pit hydrology and resulting seepage quality is assessed by the concurrent studies conducted by MPMC and Golder Associates Ltd.

2.0 BACKGROUND

Surface mining of the Boundary Pit started in 2008. The pit floor reached an elevation of approximately 1,068 m, or about 14 m below the original ground surface at the northwest pit crest. Similar to the adjacent Wight Pit, most of mining at the Boundary Pit occurred in monzonite bedrock that was intruded by hydrothermal breccias and intersected by northeast striking faults.

At present, hydrogeological data specific to the Boundary Pit are not available. However, MPMC indicated that during mining seepage was not observed along the pit walls. This lack of seepage is considered reasonable due to the relatively shallow depth of this pit and depth to water table measured at monitoring wells that were installed near other mine facilities. It is thus considered likely that the water table was located near or below the floor of the Boundary Pit before mining at this location commenced.

Although seepage to the Boundary Pit from the surrounding rock mass is not expected, seepage out of this pit could occur due to water entering the pit via surface water run-off and direct precipitation. An estimate of these potential seepage rates out of the pit was made to provide input to the pit water balance and to characterize a potential seepage pathway originating from the Boundary Pit.

3.0 PRELIMINARY ESTIMATES OF SEEPAGE

The preliminary estimates of seepage from the Boundary Pit were based on the following assumptions:

- The pit bottom is located at an elevation of 1,068 m, or approximately 14 m below the ground surface at the northeast pit crest, and approximately 5 m below the lowest point along the pit crest (towards northeast). It is likely that the pit bottom does not extend to a significant depth below the water table.

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- If the Boundary Pit is flooded, seepage from this pit would be directed northeast towards the Wight Pit and discharge to that pit. This could occur not only during operation, when the Wight Pit is dewatered, but also during closure due to water table depression that would develop southwest of the Wight Pit after it is flooded to an elevation of 926 m (Golder 2015).
- Seepage from the Boundary Pit would occur via the upper bedrock zone, as incorporated in the groundwater model for the Springer and Cariboo pits (Golder 2014). This zone is assumed to extend 40 m below the surface with a bulk hydraulic conductivity of 1×10^{-6} m/s (lower bound of 6×10^{-7} m/s, upper bound of 3×10^{-6} m/s). Due to a decrease in permeability with depth, potential seepage via deeper bedrock is assumed to be negligible.
- Seepage would occur under an average hydraulic gradient of 0.1 m/m, which corresponds to the approximate slope in ground surface between the crest of the Boundary Pit and the crest of the Wight Pit.
- The maximum depth of flooding could be approximately 5 m, considering pit wall height northeast from the pit bottom (approximately 1,073 m elevation).

Based on the above assumption and a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded, the seepage rate from the Boundary Pit when the pit lake level is 5 m above its base is estimated at approximately 60 m^3/d, and could range between 40 m^3/d and 180 m^3/d due to uncertainty in bedrock permeability. Seepage is estimated to decrease as the height of water column above the pit bottom decreases (Table 1).

Table 1: Predicted Seepage Quantities from the Boundary Pit

Water Level above Boundary Pit Bottom (m)	Estimated Groundwater Seepage (m^3/d)		
	Lower Bound	Base Case	Upper Bound
0	2	3	10
1	6	10	29
2	12	20	61
3	16	26	79
4	32	53	159
5	35	59	177

4.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please do not hesitate contact the undersigned at 604-296-4200.

GOLDER ASSOCIATES LTD.

ORIGINAL SIGNED AND SEALED

Willy Zawadzki, PGeo
Principal, Senior Hydrogeologist

ORIGINAL SIGNED

Don Chorley, PGeo
Principal, Senior Hydrogeologist

WZ/DWC/pn/it/kp

Attachment: Study Limitations

o:\final\2014\1421\1411734\1411734-152-tm-rev0-16000\1411734-152-tm-rev0-16000-boundry pit - seepage 17oct_16.docx

REFERENCES

Golder (Golder Associates Ltd.). 2014. Updated Predictions of Pit Lake Formation for the Springer Open Pit – Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Golder Doc. No. 1411734-002-TM-Rev0. 16 December 2014.

Golder. 2015. Preliminary Predictions of Groundwater Seepage for the Wight Open Pit at Closure – Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Golder Doc. No. 1411734-070-TM-Rev0. 11 September 2015.

STUDY LIMITATIONS

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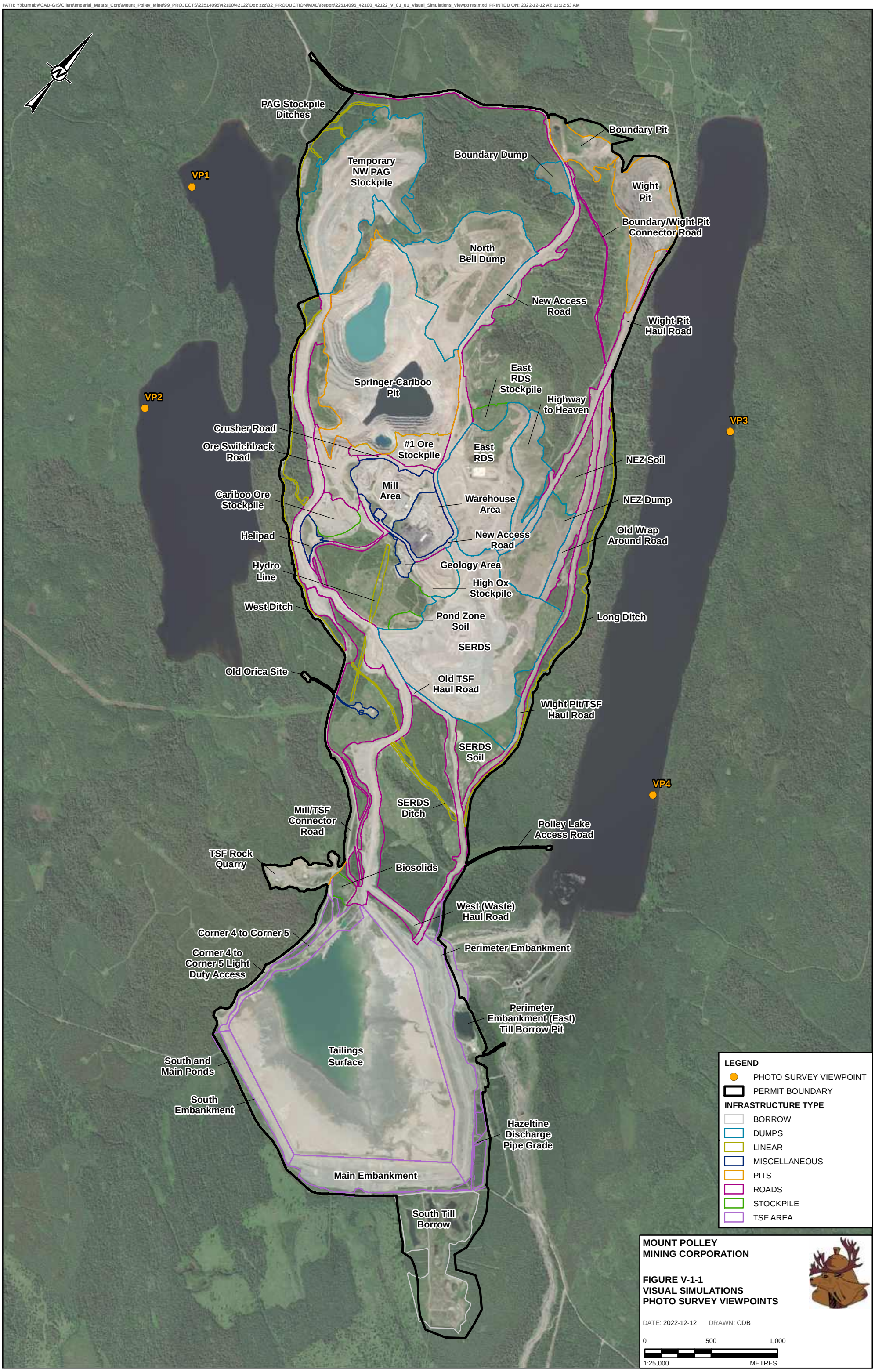
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The professional groundwater modelling services performed as described in this document were conducted in a manner consistent with that level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the quantity and quality of available data, the time limits and financial and physical constraints applicable to the services. Unless otherwise specified, the results of previous or simultaneous work provided by sources other than Golder and quoted and/or used herein are considered as having been obtained according to recognised and accepted professional rules and practices, and therefore deemed valid. This model provides a predictive scientific tool to evaluate the impacts on a real groundwater system of specified hydrological stresses and/or to compare various scenarios in a decision-making process. However and despite the professional care taken during the construction of the model and in conducting the simulations, its accuracy is bound to the normal uncertainty associated to groundwater modelling and no warranty, expressed or implied, is made.

Appendix V
2022 Visual Simulations

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VP1 - EXISTING - CURRENT VIEW FROM BOOTJACK LAKE, NEAR THE EXISTING RECREATION AREA



VP1 - CLOSURE - FUTURE VIEW FROM BOOTJACK LAKE, NEAR THE EXISTING RECREATION AREA



MOUNT POLLEY
MINING CORPORATION

FIGURE V-2-1
VISUAL SIMULATIONS - VP1

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FIGURE V-2-2
VISUAL SIMULATIONS - VP2

DATE: 2022-12-21 DRAWN: CDB

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FIGURE V-2-3
VISUAL SIMULATIONS - VP3

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VP4 - EXISTING - CURRENT VIEW FROM POLLEY LAKE, NEAR THE EXISTING BOAT LAUNCH



VP4 - CLOSURE - FUTURE VIEW FROM POLLEY LAKE, NEAR THE EXISTING BOAT LAUNCH



MOUNT POLLEY
MINING CORPORATION

FIGURE V-2-4
VISUAL SIMULATIONS - VP4

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Appendix W
2021 OMS Manual



MOUNT POLLEY MINING CORPORATION

MOUNT POLLEY MINE

TAILINGS STORAGE FACILITY

OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL

MATT O'LEARY
WATER AND TSF SUPERINTENDENT

KELLY PARKER
GENERAL MANAGER

UPDATE CONTROL

Rev. No.	Revision	Date	Approved
0	Annual Revision	December 22, 2004	RM
1	Annual Revision	February 06, 2006	RM
2	Issued in Draft	March 31, 2006	RM
3	Issued in Draft	August 28, 2006	RM
4	Annual Revision	October 06, 2006	RM
5	Annual Revision	November 28, 2007	RM
6	Annual Revision	July 01, 2008	RM
7	Annual Revision	December 31, 2009	RM
8	Annual Revision	March 30, 2010	RM
9	Issued in Draft	January 01, 2012	LM
10	Annual Revision	July 01, 2012	LM
11	Annual Revision	July 01, 2013	LM
12	Revision for 2015 Freshet Embankment	March 27, 2015	LM/TE
13	Revision for Water Monitoring Update	May 20, 2015	LM/KM
14	Revision for Springer Pit Tailings Deposition	August 5, 2015	LM
15	Revision for Short-Term Effluent Discharge	December 15, 2015	LM
16	Revision for Water Management System Review	May 20, 2016	LM
17	Full Annual Update to Accommodate Return to Full Operations and TSF Discharge	December 15, 2016	SF
18	Annual Update	December 25, 2017	SF
19	Annual Update	December 31, 2019	MO
20	Revision - halt of mill operations and continued Springer Pit dredging and deposition in the TSF	August 31, 2019	MO
21	Annual Update	April 15, 2020	MO
22	Annual Update	January 30, 2021	MO
23	Annual Update - Operations	Aug 27, 2021	MO
24	Annual Update – Changes not finalized	Aug 13, 2022	MO
25	Annual Update – Incorporate suggestions from DSR. Tigger response updated to meet new regualtions	Aug 12, 2023	MO

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2. SI OPERATION MANUAL
3. IPI MANUAL
4. PIEZOMETER OPERATION MANUAL
5. SAA OPERATION MANUAL
6. TSF FIELD INSPECTION REPORT

APPENDIX D: DEPOSITION PLAN

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APPENDIX I: QUANTITATIVE PERFORMANCE OBJECTIVES

DEFINITIONS

°C	degree(s) Celsius
AMEC	AMEC Foster Wheeler (Previously AMEC Environment & Infrastructure)
CCS	Central Collection Sump
CEMP	Comprehensive Environmental Monitoring Plan
CEO	Chief Executive Officer
cm	centimetre(s)
COI	communities of interest
COO	Chief Operating Officer
DSR	Dam Safety Review
EMA	*Environmental Management Act*
EMLI	Engery, Mines and Low Carbon Inovation
EoR	Engineer of Record
EPRP	Emergency Preparedness and Response Plan
ERP	Emergency Response Plan
GLU	glaciolacustrine unit(s)
Golder	Golder Associates Ltd.
HDPE	high density polyethylene
IERP	Independent Engineering Review Panel
Imperial	Imperial Metals Corporation
km	kilometre(s)
KP	Knight Piésold Ltd.
m	metre(s)
m/s	metres/second
MAC	Mining Association of Canada
MESCP	Main Embankment Seepage Collection Pond
HSRC	Health, Safety and Reclamation Code for Mines in British Columbia
mm	millimetre(s)
BC-ENV	British Columbia Ministry of Environment
MPIC	Mount Polley Intrusive Complex
MPMC	Mount Polley Mining Corporation
NAG	non-acid-generating
OMS	Operation, Maintenance and Surveillance
PAG	potentially-acid-generating
PETBP	Perimeter Embankment Till Borrow Pond
QA/QC	quality assurance/quality control
QPO	Quantative Performance Objective
RDS	rock disposal site
SAA	Shape Acceleration Array
SERDS	Southeast Rock Disposal Site
SESCP	South Embankment Seepage Collection Pond
SEZ	Southeast Zone
t	tonne(s)
tpd	tonnes per day
TSF	Tailings Storage Facility
WTP	Water Treatment Plant

TAILINGS STORAGE FACILITY

OPERATION, MAINTENANCE AND SURVEILLANCE MANUAL

1.0 OBJECTIVE

This Operation, Maintenance and Surveillance Manual (OMS) is intended to fully describe and outline the personnel, infrastructure, and procedures for the Tailings Storage Facility (TSF) and related water management structures at the Mount Polley Mine.

Within this Manual are:

- Descriptions of the roles and responsibilities of the various personnel involved with the TSF and water management at Mount Polley, including their identities and contact information.
- Site Description, both the natural geography/geology and the mine infrastructure and access.
- Description of the TSF and water management infrastructure and their design.
- Operations procedures for all elements of the TSF and water management, including design and operating limitations and Quantitative Performance Objectives (QPOs).
- Maintenance procedures for the TSF and water management infrastructure.
- Surveillance activities for the TSF and water management infrastructure and systems.
- Record keeping and document control processes.
- Emergency procedures for tailings and water management.
- Incident Reporting

The main body of text is intended to form the background of the information and systems in place, with much of the detailed information contained within the appendices for ease of understanding and accessibility. In practical terms, not all information can be contained within a single source document such as this Manual. Certain, more detailed documents will be outlined and referenced by this Manual.

2.0 ROLES AND RESPONSIBILITIES

Personnel involved in the safe operation, maintenance, surveillance and supervision of the TSF and water management infrastructure are not limited to those employed by Mount Polley Mining Corporation (MPMC). According to the Health, Safety and Reclamation Code for Mines in British Columbia (*Mines Act*), the Mine Manager (General Manager [GM] in MPMC organization) shall be responsible for ensuring that the *Mines Act* is followed with respect to all aspects of the performance and management of tailings and water management structures.

Corporate responsibility for tailings management falls to the Chief Operating Officer (COO) of Imperial Metals Corporation. The COO is required to put in place the appropriate management structure and provide assurance to all parties concerned with the operation of MPMC tailings and water management facilities through proper stewardship. In addition to the MPMC employees interacting with the facilities on a first-hand basis, there is an extensive group of design professionals and regulatory representatives involved in the successful implementation of this Manual. The following text will outline the key personnel and a short description of their Roles & Responsibilities.

A full list of personnel and their roles and responsibilities can be found in Table 2-1. The reporting and communications structure can be found in

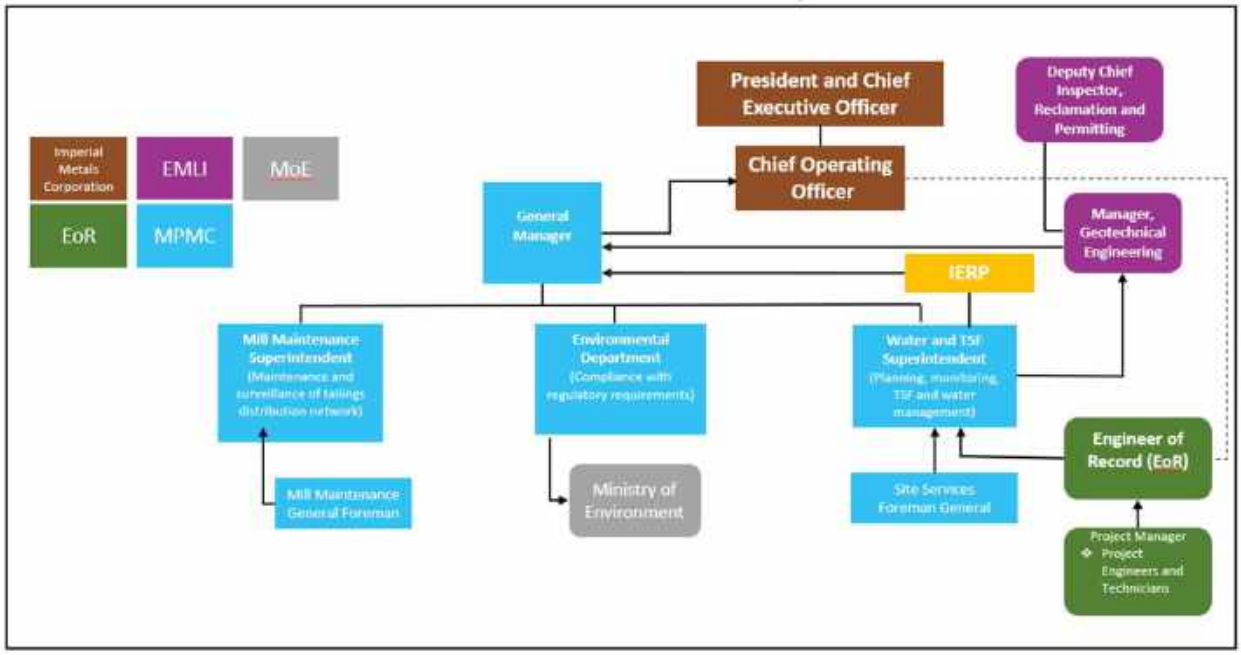


Figure 2.1.

Table 2-1 Key OMS Personnel Contact Information and Responsibilities

Title	Name	Contact Information				Responsibilities
General Manager	Kelly Parker	Home:		Cell:	250-423-8537	Responsible for the overall activities of the Mount Polley Mine, inclusive of the TSF.
		Office:	(236) 800-4771	Radio:	Channel 5	
		E-mail:	Kelly.Parker@mountpolley.com			
Water and TSF Superintendent	Matt O'Leary	Home:		Cell:	(250) 274-0658	Responsible for the planning, coordination and daily management of TSF monitoring and water management activities. Coordinates activities of the EoR, and plans for and submits required permit amendments. Responsible for updating the EPRP. Responsible for Environmental Permitting and Compliance
		Office:	(236) 317-4938	Radio:	Channel 5	
		E-mail:	Mathieu.o'leary@mountpolley.com			
Mine Operations Superintendent	Joe Grant	Home:	(250) 296-4447	Cell:	(250) 644-0975	Responsible for daily site services tasks including water infrastructor operation. Supervision of TSF construction crew
		Office:	(250) 790-2215 ext. 2108	Radio:	Channel 5	
		E-mail:	Joe.grant@MountPolley.com			
Environmental Superintendent	Designate: Matt O'Leary	Home:		Cell:	(250) 274-0658	Responible for Environmental permitting and complaince
		Office:	(236) 317-4938	Radio:	Channel 5	
		E-mail:	Mathieu.o'leary@mountpolley.com			
Mill Superintendent	Al Trottier	Home:		Cell:	(250) 267-4801	Responsible for the operation of the Mill facilities and coordination of the Mill Operations Department.
		Office:	(236) 362-1153	Radio:	Channel 2	
		E-mail:	Al.Trottier@MountPolley.com			
Corporate – President and CEO	Brian Kynoch	Home:		Cell:	(778) 836-7441	Responsible for providing appropriate resources to maintain conformance with regulatory requirements and applicable guidelines. Responsible for reporting to the Board of Directors on tailings stewardship.
		Office:	(604) 669-8959	Radio:		
		E-mail:	Brian.kynoch@ImperialMetals.com			
Corporate – COO	Randall Thompson	Home:		Cell:	(778) 895-0916	Responsible for allocation of required personnel and financial resources to ensure tailings stewardship is in conformance with regulatory requirements and applicable guidelines.
		Office:	(604) 669.8959	Radio:		
		E-mail:	Don.parsons@ImperialMetals.com			
Golder - Senior Geotechnical Engineer EoR	Germán Pizarro	Home:		Cell:	(604) 787-2166	Engineer of Record of the Mount Polley TSF
		Office:	(604) 296-2897	Radio:		
		E-mail:	German_Pizarro@Golder.com			
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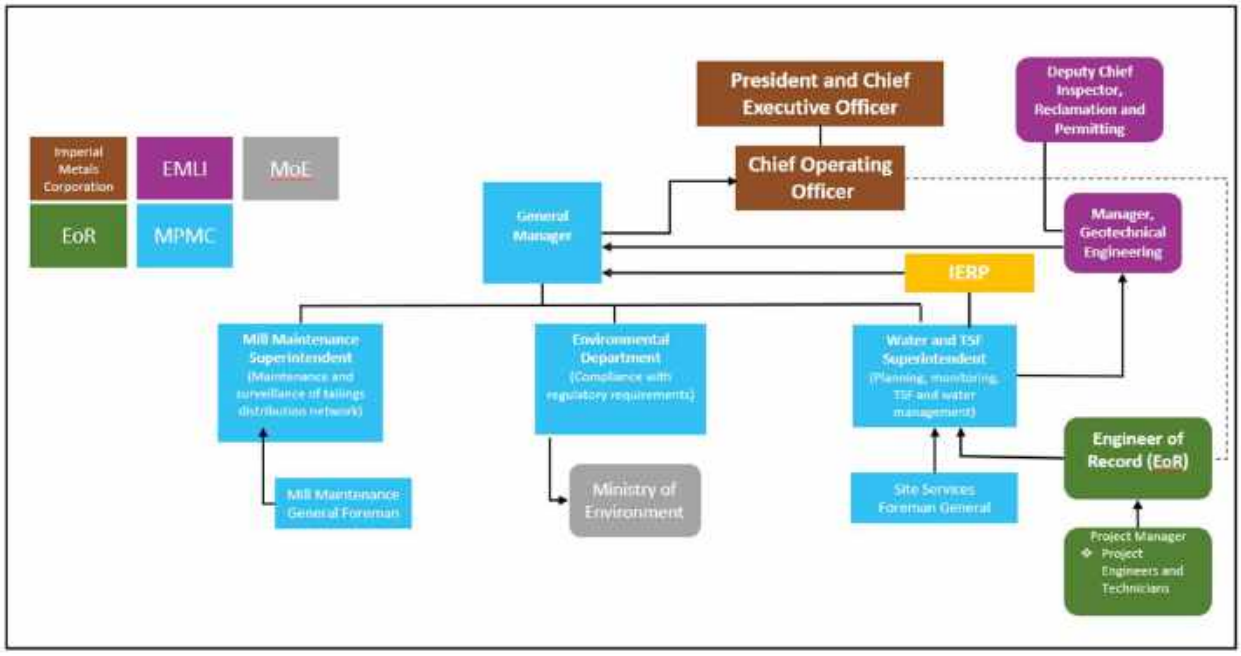


Figure 2.1 Organizational Structure

2.1 Imperial Metals Corporation

President and CEO:

- Ensures that MPMC is provided with all appropriate resources necessary to maintain conformance with all regulatory requirements and guidelines. Is also responsible for reporting to the Board of Directors regarding tailings stewardship.

Chief Operating Officer:

- Facilitates the proper allocation of personnel and financial resources in order to ensure tailings stewardship is in conformance with all regulatory requirements and guidelines. Reports to the President and CEO.

2.2 MPMC

Mine Manager (General Manager [GM]):

- Responsible for all activities occurring at the Mount Polley Mine site, inclusive of the TSF and all water management facilities, under the Mines Act. Reports to the COO.
    - Manager is ultimately responsible for the mine as per Act/Code
    - Designated under Section 21 of the Mines Act
    - Accountable for all aspects of the performance and management of Tailings and Water Retaining Structures.

- Responsible for compliance with regulatory requirements and relevant guidelines.
- Responsible to submit all compliance reports to the required regulatory agencies by the due dates.
- Defines site roles and responsibilities, authority and accountability.
- Allocates required human and financial resources.
- Reports Reportable Incidents including significant TSF or dam safety incidents to the Chief Inspector.

- In order to fulfill the Mines Act requirement of having a General Manager onsite every day, Water and TSF Superintendenta designate will be assigned when the GM is absent. The Water and TSF Superintendentdesignate will be responsible for communication directly with the General Manager and bringing them into the process as quickly as possible during an emergency or incident occurring.

Tailings Qualified Person Water and TSF Superintendent(Water and TSF Superintendent in MPMC organization):

> *"designate a TSF qualified person for safe management of the MPMC Tailings Storage Facility."*

- This includes, but is not limited to:
  - Develops and implements the tailings and water management plans for the TSFs under their supervision.
  - Coordinates the design, construction and overall management of tailings storage facilities on the site with the EoR as well as internal and external resources.
  - Develops succession plan for EoR.
  - Implements training programs for tailings and water management activities.
  - Implements the Operations, Maintenance and Surveillance Manual (OMS).
  - Provides QPOs for operational and maintenance activities for inclusion in the OMS. (Appendix I)
  - Reports to the General Manager regarding the status and performance of the Tailings Management System.

Site Services General Foreman/Supervisor

- Responsible for site maintenance activities including surveillance on dewatering/tailings pipelines as well as Water treatment plant operators and pump watch. Site Services General Foreman and Supervisor reports to Water and TSF Superintendent.

Mill Maintenance Superintendent / Mill Maintenance General Foreman

- Mill maintenance department, which deals with aspects of the operation and surveillance of the tailings distribution network to corner 5. Reports to the General Manager.

-

Environmental Department

- All activities involved in ensuring that MPMC activities remain compliant with all regulatory requirements as they pertain to the receiving environment. Reports to the General Manager or Designate.

2.3 WSP

Engineer of Record (EoR): Germán Pizarro, P. Eng

> *"The engineer of record, as a qualified professional, has professional responsibility for assuring that a tailings storage facility or dam has been designed and constructed in accordance with the applicable guidelines, standards and regulations"*

- Is employed by WSP, a consulting company capable of providing a variety of professional engineering services regarding TSF and water management operations and surveillance.
- EoR is referenced throughout this manual, referring both to the specific individual and the organization (WSP). All communication dictated by this manual shall include the specific individual serving as EoR (Germán Pizarro, P.Eng.).
    - Is a qualified and competent engineer with experience commensurate with the consequence classification and complexity of the facility.
    - The responsibilities of the EoR must be assigned to an individual and not a firm.
    - Hold the professional responsibility for the facility design, and is responsible for evaluating the adequacy of the as-built facility relative to the design as well as applicable standards, criteria, and guidelines.
    - Report on annual Dam Safety Inspections.
    - Participates in Dam Safety Reviews.
    - Participates in risk assessments.
    - Provides Quantitative Performance Objectives and monitoring frequencies required to ensure the facility is functioning as designed for inclusion in the OMS.
    - In the event of a change of the EoR, participates in implementing the succession plan, including understanding the risks and liabilities associated with such changes and employing appropriate change management procedures.

EoR's Representatives

WSP employees who provide support in all manner of TSF design, construction, operations, maintenance and surveillance. Operate under the responsibility and authority of the EoR.

2.4 Governing Bodies

Ministry of Energy, Mines and Low Carbon Innovation (EMLI)

- Serves as the primary regulatory body for the mining industry in BC. Provides inspection services and issues the necessary operating permits on behalf of the Province regarding TSF and water management activities. Receives and coordinates the review of all designs, construction, operations and surveillance reports submitted to them.

Ministry of Environment and Climate Change (BC-ENV)

- The provincial ministry responsible for issuing effluent management permits and setting environmental standards with respect to the mining activities that have the potential to affect the receiving environment around the mine site. Provides inspection and oversight services to ensure and enforce compliance.

2.5 Independent Engineering Review Panel (IERP)

- The IERP is currently comprised of three (3) qualified experts and shall meet at a minimum annually.The objectives of the IERP are to confirm that the design and operation of the TSF is consistent with industry standards of best practice, to identify areas where risk reduction measures may be required and to provide advice that may add value to the safe operation, closure and long-term maintenance of the TSF.
    - Made up of independent subject matter experts not currently involved in or responsible for the design, operation or construction of the facility.
    - Provides an independent assessment to senior mine management and regulators whether the tailings storage facility is designed, constructed and operated appropriately, safely and effectively.
    - Provides the site team with practical guidance, perspective, experiences and standard/best practices from other operations.
    - Reviews and comments on the planning and design process, monitoring programs, data analysis methodology and work performed by site team and/or contract consultants.
    - Provides non-binding advice and guidance, but does not direct the work or perform the role of the Engineer of Record.
    - Size and make-up of the ITRB based on complexity of the tailings system, in terms of risk, consequence and disciplines of substance.

- The IERP acts only to advise MPMC and has no actual decision-making capability or responsibilities other than those listed within the Terms of Reference document (Appendix G). The IERP submits all formal communication to the GM.

3.0 COMPETENCY AND TRAINING

At the corporate level, the COO is responsible for ensuring that all individuals described within this Manual have the appropriate level of training and experience to perform their roles effectively. This is accomplished through the site GM, who is responsible under the *Mines Act* for all activities that occur at the mine site, inclusive of the TSF and water management systems.

On site, it is the responsibility of the supervisory personnel involved in the operation, maintenance and surveillance of the TSF to train individuals falling under their respective management. Competency in the various roles is provided through existing orientation and training programs and is to be administered in correspondence with the procedures existing at MPMC. Review of the applicable portions of this Manual with individual workers is the responsibility of each supervisor to whom the worker reports.

Each training session must be documented, and a record kept within the TSF partition on the mine server. The records will contain a detailed list of site activities for which the trainee was trained and be signed by the person who provided/supervised the training. The primary example of this will be the distribution of and orientation to this Manual. All individuals involved in the procedures within this Manual shall be introduced to the appropriate sections and appendices of this Manual and provided access to the relevant source documents.

4.0 MANAGING CHANGE

Over time, the physical and regulatory environment is almost certainly going to change. The embankments and water control structures will continue to be developed and the application of ever-improving Best Practices will require updates to this Manual.

Changes to the design or operating plan for the TSF and related pipelines and structures must be reviewed, approved and documented by the Water and TSF Superintendent. TSF design changes will be conducted by the EoR as required for operational or regulatory changes and submitted to MPMC for review. Changes requiring authorization under the *Mines Act* shall be submitted to EMLI by MPMC. Operational changes will be reviewed and approved by the General Manager. In all cases, documentation of the change, including as-built records, are required.

At a minimum, this Manual will be fully reviewed, updated, and distributed once per year. This shall ensure that the procedures contained within shall follow Good Practices in tailings management, are up to date and apply to the most current conditions regarding the facilities and the regulatory environment. The Manual will also be updated to reflect minor changes such as to

personnel and operating conditions. Though this may not result in a full re-issue of the Manual, all affected personnel will be updated as required.

It is the responsibility of the Water and TSF Superintendent to keep this Manual up to date, ensure it is properly distributed and accessible, and that the proper training is conducted and documented.

5.0 FACILITY DESCRIPTION

The Mount Polley Mine, operated by MPMC (a wholly owned subsidiary of Imperial Metals Corporation), is an open pit/underground copper/gold mine that is permitted to process up to 8.2M tonnes per year of ore. The mine is located in central British Columbia, 8 km southwest of the town of Likely, and 56 km (100 km by road) northeast of Williams Lake. Access to and from the mine is via road by turning east off the Cariboo Highway (97) onto the Likely Road at 150 Mile House, BC and following it for approximately 75 km to the Bootjack Forest Service Road (FSR). The Bootjack FSR leads directly to the mine parking lot after 14 km. The physical location of the mine is at 52º 33' North by 121º 38' West. See Figure 5.1.

Ore concentrates from the mine are trucked to facilities at the Port of Vancouver and then shipped to overseas smelters or transported by rail to smelters in North America. MPMC was formed in 1996, and mining activities commenced in May, 1997.

The current mine site infrastructure consists of the Mill Site, Springer Pit as the active mining area, Wight Pit for temporary storage of mine contact water and two (2) rock disposal sites (RDSs): The Southeast Rock Disposal Site (SERDS); and the Temporary Northwest (NW) Potentially-Acid Generating (PAG) Stockpile, as well as the access roads, power lines, a tailings pipeline, drainage collection systems, and sediment/seepage control ponds. The Underground, Boundary Zone Pit, the Pond Zone Pit, the Southeast Zone (SEZ) Pit, the Bell Pit, the Cariboo are not active. Back-filling of the Bell Pit and Pond Zone Pit with waste rock was completed in 2012, and the SEZ Pit was backfilled in 2013. On January 7, 2019 Imperial Metals announced the suspension of operations at MPMC commencing May 31, 2019. MPMC has entered into Care and Maintenance from May 31, 2019 to Sept 2021 and restarted operation in November 2021. Deposition of tailings into the TSF commenced on June 1, 2022 with limited mill feed during commissioning. Full mill throughput has been achieved in January 2023.

There is a magnetite processing facility on the mine site owned by MPMC. The facility uses tailings to filter and screen magnetite for resale. The facility will be operating as needed.

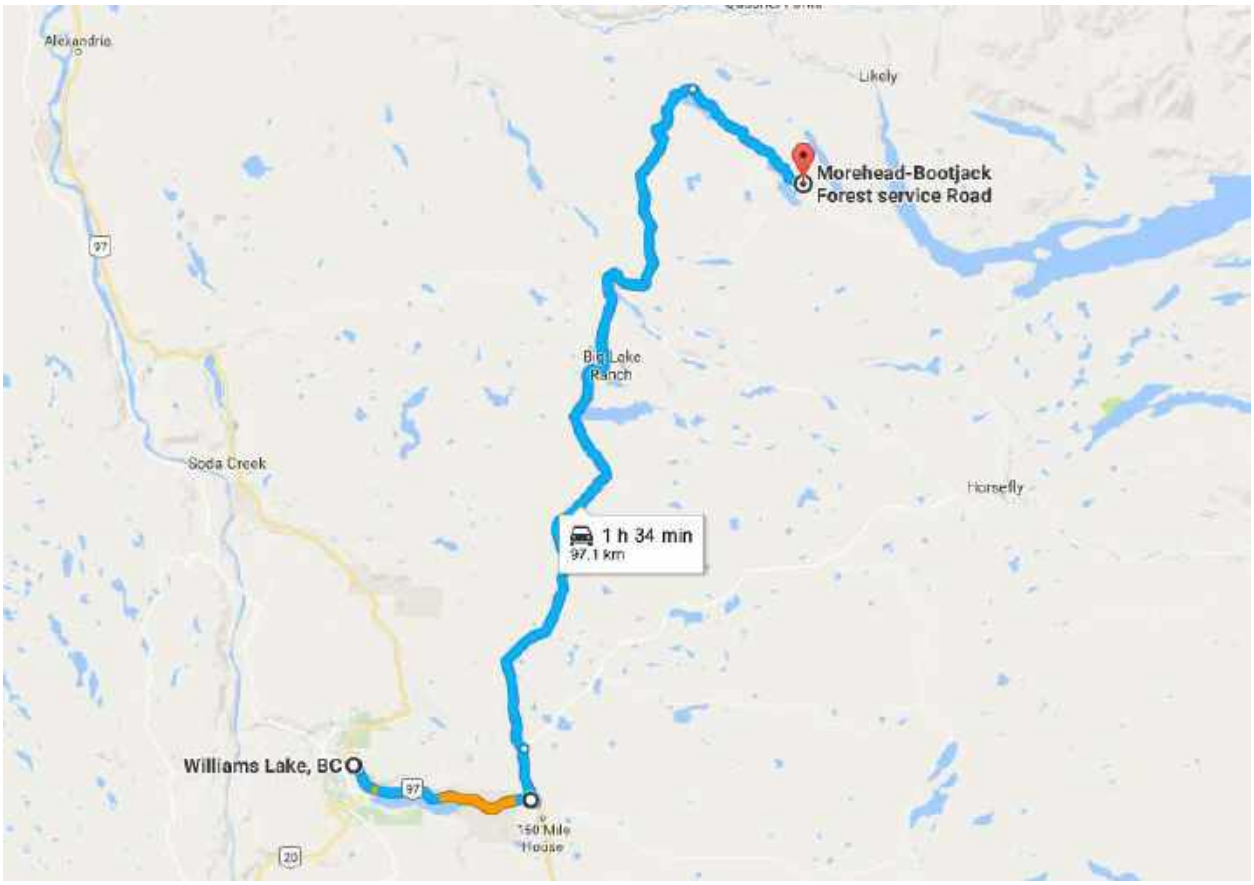


Figure 5.1 Site location and road access from Williams Lake

The TSF lies to the southeast of the mining and concentrator facilities. The Springer Pit has been partially filled with tailings and is being mined with conventional Truck/Shovel operation. Springer Pit tailings are being deposited in the SERDS Co-Disposal Tailings Facility authorized by EMLI. This facility is located on the top of the SERDS. A site aerial photograph taken in 2022 and indicating major mine components is included as Figure 5.2.

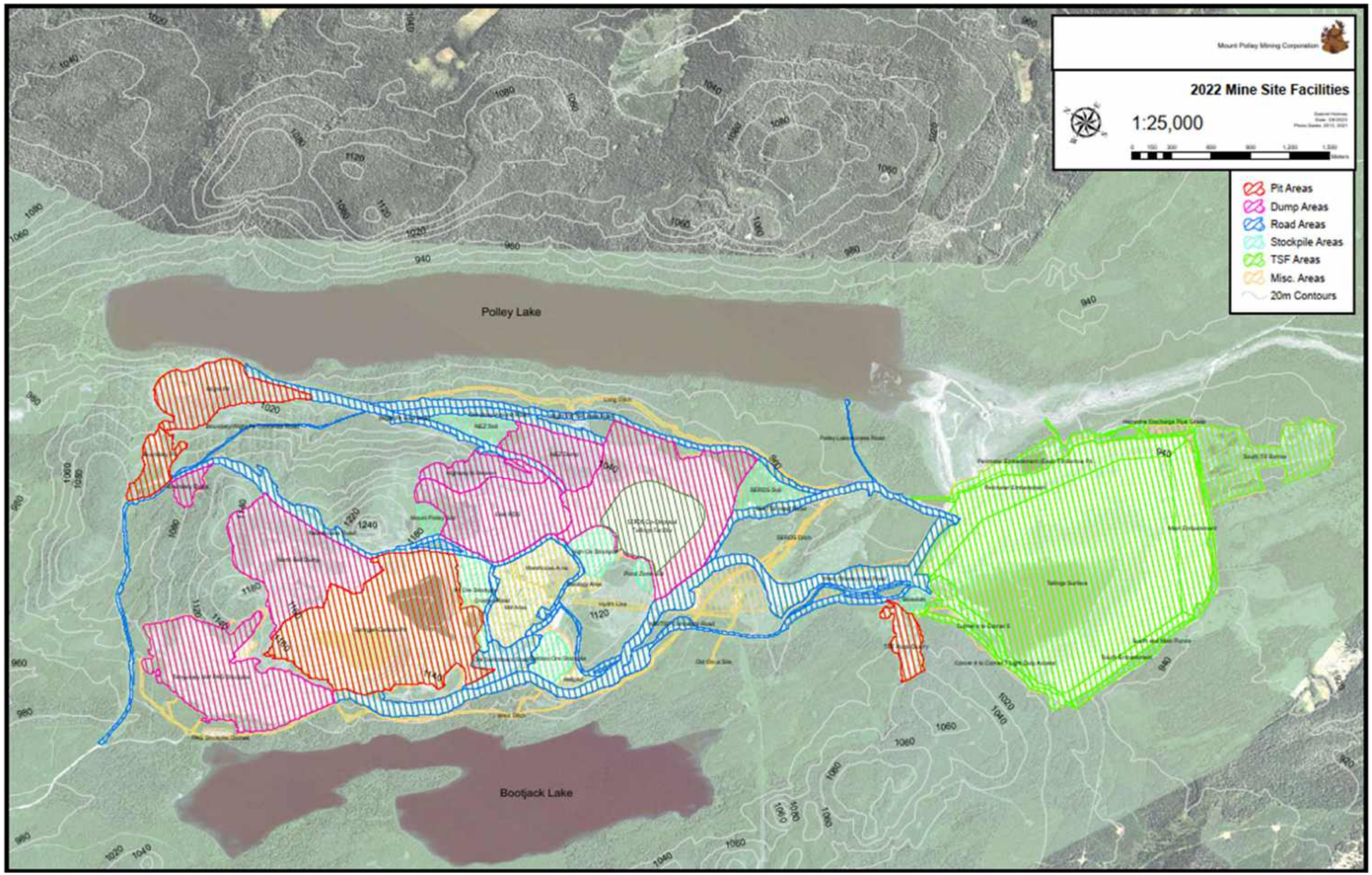


Figure 5.2 Mine Site Infrastructure

6.0 KEY TSF AND WATER MANAGEMENT COMPONENTS

All water management structures are designed in accordance with the environmental parameters as set out in the BC-ENV -issued *Environmental Management Act* (*EMA*) Permit 11678 and the EMLI-issued *Mines Act* Permit M-200.

As per clause 2.4.5 of *EMA* Permit 11678:

"Surface water control works must be provided for all areas disturbed by roads, open pits, rock disposal/storage sites, the mill site and ore storage sites. The surface water control works must be designed to convey all flows up to a 1 in 10 year 24-hour storm event and must be designed to withstand all flows up to a 1 in 200 year 24-hour storm event, without significant damage"

A formal Water Management System Review was completed in 2016, as required by condition C.2.(b) of a *Mines Act* Permit M-200 amendment from July 9, 2016 (entitled: Approving Return to Restricted Restart of Operations). The latest Water Management Plan was issued to EMLI and ENV for 2021. The Water Management System Review provides: an overview of water management planning for the Mount Polley Mine Site; an update on completed and ongoing site works; the review (and associated outcomes) of the design criteria and operational requirements of the water management system, and an outline of planned work.

The discussion is broken into the following parts:

- TSF
- West Ditch System
- Long Ditch System
- CCS, PETBP, and WTP
- Mill Site and Pit Dewatering
- Non-contact Water Ditch Systems
- Pumping and Piping

Lastly, in this section will be a sub-section referencing the various appendices and external documents which describe the tailings and water management systems in much greater detail.

6.1 TSF

The Tailings Storage Facility (TSF) at the Mount Polley Mine is located to the southeast and at lower elevation to the pits and mill site. The TSF is a constructed, (mostly) centerline embankment, currently built to a minimum crest elevation of approximately 969.6 m. At that elevation, the embankment constrains about 270^{o} of the stored tailings, with natural ground to the west-northwest

completing the containment. Utilization of the TSF began in 1997 and served as the sole destination for mill process discharge until August 2014, when a breach of the embankment occurred. The breached embankment has since been repaired to a crest elevation of being built to the 970m in 2023.The TSF system consists of a constructed embankment, the core of which defines the boundary between the upstream and downstream elements of the facility. Upstream are the stored tailings and supernatant water, as well as the infrastructure to deposit the tailings slurry and return the supernatant water to the mill (reclaim system). Downstream are the additional structural elements including the buttress, seepage collection and pumping system to manage the seepage flows. The following subsections describe in detail the various elements of the TSF.

6.1.1 Construction History

The design and construction monitoring of the TSF embankments through 2010 was completed under the direction of Knight Piésold Ltd. (KP). AMEC Environment & Infrastructure (AMEC), now John Wood Group, assumed the role of EoR for the TSF on January 28, 2011. WSP assumed the role in November 2014, with Terry Eldridge, P.Eng. and on February 4, 2019, with Germán Pizarro, P.Eng.

The overall embankment has incorporated a staged expansion design utilizing a modified centerline construction methodology up to elevation 963.5 m, at which point it became centreline construction. The embankments were approaching elevation of 970 m when the Perimeter Embankment breach occurred.

The breach of the Perimeter Embankment occurred on August 4, 2014. The width of the breach was about 100 m, and overall damage occurred to about 400 m of the Perimeter Embankment.

The 2015 Freshet Embankment was built across the breach to manage the 2015 spring freshet and prevent any further uncontrolled release of water and/or tailings from the TSF. The 2015 Freshet Embankment consists of cement-soil-bentonite cut-off wall constructed within a granular core and supported by a wide rockfill embankment.

Significant buttressing of the Main Embankment and Perimeter Embankment was also completed to increase the factor of safety of the existing facility. The buttressing has been incorporated into the current design.

On June 23, 2016, MPMC received an amendment to *Mines Act* Permit M-200 authorizing the continued repair and construction of the TSF to elevation 970 m, as well as the return to use of the TSF facility for tailings and water management. The permitted works are based on the design report: *Mount Polley Mine Tailings Storage Facility Detailed Design to Elevation 970 m* as issued by WSP on November 3, 2015.

Construction of the Corner 1 buttress was completed in 2019 prior to Care and Maintenance. The 2022 construction consisted consists of:

- Testing filter and transition material on all embankments to ensure spec is achieved. Replace material as needed.
- Removing the rockfill material at corner 1
- Raise all embankments to 970m elevation as per design

The construction season of 2023construction was a continuous of 2022 by raising all zones to the 970m elevation

6.1.2 Embankment

The TSF comprises one (1) overall embankment that is approximately 4.5 km long. The embankment, based upon original, separate embankments, is subdivided into three (3) sections: The Perimeter, Main, and South Embankments, going clockwise starting from the NW abutment. Heights vary along the embankment and are approximately 40 m, 58 m, and 32 m respectively (based upon the Perimeter, Main and South nomenclature). Crest elevations of the embankment are between 969.6 m and 970 m.

Structurally, the embankments generally follow that of a typical low permeability core centerline dam. A till core provides the low permeability structure, with downstream filter and transition zones meant to protect the core from internal erosion and conduct any seepage water quickly to the toe of the embankment. Downstream of the filter and transition zones is the rockfill portion of the embankment and buttress. Upstream of the core is the upstream structural component, which varies from rockfill, discharged tailings, and constructed sand cell tailings along the embankment.

6.1.3 Breach

On August 4, 2014, a breach of the Perimeter Embankment occurred near station 4+300, releasing tailings, embankment material, and water. Subsequent investigative works determined that the primary cause was structural failure of the foundation along a Glaciolacustrine Unit (GLU). The large volume of water impounded in the TSF at the time exacerbated the resulting embankment damage and release of stored materials.

The width of the breach was about 100 m and overall damage occurred to about 400 m of the Perimeter Embankment. Soon after the breach, the Temporary Upstream Rockfill Berm was constructed within the TSF to contain any further release of water and mine waste. Once this berm was constructed, the investigation as to the cause of the breach and subsequent cleanup and repair work commenced.

Repair began in November 2014 with the construction of the Freshet Embankment. After the breach area investigation and footprint cleanup work was completed, an engineered rockfill was emplaced to completely replace the missing portion of the embankment to elevation 950 m. Once this was completed, a specialized, rig-based tool system (a cutter-soil mixer) was brought in that systematically reworked a portion of the fill into a low permeability plastic concrete barrier. This effectively reconnected the low permeability element of the embankment (till core) across the breach area and facilitated the storage of water in the TSF.

The next stage of repair involved the planning and design of a full reconstruction of the breach area, followed by submission to the EMLI for an amendment to *Mines Act* Permit M-200 allowing the return to the TSF for ongoing tailings storage. The amendment was granted in June, 2016. Construction activities in this area resumed soon after. Construction has been carried out in stages.

As a part of reconstruction, a rock drain was installed upstream of the breach repair at approx. elevation of 950m. This drain is connected to a system of pipes, which run across the core of the

embankment and connect to a single discharge pipe, which conveys the water to the ditch system upstream of the PETBP. This is intended to promote consolidation of the tailings and unsaturated tailings conditions in the beach above and around the drain and reduce the hydraulic head applied to the cut-off wall and core in this area.

6.1.4 Buttresses

The investigations within the breach area and along the extents of the Main and Perimeter Embankments identified glaciolacustrine soil layers in some areas that control the stability of the embankments. The foundation failure at Corner 1 was primarily due to units of this material, with the path of failure going through this material. To fully repair the embankment and return the otherwise unaffected portions of the embankment to use, buttressing was determined to be necessary.

Buttresses have been installed along the Perimeter and Main Embankments. Construction of these buttresses was completed in 2016 to provide stability for the final 970 m elevation configuration of the TSF.

The buttress at Corner 1 was completed for the 970 m TSF configuration in 2019.

6.1.5 Downstream

All mine-influenced (contact) water at the Mount Polley Mine must be collected and directed to the appropriate location. Over time, the TSF will convey contact water to the downstream area by way of seepage through the embankment and upstream drains and via precipitation falling directly onto the embankment downstream of the core. To intercept and collect this water, MPMC has constructed ditching systems and collection ponds at the base of the embankment.

The Main Embankment Seepage Collection Pond (MESCP) and South Embankment Seepage Collection Pond (SESCP) are located at the downstream toe of the Main Embankment and South Embankment, respectively. The ponds collect water from the toe and foundation embankment drains as well as local runoff. The SESCP is dewatered by a single 8.8 hp Grindex pump (run off a generator), pumping through 6” pipe into an open gravity-flow ditch reporting to the MESCP. The MESCP is dewatered by two (2) 200 hp 3-stage Peerless pumps (run off grid power), pumping through a single12” HDPE pipe to the TSF. There is an additional 12” HDPE pipe at the MESCP as contingency if the primary HPDE is plugged with ice. Additional pumps are on standby in case of emergency such as high precipitation or snowmelt event.

Based on site water management objectives, the MESCP is used as feed water for TSF dust control sprinklers.

Downstream of the Perimeter Embankment, from west to east, are the Central Collection Sump (CCS), and the Perimeter Embankment Till Borrow Pond (PETBP). In addition to collecting seepage water directly from the embankment, these ponds are also an integral part of the overall

site water management strategy. They will be further described later in this section after the description of the two main ditching systems.

6.1.6 Upstream

The settled tailings and reclaim pond, the tailings discharge piping system and the reclaim pumping and piping systems are located upstream of the embankment core. During operation, tailings slurry is discharged onto the TSF from 24" lines at locations based on the beach development plan. The coarsest fraction settles out of the slurry first, forming the beach, and the remaining water and finer material report to the reclaim pond for further settling and clarification.

The reclaim pond contains the reclaim barge and the beginning of the reclaim piping system. Water from the pond is pumped to the PETBP (via the Booster Station) and water treatment plant for discharge off site.

Clean water upstream and to the west of the TSF is directed away from the facility by the TSF clean water diversion ditch into a small wetland below the South Embankment, which discharges to the natural environment.

6.2 West Ditch System

The West Ditch System collects water between the west side of the Mount Polley Mine Site and Bootjack Lake. The West Ditch System spans from the Temporary Northwest (NW) PAG Stockpile to the SERDS Sump. Mine site geometry does not allow for a continuous, open-flow ditch through this distance, so the system comprises a series of ditches and sumps, which are progressively pumped into one another progressing downstream. The system consists of the following components, described from upstream to downstream:

6.2.1 Junction Zone Ditch and Junction Zone Seepage Sump

The Junction Zone Ditch has two (2) branches; one (1) of which is now partially buried by the Temporary NW PAG Stockpile and one (1) that remains out of the Temporary NW PAG Stockpile footprint. Of the 'buried' branch, 200 m of ditch remains exposed. For the second, 'exposed', branch, the ditch is 680 m in length with an average grade of 4%. Flows from the Junction Zone Ditch report to the 9K Sump by open-ditch gravity flow.

The Junction Zone Ditch also conveys water from the Junction Zone Seepage Sump. The Junction Zone Seepage Sump has two (2) 120V, pumps (running off grid power) installed and pumping into a double 2" line to the Junction Ditch.

6.2.2 9K Sump and Ditch System

The 9K Sump collects water from the Junction Zone Ditch and localized runoff from the west side of the Temporary NW PAG Stockpile through open-ditch gravity flow in the 9K Sump Ditch. The

9K Sump Ditch is 290 m long with an average grade of 5%. The 9K Sump has two (2) 50 hp low head, high volume, Flygt pumps (running off grid power) installed and pumping into a single 12" line, 480 m in length, to the NW PAG Sump.

6.2.3 NW PAG Sump and Ditch System

Two (2) open-flow ditches run parallel to the toe of the Temporary NW PAG Stockpile dump at an (approximate) 50 m offset. The upper ditch, flowing southwest, is partially buried, with 725 m of ditch remaining exposed at an average grade of 7%, and this flows into the NW Sump.

There are 2 pumping options for the NW PAG Sump utilizing two (2) 75 hp 2-stage Peerless pumps which running off grid power. The primary option is to pump from the NW PAG Sump to the gravity feed portion of the north branch of Mine Drainage Creek Ditch (an additional 150 m through existing 12" line), The second option is to pump into a 12" line, 850 m in length, to the Springer Pit.

6.2.4 Mine Drainage Creek Sump and Ditch System

The Mine Drainage Creek Ditch System runs along the west side of the West Haul Road and collects water through open-ditch gravity flow as well as, at times, pumped flow from the NW Sump. The north (flowing southeast) and south (flowing northwest) branches of the Mine Drainage Creek Ditch collect in Mine Drainage Creek Sump, which is situated in the low topography between the two (2) ditches. Water captured in the Mine Drainage Creek Sump is pumped up the south branch of the Mine Drainage Creek Ditch and into the gravity feed portion of the Lower West Ditch.

The north reach of Mine Drainage Creek Ditch is 1,160 m in length with an average grade of 4%. The south reach of Mine Drainage Creek Ditch is 400 m in length with an average grade of 5%. The Mine Drainage Creek Sump has two (2) 140 hp high head Flygt pumps installed (running off grid power). One (1) 140 hp low head, high volume, Flygt pump installed has the capability of pumping through a 16" line, 568 m in length, to the Lower West Ditch and a second 16" backup line, to the Lower West Ditch, 630 m in length, is also installed.

6.2.5 Lower West Ditch

The Lower West Ditch is a 575 m long open-flow rock-armored gravity ditch, which collects water along the south side of the West Haul Road. It has an average grade of 4%, and feeds into four (4) 24" HDPE pipes that convey water under the TSF light vehicle road and into the SERDS Ditch. An overflow structure has also been constructed at this location such that, if the four (4) 24" HDPE pipes were to be overwhelmed, overflowing water would be conveyed over the TSF light vehicle road and into the SERDS Ditch.

6.2.6 Orica Ditch

The Orica Ditch runs west-east and collects water flowing below (south) of the old Orica explosive storage site. Water is conveyed to the SERDS Ditch via open-ditch gravity flow (and French drain under the heavy-duty Tailings Access Road). The ditch is a 725 m long open-flow gravity ditch with an average grade of 1%.

6.2.7 Bootjack Creek Sump

Bootjack Creek Sump collects water from the east side of the Tailings Access Road and pumps it via pipeline to the SERDS Ditch. The sump has one (1) 50 hp high head Flygt pump installed (running off grid power) and pumping into a 10" line, 120 m in length, to the SERDS Ditch.

6.2.8 SERDS Ditch

The Lower West Ditch, Orica Ditch and Bootjack Creek Sump all feed into the SERDS Ditch. The SERDS Ditch is a 1,475m long open-flow rock-armored gravity ditch with an average grade of 3.5% that feeds into the SERDS Sump. The SERDS Ditch is conveyed under the heavy-duty Tailings Access Road by three (3) 24" HDPE pipes. An overflow structure has also been constructed at this location such that, if the three (3) 24" HDPE pipes were to be overwhelmed, an overflow structure is constructed such that additional water would be conveyed to the Orica Ditch.

6.2.9 SERDS Sump

The SERDS Sump is located adjacent (across the haul road) from the Long Ditch Sump. The sump is 25 m wide by 60 m long and averages 1 m deep, collecting water at the terminus of the SERDS Ditch (also the terminus of the West Ditch System). 590 m of 30" HDPE pipe with an overall grade of 2.2% carries water over Bootjack Creek and into the CCS. An overflow system consisting of a 24" HDPE pipe is installed that reports to the Lower Long Ditch Sump. An overflow structure has also been constructed at this location such that, if the 30" HDPE pipe and 24" HDPE pipe were to be overwhelmed, overflowing water would be conveyed over the road to the Upper Long Ditch Sump.

The general layout of the West Ditch System can be seen in Figure 6.1. Additional information is contained in the *Water Management Inspection Manual* (Appendix C).

6.3 Long Ditch System

The Long Ditch system collects water between the east side of the Mount Polley Mine Site and Polley Lake. The Long Ditch spans from below the site access (Bootjack) road to the Long Ditch Sump. As with the West Ditch System, the Long Ditch System is composed of a series of open ditches and pumped out sumps that progressively convey the water it collects to the CCS. The system consists of the following components:

6.3.1 Joe's Creek Coffer Dam and Pipe

Joe's Creek collects seepage from the North Bell Dump and consists of a sump and dam system with a secondary overflow sump constructed and fed by a buried culvert from the first sump to the second. Both sumps feed into a 1,400 m 12" HDPE pipe that carries the water to the start of the Long Ditch and can also be directed to the Wight Pit based on site water management objective.

6.3.2 Wight Pit Dewatering

Wight Pit is ultizaed as temporary mine contact water storage and has a capacity of 3.5M m^3. Water is pumped by a barge into a Booster Tank containing two (2) 140hp Flygt 2400MT pumps. From Booster water is pumped by a 12" HDPE/steel pipe to the Long Ditch. There is also a valve located to convey water into the NEZ Booster tank to pump Wight Pit water to the mill for processing.

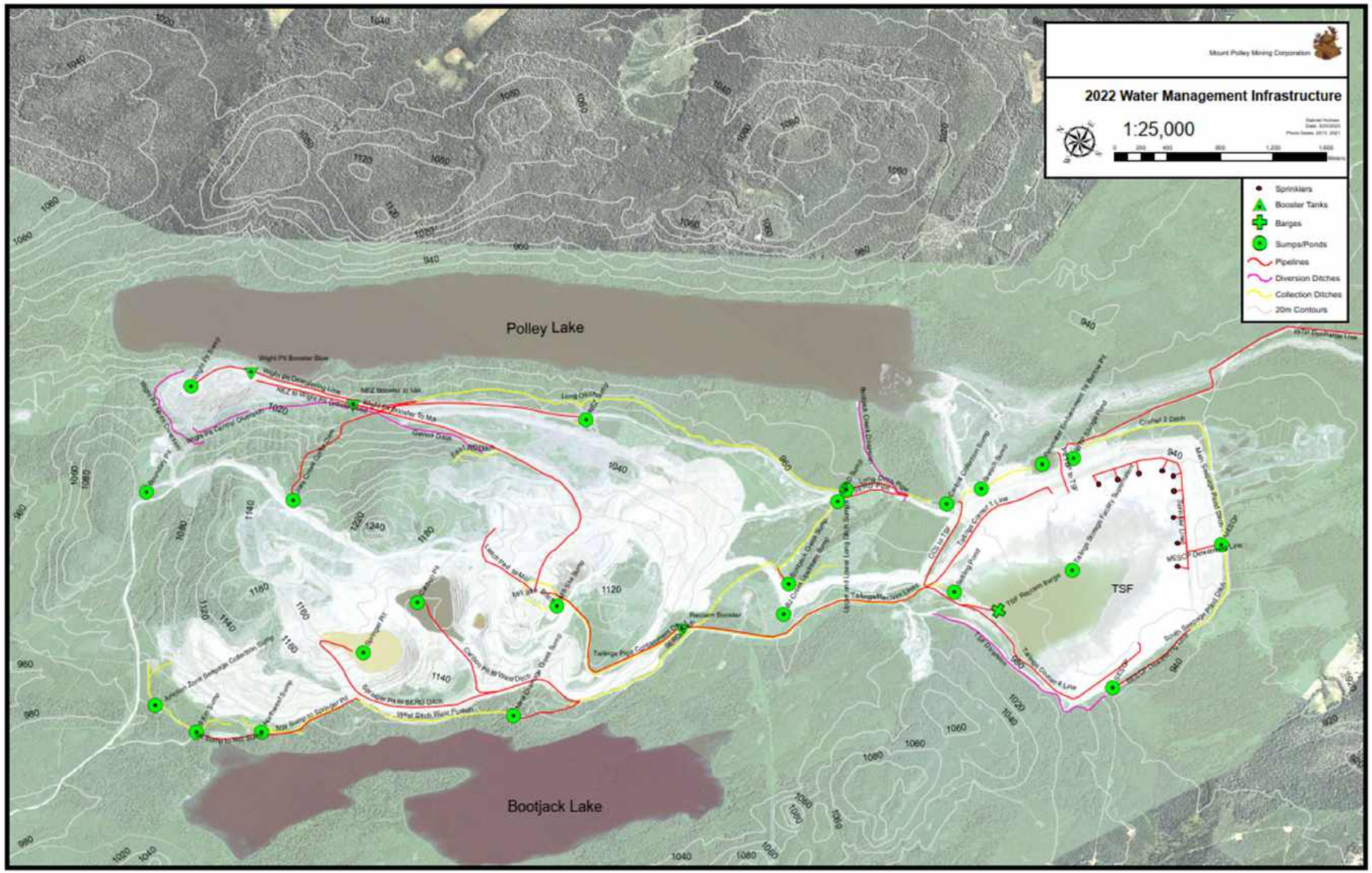


Figure 6.1 – 2022 Site Water Management Infrastructure*Fixed Water Management Infrastructure*

6.3.3 The Long Ditch

The Long Ditch is an open-ditch gravity flow system that runs along the east side of the Mount Polley Mine Site between the disturbance footprint and Polley Lake. The Long Ditch itself runs from the Wight Pit Haul Road to the Upper Long Ditch Sump. After receiving water from Joe's Creek Pipe and the Wight Pit (if directed there), the Long Ditch intercepts various surface and rock disposal sites runoff via an open-ditch gravity flow system before being collected in the Upper Long Ditch Sump.

The ditch is 3,650 m in length with an average grade of 0.9%.

6.3.4 NEZ Sump

The Northeast zone (NEZ) sump (which is located near seep 2) collects mine contact water from NEZ Seep 1 and NEZ Seep 2. These seeps have been identified as having high levels of dissolved copper levels. The seeps collect into a 24" gravity feed pipeline that conveys the water to the a booster station located on the Wight Pit ramp. From this location, the NEZ seeps water can be pumped to the mill for treatment or gravity flow to the Wight Pit sump via an open ditch along the highwall of the ramp. Water from the Wight Pit booster can also be directed into this tank as needed.

6.3.5 The Upper Long Ditch Sump

The Upper Long Ditch Sump collects water from the Long Ditch. At the end of the Long Ditch, prior to entering the sump, water is directed into a 610 m long 30" gravity-flow pipe conveying water to the CCS (over Bootjack Creek). Average pipe grade is 1.3%. An overflow structure is installed in the Upper Long Ditch Sump such that any overflow will report to the Lower Long Ditch Sump.

6.3.6 The Lower Long Ditch Sump

The Lower Long Ditch Sump is designed to convey overflow from the SERDS Sump and the Upper Long Ditch Sump. This back-up system consists of a gravity-fed 500 m, 22" HDPE pipe with an average grade of 2.1% reporting to the CCS (over Bootjack Creek) and also provides infrastructure for tie-in for mechanical pumping assistance (to supplement gravity-flow systems).

The components of the Long Ditch System can be seen in Figure 6.1. Additional information is contained in the *Water Management Inspection Manual*.

6.4 CCS, PETBP and WTP

6.4.1 The Central Collection Sump (CCS):

The CCS is at the confluence of the West Ditch and Long Ditch systems and receives water from these two systems as well as local runoff that reports directly to it. The CCS serves as a distribution

facility for the waters that report to it. Depending on water management needs, water from the CCS may be pumped into the TSF via diesel pump or allowed to overflow into the PETBP (via culvert under the Postage stamp) for discharge through the WTP.

6.4.2 Perimeter Embankment Till Borrow Pond (PETBP)

The PETBP is immediately downstream of the Perimeter Embankment and receives direct flow from the immediate area through precipitation and seepage. It serves primarily as a storage area for the various ditching systems, with overflow coming from the CCS. Total available volume within the PETBP is approximately 190,000 m^3. The PETBP also serves as the sump for the WTP.

Two electrical pumps are in place using levels to pump from the PETBP to the TSF as contingency if:

1. Water level in the PETBP increases due to large inflow of water (rain events, etc)
2. WTP is shutdown

6.4.3 Water Treatment Plant (WTP)

The WTP consists of a Veolia Actiflo® ACP-650 unit and associated infrastructure. The plant receives mine-influenced water, treats it, and discharges the treated water through a 7 km 24'' HDPE pipeline into Quesnel Lake. 'Sludge' from the WTP reports to settling ponds and is pumped to the TSF. Overflow reports to the PETBP. The primary source of input water for the WTP is the PETBP.

The WTP may be passively operated should water meet full discharge requirements and written authorization is given from the ministry. Such water would flow through the plant without the addition of reagents or operation of the mechanical components of the facility.

Additional information is contained in the *Water Management Inspection Manual*.

The WTP will be operated to maintain the TSF pond size within the normal operating range as defined by the QPOs (Appendix I). Careful planning is required to ensure volume does not exceed the QPO. This may include using the Wight Pit to temporarily hold surplus water.

6.5 Mill Site Dewatering

The mill site and shops are situated in a local low area, with associated runoff and drainage reporting to the Mill Site Ditch system. The 270 m long Mill Site Ditch runs around the northeast side of the Mill Site starting at the wash bay and flows into the Mill site sump. Water from the Mill Site Sump is pumped into the tailings deposition line. Drainage on the west side of the mill is directed into the Mill basement and pumped into the tailings box then conveyed into the tailings deposition line.

6.6 Clean Water Ditch and Sump Systems

Wherever possible, clean (non-mine-influenced) water is kept separate from mine-influenced water and conveyed to the receiving environment surrounding the mine site.

6.6.1 Site Access Road

Clean water to the north and east of the Mount Polley Mine Site is controlled by a series of under-road culverts and roadside ditching along the Site Access Road to ensure that water reports to natural receiving environments.

6.6.2 Joe's Creek (Clean Water) aka North Dump Creek

Mine-influenced water in this system is collected through the aforementioned dam and buried pipe system at Joe's Creek (Section 6.3.1). Clean water collected below this point flows through an existing drainage towards Polley Lake (North Dump Creek); a culvert carrying it under the Wight Pit Haul Road.

6.6.3 TSF Clean Water Ditch (Corner 5 to Corner 4)

Clean water upstream and to the west of the TSF is directed away from the facility and into a small wetland below the South Embankment.

6.6.4 Bootjack Creek

Bootjack Creek is a natural creek running west-to-east along the southern half of the Mount Polley Mine Site. Bootjack Lake previously flowed into Bootjack Creek, but no longer does due to the construction of a dam (prior to work by MPMC). Bootjack Creek is crossed by mine infrastructure at three (3) locations: the TSF light vehicle road, the heavy-duty Tailings Access Road, and a heavy-duty access along the old TSF haul road. Bootjack Creek flows into Polley Lake.

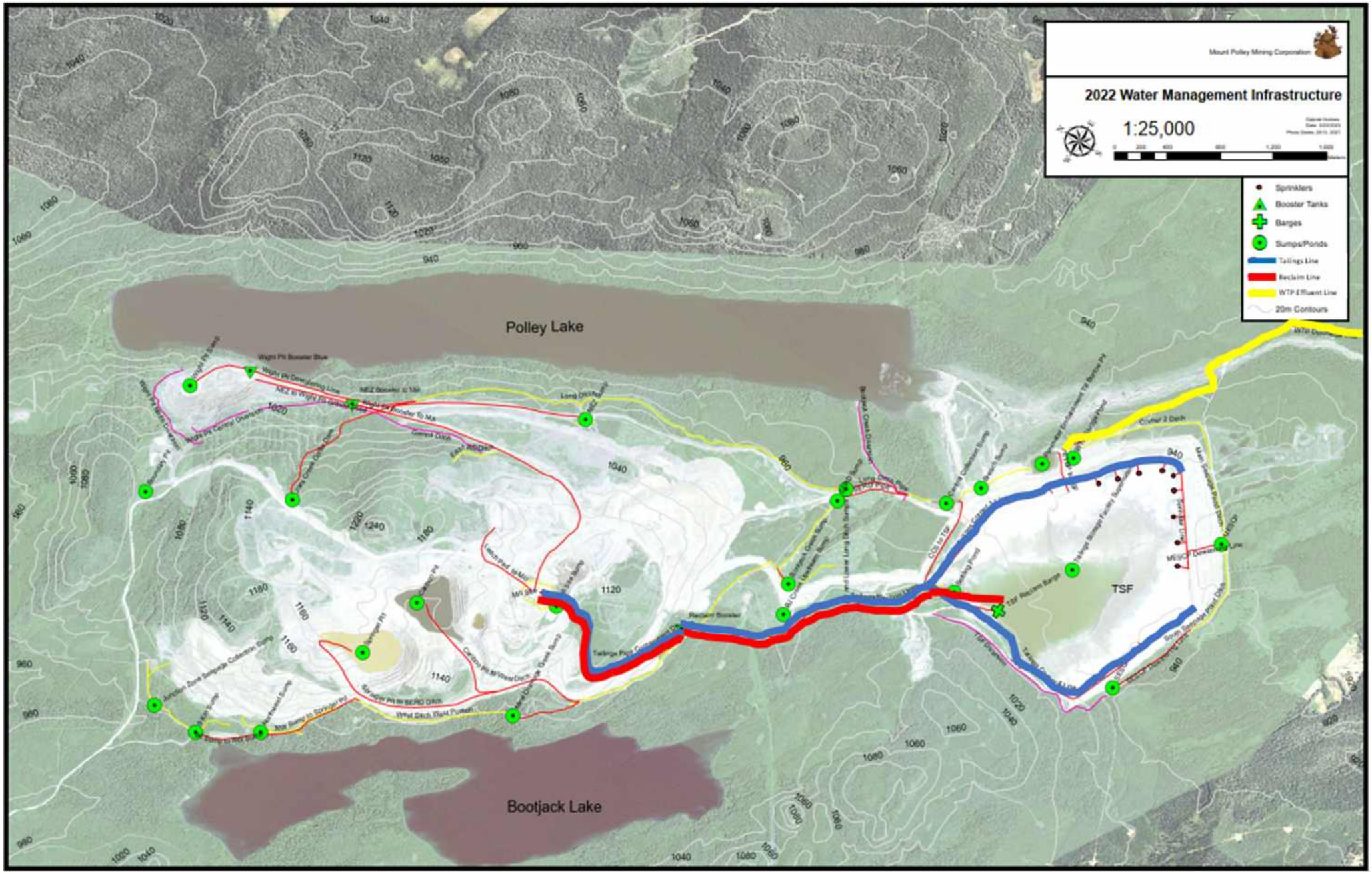
6.6.5 Gavin's Ditch and Sump System

A ditch and sump system to stop water from entering the Wight Pit Haul Road and direct it into natural receiving environments via the North Dump Creek capture clean water to the north and northwest of the Wight Pit Haul Road, from the Highway to Heaven Dump to North Dump Creek.

6.7 Major Piping and Pumping Systems

There are numerous piping and pumping systems at the Mount Polley Mine, which are utilized to meet water management goals. Many of them are quite simple, involving small pumps and small diameter HDPE pipe conveying water from one small sump to another location. These small systems are sufficiently described under their respective area titles in previous sections. This section will focus on the major pumping and piping systems, namely the Tailings Distribution

Lines and the Reclaim Pumps and Line. See Figure 6.2 for a layout of the major pumping and piping systems; TSF Discharge and Reclaim.


Mount Polley Mining Corporation
2022 Water Management Infrastructure
1:25,000
Sprinklers
Booster Tanks
Barges
Sumps/Ponds
Tailings Line
Reclaim Line
WTP Effluent Line
20m Contours
Polley Lake
Bootjack Lake
TSF
Wright Pit Booster Blue
Wright pit Discharge Line
NEZ Booster to Mill
NEZ to Wright Pit Booster Pump
Wright Pit Booster To Mill
Wright Pit Central Diversion
Wright Pit Northern Diversion
Wright Pit Booster
Wright Pit Sump
Wright Pit Northwest Sump
Wright Pit Southwest Sump
Wright Pit Southeast Sump
Junction Zone Seepage Collector Sump
Main Zone Seepage Collector Sump
Main Sump to Mill
Main Sump to Wright Pit
Wright Pit to Mill
Wright Pit to Main Sump
Wright Pit to BEPD Ditch
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6.7.1 Tailings Distribution Line

The Mill Tailings Distribution line is approximately 7,000m, 24" HDPE line sits within a containment ditch until just before entering onto the TSF. This ditch is meant to contain any potential spill. At the access onto the TSF, the CCS acts as the receiving structure should the tailings line develop a leak. On the embankment, the tailings line will be positioned just upstream of the core so as to deliver tailings to the areas that require beach development according to the deposition planning.

6.7.2 Reclaim Pumping and Piping System

Primary pumping occurs from a floating barge situated within the TSF Reclaim Pond, which outflows into a 24" HDPE pipe that extends to the Booster Station. Water pumped from the reclaim pond is deposited into a sump at the Booster Station. From the booster station, the reclaim water can be pumped to the mill for operations.

The reclaim line route follows that of the tailings distribution line from just above the TSF until the Booster Station. Any potential leakage of the reclaim line from the TSF to the Booster Station will be contained within the ditching systems or flow back into the TSF.

The pumping systems at the Reclaim Barge and Booster Station have been built-for-purpose by an offsite manufacturer. The Reclaim Barge system consists of four 250 hp vertical turbine Peerless pumps, and the Booster Station consists of five 250 hp vertical turbine pumps. More specific detail into both systems can be found in the information packages provided by the manufacturer, which are kept with the Mill Maintenance Superintendent and the Electrical Superintendent. Both pumping systems are connected to grid power and under the direct operational control of the mill, which monitors their operation in the Mill Control Room.

6.8 Reference Materials

There exists a great deal of documentation on the various TSF and water management systems described in this Manual. These documents can describe the design, operations, and regulatory permitting in much more detail than can be practically included in this Manual. Table 6.1 lists a few of the more frequently referenced documents in this Manual. Hard copies of these and additional reports are kept onsite in the Technical Services area of the main office on site at the Mount Polley Mine. Permit amendments are kept in digital format and distribution is limited due to some material being of a confidential nature. Finally, the procedural manuals are kept onsite and used regularly by Mine Technical Services department personnel. A copy of the *Water Management Inspection Manual* is included in this manual as Appendix C.

Table 6.1 Primary Resource Documents for Tailings & Water Management.

Reference Materials for Tailings and Water Management		
Document	Date	Comment
TSF		
Golder		
Tailings Storage Facility Detailed Design to elevation 970 m.	November 3, 2015	Detailed design of TSF to 970, including operational guidelines
Elevation 970 m Embankment Stability Analysis and Buttress Design	July 10, 2015	Detailed design for the Buttressing requirements for the 2015 TSF configuration
2015 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	January 5, 2016	Annual Facilities inspection performed by the EoR.
2016 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 9, 2017	Annual Facilities inspection performed by the EoR.
Mount Polley Mine Water Management Plan. Appendix B: Operations and Closure - Mount Polley Mine Water Balance	October 17, 2016	Mount Polley Mine Water Balance. Remaining document pertains to an outstanding permit amendment application.
Tailings Storage Facility Detailed Design to elevation 970 m Update	April 25, 2017	Detailed design update for TSF to 970 m including operational guidelines
SRK Dam safety Review for Tailings Storage Facility Embankment	April 4, 2017	Detailed safety evaluation of the TSF performance by a qualified engineer
2017 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	Q1 2018	Annual Facilities inspection performed by the EoR.
2018 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 27, 2019	Annual Facilities inspection performed by the EoR.
2019 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 23, 2020	Annual Facilities inspection performed by the EoR.
2020 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 31, 2021	Annual Facilities inspection performed by the EoR.
2021 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 31, 2022	Annual Facilities inspection performed by the EoR.
2022 Annual Dam Safety Inspection for Tailings Storage Facility Embankments	March 31, 2023	Annual Facilities inspection performed by the EoR.
MPMC		
Water Management Inspection Manual	May 23, 2019	Inspection manual for onsite water management personnel. Detailed maps and pictures of various elements of the water management system. Inspection checklists. Reviewed annually
Site Water Management Plan (M-200)	March 30, 2021	2020 Water Management plan as per M-200 permit condition D.4.(a)
EMLI		
Approving Return to Full Operations and Use of Tailings Storage Facility	June 23, 2016	M-200 amendment covering the repair of and resumption of tailings discharge into the TSF.
Approving Main Embankment Buttress	October 22, 2015	Initial approval of the Main Embankment Buttress Design and Construction
Amalgamted M-200 Permit	December 20, 2020	M-200 permit with all amendments combined
M-200 Permit Update	May 3, 2023	IM-200 with SERDS Co-Disposal Authorization
BC-ENV		
PE 11678 Amendment (Hazeltine Creek Discharge)	February 1, 2020	MOE Permit amendment authorizing the tailings and water management activities into the Springer Pit.
PE 11678 Amendment (Hazeltine Creek Discharge)	December 31, 2020	Incorporates Sept 2020 consent order into 11678 permit
PE 11678 Amendment (Hazeltine Creek Discharge)	December 1, 2022	Interim Extension of Quesnel Lake Discharge

7.0 OPERATIONS

This section is meant to outline and describe the operational protocols for the TSF and water management systems. All systems are designed to handle the tailings and site water management conditions that MPMC will expect to see throughout the remaining mine life as well as to adhere to the most up to date regulatory permits from EMLI and BC-ENV.

It should be expected that the systems would evolve over time to accommodate additional information, site knowledge, the pursuit of Good Practices, and all regulatory changes that may occur. Necessary updates, including the annual review, shall be performed to keep this section current.

The following operations description will be presented in three sub-sections:

- Tailings Deposition and TSF Operations
- Site Water Management
- Flood Management

7.1 Tailings Deposition and TSF Operations

The TSF serves MPMC as the facility for storing tailings and supernatant water, as well as the temporary storage of site water pumped into it and rainfall that reports directly to it. Care must be taken to ensure that safe operations are maintained, and that the following primary storage conditions are met: QPO's were updated in Sept 2023 and TSF Water Management summarized below in Figure 7.1.

Normal Operating Pond Storage Volume	Inspection frequency	Once per week	Estimated based on storage curve determined from most recent topographic and bathymetric surveys. Surveys are to be completed a minimum of two times per year (spring and fall). The majority of water inflows to the TSF are pumped and therefore the pond volume is in the direct control of the operator; however, temporary detention of large runoff volumes in the TSF is required and the pond volume can increase above 1.7 million m³ during large freshet events (e.g., about 2.1 million m³ during a 1 in 10 year freshet event; about 3.5 million m³ during a 1 in 200 year freshet event [Golder 2015]).
	Minimum	1.5 million m³	Target provided by MPMC to allow reclaiming water for operation of the mill. Aimed to allow for an approximate 4 m deep pond at the barge location.
	Maximum	1.7 million m³	To limit storage of water in the TSF.
Freeboard	Inspection frequency	Once per week	Difference in elevation between the pond and the lowest completed section along the crest of the embankment.
	Normal Operating Zone	≥ 1.1 m	Inflow design flood (IDF) based on the probable maximum precipitation (PMP) 72-hour event. Golder (2017).
	Concern Zone	1.0 to 1.1 m	Stop all pumps pumping water into the TSF. Increase monitoring frequency of freeboard and beach width, particularly in areas of reduced beach width. If reduced freeboard is unrelated to freshet, construct emergency spillway at Corner 5, or as directed by the EoR, and increase pumping from TSF to other facilities.
	Buffer Zone	0.8 to 1.0 m	Stop all pumps pumping water into the TSF. Increase monitoring frequency of freeboard, beach width, piezometers and seepage rate/turbidity, particularly in areas of reduced beach width. If reduced freeboard is unrelated to freshet, construct emergency spillway at Corner 5, or as directed by the EoR, and maximize pumping from TSF to other facilities.
	Unsafe or Out of Compliance Operating Zone	< 0.8 m	Stop all pumps pumping water into the TSF. Stop slurry deposition into the TSF. Increase monitoring frequency of freeboard, beach width, piezometers and seepage rate/turbidity, particularly in areas of reduced beach width. If reduced freeboard is unrelated to freshet, construct emergency spillway at Corner 5, or as directed by the EoR, maximize pumping from TSF to other facilities.

Figure 7.1 2023 QPO – TSF Water Management

Adhering to these conditions will require the careful planning of the transfer of waters into and out of the TSF.

7.1.1 Construction

Construction of the TSF occurs under the authority granted by the EMLI and must meet all conditions outlined in *Mines Act* Permit M-200 and its' amendments. All construction activities will occur under the surveillance of the EoR or designate and follow the designs outlined in the design report *Tailings Storage Facility Detailed Design to Elevation 970 m* as well as any updates received from the EoR. Regular communication between the EoR and MPMC will occur throughout the construction period to ensure that the intent of the design is met and any changes occur only with the appropriate engineering work to guide it.

At the end of the construction period, a Construction Record report shall be prepared by the EoR and submitted to EMLI by MPMC by March 31st of the following year. Any additional reporting stated in *Mines Act* Permit M-200 amendments shall be adhered to as well. Figure 7.2 indicates a typical cross section of the dam at Corner 1.

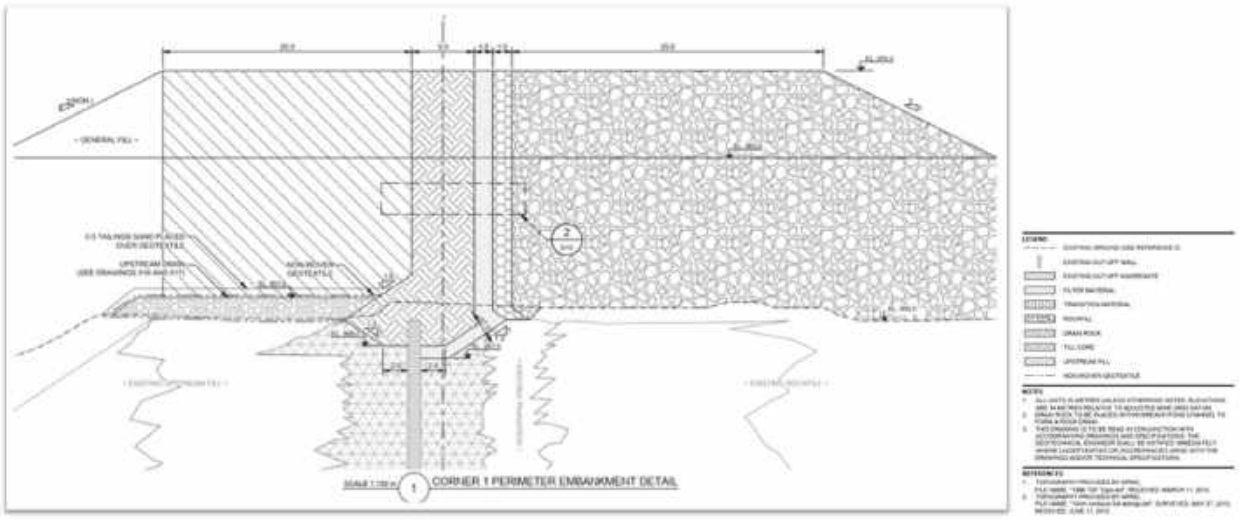


Figure 7.2 – Typical TSF Cross-section at Corner 1

Construction activities may begin or end at any time, so long as the conditions stated above are adhered to and QA/QC protocols are met. The primary intent of construction is to provide ongoing tailings and water storage as the TSF continues to fill, which will require planning and setting construction goals which ensure the appropriate amount of storage is available at all times.

7.1.2 Tailings Deposition and Beach Management

Tailings shall be delivered to the TSF from the Mill Tailings Distribution line when the mill is operating. Within the TSF, the line shall be situated in such a way to be upstream of the embankment core and emplaced in a way that, should a breach of the line occur, any unmanaged flow would not flow over the crest of the embankment. Discharge may occur via spigot or through the full pipe. A deposition plan will be updated on a regular basis using the latest bathymetric survey and mining plan available.

Figure 7.3 shows the zones of operation for the Beach Width from the QPO document.

Beach Width			
Normal Operating Beach Width	Inspection frequency	Daily	Portion of beach above pond level. The pond is to be maintained within the centre of the facility against the western boundary of the TSF against the natural topography. Temporary detention of large runoff volumes in the TSF is required and the beach widths are expected to decrease below 100 m during large freshet events.
	Normal Operating Zone	> 100 m	Minimum during normal operating conditions.
	Concern Zone	60 to 100 m	Regain 100 m beach along all the facility within 1 month (pumping to other facilities may be required [e.g., open pits]). Adjust tailings deposition to build tailings beach in area of reduced beach width. Increase pumping from TSF to the water treatment plant. Increase monitoring frequency of beach width, freeboard, piezometers, and seepage rate and turbidity, particularly in area of reduced beach width
	Buffer Zone	20 to 60 m	Regain 100 m beach along all the facility within 2 months (pumping to other facilities may be required [e.g., open pits]). Adjust tailings deposition to build tailings beach in area of reduced beach width. Maximize pumping from TSF to the water treatment plant. Increase monitoring frequency of beach width, freeboard, piezometers, and seepage rate and turbidity, particularly in area of reduced beach width

Figure 7.3 – QPO Beach Width Zones of operation

The area of discharge shall change according to beach development requirements, as determined by visual inspection. Water and TSF Superintendent is responsible for tailings deposition through written authorization on the weekly dewatering meeting. Site Services will be contacted to perform the necessary valve and line work to move the discharge. Occasionally, deposition will be controlled by line maintenance needs, but shall return to normal configuration once maintenance work is completed.

The objective of beach development will be to provide an adequate buffer between the free water within the reclaim pond and the embankment core throughout all foreseeable flood events. This will normally allow beaches of 300 m length or more around the entire facility, depending on elevation. Maintaining beaches of minimum 100 m width during normal operations ("normal" being defined as a pond volume between 1.5M m^3 to 1.7M m^3 after freshet and 3.5 million m^3 following a 1 in 200 year freshet event, respectively – see Pond Management sub section) is the minimum target. Of necessity, beaches will be constructed much greater than 100 m wide before

moving discharge to another location so that the loss of beach while discharging elsewhere does not reduce the beach to less than 100 m.

Beach width will be determined primarily by visual estimation based on the minimum distance from the TSF pond to the embankment. Drone flyover and Online resources (Figure 7.4) can also be used to determine beach width.

Sentinel Playground | Sentinel Hub (sentinel-hub.com)

Website:https://apps.sentinel-hub.com/sentinel-playground/?source=S2&lat=52.51458338709581&lng=-121.60340022935998&zoom=15&preset=1-NATURAL-COLOR&layers=B01,B02,B03&maxcc=64&gain=1.0&gamma=1.0&time=2022-11-01%7C2023-05-15&atmFilter=&showDates=false

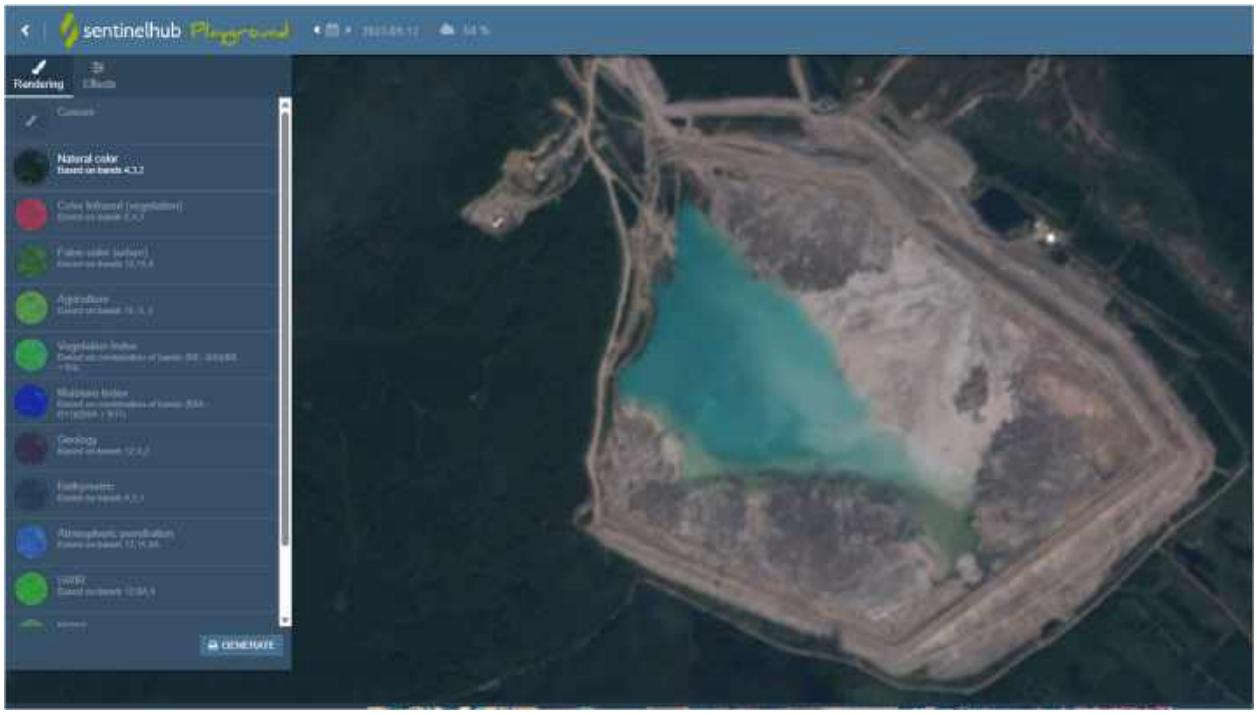


Figure 7.4 Sentinelhub – MPMC TSF location

Small ponds will occasionally form on the beaches themselves. If they are not connected to the main pond, they will not impact beach length consideration. Effort will be made to 'push' out these ponds via tailings deposition management.

Tailings Distribution lines which are in operation will be visually inspected every shift by Mill Maintenance personnel (Mill to corner 5) and Site Services personnel (Corner 5 to discharge). The person performing the inspection has the authority to stop tailings flow to the TSF by contacting the Mill Manager/Water and TSF Superintendent or designate. Changes to tailings deposition shall be communicated to the Water and TSF Superintendent.

The beaches are formally inspected weekly by Water and TSF personnel and informally by operations and supervisory personnel as a part of their daily routine. There are also many informal inspections performed by other individuals on the embankment performing their regular duties.

7.1.3 Reclaim Pond Management

Under normal operating conditions and average meteorological conditions, including freshet, the reclaim pond within the TSF shall contain between 1.5 and 1.7 million m^3 of water. The TSF is used for temporary detention and attenuation of flow rates; therefore, for example, the reclaim pond size could increase to 3.5 million m^3 during a 1 in 200 year freshet event. The fundamental basis of the water management on site is to ensure that water does not accumulate in the TSF, specifically to the point of increasing the onsite water reserve year-over-year. Exceeding the estimated reclaim pond volumes for average and 1 in 200 year freshet events does not necessarily compromise embankment safety but is not consistent with Best Practice.

The key parameters further restricting the allowable pond volume are freeboard, beach length and flood storage capacity. The site water balance does not predict the pond to contain more than 3.5million m^3 of free water except as the result of an event larger than a 1 in 200 year freshet event. Planning for freshet management is based upon being able to safely manage this scenario.

However, if an event or events lead to this happening, there are certain factors that must be checked. The primary factor will be freeboard and beach width, specifically any expectation of beach width going below 20 m. MPMC must engage all practical effort to prevent this from happening and the excess water would have to quickly be brought down to acceptable levels afterward.

Pond volume will be regularly tracked by the Water and TSF Superintendent on a spreadsheet utilizing pond elevation pickups and mass balance calculations based on flyover survey and communicated to the EoR weekly in the TSF Weekly Report. A pond sounding is conducted on an as needed basis to calibrate and confirm the accuracy of the water balance. Snow and beach ice do not contribute to the free water pond volume calculation, nor does pond ice. If determinable, snow and ice do count as impounded materials and will cause the lowering of total storage, and will be tracked, though likely by estimation.

7.1.4 Reclaim Barge

The reclaim barge shall be operated by an automated system controlled by Mill Operations. Water will be pumped through the reclaim piping system (i.e., via the Booster Station) back to the Mill on an as-needed basis. Instrumentation installed on the operating systems within the barge and Booster Station pumps monitor the systems' operation on a continual basis. Mill Operations shall formally inspect the reclaim line and supporting infrastructure at least once per shift.

Reclaim barge raises will be required at the elevation of the tailings deposition increase. Planning will be discussed in the weekly dewatering meetings. Execution will be carried out as quickly as possible to avoid interrupting the flow of reclaim water out of the TSF.

7.2 Site Water Management

This sub-section shall describe the operations of the various water management structures and systems (exclusive of the TSF reclaim). Some of the systems are described in much detail within the *Water Management Inspection Manual* (Appendix C), and will be referenced as such within this section.

In general, water management at the Mount Polley Mine is intended to ensure that the utmost care is given to manage the site water in a socially responsible way, adhering to all permits and making efficient use of the water resource utilized. The systems are designed to be robust and easily understood and implemented. Redundancy or overdesign is included wherever practical and MPMC will continue to improve upon these systems as water management experience continues to develop. MPMC also has a strong commitment to including the local community groups in the planning and implementation of the activities on site that affect the local receiving environment.

The site water management operations' section will be broken into the following topics:

- Cariboo Pit Sump
- Wight Pit Temporary water storage and dewatering
- West and Long Ditch Systems
- TSF Seepage
- CCS and PETBP
- Other Water Management Facilities

7.2.1 Springer and Cariboo Pit Storage and Dewatering

Cariboo Pit Sump

The Cariboo pit is an active dewatering sump for the Springer Pit. Water from the Springer pit is pumped into the Cariboo Pit Sump. Water from this sump is pumped into a booster station, from

there the water can be pumped to the mill process tank or to the West Ditch. This is shown in Figure 7.5 below.

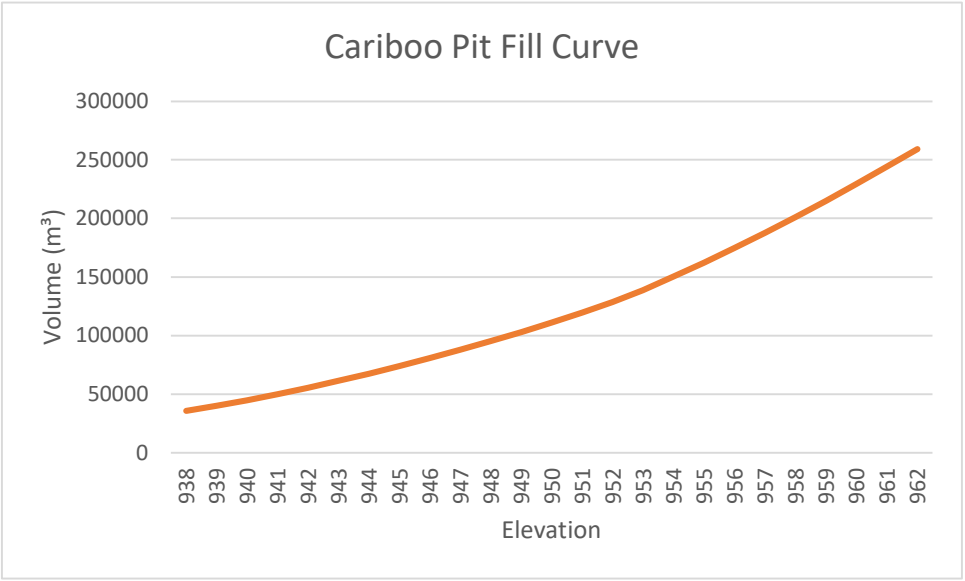


Figure 7.5 Cariboo Pit Sump Storage Curve 2023

Springer Pit

The Springer pit is the main mining location for Phase 4 and future mining once permitted. Temporary sumps are established as needed and the water is pumped to the Cariboo Pit Sump. It's noted that the maximum water elevation is permitted to 1025 masl (EMA 11678 section 1.3.1)

7.2.2 (1025m elevation) including the deposited tailings. This is shown in Figure 65. belowWest and Long Ditch Systems

A majority of the West Ditch and Long Ditch sub-systems performs automatically and do not require operational input, instead relying upon regular inspections and maintenance to ensure they continue to function properly. There are a few small components that do require manual interaction, and this is generally performed by the individuals performing the inspections according to the *Water Management Inspection Manual* (Appendix C).

As mentioned above, the seepage collection ponds and recycle pumps typically operate without requiring any external adjustments; however, the following special circumstances will require specific actions:

- In the event of an emergency that may compromise a water storage facility, all diversion ditches that feed the facility may need to be directed away. In addition, if water quality and permits allow, discharge of water to natural receiving environments may be possible. Many of the structures already include overflow devices or structures within them, and other bypasses

may need to be installed, if safe to do so at the time. See the *Water Management Inspection Manual* for detail.

- During freezing conditions, pumps may be operated on a timed pumping cycle (based on site conditions) to prevent conveyance pipes from freezing. Pumps may be turned on and off based on cycle time rather than water level (the latter representing the more standard level setting). Once temperatures return to those suitable, pumps can operate under normal conditions.

The West and Long Ditch systems are required to handle the following precipitation events:

- Safely contain and convey a 1 in 10 year 24-hour storm event.
- Be capable of withstanding all flows resulting from up to a 1 in 200-year 24-hour storm event without significant damage.

It is therefore expected that the system shall effectively manage all normal meteorological events, with environmental discharge being a distinct possibility in extreme weather events, but accommodation for this is included in the design. As it is not possible to determine the magnitude of an event in real time, the assumption shall be to contain and convey all flows until it is observed impractical under the guidance of the *Water Management Inspection Manual*. Trust in the design and ensuring the system is properly maintained are therefore necessary to ensure the systems operate as intended.

7.2.3 TSF Seepage

All waters that report through the TSF shall be considered contact water and must be managed accordingly. Seepage through the embankment (including the upstream drain), and precipitation that falls on the embankment, but downstream of the core will report to one of the seepage control structures and make its way to one of the seepage ponds. All collection ponds described below have permanently installed, color coded water level indicators. The appropriate response for a given water level is described within the *Water Management Inspection Manual*. The general goal will be to maintain as little water in any of these systems as is practical, reserving storage for times of high flow.

Seepage management for the Main and South Embankments is primarily automated. Flows report through a ditching system to one of the seepage ponds, which are then conveyed by pumping to the TSF. There are periods of time when the pumping systems are not on automatic, specifically the summer months, with pumping controlled by the individuals performing the inspection duties. Maintenance and surveillance following the *Water Management Inspection Manual* is essential for proper operability of this system.

Seepage at the Perimeter Embankment eventually reports to either the CCS, or PETBP. It is essentially a gravity driven system, and is therefore automated, and kept functional through the surveillance and maintenance protocols. The CCS and PETBP also serve other functions beyond that of purely TSF seepage control and are described in the following sub-section.

The MESCP and SESCP serve as the supply source for dust control waters on the TSF beaches as well as the utilization of water cannons (if setup) to optimize evaporation of excess water. Excess water in the MESCP may also be pumped back into the TSF via the same line that conveys water to the dust control sprinklers.

7.2.4 CCS and PETBP

As with the other water management systems, operational guidance for both the CCS and PETBP is contained within the *Water Management Inspection Manual*.

Overflow from the CCS reports to the PETBP. The PETBP is the central water management control structure for site waters outside of the TSF. Water level in the PETBP is controlled by the WTP discharge and 2 electric pumps in the PETBP on automatic floats to pump to the TSF. During the times of low site flow, the excess water in the TSF will be conveyed to the PETBP for eventual discharge through the WTP. This water transfer will occur by overflowing the Booster Stations allowing the water to flow into the west ditch. These systems are capable of meeting the design criteria to manage the 1 in 10 year 24-hour storm event (PETBP to TSF) and 0.3 m^3/s for the TSF to PETBP system to maximize site discharge through the WTP.

7.2.5 Other Water Management Facilities

Non-Contact Water Ditches

The non-contact water system is composed of fully self-functioning ditches and sumps. The key to ensuring this system remains operable lies in the regular inspection and maintenance of these structures, following the *Water Management Inspection Manual*.

Dust Control Systems

The primary method of dust control on site is to wet down the mine roads system. A fill station is setup at the crest of the Cariboo Pit and is supplied by water from the Cariboo Pit Sump. Temporary stations may also be utilized at other locations as needed, so long as any necessary protections are installed.

Secondarily, there is need to control dust on the large, dry surface within the TSF. There is a non-fixed system to supply water to large sprinklers, which are placed in various locations within the TSF. The system typically sources its water from the MESCP, but any location will suffice to get water to the appropriate locations. Mine Operations operated the fill stations and Site Services is responsible for the TSF sprinklers.

7.3 Water Management Meeting

To effectively manage the site water system and infrastructure, a water management meeting facilitated by the Water and TSF SuperintendentWater and TSF Superintendent shall be held at regular intervals. During periods of high water management activity, such as freshet, these meetings will occur weekly or bi-weekly, and occur monthly during times of little activity, such as winter and late summer.

The meetings will address all site water related matters such as pumping requirements, pit dewatering, projects, WTP, tailings discharge, water discharge, ponds, sumps and ditches. Representatives from the following Departments will attend the meeting:

1. Mill Maintenance / Electrical
2. Mine Operations
3. Environmental
4. Procurement (optional)

7.4 Emergency Flood Management

A great deal of effort has been undertaken to study, design, and implement the water management systems in place at MPMC to ensure that water is controlled and conveyed in an appropriate way without undue harm to the systems or the receiving environment. Each system is designed according to its own set of criteria, which is not common everywhere on site. When an unusually large precipitation or flood event occurs, it is essential to know how to deal with it.

First, it needs to be understood that, although there are definitions such as “1 in 10-year 24-hour storm event’ or “1 in 200-year freshet” there is no practical way of determining this while it is occurring. During such occurrence, the first priorities shall be the safety of the TSF, which will be guided by the TSF Operations Parameters, QPOs and the Water Management Inspection Manual. Facilities may need to be prioritized, and it may become necessary to abandon action for a lower priority facility to ensure that higher priority infrastructure is protected.

It will also be crucial to maintain the appropriate level of communication, through normal operating parameters or by way of the EPRP protocols, with the EoR and Regulators. Extreme events will present MPMC with a wide variety of potential problems, and decision making amongst the various stakeholders may become necessary. However, the responsibility to protect the facilities and the receiving environment is MPMC’s and it may become necessary to react without the consent of regulators or the EoR. Planning (and proper implementation of the plan) will be the corrective action to this type of action having to occur.

7.4.1 Systems Priority

The highest priority will be given to the health and welfare of personnel and, following this, the receiving environment. Stating the priority level for the various water management components will be based upon these two overarching goals.

The TSF is the most potentially hazardous component. The TSF is designed to a much higher standard than the other facilities on site as it is expected to handle a much greater flood event than any other (non-pit) component. Though the standard procedure for excess site water reporting to the CCS and PETBP will be to pump it into the TSF, this will need to cease if the water level increases too rapidly or freeboard requirements are approached. Conditions within the TSF at the time will form the basis of decision making regarding potential danger. Site Management and the EoR will have to be involved in the action planning surrounding any type of event that may cause an unsafe condition in the TSF.

Below is a list of possible actions to limit damage in an extreme run-off or precipitation event:

- Cease tailings delivery.
- Cease all water pump-back into the TSF.
- Maximize WTP throughput without compromising permit criteria
- Maximize reclaim and facilitate an alternative storage location.
- Re-direct into the Cariboo Pit from the Mill Process Water Tank.
- Re-direct into the Wight Pit from the Mill Process Water Tank.
- Cease all pit dewatering.
- Install additional pumps in a facility at risk. United Rental has pumps available for MPMC
- Direct as much water into the pits as possible. They are, practically speaking, unfillable by a single event.
- Engage the EoR to aid in evaluating the situation and formulating the appropriate action plan, which may include construction of a Spillway.
- Facilitate offsite discharge.
- Stop concentration of flows by shutting off pumping systems that pump from one sump to another and allowing individual sumps and ditches to overflow, ideally into a pre-existing channel.
- Install pumps in the TSF and pump water downstream.

Ideally, communication with the EoR, regulators and the directly affected communities will have been initiated. No assumption of permission being granted should be made. MPMC and/or the EoR may have to make the determination themselves, but it is preferable to have advanced notice to all affected groups.

The Water Management Inspection Manual (Appendix C) and the EPRP both contain pre-arranged information meant to aid in emergency level event decision making (cheat sheets).

7.4.2 Emergency Spillway

The emergency Spillway has been designed by WSP and the liner material has been procured and is available on site. The liner (ENVIRO 6000) material is approved by the EoR and is located in

the instrumentation seacan near the quarry. The Mine Operation Superintendent (or designate) holds the keys to this locked seacan. The design is referenced in Appendix F of this document.

8.0 MAINTENANCE

As outlined in this Manual, water management on site comprises multiple components and associated facilities. These components and facilities must be inspected and maintained regularly to ensure that any changes to their condition, performance, or a potentially hazardous condition can be identified and promptly addressed.

Maintenance will be broken into two groups: Equipment maintenance and Facility maintenance. Both types will be heavily dependent on proper surveillance of the associated systems.

8.1 Equipment Maintenance

Equipment maintenance refers to maintenance of the pumping and piping systems and their associated structures and power systems. Equipment maintenance is generally performed by certified tradespeople following common maintenance practices. The maintenance they perform will be that associated with regular operations, at regular intervals, as well as reactive maintenance as the result of an observed substandard condition. Equipment maintenance will follow the recommendations of the manufacturer or site specific Standard Operating Procedures (SOPs.)

Mill Maintenance Superintendent or designate

- 24" and larger pipes, valves, and gates for the reclaim and discharge lines from the Mill building, through the Booster Station, and down to the Corner 5 "Y" (discharge line) or the TSF Barge (reclaim line).

- Mechanical components of all fixed pumping systems, including:
    - Reclaim Barge, pumps and associated non-electrical equipment
    - Booster Station pumps and associated non-electrical equipment.
    - PETBP-TSF pump-back system.

- All water and tailings distribution equipment within the mill complex
- All fixed power distribution equipment – poles, lines, and transformers, all protective devices
- Installation and maintenance of electric motors and other components
- Instrumentation installation and maintenance. This does not refer to TSF performance monitoring instrumentation, rather instrumentation on the mechanical and electrical pumping systems.

Water and TSF Superintendent or designate

- All pumps, pipelines and associated equipment throughout the mine site not under the responsibility of the Mill department, including:
    - All discharge pipeline downstream of the Corner 5 “Y”, and all other components of the discharge system on the TSF.
    - All non-electrical components of the ditch systems’ dewatering infrastructure.

8.2 Facility Maintenance

Facility maintenance is maintenance on the TSF embankments, buttresses, seepage collection ponds, ditches, geotechnical instrumentation and groundwater wells. It is generally the maintenance of any structure made of earth materials. These structures do not move, and so typically only degrade because of outside forces, such as running water, gravity, and equipment activity. Following the proper surveillance protocols is crucial to ensure that facility maintenance items are properly identified in a timely fashion.

All facility maintenance is done under the Water and TSF Superintendent’s authority through MPMC personnel and contractors. It can be the result of either an automatic response to an obvious deficiency, through instrumentation readings and analysis or indirect observations, such as seepage increases. The extent of the maintenance may need to be determined by the EoR and effective communication is essential for this to occur.

8.2.1 Embankments

The embankments will be subject to gravity, weather and equipment activity. The crests of the embankment shall be kept in such a way as to facilitate traffic and avoid water ponding. Ponded water should not be allowed to flow over the crest of the embankment as that could result in erosion of the downstream slope, rather it should be encouraged to flow through the coarse downstream shell or pumped into the TSF. Trenching across the core is not permitted.

Settlement of the embankment may result in cracking along the crest. Any crack(s) shall be documented and communicated with the EoR, who will determine the course of action to be taken.

8.2.2 Ditches and Sumps

Ditches and sumps will be kept clear of built up material and obstructions and shall be repaired after any damage that may occur to them is observed. Damaged areas should be built up beyond their original condition so as not to repeat the damage for a similar event. Culverts will be kept open and weirs will be kept free of debris and maintained such that they perform as required. The Site Services group will perform maintenance. There will also be the occasional need to clear plants and trees that may grow in the ditches and sumps.

8.2.3 Access

Roads, trails, ladders and all other means of accessing the various facilities need to be kept usable to ensure their proper functionality. The majority of this work is the plowing of roads (year round), but also includes snow shoveling, ice removal, and other types of access related maintenance issues. This is typically reaction-based maintenance and requires proper communication from the impacted individuals to Mine Operations.

8.2.4 Geotechnical Instrumentation

Generally, the instruments do not require regular maintenance, but may require occasional maintenance as follows:

- The piezometer wires may need to be cut and re-attached if the readout box is unable to acquire any data.
- Piezometer wires that are exposed may become corroded and may need to be trimmed until a fresh surface is exposed to allow readings to be taken.
- Extension of Slope Inclinometer casings to facilitate embankment buttress construction.
- Power systems for instrumentation, such as the SAA's, in-place inclinometer (IPI) and dataloggers.

The TSF Instrumentation Technician will facilitate the repairs of any of the Geotechnical Instrumentation with guidance from the Water and TSF Superintendent and EoR when necessary.

8.2.5 Groundwater Wells

Decommissioning and replacement of existing groundwater wells and construction of groundwater wells at new monitoring locations are addressed by a third party Qualified Professional in an assessment of the monitoring program and possible impacts for groundwater every three (3) years, as per *EMA* Permit 11678.

Well development is completed as soon as possible after installation of new wells and is completed on any wells where water being purged contains significant amounts of sediment (the presence of sediment is noted in sampling observations).

During bi-annual sampling, any wells missing PVC J-plugs, casing protector lids, or locks are noted and fixed. Additional maintenance items are noted during bi-annual sampling, based on observations of the physical state of the well and/or properties of the water.

9.0 SURVEILLANCE

As outlined in this Manual, water management on site comprises multiple components and associated facilities. These components and facilities must be inspected regularly to ensure that any changes to their condition, performance, or a potentially hazardous condition can be identified and promptly addressed.

The Mill Maintenance Superintendent and Water and TSF Water and TSF Superintendent are responsible for ensuring that surveillance is carried out regularly. The Water and TSF Superintendent is responsible for daily management of the TSF water management systems and ensures crew carries out routine activities. The Water and TSF Superintendent is also responsible for directing and coordinating all TSF surveillance and facility maintenance to the specifications of the EoR.

The Water and TSF Superintendent will conduct and document an embankment surveillance walkover at least once per quarter. Weekly Embankment surveillance reports, completed by the MPMC Instrumentation Technician, shall be reviewed by the Water and TSF SuperintendentWater and TSF Superintendent and filed at the Mount Polley Mine Site. Additional (non-routine), documented "drive-bys" of the TSF and associated facilities will be required following extreme or unusual events. The Water and TSF Superintendent must be made aware of any unusual events or observations and shall contact the EoR as required. Typical examples of unusual events and observations to be made during such walkovers are outlined in the "Unusual Event or Observation" section included in the *Water Management Inspection Manual*.

Guidance documents are included in the *Water Management Inspection Manual* (provided in Appendix C) to help guide the observation and surveillance process. The documents cover major items related to the TSF and associated facilities. Additional details are provided in the following sections.

9.1 Water Management Systems

Site Services personnel in accordance with the Water Management Inspection Manual, which includes water management checklists, shall inspect the seepage collection ponds and recycle pumps. Typical observations to be made during surveillance are as follows:

- Water levels in ditches, sumps, ponds and within the TSF;
- Pump back flow rates from pumps;
- Evidence indicating seepage from the ditches, sumps and/or ponds;
- Evidence indicating erosion or instability on the slopes of ditches, sumps and/or ponds;
- The overflow culverts and pipelines between sumps and/or ponds are free of any obstructions; and
- Ensuring that the discharge end of pipelines, culverts and spillways are not obstructed
- Ensuring that ditches are not obstructed/blocked.

Additional observations will also be required under special circumstances as follows:

- Monitor the pumping from sumps and/or ponds during freezing conditions to ensure that the pumping cycle is adequate at keeping the pipes from freezing and in keeping the pond level constant; and

- Monitor the water quality in the sumps and/or ponds during spring freshet to ensure that the seepage water is at acceptable levels if water permits allow for discharge.

The Unusual Event or Observation document identifies additional events and circumstances that may require increased observations and documentation.

Environmental Department personnel will also be indirectly inspecting the various facilities as they perform their required materials sampling.

9.2 Tailings Impoundment and Pond

The TSF is operated according to the protocols outlined in the Operations Section of this manual. Daily measurements of the pond level shall be carried out and instrumented flows into and out of the TSF will be measured. Increasing the number of measurements of, and improving upon the measurement of, flows into and out of the TSF will continue and provide for a more accurate TSF mass balance. This information will be utilized to form a materials balance for the TSF impoundment. This balance will be regularly checked against actual conditions and modified as information is gained and understanding of the facility improves. Topographic and bathymetric surveys will be carried out after freshet and during fall each year to confirm the pond size.

Visual inspection, specifically for beach condition and deposition line condition will also be performed daily. However, winter conditions will likely preclude proper beach inspection, and beaches may have to be determined indirectly via survey data.

The weekly TSF Field Inspection conducted by Instrumentation Technicians according to the *Water Management Inspection Manual* includes some areas of pond inspection. Freeboard and beach width are to be checked against the QPO triggers and any QPO dictated actions are to be followed. Pond depth is operational only. There are no directly related QPO dictated actions, and pond depth is not practical to determine for much of the year.

9.3 Tailings Embankment

Weekly surveillance of the embankments and associated structures should follow the Field Inspection Report (included in the *Water Management Inspection Manual*). Typical observations to be made during surveillance include:

- Evidence indicating embankment structure deformation (e.g. slope bulging, tension cracks on the crest or crest settlement);
- Evidence indicating seepage, runoff or erosion;
- Clarity and quantity (visual estimate) of seepage water entering the seepage collection sumps;
- Other unusual conditions in the TSF area.
-

The embankment and associated earthwork structures do not require regular maintenance; however, specific maintenance items may be identified as a result of regular observations and surveillance of the embankment.

The Unusual Event or Observation document outlines additional observations that may need to be documented after any unusual event.

In addition to regular inspections of the TSF by site personnel, the EoR will conduct an annual Dam Safety Inspection (DSI) and will include all elements of the TSF (Pond, Embankments, Buttresses, Seepage, and Operations). Recommendations from this inspection will be delivered to MPMC for review and implementation. The inspection report shall be completed and submitted to EMLI by March 31 of the year following the inspection. Additionally, the IERP may conduct a review of any structure or process at their discretion, followed up with a written report submitted to the Mount Polley General Manager.

9.4 Tailings Discharge Pipelines

The tailings discharge pipelines will be inspected each shift and maintained regularly to ensure that the system operates properly. The *Water Management Inspection Manual* includes a Daily (each shift) Tailings Line Inspection Checklist for regular surveillance of the pipelines. Typical observations to be made during surveillance include:

- Evidence indicating leakage from the pipelines;
- Evidence indicating grade variations and/or blockages;
- Confirmation that conveyance ditch lining (where appropriate) is continuous;
- Evidence of overhanging rock or objects that could fall and damage the pipelines

The Unusual Event or Observation document outlines additional observations that will need to be documented after any unusual event. Repairs to the discharge pipeline, and/or discharge sections may be required after any such unusual event.

Noted deficiencies shall be communicated to the Mill Maintenance Superintendentand the Water and TSF Superintendent. The individual performing the inspection has the authority to stop the tailings flow through communication with the Mill Manager or Mill Maintenance Superintendentand Water and TSF Superintendent if he or she feels a line deficiency has the potential to cause significant damage to a structure or the environment.

9.5 Beaches

MPMC Technical Service staff shall formally inspect and document the beaches weekly according to the protocols in the *Water Management Inspection Manual*. Daily, informal inspections shall also occur by the various operations and supervisory personnel. Beach maintenance will occur through proper deposition management, which will be done through the Water and TSF

Superintendent. Deposition will be moved according to beach development needs. A model of the tailings deposition is included in the TSF design report (*Tailings Storage Facility Detailed Design to Elevation 970 m*, Nov. 3, 2015) as Appendix D of that report. The latest deposition model was completed in March 2019 (reference number 1894924-073-PP-Rev0-51141). There are some assumptions within the model that may have to be modified as actual deposition conditions are observed.

Within the QPO's (Appendix I), beach width monitoring has trigger levels indicating the various response actions based upon the reading or change in reading. MPMC is responsible for implementing the QPO actions based upon the recorded data or through direction of the EoR. The EoR must be notified of any anomalous trends. Additional readings and inspections may also be required after any *Unusual Event or Observation*, at the direction of the EoR or at the direction of the Water and TSF Superintendent.

9.6 Drain Pipes/ditches and Seepage Pipes.

Measurements of the Seepage Turbidity and Seepage rates will be conducted by Environmental Technicians. Figure 9.1 summarizes the QPO zones and monitoring frequency

Quantitative Performance Objective		Value	Source/Comment/Action
Seepage turbidity (Field test)	Data gathering frequency	Once every two weeks.	South Embankment drain, Main Embankment east drain, Main Embankment west drain, Corner 1 cutoff wall seepage drain, Corner 1 upstream drain, South diversion ditch and North diversion ditch. Probe is highly sensitive to sampling quality. Re-test turbidity immediately if reading exceeds 1.5 NTU.
	Normal Operating Zone	Turbidity < 1.5 NTU	A copy of the figures reported in the 2022 annual dam safety inspection presenting the historical turbidity readings is attached.
	Concern Zone	Turbidity < 2.0 NTU	Increase monitoring frequency of seepage rate/turbidity and piezometers around the area of concern. Complete inspection of tailings beach, embankment, buttress, downstream toe and seepage collection ditch/pond near the area of concern.
	Buffer Zone	Turbidity < 3.0 NTU	Same actions as for Concern Zone and collect and submit seepage water samples for expedited laboratory testing.
	Unsafe or Out of Compliance Operating Zone	Turbidity > 3.0 NTU	Same actions as for Buffer Zone. If laboratory test results confirm the turbidity levels measured in the field: - increase pumping from TSF to other facilities. - adjust tailings deposition to build tailings beach upstream of the embankment. - stop all other pumps pumping water into the TSF.
Seepage rate	Data gathering frequency	Once every two weeks.	If the seepage rate from the South Embankment drain, Main Embankment east drain, Main Embankment west drain, or Corner 1 upstream drain increase or decrease significantly (e.g., more than 50% between readings), notify the Engineer-of-Record (EoR) and the TSF Qualified Person within 24 hours.
	Normal Operating Zone	Corner 1 cutoff wall seepage drain: < 1.0 l/s	Maximum rate expected during normal operating conditions (i.e., beach width > 100 m, pond size < 1.5 million m³) based on readings since 2015. Higher rates can be expected during freshet or large precipitation events. A copy of the figures reported in the 2022 annual dam safety inspection presenting the historical seepage rates are attached.
	Concern Zone	Corner 1 cutoff wall seepage drain: < 3.0 l/s	Increase monitoring frequency of seepage rate/turbidity, piezometers and beach width around the area of concern. Complete inspection of tailings beach, embankment, buttress, downstream toe and seepage collection ditch/pond near the area of concern.
	Buffer Zone	Corner 1 cutoff wall seepage drain: < 6.0 l/s	Same actions as for Concern Zone. Increase pumping from TSF to the water treatment plant.
	Unsafe or Out of Compliance Operating Zone	Corner 1 cutoff wall seepage drain: > 6.0 l/s	Same actions as for Buffer Zone. Maximize pumping from TSF to the water treatment plant and increase pumping to other facilities (e.g., open pits). Adjust tailings deposition to build tailings beach upstream of the embankment. Stop all other pumps pumping water into the TSF.

Figure 9.1 – QPO Turbidity and Seepage Zones and monitoring frequency

- Bi-Weekly measurement of flow and field parameters (temp, pH, Specific conductivity, turbidity) at:
  - Upstream Drain (Turbidity & Seepage Rate)
  - South Diversion Ditch (Turbidity)
  - North Diversion Ditch (Turbidity)
  - Cut-off-Wall (COW) Drain (Turbidity)
  - East Main Toe Drain (MTD) (Turbidity & Seepage Rate)

- West MTD (Turbidity & Seepage Rate)
- South Toe Drain (STD) (Turbidity & Seepage Rate)

9.7 Reclaim System

The reclaim pipeline, Reclaim Barge (including pumps), and Booster Station are inspected each shift as a part of the shift inspection performed by Mill Operations staff or Site Services which also inspects the discharge line. The mechanical systems are constantly monitored by instrumentation, which reports to the Mill Operations Control Room.

Typical areas to inspect during visual surveillance of the reclaim pipeline include:

- Locations of excessive wear of the pipeline (filed with Mill Maintenance Department); and,
- Evidence indicating leakage from the pipeline.
- Evidence of leakage or improper operation of a pump, header, or distribution tank.

Additional inspections are required after any unusual event. The Unusual Event or Observation document outlines additional observations that will need to be documented. Repairs to the reclaim pipeline, reclaim barge and/or Booster Station may be required after any such unusual event.

9.8 Instrumentation

All instrumentation components must be read regularly by the Instrumentation Technician. The monitoring frequency for the geotechnical instrumentation is determined by the EoR and specifies the schedule by which data must be collected, plotted and reported. The readings are to be collected, reviewed and forwarded to the EoR according to his prescribed schedule. Within the QPO's (Appendix I), all instruments have trigger levels indicating the various response actions based upon the reading or change in reading. MPMC is responsible for implementing the QPO actions based upon the recorded data or through direction of the EoR. The EoR must be notified of any anomalous trends. Additional readings and inspections may also be required after any *Unusual Event or Observation*, at the direction of the EoR or at the direction of the Water and TSF Superintendent.

9.8.1 Geotechnical Instrumentation

MPMC personnel in accordance with the frequencies determined by the EoR gather Geotechnical instrumentation data.

Existing instrumentation locations are presented in Figure 9.2 and Figure 9.3 and a summary is provided in the sections below.

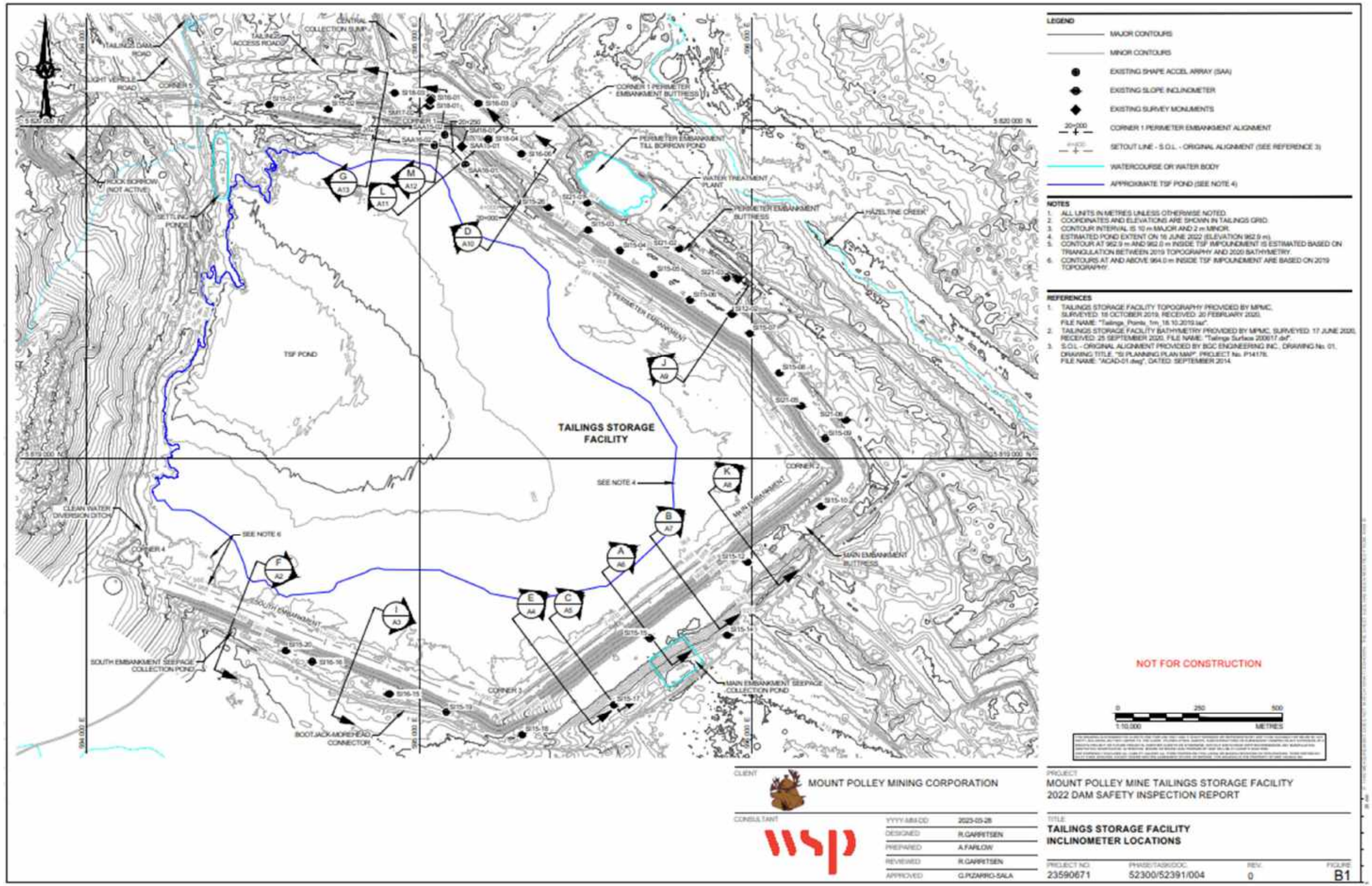


Figure 9.2 Slope Inclinometer and SAA locations

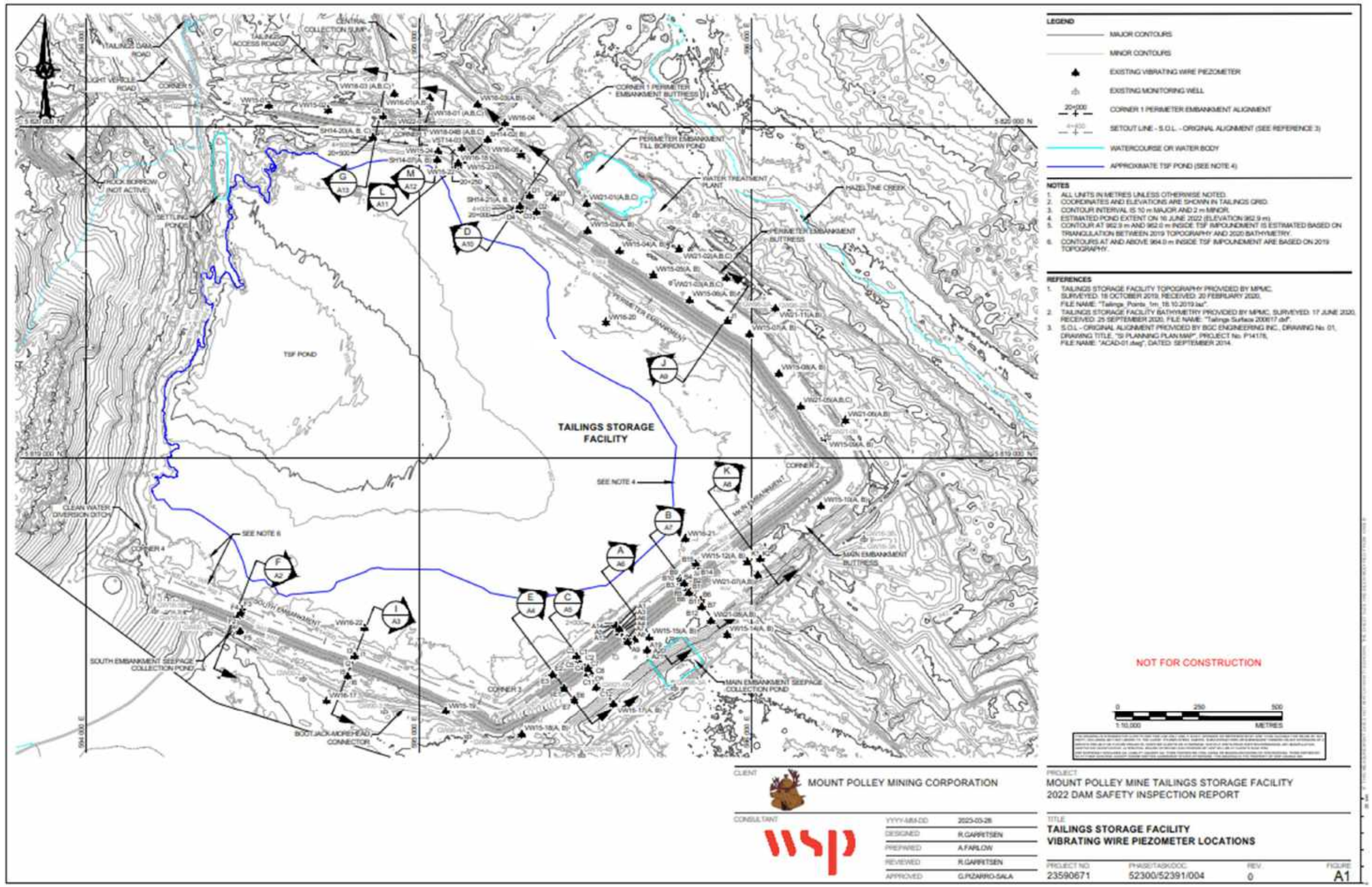


Figure 9.3Vibrating Wire Piezometer Locations

See the QPO (Appendix I) for specific triggers and response actions for geotechnical instrumentation, beach width and freeboard. The trigger values define four (4) operating zones: Normal Operating Zone, Concern Zone, Buffer Zone, and Unsafe or Out of Compliance Operating Zone. If the trigger levels are exceeded, the instruments are to be re-read immediately. If the initial readings are proven accurate, the EoR is to be contacted. If a change below the trigger level is recorded in multiple instruments in a similar location, the EoR is to be notified immediately. Interpretation of the instrumentation data is performed by the EoR, so the EoR will initiate communication with site related to interpretation of dam performance issues based on the instrumentation data. Communication related to any other issues related to dam performance that are identified on site will be initiated by site personnel to the EoR. If the instrumentation readings are within the Buffer Zone, the EoR and Water and TSF Superintendent are to be contacted immediately.

If the instrumentation readings are within the Unsafe or Out of Compliance Zone, the EoR, Water and TSF Superintendent, and onsite General Manager are to be contacted immediately, and the emergency response actions and notification under the EPRP (and section 11.0 of this document) are to be followed.

9.8.2 Inclinometers

A list of active inclinometers installed is included in Appendix B.

The slope inclinometers are to be read, and the data downloaded, reviewed and submitted to the EoR, once every two weeks. The tops of the inclinometer casings are to be surveyed quarterly, and the survey data supplied to the EoR with the inclinometer readings. The Water and TSF Superintendent is responsible for checking the readings against the QPOs and implementing the associated actions listed in Appendix I when the recorded instrumentation readings exceed the normal operating zone. The EoR shall be responsible for interpreting the data collected. Based on TSF performance, the reading frequency may be increased or decreased and installation of the in-place inclinometer may be required at the sole discretion of the EoR.

See the QPO table (Appendix I) for specific triggers and response actions for inclinometers. Inclinometer instrumentation is operated in accordance with the *Inclinometer Operation Manual* (attached in Appendix C.2).

Inclinometer instrumentation is operated in accordance with the *In-Place Inclinometer Manual* (attached in Appendix C.3).

9.8.3 Vibrating Wire Piezometers

The list of vibrating wire piezometers installed in the foundation can be found in Appendix B.

The piezometers are to be read, recorded, reviewed and submitted to the EoR once every two weeks. The Water and TSF Superintendent is responsible for checking the readings against the

QPOs and implementing the associated actions listed in Appendix I when the recorded instrumentation readings exceed the normal operating zone. The EoR shall be responsible for interpreting the data collected. Based on TSF performance, the reading frequency may be increased or decreased at the sole discretion of the EoR.

Trigger levels and the required follow-up actions for vibrating wire piezometers are listed in the QPO's (Appendix I). The embankment piezometers will fluctuate based on the pond level within the TSF, and will be interpreted by the EoR once every two weeks. Piezometer instrumentation is operated in accordance with the *Piezometer Operation Manual* (attached in Appendix C.4).

9.8.4 Shape Acceleration Arrays (SAA)

The four (4) SAAs installed in the 2015 Freshet Embankment are listed in Appendix B.

The SAAs are to be read by the data-logger daily and the data downloaded, reviewed and submitted to the EoR once every two weeks. The Water and TSF Superintendent is responsible for checking the readings against the QPOs and implementing the associated actions listed in Appendix I when the recorded instrumentation readings exceed the normal operating zone. The EoR shall be responsible for interpreting the data collected. Based on TSF performance, the reading frequency may be increased or decreased at the sole discretion of the EoR.

SAA instrumentation is operated in accordance with the *SAA Operation Manual* (attached in Appendix C.5).

9.8.5 Groundwater Wells

MPMC has a *QA/QC Manual* (Appendix H), which is required under *EMA* Permit 11678. This manual was last updated in November 2020 for the annual review. This manual includes a Groundwater Well Standard Operating Procedure and Groundwater Well Work Method for the operation of groundwater wells at Mount Polley Mine; both are included for reference in Appendix H.

Wells are used to collect information for both environmental and embankment performance monitoring. Any wells sampled for environmental reasons shall do so under their respective requirements and procedures. Information gathered for the purposes of embankment performance monitoring will be sent to the EoR for analysis.

10.0 DOCUMENTATION

10.1 Annual Dam Safety Inspection (DSI)

Annual inspections of the TSF and associated facilities are required to evaluate the current performance of the TSF and to observe potential deficiencies in its condition, performance and/or operation. The Water and TSF Superintendent is responsible for arranging the inspections. This

level of dam safety evaluation should be based on detailed observations made by the EoR on site and the relevant information on the TSF operations collected by site personnel. Additional reviews may be required also as a follow up to the report of an unusual event or observation.

The EoR will evaluate the safety of the TSF and incorporate a routine review of the following:

- The consequence classification of the dam;
- The OMS Manual;
- The availability of all documents pertaining to dam safety on site;
- The site surveillance practice; and
- Changes in relevant regulatory requirements since the last inspection.

The EoR will issue an annual inspection report after completing the review. The report will be prepared in accordance with the EMLI *Guidelines for Annual Dam Safety Inspection Reports*. The report will include the following:

- Conclusions on the status of the TSF;
- Statements indicating completion of recommendations from previous inspections and reviews; and

Recommendations, setting priorities and a timeline for completion, if necessary.The Mount Polley General Manager and the EMLI should review each annual inspection report. The report shall be submitted to the EMLI Chief Inspector by March 31 of the following year. Copies of the reports should be made available on site and are available in the office of the EoR. The Mount Polley General Manager will ensure that an appropriate action plan is prepared and executed to ensure that all recommendations made in the annual inspection report are followed. This action plan shall be documented within the General Managers Summary Report which is submitted to EMLI before March 31 annually.

10.2 Independent Engineering Review Panel (IERP)

An independent engineering review panel (IERP) has been established to provide expert technical guidance related to all aspects of the design, construction, operation and closure planning for the TSF.

The IERP comprises at least three (3) qualified experts, and shall meet at a minimum annually. The objectives of the IERP are to confirm that the design and operation of the TSF is consistent with industry standards of best practice, to identify areas where risk reduction measures may be required and to provide advice that may add value to the safe operation, closure and long-term maintenance of the TSF.

A report prepared by the IERP shall be submitted to the Mount Polley General Manager within one (1) month of completion of a review meeting. The Mount Polley General Manager shall

provide a summary of IERP activities and recommendations to the EMLI Chief Inspector on an annual basis.

10.3 Dam Safety Review

The principle objective of a Dam Safety Review (DSR) is to ascertain that a dam has an adequate margin of safety, based on the current engineering practice and updated design input data. A DSR may also be carried out to address a specific problem. The 2022 DSR was finalized and recommendations and action plans are tracked.

A qualified engineer will be responsible for conducting each DSR at the TSF. The engineer conducting the DSR must be qualified to conduct safety evaluations and be familiar with the designs and other site-specific conditions and requirements pertaining to operations of the impoundment and associated facilities; but ideally should not have been involved in the design, construction or operation of the TSF.

Routine DSRs at the TSF will be scheduled, confirmed or revised at the time of each annual inspection. As required under the *Mines Act* Permit M-200; a DSR for the TSF was completed in April, 2017 and 2022.

A detailed scope of work for each DSR will be defined by the engineer prior to conducting the review and will be consistent with current engineering practice at the time it is conducted. Each DSR will evaluate the safety of the TSF and incorporate a detailed review of the following:

- The consequences classification of the dam;
- The adequacy of past annual inspection practice, the annual inspection recommendations, and their implementation;
- The OMS Manual; and
- Timing for the next regular DSR.

Each DSR report should include conclusions and, if necessary, recommendations pertaining to the safety of the TSF. Copies of the DSR will be sent to the Mount Polley Mine General Manager and the EMLI for review. Similar to the annual inspection report, an action plan should be prepared by the Mount Polley General Manager to address any DSR recommendations. A copy of each DSR will be sent to the EMLI and will also be available at the site and at the office of the EoR.

10.4 Construction Records (As-built) Report

At the end of each year's construction activities, the EoR shall prepare a construction record report of the activities. The report will document the extent of the construction activities, QA/QC results, and modifications to the design, which have occurred. It will also comment on whether construction was completed to the nature of the design, and, if not, detail all required works to

ensure that embankment safety shall be maintained. The report is due by March 31 of the year following construction.

11.0 EMERGENCY PROCEDURES

All operation of water management structures as outlined in this OMS Manual, including that relating to emergency procedures, is completed in accordance with regulatory requirements, company policies and sound operating practices, encompassing all significant aspects of, and activities for, the economical, safe and environmentally responsible storage of tailings and management of water. Additionally, there are two (2) documents, independent to the OMS Manual that specifically address emergency response: the TSF-specific *Emergency Preparedness and Response Plan* (EPRP) and the Mount Polley Mine Site *Emergency Response Plan* (ERP). The TSF *EPRP* is included in Appendix E for reference.

The *EPRP* enables MPMC to identify emergency and hazardous conditions threatening the TSF, expedite effective response actions to prevent failure, and reduce loss of life and property damage should failure occur. The *EPRP* provides TSF-specific guidance to complement the Mount Polley Mine Site *ERP*.

EMLI has outlined the definition of a Reportable Incident shown below in **Error! Reference source not found.**. Section 1.7.1 (2)(c) of the HSRC is specific to the Tailings Dam Facilities.

Reportable Incidents

Reportable Incidents

1.7.1 (1) The following incidents are classified as dangerous occurrences and must be reported in accordance with section 1.7.2:

(a) an incident that causes serious injury or loss of life;

(b) an incident that had the potential to cause serious injury or loss of life.

(2) In addition to an incident referred to in subsection (1), the following incidents are classified as dangerous occurrences and must be reported in accordance with section 1.7.2:

(a) unexpected major groundfall, slope failure or subsidence;

(b) unexpected structural failure or collapse of any part of the mine;

(c) for dams or dikes:

(i) unexpected cracking, subsidence, seepage, springs;

(ii) loss of freeboard;

(iii) washout, structural erosion, or any other deficiency that may adversely affect the integrity of the structure.

Figure 11.1 – 2022 HSRC Reportable Incidents

In the event of a Reportable Incident, the TSF QP or designate will notify EMLI. HSRC Section 1.7.2 outlines the requirements of this notification

Notification of a Reportable Incident

1.7.2 (1) In the event of a reportable incident, the manager must

(a) in the case of a reportable incident referred to in section 1.7.1. (1) (a), within 4 hours of the reportable incident, provide a verbal notification of the incident to an inspector, the management co-chair and the worker co-chair of the OHS committee or their designates and the local union,

(b) within 16 hours of a reportable incident, provide a written notice of the incident to an inspector, the management co-chair and the worker co-chair of the OHS committee or their designates and the local union, and

(c) within 60 days of a reportable incident, or within any longer time that may be specified by the chief inspector, submit the investigation report required under section 1.7.4 (2) to the chief inspector.

(2) The manager must engage with First Nations that may be affected by reportable incidents to determine which reportable incidents must be reported to the First Nations.

Figure 11.2 2022 HSRC Reportable Incident Notification

In the event that MPMC is unable to comply with any of the terms and conditions of the *Mines Act* Permit M-200 regarding the TSF, due to any cause, MPMC will:

- Immediately notify the EMLI of the failure to comply;
- Immediately take action to stop, contain, and/or clean up unauthorized discharges or otherwise stop the non-compliance, correct the problem, and if applicable, repeat sampling and analysis of any non-compliance immediately; and,
- The report will contain a description of the non-compliance, including dates and times, if the non-compliance has not been corrected, the anticipated time it is expected to continue, and the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the non-compliance.

11.1 Warning Signs

There are three status levels (or warning signs) which can be assigned to observations or conditions noted with respect to the TSF and other water management facilities. Certain triggers for the TSF, as listed within the QPO tables, (Appendix I), already contain stated actions, which shall be the

default reaction to such an occurrence since they refer to very specific criteria. However, the responses listed in the QPO's are very specific, and these and other observations and conditions should also be incorporated into the site EPRP, which defines and describes the general response to varying degrees of emergency condition, as follows:

Level 1 - Condition

Unusual conditions that do not yet represent a potential emergency, but do require prompt investigation and resolution.

The action in the event of a Level 1 Condition will typically involve an investigation, intensified monitoring, inspecting and/or testing, and defining and implementing possible corrective measures. The trigger levels, which elicit a description of "Concern Zone" within the QPO table, would be described as Level 1 within the EPRP guidelines.

Construction equipment will be available at the Mount Polley Mine Site and include, but not be limited to: excavator(s), grader(s), haul truck(s) and bulldozer(s). Construction materials will be available at the TSF and around the Mine Site for use in repairing or remediation of any damaged areas.

The notification procedures are as follows:

- The person first noticing a Level 1 Condition shall notify the Mine Operations Superintendent and the Water and TSF Superintendent and initiate corrective actions and intensified monitoring.
- The Water and TSF Superintendent shall notify the General Manager and the EoR as appropriate.

Level 2 – Condition

Conditions that represent a potential emergency, if sustained or allowed to progress, but no emergency is imminent.

The first action in the event of a Level 2 Condition is to discuss and define an action plan, at the site, under the direction of the Water and TSF Superintendent. The trigger levels which elicit a description of "Buffer Zone" or "Unsafe or Out of Compliance Operating Zone" within the QPO table would be described as Level 2 within the EPRP guidelines. A more complete understanding of the full condition and consultation with the EoR may upgrade any of these triggers to Level 3.

In many cases, this will also involve contacting, and discussing the event with the EoR. After such a plan is prepared, it must be presented to the Mount Polley General Manager for approval. Construction equipment should be made available, if required, at short notice.

The notification procedures are as follows:

- The person first noticing a Level 2 Condition shall notify the Mine Operations Superintendent and the Water and TSF Superintendent. Initiate corrective actions and/or intensified monitoring as appropriate.
- The Water and TSF Superintendent shall notify the Mount Polley General Manager and the EoR as appropriate.
- Buffer Zone and Unsafe or Out of Compliance Operating Zone will trigger a Reportable Incident Notification to EMLI

Level 3 - Condition

An emergency defined by either failure of a significant component of the TSF and/or associated facility or a significant failure of the performance of a component of the TSF. Such failure may have already occurred, or be imminent.

The first actions in the event of any Level 3 (Emergency) Condition are:

- Check that all persons who could possibly be affected are safe; and
- Initiate the appropriate chain of communications.
- If not done so already, a Reportable Incident Notification must be submitted to EMLI

The person who initiated the communication should then stand by at a safe location near the problem area and await further instructions or decisions. All those involved in emergency response, after first having communicated with the appropriate parties, should consider two (2) types of actions as first steps in the emergency response, with respect to the protection of human life and health, environment and property:

- What can be done to prevent the situation from worsening?
- What can be done to reduce the consequences of the impending or actual failure?

Any such action must be presented to the Water and TSF Superintendent, who will refer the action to the Mount Polley General Manager and the EoR, who collectively will decide on its implementation in consultation with the EMLI.

The notification procedure for a Level 3 (Emergency) Condition is as follows:

- The person noticing a Level 3 (Emergency) Condition shall notify the Mine Operations Superintendent, who will inform the Water and TSF Superintendent and the Mount Polley

General Manager. Corrective actions and/or intensified monitoring are to be initiated, as appropriate.

- The Water and TSF Superintendent will contact the EoR.
- The Mount Polley General Manager shall notify the Corporate (Vancouver) office and the EMLI.

In the event of an emergency that will result in an actual or potentially imminent embankment failure, or unplanned release of water to the environment, the Mount Polley Mine General Manager shall also notify the BC-ENV, and Emergency Management BC.

Names and telephone numbers for the key contacts are given in Table 2-1..

Certification of This Manual

This manual was produced onsite and is intended to provide full guidance with respect to the Operation, Maintenance, and Surveillance of the TSF as well as the Site Water Management Infrastructure. It is a live document in the sense that it shall be kept up to date to reflect the most current conditions and shall be re-distributed in part or whole if it deemed necessary to maintain a safe, operable site.

The Master Hardcopy shall be kept onsite in the Water and TSF Superintendent's Office. Digital Copies of this Manual, in its entirety, shall be kept in the Environmental partition of the Mount Polley Server. Digital copies of the reference documents listed in Table 6.1 shall also be kept in the same folder.

The Water and TSF Superintendent as well as the General Manager shall sign the Master Hardcopy. All other copies are reproductions only.

The Manual is valid until March, 2022

APPENDIX 4-1B: Geochemistry of Tailings from the Mount Polley Mine, British Columbia

Geochemistry of tailings from the Mount Polley Mine, British Columbia

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To support remedial decisions for the Tailings Storage Facility breach at the Mount Polley Mine (MPM), a geochemical characterization program assessing the metal leaching and acid rock drainage potential of the tailings and other materials released into Polley Lake, Hazeltine Creek, and Quesnel Lake was performed. Because the tailings and other materials settled under subaerial conditions along the banks of Hazeltine Creek and in subaqueous conditions in Polley and Quesnel Lakes, the geochemical characterization assessed reactivity in both terrestrial and aquatic environments. Tailings and other materials deposited in these areas were found to be consistently non-acid generating indicating that weathering conditions are expected to be pH-basic under all depositional conditions. Leaching potential of tailings in subaerial environments was low and the potential for oxidative and reductive dissolution under deep water conditions was found to be negligible. Sub-aerial copper leaching is likely controlled by mineral solubility, which will limit loadings to the environment and can be used to inform remedial decisions.

1 INTRODUCTION

A failure of a glacial lacustrine layer beneath the Perimeter Embankment of the Tailings Storage Facility at the Mount Polley Mine (MPM), British Columbia caused a breach of the embankment tailings dam on August 4, 2014 (IEEIRP, 2015). The dam breach resulted in a release of tailings and other materials into Polley Lake, Hazeltine Creek, and Quesnel Lake. As part of remediation planning, a geochemical characterization program assessed the metal leaching and acid rock drainage (ML/ARD) potential of the spilled tailings and other materials and this paper presents the key findings from the investigation.

2 BACKGROUND

2.1 *Geological Setting*

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008). The host rocks for porphyry mineralization are intrusions into the Nicola Volcanics varying in composition from diorite to syenite. Alteration is potassic (secondary biotite and pink orthoclase) and propylitic (calcite-epidote-chlorite-pyrite). Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5). Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$); iron carbonates have not been reported.

A significant portion of the copper at the MPM is not associated with sulphides (upwards of

50% in the upper portions of each pit) and has been historically been termed copper-oxide, although this includes both silicate hosted copper (e.g., chlorite) and copper carbonates like malachite (Taplin 2002).

2.2 *Ore Processing and Tailings Deposition*

Processing of ore mined from the Mount Polley yields a copper sulphide concentrate. In general terms, the concentrate is produced by blasting the ore and then hauling it to the processing plant, where it undergoes three stages of crushing, and three stages of grinding, followed by rougher and cleaner flotation to produce a copper concentrate. The flotation circuit concentrates sulphide minerals as they are hydrophobic. Following the removal of the copper sulphide minerals by flotation, the remainder of the slurry is disposed of as tailings. The tailings are lower in sulphide mineral content compared to the ore as majority of the copper sulphides have been removed.

Mill process reagents, with the exception of lime, are not expected to be present with the tailings and other materials deposited as they would either have remained with the concentrate (chemically bound to mineral surfaces) or degraded quickly in the environment. Life-of-mine processing changes were minimal and not expected to affect the geochemical reactivity of the tailings. As a result, the tailings geochemistry can be considered in aggregate.

Tailings slurry produced in the mill is gravity-fed to the TSF with deposition by single-point discharge. The single point discharge was often directed to cells, where bulldozers and weirs were used to separate the coarser fraction of the tailing from the finer fractions and build up sand adjacent to the embankments. The discharge point was sequentially rotated along the entire length of the three embankments (i.e. the Perimeter, Main, and South Embankments). The tailings produced during operations would have been well mixed and there appears to have been limited potential to create anomalous geochemistry zones that could have spilled after the dam breach.

3 CONCEPTUAL MODEL AND STUDY DESIGN

An initial geochemical conceptual model (IGCM) was formulated to guide the design of the characterization approach for the tailings and other materials deposited, which effectively represents hypotheses about tailings characteristics and reactivity that are subsequently evaluated through observations, sampling, testwork, and interpretation.

Complete details of the IGCM are provided in SRK (2015) and indicated that two main configurations of the tailings and other materials deposited needed to be evaluated. First, subaerial tailings along the banks of Hazeltine Creek would be susceptible to oxidation of sulphides due to exposure to atmospheric oxygen. Second, subaqueous tailings on the bottom of Polley Lake and Quesnel Lake would be much less reactive in terms of sulphide oxidation due low or oxygen free water but could facilitate dissolution of secondary minerals (i.e. iron hydroxides).

4 CHARACTERIZATION METHODS

4.1 *Overview*

Geochemical characterization of the tailings and other materials deposited consisted of field sampling along Hazeltine Creek and a series of geochemical tests to understand the composition, mineralogy and leaching characteristics under various storage configurations. SRK focused on the tailings and other materials deposited along Hazeltine Creek because weathering under sub-aerial conditions should represent the most likely scenario for leaching based on the IGCM. In addition, sampling by another consulting group (Minnow Environmental) included tailings and other materials deposited that settled in Polley and Quesnel Lakes. Between the historical data for the site, and two independent sampling campaigns, the assumption was that geochemical variability would be characterized. Complete details of field sampling and analytical

methods are provided in SRK (2015) and the following section provides key aspects of the methods used as part of the ML/ARD characterization program.

4.2 *Hazeltine Creek Sampling*

Samples of exposed tailings and other materials deposited in Hazeltine Creek were collected along 18 parallel transects, oriented roughly perpendicular to the course of Hazeltine Creek. The transects were spaced approximately 500 m apart beginning with transect ST17/18 in the area of the dam breach and ending with transect ST01 near the mouth of Hazeltine Creek at Quesnel Lake (Figure 4-1).

At each transect, major physical/depositional features were sampled, with up to five samples per transect. Physical/depositional features were determined in the field based on particle size (fine grained versus coarse), colour, or depositional area (e.g. high on a bank or shoulder versus adjacent to the creek). In total, 68 samples containing tailings and other materials deposited were collected. Approximately 10% of samples were collected as field duplicates and silica sand samples were included as field blanks.



Figure 4-1: Location of Hazeltine Creek Sampling Locations (SNC-Lavalin, 2015).

A total of 78 additional samples were collected from the study area for sequential extraction analyses by Minnow Environmental between August 13 and October 24, 2014. Specific details of the sample collection procedures and locations are provided in Minnow (2015). Of the samples collected, 18 were from the profundal zone in Quesnel Lake (6 lake sediment samples and 12 tailings and other materials deposited), 18 were from the littoral zone in Quesnel Lake (2 lake sediment samples and 16 tailings and other materials deposited), and 15 were tailings and other materials deposited from along Hazeltine Creek. Fifteen samples from the bottom of Polley Lake were also collected.

4.3 *Laboratory Analyses*

4.3.1 *Acid-Base Accounting and Trace Element Composition*

A two-phase testing approach was used for geochemical characterization in order to constrain composition variability and understand specific acid-base accounting (ABA) and mineralogical characteristics of the Hazeltine Creek samples.

Phase one testing included moisture content, multi-element analysis, including sulphur content by aqua regia digestion with an inductively coupled plasma mass spectrometry (ICP-MS) finish, total inorganic carbon (TIC), and particle size distribution by sieving.

Phase two testing was conducted on 25% of the samples, which were selected to capture the range of sulphur, TIC, copper, and selenium content in the Hazeltine Creek samples based on the results of the phase 1 analyses. Testing included paste pH and conductivity, modified Sobek Neutralization Potential determination (MEND 1991), total sulphur (by LECO furnace) and sulphate sulphur (by hydrochloric acid (HCl) leach). A non-sulphide copper analysis was also conducted by leaching sampled using 2.5% sulphuric acid with the filtered leachate submitted for ICP-MS multi-element scans.

4.3.2 *Mineralogical Characterization*

Mineralogical characterization using Quantitative Evaluation of Minerals by Scanning Electron Microscopy (QEMSCAN) was conducted on splits from all of the kinetic test program samples (see Section 4.3.4). Rietveld X-ray diffraction (XRD) and electron microprobe were selectively used to refine and confirm modal abundances, mineral form (e.g. the different iron oxides present) and element deportment for low concentrations that could not be resolved by QEMSCAN.

4.3.3 *Sequential Extractions*

Sequential extractions involve a progressive series of chemical extractions applied to the same sample in order to partition the total element content into geochemical 'fractions'. The sequential extractions conducted for the tailings were designed and directed by Minnow Environmental (Minnow 2015) and based on Tessier et al.'s (1979) procedure with modifications. However, the procedure is designed for soils, and as a result, some of the reagents used would likely target different mineral fractions in tailings than they would in soils. The most significant deviation included the 'organically bound' elements as there are expected to be limited amounts of organic materials in the tailings and the reagents (nitric acid, hydrogen peroxide) and temperatures (85°C) used likely oxidized some of the sulphide and may also leach more resistant oxide minerals. Tessier et al. (1979) also noted some alteration of the minerals smectite, chlorite and mica in this digestion step and these minerals are present in the MPM tailings.

4.3.4 *Kinetic Testing*

The kinetic testing program consists of six standard laboratory humidity cells (MEND, 1991) (labelled HCs 1 - 6), three column leach tests (COLS 1 – 3), two blanks (a HC and a column), and one HC duplicate. The intent of the kinetic testing program was to establish weathering rates under oxygen unlimited conditions using humidity cell testing and then use column tests to evaluate the effect of longer flow paths and lower water to solids ratios that were more similar to the field than dilute HC tests.

A range of tailings samples containing mean and upper 95th percentile materials for copper, selenium and sulphur were selected. Columns tests consisted of between 1.5 and 4.5 kg of material that were splits from the humidity cells (i.e. HC-1 = COL-1) and were leached with between 150 and 500 mL of water in a week, respectively. All kinetic tests were flushed weekly with leachate analysed for anions, major cations and trace elements needed for the province of British Columbia water quality assessments.

5 RESULTS

5.1 *Hazeltine Creek Field Sampling*

Two types of tailings-bearing samples were observed along Hazeltine Creek. They were classified in the field as 'grey tailings' and 'magnetite sands' based on physical and mineralogical characteristics. The grey tailings were silty-sand sized particles, and reacted strongly to HCl fizz test in the field. The magnetite sands samples were pinkish-orange, had a moderate to weak fizz reaction and were strongly magnetic.

The grey tailings tended to be most abundant along the embankments and upper benches of the creek, whereas the magnetite sands were commonly present in low-lying areas near the creek. With the exception of the area near the tailings dam breach and Polley Lake, the tailings were deposited in relatively thin 'skiffs' (e.g. 10 to 20 cm deep). The thickest observed subaerial tailings deposits (e.g. 1 to 1.5 m deep) were in the immediate vicinity of the tailings dam breach and Polley Lake (SNC-Lavalin 2015).

5.2 *Laboratory Analyses*

5.2.1 *Acid Base Accounting*

The form of sulphur was found to be sulphide, with sulphate typically below detection. Sulphide sulphur from ICP-MS was used for calculating acid-potential (AP). Neutralization potential (NP) by titration was found to be overestimated and carbonate by TIC was used to estimated NP for acid-base account calculations (SRK 2015). Iron carbonates, which can also overestimate carbonate NP, have not been identified at MPM.

Consistent with expectations from operational sampling (data provided by MPMC to BC Ministry of Environment (MoE) http://www.env.gov.bc.ca/eemp/incidents/ 2014/mount-polley.htm), the tailings and other materials deposited were found to all be non-ARD generating (Figure 5-1).

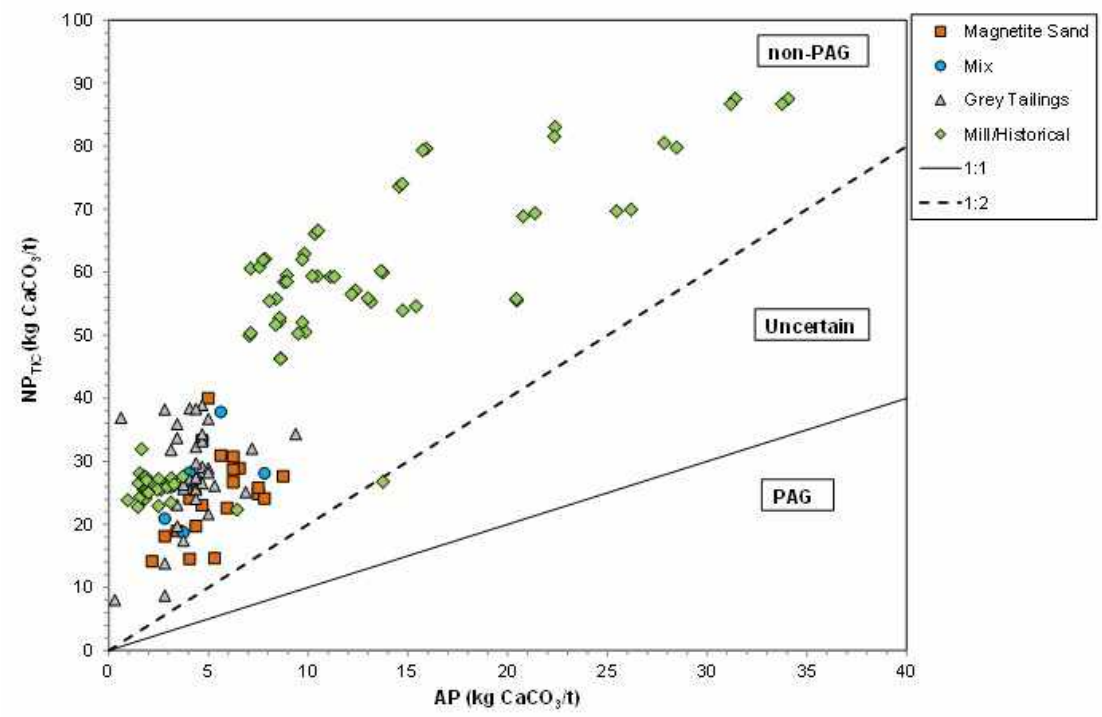


Figure 5-1: Comparison of tailings and other materials deposited and MPM mill/historical tailings.

5.2.2 *Trace Element Occurrence*

Complete analytical composition results for all samples from a 35 element scan are provided in SRK (2015). A statistical summary and shortened list of element concentrations that have guidelines for the protection of freshwater aquatic life in British Columbia is provided in (Table 5-1).

Table 5-1: Statistical summary of selected trace elements in MP tailings and other materials deposited.

Statistic	As mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Se mg/kg	V mg/kg	Zn mg/kg
Min	7.2	29	4.0	0.03	0.57	0.3	86	40
P5	8.7	360	4.4	0.06	1.9	0.74	120	45
P25	10	800	4.9	0.08	3.9	1.2	160	52
Mean	11	880	5.7	0.091	4.3	1.4	180	57
Median	11	910	5.4	0.08	4.6	1.5	180	56
P75	12	990	6.0	0.10	5.0	1.6	200	61
P95	13	1300	8.5	0.13	5.5	1.8	250	74
Max	13	1500	12	0.28	6.5	1.9	300	82

To provide an indication of trace element enrichment in the tailings and other materials deposited samples, concentrations were compared to typical global average concentrations for basalt (Price 1997). This comparison approach is a standard element leaching screening practice as outlined by MEND (2009). Concentrations present at more than an order-of-magnitude above global average values were considered enriched for the purpose of screening and enrichment ratios are shown in Figure 5-2. The ratios were calculated by dividing the concentration of copper (for example) in the sample by the typical concentration of copper in basalt. Ratios greater than 10 are considered enriched. Ratios less than one indicate lower concentrations in the Hazeltine Creek samples than in average basalt. 'Box and whisker' plots were used to illustrate the results, with the boxes representing the 25th to 75th percentile ranges. The solid horizontal line represents equivalence with typical basalt, whereas the dashed line represents ten times the concentration of basalt.

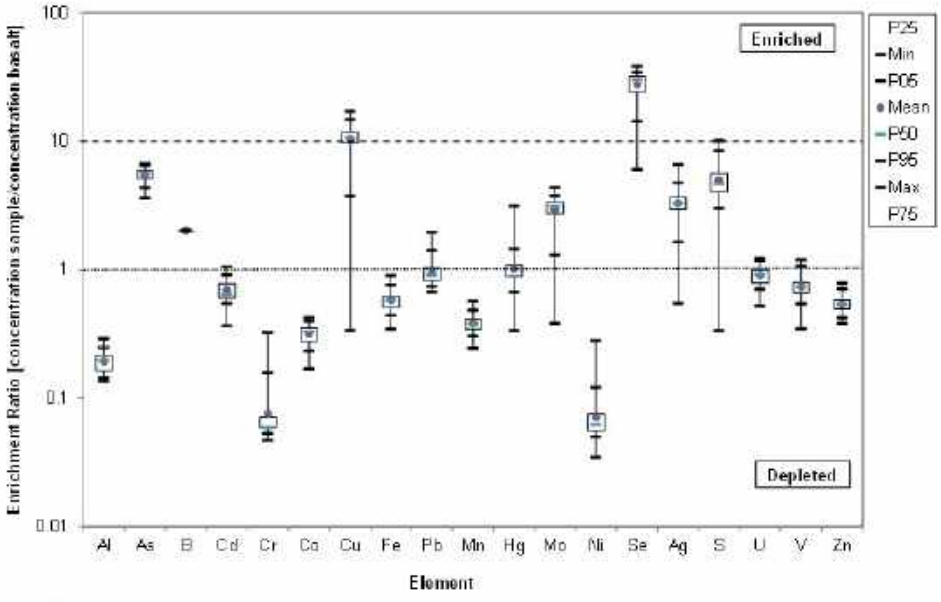
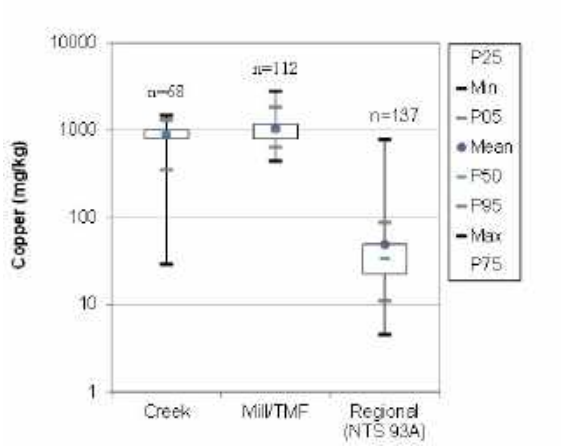
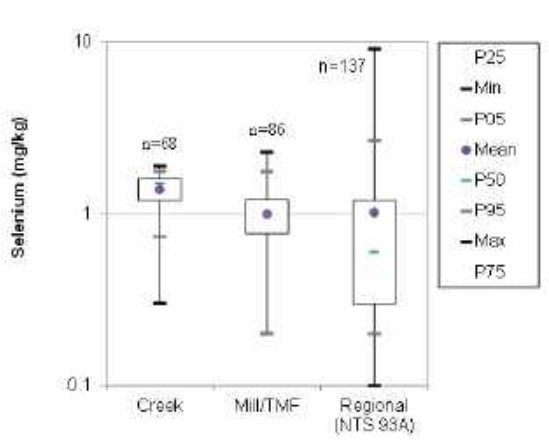


Figure 5-2: Element enrichment assessment for Hazeltine Creek tailings samples.

Based on the enrichment screening method of MEND (2009), copper and selenium are considered to be enriched in the tailings. However, the average concentration of selenium in operational tailings from within the TSF is lower (1.1 mg/kg) than the spilled materials and similar to the average of 137 regional stream sediment samples from the region surrounding Mount Polley (average 1.0 ppm, range 0.1 to 9.1 ppm)(GSC 1981; Jackman 2008)(Figure 5-3).



(A)



(B)

Figure 5-3: Comparison of copper (A) and selenium (B) concentrations in Hazeltine Creek tailings and other materials deposited, operational mill tailings and regional sediments.

5.2.3 *Mineralogy*

The samples are dominated by silicates, including feldspars, chlorite and quartz. Iron oxides (mainly magnetite) were frequently the next most abundant minerals after the silicates, followed by carbonates and the minor amounts of sulphides. The presence of quartz at concentrations greater than 1% is a good indication that the tailings are intermixed with native sediments as the deposit is syenitic to monzonitic and the tailings should contain very little to no quartz (BC MINFILE No. 093A 008).

Sulphide mineralogy is consistent with the ore mineralogy previously described for the project, including pyrite and chalcopyrite as the two main sulphide minerals in approximately equal proportions (approximately 0.2% for each mineral), followed by bornite (less than 0.1%) and other copper sulphides (likely covellite).

The main carbonate present was calcite, ranging from 0.7% to 4.5%. Dolomite was also present, although typically less than 0.1% with the exception of one sample (HC-4) at 0.4%. Malachite was also present, although at near detection levels.

Copper and selenium deportment was investigated, however, the concentration of selenium was too low to be detected by QEMSCAN or electron microprobe and only copper results are available. Chalcopyrite contained approximately half of the copper when total copper concentrations were above 0.05%. Chlorite was the next most abundant mineral to host copper, followed by bornite and covellite/chalcocite.

The deportment in chlorite was unexpected as previous investigations have indicated that chrysocolla was the non-sulphide mineral phase hosting copper. However, other studies have also noted the same finding (Chanquıa et al, 2010) and the overall implication is likely insignificant in terms of reactivity as previous work by MPMC has shown copper in the non-sulphide phase extremely resistant to leaching by acidic solutions (Taplin 2002; Henry 2009). Results from the non-sulphide copper leach also support these findings with an average of 50% of the copper in a non-sulphide phase. Given the recalcitrant nature of this copper mineral phase, it is also considered a much less reactive phase compared to copper sulphides.

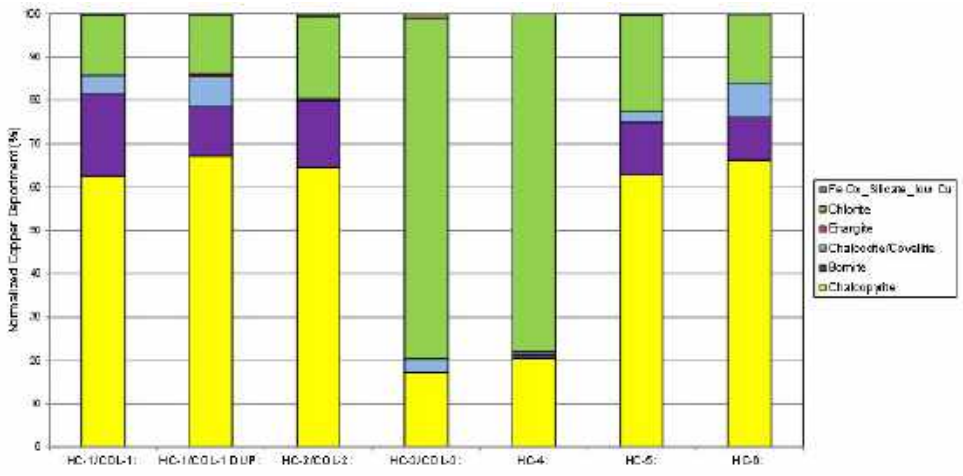


Figure 5-4: Mineral deportment of copper in Hazeltine Creek tailings and other materials deposited samples.

5.2.4 *Sequential Extraction Results*

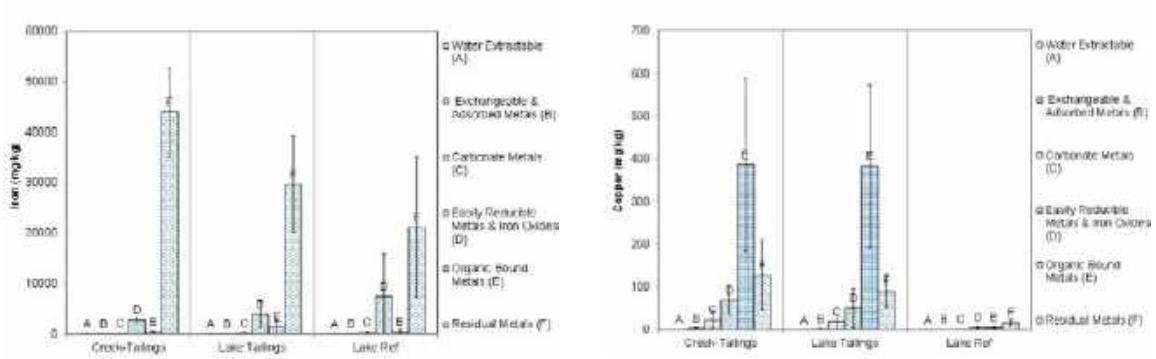
Results from the extractions were grouped together to represent tailings and other materials deposited from Hazeltine Creek, from the bottom of Quesnel and Polley Lake, and also lake sediments that were not impacted by the tailings discharge (i.e. a background lake reference). Iron and copper are shown in

Figure 5-5. Iron is not considered enriched the tailings, but is often associated with minerals that are susceptible to dissolution under sub-oxic conditions.

Iron was predominantly associated with the 'residual metals' fraction (e.g. 85% of total iron extracted in lake tailings) in all samples tested, which is likely comprised of mainly sulphides due to the use of an aqua regia digest as the final step. Magnetite was not likely dissolved in any of the sequential extraction steps. Only a small portion of the iron was present in the reducible fraction (~ 12%) and at lower concentrations than the background lake reference samples.

Copper was mainly associated with the 'organic bound' fraction, although as previously discussed in Section 4.3.3, this is likely partially associated with sulphide minerals and also chlorite due to the reagents and temperatures used in the extraction step (Tessier 1979). Mineralogy results also support this with the deportment of copper partially in chlorite. The 'residual' fraction contained the next highest amount, but also notable for copper was the presence of 4% in the 'carbonate metal', likely reflecting the presence of malachite.

Selenium results (not shown) were predominantly below detection (0.2 mg/kg based on aqueous concentrations in the extractions), with only the 'organic bound' and residual fraction slightly above detection limits.



(A) (B)

Figure 5-5: Sequential extraction results for iron (A) and copper (B).

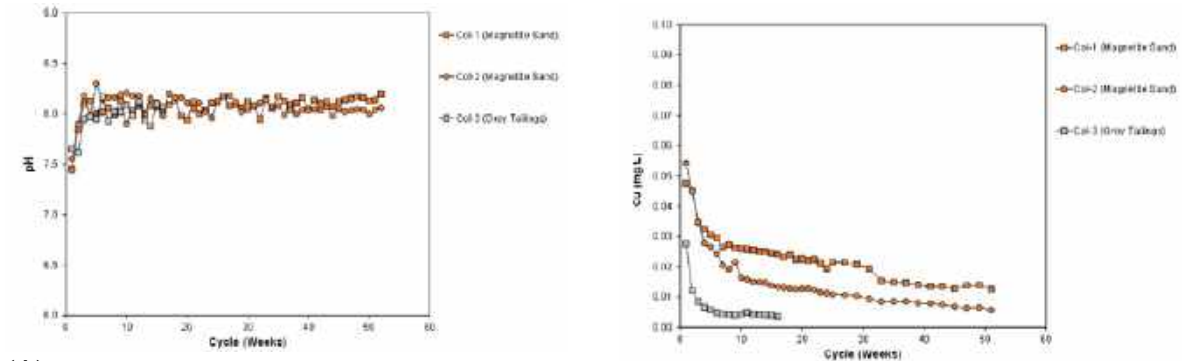
5.2.5 *Kinetic Testing*

Complete results for all elements regulated by the province of British Columbia are provided in SRK (2015) for both humidity cells and columns. Approximately one year of testing has been completed for this investigation, with testing on-going.

Copper is the focus of results presented below as copper is one of the two elements identified as enriched in the tailings. Sampling by the British Columbia Ministry of Environment (BC MOE) at the Mount Polley Mine has also identified copper as the main element of concern. Copper leaching is strongly pH dependent and therefore pH is also included for discussing long term copper behavior.

Humidity cell results (data not shown) have shown steadily declining rates of copper leaching under pH neutral conditions (pH of 8). Copper is leaching at a rate of 0.002 mg/kg/week, with concentrations around 0.005 mg/L. The columns (which are splits from HC composites) are also pH slightly basic (pH of 8) with a copper leaching rate slightly lower than the humidity cells at 0.001 mg/kg/week with concentrations now around 0.01 mg/L (Figure 5-6). The higher concentrations and lower leaching rate in the columns are interpreted here to reflect a solubility limit being reached, which is discussed in Section 6.1.1.

The lower pH and higher copper concentrations during the start of the kinetic tests are likely a result of the samples being stored in the laboratory for several months before testing began. During this time, the sulphide minerals would still have been oxidizing but the acidity formed could not be neutralized by the available carbonate minerals as there was no flow of water through the sample. As the column test started and water was passed through the tailings, pH increased and copper concentrations decreased.



(A) (B)

Figure 5-6: Column testing results of pH (A) and copper (B).

6 DISCUSSION

6.1 *Leaching Mechanisms*

6.1.1 *Subaerial Weathering of Tailings*

Tailings and other materials deposited are expected to weather under neutral pH conditions. ARD has not been identified as a concern for Mount Polley tailings historically and the results of this program confirm the previous findings that weathering and trace element release will be under neutral pH.

The tailings and other materials deposited and mixed-in sediment materials deposited along the banks of Hazeltine Creek and any other subaerial setting will weather in the presence of oxygen. However, leaching is expected to be slow because sulphides leach at relatively slow rates under neutral to basic pH conditions when compared to acidic conditions, which is typically orders-of-magnitude faster. On-going geochemical testing is supporting this assessment and showing slowly declining copper release rates. Silicates will also weather, but at even slower rates that are dependent on mildly acidic rainwater (the dissolved carbon dioxide equilibrium pH of rainwater is ~5.5). Given the carbonates present in the MPM tailings, mildly acidic rainwater will be neutralized upon contact and leaching of silicates would be slower than could occur by rainwater.

Thermodynamic first principles and the equilibrium modelling software package PHREEQC (version 2.17.4137) (Parkhurst and Appelo, 1999) predicts low solubility of copper at neutral pH as compared to concentrations that are associated with copper porphyry deposits under acidic pH (Day and Rees, 2006). This is because secondary copper oxide minerals (i.e. malachite, tenorite) that would form after oxidative dissolution from a copper sulphide are only sparingly soluble. The prediction of contact water (i.e. tailings seepage) by PHREEQC under aerobic conditions and pH 8 carbonate buffered rainwater is an upper limit of 0.02 mg/L due to copper oxide solubility limits. This is consistent with other copper concentrations measured under neutral pH at the MPM and other copper porphyry sites (Day and Rees, 2006).

Copper concentrations were used to evaluate copper solubility control in water samples from the laboratory and field. The sites included a sampling site in upper Hazeltine Creek downstream of a one kilometre stretch of deposited sub-aerial tailings (referred to as HAC-13), from the column test containing tailings with 95th percentile copper content, and from a ditch collecting seepage from subaerial tailings and other materials deposited after two years since the tailings spill (provided by the BC MOE and MPM). The ditch water is from an area referred to as the Polley Flats, which is just below Polley Lake and one kilometer downstream of where the width of the area of tailings and other materials deposited is narrow (Figure 4-1). Results were plotted against solubility curves generated using PHREEQC for malachite ($Cu_2CO_3(OH)_2$), tenorite (CuO), and copper hydroxides ($Cu(OH)_2$). A saturation index of zero was used for all three secondary copper minerals, but a saturation index of 0.5 was also used for malachite as activation energy barriers often need to be overcome before a mineral can precipitate and this requires a higher degree of saturation. Malachite (as opposed to tenorite or copper hydroxides) was chosen to evaluate the saturation index range as it is the most likely secondary mineral control based on it being commonly identified on site and in the tailings.

The outcome of the comparison is shown in Figure 6-1. There is a good fit of the dissolved copper concentration results to the predicted concentrations based on pH and mineral solubility, especially to malachite with an SI of 0.5. Lower pH values were associated with spring freshet were similar to the initial flush of material in the laboratory kinetic testing program. During the winter (or prolonged dry periods), the majority of tailings are no longer receiving infiltration due to snow and ice cover allowing oxidation products and acidity to accumulate around the sulphide grains in tailings that do not freeze in the winter. Once freshet begins, these oxidation products and acidity will be neutralized and get flushed from the tailings, with pH increasing while copper concentrations decrease.

Selenium was shown to be correlated with copper (SRK 2015) and likely is present as an accessory element in the copper sulphides as this element often replaces sulphur owing to similar

geochemical properties (Ralston et al, 2008; MEND 2015). However, the methods used in this study could not detect selenium co-precipitated with silicate minerals and so selenium release should be conservatively assumed to be associated only with oxidative dissolution of sulphides.

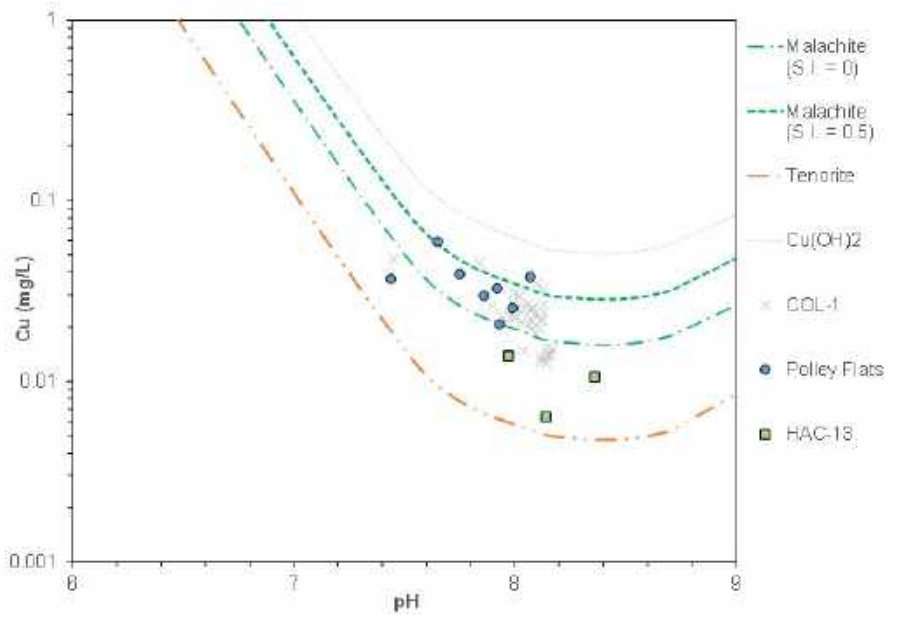


Figure 6-1: Secondary copper mineral solubility curves and monitoring results.

6.1.2 *Subaqueous Dissolution of Tailings*

For any of the tailings and other materials deposited that ended up in Quesnel or Polley Lake, water saturation is the best way to inhibit oxidation of sulphides (INAP 2010). Therefore, leaching of any elements hosted in sulphides (i.e. copper and selenium) that would be released by oxidation is effectively inhibited for tailings present in Quesnel and Polley Lakes.

Based on the results of the mineralogical characterization work and sequential extractions, the risk for mobilization of elements under reducing conditions was found to be low. Easily reducible iron oxides were minor components of the tailings samples tested and neither copper nor selenium were associated with a mineral phase that would be susceptible to reductive dissolution.

It should also be noted that selenium behaves quite differently under reducing conditions and will either sorb to mineral surfaces if it is present as selenite, or precipitate as elemental selenium (Ralston et al, 2008; MEND 2015). In either event, even if selenium was released from reductive dissolution processes, its geochemical behaviour under reducing conditions would result in it being removed from the water column and it is not considered a water quality risk under subaqueous reducing conditions.

6.2 *Reclamation Considerations*

The presence of a secondary mineral control on copper concentrations is an important finding for reclamation planning. This is because any efforts to encourage precipitation run-off and discourage infiltration into the tailings, through either grading or evapotranspiration through soil covers and vegetation growth, will likely result in a decreased loading of copper to the receiving environment. Mineral solubility control will maintain concentrations at a fixed level, so despite unchanging copper concentrations, with less water moving through the tailings, less copper can be transported. The establishment of vegetation on the top of the tailings may also help slow

down oxygen diffusion into the tailings and probably result in lower rates of sulphide oxidation and therefore primary copper leaching rates.

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APPENDIX 5-1: NPR Criterion Report

FINAL

Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones

Mount Polley Mine, British Columbia Canada
Mount Polley Mining Corporation



SRK Consulting (Canada) Inc. ▪ CAPR002434 ▪ October 2023

srk consulting

FINAL

Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones

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Cover Image(s):
Photo of the Springer Pit at the Mount Polley Mine

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Useful Definitions

This list contains definitions of symbols, units, abbreviations, and terminology that may be unfamiliar to the reader.

ABA	Acid-Base Accounting
AP	Acid Potential; expressed in units of kg $CaCO_3$/t
ARD	Acid Rock Drainage
HCT	Humidity Cell Test
ML	Metal Leaching
MPM	Mount Polley Mine
MPMC	Mount Polley Mining Company
Non-PAG	Non-Potentially Acid-Generating
PAG	Potentially Acid-Generating
SERDS	Southeast Rock Disposal Site
TIC	Total inorganic carbon or carbonate. Expressed in units of %C.
TIC-NP	Neutralization Potential calculated from total inorganic carbon or carbonate; expressed in units of kg $CaCO_3$/t
TIC-NP/AP_{crit}	Critical ratio of TIC-NP to AP that is used to segregate waste rock at the mine for ARD potential.

1 Introduction

Mount Polley Mining Corporation (MPMC) operates the Mount Polley Mine (MPM) to produce gold and copper concentrates. Waste rock produced by mining has varying degrees of acid rock drainage (ARD) potential which is managed by MPMC to limit the potential for development of ARD in the future. The metric used to date to classify waste rock is the total inorganic carbon neutralization potential (TIC-NP) to acid potential (AP) ratio (TIC-NP/AP) with TIC-NP/AP≤2 defining potentially ARD generating (PAG) materials. SRK Consulting (SRK) has been working with MPMC to refine acid-base accounting procedures and understand the specific factors controlling ARD potential at MPM to support mining of the Springer Deep and WX zones. This work has resulted in development of site-specific acid-base accounting procedures for these specific geological zones that will be mined consistent with theoretical considerations and similar approaches used at other mining operations in BC.

This report provides a summary of the methods and factors considered in the development of the site-specific acid-base accounting procedures and evaluation of a site-specific TIC-NP/AP criterion for waste rock from the Springer Deep and WX Zones at MPM.

2 Background

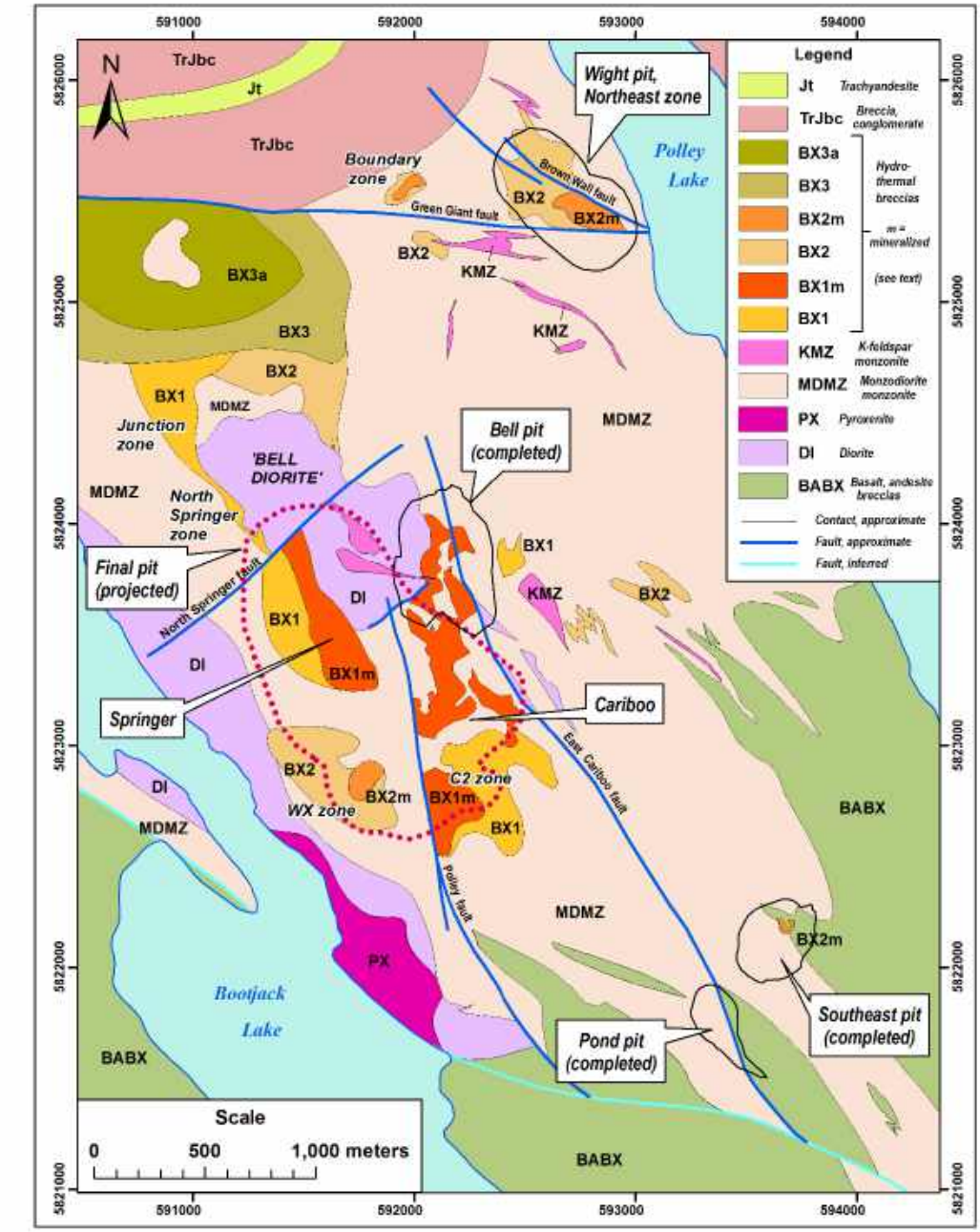
2.1 Geology

The Mount Polley deposit is classified as an alkalic porphyry copper gold deposit (BC MINFILE No. 093A 008) and has been mined from several mineralized zones. With the exception of the distinctive small Pond Zone, common features of these zones are:

- The host rock for porphyry mineralization is the Mount Polley Intrusive Complex (MPIC) which intruded into Nicola Group Volcanics (Figure 2-1). The intrusion is primarily monzonite to monzo-diorite in composition. Smaller phases vary in composition from diorite to syenite.
- Mineralization is associated with magmatic-hydrothermal breccias. Alteration and mineralization occur in the matrix of the breccias, and in veins and swarms distributed around the breccias. BX1 is the main host for the bulk of the mineralization at MPM which is mined in the Cariboo and Springer Pits (Figure 2-1) and is planned to be mined from the Springer Deep and WX Zones. BX1 is characterized by alteration which resulted in the strongest destruction of both primary and breccia textures.
- Alteration at MPM is classified as potassic (sodic and calcic) with salmon-pink potassium feldspar as the main alteration mineral. Biotite is less common. Sodic alteration is defined by albite and calcic alteration is defined by actinolite, diopside, epidote, clinozoisite, and sporadic andraditic garnet. Calcite is pervasive. Alteration is zoned with the strongest calcic-potassic alteration in the core associated with BX1. Nicola Group rocks and fringing MPIC rocks have propylitic alteration.
- Like other alkalic porphyry deposits (e.g., Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g., Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPM geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit. Samples from Bell Pit blast holes collected in the early years of operations were identified as being from a Pyrite Zone but the location of this feature is not known.
- Sulphide mineralization consists mainly of chalcopyrite ($CuFeS_2$) and pyrite (FeS_2), with lesser bornite (Cu_5FeS_4), covellite (CuS), and digenite (Cu_9S_5).
- Carbonate mineralization is principally calcite, with occurrences of malachite ($Cu_2CO_3(OH)_2$) formed as a natural weathering product of copper sulphides. Iron carbonates have not been reported.
- A significant portion of the copper at the MPM is not associated with sulphides (upwards of 50% in the upper portions of each pit). This fraction has been termed ‘copper oxide’ by MPM personnel and is associated primarily with chrysocolla ($(Cu,Al)_2H_2Si_2O_5(OH)_4 \cdot nH_2O$) and malachite ($Cu_2CO_3(OH)_2$) in equal proportions (Henry 2009). SRK (2015) showed that chlorite is a significant host for copper.

The WX and Springer Deep zones share these characteristics with copper-gold mineralization that is hosted by the BX1 magmatic-hydrothermal breccia that crosscuts monzonite and monzodiorite intrusive units of the MPIC.

Figure 2-1: Geological Map of the Mount Polley Mine



Sources: Rees (2013)

2.2 Site Location, Layout, and Mine Plan

MPMC has been operating MPM, located approximately 56 km northeast of Williams Lake and approximately 15 km southwest of the community of Likely in British Columbia, Canada, since 1996. MPMC recovers copper and gold from porphyry-style mineralization by open pit and underground mining. The plant is capable of processing 22,000 tonnes of ore per day using standard mineral flotation technology.

Full scale mining began in the Cariboo Pit by mining high grade oxide and gold parts of the ore body prior to transitioning to the Bell Pit in 1999. Mining was suspended in 2001 due to unfavorable market conditions. The mine re-opened in 2005 after a three- and half-year care-and-maintenance period. The following zones have been mined since 2005:

- Completed mining and backfilling of the Bell Pit.
- Completed mining and backfilling of the small Southeast Zone and Pond Zone Pits.
- Completed mining and flooding of the Wight Pit (Northeast Zone).
- Completed mining of the Boundary Pit.
- Completed mining and flooding of Northeast Zone underground (access from the Wight Pit).

In May 2019, mining was again suspended due to unfavourable market conditions. Mining operations restarted in November 2021 and milling operations resumed in June 2022.

The current approved mine plan includes mining from the Springer Pit until year 2025. Non-PAG waste rock is currently being placed in the southeast rock disposal site (SERDS) and used as construction material, with PAG waste rock placed in the temporary NW PAG stockpile until being re-handled to the Springer Pit at closure.

MPMC is in the process of preparing a joint Mines and Environmental Management Act (MEMA) permit amendment application package to cover the Springer Pit Expansion which would include mining of the Springer Deep and WX Zones from years 2024 to 2031. The mine plan within the amendment calls for non-PAG rock to similarly be placed in the SERDS and used as construction material, with PAG waste rock placed in the temporary NW PAG stockpile until being backfilled to the open pit at closure.

2.3 Regulatory Framework

The Mount Polley Mine development project received a BC Environmental Assessment certificate in 1992 and the Mines Act Permit *M-200* in 1995. Mining at the site has been carried out under the *M-200* permit since commercial production began in 1997.

The *M-200* permit governs how mine wastes are managed to minimize the impacts of metal leaching and acid rock drainage (ML/ARD). Within the *M-200* Permit, waste rock is required to be segregated for ARD potential and the ARD potential of waste rock is defined using an NP/AP (or NPR) criterion of 2, where NP is calculated using total inorganic carbon (termed TIC-NP) and AP is calculated using total sulfur.

The *M-200* Permit Section 3 (c) stipulates that:

- PAG waste rock can only be disposed in the Cariboo, combined Cariboo/Springer, Wight, and Southeast Zone pits, where it will be submerged permanently beneath a water cover.
- A maximum of 62 million tonnes of PAG waste rock can be stored in the Temporary NW PAG Stockpile until being re-handled to one of the approved pits at closure for permanent submergence.
- Isolated pockets of PAG materials (less than 1,000 tonnes) may be blended with non-PAG materials within the waste rock dumps, at a minimum non-PAG:PAG ratio of 20:1.

Within the framework of evaluating a site-specific TIC-NP/AP criterion for incorporation to the *M-200* Permit, Federal guidance (MEND 2009) outlines that materials with NP/AP within the range of 1 to 2 are considered to have uncertain potential for ARD. Site-specific NP/AP criteria can be developed provided that “acid potential generates acid identical to pyrite and neutralization potential reacts like calcite” (MEND 2009).

2.4 Waste Rock Segregation and Confirmatory Sampling

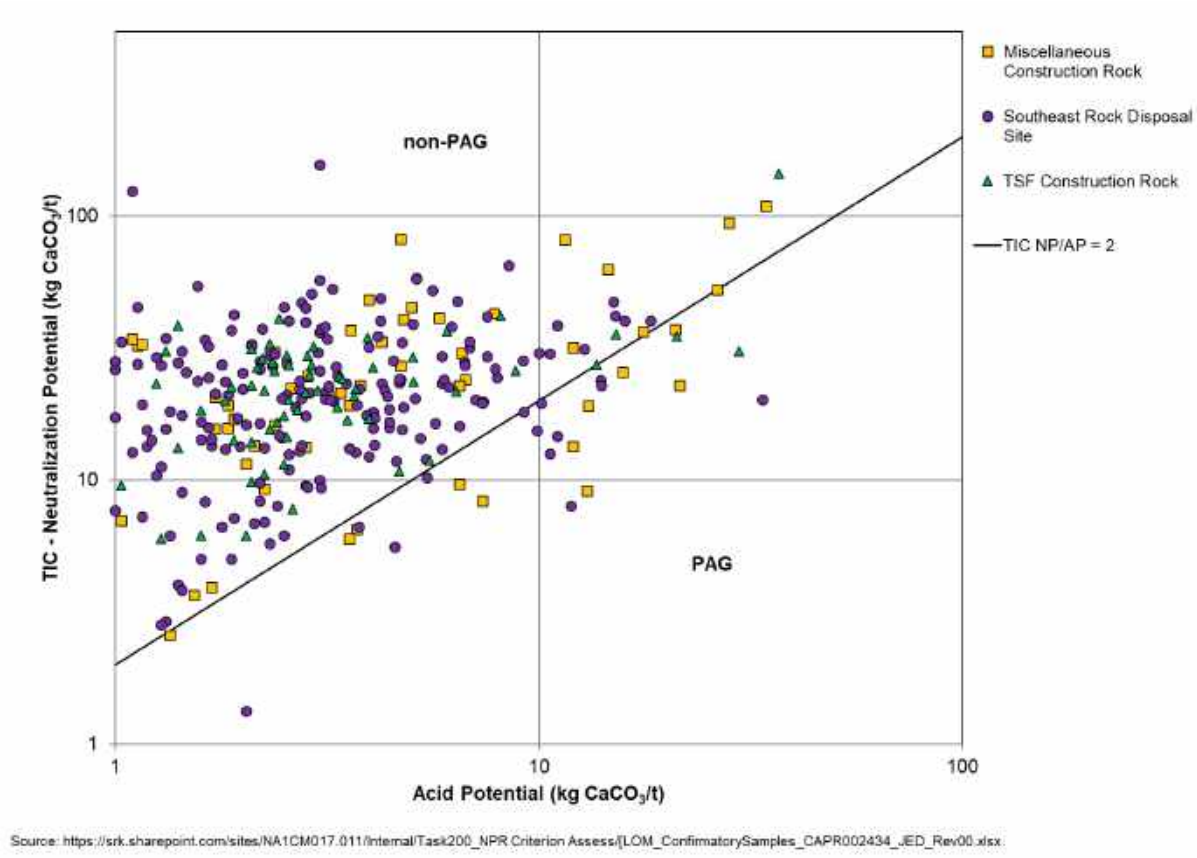
Waste rock is segregated during mining at MPM using procedures outlined in MPMC (2022). To summarize, waste rock and ore domains are modelled within an ore control and ABA block model prior to mining to support mine planning. Modelled ore control and ABA values are then confirmed by analysis of blasthole cuttings to confirm ore/waste boundaries and PAG/non-PAG boundaries on the pit bench prior to mining.

The success of operational segregation is confirmed through yearly collection of samples from segregated non-PAG rock, results of which are reported in annual ML/ARD reports (i.e. SRK, 2023).

Since 2009, 351 samples have been collected from non-PAG waste rock which has been segregated and placed in the SERDS, used as construction rock for various roads around the site, or used for tailings facility construction. The total dataset of confirmatory samples from 2009 to 2022 (n = 351) is plotted in Figure 2-2 as a function of TIC-NP/AP, which shows that operational segregation is effective with 9% of the samples collected to date thus far having been classified as PAG.

The samples identified as PAG had an average TIC-NP/AP of 1.3, relative to the average TIC-NP/AP of all non-PAG samples of 14. These results indicate successful operational waste rock segregation which results in a mass balance TIC-NP/AP that far exceeds 2 for NAG waste rock.

Figure 2-2: ARD Classification for NAG Waste Rock Confirmatory Samples



3 Conceptual Geochemical Model for Site-Specific NP/AP Criterion

3.1 Mineralogical Considerations

Implementation of a site-specific or the generic TIC-NP/AP criterion stipulated by the Permit relies on analytical methods appropriately quantifying NP and AP within the bulk rock mass. At MPM, the mineralogical data have shown that calcite is the dominant carbonate mineral and that calcite abundance can accurately be quantified by total inorganic carbon or total carbon from the onsite laboratory (SRK 2023). Pyrite is the dominant sulfide mineral and other sulfur forms (including sulfate) are not common. Acid potential is therefore appropriately calculated from total sulfur.

Since waste segregation is based on analysis of drill core or blast hole cuttings which represent the bulk size fraction, an additional consideration is the degree to which carbonate and sulphur minerals partition during blasting. If the minerals segregate equivalently, the TIC-NP/AP criterion (TIC-NP/AP_{crit}) can be applied directly to the drill samples but if fractionation occurs it may be necessary to correct for the effect. Methods and results used to evaluate the effects of mineral partitioning are further outlined in Section 4.2 and Section 6.2 respectively.

3.2 Acid Neutralization Reactions

The TIC-NP/AP_{crit} reflects the ratio at which carbonate minerals are consumed relative to the rate of sulphide oxidation. For example, a TIC-NP/AP criterion of 2 assumes 2 moles of carbonate are needed to buffer the acid generated by oxidizing each mole of sulphide. The criterion is intended to ensure sufficient carbonates are available within the material to buffer acid produced by the total amount of sulphide to prevent formation of ARD.

The following processes affect the rate of carbonate utilization.

Pyrite oxidation and the generation of acidity (as H^+ equivalent) are summarized by reaction (1) below, where oxidation of one mole of pyritic sulphur generates two moles of H^+:

$$FeS_2 + 15/4O_2 + 7/2H_2O \rightarrow Fe(OH)_3 + 2SO_4^{2-} + 4H^+ \quad (1)$$

Carbonate in solution at near neutral pH values is speciated between dissolved carbon dioxide ($H_2CO_3^0$) and bicarbonate (HCO_3^-) as follows:

$$CaCO_3 + 2H^+ \rightarrow Ca^{2+} + H_2CO_3^0 \quad (2)$$

$$CaCO_3 + H^+ \rightarrow Ca^{2+} + HCO_3^- \quad (3)$$

If reaction (2), which is thermodynamically favored at lower pH, dominates the TIC-NP/AP_{crit} would be 1 given that the two protons produced per mole of sulphur (Equation 1) are neutralized by one mole of calcium carbonate equivalent. Reaction (3), which prevails at higher pHs, indicates a criterion of 2. Kinetic test data for samples from numerous other porphyry mines in BC show a similar outcome and yield the conclusion that the TIC-NP/AP_{crit} lies between 1 and 2.

A generic (not site-specific) TIC-NP/AP_{crit} assumes that reaction (3) is dominant and that a ratio of 2 would be required to prevent onset of acid generation. However, once the kinetics of the acid generation and neutralization reactions and the mineralogy of the materials are better understood (i.e., through static and kinetic laboratory geochemical testing), a site-specific TIC-NP/AP_{crit} can be evaluated.

4 Methods

4.1 Confirmation of Total Carbon and Total Sulfur as Analytical Proxies for Pyrite and Calcite

Previous work reported in SRK (2016) confirmed that total carbon can act as a proxy for calcium and magnesium carbonate content and that total sulfur can act as a proxy for pyrite. These conclusions were tested by mineralogical characterization of the drill core samples collected for humidity cell testing of representative samples from the Springer Deep and WX zones (Section 4.3.1) and of twenty of the bulk samples of blasted Springer Deep and WX zone waste rock collected to evaluate blast fractionation (Section 4.2) to confirm the existing ABA procedures apply to these new zones to be mined.

The blasted samples were shipped to the University of British Columbia Department of Earth, Ocean, and Atmospheric Sciences laboratory with the humidity cell samples tested at the SGS laboratory in Burnaby, BC. At both labs, the mineralogy was analyzed using quantitative x-ray diffraction (qXRD) by Rietveld refinement.

4.2 Blast Fractionation

Mineral partitioning during blasting can have an effect on the classification of waste rock ARD potential since fines tend to be more reactive. If carbonate minerals preferentially partition into the blast fines, the use of a bulk TIC-NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially partition to the fines. SRK (2016) showed that both carbonate and sulphide minerals partitioned into the fine fractions for samples from the Bell and Cariboo Pits, but that this effect was much stronger for carbonate resulting in ARD potential classifications based on the bulk fraction leading to misclassification of some of some non-PAG rock as PAG.

To confirm the blast fractionation behavior of Springer and WX Zone rock, MPMC environmental technicians collected forty-four samples of blasted Springer and WX Zone Waste rock. Sample collection involved:

- Identification of two locations where Springer waste rock was being blasted and two locations where WX zone waste rock was being blasted through liaison with site mine geologists (i.e. four locations total);
- Location of each site in the open pit using coordinates supplied from the mine geologists. At the active digging face which was being excavated following blasting at each location, 10 samples and 1 field duplicate were collected of the bulk blasted size fraction on a 5 x 2 m grid yielding 44 samples total. Samples were collected with a shovel and placed in new plastic buckets.

Buckets were labelled, sealed, and shipped to Global ARD Testing in Burnaby, BC. At Global ARD, all forty-four samples were sieved into coarse (+10 mm), medium (-10 mm +2 mm), and fine fractions (-2 mm). Each fraction was weighed and analyzed for total sulfur, sulphate sulphur by hydrochloric acid leach, Modified Sobek NP using the MEND (1991) method, and total inorganic carbon (TIC) by hydrochloric acid leach and measurement of the evolved gas by coulometer.

4.3 Determination of NP/AP_{crit} for Springer Deep and WX Zones

4.3.1 Kinetic Testing Program

Humidity Cell Tests Initiated from 2004 to 2009

Humidity cell tests were performed on fifteen samples in support of geochemical characterization for permitting of mining of the Wight Pit (Northeast Zone), Southeast Zone, Boundary Zone, Pond Zone, and expansion of the Springer Pit. Results have been reported annually as part of Permit M-200 requirements. The samples were selected to evaluate oxidation rates for typical and elevated sulphide concentrations within waste rock. Results from testing of nine samples of monzonite, breccia, and diorite samples were used as part of the assessment owing to having similar lithology to the Springer Deep and WX Zones. Two samples from the Pond Zone which has distinctive skarn type mineralization and four samples of unknown lithology from the Springer and SE Zones were not considered relevant and were not used (HC-8 to HC-13).

Humidity Cell Tests Initiated in 2022

In 2022, four humidity cells samples were specifically selected to represent future waste rock that would be generated by mining the Springer Deep and WX Zones, which represent the source of waste rock for the remaining mine life. Samples were selected by SRK from the drill hole database to represent upper range sulphur content for the dominant rock types in both zones.

All four humidity cell tests and a method blank test are in operation at the SGS Laboratory in Burnaby, BC and were initiated on August 5, 2022. HCT leachate analysis is as follows:

- Weekly pH and conductivity to 12 weeks, then bi-weekly.
- Anions (sulfate, acidity, alkalinity, fluoride, chloride) bi-weekly for week 0 to 8 and then every 4 weeks.
- Multi-element analysis (Al, Sb, As, Ba, Be, Bi, B, Cs, Cd, Ca, Cr, Co, Cu, La, Fe, Pb, Li, Mg, Mn, Hg, P, Mo, Ni, K, Rb, Se, Si, Ag, Na, Sr, S, Te, Tl, Th, Sn, Ti, W, U, V, Zn, Zr) bi-weekly for week 0 to 8 and then every 4 weeks

4.3.2 Interpretation of Kinetic Test Data

A site-specific TIC-NP/AP_{crit} can be developed by assessing relative rates of acid generation and carbonate mineral utilization under the high weathering conditions of the humidity cell tests. The method used has been used at several other porphyry mines and projects in BC for the same purpose (i.e., SRK 2014; 2020b) and is summarized here. The main inputs for determining a TIC-NP/AP_{crit} are stable sulphate release rates under non-acidic conditions, and the combined release rates of Ca, Mg, Na and K [(Ca+Mg+0.5Na+0.5K)/SO_4] expressed in moles. Sulphate release rates are proxy for acid generation, while the combined major cations are proxy for acid neutralization. The release of Ca, Mg, Na and K reflects the dissolution of carbonate minerals by the combined effects of sulphuric acid (from pyrite oxidation) and carbonic acid (formed by atmospheric CO_2 dissolved in the deionized water). The consideration of Na and K release reflects the potential for Ca and Mg liberated by carbonate

dissolution to exchange with Na and K on the surface of phyllosilicates due to their greater affinity for exchange sites. The release rate for Na and K are halved to account for their lower charge (univalent) compared to calcium and magnesium (divalent). Inclusion of Na and K assures that utilization of carbonate for acid neutralization is not underestimated due to cation exchange effects.

Only stable release rates calculated after the initial flush from each HCT are used to base the assessment on the release of ions resulting from both acid generation and neutralization reactions as opposed to flushing of small amounts of soluble minerals that will not reflect longer term effects. At low oxidation rates (lower sulphate release), the dominant process in the test is dissolution of carbonates by carbonic acid in deionized water under high water-to-solid ratios. As the influence of sulphide oxidation increases (shown by increase in sulphate release), the ratio better reflects the interaction of sulphuric acid with carbonates.

Under site conditions, buffering of infiltrating waters containing dissolved CO_2 by carbonate mineral dissolution occurs within a short distance within the waste rock pile and tailings profile so that the apparent flushing of carbonate minerals by carbonic acid observed in the HCT does not occur in a full-scale dump. A stabilizing [$(Ca+Mg+0.5Na+0.5K)/SO_4$] trend at higher sulphate release therefore shows how the waste rock responds to generation of sulphuric acid which is the dominant process controlling NP depletion under field conditions. This information can thus be used to determine the TIC-NP/AP_{crit} for the materials tested based on the ratio at which the materials being tested stabilize.

5 Quality Control

5.1 Quality Control Methods

QA/QC procedures for static testing programs conducted by MPM which involve analysis of total sulfur and total carbon at the onsite laboratory are reported in the annual ML/ARD reports for the mine (i.e., SRK 2023) and are not detailed herein.

QA/QC of humidity cells initiated from 2004 to 2009 has been conducted previously and is reported in several humidity cell assessments (i.e., SRK 2008, 2009, and 2010).

For static and kinetic testing programs initiated as part of this assessment, SRK followed internal QA/QC procedures as outlined in the SRK Expectations for Laboratory Geochemical Data Quality (2022) which have been agreed upon with the laboratories that SRK uses. The procedures included the following QA/QC components in addition to lab QA/QC procedures:

- Static characterization
  - A duplicate sample (split following sample pulverization) underwent static testing for every twenty samples.
  - SRK monitored static results from duplicates, in addition to checking lab-initiated QC samples (duplicates, blanks and certified reference materials) against expected values.
  - Internal consistency of the data set was checked by monitoring sulfur balance (i.e., four-acid sulfur vs total sulfur, sulfate sulfur less than total sulfur etc.), NP compared to fizz rating (based on the MEND (1991) method, paste pH (to ensure consistency with NP and TIC), and TIC (to ensure consistency with NP).
  - Results from samples that were outside of SRKs criteria were subject to further evaluation. A recheck request was issued to the lab where deemed necessary by the SRK geochemist. The lab may be asked to comment, to investigate further, or to re-run a sample to confirm a result.
- Humidity Cell Testing
  - A blank waste rock HCT was operated to test for contamination within the de-ionized water used or from the testing apparatus.
  - SRK monitored leachate data for indications of contamination, for ion balance, to ensure detection limits stay consistent, and for trend analysis to identify data spikes which could indicate analytical errors.
  - Results from blanks or samples that were outside SRK's criteria were subject to further evaluation. A re-check request was issued to the lab where deemed necessary. The lab would have been asked to comment, investigate further, or re-run a sample to confirm the result.

5.2 Quality Control Results

Results of SRK's QA/QC assessment are provided in Appendix A, with results summarized as follows:

- The static data reported herein passed SRK's QA/QC criteria and no re-check requests were issued.
- Re-check requests issued for the humidity cell data were limited to one-off data spikes, irregular detection limits resulting from dilution, and anomalously high concentrations in method blank tests. As of the time of reporting, there were no outstanding re-check requests, and the results were considered acceptable for the study.

6 Evaluation of Site-Specific ABA Procedures and NP/AP Criterion for Springer Deep and WX Zone Waste Rock

6.1 Confirmation of Total Carbon and Total Sulfur as Analytical Proxies for Pyrite and Calcite

Full results of mineralogical analysis of the HCT samples and bulk samples of blasted Springer Deep and WX zone waste rock are provided in Appendix B, with a summary of the sulfide and carbonate mineralogy results provided in Table 6-1.

The results show that calcite is the only detectable carbonate mineral, and that pyrite is the only sulfur mineral detected. This confirms that total carbon can act as a proxy for calcium and magnesium carbonate content and that sulfur can act as a proxy for pyrite for samples the WX and Springer Deep Zones.

Table 6-1: Summary of Springer Deep and WX Zone Sulfide and Carbonate Mineralogy Data

Zone	Statistic	Pyrite	Calcite
		wt%	wt%
WX	min	<DL	0.6
	median	0.5	1.7
	max	3.4	4.0
	count	12	12
SD	min	0.9	0.6
	median	1.9	1.4
	max	2.8	2.9
	count	12	12

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/Task100_C-S_Determination/[Compiled_MineralogyData_CAPR002434_JED_Rev00.xlsx

6.2 Blast Fractionation

Results of blasted WX and Springer Zone waste rock samples sieved to coarse (+10 mm), medium (-10 mm +2 mm), and fine fractions (-2 mm) are shown as box and whisker plots for total sulphur and total inorganic carbon in Figure 6-1 and Figure 6-2, which also include the bulk fraction results calculated as weighted averages using the fraction weights for each sample. Full analytical results by size fraction are provided in Appendix C. Review of the results showed:

- Total sulphur showed a higher mean in the fine fraction (mean = 0.41%) relative to the medium, coarse, and bulk size fractions which had means of 0.26%; however, all fractions had similar medians in the range of 0.15% and 0.17%. Using a t-test, there was not a statistically significant

difference between levels of total sulphur in the fine and bulk fractions using a 95% confidence level.

- TIC-NP was notably enriched in the fine fraction (median of 21 kg $CaCO_3$/t) relative to the coarse and bulk fractions which had medians of 5.4 and 7.3 kg $CaCO_3$/t respectively. Using a t-test, the fine fraction had statistically significant higher TIC-NP values compared to the coarse and bulk fractions fraction using a 95% confidence interval.

Figure 6-3 shows the size fraction relationship for the fine and bulk fractions for TIC-NP/AP. The relationship shows that TIC-NP/AP is higher in the fine fraction for the full range of measured TIC-NP/AP.

The regression line for the TIC-NP/AP relationship in (Figure 6-3) is:

$$\text{Log (TIC-NP/AP, -2 mm)} = 0.90 \text{ Log (TIC-NP/AP, bulk)} + 0.29$$

Given that the reactivity of the fine fraction dominates the reactivity of the bulk material, the equation can also be used to calculate NPR thresholds in the fines equivalent to the bulk rock mass which is tested during mining for classification purposes. Table 6-2 compares the equivalent fine and bulk fraction equivalent TIC-NP/AP ratios calculated using the regression.

The approved TIC-NP/AP_{crit} of 2 has a fine fraction equivalent of 3.6 indicating that the effects of mineral partitioning during blast fractionation within Springer Deep and WX Zone rock will lead ARD classifications based on bulk TIC-NP/AP ratios to be overly conservative leading to misclassification of non-PAG waste rock as PAG. TIC-NP/AP_{crit} of 2.0 for the fine size fraction has a bulk size fraction equivalent of 0.9.

Table 6-2: Fine to Bulk Fraction Equivalents Calculated from Regression

TIC/AP Bulk Size Fraction	TIC/AP -2 mm Size Fraction
0.7	1.6
0.9	2.0
1.0	2.3
1.5	3.1
2.0	3.8
3.0	5.2

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/Task300_BlastFractionation/[BlastFractionationAssess_CAPR002434_JED_Rev00.xlsx

Figure 6-1: Box and Whisker Summary of Total Sulphur Size Fraction Analysis

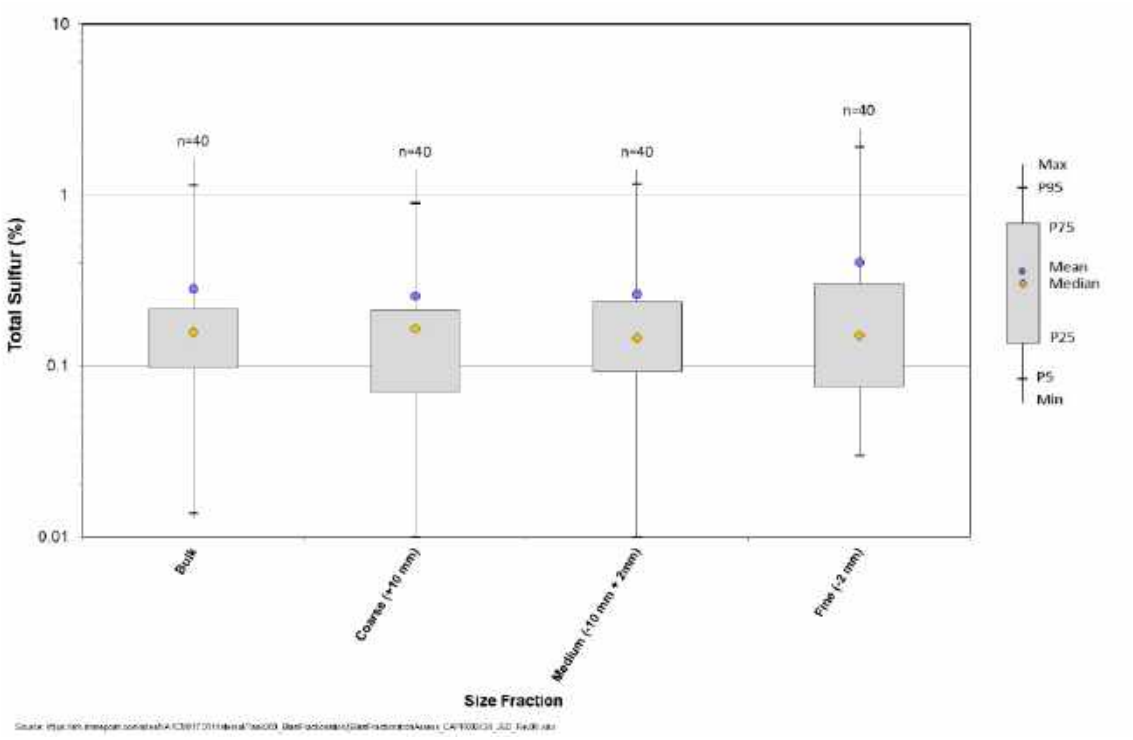


Figure 6-2: Box and Whisker Summary of Total Inorganic Carbon Size Fraction Analysis

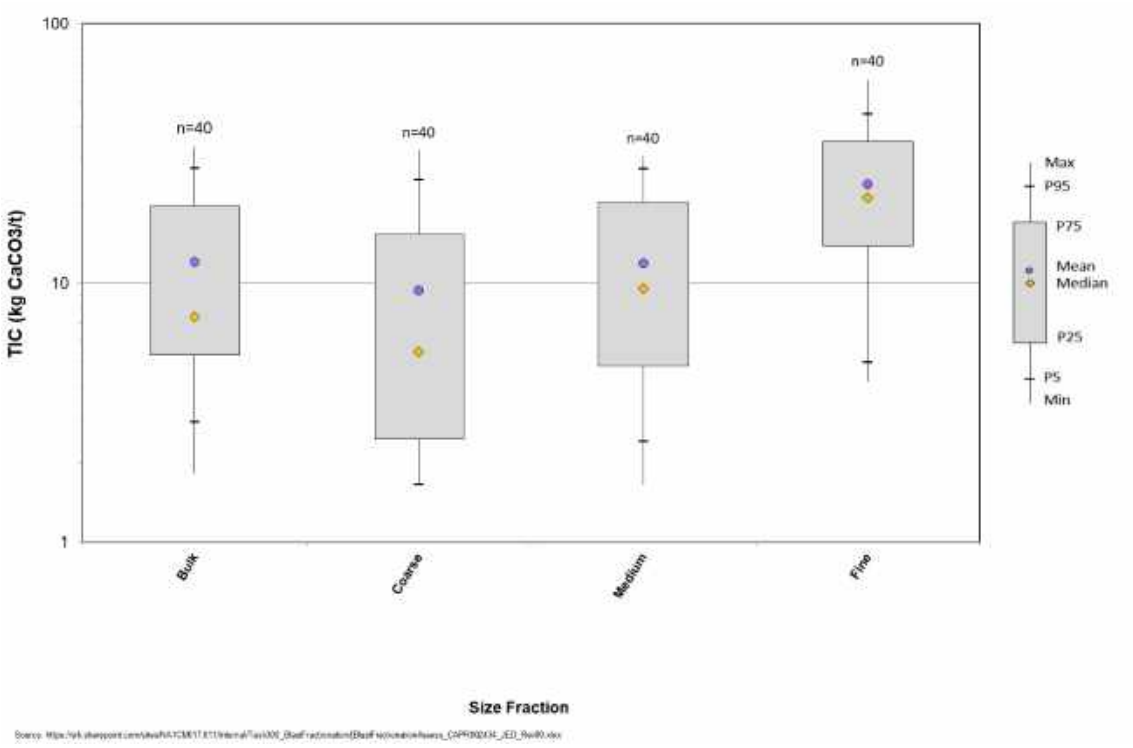


Figure 6-3: Measured TIC/AP for the -2mm versus calculated TIC/AP for the Bulk Fraction

6.3 Kinetic Characteristics

6.3.1 Trend Description

Humidity cell leachate concentration timeseries charts for the 2022 HCTs up to September 2023 are provided in Appendix B, with kinetic stable rates summarized in Table 6-3. All four tests yielded non-acidic leachate (pH 7.1 to 8.3) from weeks 0 to 57 (Figure 6-4) and showed stabilizing weathering rates after 16 to 24 weeks for most major and trace elements following an initial flush of accumulated weathering products (Figure 6-4 and Appendix B). Based on the mineralogical results (Section 6.1 and Appendix B), leaching trends following the initial flush were interpreted to represent the primary oxidation of pyrite with acid neutralization by calcium and magnesium carbonate minerals.

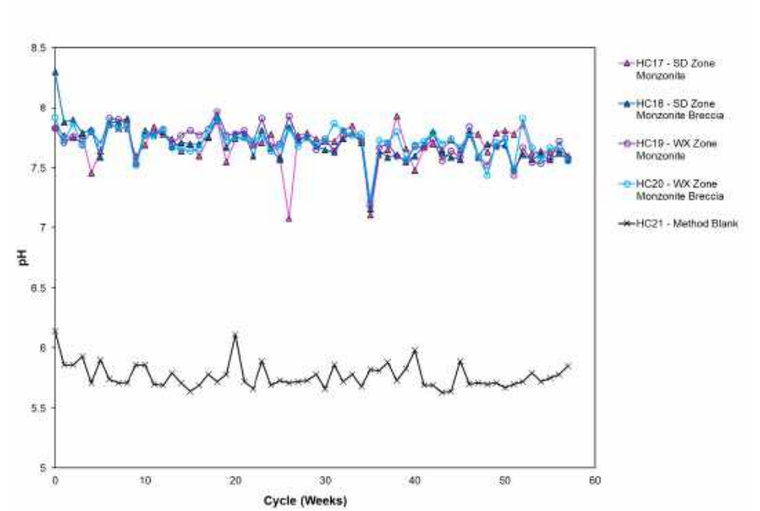
Stable HCT concentrations for major cations (Ca, Mg, Na, and K) and sulphate, the major proxy for acid generation (Figure 6-4 and Appendix B), indicated release rates had stabilized for development of the site-specific TIC-NP/AP classification threshold. Figure 6-4F showed that the ratio of major ions to sulphate was showing slight variability but was varying within the expected range, further confirming release rates had sufficiently stabilized for development of the site-specific TIC-NP/AP for the Springer Deep and WX Zone samples.

Table 6-3: Summary of Waste Rock Humidity Cell Pre-Test and Kinetic Characteristics

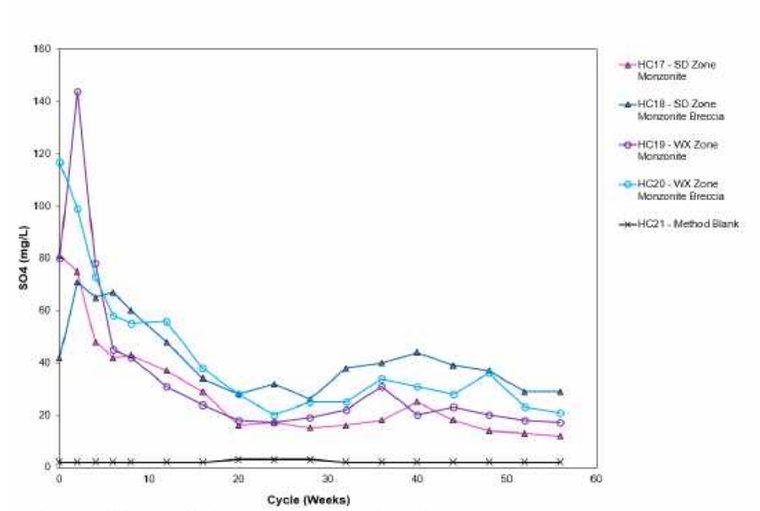
			Pre-Test Static Data								Stable Rates									
HCT ID	**Zone**	**Lithology**	**Paste pH**	**Total S**	**SO_4 S**	**AP**	**Mod. Sobek NP**	**TIC-NP**	**TIC-NP/AP**	**Cu**	**Start Date**	**Last Date of Data**	**Start of Stable Period**	**SO_4**	**Dissolved Ca**	**Dissolved Mg**	**Dissolved K**	**Dissolved Na**	**Ca+Mg/SO_4**	**(Ca+Mg+0.5Na+0.5K)/SO_4**
				%S	%S	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t		mg/kg				mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mol/mol	mol/mol
HC3	NE	Breccia	8.3	0.45	<0.01	14	140	91	6.4	1700	7/21/2004	8/11/2008	63	2.2	4.5	0.14	0.083	0.041	5.2	5.2
HC4	NE	Breccia	8.4	0.99	<0.01	31	130	88	2.9	1300	7/21/2004	8/11/2008	75	2.1	5	0.08	0.076	0.038	5.8	5.8
HC5	NE	Plagioclase Porphyry Intrusive	8.6	0.54	<0.01	17	88	52	3.1	1700	7/21/2004	8/11/2008	75	2.1	4	0.19	0.073	0.036	4.9	4.9
HC2	NE	Plagioclase Porphyry Intrusive	8	1.4	<0.01	44	83	66	1.5	330	7/21/2004	1/7/2013	17	5.4	5.5	0.14	0.1	0.053	2.5	2.6
HC6	SE	Monzonite	8.4	0.72	<0.01	23	21	9.8	0.43	710	9/26/2005	1/7/2013	64	3	3.5	0.029	0.033	0.026	2.8	2.8
HC7	SE	Monzonite	8.7	0.37	<0.01	12	40	9.8	0.85	180	9/26/2005	1/7/2013	33	2.7	3.3	0.05	0.049	0.027	2.9	3
HC14	Springer	Breccia	8.1	0.39	-	12	96	40	3.3	720	10/12/2009	1/7/2013	39	3.2	7.2	1	0.27	0.062	6.6	6.7
HC15	Springer	Diorite	8.1	2.5	-	79	94	23	0.29	780	10/12/2009	1/7/2013	100	12	7.2	0.12	0.063	0.73	1.5	1.6
HC16	Springer	Monzonite	8.9	0.06	-	1.9	69	12	6.4	360	10/12/2009	1/7/2013	7	0.92	4	0.38	0.074	0.72	12	14
HC-17 SD MZ	Springer Deep	Monzonite	8.8	1.4	0.03	43	32	23	0.55	520	8/5/2022	9/8/2023	20	8.2	7.1	0.27	0.088	0.43	2.2	2.3
HC-18 SD FBXm	Springer Deep	Monzonite breccia	8.8	2	0.02	61	36	14	0.23	1400	8/5/2022	9/8/2023	16	17	9.3	0.27	0.13	1.7	1.4	1.6
HC-19 WX MZ	WX	Monzonite	8.6	2	0.03	63	23	12	0.19	580	8/5/2022	9/8/2023	20	9.9	6.2	0.19	0.038	2	1.6	2
HC-20 WX FBXm	WX	Monzonite breccia	8.5	2.5	0.02	78	40	31	0.39	830	8/5/2022	9/8/2023	24	14	9.5	0.24	0.039	1	1.7	1.9

Source: https://srk.sharepoint.com/sites/NA1CM017.011/Internal/!020_Project_Data/030_Lab Data/Kinetic Data/Calculations/[Mt_Polley_ HCT_WR_Outcomes_1CM017.011_rtc_rev00.xlsx

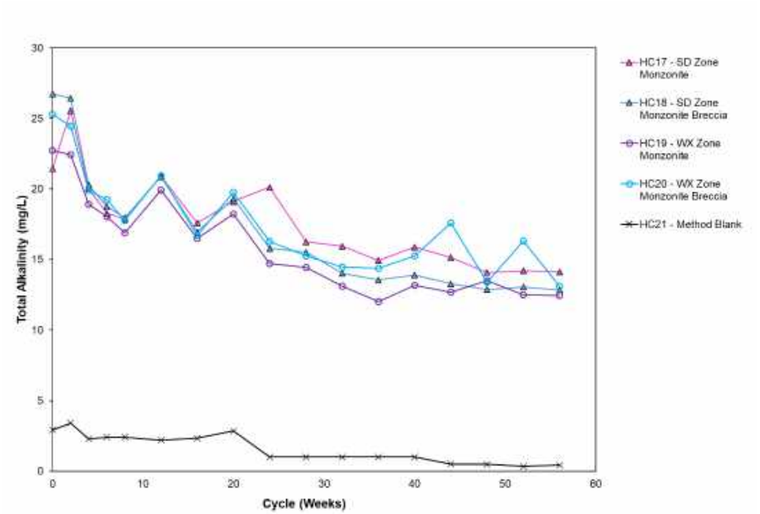
Figure 6-4: Summary of 2022 HCT Results for A) pH, B) Sulphate, C) Total Alkalinity, D) Dissolved Calcium, E) Dissolved Magnesium, F) Molar Ratio of Major Ions to Sulphate



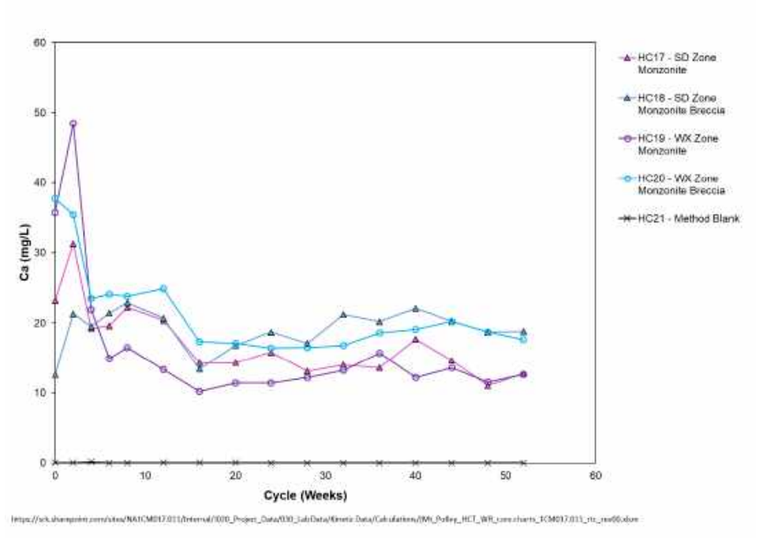
A)



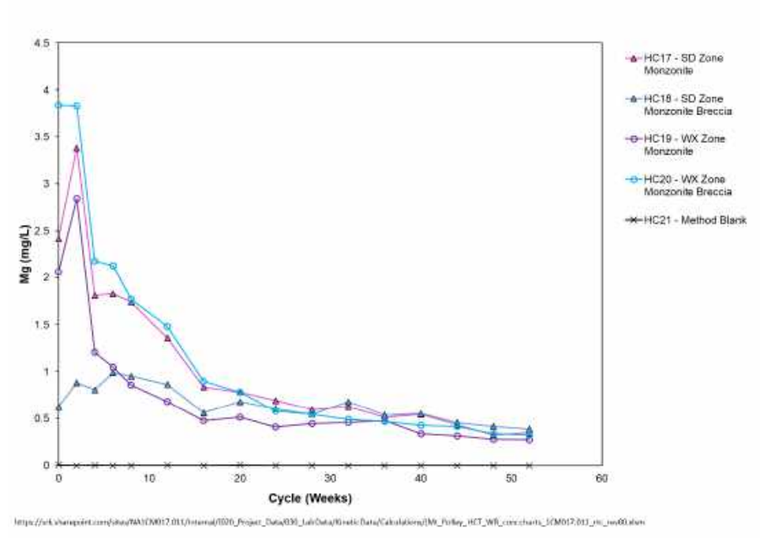
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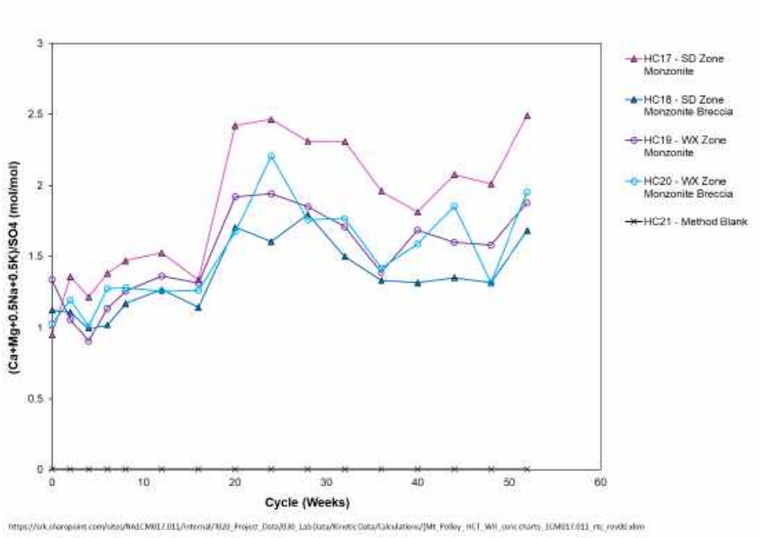
C)



D)



E)



F)

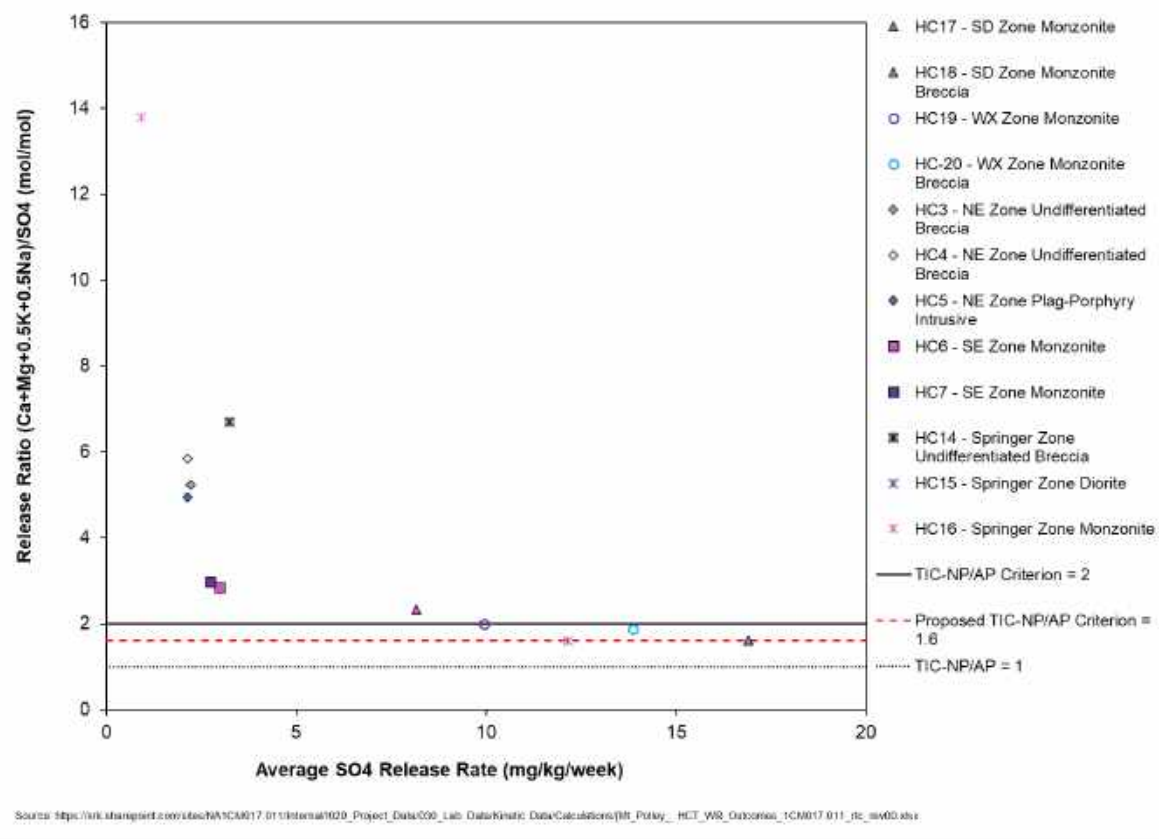
6.3.2 Interpretation

Given the stability of major ion release rates, the data were evaluated to develop a site-specific TIC-NP*/AP_{crit}.

Figure 6-5 shows the rate of sulphate release (i.e., the approximate sulphide oxidation and acid generation rate) compared to the relative rate of acid neutralization by calcium and magnesium carbonate minerals in addition to sodium and potassium to account for cation exchange processes. As expected, the plot shows that at low sulphate release rates (e.g. <8 mg SO_4/kg/week), carbonate dissolution is primarily controlled by interaction with the de-ionized water used in the humidity cell test procedure which has a slightly acidic pH of 5.5 to 6.1 due to equilibration with atmospheric carbon dioxide (Figure 6-4).

At higher oxidation rates (e.g., >10 mg SO_4/kg/week) where release ratios are indicative of the material responding to sulphuric acid generated by sulphide oxidation, the data shows there is a tendency toward consumption of approximately 1.6 moles of calcium, magnesium, sodium, and potassium per mole of sulphate released. The data therefore indicate that a site-specific NP*/AP_{crit} of 1.6 is supported by the kinetic data.

Figure 6-5: Average Stable Molar Ratio of Calcium, Magnesium, Sodium and Potassium Relative to Sulphate, Compared to Average Stable Sulphate Release Rates for all Waste Rock HCTs Assessed



6.4 Risk Assessment for Implementation of Site-Specific TIC-NP/AP_{crit}

In order to assess the risk of implementing the TIC-NP/APcrit as an operational criterion for classifying acid generation potential of waste rock, SRK has considered risk factors related to the potential for localized acidification due to PAG materials being incorporated with non-PAG waste rock and potential neutral pH leaching effects due to use of a lower NPR.

The main risk factors considered in this evaluation are:

- The effect of the PAG rock on overall mass balance TIC-NP/AP of the segregated non-PAG rock. As the proportion of PAG rock increases, the mass balance TIC-NP/AP will decrease, and the risk of acidification progressing beyond the PAG rock to the surrounding non-PAG rock increases.
- The degree to which changing the TIC-NP/AP_{crit} will change the neutral pH metal leaching potential of the segregated non-PAG rock.

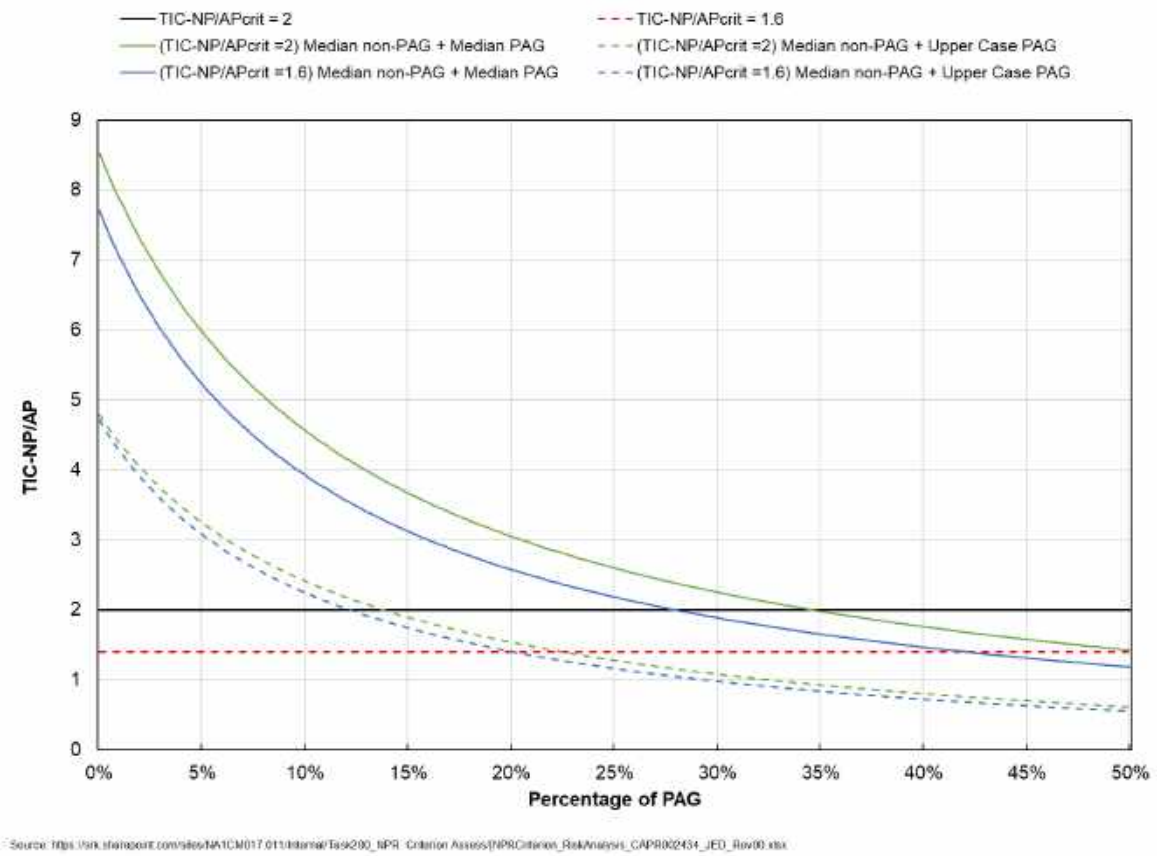
6.4.1 Effect of PAG Rock Included with non-PAG Rock

Assuming the ML/ARD management plan continues to be properly implemented, the main reason for PAG rock to be used in construction or placed in the SERDS non-PAG rock are operational upsets whereby waste rock with TIC-NP/AP below the criterion is deposited.

Mass balance calculations were used to assess the effect of increasing the PAG content within construction rock or the SERDS using blast hole ABA data, which provides an indication of the range of TIC-NP and AP values observed in non-PAG and PAG material at the site. The calculations aimed to model mixing of non-PAG material that had median ABA characteristics (median TIC-NP and AP based on the total dataset of blast hole samples) with PAG material that had a range of TIC-NP and AP values. Non-PAG and PAG statistics were calculated separately using a TIC-AP/AP_{crit} of 2.0 and 1.6 to classify waste rock ARD potential to assess the influence of the TIC-NP/AP criteria on mass balance TIC-NP/AP.

The simulated PAG rock used in the mixing calculations consisted of: median TIC-NP and AP values (median TIC-NP/AP; solid lines in Figure 6-6) and 25th percentile TIC-NP and 75th percentile AP (upper case PAG; dashed lines in Figure 6-6).

Figure 6-6: Mass Balance Calculations Simulating the Effects of Mixing non-PAG and PAG Waste Rock



The results from the mass balance calculations shown in Figure 6-6 indicate that the change of the TIC-NP/AP_{crit} from 2.0 to 1.6 does not result in a large downward shift in mass balance ARD potential of non-PAG rock across a range of incorporated PAG content. Based on the observation that 9% of the confirmatory non-PAG samples collected to date were classified as PAG (defined as bulk TIC-NP/AP>2) (Section 2.4), these results indicate that lowering the TIC-NP/AP_{crit} does not pose a risk to mass balance TIC-NP/AP. The mix modelling indicates that a typical mix of segregated non-PAG which incorporates 9% PAG would have a TIC-NP/AP ratio of 4.1 in the bulk fraction which is in excess of 2 (Figure 6-6). This is equivalent to a TIC-NP/AP ratio of 6.7 in the blast rock fines.

6.4.2 Implications for Neutral pH Leaching in non-PAG Rock

The use of waste rock segregation addresses the potential for pH depression to levels at which sulphide oxidation accelerates and the solubility of metals increases exponentially. However, a lower TIC-NP/AP criterion could lead to higher sulphide content in segregated non-PAG which in turn could lead to higher sulphide oxidation rates and metal(oid) release rates.

For the Springer Deep and WX zones, decreasing the TIC-NP/AP criterion from 2.0 to 1.6 would increase the mean bulk size fraction sulphur content of non-PAG rock from 0.15 to 0.17 %S (medians of 0.091 and 0.099 %S respectively).

Given the negligible change in the sulphide sulphur content of non-PAG rock, the use of the site-specific TIC-NP/AP criterion is not expected to increase the neutral pH metal leaching potential of non-PAG rock for constituents released from oxidation of sulphide minerals including sulphate, copper, selenium, and zinc and the source term for non-PAG rock would remain unchanged.

7 Conclusion and Recommendations for TIC-NP/AP_{crit}

Based on the results of the assessment of site-specific ABA procedures and a TIC-NP/AP_{crit} for the Springer Deep and WX Zones, SRK recommends the following:

1. MPM can segregate waste rock for the Springer Deep and WX Zones according to the site-specific TIC-NP/AP criterion of 1.6 established herein.
2. MPM should account for blast fractionation prior to segregation of waste rock on the pit bench to ensure that non-PAG waste rock is not misclassified as PAG as follows:
    a. For the fine fraction (<2mm), PAG rock is defined as TIC-NP/AP ≤ 1.6;
    b. For the bulk fraction (i.e., samples of blast hole cuttings or drill core), PAG rock is defined as TIC-NP/AP ≤ 0.7. This accounts for preferential enrichment of carbonate minerals in blast fines.

SRK recommends that the regression to account for the effects of blast fractionation be tested and updated each year during mining of these zones to ensure that the samples collected are represented by the larger zones to be mined.

Closure

This report, Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones, was prepared by:



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Corporate Consultant (Geochemistry)

EGBC Permit to Practice: 1003655

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

References

MPMC. 2022. ML/ARD Management Procedure Manual. Mount Polley Mining Corporation. August 4, 2022.

SRK Consulting (Canada) Inc. 2023. Metal Leaching/Acid Rock Drainage Characterization and Monitoring Program – 2022 Annual Report. Prepared for Mount Polley Mining Corporation. SRK Project Number CAPR002434.

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Appendix A. QA/QC Results

Appendix A: QA/QC Results

QC Test	SRK QC Criteria	Results
Paste pH		
Lab Duplicate (n=14)	For any samples, +/- 0.5 difference pH unit	All passed.
Split Duplicate (n=12)	For any samples, +/- 0.5 difference pH unit	All passed.
Standard Reference Material (n=1)	For any samples, +/- 0.5 difference pH unit	All passed.
TIC		
Method Blank (n=7)	<2X detection limit (DL)	All passed.
Lab Duplicate (n=8)	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Split Duplicate (n=12)	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed.
Standard Reference Material (n=8)	Within specified tolerance ranges.	All passed.
Total S & Total Sulphate		
Method Blank (n=4) for Total S and (n=3) for SO4	<2X detection limit (DL)	All passed.
Sulphur balance (total S > sulphate S) (n=124)	For samples > 10X the detection limit (DL), Total Sulphur should be greater than Total Sulphate, if not the % difference should be within +/-20%	All passed.
Lab Duplicate (n=13) for Total Sulphate, (n=3) for Total S	For samples > 10X the detection limit (DL), % RPD within +/-20%	All passed.
Split Duplicate (n=12) for Total S and SO4	For samples > 10X the detection limit (DL), % RPD within +/-30%	All passed except for the following samples: SP-1-1B and SP-1-1-DupB failed for Total S, both parent and dup samples >10X DL.
Standard Reference Material (n=5) for Total S, (n=4) for Total Sulphate	Within specified tolerance ranges.	All passed.
Modified NP		
NP consistent with paste pH (n=124)	Negative NP has paste pH <= 5	All passed.
Lab Duplicate (n=12) for NP and (n=14) for Fizz Rating	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed.
Split Duplicate (n=12) for NP and Fizz Rating	% RPD better than +/-15% for NP>20 kg/t, % RPD better than +/-20% for NP>10 kg/t, Difference within +/-5kg/t for NP<10 kg/t. Fizz test rating is the same.	All passed except for the following samples that failed for Fizz Rating (parent and dup samples have different fizz rating): SP-1-1B and SP-1-1-DupB; WX-1-1A and WX-1-1-DupA; WX-1-1B and WX-1-1-DupB; WX-1-1C and WX-1-1-DupC; WX-2-1A and WX-2-1-DupA; WX-2-1B and WX-2-1-DupB.
Fizz test rating with NP (n=124)	Max NP does not exceed fizz test rating	All passed.
Standard Reference Material (n=4) for NP and (n=1) for Fizz Rating	Within specified tolerance ranges.	All passed.
Modified NP and TIC		
Comparison between Modified NP and TIC (n=124)	Check for trends/co-relation	NP generally higher than TIC

Appendix B. Mineralogy Results

QUANTITATIVE PHASE ANALYSIS OF TWENTY POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA

Project #: 2221 (B1)
PO #: GL22-1707

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May 31, 2023 - Revised-

EXPERIMENTAL METHOD

The 20 samples of **Project #: 2221 (B1)** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone XRD Mill (Retsch GmbH, Germany) for 10 minutes. Continuous-scan X-ray powder-diffraction data were collected over a range of 3-80°2θ with CoKα radiation on a Bruker D8 Advance Bragg-Brentano diffractometer equipped with an Fe filter foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye-XE detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Bruker. X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1 (separate file, ***Global ARD Testing Services Inc Revised Results May 31 2023 - Project 2221 (B1) PO GL22-1707 - 20 samples.xlsx***). These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1-20. Ideal formulae of the mineral phases present are shown in Table 2.

Note that the X-ray diffraction patterns in many of the samples are affected by the presence of some unknown clays which could not be analyzed (see hump fitted with calculated peak at ~7°2θ in Figures 1-15). Therefore, the results should be considered approximate.

Table 2. Ideal formulae for phases present; proj: 2221(B1)

Mineral	**Ideal Formula**
Actinolite	$Ca_2(Mg,Fe^{2+})_5Si_8O_{22}(OH)_2$
Analcime	$Na[AlSi_2O_6]\cdot H_2O$
Calcite	$CaCO_3$
Chabazite	$(Ca,K_2,Na_2)_2[Al_2Si_4O_{12}]_2\cdot 12H_2O$
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$
Clinozoisite	$Ca_2Al_3(SiO_4)_3(OH)$
Diopside	$CaMgSi_2O_6$
Grossular	$Ca_3Al_2(SiO_4)_3$
Hematite	α-Fe_2O_3
Illite-Muscovite 1M & 2M	$K_{0.65}Al_{2.0}Al_{0.65}Si_{3.35}O_{10}(OH)_2$-$KAl_2AlSi_3O_{10}(OH)_2$
Kaolinite	$Al_2Si_2O_5(OH)_4$
K-feldspar (microcline, orthoclase)	$KAlSi_3O_8$
Magnetite	$Fe^{2+}Fe^{3+}{}_2O_4$
Plagioclase (albite; albite, calcian)	$NaAlSi_3O_8$-$CaAl_2Si_2O_8$
Prehnite	$Ca_2Al_2Si_3O_{10}(OH)_2$
Pyrite	FeS_2
Quartz	SiO_2
Stilbite	$NaCa_4(Si_{27}Al_9)O_{72}\cdot 28H_2O$
Talc	$Mg_3Si_4O_{10}(OH)_2$
Titanite	$CaTiSiO_5$

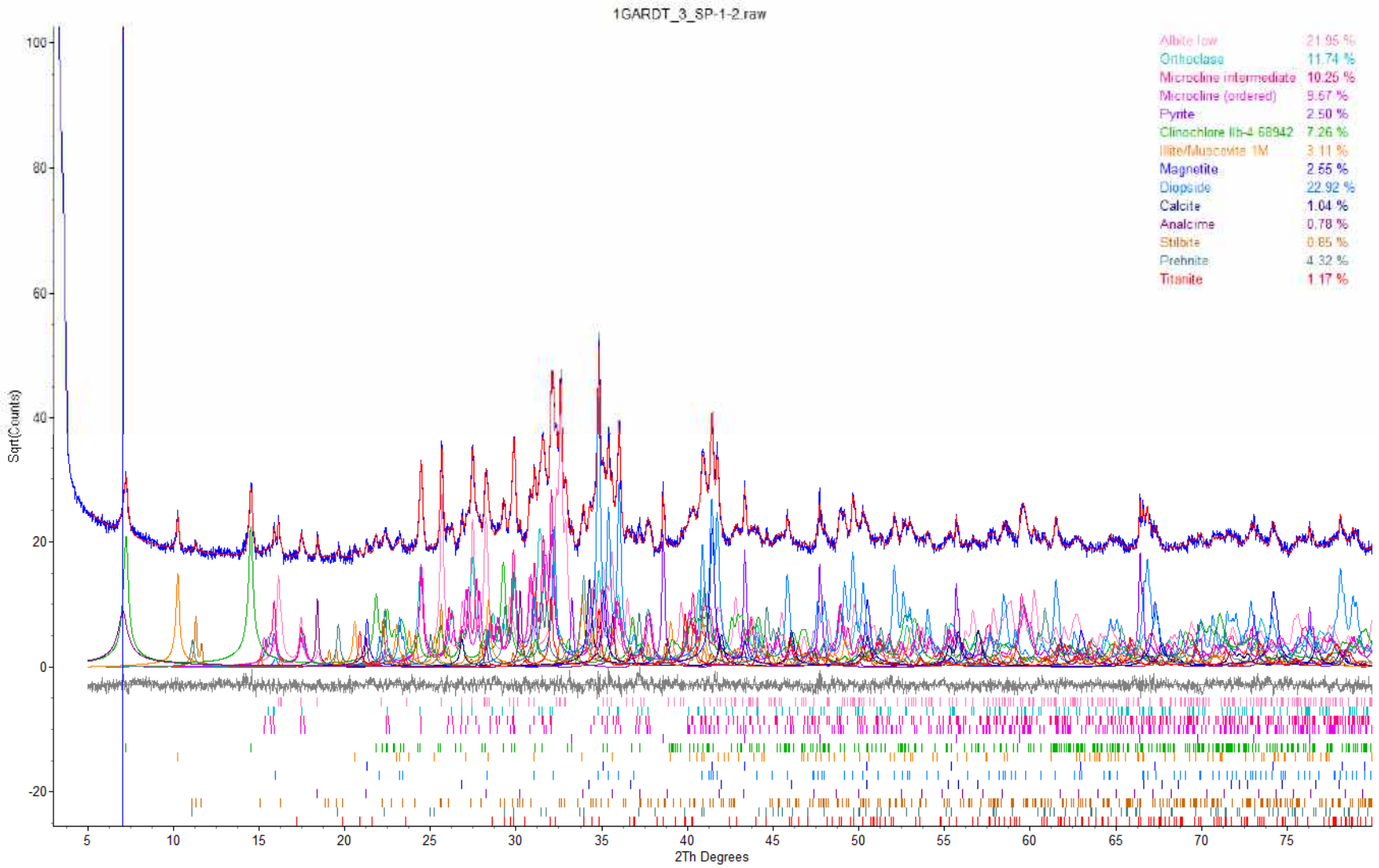


Figure 1. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 3_SP-1-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

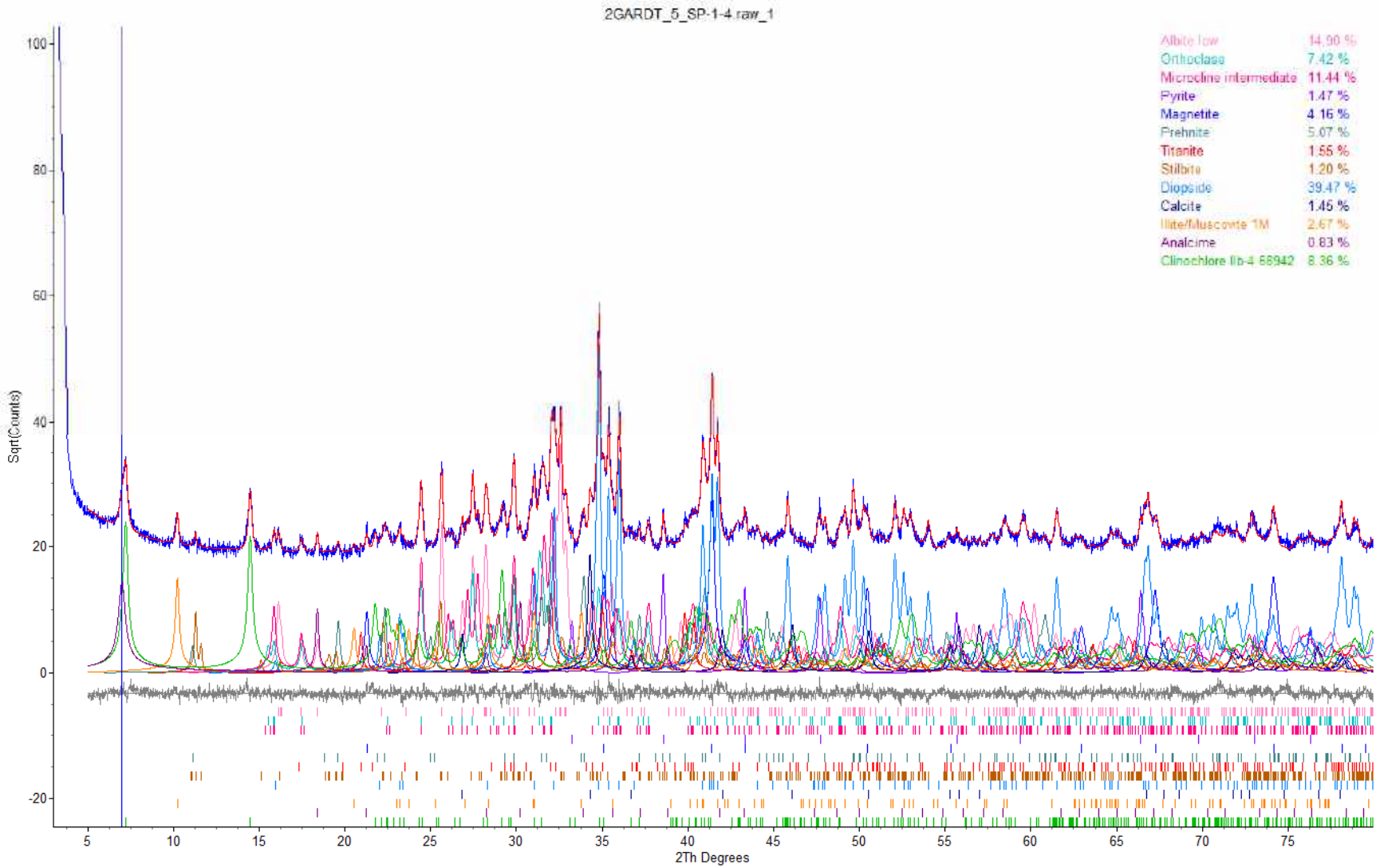


Figure 2. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 5_SP-1-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

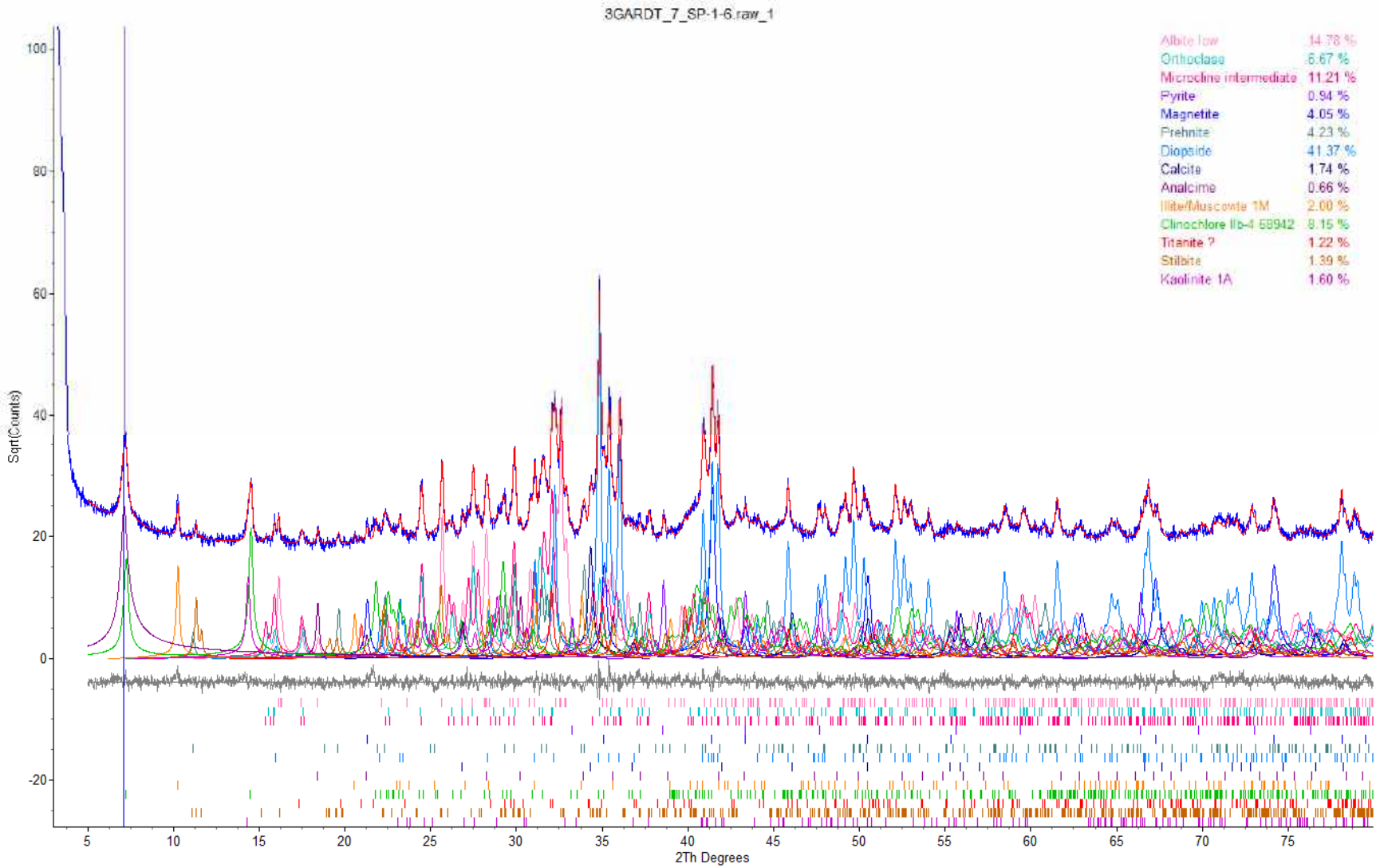


Figure 3. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 7_SP-1-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - positions of peaks phase). Coloured lines are individual diffraction patterns of all phases.

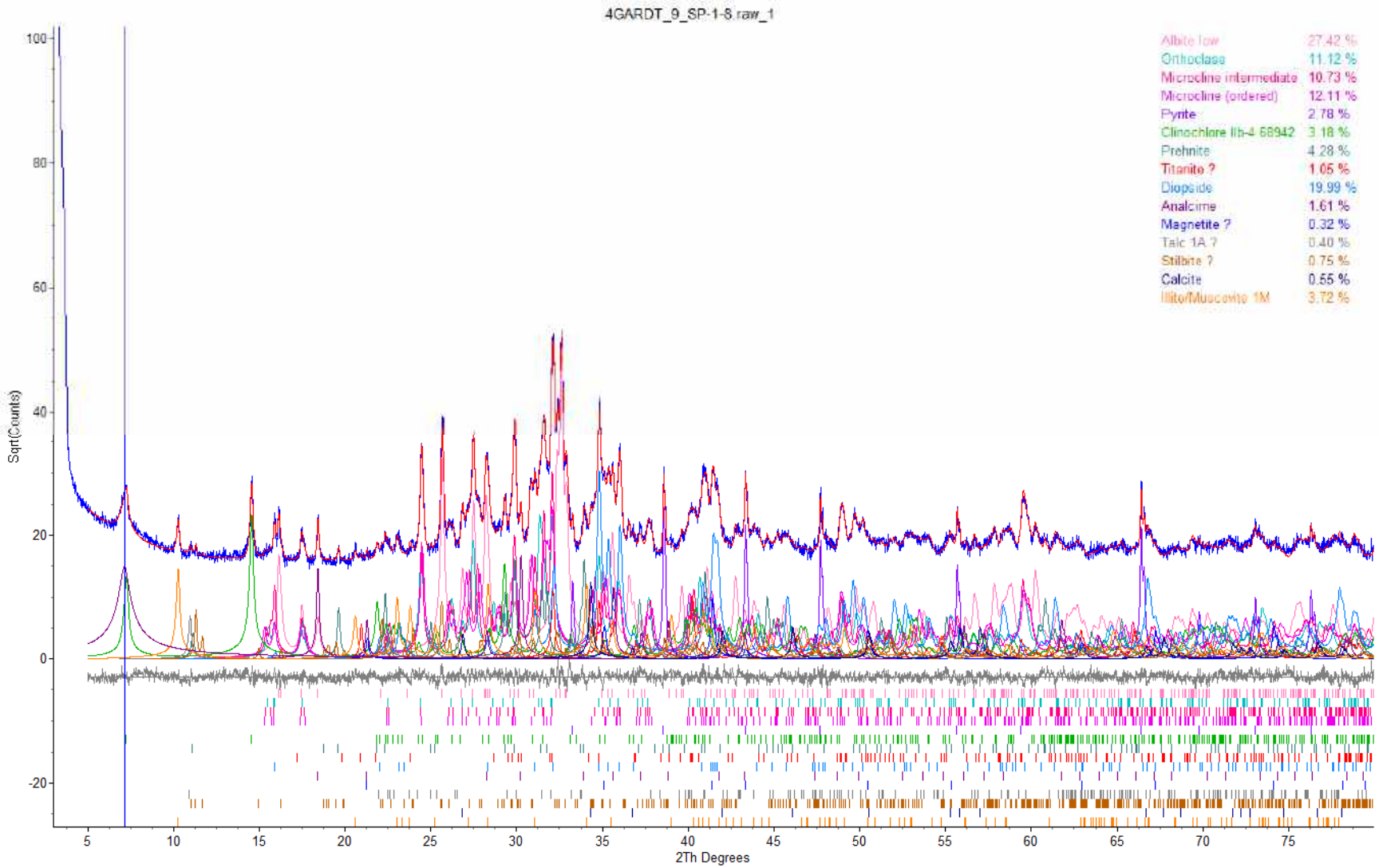


Figure 4. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 9_SP-1-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

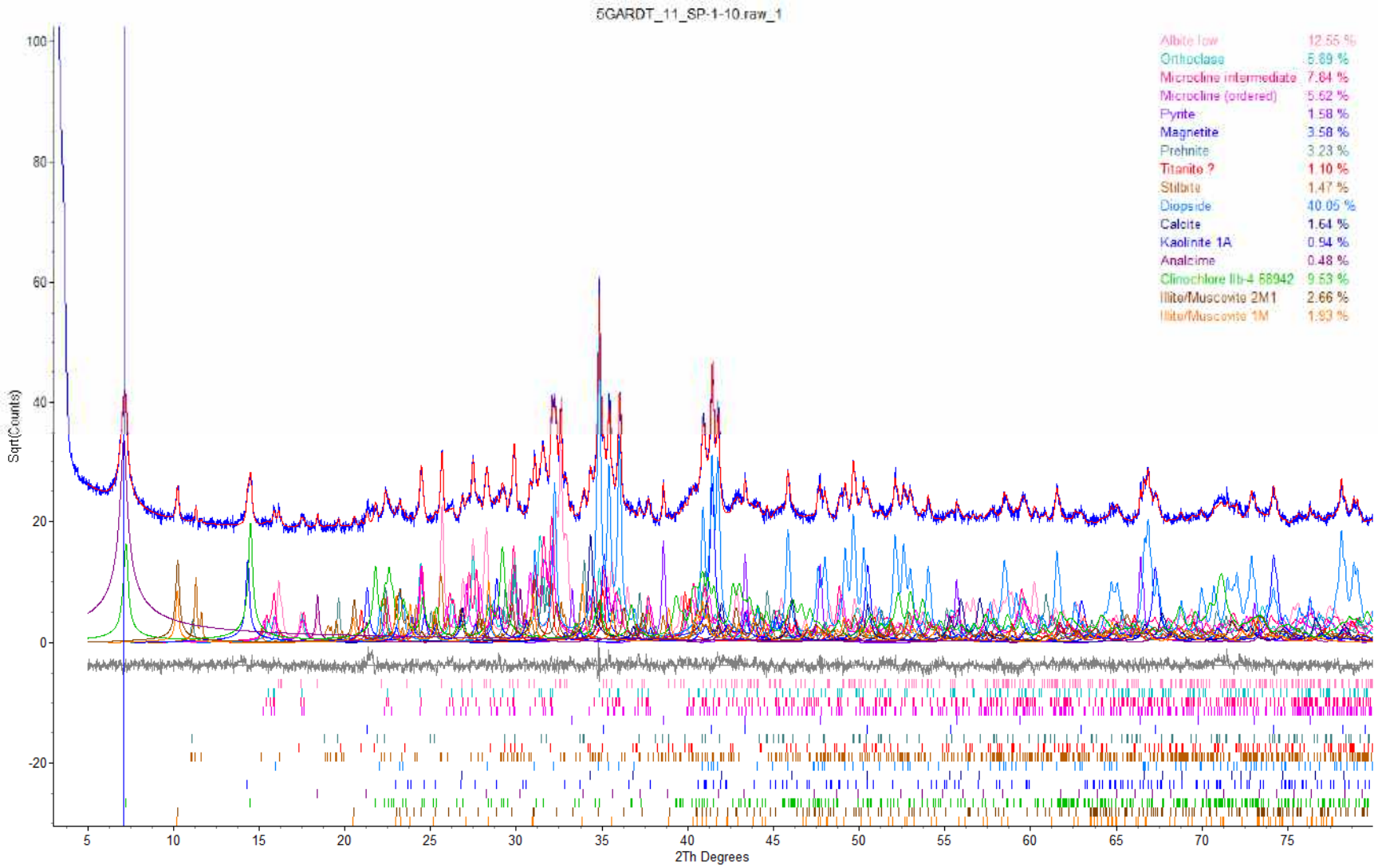


Figure 5. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 11_SP-1-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

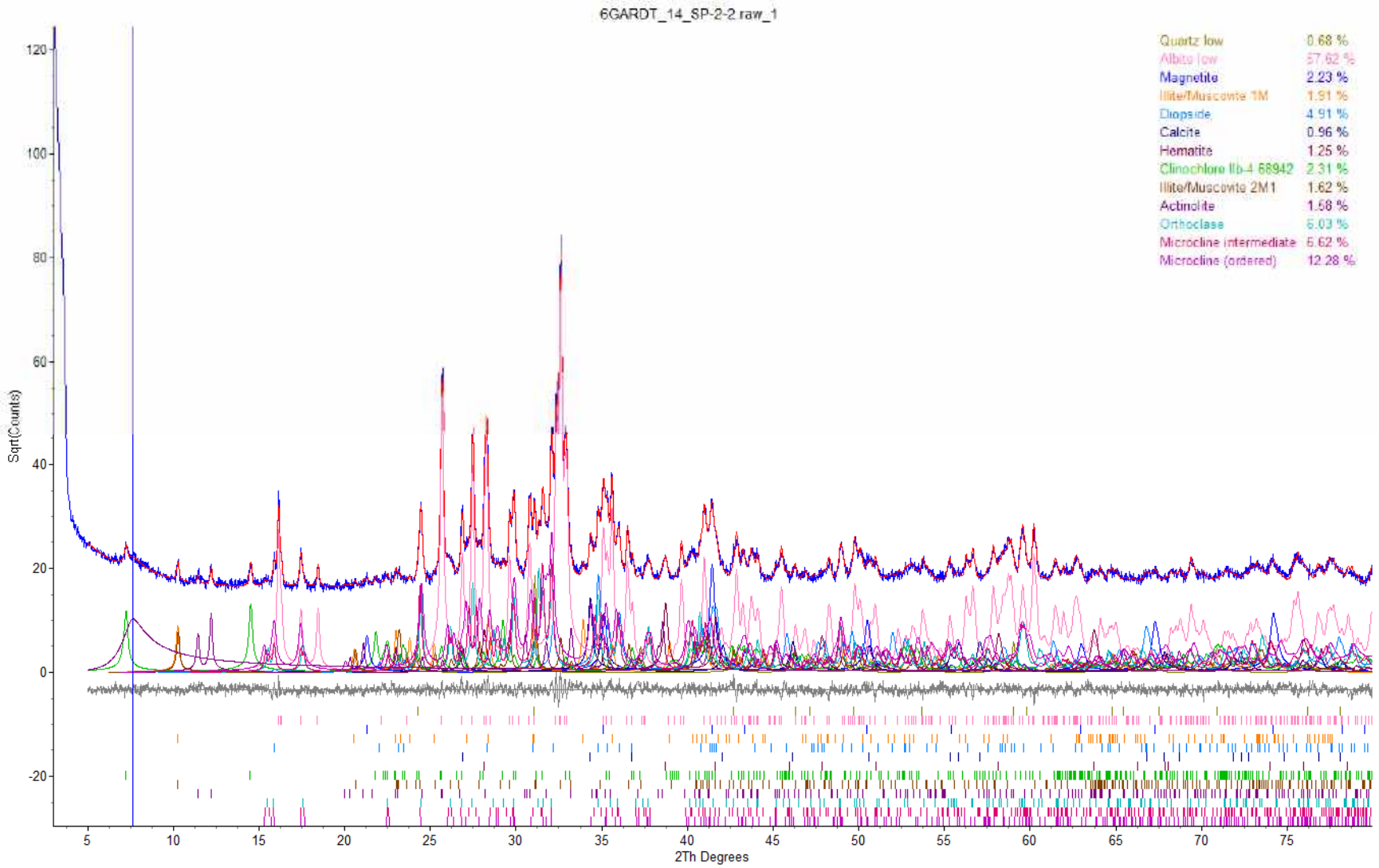


Figure 6. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 14_SP-2-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

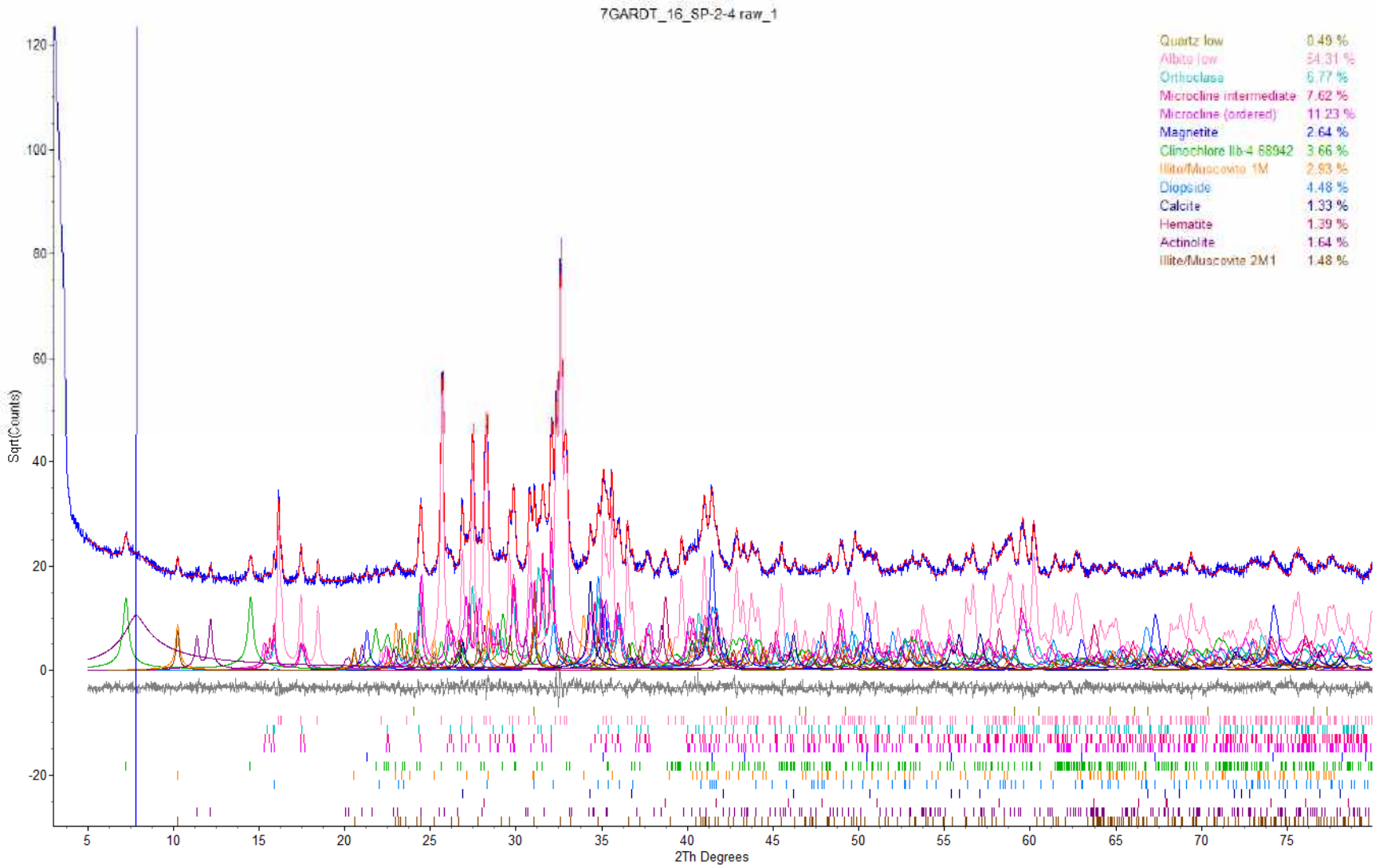


Figure 7. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 16_SP-2-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

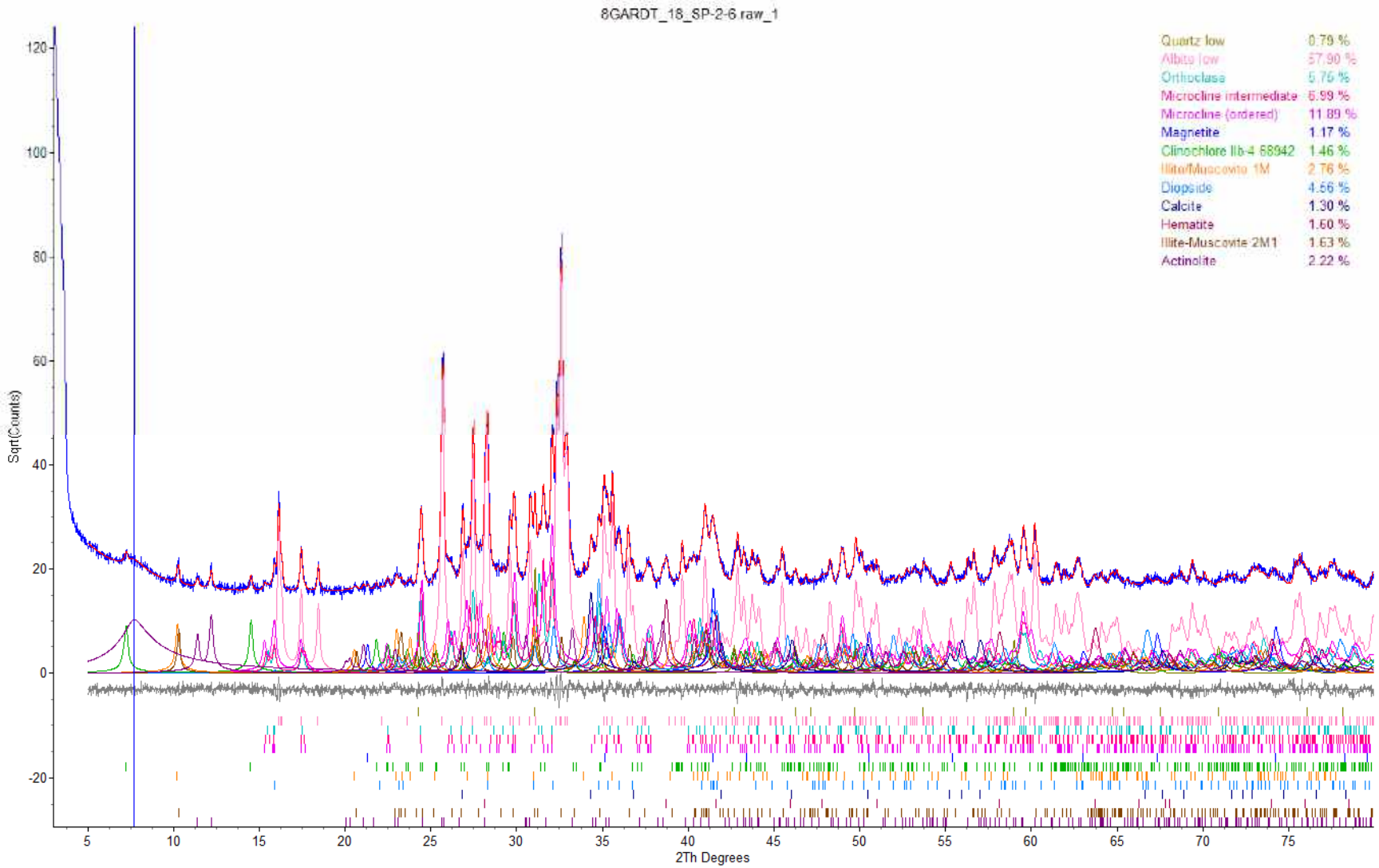


Figure 8. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 18_SP-2-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

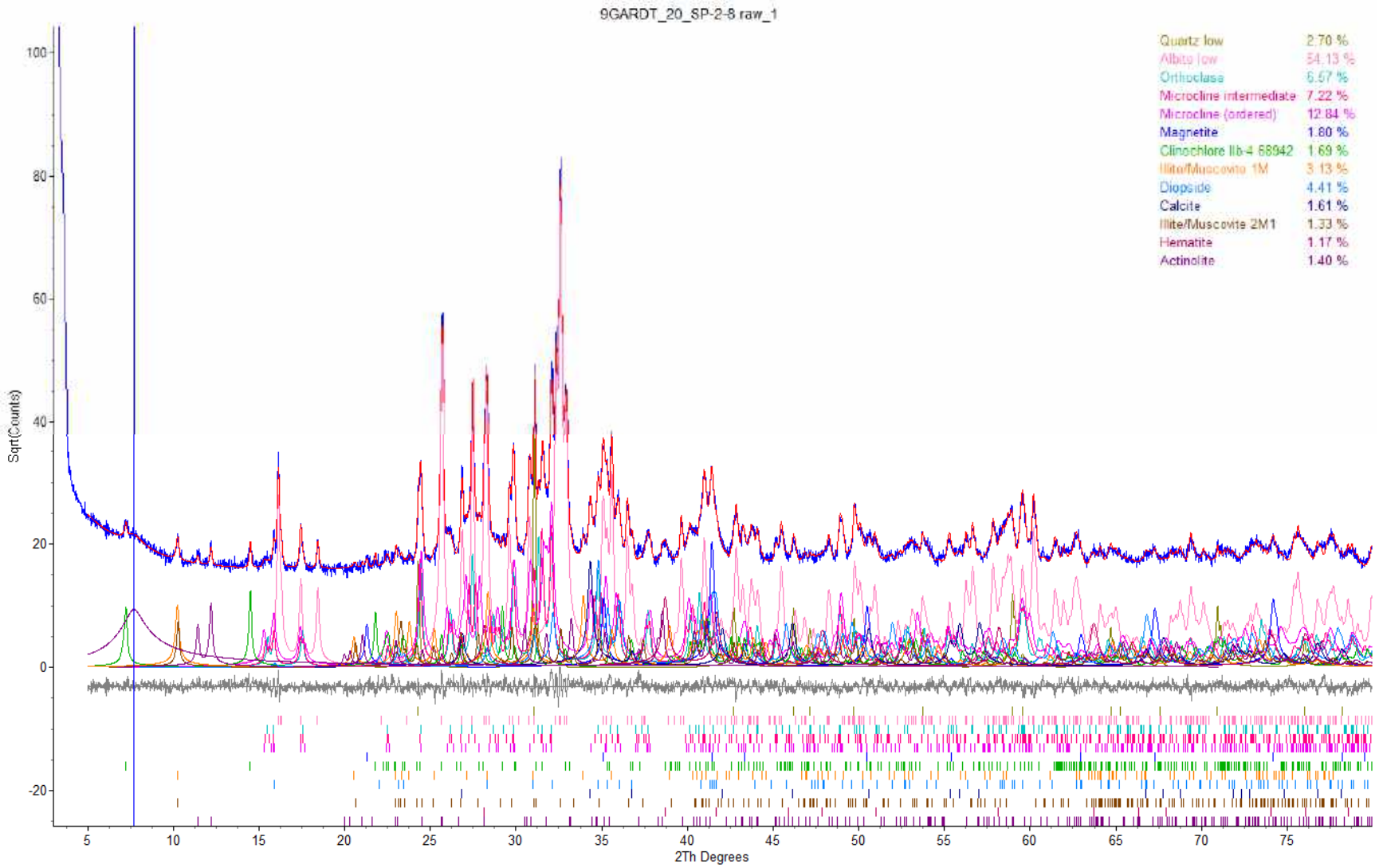


Figure 9. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 20_SP-2-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

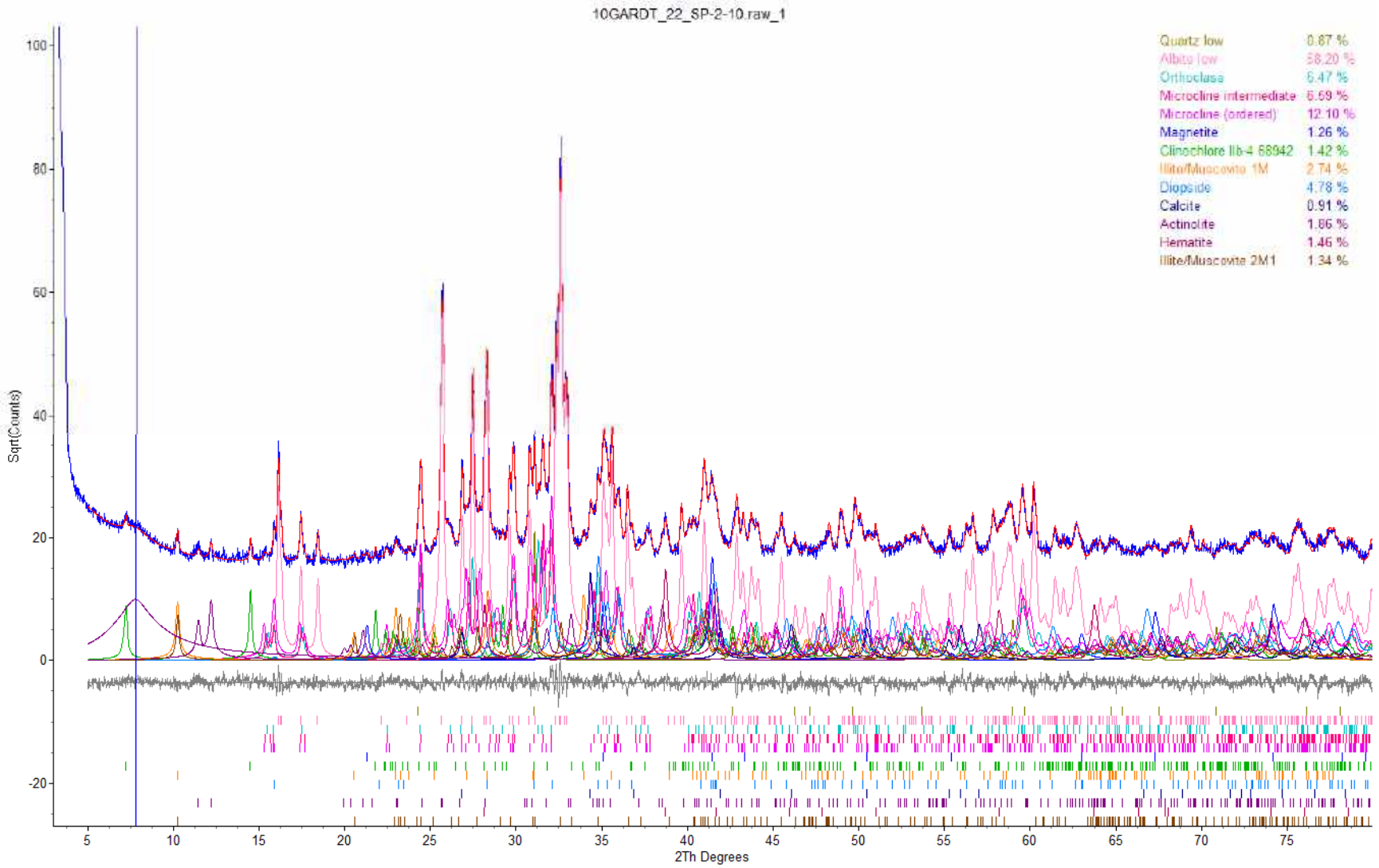


Figure 10. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 22_SP-2-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.



Figure 11. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 25_WX-1-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

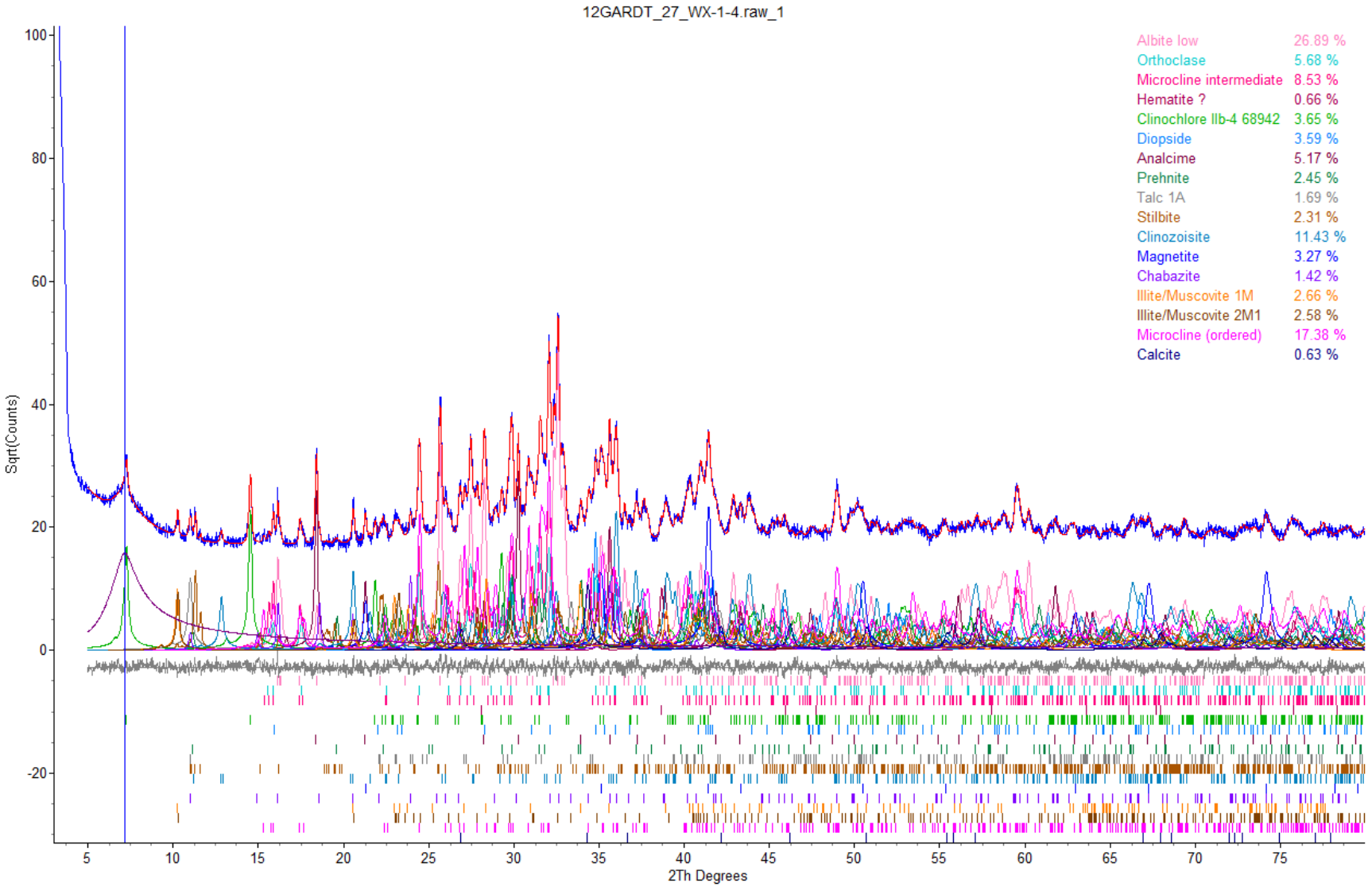


Figure 12. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 27-WX-1-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

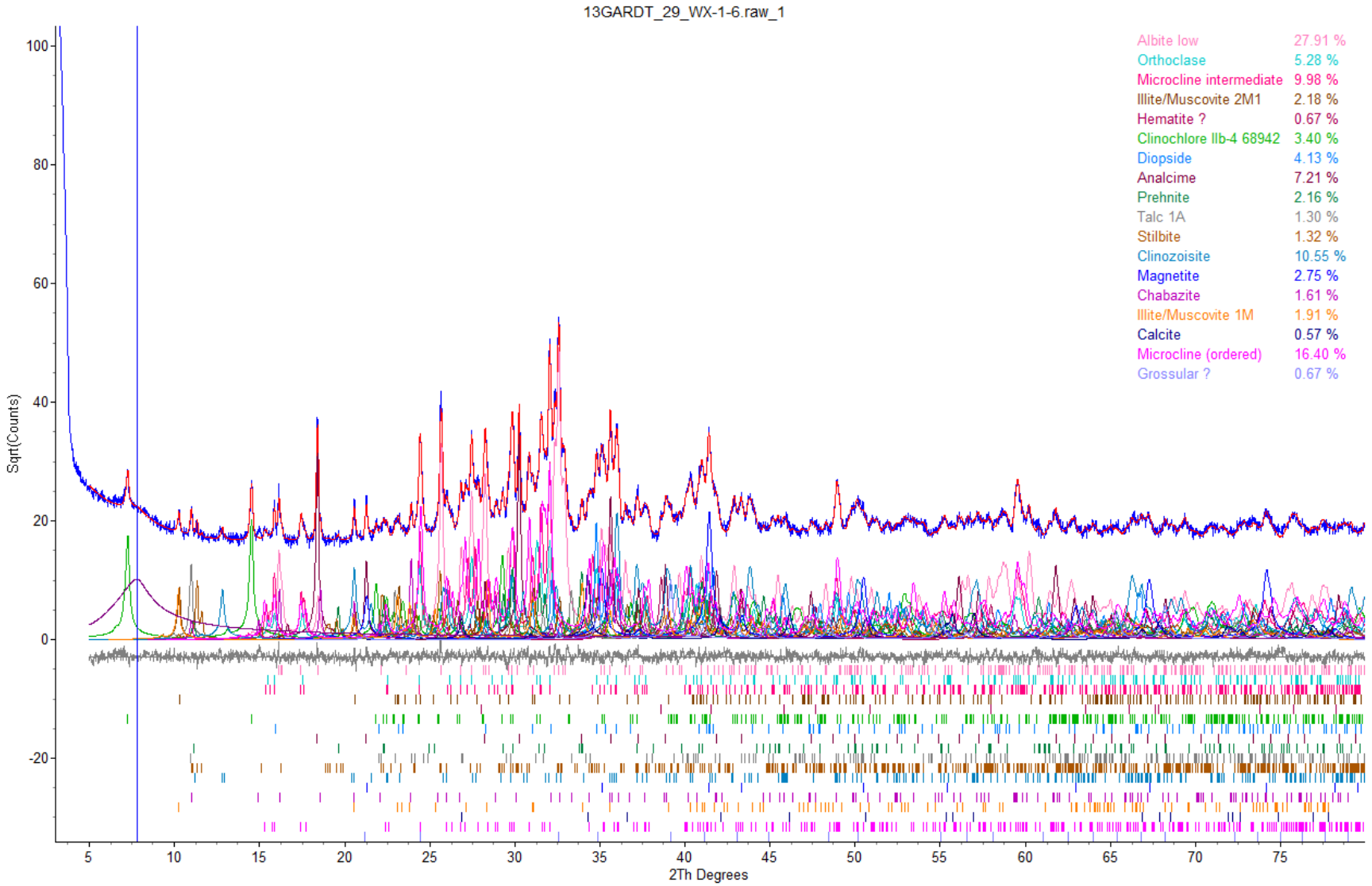


Figure 13. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 29_WX-1-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

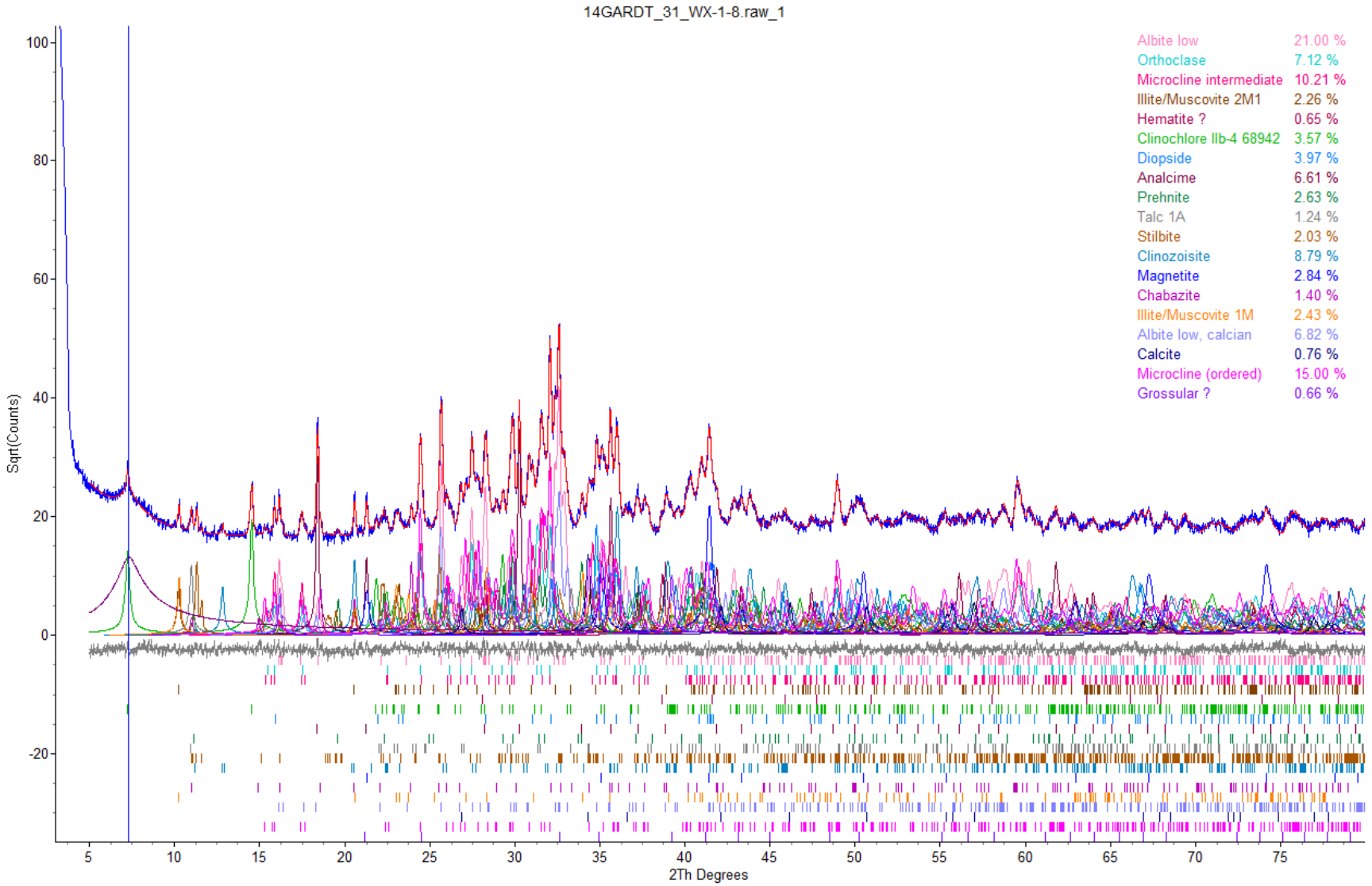


Figure 14. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 31_WX-1-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

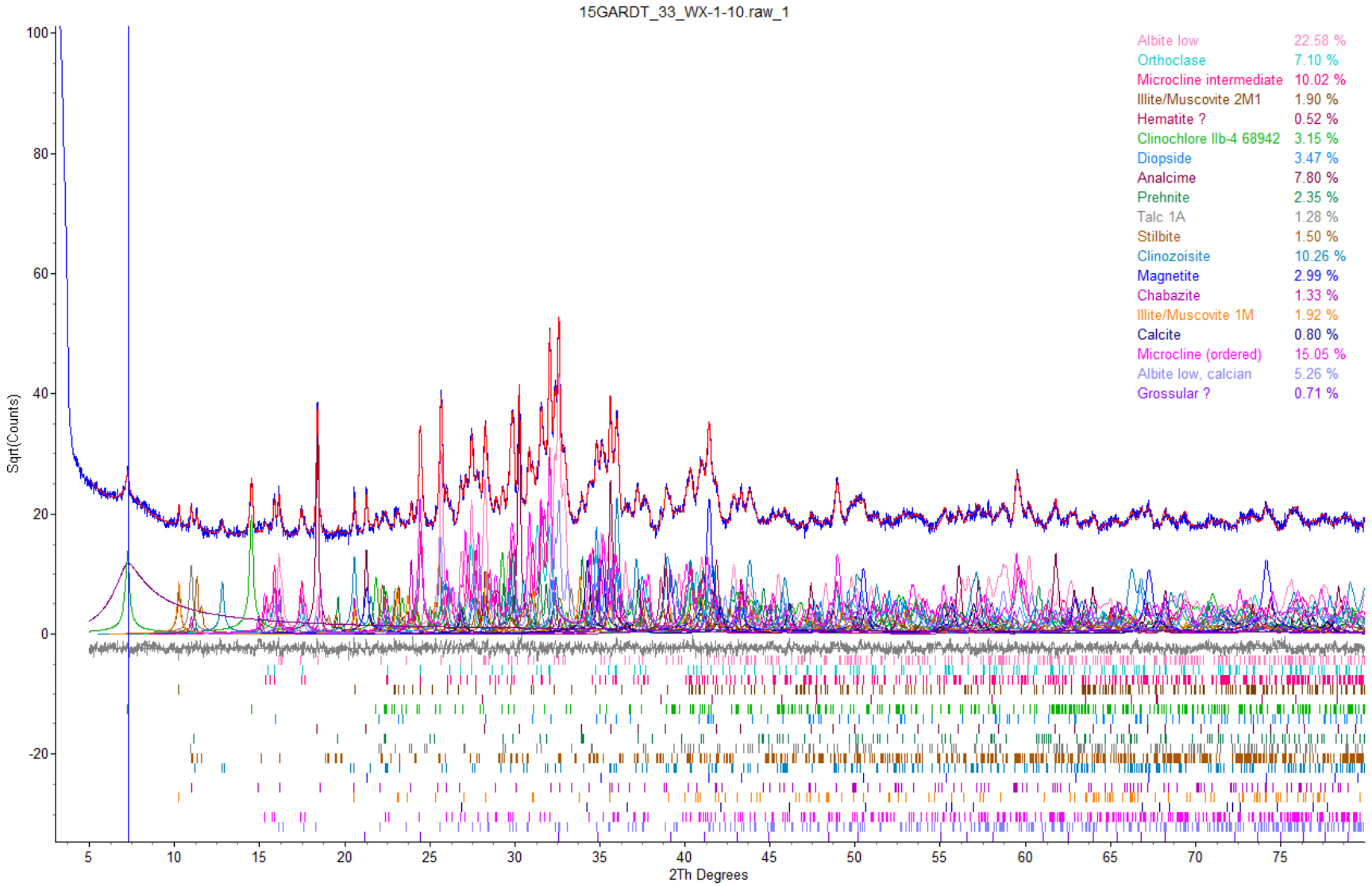


Figure 15. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 33_WX-1-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections; vertical blue line - position of peaks phase). Coloured lines are individual diffraction patterns of all phases.

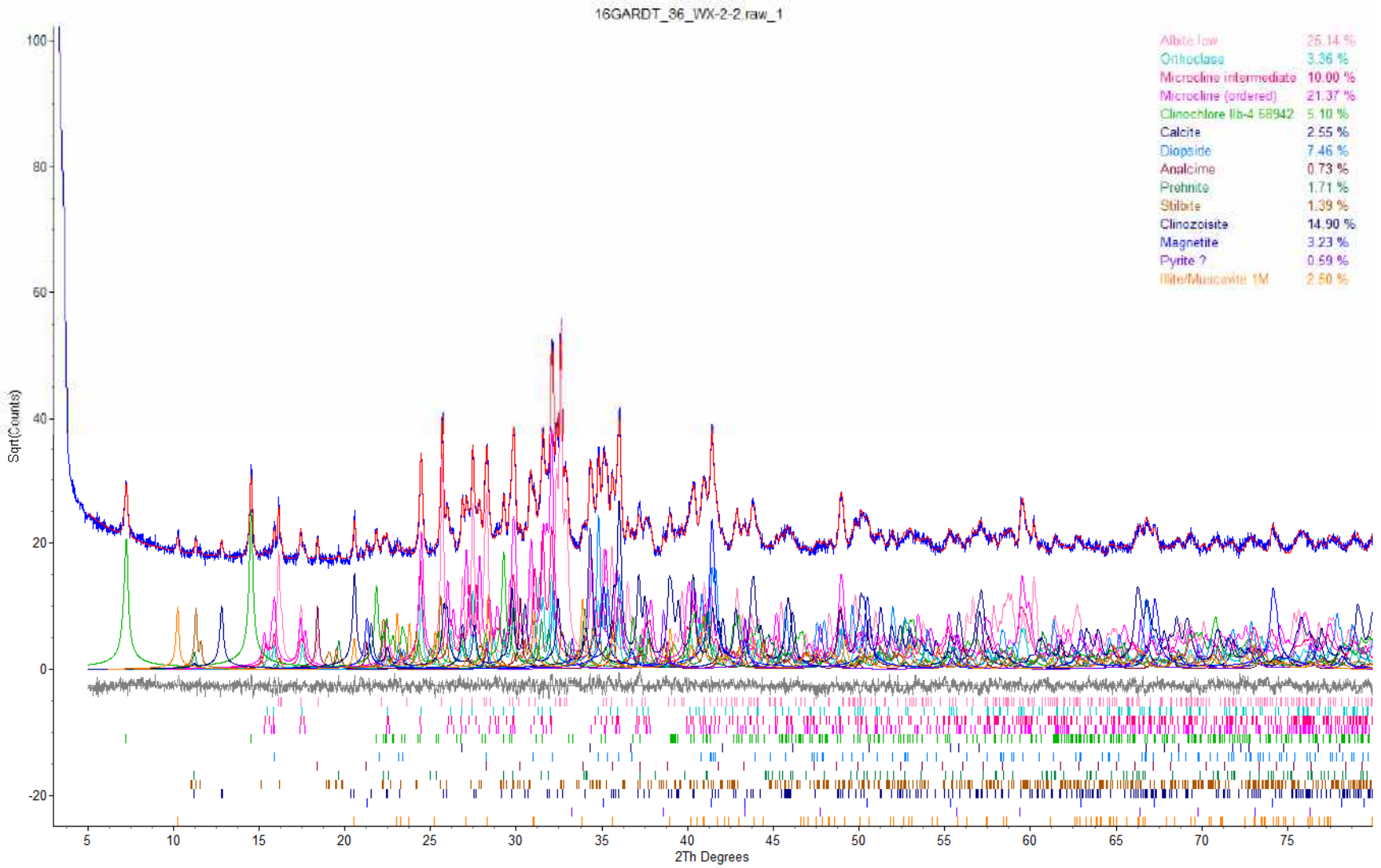


Figure 16. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 36_WX-2-2** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

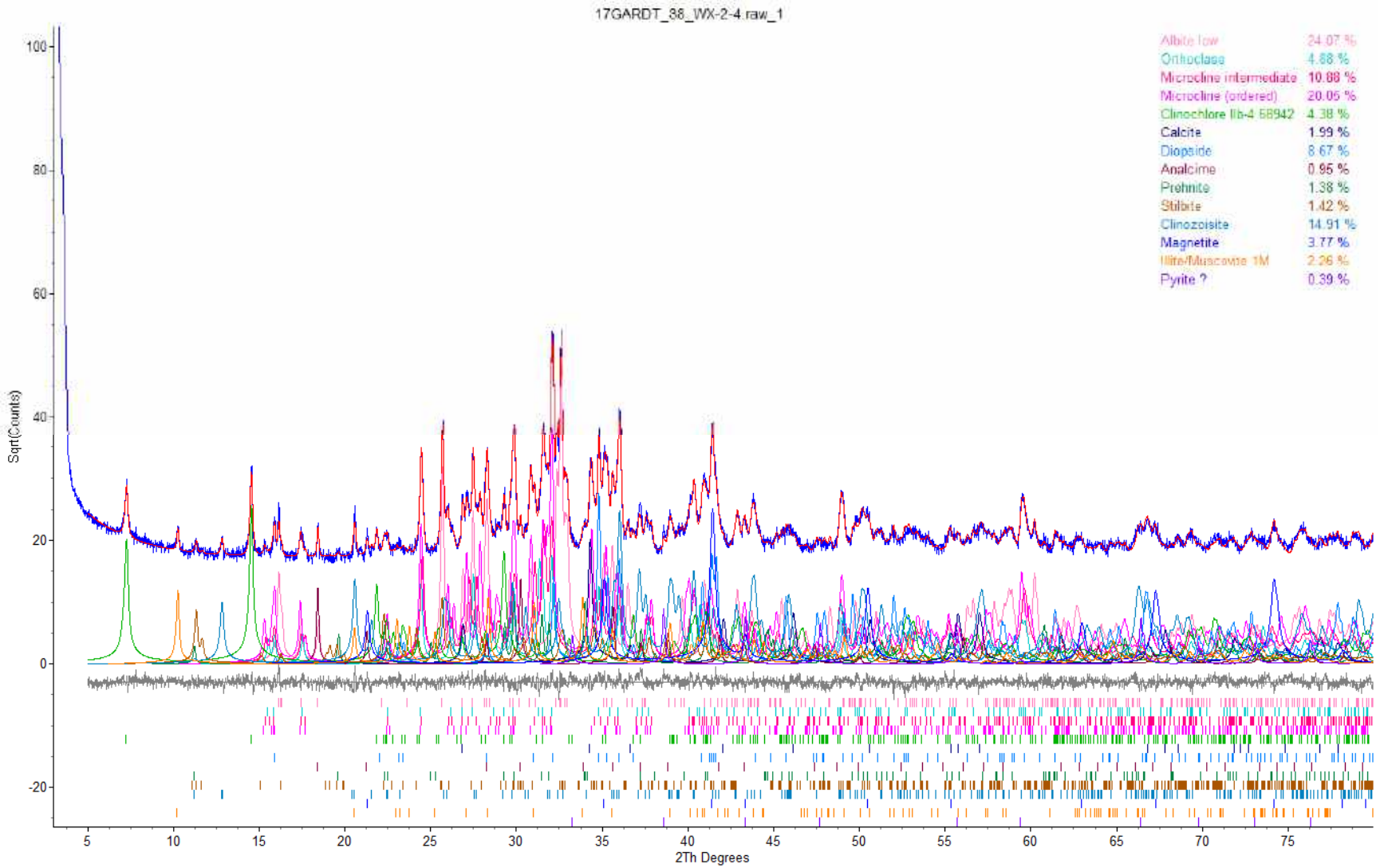


Figure 17. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 38_WX-2-4** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

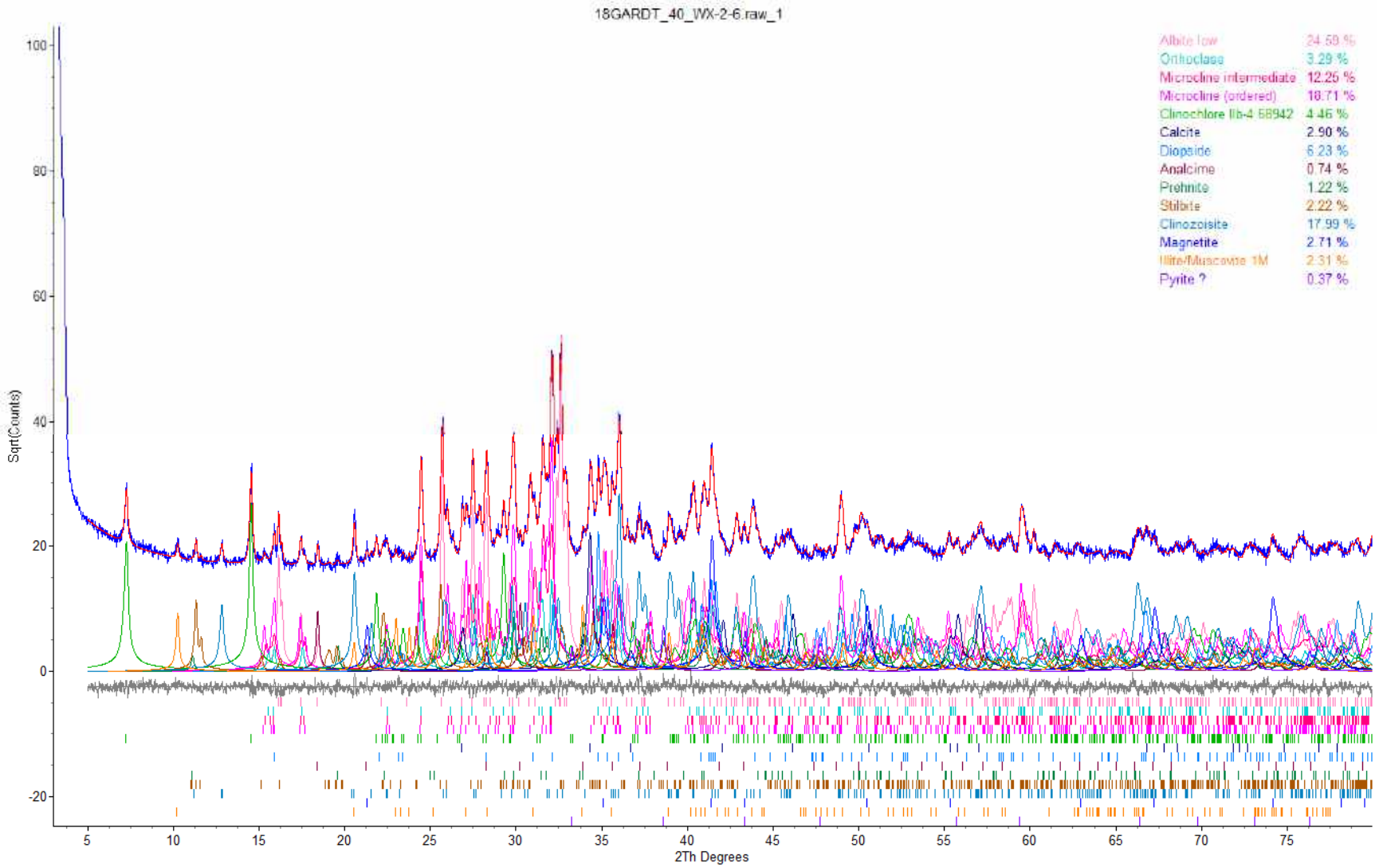


Figure 18. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 40_WX-2-6** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

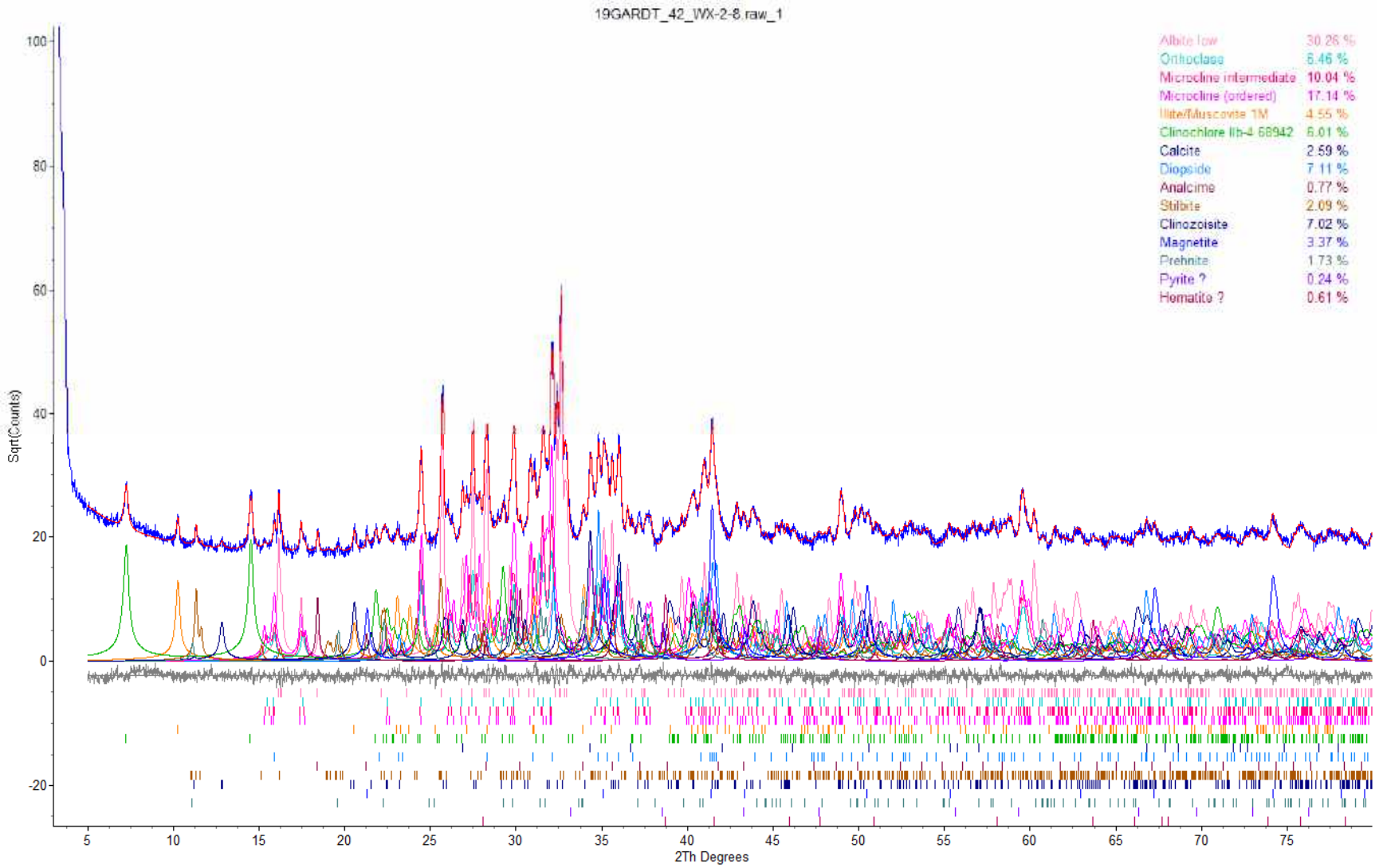


Figure 19. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 42_WX-2-8** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

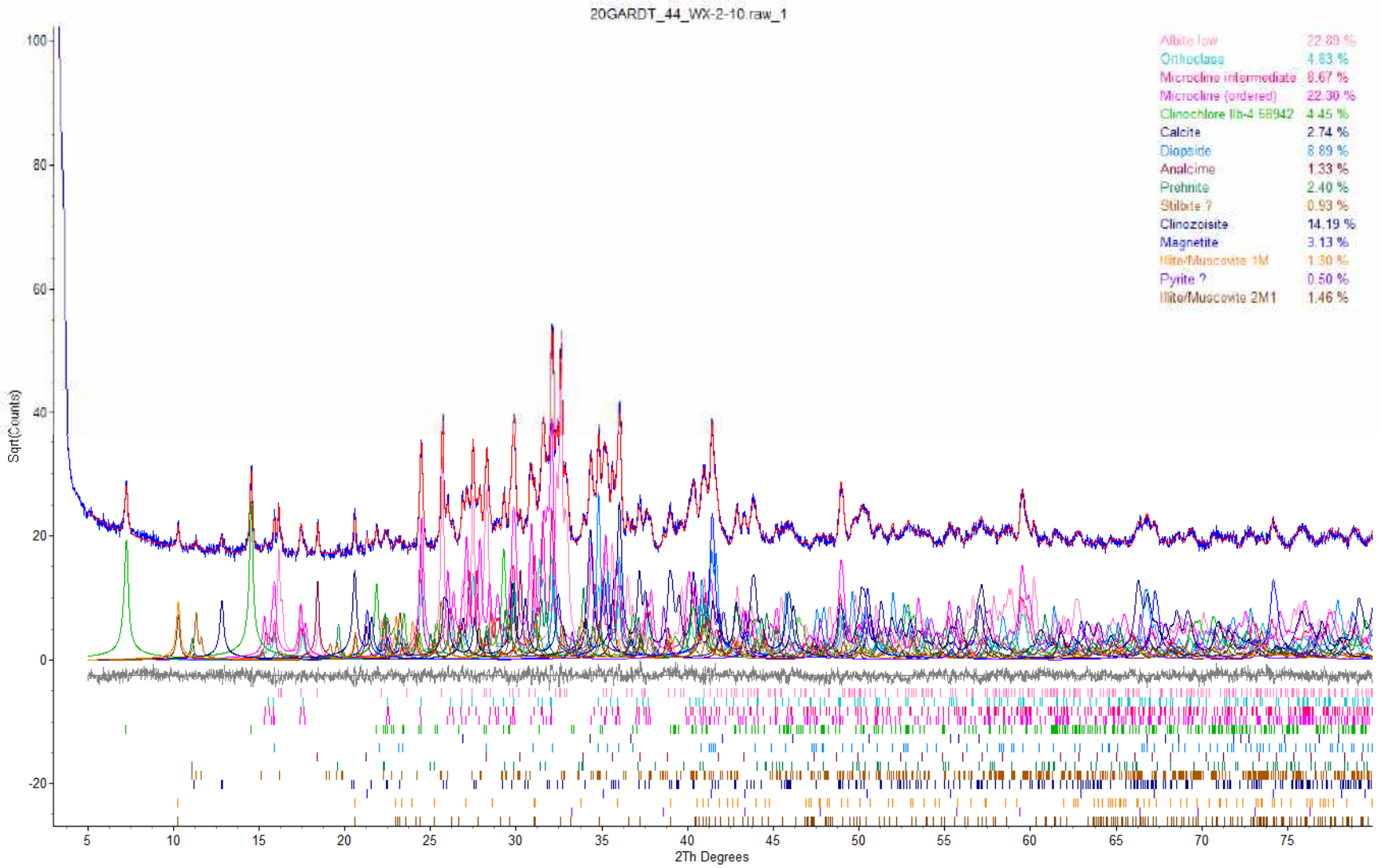


Figure 20. Rietveld refinement plot of sample **Global ARD Testing Services Inc. - 44_WX-2-10** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

Appendix C. Acid-Base Accounting Data for Springer Deep and WX Zones Samples Sieved to Various Size Fractions

CERTIFICATE OF ANALYSIS ▪ COVER PAGE

Global ARD Testing Services Inc.

Company:		SRK Consulting (Canada) Inc.
Project Manager(s):	**1**	Shauna Litke
	2	Mathieu O'Leary
Contact Person:		Shauna Litke
Mailing Address:		22nd Floor, 1066 West Hastings Street,
		Vancouver, BC V6E 3X2, Canada.
Contact No:		(604) 681-4196
Fax No:		(604) 687-5532

COMPANY INFORMATION	
Legal Name:	Global ARD Testing Services Inc.
Mailing Address:	6891 Antrim Avenue, Burnaby, BC, Canada, V5J 4M5
Contact No:	Main: (604) 428-2730
	Alt: (604) 603-1359

PROJECT INFORMATION	
Project Name:	Mount Polley NPR Criterion
Project Number:	1CM017.011

RESULTS		
Reported To:	**1**	Shauna Litke (slitke@srk.com)
	2	Mathieu O'Leary (mathieu.oleary@mountpolley.com)
	3	
	4	
cc:		
	V1:	22-May-22
Date Reported:		

REPORT INFORMATION	
Global Project No:	2221
Report Version:	1
Pages (Including Cover):	4
Report Title:	COA x44 Samples Mount Polley (rec'd 25-Mar22)
Analysis Reviewed By:	Prab Bhatia (PBhatia@globalARDtesting.com)
Position:	Project Manager
Report Certified By:	Prab Bhatia
Signature:	

INVOICE		
Submitted To:		Mount Polley
cc:	**1**	Mathieu O'Leary (mathieu.oleary@mountpolley.com)
	2	
Mailing Address:		
Client PO No:		N/A
Global Invoice No:		ARD2221-0622A
Date Submitted:		May 30, 2022

NOTES
All samples are stored at no charge for 90 days past reporting date.
HCT, column, custom leach columns (Lysimeters) & SAD column samples
will be stored free for 90 days past kinetic testing program or Closedown.
Please contact the lab if you require additional sample storage time.

CERTIFICATE OF ANALYSIS ▪ SAMPLE DETAILS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Sample Description	Condition	Total Sample Wt Rec'd (kg)	Global Notes:
1	SP-1-1	Rock	Wet	29.50	
2	SP-1-1-Dup	Rock	Wet	29.15	
3	SP-1-2	Rock	Wet	29.55	
4	SP-1-3	Rock	Wet	27.00	
5	SP-1-4	Rock	Wet	28.60	
6	SP-1-5	Rock	Wet	25.20	
7	SP-1-6	Rock	Wet	26.65	
8	SP-1-7	Rock	Wet	30.05	
9	SP-1-8	Rock	Wet	25.00	
10	SP-1-9	Rock	Wet	29.00	
11	SP-1-10	Rock	Wet	28.50	
12	SP-2-1	Rock	Wet	24.40	
13	SP-2-1-Dup	Rock	Wet	25.30	
14	SP-2-2	Rock	Wet	24.80	
15	SP-2-3	Rock	Wet	25.00	
16	SP-2-4	Rock	Wet	27.55	
17	SP-2-5	Rock	Wet	25.00	
18	SP-2-6	Rock	Wet	24.20	
19	SP-2-7	Rock	Wet	25.05	
20	SP-2-8	Rock	Wet	23.50	
21	SP-2-9	Rock	Wet	23.00	
22	SP-2-10	Rock	Wet	27.05	
23	WX-1-1	Rock	Wet	19.80	
24	WX-1-1-Dup	Rock	Wet	19.65	
25	WX-1-2	Rock	Wet	23.30	
26	WX-1-3	Rock	Wet	20.80	
27	WX-1-4	Rock	Wet	21.50	

SAMPLE RECEIPT INFO:

Date Samples Rec'd:	Friday, March 25, 2022
No. of Samples Rec'd:	44
Samples Rec'd By:	Mark

ANALYTICAL INSTRUCTIONS:

From:	Shauna Litke
Date:	Friday, March 25, 2022

INSTRUCTIONS:

Sieve Samples as instructed and Analyze all fractions.
A (+10mm)
B(-10mm + 2mm)
C (-2mm)

CERTIFICATE OF ANALYSIS ▪ SAMPLE DETAILS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

28	WX-1-5	Rock	Wet	24.25	
29	WX-1-6	Rock	Wet	20.60	
30	WX-1-7	Rock	Wet	22.90	
31	WX-1-8	Rock	Wet	23.50	
32	WX-1-9	Rock	Wet	17.15	
33	WX-1-10	Rock	Wet	21.20	
34	WX-2-1	Rock	Wet	25.40	Overlying Water
35	WX-2-1-Dup	Rock	Wet	20.00	Overlying Water
36	WX-2-2	Rock	Wet	21.00	Overlying Water
37	WX-2-3	Rock	Wet	21.00	Overlying Water
38	WX-2-4	Rock	Wet	22.00	Overlying Water
39	WX-2-5	Rock	Wet	22.00	Overlying Water
40	WX-2-6	Rock	Wet	21.00	Overlying Water
41	WX-2-7	Rock	Wet	21.00	Overlying Water
42	WX-2-8	Tails	Wet	17.00	Overlying Water
43	WX-2-9	Rock	Wet	24.00	Overlying Water
44	WX-2-10	Rock	Wet	21.00	Overlying Water

Total wt of sample rec'd (kg): **1053.10**

CERTIFICATE OF ANALYSIS ▪ SIEVED FRACTION WEIGHTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consul
PROJECT NAME: Mount Polle
PROJECT NO: 1CM017.01
REPORT VERSION: 1

S.No.	Fraction	Weight	
1	+10 mm	19.25	kg
	-10+2mm	6.60	kg
	-2mm	3.65	kg
2	+10 mm	16.65	kg
	-10+2mm	7.10	kg
	-2mm	5.20	kg
3	+10 mm	16.60	kg
	-10+2mm	7.75	kg
	-2mm	5.15	kg
4	+10 mm	15.25	kg
	-10+2mm	7.40	kg
	-2mm	4.15	kg
5	+10 mm	17.95	kg
	-10+2mm	6.45	kg
	-2mm	4.15	kg
6	+10 mm	14.85	kg
	-10+2mm	6.35	kg
	-2mm	3.90	kg
7	+10 mm	16.80	kg
	-10+2mm	6.00	kg
	-2mm	3.75	kg
8	+10 mm	16.95	kg
	-10+2mm	7.65	kg
	-2mm	5.45	kg
9	+10 mm	13.05	kg
	-10+2mm	6.70	kg
	-2mm	5.30	kg
10	+10 mm	18.85	kg
	-10+2mm	6.60	kg
	-2mm	3.30	kg
11	+10 mm	14.75	kg
	-10+2mm	7.50	kg
	-2mm	5.70	kg
12	+10 mm	16.75	kg
	-10+2mm	4.55	kg
	-2mm	3.05	kg
13	+10 mm	14.60	kg
	-10+2mm	5.95	kg
	-2mm	4.20	kg
14	+10 mm	15.20	kg
	-10+2mm	5.55	kg
	-2mm	3.85	kg
15	+10 mm	16.90	kg
	-10+2mm	4.95	kg
	-2mm	3.30	kg
16	+10 mm	17.20	kg
	-10+2mm	6.10	kg
	-2mm	4.10	kg
	+10 mm	14.00	kg

S.No.	Fraction	Weight	
21	+10 mm	13.50	kg
	-10+2mm	5.25	kg
	-2mm	3.95	kg
22	+10 mm	17.55	kg
	-10+2mm	6.55	kg
	-2mm	3.60	kg
23	+10 mm	9.10	kg
	-10+2mm	6.25	kg
	-2mm	2.25	kg
24	+10 mm	11.90	kg
	-10+2mm	4.25	kg
	-2mm	1.25	kg
25	+10 mm	15.90	kg
	-10+2mm	4.05	kg
	-2mm	1.45	kg
26	+10 mm	9.80	kg
	-10+2mm	6.55	kg
	-2mm	2.30	kg
27	+10 mm	12.70	kg
	-10+2mm	5.40	kg
	-2mm	1.70	kg
28	+10 mm	15.40	kg
	-10+2mm	5.55	kg
	-2mm	1.90	kg
29	+10 mm	15.35	kg
	-10+2mm	3.25	kg
	-2mm	1.00	kg
30	+10 mm	14.35	kg
	-10+2mm	5.00	kg
	-2mm	1.80	kg
31	+10 mm	15.75	kg
	-10+2mm	4.35	kg
	-2mm	1.75	kg
32	+10 mm	10.90	kg
	-10+2mm	3.45	kg
	-2mm	1.05	kg
33	+10 mm	13.50	kg
	-10+2mm	4.80	kg
	-2mm	1.85	kg
34	+10 mm	13.35	kg
	-10+2mm	5.55	kg
	-2mm	3.80	kg
35	+10 mm	11.00	kg
	-10+2mm	9.35	kg
	-2mm	2.75	kg
36	+10 mm	11.40	kg
	-10+2mm	4.55	kg
	-2mm	2.90	kg
	+10 mm	11.70	kg

CERTIFICATE OF ANALYSIS ▪ SIEVED FRACTION WEIGHTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consul
PROJECT NAME: Mount Polle
PROJECT NO: 1CM017.01
REPORT VERSION: 1

S.No.	Fraction	Weight	
17	-10+2mm	6.05	kg
	-2mm	4.55	kg
18	+10 mm	14.50	kg
	-10+2mm	5.50	kg
	-2mm	3.95	kg
19	+10 mm	14.65	kg
	-10+2mm	5.50	kg
	-2mm	3.15	kg
20	+10 mm	14.90	kg
	-10+2mm	5.00	kg
	-2mm	3.35	kg

S.No.	Fraction	Weight	
37	-10+2mm	4.10	kg
	-2mm	2.30	kg
38	+10 mm	13.95	kg
	-10+2mm	4.25	kg
	-2mm	2.60	kg
39	+10 mm	12.00	kg
	-10+2mm	4.85	kg
	-2mm	3.05	kg
40	+10 mm	11.85	kg
	-10+2mm	4.15	kg
	-2mm	2.30	kg
41	+10 mm	10.90	kg
	-10+2mm	4.60	kg
	-2mm	3.35	kg
42	+10 mm	8.45	kg
	-10+2mm	4.35	kg
	-2mm	2.45	kg
43	+10 mm	14.45	kg
	-10+2mm	4.95	kg
	-2mm	3.45	kg
44	+10 mm	11.45	kg
	-10+2mm	4.75	kg
	-2mm	3.25	kg

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
1A	SP-1-1A	8.5	Slight	0.11	9.2	0.38	0.01	0.37	11.6	24.5	12.9	2.1
1B	SP-1-1B	8.6	Moderate	0.17	14.2	0.34	<0.01	0.34	10.6	25.0	14.4	2.4
1C	SP-1-1C	8.2	Strong	0.47	39.5	0.98	0.01	0.97	30.3	56.2	25.9	1.9
2A	SP-1-1-DupA	8.6	Slight	0.13	10.8	0.50	<0.01	0.50	15.6	21.5	5.9	1.4
2B	SP-1-1-DupB	8.5	Slight	0.16	13.3	0.53	<0.01	0.53	16.6	28.8	12.2	1.7
2C	SP-1-1-DupC	8.3	Strong	0.45	37.5	0.90	0.01	0.89	27.8	50.5	22.7	1.8
3A	SP-1-2A	8.6	None	<0.02	<1.7	0.88	<0.01	0.88	27.5	11.9	-15.6	0.4
3B	SP-1-2B	8.5	Slight	0.13	10.8	1.15	0.05	1.10	34.4	15.4	-19.0	0.4
3C	SP-1-2C	8.0	Moderate	0.17	14.2	1.90	0.03	1.87	58.4	26.8	-31.6	0.5
4A	SP-1-3A	8.7	Strong	0.18	15.0	0.30	0.02	0.28	8.8	23.7	15.0	2.7
4B	SP-1-3B	8.7	Strong	0.31	25.8	0.49	0.01	0.48	15.0	31.9	16.9	2.1
4C	SP-1-3C	8.2	Strong	0.73	60.8	0.77	<0.01	0.77	24.1	64.9	40.8	2.7
5A	SP-1-4A	8.6	Slight	0.16	13.3	0.49	<0.01	0.49	15.3	21.2	5.9	1.4
5B	SP-1-4B	8.6	Moderate	0.18	15.0	0.56	<0.01	0.56	17.5	23.6	6.1	1.3
5C	SP-1-4C	8.2	Strong	0.43	35.8	1.03	0.02	1.01	31.6	50.5	18.9	1.6
6A	SP-1-5A	8.6	Slight	0.03	2.5	1.24	<0.01	1.24	38.8	15.3	-23.5	0.4
6B	SP-1-5B	8.4	Slight	0.05	4.2	1.33	0.03	1.30	40.6	18.9	-21.7	0.5
6C	SP-1-5C	8.2	Strong	0.34	28.3	2.00	0.02	1.98	61.9	39.6	-22.3	0.6
7A	SP-1-6A	8.7	Slight	0.08	6.7	0.30	0.03	0.27	8.4	19.6	11.2	2.3
7B	SP-1-6B	8.7	Moderate	0.15	12.5	0.46	0.02	0.44	13.8	27.0	13.3	2.0
7C	SP-1-6C	8.0	Strong	0.46	38.3	0.85	0.01	0.84	26.3	57.4	31.2	2.2
8A	SP-1-7A	8.4	None	<0.02	<1.7	0.68	<0.01	0.68	21.3	15.7	-5.6	0.7
8B	SP-1-7B	8.4	Slight	0.02	1.7	0.61	<0.01	0.61	19.1	17.2	-1.9	0.9
8C	SP-1-7C	8.0	Moderate	0.14	11.7	1.26	0.03	1.23	38.4	26.6	-11.8	0.7
9A	SP-1-8A	8.3	None	0.04	3.3	1.40	<0.01	1.40	43.8	14.1	-29.7	0.3
9B	SP-1-8B	8.3	None	0.03	2.5	1.40	<0.01	1.40	43.8	15.3	-28.5	0.3
9C	SP-1-8C	7.9	Slight	0.12	10.0	2.44	0.06	2.38	74.4	24.6	-49.8	0.3
10A	SP-1-9A	8.8	Slight	0.03	2.5	0.08	<0.01	0.08	2.5	18.7	16.2	7.5
10B	SP-1-9B	8.6	Moderate	0.15	12.5	0.26	<0.01	0.26	8.1	24.2	16.1	3.0
10C	SP-1-9C	8.4	Strong	0.54	45.0	0.43	0.01	0.42	13.1	58.3	45.2	4.4
11A	SP-1-10A	8.5	Slight	0.14	11.7	0.85	<0.01	0.85	26.6	23.4	-3.2	0.9
11B	SP-1-10B	8.6	Slight	0.19	15.8	0.43	0.02	0.41	12.8	26.9	14.1	2.1
11C	SP-1-10C	8.3	Moderate	0.48	40.0	0.77	<0.01	0.77	24.1	53.8	29.7	2.2
12A	SP-2-1A	9.0	Slight	0.06	5.0	0.02	<0.01	0.02	0.6	12.6	12.0	20.2
12B	SP-2-1B	8.8	Slight	0.07	5.8	0.02	<0.01	0.02	0.6	13.1	12.5	21.0
12C	SP-2-1C	9.0	Moderate	0.27	22.5	0.04	<0.01	0.04	1.3	32.3	31.1	25.8
13A	SP-2-1-DupA	8.9	Slight	0.06	5.0	0.01	<0.01	0.01	0.3	13.2	12.9	42.2
13B	SP-2-1-DupB	9.0	Slight	0.09	7.5	0.02	<0.01	0.02	0.6	13.4	12.8	21.4
13C	SP-2-1-DupC	8.5	Moderate	0.26	21.7	0.03	0.02	0.01	0.3	30.7	30.4	98.2
14A	SP-2-2A	9.0	Slight	0.03	2.5	0.02	<0.01	0.02	0.6	13.2	12.6	21.1
14B	SP-2-2B	8.8	Slight	0.09	7.5	0.02	0.02	<0.01	<0.3	18.4	18.4	N/A
14C	SP-2-2C	8.5	Moderate	0.20	16.7	0.03	<0.01	0.03	0.9	27.3	26.4	29.1
15A	SP-2-3A	9.0	None	0.04	3.3	<0.01	<0.01	<0.01	<0.3	13.6	13.6	N/A
15B	SP-2-3B	8.9	Slight	0.06	5.0	0.01	<0.01	0.01	0.3	16.3	16.0	52.2
15C	SP-2-3C	8.5	Moderate	0.13	10.8	0.03	0.02	0.01	0.3	24.3	24.0	77.8
16A	SP-2-4A	9.1	None	0.04	3.3	<0.01	<0.01	<0.01	<0.3	8.6	8.6	N/A
16B	SP-2-4B	8.9	Slight	0.10	8.3	0.01	<0.01	0.01	0.3	13.2	12.9	42.2
16C	SP-2-4C	8.3	Moderate	0.28	23.3	0.03	<0.01	0.03	0.9	34.6	33.7	36.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
17A	SP-2-5A	8.7	Slight	0.03	2.5	<0.01	<0.01	<0.01	<0.3	10.5	10.5	N/A
17B	SP-2-5B	8.8	Slight	0.06	5.0	0.01	0.01	<0.01	<0.3	15.4	15.4	N/A
17C	SP-2-5C	8.5	Moderate	0.17	14.2	0.03	<0.01	0.03	0.9	24.3	23.4	25.9
18A	SP-2-6A	9.0	Slight	0.02	1.7	0.03	<0.01	0.03	0.9	8.9	8.0	9.5
18B	SP-2-6B	9.0	Slight	0.05	4.2	0.02	<0.01	0.02	0.6	15.2	14.6	24.3
18C	SP-2-6C	8.5	Slight	0.18	15.0	0.03	<0.01	0.03	0.9	23.9	23.0	25.5
19A	SP-2-7A	9.1	Slight	0.04	3.3	0.03	<0.01	0.03	0.9	10.5	9.6	11.2
19B	SP-2-7B	8.8	Moderate	0.09	7.5	0.03	<0.01	0.03	0.9	16.2	15.3	17.3
19C	SP-2-7C	8.6	Strong	0.24	20.0	0.05	<0.01	0.05	1.6	29.3	27.7	18.8
20A	SP-2-8A	9.0	Slight	0.08	6.7	0.04	<0.01	0.04	1.3	13.6	12.4	10.9
20B	SP-2-8B	9.0	Slight	0.14	11.7	0.04	<0.01	0.04	1.3	20.2	19.0	16.2
20C	SP-2-8C	8.5	Moderate	0.05	4.2	0.06	0.02	0.04	1.3	11.1	9.9	8.9
21A	SP-2-9A	8.9	Slight	0.03	2.5	0.01	<0.01	0.01	0.3	14.0	13.7	44.8
21B	SP-2-9B	8.8	Slight	0.05	4.2	0.03	<0.01	0.03	0.9	14.3	13.4	15.3
21C	SP-2-9C	8.5	Moderate	0.20	16.7	0.05	<0.01	0.05	1.6	29.5	27.9	18.9
22A	SP-2-10A	8.9	Slight	0.05	4.2	0.02	<0.01	0.02	0.6	11.4	10.8	18.2
22B	SP-2-10B	9.0	Slight	0.06	5.0	0.03	<0.01	0.03	0.9	13.6	12.7	14.5
22C	SP-2-10C	8.5	Moderate	0.26	21.7	0.04	<0.01	0.04	1.3	25.4	24.2	20.3
23A	WX-1-1A	8.3	Slight	0.06	5.0	0.16	<0.01	0.16	5.0	21.6	16.6	4.3
23B	WX-1-1B	8.2	Slight	0.03	2.5	0.13	<0.01	0.13	4.1	21.6	17.5	5.3
23C	WX-1-1C	8.3	Moderate	0.16	13.3	0.10	<0.01	0.10	3.1	38.1	35.0	12.2
24A	WX-1-1-DupA	8.3	None	0.04	3.3	0.19	<0.01	0.19	5.9	17.7	11.8	3.0
24B	WX-1-1-DupB	8.4	None	0.02	1.7	0.11	<0.01	0.11	3.4	17.6	14.2	5.1
24C	WX-1-1-DupC	8.1	Slight	0.10	8.3	0.06	<0.01	0.06	1.9	24.9	23.0	13.3
25A	WX-1-2A	8.3	None	0.07	5.8	0.11	<0.01	0.11	3.4	21.7	18.3	6.3
25B	WX-1-2B	8.3	None	0.15	12.5	0.14	<0.01	0.14	4.4	27.5	23.1	6.3
25C	WX-1-2C	8.2	Slight	0.20	16.7	0.15	<0.01	0.15	4.7	31.2	26.5	6.7
26A	WX-1-3A	8.3	Slight	0.13	10.8	0.13	<0.01	0.13	4.1	23.7	19.6	5.8
26B	WX-1-3B	8.4	Slight	0.16	13.3	0.11	<0.01	0.11	3.4	27.0	23.6	7.9
26C	WX-1-3C	8.1	Moderate	0.25	20.8	0.08	<0.01	0.08	2.5	34.8	32.3	13.9
27A	WX-1-4A	8.4	None	0.03	2.5	0.17	<0.01	0.17	5.3	17.7	12.4	3.3
27B	WX-1-4B	8.3	None	0.03	2.5	0.14	<0.01	0.14	4.4	17.7	13.3	4.0
27C	WX-1-4C	8.1	Slight	0.06	5.0	0.09	<0.01	0.09	2.8	22.7	19.9	8.1
28A	WX-1-5A	8.4	None	0.05	4.2	0.19	<0.01	0.19	5.9	18.8	12.9	3.2
28B	WX-1-5B	8.4	None	0.04	3.3	0.14	<0.01	0.14	4.4	16.2	11.8	3.7
28C	WX-1-5C	7.8	Slight	0.13	10.8	0.10	<0.01	0.10	3.1	22.2	19.1	7.1
29A	WX-1-6A	8.3	None	0.07	5.8	0.17	<0.01	0.17	5.3	21.6	16.3	4.1
29B	WX-1-6B	8.2	None	0.07	5.8	0.16	<0.01	0.16	5.0	19.9	14.9	4.0
29C	WX-1-6C	8.1	Slight	0.17	14.2	0.16	<0.01	0.16	5.0	27.4	22.4	5.5
30A	WX-1-7A	8.1	None	0.07	5.8	0.17	<0.01	0.17	5.3	23.0	17.7	4.3
30B	WX-1-7B	8.3	Slight	0.06	5.0	0.12	<0.01	0.12	3.8	20.5	16.8	5.5
30C	WX-1-7C	8.0	Slight	0.09	7.5	0.12	<0.01	0.12	3.8	22.5	18.8	6.0
31A	WX-1-8A	8.4	None	0.04	3.3	0.14	<0.01	0.14	4.4	21.8	17.4	5.0
31B	WX-1-8B	8.2	Slight	0.09	7.5	0.13	<0.01	0.13	4.1	24.0	19.9	5.9
31C	WX-1-8C	8.1	Slight	0.20	16.7	0.13	<0.01	0.13	4.1	30.7	26.6	7.6
32A	WX-1-9A	8.3	None	<0.02	<1.7	0.16	0.03	0.13	4.1	18.2	14.1	4.5
32B	WX-1-9B	8.5	None	<0.02	<1.7	0.16	<0.01	0.16	5.0	18.2	13.2	3.6
32C	WX-1-9C	8.1	Slight	0.05	4.2	0.14	<0.01	0.14	4.4	17.2	12.8	3.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
33A	WX-1-10A	8.4	None	<0.02	<1.7	0.15	<0.01	0.15	4.7	12.9	8.2	2.8
33B	WX-1-10B	8.4	None	0.03	2.5	0.14	<0.01	0.14	4.4	16.8	12.4	3.8
33C	WX-1-10C	8.2	Slight	0.16	13.3	0.14	<0.01	0.14	4.4	27.8	23.4	6.4
34A	WX-2-1A	8.7	Slight	0.25	20.8	0.21	<0.01	0.21	6.6	33.1	26.5	5.0
34B	WX-2-1B	8.8	Slight	0.26	21.7	0.21	<0.01	0.21	6.6	33.6	27.0	5.1
34C	WX-2-1C	8.3	Strong	0.47	39.2	0.25	<0.01	0.25	7.8	50.0	42.2	6.4
35A	WX-2-1-DupA	8.8	Moderate	0.23	19.2	0.21	<0.01	0.21	6.6	31.9	25.3	4.9
35B	WX-2-1-DupB	8.7	Moderate	0.25	20.8	0.20	<0.01	0.20	6.3	33.6	27.4	5.4
35C	WX-2-1-DupC	8.5	Strong	0.42	35.0	0.24	<0.01	0.24	7.5	48.2	40.7	6.4
36A	WX-2-2A	8.7	Moderate	0.28	23.3	0.15	<0.01	0.15	4.7	35.6	30.9	7.6
36B	WX-2-2B	8.7	Moderate	0.27	22.5	0.13	<0.01	0.13	4.1	34.6	30.5	8.5
36C	WX-2-2C	8.4	Strong	0.42	35.0	0.15	<0.01	0.15	4.7	46.3	41.6	9.9
37A	WX-2-3A	8.8	Moderate	0.27	22.5	0.14	<0.01	0.14	4.4	34.5	30.1	7.9
37B	WX-2-3B	8.5	Moderate	0.33	27.5	0.12	<0.01	0.12	3.8	39.4	35.7	10.5
37C	WX-2-3C	8.5	Strong	0.38	31.7	0.15	<0.01	0.15	4.7	44.4	39.7	9.5
38A	WX-2-4A	8.7	Moderate	0.31	25.8	0.19	<0.01	0.19	5.9	34.6	28.7	5.8
38B	WX-2-4B	8.7	Moderate	0.30	25.0	0.21	<0.01	0.21	6.6	33.5	26.9	5.1
38C	WX-2-4C	8.5	Strong	0.50	41.7	0.23	<0.01	0.23	7.2	48.2	41.0	6.7
39A	WX-2-5A	8.8	Moderate	0.30	25.0	0.20	<0.01	0.20	6.3	31.8	25.6	5.1
39B	WX-2-5B	8.6	Moderate	0.33	27.5	0.20	<0.01	0.20	6.3	36.0	29.8	5.8
39C	WX-2-5C	8.4	Strong	0.48	40.0	0.21	<0.01	0.21	6.6	43.9	37.3	6.7
40A	WX-2-6A	8.8	Moderate	0.39	32.5	0.20	<0.01	0.20	6.3	36.2	30.0	5.8
40B	WX-2-6B	8.6	Moderate	0.37	30.8	0.19	0.01	0.18	5.6	37.2	31.6	6.6
40C	WX-2-6C	8.7	Strong	0.54	45.0	0.20	0.04	0.16	5.0	46.3	41.3	9.3
41A	WX-2-7A	8.7	Moderate	0.25	20.8	0.21	<0.01	0.21	6.6	35.0	28.4	5.3
41B	WX-2-7B	8.7	Moderate	0.26	21.7	0.20	0.04	0.16	5.0	32.8	27.8	6.6
41C	WX-2-7C	8.5	Strong	0.37	30.8	0.25	0.01	0.24	7.5	45.3	37.8	6.0
42A	WX-2-8A	8.8	Slight	0.20	16.7	0.16	0.01	0.15	4.7	30.6	25.9	6.5
42B	WX-2-8B	8.6	Moderate	0.28	23.3	0.15	0.07	0.08	2.5	37.1	34.6	14.8
42C	WX-2-8C	8.3	Moderate	0.33	27.5	0.14	0.02	0.12	3.8	40.2	36.5	10.7
43A	WX-2-9A	8.7	Moderate	0.28	23.3	0.21	0.01	0.20	6.3	33.8	27.6	5.4
43B	WX-2-9B	8.7	Moderate	0.24	20.0	0.23	0.02	0.21	6.6	33.0	26.4	5.0
43C	WX-2-9C	8.6	Strong	0.40	33.3	0.26	0.02	0.24	7.5	47.5	40.0	6.3
44A	WX-2-10A	8.7	Moderate	0.20	16.7	0.20	0.03	0.17	5.3	32.1	26.8	6.0
44B	WX-2-10B	8.8	Moderate	0.26	21.7	0.22	0.02	0.20	6.3	33.1	26.9	5.3
44C	WX-2-10C	8.5	Strong	0.32	26.7	0.23	0.02	0.21	6.6	41.0	34.4	6.2
QUALITY ASSURANCE / QUALITY CONTROL												
Replicate Analysis:												
4A	SP-1-3A	8.7	Strong				0.02			23.7		
4A R	SP-1-3A (Rep)	8.7	Strong				0.02			23.4		
7A	SP-1-6A					0.30						
7A R	SP-1-6A (Rep)					0.30						
7B	SP-1-6B	8.7	Moderate				0.02			27.0		
7B R	SP-1-6B (Rep)	8.6	Moderate				0.02			26.5		
8B	SP-1-7B			0.02								
8B R	SP-1-7B (Rep)			0.02								
10C	SP-1-9C	8.4	Strong				0.01			58.3		
10C R	SP-1-9C (Rep)	8.4	Strong				0.01			57.7		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
13B	SP-2-1-DupB			0.09								
13B R	SP-2-1-DupB (Rep)			0.09								
14A	SP-2-2A	9.0	Slight				<0.01					
14A R	SP-2-2A (Rep)	9.0	Slight				<0.01					
14B	SP-2-2B					0.02						
14B R	SP-2-2B (Rep)					0.02						
17B	SP-2-5B	8.8	Slight				0.01					
17B R	SP-2-5B (Rep)	8.9	Slight				<0.01					
18B	SP-2-6B			0.05								
18B R	SP-2-6B (Rep)			0.04								
20C	SP-2-8C	8.5	Moderate				0.02			11.1		
20C R	SP-2-8C (Rep)	8.5	Moderate				0.02			11.6		
23B	WX-1-1B			0.03								
23B R	WX-1-1B (Rep)			0.04								
24A	WX-1-1-DupA	8.3	None				<0.01			17.7		
24A R	WX-1-1-DupA (Rep)	8.4	None				<0.01			18.3		
27B	WX-1-4B	8.3	None				<0.01			17.7		
27B R	WX-1-4B (Rep)	8.4	None				<0.01			17.6		
27C	WX-1-4C					0.09						
27C R	WX-1-4C (Rep)					0.11						
28B	WX-1-5B			0.04								
28B R	WX-1-5B (Rep)			0.04								
30C	WX-1-7C	8.0	Slight				<0.01			22.5		
30C R	WX-1-7C (Rep)	8.0	Slight				<0.01			23.2		
33B	WX-1-10B			0.03								
33B R	WX-1-10B (Rep)			0.03								
34A	WX-2-1A	8.7	Slight				<0.01			33.1		
34A R	WX-2-1A (Rep)	8.7	Slight				<0.01			32.7		
37B	WX-2-3B	8.5	Moderate				<0.01			39.4		
37B R	WX-2-3B (Rep)	8.6	Moderate				<0.01			38.6		
38B	WX-2-4B			0.30								
38B R	WX-2-4B (Rep)			0.31								
40C	WX-2-6C	8.7	Strong				0.04			46.3		
40C R	WX-2-6C	8.7	Strong				0.04			47.0		
43B	WX-2-9B			0.24								
43B R	WX-2-9B (Rep)			0.26								
44A	WX-2-10A	8.7	Moderate				0.03			32.1		
44A R	WX-2-10A (Rep)	8.7	Moderate				0.03			32.4		
Certified Reference Material (CRM) Analysis:												
Certified Reference Material		KZK-1		KZK-1		1) OREAS 24b 2) GS310-8 3) CDN-CM-38	RTS-3a			1) KZK-1 (Slight) 2) KZK-1 (Moderate)		
CRM True Value		**8.80**		**0.92**		**1) 0.19 2) 12.0 3) 5.30**	**1.10**			**1) 58.9 2) 61.6**		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
	Reference Material Results	8.82		0.90, 0.89, 0.85, 0.93, 0.87, 0.86		1) 0.18 2) 11.3 3) 5.47	1.18, 1.14			1) 59.1, 58.5 2) 60.1		
	Tolerance (+/-) or Acceptance Range	***0.09 (+/-)***		***80% - 120%***		***90% - 110%***	***90% - 110%***			***90% - 110%***		
	Method Blank Analysis:											
	Method Blank Results			<0.02, <0.02, <0.02, <0.02, <0.02, <0.02		<0.01, <0.01, <0.01	<0.01, <0.01					
	GLOBAL SOP No. / Method:	*ARD-004*	*ARD-005*	*HCl leach/ CO2-Coulometer*	*Calc.*	*LECO*	*ARD-013 (HCl Leach)*	*Calc.*	*Calc.*	*ARD-005*	*Calc.*	*Calc.*

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents*1	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur*2	AP*3	Mod. ABA NP	NNP*4	NPR*5
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**	***kg CaCO3/tonne***			
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		

NOTES:
Acceptance criteria at Global ARD Testing for all CRMs is ±10 % of certified value.
Job No: YVR2210450

Date of Analysis (24 h): May 3-5, 2022
pH of DI water (pH Units): 5.69
EC of DI water (µS/cm): 1.21

METHODS:
Total sulphur by Leco.
Total Inorganic Carbon (TIC): HCl leach, evolved CO_2 analysed by CO_2 Coulometer.

ABBREVIATIONS:
R = Rep = Replicate (is a sub-sample scooped from a single pulp sample bag produced per client sample)
D = Dup = Duplicate (is 2nd sub-pulp sample bag produced by processing a 2nd split of the head sample received. A duplicate pulp sample is prepared only at client request)
EC = Electric Conductivity
ORP = Oxidation Reduction Potential
NP = Neutralization Potential
Calc. = Calculation
IND = Indeterminate
NR = Not Requested

CALCULATIONS:
- *1 CaCO3 Equivalents: based on TIC
- *2 Sulphide-Sulphur: Total-sulphur - sulphate-sulphur
- *3 AP (Acid Potential): Sulphide-Sulphur x 31.25
- *4 NNP (Net Neutralization Potential): NP - AP
- *5 NPR (Neutralization Potential Ratio): NP/AP

REFERENCES:
Sample Preparation: ASTM E877-08; MEND Report 1.20.1, Version 0 (2009)
ABA: Dried below 40°C (as requested by client), jaw-crushed if necessary, split by riffling and pulverized to 85% passing 200 mesh (75 µm).
Modified ABA (Sobek) NP: MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b (pages 6.2-11 to 17), March 1991.
Paste pH / Fizz Rating: Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M.; US EPA-600/2-78-054 (1978).
Sulphate Sulphur: Based on MEND method. The S extracted is determined by analysing the extract for SO4 using UV-Vis Spectrophotometer (STD Method 4500-SO42- E).

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
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GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
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PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
1A	SP-1-1A	8.5	Slight	0.11	9.2	0.38	0.01	0.37	11.6	24.5	12.9	2.1
1B	SP-1-1B	8.6	Moderate	0.17	14.2	0.34	<=0.01	0.34	10.6	25.0	14.4	2.4
1C	SP-1-1C	8.2	Strong	0.47	39.5	0.98	0.01	0.97	30.3	56.2	25.9	1.9
2A	SP-1-1-DupA	8.6	Slight	0.13	10.8	0.50	<=0.01	0.50	15.6	21.5	5.9	1.4
2B	SP-1-1-DupB	8.5	Slight	0.16	13.3	0.53	<=0.01	0.53	16.6	28.8	12.2	1.7
2C	SP-1-1-DupC	8.3	Strong	0.45	37.5	0.90	0.01	0.89	27.8	50.5	22.7	1.8
3A	SP-1-2A	8.6	None	<=0.02	<=1.7	0.88	<=0.01	0.88	27.5	11.9	-15.6	0.4
3B	SP-1-2B	8.5	Slight	0.13	10.8	1.15	0.05	1.10	34.4	15.4	-19.0	0.4
3C	SP-1-2C	8.0	Moderate	0.17	14.2	1.90	0.03	1.87	58.4	26.8	-31.6	0.5
4A	SP-1-3A	8.7	Strong	0.18	15.0	0.30	0.02	0.28	8.8	23.7	15.0	2.7
4B	SP-1-3B	8.7	Strong	0.31	25.8	0.49	0.01	0.48	15.0	31.9	16.9	2.1
4C	SP-1-3C	8.2	Strong	0.73	60.8	0.77	<=0.01	0.77	24.1	64.9	40.8	2.7
5A	SP-1-4A	8.6	Slight	0.16	13.3	0.49	<=0.01	0.49	15.3	21.2	5.9	1.4
5B	SP-1-4B	8.6	Moderate	0.18	15.0	0.56	<=0.01	0.56	17.5	23.6	6.1	1.3
5C	SP-1-4C	8.2	Strong	0.43	35.8	1.03	0.02	1.01	31.6	50.5	18.9	1.6
6A	SP-1-5A	8.6	Slight	0.03	2.5	1.24	<=0.01	1.24	38.8	15.3	-23.5	0.4
6B	SP-1-5B	8.4	Slight	0.05	4.2	1.33	0.03	1.30	40.6	18.9	-21.7	0.5
6C	SP-1-5C	8.2	Strong	0.34	28.3	2.00	0.02	1.98	61.9	39.6	-22.3	0.6
7A	SP-1-6A	8.7	Slight	0.08	6.7	0.30	0.03	0.27	8.4	19.6	11.2	2.3
7B	SP-1-6B	8.7	Moderate	0.15	12.5	0.46	0.02	0.44	13.8	27.0	13.3	2.0
7C	SP-1-6C	8.0	Strong	0.46	38.3	0.85	0.01	0.84	26.3	57.4	31.2	2.2
8A	SP-1-7A	8.4	None	<=0.02	<=1.7	0.68	<=0.01	0.68	21.3	15.7	-5.6	0.7
8B	SP-1-7B	8.4	Slight	0.02	1.7	0.61	<=0.01	0.61	19.1	17.2	-1.9	0.9
8C	SP-1-7C	8.0	Moderate	0.14	11.7	1.26	0.03	1.23	38.4	26.6	-11.8	0.7
9A	SP-1-8A	8.3	None	0.04	3.3	1.40	<=0.01	1.40	43.8	14.1	-29.7	0.3
9B	SP-1-8B	8.3	None	0.03	2.5	1.40	<=0.01	1.40	43.8	15.3	-28.5	0.3
9C	SP-1-8C	7.9	Slight	0.12	10.0	2.44	0.06	2.38	74.4	24.6	-49.8	0.3
10A	SP-1-9A	8.8	Slight	0.03	2.5	0.08	<=0.01	0.08	2.5	18.7	16.2	7.5
10B	SP-1-9B	8.6	Moderate	0.15	12.5	0.26	<=0.01	0.26	8.1	24.2	16.1	3.0
10C	SP-1-9C	8.4	Strong	0.54	45.0	0.43	0.01	0.42	13.1	58.3	45.2	4.4
11A	SP-1-10A	8.5	Slight	0.14	11.7	0.85	<=0.01	0.85	26.6	23.4	-3.2	0.9
11B	SP-1-10B	8.6	Slight	0.19	15.8	0.43	0.02	0.41	12.8	26.9	14.1	2.1
11C	SP-1-10C	8.3	Moderate	0.48	40.0	0.77	<=0.01	0.77	24.1	53.8	29.7	2.2
12A	SP-2-1A	9.0	Slight	0.06	5.0	0.02	<=0.01	0.02	0.6	12.6	12.0	20.2
12B	SP-2-1B	8.8	Slight	0.07	5.8	0.02	<=0.01	0.02	0.6	13.1	12.5	21.0
12C	SP-2-1C	9.0	Moderate	0.27	22.5	0.04	<=0.01	0.04	1.3	32.3	31.1	25.8
13A	SP-2-1-DupA	8.9	Slight	0.06	5.0	0.01	<=0.01	0.01	0.3	13.2	12.9	42.2
13B	SP-2-1-DupB	9.0	Slight	0.09	7.5	0.02	<=0.01	0.02	0.6	13.4	12.8	21.4
13C	SP-2-1-DupC	8.5	Moderate	0.26	21.7	0.03	0.02	0.01	0.3	30.7	30.4	98.2
14A	SP-2-2A	9.0	Slight	0.03	2.5	0.02	<=0.01	0.02	0.6	13.2	12.6	21.1
14B	SP-2-2B	8.8	Slight	0.09	7.5	0.02	0.02	<=0.01	<=0.3	18.4	18.4	N/A
14C	SP-2-2C	8.5	Moderate	0.20	16.7	0.03	<=0.01	0.03	0.9	27.3	26.4	29.1
15A	SP-2-3A	9.0	None	0.04	3.3	<=0.01	<=0.01	<=0.01	<=0.3	13.6	13.6	N/A
15B	SP-2-3B	8.9	Slight	0.06	5.0	0.01	<=0.01	0.01	0.3	16.3	16.0	52.2
15C	SP-2-3C	8.5	Moderate	0.13	10.8	0.03	0.02	0.01	0.3	24.3	24.0	77.8
16A	SP-2-4A	9.1	None	0.04	3.3	<=0.01	<=0.01	<=0.01	<=0.3	8.6	8.6	N/A
16B	SP-2-4B	8.9	Slight	0.10	8.3	0.01	<=0.01	0.01	0.3	13.2	12.9	42.2
16C	SP-2-4C	8.3	Moderate	0.28	23.3	0.03	<=0.01	0.03	0.9	34.6	33.7	36.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
17A	SP-2-5A	8.7	Slight	0.03	2.5	<=0.01	<=0.01	<=0.01	<=0.3	10.5	10.5	N/A
17B	SP-2-5B	8.8	Slight	0.06	5.0	0.01	0.01	<=0.01	<=0.3	15.4	15.4	N/A
17C	SP-2-5C	8.5	Moderate	0.17	14.2	0.03	<=0.01	0.03	0.9	24.3	23.4	25.9
18A	SP-2-6A	9.0	Slight	0.02	1.7	0.03	<=0.01	0.03	0.9	8.9	8.0	9.5
18B	SP-2-6B	9.0	Slight	0.05	4.2	0.02	<=0.01	0.02	0.6	15.2	14.6	24.3
18C	SP-2-6C	8.5	Slight	0.18	15.0	0.03	<=0.01	0.03	0.9	23.9	23.0	25.5
19A	SP-2-7A	9.1	Slight	0.04	3.3	0.03	<=0.01	0.03	0.9	10.5	9.6	11.2
19B	SP-2-7B	8.8	Moderate	0.09	7.5	0.03	<=0.01	0.03	0.9	16.2	15.3	17.3
19C	SP-2-7C	8.6	Strong	0.24	20.0	0.05	<=0.01	0.05	1.6	29.3	27.7	18.8
20A	SP-2-8A	9.0	Slight	0.08	6.7	0.04	<=0.01	0.04	1.3	13.6	12.4	10.9
20B	SP-2-8B	9.0	Slight	0.14	11.7	0.04	<=0.01	0.04	1.3	20.2	19.0	16.2
20C	SP-2-8C	8.5	Moderate	0.05	4.2	0.06	0.02	0.04	1.3	11.1	9.9	8.9
21A	SP-2-9A	8.9	Slight	0.03	2.5	0.01	<=0.01	0.01	0.3	14.0	13.7	44.8
21B	SP-2-9B	8.8	Slight	0.05	4.2	0.03	<=0.01	0.03	0.9	14.3	13.4	15.3
21C	SP-2-9C	8.5	Moderate	0.20	16.7	0.05	<=0.01	0.05	1.6	29.5	27.9	18.9
22A	SP-2-10A	8.9	Slight	0.05	4.2	0.02	<=0.01	0.02	0.6	11.4	10.8	18.2
22B	SP-2-10B	9.0	Slight	0.06	5.0	0.03	<=0.01	0.03	0.9	13.6	12.7	14.5
22C	SP-2-10C	8.5	Moderate	0.26	21.7	0.04	<=0.01	0.04	1.3	25.4	24.2	20.3
23A	WX-1-1A	8.3	Slight	0.06	5.0	0.16	<=0.01	0.16	5.0	21.6	16.6	4.3
23B	WX-1-1B	8.2	Slight	0.03	2.5	0.13	<=0.01	0.13	4.1	21.6	17.5	5.3
23C	WX-1-1C	8.3	Moderate	0.16	13.3	0.10	<=0.01	0.10	3.1	38.1	35.0	12.2
24A	WX-1-1-DupA	8.3	None	0.04	3.3	0.19	<=0.01	0.19	5.9	17.7	11.8	3.0
24B	WX-1-1-DupB	8.4	None	0.02	1.7	0.11	<=0.01	0.11	3.4	17.6	14.2	5.1
24C	WX-1-1-DupC	8.1	Slight	0.10	8.3	0.06	<=0.01	0.06	1.9	24.9	23.0	13.3
25A	WX-1-2A	8.3	None	0.07	5.8	0.11	<=0.01	0.11	3.4	21.7	18.3	6.3
25B	WX-1-2B	8.3	None	0.15	12.5	0.14	<=0.01	0.14	4.4	27.5	23.1	6.3
25C	WX-1-2C	8.2	Slight	0.20	16.7	0.15	<=0.01	0.15	4.7	31.2	26.5	6.7
26A	WX-1-3A	8.3	Slight	0.13	10.8	0.13	<=0.01	0.13	4.1	23.7	19.6	5.8
26B	WX-1-3B	8.4	Slight	0.16	13.3	0.11	<=0.01	0.11	3.4	27.0	23.6	7.9
26C	WX-1-3C	8.1	Moderate	0.25	20.8	0.08	<=0.01	0.08	2.5	34.8	32.3	13.9
27A	WX-1-4A	8.4	None	0.03	2.5	0.17	<=0.01	0.17	5.3	17.7	12.4	3.3
27B	WX-1-4B	8.3	None	0.03	2.5	0.14	<=0.01	0.14	4.4	17.7	13.3	4.0
27C	WX-1-4C	8.1	Slight	0.06	5.0	0.09	<=0.01	0.09	2.8	22.7	19.9	8.1
28A	WX-1-5A	8.4	None	0.05	4.2	0.19	<=0.01	0.19	5.9	18.8	12.9	3.2
28B	WX-1-5B	8.4	None	0.04	3.3	0.14	<=0.01	0.14	4.4	16.2	11.8	3.7
28C	WX-1-5C	7.8	Slight	0.13	10.8	0.10	<=0.01	0.10	3.1	22.2	19.1	7.1
29A	WX-1-6A	8.3	None	0.07	5.8	0.17	<=0.01	0.17	5.3	21.6	16.3	4.1
29B	WX-1-6B	8.2	None	0.07	5.8	0.16	<=0.01	0.16	5.0	19.9	14.9	4.0
29C	WX-1-6C	8.1	Slight	0.17	14.2	0.16	<=0.01	0.16	5.0	27.4	22.4	5.5
30A	WX-1-7A	8.1	None	0.07	5.8	0.17	<=0.01	0.17	5.3	23.0	17.7	4.3
30B	WX-1-7B	8.3	Slight	0.06	5.0	0.12	<=0.01	0.12	3.8	20.5	16.8	5.5
30C	WX-1-7C	8.0	Slight	0.09	7.5	0.12	<=0.01	0.12	3.8	22.5	18.8	6.0
31A	WX-1-8A	8.4	None	0.04	3.3	0.14	<=0.01	0.14	4.4	21.8	17.4	5.0
31B	WX-1-8B	8.2	Slight	0.09	7.5	0.13	<=0.01	0.13	4.1	24.0	19.9	5.9
31C	WX-1-8C	8.1	Slight	0.20	16.7	0.13	<=0.01	0.13	4.1	30.7	26.6	7.6
32A	WX-1-9A	8.3	None	<=0.02	<=1.7	0.16	0.03	0.13	4.1	18.2	14.1	4.5
32B	WX-1-9B	8.5	None	<=0.02	<=1.7	0.16	<=0.01	0.16	5.0	18.2	13.2	3.6
32C	WX-1-9C	8.1	Slight	0.05	4.2	0.14	<=0.01	0.14	4.4	17.2	12.8	3.9

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

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REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
33A	WX-1-10A	8.4	None	<=0.02	<=1.7	0.15	<=0.01	0.15	4.7	12.9	8.2	2.8
33B	WX-1-10B	8.4	None	0.03	2.5	0.14	<=0.01	0.14	4.4	16.8	12.4	3.8
33C	WX-1-10C	8.2	Slight	0.16	13.3	0.14	<=0.01	0.14	4.4	27.8	23.4	6.4
34A	WX-2-1A	8.7	Slight	0.25	20.8	0.21	<=0.01	0.21	6.6	33.1	26.5	5.0
34B	WX-2-1B	8.8	Slight	0.26	21.7	0.21	<=0.01	0.21	6.6	33.6	27.0	5.1
34C	WX-2-1C	8.3	Strong	0.47	39.2	0.25	<=0.01	0.25	7.8	50.0	42.2	6.4
35A	WX-2-1-DupA	8.8	Moderate	0.23	19.2	0.21	<=0.01	0.21	6.6	31.9	25.3	4.9
35B	WX-2-1-DupB	8.7	Moderate	0.25	20.8	0.20	<=0.01	0.20	6.3	33.6	27.4	5.4
35C	WX-2-1-DupC	8.5	Strong	0.42	35.0	0.24	<==0.01	0.24	7.5	48.2	40.7	6.4
36A	WX-2-2A	8.7	Moderate	0.28	23.3	0.15	<=0.01	0.15	4.7	35.6	30.9	7.6
36B	WX-2-2B	8.7	Moderate	0.27	22.5	0.13	<=0.01	0.13	4.1	34.6	30.5	8.5
36C	WX-2-2C	8.4	Strong	0.42	35.0	0.15	<=0.01	0.15	4.7	46.3	41.6	9.9
37A	WX-2-3A	8.8	Moderate	0.27	22.5	0.14	<=0.01	0.14	4.4	34.5	30.1	7.9
37B	WX-2-3B	8.5	Moderate	0.33	27.5	0.12	<=0.01	0.12	3.8	39.4	35.7	10.5
37C	WX-2-3C	8.5	Strong	0.38	31.7	0.15	<=0.01	0.15	4.7	44.4	39.7	9.5
38A	WX-2-4A	8.7	Moderate	0.31	25.8	0.19	<=0.01	0.19	5.9	34.6	28.7	5.8
38B	WX-2-4B	8.7	Moderate	0.30	25.0	0.21	<=0.01	0.21	6.6	33.5	26.9	5.1
38C	WX-2-4C	8.5	Strong	0.50	41.7	0.23	<=0.01	0.23	7.2	48.2	41.0	6.7
39A	WX-2-5A	8.8	Moderate	0.30	25.0	0.20	<=0.01	0.20	6.3	31.8	25.6	5.1
39B	WX-2-5B	8.6	Moderate	0.33	27.5	0.20	<=0.01	0.20	6.3	36.0	29.8	5.8
39C	WX-2-5C	8.4	Strong	0.48	40.0	0.21	<=0.01	0.21	6.6	43.9	37.3	6.7
40A	WX-2-6A	8.8	Moderate	0.39	32.5	0.20	<=0.01	0.20	6.3	36.2	30.0	5.8
40B	WX-2-6B	8.6	Moderate	0.37	30.8	0.19	0.01	0.18	5.6	37.2	31.6	6.6
40C	WX-2-6C	8.7	Strong	0.54	45.0	0.20	0.04	0.16	5.0	46.3	41.3	9.3
41A	WX-2-7A	8.7	Moderate	0.25	20.8	0.21	<=0.01	0.21	6.6	35.0	28.4	5.3
41B	WX-2-7B	8.7	Moderate	0.26	21.7	0.20	0.04	0.16	5.0	32.8	27.8	6.6
41C	WX-2-7C	8.5	Strong	0.37	30.8	0.25	0.01	0.24	7.5	45.3	37.8	6.0
42A	WX-2-8A	8.8	Slight	0.20	16.7	0.16	0.01	0.15	4.7	30.6	25.9	6.5
42B	WX-2-8B	8.6	Moderate	0.28	23.3	0.15	0.07	0.08	2.5	37.1	34.6	14.8
42C	WX-2-8C	8.3	Moderate	0.33	27.5	0.14	0.02	0.12	3.8	40.2	36.5	10.7
43A	WX-2-9A	8.7	Moderate	0.28	23.3	0.21	0.01	0.20	6.3	33.8	27.6	5.4
43B	WX-2-9B	8.7	Moderate	0.24	20.0	0.23	0.02	0.21	6.6	33.0	26.4	5.0
43C	WX-2-9C	8.6	Strong	0.40	33.3	0.26	0.02	0.24	7.5	47.5	40.0	6.3
44A	WX-2-10A	8.7	Moderate	0.20	16.7	0.20	0.03	0.17	5.3	32.1	26.8	6.0
44B	WX-2-10B	8.8	Moderate	0.26	21.7	0.22	0.02	0.20	6.3	33.1	26.9	5.3
44C	WX-2-10C	8.5	Strong	0.32	26.7	0.23	0.02	0.21	6.6	41.0	34.4	6.2
QUALITY ASSURANCE / QUALITY CONTROL												
Replicate Analysis:												
4A	SP-1-3A	8.7	Strong				0.02			23.7		
4A R	SP-1-3A (Rep)	8.7	Strong				0.02			23.4		
7A	SP-1-6A					0.30						
7A R	SP-1-6A (Rep)					0.30						
7B	SP-1-6B	8.7	Moderate				0.02			27.0		
7B R	SP-1-6B (Rep)	8.6	Moderate				0.02			26.5		
8B	SP-1-7B			0.02								
8B R	SP-1-7B (Rep)			0.02								
10C	SP-1-9C	8.4	Strong				0.01			58.3		
10C R	SP-1-9C (Rep)	8.4	Strong				0.01			57.7		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
13B	SP-2-1-DupB			0.09								
13B R	SP-2-1-DupB (Rep)			0.09								
14A	SP-2-2A	9.0	Slight				<=0.01					
14A R	SP-2-2A (Rep)	9.0	Slight				<=0.01					
14B	SP-2-2B					0.02						
14B R	SP-2-2B (Rep)					0.02						
17B	SP-2-5B	8.8	Slight				0.01					
17B R	SP-2-5B (Rep)	8.9	Slight				<=0.01					
18B	SP-2-6B			0.05								
18B R	SP-2-6B (Rep)			0.04								
20C	SP-2-8C	8.5	Moderate				0.02			11.1		
20C R	SP-2-8C (Rep)	8.5	Moderate				0.02			11.6		
23B	WX-1-1B			0.03								
23B R	WX-1-1B (Rep)			0.04								
24A	WX-1-1-DupA	8.3	None				<=0.01			17.7		
24A R	WX-1-1-DupA (Rep)	8.4	None				<=0.01			18.3		
27B	WX-1-4B	8.3	None				<=0.01			17.7		
27B R	WX-1-4B (Rep)	8.4	None				<=0.01			17.6		
27C	WX-1-4C					0.09						
27C R	WX-1-4C (Rep)					0.11						
28B	WX-1-5B			0.04								
28B R	WX-1-5B (Rep)			0.04								
30C	WX-1-7C	8.0	Slight				<=0.01			22.5		
30C R	WX-1-7C (Rep)	8.0	Slight				<=0.01			23.2		
33B	WX-1-10B			0.03								
33B R	WX-1-10B (Rep)			0.03								
34A	WX-2-1A	8.7	Slight				<=0.01			33.1		
34A R	WX-2-1A (Rep)	8.7	Slight				<=0.01			32.7		
37B	WX-2-3B	8.5	Moderate				<=0.01			39.4		
37B R	WX-2-3B (Rep)	8.6	Moderate				<=0.01			38.6		
38B	WX-2-4B			0.30								
38B R	WX-2-4B (Rep)			0.31								
40C	WX-2-6C	8.7	Strong				0.04			46.3		
40C R	WX-2-6C	8.7	Strong				0.04			47.0		
43B	WX-2-9B			0.24								
43B R	WX-2-9B (Rep)			0.26								
44A	WX-2-10A	8.7	Moderate				0.03			32.1		
44A R	WX-2-10A (Rep)	8.7	Moderate				0.03			32.4		
Certified Reference Material (CRM) Analysis:												
Certified Reference Material		KZK-1		KZK-1		1) OREAS 24b 2) GS310-8 3) CDN-CM-38	RTS-3a			1) KZK-1 (Slight) 2) KZK-1 (Moderate)		
CRM True Value		**8.80**		**0.92**		**1) 0.19 2) 12.0 3) 5.30**	**1.10**			**1) 58.9 2) 61.6**		

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global
ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**		***kg CaCO3/tonne***		
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		
	Reference Material Results	8.82		0.90, 0.89, 0.85, 0.93, 0.87, 0.86		1) 0.18 2) 11.3 3) 5.47	1.18, 1.14			1) 59.1, 58.5 2) 60.1		
	Tolerance (+/-) or Acceptance Range	***0.09 (+/-)***		***80% - 120%***		***90% - 110%***	***90% - 110%***			***90% - 110%***		
	Method Blank Analysis:											
	Method Blank Results			<0.02, <0.02, <0.02, <0.02, <0.02, <0.02		<0.01, <0.01, <0.01	<0.01, <0.01					
	GLOBAL SOP No. / Method:	*ARD-004*	*ARD-005*	*HCl leach/ CO2-Coulometer*	*Calc.*	*LECO*	*ARD-013 (HCl Leach)*	*Calc.*	*Calc.*	*ARD-005*	*Calc.*	*Calc.*

CERTIFICATE OF ANALYSIS ▪ ABA RESULTS

Global ARD Testing Services Inc.

GLOBAL PROJECT NO: 2221
CLIENT: SRK Consulting (Canada) Inc.
PROJECT NAME: Mount Polley NPR Criterion
PROJECT NO: 1CM017.011
REPORT VERSION: 1

S. No.	Sample ID	Paste pH	Fizz Rating	Total Inorganic C	$CaCO_3$ Equivalents[*1]	Total Sulphur	Sulphate Sulphur	Sulphide Sulphur[*2]	AP[*3]	Mod. ABA NP	NNP[*4]	NPR[*5]
	Units:	***pH Units***		**wt %**	**kg CaCO3/tonne**	**wt %**	**wt %**	**wt %**	***kg CaCO3/tonne***			
	Reported Detection Limit:	***0.01***		***0.02***	***1.7***	***0.01***	***0.01***	***0.01***	***0.3***	***0.5***		

NOTES:
Acceptance criteria at Global ARD Testing for all CRMs is ±10 % of certified value.
Job No: YVR2210450

Date of Analysis (24 h): May 3-5, 2022
pH of DI water (pH Units): 5.69
EC of DI water (µS/cm): 1.21

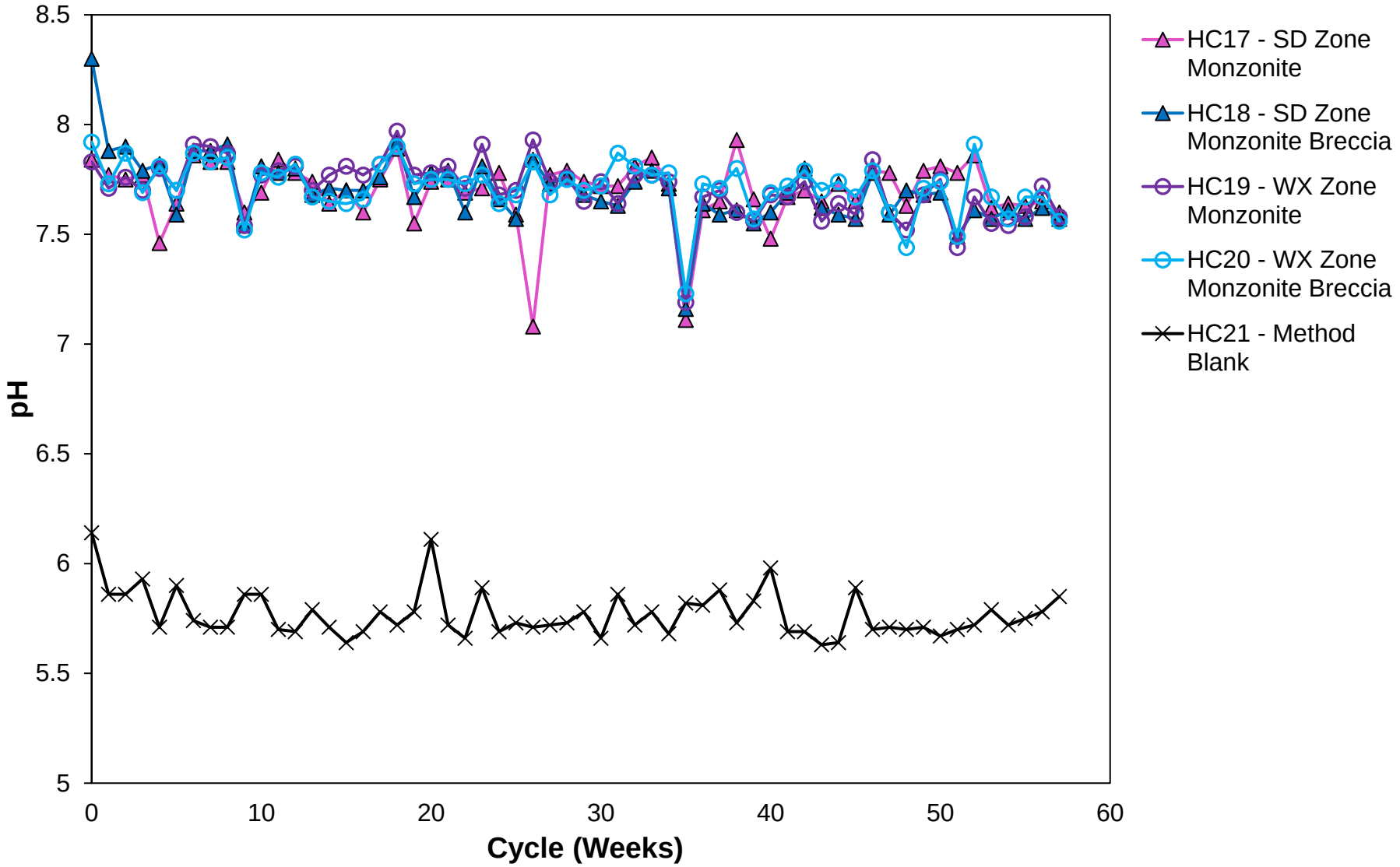
METHODS:
Total sulphur by Leco.
Total Inorganic Carbon (TIC): HCl leach, evolved CO_2 analysed by CO_2 Coulometer.

ABBREVIATIONS:
R = Rep = Replicate (is a sub-sample scooped from a single pulp sample bag produced per client sample)
D = Dup = Duplicate (is 2nd sub-pulp sample bag produced by processing a 2nd split of the head sample received. A duplicate pulp sample is prepared only at client request)
EC = Electric Conductivity
ORP = Oxidation Reduction Potential
NP = Neutralization Potential
Calc. = Calculation
IND = Indeterminate
NR = Not Requested

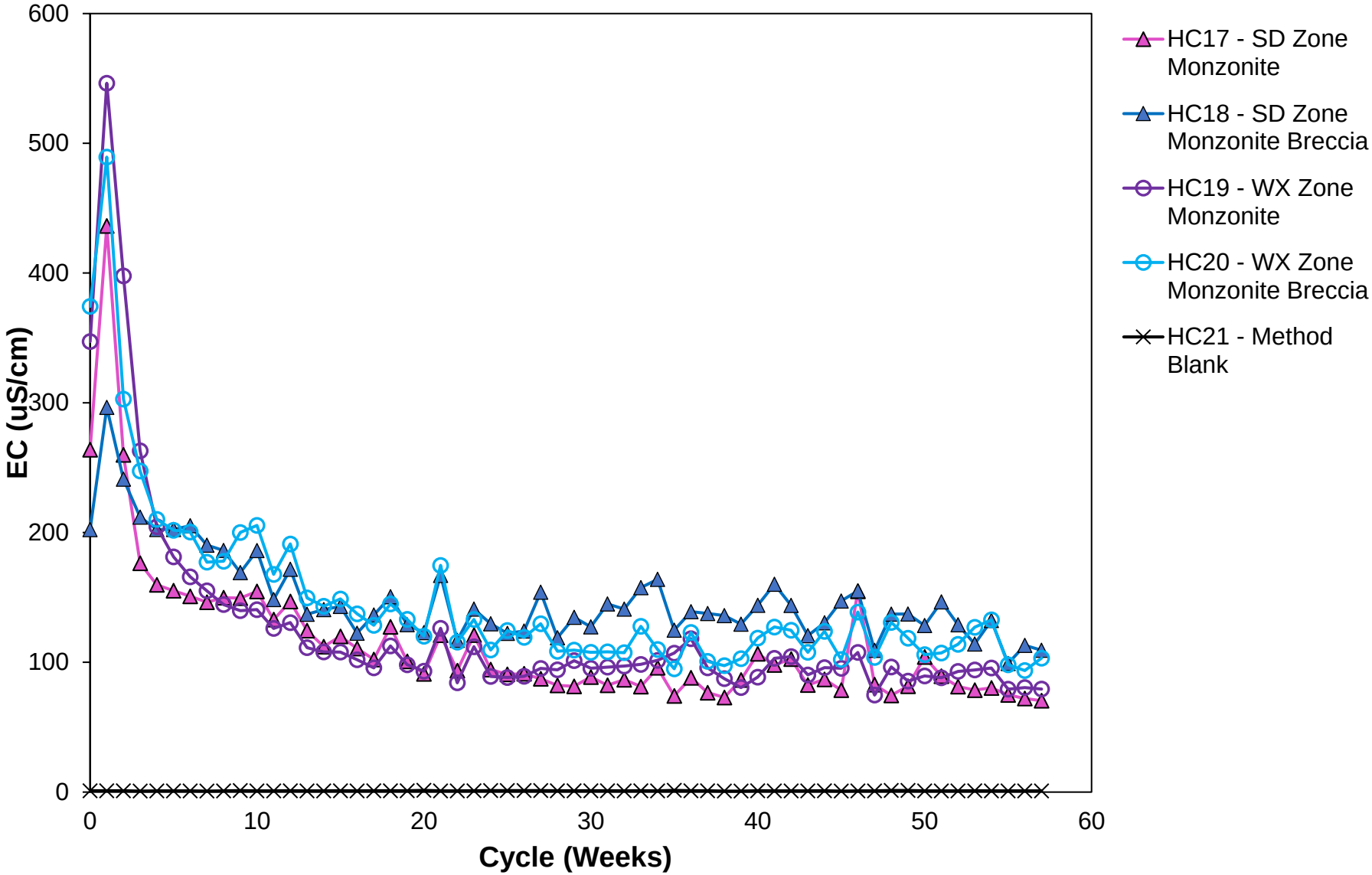
CALCULATIONS:
- *1 CaCO3 Equivalents: based on TIC
- *2 Sulphide-Sulphur: Total-sulphur - sulphate-sulphur
- *3 AP (Acid Potential): Sulphide-Sulphur x 31.25
- *4 NNP (Net Neutralization Potential): NP - AP
- *5 NPR (Neutralization Potential Ratio): NP/AP

REFERENCES:
Sample Preparation: ASTM E877-08; MEND Report 1.20.1, Version 0 (2009)
ABA: Dried below 40°C (as requested by client), jaw-crushed if necessary, split by riffling and pulverized to 85% passing 200 mesh (75 µm).
Modified ABA (Sobek) NP: MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b (pages 6.2-11 to 17), March 1991.
Paste pH / Fizz Rating: Sobek, A.A., Schuller, W.A., Freeman, J.R. and Smith, R.M.; US EPA-600/2-78-054 (1978).
Sulphate Sulphur: Based on MEND method. The S extracted is determined by analysing the extract for SO4 using UV-Vis Spectrophotometer (STD Method 4500-SO42- E).

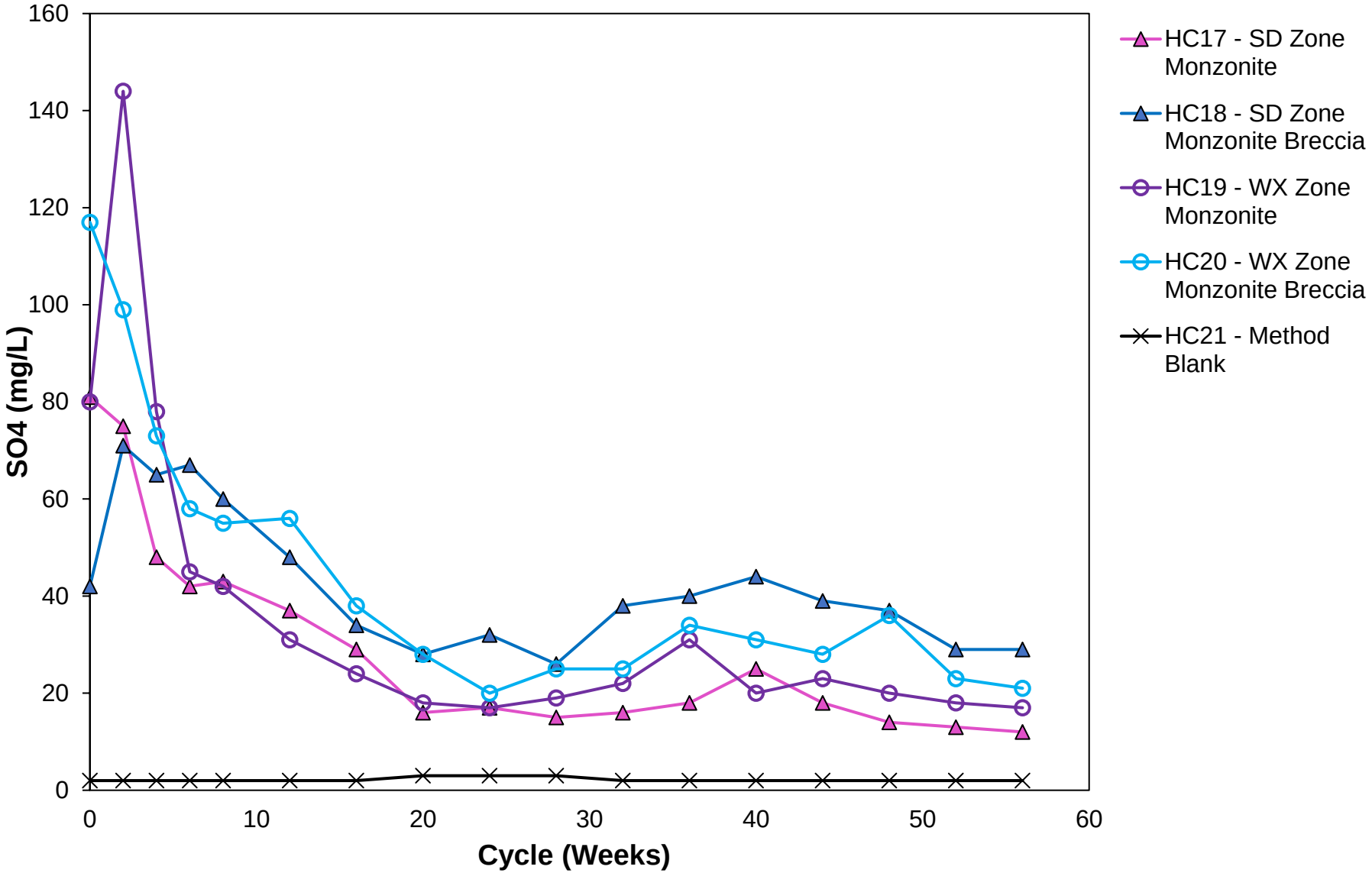
Appendix D. Humidity Cell Leachate Concentration Timeseries Charts



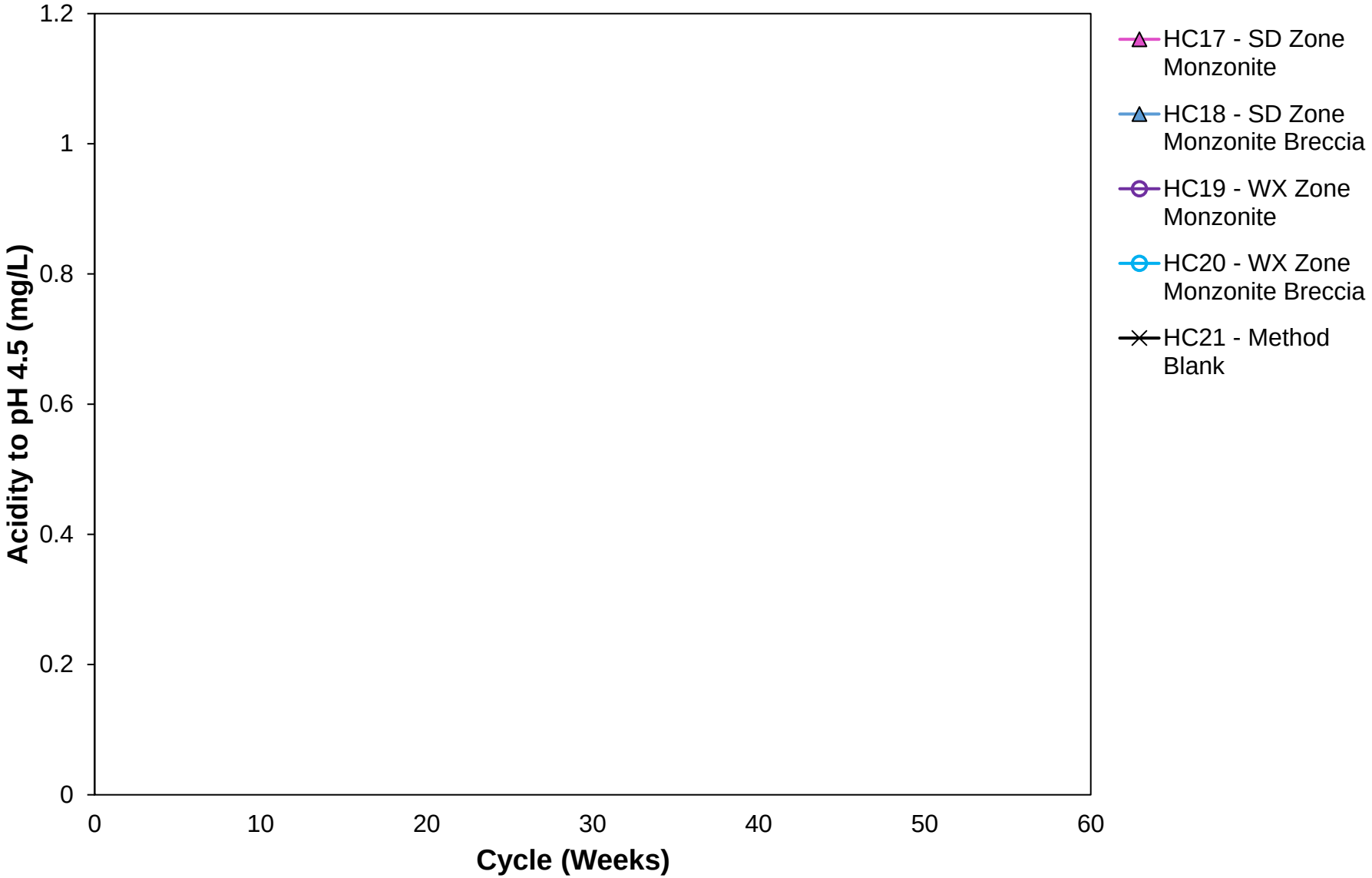
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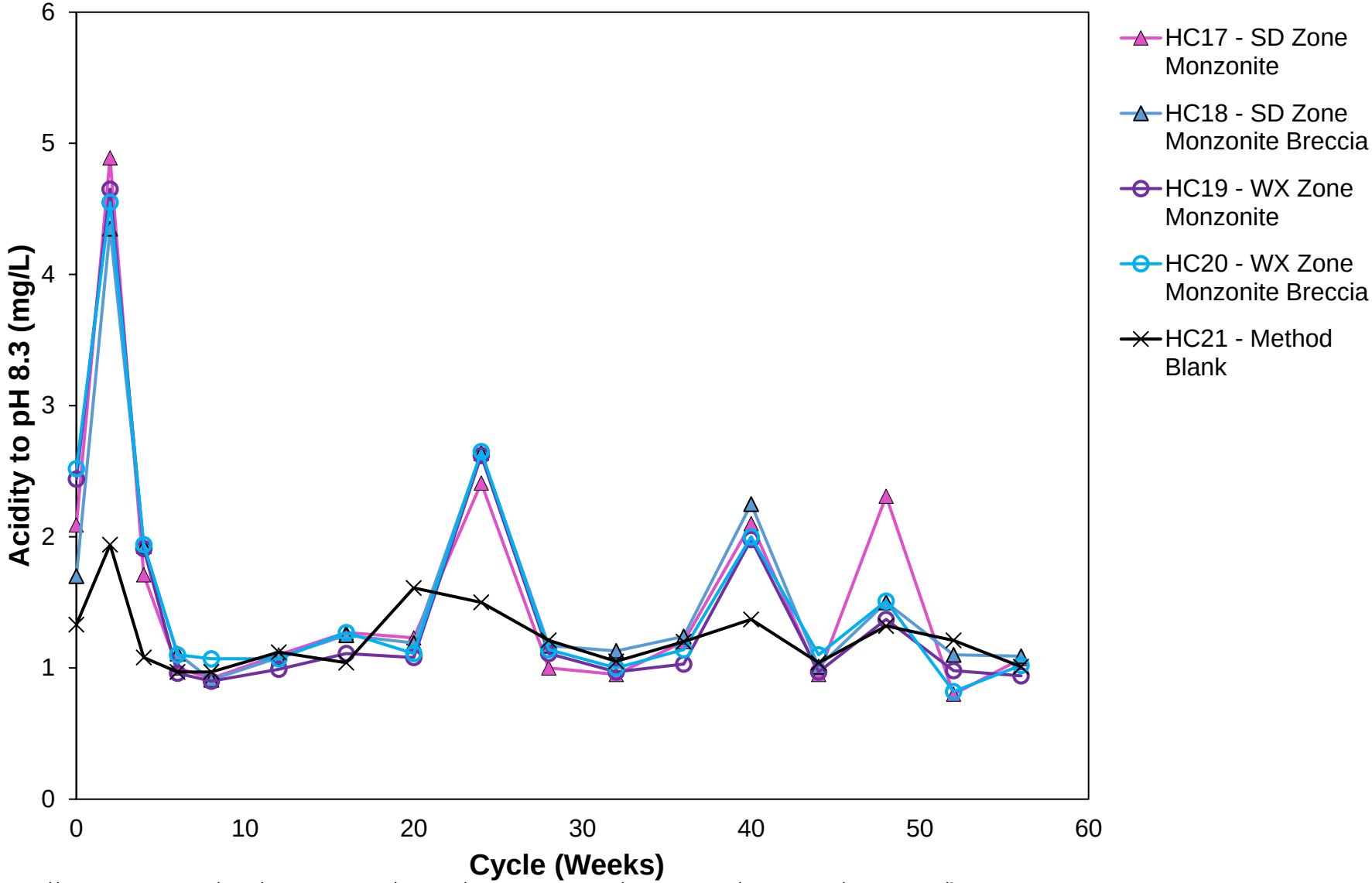
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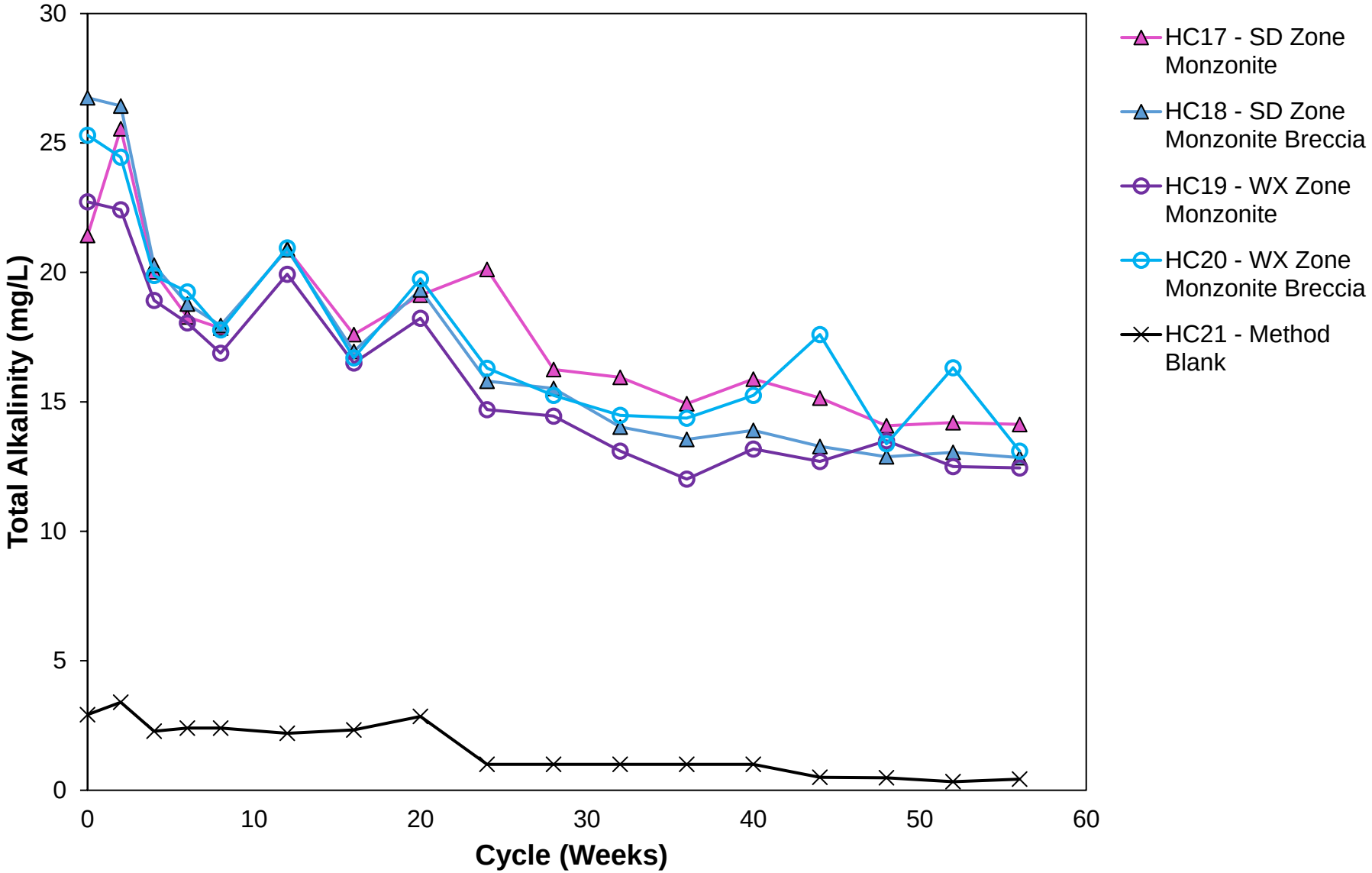
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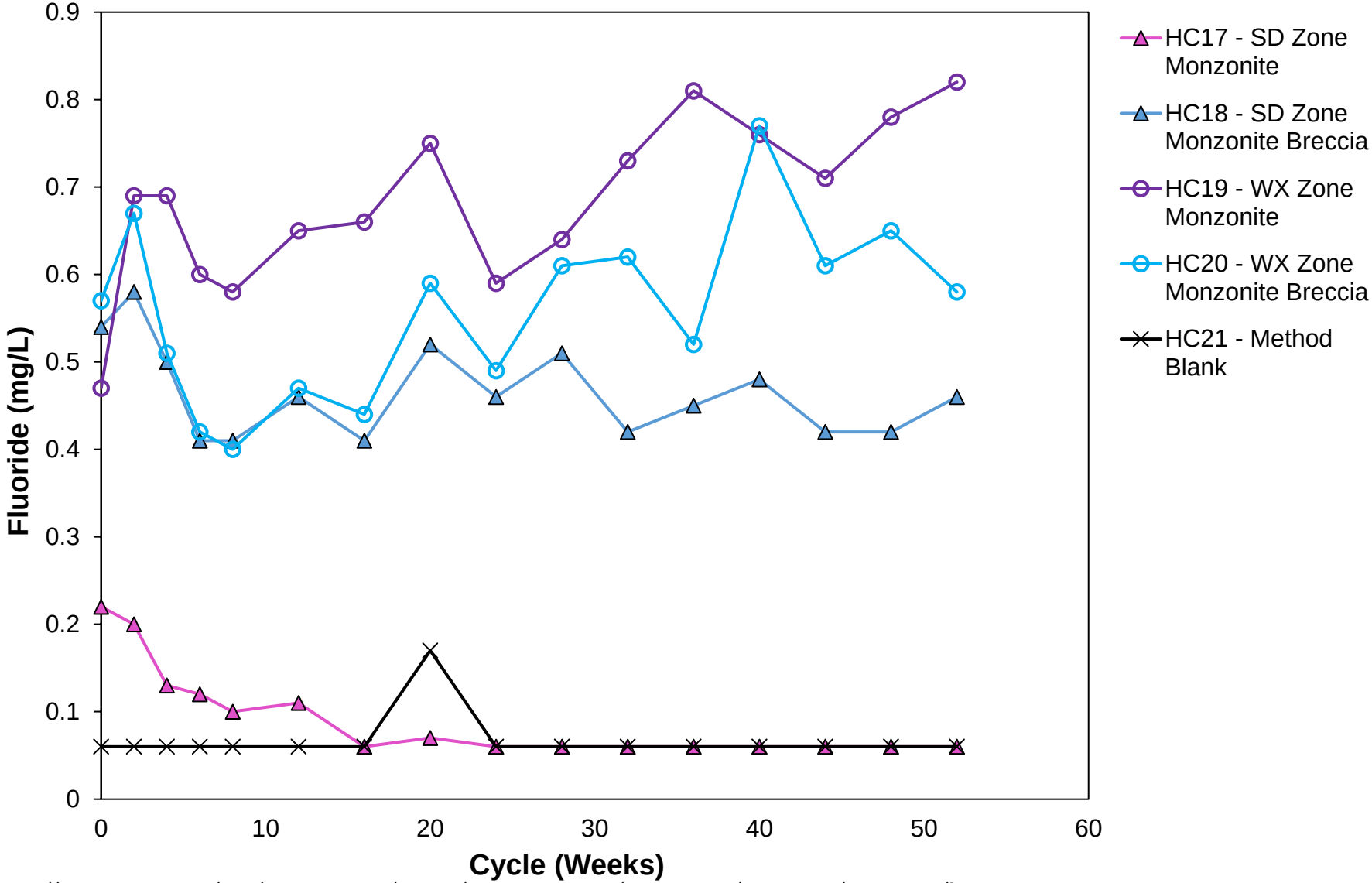
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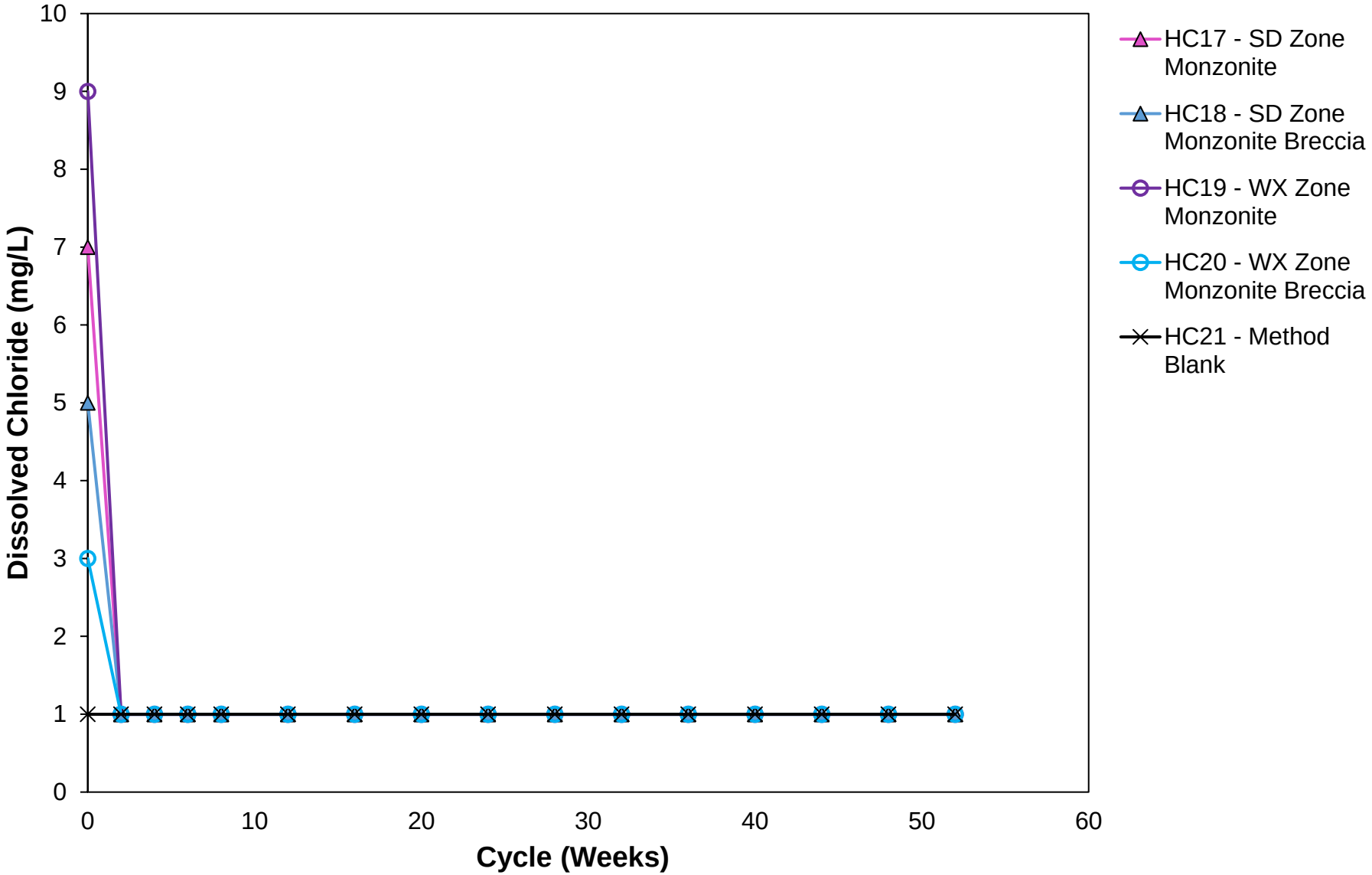
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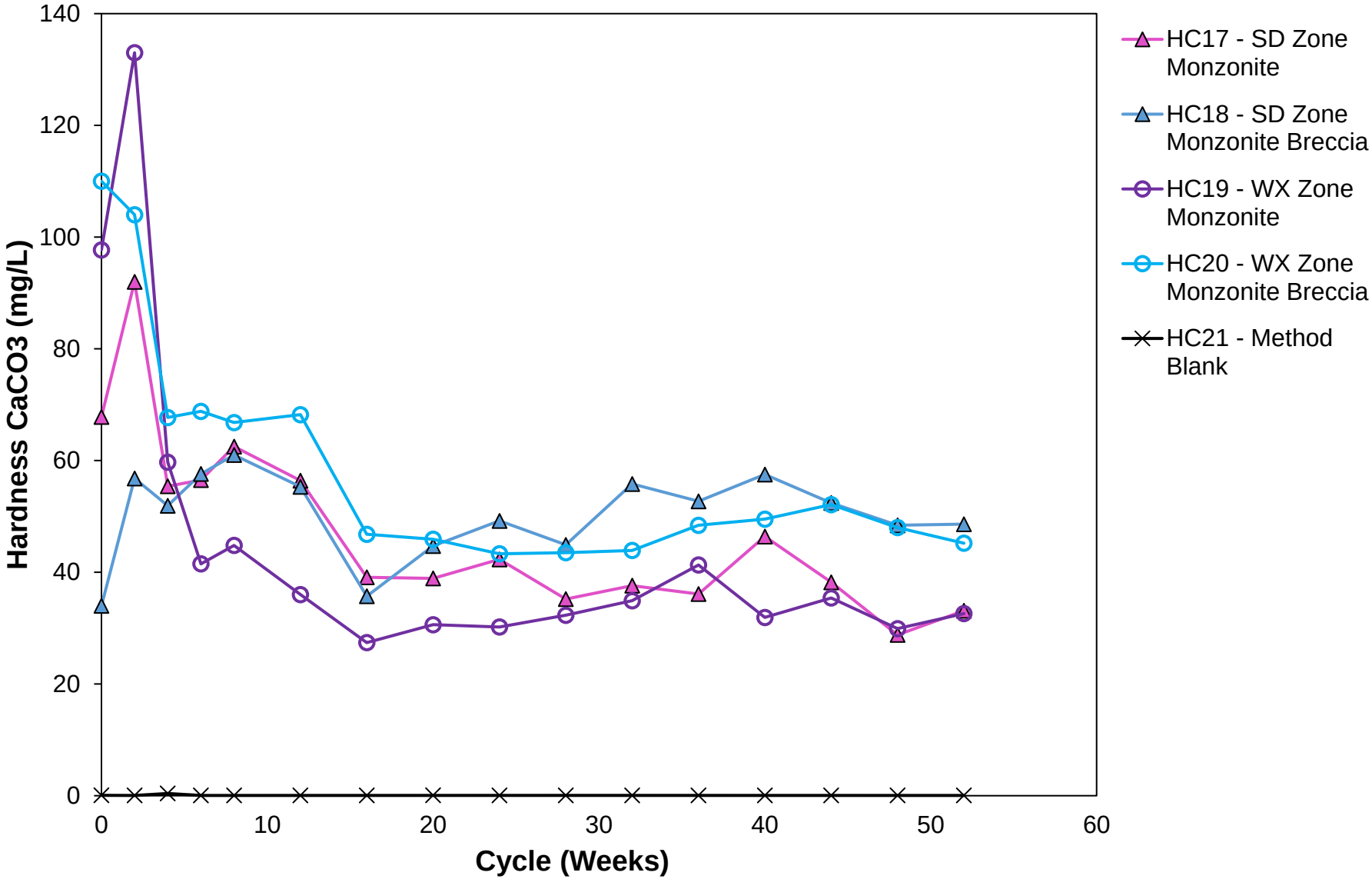
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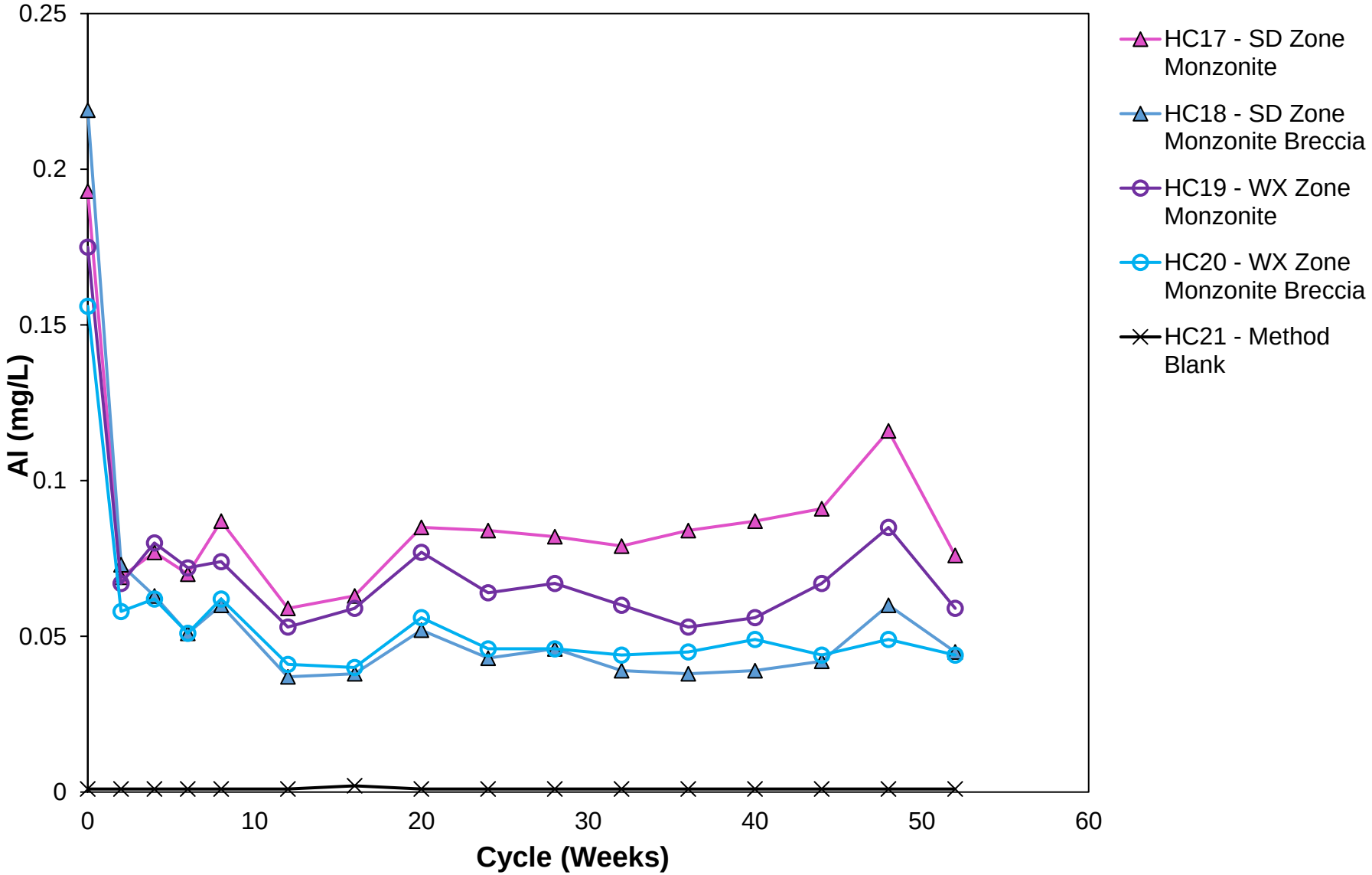
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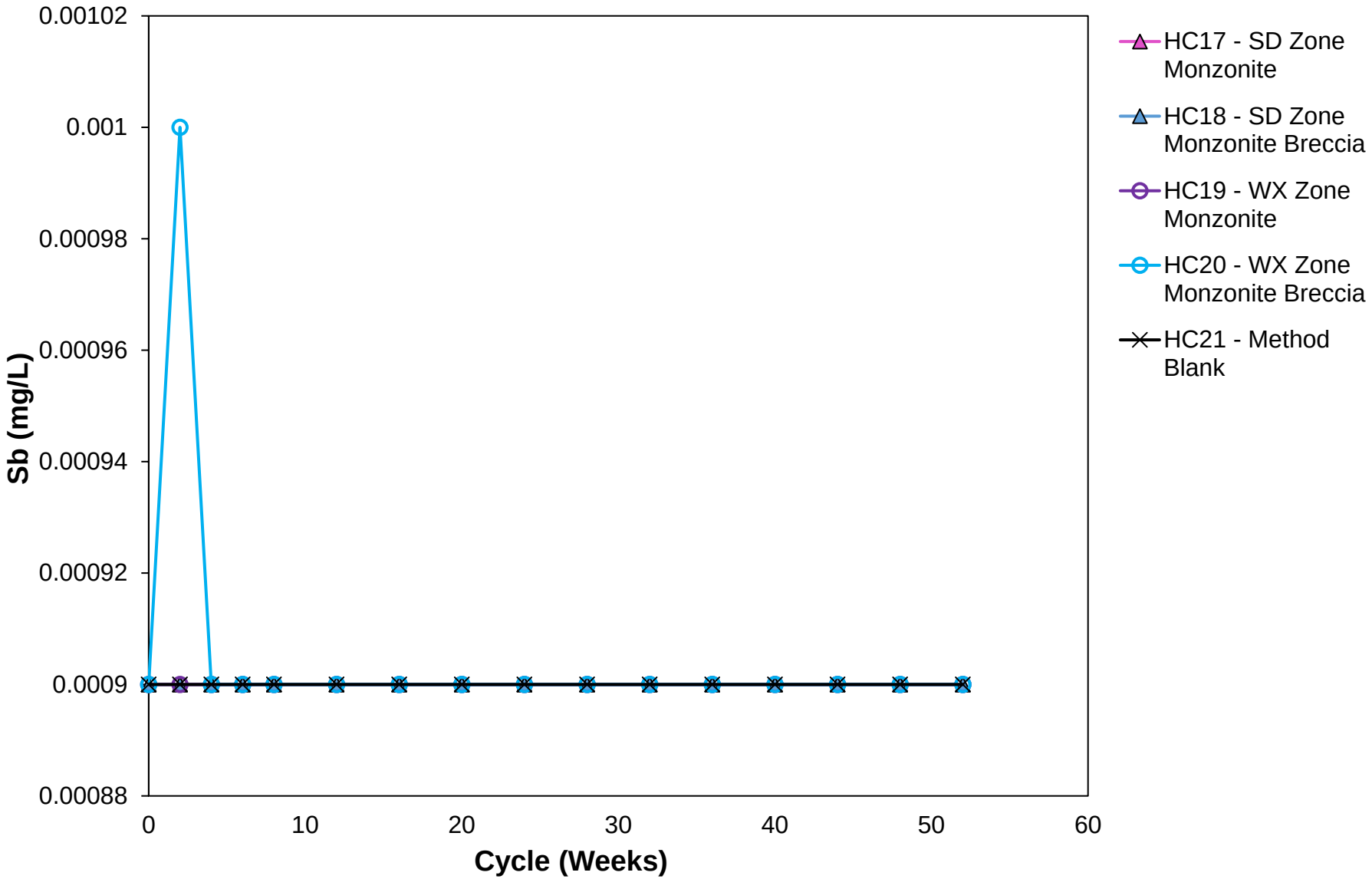
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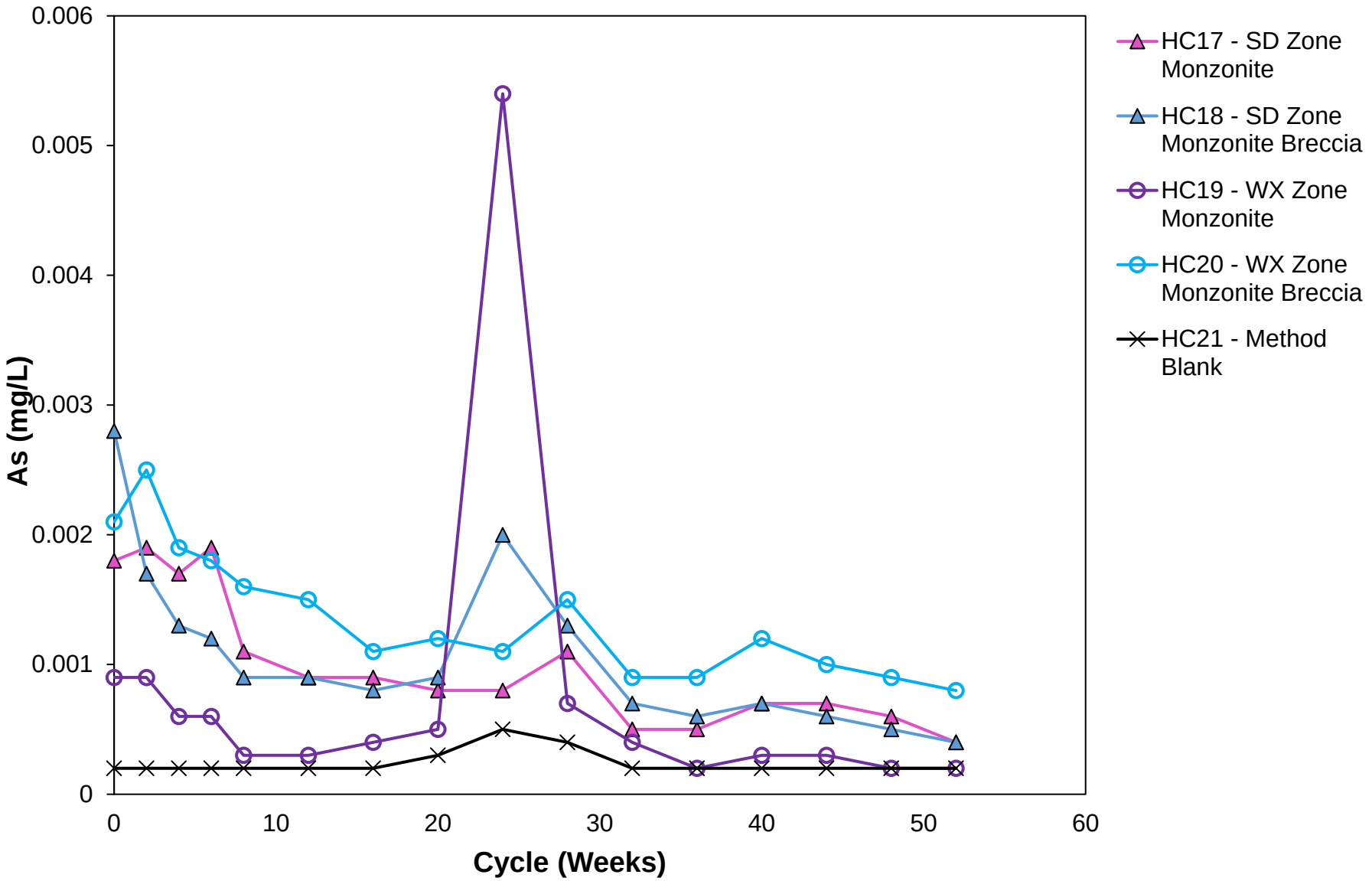
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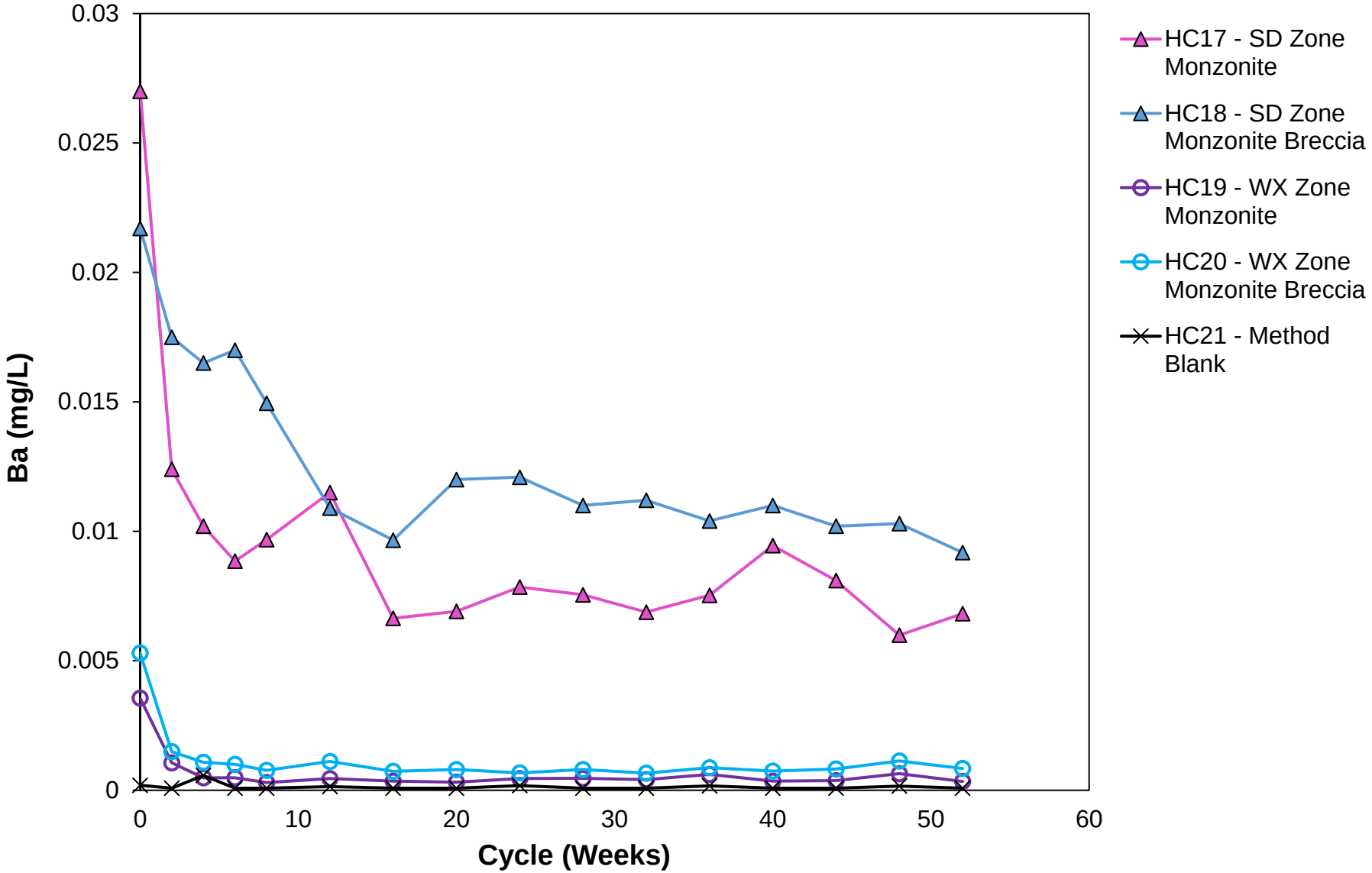
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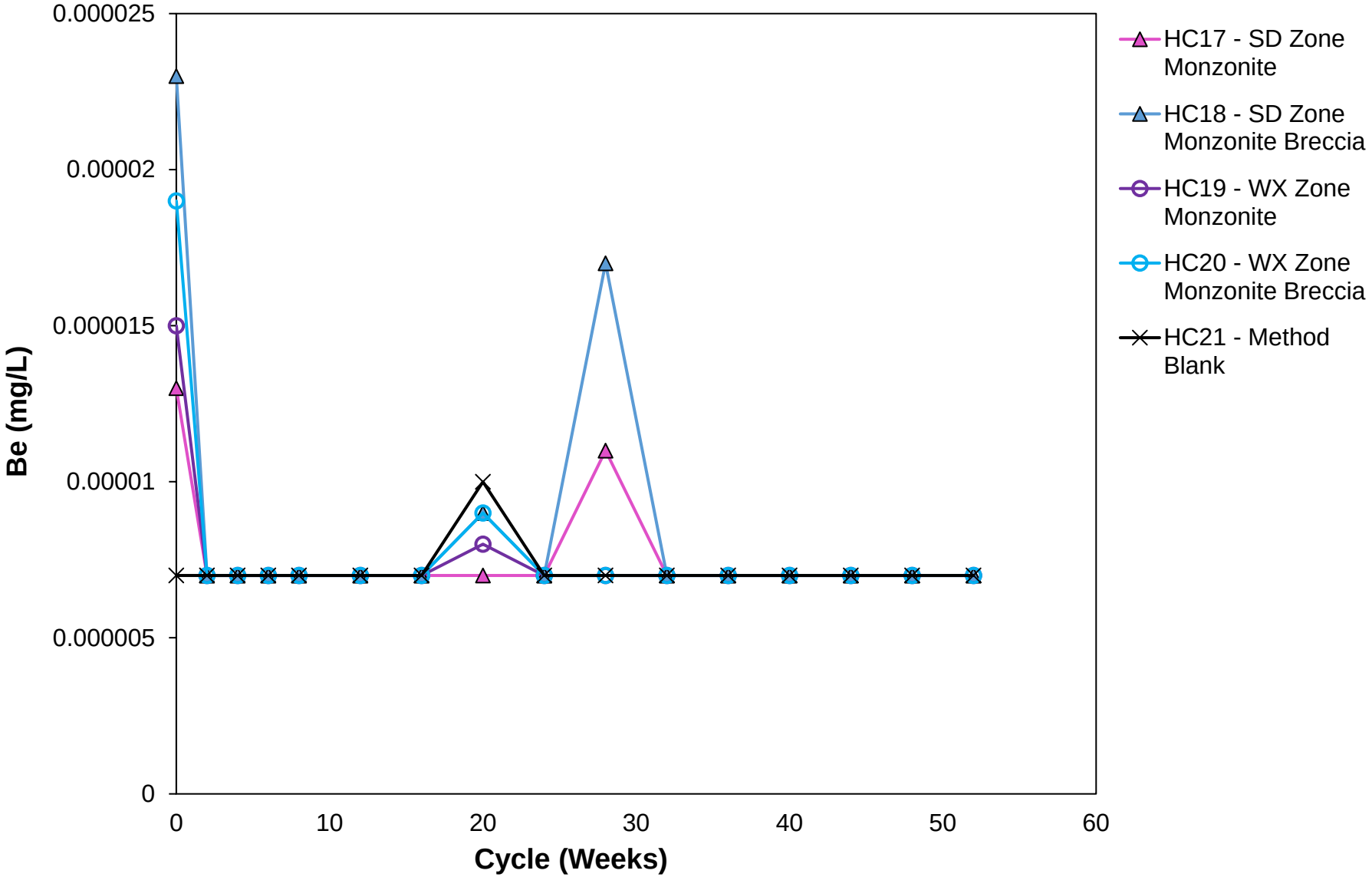
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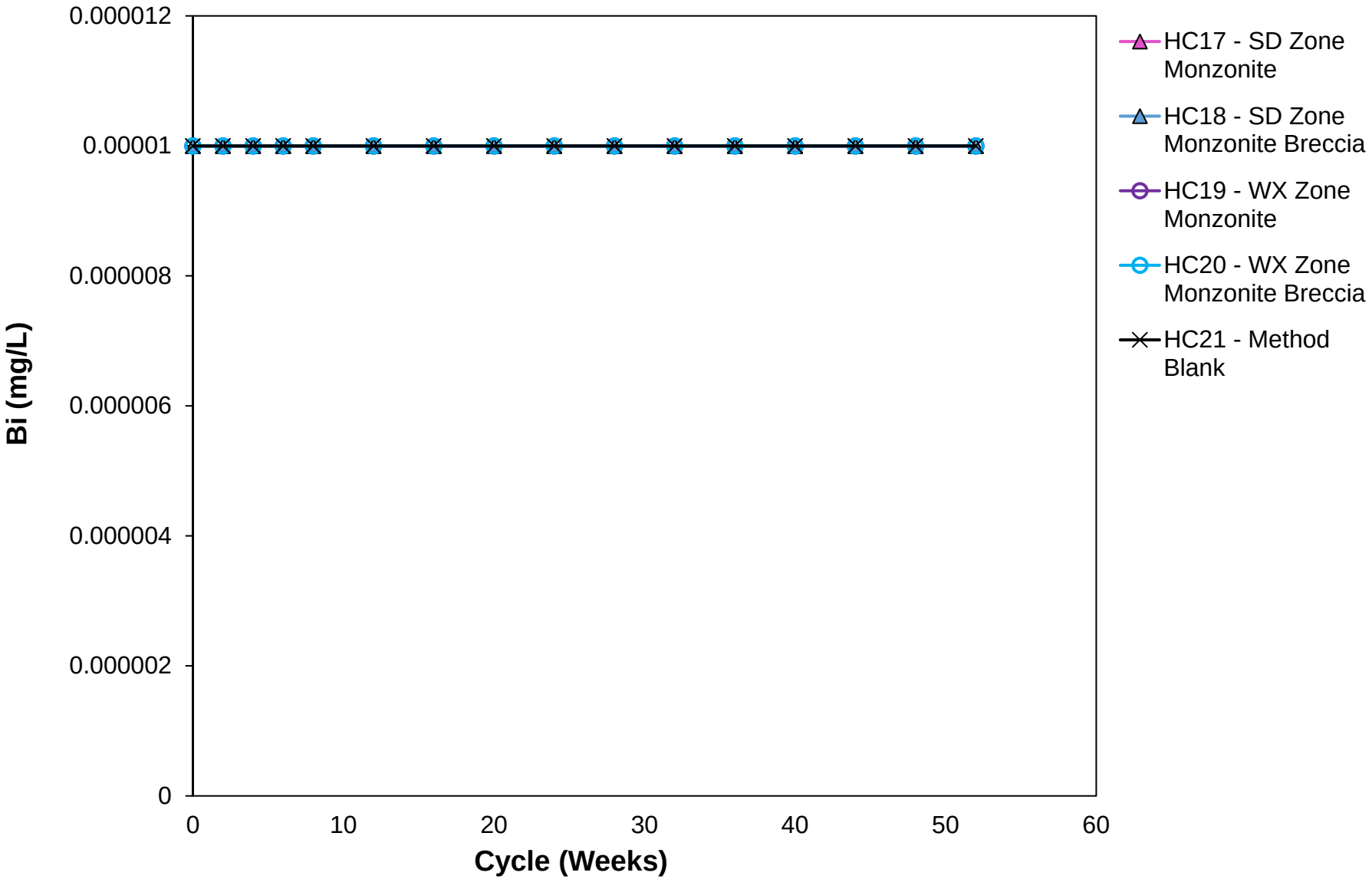
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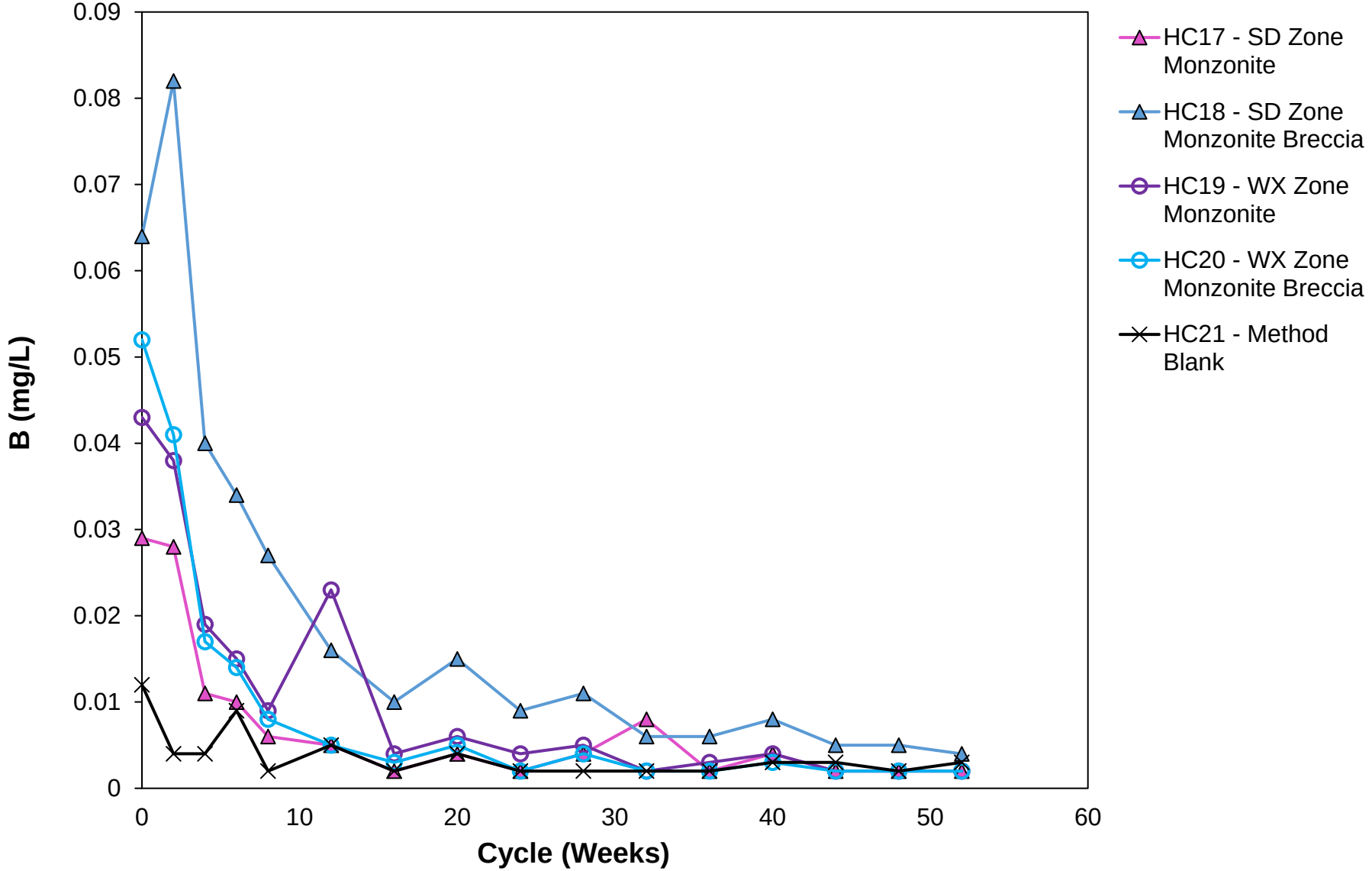
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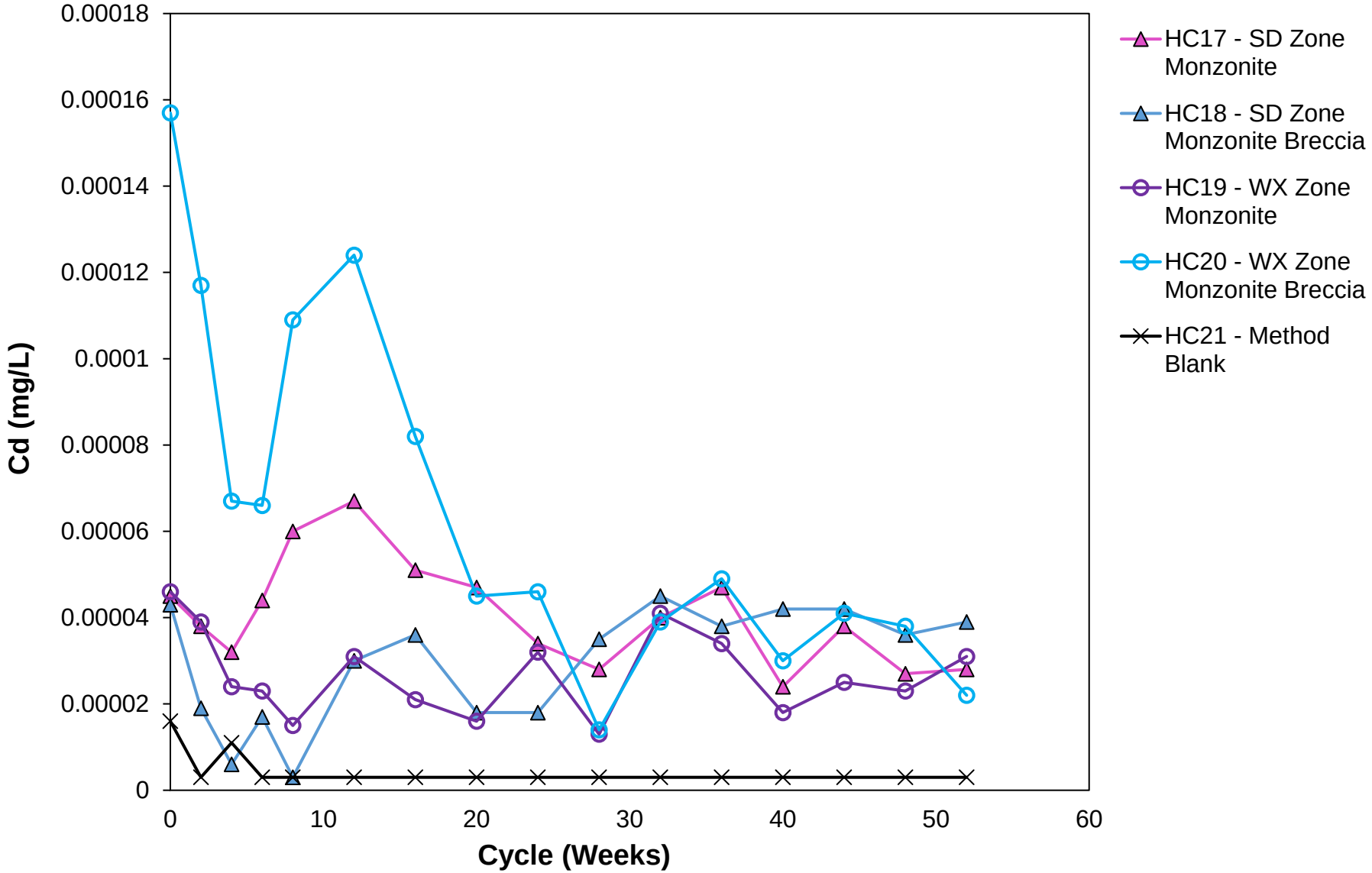
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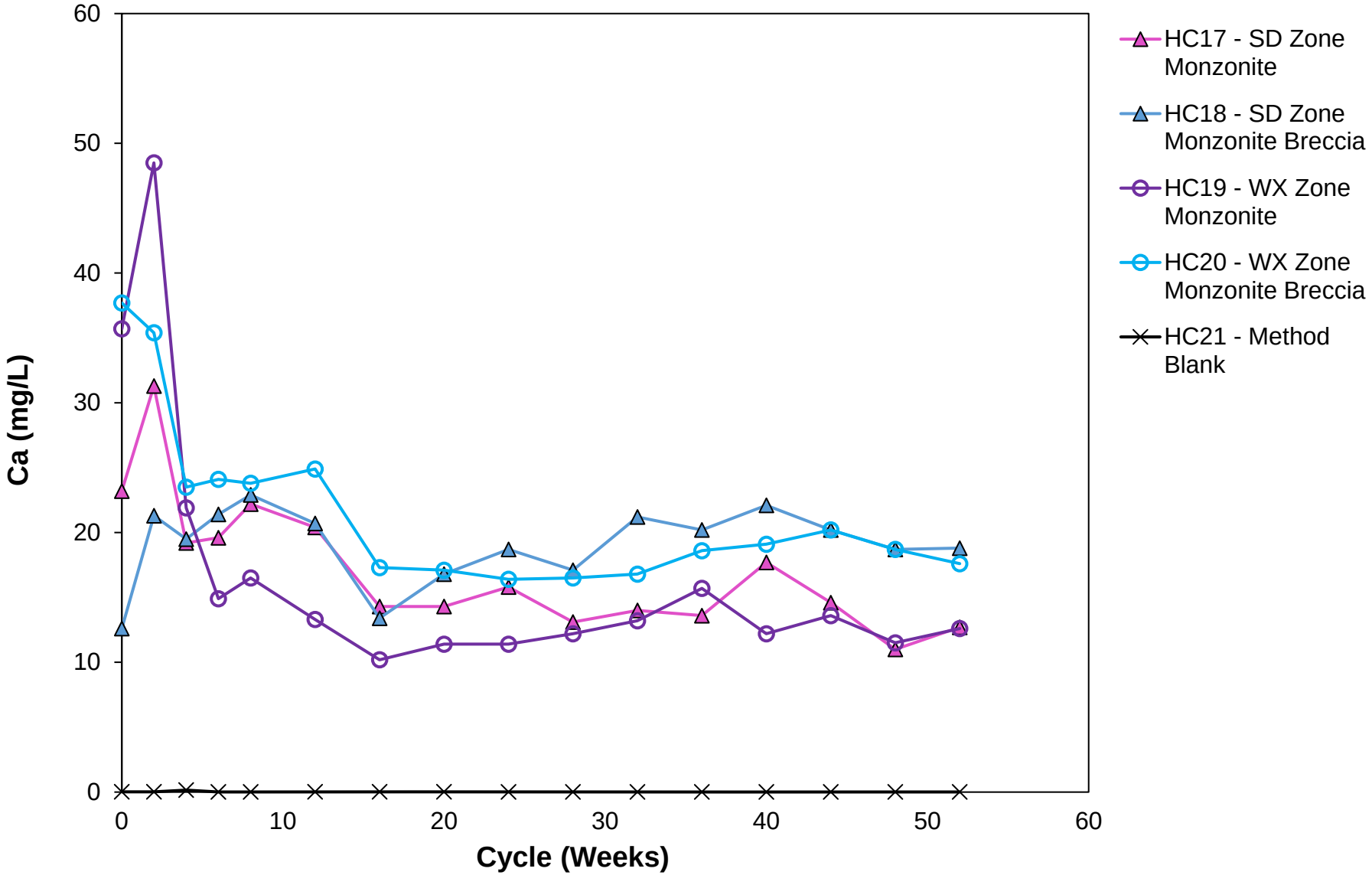
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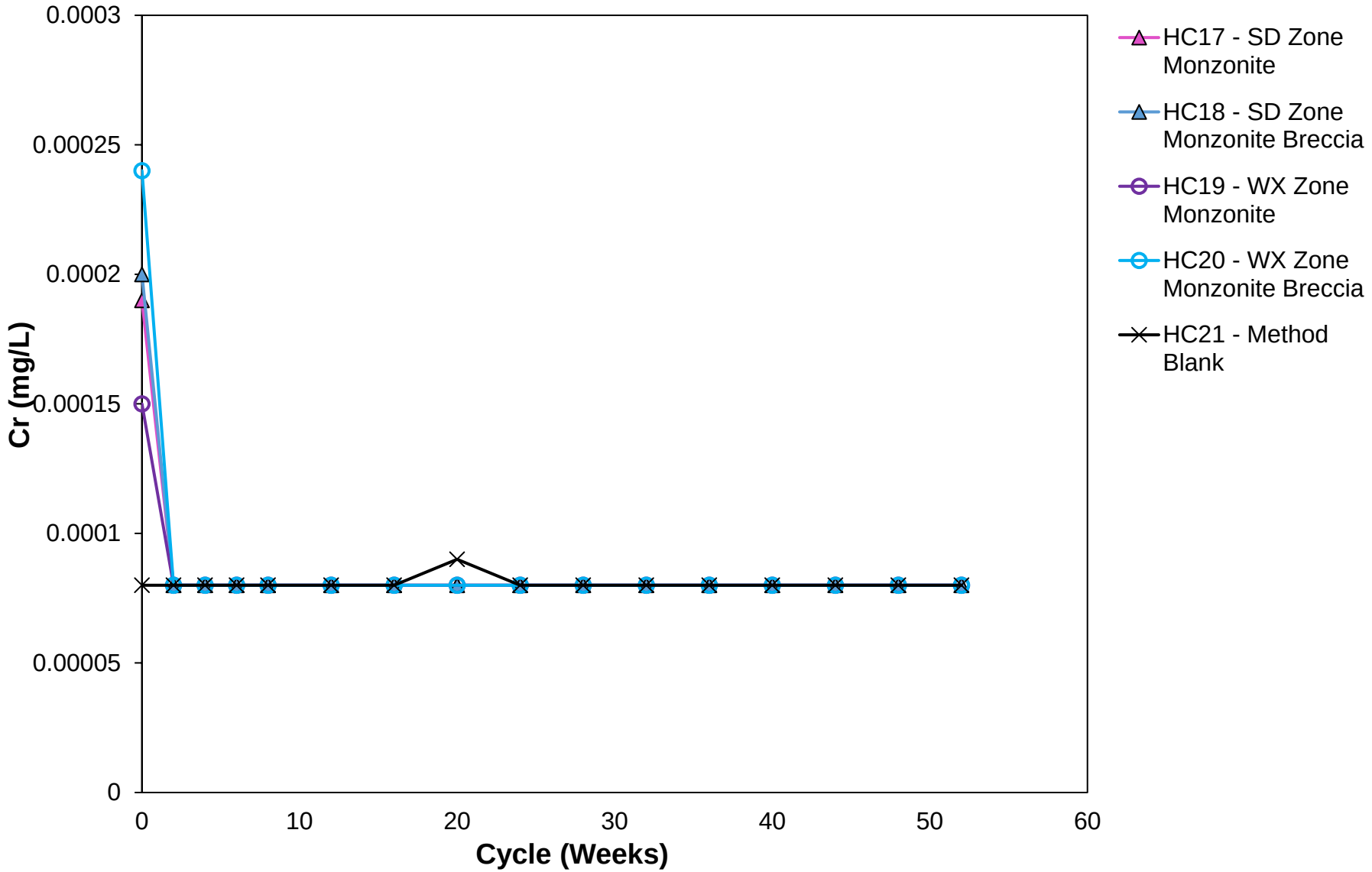
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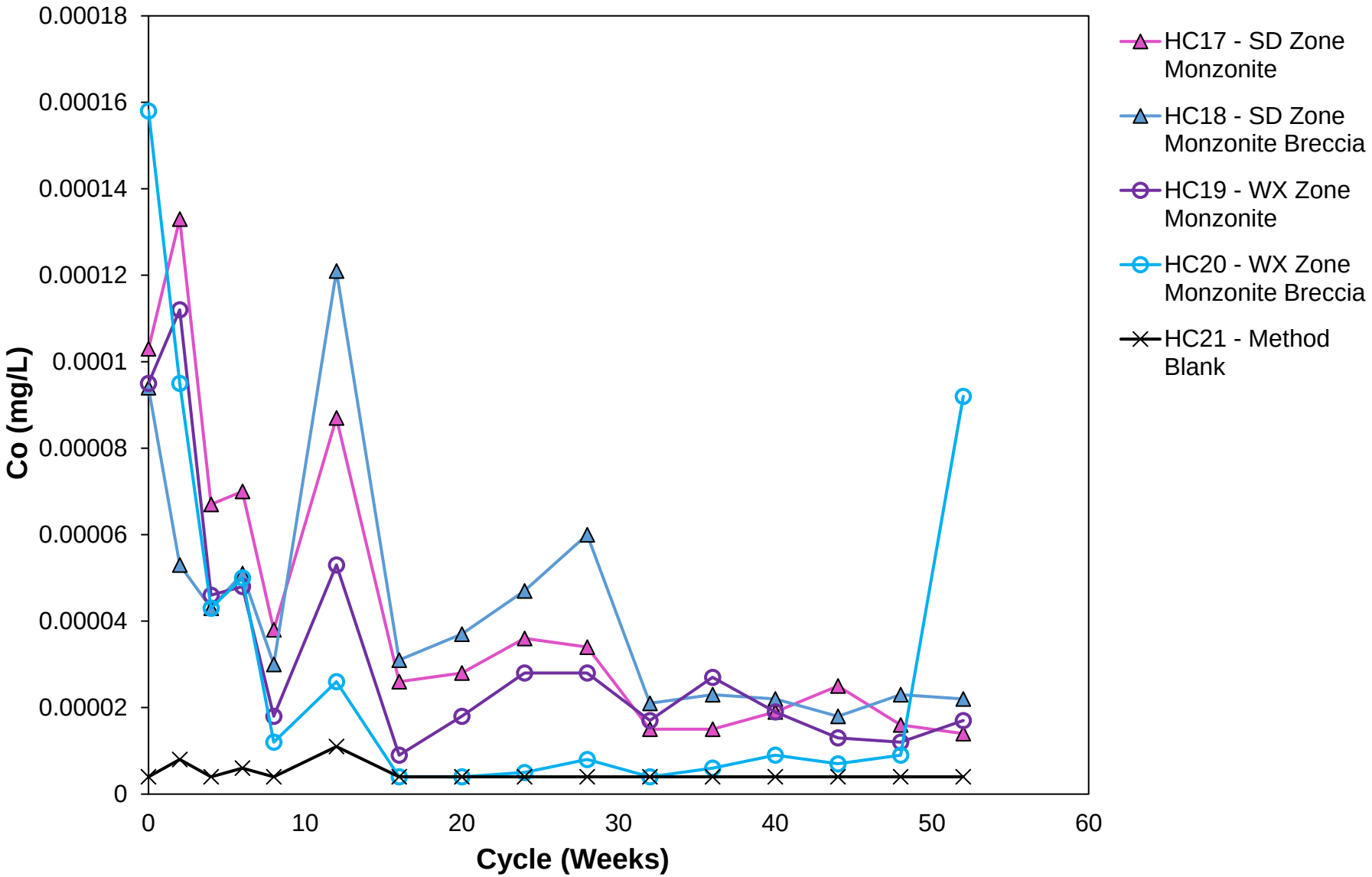
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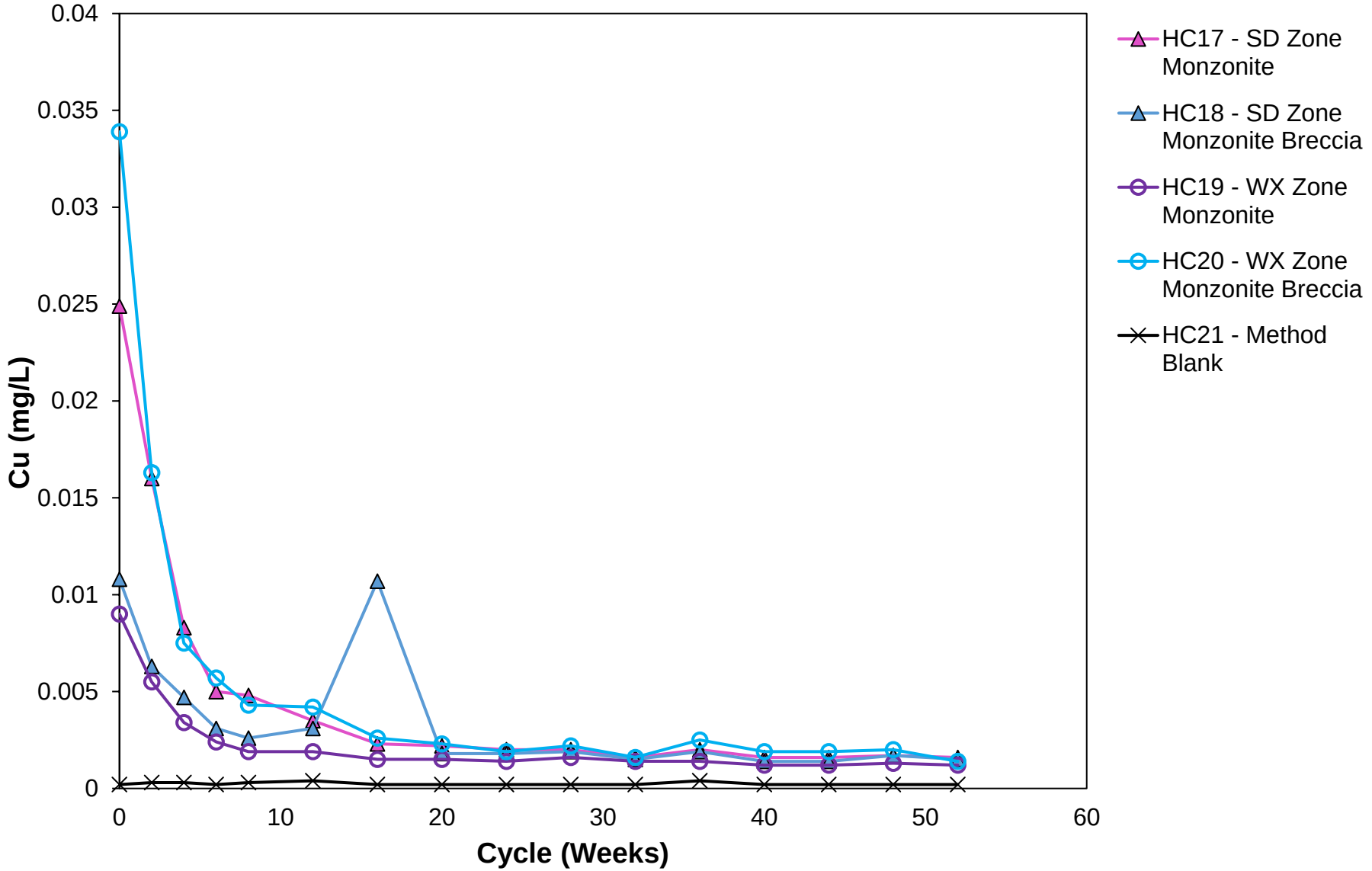
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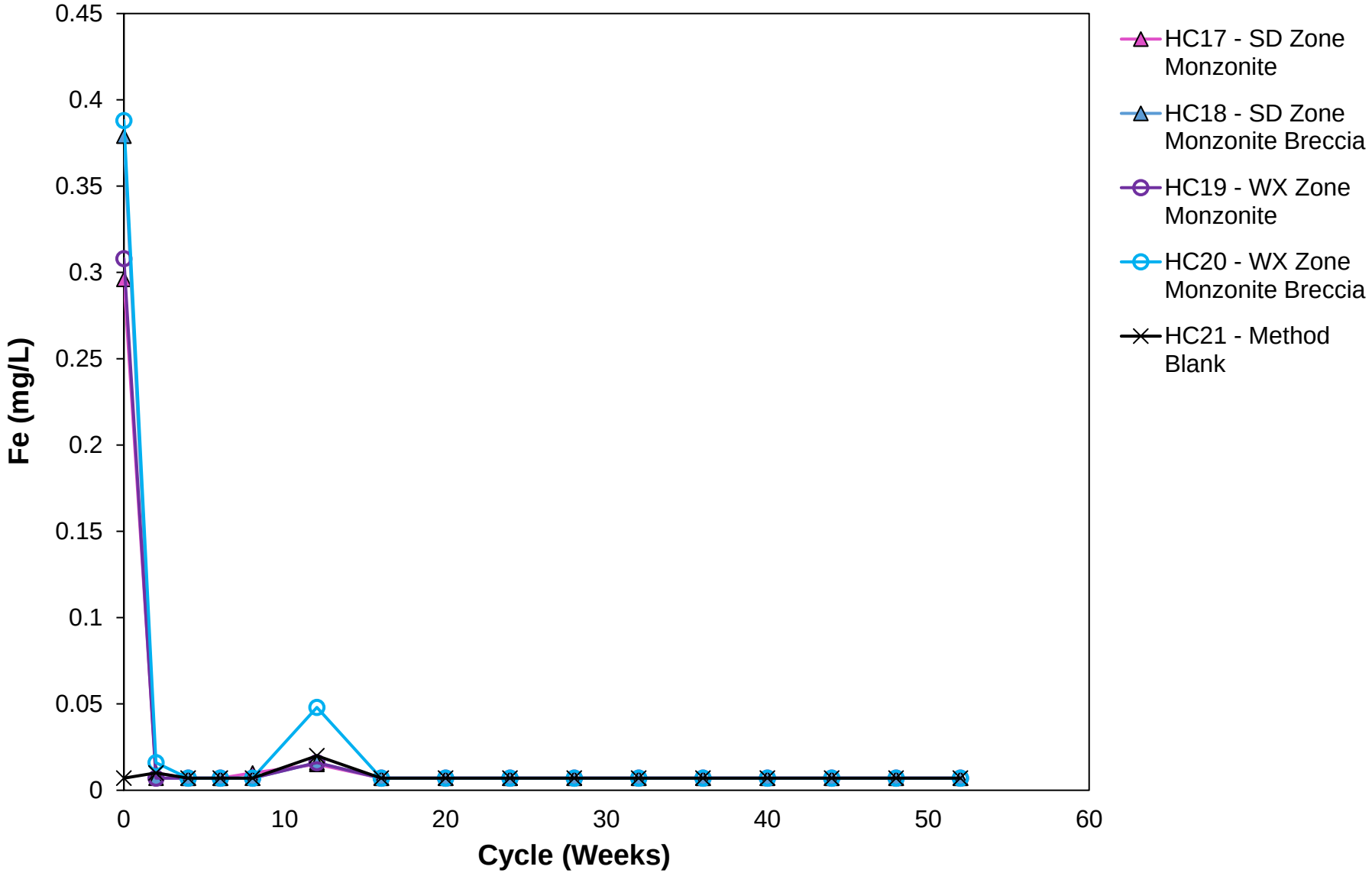
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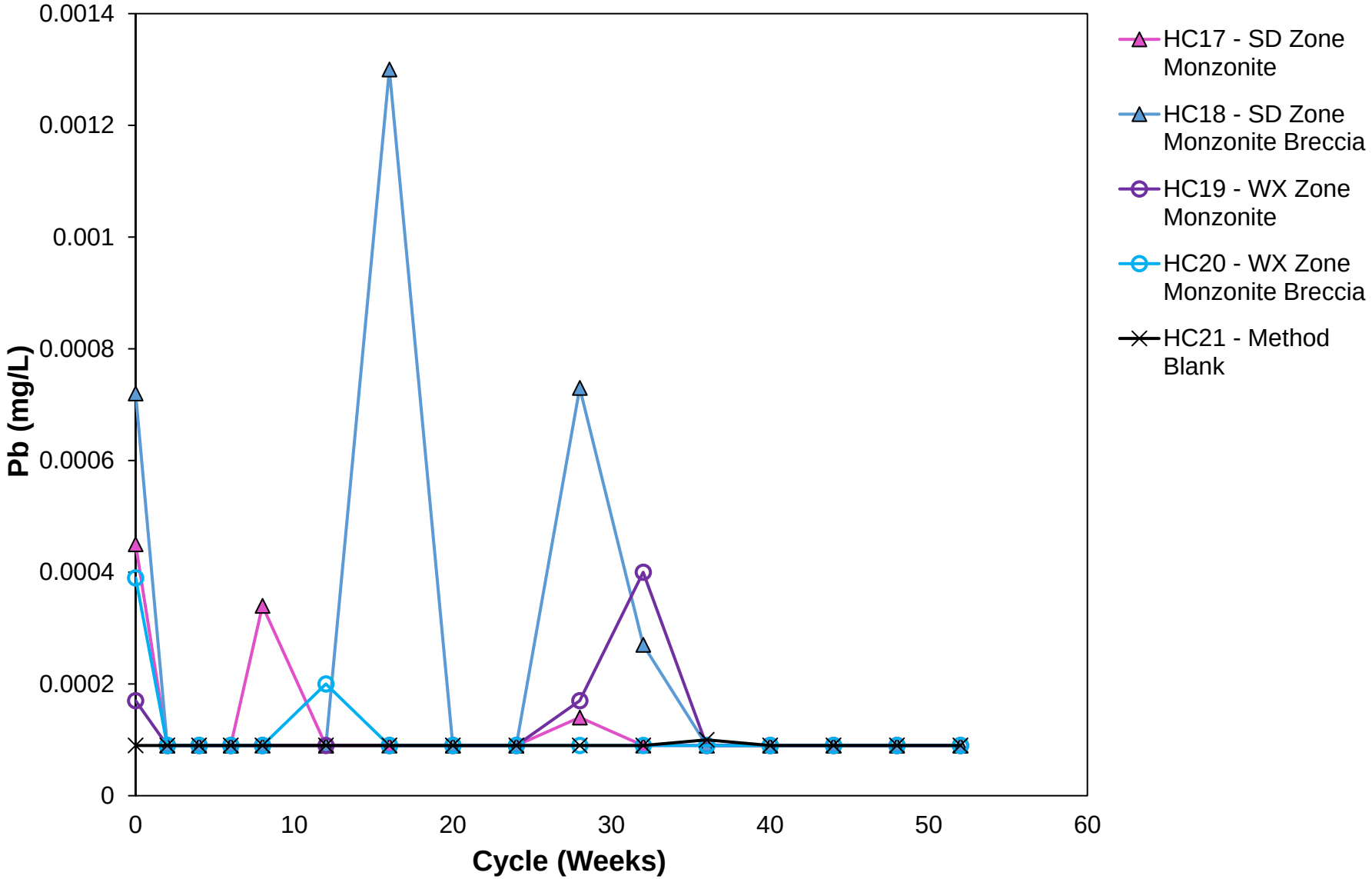
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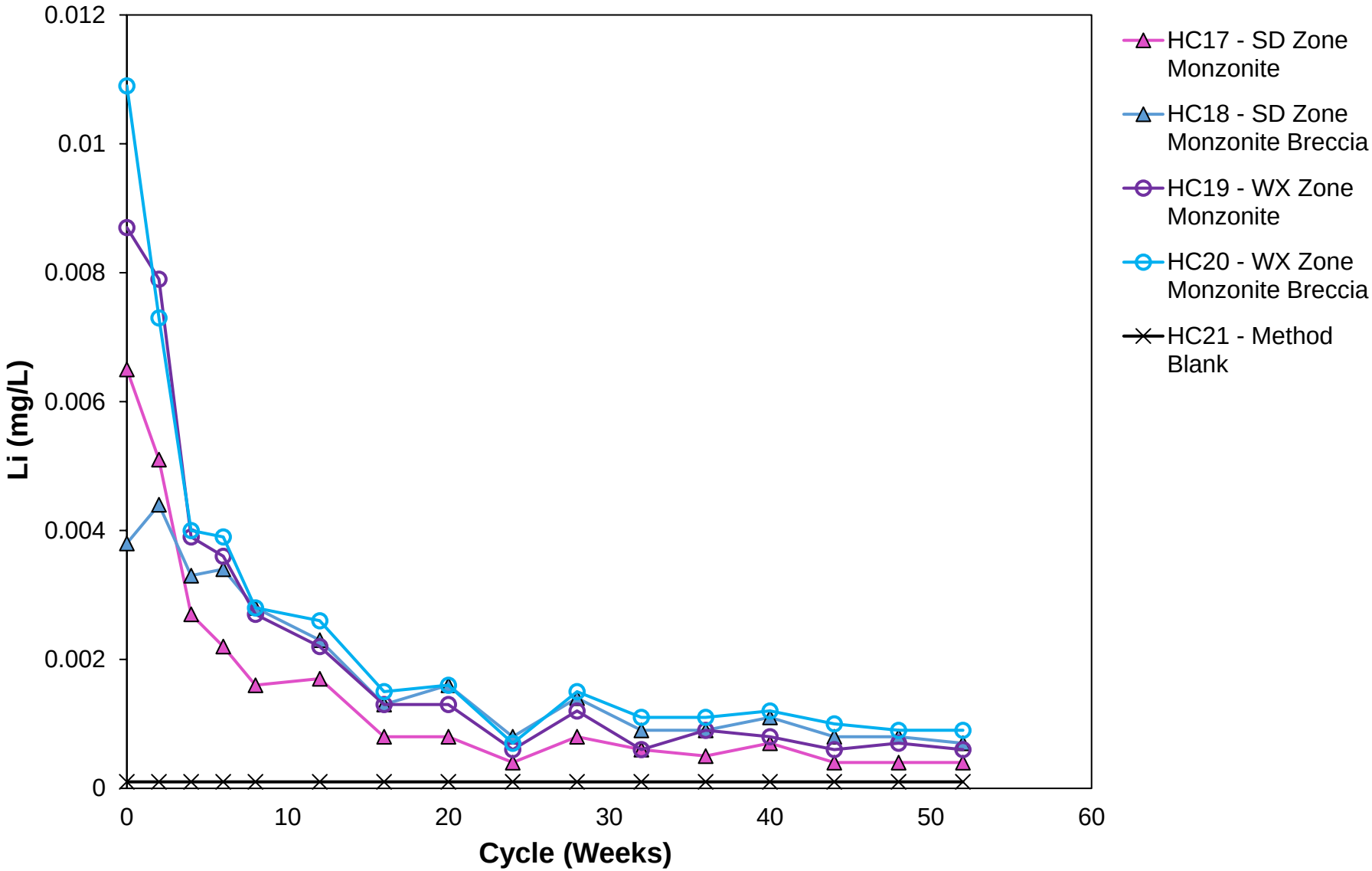
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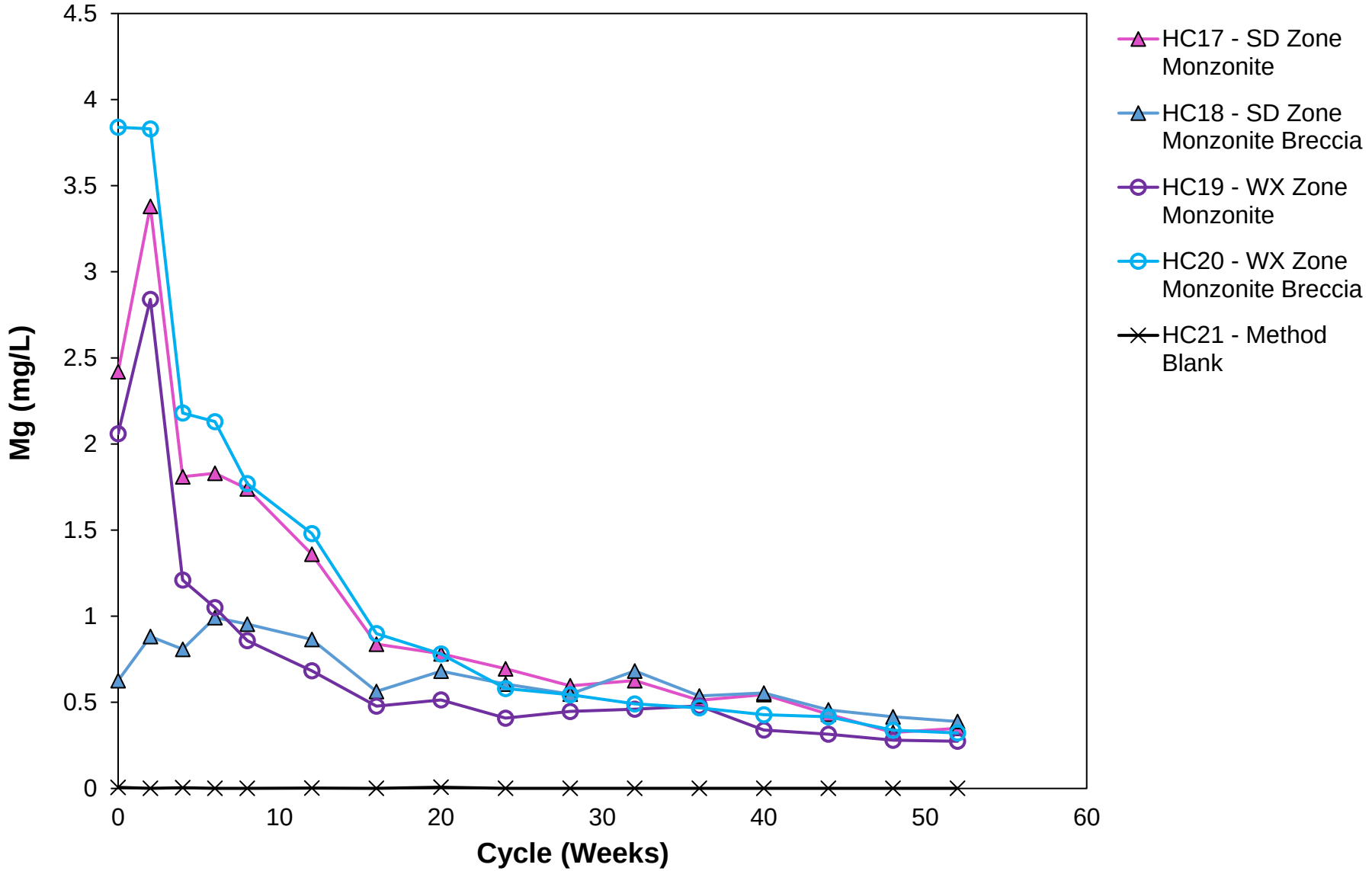
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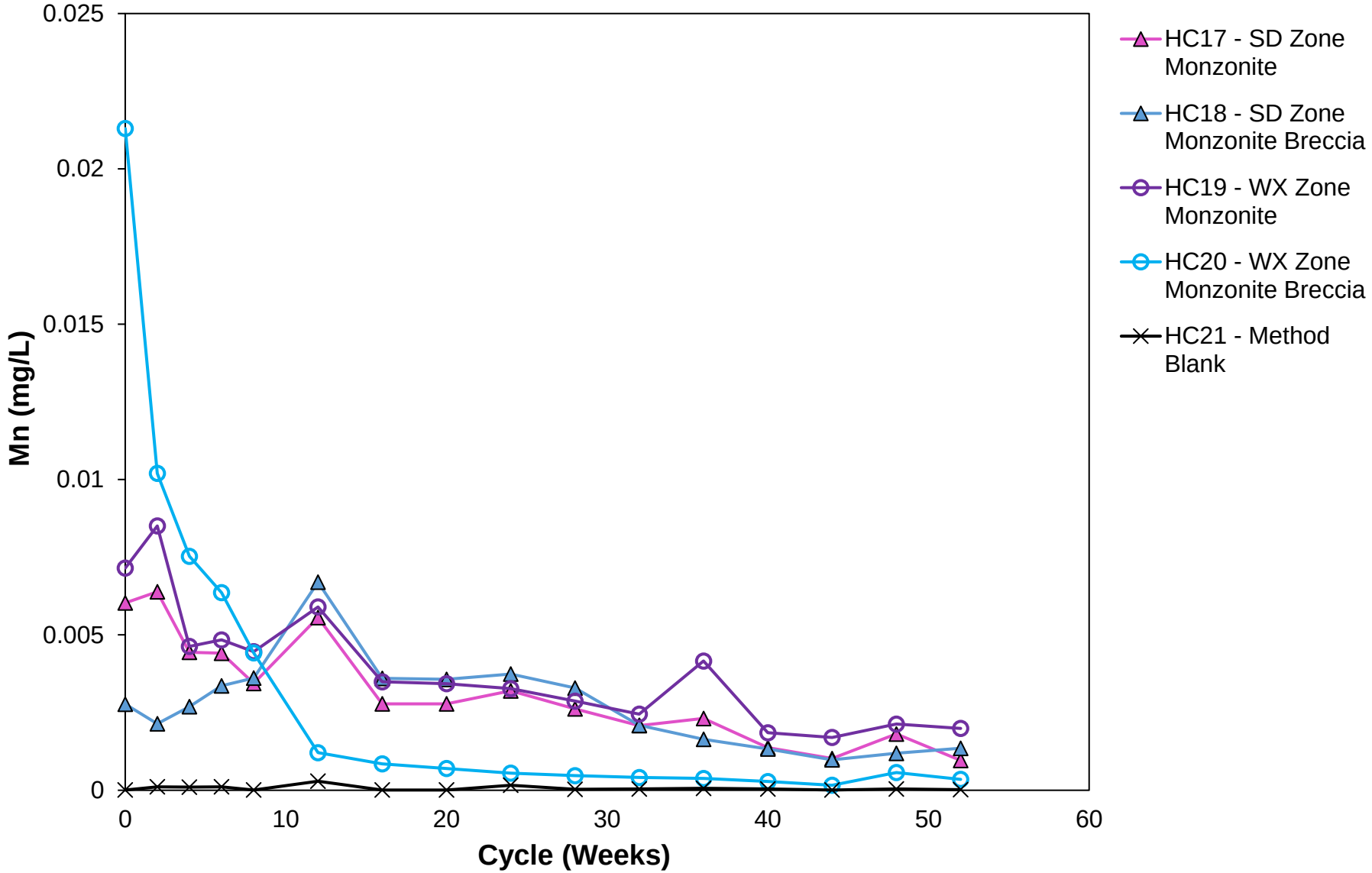
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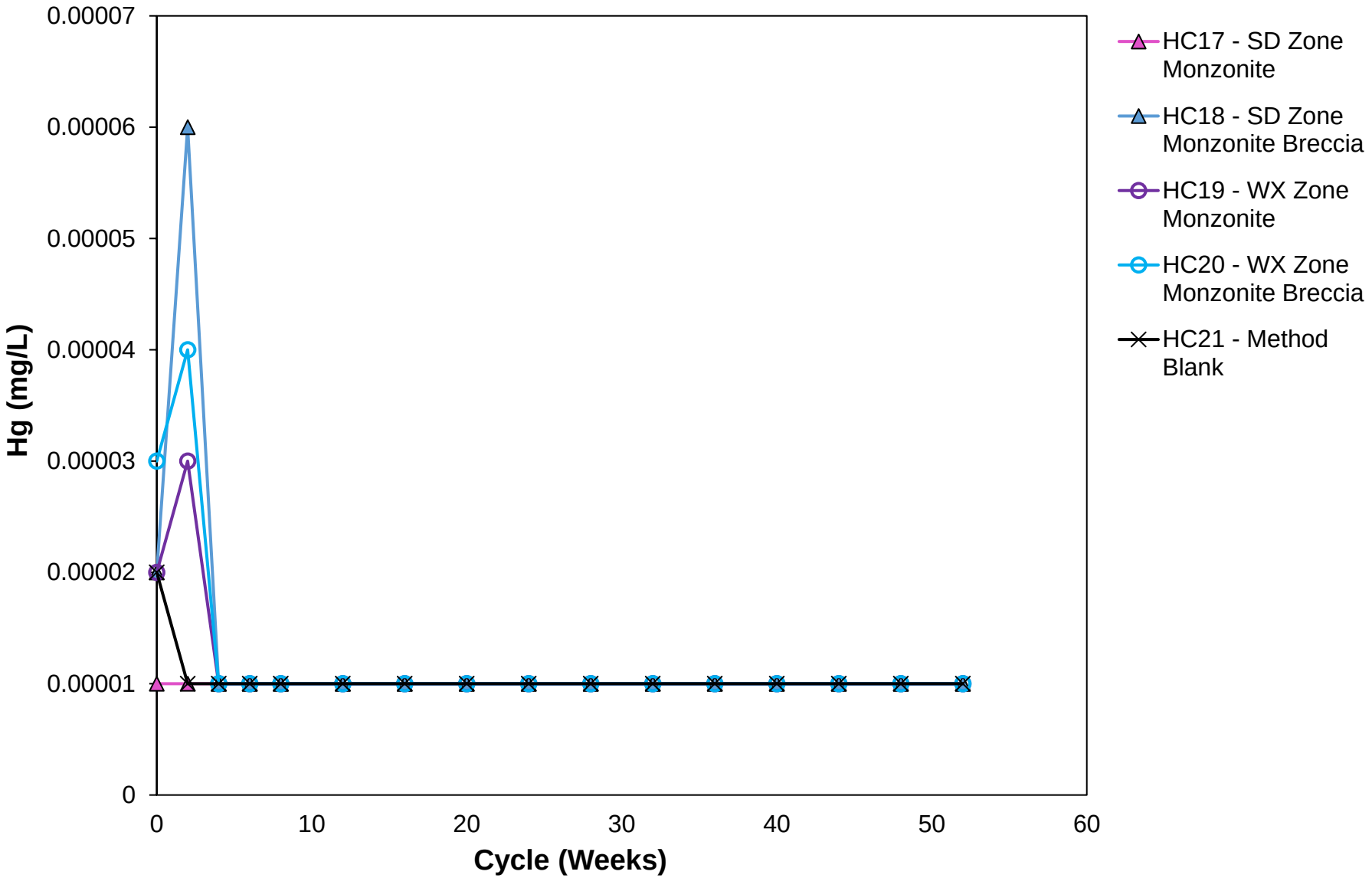
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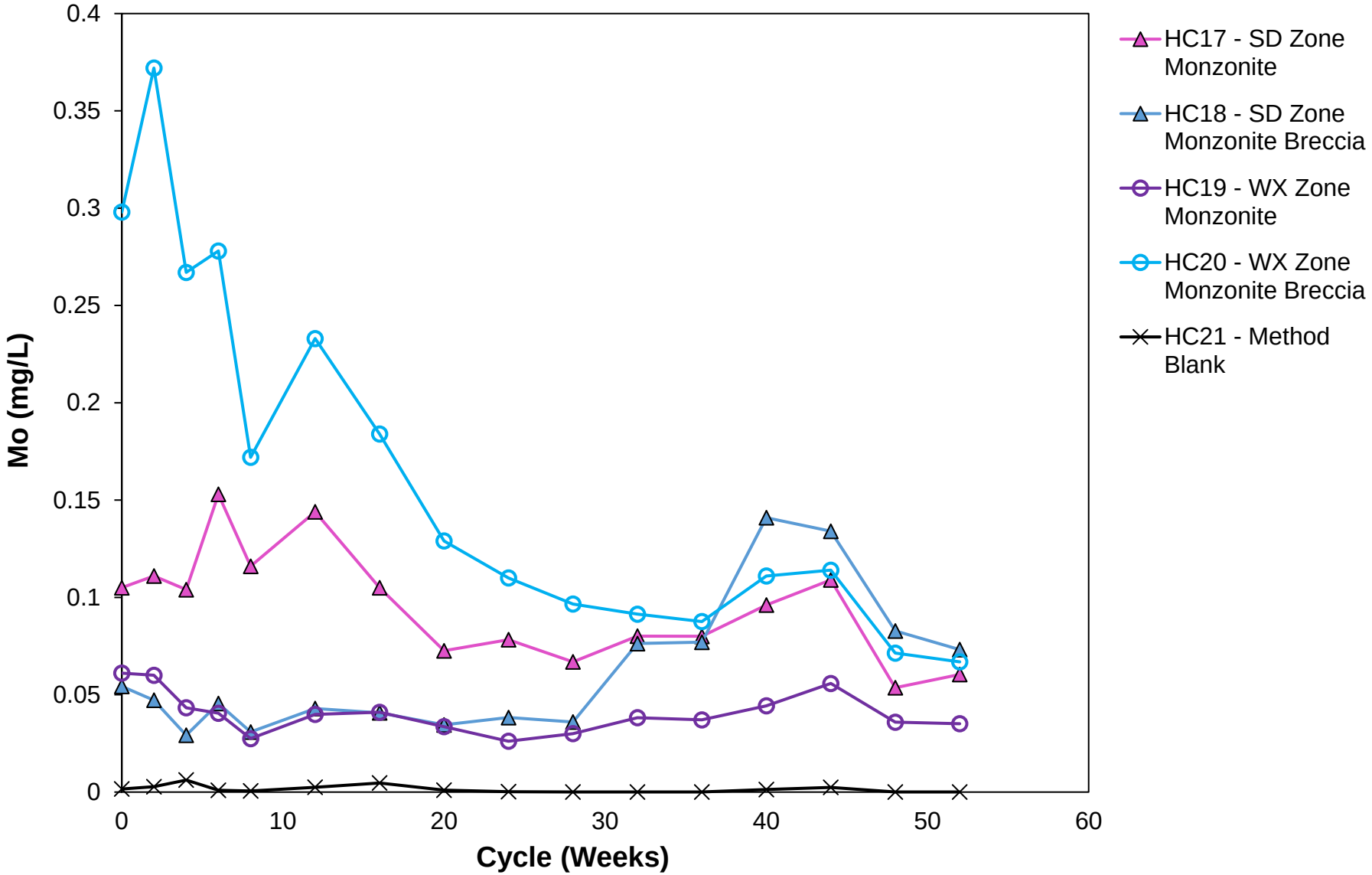
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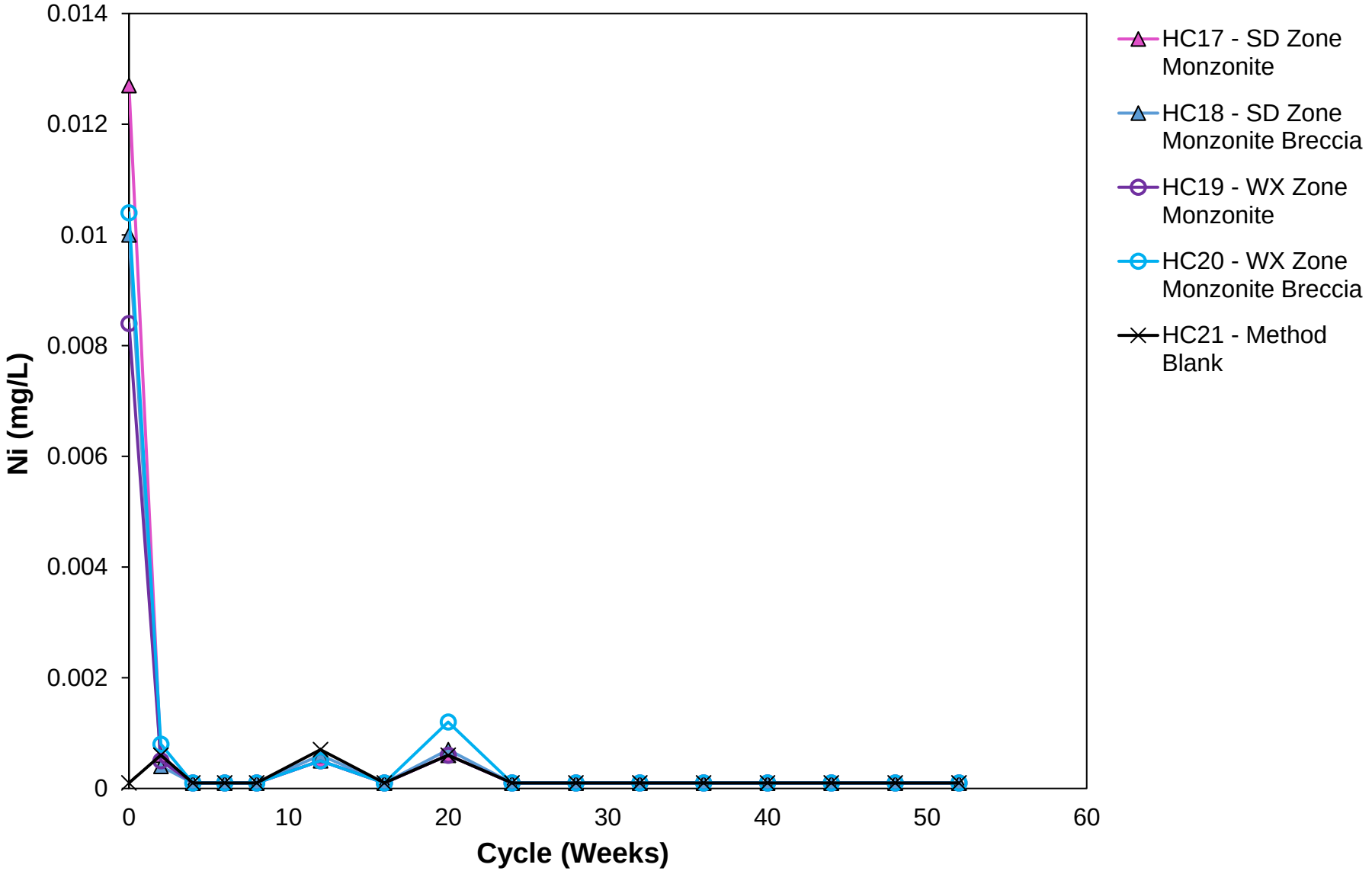
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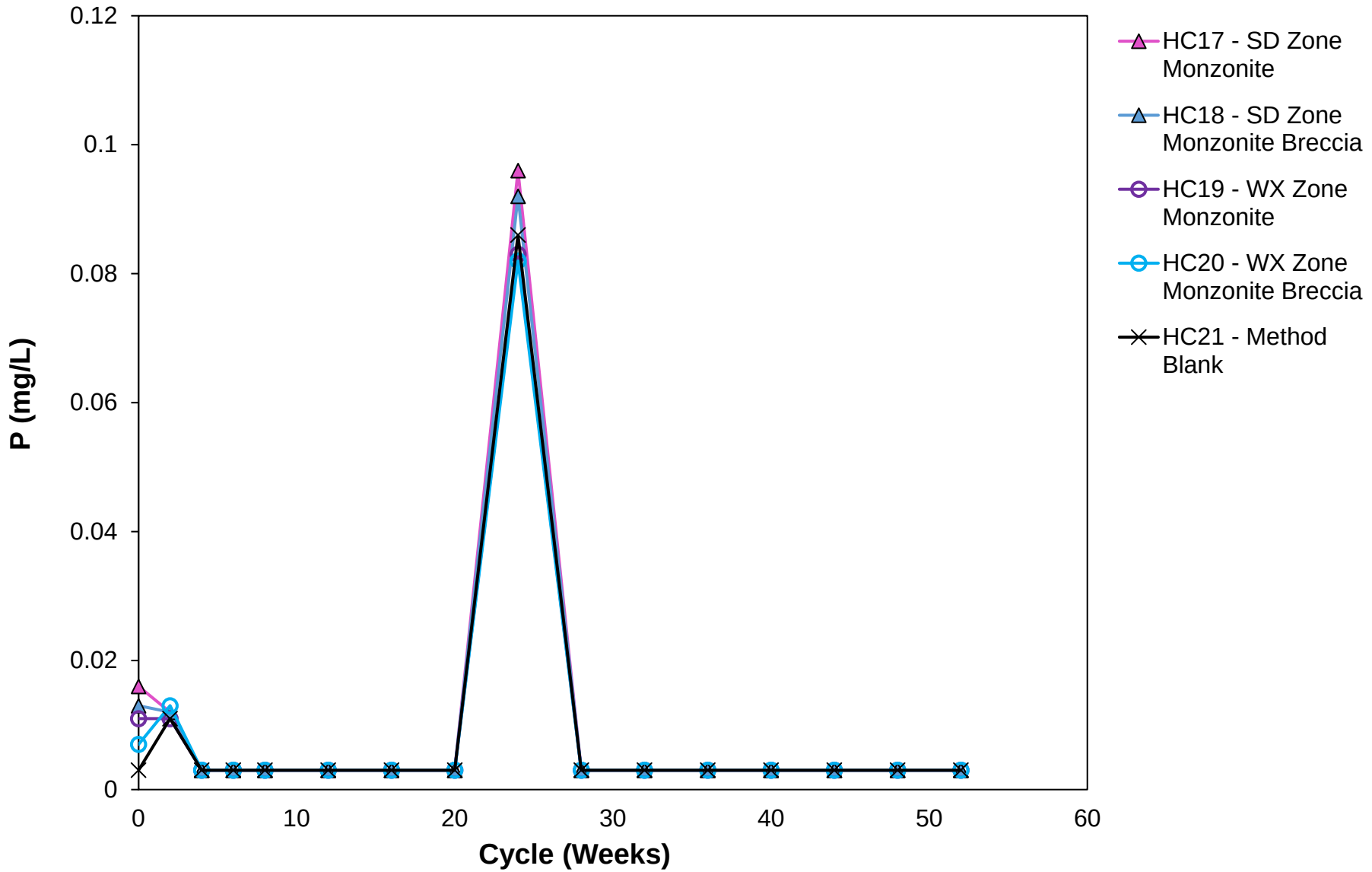
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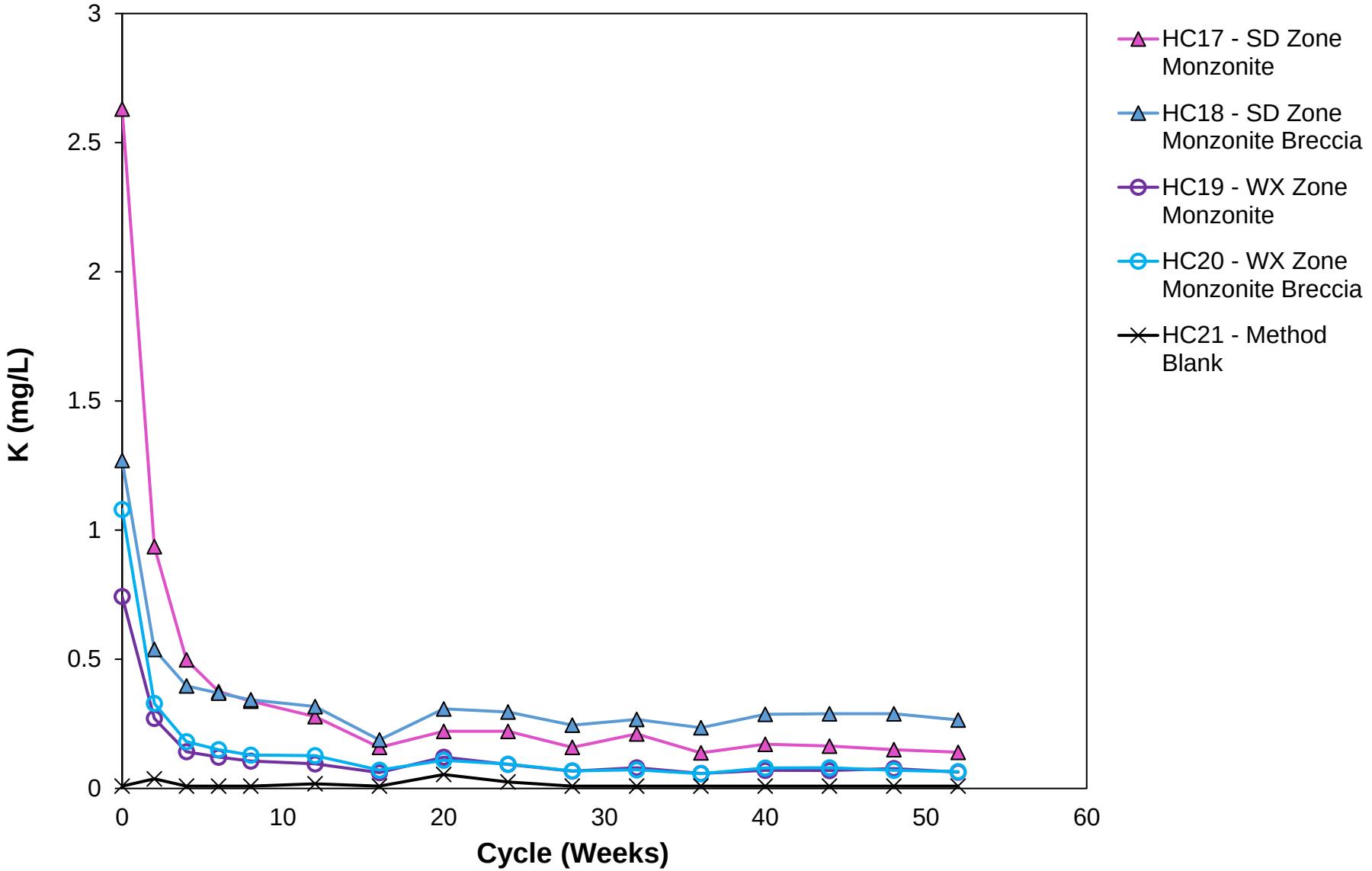
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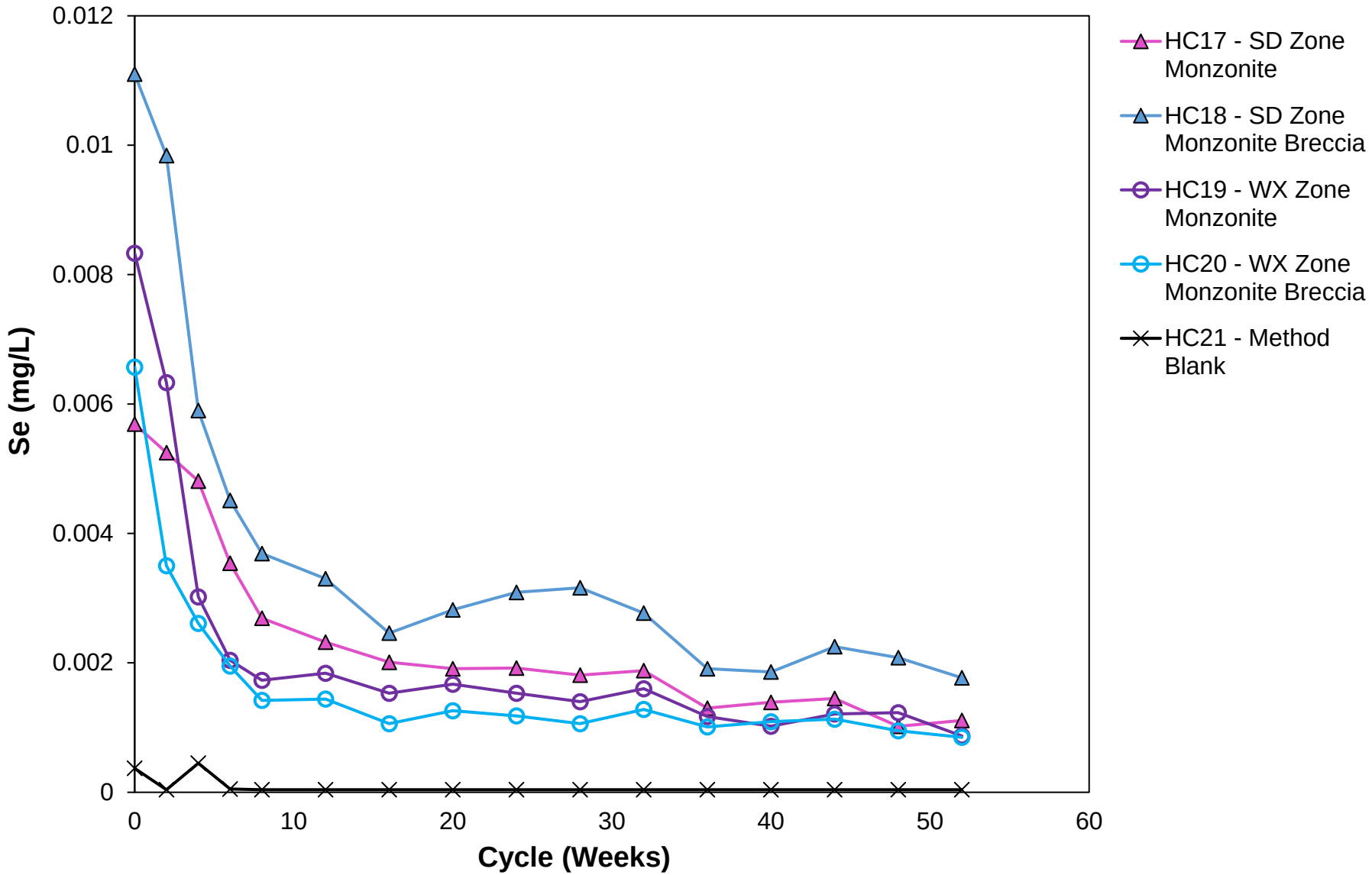
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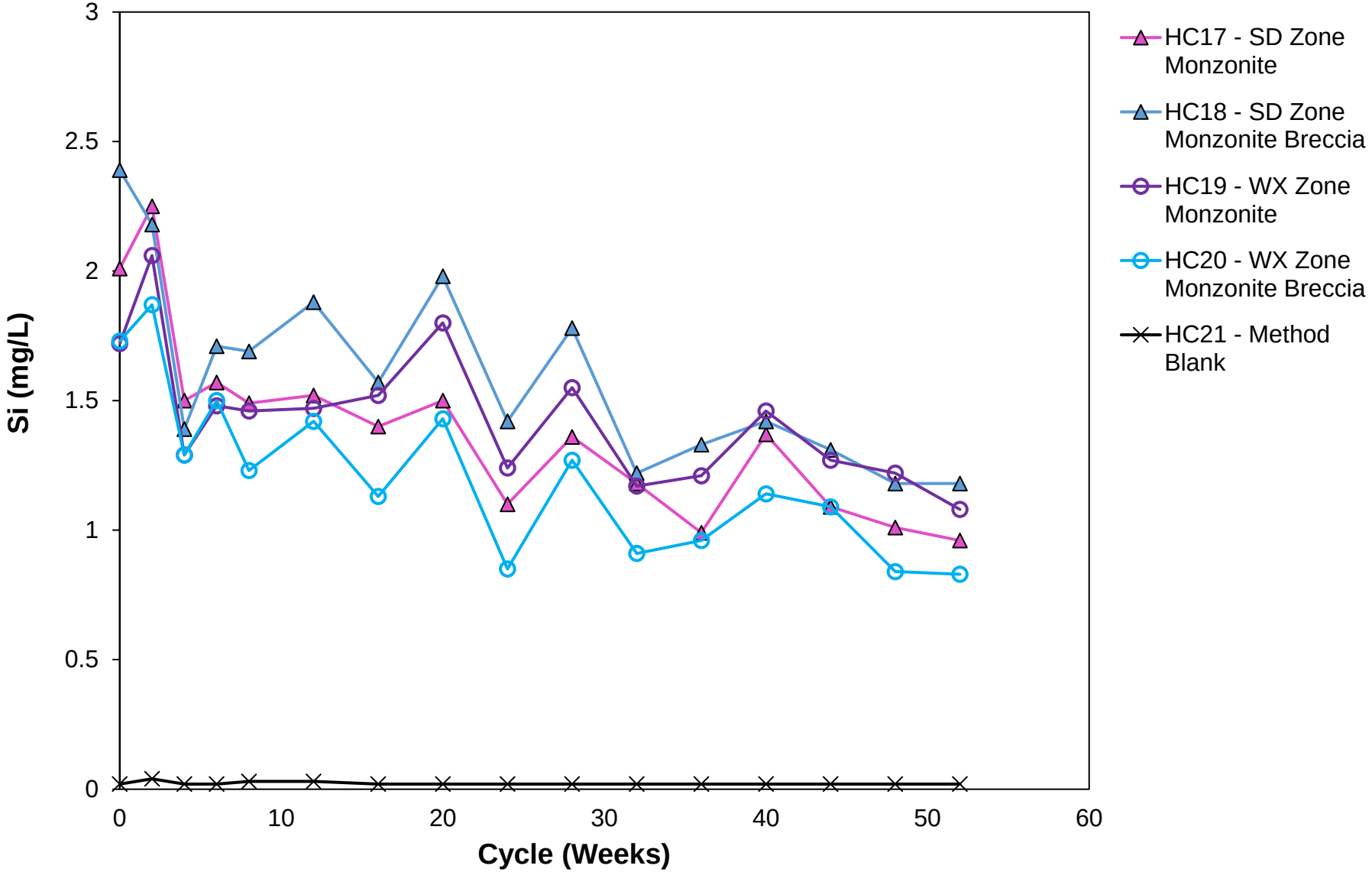
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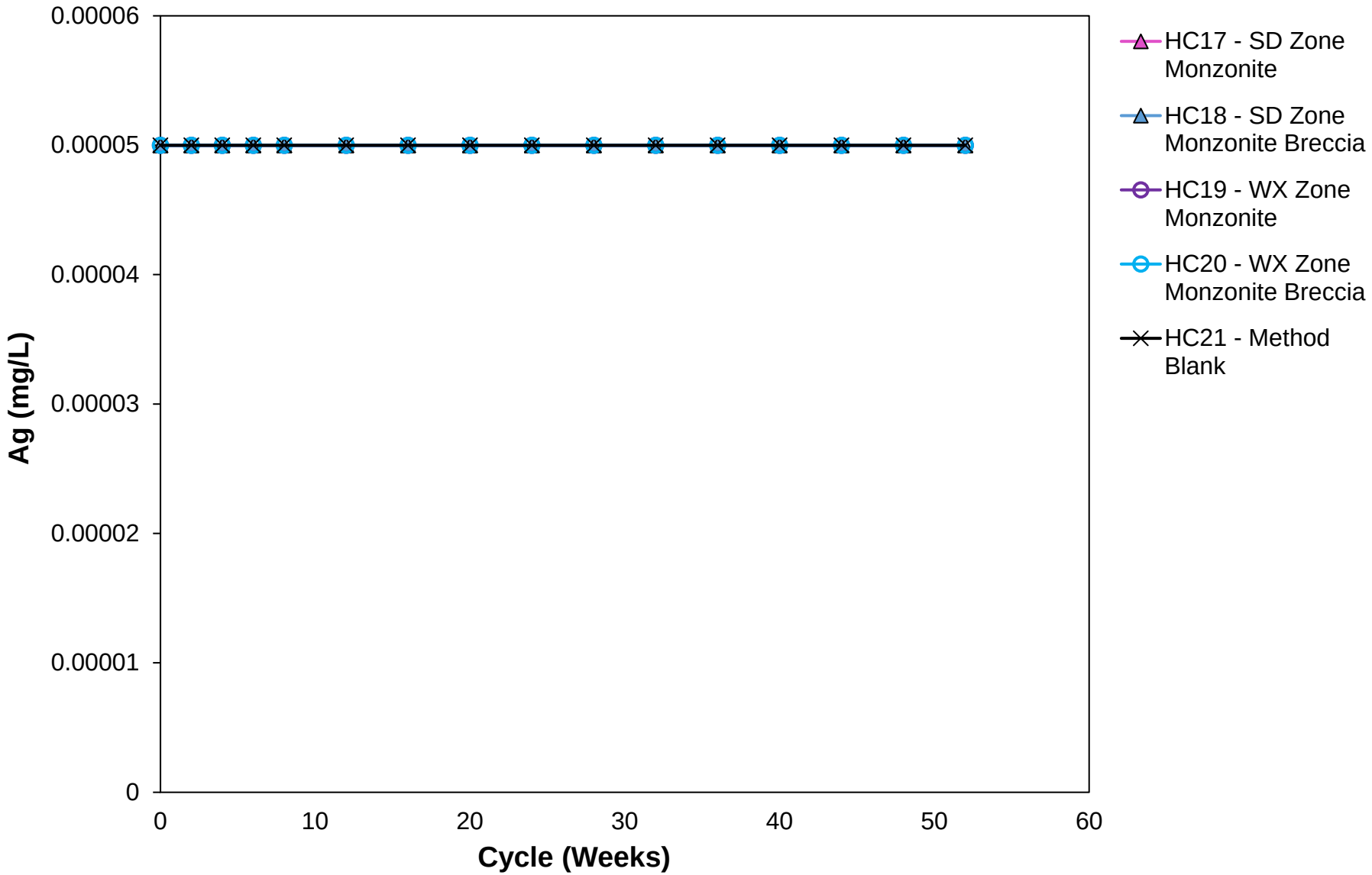
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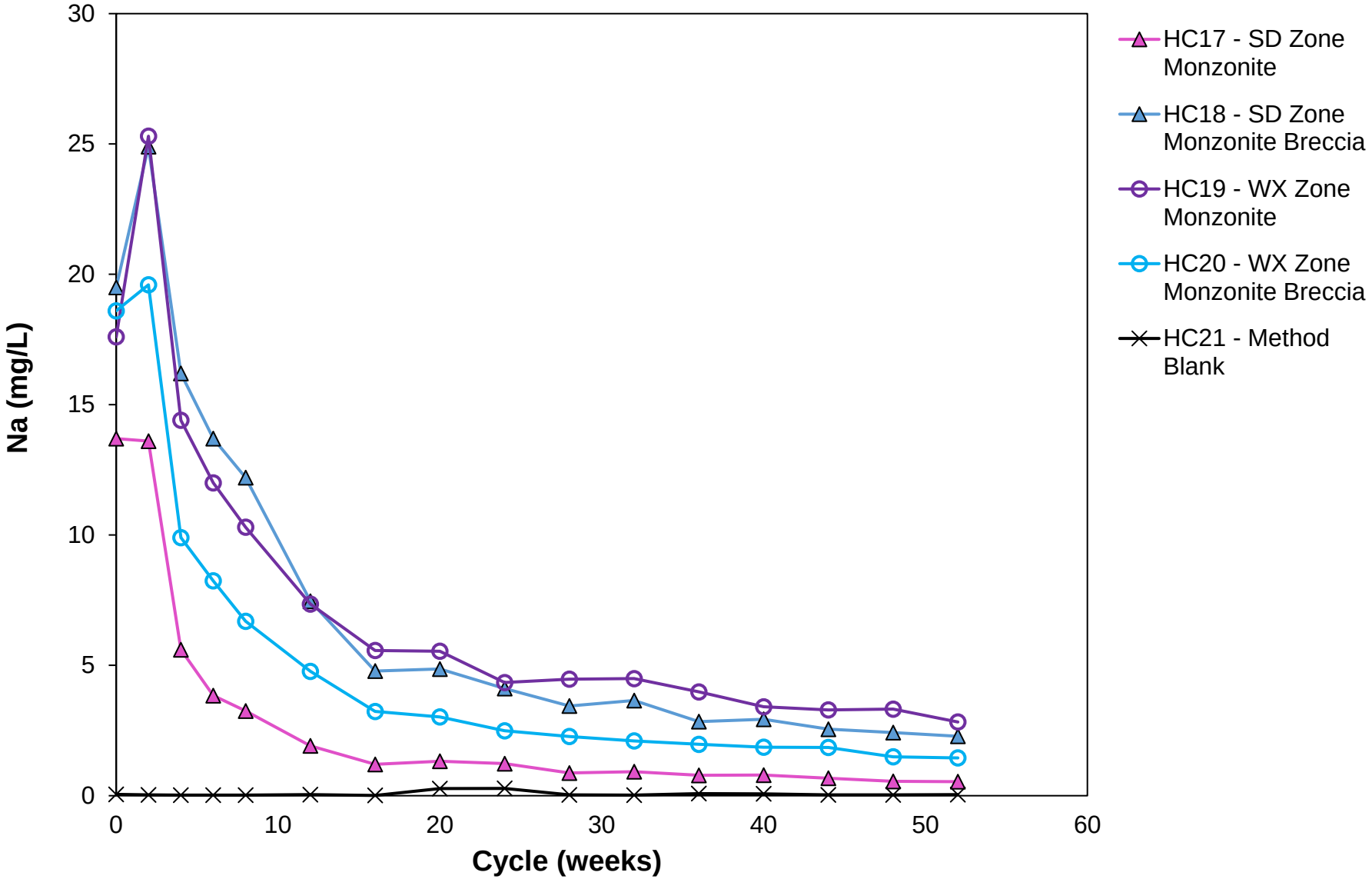
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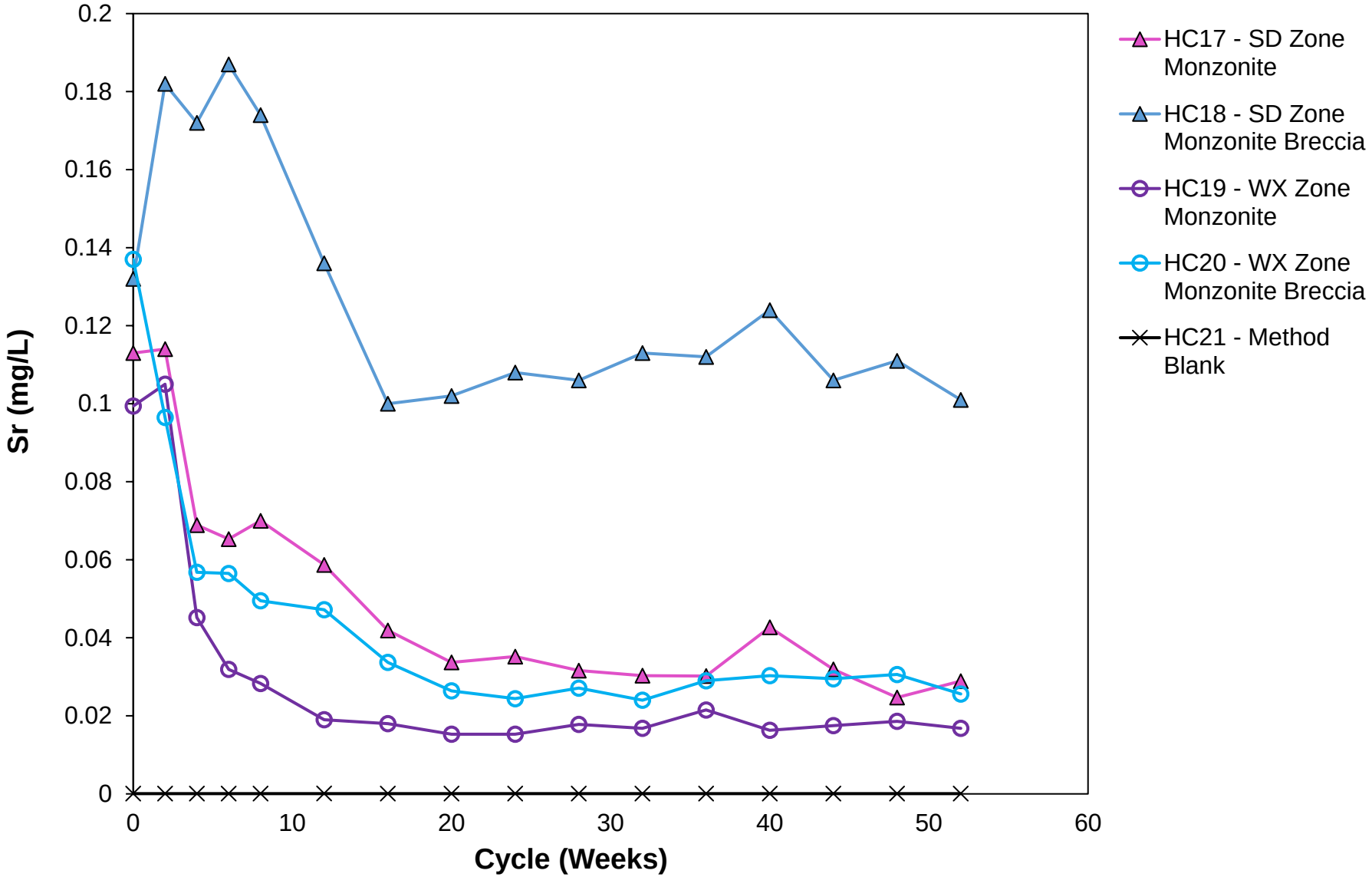
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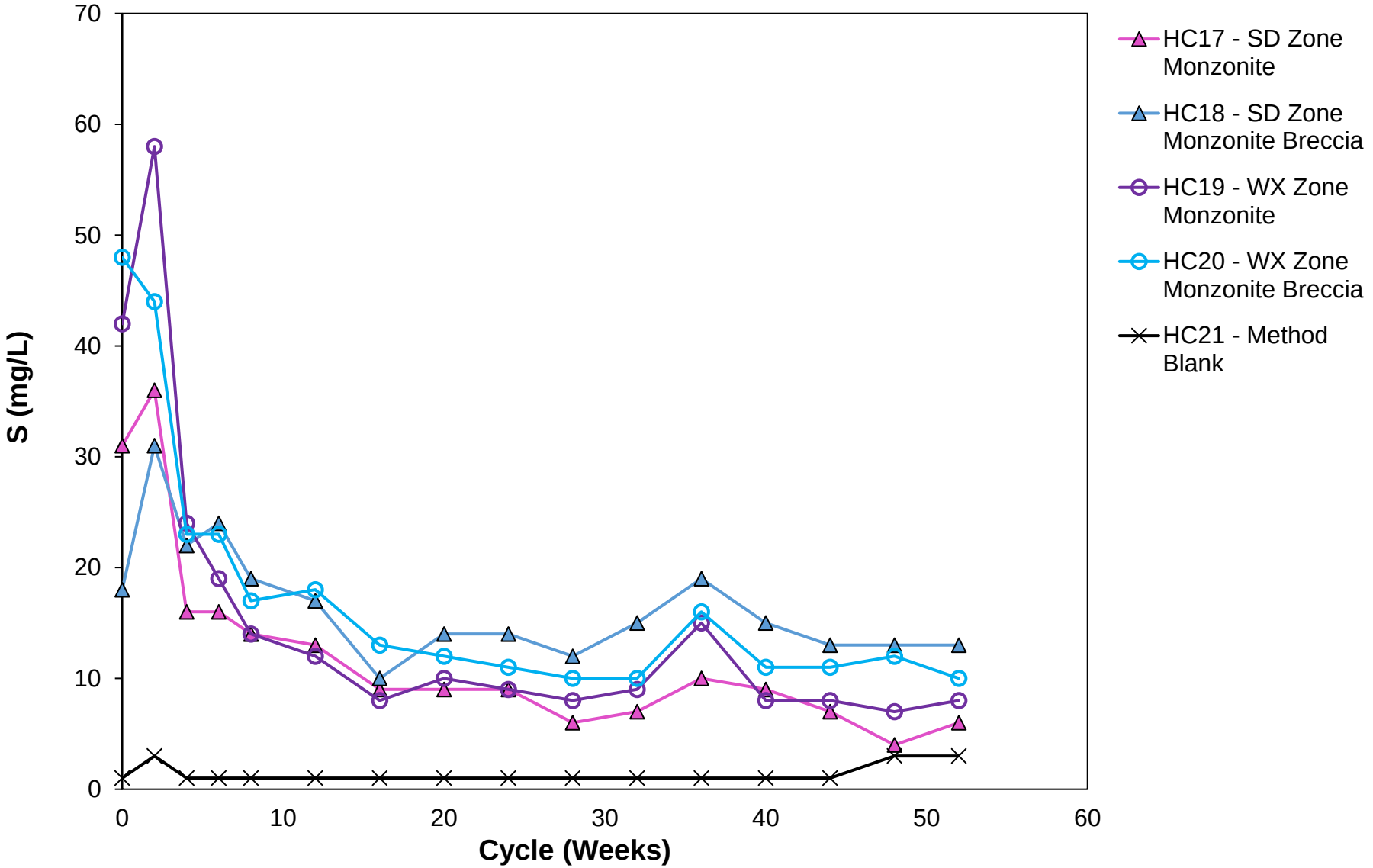
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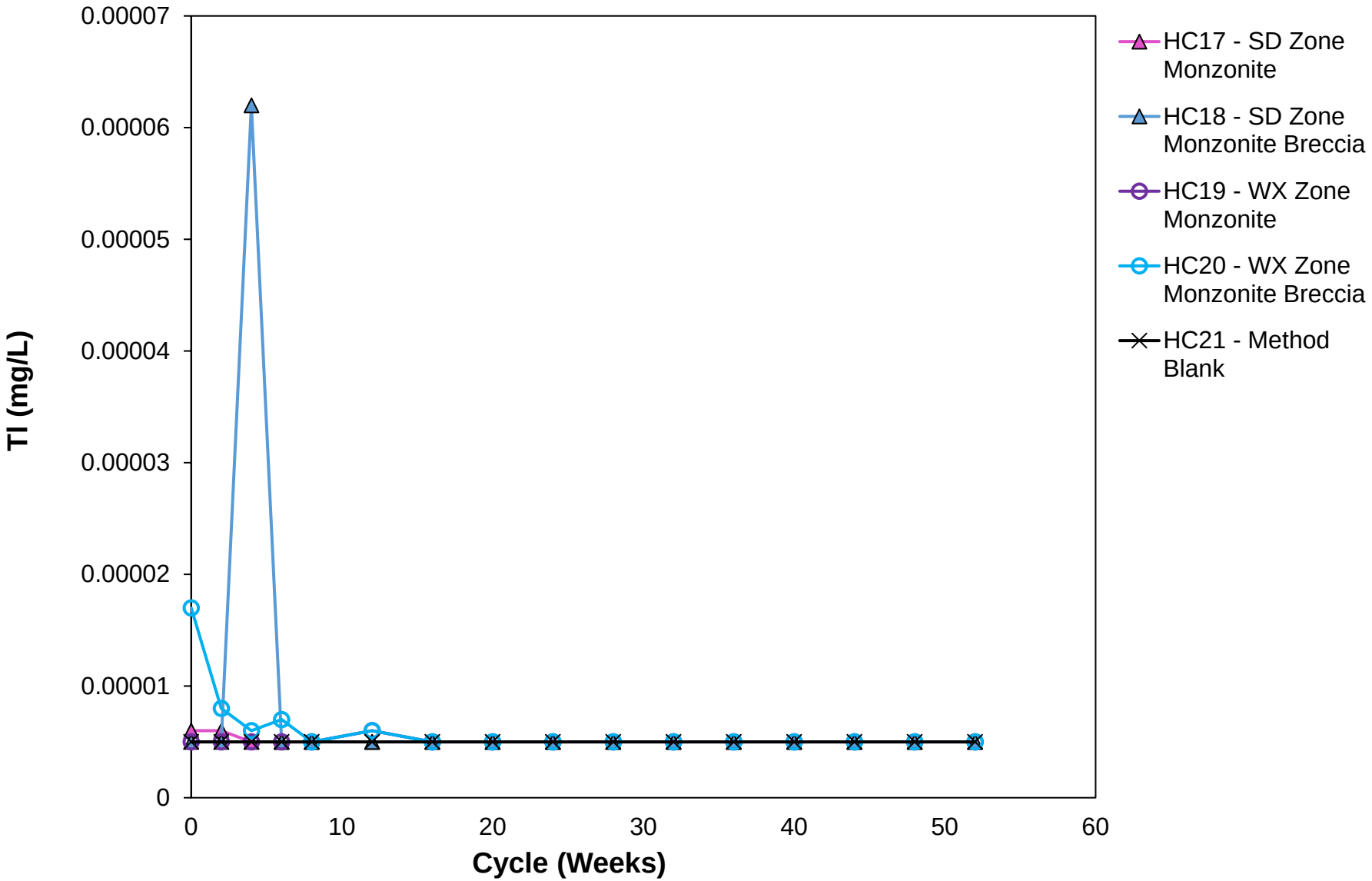
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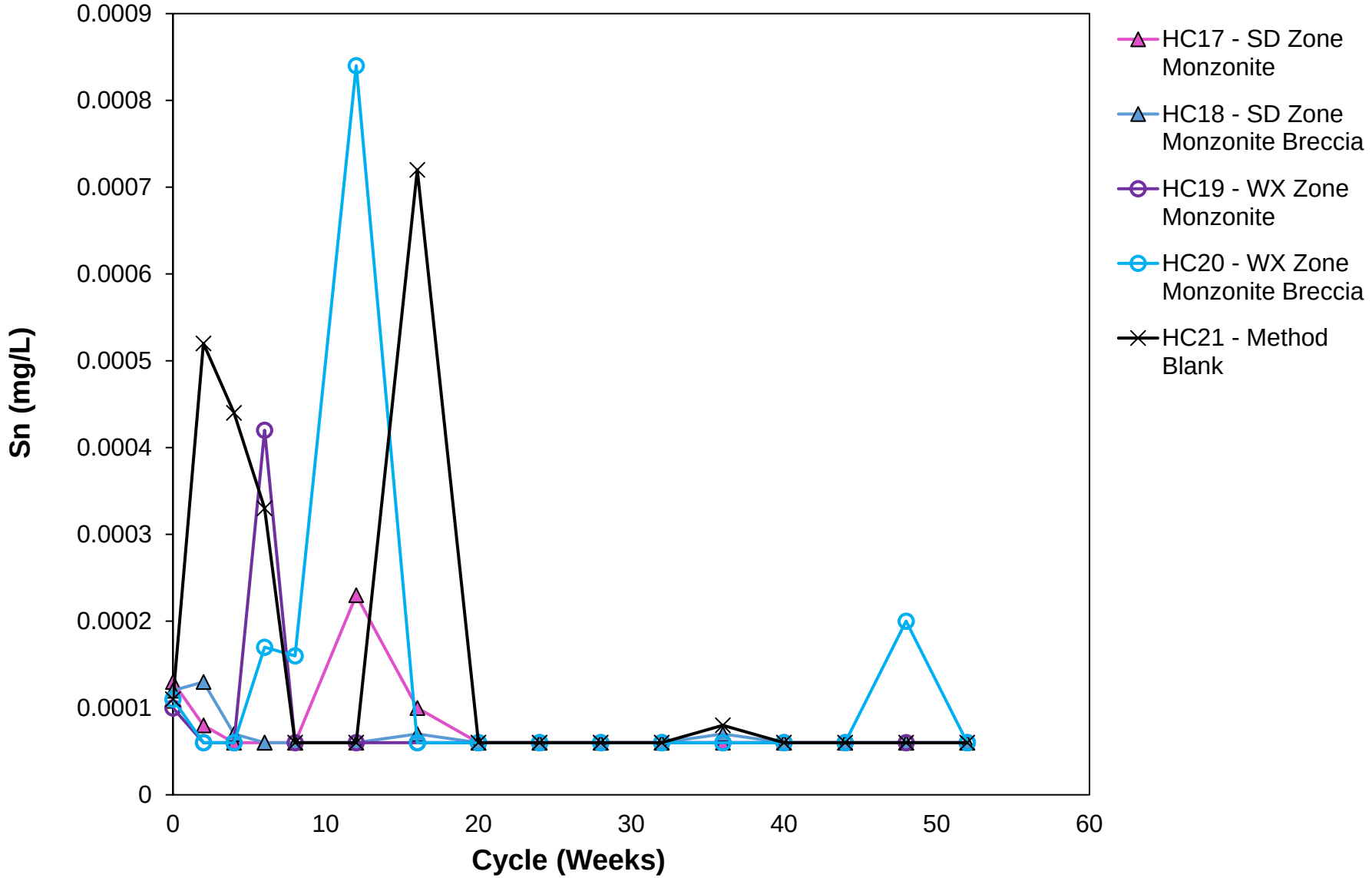
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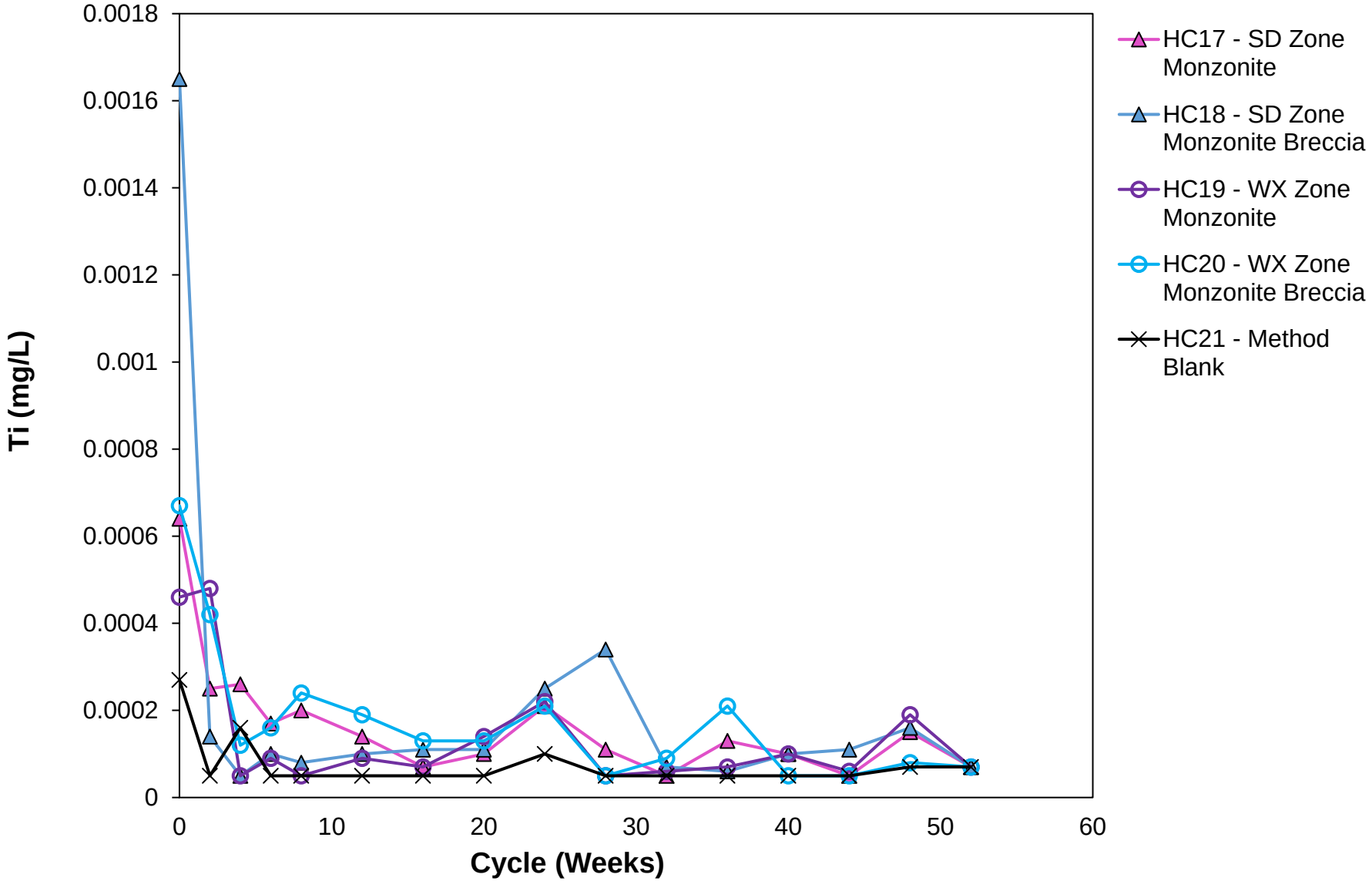
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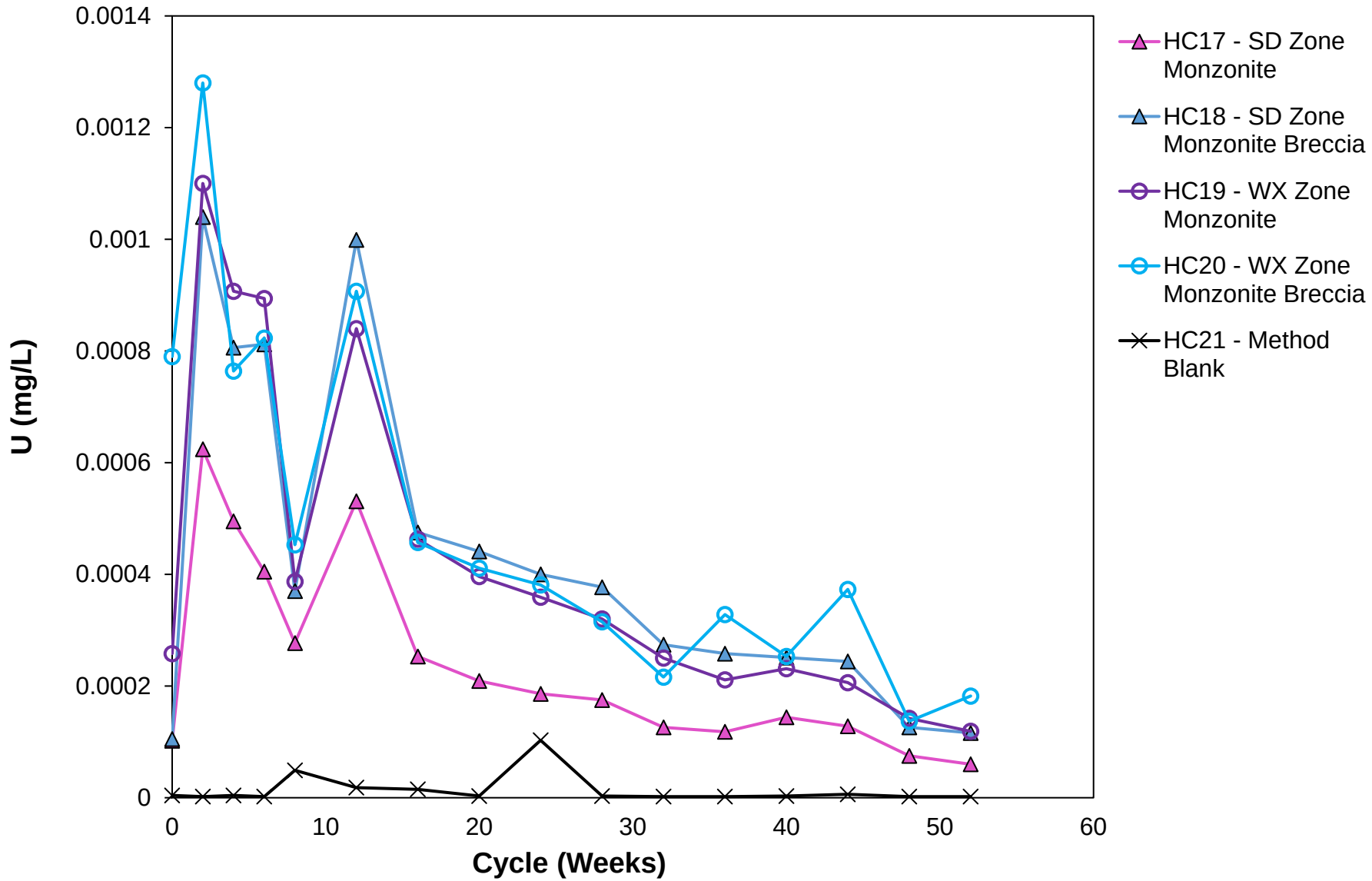
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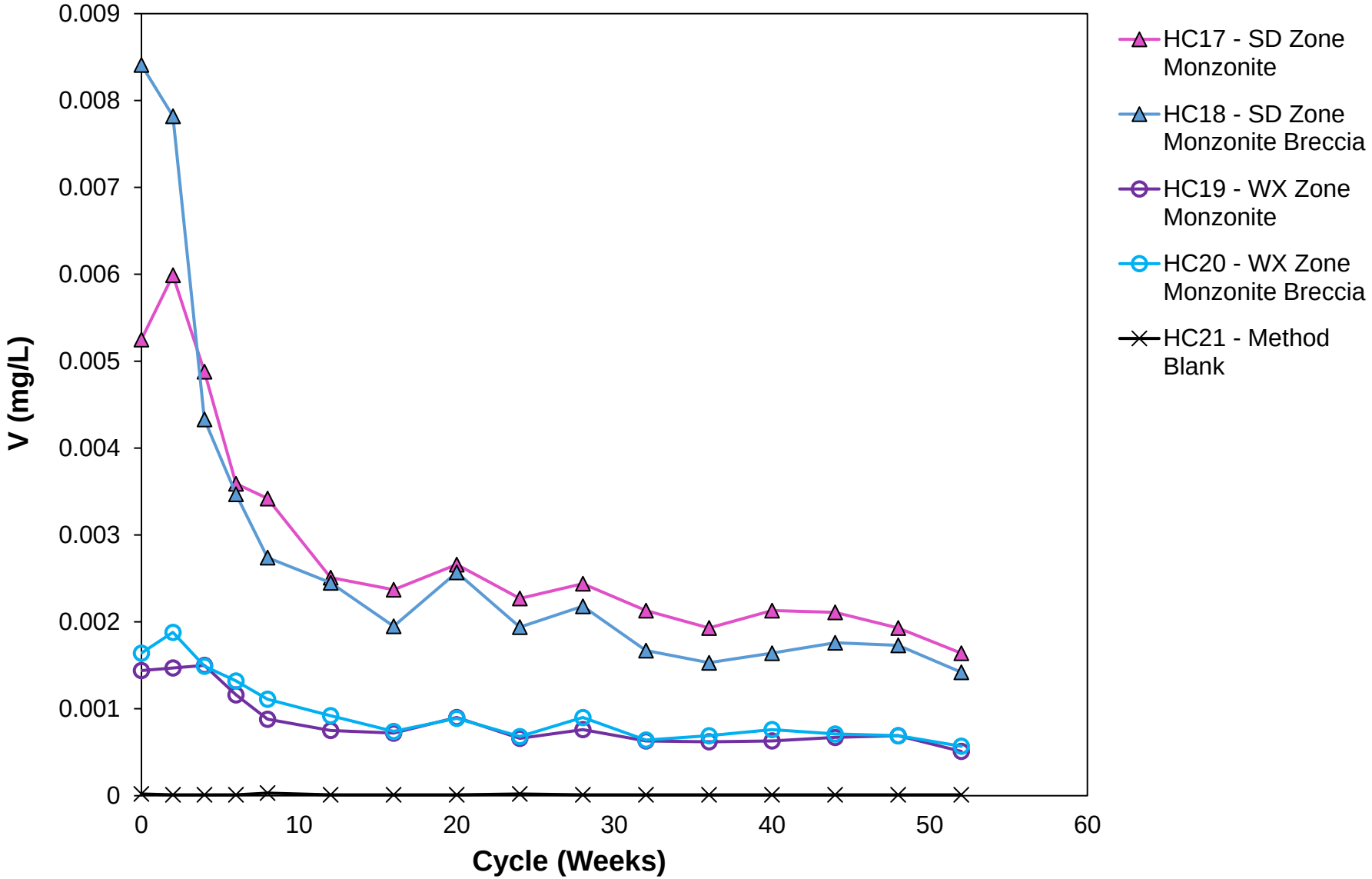
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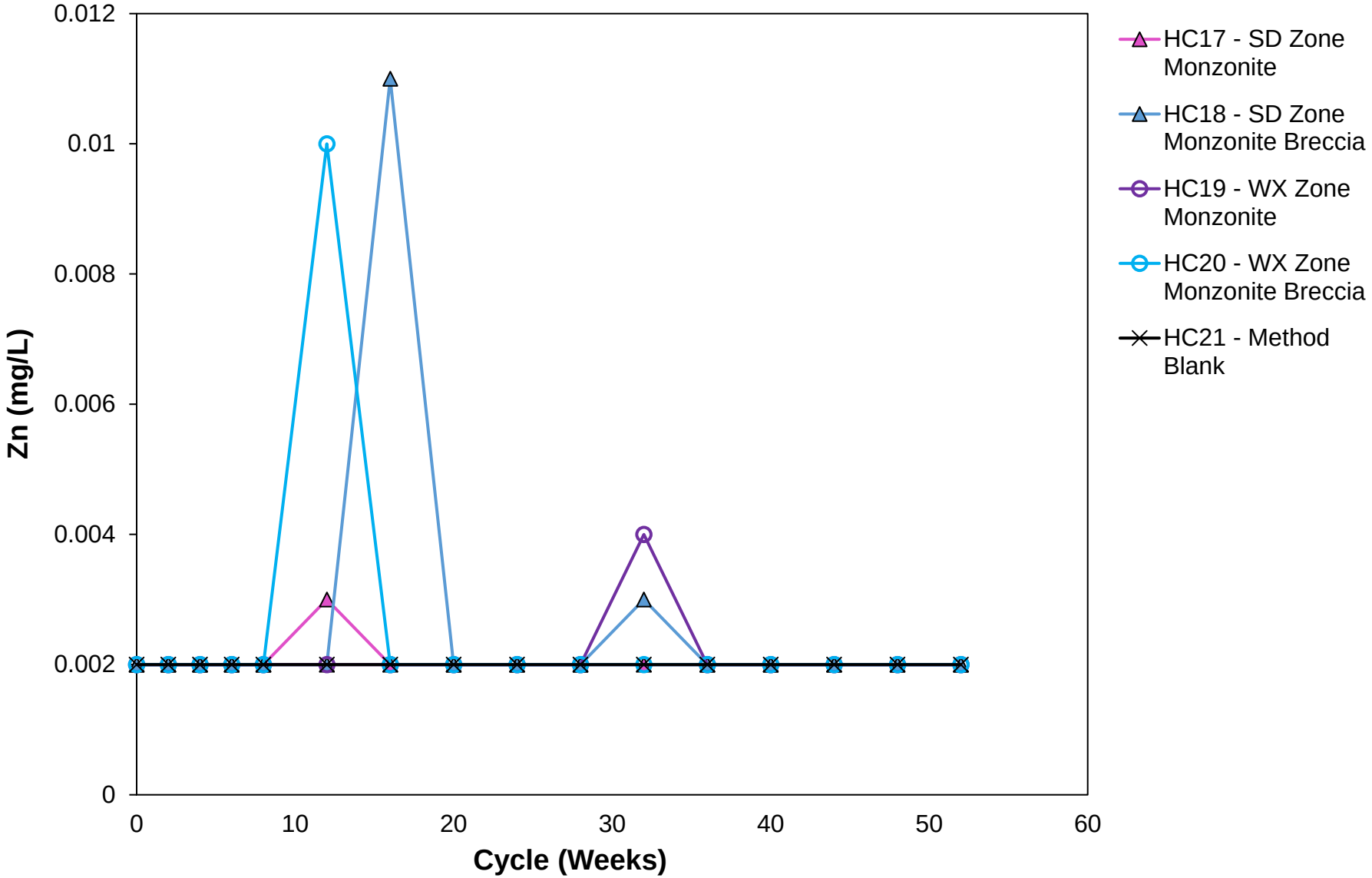
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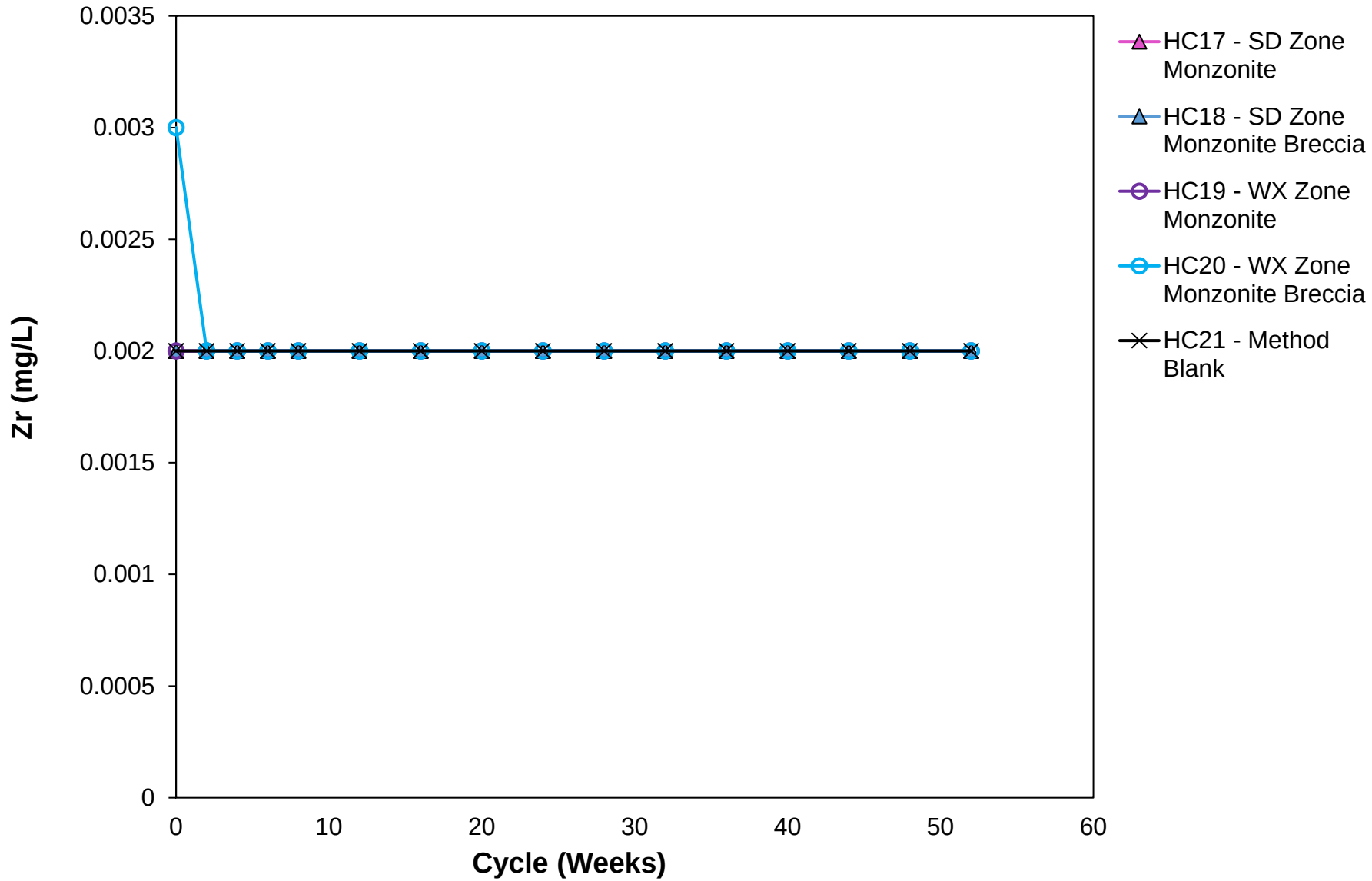
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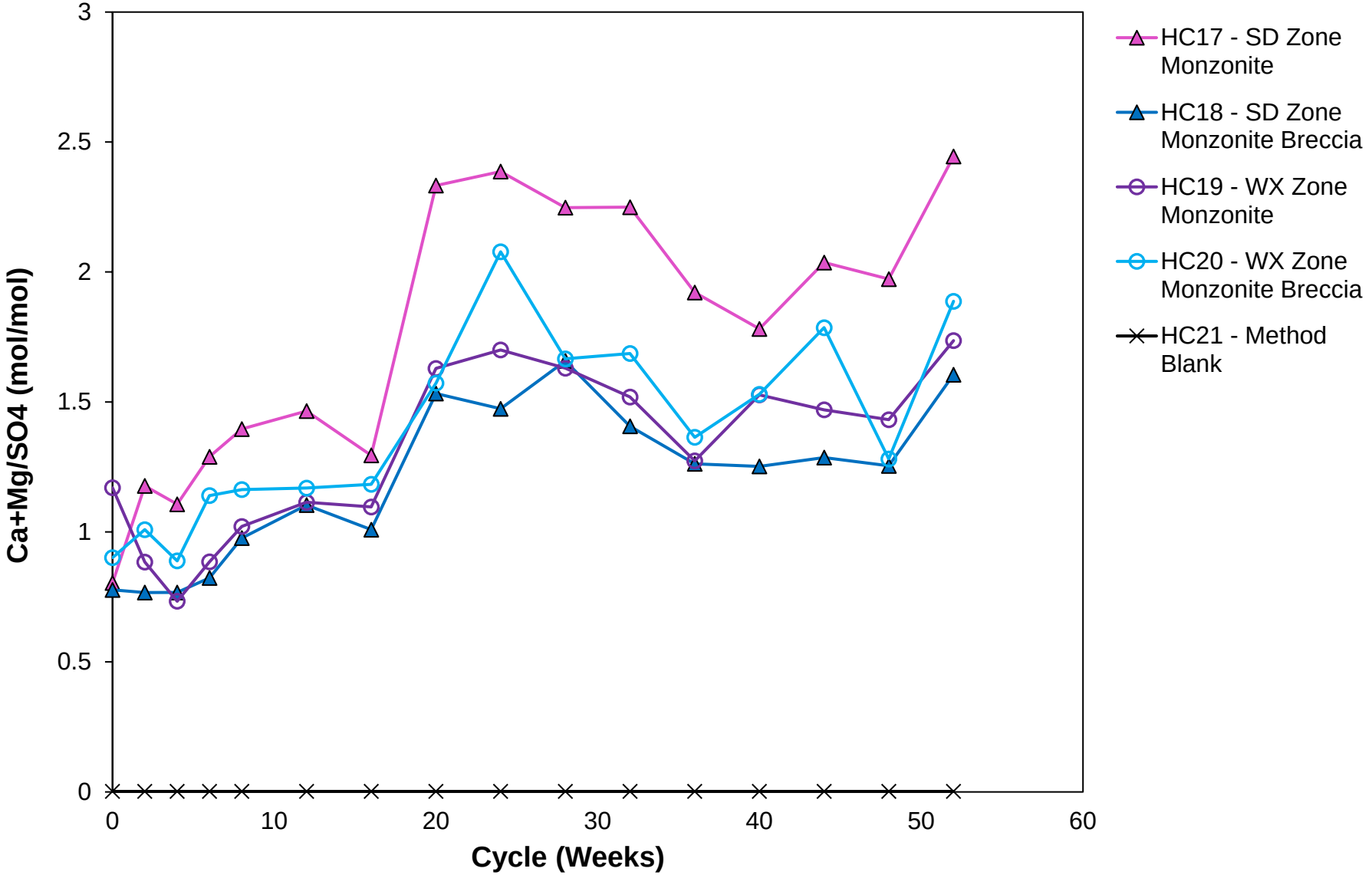
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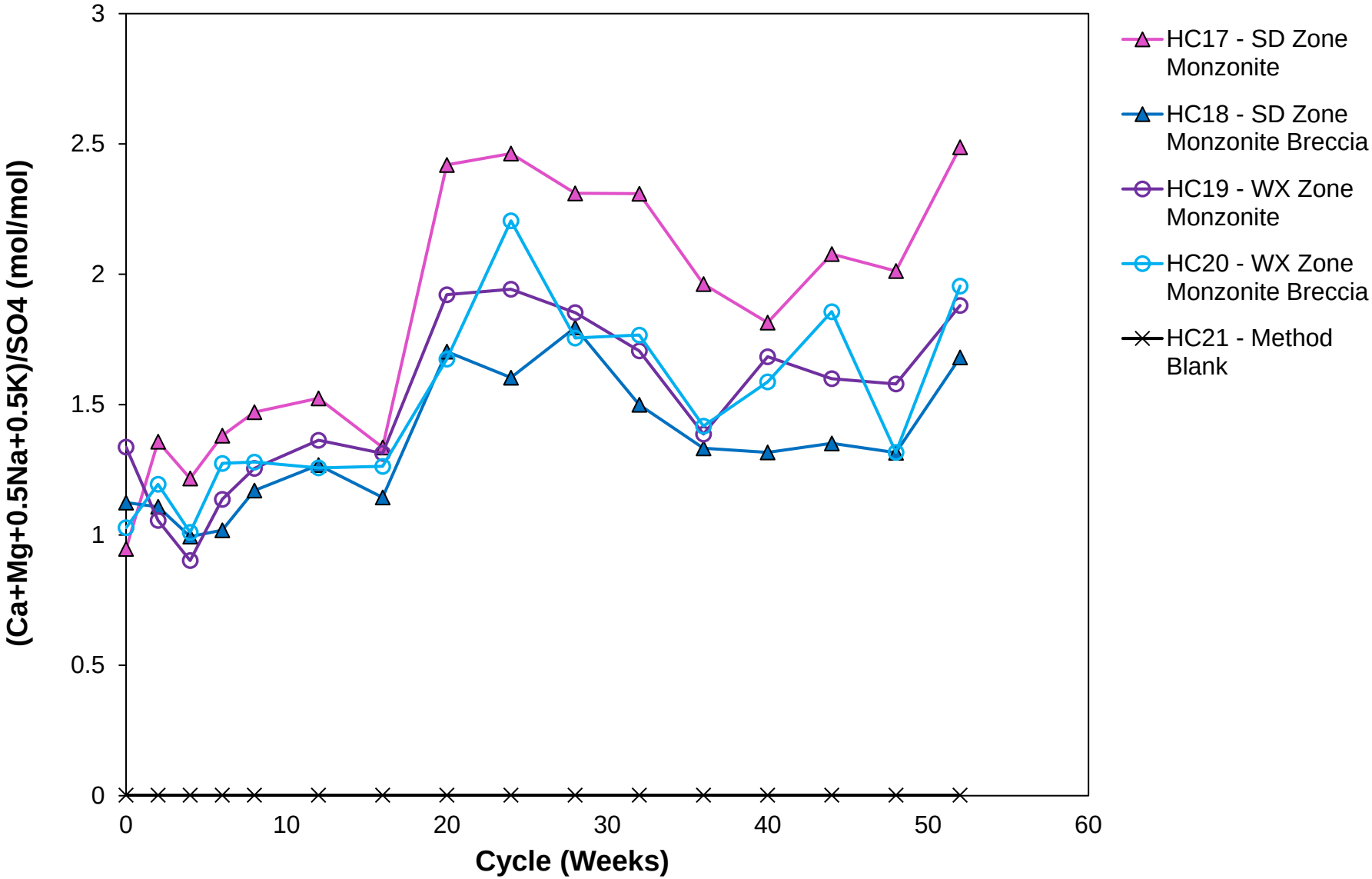
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APPENDIX 5-2: Water Infrastructure Design Report

TECHNICAL MEMORANDUM

DATE May 23, 2024 **Reference No.** 23590671-072-TM-Rev0-31152

TO Matt O'Leary
Mount Polley Mining Corporation

CC Lee Nikl, Jesse Maddaloni, German Pizarro-Sala, and Andrew McIntosh

FROM Nasim Hossein and Don Kidd **EMAIL nasim.hosseini@wsp.com; don.kidd@wsp.com**

TAILINGS STORAGE FACILITY SURFACE WATER MANAGEMENT INFRASTRUCTURE PERMITTING DESIGN MEMORANDUM (974 M RAISE)– MOUNT POLLEY MINE

1.0 INTRODUCTION

The Mount Polley Mine (the Mine) is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. MPMC has retained WSP Canada Inc. (WSP) to complete the permit level design for the surface water management infrastructure of the tailings storage facility (TSF) to support raising the TSF to a crest elevation of 974 m at the Mount Polley Mine.

The Mine is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The Mount Polley Mine began production in 1997. The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length. The embankment is subdivided into three sections: the Main Embankment, Perimeter Embankment, and South Embankment. The TSF embankment for the Mount Polley Mine is planned to be raised for future operations from its currently permitted elevation of 970 m to 974 m (WSP 2024b).

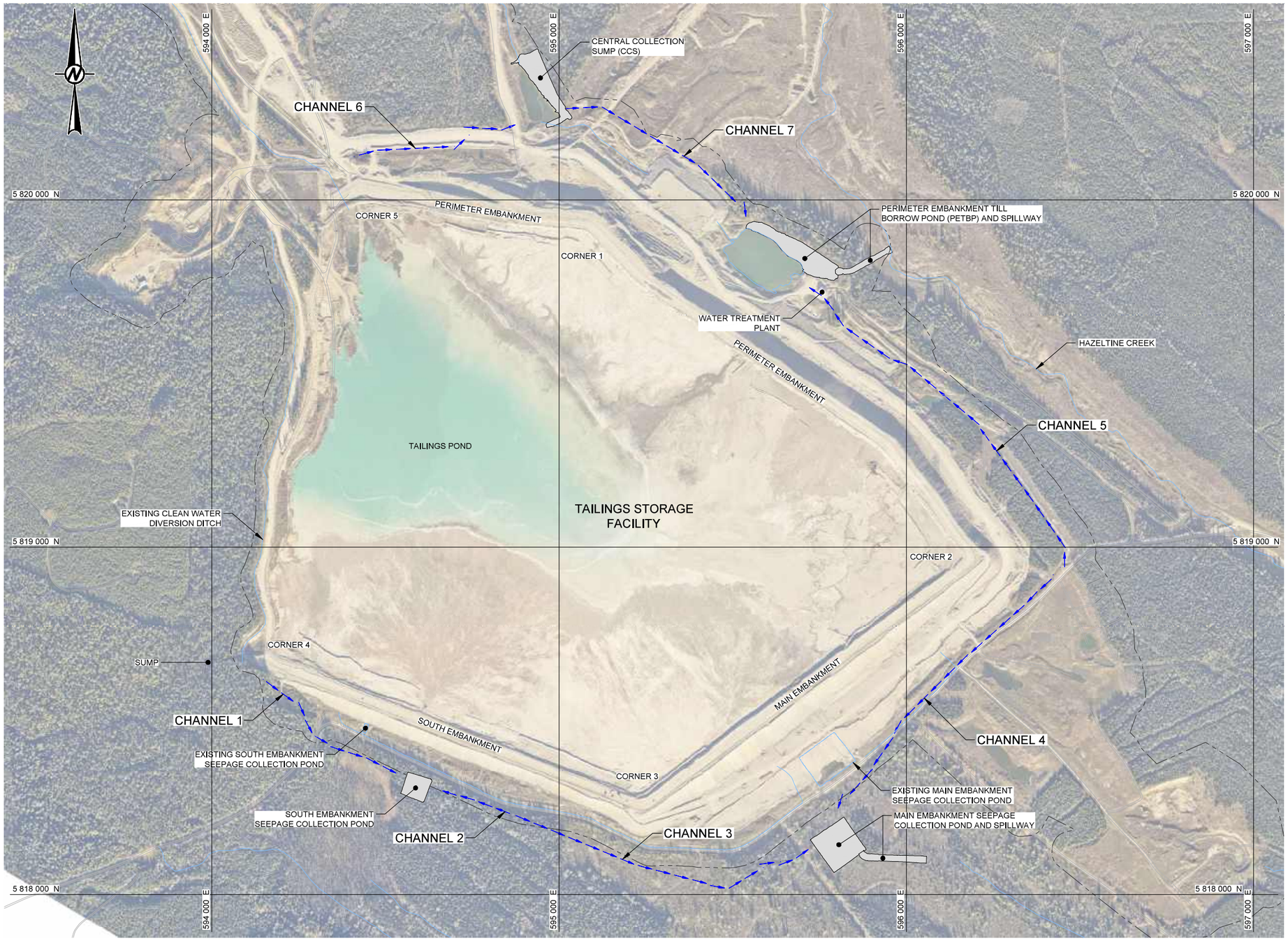
This technical memorandum and attached design drawing package (Attachment 1) present the permit level design of the TSF surface water management infrastructure to support raising the TSF to a crest elevation of 974 m.

2.0 BACKGROUND

Diversion and collection channels are currently in place at the project site around the TSF (Attachment 1, Drawing 03). The TSF 974 m raise design will partially or fully cover some of the existing surface collection and diversion structures around the TSF by the embankment raise to the 974 m elevation. Therefore, water management infrastructure designs (Figure 1) are required to support the TSF embankment raise design and permit amendment.

Permit level design includes the following water management infrastructure:

- Design of TSF seepage management infrastructure, including seepage and surface runoff collection channels listed in Table 1.
- Relocation of the South Embankment Seepage Collection Pond (SESCP) (Attachment 1, Drawing 09) and the Main Embankment Seepage Collection Pond (MESCP) (Attachment 1, Drawing 14).
- Channel 7 is the connection channel between the Central Collection Sump (CCS) and Perimeter Embankment Till Borrow Pond (PETBP) (Attachment 1 – Drawing 21).
- Extension of the PETBP (Attachment 1, Drawing 23).
- Extension of the CCS (Attachment 1, Drawing 26).



LEGEND

- WATER MANAGEMENT CHANNEL FLOW DIRECTION
- WATER MANAGEMENT INFRASTRUCTURE DESIGN
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE SHOWN IN TAILINGS GRID.
3. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 AERIAL PHOTO PROVIDED BY MPMC, FILE NAME: "231030-Lidar Ortho Reduced.jpg", FLOWN: 30 OCTOBER 2023, RECEIVED: 29 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

NOT FOR CONSTRUCTION

0 200 400
1:6,000 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
DESIGNED	N.H.
PREPARED	A.F.
REVIEWED	N.H.
APPROVED	D.A.K.

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
APPROXIMATE LOCATION OF CHANNELS 1 TO 7

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
23590671	31100/31152/072	0	01

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0 25 mm

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Table 1: Tailings Storage Facility Collection Channels

Channel ID	Receiving Collection Pond/Sump	Drawing Reference Number (Attachment 1)
Channel 1	SESCP	Drawings 05 & 06
Channel 2	SESCP	Drawings 07 & 08
Channel 3	MESCP	Drawings 10 & 11
Channel 4	MESCP	Drawings 12 & 13
Channel 5	PETBP	Drawings 17 & 18
Channel 6	CCS	Drawings 19 & 20
Channel 7	PETBP	Drawings 21 & 22

Notes: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; CCS = Central Collection Sump.

2.1 Design Inputs

According to *Environmental Management Act* Permit 11678 (EMA 2022), surface water structures "must be designed to convey all flows up to 1:10-year 24-hour storm event and must be designed to withstand all flows up to the 1:200-year 24-hour storm event, without significant damage". The collection ponds will be designed to store the inflow volume reporting to the ponds during a 1:10-year 24-hour storm event with a spillway designed to convey the 1:200-year 24-hour storm event. The water management system will be designed to convey peak flow rates during events up to and including the 1:200-year 24-hour storm event.

The design basis for the TSF water management system is included in Attachment 2.

2.2 Climate

This section summarizes the climate characteristics (precipitation, air temperature, and humidity) in the area of the Mine; further details can be found in the climate baseline update report (WSP 2022).

Local climate characterization for the site was completed using climatic data recorded at the Mine and nearby Environment and Climate Change Canada (ECCC) climate stations. The local climate stations included Mill Site Weather Station, Weather Station #1 (near mill), and Weather Station #2 (TSF). The ECCC climate stations included Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, and were selected due to their proximity to the Site, length of record, elevation range, and concurrent time-period with local site records.

A long-term precipitation time series representative of the climate conditions at the Mine was derived using the long-term data from the ECCC Likely station (1974 to 1993) and data from the three on-site climate stations with data recorded from 1995 to 2021 (WSP 2022). The data set was infilled using historical data from additional regional climate stations and adjusted for orographic effect. The Mine experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the site is estimated to be 612 mm with a standard deviation of 118 mm.

The estimated mean annual air temperature at the site varies between 1.7°C to 6.3°C, with a long-term mean of 3.9°C. The mean monthly temperature ranges from -6.7°C in January to 15.1°C in July. The historical daily maximum and minimum air temperatures were recorded at 38.1°C in June 2021 and -39.8°C in December 1996, respectively. The mean monthly air temperature usually becomes positive in April and negative in November. The mean annual relative humidity is 68.1%, and the monthly mean relative humidity values range from 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity indicate little variation from the median, which suggests that the site experiences relatively consistent relative humidity on a monthly basis from year to year.

2.3 Design Storm Depths

A frequency analysis was completed on annual maximum 24-hour rainfall depths from the long-term derived precipitation record (WSP 2022) to estimate design storm rainfall depths. 24-hour rainfall depths for select return periods are presented in Table 2.

Table 2: 24-hour Precipitation Depths for the Mount Polley Mine (1974 to 2021)

Return Period (yr)	24-hour Rainfall Depth (mm)[(a)]
2	33
10	47
25	54
100	64
200	69
1000	80

Source: WSP 2022.

(a) Log Pearson III distribution.

The largest runoff volumes are anticipated to be associated with extreme rainfall events occurring during freshet. The snowmelt is expected to occur between March and May with a relatively greater portion melting in April. Snowmelt estimates induced by a corresponding rainfall event (rain plus snowmelt event) were calculated for spring conditions (April) using the equation below (Dunne and Leopold 1978).

$$M_R = 1.42T_a + 2.5 + \frac{RT_aC_W}{L} + 0.0059T_au_2 \quad \text{(Equation 1)}$$

Where:

M_R = snowmelt in mm/d snow water equivalent

R = rainfall depth in mm for return period event duration t, averaged over the duration of the storm

T_a = average air temperature over the duration in °C

C_W = specific heat of water (equal to 1 calorie per gram Celsius [cal/g°C])

L = latent heat of fusion of ice equal to 80 calorie per gram (cal/g)

u_2 = wind speed in km/d

The input parameter values for Equation 1 are summarized in Table 3. The estimated spring maximum 24-hour snowmelt rates are presented in Table 4.

Table 3: Snowmelt Parameter Values

Parameter	Value	Rationale
R_t	See Table 2	snowmelt generated by rainfall events
T_a	3.7°C	average April air temperature (assumed snowmelt period)[(a)]
u_2	225 km/d (2.6 m/s)	average April wind speed[(b)]
C_W	1 cal/g/°C	assumed
L	80 cal/g	assumed

Notes: cal/g°C = calorie per gram Celsius; cal/g = calorie per gram.
(a) WSP 2022.
(b) Golder 2017.

Table 4: 24-Hour Rainfall, Snowmelt, and Rain Plus Snowmelt Depths

Return Period (Years)	Mean Daily Temperature in April (°C)	24-Hour Rainfall (mm)	24-Hour Snowmelt (mm)	24-Hour Rain Plus Snowmelt (mm)
10	3.7	47	14.8	61.8
200	3.7	69	15.9	84.9

2.4 Catchment Characteristics

The catchment delineation was adopted from the previous water management plan study (refer to Golder 2020). The catchment areas were further refined using LiDAR provided by MPMC (Fullerton 2024), TSF embankment and buttress design contours for the 974 and 987[1] m raises, and the alignment of the new water management infrastructure.

The catchment areas for the overall the Mount Polley Mine site are shown in Figure 2. The relevant catchment areas around the TSF embankment raise to 974 m that were refined and used to model runoff for the collection channels are shown in Figure 3 and provided in Table 5. Note that for the design of the ponds, only sloping catchments that generated gravity flow were considered.

[1] The TSF embankment and buttress design for the 987 m raise is currently in progress as of the preparation of this document.

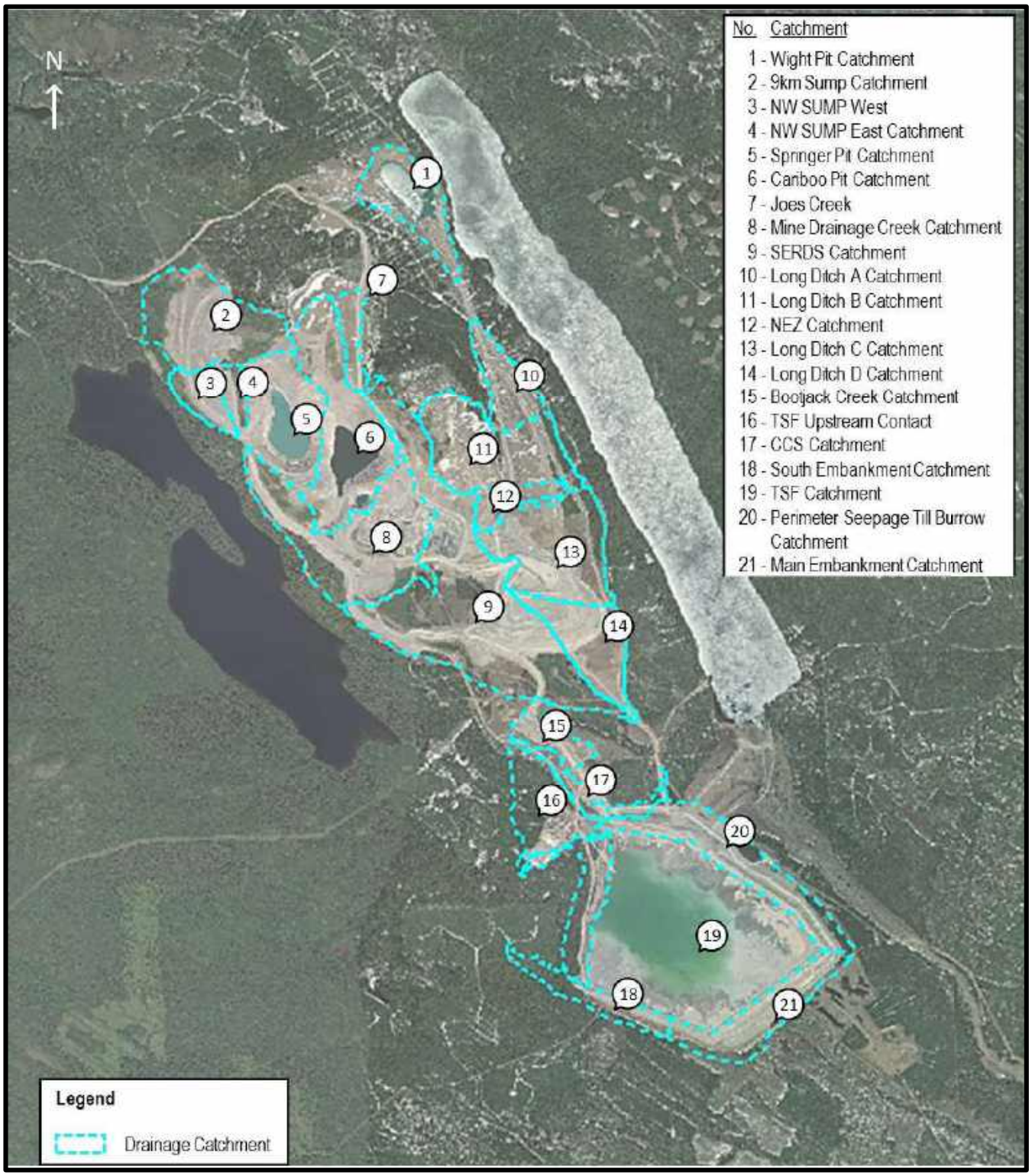


Figure 2: Catchment Areas



Figure 3: Catchment Areas Around the Tailings Storage Facility

Table 5: Catchment Areas

Collection Sump/Pond	Contributing Catchment[(a)]	Receiving Channel	Watershed Area (km^2)
SESCP	1, 2	Channels 1, 2	0.225
MESCP	3, 4, 5, 6, 7	Channels 3a, 3b, 4a, 4b	0.44
CCS	11, direct catchment area plus 2.4 km^2 from Long Ditch, 1.87 km^2 from SERDS ditch, and TSF upstream contact catchment	Channel 6	4.37
PETBP	8, 9, 10, direct catchment area plus catchment reporting to CCS	Channels 5, 6, 7	4.87

Notes: km^2 = square kilometres; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; CCS = Central Collection Sump; PETBP = Perimeter Embankment Till Borrow Pond.

(a) As shown on Figure 3.

2.5 Seepage and Drain Flow Rate to Collection Channels

Seepage analyses were undertaken to estimate flows through the upstream drain and seepage rates through the embankment and foundation at elevation 974 m to inform the design of the downstream water management infrastructure. Potential groundwater inflow rates to seepage collection ponds, seepage flow through the upstream drain, and seepage through the embankment and foundation are summarized in Table 6 (WSP 2024b). The seepage and drain inflows were considered in the design of the collection channels in Section 4.1.

Table 6: Estimated Seepage Inflow to Collection Ponds

Embankment	Flow through the Embankment and Foundation (m^3/s)[(a)]	Flow Through Upstream Drains at TSF Elevation 974m (m^3/s)[(a)]
South Embankment	4.3×10^{-3}	3.7×10^{-2}
Main Embankment	8.1×10^{-3}	3.8×10^{-2}
Perimeter Embankment	1.5×10^{-2}	5.1×10^{-2}
Perimeter Embankment at Corner 1	9.1×10^{-3}	2.3×10^{-2}

Notes: m^3/s = cubic metres per second; TSF = tailings storage facility.

Source: WSP 2024b.

(a) Seepage rate listed assumes the TSF pond against the embankment.

3.0 HYDROLOGIC ANALYSIS

A rainfall runoff model was implemented using the Hydrologic Engineering Center Hydrologic Modeling System (HEC-HMS) software, developed by the US Army Corps of Engineers (USACE 2022). This model was used to estimate the peak runoff flows from the catchments reporting to the surface water management infrastructure.

The rainfall component of the design event was distributed using the US Soil Conservation Service (SCS) Type II rainfall distribution (USDA 2009) (Attachment 2, Section 2.3). The time of concentration was estimated using the SCS TR-55 method (USDA 2009), which divides the longest flow path into sheet flow, shallow concentrated flow, natural channel flow, and constructed channel flow and considers a minimum time of concentration of 3.6 minutes. The lag time was estimated as 60% of the time of concentration. Catchment areas and corresponding time of concentration values are provided in Table 7.

The snowmelt depth was distributed evenly over a 12-hour period each day centred on the peak rainfall intensity of the events.

Catchment curve number (CN) values for different land types were provided in the design basis memorandum (Attachment 2). The weighted CN values to predict direct runoff are provided in Table 7. The wet antecedent moisture condition (AMC III) was considered in the modelling. A schematic flow diagram used for the design of the TSF collection channels and ponds is presented in Figure 4.

Table 7: Catchment Parameters

Catchment	Lag Time (min.)	Catchment Area Type	Weighted CN Value (AMC III)
Channel 1	8.7	TSF embankment and buttress	84
Channel 2	9.5	TSF embankment and buttress	84
Channel 3a[(a)]	8.9	TSF embankment and buttress	84
Channel 3b[(a)]	8.3	TSF embankment and buttress	84
Channel 4a[(b)]	8.6	TSF embankment and buttress	84
Channel 4b[(b)]	10.2	TSF embankment and buttress	84
Channel 5	15.2	TSF embankment and buttress	84
Channel 6	7.6	TSF embankment and buttress	84
Channel 7	3.6–5.6	TSF embankment and buttress	84
Long Ditch[(c)]	17.4–45.8	waste rock, disturbed, haul road, and undisturbed[(d)]	84
SERDS ditch[(c)]	35.3	waste rock, disturbed areas, haul road, mill site, and undisturbed areas[(d)]	84
TSF upstream contact[(c)]	11.4	undisturbed and disturbed areas	78
CCS direct catchment	9.7	disturbed areas, haul road, and undisturbed areas[(d)]	81
Perimeter Embankment	14.5	waste rock, disturbed areas, haul road, and undisturbed areas[(d)]	86
TSF upstream non-contact	15.2	undisturbed and disturbed areas	74

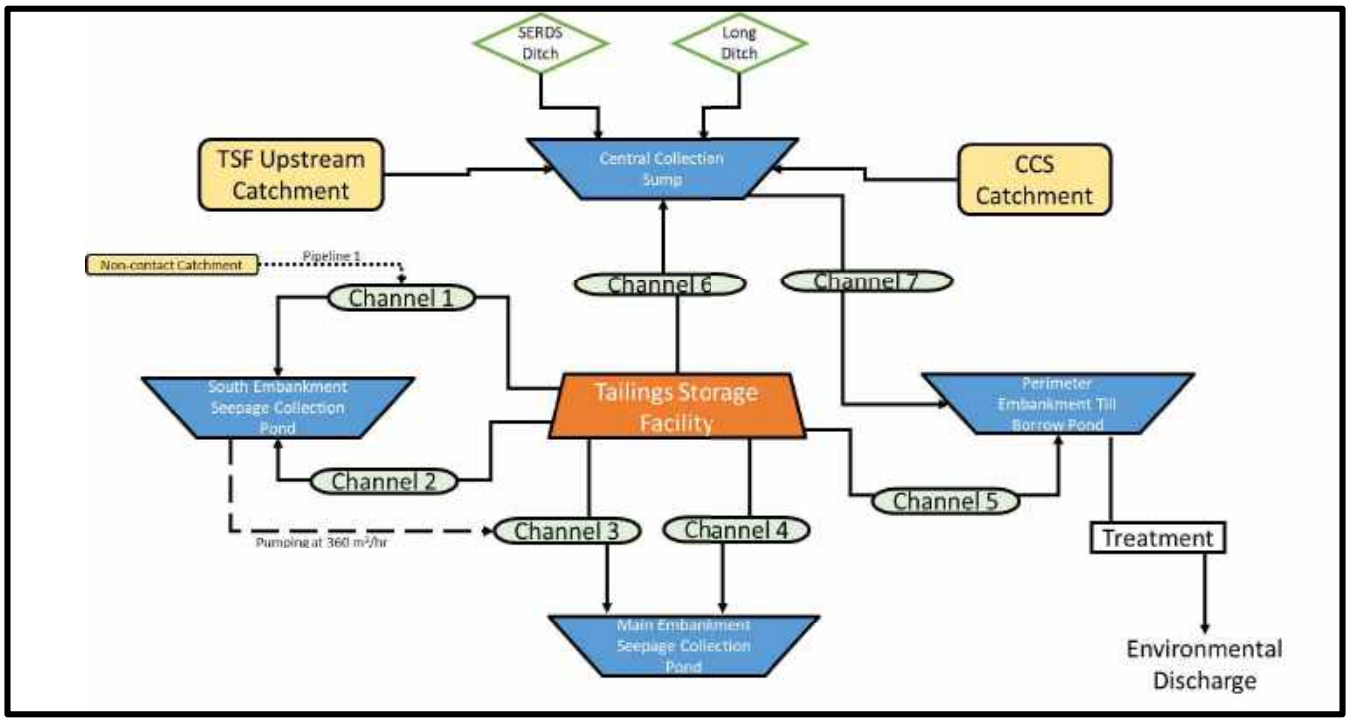
Notes: CN = curve number; AMC III = antecedent moisture condition III; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site; CCS = Central Collection Sump.

(a) Channel 3 includes channels 3a and 3b for design discharge analysis purposes.

(b) Channel 4 includes channels 4a and 4b for design discharge analysis purposes.

(c) These catchments report to CCS.

(d) Source: Golder 2016a.



Notes: TSF = tailings storage facility; SERDS = Southeast Rock Disposal Site; CCS = Central Collection Sump.

Figure 4: Flow Diagram – Tailings Storage Facility Collection Channels

The estimated peak flows for the channels resulting from the 24-hour 1:200-year rain plus snowmelt event that includes seepage flow from the TSF and pumped flow from other ponds are provided in Table 8. The estimated peak runoff inflows and volumes, from the 24-hour 1:10-year and 1:200-year rain plus snowmelt events to the SESCP, MESCP, CCS, and PETBP are provided in Table 9. Discharge from the Long Ditch and the SERDS Ditch to the CCS is limited by their conveyance capacity (3.5 cubic metres per second [m^3/s] and 2.9 m^3/s, respectively [Golder 2016b and 2016c]). These peak flows were used in the design as peak discharges to the CCS during a 1:200-year event.

Table 8: Estimated Peak Flow in Channels

Channel	Peak Flow[a] (m^3/s) (1:200-year 24-hr rain plus snowmelt)
Channel 1	1.8
Channel 2	0.7
Channel 3a[b]	0.9
Channel 3b[b]	2.7
Channel 4a[c]	1.5
Channel 4b[c]	3.1
Channel 5	2.7
Channel 6	1.3
Channel 7	10.1

(a) Peak flows include runoff, seepage flow from the TSF and pumped flow from other ponds.
(b) Channel 3 includes channels 3a and 3b for design discharge analysis purposes.
(c) Channel 4 includes channels 4a and 4b for design discharge analysis purposes.

Table 9: Estimated Runoff Inflow Rate and Volume to South and Main Embankment Seepage Collection Ponds, Central Collection Sump, and Perimeter Embankment Till Borrow Pond

Pond/Sump	Runoff Inflow Volume (1000 m^3)		Peak Runoff Inflow Rate (m^3/s)[a]	
	1:10-year	1:200-year	1:10-year	1:200-year
SESCP	4.30	7.32	0.34	0.58
MESCP[b]	15.78	26.71	1.25	2.13
CCS	115.5	168.5	10.0	13.8
PETBP	128.3	188.8	8.4	12.6

Notes: m^3/s = cubic metres per second; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; CCS = Central Collection Sump; PETBP = Perimeter Embankment Till Borrow Pond.

(a)Peak flows include direct precipitation to ponds.

(b) Estimated runoff and volume include contingency for extension of catchment reporting to Channel 4 as per potential elevation 987 m tailing storage facility embankment raise.

4.0 HYDRAULIC AND CIVIL DESIGN

This section describes the TSF surface water management infrastructure design. The estimated peak design flows used in the design are described in Section 3.0.

4.1 Channels

The collection channels were sized to convey the peak flow generated from the 1:200-year 24-hour storm event, as well as any seepage/drain flow plus any pumped flow from other ponds if applicable. The seepage flow rates are presented in Section 2.5. The channels were designed to include a minimum 0.3 metre freeboard.

The channels were sized assuming uniform flow conditions using the Manning's equation and accounting for superelevation in the curves. The Manning's coefficient values used for the channels are presented in Table 10. Manning's values for capacity were used in Manning's equation to size the channel for conveyance capacity. Manning's values for stability were used to verify the stability of the channel lining during design flow conditions; the maximum channel longitudinal slope was used for stability verification. Superelevation for each curve along the channels was estimated using the US Army Corps of Engineers (USACE 1972) method and results from the Manning's equation. The estimated superelevation was minimal, eliminating the need for any local increase in channel depth. For erosion protection of the channels, the riprap class was selected considering the maximum permissible velocity of the riprap provided in Table 11.

Table 10: Manning's Values for Channel Materials

Material	D_{50}	Manning's Values for Capacity	Manning's Values for Stability
Plastic	-	0.012	0.010
Gravel, uniform section, clean[(a)]	-	0.030	0.022
Riprap class 10 kg	200	0.038	0.034
Riprap class 25 kg	270	0.039	0.035
Riprap class 50 kg	340	0.042	0.037
Riprap class 100 kg	425	0.044	0.039
Riprap class 280 kg	610	0.046	0.042
Riprap class 1 000 kg	915	0.049	0.044
Grouted riprap	380	0.040	0.028

Notes: - = not applicable; D_{50} = median particle size.
(a) Manning's n for channels (Chow 1959).

Table 11: Maximum Permissible Velocity for Riprap and Plastic

Riprap Class	Velocity (m/s)
Plastic	5.0
Gravel, uniform section, clean	1.0
10 kg	2.7
25 kg	3.1
50 kg	3.5
100 kg	3.9
280 kg	4.5
Riprap class 1 000 kg	5.0
Grouted riprap	refer to Figure 7

Notes: m/s = metres per second.
Source: BC MOTI (2020) – values rounded.

Each of the TSF surface water management infrastructure channels is described below. The channel dimensions, normal flow depth, and normal flow velocity for each channel are provided in Table 12.

Table 12: Collection Channels Design Summary

Channel (Approximate Station PVI [m])	Total Flow (m^3/s)[(b)]	Base Width (m)	Channel Depth) (m)	Side Slopes (xH:1V)	Channel Slope (%)	Flow Depth (m)	Flow Velocity (m/s)	Material
Channel 1 (0+080 to 0+370)	1.8	1.0	1.0	2.0	12.00	0.3	3.4	50 kg class riprap
Channel 1 (0+370 to 0+614)	1.8	3.0	0.8	2.0	0.40	0.5	1.0	10 kg class riprap
Channel 2 (0+000 to 0+190)	0.7	1.0	1.0	2.0	0.3	0.5	1.0	compacted earth
Channel 2 (0+190 to 0+263)	0.7	1.0	1.0	2.0	2.0	0.3	1.4	10 kg class riprap
Channel 3 (0+000 to 0+400)	0.9	1.0	1.0	2.0	0.5–2.3	0.5	1.6	10 kg class riprap
Channel 3 (0+400 to 0+860)	2.7	1.0	1.0	2.0	5.0	0.5	2.7	25 kg class riprap
Channel 3 (0+860 to 0+928)	2.7	1.0	1.2	2.0	0.5	0.9	1.2	10 kg class riprap
Channel 4 (0+000 to 0+510)	1.5	1.0	1.0	2.0	0.50–4.3	0.7	2.2	10 kg class riprap
Channel 4 (0+510 to 0+630)	3.1	1.0	1.0	2.0	7.40	0.5	3.3	50 kg class riprap
Channel 4 (0+670 to 0+957)	3.1	1.0	1.3	2.0	0.5–2.40	0.9	2.3	10 kg class riprap
Channel 5 (0+000 to 0+810 and 0+967 to 1+153)	2.7	1.0	1.2	2.0	0.5–2.0	0.9	2.1	10 kg class riprap
Channel 6 (0+000 to 0+230 and 0+375 to 0+458)	1.3	1.0	1.0	2.0	2.5-5.0%	0.4	2.4	10 kg Class Riprap
Channel 6 (0+230 to 0+310)	1.3	1.0	1.0	2.0	8.0%	0.3	2.8	25 kg Class Riprap
Channel 7 (0+018 to 0+060 and 0+190 to 0+230)	10.1	6.0	1.5	2.0	10.00	0.4	3.9	100 kg class riprap
Channel 7 (0+060 to 0+146 and 0+172 to 0+190)	10.1	6.0	1.9	2.0	0.50	0.9	1.6	10 kg class riprap
Channel 7 (0+230 to 0+689)	10.1	6.0	1.6	2.0	0.10	1.2	1.2[(c)]	compacted earth
Channel 7 (0+689 to 0+692)	10.1	10.0	0.6	2.0	17.00	0.3	4.0	100 kg class riprap

Notes: PVI = point of vertical intersection; m^3/s = cubic metres per second.

(a) Total flow is the peak flow from storm events (presented in Table 8) plus the seepage flows.

(b) This is a temporary channel and some extension of erosion will be acceptable.

Channel 1—Channel 1 collects runoff from the embankment and the natural catchment (catchment 1 in Figure 3) and drains to SESCP. A pipeline (pipeline 1) is required to convey flow from the depression area to Channel 1. Channel 1 has a base width that varies between 1.0 m to 3.0 m with 2H:1V side slopes and channel depth that varies between 0.8 to 1.0 m. The design for pipeline 1 is described in Section 4.2 and Table 15.

Channel 2—Channel 2 collects runoff from the embankment and drains to SESCP. Channel 2 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.0 m.

Channel 3—Channel 3 collects runoff from the embankment and drains to MESCP. In addition, pumping from the SESCP at a rate of 360 m^3/hr is to be conveyed to the MESCP by Channel 3 (Attachment 2). Channel 3 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.0 to 1.2 m.

Channel 4—Channel 4 collects runoff from the embankment and drains to MESCP. The existing Channel 4 is to be maintained until future phases of TMF development (or site development). Channel 4 has a base width of 1.0 m with 2H:1V side slopes and channel depth varies between 1.0 to 1.3 m.

Channel 5—Channel 5 collects runoff from the embankment and drains to PETBP. Channel 5 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.2 m.

Channel 6—Channel 6 collects runoff from the embankment and drains to CCS Pond. Channel 6 has a base width of 1.0 m with 2H:1V side slopes and channel depth of 1.0 m.

Channel 7—Channel 7 conveys discharge from the CCS to the PETBP and collects runoff from the perimeter embankment. Culvert 7 will be located approximately 130 m downstream from the CCS discharge point to convey discharge from the pond. The channel is designed to convey discharge from a 1:200-year 24-hour storm event to PETBP through culvert 7 plus runoff from catchment 10 (Figure 3) generated from a 1:200-year 24-hour storm event with a minimum of 0.3 m freeboard. Channel 7 has a base width of 6.0 m with 2H:1V side slopes and channel depth of 0.7 to 1.9 m.

A HEC-RAS 2D model was developed to simulate discharge of the design flow and flow depth from a 1:10-year 24-hour storm event and to confirm overtopping does not occur during the storm event. The HEC-RAS 2D model was developed using terrain generated by incorporating the proposed channel 7 design to LiDAR provided by MPMC (February 2024) and covers downstream of the CCS discharge point extending to approximately 200 m downstream of culvert 7. Culvert 7 is represented by a 2D connection structure as indicated in Figure 5; its characteristics are described in Table 15. The analysis indicates that discharge from a 1:200-year 24-hour storm event (9.58 m^3/s) is sufficiently conveyed without overtopping. The maximum flow depth within the model boundary was 1.7 m and occurs immediately upstream of culvert 7 (Figure 6).



Figure 5: Extent of Simulated 1:200 Year 24-Hour Storm Event for Channel 7

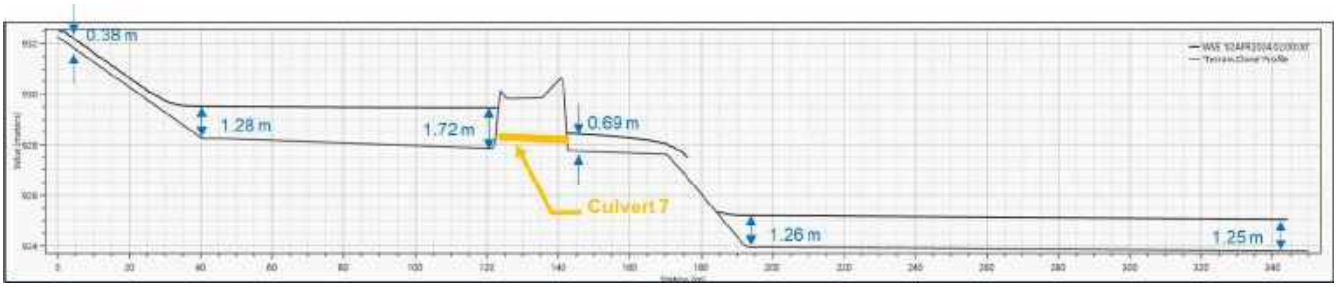
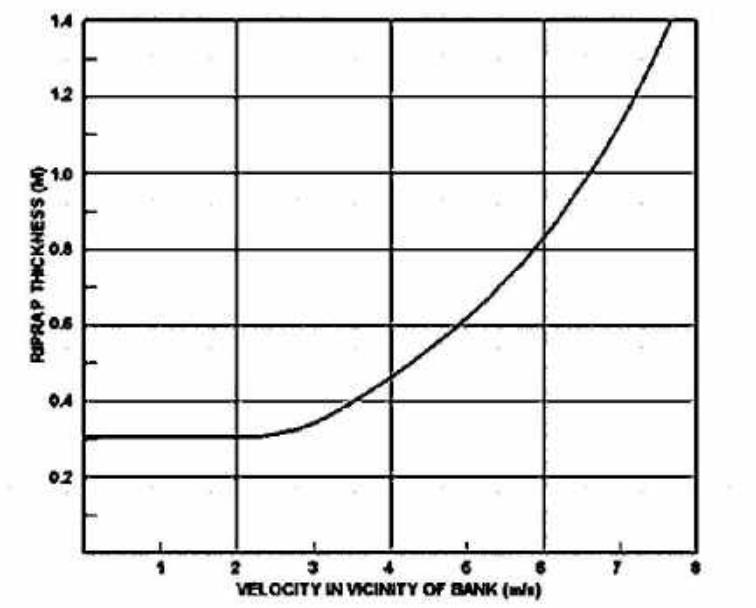


Figure 6: Channel 7 Simulated 1:200 Year 24-Hour Storm Event Water Surface Profile

4.1.1 Discharge Chute

Collection channels will require a steep (approximately 50% longitudinal slope) outfall structure for discharging to the collection ponds. Grouted riprap was selected for the lining material for erosion protection. The required riprap thicknesses were determined based on the peak flow velocity during a 1:200-year 24-hour storm event (Figure 7) and are summarized in Table 13.



Source: HEC 11 2024.

Figure 7: Required Blanket Thickness as a Function of Flow Velocity

Table 13: Discharge Chute Design Summary

Chute	Base Width (m)	Channel Depth (m)	Longitudinal Slope (%)	Flow Velocity (m/s)	Grouted Riprap Thickness (mm)	Grout Penetration Thickness (mm)
1	3.0	0.5	50	5.2	700	200
2	1.0	0.5	50	5.0	600	200
3	2.0	0.5	50	6.2	900	200
4	3.0	0.5	50	6.5	1000	200
5	2.5	0.5	50	6.5	1000	200
6	1.0	0.6	20	4.5	600	200
7	11.0	0.5	50	6.9	1,100	200

4.1.2 Energy Dissipation Structure

Energy dissipation structures (stilling basin) will be required for channels 6 and 7 at the hydraulic jump. A hydraulic jump forms during the conversion of kinetic energy to potential energy where the channel slope decreases significantly and leads to a sudden change in flow depth and velocity.

The stilling basins were sized using results from the Manning's equation and three hydraulic design methods from the Department of the Interior Bureau of Reclamation (USBR 1984; USACE 1977) and the Prairie Farm Rehabilitation Administration (PFRA 1979).

The stilling basins will be constructed with a longitudinal slope of 0%. Consistent with the channel design inputs (Attachment 2), 0.3 m of freeboard was accounted for in defining the required depth of the energy dissipation structures. The design dimensions of the stilling basins are provided in Table 14.

Table 14: Stilling Basin Dimensions

Channel	Upstream Slope%	Downstream Slope%	Flow Velocity V_1 (m/s)	Basin Depth (m)	Basin Length (m)
Channel 6	16.7%	1%	3.5	1.1	1.0
Channel 7	10.0%	0.1%	3.9	1.0	6.0

As a result, channel depth is increased to 1.4 m at station 2+507 of channel 7 for a distance of 5.9 m to maintain a minimum freeboard of 0.3 m. The freeboard requirement at station 2+209 of channel 7 is already satisfied by the 1.8 m deep channel; thus, no additional channel depth is required.

4.2 Culverts/Pipelines

Culverts will be placed along the channels at road crossings and a pipeline will be placed to convey runoff from the western portion of catchment 18 (Figure 2) that collects in a natural depression to channel 1. Culverts and pipelines were sized using the HY-8 design software (USDOT 2022), which is a 1D steady-state hydraulic modelling program developed by the U.S. Department of Transportation, Federal Highway Administration. Culverts and pipelines were sized to convey the 1:200-year 24-hour storm event from the reporting catchment. A summary of the culvert designs is provided in Table 15 and a summary of the pipeline design is provided in Table 16. A typical cross-section and plan view of the culverts and the pipeline are provided in Attachment 1, Drawings 06, 13, 20, and 22.

Table 15. Culvert Design Summary

Culvert	Diameter (mm)	No. of Barrels	Material	Design Slope (%)	Design Flow (m^3/s)	Inlet Flow Depth (m)	Outlet Flow Velocity (m/s)
Channel 1 culvert	1000	2	corrugated steel	12.5	1.8	0.8	4.5[(a)]
Channel 4 culvert	1000	2	corrugated steel	5.8	1.5	0.8	3.2
Channel 6 culvert A (station 0+310 to 0+375)	800	2	corrugated steel	2.5	1.3	0.7	2.1
Channel 6 culvert B (station 0+470 to 0+501)	900	2	corrugated steel	0.5–33	1.32	0.7	1.8
Channel 7 culvert	1400	3	corrugated steel	0.5	9.6	1.8	2.9

Notes: m^3/s = cubic metres per second.

(a) Additional erosion protection measures required at the outlet to protect bedding.

Table 16: Pipeline Design Summary

Pipeline	Diameter (mm)	No. of Barrels	Material	Design Slope (%)	Design Flow (m^3/s)	Inlet Flow Depth (m)	Outlet Flow Velocity (m/s)
Pipeline 1	800	1	HDPE	1.0	0.61	0.7	2.9

Notes: m^3/s = cubic metres per second; HDPE = high-density poly ethylene.

Construction equipment on the site includes 789 (317,515 kg) and 785 (225,826 kg) mine haul trucks. A 2.0 metre cover depth is adopted for the culverts where conditions allow, based on experience with other mine sites with similar truck loading conditions. The minimum cover requirements were calculated using the methodology in the Corrugated Steel Pipe Institute handbook (CSPI 2007) and are summarized in Table 17. Pipeline 1 has a minimum cover of 0.3 metres as it will not be subjected to traffic loading.

Table 17: Culvert Cover

Culvert	Min. Cover Calculated (m)	Adopted Cover (m)
Channel 1 Culvert	0.6	2.0
Channel 4 Culvert	0.6	2.0
Channel 6 Culvert A	0.6	2.0
Channel 6 Culvert B	0.6	2.0
Channel 7 Culvert	0.9	2.0

4.3 Ponds

The SESCP and MESCP are required to be relocated, and the PETBP extended, to accommodate the TSF embankment 974 m raise footprint. The new ponds were designed to store the inflow generated from the 1:10-year 24-hour rain plus snowmelt event while allowing 0.5 m at the bottom for sediment storage. In addition, the design included 0.3 m of freeboard for the design storm event. The SESCP and MESCP locations were proposed outside the TSF 987 m extents as per MPMC request. The design inputs for collection ponds are provided in Attachment 2.

The inflow to the ponds includes the seepage and runoff that will be collected through the collection channels and the direct precipitation to the ponds. The water transfers between the collection channels and ponds are summarized below and a schematic flow diagram is provided in Figure 4 in Section 3.0.

SESCP—Surface water and seepage from the South Embankment will be directed to the pond through channels 1 and 2 (Attachment 1, Drawings 05 to 09). Currently, water from the pond is pumped to the MESCP at the pump capacity of 360 cubic metres per hour (m^3/h) and is conveyed by channel 3 (Donoso 2023). Dimensions for the SESCP are provided in Table 18.

MESCP—Seepage and runoff from the Main Embankment will be directed to the pond through channels 3a, 3b, 4a, and 4b (see Attachment 1, Drawings 10 to 16). Currently, water from the pond is being pumped to the TSF at the pump capacity of 360 m^3/h. Dimensions for the MESCP are provided in Table 18.

CCS and PETBP—Runoff and seepage from the Perimeter Embankment will be collected through channels 5, 6, and 7 (see Attachment 1, Drawings 17 to 26) in the PETBP. CCS receives contact water runoff from its direct catchment plus runoff from SERDS Ditch, Long Ditch, and TSF upstream catchment area via CCS (Attachment 1, Drawing 26; (Golder 2020)). The pond bottom elevation used in this study was taken from a previous Golder design study for the PETBP Spillway (Golder 2021). Dimensions for the PETBP are provided in Table 18

The SESCP and MESCP will be excavated in natural ground to a depth of 3 metres. It is noted that the ponds will receive groundwater flow underneath the embankments according to the *Tailing Storage Facility Site Characterization Report* (WSP 2023). WSP also estimated the potential groundwater inflow rate or seepage rate to seepage collection ponds (WSP 2024c). The results showed that seepage rate is predicted to be lower than 0.9 L/s for MESCP and 1.3 L/s for SESCP. The assessment was based on the design depth of 3 metres and a deepened design allowing for more water storage capacity or optimizing top surface area.

Table 18: Ponds Design Summary

Dimensions	SESCP	MESCP	CCS Pond	PETBP
Total Depth (m)(3)	3	3	2.0	8 (2)
Side Slopes	2H:1V(4)	2H:1V(4)	2H:1V(1)	2H:1V(1)
Dead Volume (0.5 m depth at bottom of pond) (1000 m^3)	1.25	6.82	7.63	5.6 (2)
Live Storage Below Spillway Invert (1000 m^3)	5.37	17.31	7.63	133.9
Spillway Crest Elevation (m)	936.3	908.3	933.0(5)	923.9
Crest Elevation (m)	937	909	934.5	925

Notes: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; CCS = Central Collection Sump; PETBP = Perimeter Embankment Till Borrow Pond.

(1) Refers to extension of the Pond.

(2) Assumed PETBP pond bottom elevation of 917 m (Golder 2021).

(3) Between Pond Bottom Elevation and Minimum Crest Elevation.

(4) The stability analysis (WSP 2024a) indicates that the proposed cut slopes at a ratio of 2H:1V meets the desired safety standards across all loading conditions.

(5) Invert elevation of channel 7.

4.4 Spillways

4.4.1 Spillway Inlet

The spillway inlets for the MESCP, CCS Pond and PETBP were modelled in the HEC-HMS model (Section 3.0). The invert elevations of the spillways were estimated iteratively using the HEC-HMS model to provide the required 0.5 metre freeboard between the maximum water level design flow during 24-hr 1:200-year rain plus snowmelt event and the crest of the pond.

The spillways will be trapezoidal with side slopes of 2H:1V. The rectangular and triangular broad-crested weir equations were used to define the capacity of the weir. Rectangular weir coefficients of 1.4-1.7 and triangular weir coefficients of 1.0 to 1.3 were adopted depending on the hydraulic configuration of the spillway channel and crest (Smith 1995). Table 19 provides a summary of the spillway invert arrangements and resulting water level and discharge.

Due to the challenging topography in the vicinity of SESCP, implementing a spillway as a channel was not the most practical solution. Instead, alternative methods employing pumps to regulate and maintain specific elevation levels within the pond, will be employed. The details will be provided at the next stage of design.

Table 19: Summary of the Spillway Arrangements

Spillway	Pond Crest Elevation (m)	Spillway Invert Elevation (m)	Initial Pond Elevation (m)	Weir Bottom Width (m)	Weir Side Slope	Peak Discharge (m^3/s)	Peak Water Elevation (m)	Freeboard (m)
MESCP Spillway	909	908.3	908.3[(a)]	10.0	2H:1V	4.6	908.7	0.3
CCS Pond	934.5	933.0	933.0[(a)]	10.0	2H:1V	10.9	934.0	0.5
PETBP Spillway	925.0	923.9	922.7[(b)]	10.0	2H:1V	7.2	924.5	0.5

Notes: m^3/s = cubic metres per second.

(a) Initial water levels were assumed to be at the spillway invert elevation.

(b) Initial water level to be maintained to optimize the spillway outlet channel.

4.4.2 Spillway Outlet Channel

The MESCPand PETBP spillways and channels will be excavated in natural ground and discharge to the environment. The spillway channels will be lined with riprap along the reaches with flow velocity greater than 1 m/s. The results of the hydraulic sizing of the spillway channels are summarized in Table 20.

Table 20: Hydraulic Sizing of Spillway Channel Outlets

Spillways	Slope (%)	Channel Depth (m)	Side Slopes	Base Width (m)	Lining	Flow Depth (m)	Max Flow Velocity (m/s)
MESCP spillway outlet channel (Station 0+007to0+060)	0.54	1.8	2H:1V	2.0	10 kg class riprap	0.9	1.3
MESCP spillway outlet channel (Station 0+060 to0+201)	0.10	1.8	2H:1V	2.0	compacted earth	1.2	0.9
PETBP spillway outlet channel (Station 0+010 to 0+164)	8.0	0.7	2H:1V	5.0	50 kg class riprap	0.4	3.5
PETBP spillway outlet channel (Station 0+164 to 0+180)	1.0	1.2	2H:1V	3.0	10 kg class riprap	0.8	2

Notes: SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond.

4.4.3 Spillway Discharge Structure

Discharge (dissipation) structures will be placed at the outlet of the spillway channels to dissipate energy, prevent erosion and to spread the discharge to the downstream environment. The width of the discharge structure is based on the top width of the respective spillway outlet channel and the length is based on the channel depth reduced to natural grade following a 2H:1V slope (Attachment 1). The dissipation structure of the PETBP spillway will be lined with 400 mm of 10 kg class riprap. Table 21 summarizes the discharge structures dimensions.

Table 21: Spillway Discharge Structure Dimensions

Spillway	Slope (%)	Width (m)	Length (m)
MESCP spillway discharge structure	0.1	2-20	20.0
PETBP spillway discharge structure	1.0	13-20	11.0

5.0 RECOMMENDATIONS FOR FUTURE STUDIES

The design of surface water management structures included in this document were based on information available at the time of design preparation. The following activities are recommended to refine or update the water management structure design presented in this document:

- Resolve the conflict between the existing roads and proposed channels alignment near Corner 3, Corner 2, and between these two corners.
- Confirmation of up-to-date as built information of all the existing mine infrastructure in proximity to the proposed water infrastructure alignments.
- Test pit investigation within the SESCP and MESCP footprints and along channels near high phreatic surface area as part of their geotechnical assessment. The estimated potential groundwater inflow rates should be reviewed after hydraulic testing of the subsurface soils and the lithologic information and observations from the test pit investigation are available.
- Assessment of rock riprap sources of supply, focusing on cost, quality of rock, and availability of the rock riprap.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust that the information presented herein meets the current MPMC requirements. Please do not hesitate to contact the undersigned with any questions or concerns.

WSP Canada Inc.





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Don Kidd
Principal, Senior Water Resources Engineer

NH/DK/anr/jc/ah

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Attachments: Attachment 1: Water Management Infrastructure Drawings
Attachment 2: TSF Surface Water Management Infrastructure – Design Basis Memorandum

https://goldersassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/072-tm-31152-tsf wmi 974/rev0/23590671-072-tm-rev0-31152-tsf surface water management infrastructure design for tsf 974 m raise 23may_24.docx

STUDY LIMITATIONS

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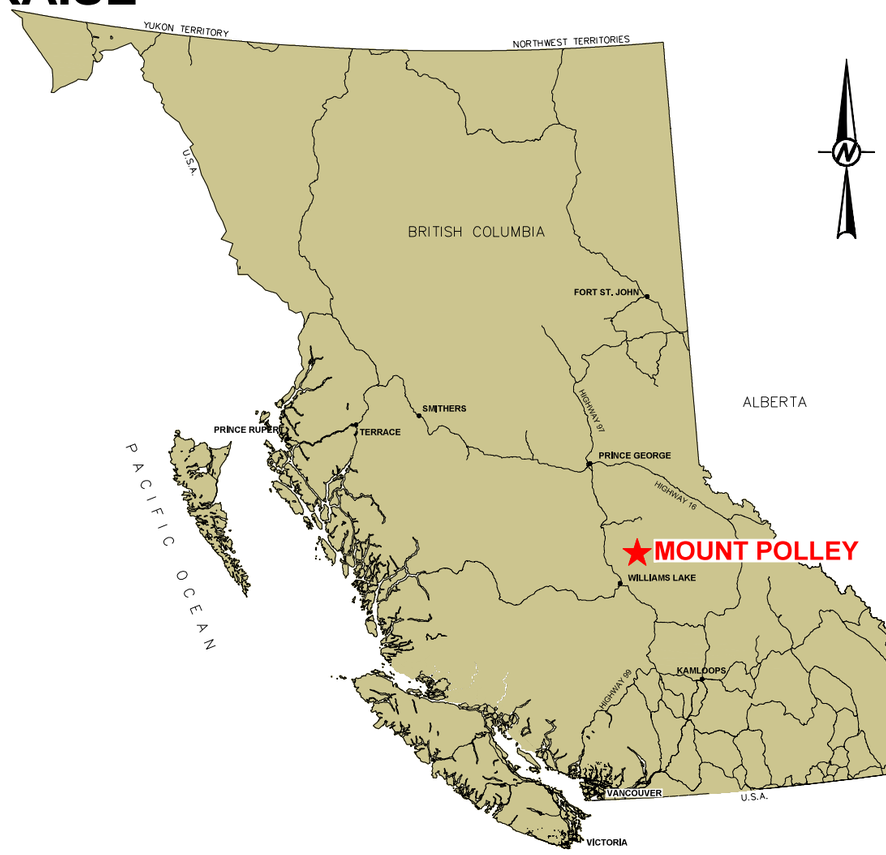
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ATTACHMENT 1

Water Management Infrastructure Drawings

MOUNT POLLEY MINING CORPORATION
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

DRAWING LIST				
DRAWING NUMBER	DRAWING TITLE	REVISION NUMBER	PURPOSE OF ISSUE	DATE OF ISSUE
01	DRAWING LIST AND PROJECT LOCATION PLAN	0	ISSUED FOR PERMITTING	2024-05-23
02	SITE PLAN	0	ISSUED FOR PERMITTING	2024-05-23
03	GENERAL ARRANGEMENT - PLAN VIEW	0	ISSUED FOR PERMITTING	2024-05-23
04	GENERAL ARRANGEMENT - PLAN VIEW WITH AERIAL PHOTO	0	ISSUED FOR PERMITTING	2024-05-23
05	CHANNEL 1 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
06	CHANNEL 1 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
07	CHANNEL 2 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
08	CHANNEL 2 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
09	SOUTH EMBANKMENT SEEPAGE COLLECTION POND - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
10	CHANNEL 3 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
11	CHANNEL 3 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
12	CHANNEL 4 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
13	CHANNEL 4 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
14	MAIN EMBANKMENT SEEPAGE COLLECTION POND - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
15	MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
16	MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
17	CHANNEL 5 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
18	CHANNEL 5 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
19	CHANNEL 6 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
20	CHANNEL 6 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
21	CHANNEL 7 - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
22	CHANNEL 7 - TYPICAL CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
23	PERIMETER EMBANKMENT TILL BORROW POND - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
24	PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - PLAN AND PROFILE	0	ISSUED FOR PERMITTING	2024-05-23
25	PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23
26	CENTRAL COLLECTION SUMP - PLAN AND CROSS-SECTIONS	0	ISSUED FOR PERMITTING	2024-05-23



PROJECT LOCATION PLAN
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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE
DRAWING LIST AND PROJECT LOCATION PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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POLLEY LAKE

BOOTJACK LAKE

WIGHT PIT

WIGHT PIT HAUL ROAD

NEZ DUMP

SOUTHEAST ROCK DISPOSAL SITE (SERDS)

MILL SITE

NORTH BELL DUMP

CARIBOO PIT

SPRINGER PIT

MINE ACCESS ROAD

NW TEMPORARY PAG STOCKPILE

OLD MINE ACCESS ROAD

TAILINGS DAM ROAD

SOUTH BOOTJACK DAM

CENTRAL COLLECTION SUMP

BOOTJACK CREEK

BIOSOLIDS STOCKPILE

HAZELTINE CREEK

PERIMETER EMBANKMENT TILL BORROW POND (PETBP)

PERIMETER EMBANKMENT

MAIN EMBANKMENT

N.E. EDNEY CREEK (TRIBUTARY 1)

MAIN EMBANKMENT SEEPAGE COLLECTION POND (MESCP)

BOOTJACK - MOREHEAD CONNECTOR

TAILINGS STORAGE FACILITY

SOUTH EMBANKMENT

SOUTH EMBANKMENT SEEPAGE COLLECTION POND (SESCP)

S.W. EDNEY CREEK (TRIBUTARY 2)

592 500 E

594 000 E

595 500 E

597 000 E

589 500 E

591 000 E

5 826 000 N

5 824 500 N

5 823 000 N

5 821 500 N

5 820 000 N

5 818 500 N

5 817 000 N

LEGEND

- GROUND CONTOURS (SEE NOTE 4)
- SHORELINE (SEE REFERENCE 4)
- WATERCOURSE (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 4)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 5)
- POWER LINE (SEE REFERENCE 6)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES RELATIVE TO UTM, NAD83 AND ELEVATIONS OF MINE SITE REPRESENT GEODETIC DATUM, AND TAILINGS STORAGE FACILITY ARE RELATIVE TO TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 25 m MAJOR AND 5 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2013-2023 (SEE REFERENCES 1-3).

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6. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

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0 500 1,000

1:12,500 METRES

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

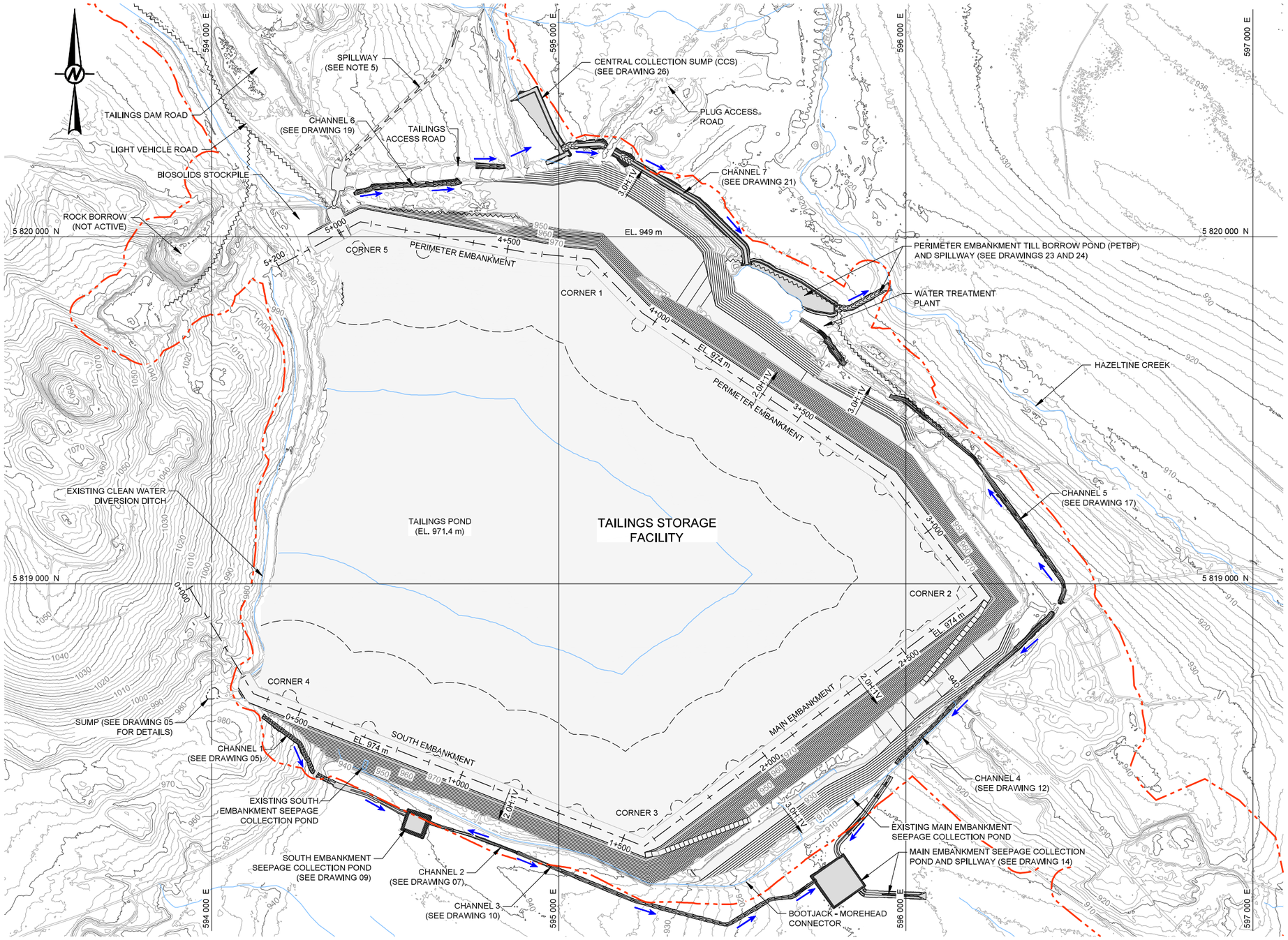
TITLE

SITE PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.	02 of 26	DRAWING
23590671	31100/31152/072	0		02

0 25 mm

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D



LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- GROUND CONTOURS (SEE REFERENCE 1)
- WATER MANAGEMENT CHANNEL FLOW DIRECTION
- WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- TSF EL. 974 m EMBANKMENT RAISE, BUTTRESS AND SPILLWAY DESIGN CONTOURS
- TAILINGS DEPOSITION DESIGN CONTOURS
- TAILINGS POND (EL. 971.4 m)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR, TAILINGS DEPOSITION CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
5. SPILLWAY DESIGN PART OF TSF EL. 974 RAISE DESIGN.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-Mine Lidar Contour 0.25.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR

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0 200 400
1:6,000 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN 29169

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

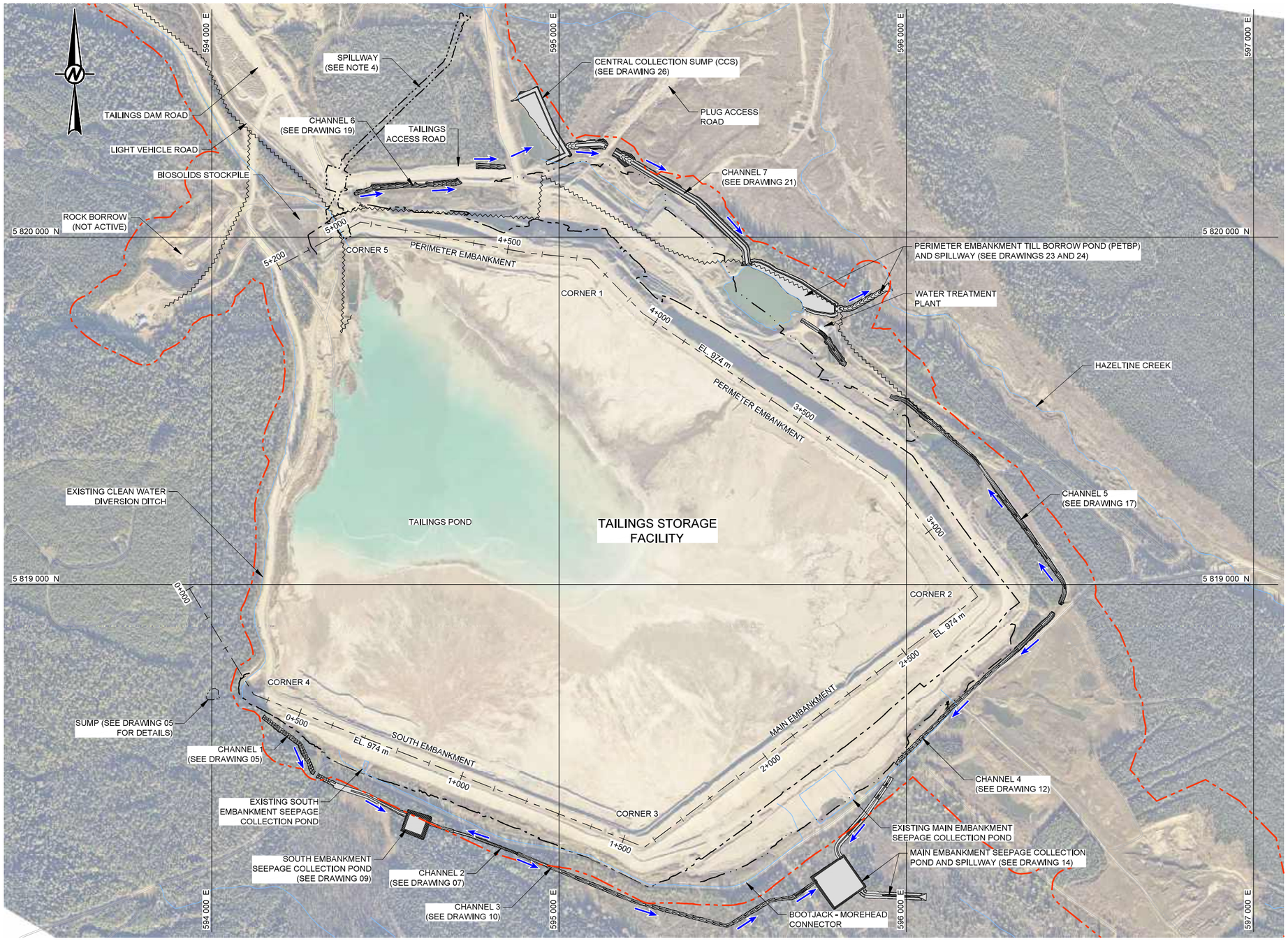
TITLE

GENERAL ARRANGEMENT PLAN VIEW

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	03 of 26	03

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

Path: V:\active_gds\comp\data\office\vancouver\CAD-GIS\Client\Imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\072\Dgc 072\02_PRODUCTION\DWG\ | File Name: 23590671-31100-31152-072-A03.dwg | Last Edited By: tyklassen Date: 2024-05-22 Time:5:57:59 PM | Printed By: TYKlassen Date: 2024-05-23 Time:2:20:47 PM



LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- WATER MANAGEMENT CHANNEL FLOW DIRECTION
- WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- EL. 974 m TSF EMBANKMENT DOWNSTREAM TOE LIMIT
- EL. 974 m TSF BUTTRESS DOWNSTREAM TOE LIMIT
- TSF EL. 974 m SPILLWAY DESIGN FOOTPRINT
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- EXISTING POWER LINE - SEE NOTE 3 (SEE REFERENCE 4)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES ARE SHOWN IN TAILINGS GRID.
3. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
4. SPILLWAY DESIGN PART OF TSF EL. 974 RAISE DESIGN.

REFERENCES

1. 2023 AERIAL PHOTO PROVIDED BY MPMC, FILE NAME: "231030-Lidar Ortho Reduced.jpg", FLOWN: 30 OCTOBER 2023, RECEIVED: 29 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR

PERMITTING

0 200 400
1:6,000 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN # 51163

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

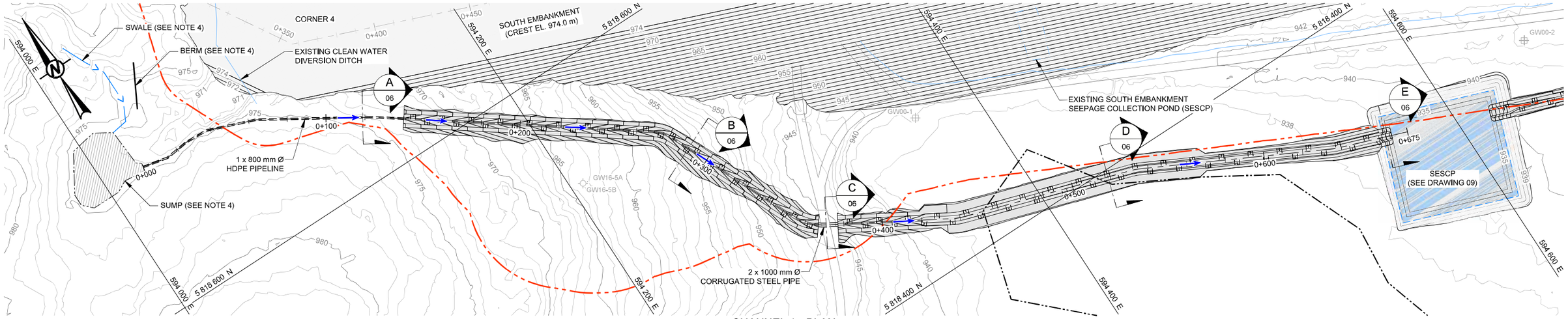
GENERAL ARRANGEMENT
PLAN VIEW WITH AERIAL PHOTO

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	04 of 26	04

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

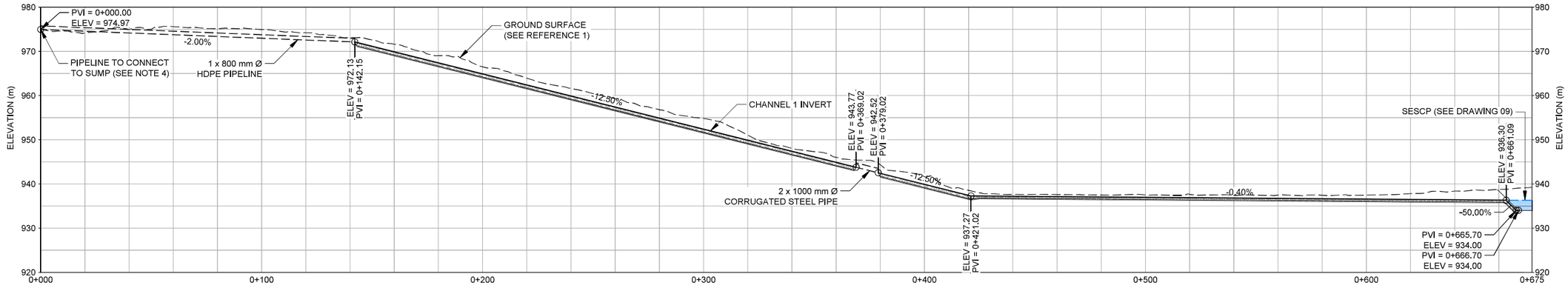
0 25 mm

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CHANNEL 1 - PLAN

SCALE 1:1 000 m



CHANNEL 1 - PROFILE

HORIZ. SCALE 1:1 000 m
VERT. SCALE 1:500 m

LEGEND

- TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE (4+400)
- CHANNEL 1 DESIGN CENTRELINE (0+100)
- CHANNEL 1 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL GROUNDWATER INVESTIGATION LOCATION
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. SUMP, SWALE AND BERM AROUND CORNER 4 TO BE FIELD FIT AND APPROVED BY QA MANAGER.
5. SOUTH EMBANKMENT SEEPAGE COLLECTION POND = SESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR

PERMITTING

0 20 40
1:500 VERTICAL METRES

0 50 100
1:1,000 HORIZONTAL METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN # 9109

CLIENT: MOUNT POLLEY MINING CORPORATION

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

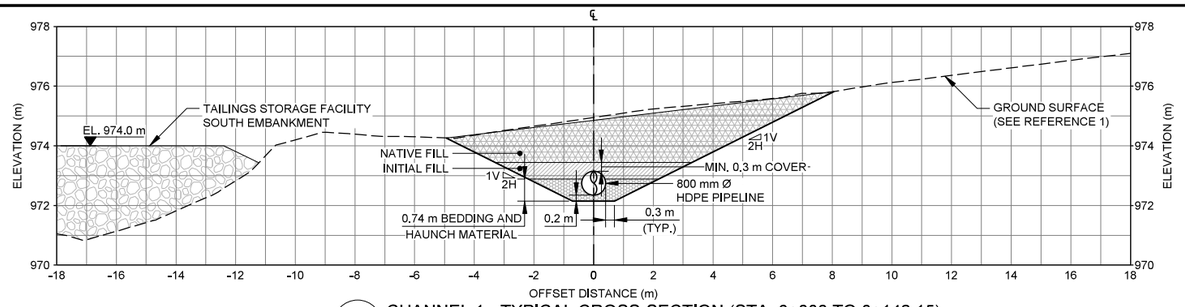
TITLE
CHANNEL 1
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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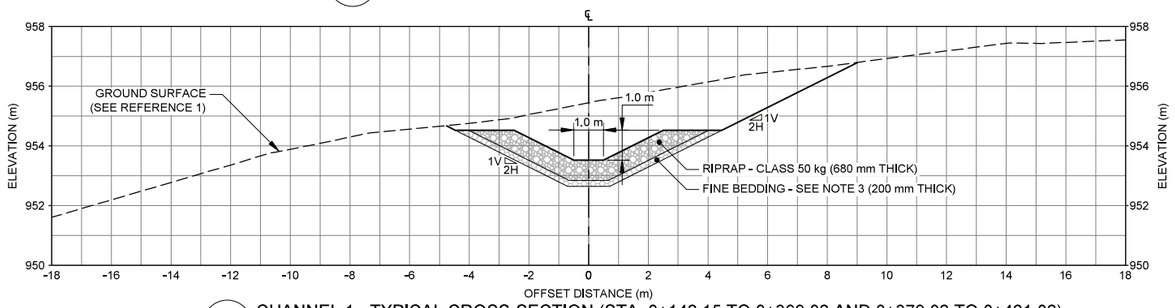
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0 25 mm

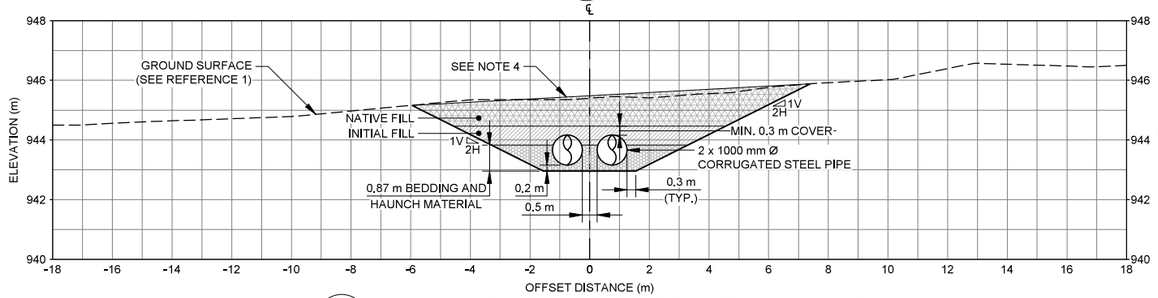
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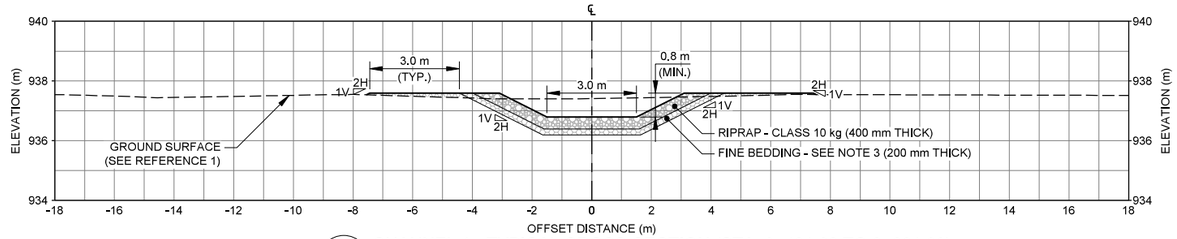
SCALE 1:100 m (A 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+142.15)



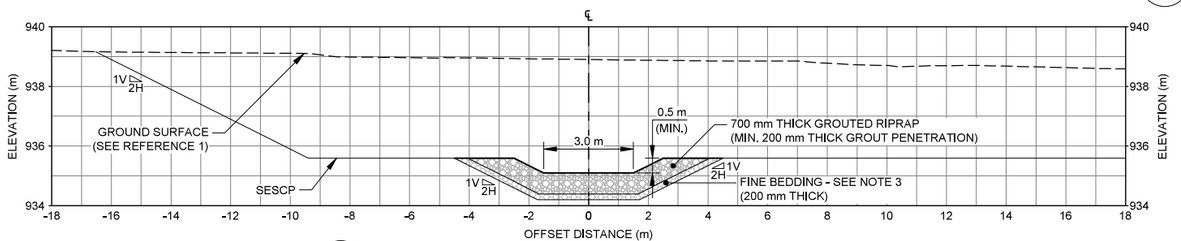
SCALE 1:100 m (B 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+142.15 TO 0+369.02 AND 0+379.02 TO 0+421.02)



SCALE 1:100 m (C 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+369.02 TO 0+379.02)



SCALE 1:100 m (D 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+421.02 TO 0+661.09)



SCALE 1:100 m (E 05) CHANNEL 1 - TYPICAL CROSS-SECTION (STA. 0+661.09 TO 0+666.70)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 1 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL
- EMBANKMENT ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

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0 5 10
1:100 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

CLIENT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

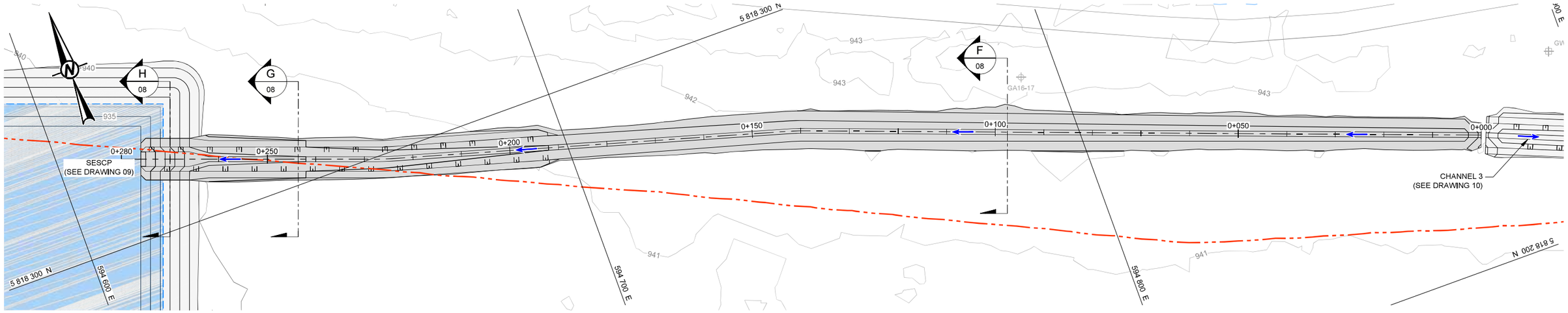
CHANNEL 1
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	06 of 26	DRAWING
23590671	31100/31152/072	0		06

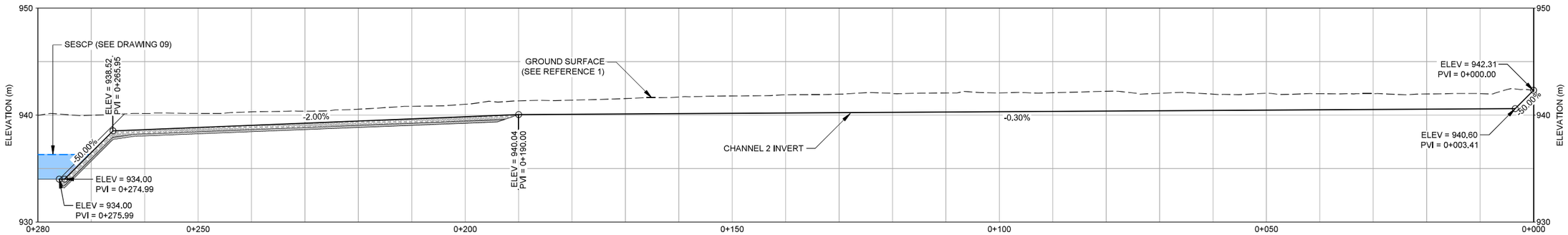
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0 25 mm

Path: \\pdfec-pfs\comsite\vancouver\data\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\23590671\31100\31152\Dwg\23590671-31100-31152-072-D05.dwg | Last Edited By: tyklassen Date: 2024-05-23 Time:9:21:30 AM | Printed By: TYKlassen Date: 2024-05-23 Time:2:17:23 PM



CHANNEL 2 - PLAN
SCALE 1:400 m



CHANNEL 2 - PROFILE
HORIZ. SCALE 1:400 m
VERT. SCALE 1:200 m

LEGEND

- CHANNEL 2 DESIGN CENTRELINE (0+100)
- CHANNEL 2 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. SOUTH EMBANKMENT SEEPAGE COLLECTION POND = SESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR
PERMITTING

0 10 20
1:200 VERTICAL METRES

0 20 40
1:400 HORIZONTAL METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN 35169

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

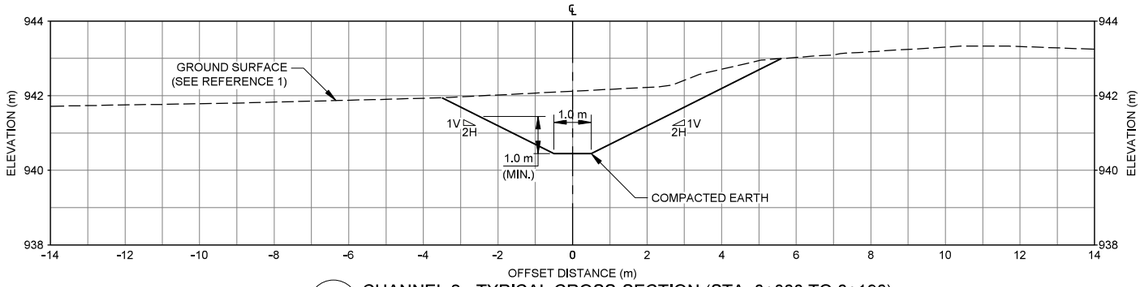
TITLE
CHANNEL 2
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.	07 of 26	DRAWING
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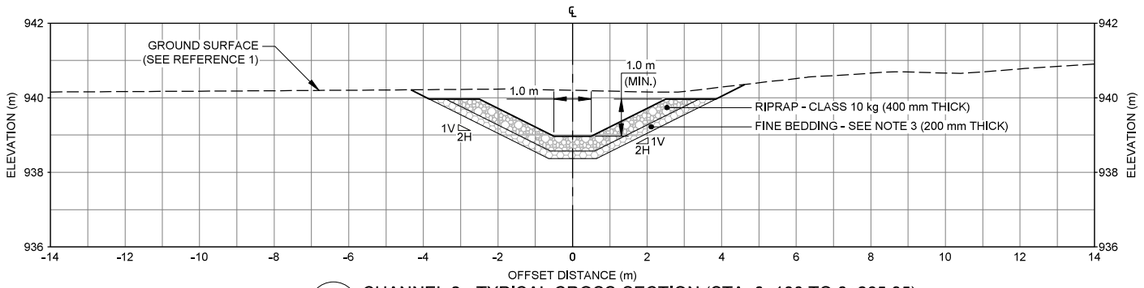
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0 25 mm

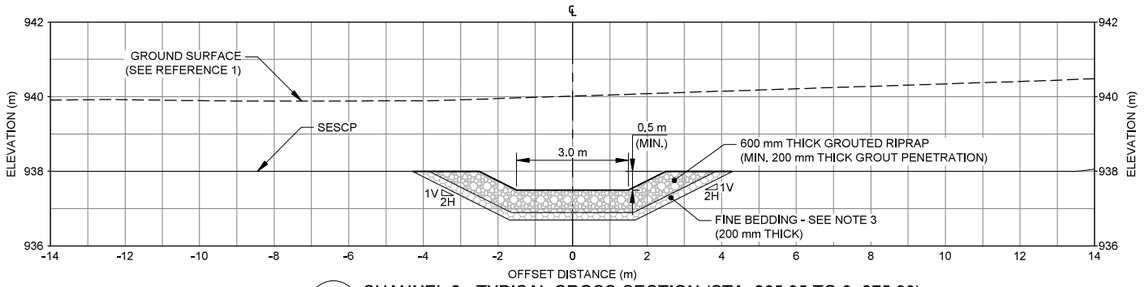
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SCALE 1:80 m — F / 07 — CHANNEL 2 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+190)



SCALE 1:80 m — G / 07 — CHANNEL 2 - TYPICAL CROSS-SECTION (STA. 0+190 TO 0+265.95)



SCALE 1:80 m — H / 07 — CHANNEL 2 - TYPICAL CROSS-SECTION (STA. 265.95 TO 0+275.99)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 2 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 4 8

1:80 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN — 39169

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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+1 (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

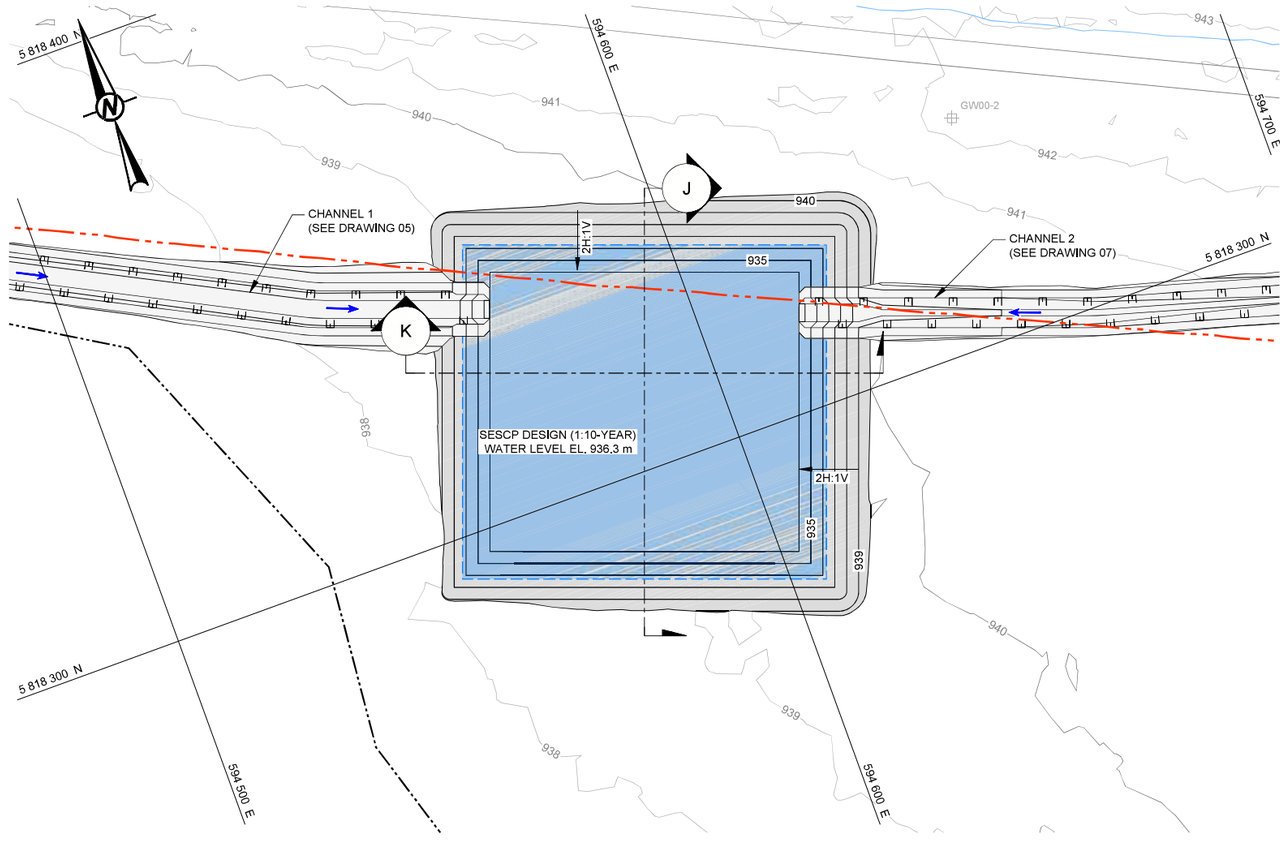
CHANNEL 2
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	08 of 26	DRAWING
23590671	31100/31152/072	0		08

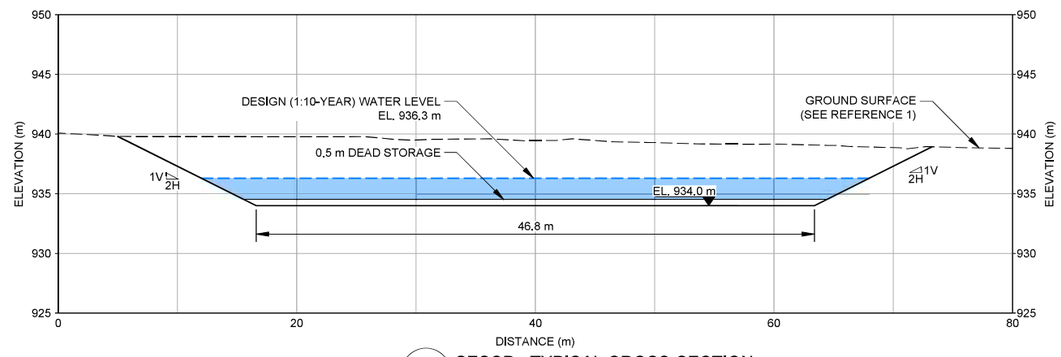
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

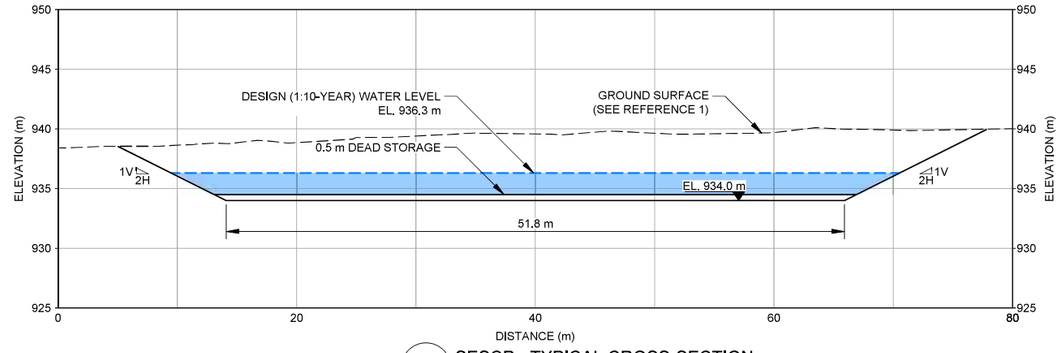
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SESCP - PLAN
SCALE 1:500 m



SCALE 1:250 m — J — SESCP - TYPICAL CROSS-SECTION



SCALE 1:250 m — K — SESCP - TYPICAL CROSS-SECTION

LEGEND

- SESCP DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. SOUTH EMBANKMENT SEEPAGE COLLECTION POND = SESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR
PERMITTING

0 10 20
1:250 METRES

0 20 40
1:500 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEIN # 51163

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

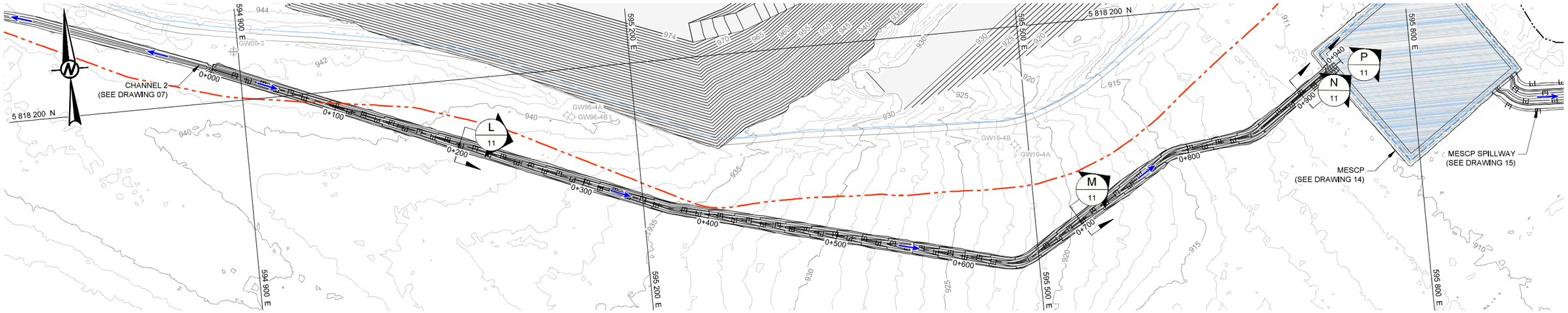
TITLE
SOUTH EMBANKMENT SEEPAGE COLLECTION POND PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	09 of 26	09

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

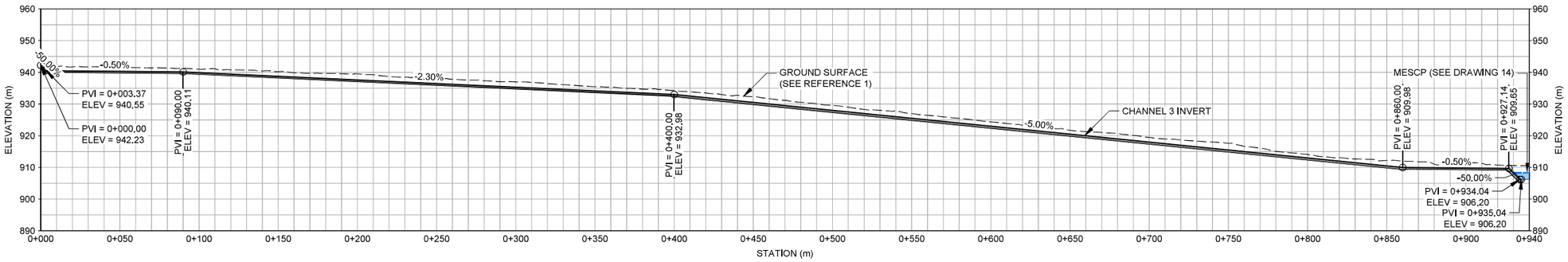
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CHANNEL 3 - PLAN

SCALE 1:1 500 m



CHANNEL 3 - PROFILE

HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

LEGEND

- CHANNEL 3 DESIGN CENTRELINE (0+100)
- CHANNEL 3 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
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3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR

PERMITTING

0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN # 50169

CLIENT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

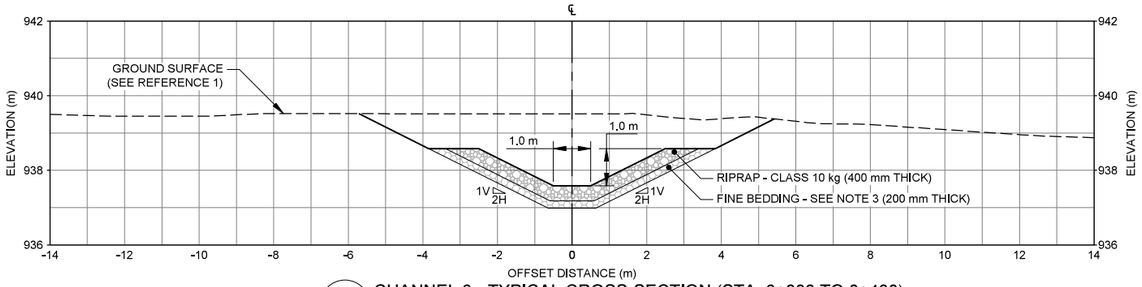
CHANNEL 3
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	10 of 26	10

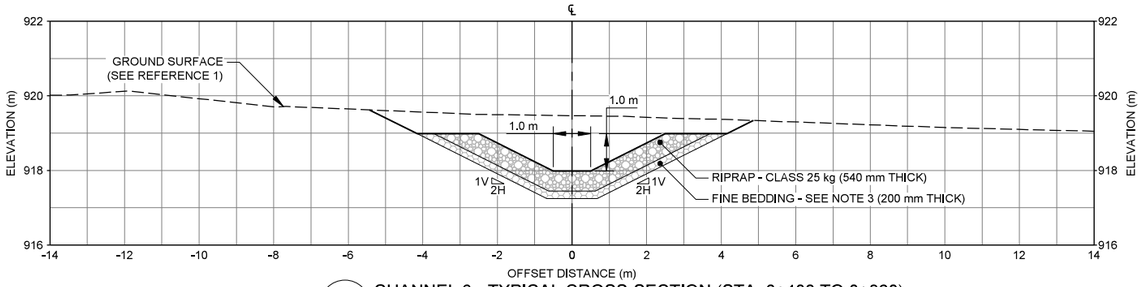
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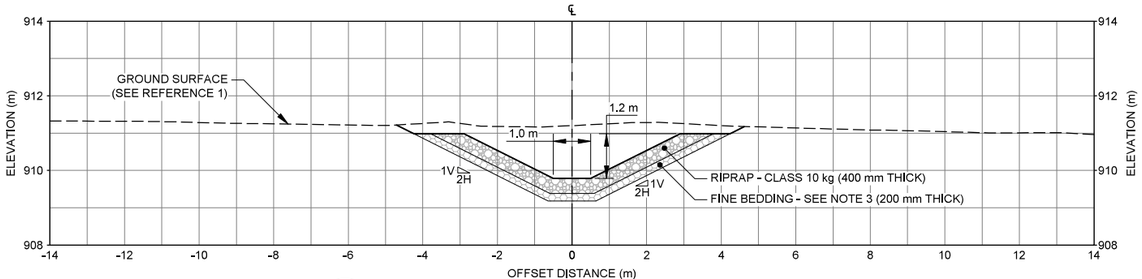
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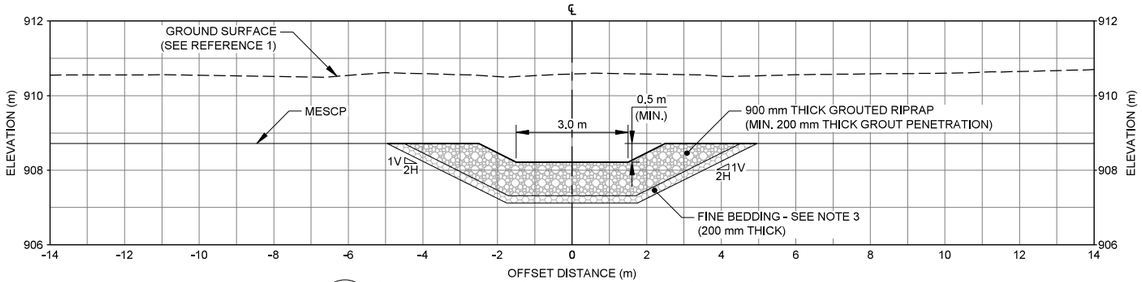
SCALE 1:80 m — L / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+400)



SCALE 1:80 m — M / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+400 TO 0+860)



SCALE 1:80 m — N / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+860 TO 0+927.14)



SCALE 1:80 m — P / 10 — CHANNEL 3 - TYPICAL CROSS-SECTION (STA. 0+927.14 TO 0+935.04)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 3 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)

NOTES

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ISSUED FOR

PERMITTING

0 4 8

1:80 METRES

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SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N.A. HOSSEIN — 39169

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

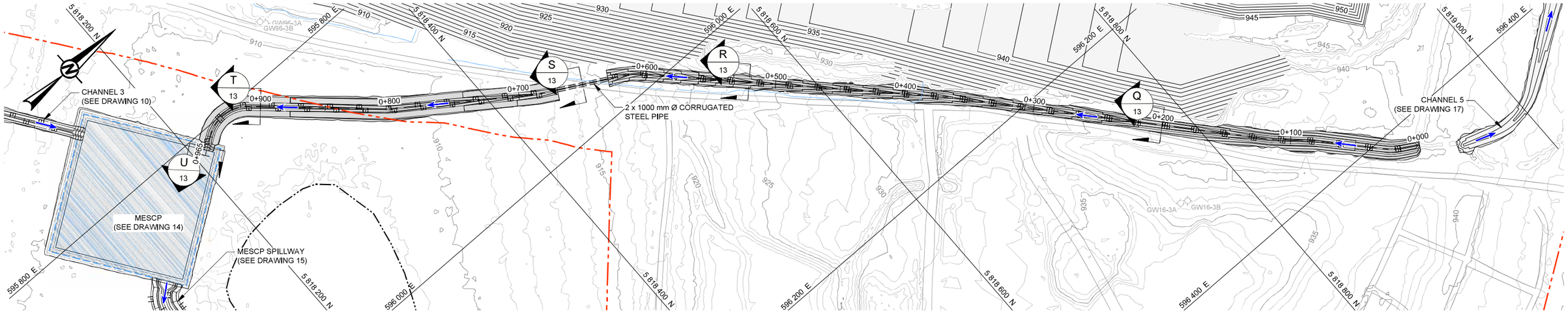
CHANNEL 3
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	11 of 26	DRAWING
23590671	31100/31152/072	0		11

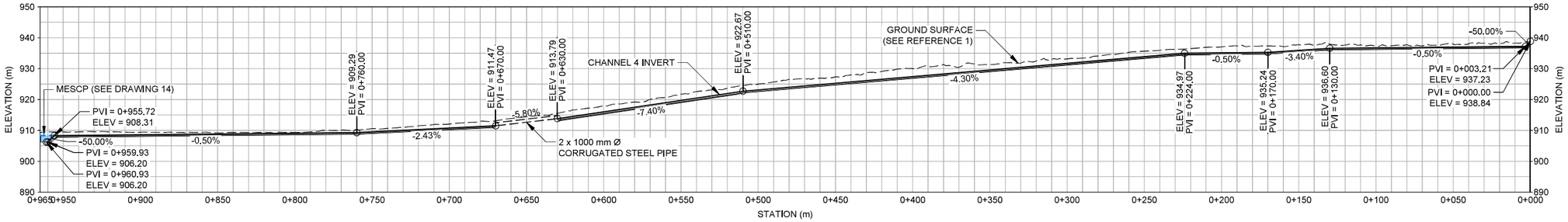
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0 25 mm

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CHANNEL 4 - PLAN
SCALE 1:1 500 m



CHANNEL 4 - PROFILE
HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

LEGEND

- CHANNEL 4 DESIGN CENTRELINE (0+100)
- CHANNEL 4 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- HISTORICAL INVESTIGATION LOCATION
- HIGH PHREATIC SURFACE AREA
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING

NOTES

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3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

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0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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SEAL

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CLIENT
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SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

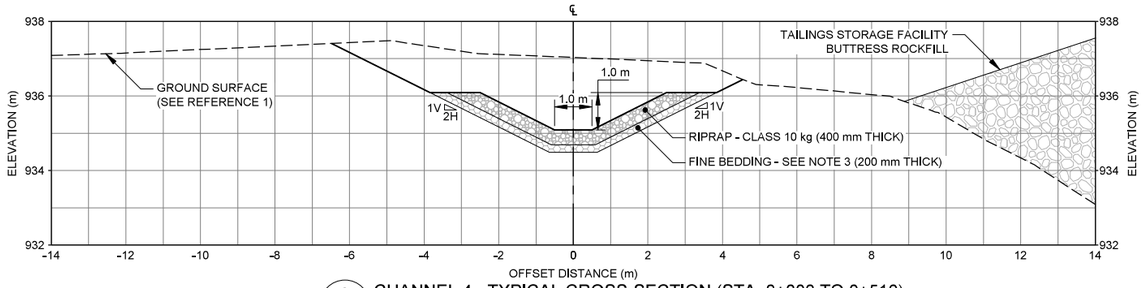
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CHANNEL 4
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	12 of 26	12

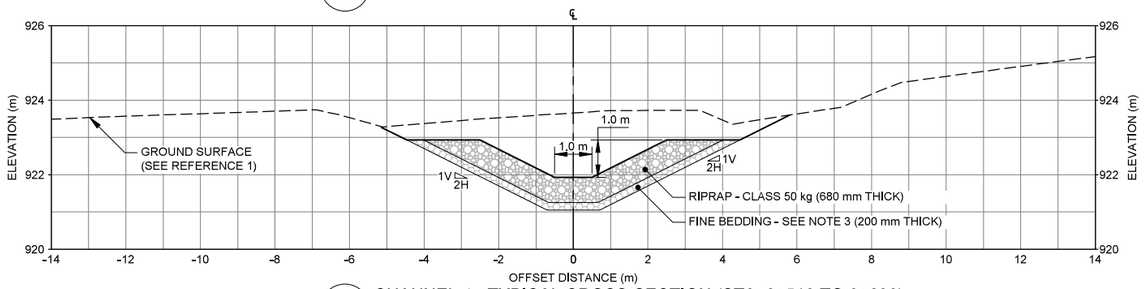
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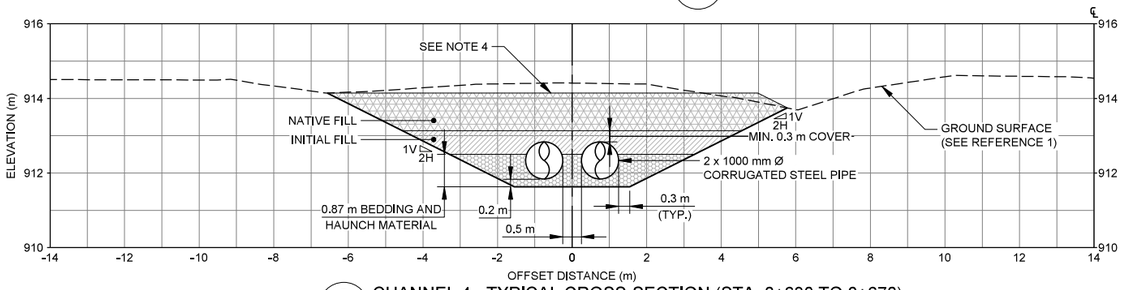
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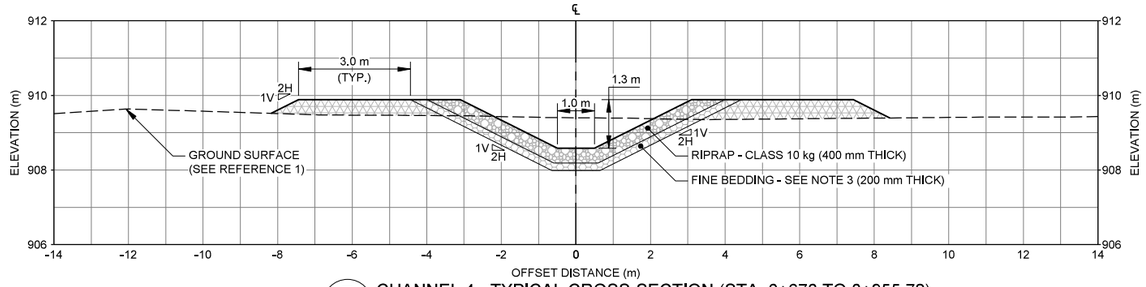
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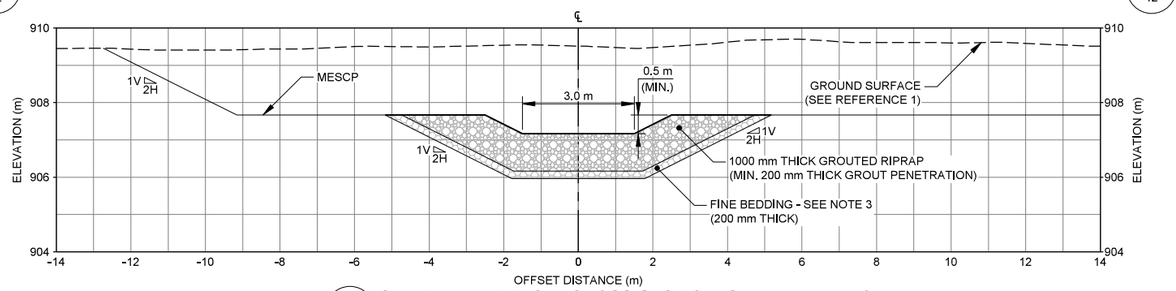
SCALE 1:80 m — R/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+510 TO 0+630)



SCALE 1:80 m — S/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+630 TO 0+670)



SCALE 1:80 m — T/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+670 TO 0+955.72)



SCALE 1:80 m — U/12 — CHANNEL 4 - TYPICAL CROSS-SECTION (STA. 0+955.72 TO 0+960.93)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 4 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL
- EMBANKMENT ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 4 8
1:80 METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

CLIENT
MOUNT POLLEY MINING CORPORATION

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840 HOWE STREET, SUITE 1000
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

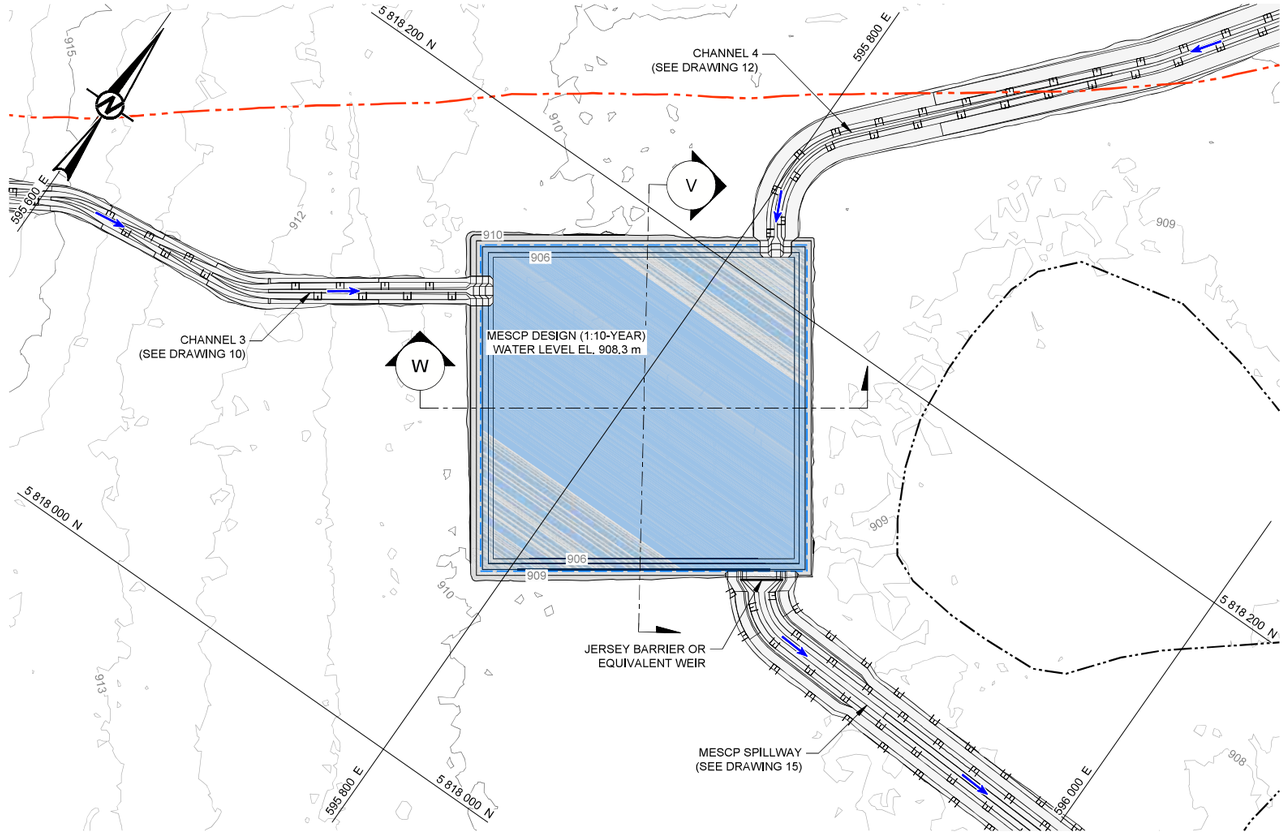
TITLE
CHANNEL 4
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	13 of 26	13

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

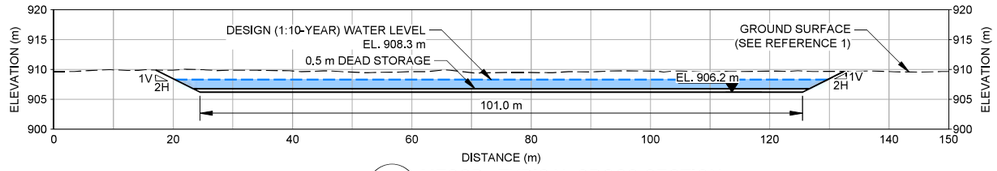
0 25 mm

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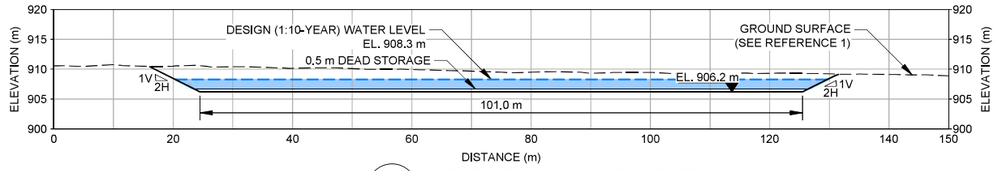


MAIN EMBANKMENT SEEPAGE COLLECTION POND - PLAN

SCALE 1:1 000 m



SCALE 1:500 m (V) MESCP - TYPICAL CROSS-SECTION



SCALE 1:500 m (W) MESCP - TYPICAL CROSS-SECTION

LEGEND

- MESCP DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- M-200 PERMIT BOUNDARY (SEE REFERENCE 2)
- HIGH PHREATIC SURFACE AREA

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR

PERMITTING

0 20 40
1:500 METRES

0 50 100
1:1,000 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEIN # 51163 SCIENCE & ENGINEERING

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

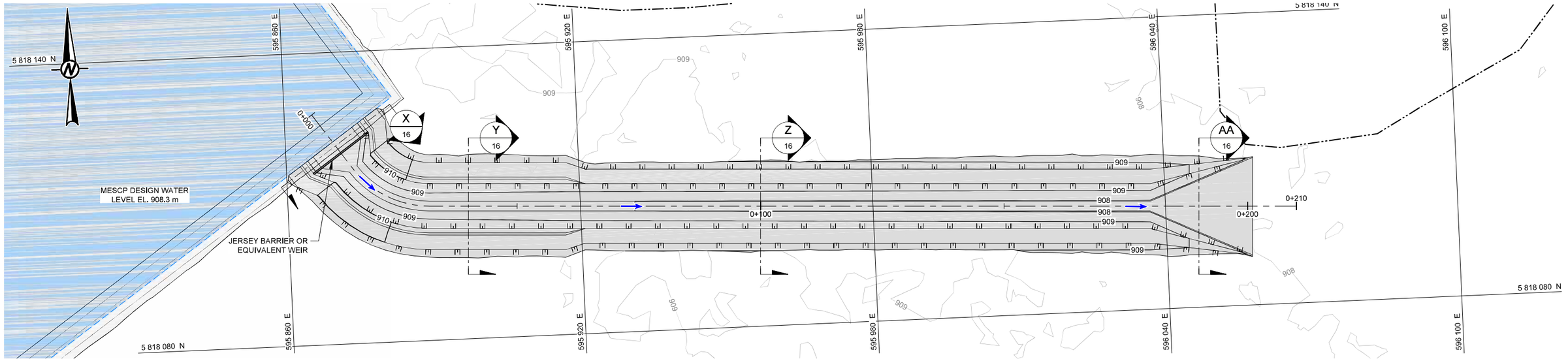
MAIN EMBANKMENT SEEPAGE COLLECTION POND PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	14 of 26	14

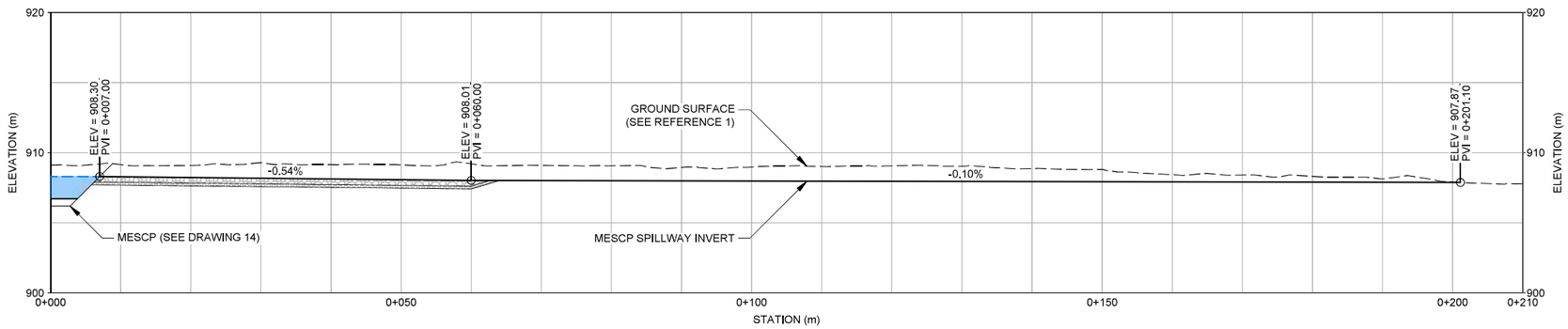
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

25 mm

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MESCP SPILLWAY - PLAN
SCALE 1:400 m



MESCP SPILLWAY - PROFILE
HORIZ. SCALE 1:400 m
VERT. SCALE 1:200 m

LEGEND

- MESCP SPILLWAY DESIGN CENTRELINE (0+100)
- MESCP SPILLWAY DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m WATER MANAGEMENT INFRASTRUCTURE DESIGN CONTOURS
- M-200 PERMIT BOUNDARY (SEE REFERENCE 2)
- HIGH PHREATIC SURFACE AREA
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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PERMITTING

0 10 20
1:200 VERTICAL METRES

0 20 40
1:400 HORIZONTAL METRES

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SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N. A. HOSSEIN # 29169

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

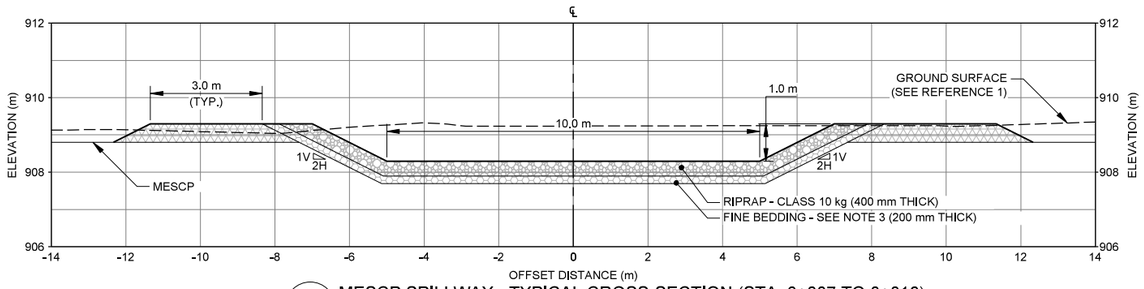
TITLE
MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.	15 of 26	DRAWING
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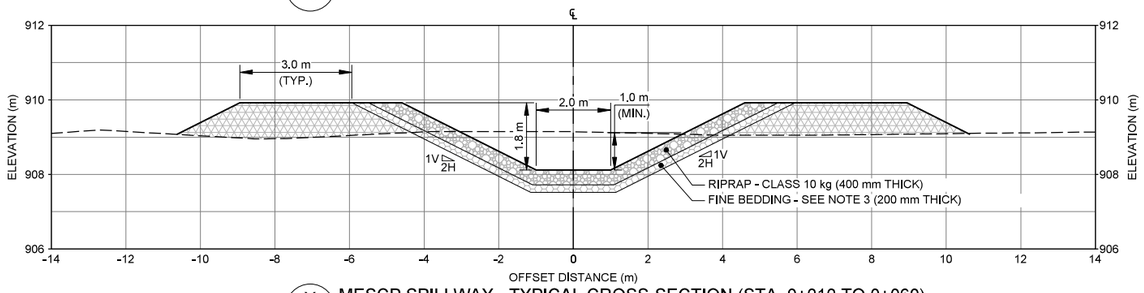
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

0 25 mm

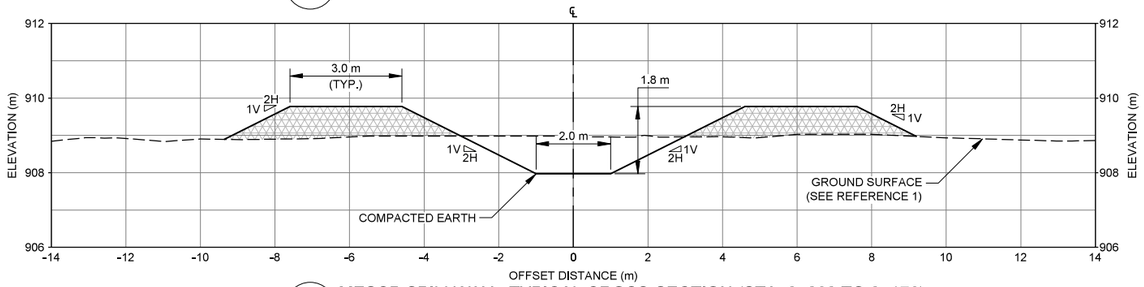
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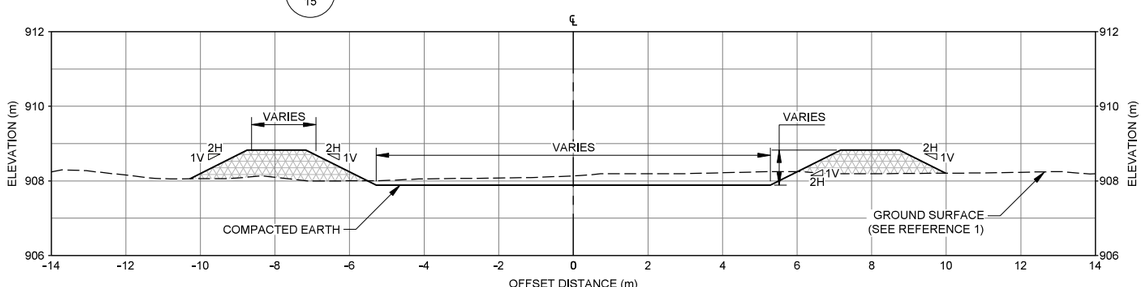
SCALE 1:80 m — X / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+007 TO 0+010)



SCALE 1:80 m — Y / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+010 TO 0+060)



SCALE 1:80 m — Z / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+060 TO 0+176)



SCALE 1:80 m — AA / 15 — MESCP SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+176 TO 0+201)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- MESCP SPILLWAY FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. MAIN EMBANKMENT SEEPAGE COLLECTION POND = MESCP.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 4 8

1:80 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER — PROVINCE OF BRITISH COLUMBIA — N. A. HOSSEIN — # 29169

CLIENT

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CONSULTANT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

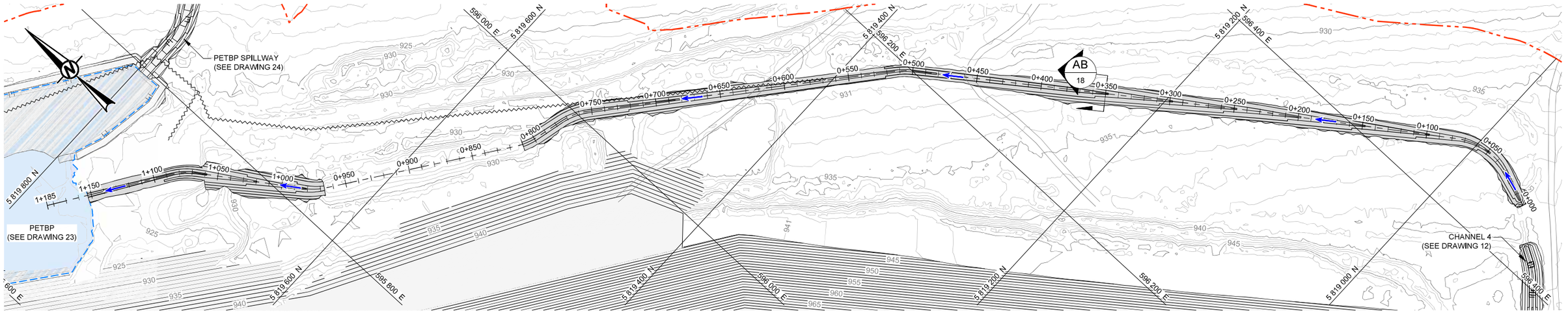
MAIN EMBANKMENT SEEPAGE COLLECTION POND SPILLWAY TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	16 of 26	DRAWING
23590671	31100/31152/072	0		16

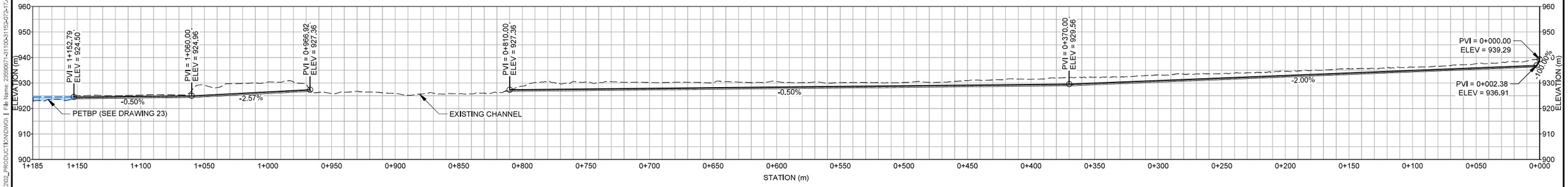
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

0 — 25 mm

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CHANNEL 5 - PLAN
SCALE 1:1 500 m



CHANNEL 5 - PROFILE
HORIZ. SCALE 1:1 500 m
VERT. SCALE 1:750 m

LEGEND

- CHANNEL 5 DESIGN CENTRELINE (0+100)
- CHANNEL 5 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE BEDDING

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-Mine Lidar Contour 0.25.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC, FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR
PERMITTING

0 25 50
1:750 VERTICAL METRES

0 50 100
1:1,500 HORIZONTAL METRES

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REV.	YYYY-MM-DD	DESCRIPTION	DESIGNED	PREPARED	REVIEWED	APPROVED
0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEERS PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN # 19169 PERMIT TO PRACTICE

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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

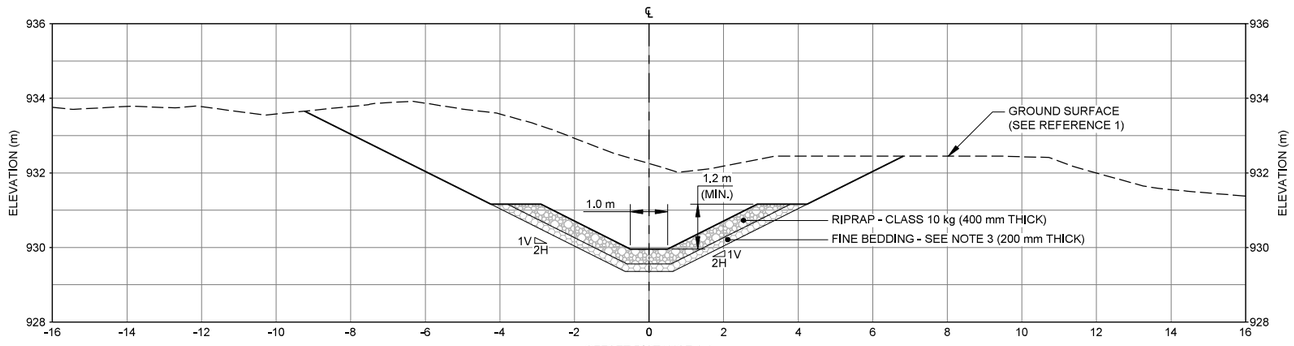
TITLE
CHANNEL 5
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	17 of 26	17

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

25 mm

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SCALE 1:80 m

AB
17

CHANNEL 5 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+810 AND 0+966.92 TO 1+152.79)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 5 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

ISSUED FOR

PERMITTING

0 4 8

1:80 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEINI # 29103

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
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TITLE

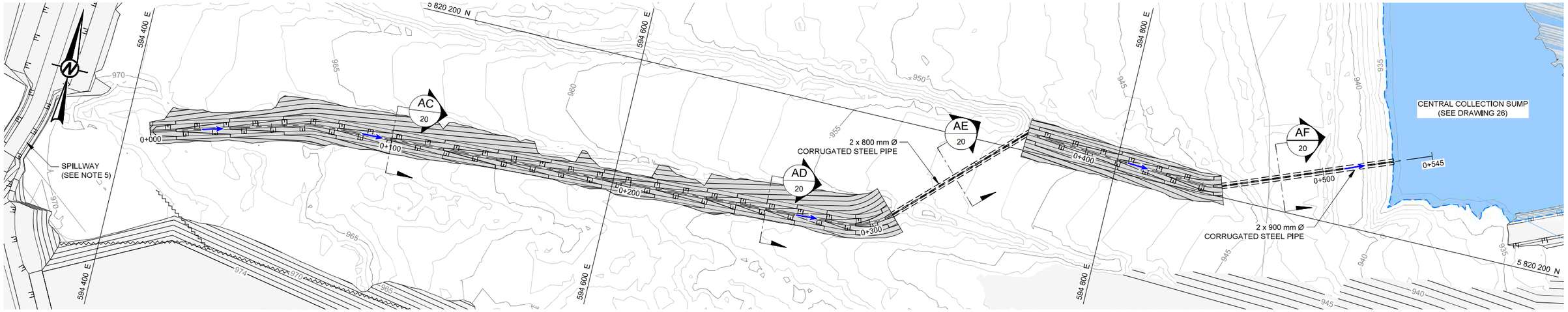
CHANNEL 5
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
23590671	31100/31152/072	0	18 of 26	18

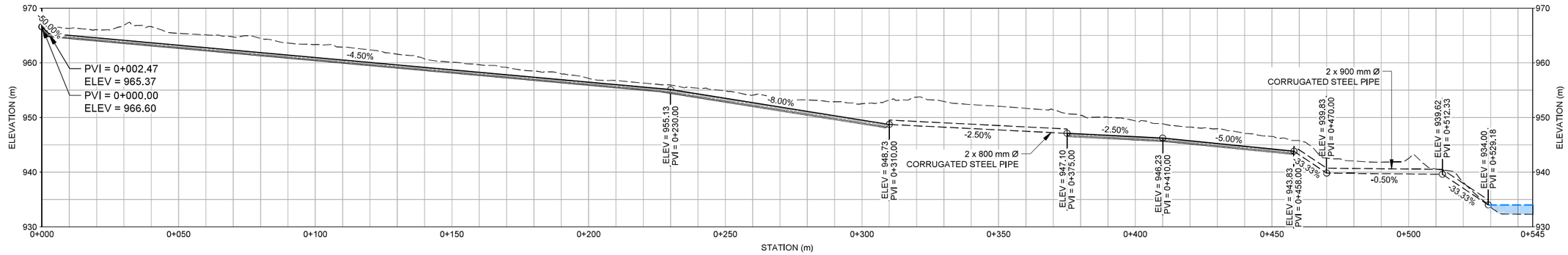
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI D

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CHANNEL 6 - PLAN
SCALE 1:800 m



CHANNEL 6 - PROFILE
HORIZ. SCALE 1:800 m
VERT. SCALE 1:400 m

LEGEND

- CHANNEL 6 DESIGN CENTRELINE (0+100)
- CHANNEL 6 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.
5. SPILLWAY DESIGN PART OF TSF EL. 974 RAISE DESIGN.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

ISSUED FOR
PERMITTING

1:400 VERTICAL METRES (0 20 40)
1:800 HORIZONTAL METRES (0 40 80)

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

CLIENT: MOUNT POLLEY MINING CORPORATION

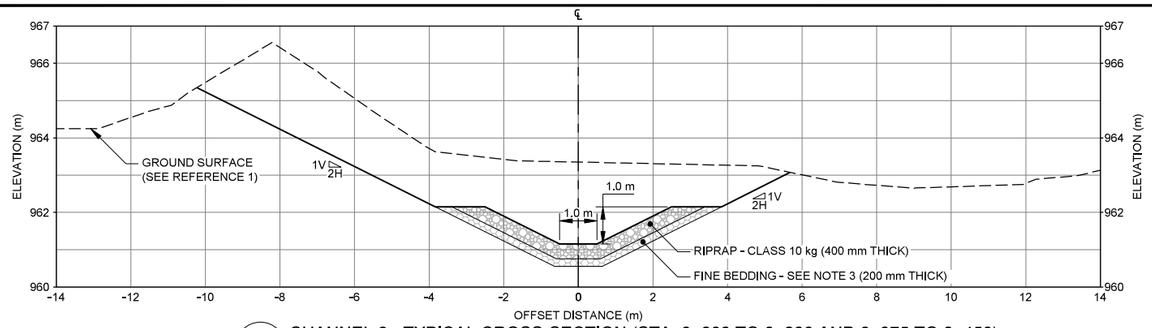
CONSULTANT
WSP CANADA INC.
840 HOWE STREET, SUITE 1000
VANCOUVER, BC
V6Z 2M1
+1 (604) 685 9381

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

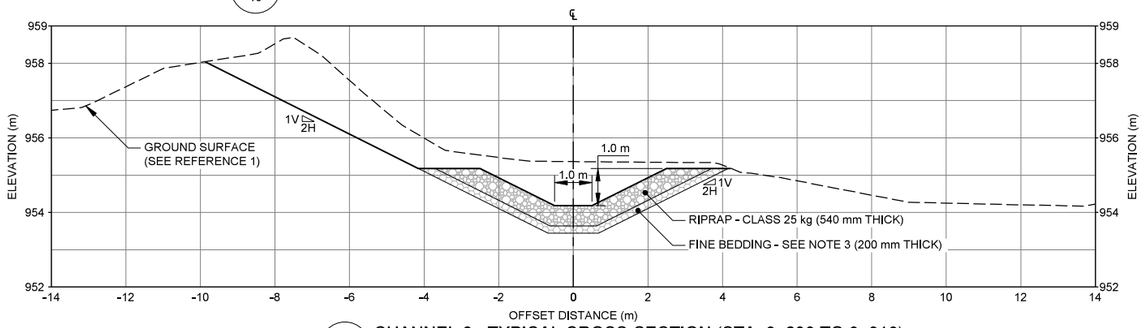
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CHANNEL 6
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.	DRAWING
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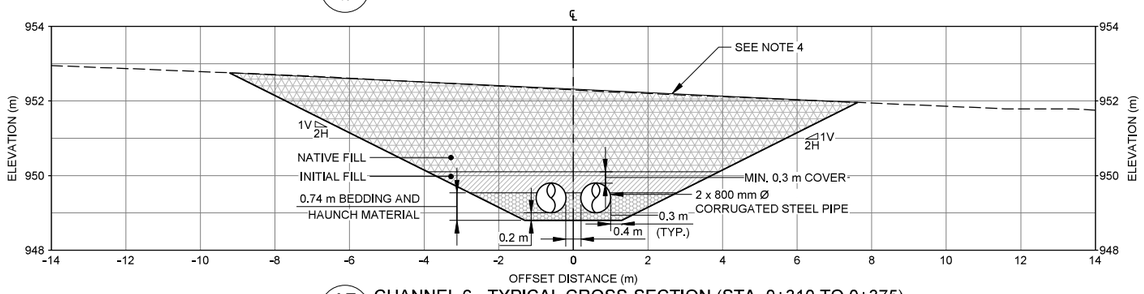
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0 25mm



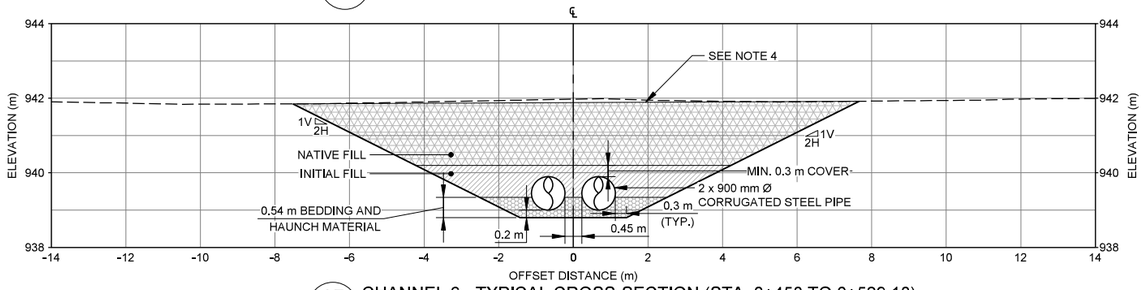
SCALE 1:80 m — AC 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+000 TO 0+230 AND 0+375 TO 0+458)



SCALE 1:80 m — AD 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+230 TO 0+310)



SCALE 1:80 m — AE 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+310 TO 0+375)



SCALE 1:80 m — AF 19 — CHANNEL 6 - TYPICAL CROSS-SECTION (STA. 0+458 TO 0+529.18)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 6 FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

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0 4 8

1:80 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEINI 6 29103

CLIENT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

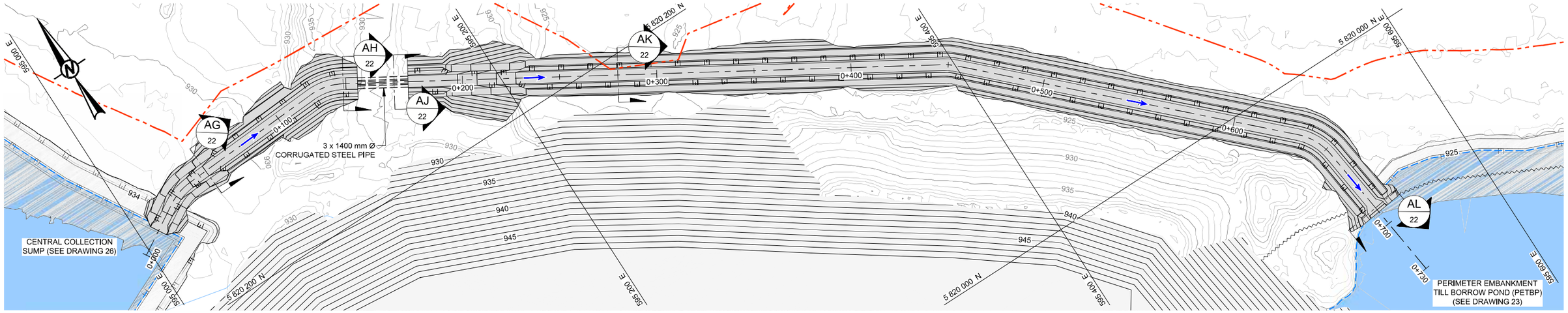
CHANNEL 6
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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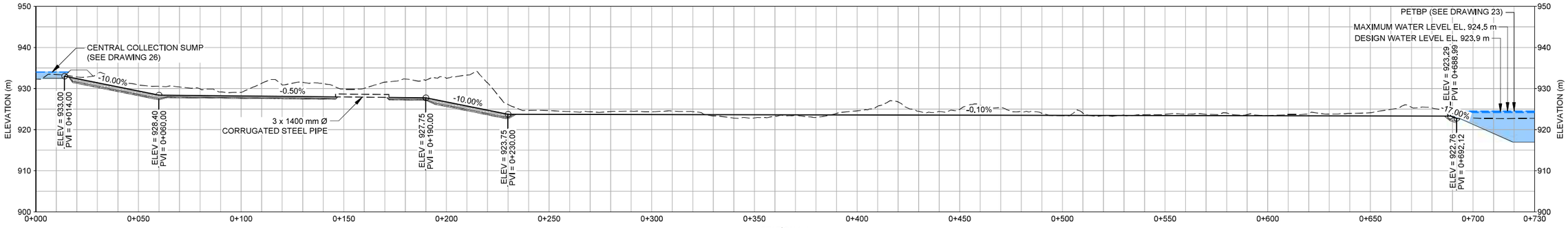
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0 25 mm

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CHANNEL 7 - PLAN
SCALE 1:1 000 m



CHANNEL 7 - PROFILE
HORIZ. SCALE 1:1 000 m
VERT. SCALE 1:500 m

LEGEND

- CHANNEL 7 DESIGN CENTRELINE (0+100)
- CHANNEL 7 DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- TSF EL. 974 m EMBANKMENT RAISE AND BUTTRESS DESIGN CONTOURS
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE ROCKFILL

NOTES
1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.

REFERENCES
1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

ISSUED FOR
PERMITTING

0 20 40
1:500 VERTICAL METRES

0 50 100
1:1,000 HORIZONTAL METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEERS PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN 6 29103

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+1 (604) 685 9381

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

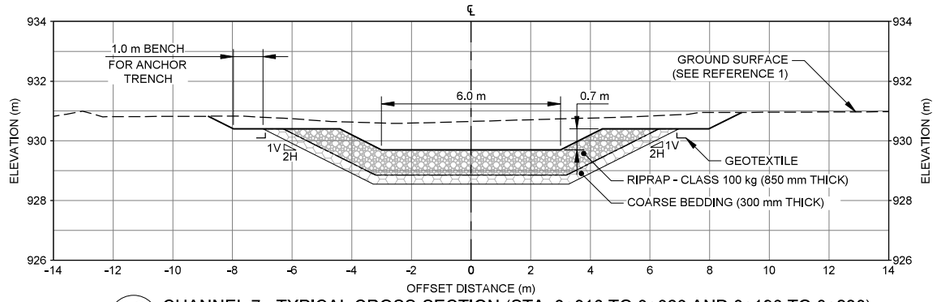
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CHANNEL 7
PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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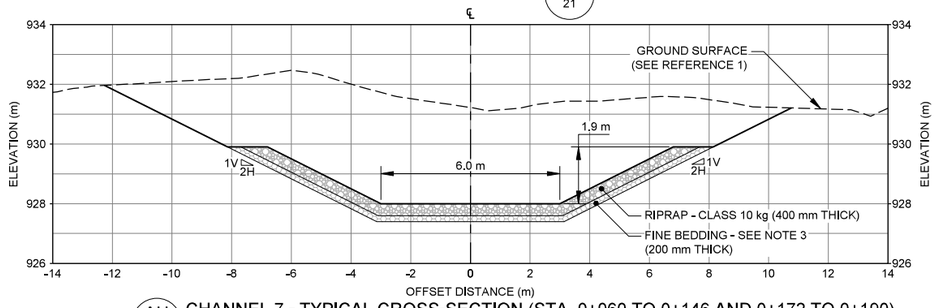
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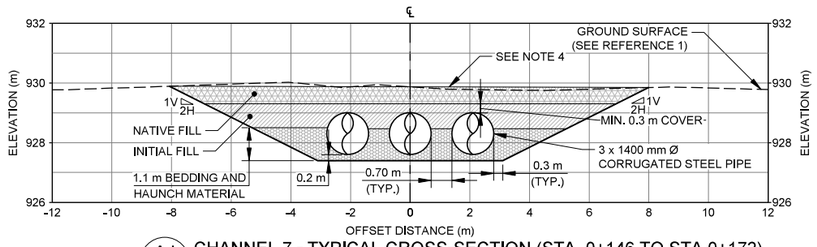
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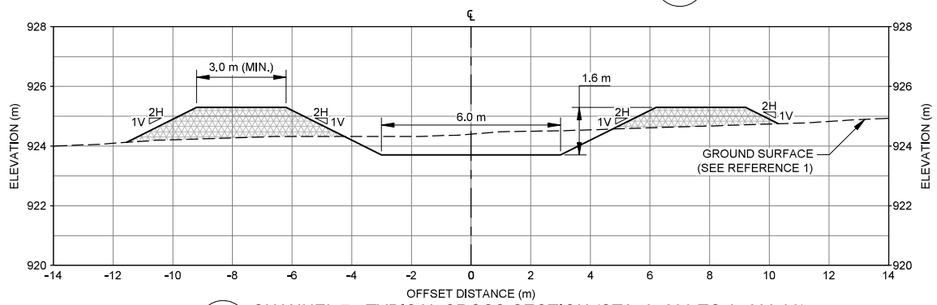
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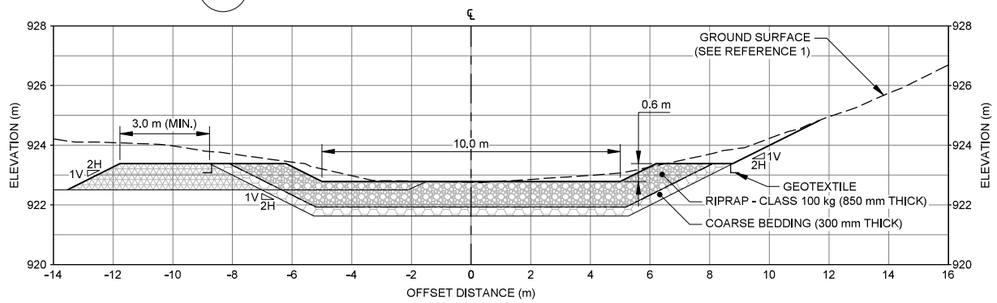
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SCALE 1:100 m — AJ / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+146 TO STA 0+172)



SCALE 1:100 m — AK / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+230 TO 0+688.99)



SCALE 1:100 m — AL / 21 — CHANNEL 7 - TYPICAL CROSS-SECTION (STA. 0+688.99 TO 0+692.11)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- CHANNEL 7 FINISHED GRADE
- RIPRAP
- COARSE BEDDING
- FINE BEDDING (SEE NOTE 3)
- BEDDING AND HAUNCH MATERIAL
- INITIAL FILL
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE BEDDING REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.
4. ORIGINAL MATERIAL FOR ROAD TO BE REINSTATED AS PER MPMC STANDARDS.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

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0 5 10
1:100 METRES

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT

WSP CANADA INC.
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+1 (604) 685 9381

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

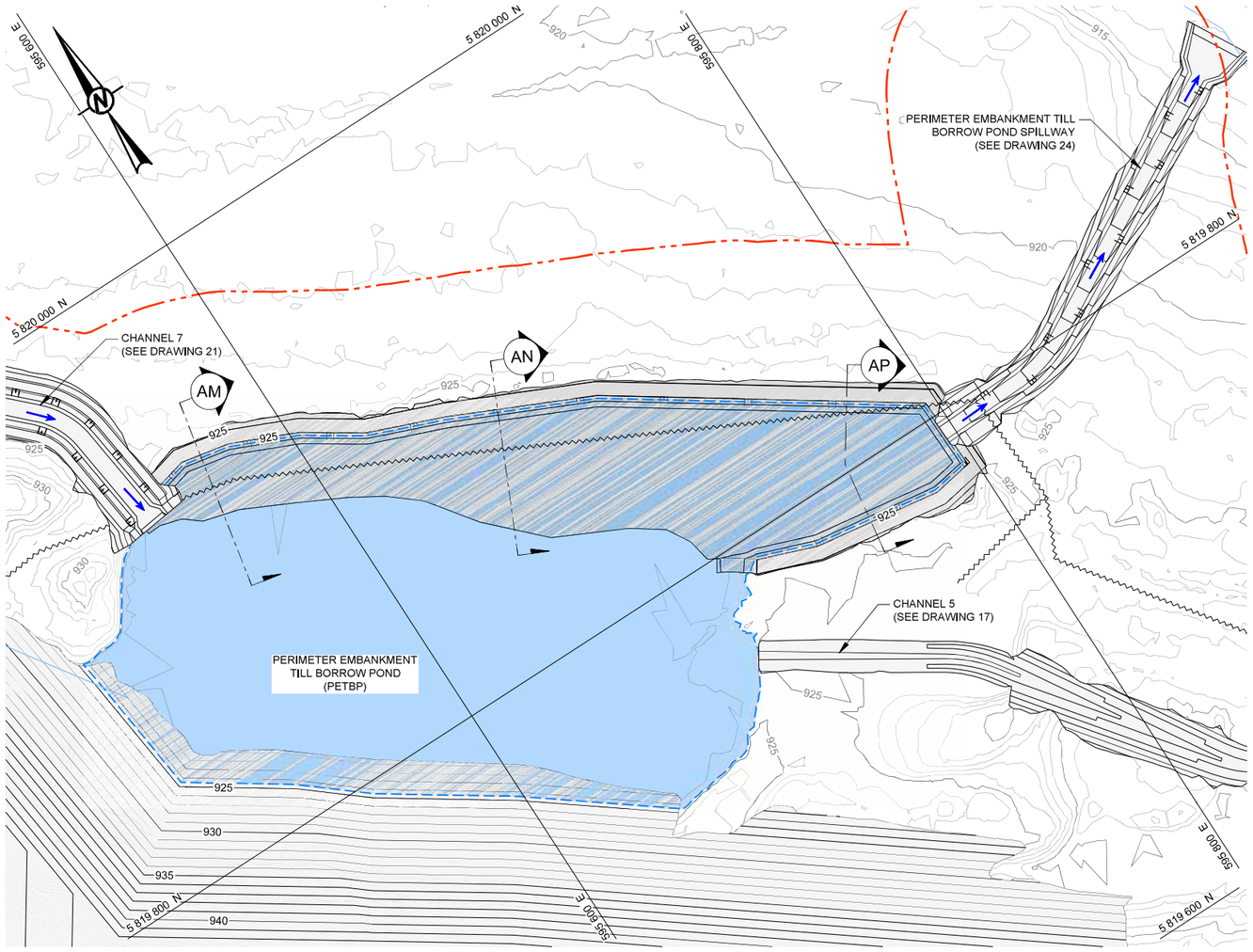
TITLE
CHANNEL 7
TYPICAL CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

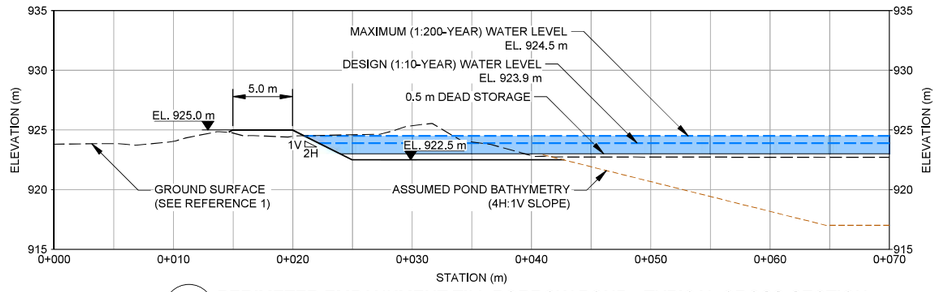
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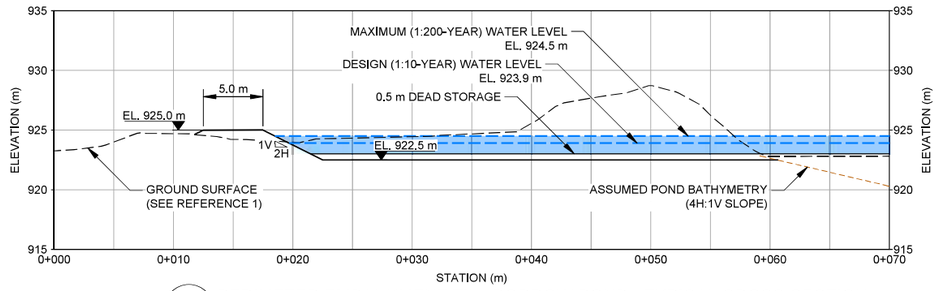


PERIMETER EMBANKMENT TILL BORROW POND - PLAN

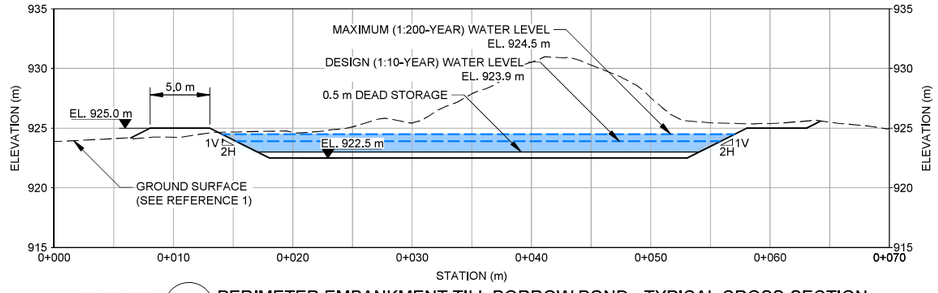
SCALE 1:1 000 m



SCALE 1:250 m AM PERIMETER EMBANKMENT TILL BORROW POND - TYPICAL CROSS-SECTION



SCALE 1:250 m AN PERIMETER EMBANKMENT TILL BORROW POND - TYPICAL CROSS-SECTION



SCALE 1:250 m AP PERIMETER EMBANKMENT TILL BORROW POND - TYPICAL CROSS-SECTION

ISSUED FOR

PERMITTING

0 10 20
1:250 METRES

0 50 100
1:1,000 METRES

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LEGEND

- PERIMETER EMBANKMENT TILL BORROW POND DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)

NOTES

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4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

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2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

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0	2024-05-23	ISSUED FOR PERMITTING	C.T.	T.A.K.	N.H.	D.A.K.

SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEINI 29103

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CONSULTANT

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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

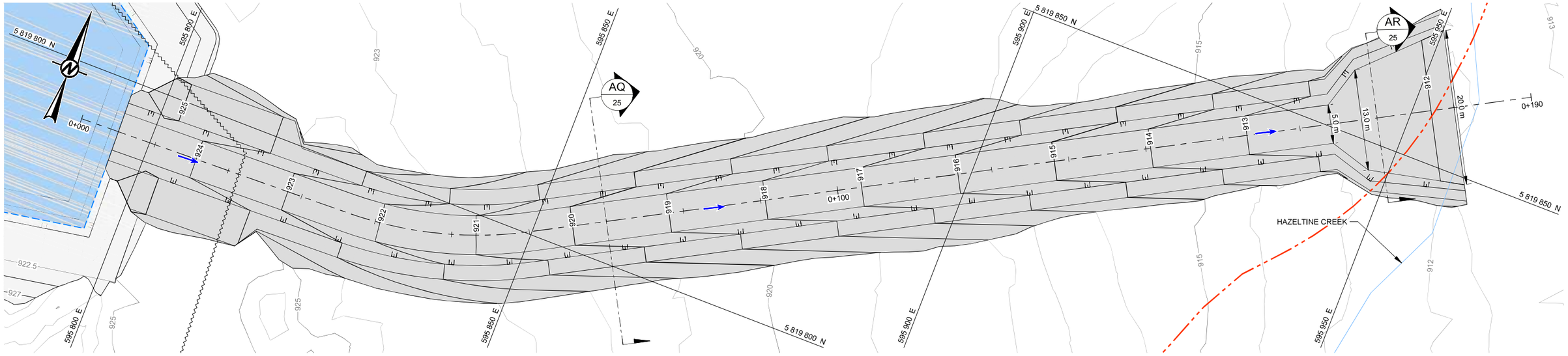
PERIMETER EMBANKMENT TILL BORROW POND PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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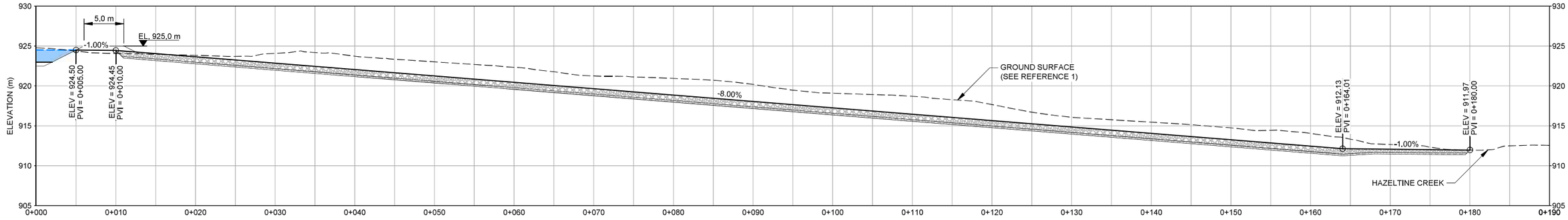
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PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - PLAN

SCALE 1:250 m



PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - PROFILE

SCALE 1:250 m

LEGEND

- PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY DESIGN CENTRELINE (0+100)
- PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- PERIMETER EMBANKMENT TILL BORROW POND DESIGN CONTOURS
- EXISTING POWER LINE - SEE NOTE 4 (SEE REFERENCE 4)
- GROUND CONTOURS (SEE REFERENCE 1)
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)
- RIPRAP
- FINE ROCKFILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES AND ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 5 m MAJOR AND 1 m MINOR.
4. EXISTING POWER LINES TO BE RELOCATED PRIOR TO CONSTRUCTION.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
2. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", RECEIVED: 05 SEPTEMBER 2014.
3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.
4. POWER LINES PROVIDED BY MPMC, FILE NAME: "211012 SERD Site Plan.dxf", RECEIVED: 12 OCTOBER 2021.

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1:250 METRES

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SEAL

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA N.A. HOSSEIN 6 5103

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+1 (604) 685 9381

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

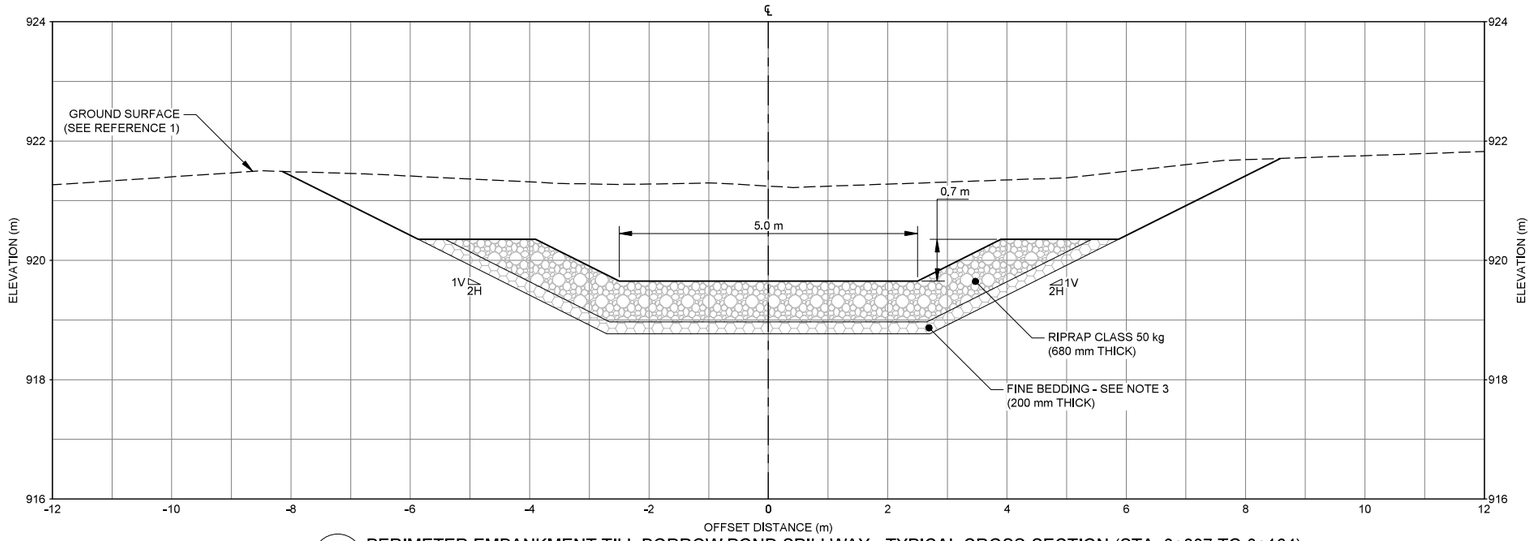
PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY PLAN AND PROFILE

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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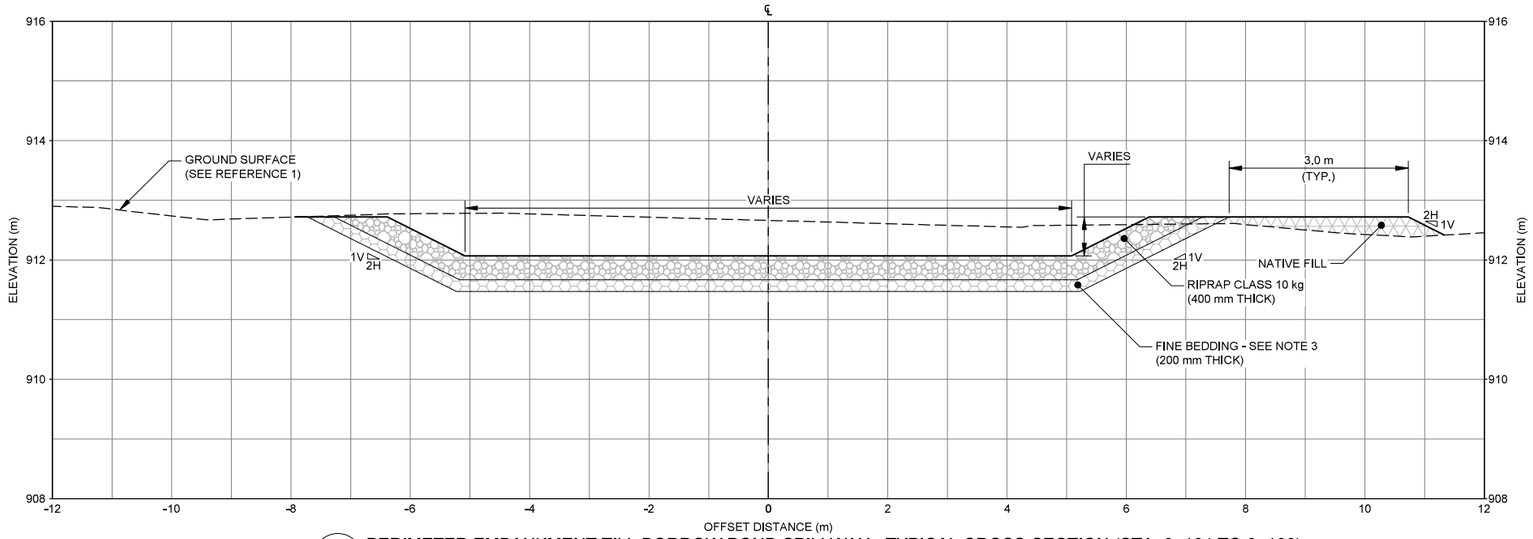
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PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+007 TO 0+164)



SCALE 1:50 m

AR
24

PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY - TYPICAL CROSS-SECTION (STA. 0+164 TO 0+180)

LEGEND

- GROUND SURFACE (SEE REFERENCE 1)
- PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY FINISHED GRADE
- RIPRAP
- FINE BEDDING (SEE NOTE 3)
- NATIVE FILL

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. ELEVATIONS ARE SHOWN IN TAILINGS GRID.
3. GREATER DEPTH OF FINE ROCKFILL REQUIRED IF WEAK SUBGRADE MATERIAL FOUND.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.

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1:50 METRES

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SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

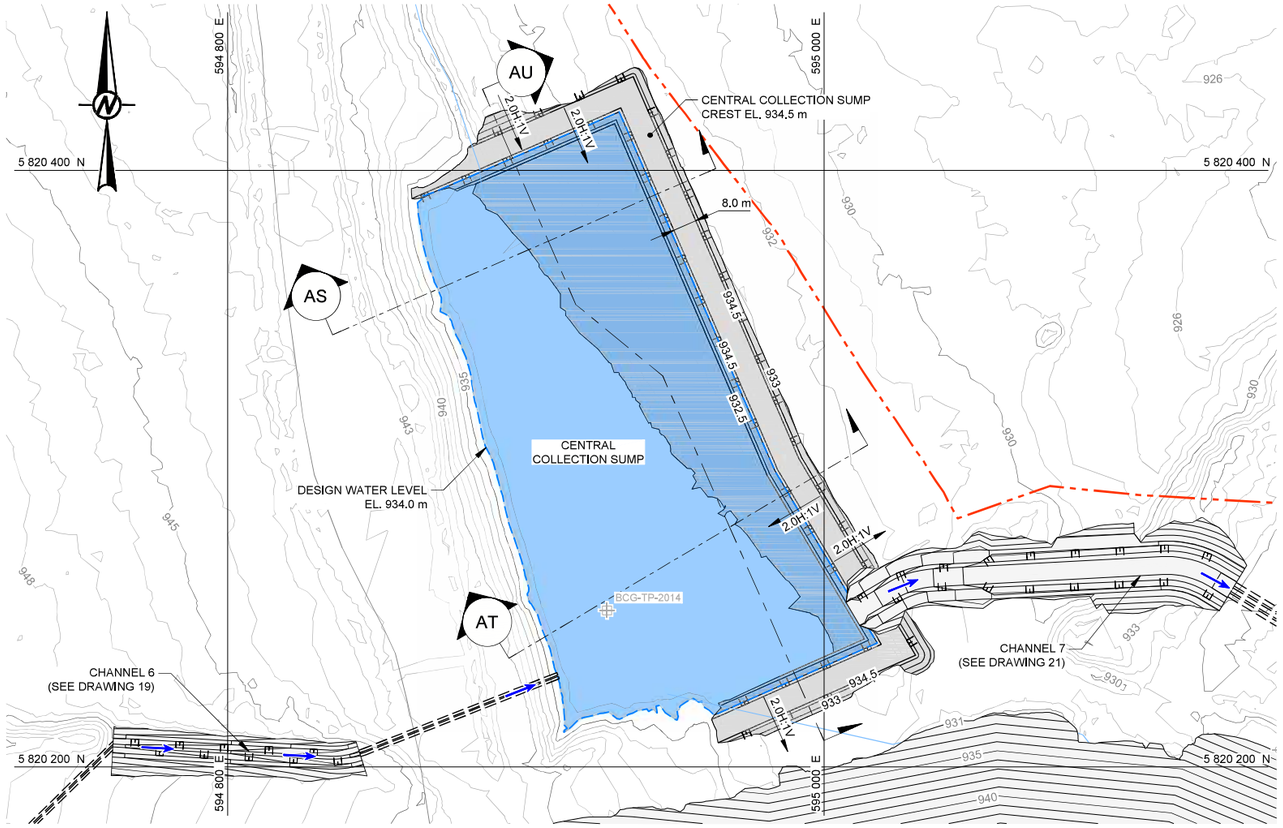
PERIMETER EMBANKMENT TILL BORROW POND SPILLWAY CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.		DRAWING
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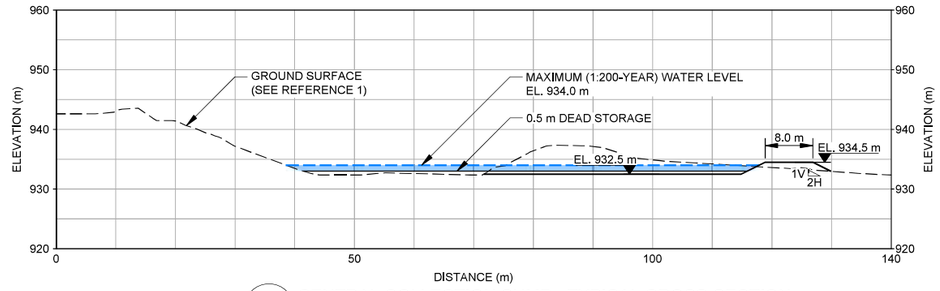
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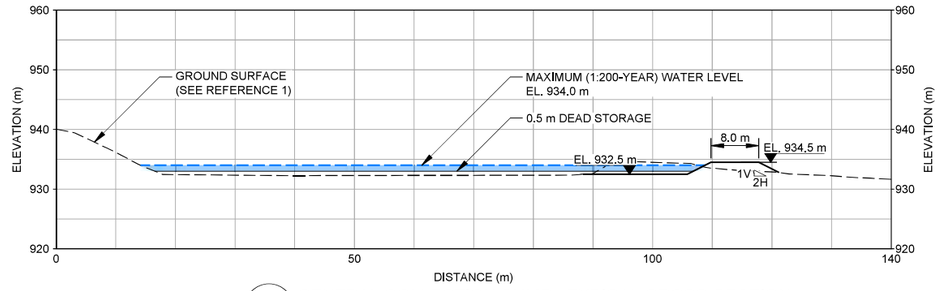


CENTRAL COLLECTION SUMP - PLAN

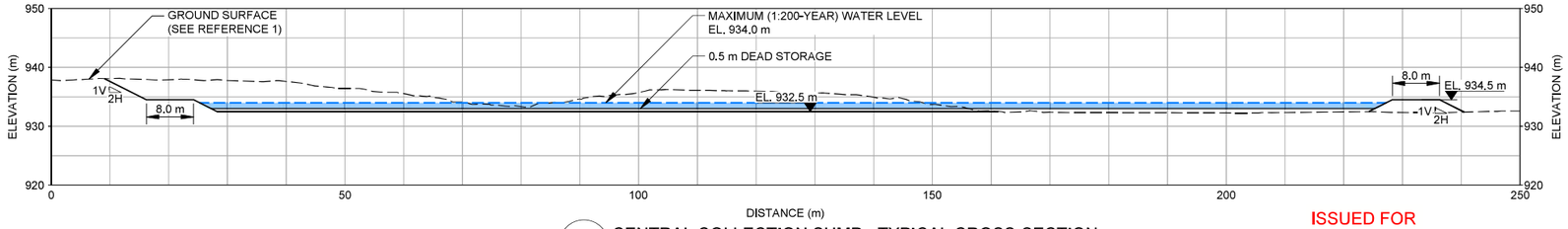
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SCALE 1:500 m — AT — CENTRAL COLLECTION SUMP - TYPICAL CROSS-SECTION



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LEGEND

- CENTRAL COLLECTION SUMP DESIGN CONTOURS
- WATER MANAGEMENT FLOW DIRECTION
- GROUND CONTOURS (SEE REFERENCE 1)
- HISTORICAL INVESTIGATION LOCATION
- SITE ACCESS ROADS (SEE REFERENCE 2)
- WATERCOURSE (SEE REFERENCE 2)
- M-200 PERMIT BOUNDARY (SEE REFERENCE 3)

NOTES

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REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "231030-TSF Lidar Contour 0.1.dxf", SURVEYED: 30 OCTOBER 2023, RECEIVED: 01 FEBRUARY 2024.
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3. M-200 PERMIT BOUNDARY PROVIDED BY MPMC, FILE NAME: "MAJ_MINE_P_polygon.shp", RECEIVED: 16 JUNE 2022.

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PROJECT

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SURFACE WATER MANAGEMENT INFRASTRUCTURE
PERMITTING DESIGN FOR TSF EL. 974 m RAISE

TITLE

CENTRAL COLLECTION SUMP
PLAN AND CROSS-SECTIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	26 of 26	DRAWING
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ATTACHMENT 2

TSF Surface Water Management Infrastructure – Design Basis Memorandum

TECHNICAL MEMORANDUM

DATE May 16, 2024 **Reference No.** 23590671-059-TM-Rev1-31151

TO Matt O'Leary
Mount Polley Mining Corporation

CC Lee Nikl and Germán Pizarro

FROM Nasim Hossein and Don Kidd **EMAIL nasim.hosseini@wsp.com; don.kidd@wsp.com**

TSF SURFACE WATER MANAGEMENT INFRASTRUCTURE – DESIGN BASIS MEMORANDUM – MOUNT POLLEY MINE

1.0 INTRODUCTION

The Mount Polley Mine is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The site is located approximately 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The Mount Polley Mine began production in 1997.

The Tailings Storage Facility (TSF) for Mount Polly mine is being extended for future operations. The TSF is located about 3 km southeast of the mill and includes one embankment that is approximately 4.8 km in length. This design basis memorandum (DBM) has been prepared by WSP to guide the design of TSF surface water management infrastructure, and to document the parameters and criteria to be used to develop the design inputs.

This memorandum provides the design basis of the TSF surface water management infrastructure to support raising the existing TSF from its currently permitted elevation of 970 m to about 974 m. This document is the updated version of Rev0 issued on 25 December 2023.

2.0 DESIGN BASIS

The design basis and criteria include hydraulic and hydrologic design assumptions for TSF water management at the Mount Polley Mine. This document does not include the design basis and criteria for the TSF spillway. The design basis and criteria for the TSF spillway, including the design event, freeboard, and catchments are provided in the design criteria technical memorandum for tailings storage facility raise to elevation 974 m (WSP 2024).

2.1 Hydrologic and Hydraulic Design Basis

The following tables summarize the criteria for design of the TSF surface water management infrastructure.

Table 1: Design Criteria – Water Diversion and Collection Channels

Parameter	Criteria	Reference/Comment
Design Storm	1:200-year, 24-hour rain plus snowmelt.	HSRC Part 10 guidance (2016), section 3.5.2 Sediment Ponds and Diversion Structures; BC Ministry of Environment-Section 5; Permit M-200
Pumped Flow	A pump capacity of 360 m^3/hr from South Embankment Pond to the collection channel near corner 3 flowing towards Main Embankment Pond.	Informed by MPMC, May 2023
Seepage Rate to the Collection Channels	Seepage rates will be based on the maximum seepage rate that will be estimated as part of the TSF design scope of work.	WSP2024b
Drain Flow Rate to Collection Channels	Drain flow rates will be based on the maximum drain flow capacity that will be designed as part of the TSF design scope of work.	WSP2024b
24-hr 1:200-year rainfall	69 mm	WSP 2022
24-hr 1:200-year snowmelt depth	15.9 mm (See section 2.2)	Estimated using Dunne & Leopold (1978) method for a corresponding rainfall event calculated for spring conditions (April).
Catchment Area	Delineated based on topography using 2023 contours with 0.1m resolution, 2023 LiDAR topography survey provided by MPMC, and embankment and buttress contours as part of the TSF design scope of work.	Channels 1-3 reporting to the South and Main Embankment Seepage Ponds will be designed considering the ultimate TSF embankment raise (987 m crest) . [(a)] other channels will be designed considering interim TSF raise (974 m crest).
24-hour storm distribution	Soil Conservation Service Storm Type II	Section 2.3
Side slopes	2H:1V	Adopted
Longitudinal slope	Minimum 0.1% slope, to optimize excavation volume	Adopted
Freeboard	Minimum 0.3 m	Permit M-200
Minimum channel base width	1.0 m	Adopted
Minimum channel depth	0.5 m	Adopted
Erosion Protection requirements and Permissible Flow Velocity	Erosion protection materials will be selected based on estimated peak velocities along the channel alignment using the hydraulic calculations.	BC MOTI 2019 Flows estimated using HEC-HMS model. Velocities estimated using Manning's equation.
Road Crossing Culverts	1:200-year, 24-hour rain plus snowmelt.	Match design flow inputs of adjacent conveyance structure.
Road Crossing Ford (as an alternative for culverts, if needed)	5H:1V maximum crossing side slopes.	BC Ministry of Forest Lands and Natural Resource Operations (2012).

MPMC = Mount Polley Mining Corporation; TSF = Tailings Storage Facility; BC MOTI = British Columbia Ministry of Transportation and Infrastructure.

(a) Design is in progress.

Table 2: Design Inputs– Collection Ponds

Parameter	Criteria	Comment/Reference
Storage Volume – Storm	Store 1:10-year, 24 hour rain plus snowmelt storm event	This design event is consistent with requirement in Environmental Management Act Permit 11678 (EMA 2022) Permit 11678 Paragraph 2.4.5, which states that "surface water control works must be designed to convey all flows up to a 1 in 10 year 24-hour storm event and must be designed to withstand all flows up to a 1 in 200 year 24-hour storm event, without significant damage".
Storage Volume – TSF Seepage	Excluded	Seepage inflow to the South and Main Embankment Ponds will be pumped out to the TSF or Perimeter Embankment Till Borrow Pit (PETBP). MPMC operates the ponds by a water level control and pumping system that ensures sufficient storage capacity is maintained in the pond for storm events. Seepage inflow to PETBP will be pumped out to the Treatment Plant or TSF. MPMC operates the pond by a water level control and pumping system that ensures sufficient storage capacity is maintained in the pond for storm events. Extra storage allowance may be an option to allow greater operational flexibility with pumping seepage flows. To be discussed and confirmed with MPMC.
Storage Volume – TSF Upstream drain flow	Excluded	Drain inflow to the South and Main Embankment Ponds will be pumped out to the TSF or PETBP. MPMC operates the ponds by a water level control and pumping system that ensures sufficient storage capacity is maintained in the pond for storm events. Drain inflow to PETBP will be pumped out to the Water Treatment Plant or TSF by the water level control system to leave enough storage capacity for storm events. Extra storage allowance may be an option to allow greater operational flexibility with pumping upstream drain flows.
24-hr 1:10-year rainfall	47 mm	WSP 2022
24-hr 1:10-year snowmelt depth	14.8 mm (See section 2.2)	Estimated using Dunne & Leopold (1978) method for a corresponding rainfall event calculated for spring conditions (April).
Dead Volume	0.5 m bottom of the pond	Adopted
Freeboard at Spillway Entrance	Minimum 0.3 m	Between the maximum water level design flow during 24-hr 1:200-year rain plus snowmelt event and the crest of the collection pond.
Pond geometry and side slope	Minimum 2H:1V	The stability analysis (WSP 2024a) indicates that the proposed cut slopes at a ratio of 2H:1V meets the desired safety standards across all loading conditions.
South and Main Embankment Ponds pumping capacity	The current pumping capacity is: South Embankment Pond to Main Embankment Pond = 360 m^3/hr. Main Embankment Pond to TSF = 360 m^3/hr.	Informed by MPMC, May 2023 The current pumping rates must be verified or updated according to the updates to the operational pumping rules and upstream drain and seepage flow rates. The opportunity of sending water from the South and Main Embankment Ponds to the PETBP to be evaluated.
Emergency Spillways	Convey the 1:200-year, 24-hour rain plus snowmelt storm event	EMA 2022 - Permit 11678

Table 2: Design Inputs– Collection Ponds

Parameter	Criteria	Comment/Reference
Freeboard at Spillway Outlet Channel	Minimum 0.3 m freeboard	Permit M-200
Pond Liners	Native material liner	Native material is anticipated to have sufficiently low permeability to act as pond lining.

2.2 Design Precipitation Depth

Extreme runoff volumes are anticipated to be associated with extreme rainfall events occurring during freshet. The snowmelt is expected to occur between March and May with a relatively greater portion melting in April. Snowmelt estimates induced by a corresponding rainfall event (rain plus snowmelt event) were calculated for spring conditions (April) using equation below (Dunne & Leopold, 1978).

$$M_R = 1.42T_a + 2.5 + \frac{RT_aC_W}{L} + 0.0059T_au_2$$

Where:

M_R = snowmelt in mm/day Snow Water Equivalent (SWE).
R = rainfall depth in mm/day averaged over the duration of the storm.
T_a = average air temperature over the duration in °C.
C_W = specific heat of water (equal to 1 cal/g/°C).
L = latent heat of fusion of ice equal to 80 cal/g.
u_2 = wind speed in km/day

The potential snowmelt during a rainfall event was estimated using the mean daily temperature in April of 3.7°C (WSP 2022). The spring average wind speed of 2.6 m/s (Golder 2017) was used for this equation. The estimated spring maximum 24-hour snowmelt rates are presented in Table 3.

Table 3: 24-Hour Rainfall, Snowmelt, and Rain Plus Snowmelt (mm)

Return Period (Years)	Mean Daily Temperature in April (°C)	24-Hour Rainfall (mm)	24-Hour Snowmelt (mm)	24-Hour Rain Plus Snowmelt (mm)
10	3.7	47	14.8	61.8
200	3.7	69	15.9	84.9

2.3 Design Storm Event Rainfall Distribution

Natural Resources Conservation Service (NRCS) (formerly known as Soil Conservation Service (SCS)) defines three storm distributions: Types I, Type IA, and Type II. The SCS storm type distribution over 24 hours at the Site was estimated based on the 1:100-year depth-duration-frequency (DDF) values at the Williams Lake (Station ID 1098940) and Quesnel (Station ID 1096631) climate stations operated by ECCC. The rainfall distribution at the Williams Lake and Quesnel climate stations for 5-minute to 12-hour durations were estimated as a percentage of the 24-hour rainfall and the results were compared to the representative percentages of each of the SCS curves. The DDF values were plotted and compared to the representative percentages of each of the SCS curves (Table 4 and Figure 1).

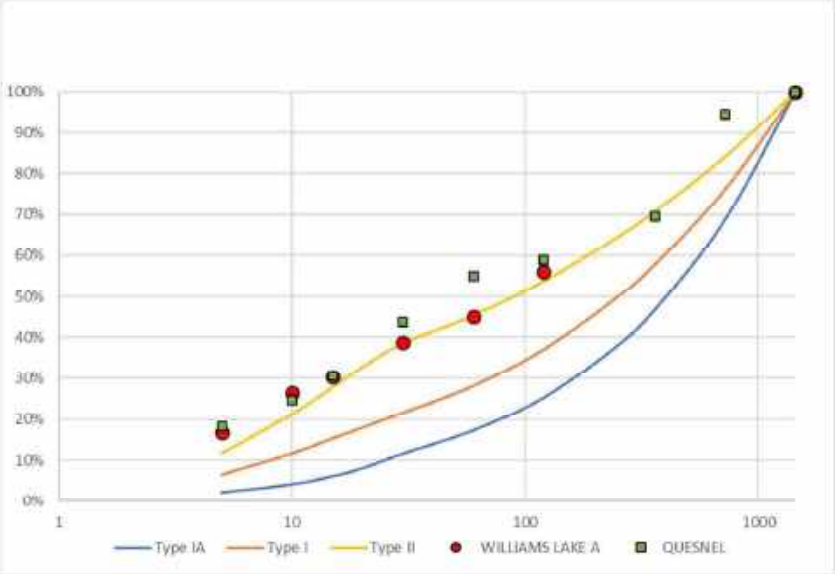


Figure 1: 1:100-year depth-duration values at the Williams Lake and Quesnel

Table 4: 1:100-year Depth-Duration-Frequency Values in mm for the Williams Lake and Quesnel Climate Stations

Duration	Williams Lake	Quesnel
5 min	7.8	8.8
10 min	12.4	11.9
15 min	14.2	14.7
30 min	18.2	21.1
1 hr	21.1	26.5
2 hr	26.3	28.4
6 hr	Not Available	33.5
12 hr	Not Available	45.6

Table 5: Comparison of DDF to NRCS Storm Distributions

Durations	DDF At Williams Lake	DDF At Quesnel	SCS Type IA	SCS Type I	SCS Type II
5 min	17%	18%	2%	6%	12%
10 min	26%	25%	4%	12%	21%
15 min	30%	30%	6%	15%	28%
30 min	39%	44%	12%	22%	39%
1 hr	45%	55%	17%	28%	45%
2 hr	56%	59%	25%	37%	54%
6 hr	Not Available	70%	47%	58%	71%
12 hr	Not Available	95%	69%	76%	84%

Table 5 indicates that the short-duration rainfall distribution at the Mt Polley mine site follows Type II distribution. Millar (2017) presented similar results and indicated that the SCS Type II distribution is considered representative of the 24-hour storm distribution for the Williams Lake climate station. For the design purpose, the SCS Type II storm was identified as the best representation of the typical rainstorm intensities at the site and was used to derive the design 24-hour rainfall distribution.

2.4 Hydrologic and Hydraulic Methods

The design of the TSF water management infrastructure will be based on design peak flows and volumes estimated using the Hydrologic Engineering Center hydrologic modelling system software (HEC-HMS) version 4.10 (USACE 2022). The US Department of Agriculture, Soil Conservation Service (SCS) Type IA rainfall distribution curve (USDA 1986) will be used to derive the design of storm hyetographs.

The SCS curve number (CN) method (USDA, 1986) will be used to estimate general catchment area losses. These losses are considered when determining the amount of rainfall during a storm that becomes direct runoff.

Time of concentration is estimated using SCS TR-55 method (USDA 2009), which divides the longest flow path into sheet flow, shallow concentrated flow, and open channel flow, and considers a minimum time of concentration of 6 minutes. The lag time was estimated as 60% of the time of concentration.

Catchment Curve Number (CN) values, to predict direct runoff, are provided in Table 4.

Table 6: Soil Conservation Services Curve Numbers Used for the Project

Land Type	CN (AMC II)	CN (AMC III)
Undisturbed catchment	55	73.8
TSF Embankment and Buttress	70	84.3
Disturbed catchment	79	89.6
Open Water	No loss	

CN = Curve number; AMC II = Average antecedent moisture conditions, AMC III = Wet antecedent moisture condition.

Channels will be sized for uniform flow conditions using Manning's equation for open channel flow. Manning's n values for different riprap sizes and plastic liner are shown in Table 5. For erosion protection of the channels, the riprap class was selected considering the maximum permissible velocity of the riprap provided in Table 8.

Table 7: Manning's n Values for Channels

Material Type	Manning's n for Capacity	Manning's n for Stability
Plastic	0.012	0.010
gravel, uniform section, clean(1)	0.03	0.022
Riprap class 10 KG	0.038	0.034
Riprap class 25 KG	0.039	0.035
Riprap class 50 KG	0.042	0.037
Riprap class 100 KG	0.044	0.039
Riprap class 250 KG	0.046	0.042

(1) Manning's n for Channels (Chow, 1959).

Table 8: Maximum Permissible Velocity for Riprap and Plastic (MOTI 2019)

Riprap Class	Velocity (m/s)
Plastic	5.0
Gravel, uniform section, clean	1.0
10 kg	2.7
25 kg	3.1
50 kg	3.5
100 kg	3.9
280 kg	4.5
Riprap class 1 000 KG	5.0
Grouted riprap	Refer to Figure 2

(2) Source: BC MOTI (2019) - values rounded

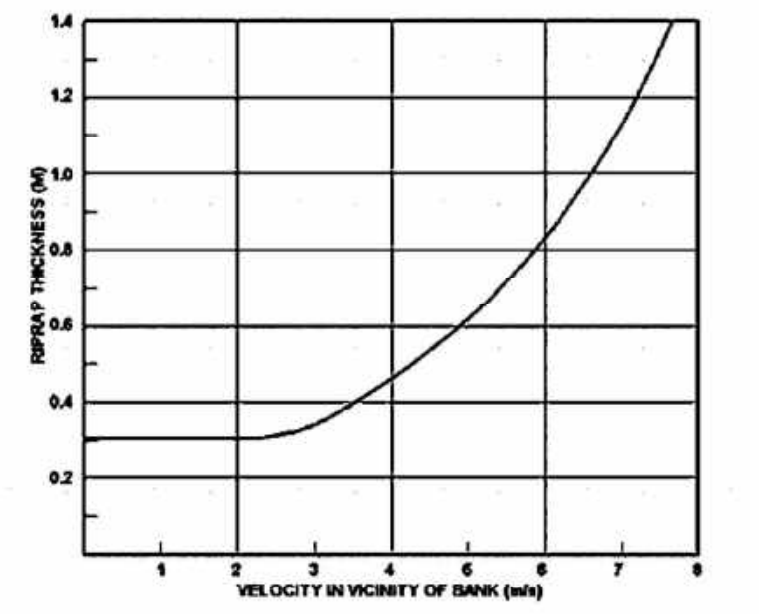


Figure 2: Required Blanket Thickness as a Function of Flow Velocity (HEC 11, 2024)

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions or comments, please contact the undersigned.

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APPENDIX 5-3: Site-Wide Water Balance Model

REPORT

Mount Polley Mine Water Balance Model

Springer Expansion Life-of-Mine

Submitted to:

Mount Polley Mining Corporation

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May 21, 2024



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APPENDIX A
Springer Expansion LOM SWWBM Inputs

APPENDIX B
Flow Diagrams and 2022 Water Management Infrastructure

APPENDIX C
SWWBM Results

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) is currently submitting a permit application for the new Springer Expansion phase, extending assumed operations until March 31, 2031. The Site Wide Water Balance Model (SWWBM) presented in this report is a critical component, essential to support the Water Management Plan required for the Springer Expansion permit application. It should be noted that the specific operation, closure, and post-closure dates in this report have been assumed for the purpose of modelling. There are many factors that exist that can alter these dates, such as delays on the mine production as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan. Thus, these time frames should not be considered static.

The SWWBM was originally developed for the Technical Assessment Report (TAR) to support the effects predictions in the Mount Polley Mine Long Term Water Management Plan (Golder 2016a) for the Mount Polley Mine (the Mine) and has since been calibrated on an annual basis (refer to WSP 2023a for the latest 2022 annual calibration). This report presents the SWWBM based on the Springer Expansion Life-of-Mine (LOM) Plan informed by MPMC (MPMC 2022), to a crest elevation of 987 m of the TSF.

The work presented in this report is as follows:

- A summary of the physical setting at the Site (Section 2.0)
- An overview of the climate and hydrology at the Site (Section 3.0)
- A description of the SWWBM, including inputs and assumptions (Section 4.0)
- A presentation of SWWBM results, including operational, closure, post-closure phases (Section 5.0)
- Tabular inputs of the SWWBM (APPENDIX A)
- Flow Diagrams and 2022 Water Management Infrastructure Drawing (APPENDIX B)

This report has been prepared in accordance with the “Study Limitations,” which are presented at the beginning of the report. The reader’s attention is specifically drawn to this information for reference during use of this report.

2.0 BACKGROUND

2.1 General Information

Mount Polley Mine is a copper and gold mine operated by MPMC, a subsidiary of Imperial Metals Corporation. The Mine is located approximately 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake. Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

MPMC is applying for a permit for the new Springer Expansion phase, which extends operations until 2031. Updating the SWWBM to reflect the Springer Expansion LOM plan is required to support the Water Management Plan for this permit application. The updated SWWBM will generate results throughout the operational phase to a crest level of 987 m of the TSF (to be completed before the end of operations), extending into the closure and post-closure phases.

3.0 CLIMATE AND HYDROLOGY

3.1 Climate

In 2022, WSP Canada Inc. (WSP) updated the climate baseline data for the Mine. The climate of the Mine was characterized in the Baseline Climate Update Report (Golder 2022b) using historical measurements from local climate stations, supported by data obtained from five nearby regional Environment and Climate Change Canada (ECCC) climate stations. During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically being taken during the melt phase. Detailed climate information can be viewed in Golder 2022b. The climate inputs for the SWWBM are presented in Section 4.5.1.

3.2 Site Drainage and Surface Hydrology

A network of ditches, sumps, and pumping systems are operated by MPMC to manage surface water at the Mine. The current water management infrastructure of Mount Polley is presented in the MPMC 2022 Water Management Infrastructure Drawing provided in APPENDIX B. Surface water is separated between contact (mine affected) and non-contact (non mine affected) sources of runoff. The two water sources can be characterized as follows:

- Contact water: water that may have come into direct contact with mining and milling activities. This water generally requires treatment before release to the environment.
- Non-contact water: runoff originating from areas unaltered by mining activity that does not contact mining areas. It is typically diverted to the maximum extent practicable and allowed to discharge directly to the receiving environment.

The objective of current water management practices is to minimize the mingling of contact and non-contact surface water sources whenever possible. These flows originate from direct precipitation, runoff, and snowmelt from catchments. Contact water is mainly collected along two ditches running north to south along the Site: West Ditch and Long Ditch. A block flow diagram provides a conceptual overview of the sumps and their respective connections across the Mine area presented in Figure 1.

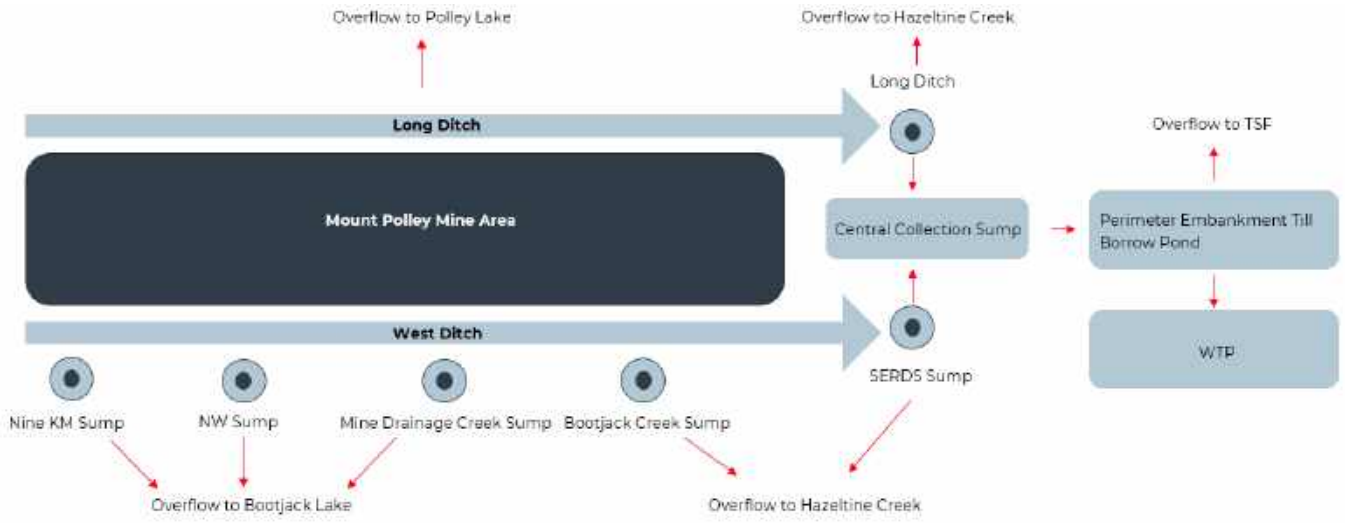


Figure 1: Conceptual Block Flow Diagram of Mount Polley Mine Contact Water Management Infrastructure

The West Ditch system collects contact water starting from the west side of the Site, progressing from the Nine KM Sump to the SERDS Sump. Components of the West Ditch system include various sumps, ditches, and pumping systems.

Similarly, the Long Ditch system manages contact water from the east side of the Site, extending from below the site access road to the Central Collection Sump. This system also comprises various sumps, ditches, and pumping systems.

3.3 Pit Groundwater Hydrogeology

Groundwater flow has been assessed for the following open pits at the mine: Springer Pit, Cariboo Pit, Wight Pit, and Boundary Pit. The analysis for each pit is described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a).

Hydrogeological assessments for the pits were conducted as part of the TAR to estimate groundwater seepage into and out of the pits. Seepage estimates have not been updated for the WBM results presented in this document, which relies on the estimates completed in the 2016 TAR. WSP is currently updating these seepage estimates for the Mine pits, the seepage estimates will be updated in the SWWBM when available. Results will be assessed to identify any notable changes to the seepage estimate. Updated seepage parameters are not expected to alter the water balance results for the site or alter the water treatment quantity design basis; however, this will be confirmed once updated parameters are available. Groundwater inputs for the SWWBM are presented in Section 4.5.3.

3.4 Tailings Storage Facility

Flows from the TSF have been discussed in the TAR (Golder 2016a). WSP is currently designing a new upstream drainage system within the TSF to accommodate the increase in the TSF pond elevation (WSP 2023e). Updated estimations of seepage flow rates have been developed for each embankment as part of the TSF embankment crest at elevation 987 m design and are provided in Section 4.5.7.5.

4.0 SITE WIDE WATER BALANCE MODEL

An update to the existing SWWBM was carried out using GoldSim™ (Version 14.0). This section presents SWWBM software, model objectives, general assumptions, processes, and inputs.

4.1 Model Software

GoldSim allows dynamic and complex water quantity interactions to be represented through a visual and highly modular framework. All input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. GoldSim is widely used for mine water quantity studies and provides the following capabilities:

- Deterministic and probabilistic simulations can be run within the model, which allows statistics and probabilities to be assigned to the model outputs.
- Simulation periods can be varied within the same model.
- The model framework can be easily adjusted to account for evolving conditions on a mine site, which allows the model to be used as an operational planning tool.
- Water quantity and water quality modules can be directly linked within the model, which allows both modules to be updated simultaneously; this is particularly useful when evaluating a range of scenarios (e.g., alternative water management strategies).

4.2 Model Objectives

This SWWBM was updated to include the future operational phase, in line with the assumed Springer Expansion LOM plan. Additionally, it has been updated to reflect changes in the closure and post-closure phases since the Reclamation and Closure Model update completed in 2022 (Golder 2022a).

This SWWBM has the following objectives:

- Include a future operational phase that will extend from May 2, 2023, to March 31, 2031.
- Include a closure phase extending from April 1, 2031, to March 31, 2041.
- Include a post-closure phase commencing on April 1, 2041, and extending to March 31, 2131 (100 years including closure).
- Estimate the quantity of contact water collected on-site per the climate conditions.
- Estimate water retention requirements in major storage locations at site such as the TSF and pits.
- Estimate the quantity of contact water requiring treatment.
- Enable assessment of future operations water quality and associated water treatment and/or discharge options.
- Provide a model that can be linked to a water quality module that assesses site water quality during forecasted future operations.

4.3 Assumptions and Key Input Parameter Values

General assumptions applied to this model are as follows:

- Continuation of mining of the Springer Pit and Cariboo Pit will not significantly increase the footprint of the pits.
- There is no seepage from the ponds or sumps other than the TSF (i.e., all ponds and sumps are assumed to be lined, or seepage is assumed to be negligible).
- Direct precipitation, evaporation, and seepage loss from ditches are assumed to be negligible.
- Precipitation occurs as snow from December to February and as rain or a mixture of rain and snow in all other months.
- Snowpack is represented by the cumulative precipitation depths over the months of December, January, and February, spanning a period of three months.
- Snowmelt occurs in the months of March, April, and May as a percentage of the maximum snowpack at the end of February (5% in March, 90% in April, and 5% in May).
- The closure and post-closure phases are included in the SWWBM, and the flow logic and model wiring for these phases are based on the 2022 Reclamation and Closure Plan (RCP) (Golder 2022a). Flow diagrams for closure and post-closure phases are also presented in Appendix B.

Key input parameter values and assumptions for the operational phase simulations are presented in Table 1.

Table 1: Key Input Parameter Values and Assumptions

Parameter	Value	Reference
TSF emergency spillway invert elevation at 987 m dam crest elevation during operations	985.8 m	WSP 2023c
Initial TSF water volume	2.84 M-m^3	TSF Weekly Report (MPMC 2023a)
Initial Springer Pit water level	970.66 m	TSF Weekly Report (MPMC 2023a)
Initial Cariboo Pit water level	954.72 m	TSF Weekly Report (MPMC 2023a)
Initial Wight Pit water level	912.87 m	TSF Weekly Report (MPMC 2023a)
Tailings stored in Springer Pit	2.00 M-m^3	TSF Weekly Report (MPMC 2023a)
Water Treatment Plant (WTP) treatment capacity	25,000 m^3/d	Provided by MPMC (MPMC 2023b)

4.4 Model Domain

A description of the model flows is provided in APPENDIX A. The domain and structure of the SWWBM is outlined in the conceptual flow diagrams for the forecasted operational, closure and post-closure phases in Appendix B. The flow diagrams illustrate the assumed water circuit system at the Site during operations, closure, and post-closure, including the storage and conveyance of water. The water management infrastructure within the SWWBM for the operational phase is summarized in Table 2 and flow types are outlined in Table 3.

From closure and progressively to post-closure, certain Site areas will be reclaimed, and run-off will become non-contact water and the volume of annual contact water will reduce. Pumping rates for the Site will be reduced at the end of the closure period, as certain areas are assumed reclaimed. The progression of flow routes and discharges to the environment are shown on the flow diagrams presented in Appendix B.

Table 2: Water Management Infrastructure during Operations

Major Ditches	Sumps and Minor Ponds	Major Ponds and Storage Facilities
▪ Long Ditch ▪ SERDS Ditch (lower portion of West Ditch)	▪ South Seepage Pond ▪ Main Embankment Seepage Pond ▪ Central Collection Pond ▪ Bootjack Creek Sump ▪ Mill Site Sump ▪ Mine Drainage Creek Sump ▪ NW Sump ▪ 9K Sump ▪ Boundary Pit	▪ TSF ▪ Cariboo Pit ▪ Springer Pit ▪ Wight Pit ▪ Perimeter Embankment Till Borrow Pond

SERDS=Southeast Rock Disposal Site; TSF = Tailings Storage Facility

Table 3: Types of Flows Represented in the SWWBM

Site Inflows	Site Outflows or Transfers
▪ Direct precipitation ▪ Runoff ▪ Seepage (includes baseflows)	▪ Water consumption flows (turbo-misters, and water trucks) ▪ Water treatment discharge ▪ permanent, unrecoverable storage in tailings (interstitial water) ▪ Open water evaporation ▪ Pumped flows between facilities ▪ Transfer flows (gravity flows between facilities) ▪ Groundwater flows

4.5 Model Inputs

4.5.1 Climate Inputs

The following sections describe the climate inputs used in the SWWBM.

4.5.1.1 Precipitation

The SWWBM was run with probabilistic monthly climate inputs for this assessment. To develop probabilistic inputs, monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022b) were fitted to a log-normal probability distribution. The mean and standard deviation for the monthly precipitation values are shown in Table 4.The model is run using a daily time step, which represents better variation between months such as the water volume in the TSF or the pits.

The derived monthly means and standard deviations of the precipitation values, defined in the model as stochastic elements, were used to generate random values based on the distribution of the dataset. The stochastic generator was set to perform 2000 realizations to create a sample size that was sufficiently large to account for a range of conceivable monthly climatic precipitation scenarios for the study period. The results of these 2000 realizations were compiled to generate probability distributions that yield percentile values. To represent average and extreme climate scenarios, results for the 50th, 90th and 99.5th percentiles are presented in Section 5.0.

Table 4: Stochastic Climate Generator Log-Normal Distribution Input Arguments

Month	Mean of the Monthly Precipitation Depths (mm)	Standard Deviation of the Monthly Precipitation Depths (mm)
January	49.4	30.9
February	35.8	24.2
March	29.7	13.9
April	44.7	43.6
May	49.9	20.2
June	70.8	32.9
July	63.6	55.1
August	50.6	31.2
September	52.3	30.1
October	58.1	27.9
November	49.8	28.9
December	57.6	32.7

4.5.1.2 Evaporation

The median annual shallow lake evaporation rate is estimated to be 670 mm. Monthly evaporation rates vary between 0 mm in December to 136 mm in July. Estimated median monthly and annual shallow lake evaporation from 1974 to 2001 are presented in Table 5.

Table 5: Median Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Median Shallow Lake Evaporation (mm)
January	0
February	7
March	32
April	67
May	102
June	121
July	136
August	113
September	60
October	21
November	4
December	0
Annual	**663**

4.5.1.3 Climate Change

An ensemble of monthly temperature and precipitation projections were obtained from ClimateBC consisting of 8 Global Climate Models (UBC 2022) and two emissions scenarios (SSP2-4.5 and SSP5-8.5) covering mid to high emissions from the Sixth Intergovernmental Panel on Climate Change Assessment Report (IPCC 2021). A stochastic approach (outside the GoldSim model) was used to extend these projections from year 2100 to 2200 by resampling monthly data from 2071-2100 and relating projected changes in temperature and precipitation climate variables to a set of extended greenhouse gas concentration pathways beyond year 2100 (van Vuuren et al. 2011). The range of projected temperature and precipitation values for each month was summarized across the ensemble of climate models and emissions scenarios using a range of values. The mean, and the upper bound, have been included in the SWWBM to analyze the effects of climate change. Lake evaporation, snow accumulation and snowmelt were calculated in the same way as for the average scenario.

4.5.2 Hydrology Inputs

The following sections describe the hydrologic processes and inputs used in the SWWBM.

4.5.2.1 Runoff Parameters

Runoff in the SWWBM is estimated using seasonal runoff coefficients. Runoff coefficients represent the proportion of rainfall that reports as runoff or seepage, accounting for losses due to evaporation, storage, and infiltration. Adjustment during the calibration process resulted in a 30% increase of the general runoff coefficients in cases where the monthly precipitation exceeds 50 mm. The runoff coefficients account for the following two seasonal climate periods:

- **General (July to February)** – mid-range coefficients to reflect soil moisture contents for intermittent runoff events.
- **Freshet (March to June)** – highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.

The seasonal runoff coefficients defined for the catchment types considered in the SWWBM are presented in Table 6.Runoff coefficients are adjusted during the annual SWWBM calibration to align estimated runoff volumes with Site monitoring data.

Table 6: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Source: Golder 2020

4.5.2.2 Catchment Areas

To model runoff, direct precipitation, and evaporation, the catchment areas for each storage element were defined in the model. The catchment/reporting area for each storage element remains consistent with the TAR (Golder 2016a). However, there's one exception: the TSF impoundment catchment at the projected 987 m crest. Any alterations would mainly affect the infrastructure downstream of the TSF, but these changes are expected to have minimal impact on the model results. The catchments are shown in Table 7. Subdivision of catchments areas by land type are presented in Table A-1 in APPENDIX A.

Table 7: Current Catchment Areas for SWWBM Storage/Conveyance Elements

Storage or Conveyance Element	Total Reporting Area (m^2)
South Seepage Pond	385
Main Embankment Seepage Pond	376,900
TSF Upstream Catchment (External)	622,800
TSF Impoundment Catchment (Internal – current)	2,269,700
TSF Impoundment Catchment (Internal – projected at 987m raise) [(a)]	2,860,000
Perimeter Embankment Till Borrow Pond (PETBP)	524,300
Central Collection Sump (CCS)	438,600
Bootjack Creek Sump	175,200
SERDS Ditch[(b)]	1,537,600
Mill Site Sump	1,630
Mine Drainage Creek Sump	1,115,900
Long Ditch	2,494,000
Cariboo Pit	1,320,400
Springer Pit	651,900
NW Sump	330,200
9K Sump	698,700
Wight Pit	413,900
Boundary Pit	23,400
Total Reporting Area	**12,997,315**

Source: Golder 2016a. Update on TSF impoundment based on TSF projections.

(a) The raise of the TSF will affect the catchments producing runoff into the TSF pond. To consider the increase of the TSF impoundment catchment, the model interpolates the TSF impoundment catchments between the current state and the TSF raise to 987m. Changes in other catchments are minor.

(b) The current SERDS Tailings Co-Disposal project does not affect the delineation of the catchment.

After finishing operations, some mining features become remediated during closure and become non-contact water during post-closure. This is modelled by changing the land types, from disturbed to not disturbed areas. The land types define the runoff coefficients (Table 6) and the water quality, which is analyzed in the Water Quality Report (WSP 2023d). The model logic to convert the land types it is as follows (all timeframes are from start of closure on April 1, 2031 – assumed for the purpose of modelling):

- Roads:
  - 14% of total road area switch to disturbed at year 3.
  - 21% of total road area (additional 7%) switch to disturbed at year 4.
  - Negligible amount of road surface is fully reclaimed (no undisturbed road area ever).
- Dump areas transition to disturbed at the following rate:
  - Closure + year 1 = 22%.
  - Closure + year 2 = 37%.
  - Closure + year 3 = 61%.
  - Closure + year 4 = 100%.
- Mill site
  - Areas switch to disturbed at year 2.
- All Disturbed areas, not including unreclaimed roads, will transition to undisturbed at the following schedule:
  - year 5 = 25%.
  - year 10 = 50%.
  - year 15 = 75%.
  - year 20 = 100%.

After this time all areas will be undisturbed except Pit areas and unreclaimed roads.

4.5.3 Groundwater Inputs

Groundwater flow has been assessed for the following open pits at the mine: Springer Pit, Cariboo Pit, Wight Pit, and Boundary Pit. Groundwater flows with dependency on the water level of the pits are presented in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a) and repeated in Appendix A of this report.

4.5.4 Storage Capacities

Free water volumes in storage ponds, sumps, and the TSF depend on a balance between their inflows and outflows. The stage (elevation) can be directly correlated to a specific storage volume using bathymetric and topographic data. These relationships are referred to as stage-storage curves.

Dynamic storage facilities such as the TSF, where tailings deposition changes the available storage, require regular survey updates to confirm whether existing stage storage curves are appropriate for projecting free water volumes. Stage-storage curves for the TSF up to a crest elevation of 987 m were developed from the 2020 TSF survey. These curves were obtained from preliminary tailings deposition modelling carried out in support of the design of the 987 m TSF.

The stage-storage curves projected up to a crest elevation of 987 m constitute a 2-D element that considers the tailings tonnage. These curves will interpolate according to the dry tailings volume across the Springer Expansion LOM schedule. Additionally, these curves are limited by the spillway invert stated in Table 1, serving as the upper boundary for the maximum TSF elevation. The stage-storage curves up to a crest elevation of 987 m crest in this report are provided in APPENDIX A.

Stage-storage curves were available for the following major storage elements and are provided in APPENDIX A:

- Springer Pit (November 7, 2019, bathymetry survey)
- Cariboo Pit (June 3, 2022, topographic survey)
- TSF (June 17, 2020, bathymetric survey tied-in with October 22, 2019, topographic survey)
- Wight Pit (January 13, 2022, bathymetric survey)

The estimated volume capacities for the facilities listed above and other storage locations are presented in Table 8.

Table 8: Maximum Capacities for Major Storage Facilities

Major Storage Facility	Estimated Capacity (M-m^3)
Springer Pit[(a)]	14.8
Cariboo Pit[(a)]	5.1
Combined Springer-Cariboo Pit final mine-out	30.3
TSF – 987 m crest elevation design	5.7[(b)]
Wight Pit	3.8
PETBP	0.17

(a) Represents current individual pit volumes (i.e., before pits are combined or further mined.)

(b) Capacity at the final stage of the TSF, when tailings deposition ends.

When the embankment reaches an elevation of 987 m, the TSF pond will be pushed towards the north abutment. The TSF will be available to store freshet water until four months after the start of the closure phase (July 31, 2031) in order to capture the last freshet period during the operations phase. Commencing August 1, 2031, TSF volume will be progressively reduced to 0.25 M-m^3 over the course of two months due to construction of the closure spillway.

4.5.5 Mine Plan

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage/volume of dry tailings during the project is provided in Table 9 (MPMC 2022). It is assumed that 6.55 M-tons of dry tailings have been placed in the TSF between the mine plan start date of July 1, 2022, and the assumed SWWBM operations start date of May 2, 2023.

Table 9: Mine Plan (Annual Totals)

Year	Dry Tailings (tons)
2022[(a)]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[(b)]	860,381

(a) Mine plan starts on July 1, 2022.

(b) Mine plan ends on March 31, 2031.

4.5.6 TSF Pond Volumes

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on-site year over year (including within the TSF) by treating and discharging water.

The minimum and maximum operational water volumes in the TSF under normal conditions are 1.5 M-m^3 and 1.7 M-m^3, respectively.

The water balance model activates and deactivates pumping flows. As a result, the TSF pond volume is set at 1.5 M-m^3 prior to freshet and it returns to the specified normal operating range after freshet. TSF volume conditions are presented in Table 10.

Table 10: TSF Pond Volume Values

Condition	TSF Pond Volume (M-m^3)
Minimum under normal conditions	1.5
Maximum prior to freshet (February-April)	1.5
Maximum after freshet and until freeze-up	1.7

Note: M-m^3 = 1 × 10^6 m^3

4.5.7 Flow Derivation and Logic

This section describes the model logic for pumped flows, seepage (from the TSF), groundwater inflows and outflows, consumption, and transfer flows.

In general, the model localizes the outflows of the TSF and pits and ponds; based on demand priorities using modeling elements known as "allocators." When water is present in storage, the allocator calculates evaporation as the first priority, followed by all pumping flows depending on the configured priorities. The maximum pumping capacity is utilized when water is available. If the total outflow is restricted, a lower or zero pumping rate is applied.

4.5.7.1 Pumped Flows

The most relevant transfer rates, including rates between TSF, Pits and PETBP; have been informed by MPMC (MPMC 2023b), while the remaining rates remain consistent with the TAR model and were based on engineering judgement (Golder 2016a). Maximum pumping rates for the operational, closure, and post-closure phases (2023 to 2131) are shown in APPENDIX A.

It should be noted that the capacity set for transfer from TSF to Wight Pit (P30) was assumed at a capacity to avoid PETBP overflow during operations. Capacity set for transfer from CCS to Wight Pit (P35) during closure is a WSP assumption to allow suitable water transfer capacity between CCS and Wight Pit during the closure phase, and this future conveyance system will require design confirmation as the Site approaches closure.

4.5.7.2 PETBP Pumping Logic

PETBP will begin pumping water to the TSF when the water elevation at the PETBP surpasses 923.25 m or when the TSF water volume drops below the minimum threshold by 50,000 m^3 or more.

4.5.7.3 Mill Process Flows

The mill process water requirements are based on 2.0 m^3/t of tailings. Interstitial water sequestered in the deposited tailings is based on 0.347 m^3/t of tailings deposited.

4.5.7.4 Consumption Flows

Consumption flows are system losses attributed to the operation of dust suppression equipment. Consumption flows were estimated by MPMC staff for operations (MPMC 2023b) and are modelled according to the following logic:

- Turbo-misters operate from May to September.
- Water trucks withdraw water at variable rates from May to September.

Consumption flow rates are presented in APPENDIX A.

4.5.7.5 Tailings Storage Facility Flows

WSP is currently designing a new upstream drain system to accommodate the increase in the TSF pond elevation (WSP 2023e). The new upstream drain system will capture water within the tailings above 970 m and convey it to the seepage collection system, downstream of the TSF embankment. WSP has estimated the water flows through the upstream drains based on the distance between the pond and the embankment (beach width).

Estimation of flows have been made for each embankment:

- S1: South Embankment
- S2: Main Embankment
- S4: Corner 1 Embankment
- S5: Perimeter Embankment

Seepage flows from the TSF (S1 to S5) during operations were estimated using a two-dimensional numerical groundwater flow model to quantify anticipate seepage rates through the embankment and foundation. Seepage analyses for typical sections of the elevation of 987 m configuration of the South Embankment, Main Embankment, Perimeter Embankment, and Corner 1 Embankment under steady-state conditions. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. Table 11 presents the estimated seepage flow rates through each embankment with dependency on the beach width.

Table 11: Seepage Flow Rates

Beach (m)	Flow Rate (L/s)			
	S1	S2	S4	S5
0	79	96	81	89
50	39	50	53	46
100	25	32	38	31
200	14	18	23	18
300	9	12	15	13

Note: includes flows through upstream drains and embankment. All flows estimated for the 987 m raise.

The progressive location of the TSF pond will depend on operational decisions during the deposition of tailings; thus, the change in beach widths have been assumed consistent for each embankment. Based on estimates of the TSF pond volume and satellite imagery of the pond location since restart of operation in 2016, an estimation of embankment beach width has been made for different pond sizes. The estimates are provided in Table 12, which outline a conservative scenario, in terms of seepage flow quantities.

Table 12: Tailings Beach Width

TSF Pond Volume (m^3)	Beach Width (m)			
	S1	S2	S4	S5
0	300	300	300	300
1,500,000	300	300	300	300
2,500,000	200	200	200	200
3,000,000	100	100	100	100
5,500,000	0	0	0	0

The model uses both Table 11 and Table 12 presented above to calculate the beach width and consequently the seepage flow rates through the embankments during operations. For every time step the model calculates the TSF volume and consequently the beach width, and finally the seepage flow rate.

Starting from four months into closure (August 1, 2031), the TSF pond reduces its volume to 0.25 M-m^3 within two months due to the construction of the closure TSF spillway. This is estimated to increase in the seepage flow rate on the perimeter embankment close to corner 1, as the TSF pond will be pushed to that corner. For modelling purposes, it is considered that the seepage flow rate in Table 13 will be in effect 6 months after the end of the operation phase and throughout the post-closure phase.

Table 13: Tailings Beach Width at Last Year of Operation and Closure

Flow Rate (L/s)			
S1	**S2**	**S4**	**S5**
70	0	0	0

Note: Values start 6 months after end of operation. Maximum capacity of TSF pond is limited to 250,000 m³.

5.0 WATER BALANCE RESULTS

The following sections present major model results for the operational and closure phases, and partial results for post-closure phase. Full extension of post-closure results are presented in Appendix C.

5.1 WTP Treatment Capacity

Throughout the entire planned future operations and closure periods to March 31, 2041, the maximum treatment capacity of the WTP in the model is assumed to be 25,000 m^3/day (0.29 m^3/s, 9.15 M-m^3/year). Excess water beyond this discharge rate is temporarily stored within the TSF until it can be treated and discharged. Centralized collection and treatment of contact water is assumed during operations, closure, and post-closure. The Mine's current discharge permit authorizes an annual discharge volume of 10.59 M-m^3.

In year 2041, the assumed treatment capacity of the WTP in the model remains at 25,000 m^3/day (0.29 m^3/s). However, annual contact water requiring treatment is reduced over the post-closure phase as site areas are remediated and some runoff is considered non-contact water, as shown in the flow diagram Figure B-3 provided in Appendix B. The annual contact water treated discharge volume declines further in year 2051 when the South Seepage Pond and Main Embankment Seepage Pond catchments are considered remediated, commencing 10 years after the post-closure phase. At the end of the operations phase, contact water requiring treatment notably increases in 2031, as milling is assumed to terminate in 2031 and the demand for milling process water also terminates.

Estimated annual contact water volumes requiring treatment from operations to post-closure are presented in Table 14, and Figure 2 illustrates daily WTP discharge rates from operations to 10 years after post-closure.

Table 14: WTP Annual Volume Requiring Treatment (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[a]	3.90	4.57	5.72
2024	5.00	5.94	7.24
2025	3.50	4.97	6.79
2026	3.37	4.72	6.53
2027	3.35	4.79	6.60
2028	3.36	4.80	6.70
2029	3.39	4.78	6.46
2030	3.31	4.75	6.56
2031[b]	3.93	4.39	5.04
2032	5.56	6.68	7.82
2033	5.54	6.57	7.57
2034	5.50	6.54	7.49
2035	5.42	6.42	7.44
2036	5.43	6.44	7.36

Table 14: WTP Annual Volume Requiring Treatment (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2041[(c)]	2.36	2.88	4.04
2046	1.80	2.27	3.31
2051	0.46	0.83	1.39
2071	0.33	0.71	1.48
2091	0.32	0.69	1.60
2111	0.32	0.71	1.44
2131	0.02	0.03	0.05

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

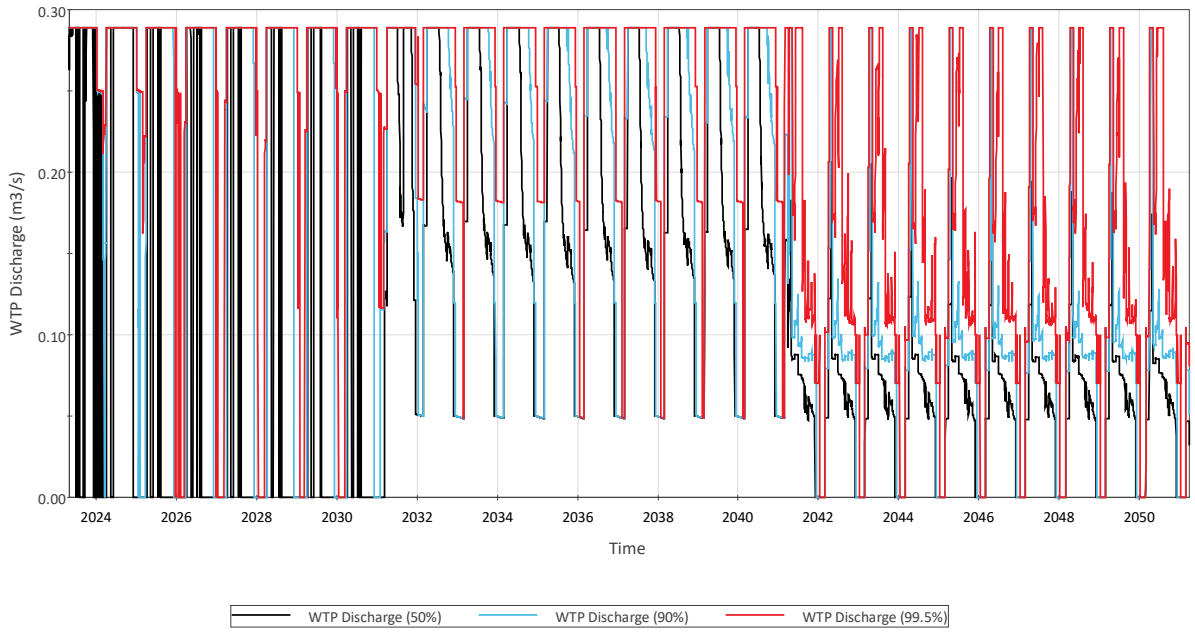


Figure 2: WTP Discharge Rate from Operations to 10 years after Post-Closure

5.2 Tailings Storage Facility

Temporary detention of water will be necessary to manage the large runoff volumes generated during freshet (typically April to June). The inflows during freshet will exceed treatment capacity, and detention volume is required to prevent uncontrolled release from the PETBP and to equalize the flow for treatment. The TSF is available to store excess freshet water until four months after the start of closure. At that time, the TSF pond will decrease its volume to 0.25 M-m³, the maximum allowable volume at closure.

To create the reduced TSF pond, a closure spillway will be constructed at the north abutment (Corner 5) of the TSF. Water will discharge from the TSF to the CCS, and then flow to the PETBP for treatment prior to discharge.

During closure and post-closure, the TSF pond is modelled to discharge annually via the spillway, and the TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3. As from Figure 3, the volume fluctuation follows a consistent pattern during both closure and post-closure periods, with minimum values occurring in winter and reaching maximum capacity during freshet (0.25 M-m^3).

Figure 3 shows the water volume in the TSF throughout future operations and into closure until 10 years after post-closure. The TSF volume pattern shown for the 2041-2051 post-closure period is continued for the remaining 80 years of post-closure (until 2131). Table 15 shows tabulated minimum, average, and maximum bounds for the three percentile trends shown in Figure 3.

Table 15: TSF Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1,330,244	1,390,394	1,429,751
	Average	1,493,500	1,576,822	1,809,717
	Maximum	2,840,000	2,840,000	3,493,139
Closure	Minimum	0	0	0
	Average	119,248	188,149	265,076
	Maximum	1,756,506	2,012,120	2,479,271
Post-Closure	Minimum	0	0	0
	Average	50,710	116,082	182,881
	Maximum	252,571	252,571	252,571

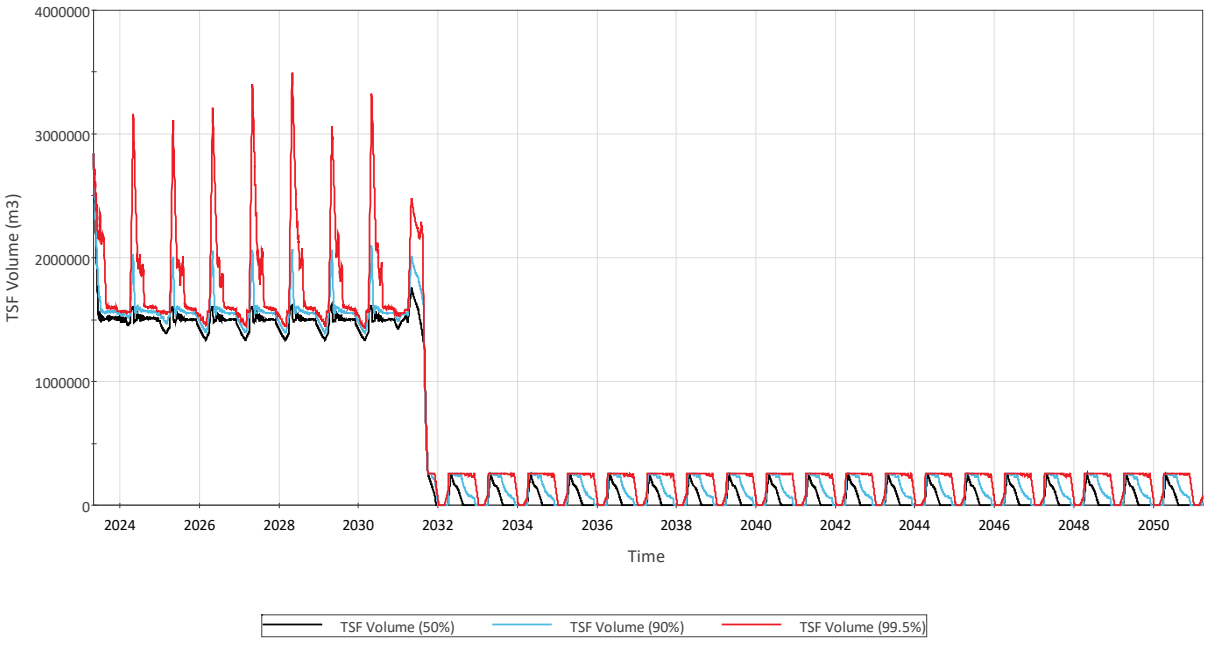


Figure 3: TSF Water Volume from Operations to 10 Years after Post-Closure

5.3 Springer Pit

The simulated Springer Pit water volume during the operational phase is shown in Figure 4 for the 50th, the 90th, and the 99.5th percentiles. The simulations were run from an initial Springer Pit storage volume of 0 m^3 on May 2, 2023. During the operational phase, the volume in Springer Pit is reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet, as freshet inflow exceeds pit dewatering pumping capacity.

Springer Pit and Cariboo Pit are modelled as a single pit in the closure phase, using the stage-storage curve based on the ultimate projected topography, as detailed in Section 5.5.

Table 16: Springer Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	8,620	35,720	117,745
	Maximum	74,124	169,623	361,074

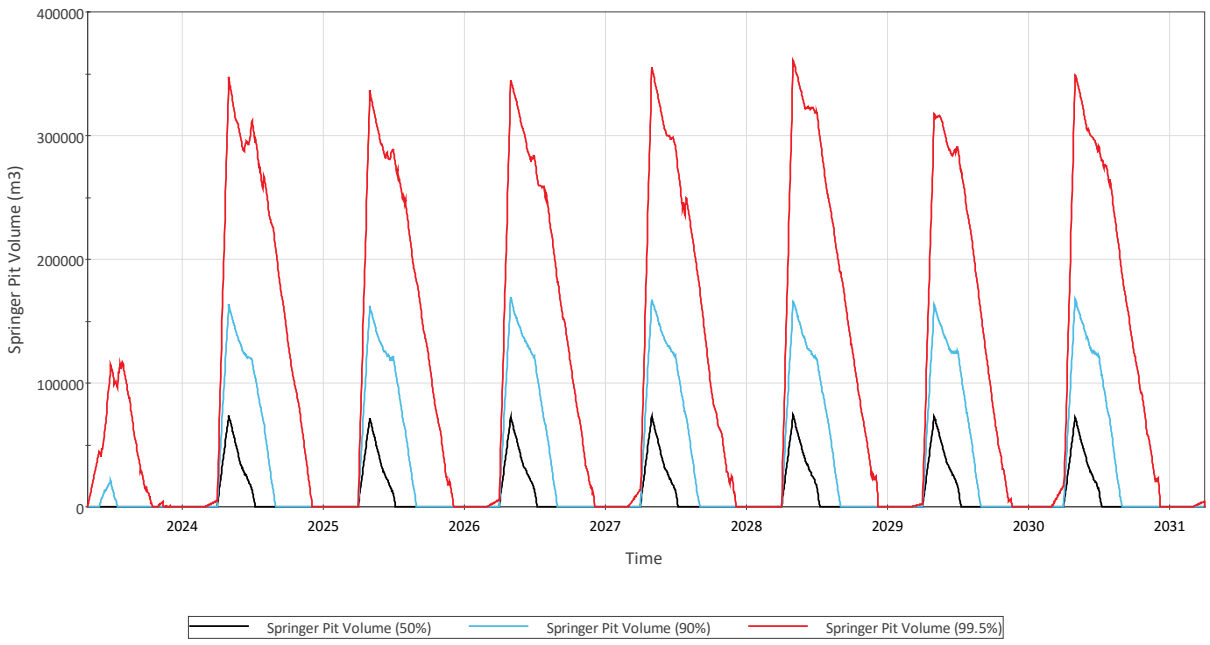


Figure 4: Springer Pit Water Volume during Operations

5.4 Cariboo Pit

Simulated Cariboo Pit water volumes during the operational phase are shown in Figure 5 for the 50th, the 90th, and the 99.5th percentiles. The simulations were run from an initial Cariboo Pit storage volume of 0.24 M-m^3 on May 2, 2023. During the operational phase, the volume in Cariboo Pit is reduced to the minimum volume before each freshet, and temporary storage will increase to its maximum volume of 0.26 M-m^3 during the freshet. Springer Pit and Cariboo Pit have been modelled as one combined pit in the closure phase as explained in Section 5.3.

Table 17: Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	81,256	112,813	169,463
	Maximum	259,249	259,249	259,249

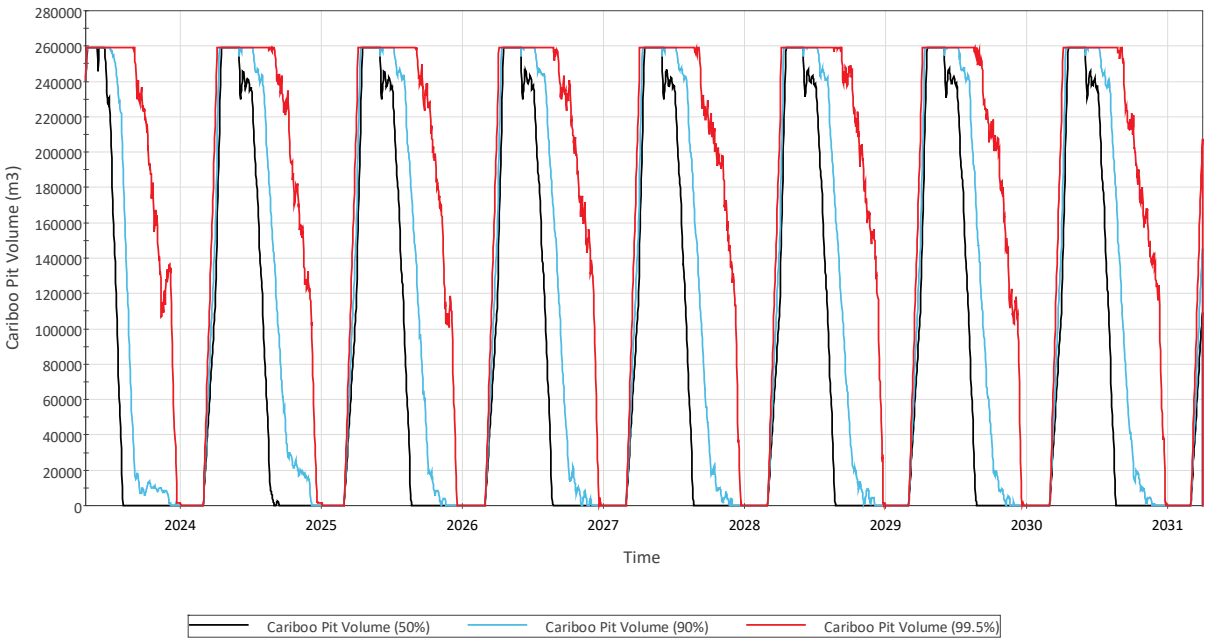


Figure 5: Cariboo Pit Water Volume during Operations

Table 18 shows the modelled average annual overflow volume from the Cariboo Pit during operations, and these overflow volumes are included in the total annual volumes required for treatment shown in Table 14.

Table 18: Cariboo Pit Annual Overflow (m^3)

Phase	Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Operations	283,897	574,260	1,221,920

5.5 Combined Springer-Cariboo Pit

Springer Pit and Cariboo Pit were modelled as a single pit for the closure phase (starting April 1, 2031). A result comparison between different percentiles for Combined Springer-Cariboo Pit volume during closure and post-closure is provided in Figure 6 . Potentially Acid Generating (PAG) waste rock will be stacked uniformly to an elevation of 1,004 m in the base of the Combined Springer-Cariboo Pit at the end of the operations phase. Results of the simulations indicate that water levels within the pit will cover the PAG material placed in pit by approximately 2033 under the 99.5th percentile condition, while under the rest of the climate conditions it is estimated to cover the PAG material placed in pit by 2034. Under the 50th percentile results, the combined Springer-Cariboo Pit lake is estimated to start overflowing in 2058, while under the 90th percentile it is estimated to start overflowing in 2056, and in 2055 under the 99.5th percentile. The Water Quality Report (WSP 2023d) discusses modelled water quality of the Springer-Cariboo pit lake at the estimated time of overflow.

Table 19: Combined Springer-Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Closure	Minimum	109,345	145,263	211,031
	Average	4,827,785	5,199,295	5,652,177
	Maximum	9,030,590	9,598,661	10,300,000
Post-Closure	Minimum	9,032,744	9,600,627	10,300,000
	Average	20,033,811	20,167,573	20,287,305
	Maximum	21,100,000	21,100,000	21,100,000

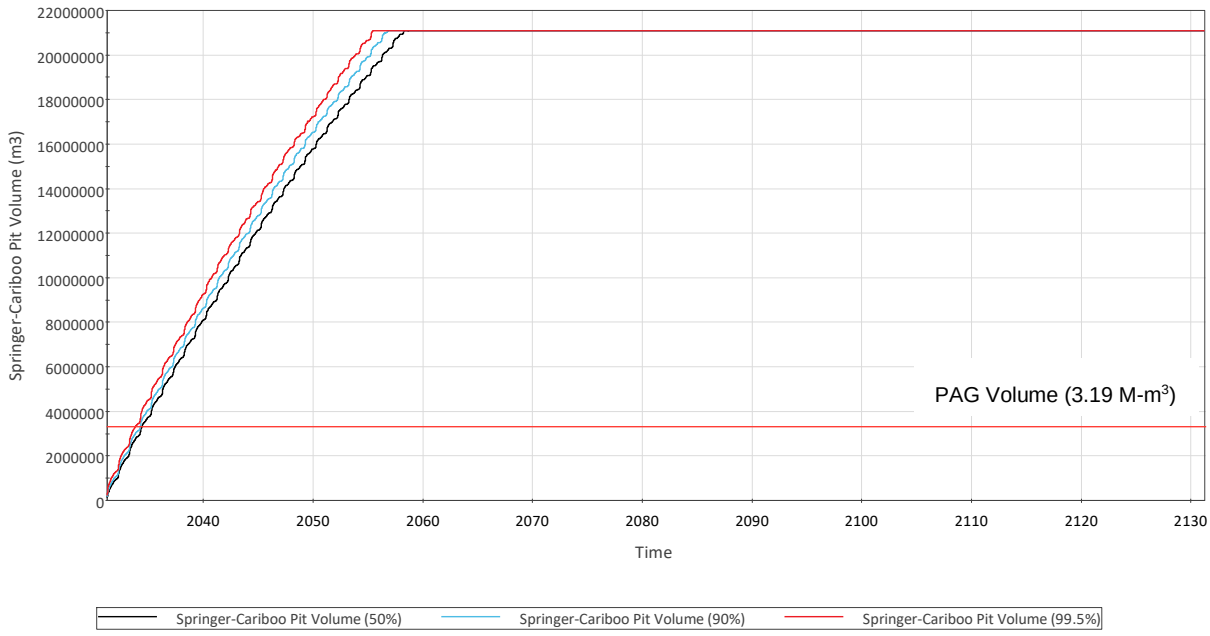


Figure 6: Combined Springer-Cariboo Pit Water Volume from Closure

The combined Springer-Cariboo Pit is modelled to fill to its maximum volume during post-closure. Following that time, additional volume collected in the combined pit will overflow from the pit's spillway and is assumed to direct discharge to the receiving environment in the SWWBM. Water quality and water treatment discussion is included under separate cover regarding this assumption of direct environmental discharge of pit lake overflow during post-closure.

Table 20 shows the modelled average annual overflow volume from the combined Springer-Cariboo Pit.

Table 20: Combined Springer-Cariboo Pit Annual Overflow (m^3)

Phase	Combined Springer-Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	469,711	1,051,048	2,249,910

5.6 Perimeter Embankment Till Borrow Pond (PETBP)

The PETBP serves as the final component of the centralized water management infrastructure, collecting water from the entire site. From this point, the water is pumped back to the mine for reuse, storage, or treated and discharged through the adjacent WTP. The current maximum capacity of the PETBP is 170,000 m^3. When the water volume in the PETBP exceeds 121,700 m^3 during the operations phase, modelled pumps to the TSF are activated to prevent overflow.

The 50th percentile results show that the maximum volume in the pond approaches 125,000 m^3 during the freshet. There are no occurrences of overflow from the PETBP under the simulated conditions during the future operational phase. During closure and post-closure, less storage is available in the overall water management system, and the PETBP reaches higher maximum volumes during freshet periods and does not have the capacity to prevent overflow for the 99.5th percentile results (as shown in PETBP overflow volumes listed in Table 22). The SWWBM predicts that the PETBP will have sufficient capacity to prevent overflow for the 50th and 90th percentile climate conditions. It is assumed that sufficient storage will be implemented during closure to prevent any unwanted overflow of contact water requiring treatment during the closure phase. The volumes listed in Table 22 are included in the total annual volumes required for treatment shown in Table 14.

Estimated storage volumes in the Perimeter Embankment Till Borrow Pond (PETBP) from operations to 10 years after post-closure are presented in Figure 7, with minimum, average, and maximum bounds of those trends shown in Table 21.

Table 21: PETBP Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	57,800	57,800	57,800
	Average	70,564	86,981	108,041
	Maximum	122,966	148,674	170,000
Closure	Minimum	57,800	57,800	57,800
	Average	65,872	73,383	93,979
	Maximum	120,397	149,882	170,000
Post-Closure	Minimum	57,800	57,800	57,800
	Average	58,029	57,924	65,613
	Maximum	72,012	137,714	170,000

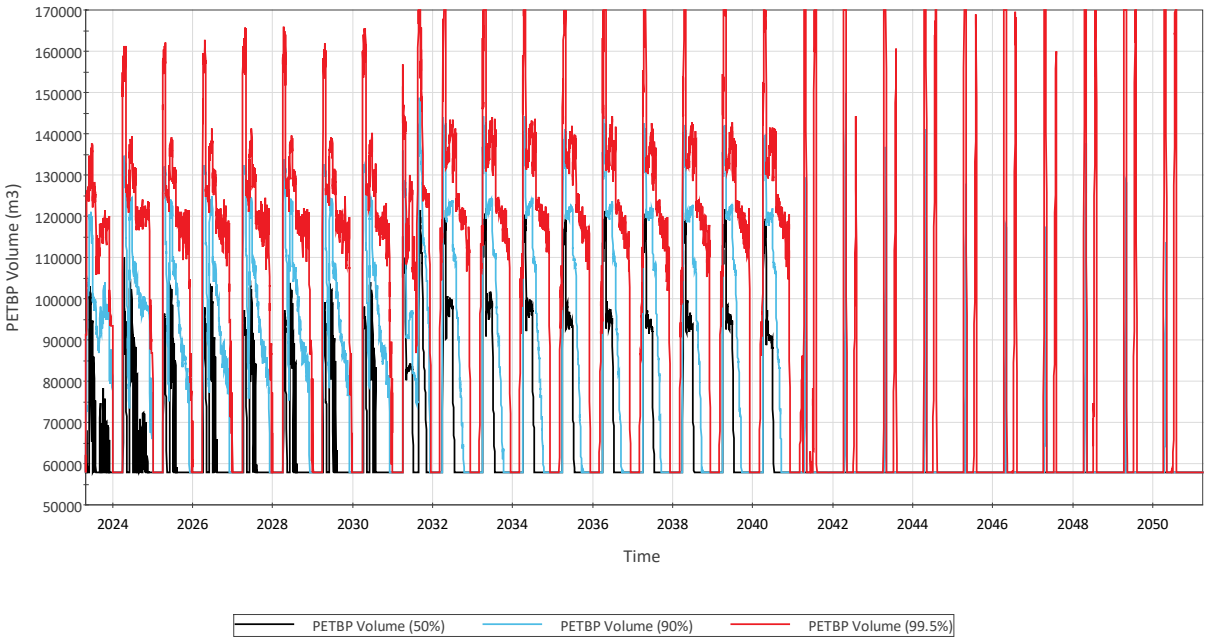


Figure 7: PETBP Water Volume in Pond during Operations to 10 years after Post-Closure

Table 22: Annual PETBP Overflow Volume for Treatment (m^3)

Year	Annual Overflow Volume at PETBP (m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[(a)]	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	0	0
2029	0	0	0
2030	0	0	0
2031	0	0	0
2032	0	0	227,098
2033	0	0	39,339
2034	0	0	9,640
2035	0	0	0
2041	0	0	498,988
2046	0	0	456,228

Table 22: Annual PETBP Overflow Volume for Treatment (m^3)

Year	Annual Overflow Volume at PETBP (m^3)		
	50th Percentile	90th percentile	99.5th percentile
2051	0	0	126,721
2056	0	0	334,984
2076	0	0	259,000
2096	0	0	269,515
2116	0	0	240,229
2131	0	0	0

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

5.7 Wight Pit

The water volume in Wight Pit is expected to increase during every freshet season. Four months into the closure phase, the TSF pond will be reduced to 0.25 M-m^3 within two months. Once the TSF can no longer provide freshet storage, Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for freshet storage and will be allowed to fill. Wight Pit is projected to start overflowing in 2049 under the 50th percentile results, and in 2047 under the 90th and 99.5th percentile results. Overflow from Wight Pit during post-closure is assumed as direct environmental discharge to Polley Lake and the water quality implications of this assumption are discussed under separate cover. Estimated volumes stored in Wight Pit from operations to 10 years after post-closure are presented in Figure 8 and the average annual post-closure overflow volumes are shown in Table 24.

Table 23: Wight Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	459,747	650,947	1,128,389
	Maximum	3,427,576	3,483,974	3,495,141
Closure	Minimum	0	0	0
	Average	80,815	373,440	1,188,190
	Maximum	490,123	1,153,040	2,326,346
Post-Closure	Minimum	0	0	0
	Average	4,835,386	4,841,820	4,849,597
	Maximum	4,984,114	4,984,114	4,984,114

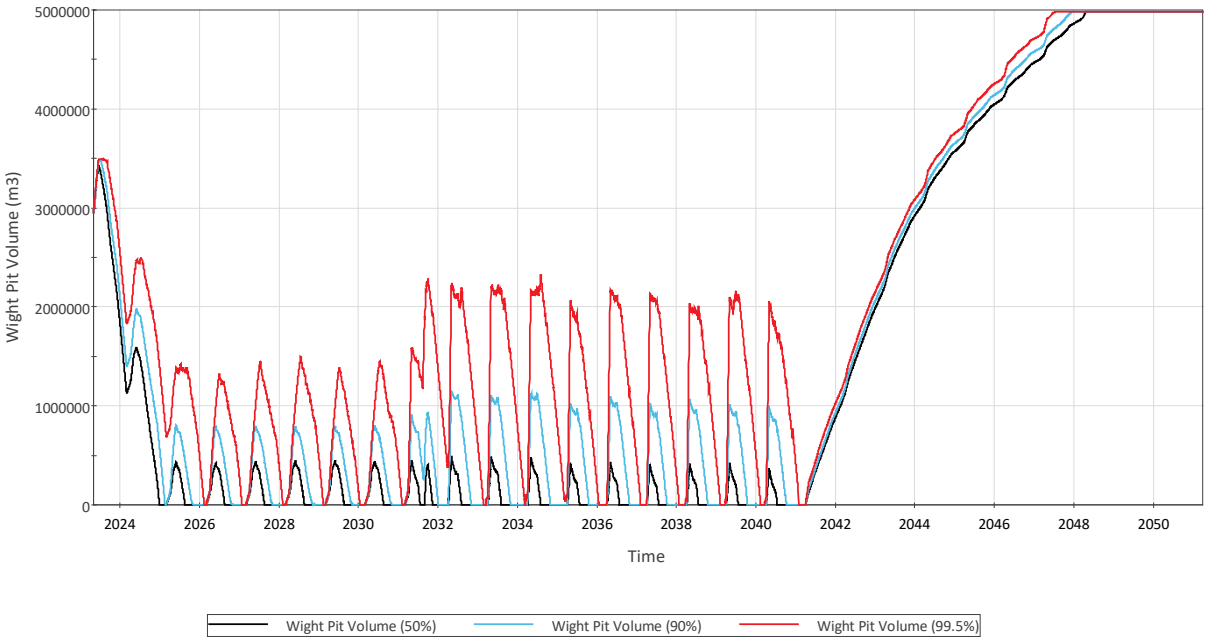


Figure 8: Wight Pit Water Volume from Operations to 10 years after Post-Closure

Table 24: Wight Pit Annual Average Overflow (m^3)

Phase	Wight Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	466,741	617,692	993,214

6.0 SUMMARY

The SWWBM was updated to reflect the Springer Expansion LOM plan during the operational phase and incorporates closure and post-closure phases for the Mount Polley Mine. The SWWBM supports water management planning and the assessment of water quality and associated water treatment and discharge options.

The model was run from May 2, 2023, to March 31, 2131, and included the following LOM phases:

- operational phase extending from May 2, 2023, to March 31, 2031.
- closure phase extending from April 1, 2031, to March 31, 2041.
- post-closure phase commencing on April 1, 2041, and extending, for the purposes of this analysis, to 2131.

The model was run stochastically for 2000 realizations to present 50th, 90th, and 99.5th percentile model results. The results for the modelling during the operational phase are presented as follows:

- The average annual treated discharge for the 50th percentile is approximately 3.65 M-m^3 between 2023 and 2031, while the milling process water demand exists.
- The maximum annual treated discharge for the 99.5th percentile 7.21 M-m^3 in 2031.
- The maximum TSF pond volume during the operational phase is approximately 3.49 M-m^3 for 99.5th percentile, and 1.62 M-m^3 for the 50th percentile results (excluding 2023 when the TSF is initially set to 2.84 M-m^3 in the model).
- During the operational phase, the volume in Springer Pit and Cariboo Pit are both decreased to empty before each freshet, and temporary storage will occur during the freshet.
- There are no overflows from the PETBP under the simulated conditions during the operational phase.

The conclusions for the modelling during closure and post-closure phases are as follows:

- The average annual treated discharge for the 50th percentile result is approximately 0.95 M-m^3.
- The TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3.
- The combined Springer-Cariboo Pit Lake is estimated to start overflowing between 2055 and 2058, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.
- PAG material placed in the combined Springer-Cariboo Pit is estimated to be inundated and covered by the pit lake between 2033 and 2034.
- During closure, the volumes in PETBP are reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet under each of the climate conditions simulated. During closure and post-closure phases, the PETBP does not have sufficient storage capacity to prevent overflow during freshet for the 99.5th percentile condition; however, these overflow volumes are included with the annual treatment requirement volumes.
- The Wight Pit is expected to initiate spilling between 2047 and 2049, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.

7.0 CLOSING

This report summarizes the SWWBM to support the water management information requirements for the Springer Expansion LOM plan.

We trust that this report satisfies your current requirements. Please contact the undersigned should you have any questions.

WSP Canada Inc.



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https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/084-r-31182- mount polley mine water balance model - springer expansion life-of-mine/rev1/23590671-084-r-rev1-31182-wbm_springer_expansion 21may_24.docx

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APPENDIX A

Springer Expansion LOM SWWBM Inputs

A1.0 CATCHMENT AREAS BY LAND TYPE

Table A-1: Catchment Areas by Land Type

Catchment	Land Types (m^2)						
	Waste Rock	Haul Roads	Mill Site Area	Disturbed Area	Undisturbed Area	Maximum Pond Area	Total Catchment
South Seepage Pond	0	0	0	0	0	385	385
Main Embankment Seepage Pond	214,904	0	0	124,485	0	37,546	376,935
TSF Upstream (External)	0	238,423	0	63,800	320,559	0	622,782
PETBP	100,535	96,348	0	193,072	65,060	69,307	524,322
CCS	0	67,918	0	122,204	248,419	21,823	438,541
Bootjack Creek Sump	0	103,986	0	70,041	0	1,130	175,157
SERDS Ditch	401,235	165,456	273,919	313,059	383,918	0	1,537,587
Mill Site Sump	0	0	0	0	0	1,628	1,628
Cariboo Pit	922,698	0	129,436	0	0	268,208	1,320,342
Mine Drainage Creek Sump	437,190	137,335	314,166	114,972	111,134	1,125	1,115,922
Nez Dump	199,116	261,421	0	237,889	202,646	0	1,299,306
North Bell Dump	0	0	0	0	0	0	597,350
East RDS	693,392	0	0	899,543	0	0	597,350
Springer Pit	0	0	0	156,100	0	280,478	436,578
NW Sump	205,919	63,800	0	60,210	0	231	330,160
9K Sump	497,228	0	0	60,735	140,272	400	698,635
Wight Pit	162,022	0	0	0	0	251,888	413,910
Boundary Pit	3,511	0	0	0	10,286	9,616	23,413

Note: TSF-Tailing Storage Facility; PETBP-Perimeter Till Borrow Pond; CCS-Central Collection Sump.

A2.0 FLOW INVENTORY

A description of the model flows is provided in Table A-2. Direct precipitation, runoff and environmental discharge flows are numbered according to their associated elements and are therefore not described herein.

Table A-2: Description of Flows for Operational Phase

Flow Process	Component	Flow Label
Hydrology	Precipitation	N/A[(a)]
	Evaporation	N/A[(a)]
	Runoff	All flows labelled R[(b)]
Consumption	Turbo-misters	C1, C10
	Water Truck Usage	C4, C8
Seepage (from Tailings Storage Facility)	South Seepage Pond Inflow	S1
	Perimeter Embankment Till Borrow Pond (PETBP)	S4, S5
	Main Embankment Seepage Pond	S2, S3
	Seepage to Environment	S14
Seepage (from Other Facilities)	SERDS Dump to SERDS Ditch	S6
	North Bell Dump to Wight Pit	S7
	East RDS to Long Ditch	S8
	NEZ Dump to Long Ditch	S9
	To 9KM Sump	S10
	To NW Sump	S11
	To Mine Drainage Creek Sump	S12
	To Bootjack Creek Sump	S13
Groundwater Flows	Wight Pit Groundwater Inflow	GW1
	Springer Pit Groundwater Inflow	GW2
	Cariboo Pit Groundwater Inflow	GW3
	Springer Pit Groundwater Outflow	GW4
	Boundary Pit to Wight Pit	GW5
	Cariboo Pit Groundwater Outflow	GW6
	Wight Pit Groundwater Outflow	GW7
Transfers	Long Ditch to Central Collection Sump (CCS)	T1
	SERDS Ditch to Long Ditch	T2
	CCS to PETBP	T3
	PETBP to Water Treatment Plant (WTP)	T6
Pumped Flows – Wight Pit	TSF to Wight Pit	P30
	Boundary Pit to Wight Pit	P34
	Wight Pit to Long Ditch	P21
Pumped Flows – Springer Pit	NW Sump to Springer Pit	P18
	Springer Pit to Cariboo Pit	P17b
	Springer Pit to SERDS Ditch	P9b

Table A-2: Description of Flows for Operational Phase

Flow Process	Component	Flow Label
Pumped Flows – Process Plant	Process flow from TSF	P28
	Process return to TSF	P27
Pumped Flows – Sumps	Cariboo Pit to SERDS Ditch	P4b
	PETBP to TSF	P5
	South Seepage Pond to Main Embankment Seepage Pond	P6
	Main Embankment Seepage Pond to PETBP	P8
	Mine Drainage Creek Sump to SERDS Ditch	P10
	Bootjack Creek Sump to SERDS Ditch	P11
	Mill Domestic Water to Mill Site Sump	P13
	Geology Domestic Water Effluent to Mill Site Sump	P15
	9K Sump to NW Sump	P20
	NW Sump to Mine Drainage Creek Sump	P24
	Mill Site Sump to TSF	P31
	TSF to Mine Drainage Creek Sump	P32

(a) Evaporation and direct precipitation flows not shown on flow diagram.

(b) No flows were assigned specifically for snowmelt. Instead, snowpack was accumulated in the model and snowmelt was included in the runoff flows.

Source: Springer Pit Expansion LOM SWWBM Flow Diagram (Appendix B).

A3.0 FLOW RATES

A3.1 Pumped Flows

Except for P13 and P15, which were measured at 545 m^3/d and 2.5 m^3/d, respectively (Golder 2016a), all maximum pumping rates have been assumed. Among these rates, P4b, P5, T6, P9b, P17b, P21, P30, and P32 were provided by MPMC (MPMC 2023b), while the remaining rates remain consistent with the TAR model and were based on Golder's engineering judgement (Golder 2016a).

Maximum pumping rates for operational flows are shown in Table A-3, and maximum pumping rates for closure flows are shown in Table A-4. It should be noted that any pumped flows shown in Table A-3, but not shown in Table A-4, are assumed to be decommissioned with zero transfer capacity.

Table A-3: Maximum Pumping Rates for Operational Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P4b	Cariboo Pit	PETBP	13,000	MPMC 2023b
P5	PETBP	TSF	100,000	Golder 2016a
P6	South Seepage Pond	Main Embankment Seepage Pond	8,640	Golder 2016a

Table A-3: Maximum Pumping Rates for Operational Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P8	Main Embankment Seepage Pond	PETBP	8,640	MPMC 2023b
P9b	Springer Pit	PETBP	0	MPMC 2023b
P10	Mine Drainage Creek Sump	SERDS Ditch	N/A[a]	Golder 2016a
P11	Bootjack Creek Sump	SERDS Ditch	8,640	Golder 2016a
P13[b]	Mill Domestic Water	Mill Site Sump	545	Golder 2016a
P15[b]	Geology Domestic Water	Mill Site Sump	2.5	Golder 2016a
P17b	Springer Pit	Cariboo Pit	4,000	MPMC 2023b
P18	NW Sump	Springer Pit	9,594	Golder 2016a
P20	9KM Sump	NW Sump	13,633	Golder 2016a
P21	Wight Pit	PETBP	8,712/14,088[c]	MPMC 2023b
P24	NW Sump	Mine Drainage Creek Sump	8,640	Golder 2016a
P27	Mill	TSF	N/A[e]	Golder 2016a
P28	TSF	Mill	N/A[e]	Golder 2016a
P30[d]	TSF	Wight Pit	10,000	Determined in this SWWBM
P31	Mill Site Sump	TSF	8,640	Golder 2016a
P32	TSF	PETBP	13,000	MPMC 2023b

(a) No maximum pumping rate applied. This pumping demand is dynamic and depend on the required pumping rate to dewater the Mine Drainage Creek Sump.

(b) Based on measured flow rates (Golder 2016a).

(c) 14,088 m3/day effective starting September 2023.

(d) Capacity assumed to avoid PETBP overflow during operation. See Section 4.5.7.1 in the main report.

(e) No maximum pumping rate applied. These are defined based on the process flow requirements from the Mill, where P27 is defined as process water (including interstitial water) in addition to tailings solids, and P28 is defined as process water demand.

Table A-4: Maximum Pumping Rates for Closure Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P6	South Seepage Pond	Main Embankment Seepage Pond	8,640	Golder 2016a
P8	Main Embankment Seepage Pond	PETBP	8,640	MPMC 2023b
P10	Mine Drainage Creek Sump	SERDS Ditch	8,640	Golder 2016a
P11	Bootjack Creek Sump	SERDS Ditch	8,640	Golder 2016a
P20	9KM Sump	NW Sump	8,640	Golder 2016a
P21	Wight Pit	PETBP	8,712	MPMC 2023b
P24	NW Sump	Mine Drainage Creek Sump	8,640	Golder 2016a
P35[(a)]	CCS	Wight Pit	85,000	Determined in this SWWBM

(a) Active to use Wight Pit to store water when TSF is not available for storage during closure. See Section 4.5.7.1 in the main report.

A3.2 Consumption Flows

The flow parameters for the turbomisters are shown in Table A-5 and Table A-6.

Table A-5: Operational Hours per Day for Turbomisters

Flow ID	From	Hours per Day				
		May	June	July	August	September
C1	Main Embankment Seepage Collection Pond	10	10	10	10	10
C10	Wight Pit	10	10	10	10	10

Table A-6: Operational Flow Rates for Turbomisters

Flow ID	From	Evaporation Rates (m^3/hr)	
		May and June	July to September
C1	Main Embankment Seepage Collection Pond	5.5	12.7
C10	Wight Pit	5.5	12.7

The flow parameters for water trucks are shown in Table A-7 and Table A-8 below.

Table A-7: Operational Days per Month for Water Trucks

Flow ID	From	Days per Month				
		May	June	July	August	September
C4	Wight Pit	0	0	20	20	15
C8	CCS	4.5	19	12.6	21.5	10.6

Table A-8: Operational Flow Rates for Water Trucks

Flow ID	From	Flow Rates (m^3/day)
C4	Wight Pit	818
C8	CCS	818

A3.3 Transfer Flows

The flow rates for the transfer flows were defined in the model as described in Table A-9.

Table A-9: Transfer Flows

Flow ID	From	To	Flow Definition/Rates
T1	Long Ditch	Central Collection Sump	Flow rates determined by runoff and baseflow from the Long Ditch catchment.
T2	SERDS Ditch	Central Collection Sump	Flow rates determined by runoff and baseflow from the SERDS ditch catchment.
T3	Central Collection Sump	PETBP	Modelled as the overflow rate from the CCS.
T6[(a)]	PETBP	Water Treatment Plant	Maximum capacity 25,000 m^3/day during operations until post-closure.

(a) Provided by Maximum pumping rates provided by MPMC (MPMC 2023b).

A3.4 Groundwater inputs

Springer Pit

A hydrogeological assessment was conducted to predict the quantity of long-term groundwater seepage from both the Springer and the Cariboo pits towards Bootjack Lake (Golder 2016b). The analysis considered placing waste rock in the ultimate pit prior to the pit lake formation. As the pit lake level increases between 1,020 masl and 1,030 masl, seepage in the range of 10 to 100 m^3/d from the Springer Pit Lake into the subsurface was predicted to occur (Table A-10). Seepage was found to gradually increase to approximately 400 m^3/d when the pit lake reaches the spillway at 1,050 masl.

Table A-10: Springer Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
880	520	0
940	510	0
960	490	0
980	460	0
1000	420	0
1020	320	10
1030	300	100
1040	280	250
1050	270	400

Cariboo Pit

Predicted groundwater flows of Cariboo Pit remain consistent from Golder 2016b. In the Cariboo Pit, seepage towards the Bootjack Lake of approximately 20 m^3/d was predicted to occur only when the pit lake level approaches 1,050 masl.

Table A-11: Cariboo Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
880	600	0
940	610	0
960	610	0
980	590	0
1000	540	0
1020	460	0
1030	420	0
1040	380	0
1050	320	20

Wight Pit

Groundwater inflow to the Wight Pit is projected to gradually decrease from 2,600 m^3/d at of 804 masl, to 600 m^3/d at 935 masl (Golder 2015). Table A-12 shows the predicted groundwater flows for Wight Pit.

Table A-12: Wight Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
804	2600	0
880	2600	0
900	2500	0
910	2100	0
920	800	0
926	600	500
930	600	500
935	600	500

Boundary Pit

MPMC reported that seepage was not observed along the pit walls during mining. However, seepage out of the pit could still occur due to water entering via surface water runoff and direct precipitation. Potential seepage rates out of the pit were estimated to incorporate them into the pit water balance and to characterize a possible seepage pathway originating from this pit (Golder 2016c).

Seepage rates out of the Boundary Pit were estimated from a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded. The estimated seepage rate from the Boundary Pit when the pit lake surface level is 5m above its base (1,072 masl) is approximately 59 m^3/d, with a potential range between 35 m^3/d and 177 m^3/d due to uncertainty in bedrock permeability. Seepage outflow is estimated to decrease as the height of water column above the pit bottom decreases as shown in Table A-13.

Table A-13: Boundary Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Outflow (m^3/d)
1067	3
1068	10
1069	20
1070	26
1071	53
1072	59
1073	59

A4.0 STORAGE CHARACTERIZATION

Table A-14 to Table A-18 show the stage-storage curves for the following facilities:

- Springer Pit
- Cariboo Pit

- Combined Springer-Cariboo Pit
- Tailings Storage Facility
- Wight Pit

Table A-14: Springer Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
970.66	0
975	34,449
980	281,473
985	689,185
990	1,150,873
995	1,693,101
1000	2,297,269
1005	3,045,813
1010	3,869,395
1015	4,768,531
1020	5,738,839
1025	6,755,500
1030	7,834,556
1035	8,957,496
1040	10,176,962
1045	11,466,163
1050	12,809,134
1053	13,659,688

Table A-15: Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
920	0
925	3,372
930	12,800
935	29,815
940	54,426
945	91,091

Table A-15: Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
950	138,417
955	203,118
958.3	259,149

Table A-16: Combined Springer-Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
878	0
880	5,448
890	35,320
900	80,294
910	146,856
920	238,531
930	356,228
940	511,132
950	722,060
960	997,061
970	1,333,646
980	1,732,505
990	2,217,857
1,000	2,813,866
1,010	4,854,554
1,020	8,247,385
1,030	12,008,865
1,040	16,312,811
1,050	21,104,196

Table A-17: TSF Stage-storage Curves

Elevation (masl)	Storage (m^3)			
	2020 Survey	Projected 972.5 m TSF Crest	Projected 975m TSF Crest	Projected 987m TSF Crest
956.2	0	0	0	0
957	30,784	0	0	0
958	162,897	0	0	0
959	374,780	0	0	0
960	711,559	0	0	0
961	1,173,550	0	0	0
962	1,790,644	0	0	0
963	2,875,098	0	0	0
964	4,542,339	0	0	0
965	6,448,707	179,178	0	0
966	8,512,995	486,916	0	0
967	10,624,891	881,413	39,874	0
968	12,568,198	1,366,370	307,114	0
969	12,568,198	2,006,216	656,772	0
970	12,568,198	2,973,695	1,096,052	0
971	12,568,198	4,343,412	1,634,717	0
972	12,568,198	6,174,788	2,418,560	0
973	12,568,198	7,184,001	3,568,309	0
974	12,568,198	7,184,001	5,176,980	0
975	12,568,198	7,184,001	7,180,246	0
976	12,568,198	7,184,001	7,180,246	0
977	12,568,198	7,184,001	7,180,246	0
978	12,568,198	7,184,001	7,180,246	0
979	12,568,198	7,184,001	7,180,246	0
980	12,568,198	7,184,001	7,180,246	0
981	12,568,198	7,184,001	7,180,246	273
982	12,568,198	7,184,001	7,180,246	67,347
983	12,568,198	7,184,001	7,180,246	323,880
984	12,568,198	7,184,001	7,180,246	890,494
985	12,568,198	7,184,001	7,180,246	1,912,234

Table A-17: TSF Stage-storage Curves

Elevation (masl)	Storage (m^3)			
	2020 Survey	Projected 972.5 m TSF Crest	Projected 975m TSF Crest	Projected 987m TSF Crest
986	12,568,198	7,184,001	7,180,246	3,505,768
987	12,568,198	7,184,001	7,180,246	5,704,281

Table A-18: Wight Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
803.99	5
804.99	52
809.99	3,282
814.99	8,195
819.99	14,407
824.99	22,909
829.99	34,808
834.99	57,021
839.99	84,080
844.99	122,282
849.99	167,552
854.99	223,215
859.99	289,126
864.99	363,462
869.99	449,185
874.99	544,867
879.99	696,584
884.99	883,743
889.99	1,100,537
894.99	1,349,504
899.99	1,630,787
904.99	1,970,250
909.99	2,341,775
914.99	2,881,655

Table A-18: Wight Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
919.99[(a)]	3,546,163
924.99	4,266,921
927.99	4,752,523

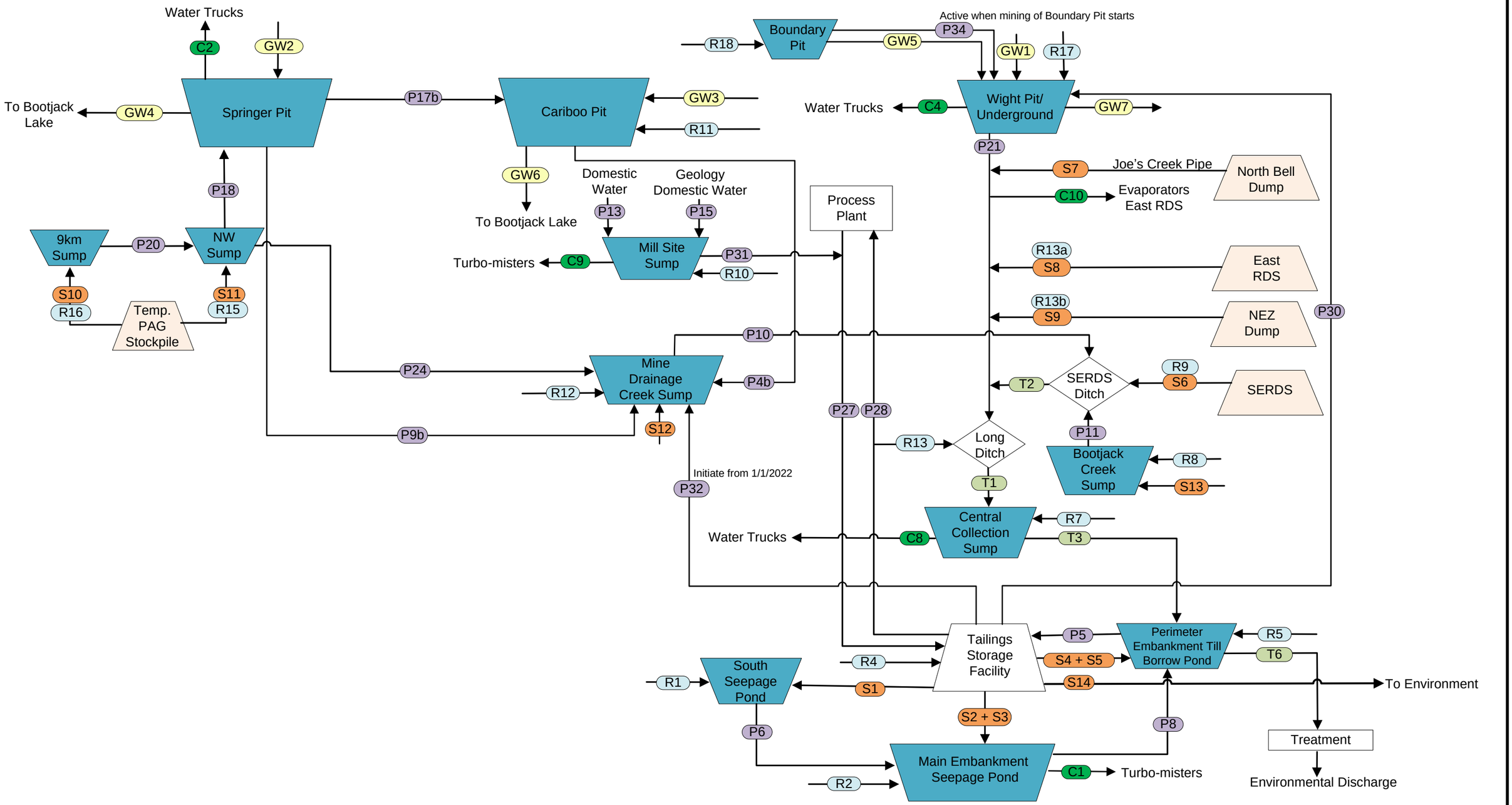
(a) Upper bound during operations is 919.99 m

Table A-19: Maximum Capacities for All Storage Facilities

Storage Facility	Estimated Capacity (m^3)
South Seepage Pond	315
Main Embankment Seepage Pond	86,146
TSF Upstream (External)	2,300,000
PETBP	170,000
CCS	50,990
Bootjack Creek Sump	1,420
Mill Site Sump	2,106
Cariboo Pit	1,234,641
Mine Drainage Creek Sump	1,420
Springer Pit	14,806,107
NW Sump	200
9K Sump	330
Wight Pit	3,779,404
Boundary Pit	14,468

APPENDIX B

Flow Diagrams and 2022 Water Management Infrastructure



Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023

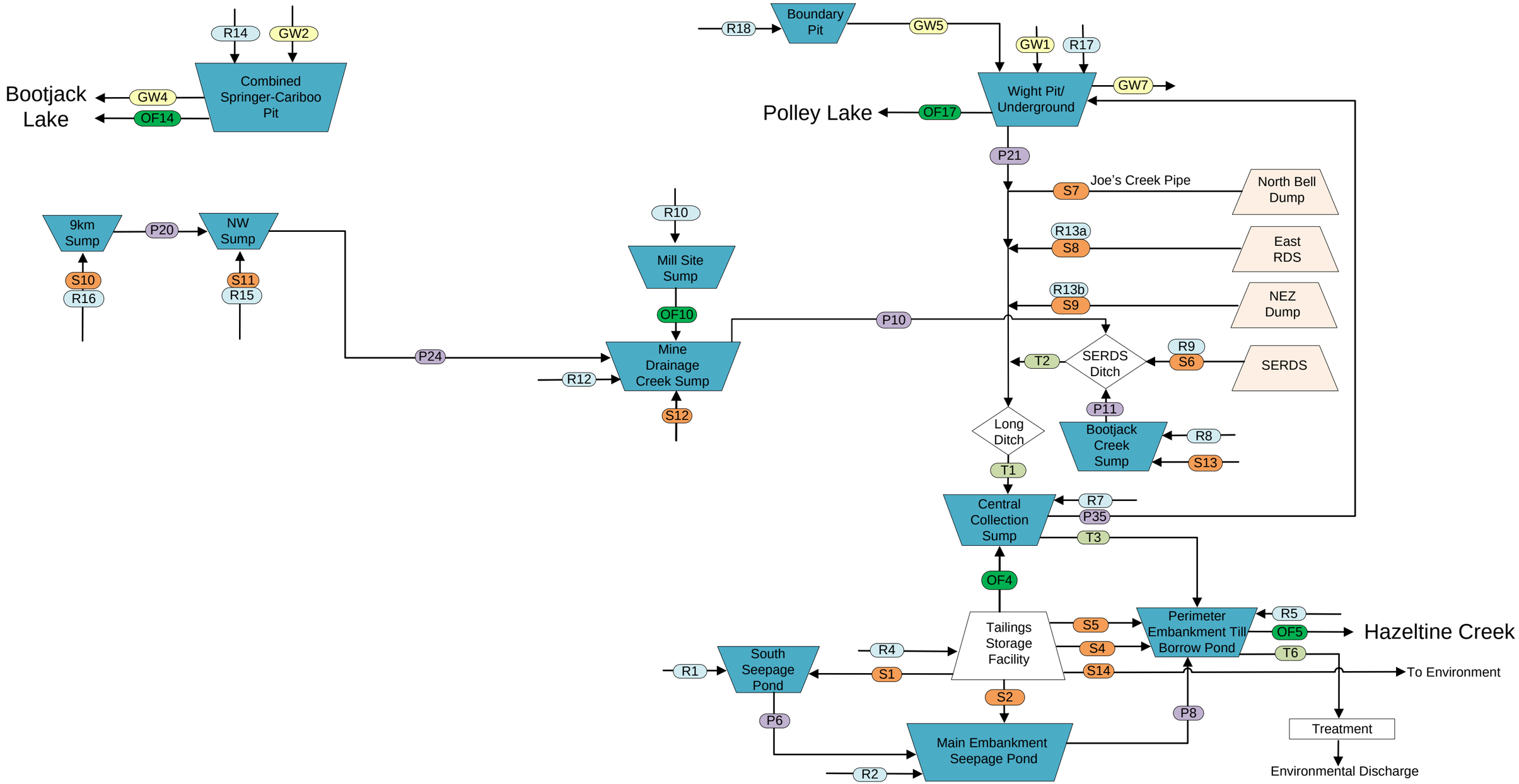
CHECKED: GD
DATE: 31 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance Operational Phase Flow Diagram 2 May 2023 – 31 April 2031

FIGURE No: B-1
REV No: 0



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023

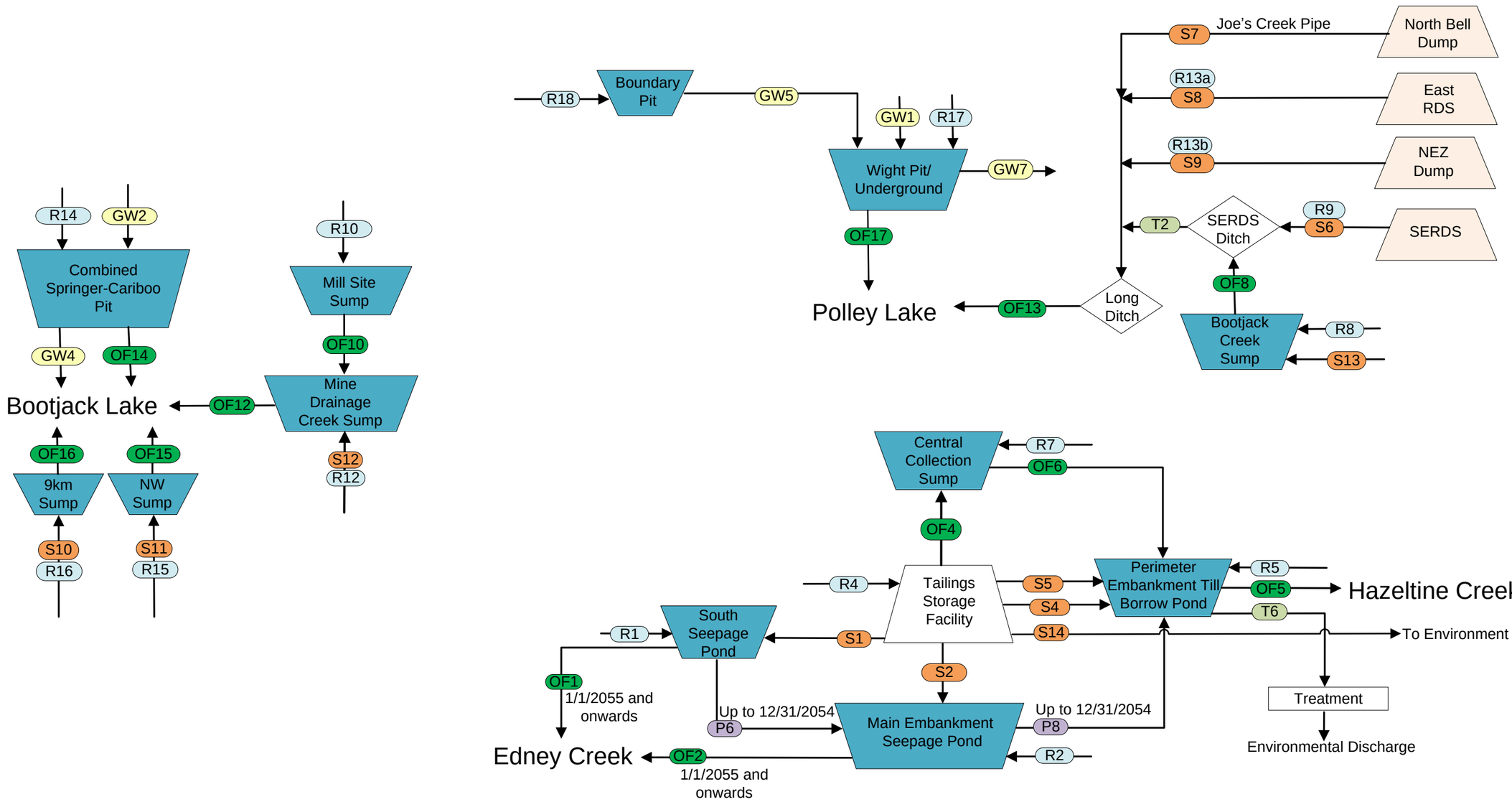
CHECKED: GD
DATE: 31 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 April 2031 – 31 March 2041

FIGURE No: B-2
REV No: 0



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023
CHECKED: GD
DATE: 31 October 2023
SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Post-closure Phase Flow Diagram
1 April 2041 Onwards

FIGURE No: B-3
REV No: 0

Mount Polley Mining Corporation

2022 Water Management Infrastructure

1:25,000

Gabriel Holmes
Date: 3/20/2023
Photo Dates: 2013, 2021

0 200 400 800 1,200 1,600
Meters

- Sprinklers
- Booster Tanks
- Barges
- Sumps/Ponds
- Pipelines
- Diversion Ditches
- Collection Ditches
- 20m Contours

Polley Lake

Bootjack Lake

TSF

Wight Pit Sump
Wight Pit Booster Blue
Wight Pit Dewatering Line
NEZ Booster to Mill
NEZ to Wight Pit Gravity Feed
Wight Pit Booster To Mill
Wight Pit North Diversion
Wight Pit Central Diversion
Boundary Pit
Joes Creek Coffer Dam
Gavins Ditch
East RD Ditch
NEZ Sump
Long Ditch
Bootjack Creek Diversion
SERD Sump
Long Ditch Pipe
SERD Pipe
Central Collection Sump
Breach Sump
Perimeter Embankment Till Borrow Pit
WMP Sludge Pond
PERP to TSF
Corner 2 Ditch
WTP Discharge Line
Main Seepage Pond Ditch
Sprinkler Line
MESCP
MESCP Dewatering Line
Tailings Storage Facility Supernatant
Tailings Corner 1 Line
CCS to TSF
Settling Pond
TSF Reclaim Barge
TSF Diversion
Tailings Corner 4 Line
SESCP
SESCP Dewatering Line
South Seepage Pond Ditch
Upper and Lower Long Ditch Sumps
Bootjack Creek Sump
BJ Creek Upstream Sump
Tailings/Reclaim Lines
Reclaim Booster
Tailings Pipe Containment Ditch
SERD Ditch
Canboo Pit
Canboo Pit to West Ditch
Leach Pad to Mill
Mill Site Ditch
Mill Site Sump
Springer Pit
Springer Pit to SERD Ditch
West Ditch West Portion
Mine Drainage Creek Sump
Junction Zone Seepage Collection Sump
9 Km Sump
Northwest Sump
NW Sump to Springer Pit
9K Sump to NW Sump

APPENDIX C

SWWBM Results

C1.0 SWWBM RESULTS FOR THE ENTIRE MODELLED DURATION

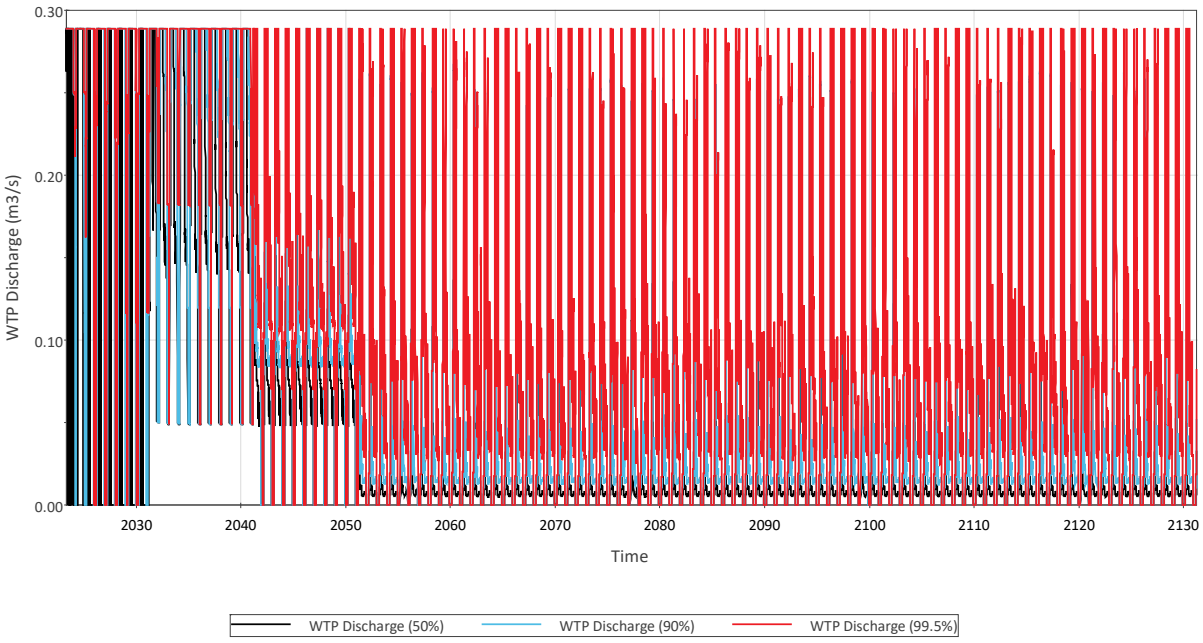


Figure C-1: WTP Discharge Rate

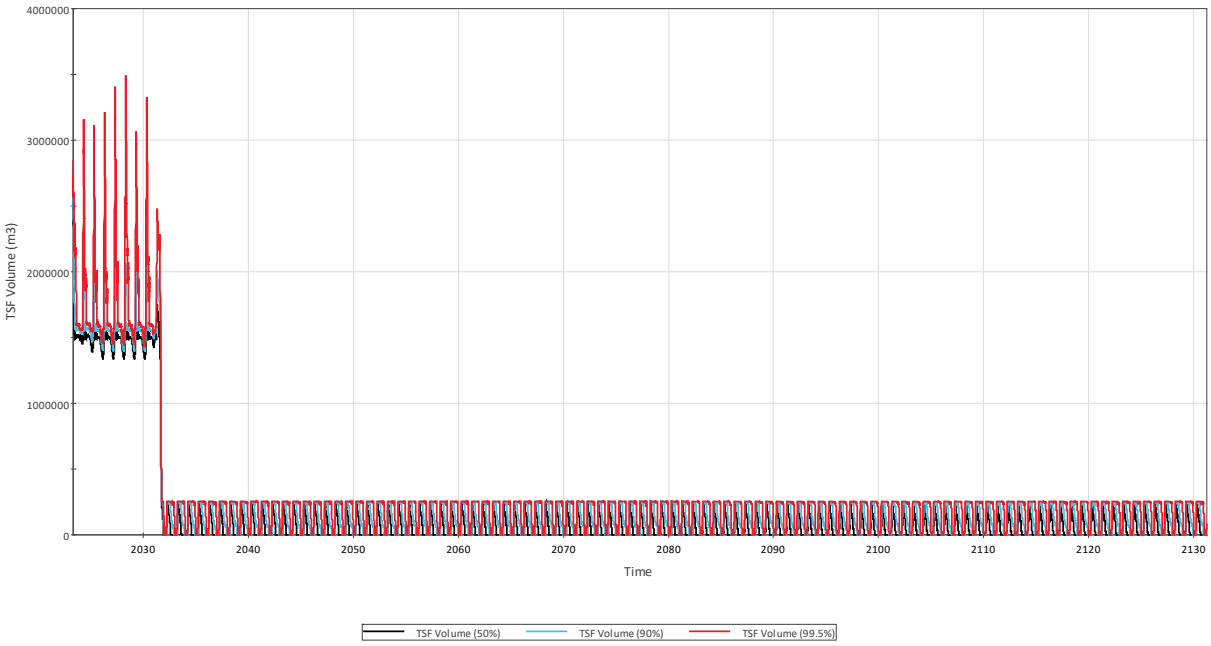


Figure C-2: TSF Water Volume

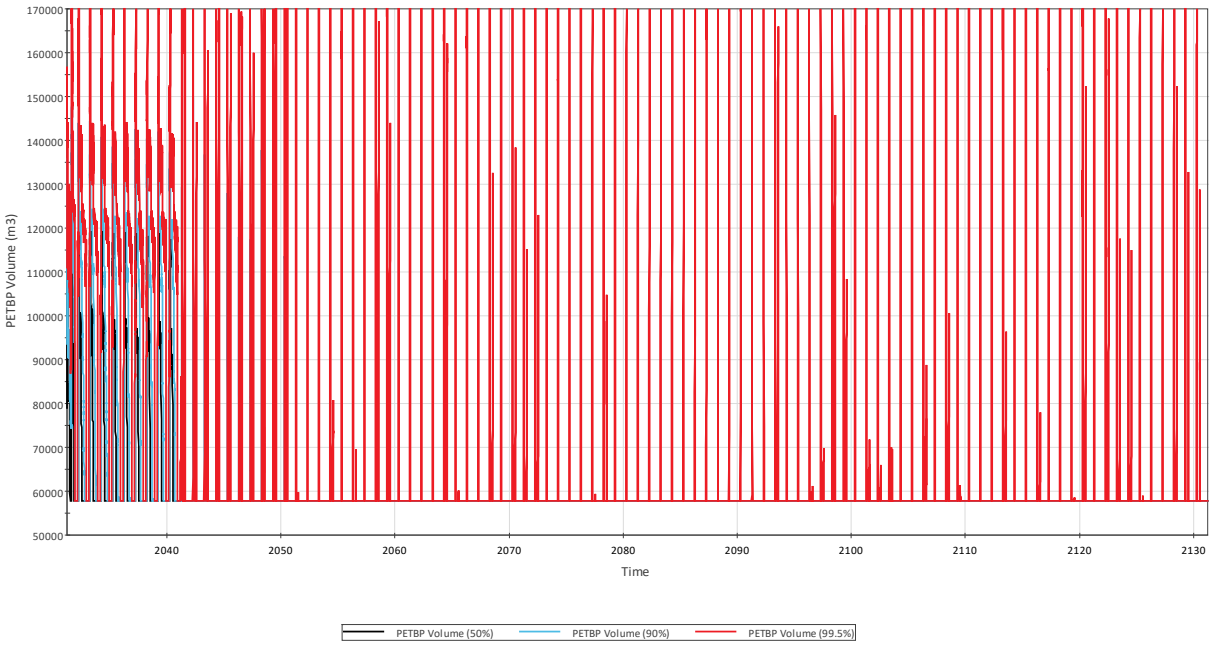


Figure C-3: PETBP Volume

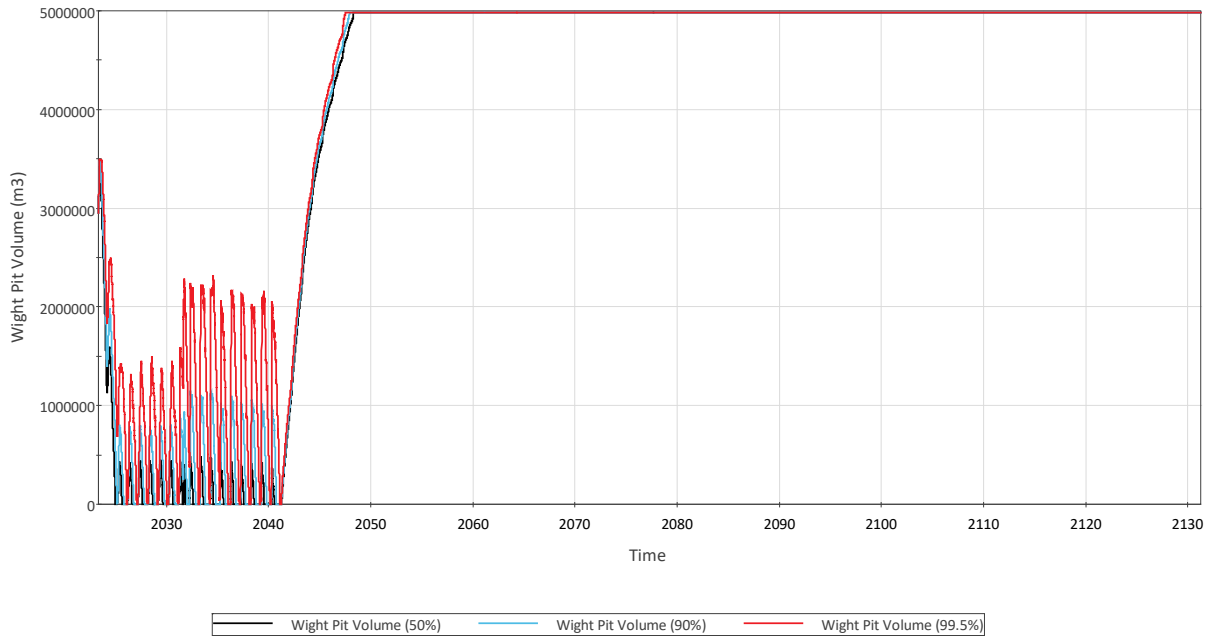


Figure C-4: Wight Pit Volume

C2.0 WTP MONTHLY VOLUME REQUIRING TREATMENT

This section is the monthly WTP volume requiring treatment corresponding to Table 14 in the main report. Results for the 50th, 90th, and 99.5th percentiles are shown in Table C-1,Table C-2, and Table C-3, respectively.

Table C-1: Monthly WTP Volume Requiring Treatment for the 50th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	816,200	714,510	466,465	298,682	393,832	463,508	445,012	301,332	3,899,541
2024	301,982	322,462	76,026	726,922	523,873	539,217	517,617	447,473	414,717	452,531	431,880	246,110	5,000,810
2025	0	0	53,142	720,473	591,207	534,104	514,400	382,392	201,214	243,282	229,247	27,300	3,496,761
2026	0	0	0	688,329	521,182	542,808	524,114	386,785	176,998	244,214	243,589	40,074	3,368,093
2027	0	0	0	688,776	534,057	536,783	519,699	387,212	196,149	226,169	214,556	42,347	3,345,748
2028	0	0	0	688,891	531,950	539,151	521,670	396,985	195,580	234,616	211,572	40,014	3,360,429
2029	0	0	0	688,784	544,074	541,812	528,879	381,832	204,143	238,037	220,087	42,961	3,390,609
2030	0	0	0	688,176	538,822	531,757	509,464	354,337	172,519	251,827	215,659	46,981	3,309,542
2031	0	0	237,630	731,590	765,112	731,759	662,575	497,020	747,088	751,567	580,182	269,013	5,973,536
2032	131,342	125,704	448,444	738,838	769,600	740,196	716,634	556,391	384,194	421,400	381,192	148,665	5,562,600
2033	127,587	117,879	445,027	738,690	768,837	739,082	713,725	575,883	385,994	414,549	366,935	147,325	5,541,513
2034	127,597	117,891	437,865	738,650	768,819	742,270	713,301	541,642	385,473	408,260	370,575	150,231	5,502,574
2035	127,586	117,878	444,939	738,787	766,046	735,339	695,924	494,783	377,100	398,504	366,789	158,514	5,422,189
2036	127,576	122,067	429,120	737,706	767,650	736,600	701,205	515,991	380,646	401,859	364,644	148,376	5,433,440
2041	127,587	117,877	413,048	362,220	249,322	241,876	208,531	165,735	151,247	157,910	143,254	22,615	2,361,222
2046	0	0	123,083	323,226	243,391	241,126	220,680	179,310	153,569	162,800	135,467	13,109	1,795,761
2051	0	0	119,167	121,927	44,866	45,020	32,832	21,846	20,830	24,124	24,756	648	456,016
2071	0	0	17,031	87,326	47,547	45,644	34,582	21,884	21,211	24,356	25,574	604	325,759
2091	0	0	16,622	86,552	42,145	52,098	36,589	17,207	19,486	30,153	21,007	501	322,360
2111	0	0	16,769	87,191	47,016	44,779	37,451	20,173	21,125	26,512	23,155	531	324,702
2131	0	0	16,786	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16,786

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

Table C-2: Monthly WTP Volume Requiring Treatment for the 90th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	885,614	958,697	578,613	446,170	447,714	481,672	462,761	309,174	4,570,415
2024	377,183	322,277	113,359	894,904	779,430	707,385	562,135	490,842	459,376	483,603	469,228	278,584	5,938,306
2025	323,561	171,779	98,804	780,798	646,909	707,544	569,266	473,066	423,510	388,419	316,149	65,368	4,965,173
2026	0	0	13,559	921,364	860,396	697,753	558,474	498,251	448,535	417,750	261,713	45,218	4,723,013
2027	0	0	0	909,318	883,083	690,653	567,414	494,660	461,943	440,356	286,990	54,549	4,788,966
2028	0	0	0	905,149	887,772	719,201	557,734	472,854	449,297	463,258	297,832	51,563	4,804,660
2029	0	0	31,781	908,298	851,264	743,112	563,432	469,271	458,404	424,635	285,248	48,768	4,784,213
2030	0	0	0	921,523	871,912	711,883	548,263	482,499	432,592	421,499	312,624	51,493	4,754,288
2031	0	139,919	257,819	737,112	766,533	738,071	713,096	711,970	749,089	768,000	724,613	524,247	6,830,469
2032	187,843	126,063	625,665	745,943	767,394	745,350	723,700	692,818	669,208	655,228	519,533	221,585	6,680,330
2033	127,805	118,150	644,497	745,302	770,615	740,246	731,736	697,401	661,853	636,522	498,198	198,112	6,570,437
2034	127,800	118,135	637,439	745,437	768,720	741,344	723,879	696,275	672,179	649,275	476,996	183,273	6,540,752
2035	127,802	118,141	645,117	745,232	763,488	736,645	727,405	695,144	649,488	628,630	419,917	163,355	6,420,364
2036	127,797	122,341	613,083	744,624	767,206	737,447	719,757	703,975	656,267	626,538	438,312	183,768	6,441,115
2041	127,799	118,132	580,468	469,180	331,660	250,918	239,674	194,673	184,385	183,246	175,373	25,134	2,880,642
2046	0	0	197,894	487,380	328,197	255,875	244,583	189,140	163,557	181,219	165,921	55,582	2,269,348
2051	0	0	197,677	329,334	74,348	62,290	63,306	27,312	25,911	26,119	20,689	578	827,564
2071	0	0	28,327	359,639	84,532	60,635	73,332	29,193	23,735	25,201	21,288	629	706,511
2091	0	0	27,250	340,424	87,555	69,665	69,251	29,607	16,467	27,933	23,053	439	691,644
2111	0	0	27,975	361,283	80,159	60,050	73,821	30,598	25,085	24,980	24,788	646	709,385
2131	0	0	27,475	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	27,475

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

Table C-3: Monthly WTP Volume Requiring Treatment for the 99.5th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	940,831	1,017,066	1,014,689	840,704	540,347	540,241	486,389	343,028	5,723,295
2024	385,574	322,644	375,957	1,052,693	876,096	941,834	805,020	635,879	467,136	543,423	512,886	324,468	7,243,610
2025	380,429	308,546	172,950	1,041,321	857,806	918,684	799,156	649,819	510,215	471,458	466,990	210,118	6,787,492
2026	268,122	205,663	137,139	1,006,448	664,073	928,893	776,396	656,365	484,345	507,440	543,055	353,048	6,530,987
2027	248,025	987	174,709	1,079,656	779,401	899,129	839,908	631,130	532,026	571,311	506,640	339,650	6,602,572
2028	301,944	154,165	17,859	1,070,472	856,776	913,431	833,476	624,229	500,595	561,590	537,481	331,434	6,703,452
2029	323,617	171,421	36,359	1,004,402	813,070	885,392	783,514	584,930	486,866	548,893	479,899	342,520	6,460,883
2030	235,921	0	169,714	1,092,716	879,138	846,907	878,625	572,737	469,739	557,987	494,851	356,974	6,555,309
2031	366,468	232,600	99,485	735,675	764,489	744,587	754,595	713,896	749,088	774,058	691,134	580,977	7,207,052
2032	525,067	415,819	756,422	976,186	774,058	748,499	765,138	727,786	604,316	631,416	502,789	391,970	7,819,466
2033	471,811	382,127	429,403	777,737	774,058	749,088	593,182	679,723	736,429	727,938	679,985	572,660	7,574,141
2034	471,811	439,306	616,955	746,919	774,058	749,088	667,234	535,682	667,972	674,220	661,799	487,664	7,492,708
2035	471,811	439,306	571,375	741,446	774,058	749,088	669,320	543,308	604,006	754,476	637,604	481,521	7,437,319
2036	354,383	122,484	525,917	749,088	773,390	748,129	772,095	769,990	695,682	685,335	650,794	512,808	7,360,095
2041	471,811	174,423	458,123	1,005,000	408,139	247,481	375,939	247,970	235,638	162,452	169,983	82,562	4,039,521
2046	54,814	0	193,956	1,025,727	466,256	307,922	362,470	246,942	211,775	170,928	144,565	128,795	3,314,150
2051	54,672	0	191,316	611,260	216,955	112,875	61,647	51,906	31,348	38,903	11,959	11,056	1,393,897
2071	0	0	49,327	704,072	231,146	68,286	221,257	108,687	41,189	25,820	26,475	499	1,476,758
2091	0	0	48,392	869,063	209,395	89,442	113,091	149,427	51,126	17,419	53,586	989	1,601,930
2111	0	0	48,511	786,421	233,424	73,247	94,044	65,403	77,612	29,724	34,557	1,166	1,444,109
2131	0	0	48,429	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	48,429

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

C3.0 TOTAL ANNUAL RUNOFF VOLUME FROM STOCKPILES/DUMPS

C3.1 Temp PAG Stockpile

The total annual runoff volume during operations for Temp PAG Stockpile is shown in Table C-5. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, and haul road). This catchment area breakdown was inserted as input into SWWBM. Table C-4 presents the distribution of these land types.

Table C-4: Temp PAG Stockpile Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	703,147
Disturbed Area	120,945
Undisturbed Area	140,272
Haul Road Area	63,800

Table C-5: Temp PAG Stockpile Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	122,711	226,570	445,588
2024	248,347	421,842	768,449
2025	247,456	422,850	766,070
2026	247,757	428,520	753,043
2027	247,936	425,785	793,090
2028	248,912	426,147	794,141
2029	249,343	422,660	755,345
2030	248,572	425,593	777,709
2031	26,050	41,089	68,748

C3.2 SERDS

The total annual runoff volume during operations for SERDS is shown in Table C-7. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, haul road, and mill site). This catchment area breakdown was inserted as input into SWWBM. Table C-6 presents the distribution of these land types.

Table C-6: SERDS Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	401,235
Disturbed Area	313,059
Undisturbed Area	383,918
Mill Site Area	273,919
Haul Road Area	165,456

Table C-7: SERDS Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	192,874	365,010	738,562
2024	360,384	625,704	1,163,887
2025	359,170	627,159	1,167,189
2026	359,541	635,520	1,138,079
2027	359,635	632,119	1,195,850
2028	360,975	631,021	1,198,955
2029	361,394	625,581	1,140,716
2030	360,604	629,622	1,172,763
2031	34,619	54,596	91,336

C3.3 NEZ Dump

The total annual runoff volume during operations for NEZ Dump is shown in Table C-9. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, and haul road). This catchment area breakdown was inserted as input into SWWBM. Table C-8 presents the distribution of these land types.

Table C-8: NEZ Dump Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	199,116
Disturbed Area	237,889
Undisturbed Area	202,646
Haul Road Area	261,421

Table C-9: NEZ Dump Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	134,053	250,501	499,643
2024	261,170	448,211	824,647
2025	260,297	449,304	824,468
2026	260,554	455,313	807,290
2027	260,710	452,591	849,291
2028	261,692	452,458	850,911
2029	262,082	448,643	809,462
2030	261,399	451,677	832,800
2031	26,321	41,516	69,459

C3.4 East RDS

The total annual runoff volume during operations for East RDS is shown in Table C-11. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock and disturbed). This catchment area breakdown was inserted as input into SWWBM. Table C-10 presents the distribution of these land types.

Table C-10: East RDS Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	693,392
Disturbed Area	899,543

Table C-11: East RDS Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	235,819	436,431	860,762
2024	473,874	806,323	1,471,681
2025	472,115	808,296	1,467,921
2026	472,643	819,122	1,441,909
2027	472,982	813,946	1,518,218
2028	474,853	814,415	1,520,466
2029	475,642	807,784	1,446,191
2030	474,205	813,412	1,488,869
2031	49,338	77,807	130,151



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APPENDIX 5-4: Responses to Comments from the Ministry of Environment and Climate Change Strategy – Technical Assessment Report for the Quesnel Lake Interim Discharge Extension

TECHNICAL MEMORANDUM

DATE 25 July 2022 **Reference No.** 22514095-052-TM-Rev0-81100

TO Mathieu O'Leary
Mount Polley Mining Corporation

CC Don Parsons

FROM Jesse Maddaloni, Lee Nikl and Tom Rutkowski **EMAIL Jesse.Maddaloni@wsp.com; Lee.Nikl@wsp.com; Tom.Rutkowski@wsp.com**

RESPONSES TO COMMENTS FROM THE MINISTRY OF ENVIRONMENT AND CLIMATE CHANGE STRATEGY – TECHNICAL ASSESSMENT REPORT FOR THE QUESNEL LAKE INTERIM DISCHARGE EXTENSION

1.0 INTRODUCTION

This technical memorandum (memo) supports assumptions made in Golder Associate Ltd. (Golder)'s memo 22514095-051-TM-Rev0-81112 (Golder 2022a) which addressed water quality information requests received 21 June 2022 from the British Columbia Ministry and Environment and Climate Change Strategy (BC ENV) resulting from the Screening Phase review of the Technical Assessment Report for the Quesnel Lake Interim Discharge Extension. This memo specifically discusses the performance and operation of the Water Treatment Plant (WTP) upstream of the Quesnel Lake discharge.

The water quality memo (Golder 2022a) provided concentrations of parameters at the edge of the initial dilution zone in Quesnel Lake assuming that Environmental Management Act (EMA) Permit 11678 limits for parameters are met at the WTP outlet. This memo describes the performance and operation of the WTP from 2016 through 2021 and provides justification that parameter permit limits are achieved at the WTP outlet. This memo only discusses parameters of interest (Total Suspended Solids, Copper, and Selenium); information regarding other permitted parameters can be found in Golder 2022a.

2.0 WATER TREATMENT PLANT PERFORMANCE

The WTP receives influent from the Perimeter Embankment Till Borrow Pond (PETBP) and discharges effluent to a pipeline directed to the Quesnel Lake diffuser. Water quality is measured upstream of the WTP at point E19 and measured downstream of the WTP at point HAD-3. Figures in this memo show and compare parameter data recorded between these two monitoring points.

The WTP itself is a patented high-rate ballasted coagulation and flocculation process under the tradename Actiflo supplied by Veolia. The WTP is primarily designed for removal of Total Suspended Solids (TSS), but also removes metals mainly through TSS reduction.

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2.1 Total Suspended Solids

WTP influent, effluent, and permit limit concentrations for TSS are shown in Figure 1 over a six-year period between 2016 and 2021. Influent TSS is mainly below the permit limit (excluding one single sample) and effluent TSS is consistently below permit limit.

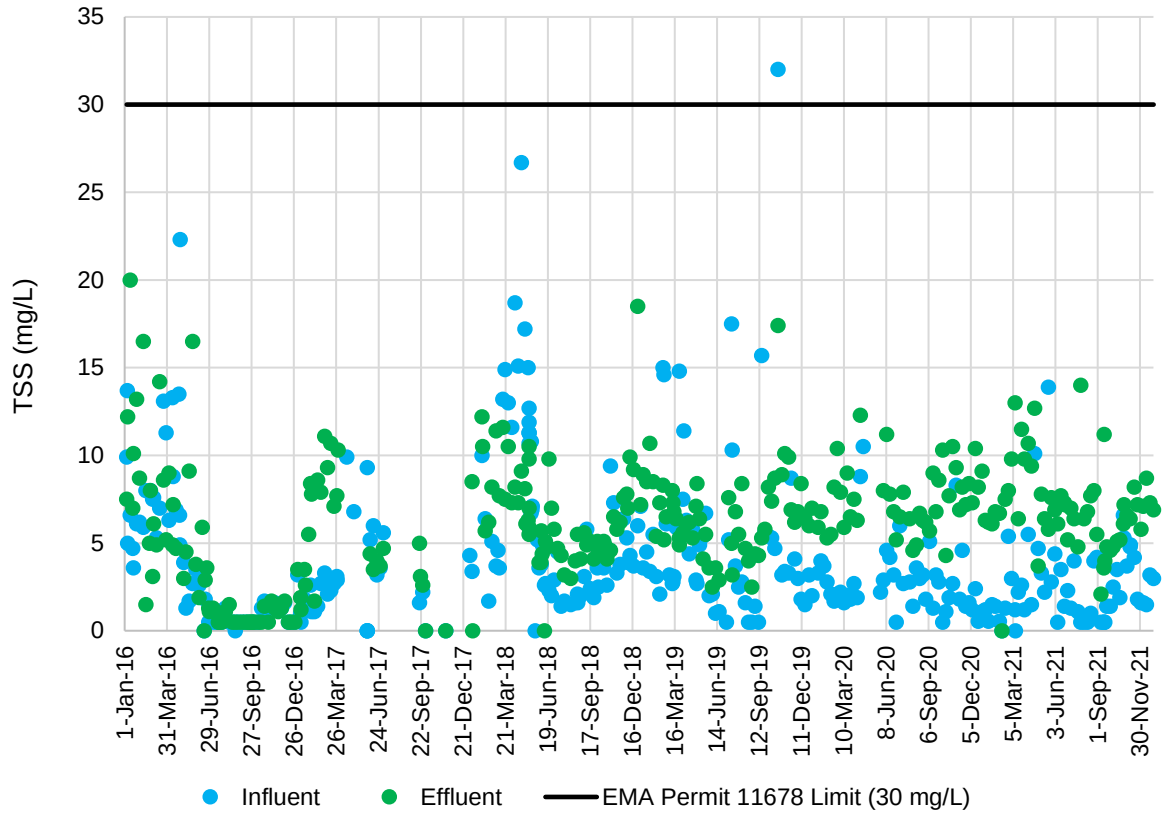


Figure 1: WTP Influent and Effluent TSS Measured at E19 and HAD-3 from 2016 to 2021

TSS treatment performance for the WTP is plotted in Figure 2, where influent TSS concentration is shown on the horizontal axis and TSS treatment efficiency (percent of influent TSS removed) is shown on the vertical axis. Figure 2 shows data points for samples collected over 2019 and 2021. It can be seen that TSS treatment performance ranges from approximately 0% to 70%, with the trend of growing treatment efficiency as influent TSS increases. At low influent TSS concentrations (approximately 5 mg/L and below), the WTP is not able to further reduce TSS and treatment efficiencies are low (and sometimes negative due to added TSS from treatment process). As influent TSS increases to the 10-20 mg/L range, the WTP is able to reduce effluent TSS and treatment efficiencies increase. Irrespective of the TSS treatment efficiency, Figure 1 shows that effluent TSS is consistently below the permit limit.

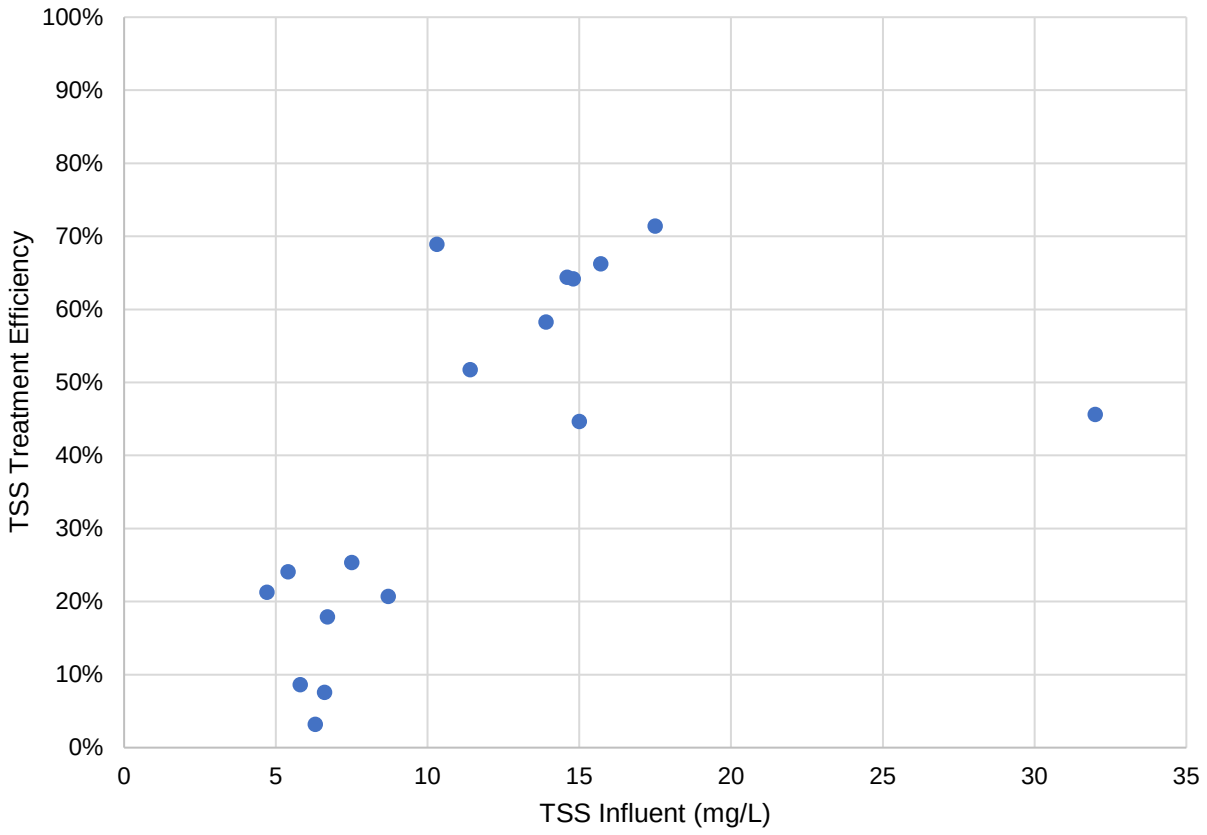


Figure 2: WTP TSS Treatment Efficiency vs. TSS Influent Concentration for Samples over 2019 and 2021

2.2 Copper

WTP influent, effluent, and permit limit concentrations for total copper are shown in Figure 3 over a six-year period between 2016 and 2021. Influent and effluent total copper concentrations are mainly below the permit limit, though there were some short infrequent periods where influent and effluent total copper levels were above the permit limit. Some data has been cropped from Figure 3 to allow a better zoomed view of data points near the permit limit. There is one copper occurrence that was cropped from the figure, occurring over 9 days in May 2018, where influent total copper had a maximum of 0.93 mg/L and effluent total copper had a maximum of 0.28 mg/L.

If total copper in the effluent exceeds the permit limit, the WTP is shut-down (or put into recirculation mode) and a Trigger Response Plan is activated, with WTP operation resumed once copper levels in the WTP effluent are confirmed below permit level. A summary of permit limit exceedances is provided in Table 7 of the Technical Assessment Report (Golder 2022b).

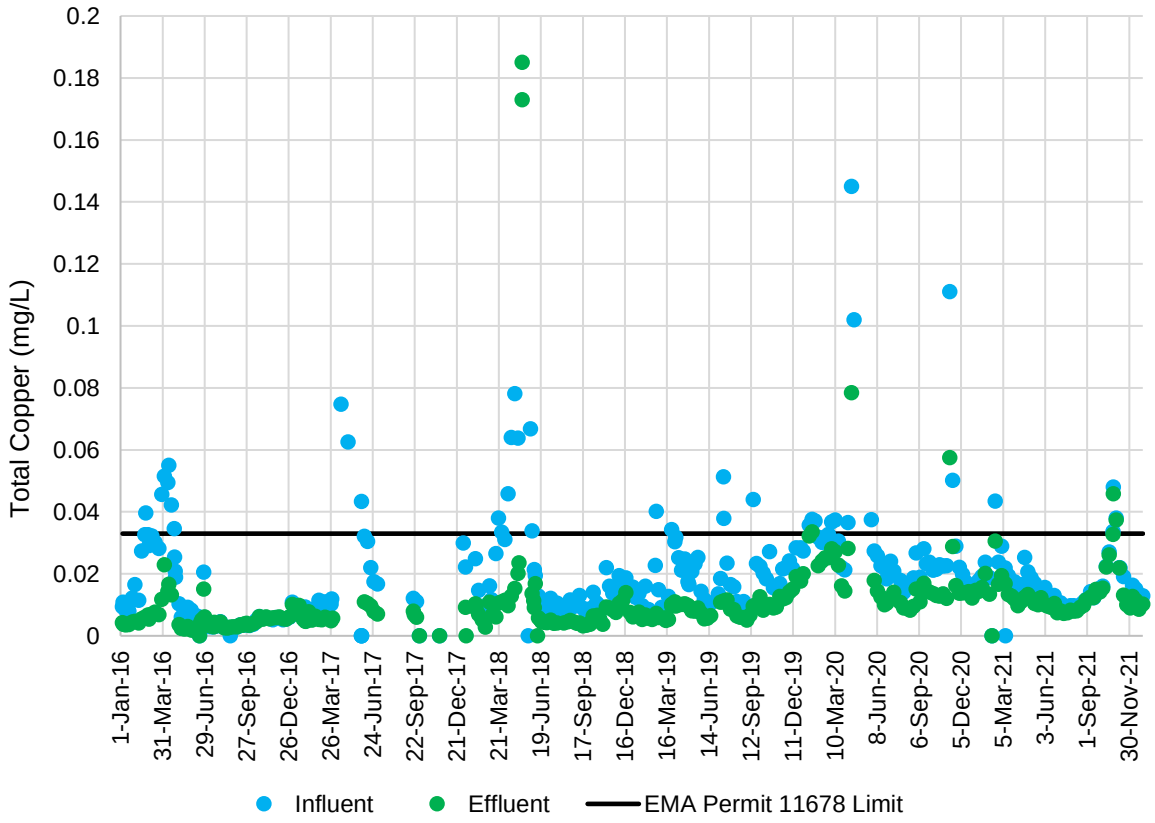


Figure 3: WTP Influent and Effluent Total Copper Measured at E19 and HAD-3 from 2016 to 2021

The water quality estimates provided in Golder 2022a show predicted WTP influent total copper concentrations from January 2023 through June 2025. The 95th percentile estimated concentration for total copper had a maximum of 0.061 mg/L. There are multiple instances in Figure 3 where influent total copper was near or above 0.061 mg/L and the WTP achieved an effluent total copper concentration below the permit limit, confirming that the WTP is able to treat that level of influent total copper. In the few instances where the WTP is not able to meet the permit limit for copper, the plant is shut-down or placed into re-circulation mode until the circumstances leading to that exceedance are remedied.

Total copper is the sum of dissolved copper and particulate copper. The WTP is primarily designed for TSS removal, and particulate copper is expected to be removed with TSS which is settled out during the treatment process. Dissolved copper also shows a reduction through the WTP, which may be attributable to co-precipitation with the Polyaluminum Chloride that is added at the start of the treatment process.

2.3 Selenium

WTP influent, effluent, and permit limit concentrations for total selenium are shown in Figure 4 over a six-year period between 2016 and 2021. Influent and effluent total selenium concentrations are consistently below the permit limit.

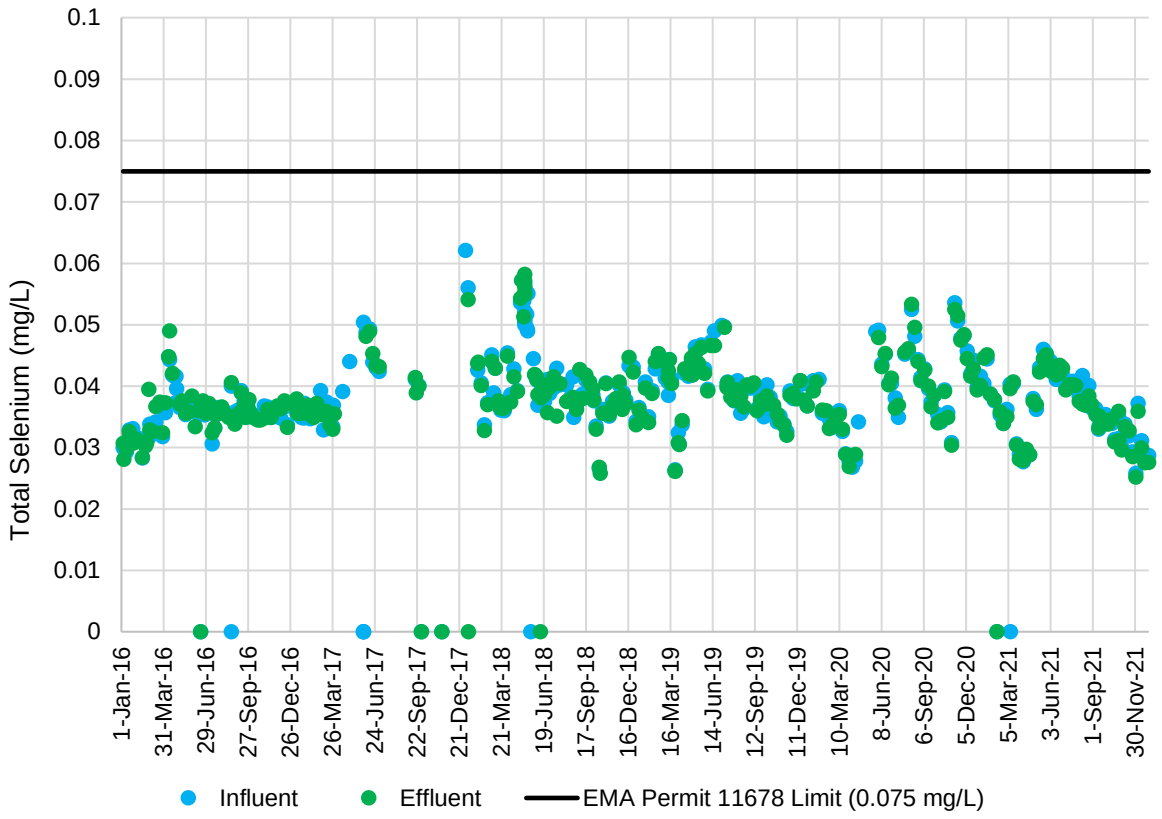


Figure 4: WTP Influent and Effluent Total Selenium Measured at E19 and HAD-3 from 2016 to 2021

The water quality estimates provided in Golder 2022a show predicted WTP influent total selenium concentrations from January 2023 through June 2025. The 95th percentile estimated concentration for total selenium had a maximum of 0.1 mg/L (with the maximum median value of 0.025 mg/L). The WTP is primarily designed for the removal of TSS and total selenium reduction through the plant is generally less than 10%. If WTP influent total selenium concentrations increase to 0.1 mg/L, then the WTP is not expected to meet the effluent permit limit; however, the historic data in Figure 4 demonstrates that influent selenium has not reached this level and that the maximum 95th percentile concentration of selenium is a conservatively high estimate. Current impacted water from mining activities at the site have not resulted in influent selenium concentrations beyond the permit limit.

Selenium concentrations may become an issue during mine post closure and development of passive treatment technologies targeting selenium reduction are currently being assessed and developed to address that possibility.

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions or require additional information, please contact the undersigned.

Golder Associates Ltd.

Jesse Maddaloni, P.Eng., M.A.Sc.
Lead Mechanical Engineer, Site Water Management Task Lead

Lee Nikl, M.Sc., R.P.Bio.
Project Director

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
T. L. RUTKOWSKI
203939

July 25, 2022

Tom Rutkowski, P.Eng.
Senior Process Engineer

JDM/LN/TR/sd

https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/052-tm-81112-technical assessment report/22514095-052-tm-rev0-81100-quesnel lake far tmt plant performance 25jul_22.docx

PERMIT TO PRACTICE #1003064
Engineers & Geoscientists BC

REFERENCES

Golder (Golder Associates Ltd.). 2022a. Mount Polley Mining Corporation. Responses to Comments from the Ministry of Environment and Climate Change Strategy – Technical Assessment Report for the Quesnel Lake Interim Discharge Extension. Prepared for Mount Polley Mining Corporation. No. 22514095-051-TM-Rev0-81112. 19 July 2022.

Golder. 2022b. Technical Assessment Report – Quesnel Lake Interim Discharge Extension. Reference No. 22514095-018-R-Rev0-81100. 9 June 2022.

STUDY LIMITATIONS

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APPENDIX 5-5: Weekly TSF & Water Management Systems Status

Weekly TSF & Water Management Systems Status

May 2, 2023



Water Management Status

TSF Pond Elevation	963.71	m
Freeboard	3.9	m
Supernatant	2.84	Mm^3
Remaining Storage	6.64	Mm^3
Min. Till Height	967.6	m
WTP Effluent Discharge	1103	m^3/h
Springer Tails Remaining	2.00	Mm^3
SP Tails Removed	0.02	Mm^3
Springer Well 1 Elevation	936.12	m
Cariboo Water Elevation	957.27	m
CP Volume	0.25	Mm^3
Wight Water Elevation	913.689	m
WP Volume	2.69	Mm^3
TSF Elev Under Barge	958.60	m

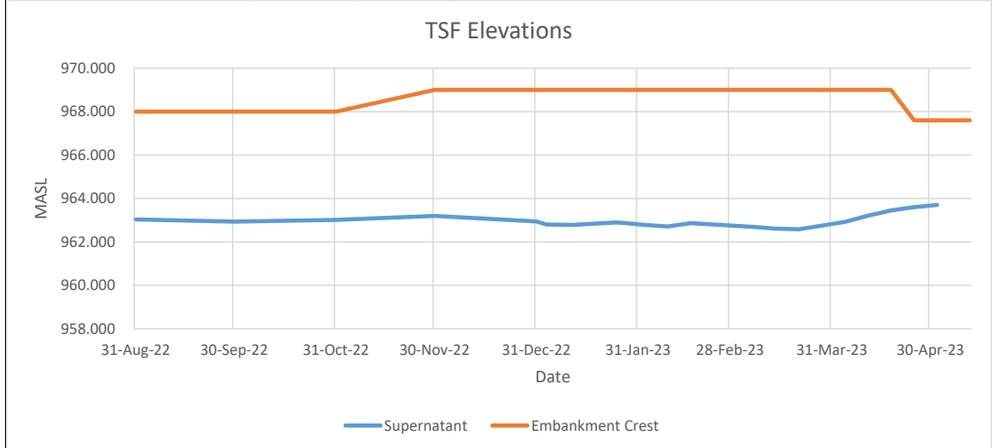
Instrumentation Status

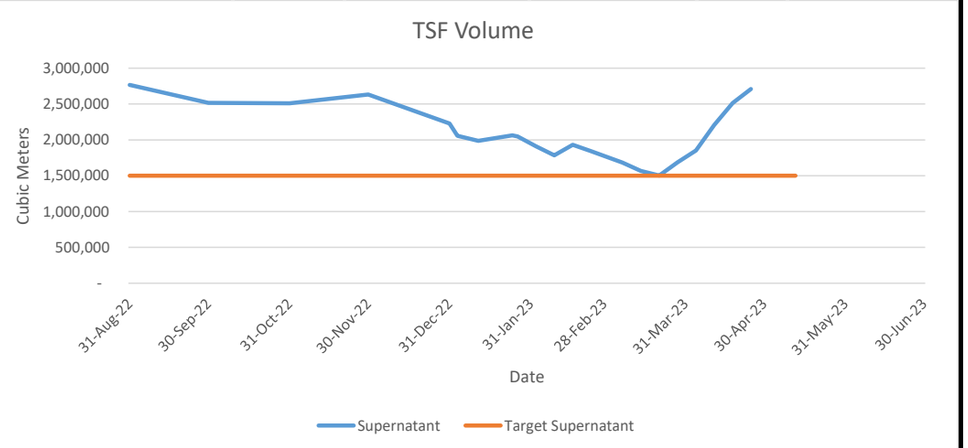
Inclinometers	0 SI OVER QPO
Piezometers	within QPO*
IPI	within QPO*
Survey Monuments	within QPO*
SAA	Golder Provides Review
Beach @ Corner 1	>100 Meters
Beach @ P. Emb	>100 Meters
Beach @ M. Emb	>100 Meters
Beach @ S. Emb	>100 Meters
Refer to TSF Weekly Report	
TSF Volume (Mm^3)	9.48
Pit Monitors	Good

*QPO Ref #:1413803-085-TM-Rev3-5115

Pumping/Flow Status

Location	Pumps	Destination	Max Vol per Pump (m3/day)	Usage	Approx Vol Pumped (m3/day)
WTP	2 of 2	To Quesnel Lake	28,000	25%	6,888
NEZ Sump	1 of 1	Mill	1,920	0%	0
NW Sump	1 of 2	To Mine Drainage	20,000	2%	400
NW Sump	1 of 2	Springer Pit	20,000	0%	0
Barge	4 of 4	To Booster	50,000	87%	43,500
Wight Pit	1 of 2	To Long Ditch	8,712	0%	0
Till Borrow	0 of 2	To TSF	20,000	0%	0
CCS	0 of 3	To TSF	20,000	0%	0
TSF Booster	4 of 5	To Mill	43,608	100%	43,608
TSF Diesel	1 of 1	To CCS	13,000	0%	0
TSF Booster	0 of 3	To Cariboo Pit	13,000	0%	0
Springer Wells	2 of 2	To West Ditch	3,840	21%	823
Cariboo sump	2 of 2	To West Ditch	24,000	4%	857
Site Runoff		To Long Ditch	3,500		500
Site Runoff		To SERD Ditch	2,500		1,200





Comments

- The WTP is operating normally with average effluent at 1103m³/hour.
- All beach widths are in normal operating zones.
- Lake Excavating has started construction for the year and is currently working between corners 1 and 2.
- South embankment beach width is in concern zone.
- The sink hole was discovered on March 16th (Thursday) @ 4pm near corner 1 in the Zone U (upstream of the till core). The hole is ~2m deep.

- The team has been notified and area will be monitored.
- The sink hole was dug up and there was no continuity found into the underlaying rock fill. Area is still taped off due to open excavation still being present.

APPENDIX 5-6: Email with Mathieu O'Leary August 1, 2023

Maddaloni, Jesse

From:	Donoso, Gonzalo
Sent:	August 1, 2023 12:57 PM
To:	Mathieu O'Leary
Cc:	Bainbridge, Sophie; Pizarro-Sala, German; Maddaloni, Jesse; GLD - Mount_Polley_Coordinators; Hosseini, Nasim; Malekialavi, Hossein; Cheng, Stella
Subject:	Diversion ditch / Seepage infrastructure / limitations by road and permit boundary

[illegible]

[illegible]

[illegible]

- [illegible]
  - a[illegible] we will proceed with the alignment considering the ultimate TSF raise.
  - [illegible] A New permit boundary will be requested with the application.
  - [illegible] [illegible]
- [illegible]
  - a[illegible] [illegible]
  - [illegible] We will review a potential use of the big ponds located on the east side of the main embankment to [illegible]
  - d[illegible] [illegible]

[illegible]

- [illegible]
- [illegible]
- [illegible] [illegible]
- [illegible]

[illegible]
[illegible]

APPENDIX 5-7: 2023 Annual Dam Safety Inspection for Tailings Storage Facility Embankment

REPORT

2023 Annual Dam Safety Inspection for Tailings Storage Facility Embankment

Mount Polley Mine

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Attention: Matt O'Leary

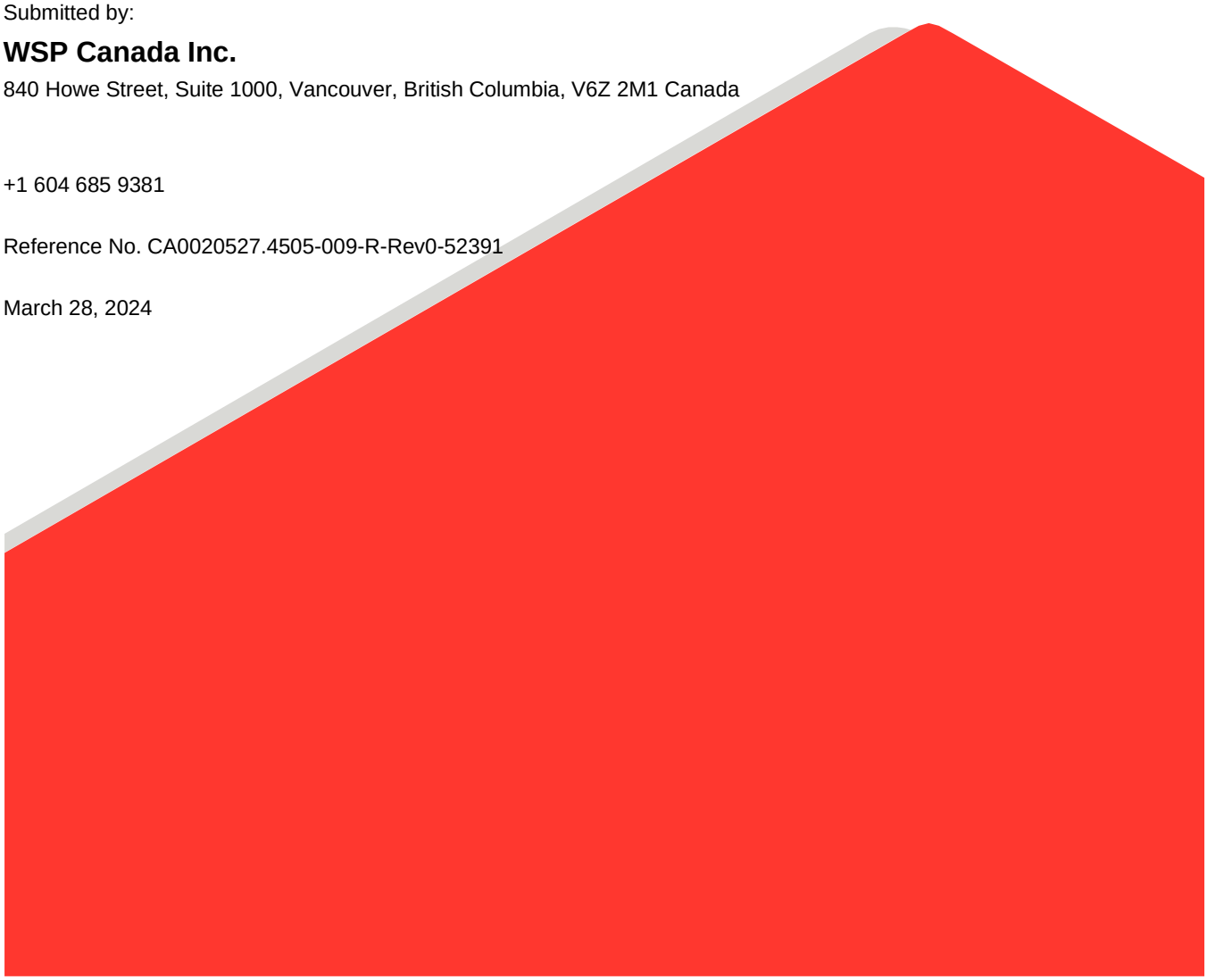
Submitted by:

WSP Canada Inc.
840 Howe Street, Suite 1000, Vancouver, British Columbia, V6Z 2M1 Canada

+1 604 685 9381

Reference No. CA0020527.4505-009-R-Rev0-52391

March 28, 2024



Distribution List

Electronic Copy: Mount Polley Mining Corporation

Electronic Copy: WSP Canada Inc.

Executive Summary

This report presents the results of the 2023 annual dam safety inspection (DSI) for the tailings storage facility (TSF) at Mount Polley Mine, located near Likely, British Columbia. This report was prepared by WSP Canada Inc. (WSP) based on a site visit carried out on October 4 and 5, 2023, and a review of data provided by Mount Polley Mining Corporation (MPMC).

Facility Description

The TSF includes one embankment that is approximately 4.6 km long. The embankment is subdivided into three sections referred to as the Main Embankment, Perimeter Embankment, and South Embankment. The embankment is founded on glacially derived soils and was constructed in stages using centreline and modified centreline construction methods. Tailings generated at the mill have been deposited into the TSF as a low-density slurry.

The TSF Clean Water Ditch is located upstream of the facility between Corner 4 and Corner 5 and diverts runoff into a small wetland downstream of the South Embankment. The Main Embankment Seepage Collection Pond (MESCP), South Embankment Seepage Collection Pond (SESCP), and Perimeter Embankment Till Borrow Pond (PETBP) collect seepage and runoff from the embankments.

Operation and Construction History

Mount Polley Mine began production in 1997 and operated until October 2001 when operations were suspended for economic reasons. In March 2005, the mine restarted and was in operation up to the time of the TSF breach in August 2014. The embankment crest was near elevation 968 m relative to the Mount Polley Tailings Grid system at the time.

In 2015, the Freshet Embankment was constructed to elevation 950 m through the breach area to allow the capture and temporary storage of the 2015 and 2016 freshet flows. The Freshet Embankment design includes a low-permeability cut-off wall constructed using the cutter-soil mixing technique. The construction of buttresses along the Perimeter Embankment and Main Embankment was completed in October 2016 (Golder 2015a, 2017a).

The June 23, 2016, amendment of *Mines Act* Permit M-200 authorized the return to full operations at the mine, including construction and operation of the TSF to design elevation 970 m (Golder 2015b). Construction to raise the Freshet Embankment at Corner 1 to elevation 970 m started in June 2016. By September 2018, construction of the embankment at Corner 1 had been completed to elevation 968 m (Golder 2019a). The raise of the Freshet Embankment is referred to as the Perimeter Embankment at Corner 1.

Mining operations were halted in May 2019 for economic reasons. In June 2022, the mill restarted operations and tailings deposition into the TSF resumed. Construction to raise the embankments to elevation 970 m resumed in July 2022. By the end of 2022, the minimum elevation of the till core connection at the North Abutment remained at an estimated elevation of 966.2 m. Construction of the embankments and abutment connections was completed to about elevation 970 m between May and November 2023.

Summary of Key Hazards

The most relevant failure mode of the TSF is a failure through the foundation of the embankment. This failure mode has been the focus of geotechnical investigations, analyses, and design that have resulted in the construction of buttresses along the Main Embankment and Perimeter Embankment (including at Corner 1).

As the pond level rises due to deposition of tailings and the gradient across the till core increases, internal erosion of the embankment becomes a relevant failure mode. However, the highest TSF pond elevation since the restart of operation in 2016 has been 964.7 m, which is approximately 1.8 m lower than the maximum elevation prior to the breach. Wide tailings beaches, minimum 100 m, have generally been maintained between the embankment and the TSF pond, except from May to August 2020, May to November 2022, and May to June 2023. The current water level in the TSF imposes a hydraulic gradient across the till core that is less than the till core has previously resisted. No signs of turbid water or significant changes in flow rate have been observed at the seepage collection drains or ponds.

Overtopping of the embankment is an unlikely failure mode if the TSF is operated according to design. Most of the inflow to the TSF can be stopped by ceasing pumping water from the PETBP. The design freeboard criterion of 1.1 m was met throughout 2023. The freeboard remained above 2.3 m through 2023 and increased to more than 5.0 m after construction of the Corner 5 abutment in September/October 2023. The TSF pond level was about 964.7 m at the end of 2023, resulting in a freeboard of 5.3 m.

At the beginning of 2023, the TSF pond volume was estimated by MPMC to be in the order of 2.2 million m^3 (Mm^3) and exceeded the quantitative performance objectives (QPOs). The exceedance was due to MPMC allowing excess water to accumulate in the facility in 2021 and 2022. Prior to freshet, MPMC reduced the TSF pond volume to an estimated 1.5 Mm^3. The freshet flows increased the TSF pond volume to about 1.7 Mm^3 as estimated by MPMC. During the summer, MPMC continued reducing the pond volume, and by September 2023, it was estimated to be about 0.8 Mm^3. The TSF pond increased for the remainder of the year back towards the lower limit of the normal operating criteria. The TSF pond volume was estimated by MPMC to be about 1.4 Mm^3 as of December 2023.

It is important that MPMC continues to proactively manage site water, so the TSF pond size is maintained within the specified operating volume range and accumulation of water does not occur within the TSF.

Summary of Significant Changes

MPMC reported that approximately 5.9 million tonnes (Mt) of tailings were discharged into the TSF in 2023. A total of about 28.0 Mt of tailings have been deposited into the TSF since the restart of operations in June 2016.

Construction to raise the embankments from about elevation 968 to 970 m resumed in May 2023 and was completed by the end of October 2023.

Significant Changes in Instrumentation and/or Visual Monitoring Records

All inclinometers along the South Embankment, Main Embankment, and Perimeter Embankment show consistent conditions with measured movement within the accuracy of the instrumentation; however, weekly review of the inclinometer data during 2023 showed that at times the error was greater than what the system can achieve. Erratic readings started being recorded in deeper inclinometers along the Perimeter Embankment and Main Embankment in March 2022. Generally, the erratic readings included a combination of rotation from the base of the inclinometer and/or a sinusoidal shape from the base of the inclinometer. MPMC has sent its inclinometer probes for recalibration on multiple occasions; however, they have continued to malfunction periodically. The readings do not indicate downstream movement of the embankment, and the apparent movements are interpreted to be a systematic error. MPMC has purchased inclinometer probes supplied by another manufacturer and is in the process of re-establishing baselines for each inclinometer.

Survey monument SM18-01, installed at the downstream crest of the Perimeter Embankment at Corner 1, showed approximately 10 to 20 mm/year creep to the northeast since installation and until the monument was struck by equipment in May 2023. Settlement of the foundation and rockfill is expected. Survey monument SM18-01 was decommissioned in August 2023 while construction to raise the embankment to elevation 970 m was in progress.

On March 23, 2023, MPMC informed the Engineer of Record that the tailings slurry pipeline had leaked upgradient of the TSF and tailings had flowed along the toe of the Perimeter Embankment from Corner 5 to Corner 1 and deposited against the west side of the Perimeter Embankment buttress at Corner 1. High turbidity values were recorded at the Corner 1 north and south diversion ditches starting on March 23, 2023. The in situ turbidity test results remained elevated until May 2023 when conditions returned within the historical range. The high turbidity values are interpreted to be a result of the tailings slurry leak and freshet. Pore pressures at piezometers VW18-03A (till) and VW18-03B (till), located near the west side of the buttress at Corner 1, increased about 1.8 m to elevation 937.8 m (near original ground) in late March 2023 and have since stabilized at that level. The increase is interpreted to be a response to the tailings that deposited in the area on March 23, 2023. Piezometer VW18-03C, installed in the underlying bedrock, did not respond to these conditions and remained consistent for the year.

All other recorded seepage rates and turbidity values recorded in 2023 at all monitoring locations are within the historical range.

The groundwater quality trends for monitoring wells located around the TSF show that sulfate concentrations in the shallow groundwater downgradient of the TSF approached or reached levels observed in the TSF pond water next to the Perimeter Embankment at GW16-2B and GW96-2B and next to the South Embankment at GW96-4B. These wells are known or inferred to be completed in glaciofluvial units based on soil descriptions and the relatively high hydraulic conductivity results. The remaining wells indicated relatively stable or slightly decreasing sulfate concentration trends (WSP 2023e).

Erosion gullies have continued to form through the upstream fill due to snowmelt ponding on the crest of the embankment between the till core and tailings discharge pipeline. The tailings discharge pipeline should be relocated onto a bench along the upstream slope of the upstream fill. Alternatively, the tailings pipeline could be raised from the crest of the upstream fill to limit water ponding between the till core and the tailings slurry pipeline.

On March 16, 2023, MPMC reported that a sinkhole had developed on the upstream fill of the Perimeter Embankment near Sta. 4+465. The sinkhole is interpreted to have developed due to snowmelt ponding on the upstream fill at the crest of the embankment, infiltrating through the upstream fill and eroding the upstream fill tailings sands into the underlying rockfill (i.e., remaining temporary upstream rockfill berm). Details of the test pit investigation, review of construction record and instrumentation data, interpretation of the findings, and recommendations are presented in WSP (2023c). As indicated in the TSF sinkholes investigation and interpretation memorandums (Golder 2020c,d), sinkholes could redevelop if surface water conditions were allowed to repeat. The sinkhole that developed on the upstream fill of the Perimeter Embankment does not present a dam stability concern.

The tailings discharge pipeline was installed on a rockfill berm 2 to 3 m higher than the embankment crest immediately upstream of the embankment along Corner 5. The tailings pipeline has since been relocated onto the upstream crest of the embankment. However, the rockfill berm should be removed to allow tailings deposition to occur into this area of the TSF.

Significant Changes to Stability and/or Surface Water Control

The Perimeter Embankment, Main Embankment, and South Embankment were observed to be in generally good condition at the time of the site visit in 2023. No significant changes in stability were noted based on instrumentation and visual monitoring records.

The beach slopes upstream of the embankment were surveyed to be in the order of 0.5%, which is flatter than in previous years. The flatter beach slopes increase the difficulty to maintain the minimum beach width QPO of 100 m upstream of the embankment. Topographic and bathymetric surveys should continue to be performed periodically to monitor the beach slopes. The tailings deposition method should be assessed and modified to increase the beach slopes if surveys do not show improvements.

Dam Classification

The TSF embankment is classified as a significant consequence dam based on the guidelines presented by the Canadian Dam Association (CDA 2013, 2019).

Operation, Maintenance, and Surveillance Manual; Emergency Preparedness and Response Plan; and Dam Safety Review

The operation, maintenance, and surveillance (OMS) manual and the emergency preparedness and response plan (EPRP) for the TSF were updated in August 2023 to keep information up to date and to identify potential improvements. An additional update to the OMS manual and the EPRP was in progress at the end of 2023 to address comments made in the 2022 dam safety review (DSR) (Tetra Tech 2023).

A test of the EPRP was carried out on November 30, 2023, with Mine Rescue site personnel and the Technical Services Group simulating an exceedance of the TSF freeboard QPO (unsafe zone).

An audit level DSR was conducted by Tetra Tech Canada Inc. in 2022. The TSF embankment was considered reasonably safe with non-conformances (Tetra Tech 2023).

Recommendations

Table E-1 summarizes the status of priority level 1 and 2 outstanding recommended actions and the 2023 DSI recommended actions Each recommendation has been given a priority level from 1 to 4 as described in Table E-2. Priority level 3 and 4 recommended actions are presented in Table 4.

Table E-1: Summary of Priority Level 1 and 2 Key Issues and Recommended Actions

ID	Identified Issue	Potential Dam Safety Impact or Risk	Recommended Action	Priority	Recommended Timing for Completion or Status
2023DSI-01	The tailings pipeline is installed on a 2 to 3 m high berm immediately upstream of the upstream fill which is at a higher elevation than the TSF embankment at Corner 5.	Risk of discharging tailings upstream of the berm to a higher elevation than the embankment (i.e., >970 m). The berm is not engineered to retain tailings. Increased risk of potential pipeline leaks flowing over and eroding the embankment.	Relocate the tailings slurry pipeline onto a berm along the upstream slope of the upstream fill or onto the crest of the upstream fill, locally raised with blocking or similar. Excavate the existing pipeline berm upstream of the embankment.	2	Complete. Spring 2024.
2023DSI-07	Recommendation 2017DSR-09 has been addressed for the MESCP and PETBP (Golder 2018b). Documentation of peak flow, inflow volumes, and pumping requirements pending for the SESCP.	Potential insufficient storage or pumping capacity resulting on overtopping of the SESCP.	Determine and document the peak flow, inflow volumes, and pumping requirements for the SESCP.	2	Spring 2024.
2023DSI-08	Stress-deformation analyses (Zabolotnii et al. 2022) indicate that slope inclinometers could provide indication of movement in advance of a potential foundation failure through a layer of GLU in the foundation if the slope inclinometers are located where plastic strains would first occur. Slope inclinometers are installed downstream of the embankment along the South Embankment. Two slope inclinometers are installed near the toe of the starter dam at the Main Embankment.	Potential stability issues may not be identified in a timely manner.	Install and monitor slope inclinometers near the toe of the starter dam near Sta. 0+700 and 1+100 at the South Embankment and near the toe of the starter dam near Sta. 1+900, 2+300, and 2+600 at the Main Embankment.	2	During construction to re-slope the embankment to 2H:1V in 2024.
2022DSI-01	Inclinometer readings show systematic reading errors greater than the capability of the instrument.	Potential issues may not be identified in a timely manner. Misinterpretation or overestimation/underestimation of movement of the embankment.	Periodic review of data collection technique by experienced operator followed by retraining as required. Periodic recalibration of the inclinometer probe by manufacturer on an as required basis.	2	Ongoing. MPMC repaired and purchased new inclinometer probes in 2023; however, malfunctions persisted. MPMC purchased inclinometer probes supplied by another manufacturer and is in the process of re-establishing baselines for each inclinometer.
2022DSI-02	The OMS manual and EPRP were last updated in 2021 before tailings deposition into the TSF resumed. Changes made to slurry deposition in 2022 need to be included in the OMS manual.	Increased risk due to potential miscommunication or misunderstanding of TSF operation, maintenance, surveillance, and emergency response.	Complete updates of the OMS manual and EPRP as required (minimum once per year) and train personnel as required.	2	Completed August 2023. Updates to the OMS manual and EPRP were in progress at the end of 2023.

Table E-1: Summary of Priority Level 1 and 2 Key Issues and Recommended Actions

ID	Identified Issue	Potential Dam Safety Impact or Risk	Recommended Action	Priority	Recommended Timing for Completion or Status
2022DSI-03	By the end of 2022, the minimum elevation of the till core was about 968.2 m near Corner 3 while the filter and transition zones remained lower at an elevation ranging from 965 to 968 m. The till core connection at the North Abutment remained at an estimated elevation of 966.2 m.	Potential insufficient storage capacity to store target tailings production in 2023.	Complete construction of the filter and transition zones to match the minimum elevation of the till core and abutments. Review tailings production forecast and storage capacity and plan construction as required.	2	Complete.
			Complete construction to raise the embankment to elevation 970 m. Review tailings production forecast and storage capacity and plan construction as required.		Complete.
2021DSI-01	By the end of 2021, an approximate total of about 7.0 Mm^3 of water remained on site at the Springer Pit, Cariboo Pit, and TSF. The restart of mining operations requires dewatering the Springer Pit and Cariboo Pit and reduces the ability to use these pits to store the current excess water on site. The TSF cannot be used to store excess site water.	Increased risk due to the accumulation of a larger volume of water on site that reduces the capacity to manage runoff from freshet and extreme events.	Implement actions to increase the site water discharge rate so the current excess water on site is eliminated, the TSF pond size is maintained within the specified operating volume range, and accumulation of water does not occur within the TSF. Actions could involve: ▪ obtaining approval to discharge untreated water that meets the requirements of the permit ▪ developing a flowchart and triggers to help determine the magnitude of precipitation events in a timely manner	2	Ongoing since 2020. In 2023, the TSF pond had an estimated net water reduction of about 0.9 Mm^3 and has remained within or below the normal operating pond volume range since about June 2023. MPMC reported a year-over-year site-wide water reduction of about 2.7 Mm^3 in 2023; however, approximately 3.2 Mm^3 remained on site by end of 2023.
2018DSI-02	Clean water diversion ditch along the west side of the TSF is partially blocked by fallen trees and woody vegetation.	Overtopping of the ditch during large storm events, with washout of access road along the west side of the TSF.	Remove obstructions (i.e., fallen trees, woody vegetation, and branches) and re-establish the diversion ditch along the perimeter of the TSF.	2	Ongoing. No progress in 2023.

DSI = dam safety inspection; TSF = tailings storage facility; PETBP = Perimeter Embankment Till Borrow Pond; CCS = Central Collection Sump; DSR = dam safety review; MESCP = Main Embankment Seepage Collection Pond; SESCP = South Embankment Seepage Collection Pond; GLU = glaciolacustrine unit; OMS = operation, maintenance, and surveillance; EPRP = Emergency Preparedness and Response Plan.

Table E-2: Description of Priority Levels

Priority Level	Description
1	A high probability or actual dam safety issues considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

Source: Health, Safety and Reclamation Code Guidance Document, Section 4.2 (BCMEM 2016).

Study Limitations

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1.0 INTRODUCTION

WSP Canada Inc. (WSP) completed an annual dam safety inspection (DSI) of the tailings storage facility (TSF) at Mount Polley Mine, located near Likely, British Columbia. The mine is owned and operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The following structures were inspected during the annual review:

- Perimeter Embankment and buttress
- Main Embankment and buttress
- Main Embankment Seepage Collection Pond (MESCP)
- South Embankment
- South Embankment Seepage Collection Pond (SESCP)
- TSF Clean Water Ditch

This DSI report has been prepared in accordance with Part 10 of the Health, Safety and Reclamation Code for Mines in British Columbia (EMLI 2022). It is understood that MPMC will submit this report to the British Columbia Ministry of Energy, Mines and Low Carbon Innovation Chief Inspector of Mines. The annual DSI report guidelines outlined by the British Columbia Ministry of Energy, Mines and Low Carbon Innovation (formerly British Columbia Ministry of Energy and Mines) were followed during the preparation of this report (BCMEM 2016).

This report is based on a review of annual data pertaining to the mine site and TSF, discussions with MPMC staff, and a site visit carried out on October 4 and 5, 2023. This report includes:

- site conditions and background information of the facility
- summary of the construction, operation, and maintenance activities in 2023
- review of climate data, water balance, TSF operation, failure modes, and instrumentation data
- review of dam classification and required operational documents
- recommendations for future operation, maintenance, and inspection activities
- site photographs and records of DSI
- figures with updated instrumentation in plan and cross-sections

A dam safety review (DSR) was conducted in 2022 (Tetra Tech 2023). The recommendations made in the DSR report and WSP's recommended actions to address the comments are included in Section 7.3.3 of this report.

All elevations and coordinates are presented relative to the Mount Polley Tailings Grid system unless otherwise noted. This report is to be read in conjunction with the Study Limitations provided at the beginning of the report.

2.0 METHOD

2.1 Site Inspection

A site inspection was carried out by Germán Pizarro, P.Eng., and Ryan Garritsen, P.Eng., on October 4 and 5, 2023. Germán Pizarro has been the Engineer of Record (EoR) for the Mount Polley Mine TSF since February 2019.

The weather during the site inspection was between about 4°C and 12°C, with cloudy to partly sunny conditions. The inspection involved observing and photographing the condition of the embankments and associated structures while walking the complete length of the following:

- crests of the Perimeter Embankment, Main Embankment, and South Embankment
- crests of the Perimeter Embankment buttress and Main Embankment buttress
- downstream toe of the South Embankment
  - Sections of the downstream toe were not accessible due to vegetation.
- downstream toe of the Perimeter Embankment buttress and Main Embankment buttress
- MESCP
- SESCP
- TSF Clean Water Ditch
  - Sections of the ditch were not accessible due to vegetation.

2.2 Review of Monitoring Information

The following monitoring records were reviewed as part of the annual DSI:

- weekly TSF inspection reports prepared by MPMC
- climate data including temperature, rainfall, and snowpack
- TSF pond elevation measurements and estimated TSF pond volume
- monthly tailings production rates
- weekly water treatment plant (WTP) operating rates
- geotechnical instrumentation installed within and downstream of the embankment including vibrating wire piezometers (VWPs); monitoring wells (i.e., standpipe piezometers); inclinometers (manual readings, in-place inclinometer probes, and shape acceleration arrays [SAAs]); and survey monuments
- turbidity and drain flow rates from the Freshet Embankment seepage collection ditch, north and south diversion ditches, Perimeter Embankment upstream drain at Corner 1, west and east Main Embankment toe drains, and South Embankment toe drain

3.0 FACILITY DESCRIPTION

3.1 General

Mount Polley Mine is a copper and gold mine operated by MPMC. The site is located 56 km northeast of Williams Lake, British Columbia, between Polley Lake and Bootjack Lake. The TSF is located about 3 km southeast of the mill.

The TSF includes one embankment that is approximately 4.6 km in length. The embankment is subdivided into three sections referred to as the South Embankment, Main Embankment, and Perimeter Embankment. The mine site layout with the TSF configuration is shown in Figure 1.

The embankment is founded on glacially derived soils. The embankment incorporates a staged expansion design using modified centreline and centreline construction methods. The general zoning of the embankment includes:

- upstream fill generally composed of tailings sand and rockfill
- low permeability till core
- filter zone
- transition zone
- rockfill forming the downstream zone of the embankment and the downstream buttress along the Perimeter Embankment and Main Embankment
    - Sandy tailings reclaimed from Hazeltine Creek were also used in the construction of the Perimeter Embankment buttress at Corner 1.

The TSF Clean Water Ditch is located to the west and upstream of the TSF between Corner 4 and Corner 5 and diverts runoff into a small wetland downstream of the South Embankment.

The MESCP and SESCP are located at the downstream toe of the Main Embankment buttress and South Embankment, respectively. The Perimeter Embankment Till Borrow Pond (PETBP) is located at the downstream toe of the Perimeter Embankment buttress. The ponds collect seepage and surface water runoff from the embankments. The PETBP also collects site contact water from the Central Collection Sump (CCS) and is the source of water for the WTP. The SESCP is pumped into a gravity-flow open ditch reporting to the MESCP. Water in the MESCP is pumped back into the TSF. Water in the PETBP is either pumped to the WTP or the TSF.

3.2 Recent Construction and Operation History

On August 4, 2014, a foundation failure at Corner 1 of the Perimeter Embankment near Sta. 4+300 resulted in a breach of the TSF. Placement of fill to raise the embankment crest to an elevation of 970 m was nearing completion at the time.

The Freshet Embankment was constructed to elevation 950 m through the breach area during the period from November 2014 to June 2015. The Freshet Embankment design includes a low permeability cut-off wall constructed using the cutter-soil mixing technique. The cut-off wall, cut-off wall aggregate, and transition materials are supported by tailings sand on the upstream side and rockfill on the downstream side. The construction of a buttress along the Perimeter Embankment was also completed as part of the 2015 Freshet Management Embankment (Golder 2015a).

Construction of a buttress extension along the Main Embankment and Perimeter Embankment commenced in December 2015. Construction of the buttress extensions was completed in October 2016 (Golder 2017a).

The June 23, 2016, amendment of *Mines Act* Permit M-200 authorized the return to full operations at the mine including construction and operation of the TSF to design elevation 970 m (Golder 2015b). Construction to raise the Freshet Embankment to elevation 970 m started in June 2016. The raise of the Freshet Embankment is referred to as the Perimeter Embankment at Corner 1. Construction of the Perimeter Embankment at Corner 1 was completed to elevation 958 m by the end of 2016 (Golder 2017b).

The Perimeter Embankment at Corner 1 was raised to about elevation 966 m in 2017. Construction of the buttress at Corner 1 (as per the elevation 970 m TSF design) was in progress in 2017 and was generally completed by April 2018 (Golder 2018a). The downstream slope of the buttress extension was re-sloped from October 2018 to January 2019. Construction to raise the Perimeter Embankment at Corner 1 resumed in July 2018 and was completed to elevation 968 m by September 2018 (Golder 2019a).

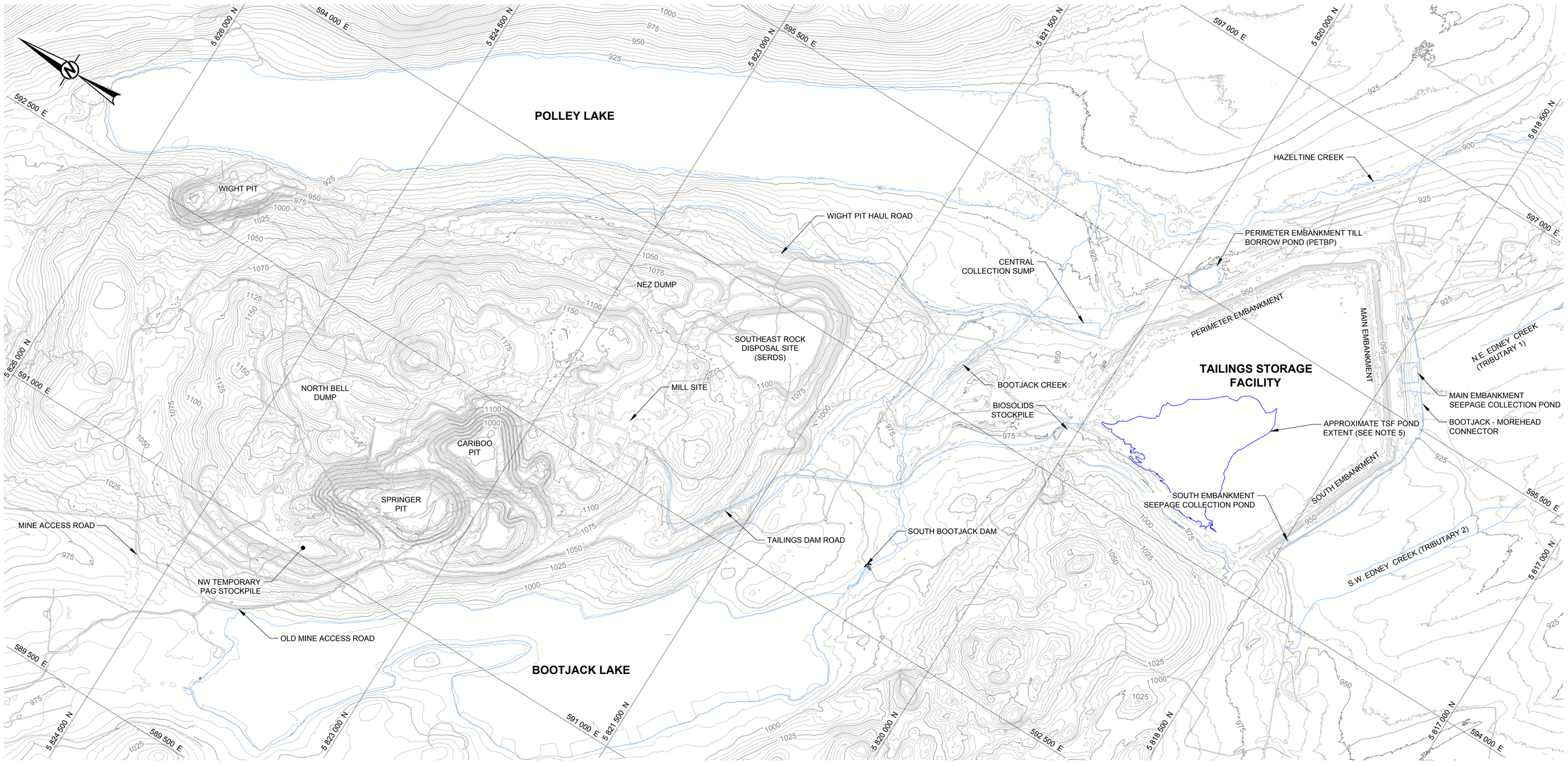
Mining operations were halted in May 2019 for economic reasons. The mine remained in care and maintenance until late 2021. No construction activities were carried out on the embankments during 2020 and 2021. The crest elevation remained at 968 m throughout this period.

Construction to raise the embankments to elevation 970 m resumed in July 2022. By the end of 2022, the minimum elevation of the till core was about 968.2 m near Corner 3, while the filter and transition zones remained lower at an elevation ranging from 965 to 968 m. Construction of the embankments and abutment connections was completed to about elevation 970 m between May and November 2023.

Tailings have been deposited as a low-density slurry since the restart of operations of the TSF in 2016. The tailings slurry has been conveyed from the mill to the TSF via gravity-driven tailings discharge pipelines. Tailings were not deposited in the TSF in 2020 and 2021 while the mine was in care and maintenance.

Since 2022, tailings slurry has been deposited in the TSF from multiple locations along the South Embankment and Perimeter Embankment to build tailings beaches upstream of the embankments and to maintain the pond in a centralized location within the TSF. Tailings deposition from the crest of the Main Embankment has not been attempted. However, the South Embankment tailings slurry pipeline was extended along a berm on the tailings beach upstream of the Main Embankment. The size of the TSF pond is managed by pumping supernatant water to the WTP for discharge from the mine site.

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NOT FOR CONSTRUCTION

REDUCED SIZE

LEGEND

- GROUND CONTOURS (SEE NOTE 4)
- APPROXIMATE TSF POND (SEE NOTE 5)
- SHORELINE (SEE REFERENCE 6)
- WATERCOURSE (SEE REFERENCE 6)
- SITE ACCESS ROADS (SEE REFERENCE 6)

NOTES

1. ALL UNITS ARE IN METRES UNLESS NOTED OTHERWISE.
2. COORDINATES RELATIVE TO UTM, NAD83 AND ELEVATIONS OF MINE SITE REPRESENT GEODETIC DATUM, AND TAILINGS STORAGE FACILITY ARE RELATIVE TO TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 25 m MAJOR AND 5 m MINOR.
4. GROUND CONTOURS REPRESENT COMPOSITE SURVEYS FROM 2013-2023 (SEE REFERENCES 1-4).
5. ESTIMATED POND EXTENTS DIGITIZED FROM AERIAL IMAGERY, SEE REFERENCE 5.

REFERENCES

1. 2013 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MTPOLLEY2013-DTM.dwg", SURVEYED: 2013, RECEIVED: 1 OCTOBER 2014.
2. 2014 TOPOGRAPHY PROVIDED BY MPMC, FILE NAME: "MtPolley_20140805_1m_LiDAR_Contour.dwg", SURVEYED: 5 AUGUST 2014, RECEIVED: SEPTEMBER 3, 2014.
3. 2019 TOPOGRAPHY PROVIDED BY MPMC AS MULTIPLE .las FILES, SURVEYED: 18 OCTOBER 2019, RECEIVED: 09 FEBRUARY 2020.
4. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
5. AERIAL IMAGERY PROVIDED BY MPMC, TAKEN: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF GRID.jgw AND 231030-TSF Grid.jpg ".
6. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", SURVEYED: 2013, RECEIVED: 5 SEPTEMBER 2014.

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CONSULTANT
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YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SITE PLAN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	01

0 25 mm
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4.0 REVIEW OF CLIMATE DATA

Weather data is recorded at two weather stations on the mine site which are located near the mill and TSF. Climate data is recorded at both weather stations including daily temperature, relative humidity, wind speed, solar radiation, evaporation, and rainfall.

The daily temperatures recorded on site from January 2015 to December 2023 are shown in Figure 2 and Figure 3. Most of the temperature data were recorded at the TSF weather station except for years 2015, 2020, and 2023 where limited data were available. Temperature data were also not recorded at the TSF weather station in 2022 from about mid-January to mid-February and in December. In 2023, air temperatures on site were generally above average but still within the historical range throughout the year based on the climate baseline (WSP Golder 2022a).

The rainfall gauges are usually removed from the weather stations each year due to freezing conditions from about November to April. The rainfall data from 2015 to 2023 are shown in Figure 4. The precipitation data recorded for the mill site correspond to manual readings taken throughout the year. Manual readings are not collected daily and often represent multiple days of rainfall grouped together. The precipitation data recorded for the TSF correspond to automatic tipping gauge readings taken daily at the weather station. The recorded data generally show drier than average conditions in April, June, July, September, and October 2023. The combined precipitation from April to October was about 60% of the average amounts for those months based on the climate baseline (WSP Golder 2022a).

The measured snowpack of 263 mm in late February 2023 was slightly above average with an extended period of snowmelt from March to May 2023 as shown in Figure 5. The reported snowpack of 18 mm near year end is below average compared to the measurements taken since December 2014.

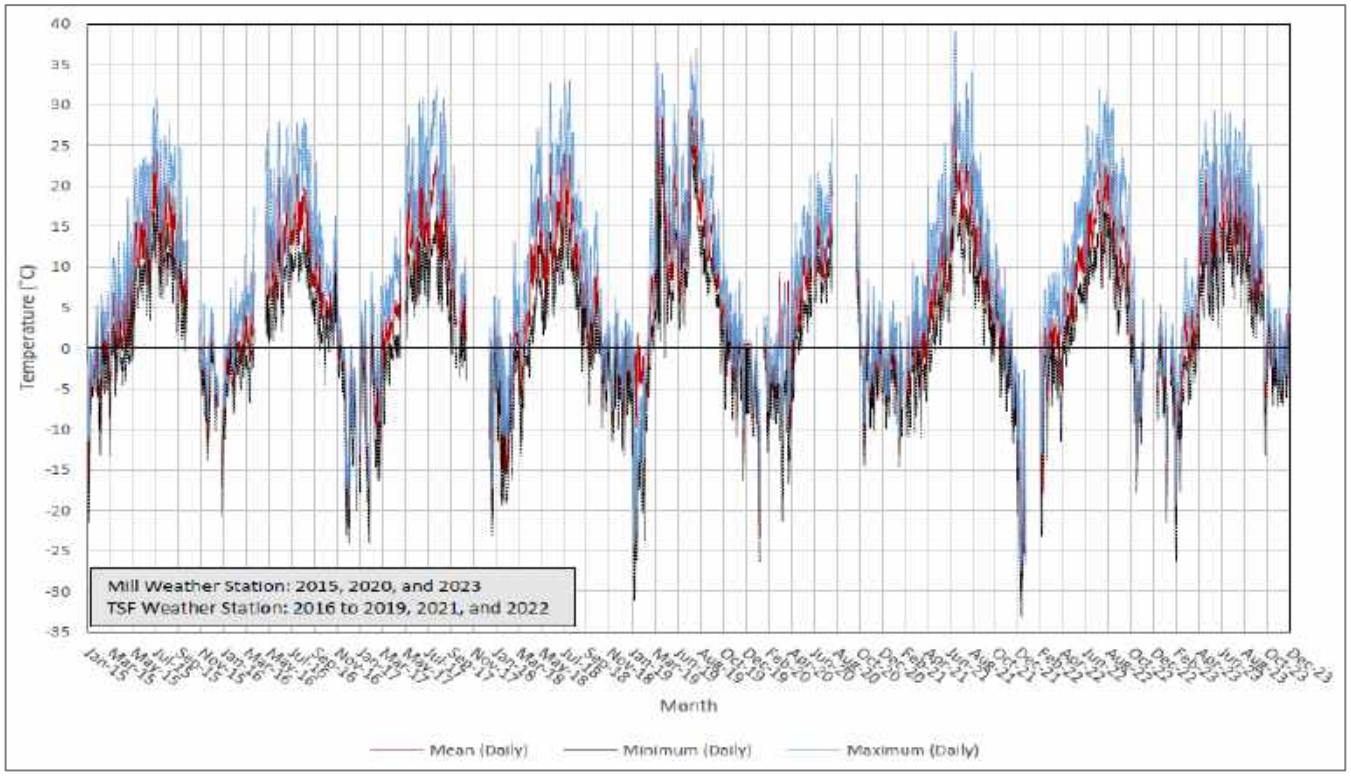


Figure 2: Daily Temperature Recorded at Mount Polley Mine

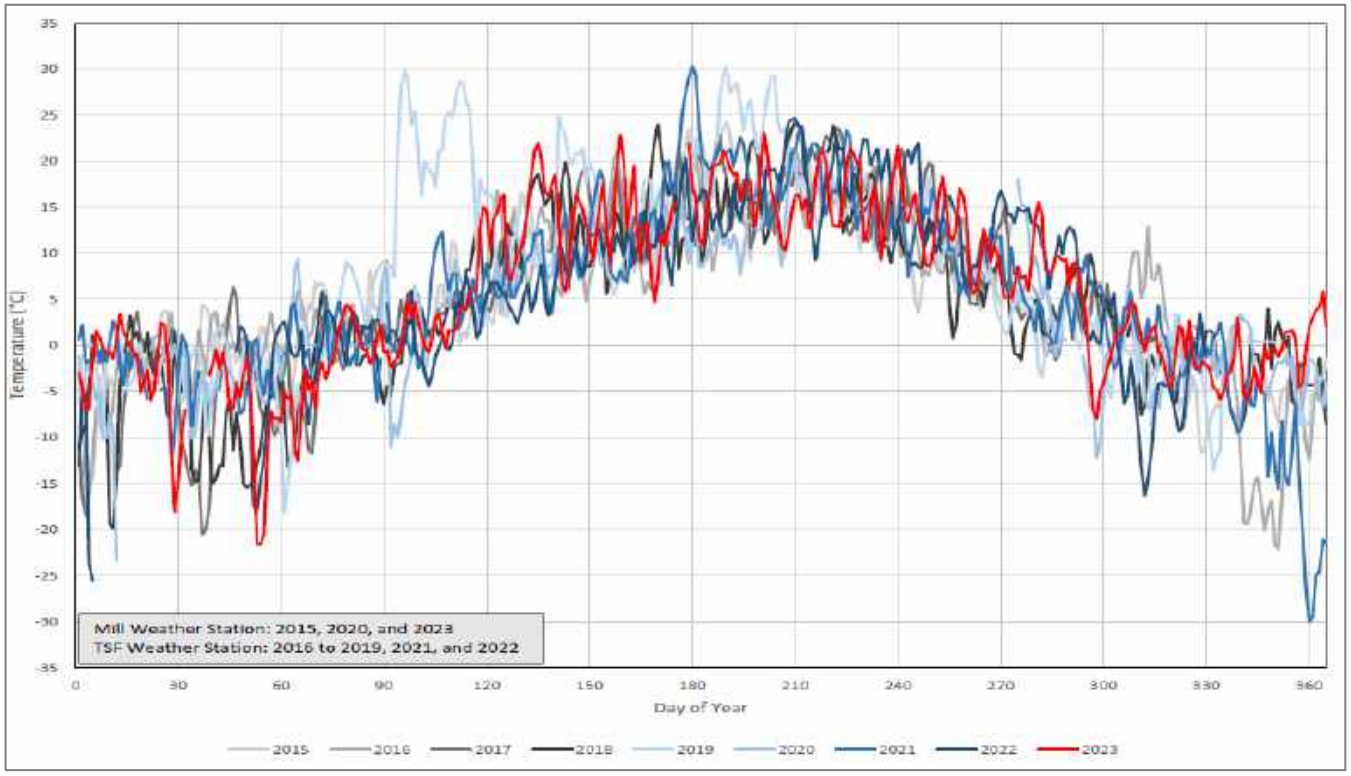


Figure 3: Mean Daily Temperature Recorded at Mount Polley Mine

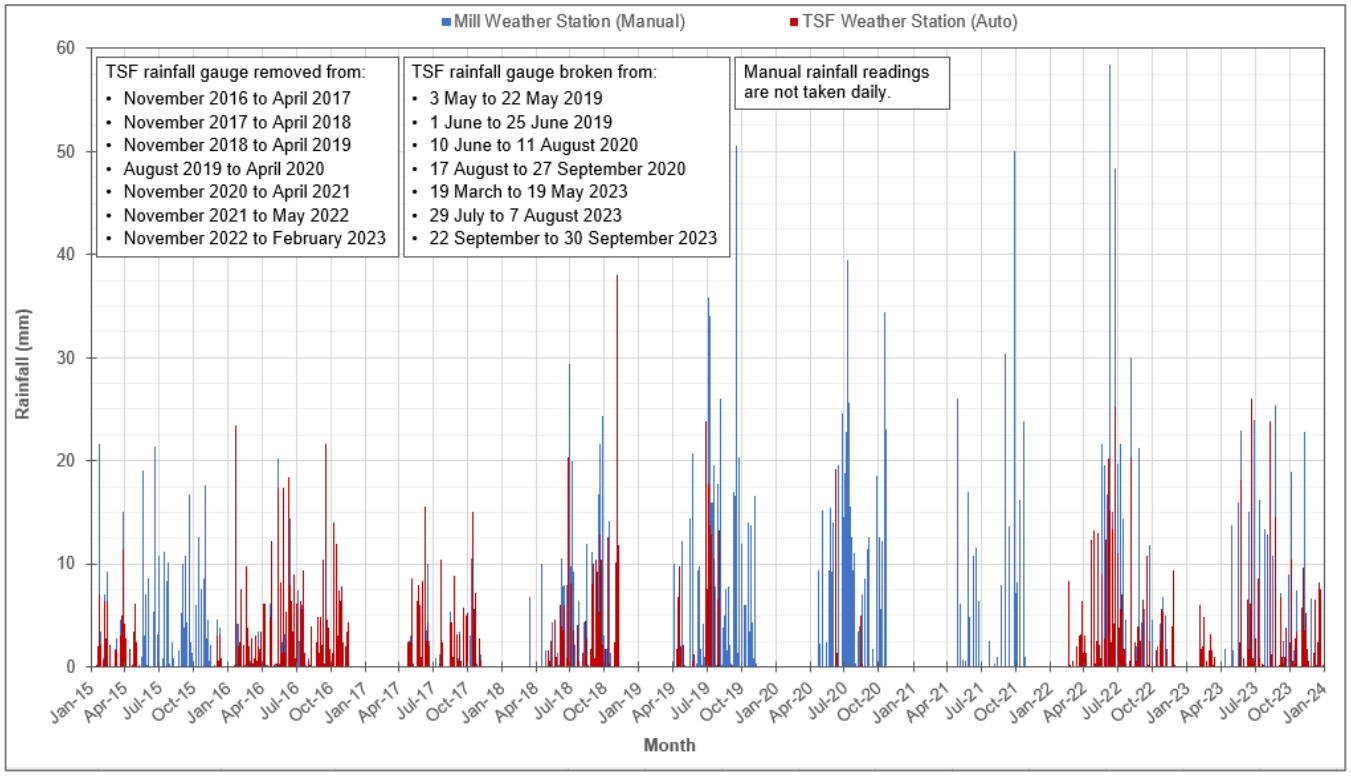


Figure 4: Measured Rainfall

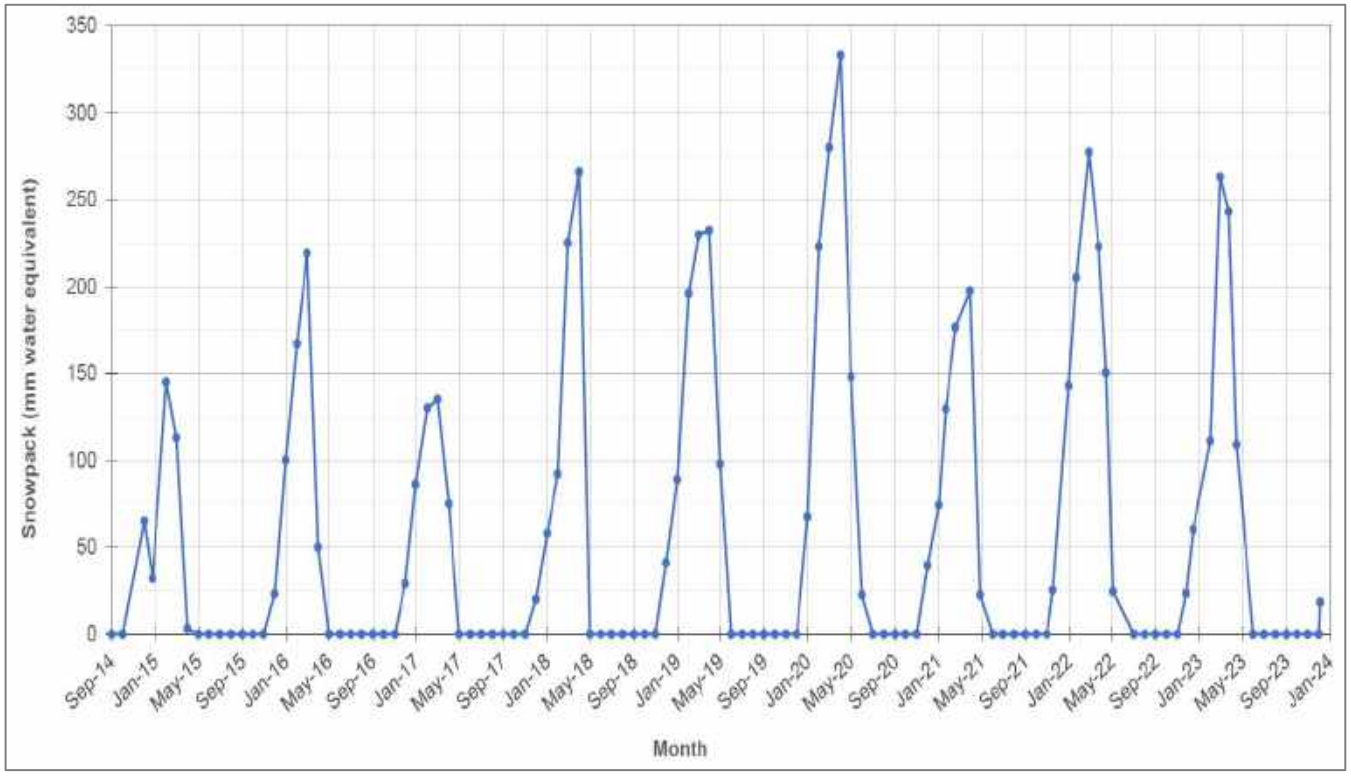


Figure 5: Snowpack Surveyed On Site

5.0 REVIEW OF TAILINGS STORAGE FACILITY OPERATION AND WATER BALANCE

Mining operations were halted in 2019, and the mine remained in care and maintenance until late 2021. The mill restarted operations and tailings deposition into the TSF resumed by the end of June 2022. MPMC reported that a total of 5.9 million tonnes (Mt) of tailings were discharged into the TSF in 2023. A total of about 28.0 Mt of tailings have been deposited into the TSF since the restart of operations in June 2016.

The TSF is required to have sufficient available storage capacity for containment of runoff from the contributing catchment area for the inflow design flood (IDF) event. The design spring and summer 72-hour IDF events are 1.16 Mm^3 and 0.67 Mm^3, respectively (Golder 2017c). The design freeboard criterion of 1.1 m provides storage capacity of approximately 1.9 Mm^3 for an embankment crest elevation of 968 m, which exceeds the requirement to store the 72-hour IDF.

Figure 6 shows the elevation and estimated volume of the TSF pond since the restart of operations in 2016. Since the restart of operations, the TSF pond elevation steadily increased to about 961.8 m by the end of June 2018 and then remained between elevation 961.1 and 963.2 m until the end of 2022. In 2023, the TSF pond elevation rose to 963.7 m during freshet and continued to increase gradually for the remainder of the year. The freeboard remained above 2.3 m and increased as construction to raise the embankment progressed in 2023. The TSF pond level was about 964.7 m by the end of 2023, resulting in a freeboard of 5.3 m. The beach width upstream of the embankments was generally greater than 100 m during the year. There were relatively short periods of time where the TSF pond encroached within these limits including:

- short sections, between deposition locations, along the Perimeter Embankment for a variable period after freshet from about Sta. 3+800 to 4+900
- a section along the Perimeter Embankment from about Sta. 3+050 to 3+600 where sand was borrowed from the beach for use as upstream fill during construction to raise the embankment; the beach widths were re-established to at least 100 m after about two-weeks

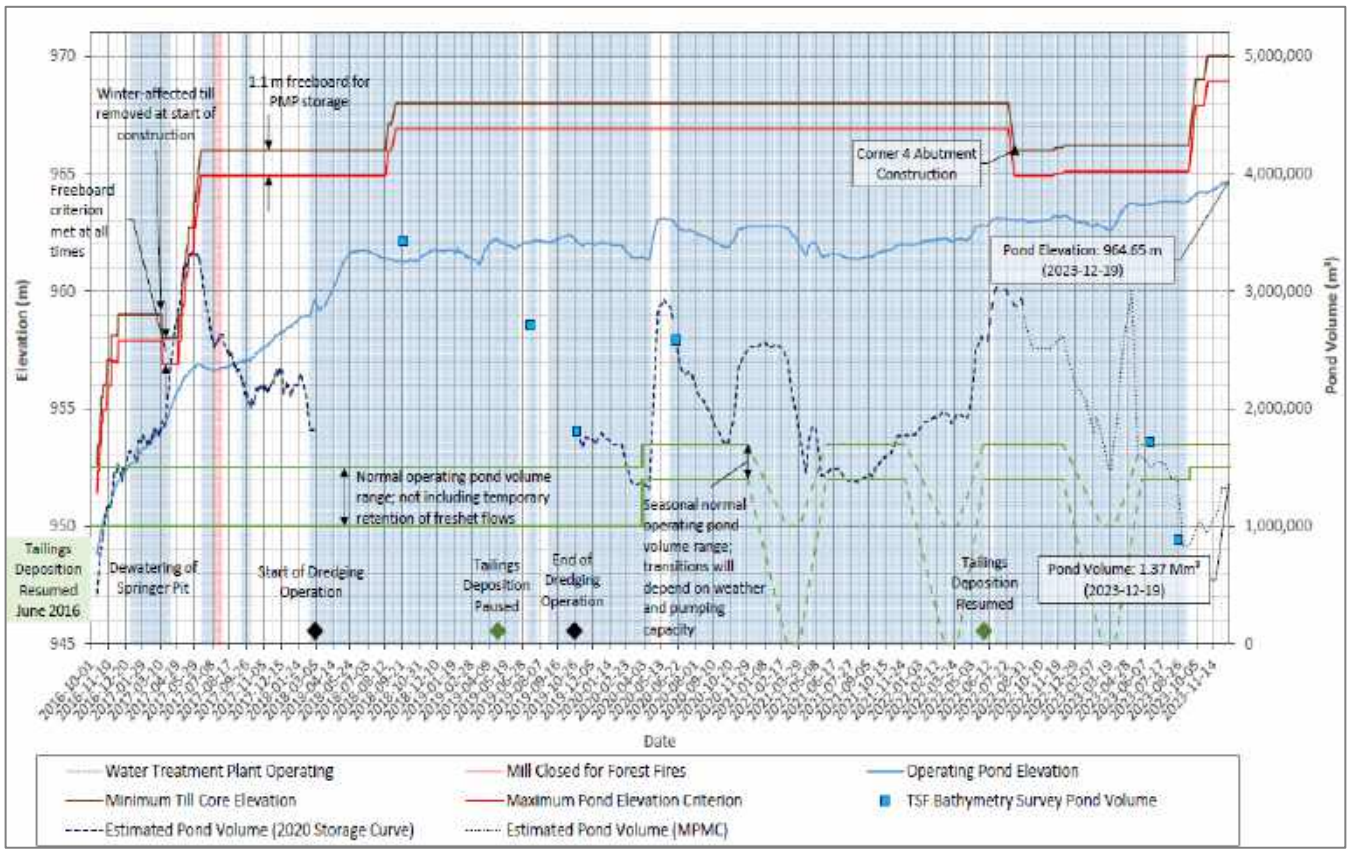
The TSF is designed to provide temporary retention of water to manage large runoff volumes generated during spring freshet or precipitation events (Golder 2015b). However, the pond volume is to be maintained within the normal operating pond volume criteria as outlined in the quantitative performance objectives (QPOs) (Golder 2020a; WSP 2023b). In September 2023, the normal operating pond volume range for the elevation 970 m embankment was revised to 1.5 Mm^3 to 1.7 Mm^3 year-round (as presented in Figure 6) based on input by MPMC that the required 1.0 Mm^3 prior to freshet resulted in inadequate water conditions for mill operation.

MPMC completed surveys of the tailings surface above and below the pond level after deposition of tailings was halted in 2019. However, surveys were not completed in 2022 after deposition of tailings resumed, and therefore the estimated pond volumes using the 2019 survey are progressively inaccurate after June 2022. In 2023, MPMC carried out surveys of the tailings surface in May, June, August, and October; however, inaccuracies were observed in the May survey, while the October survey did not include a bathymetry. MPMC revised the storage curves using the survey data to estimate the TSF pond volumes presented in Figure 6.

At the beginning of 2023, the TSF pond volume was estimated by MPMC to be in the order of 2.2 Mm^3 and exceeded the QPOs. The exceedance was due to MPMC allowing excess water to accumulate in the facility in 2021 and 2022. Prior to freshet, MPMC reduced the TSF pond volume to an estimated 1.5 Mm^3. The freshet flows increased the TSF pond volume to about 1.7 Mm^3 as estimated by MPMC. During the summer, MPMC continued reducing the pond volume and by September 2023, it was estimated to be about 0.8 Mm^3. The TSF pond increased for the remainder of the year back towards the lower limit of the normal operating criteria. The TSF pond volume was estimated by MPMC to be about 1.4 Mm^3 as of December 2023.

In 2023, a year-over-year site-wide water reduction of about 2.7 Mm^3 was achieved based on the water volumes inferred from measured water levels in the Springer Pit, Cariboo Pit, Wight Pit, and TSF.

It is important that MPMC continues to proactively manage site water, so the TSF pond size is maintained within the specified operating volume range and accumulation of water does not occur within the TSF.



PMP = probable maximum precipitation; Mm^3 = million cubic metres; MPMC = Mount Polley Mining Corporation; TSF = tailings storage facility.

Figure 6: Tailings Storage Facility Pond and Till Core Elevation

6.0 DAM CLASSIFICATION

Guidelines for the classification of dams are presented in the Canadian Dam Association (CDA) *Dam Safety Guidelines* (CDA 2013) and *Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams* (CDA 2019). Tailings dams in British Columbia are regulated under the Health, Safety and Reclamation Code for Mines in British Columbia (BCMEM 2016; EMLI 2022), which references the CDA guidelines.

Consequence categories are based on the incremental losses that a failure of the dam might inflict on downstream or upstream areas, or at the dam location itself. Incremental losses are those over and above the losses which might have occurred in the same natural event or condition had the dam not failed. Infrastructure and economic consequences are based on third-party losses. The consequences of a dam failure are ranked as Low, Significant, High, Very High, or Extreme for each of the loss categories. The classification assigned to a dam is the highest rank determined among the loss categories. Table 1 presents the dam classification criteria outlined by the CDA (2013, 2019).

A dam break analysis and inundation study was carried out considering a hypothetical sunny day and flood-induced failure of the Main Embankment and South Embankment (Golder 2017d). A summary of the results is provided below.

- **Main Embankment**—The runoff would flow southeast along Hazeltine Creek and Edney Creek to Quesnel Lake.
- **South Embankment**—The runoff would flow south to Edney Lake and southeast along Hazeltine Creek and Edney Creek to Quesnel Lake.

There are no permanent structures in these areas.

The runoff from a breach of the Perimeter Embankment (as the breach at Corner 1) would flow southeast along Hazeltine Creek or Edney Creek to Quesnel Lake depending on the location of the breach. The WTP is the only permanent structure in this area.

The TSF was evaluated according to the dam classification and loss criteria summarized in Table 1. The TSF is ranked as a Significant consequence of failure based on the following assessment.

- The loss of life is considered unspecified based on the limited exposure time of the general population and mine staff.
  - The area at risk for the general population is limited to the section of Gavin Lake Road downstream of the TSF, bridge crossings on Edney Creek, and the area at the confluence of Hazeltine Creek and Edney Creek with Quesnel Lake. There is no permanent population in these areas.
  - The area at risk for mine staff is limited to the TSF (i.e., embankment crest and buttress) and the downstream water management infrastructure (i.e., WTP, SESCP, and MESCP). Mine staff conduct periodic inspections and maintenance activities at these locations but are not permanently in the area.
- Restoration of fish habitat is possible as demonstrated by the rehabilitation works completed in the Hazeltine Creek channel.
- Third-party economic losses would be low (e.g., Gavin Lake Road and Edney Creek bridge crossing).

Table 1: Dam Classification in Terms of Consequence of Failure (Source: Table 3-1 of CDA 2019)

Dam Class	Population at Risk[a]	Incremental Losses		
		Loss of Life[b]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	▪ Minimal short-term loss. ▪ No long-term loss.	▪ Low economic losses: area contains limited infrastructure or services.
Significant	Temporary Only	Unspecified	▪ No significant loss or deterioration of fish or wildlife habitat. ▪ Loss of marginal habitat only. ▪ Restoration or compensation in kind highly possible.	▪ Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes.
High	Permanent	10 or fewer	▪ Significant loss or deterioration of important fish or wildlife habitat. ▪ Restoration or compensation in kind highly possible.	▪ High economic losses affecting infrastructure, public transportation, and commercial facilities.
Very High	Permanent	100 or fewer	▪ Significant loss or deterioration of critical fish or wildlife habitat. ▪ Restoration or compensation in kind possible but impractical.	▪ Very high economic losses affecting important infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances).
Extreme	Permanent	More than 100	▪ Major loss of critical fish or wildlife habitat. ▪ Restoration or compensation in kind impossible.	▪ Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances).

a) Definitions for population at risk:

None – There is no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary – People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).
Permanent – The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

b) Implications for loss of life:

Unspecified – The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

7.0 TAILINGS STORAGE FACILITY SAFETY ANALYSIS

7.1 General

This section presents the dam safety analysis for the TSF based on the observations and data review for the failure modes relevant to the current conditions and configuration of the facility. The most relevant failure modes of the TSF are a failure through the foundation of the embankment and internal erosion of the embankment since the hydraulic gradient across the till core increases as the pond level rises. Overtopping of the embankment remains an unlikely failure mode if the TSF is operated according to the design criteria and QPOs since most of the inflow to the TSF can be stopped by ceasing pumping water from the PETBP to the TSF.

The performance of the TSF relative to stability and pond level management is presented in more detail in Sections 7.2.1 to 7.2.3.

7.2 Potential Failure Modes

7.2.1 Foundation Instability

The design of the elevation 970 m TSF embankment is based on achieving a factor of safety greater than 1.5 at the end of construction and in the long term. The upstream loading condition was tailings and water impounded to elevation 969 m (Golder 2015b, 2017e).

Construction of the Main Embankment buttress and Perimeter Embankment buttress extension was completed in October 2016. Construction of the buttress at Corner 1 per the elevation 970 m TSF design was completed in January 2019.

The results of the stability analyses carried out for the 2019 as constructed configuration of the Perimeter Embankment at Corner 1 meet the stability design criteria (Golder 2020b).

7.2.1.1 Instrumentation

The following instrumentation is used to monitor the performance of the TSF embankment:

- VWPs to measure porewater pressure within the embankment, foundation, and tailings upstream of the embankment
- slope inclinometers (manual probe inclinometers and in-place inclinometers) and SAAs to measure horizontal movements of the embankment and foundation
- survey monuments to monitor movement of the surface of the Perimeter Embankment at Corner 1

The instrumentation is read in the field by MPMC staff and provided to WSP for review and interpretation by the EoR team. The collected data are assessed to determine if the embankment is responding to changing conditions as expected. The instrumentation data including plan and section figures showing instrument locations are presented in Appendix A and Appendix B and summarized in the following subsections.

Instrumentation monitoring procedures and the potential for errors or inaccuracies are discussed below:

- VWP readings are either recorded automatically with data loggers or manually with a readout box. The VWP data loggers were installed during the summer in 2023. The data loggers are configured to collect readings once every 12 hours, which are wirelessly transmitted or downloaded directly into a calculation file weekly. Reading errors can be random or systematic, systematic errors typically being the larger component of the error which can be more easily identified. The readout box displays a frequency and temperature value representative of the conditions at the time of the reading. These values are stored in the readout box and then converted into pressure using an instrument-specific calibration. The sources of error in the measurement are typically random, being incorrect recording of the instrument identification number. Errors of this type can be difficult to detect, but do not repeat over time and do not affect the interpretation of embankment performance over time. Larger errors are detected when the readings are reviewed, and if an error is confirmed, the reading is retaken.
- The slope inclinometer system used by MPMC has an accuracy, defined by the supplier, of ±6 mm accumulated over 25 readings. Errors in a reading can be random or systematic; systematic errors typically being the larger component of the error. Systematic errors can be reduced by careful operator attention and periodic recalibration of the tools, such that the maximum accuracy for 50 readings is ±1.4 mm.
    - Weekly review of the inclinometer data during 2023 continued to show that at times the error was greater than the accuracy defined by the supplier. In 2018, MPMC purchased a digital slope inclinometer probe, cable, and readout unit to ease operation of the system and reduce reading errors. However, the system provided increasingly inaccurate data until it finally malfunctioned in January 2019. Since then, multiple inclinometer probes have been purchased and recalibrated by the original manufacturer, but readings continue to provide inaccurate and erratic results at some locations (predominately recorded in the deeper slope inclinometers). MPMC has recently purchased inclinometer probes supplied by another manufacturer and is in the process of re-establishing baselines to improve the reliability and accuracy of the inclinometer readings.
- In 2016, MPMC purchased an in-place inclinometer system consisting of five 2 m long segments. The in-place inclinometer system is connected to a data logger, and the readings are downloaded directly into a calculation file, thereby reducing the potential for operator error. The repeatability of the in-place inclinometer probes is defined by the supplier as being ±0.1 mm per metre.
    - The in-place inclinometer system malfunctioned in May 2023 and has not been available since then.
- SAA readings are recorded with a data logger, and the data are downloaded directly into a calculation file, thereby reducing the potential for operator error. The repeatability of the SAA system is ±1.5 mm for a 32 m installation, as defined by the supplier. Erroneous readings can result when the system is low on power, but these errors are generally large and easily identified. Small bias shifts (generally less than 2 mm) have been observed in the SAA readings. Identification is done by checking the raw data prior to any correction or rotation following the direction of the instrument. Bias shifts are filtered after confirmation.

The instrumentation has been installed and distributed along the TSF embankments. At the South Embankment, VWPs have been installed at the tallest section of the embankment (Section F at Sta. 0+720) and in the area where a layer of low plasticity silty clay was identified in the foundation (Section I at Sta. 1+100). VWPs monitor the porewater pressure within the till core and filter of the embankment and foundation at each location. The VWPs currently installed at the South Embankment provide sufficient coverage. Four slope inclinometers have been installed downstream of the embankment between approximately Sta. 0+900 and 1+400.

Based on stress-deformation analyses (Zabolotnii et al. 2022), it is recommended that slope inclinometers be installed near the toe of the starter dam at the tallest section of the embankment near Sta. 0+700 and in the area where a layer of low plasticity silty clay was identified in the foundation (near Sta. 1+100).

At the Main Embankment, VWPs have been installed primarily along five sections (Section E, C, A, B, and K) distributed along the length of the embankment. VWPs monitor the porewater pressure within the till core, filter, and drains of the embankment and foundation (i.e., till, glaciofluvial, and glaciolacustrine unit [GLU]) below and downstream of the embankment at each location. The VWPs currently installed at the Main Embankment provide sufficient coverage. Six slope inclinometers have been installed through the buttress and downstream of the buttress. Based on stress-deformation analyses (Zabolotnii et al. 2022), it is recommended to install slope inclinometers near the toe of the starter dam near Sta. 1+900, Sta. 2+300, and Sta. 2+600.

At the Perimeter Embankment from Corner 2 to Corner 1, VWPs have been installed primarily in the foundation under the buttress. The VWPs currently installed at the Perimeter Embankment provide sufficient coverage in the foundation. Fourteen slope inclinometers have been installed through the buttress and downstream of the buttress. The slope inclinometers currently installed at the Perimeter Embankment provide sufficient coverage to monitor the performance of the embankment.

At the Perimeter Embankment at Corner 1, VWPs have been installed within the upstream fill and filter of the embankment and foundation (i.e., till, glaciofluvial, and GLU) below and downstream of the embankment. The VWPs currently installed at Corner 1 provide sufficient coverage. Ten slope inclinometers and four SAAs have been installed in the foundation and cut-off wall of the embankment. The slope inclinometers currently installed at Corner 1 provide sufficient coverage to monitor the performance of the embankment.

At the Perimeter Embankment from Corner 1 to Corner 5, two VWPs have been installed in the foundation under the buttress. The VWPs currently installed at the Perimeter Embankment provide sufficient coverage in the foundation. Two slope inclinometers have been installed through the ramp downstream of the embankment. The slope inclinometers currently installed at the Perimeter Embankment provide sufficient coverage to monitor the performance of the embankment.

South Embankment – Station 0+720 – Section F

There are four active VWPs at Sta. 0+720 (F2, F3, F4, and F5). The piezometers continue to show the trends observed since the restart of operations in 2016. Pressures in the till core (F3) remain between about elevation 954 and 956 m and vary following the trend of the TSF pond level. Piezometer F4 installed in the filter downstream of the till core continued to show unsaturated conditions. Pressures near the downstream toe of the till core (F2) remained stable during 2023. Piezometer F5, located in the till downstream of the embankment toe, recorded a pressure decrease of approximately 0.4 m after freshet. The lower pressure is interpreted as seasonal variability as recorded in previous years.

South Embankment – Station 1+100 – Section I

There are seven active VWPs at or near this section (I2, I3, I5, I6, VW15-19, VW16-17, and VW16-22). The piezometers continue to show the trends observed since the restart of operations in 2016. Measured groundwater levels downstream of the South Embankment at piezometers I5 and I6 remain near the natural ground surface as in previous years. Both piezometers recorded pressure decreases of approximately 0.4 m after freshet. The lower pressure is interpreted as seasonal variability similar to records from previous years. Pressures of the embankment foundation (I2) remained stable throughout the year. Piezometer I3, installed in the filter downstream of the till core, continued to show unsaturated conditions. Readings at the upstream tailings piezometer VW16-22 showed a pore pressure increase of approximately 1.2 m during freshet which is consistent with the TSF pond volume increase seen during this period. The pore pressure decreased about 0.6 m and stabilized at this level by the end of the year.

The measured pore pressure in the till core (I1) remained consistent and continued to show no increase in response to the pond elevation for readings collected up to June 2023. Erroneous and unreliable readings were observed for the remainder of the year. Piezometer I1 should continue to be monitored to confirm that it is operational.

The four slope inclinometers near this section (SI15-19, SI15-20, SI16-15, and SI16-16) show measured movement within the accuracy of the instrumentation. A compression response was recorded in inclinometer SI16-15 after installation and until July 2018. The recorded compression response has since changed direction towards the downstream. The change in direction is interpreted as an operator error (i.e., modifying the assigned inclinometer A+ direction) and is not considered to reflect a change in conditions near the original ground surface. An approximate additional 2 to 3 mm compression was recorded in 2023. The borehole log of GA16-15 shows a 2.3 m thick layer of fill (rockfill) and topsoil between elevation 944.8 and 947.1 m. The initial compression of the casing was due to placement of the drill pad (rockfill) on top of the natural ground. Continued compression of the casing might be related to work carried out in the area to remove vegetation.

Main Embankment – Station 1+760 – Section E

There are seven active VWPs at this area (E1, E2, E3, E6, E7, VW15-18A, and VW15-18B). The piezometers installed in the embankment (E2 and E3) show consistent conditions since the restart of operation in 2016. The core drained to below the level of piezometer E2, and the filter remains drained below the level of piezometer E3.

Piezometer E6, installed in the foundation of the Main Embankment buttress in a GLU at elevation 911.8 m, showed a 0.7 m pressure raise in early February 2020. Piezometer E7, installed in the same borehole in glaciofluvial at elevation 908.1 m, showed a pressure decrease of about 0.3 m at that time. Readings have remained consistent since the pore pressure change in early February 2020. Piezometer E1, installed in the foundation of the embankment, has shown consistent conditions since 2016. The pore pressure change recorded at piezometers E6 and E7 is interpreted to be a result of a localized change in the hydraulic connectivity at the location of the piezometers or an operator error (i.e., crossing the wires).

Piezometers VW15-18A and VW15-18B, located at Sta. 1+580, remain stable and continue to show a downward gradient in the foundation near Corner 3.

Inclinometer SI15-18 shows measured movement within the accuracy of the instrumentation. Readings show an apparent downstream movement from the base that increases up the inclinometer (i.e., rotation from the base) to about 2 mm at elevation 933 m. The apparent downstream movement is interpreted to be a systematic error in the readings (i.e., increases up the hole).

Main Embankment – Station 1+850 – Section C

There are nine active VWPs at this section. Piezometer C2 (till core) began functioning again in late fall 2023. The pore pressures remained consistent with conditions seen in previous years. Currently, the remaining active piezometers at the Main Embankment provide sufficient coverage to monitor the performance of the embankment.

Piezometer C1, installed in the till core, showed steady readings during 2023 near elevation 938 m. The pore pressures in the till core at the location of piezometer C3 continue to show a slow but steady decrease since the TSF breach in 2014. Piezometer C3 should continue to be monitored as the TSF pond rises and the till core re-wets to confirm that it is operational.

Piezometer C7, installed in the drain downstream of the till core, continues to show the water level is below the level of the piezometer. Piezometer C8, installed in the embankment foundation, has shown consistent conditions since 2016. The piezometers installed in the foundation downstream of the embankment (C11, C12, VW15-17A, and VW15-17B) continue to show an upward gradient with the groundwater level near the original ground surface. This condition was used in the stability analyses carried out during the design of the Main Embankment buttress.

The water level measured in standpipe piezometer GW21-09, installed in the foundation below the buttress, is consistent with adjacent VWPs.

Inclinometer SI15-17 continues to show measured movement within the accuracy of the instrumentation.

Main Embankment – Station 2+060 – Section A

There are 16 active VWPs at this section. The piezometer data remain consistent with seasonal and pond elevation changes since 2016.

The pore pressures in the till core (piezometers A1, A3, A4, and A14) remained stable throughout the year. Piezometer A1 had previously shown a slow and steady decrease since the TSF breach in 2014 but has since stabilized slightly above the elevation of the piezometer. Piezometer A1 should continue to be monitored as the TSF pond rises and the till core re-wets to confirm that it is operational.

Piezometer A5, installed in the upstream fill (immediately upstream of the till core), showed similar conditions and remained consistent throughout the year. The piezometer installed in the filter downstream of the till core (A13) continued to show unsaturated conditions.

Piezometer A6 in the chimney drain continued to show that the water level is below the level of the piezometer. Piezometer A7 in the foundation drain shows an elevated pore pressure that is consistent with the values measured since the piezometer was installed in 1996.

The piezometers installed in the foundation downstream of the embankment continue to show an upward gradient with the groundwater level at or slightly above the original ground surface. The pore pressures shown in these piezometers (A8, A9, A19, A20, A21, VW15-15A, and VW15-15B) remained consistent with minor changes, up to about 0.4 m, throughout the year. The pressure variations are interpreted as seasonal variability similar to records from previous years. These pressures are consistent with the pressures measured when these piezometers were installed and have been accounted for in the stability analyses carried out during the design of the Main Embankment buttress extension.

Inclinometer SI15-15 continues to show erratic readings, but measured movement is within the accuracy of the instrumentation (based on the reading from December 14, 2023). Some readings taken in 2022 and 2023 appear to show an apparent downstream movement (Direction A) near the base of the inclinometer, which is approximately 30 m below original ground in bedrock. The apparent downstream movement is interpreted to be a systematic error in the readings.

Main Embankment – Station 2+240 – Section B

Piezometers VW16-21 (tailings) and B9 (till core) malfunctioned in February and August 2023, respectively. There remain 17 active VWPs at this section. Currently, the remaining active piezometers at the Main Embankment provide sufficient coverage to monitor the performance of the embankment. The piezometer data generally remain consistent with seasonal and pond elevation changes since 2016.

Before malfunctioning in February 2023, piezometer VW16-21, installed in tailings upstream of the embankment, showed a pore pressure decrease of about 0.4 m in response to the pond volume reduction. Piezometers B14 and B15, installed in the upstream fill, showed stable conditions in 2023.

The pore pressures in the till core remained generally consistent. Piezometer B2 continued to show a slow but steady decrease since the TSF breach in 2014. Piezometer B9 showed consistent pore pressures until it malfunctioned in August 2023. The piezometer installed in the filter (B10) downstream of the till core continued to show unsaturated conditions.

The piezometers installed in the chimney and foundation drain downstream of the till core continue to show that water levels are below the level of the drain. The pressures measured in the piezometers installed in the foundation beneath the embankment show a downward gradient with the water level about 2.0 m above the original ground surface. The piezometers installed in the foundation beneath the buttress (B6, B7, B11, and B12) continue to show near hydrostatic conditions with the water level at the original ground surface. A pore pressure decrease of about 0.5 m was observed in piezometers B11 and B12 from June to August 2023 but, they have since returned to previous levels. Piezometers VW21-08A and VW21-08B, installed beneath the downstream crest of the buttress, show an upward gradient with the water level near the original ground surface.

Piezometer VW15-14A, installed in a layer of GLU in the foundation downstream of the Main Embankment buttress, showed a pore pressure decrease of about 1.3 m (elevation 908.7 m) from December 2021 to March 2022 and has since remained near elevation 909 m. Piezometer VW15-14B has shown a slow and steady decrease of about 3.2 m since December 2021. Piezometers VW21-08A and VW21-08B were installed upstream of these piezometers in the same interpreted soils units (GLU and glaciofluvial). The pore pressures recorded at piezometers VW21-08A and VW21-08B remained consistent during 2022 and 2023 and did not follow the pressure decreases recorded at VW15-14A and VW15-14B. All other piezometers installed in the foundation at the Main Embankment recorded readings that continue to follow previous trends. The pore pressure decrease recorded at piezometers VW15-14A and VW15-14B is interpreted to be a result of a localized change in the hydraulic connectivity at the location of the piezometers (e.g., grout around inclinometer) or a piezometer malfunction.

The inclinometer installed near this section (SI15-14) shows measured movement within the accuracy of the instrumentation. The compression response seen in inclinometer SI15-14 remains unchanged since June 2020.

Main Embankment – Station 2+460 – Section K

There are six active VWPs installed in the foundation beneath the buttress at this section (K1, K2, VW15-12A, VW15-12B, VW21-07A, and VW21-07B). The piezometers continue to show the trends observed in previous years.

Piezometers VW15-12A and VW15-12B continue to show an upward gradient with the water table located about 8 m below the original ground surface. Piezometers VW21-07A and VW21-07B, installed in the foundation below the downstream crest of the buttress, show a downward gradient with the water table located about 9 m below the original ground surface. Piezometers K1 and K2 continue to show an upward gradient with artesian conditions. The pressures measured in K1 and K2 are anomalous relative to the pressures measured in the other piezometers in the vicinity. The pore pressures measured in piezometers K1 and K2 have been essentially constant since the time of installation in 2011. The piezometers showed no significant response to the rising water level in the TSF prior to the breach nor during construction of the Main Embankment buttress in 2016.

Inclinometer SI15-12 continues to show erratic readings, but the measured movement is within the accuracy of the instrumentation (based on reading from December 18, 2023). The readings continued to show a sinusoidal type of deformation from the base of the inclinometer. This type of deformation could be associated with compression of the casing, but there has not been construction in this area of the buttress and the deformation starts from the base of the inclinometer, which is installed in bedrock (about 50 m below original ground). The apparent movement is interpreted to be a systematic error in the readings.

Main Embankment – Station 2+700

The two active VWPs at this section (VW15-10A and VW15-10B) are installed in the foundation beneath the buttress and have shown consistent readings since their installation in March 2015. Piezometer VW15-10A in glaciofluvial has remained unsaturated during this period.

Inclinometer SI15-10 showed measured movement within the accuracy of the instrumentation (based on reading from November 30, 2023). The multiple zones of casing compression observed in SI15-10 have remained consistent since 2018. Similar to previous years, readings taken in 2023 showed an apparent downstream movement (Direction A) near the base of the inclinometer approximately 70 m below original ground in bedrock. The apparent downstream movement is interpreted to be a systematic error in the readings.

Perimeter Embankment – Station 2+800 to Station 3+150

There are nine active VWPs in this region.

Piezometer VW15-08A, located in the foundation (silty sand) beneath the Perimeter Embankment buttress, showed a slow, approximately 1.5 m pressure increase during the spring of 2017, but the pressure slowly decreased by about 1.0 m from 2017 to 2021. The piezometer recorded a gradual rise of about 0.9 m from 2021 to 2022 and started to decrease by November 2022. Piezometer VW15-08A has since stabilized and showed consistent readings in 2023.

Piezometers VW15-08A and VW15-08B continue to show a strong downward gradient. Piezometers VW15-08B, VW15-09A, and VW15-09B, located beneath the Perimeter Embankment buttress, continue to show consistent readings since their installation in March 2015.

Piezometers VW21-05 (A, B, and C), installed in the foundation beneath the buttress, have showed consistent readings since their installation in October 2021. These three piezometers show a downward gradient, which aligns with the conditions seen at VW15-08. VW21-06 (A and B), installed in glaciofluvial layers near the toe of the buttress, continued to show unsaturated conditions in 2023.

The water level measured in standpipe piezometer GW21-06, installed in a till unit below the buttress, increased by about 1.0 m in February 2023. The water level reduced back to previous levels after about two weeks and has since remained unchanged. The adjacent VWPs did not show similar trends during this period.

Three of the inclinometers in this area (SI15-08, SI15-09, and SI21-06) showed measured movement within the accuracy of the instrumentation.

Inclinometer SI21-05 continued to show erratic readings in 2023 (mostly seen in Direction B). The readings do not show downstream movement; however, they show an upstream rotation from the base of the inclinometer. The apparent movement is interpreted to be a systematic error in the readings.

Perimeter Embankment – Station 3+150 to Station 3+500 – Section J

There are 10 active VWPs at this section.

Piezometers J1, VW15-06A, VW15-06B, VW15-07A, and VW15-07B, located beneath the Perimeter Embankment buttress, continue to show consistent readings to previous years.

Piezometers VW21-03 (A, B, and C) and VW21-11A, installed near till borrow excavations near the toe of the buttress, show pore pressure increases of up to about 1.5 m during and after freshet, similar to previous years. Piezometer VW21-11B continues to show unsaturated conditions.

Piezometers VW15-06, VW21-03, and VW21-11 show a downward gradient.

Inclinometers SI12-02, SI15-06, and SI15-07 continue to show erratic readings; however, the measured movement in the foundation is within the accuracy of the instrumentation.

The inclinometer installed in 2021 near the toe of the buttress (SI21-03) showed measured movement in the foundation within the accuracy of the instrumentation (based on reading from December 13, 2023). Some readings show an apparent upstream movement (Direction A) from the base that increases up the inclinometer (i.e., rotation from the base) to about 5 mm at the elevation of the original ground surface. The apparent upstream movement is interpreted to be a systematic error in the readings (increases up the hole).

Perimeter Embankment – Station 3+500 to Station 3+800

Piezometers VW21-01A and VW21-01B were damaged in August 2023. There remain 11 active VWPs in this area.

The piezometers located upstream of the PETBP and beneath the Perimeter Embankment buttress showed a response to freshet and water level changes in the PETBP similar to previous years. Piezometer VW15-03B (glaciofluvial) and VW15-05B (till) showed pore pressure increases of up to 1.1 m during and after freshet in 2023. Similar to previous years, the pressure increases occurred during freshet or when the PETBP water level rose. Piezometers VW21-01A (glaciofluvial), VW21-01B (glaciofluvial), VW21-01C (GLU), VW21-02A (glaciofluvial), VW21-02B (GLU), and VW21-02C (glaciofluvial) show pore pressure increases of up to 1.7 m during and after freshet in 2023.

Piezometers VW15-03, VW15-04, and VW15-05 continue to show a downward gradient.

Piezometer VW16-20, located in the tailings beach upstream of the Perimeter Embankment, showed readings consistent with TSF pond elevation changes in 2023.

The three inclinometers installed beneath the buttress in this section (SI15-03, SI15-04, and SI15-05) showed measured movement in the foundation within the accuracy of the instrumentation (based on readings from November and December 2023). However, some readings continued to show a sinusoidal type of deformation from the base of the inclinometer. This type of deformation could be associated with compression of the casing; however, there has been no construction on the buttress and the deformation is from the base of the inclinometers which are installed in bedrock (about 40 to 50 m below original ground). The apparent movement is interpreted to be a systematic error in the readings.

The two inclinometers installed in 2021 near the toe of the buttress (SI21-01 and SI21-02) showed measured movement in the foundation within the accuracy of the instrumentation. However, some readings showed a sinusoidal type of deformation of about 2 mm from the base of the inclinometer. The apparent movement is interpreted to be a systematic error in the readings.

Perimeter Embankment – Station 3+990 – Section D

There are nine active VWPs at this section. The piezometer data remain consistent with seasonal, TSF, and PETBP water levels during 2023. Piezometer D4, located in the till core, continues to show that the water level is below the elevation of the piezometer (elevation 948 m). Piezometer D2, installed in the foundation drain, also shows that the water level is below the elevation of the piezometer. Piezometer D3 installed in the filter downstream of the till core showed consistent conditions similar to previous years.

Piezometers SH14-21A, D6, and D7 installed in the foundation (glaciofluvial and GLU) showed pore pressure increases of up to 1.5 m during freshet in 2023. Similar to previous years, the pressure increases occurred during freshet or when the PETBP water level rose. The pore pressure measured at piezometers SH14-21A, D6, and D7 decreased by the fall. Piezometer SH14-21B, installed in the foundation till, showed a less pronounced response to freshet and water level changes in the PETBP. A pore pressure increase of 0.5 m was observed during freshet in 2023. Piezometers SH14-21C and D1, also installed in the foundation till, remained consistent throughout the year.

Piezometer VW16-06, installed in the foundation till below the buttress at Corner 1, continued to show consistent pore pressure readings during 2023. The piezometers in this area continue to show a downward gradient.

Inclinometer SI16-06 showed measured movement in the foundation within the accuracy of the instrumentation.

Inclinometer SI15-26 showed measured movement in the foundation within the accuracy of the instrumentation in 2023. However, readings showed a sinusoidal type of deformation from the base of the inclinometer. This type of deformation could be associated with compression of the casing; however, there has been no construction on the buttress, and the deformation is from the base of the inclinometer, which is installed in bedrock (about 30 m below original ground). The apparent movement is interpreted to be a systematic error in the readings.

Perimeter Embankment at Corner 1 – Station 4+000 to Station 4+450 – Section L and Section M

Fifteen VWPs were installed in the foundation underlying the Perimeter Embankment and buttress at Corner 1 during the investigation carried out from September to October 2023. There are now 31 active VWPs and one standpipe piezometer at Corner 1.

Piezometer VST14-03, installed in the upper GLU, showed pore pressure increases due to construction and raise of the embankment between 2015 and 2018. The excess pore pressures have dissipated since late October 2018 and have stabilized near elevation 930 m. In 2023, the pore pressure increased about 0.5 m during freshet but reduced back to previous levels by the end of the year. Piezometer VW16-04, installed in the upper GLU below the buttress, has remained constant and showed no response to construction in previous years. Piezometers VW18-04A and VW18-04B, installed in the upper GLU near the toe of the embankment under the buttress, have remained about constant since installation.

Piezometer VW18-01B, installed in foundation till under the buttress at approximate elevation 922.2 m, showed a pore pressure decrease of about 5 m in early December 2020 and has since steadily increased about 2.5 m during 2021 and 2022. Piezometer VW18-01A, installed at the same location at approximate elevation 925.0 m, showed a pore pressure increase of about 0.4 m in early December 2020 and has since increased about 3.5 m in steps during 2021 and 2022. Borehole GA22-01 was drilled within 5 m of GA18-01 to install a VWP (VW22-01) and standpipe piezometer (GW22-01) in the same units as VW18-01A and VW18-01B, respectively. Piezometer VW22-01, installed in till at approximate elevation 925.8 m, has shown a consistent pore pressure near the elevation of the original ground surface (about elevation 931 m), which correlates well with readings at VW18-01A prior to December 2020 (about elevation 929.5 m). Standpipe piezometer GW22-01, installed in till between approximate elevations 919.2 and 920.7 m, has shown a consistent pore pressure near elevation 932.5 m.

However, the monitoring well needs to be developed to confirm the readings. All other piezometers installed in the foundation at Corner 1 recorded readings that continue to follow previous trends.

Inclinometer SI18-01 has shown a compression response between approximate elevation 924 and 929 m since its installation. The compression response started to stabilize in 2019; however, an approximate 1 to 2 mm/yr creep has been recorded since 2020. A layer of high plasticity silty clay was identified at this elevation. Inclinometer SI16-01, installed immediately downstream of SI18-01, does not show movement or compression of the inclinometer. The pore pressure decrease recorded at piezometer VW18-01B and increase in piezometer VW18-01A is interpreted to be a result of a localized change in the hydraulic connectivity at the location of the piezometer (e.g., grout around inclinometer).

The piezometers installed in late 2023 have generally showed consistent readings since installation and should continue to be monitored to establish a trend in the following year.

The piezometers installed in glaciofluvial and till, SH14-07A and SH14-07B, beneath the upstream general fill at Corner 1 showed consistent readings near the elevation of the upstream drain. The response of the piezometers indicates that the Corner 1 upstream drain is performing as intended. Piezometer VW16-18, installed at elevation 954.5 m in the upstream fill, showed that the water level remains below the elevation of the piezometer.

Piezometer VW15-23, installed in the filter downstream of the cut-off wall, shows that the water level is below the level of the piezometer.

During construction of the Freshet Embankment in 2015, SAA15-01 and SAA15-02 were installed in inclinometer casings from the forensic investigation in 2014. The measured movement of about 1 to 3 mm in SAA15-01 within the upper and lower GLU in the direction perpendicular (Direction X) to the embankment axis remained consistent within the accuracy of the instrumentation in 2023. SAA15-02 shows a pattern of deformation consistent with settlement and compression of the cable due to settlement.

The readings of inclinometer SI16-03 show movement within the accuracy of the instrumentation within the foundation. The upper portion of SI16-03 is on the downstream slope of the buttress. At this location, the buttress was raised with sandy tailings and has not been re-sloped.

On July 15, 2021, inclinometer SI18-04 showed an apparent downstream movement (Direction A) from the base (approximately elevation 912 m) that increased up the inclinometer (i.e., rotation from the base) to about 2 mm at the elevation of the original ground (approximately elevation 928.7 m). The in-place inclinometer was installed between elevation 915 m (bedrock) and 923 m (above GLU) on September 23, 2021, and the readings have shown movement within the accuracy of the instrument. The in-place inclinometer sensors malfunctioned in May 2023 and were removed from the inclinometer casing in September 2023. Manual readings of inclinometer SI18-04 resumed while the in-place inclinometer was sent back to the manufacture for repairs. The measured movements of the foundation were consistent with the last manual inclinometer reading taken in July 2021. Piezometers VW18-04A and VW18-04B installed in GLU at elevation 922.1 and 921.5 m did not show pressure changes. Inclinometers SI16-01, SI18-01, SAA15-01, SAA15-02, SI16-03, and SI16-06 showed no discernable movement. The apparent downstream movement is interpreted to be a systematic error in the readings (increases up the hole).

Four additional inclinometers were installed within this area during the site investigation in late 2023 (SI23-01, SI23-02, SI23-03, and SI23-10). These inclinometers were installed at the crest, mid-slope, and buttress at Corner 1. The measured movements recorded to date are within the accuracy of the instrumentation.

Survey monument SM17-02, installed on the buttress was struck by equipment between February and April 2023. The readings show that movement has remained within the accuracy of the instrument since its installation in December 2017.

Survey monument SM18-01, installed at the downstream crest of the embankment, showed approximately 20 mm of movement to the northeast during the week after installation in October 2018 while rockfill placement at the crest of the embankment was in progress. Since then, the readings have shown approximately 10 to 20 mm/yr creep to the northeast until the monument was struck by equipment in May 2023. Settlement of the foundation and rockfill is expected. The survey monument was decommissioned in August 2023 while construction to raise the embankment to elevation 970 m was in progress.

Perimeter Embankment at Corner 1 – Cut-Off Wall

The SAA16-01 and SAA16-02 data show that the slight downstream rotation of the cut-off wall observed in the first few years after tailings deposition started upstream of the embankment (i.e., 2016 and 2017) has almost stopped. This is interpreted to be a result of the slower tailings beach raise rate in 2019 and stoppage in 2020 and 2021 and that there was no construction to raise the embankment until 2022. The maximum movement of the top of the cut-off wall has been measured at about 55 to 60 mm (including recorded data in SI15-28 and SI15-30 prior to installation of the SAAs), which is equivalent to a shear strain of about 0.2% over the height of the cut-off wall. The recorded movement of the cut-off wall is within the expected deformation due to tailings deposition in the TSF.

Perimeter Embankment – Station 4+480 – Section G

Piezometer SH14-20B (glaciofluvial) malfunctioned in 2023. There remain six active VWPs at this section.

Piezometer G5, installed in the foundation under the Perimeter Embankment, showed consistent pore pressures near the elevation of the original ground surface in 2023. As in previous years, the piezometers installed in the till, glaciofluvial, and bedrock (SH14-20A, SH14-20B, and SH14-20C) responded to TSF pond changes throughout 2023. Piezometer SH14-20A and SH14-20B showed a pore pressure increase of up to 1.2 m in May 2023, which followed the trend of the TSF pond at the time.

On March 23, 2023, MPMC informed the EoR that the tailings slurry pipeline had leaked upgradient of the TSF and tailings had flowed along the toe of the Perimeter Embankment from Corner 5 to Corner 1 and deposited against the west side of the Perimeter Embankment buttress at Corner 1. Pore pressures at VW18-03A (till) and VW18-03B (till) increased about 1.8 m to elevation 937.8 m (near original ground) around the same time in late March 2023 and have since stabilized at that level. The increase is interpreted to be a response to the tailings that deposited in the area. Piezometer VW18-03C, installed in the underlying bedrock, did not respond to these conditions and remained consistent for the year.

The inclinometer installed at this section (SI18-03) showed an apparent upstream movement (Direction A) from the base that increased up the inclinometer (i.e., rotation from the base) to about 3 to 5 mm at the elevation of the original ground. The apparent upstream movement is interpreted to be a systematic error in the readings (increases up the hole).

Perimeter Embankment – Station 4+600 to Station 4+800

The two VWPs at this section (VW15-01A and VW15-02A) are installed in the foundation till beneath the Perimeter Embankment buttress and show consistent readings since their installation in 2015. The piezometers recorded a slight increase in pore pressures as the TSF pond level increased during and after freshet.

The two inclinometers installed in this area (SI15-01 and SI15-02) showed measured movement in the foundation within the accuracy of the instrumentation.

7.2.1.2 Visual Inspection of Embankment Performance

In June and July 2020, MPMC reported sinkholes had developed on the upstream fill of the Perimeter Embankment near Sta. 4+490 and 4+560 and on the upstream fill of the Main Embankment between Sta. 2+100 and 2+170. Details of the investigations, review of construction record data, interpretation of the findings, and recommendations are presented in the TSF sinkholes investigation and interpretation memorandums (Golder 2020c,d). As indicated in those documents, sinkholes could redevelop if surface water conditions were allowed to repeat.

Sinkholes were reported to have redeveloped at about Sta. 2+100 at the Main Embankment in July 2022 and at about Sta. 4+450 at the Perimeter Embankment at Corner 1 in August 2022 (WSP Golder 2022b, 2022c).

In March 2023, a sinkhole was reported to have developed on the upstream fill of the Perimeter Embankment near Sta. 4+465. The sinkhole developed due to snowmelt ponding on the upstream fill at the crest of the embankment, infiltrating through the upstream fill and eroding the upstream fill tailings sands into the underlying rockfill (i.e., remaining temporary upstream rockfill berm). Details of the test pit investigation, review of construction record and instrumentation data, interpretation of the findings, and recommendations are presented in WSP (2023c). The sinkhole that developed on the upstream fill of the Perimeter Embankment does not present a dam stability concern.

The vegetation and trees along the South Embankment toe were in similar conditions compared to 2022. Vegetation should be removed as part of routine maintenance to allow suitable inspections of the facility.

Erosion of sandy tailings at the downstream slope of the Perimeter Embankment buttress at Corner 1 was observed to be in similar condition to that observed in previous years. The area should continue to be monitored.

Erosion gullies have continued to form through the upstream fill due to snowmelt ponding on the crest of the embankment between the till core and tailings discharge pipeline. The tailings discharge pipeline should be relocated onto a bench along the upstream slope of the upstream fill. Alternatively, the tailings pipeline could be raised from the crest of the upstream fill to limit water ponding between the till core and the tailings slurry pipeline.

The tailings discharge pipeline was installed on a rockfill berm 2 to 3 m higher than the embankment crest immediately upstream of the embankment along Corner 5. The tailings pipeline has since been relocated onto the upstream crest of the embankment. However, the rockfill berm should be removed to allow tailings deposition to occur into this area of the facility.

In 2023, the beach slopes upstream of the embankment were surveyed to be in the order of 0.5%, which is flatter than in previous years. The flatter beach slopes increase the difficulty to maintain the minimum beach width QPO of 100 m upstream of the embankment. Topographic and bathymetric surveys should continue to be performed periodically throughout the year to monitor the beach slopes. The tailings deposition method should be assessed and modified to increase the beach slopes if surveys do not show improvements.

Erosion and shallow ravelling were observed along the downstream slope of the Main Embankment near Corner 3. The area should continue to be monitored and covered with coarse rockfill or re-sloped to prevent further erosion.

Tailings were observed along the west bank of the PETBP where the ditch from the CCS connects to the PETBP. No signs of tailings were observed along other sections of the ditch between the CCS and the PETBP. Based on a review of historical data, the tailings are interpreted to have deposited during the TSF repairs in 2014/2015. The tailings should be removed, and the area should continue to be monitored.

Photographs taken during the site inspection on October 4 and 5, 2023 are provided in Appendix D.

7.2.2 Internal Erosion

A filter compatibility assessment of the embankment materials using the procedures described by the International Commission on Large Dams (ICOLD 2013) and Fell et al. (2015) was completed by Golder Associates Ltd. (amalgamated into WSP in 2023) (Golder 2016). Representative envelopes of grain size distribution curves for all stages of construction materials were used to evaluate the filter compatibility between the different zones of the existing embankment. The results of the assessment showed that most of the filter gradations reported meet modern filter criteria. However, a fraction of all the filter sample gradations did not satisfy the filter criteria. If the hydraulic gradients were to rise to a level sufficient to initiate backward erosion of the till core, some erosion of the till core could be expected before the filter seals it.

The TSF pond reached a maximum elevation of 966.45 m prior to the breach at Corner 1 of the Perimeter Embankment. The pond was in contact with the upstream fill and core in some areas, and no signs of erosion or sinkholes were reported. Since the restart of operations in 2016, the TSF pond elevation has steadily increased as tailings have been deposited. During 2023, the TSF pond elevation ranged between 962.6 m and 964.7 m. Wide tailings beaches, minimum 100 m, have generally been maintained between the embankment and the TSF pond, except from May to August 2020, May to November 2022, and short durations in 2023. Therefore, the current water level in the TSF imposes a hydraulic gradient across the till core that is less than the till core has previously resisted.

Turbidity and Flow Rate

Seepage from the Main Embankment is collected at the MESCP and pumped back into the TSF. Seepage from the South Embankment is collected at the SESCP and pumped into a ditch that flows to the MESCP. Seepage from the Perimeter Embankment flows by gravity ditches into the PETBP. No signs of turbid water were observed at the seepage collection drain at Corner 1 or in the seepage collection ponds at the South and Main embankments.

High turbidity values were recorded at the Corner 1 north and south diversion ditches on March 23, 2023. The in situ turbidity test results remained elevated until May 2023 when conditions returned to within the historical range. The high turbidity values were interpreted to be a result of a tailings slurry leak that deposited to the west of the buttress at Corner 1 during freshet.

Table 2 presents the range of seepage flows and turbidity recorded in 2023 at the east and west Main Embankment toe drains, South Embankment toe drain, Freshet Embankment seepage collection ditch (seepage through the foundation and cut-off wall, and direct infiltration into the rockfill), Corner 1 Embankment upstream drain flow, and Corner 1 Embankment north and south diversion ditches.

Table 2: 2023 Tailings Storage Facility Seepage Rates and Turbidity

Monitoring Location	Flow Rate (L/s)	Seepage Turbidity Range (NTU)	
		Field Tests	Laboratory Tests
Main Embankment West Toe Drain	0.5–1.3	0.10–1.58	0.12–0.28
Main Embankment East Toe Drain	1.8–3.3	0.04–1.07	0.14–0.23
South Embankment Toe Drain	7.2–12.8	0.06–1.03	1.01–1.33
Freshet Embankment Seepage Collection Ditch	Not measured	0.05–2.40	0.10
Corner 1 Embankment Upstream Drain	20 (visually estimated by MPMC)	0.02–1.97	0.11–0.30
Corner 1 North Diversion Ditch	Not measured	0.08–0.90[a]	Not tested
Corner 1 South Diversion Ditch	Not measured	0.10–0.71[a]	Not tested

a) Turbidity values recorded between March and May after tailings were deposited to the west of the buttress at Corner 1 were excluded from the range.

NTU = nephelometric turbidity unit; MPMC = Mount Polley Mining Corporation.

Appendix C presents historical seepage flows and turbidity data recorded at all the toe drains from 2010 to 2023. Turbidity was measured through laboratory testing of sampled water and in situ with a portable turbidity meter. The in situ turbidity tests are carried out with a YSI EXO sonde. The manufacturer reports a reading accuracy of ±2%. However, the results have been observed to be sensitive to entrapping bubbles in the sampling tube; therefore, additional laboratory tests were completed when the in situ turbidity testing results were higher than 1.0 nephelometric turbidity units (NTU). The in situ turbidity test result of 2.4 NTU recorded on the Freshet Embankment seepage collection ditch on March 29, 2023, is interpreted to be a sampling error based on subsequent test results and observations in the field.

The Freshet Embankment seepage collection ditch flow rate could not be directly measured since the seepage collection pipe outlet was submerged during 2023. In situ turbidity tests were completed when the pipe was not fully submerged. Instrument or modify the pipe outlet so the seepage flow rate can be monitored.

The recorded seepage rate and turbidity at all the monitoring locations is within the historical range. No significant changes in flow rate or turbidity were reported in 2023.

Groundwater Monitoring

Groundwater monitoring by MPMC has been ongoing at the mine site since 1995 with the objectives to monitor direction, quantity, and quality of groundwater flow near all mine facilities. The monitoring wells used to monitor groundwater levels around the perimeter of the TSF are also used to monitor groundwater quality. The monitoring well network is shown in Figure A1 in Appendix A.

Groundwater samples from the monitoring wells are collected quarterly or semi-annually, depending on location, and are analyzed for field parameters, anions, nutrients, and dissolved metals and are reported annually. The analyses are focused on nine parameters of interest which include hardness, sulfate, nitrate, and the following dissolved metals: aluminum, arsenic, cadmium, molybdenum, and selenium.

Over the last decade or so, although there were increasing parameter of interest concentration trends at some locations, significant changes to groundwater quality at the perimeter of the TSF had not been identified except with respect to sulfate. Sulfate concentrations in the shallow groundwater downgradient of the TSF approached or reached levels observed in the TSF pond water next to the Perimeter Embankment at GW16-2B and GW96-2B and next to the South Embankment at GW96-4B (WSP 2023e). The measured concentrations of sulfate do not exceed the BC ENV (1997) Contaminated Sites Regulation water quality standards for protection of freshwater aquatic life; however, they show that groundwater quality downstream of the TSF is being affected by seepage from the TSF. The remaining wells indicated relatively stable or slightly decreasing sulfate concentration trends.

7.2.3 Overtopping

Tailings Storage Facility Embankment

The TSF is required to have sufficient available storage capacity for containment of runoff from the contributing catchment area for the IDF event. The design freeboard criterion of 1.1 m provides storage capacity of approximately 1.9 Mm^3 for an embankment crest elevation of 968 m, which exceeds the requirement to store the 72-hour IDF. As shown in Figure 6, the TSF pond elevation steadily increased to about 961.8 m by the end of June 2018 and remained between about 961 and 963 m until the end of 2022. In 2023, the TSF pond elevation rose about 1.1 m during freshet to 963.7 m and continued to increase gradually for the remainder of the year. The freeboard remained above 2.3 m through 2023 and increased to more than 5.0 m after construction of the Corner 5 abutment in September/October 2023. The TSF pond level was at about elevation 964.7 m by the end of 2023, resulting in a freeboard of 5.3 m.

In 2023, the TSF pond had a net water decrease estimated to be about 0.9 Mm^3 and was returned to normal operating conditions as defined in the QPOs.

At the time of the inspection, obstructions along the clean water diversion ditch had not been removed and debris and branches were still observed. The diversion ditch needs to be re-established along the entire alignment and fallen trees, and woody vegetation should be removed as part of the routine maintenance.

The damaged section of the sidewall of the clean water diversion ditch near Corner 4 that eroded in 2020 was observed to be in similar conditions to 2021. The side wall repair should be excavated and rebuilt with adequate till material and placed in compacted layers.

Main Embankment Seepage Collection Pond

The MESCP has two corrugated steel pipe culverts that act as the emergency spillway. The culverts extend beneath Gavin Lake Road. The culverts were unobstructed during the inspection in October 2023.

7.3 Operational Documents and Dam Safety Review

7.3.1 Operation, Maintenance, and Surveillance Manual

The operation, maintenance, and surveillance (OMS) manual for the TSF was most recently updated as follows:

- in January 2021, as part of the annual update and to identify potential improvements
- in August 2021, as plans to restart mining operations were advancing
- in August 2023, as part of the annual update and to identify potential improvements

Another update to the OMS manual was in progress at the end of 2023.

7.3.2 Emergency Preparedness and Response Plan

The TSF emergency preparedness and response plan (EPRP) was most recently updated as follows:

- in April 2021, to keep information up to date and to identify potential improvements
- in August 2021, as plans to restart mining operations were advancing
- in August 2023, as part of the annual update and to identify potential improvements

Another update to the EPRP was in progress at the end of 2023.

A test of the EPRP was carried out on November 30, 2023, with Mine Rescue site personnel and the Technical Services Group simulating an exceedance of the TSF freeboard QPO (unsafe zone).

7.3.3 Dam Safety Review

An audit level DSR was conducted by Tetra Tech Canada Inc. (Tetra Tech) in 2022. The TSF embankment was considered reasonably safe with non-conformances (Tetra Tech 2023). Table 3 provides a summary of the recommendations presented in the DSR with corresponding actions to address each item.

Table 3: 2022 Dam Safety Review Recommendations (Tetra Tech 2023) and WSP Recommended Actions

DSR ID	DSR Description of Actionable Item, Deficiency, or Non-Conformance	DSR Recommended Action	DSR Priority	DSR Recommended Deadline	WSP EoR Comment	Status or EoR Recommended Action
2022DSR-01	Some recommendations from past DSIs and DSR have not yet been closed out.	Recommendations from previous DSIs and past DSR need to be addressed.	2	December 2023	The outstanding DSI recommendations are identified and tracked in the annual DSI reports (WSP 2023d). Recommendations included in the DSI reports need to be addressed following the priority and recommended timing for completion. DSR recommendations 2017DSR-08 and -09 have not been completed. DSR recommendation 2017DSR-08 is tracked as DSI recommendation 2020DSI-06. For tracking purposes, DSR recommendation 2017DSR-09 is included in this report as DSI recommendation 2023DSI-07. All other recommendations from the 2017 DSR are complete.	Actions to be implemented by MPMC following the priority and recommended timing for completion. Progress tracked by MPMC and in the annual DSI reports.
2022DSR-02	There are multiple instances where instruments have presented anomalous readings or where observed trends are interpreted as due to seasonal variation.	For all applicable embankments and instruments, ongoing assessment of new data should continue to: ▪ identify which instruments are providing anomalous readings ▪ confirm or further revise interpretations of seasonal variation vs. dam stability condition ▪ in both cases allowing MPMC to respond accordingly	2	December 2023	Instrumentation data are collected and reviewed by MPMC following the frequency specified in the QPOs. The data are provided to the EoR for review and interpretation weekly and a summary is provided to MPMC periodically (typically every 1 to 3 months). All available data are summarized and interpreted by the EoR as part of the DSI reports (WSP 2023a). DSR recommendation action is to continue assessing the data.	No new action required.
2022DSR-03	There are multiple instruments which have been destroyed, readings have ceased, or the readings have uncertain reliability.	For all applicable embankments, where instruments have been destroyed, readings have ceased or the readings have questionable reliability, a formal assessment of the spatial instrumentation coverage should be considered.	2	December 2023	The coverage of the instrumentation is reviewed periodically and documented in the annual DSI reports (WSP 2023d). Instrumentation was installed in 2015, 2016, 2018, 2021, 2022, and 2023 based on the findings of the instrumentation review.	No new action required.
2022DSR-04	Select instrumentation sections of the TSF have experienced/are experiencing gradual increases in pore pressure and/or movement.	For all applicable embankments, in areas where there are slow ongoing changes in the instrumentation data, a rolling comparison of these conditions against existing stability model inputs should be made to ensure the modelled dam safety conditions are representative.	2	December 2023	The VWP data remain consistent with seasonal and pond elevation changes since 2016. Seasonal changes are relatively small. Excess porewater pressure generated during construction and artesian pressures are monitored and have remained within expected values. The pond elevation is monitored, and the stability models were completed assuming 0 m beach for elev. 970 m embankment. Slope inclinometer data (including SAAs and in-place inclinometer) do not indicate downstream movement. Clarification was requested about which instruments were interpreted in the DSR to show gradual increases in movement or porewater pressure (email communication from Mathieu O'Leary to Bereket Fisseha dated March 25, 2023) but no specifics were provided.	No new action required.
2022DSR-05	There might be a situation where the stability model inputs and/or on-site conditions have changed (related to the previous recommendation – 2022DSR-04).	For all applicable embankments, if changes are made to governing stability models, updates should be made to all impacted dam safety documentation, such as the OMS manual.	3	March 2024	Refer to response to recommendation 2022DSR-04. Clarification was requested about which specific inputs or conditions were interpreted in the DSR to have changed (email communication from Mathieu O'Leary to Bereket Fisseha dated March 25, 2023) but no specifics were provided.	No new action required.

Table 3: 2022 Dam Safety Review Recommendations (Tetra Tech 2023) and WSP Recommended Actions

DSR ID	DSR Description of Actionable Item, Deficiency, or Non-Conformance	DSR Recommended Action	DSR Priority	DSR Recommended Deadline	WSP EoR Comment	Status or EoR Recommended Action
2022DSR-06	Following the previous development of erosion and sinkholes within the TSF, the EoR made recommendations to remediate and prevent from re-occurring.	For all applicable embankments, follow EoR recommendations for suitable beach lengths and discharge locations.	2	December 2023	EoR recommendations 2022DSI-06 and 2022DSI-07 (WSP 2023d).	Complete
2022DSR-07	It was found that understanding which design reports and stability models were valid versus superseded was challenging, given the complex structure history.	Tetra Tech suggests that MPMC consider a design summary report, or similar, to summarize the current design considerations and stability models of the structure in a single document. Note, this action would provide the most value if the information was presented in this recommended document, instead of only referencing a series of separate reports.	4	March 2024	There are two design reports that are applicable to the elev. 970 m TSF: ▪ *Tailings Storage Facility Detailed Design to Elevation 970 m* (Golder 2015b). ▪ *Tailings Storage Facility Detailed Design to Elevation 970 m Update* (Golder 2017e). The update to the detailed design report includes updates to the foundation characterization and updated seismic loading design criteria (BCMEM 2016). An additional section at the Corner 1 Embankment was analyzed following the 2018 instrumentation installation (Golder 2018c). Stability analyses of the as-constructed Main Embankment buttress and Corner 1 Embankment were completed in 2017 and 2020 (Golder 2017a, 2020b).	MPMC to include a table in the OMS manual listing the applicable design reports.
2022DSR-08	It was noted that the current SWMP, DSI, and DSRs did not include current TSF fill curves.	TSF stage-storage (or fill curve) relationships determined from regular bathymetric and drone surveys should be included in future SWMP, DSI, and DSR reports.	2	December 2023	Freeboard, pond volume, and available storage capacity are monitored by MPMC weekly and provided to the EoR. Stage-storage curves are updated with bathymetric and topographic survey twice per year by MPMC (2022DSI-08).	MPMC to include a note of current fill curve and a link to storage location in MPMC's server in weekly water management dashboard.
2022DSR-09	It was noted that the current Water Management Performance Objectives do not include Normal Operating Water Levels.	TSF Normal Operating Water Levels should be established and included in future updates to the Water Management Performance Objectives, either replacing or supplementing Normal Operating Pond Volumes.	3	December 2023	Pond water volumes have been used since the restart of operations in 2016. MPMC has a good understanding of assumptions and limitations of estimating the pond water volume. Normal operating pond volume QPOs are aligned with minimum beach width QPOs. Changing or adding pond water levels is not recommended at this point.	No new action required.
2022DSR-10	There is an operational requirement which requires the TSF perimeter berm to be breached under TSF high water level conditions, causing loss of storage capacity that was specifically reserved for an extreme event.	The legacy requirement to breach the TSF perimeter berm under high water level conditions should be re-evaluated during the next EPRP and OMS manual Revisions.	3	March 2024	The requirements to construct an emergency spillway was introduced as part of the restart of operations in 2016 to mitigate potential insufficient storage capacity due to delays in construction. After the initial raise of the Perimeter Embankment at Corner 1 and start of tailings deposition, the pond was moved to a central location between Corner 4 and Corner 5.	MPMC and EoR to confirm consistency in QPOs, EPRP, and OMS manual and remove legacy requirement to build an emergency spillway.

Table 3: 2022 Dam Safety Review Recommendations (Tetra Tech 2023) and WSP Recommended Actions

DSR ID	DSR Description of Actionable Item, Deficiency, or Non-Conformance	DSR Recommended Action	DSR Priority	DSR Recommended Deadline	WSP EoR Comment	Status or EoR Recommended Action
2022DSR-11	It is unclear if the TSF Clean Water Diversion Ditch could withstand the design freshet and summer PMP events.	An assessment is required to determine if the TSF Clean Water Diversion Ditch can withstand design freshet and summer PMP events. If the ditch is vulnerable to blockages or breaches, TSF inflows for IDF events should include runoff from the diverted basin.	2	December 2023	The TSF inflows for IDF events assume that the TSF Clean Water Diversion Ditch is non-operational and runoff from the diverted basin reports to the TSF (Golder 2017c).	No new action required.
2022DSR-12	The site-wide water balance modelling that identified 200-year freshet inflows may have also identified TSF 200-year water levels with insufficient freeboard to satisfy dam safety requirements.	A conflict between the TSF freeboard QPOs and EPRP emergency levels to trigger implementation of imminent failure response measures should be reviewed and resolved to be consistent with dam safety requirements.	3	March 2024	The TSF freeboard QPO is consistent with dam safety requirements.	MPMC and EoR to review EPRP emergency levels to confirm that it is not in conflict with the TSF freeboard QPO.
2022DSR-13	There are multiple inconsistencies and/or deficiencies noted in the OMS manual, as detailed in Section 9.1.5 and Section 9.2.3.	Correct the various inconsistencies and/or deficiencies noted in the OMS manual, as detailed in Section 9.1.5 and Section 9.2.3, and summarized below. ▪ Update OMS manual headers/footers throughout the entire document, including appendices, with applicable Document ID and Revision date. ▪ The OMS manual appendix fly sheets discrepancies (e.g., referencing incorrect OMS manual revision, incorrect sequence) should be corrected. ▪ It is recommended all appendix fly sheets identify the title and date of the report being appended. ▪ The OMS manual table of contents should be updated to correctly show all appendices and their respective sub-headings. ▪ It is recommended that the update date be included page footers in subsequent versions. These discrepancies and/or omissions should be corrected in subsequent updates. ▪ The undated organization chart and table of key contacts in Appendix C of the EPRP (OMS manual Appendix E) can be removed since it is redundant to information provided in the EPRP and OMS manual. If it is kept in, it should be maintained with up-to-date information and revision date. ▪ The EPRP table of contents should be updated to present a list of figures and tables within the EPRP.	3	March 2024	-	MPMC to address inconsistencies in OMS manual.

Table 3: 2022 Dam Safety Review Recommendations (Tetra Tech 2023) and WSP Recommended Actions

DSR ID	DSR Description of Actionable Item, Deficiency, or Non-Conformance	DSR Recommended Action	DSR Priority	DSR Recommended Deadline	WSP EoR Comment	Status or EoR Recommended Action
		▪ Key DBI maps should be included in the EPRP and provided to downstream stakeholders.				
2022DSR-14	It is unclear what locations and volumes of material sources are available for TSF repairs.	Identify locations and volumes of material sources that may be required for repair of TSF, including person(s) responsible for authorizing and directing their use.	3	March 2024	Location and quantities of construction materials are identified in the QPOs (WSP 2023b).	MPMC to include in OMS manual person(s) responsible for authorizing and directing production and use of construction materials.
2022DSR-15	It is unclear what procedures and personnel are responsible for completing incident investigation, and for the communication and implementation of any required changes.	Identify procedures and personnel responsible for completing incident investigation, and for communicating and implementing any required changes.	3	March 2024	The EPRP and OMS manual should include this information.	MPMC to confirm that reference to procedures and personnel responsible for completing incident investigation is included in the EPRP and OMS manual.
2022DSR-16	EPRP document clerical error review.	Review the EPRP for clerical errors to ensure consistency with OMS manual.	4	March 2024	-	MPMC to address clerical errors in EPRP.
2022DSR-17	A test of the EPRP is required with all applicable personnel.	Complete a test of EPRP by the end of 2023, which includes mine management and operation staff, and downstream emergency response and management personnel. Complete periodic EPRP tests thereafter.	3	March 2024	-	EPRP test completed on November 30, 2023.
2022DSR-18	There might be opportunities for improvement in scheduling construction activities.	Seasonal construction planning and coordination could be improved to avoid late season work on the clay core and upstream materials.	3	March 2024	MPMC to plan and coordinate construction yearly.	MPMC to plan and coordinate construction yearly.
2022DSR-19	At present, for each embankment raise the power building and pump system infrastructure needs to be moved.	Consider improvements to avoid this requirement.	3	March 2024	The current location of the reclaim system is incompatible with required beach width upstream of the Perimeter Embankment near Corner 5. Reclaim system is to be relocated to a central location between Corner 4 and Corner 5.	MPMC to consider recommendation when relocating the reclaim system.

DSR = dam safety review; WSP = WSP Canada Inc.; EoR = Engineer of Record; DSI = dam safety inspection; MPMC = Mount Polley Mining Corporation; QPO = quantitative performance objective; VWP = vibrating wire piezometer; SAA = shape acceleration array; OMS = operation, maintenance, and surveillance; TSF = tailings storage facility; SWMP = Site Water Management Plan ; EPRP = emergency preparedness and response plan; PMP = probable maximum precipitation; IDF = inflow design flood.

8.0 FINDINGS AND RECOMMENDED ACTIONS

The Perimeter, Main, and South embankments were observed to be in generally good condition at the time of the 2023 site inspection. No significant changes in condition were noted based on the review of instrumentation, visual monitoring records, and dam stability. Table 4 summarizes the DSI key issues, recommended actions, and timing for completion or status. Each recommendation has been given a priority level from 1 to 4 as described in Table 5. None of the key issues identified represent a dam safety concern at this time.

Table 4: Summary of Key Issues and Recommended Actions

ID	Identified Issue	Potential Dam Safety Impact or Risk	Recommended Action	Priority	Recommended Timing for Completion or Status
2023DSI-01	The tailings pipeline is installed on a 2 to 3 m high berm immediately upstream of the upstream fill which is at a higher elevation than the TSF embankment at Corner 5.	Risk of discharging tailings upstream of the berm to a higher elevation than the embankment (i.e., >970 m). The berm is not engineered to retain tailings. Increased risk of potential pipeline leaks flowing over and eroding the embankment.	Relocate the tailings slurry pipeline onto a berm along the upstream slope of the upstream fill or onto the crest of the upstream fill, locally raised with blocking or similar.	2	Complete.
			Excavate the existing pipeline berm upstream of the embankment.		Spring 2024.
2023DSI-02	Beach slopes upstream of the embankment are flatter than prior to resuming operations in 2022. In 2023, the beach slopes were surveyed to be in the order of 0.5%.	Increased difficulty to maintain the minimum beach width quantitative performance objective of 100 m upstream of the embankment. Increased hydraulic head against the embankment.	Breach or remove tailings berms used to channel the tailings slurry along the tailings beach upstream of the embankment. Continue to perform periodic topographic and bathymetric surveys to monitor the beach slopes. Implement changes to the tailings deposition method to increase the beach slopes (e.g., spigots) if surveys do not show steeper beach slopes in 2024.	3	Winter/Spring 2024.
2023DSI-03	The TSF pond volume is being estimated throughout the year based on topographic and bathymetric surveys completed between spring and autumn. Pond estimate becomes less accurate with time (e.g., winter).	Increased risk of over or underestimating the TSF pond volume and potential accumulation of excess water in the TSF prior to freshet.	Implement and maintain a TSF water balance to estimate the pond volume. Check and refine the TSF water balance assumptions using periodic surveys of the tailings surface.	3	Spring/Summer 2024.
2023DSI-04	Shallow ravelling observed of the downstream slope of the Main Embankment near Corner 3 (Photograph 22).	If left unattended, minor erosion and gullies could form on the downstream slope.	Continue monitoring and cover with coarse rockfill or re-slope.	4	During construction to re-slope the embankment to 2H:1V.
2023DSI-05	Erosion gullies along the upstream fill due to snowmelt ponding on the crest of the upstream fill between the till core and the tailings slurry pipeline.	Progressive erosion of the upstream fill. If left unattended, more erosion could occur and displace the tailings slurry pipeline or reach the till core.	Continue monitoring and re-grade the upstream fill surface if excessive erosion occurs prior to embankment construction in 2024.	3	Winter/Spring 2024.
			Relocate the tailings slurry pipeline onto a berm on the upstream slope of the upstream fill. Alternatively, locally raise the tailings slurry pipeline from the crest of the upstream fill (with blocking or similar) to limit water ponding between the till core and the tailings slurry pipeline.		Autumn/Winter 2024.
2023DSI-06	Tailings were observed at the west bank of the PETBP where the ditch from the CCS connects to the PETBP. No signs of tailings were observed along other sections of the ditch between the CCS and the PETBP. The tailings are interpreted to have deposited during the TSF repairs in 2014/2015.	Potential migration of tailings from other sources and deposition in the PETBP may not be identified in a timely manner.	Excavate the tailings and continue to monitor the ditch between the CCS and the PETBP, and the drains at Corner 1.	3	Spring 2024.
2023DSI-07	Recommendation 2017DSR-09 has been addressed for the MESCP and PETBP (Golder 2018b). Documentation of peak flow, inflow volumes, and pumping requirements pending for the SESCP.	Potential insufficient storage or pumping capacity resulting on overtopping of the SESCP.	Determine and document the peak flow, inflow volumes, and pumping requirements for the SESCP.	2	Spring 2024.

Table 4: Summary of Key Issues and Recommended Actions

ID	Identified Issue	Potential Dam Safety Impact or Risk	Recommended Action	Priority	Recommended Timing for Completion or Status
2023DSI-08	Stress-deformation analyses (Zabolotnii et al. 2022) indicate that slope inclinometers could provide indication of movement in advance of a potential foundation failure through a layer of GLU in the foundation if the slope inclinometers are located where plastic strains would first occur. Slope inclinometers are installed downstream of the embankment along the South Embankment. Two slope inclinometers are installed near the toe of the starter dam at the Main Embankment.	Potential stability issues may not be identified in a timely manner.	Install and monitor slope inclinometers near the toe of the starter dam near Sta. 0+700 and 1+100 at the South Embankment and near the toe of the starter dam near Sta. 1+900, 2+300, and 2+600 at the Main Embankment.	2	During construction to re-slope the embankment to 2H:1V in 2024.
2023DSI-09	The groundwater quality trends for monitoring wells located around the TSF show that sulfate concentrations in the shallow groundwater downgradient of the TSF approached or reached levels observed in the TSF pond water next to the Perimeter Embankment at GW16-2B and GW96-2B and next to the South Embankment at GW96-4B. However, it does not exceed the BC ENV (1997) Contaminated Sites Regulation water quality standards for protection of freshwater aquatic life (WSP 2023e).	Potential to affect water quality at surface water receptors downgradient of the TSF.	Additional groundwater monitoring downgradient of the TSF between monitoring wells showing elevated sulfate concentrations and surface water receptors should be planned.	3	2024
2022DSI-01	Inclinometer readings show systematic reading errors greater than the capability of the instrument.	Potential issues may not be identified in a timely manner. Misinterpretation or overestimation/underestimation of movement of the embankment.	Periodic review of data collection technique by experienced operator followed by retraining as required. Periodic recalibration of the inclinometer probe by manufacturer on an as required basis.	2	Ongoing. MPMC repaired and purchased new inclinometer probes in 2023; however, malfunctions persisted. MPMC purchased inclinometer probes supplied by another manufacturer and is in the process of re-establishing baselines for each inclinometer.
2022DSI-02	The OMS manual and EPRP were last updated in 2021 before tailings deposition into the TSF resumed. Changes made to slurry deposition in 2022 need to be included in the OMS manual.	Increased risk due to potential miscommunication or misunderstanding of TSF operation, maintenance, surveillance, and emergency response.	Complete updates of the OMS manual and EPRP as required (minimum once per year) and train personnel as required.	2	Completed August 2023. Updates to the OMS manual and EPRP were in progress at the end of 2023.
2022DSI-03	By the end of 2022, the minimum elevation of the till core was about 968.2 m near Corner 3 while the filter and transition zones remained lower at an elevation ranging from 965 to 968 m. The till core connection at the North Abutment remained at an estimated elevation of 966.2 m.	Potential insufficient storage capacity to store target tailings production in 2023.	Complete construction of the filter and transition zones to match the minimum elevation of the till core and abutments. Review tailings production forecast and storage capacity and plan construction as required.	2	Complete.
			Complete construction to raise the embankment to elevation 970 m. Review tailings production forecast and storage capacity and plan construction as required.		Complete.

Table 4: Summary of Key Issues and Recommended Actions

ID	Identified Issue	Potential Dam Safety Impact or Risk	Recommended Action	Priority	Recommended Timing for Completion or Status
2022DSI-04	Tailings slurry has not been deposited from the Main Embankment since the restart of operations in 2016. Deposition of tailings from the Main Embankment is required to build beaches and maintain the pond away from the embankment.	Inability to maintain the minimum beach width quantitative performance objective of 100 m upstream of the embankment. Increased hydraulic head against the embankment. Increased risk due to having ponded water against the embankment.	Complete field trial to confirm that deposition of tailings slurry from the Main Embankment is feasible and implement changes if required. Deposit tailings slurry from the Main Embankment to build up the tailings beach.	3	No progress in 2023. In 2023, the tailings slurry pipeline was extended along the South Embankment and down a berm on the beach towards the central portion of the Main Embankment.
2022DSI-05	Monitoring well GW22-01 at the Perimeter Embankment has not been developed and could be providing misleading readings.	Misinterpretation of phreatic conditions at the west side of the Perimeter Embankment at Corner 1.	Develop the monitoring well.	3	No progress in 2023.
2022DSI-06	Sinkholes developed on the upstream crest of the Main Embankment near Sta. 2+100 due to water (i.e., TSF pond) transporting fine material from the tailings sand layers of the upstream fill into voids of the rockfill layers of the upstream fill or upstream to the tailings beach. Sinkholes developed in the same area in 2020 when the pond was against the embankment.	If left unattended, sinkholes could redevelop and potentially reach the till core.	Deposit tailings slurry from the Main Embankment to build the tailings beach. Maintain the TSF pond size within the specified operating volume range. Confirm that water from the MESCP discharge line does not flow towards the upstream fill. Confirm that ponding does not occur on the crest of the upstream fill.	3	Complete.
2022DSI-07	Sinkholes developed on the upstream fill of the Perimeter Embankment near Sta. 4+450 due to water (i.e., TSF pond and tailings slurry) transporting fine material from the upstream fill sand into voids of the underlying rockfill (i.e., remaining temporary upstream rockfill berm).	If left unattended, sinkholes could redevelop.	Maintain the TSF pond size within the specified operating volume range. Confirm that ponding does not occur on the crest of the upstream fill. Confirm that tailings slurry does not pond against the upstream fill during deposition.	3	Complete.
2022DSI-08	A topographic and bathymetric survey of the TSF was completed in October 2022; however, survey errors were identified and the TSF storage curve could not be updated. The estimated TSF pond volume is increasingly inaccurate.	Inaccurate estimation of the pond volume could result in accumulating excess water in the TSF.	Perform topographic and bathymetric surveys of the TSF twice per year. Develop and maintain a solids and water volume tracking sheet to estimate the TSF pond volume.	3	Complete for 2023. Continue surveying the TSF in the spring and autumn each year.
2021DSI-01	By the end of 2021, an approximate total of about 7.0 Mm^3 of water remained on site at the Springer Pit, Cariboo Pit, and TSF. The restart of mining operations requires dewatering the Springer Pit and Cariboo Pit and reduces the ability to use these pits to store the current excess water on site. The TSF cannot be used to store excess site water.	Increased risk due to the accumulation of a larger volume of water on site that reduces the capacity to manage runoff from freshet and extreme events.	Implement actions to increase the site water discharge rate so the current excess water on site is eliminated, the TSF pond size is maintained within the specified operating volume range, and accumulation of water does not occur within the TSF. Actions could involve: ▪ obtaining approval to discharge untreated water that meets the requirements of the permit ▪ developing a flowchart and triggers to help determine the magnitude of precipitation events in a timely manner	2	Ongoing since 2020. In 2023, the TSF pond had an estimated net water reduction of about 0.9 Mm^3 and has remained within or below the normal operating pond volume range since about June 2023. MPMC reported a year-over-year site-wide water reduction of about 2.7 Mm^3 in 2023; however, approximately 3.2 Mm^3 remained on site by end of 2023.

Table 4: Summary of Key Issues and Recommended Actions

ID	Identified Issue	Potential Dam Safety Impact or Risk	Recommended Action	Priority	Recommended Timing for Completion or Status
2021DSI-02	The tip used to connect the GPS unit to survey monument SM18-01 was observed to be loose.	Misinterpretation or overestimation/underestimation of movement of the Perimeter Embankment at Corner 1.	Secure the tip to the top of the settlement monument.	3	Complete. Survey monument SM18-01 was decommissioned during construction of the embankment in 2023. The tip at survey monument SM17-02 was secured at the time of the inspection.
2021DSI-03	Longitudinal cracks were observed along the crest of the sidewall of the clean water ditch near Corner 4.	Runoff exiting the ditch during freshet or large storm events and reporting to the TSF. Washout of the access road along the west side of the facility.	Excavate and reconstruct the damaged section of the sidewall with suitable till material. Place and compact the till in lifts.	3	No progress in 2023.
2021DSI-05	Vegetation growing along the downstream toe of the South Embankment.	Increased risk due to difficulty of inspecting the embankment regularly. Potential issues may not be identified in a timely manner.	Remove vegetation as part of routine maintenance of the facility.	3	No progress in 2023.
2020DSI-04	Erosion of the upstream fill around the sprinklers and water discharge from the PETBP.	Progressive erosion of the upstream fill. If left unattended, more erosion could occur and reach the till core.	Extend the PETBP discharge line farther into the facility and relocate sprinklers farther upstream. Re-slope the upstream fill to prevent increased erosion and place rockfill at the location of water discharge from the PETBP.	3	Complete. Sprinklers are not used.
2020DSI-06	Flow rate measurements of the Freshet Embankment seepage collection pipe have not been taken regularly since 2018 as the pipe outlet has been submerged.	Increased risk as seepage rate through the Perimeter Embankment at Corner 1 cannot be monitored regularly. Potential changes to the seepage conditions may not be identified in a timely manner.	Raise or trim back the pipe outlet so the seepage flow rate can be monitored.	3	No progress in 2023.
2020DSI-07	The diversion ditch along the north and west sides of the Perimeter Embankment buttress extension at Corner 1 does not flow to the breach pond or the PETBP.	If left unattended, water flowing through the Perimeter Embankment buttress extension that reports to the ditch may be released to the downstream environment.	Install a sump to direct the water to the PETBP. Regrade the ditch or berm so water flows to the PETBP.	3	No progress in 2023.
2019DSI-01	The downstream slope of the Perimeter Embankment at Corner 1 is locally overbuilt and steeper than designed from about Sta. 4+200 to 4+450.	This is a deviation from the design; however, the slope stability factor of safety meets the design criteria. The steeper slope does not impact dam safety.	Re-slope the overbuilt section of the downstream slope to the design slope of 2H:1V.	3	Ongoing. A portion of the overbuilt section was re-sloped during 2023.The remaining overbuilt portion should be re-sloped in spring 2024.
2018DSI-02	Clean water diversion ditch along the west side of the TSF is partially blocked by fallen trees and woody vegetation.	Overtopping of the ditch during large storm events, with washout of access road along the west side of the TSF.	Remove obstructions (i.e., fallen trees, woody vegetation, and branches) and re-establish the diversion ditch along the perimeter of the TSF.	2	Ongoing. No progress in 2023.
2018DSI-06	Localized erosion of sandy tailings along the downstream slope of the Perimeter Embankment buttress at Corner 1.	Progressive erosion of sandy tailings from the downstream slope of the Perimeter Embankment buttress at Corner 1. If left unattended, more erosion and the formation of gullies could occur.	Monitor, cover exposed sandy tailings slopes, and install filter material if necessary.	3	Ongoing, no significant changes noted during 2023 inspection.

DSI = dam safety inspection; TSF = tailings storage facility; PETBP = Perimeter Embankment Till Borrow Pond; CCS = Central Collection Sump; DSR = dam safety review; MESCP = Main Embankment Seepage Collection Pond; SESCP = South Embankment Seepage Collection Pond; GLU = glaciolacustrine unit; OMS = operation, maintenance, and surveillance; EPRP = Emergency Preparedness and Response Plan.

Table 5: Description of Priority Levels

Priority Level	Description
1	A high probability or actual dam safety issues considered immediately dangerous to life, health or the environment, or a significant risk of regulatory enforcement.
2	If not corrected, could likely result in dam safety issues leading to injury, environmental impact or significant regulatory enforcement; or, a repetitive deficiency that demonstrates a systematic breakdown of procedures.
3	Single occurrences of deficiencies or non-conformances that alone would not be expected to result in dam safety issues.
4	Best Management Practice – Further improvements are necessary to meet industry best practices or reduce potential risks.

Source: Health, Safety and Reclamation Code Guidance Document, Section 4.2 (BCMEM 2016).

9.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust that this report meets your present requirements. If you have any questions or additional requirements, please contact the undersigned.

WSP Canada Inc.



2024-03-28

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RG/GP/na/lt/ca/ap

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WSP Golder. 2022c. Tailings storage facility Corner 1 Perimeter Embankment sinkholes inspection and proposed investigation – Mount Polley Mine. Prepared for Mount Polley Mining Corporation. Golder Doc. No. 22514095-068-TM-RevA-51115. October 12, 2022.

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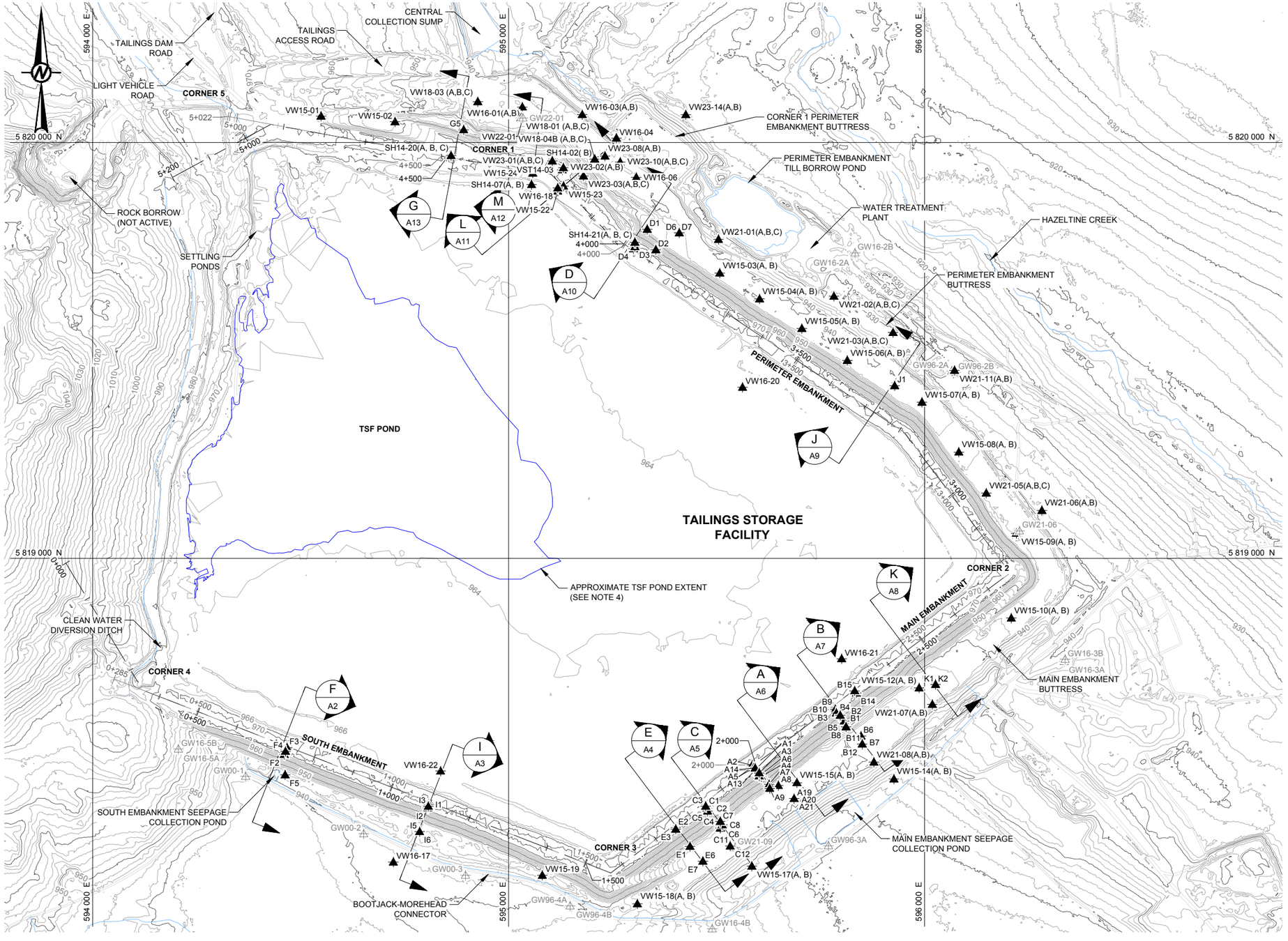
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APPENDIX A

Vibrating Wire Piezometer Data



LEGEND

- GROUND CONTOURS (SEE REFERENCE 1)
- 4+400 — TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE
- 4+400 — SETOUT LINE - S.O.L. - ORIGINAL ALIGNMENT (SEE REFERENCE 3)
- APPROXIMATE TSF POND (SEE NOTE 4)
- WATERCOURSE OR WATER BODY (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 4)
- EXISTING VIBRATING WIRE PIEZOMETER
- EXISTING MONITORING WELL

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. COORDINATES RELATIVE TO UTM, NAD83 AND ELEVATIONS OF MINE SITE REPRESENT GEODETIC DATUM, AND TAILINGS STORAGE FACILITY ARE RELATIVE TO TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. POND EXTENT DIGITIZED FROM AERIAL IMAGERY, SEE REFERENCE 2.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. AERIAL IMAGERY PROVIDED BY MPMC, TAKEN: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Grid.jgw AND 231030-TSF Grid.jpg "
3. S.O.L - ORIGINAL ALIGNMENT PROVIDED BY BGC ENGINEERING INC., DRAWING No. 01, DRAWING TITLE, "SI PLANNING PLAN MAP", PROJECT No. P14178, FILE NAME: "ACAD-01.dwg", DATED: SEPTEMBER 2014.
4. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", SURVEYED: 2013, RECEIVED: 5 SEPTEMBER 2014.

NOT FOR CONSTRUCTION

0 250 500

1:10,000 METRES

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CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: wsp

YYYY-MM-DD	2024-03-28
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PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

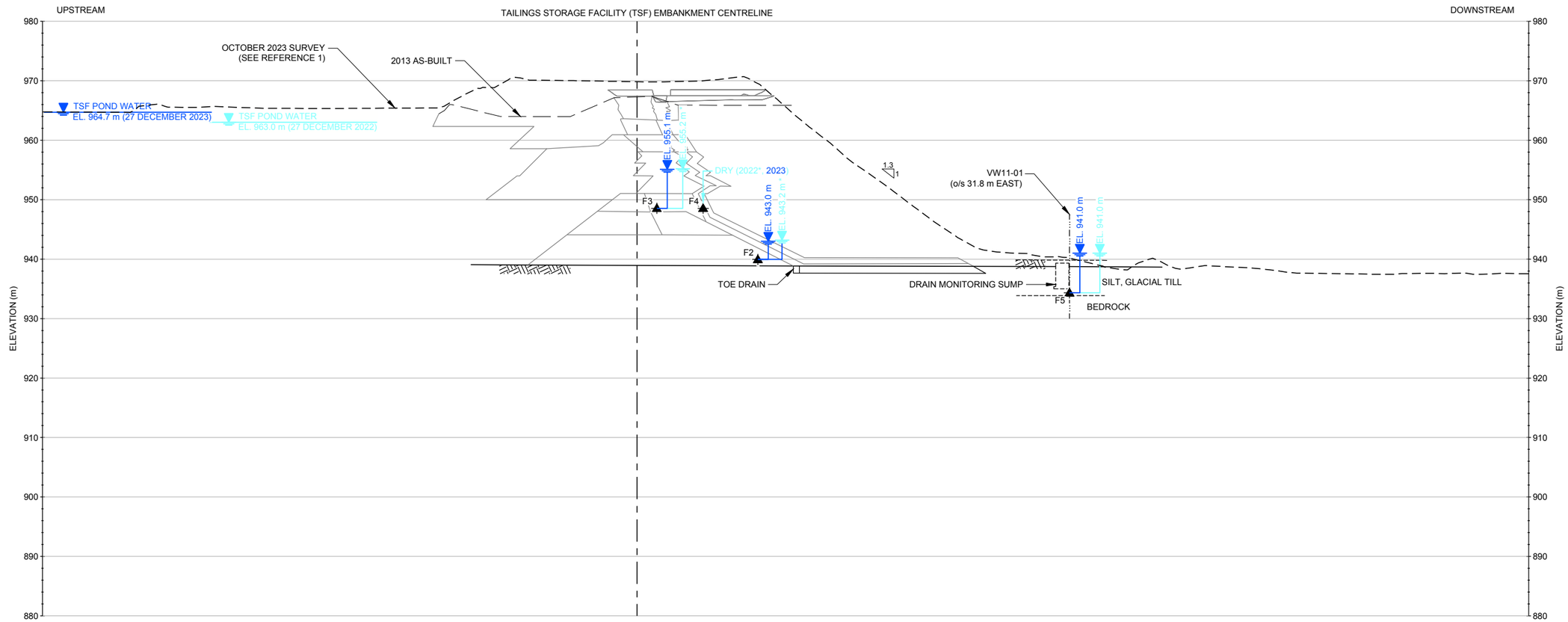
TITLE
TAILINGS STORAGE FACILITY
VIBRATING WIRE PIEZOMETER LOCATIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

Path: R:\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\69_projects\ca0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG\CA0020527_4505_52300_52391-A1.dwg | File Name: CA0020527_4505_52300_52391-A1.dwg



SCALE 1:750 m

F (A1 / B1)

SOUTH EMBANKMENT SECTION - STATION: 0+720

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2023
- EL. 940.0 — PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2022 (SEE NOTE 6)

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
4. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
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6. PIEZOMETRIC HEAD READINGS TAKEN IN NOVEMBER 2022 ARE DEFINED WITH AN ASTERISK.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
F2	FOUNDATION	F1-PE1-03
F3	TILL CORE	F1-PE1-02
F4	FILTER	F1-PE1-01
F5	TILL	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

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REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

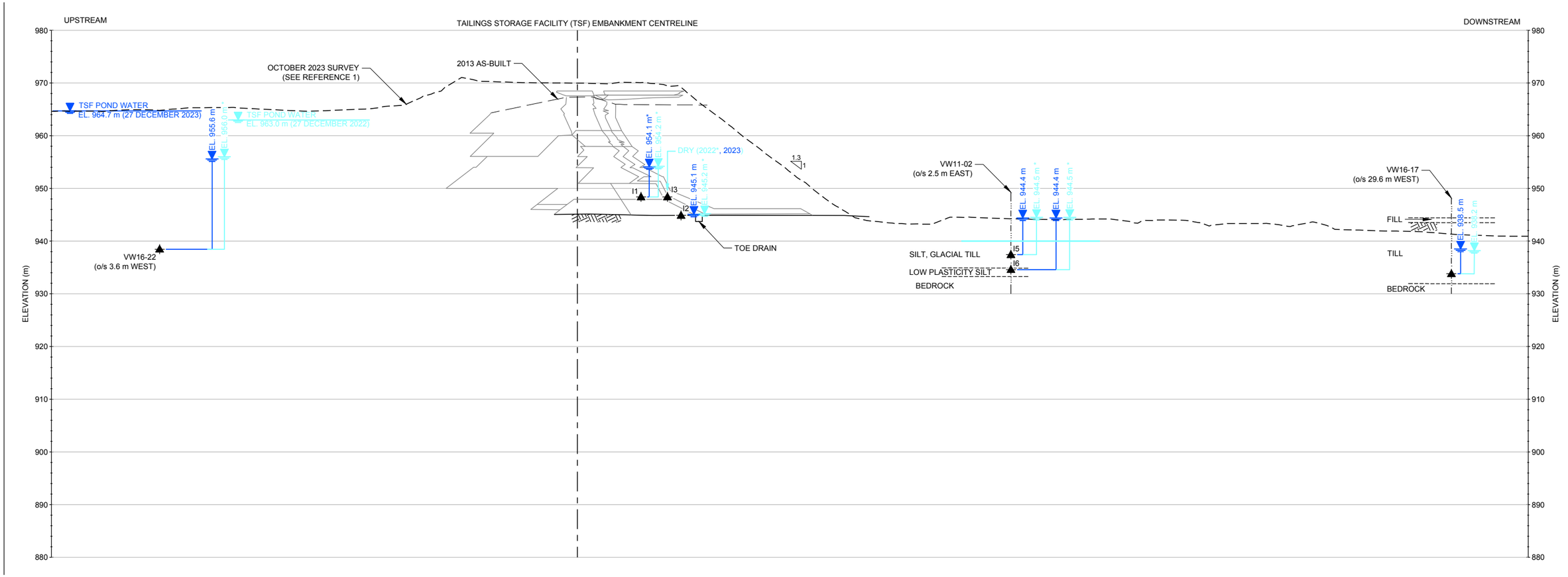
TITLE
SOUTH EMBANKMENT SECTION
STATION 0+720

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm
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SCALE 1:750 m

I (A1 / B1) SOUTH EMBANKMENT SECTION - STATION: 1+100

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN JUNE / DECEMBER 2023 (SEE NOTE 6)
- EL. 940.0 — PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2022 (SEE NOTE 7)

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
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6. PIEZOMETRIC HEAD READINGS TAKEN IN JUNE 2023 ARE DEFINED WITH AN ASTERISK.
7. PIEZOMETRIC HEAD READINGS TAKEN IN NOVEMBER 2022 ARE DEFINED WITH AN ASTERISK.

REFERENCE

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VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
I1	TILL CORE	I2-PE2-02
I2	FOUNDATION	I2-PE2-03
I3	FILTER	I2-PE2-01
I5	TILL	-
I6	LOW PLASTIC SILT	-
VW16-17	TILL	-
VW16-22	TAILINGS	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: wsp

YYYY-MM-DD	2024-03-28
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PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SOUTH EMBANKMENT SECTION
STATION 1+100

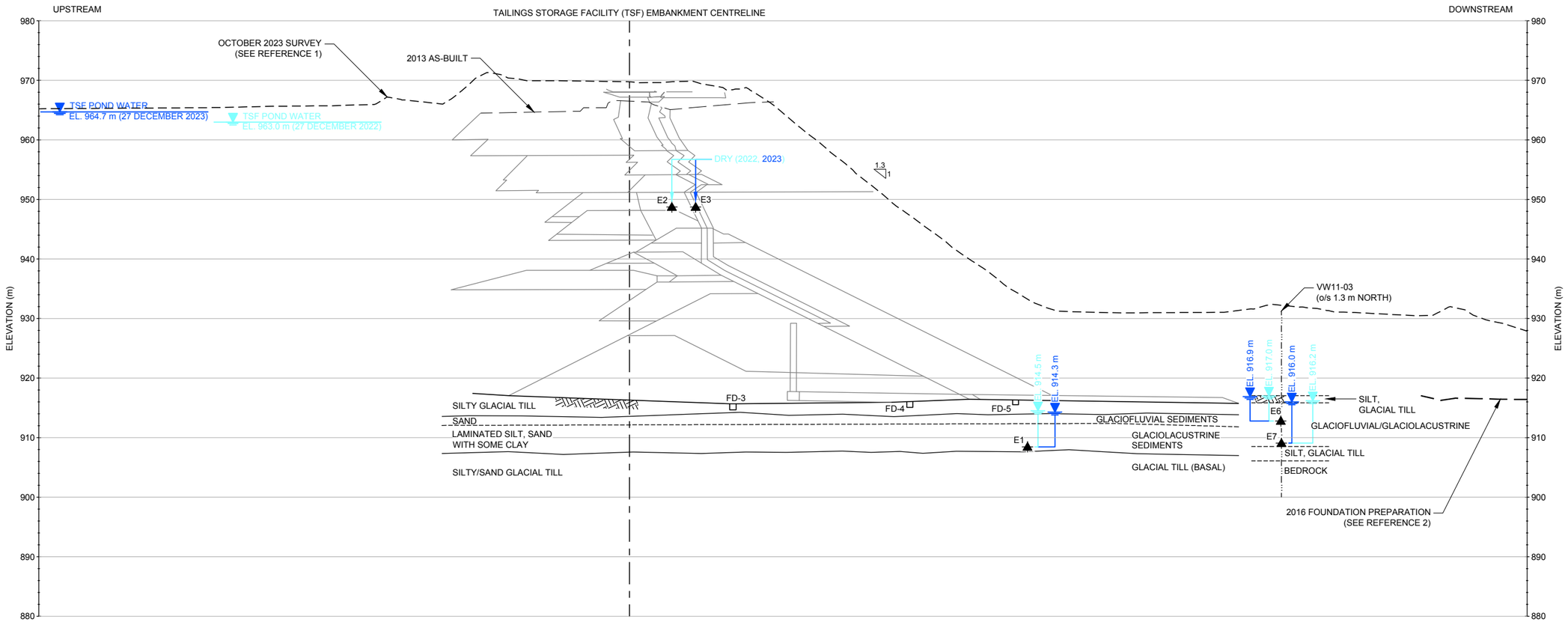
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25 mm

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SCALE 1:750 m

E (A1 / B1) MAIN EMBANKMENT SECTION - STATION: 1+760

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2023
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
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3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
4. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
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REFERENCES

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VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
E1	FOUNDATION	E2-PE2-02
E2	TILL CORE	E2-PE2-04
E3	FILTER	E1-PE1-01
E6	GLACIOLACUSTRINE	-
E7	INTERFACE GLACIOFLUVIAL/TILL	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT
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CONSULTANT
wsp

YYYY-MM-DD	2024-03-28
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PREPARED	A. FARLOW / J. HOPSON
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

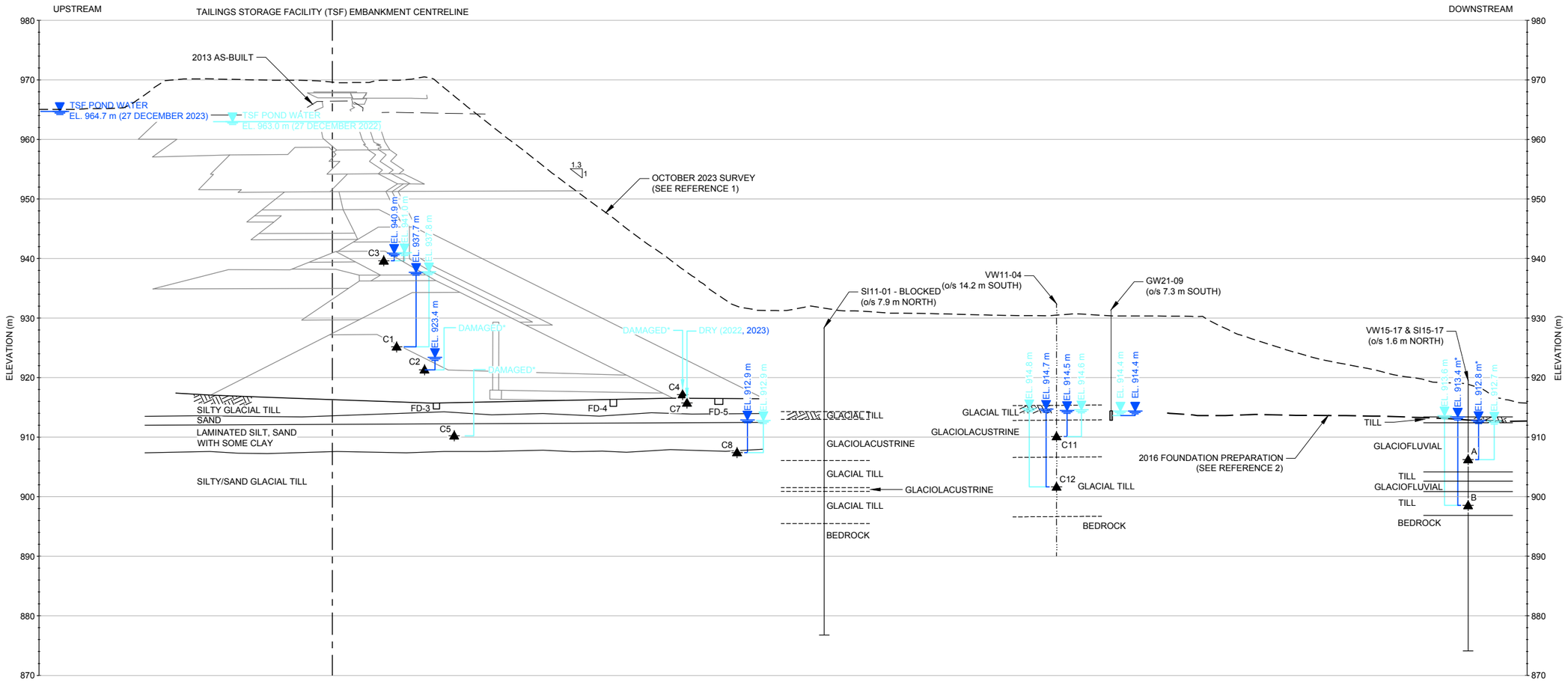
TITLE
MAIN EMBANKMENT SECTION
STATION 1+760

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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SCALE 1:750 m — C (A1 / B1) — MAIN EMBANKMENT SECTION - STATION: 1+850

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
C1	TILL CORE	C2-PE2-05
C2	TILL CORE	C2-PE2-03
C3	TILL CORE	C2-PE1-02
C4	TRANSITION	C2-PE1-01
C5	FOUNDATION	C2-PE2-02
C6	FOUNDATION DRAIN	C2-PE1-04
C7	FOUNDATION	C2-PE2-08
C8	FOUNDATION	C2-PE2-06
C11	GLACIOLACUSTRINE	-
C12	TILL	-
VW15-17(A)	GLACIOFLUVIAL	-
VW15-17(B)	TILL	-

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2023 (SEE NOTE 7)
- EL. 940.0 — PIEZOMETRIC HEAD IN NOVEMBER / DECEMBER 2022 (SEE NOTE 8)

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
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5. SECTION AND INSTRUMENTATION SHALL BE USED AS REFERENCE ONLY. INSTRUMENTATION, FOUNDATION, MATERIAL BOUNDARIES AND DIMENSIONS ARE APPROXIMATE.
6. PIEZOMETER C6 LOCATION WAS UPDATED USING THE AS-BUILT REPORT WHEN THE PIEZOMETER WAS FIRST INSTALLED.
7. PIEZOMETRIC HEAD READINGS TAKEN IN NOVEMBER 2023 ARE DEFINED WITH AN ASTERISK.
8. PIEZOMETRIC HEAD READINGS TAKEN IN NOVEMBER 2022 ARE DEFINED WITH AN ASTERISK.

REFERENCES

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NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
MAIN EMBANKMENT SECTION
STATION 1+850

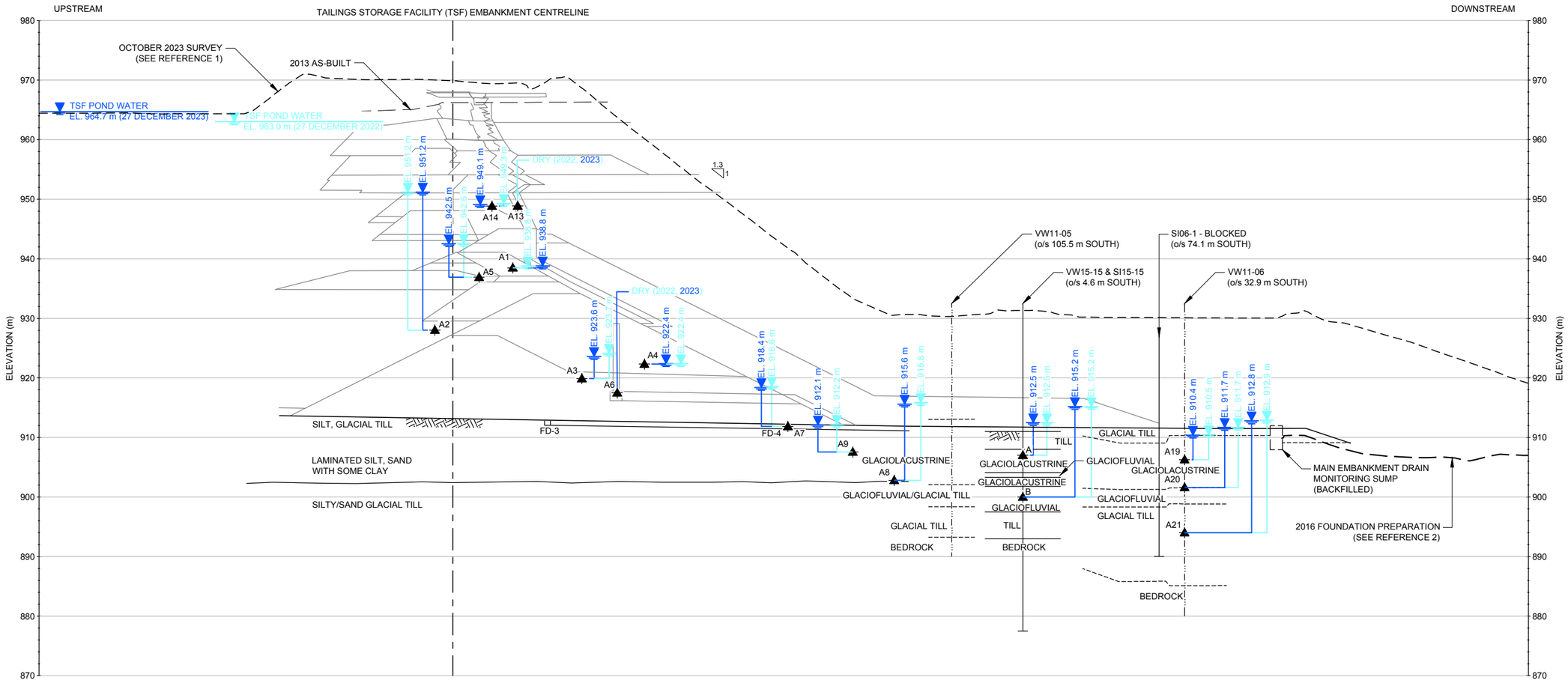
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0

Path: \\golder.gds\com\plex\data\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_project\cad\0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG\ | File Name: ca0020527_4505_52300_52391-A5.dwg



SCALE 1:750 m

A1 / A / B1

MAIN EMBANKMENT SECTION - STATION: 2+060

VIBRATING WIRE PIEZOMETERS

POINT ID	LOCATION	FORMER NAME
A1	TILL CORE	A2-PE1-02
A2	TAILINGS	A0-PE2-01
A3	TILL CORE	A2-PE2-03
A4	TILL CORE	A2-PE2-05
A5	UPSTREAM FILL	A1-PE1-04
A6	CHIMNEY DRAIN	A1-PE1-03
A7	FOUNDATION DRAIN	A1-PE102
A8	FOUNDATION	A2-PE2-08
A9	FOUNDATION	A2-PE2-07
A13	FILTER	A1-PE1-05
A14	TILL CORE	A2-PE2-10
A19	GLACIOLACUSTRINE	-
A20	INTERFACE GLACIOLACUSTRINE / GLACIOFLUVIAL	-
A21	TILL	-
VW15-15(A)	GLACIOLACUSTRINE	-
VW15-15(B)	GLACIOFLUVIAL	-

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2023
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
4. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
5. SECTION AND INSTRUMENTATION SHALL BE USED AS REFERENCE ONLY. INSTRUMENTATION, FOUNDATION, MATERIAL BOUNDARIES AND DIMENSIONS ARE APPROXIMATE.
6. PIEZOMETER A7 LOCATION WAS UPDATED USING THE AS-BUILT REPORT WHEN THE PIEZOMETER WAS FIRST INSTALLED.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. MAIN EMBANKMENT BUTTRESS FOUNDATION PREPARATION PROVIDED BY MPMC, SURFACE CREATED USING MULTIPLE DXF FILES, FILE NAME: "160322 ME Till Topo.dxf", SURVEYED: MARCH 22, 2016, RECEIVED: 29 NOVEMBER 2016, AND FILE NAME: "Till Fnd Complete 161110.dxf", RECEIVED: 24 NOVEMBER 2016.

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
MAIN EMBANKMENT SECTION
STATION 2+060

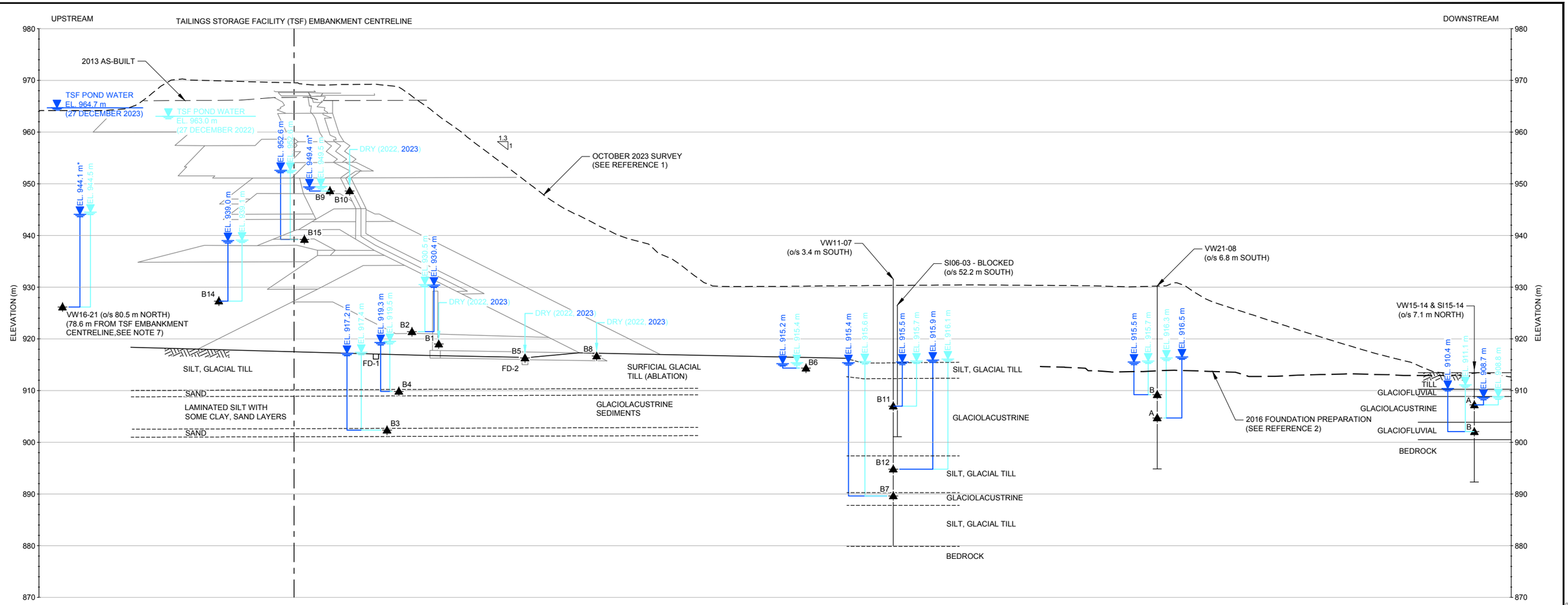
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A6

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

25 mm

0

Path: \\gpfdir.gds\complexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG\ | File Name: CA0020527_4505_52300_52391-A6.dwg



SCALE 1:750 m

B / A1 — B1

MAIN EMBANKMENT SECTION - STATION: 2+240

VIBRATING WIRE PIEZOMETERS

POINT ID	LOCATION	FORMER NAME	POINT ID	LOCATION	FORMER NAME
B1	CHIMNEY DRAIN	B1-PE1-03	B11	GLACIOLACUSTRINE	-
B2	TILL CORE	B2-PE2-04	B12	TILL	-
B3	FOUNDATION	B2-PE2-01	B14	UPSTREAM FILTER	B0-PE2-02
B4	FOUNDATION	B2-PE2-02	B15	CYCLONE SAND	B0-PE1-01
B5	FOUNDATION DRAIN	B1-PE1-02	VW15-14(A)	GLACIOLACUSTRINE	-
B6	FOUNDATION	B1-PE1-03	VW15-14(B)	GLACIOFLUVIAL	-
B7	GLACIOLACUSTRINE	B13	VW16-21	TAILINGS	-
B8	TRANSITION	B2-PE1-01	VW21-08(A)	GLACIOLACUSTRINE	-
B9	TILL CORE	B2-PE2-08	VW21-08(B)	GLACIOFLUVIAL	-
B10	FILTER	B1-PE1-04			

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN FEBRUARY / JUNE / DECEMBER 2023 (SEE NOTE 8)
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
4. DIGITALIZED SECTION WAS UPDATED WITH THE 2014 AS-BUILT SURVEY PROVIDED BY MPMC ON 14 SEPTEMBER 2015 AND MAY 2015 SURVEY.
5. SECTION AND INSTRUMENTATION SHALL BE USED AS REFERENCE ONLY. INSTRUMENTATION, FOUNDATION, MATERIAL BOUNDARIES AND DIMENSIONS ARE APPROXIMATE.
6. PIEZOMETER B10 LOCATION WAS UPDATED USING THE AS-BUILT REPORT WHEN THE PIEZOMETER WAS FIRST INSTALLED.
7. VW16-21 OUT OF THE SCALE OF THIS FIGURE, DISTANCE FROM TSF EMBANKMENT CENTRELINE PROVIDED.
8. PIEZOMETRIC HEAD READINGS TAKEN IN FEBRUARY AND JUNE 2023 ARE DEFINED WITH AN ASTERISK.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. MAIN EMBANKMENT BUTTRESS FOUNDATION PREPARATION PROVIDED BY MPMC, SURFACE CREATED USING MULTIPLE DXF FILES, FILE NAME: "160322 ME Till Topo.dxf", SURVEYED: MARCH 22, 2016, RECEIVED: 29 NOVEMBER 2016, AND FILE NAME: "Till Fnd Complete 161110.dxf", RECEIVED: 24 NOVEMBER 2016.

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
MAIN EMBANKMENT SECTION
STATION 2+240

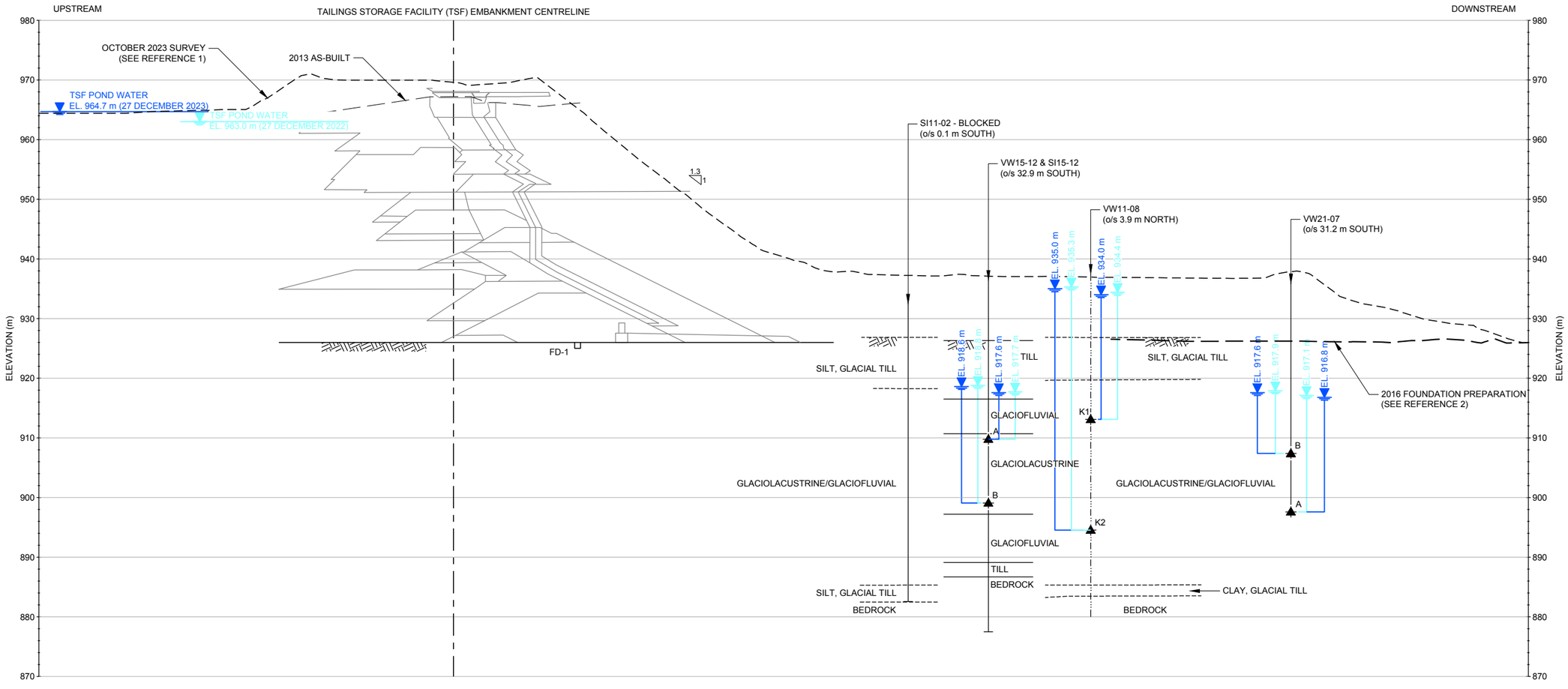
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A7

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0

Path: \\golder.gds\complexdata\c\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG\ | File Name: CA0020527_4505_52300_52391-A7.dwg



SCALE 1:750 m

K (A1 / B1) MAIN EMBANKMENT SECTION - STATION: 2+460

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2019 SURVEY (SEE REFERENCE 1)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 PIEZOMETRIC HEAD IN DECEMBER 2023
- EL. 940.0 PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
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REFERENCES

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2. MAIN EMBANKMENT BUTTRESS FOUNDATION PREPARATION PROVIDED BY MPMC, SURFACE CREATED USING MULTIPLE DXF FILES, FILE NAME: "160322 ME Till Topo.dxf", SURVEYED: MARCH 22, 2016, RECEIVED: 29 NOVEMBER 2016, AND FILE NAME: "Till Fnd Complete 161110.dxf", RECEIVED: 24 NOVEMBER 2016.

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
K1	GLACIOFLUVIAL	-
K2	GLACIOFLUVIAL	-
VW15-12(A)	GLACIOLACUSTRINE	-
VW15-12(B)	GLACIOLACUSTRINE	-
VW21-07(A)	GLACIOFLUVIAL	-
VW21-07(B)	GLACIOFLUVIAL	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

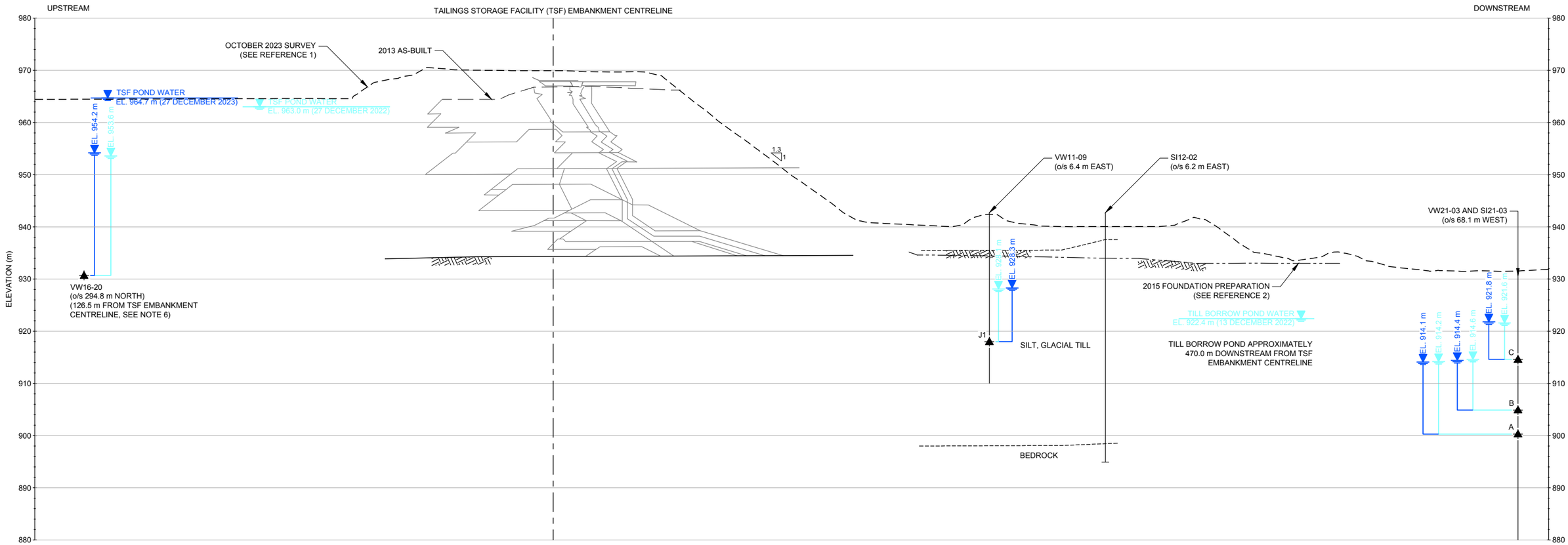
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
MAIN EMBANKMENT SECTION
STATION 2+460

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A8

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_project\eca\0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG | File Name: CA0020527_4505_52300_52391-A8.dwg

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm



SCALE 1:750 m

J
A1 B1

PERIMETER EMBANKMENT SECTION - STATION: 3+280

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2015 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2023
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
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5. SECTION AND INSTRUMENTATION SHALL BE USED AS REFERENCE ONLY. INSTRUMENTATION, FOUNDATION, MATERIAL BOUNDARIES AND DIMENSIONS ARE APPROXIMATE.
6. VW16-20 OUT OF THE SCALE OF THIS FIGURE, DISTANCE FROM TSF EMBANKMENT CENTRELINE PROVIDED.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. PERIMETER EMBANKMENT BUTTRESS FOUNDATION PREPARATION PROVIDED BY MPMC, FILE NAME: "final foundation.dxf", SURVEYED: 7 JUNE 2015, RECEIVED: 2 JULY 2015.

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
J1	GLACIOLACUSTRINE (400 mm SEAM)	-
VW16-20	TAILINGS	-
VW21-03(A)	GLACIOFLUVIAL	-
VW21-03(B)	GLACIOLACUSTRINE	-
VW21-03(C)	TILL	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PERIMETER EMBANKMENT SECTION
STATION 3+280

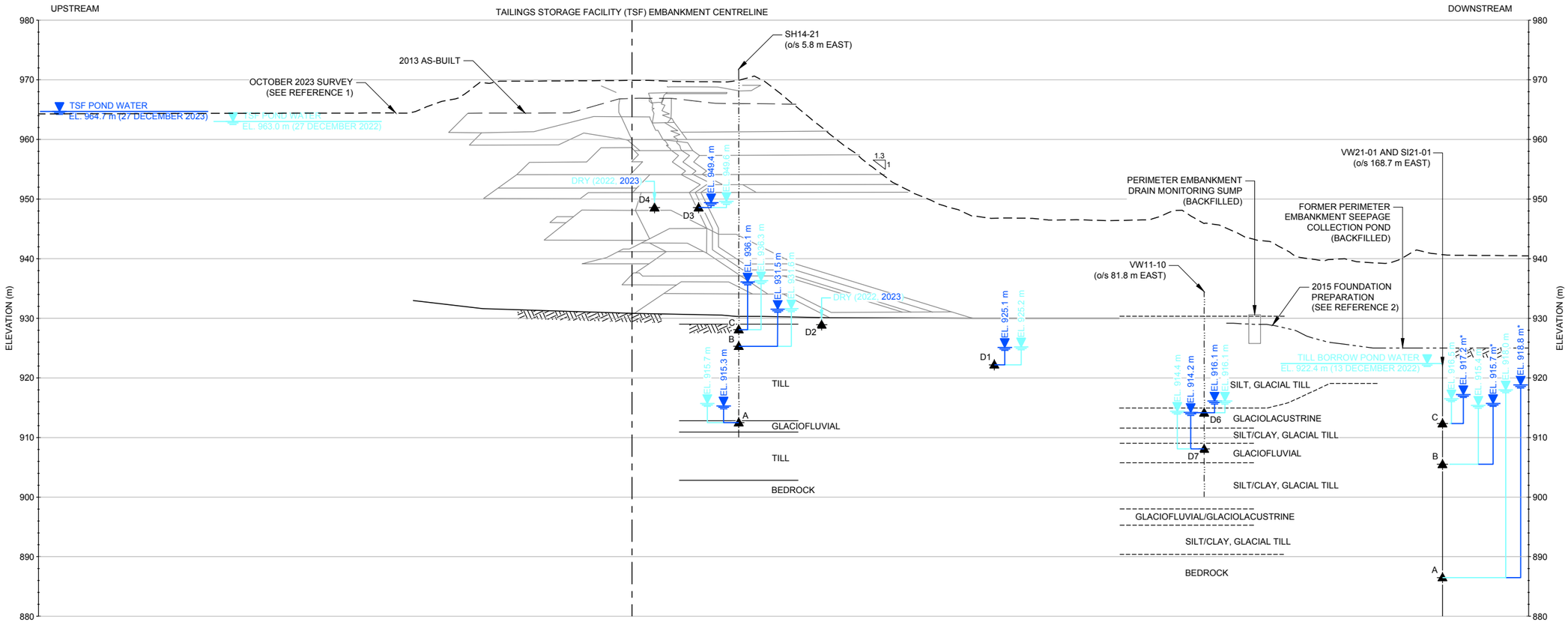
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A9

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

25 mm

0

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_projects\ca0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG\ | File Name: CA0020527_4505_52300_52391-A9.dwg



SCALE 1:750 m — D (A1 / B1) — PERIMETER EMBANKMENT SECTION - STATION: 3+990

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2015 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN AUGUST / DECEMBER 2023 (SEE NOTE 7)
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION INFORMATION WAS DIGITALIZED USING THE AMEC 2013 AS-BUILT AND ANNUAL REVIEW REPORT, FILE NAME: "2014 03 12 - 2013 AS-BUILT & ANNUAL REVIEW REPORT (AMEC).pdf", DATED: 12 MARCH 2014.
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5. SECTION AND INSTRUMENTATION SHALL BE USED AS REFERENCE ONLY. INSTRUMENTATION, FOUNDATION, MATERIAL BOUNDARIES AND DIMENSIONS ARE APPROXIMATE.
6. TILL BORROW POND APPROXIMATELY 220.0 m DOWNSTREAM FROM TSF EMBANKMENT CENTRELINE.
7. PIEZOMETRIC HEAD READINGS TAKEN IN AUGUST 2023 ARE DEFINED WITH AN ASTERISK.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. PERIMETER EMBANKMENT BUTTRESS FOUNDATION PREPARATION PROVIDED BY MPMC, FILE NAME: "final foundation.dxf", SURVEYED: 7 JUNE 2015, RECEIVED: 2 JULY 2015.

VIBRATING WIRE PIEZOMETERS

POINT ID	LOCATION	FORMER NAME
D1	FOUNDATION	D2-PE2-02
D2	FOUNDATION DRAIN	D1-PE1-02
D3	FILTER	D1-PE1-04
D4	TILL CORE	D1-PE2-04
D6	GLACIOLACUSTRINE	-
D7	GLACIOFLUVIAL	-
SH14-21 (A)	GLACIOFLUVIAL	-
SH14-21 (B)	TILL	-
SH14-21 (C)	TILL	-
VW21-01 (A)	GLACIOFLUVIAL	-
VW21-01 (B)	GLACIOFLUVIAL	-
VW21-01 (C)	GLACIOLACUSTRINE	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT: MOUNT POLLEY MINING CORPORATION

CONSULTANT: wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

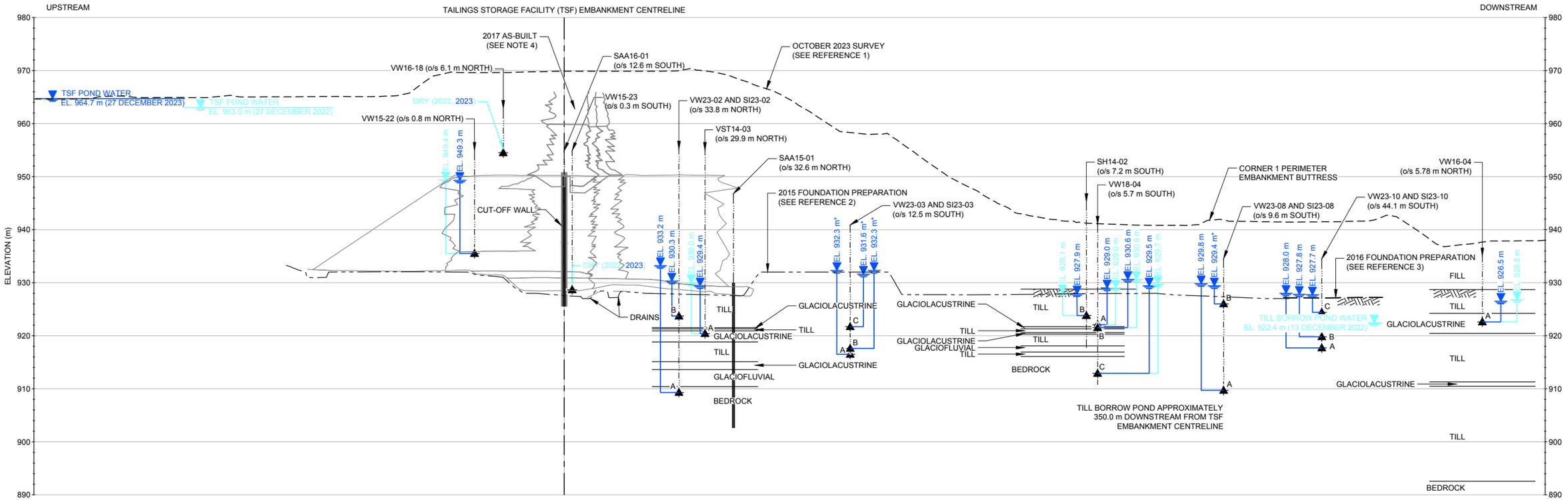
TITLE
PERIMETER EMBANKMENT SECTION
STATION 3+990

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A10

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 25 mm

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\imperial | metals_corp\mount_polley_mine\99_project\sia\0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG | File Name: CA0020527_4505_52300_52391-A10.dwg



SCALE 1:750 m (L A1 B1) CORNER 1 PERIMETER EMBANKMENT SECTION - STATION: 4+200

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
SH14-02 (B)	TILL	-
VST14-03	GLACIOLACUSTRINE	-
VW15-22	UPSTREAM FILL	-
VW15-23	FILTER	-
VW16-04	GLACIOLACUSTRINE	-
VW16-18	TAILINGS	-
VW18-04(A)	GLACIOLACUSTRINE	-
VW18-04(B)	GLACIOLACUSTRINE	-
VW18-04(C)	BEDROCK	-

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
VW23-02 (A)	BEDROCK	-
VW23-02 (B)	TILL	-
VW23-03 (A)	TILL	-
VW23-03 (B)	GLACIOLACUSTRINE	-
VW23-03 (C)	GLACIOLACUSTRINE	-
VW23-08 (A)	BEDROCK	-
VW23-08 (B)	TILL	-
VW23-10 (A)	TILL	-
VW23-10 (B)	GLACIOLACUSTRINE	-
VW23-10 (C)	GLACIOLACUSTRINE	-

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- CUT-OFF WALL
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2015 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN OCTOBER / DECEMBER 2023 (SEE NOTE 5)
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION OBTAINED FROM THE 2015 AS-BUILT SURVEY AND MAY 2015 SURVEY.
4. 2017 AS-BUILT REFLECTS DIMENSIONS AT STATION 4+200.
5. PIEZOMETRIC HEAD READINGS TAKEN IN OCTOBER 2023 ARE DEFINED WITH AN ASTERISK.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. FOUNDATION SURFACE WAS PREPARED BY GOLDER ON 9 JULY 2015 BASED ON AS-BUILT, MATERIAL PLACEMENT AND CONSTRUCTION PROGRESS SURVEYS; AND FIELD NOTES.
3. CORNER 1 PERIMETER EMBANKMENT FOUNDATION PREPARATION PROVIDED BY MPMC, FILE NAME: "MP - 160606 c1 till topo.dxf", SURVEYED: 6 JUNE 2016, RECEIVED: 8 JUNE 2016.

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

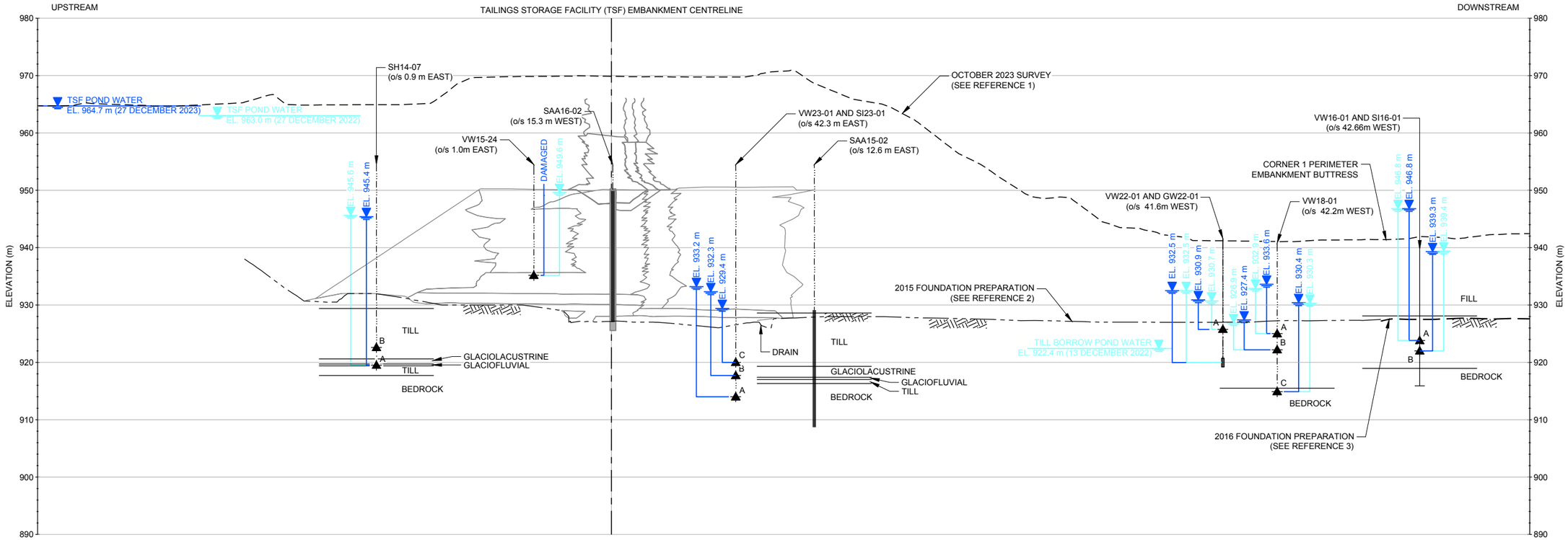
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
CORNER 1 PERIMETER EMBANKMENT SECTION
STATION 4+200

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A11

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
0 25 mm

Path: \\golder.gds\complexdata\office\vancouver\CAD-GIS\Client\imperial_metals_corp\mount_polley_mine\99_project\eca\0020527_4505\52300\52391\009_2023 DSI Report\02_PRODUCTION\DWG\ | File Name: CA0020527_4505_52300_52391-A11.dwg



SCALE 1:750 m — M (A1 / B1) — CORNER 1 PERIMETER EMBANKMENT SECTION - STATION: 4+290

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- CUT-OFF WALL
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2015 FOUNDATION PREPARATION (SEE REFERENCE 2)
- 2016 FOUNDATION PREPARATION (SEE REFERENCE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2023
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION OBTAINED FROM THE 2015 AS-BUILT SURVEY AND MAY 2015 SURVEY.
4. PEIZOMETERS VW16-01A AND VW16-01B ARE INTERPRETED TO BE INACCURATE BASED ON RESPONSE SINCE INSTALLATION IN 2016 AND INVESTIGATION IN 2018.
5. NO PIEZOMETRIC READINGS WERE TAKEN FROM PIEZOMETER SH14-07 (B) IN 2022 AND 2023.
6. VW15-24 WAS DAMAGED IN 2023.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. FOUNDATION SURFACE WAS PREPARED BY GOLDER ON 9 JULY 2015 BASED ON AS-BUILT, MATERIAL PLACEMENT AND CONSTRUCTION PROGRESS SURVEYS; AND FIELD NOTES.
3. CORNER 1 PERIMETER EMBANKMENT FOUNDATION PREPARATION PROVIDED BY MPMC, FILE NAME: "MP - 160606 c1 till topo.dxf", SURVEYED: 6 JUNE 2016, RECEIVED: 8 JUNE 2016.

VIBRATING WIRE PIEZOMETERS		
POINT ID	LOCATION	FORMER NAME
SH14-07 (A)	GLACIOFLUVIAL	-
SH14-07 (B)	TILL	-
VW15-24	UPSTREAM FILL	-
VW16-01(A)	TILL	-
VW16-01(B)	TILL	-
VW18-01(A)	TILL	-
VW18-01(B)	TILL	-
VW18-01(C)	BEDROCK	-
VW22-01	TILL	-
VW23-01(A)	GLACIOFLUVIAL	-
VW23-01(B)	GLACIOLACUSTRINE	-
VW23-01(C)	GLACIOLACUSTRINE	-

NOT FOR CONSTRUCTION

0 — 12.5 — 25
1:750 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-28
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PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

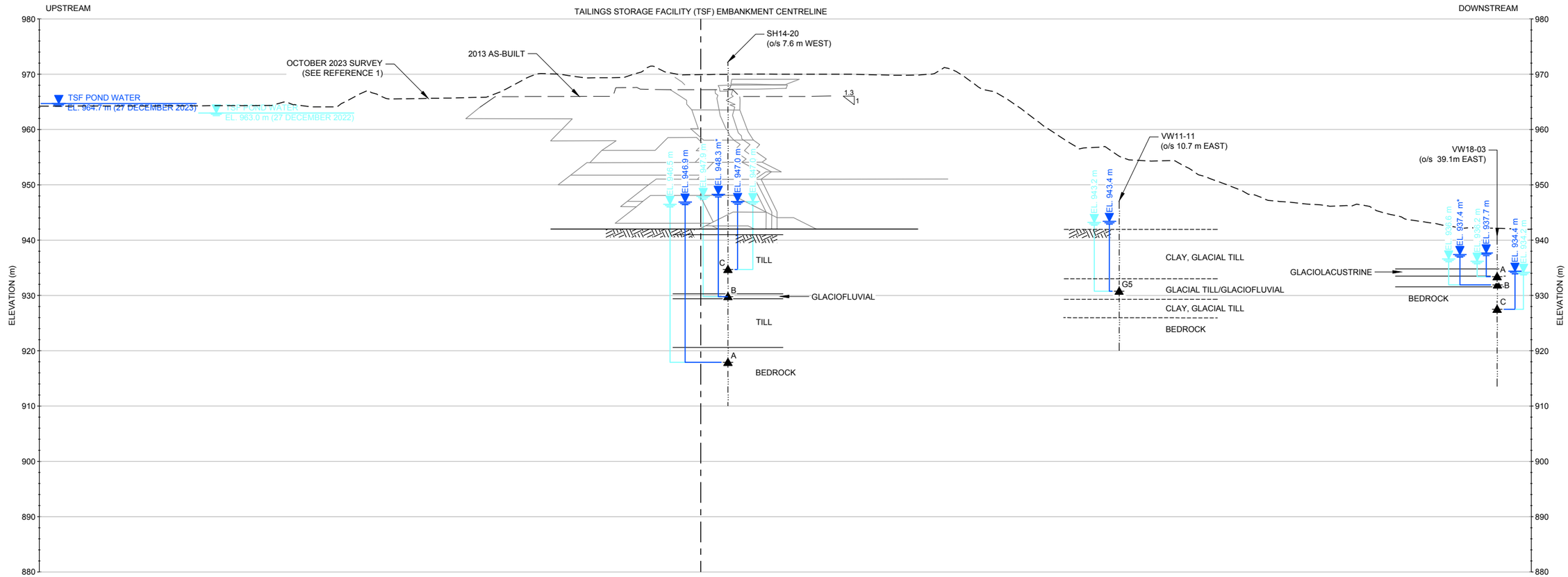
TITLE
CORNER 1 PERIMETER EMBANKMENT SECTION STATION 4+290

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A12

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

0 — 25 mm

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SCALE 1:750 m

G (A1 / B1)

PERIMETER EMBANKMENT SECTION - STATION: 4+480

LEGEND

- EXISTING VIBRATING WIRE PIEZOMETER
- OCTOBER 2023 SURVEY (SEE REFERENCE 1)
- 2013 AS-BUILT (SEE NOTE 3)
- PREVIOUSLY CONSTRUCTED MATERIAL BOUNDARY
- EL. 940.0 — PIEZOMETRIC HEAD IN MAY / NOVEMBER / DECEMBER 2023 (SEE NOTE 4)
- EL. 940.0 — PIEZOMETRIC HEAD IN DECEMBER 2022

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. ELEVATIONS ARE RELATIVE TO TAILINGS GRID DATUM.
3. SECTION OBTAINED FROM THE 2015 AS-BUILT SURVEY AND MAY 2015 SURVEY.
4. PIEZOMETRIC HEAD READINGS TAKEN IN MAY AND NOVEMBER 2023 ARE DEFINED WITH AN ASTERISK.

REFERENCE

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .

VIBRATING WIRE PIEZOMETERS

POINT ID	LOCATION	FORMER NAME
G5	GLACIAL TILL/GLACIOFLUVIAL	-
SH14-20 (A)	BEDROCK	-
SH14-20 (B)	GLACIOFLUVIAL	-
SH14-20 (C)	TILL	-
VW18-03(A)	TILL	-
VW18-03(B)	TILL	-
VW18-03(C)	BEDROCK	-

NOT FOR CONSTRUCTION

0 12.5 25
1:750 METRES

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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PERIMETER EMBANKMENT SECTION
STATION 4+480

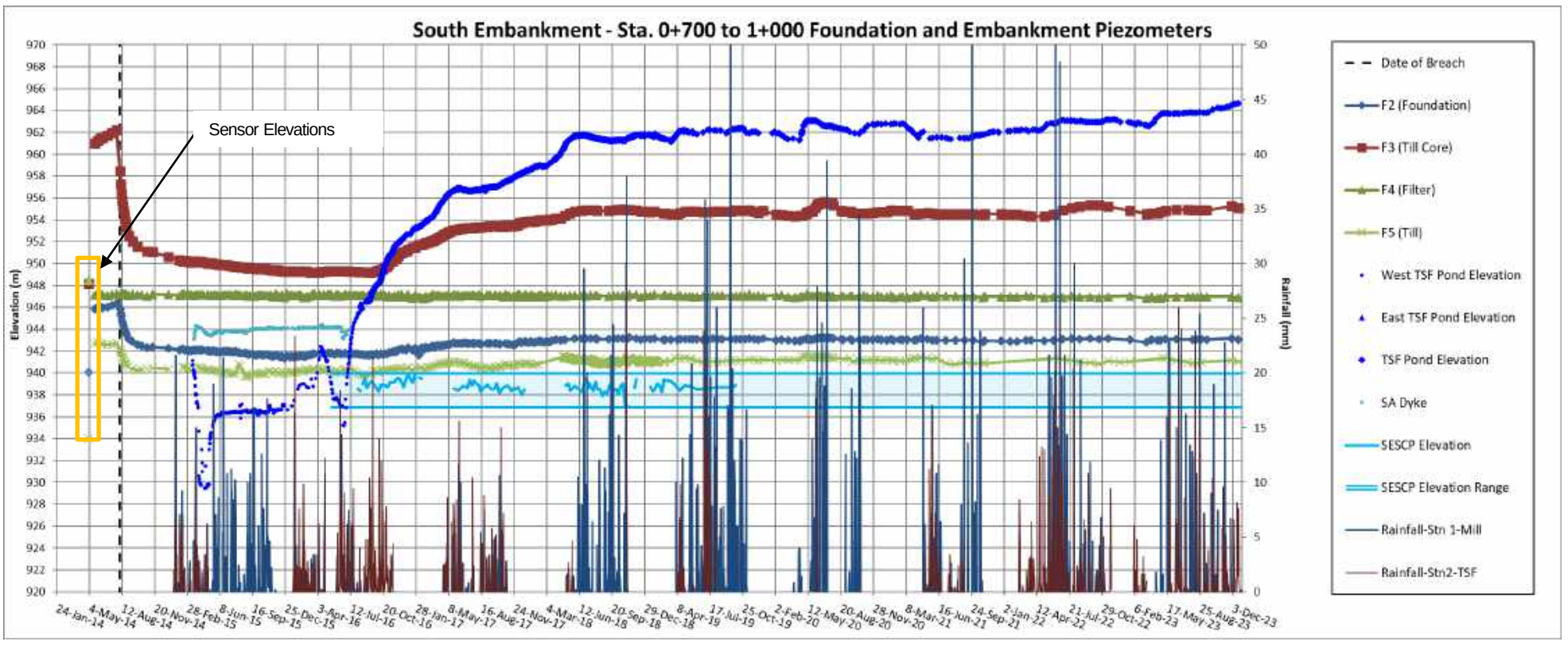
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CA0020527.4505	52300/52391/009	0	A13

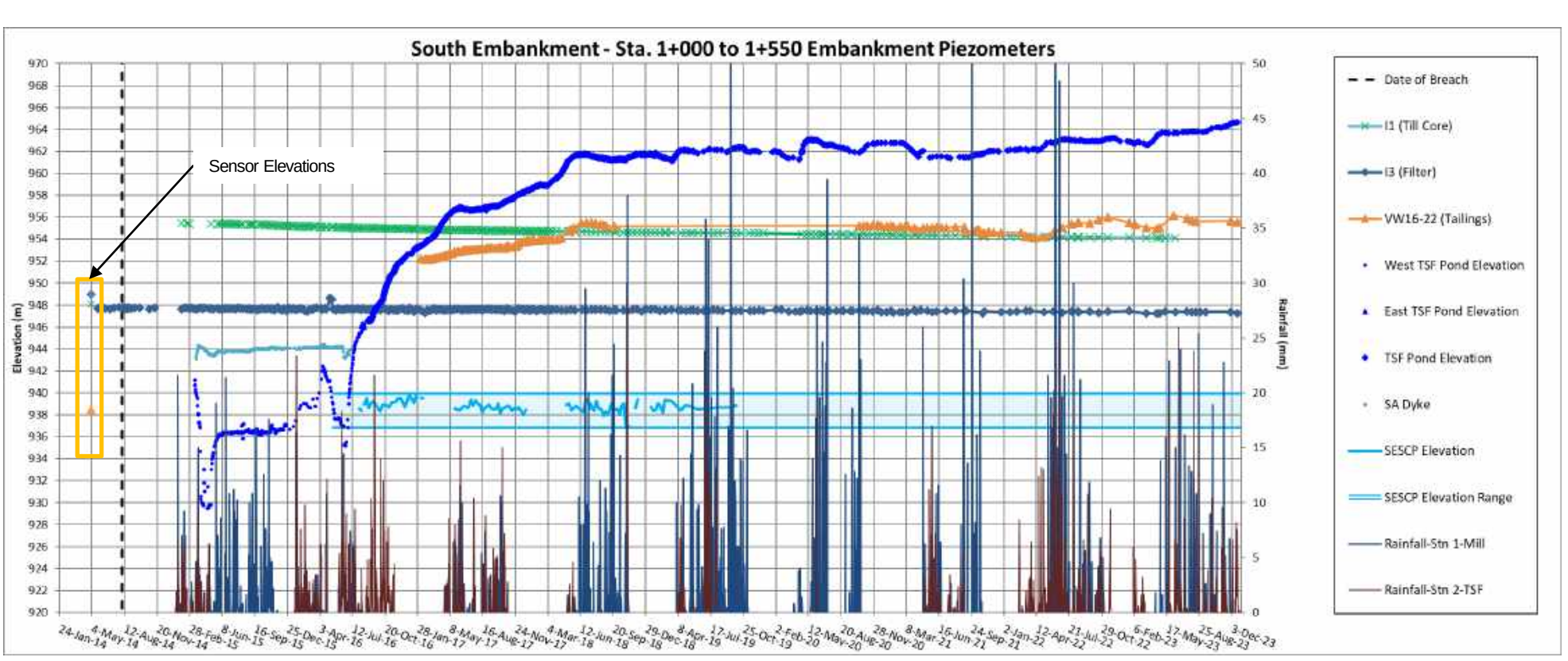
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

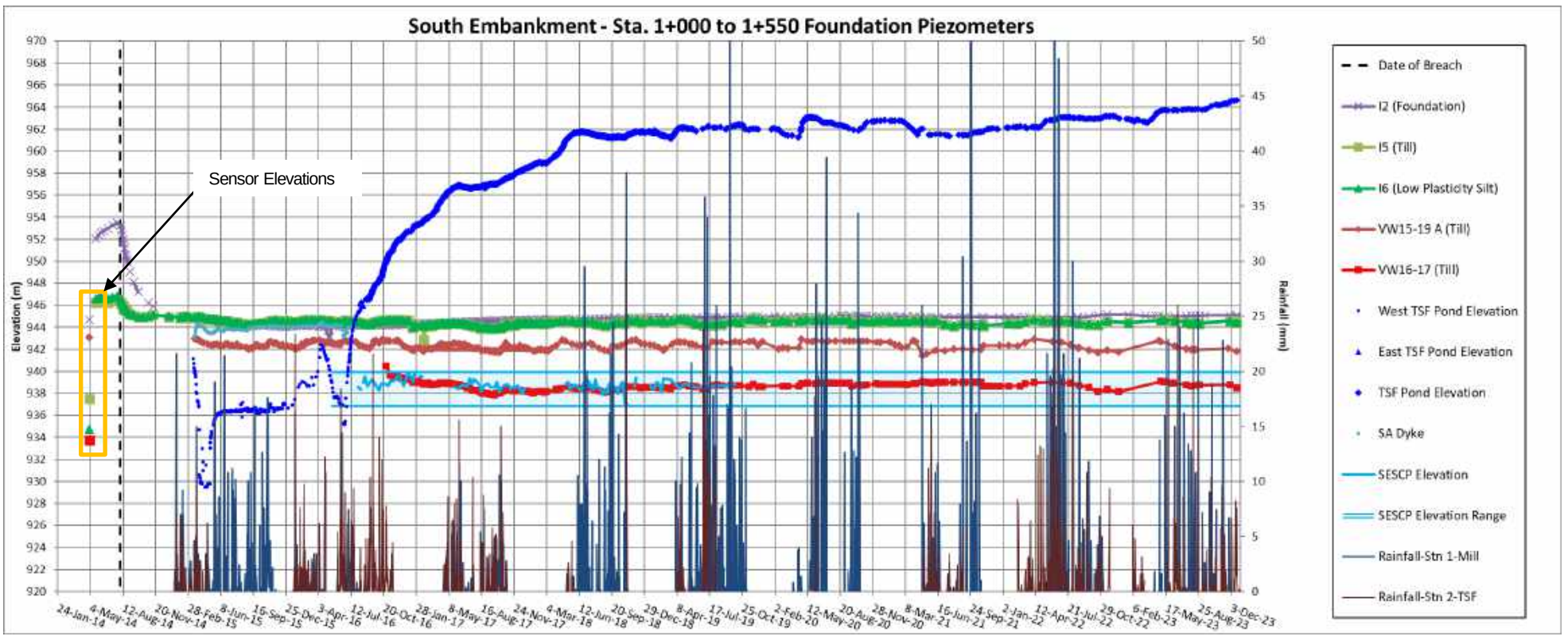
25 mm

0

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NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
   - November 2016 to April 2017
   - November 2017 to April 2018
   - November 2018 to April 2019
   - August 2019 to April 2020
   - November 2020 to April 2021
   - November 2021 to May 2022
   - November 2022 to April 2023
3. TSF rainfall gauge broken from:
   - May 3, 2019 to May 22, 2019
   - June 1, 2019 to June 25, 2019
   - June 10, 2020 to August 11, 2020
   - August 17, 2020 to September 27, 2020

CLIENT
MOUNT POLLEY MINING CORPORATION

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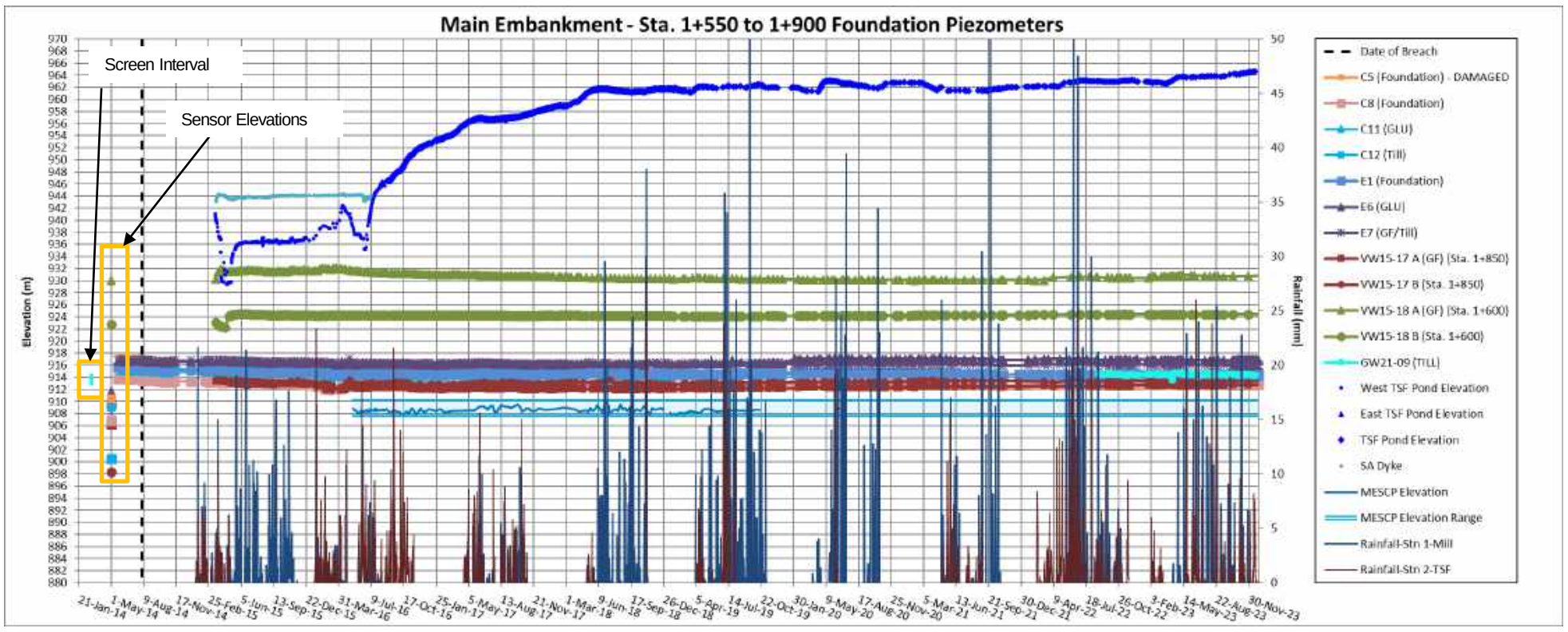
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

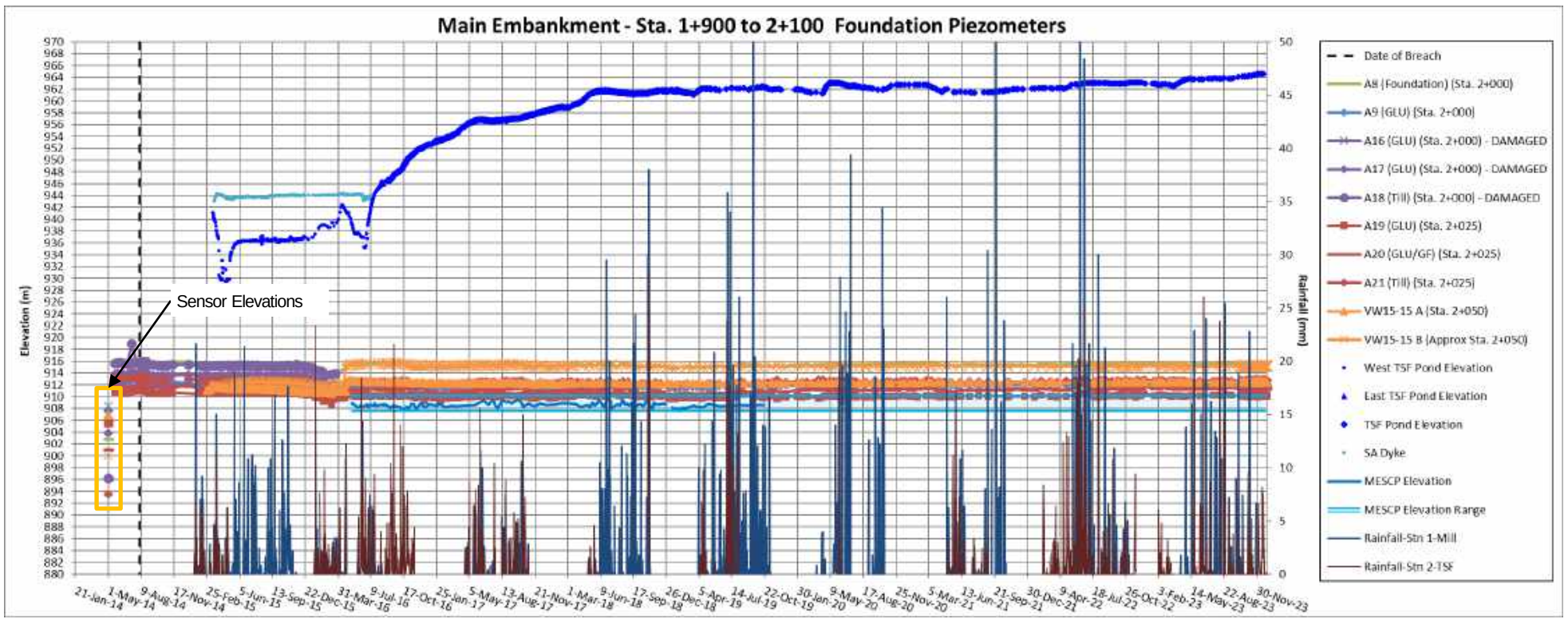
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
SOUTH EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm





NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
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CLIENT
MOUNT POLLEY MINING CORPORATION

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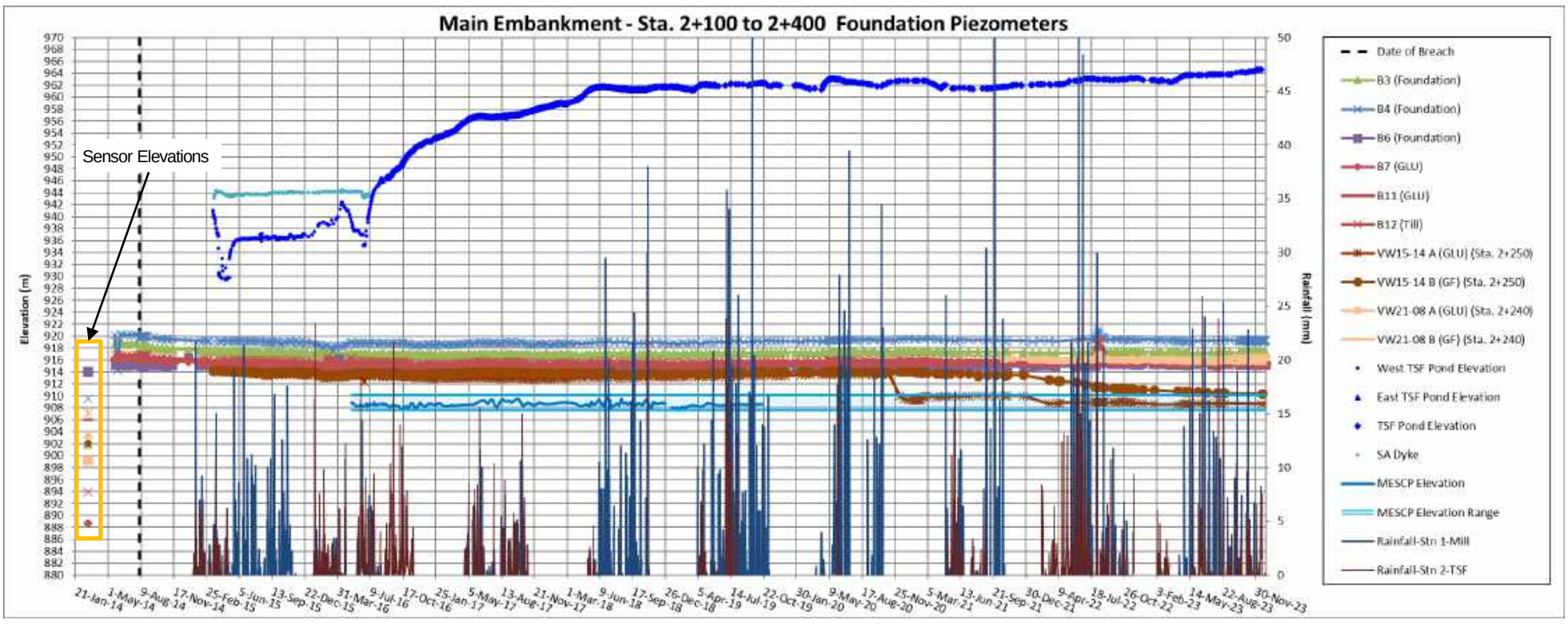
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

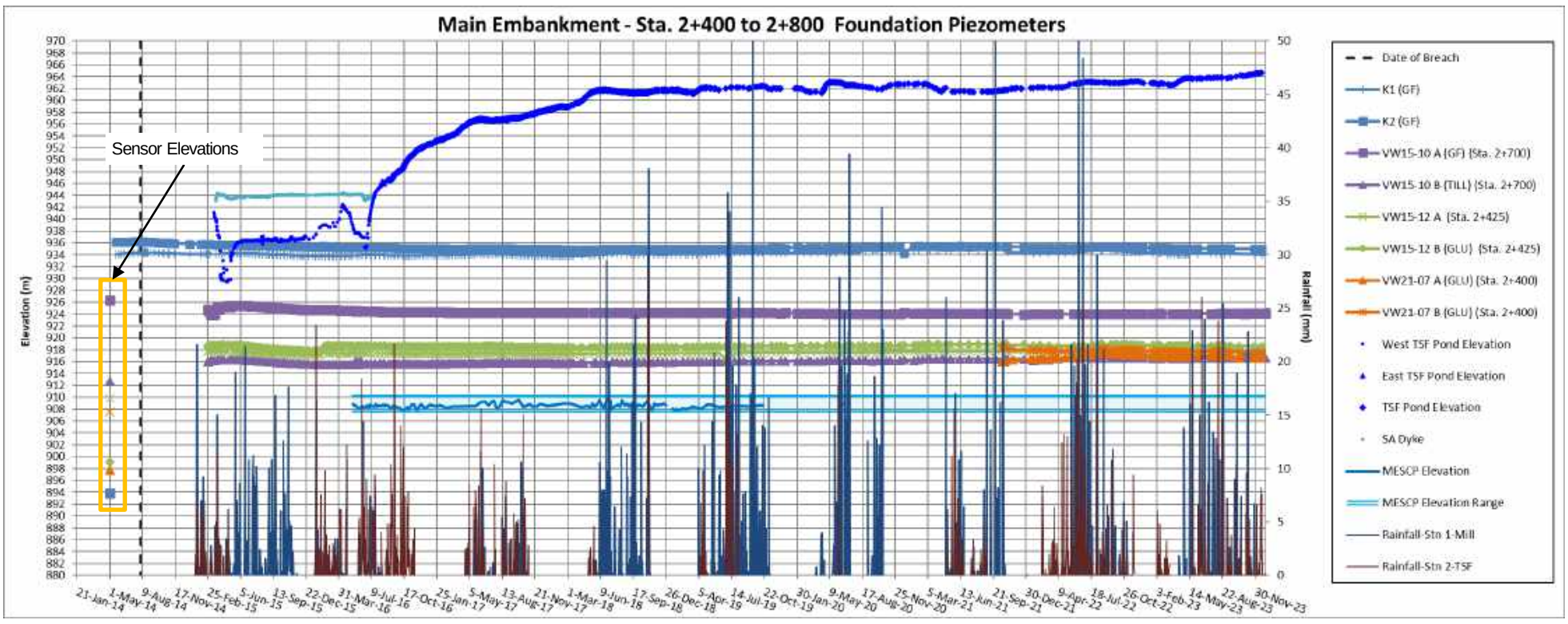
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm





NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
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CLIENT
MOUNT POLLEY MINING CORPORATION

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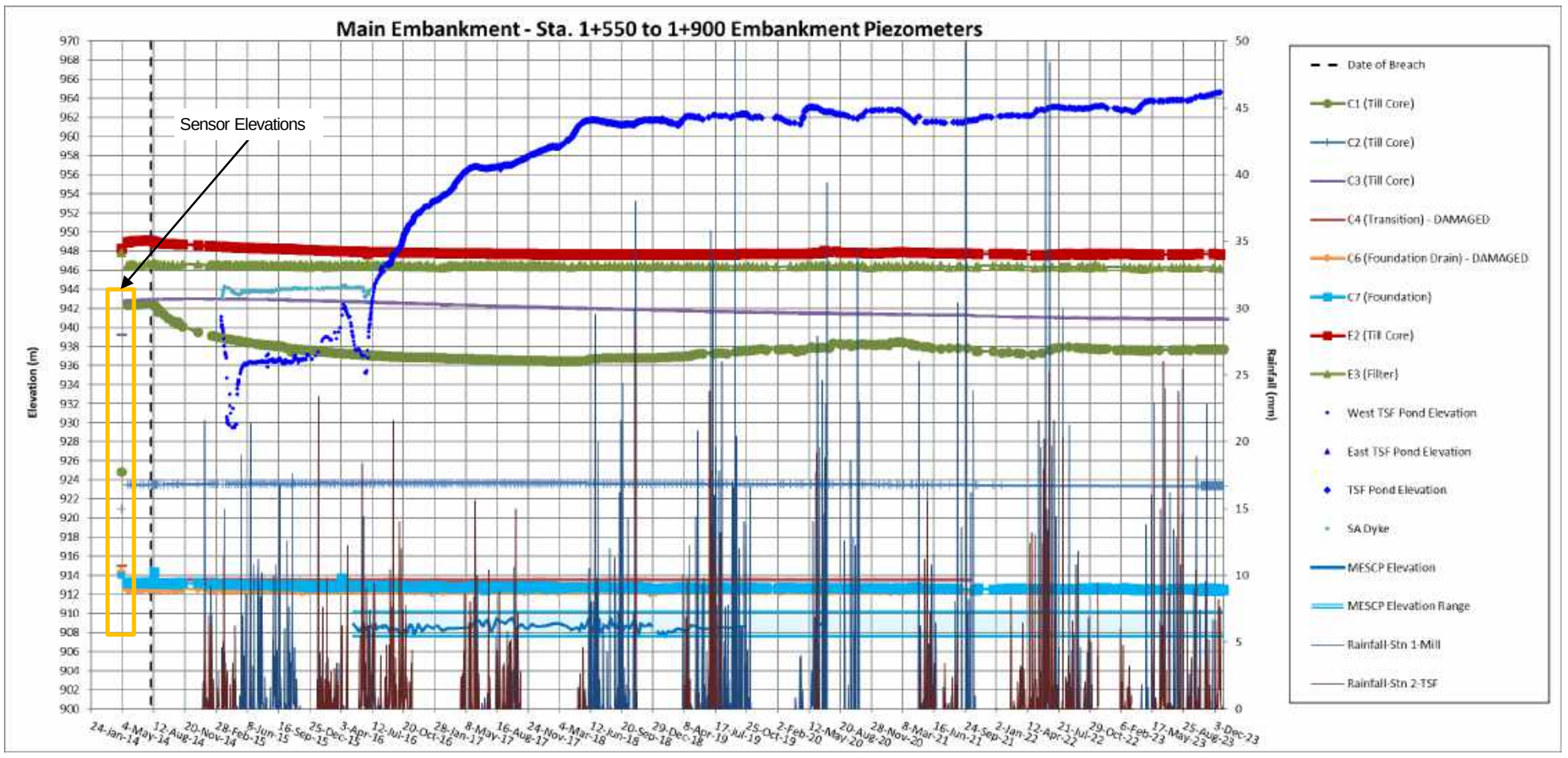
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

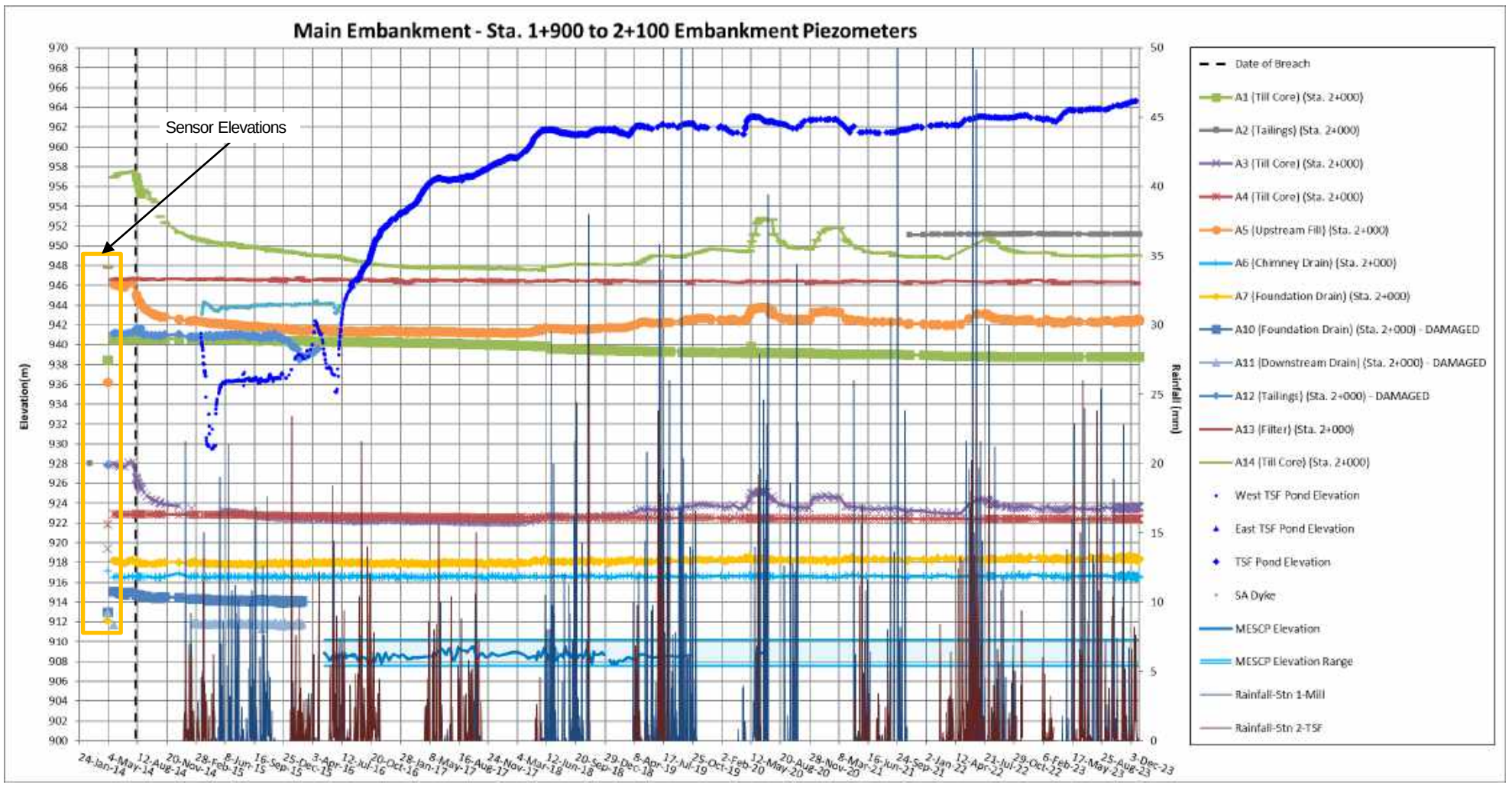
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm





NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
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CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

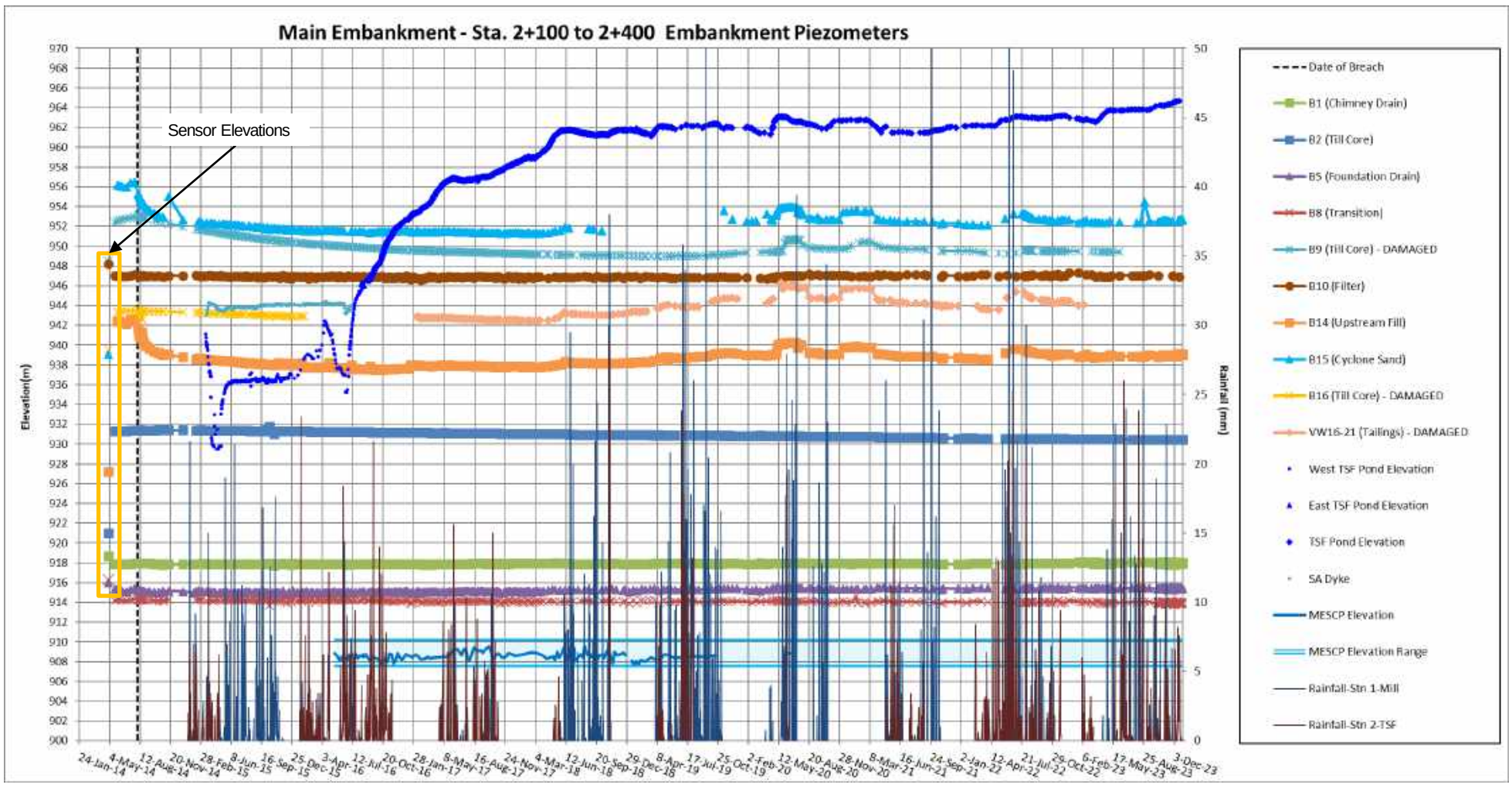
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A17**

IF THIS MEASURE MEASURES NOT AS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm



NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
   - November 2016 to April 2017
   - November 2017 to April 2018
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   - June 10, 2020 to August 11, 2020
   - August 17, 2020 to September 27, 2020

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

wsp

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

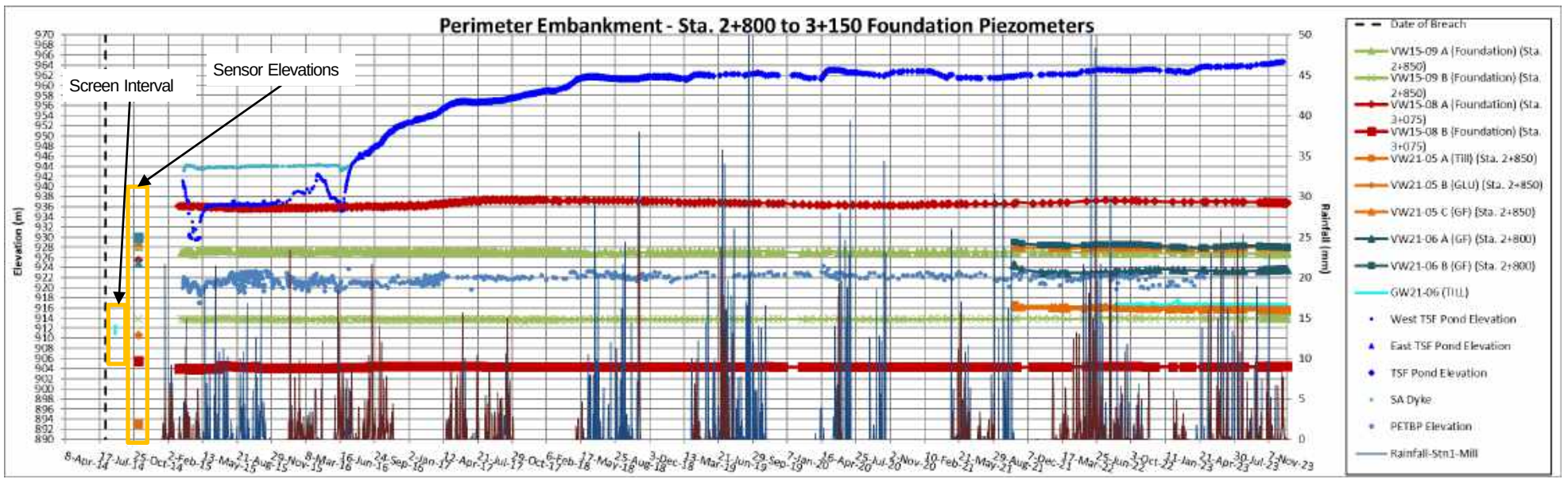
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

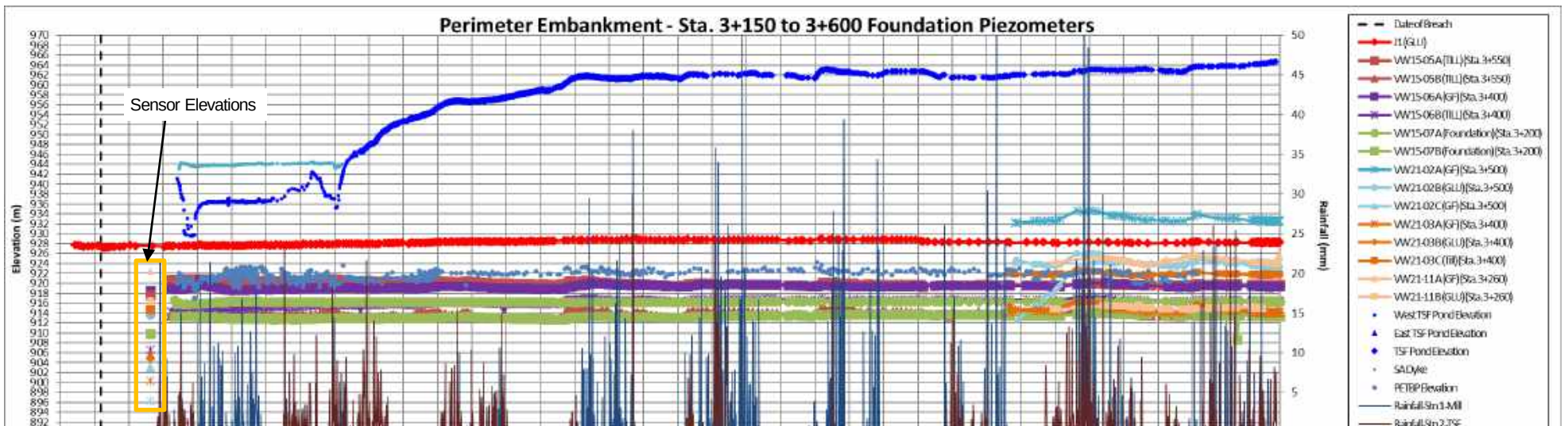
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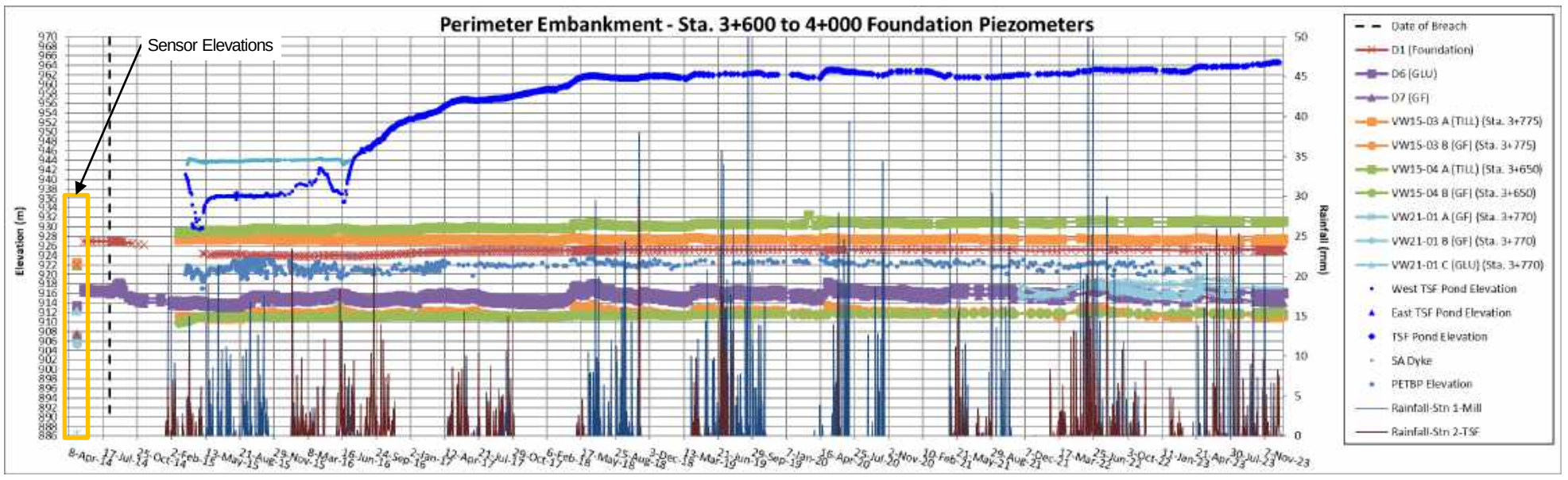
VIBRATING WIRE PIEZOMETERS
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm







NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
   - November 2016 to April 2017
   - November 2017 to April 2018
   - November 2018 to April 2019
   - August 2019 to April 2020
   - November 2020 to April 2021
   - November 2021 to May 2022
   - November 2022 to April 2023
3. TSF rainfall gauge broken from:
   - May 3, 2019 to May 22, 2019
   - June 1, 2019 to June 25, 2019
   - June 10, 2020 to August 11, 2020
   - August 17, 2020 to September 27, 2020

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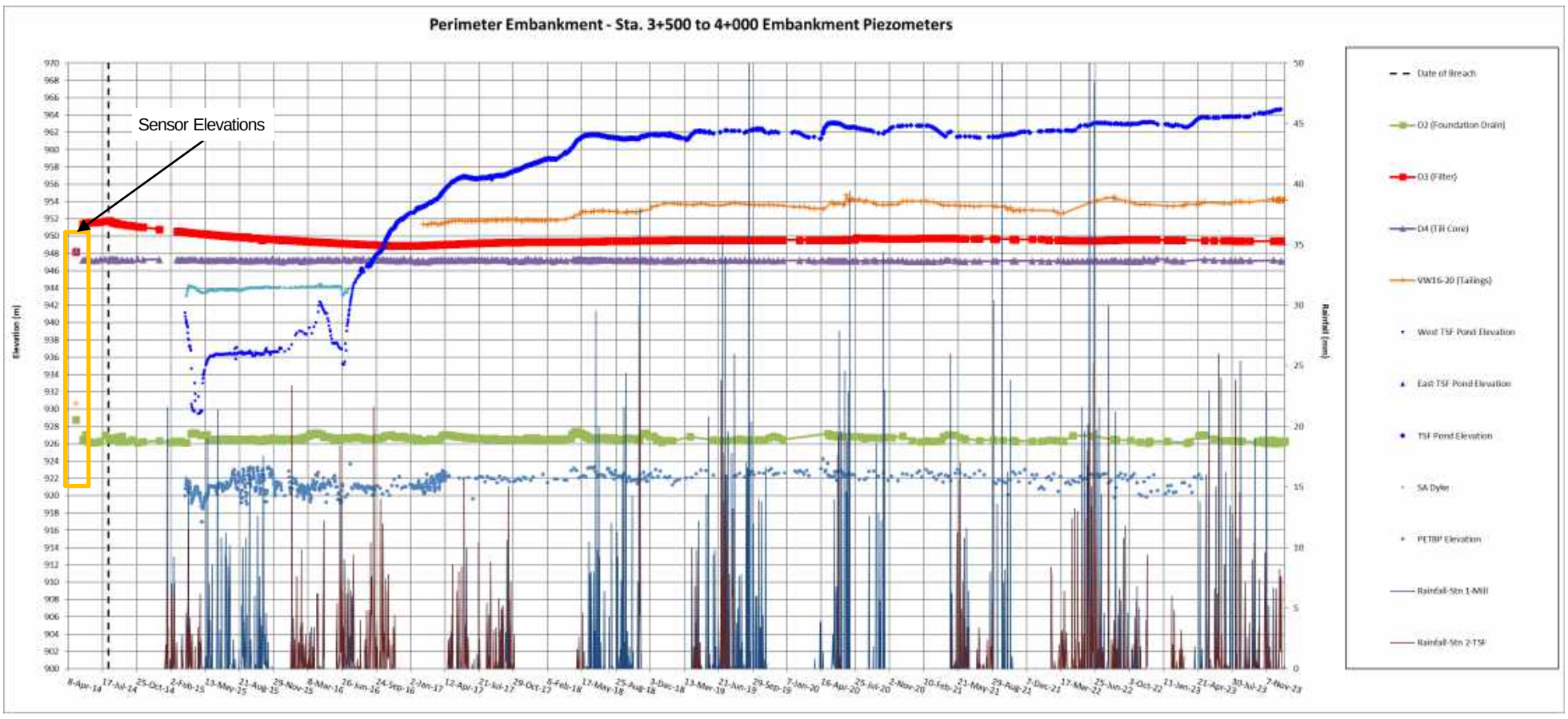
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

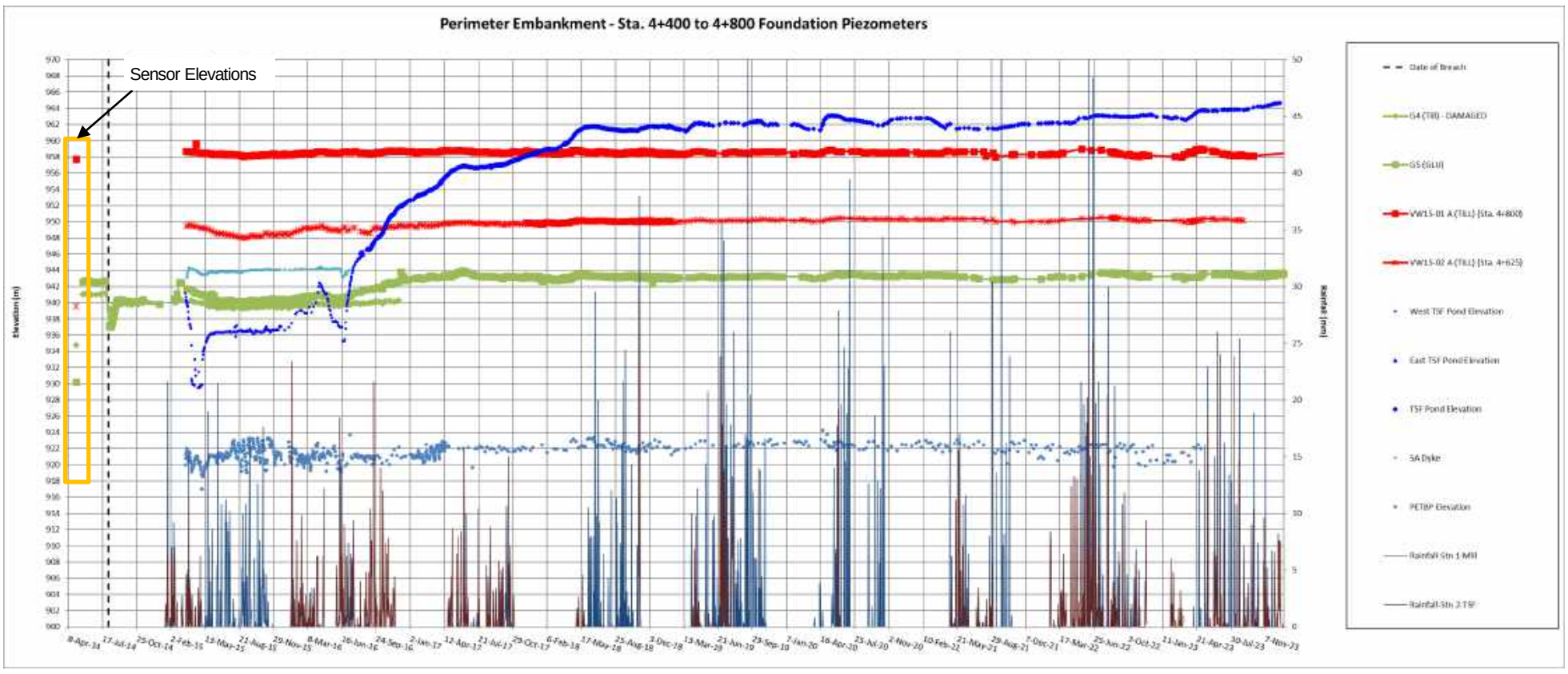
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A19**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET HAS BEEN MODIFIED FROM ANSI B
23 mm





NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
   - November 2016 to April 2017
   - November 2017 to April 2018
   - November 2018 to April 2019
   - August 2019 to April 2020
   - November 2020 to April 2021
   - November 2021 to May 2022
   - November 2022 to April 2023
3. TSF rainfall gauge broken from:
   - May 3, 2019 to May 22, 2019
   - June 1, 2019 to June 25, 2019
   - June 10, 2020 to August 11, 2020
   - August 17, 2020 to September 27, 2020

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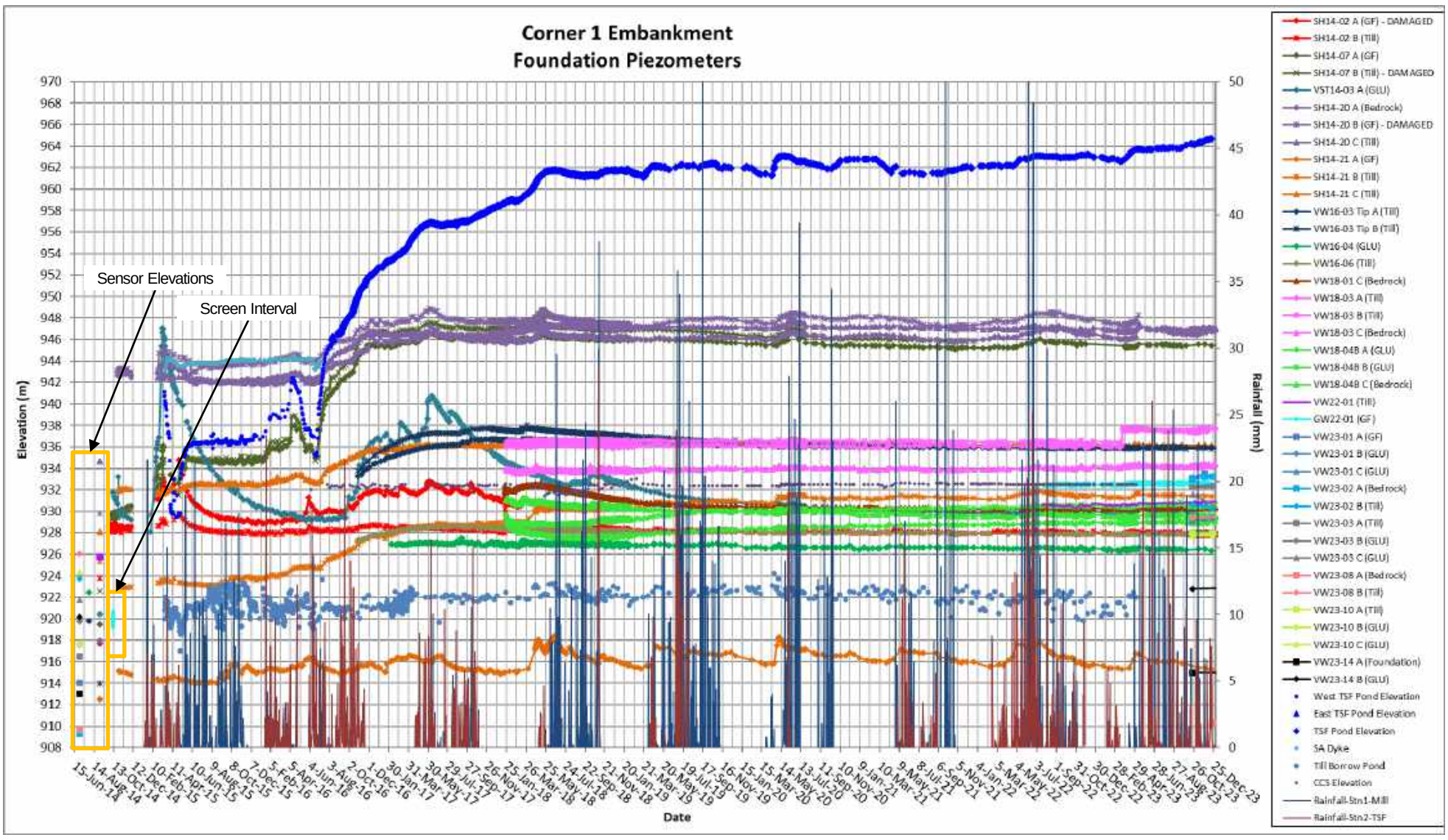
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

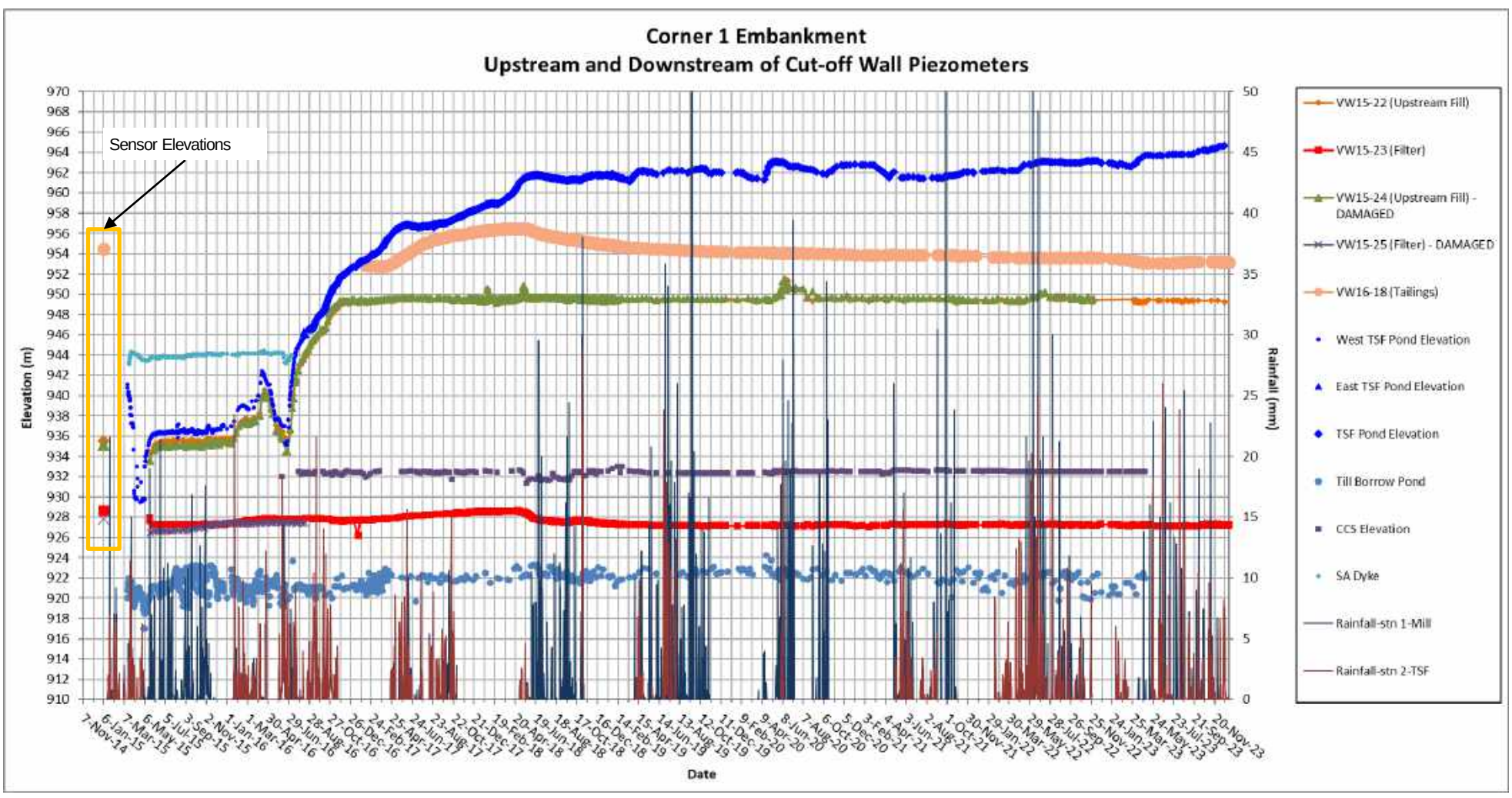
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm





NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
   - November 2016 to April 2017
   - November 2017 to April 2018
   - November 2018 to April 2019
   - August 2019 to April 2020
   - November 2020 to April 2021
   - November 2021 to May 2022
   - November 2022 to April 2023
3. TSF rainfall gauge broken from:
   - May 3, 2019 to May 22, 2019
   - June 1, 2019 to June 25, 2019
   - June 10, 2020 to August 11, 2020
   - August 17, 2020 to September 27, 2020

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

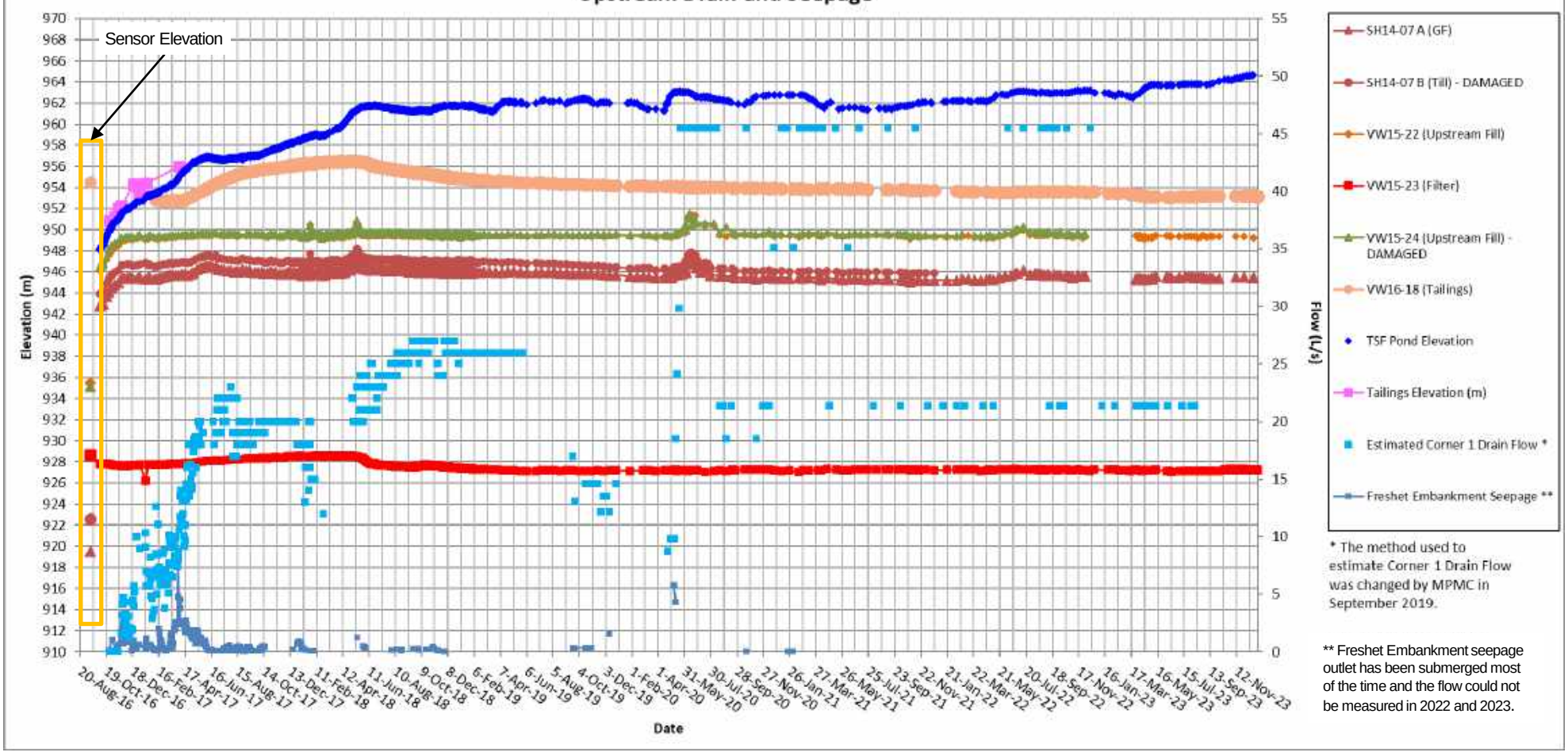
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
VIBRATING WIRE PIEZOMETERS
CORNER 1 EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	A21

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm

Corner 1 Embankment
Upstream Drain and Seepage



* The method used to estimate Corner 1 Drain Flow was changed by MPMC in September 2019.

** Freshet Embankment seepage outlet has been submerged most of the time and the flow could not be measured in 2022 and 2023.

NOTES:

1. Manual rainfall readings are not taken daily at the Mill Weather Station and may represent accumulation of rainfall from multiple days.
2. TSF rainfall gauge removed from:
   - November 2016 to April 2017
   - November 2017 to April 2018
   - November 2018 to April 2019
   - August 2019 to April 2020
   - November 2020 to April 2021
   - November 2021 to May 2022
   - November 2022 to April 2023
4. TSF rainfall gauge broken from:
   - 3 May 2019 to 22 May 2019
   - 1 June 2019 to 25 June 2019
   - 10 June 2020 to 11 August 2020
   - 17 August 2020 to 27 September 2020
5. The Corner 1 upstream drain flow was visually estimated before June 2019. Subsequent drain flow estimates are based on water depth measured in the pipe.

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YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

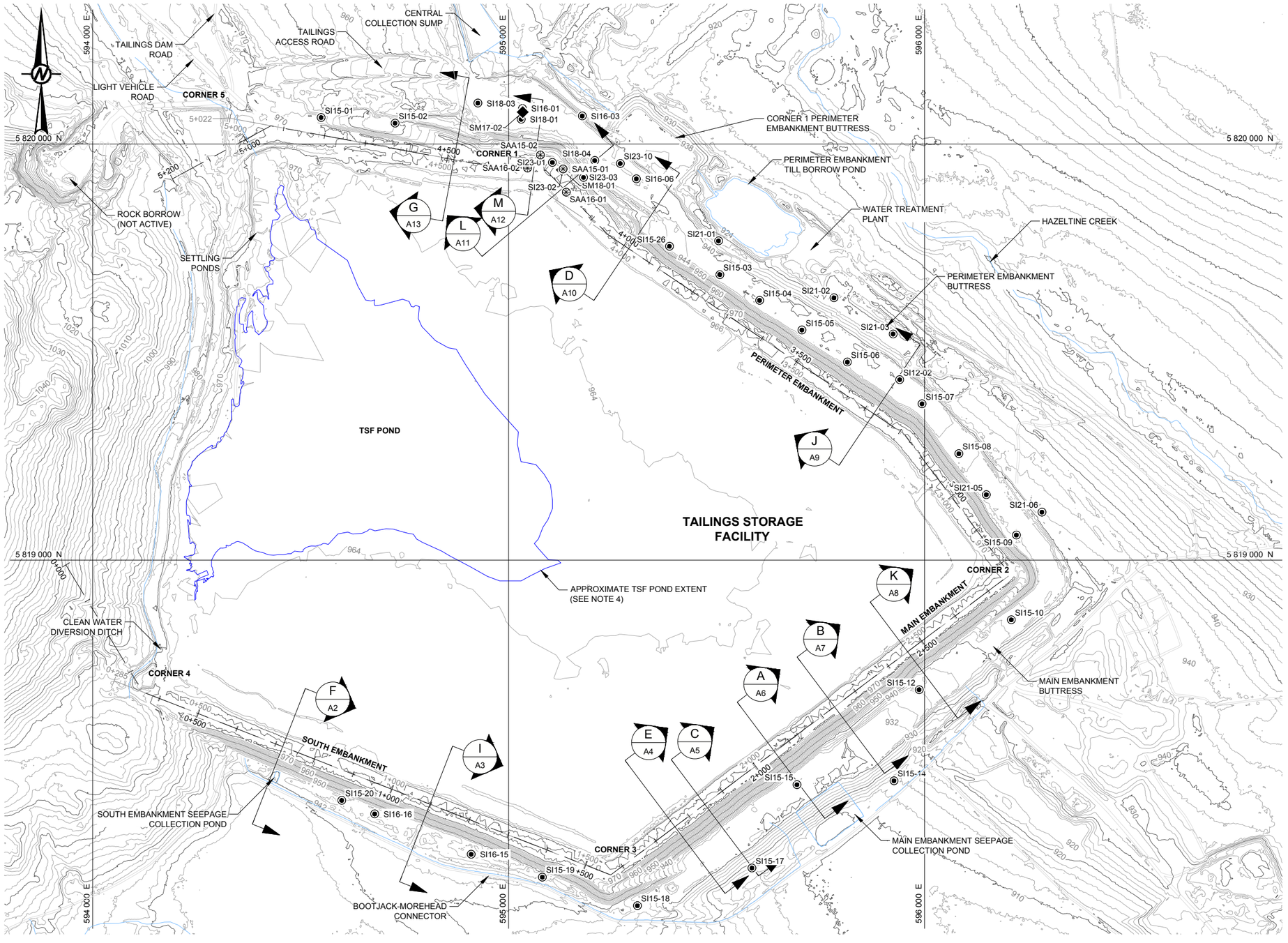
TITLE
UPSTREAM DRAIN AND SEEPAGE
CORNER 1 EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**A22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

APPENDIX B

Slope Inclinometer, Shape Accel Array and Survey Monument Data



LEGEND

- GROUND CONTOURS (SEE REFERENCE 1)
- 4+400 — TAILINGS STORAGE FACILITY (TSF) EMBANKMENT CENTRELINE
- 4+400 — SETOUT LINE - S.O.L. - ORIGINAL ALIGNMENT (SEE REFERENCE 3)
- APPROXIMATE TSF POND (SEE NOTE 4)
- WATERCOURSE OR WATER BODY (SEE REFERENCE 4)
- SITE ACCESS ROADS (SEE REFERENCE 4)
- EXISTING SHAPE ACCEL ARRAY (SAA)
- EXISTING SLOPE INCLINOMETER
- EXISTING SURVEY MONUMENTS

NOTES

1. ALL UNITS IN METRES UNLESS OTHERWISE NOTED.
2. COORDINATES RELATIVE TO UTM, NAD83 AND ELEVATIONS OF MINE SITE REPRESENT GEODETIC DATUM, AND TAILINGS STORAGE FACILITY ARE RELATIVE TO TAILINGS GRID.
3. CONTOUR INTERVAL SHOWN AT 10 m MAJOR AND 2 m MINOR.
4. POND EXTENT DIGITIZED FROM AERIAL IMAGERY, SEE REFERENCE 2.

REFERENCES

1. 2023 TOPOGRAPHY PROVIDED BY MPMC AS 0.1 m CONTOUR DATA, SURVEYED: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Lidar Contor 0.1.dxf" .
2. AERIAL IMAGERY PROVIDED BY MPMC, TAKEN: 30 OCTOBER 2023; RECEIVED: 01 FEBRUARY 2024; FILE NAME: 231030-TSF Grid.jgw AND 231030-TSF Grid.jpg "
3. S.O.L - ORIGINAL ALIGNMENT PROVIDED BY BGC ENGINEERING INC., DRAWING No. 01, DRAWING TITLE, "SI PLANNING PLAN MAP", PROJECT No. P14178, FILE NAME: "ACAD-01.dwg", DATED: SEPTEMBER 2014.
4. SITE FEATURES PROVIDED BY MPMC. FILE NAME: "MtPolley2013-Pln.dwg", SURVEYED: 2013, RECEIVED: 5 SEPTEMBER 2014.

NOT FOR CONSTRUCTION

0 250 500

1:10,000 METRES

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YYYY-MM-DD	2024-03-28
DESIGNED	Y. JANI
PREPARED	A. FARLOW / J. HOPSON
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

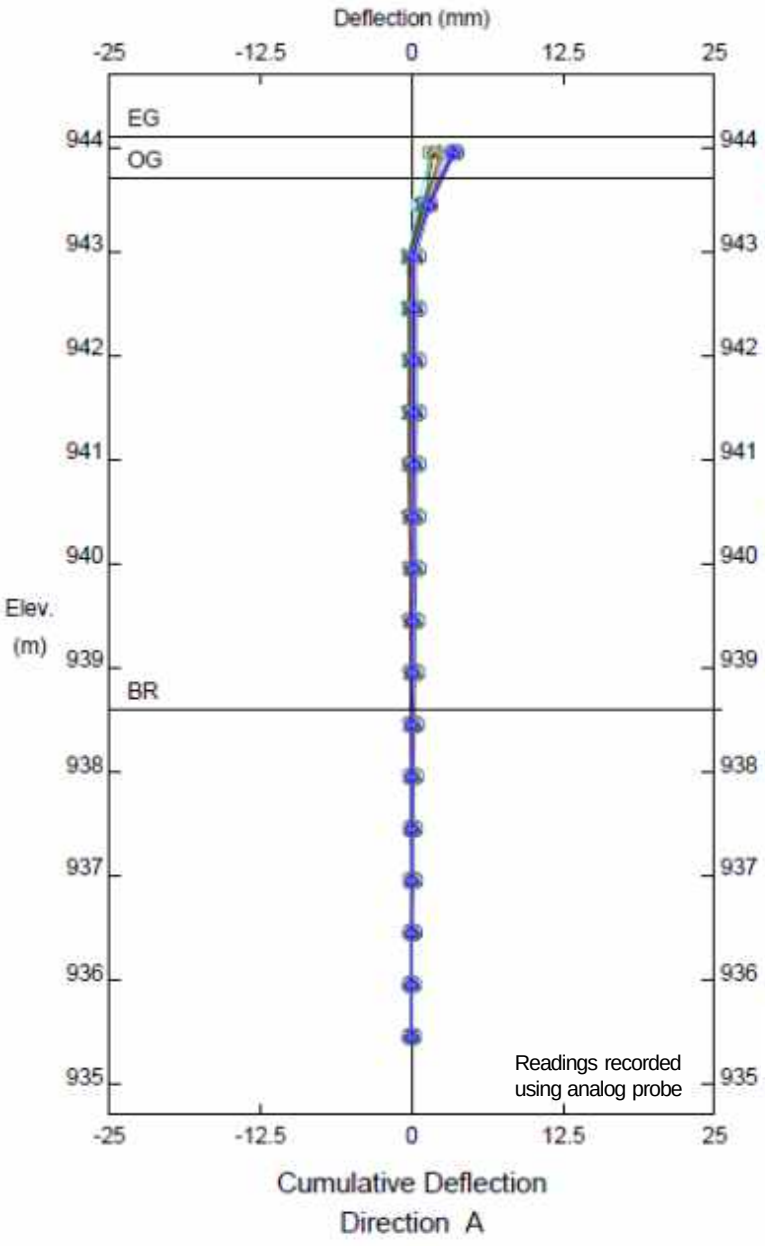
TAILINGS STORAGE FACILITY
SLOPE INCLINOMETER LOCATIONS

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
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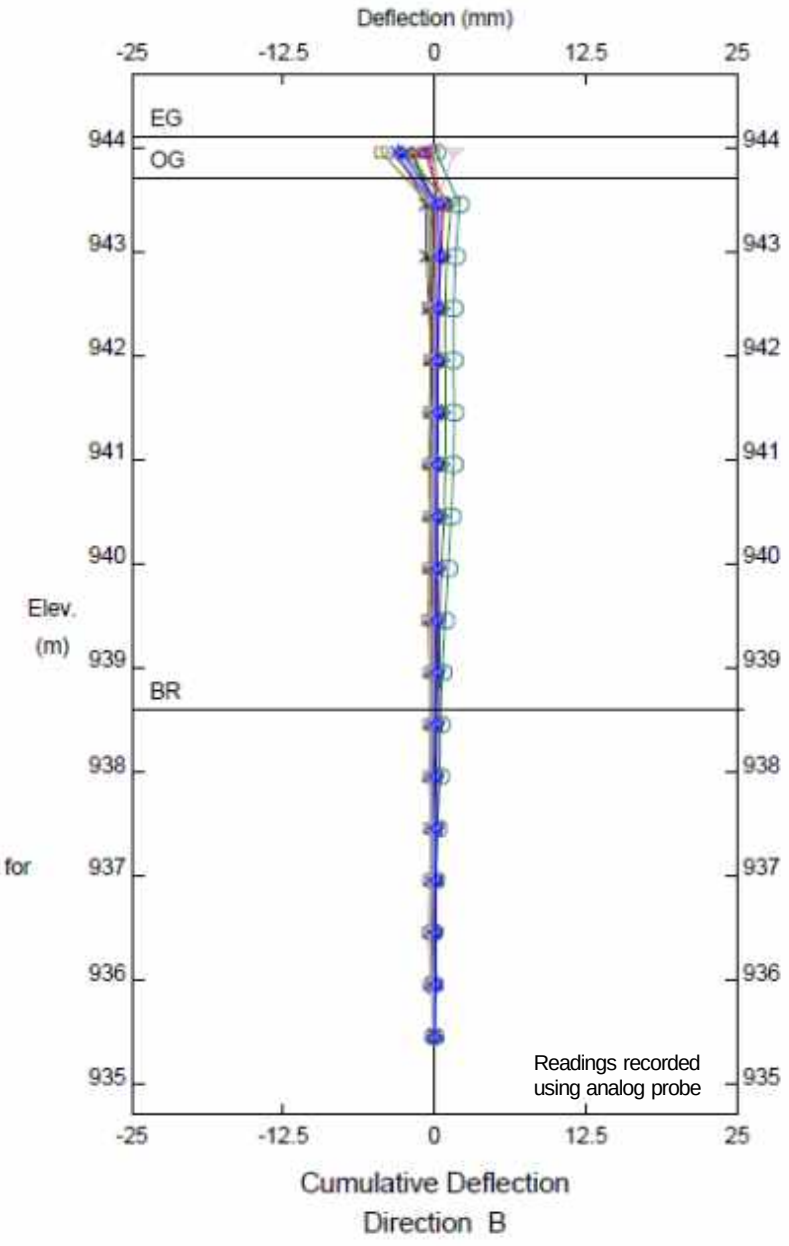
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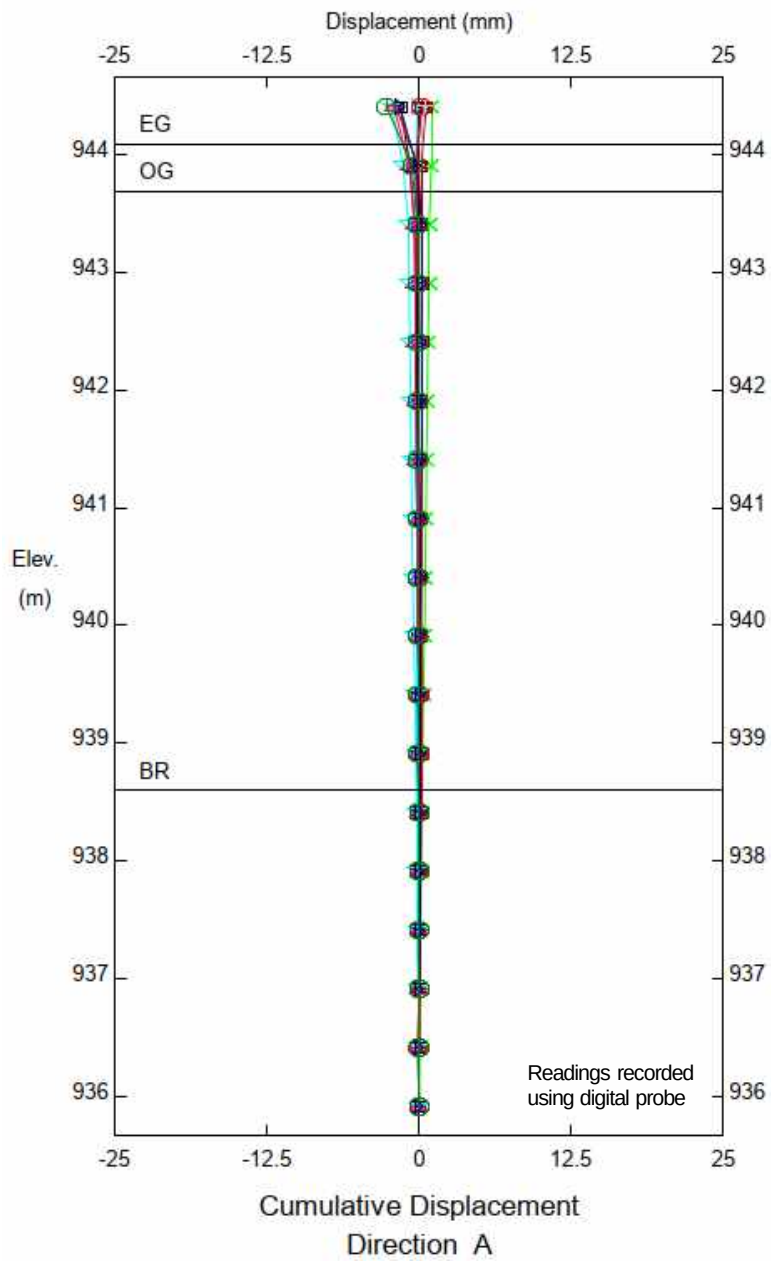
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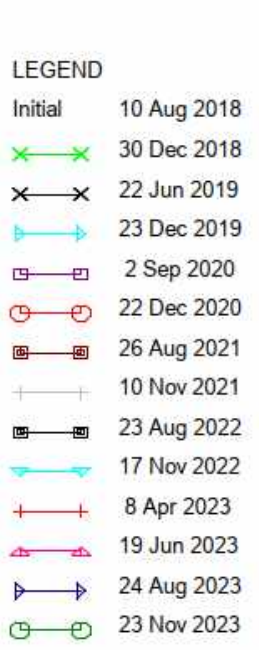
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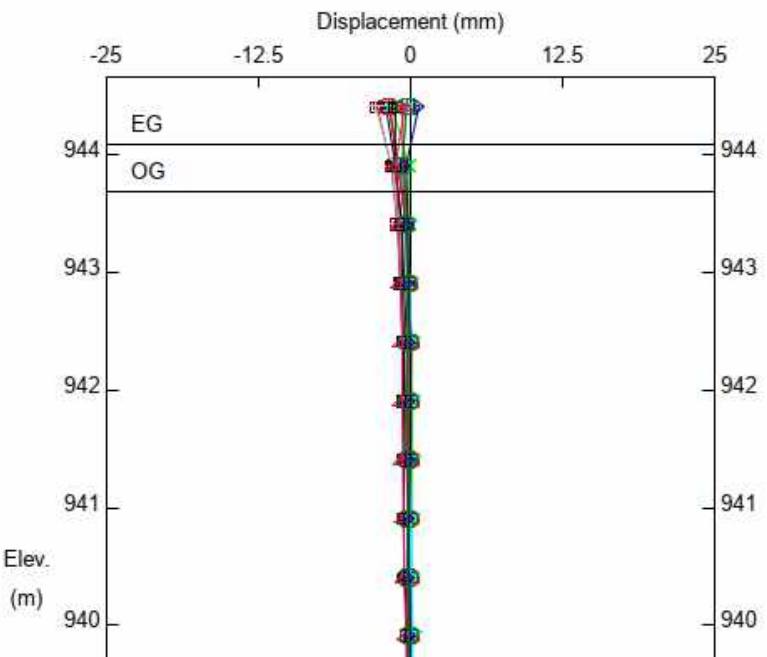












Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

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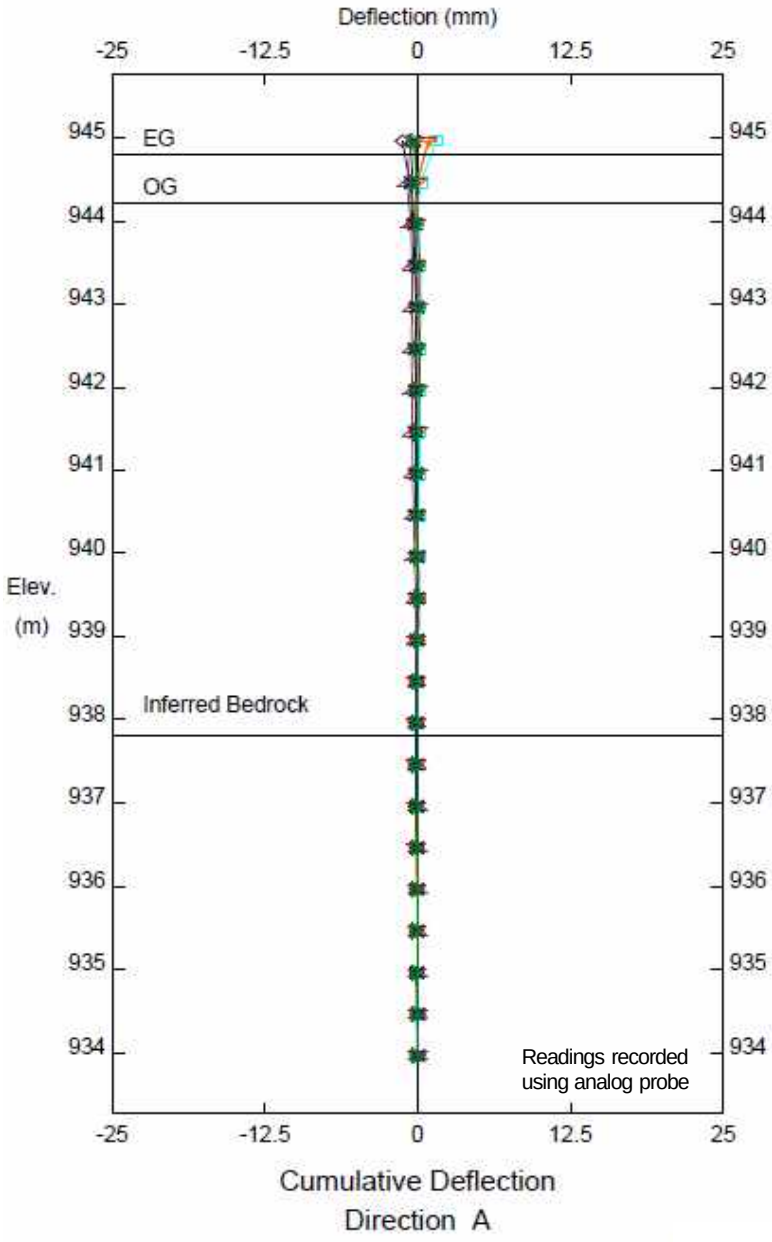
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

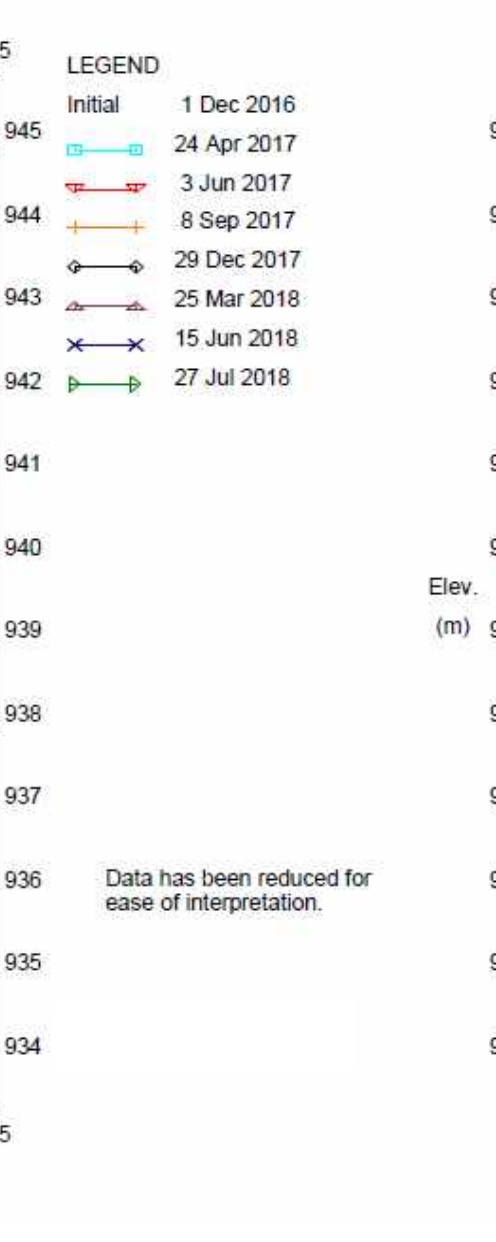
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MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

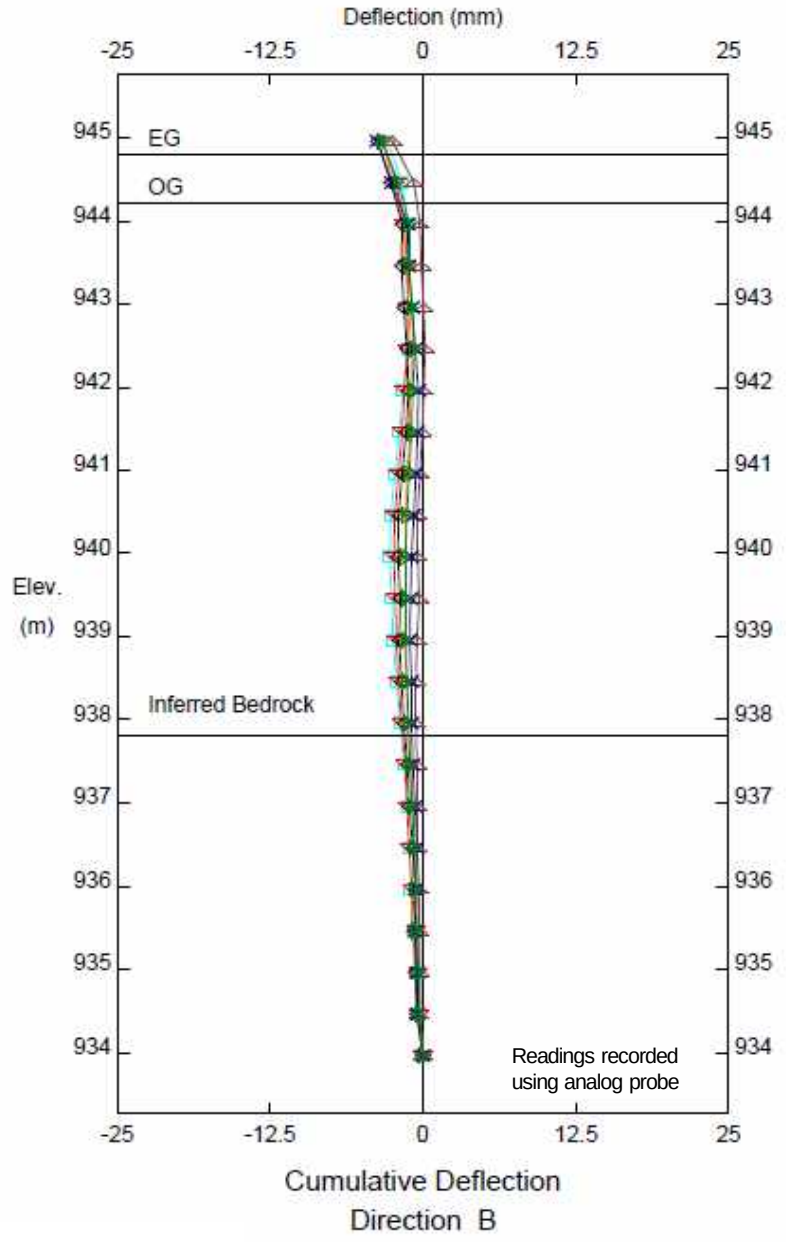
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SOUTH EMBANKMENT

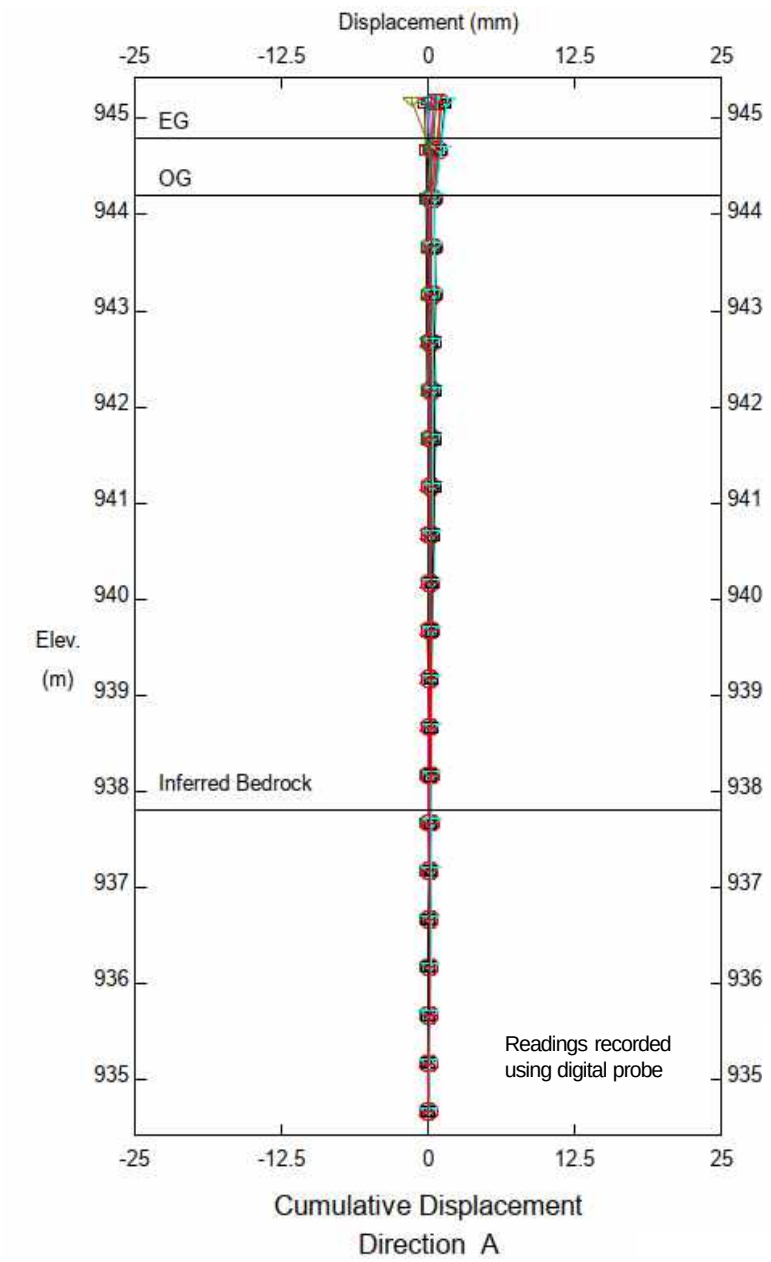
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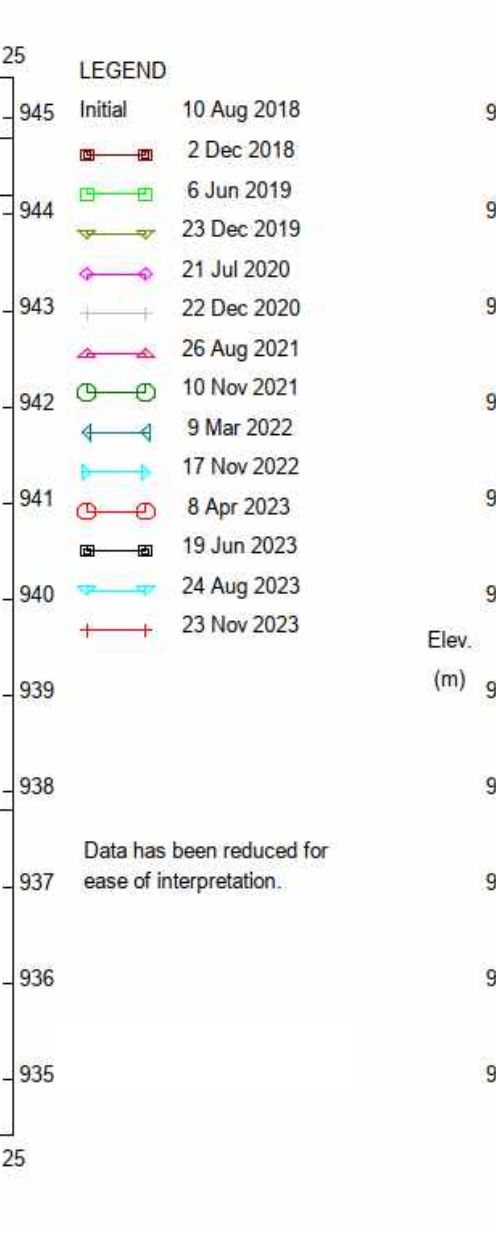
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25 mm

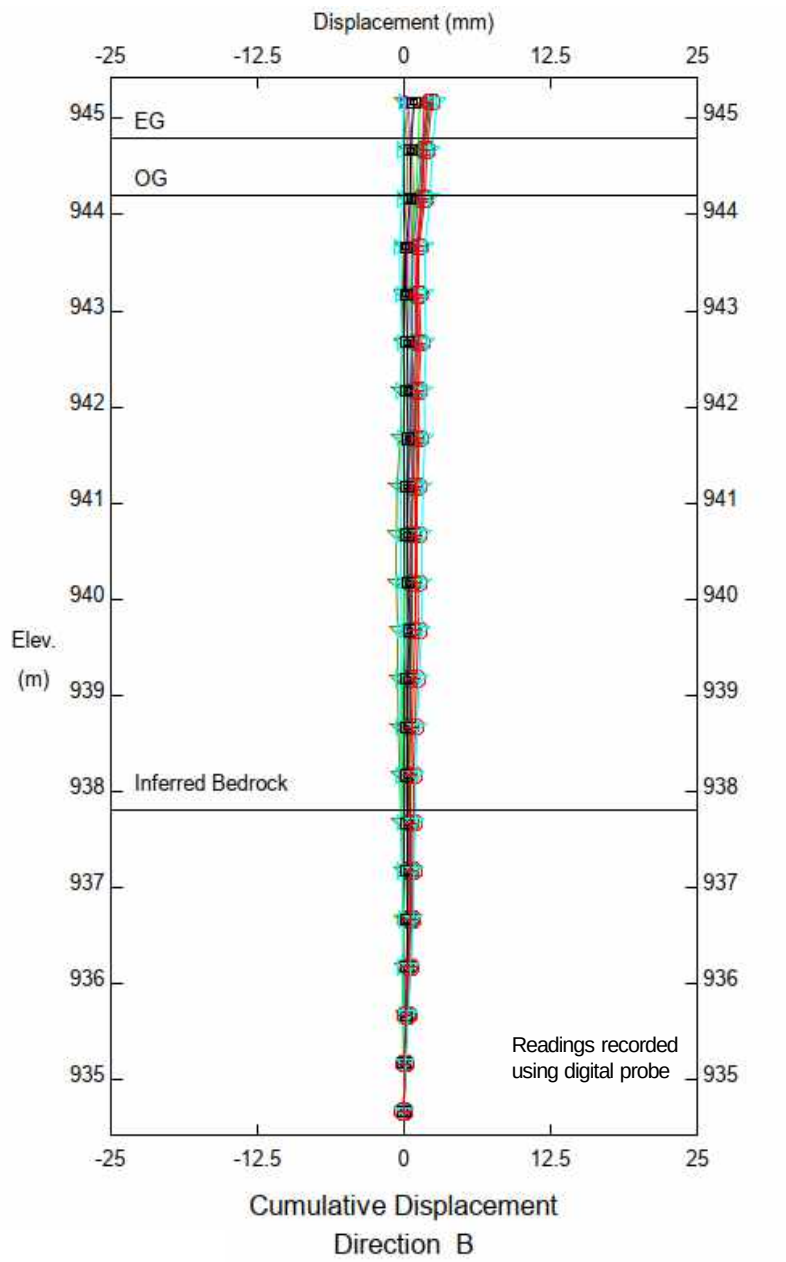












Note:
EG: Existing Ground
OG: Original Ground

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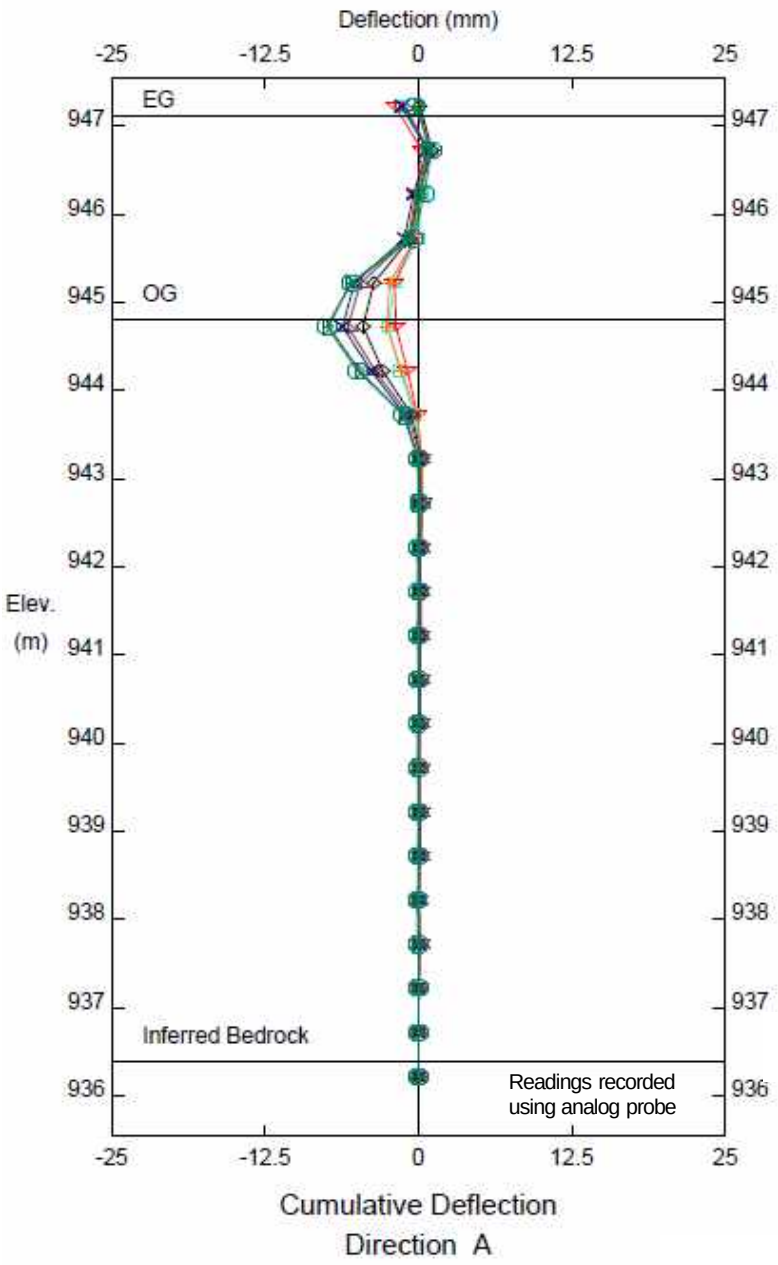
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

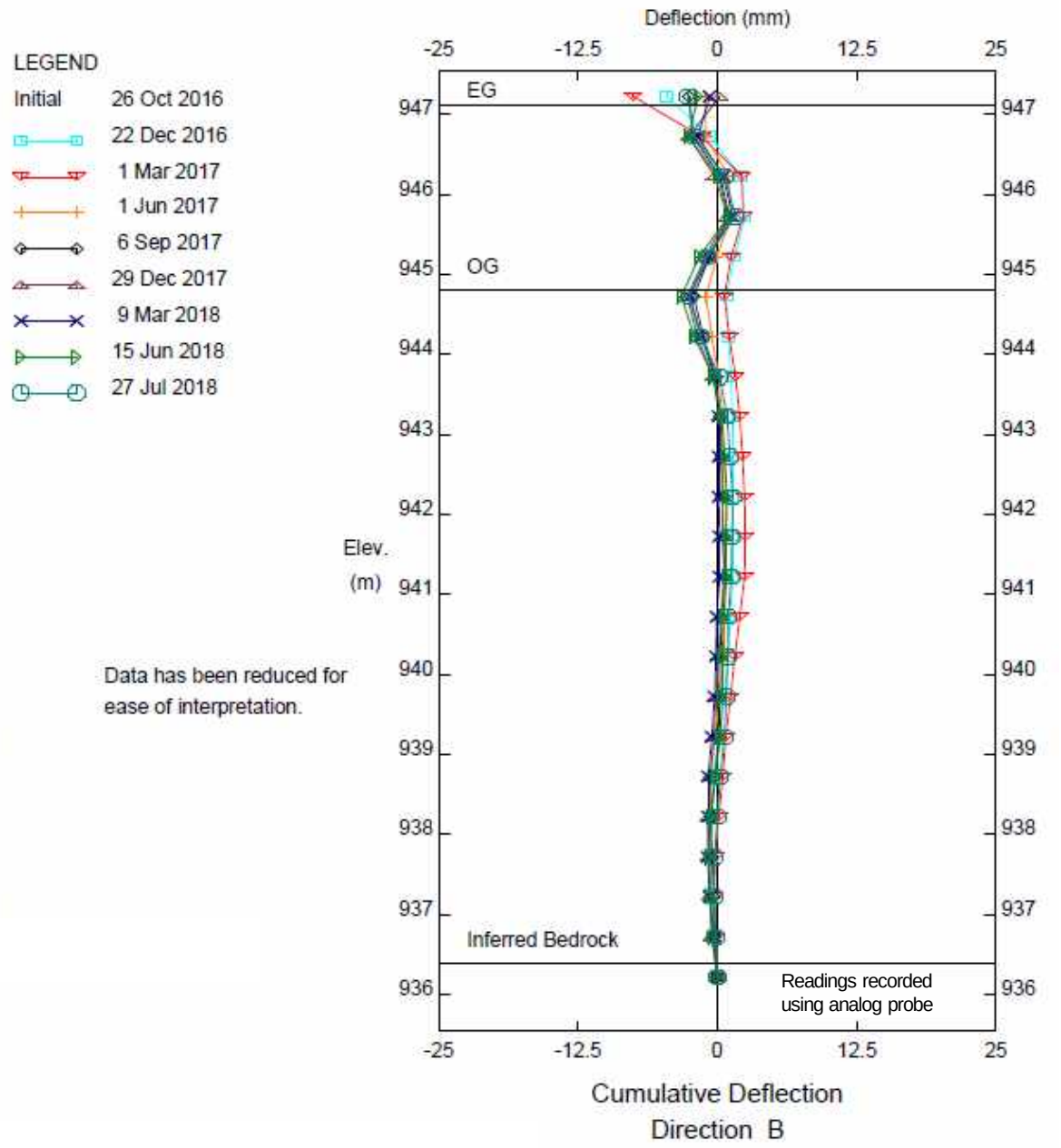
TITLE
SLOPE INCLINOMETER SI16-16
SOUTH EMBANKMENT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm

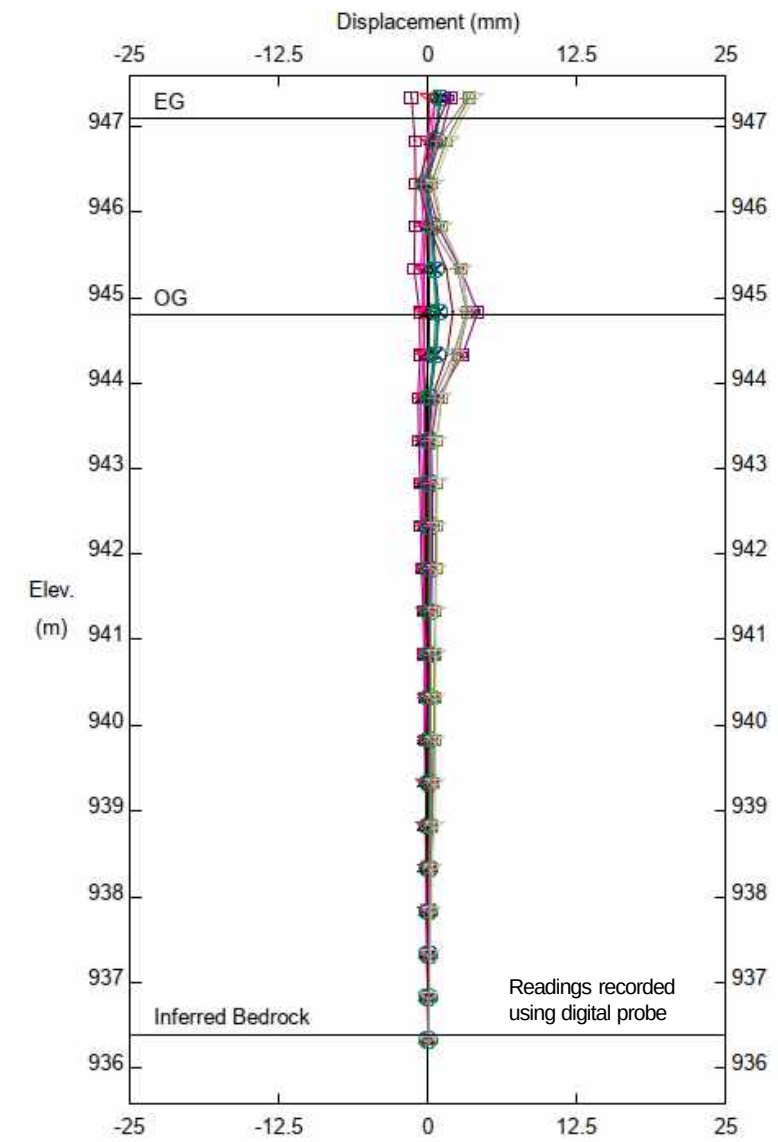


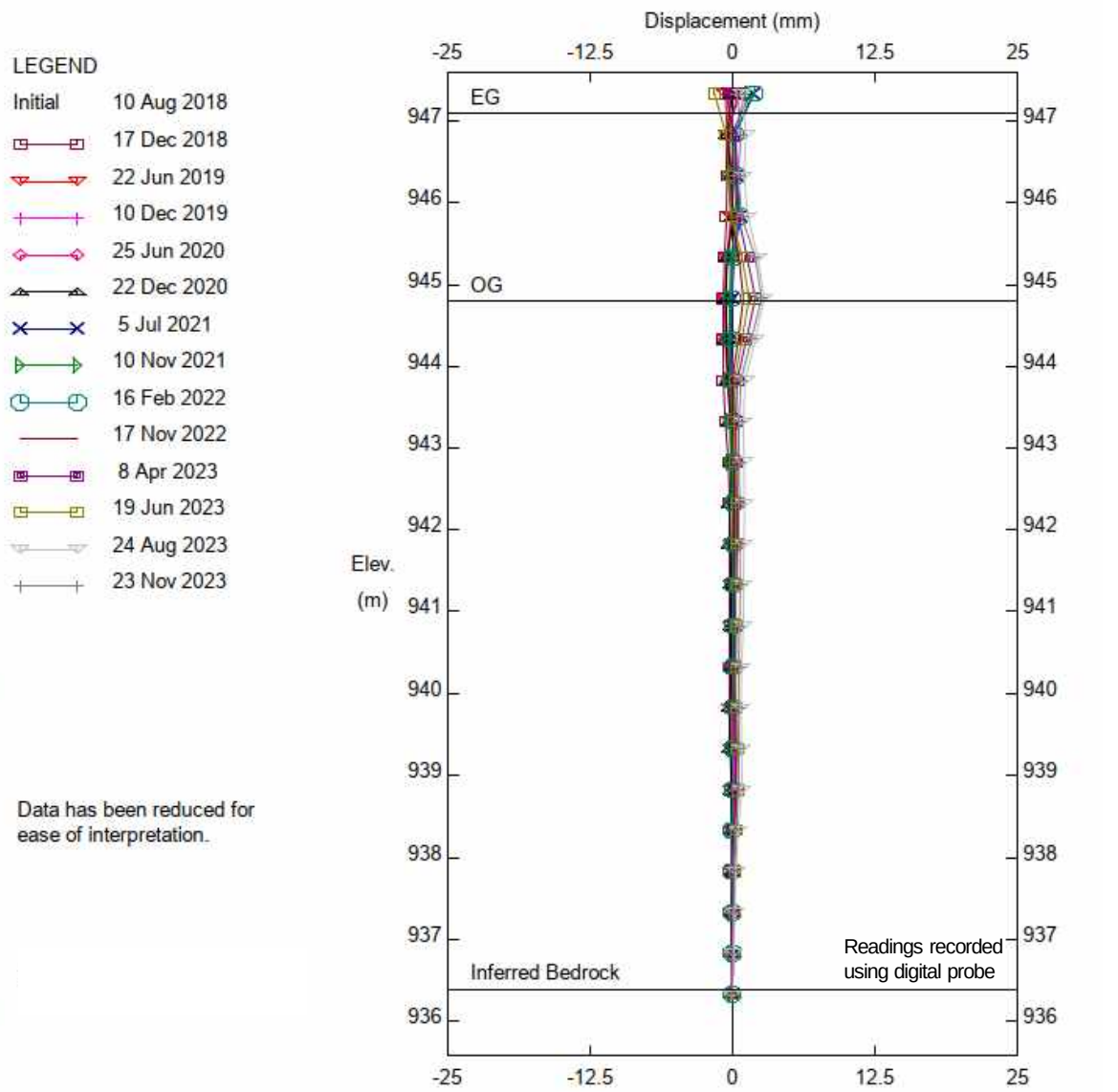


Data has been reduced for ease of interpretation.

Cumulative Deflection
Direction A

Cumulative Deflection
Direction B





Data has been reduced for ease of interpretation.

Cumulative Displacement
Direction A

Cumulative Displacement
Direction B

Note:
EG: Existing Ground
OG: Original Ground

CLIENT
MOUNT POLLEY MINING CORPORATION

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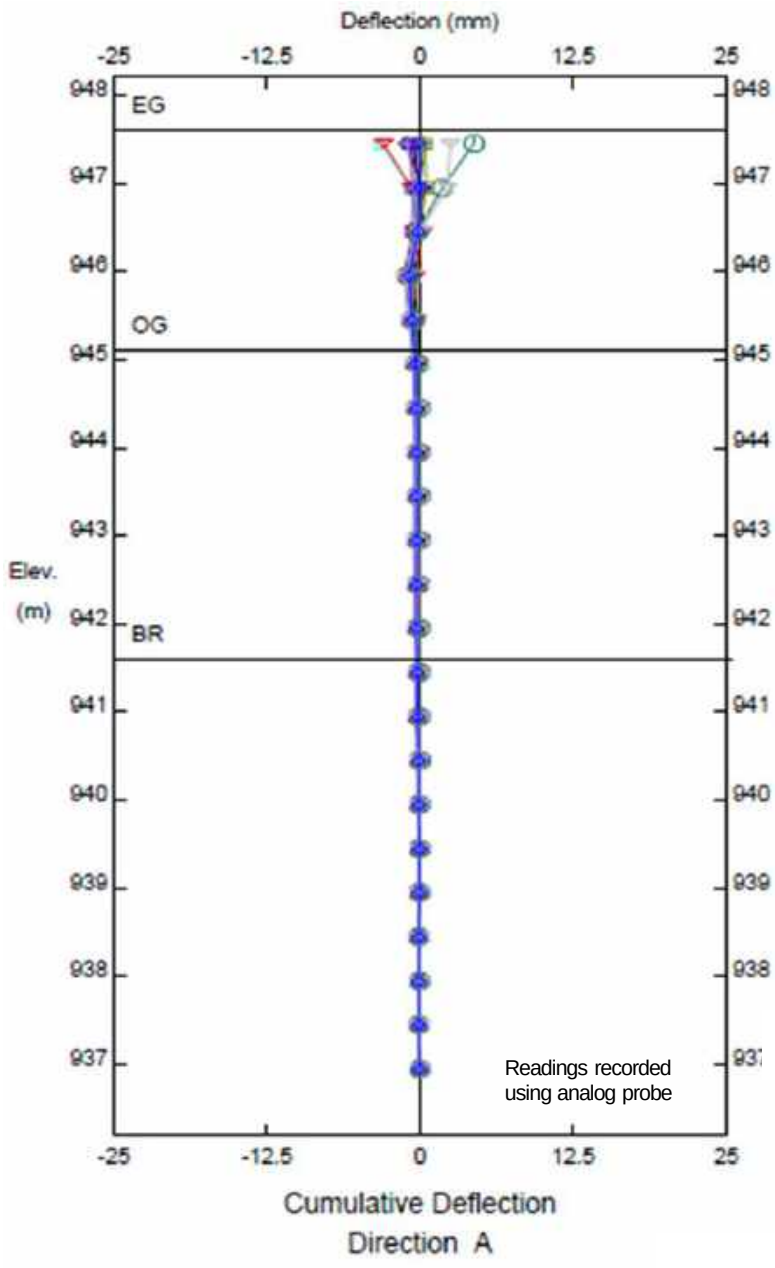
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

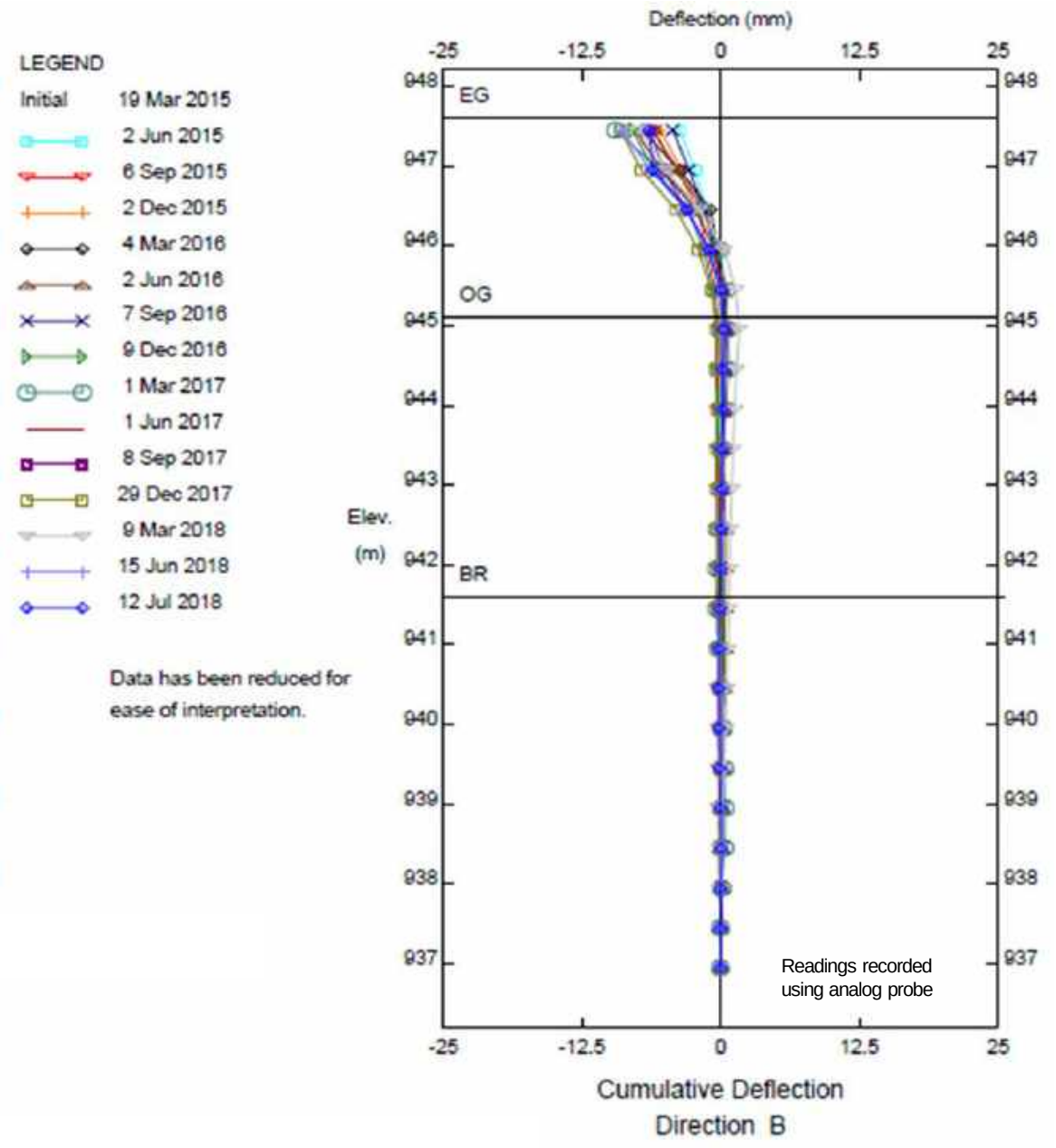
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MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
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SOUTH EMBANKMENT

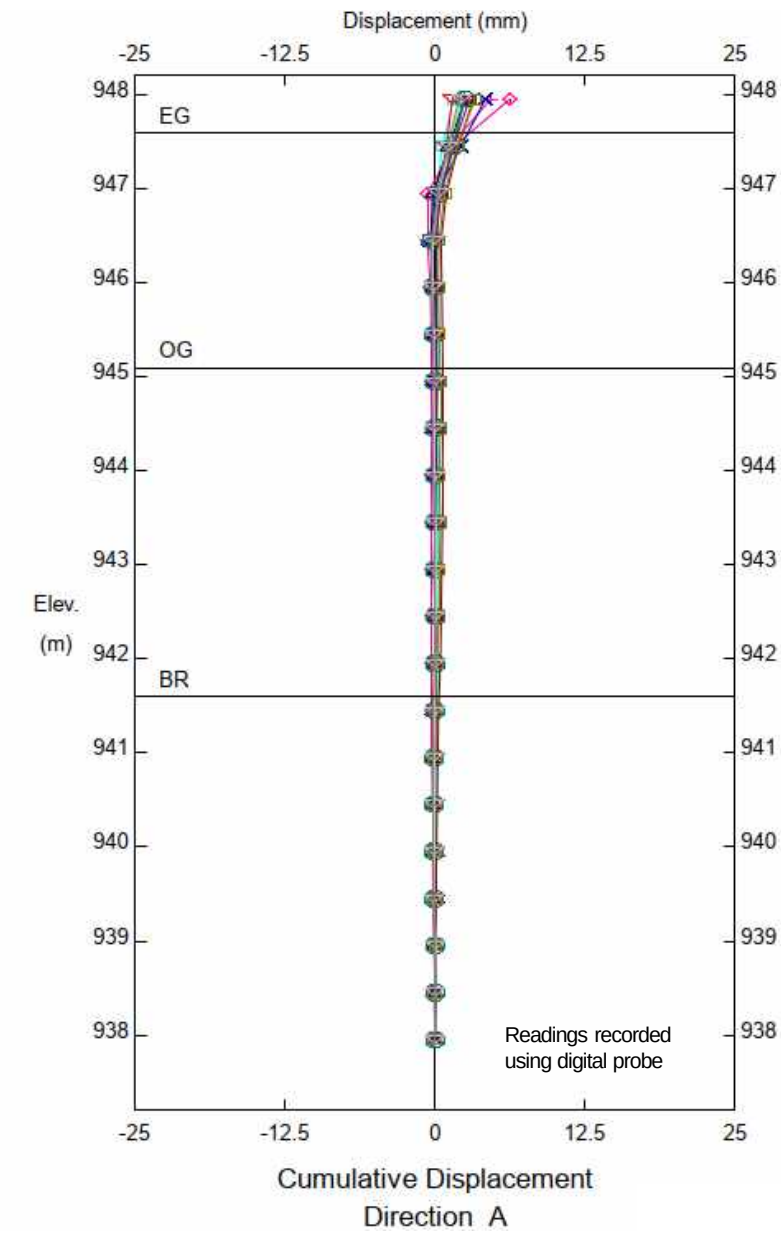
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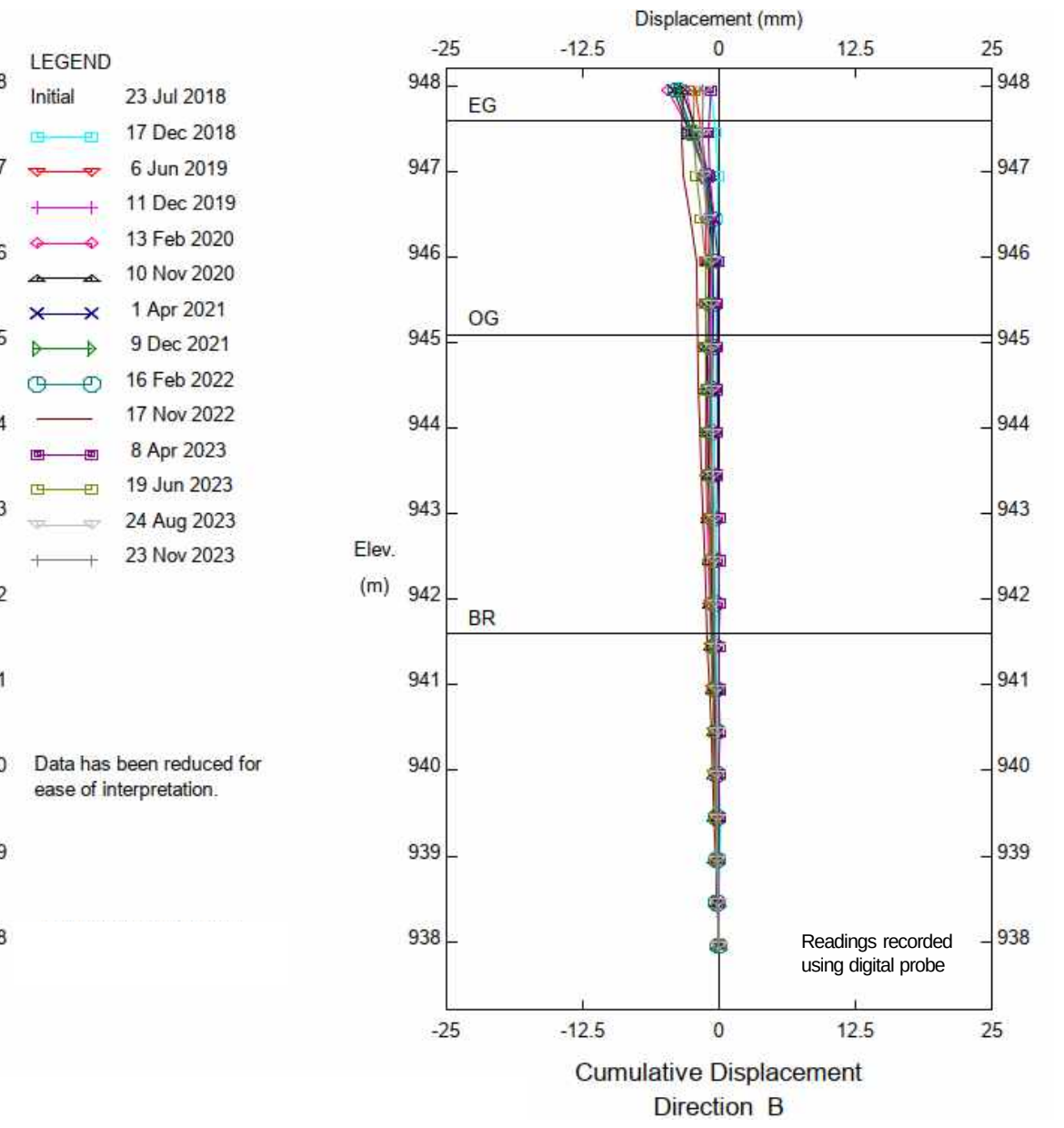
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm





Data has been reduced for ease of interpretation.





Data has been reduced for ease of interpretation.

Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

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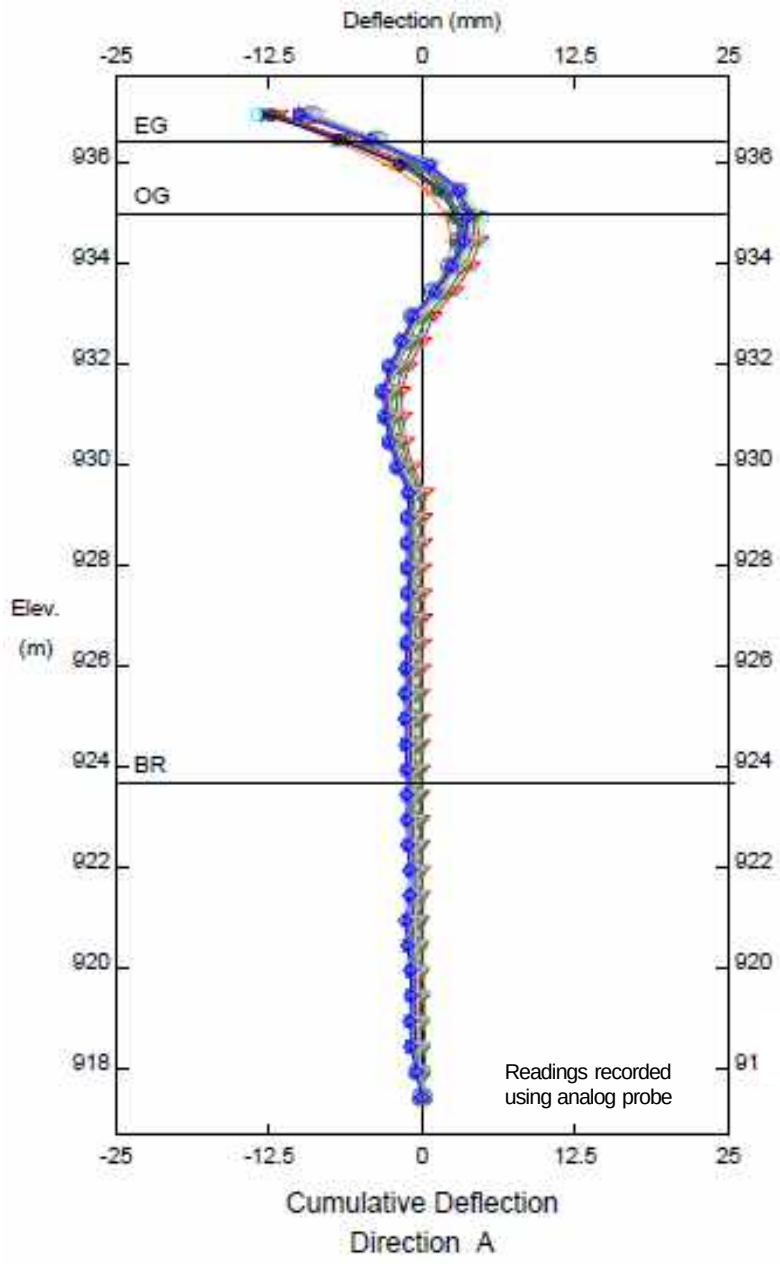
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

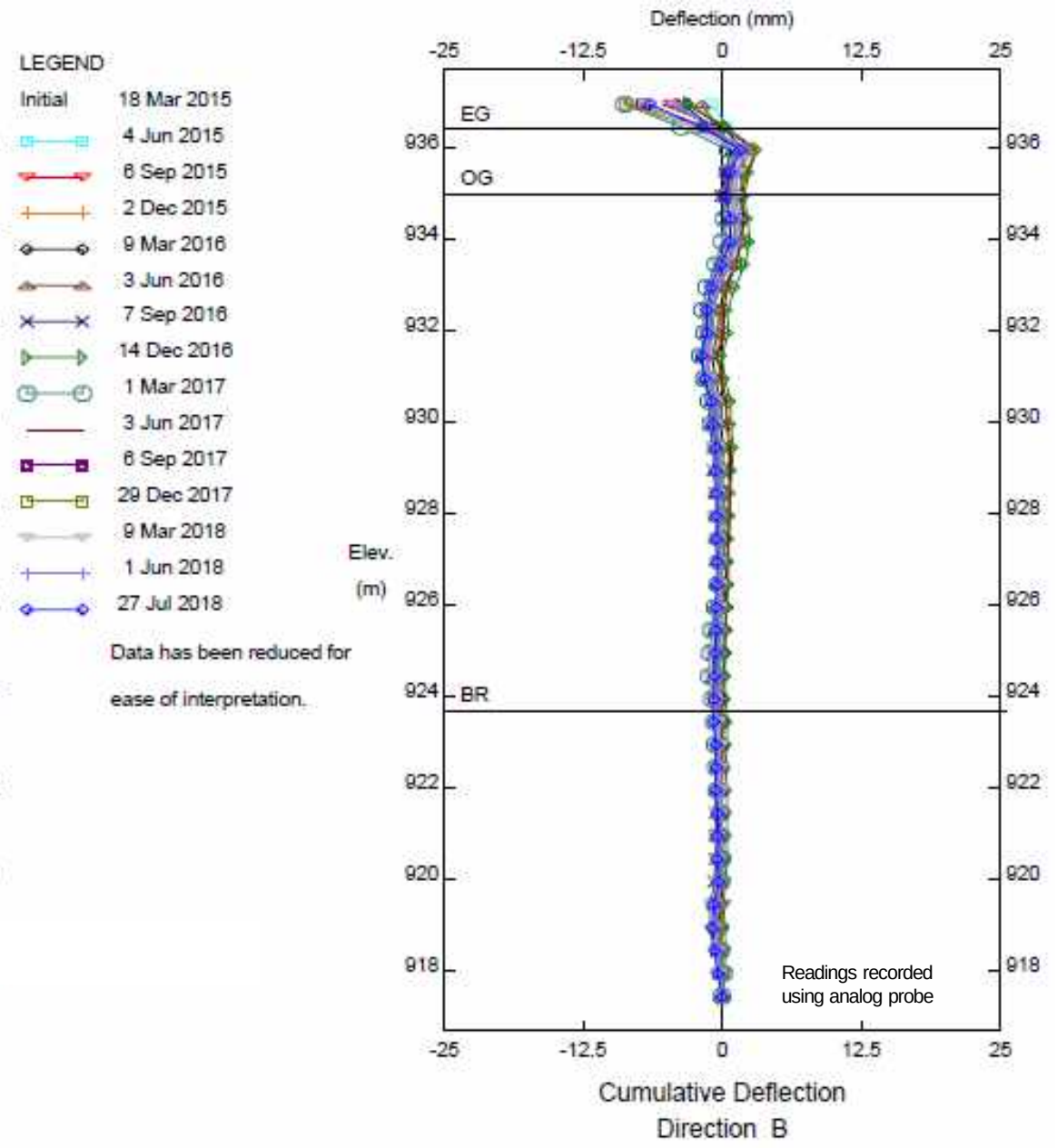
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MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

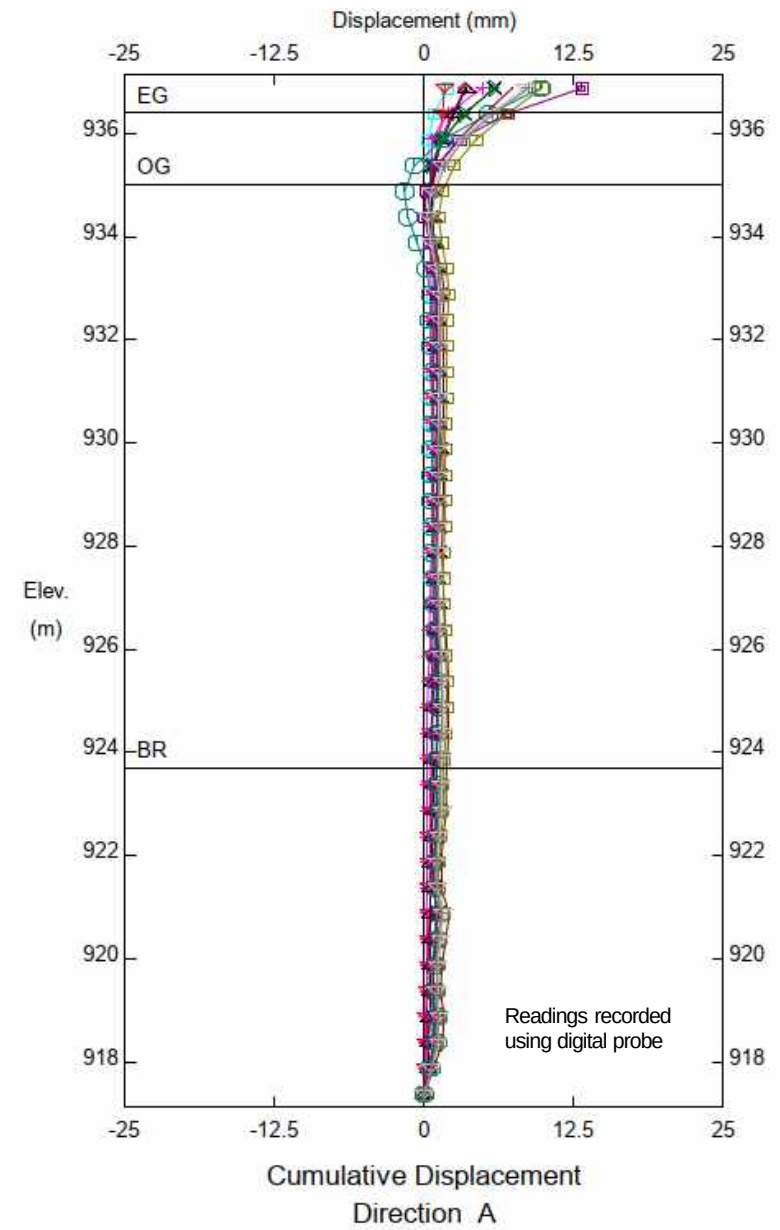
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SLOPE INCLINOMETER SI15-19
SOUTH EMBANKMENT

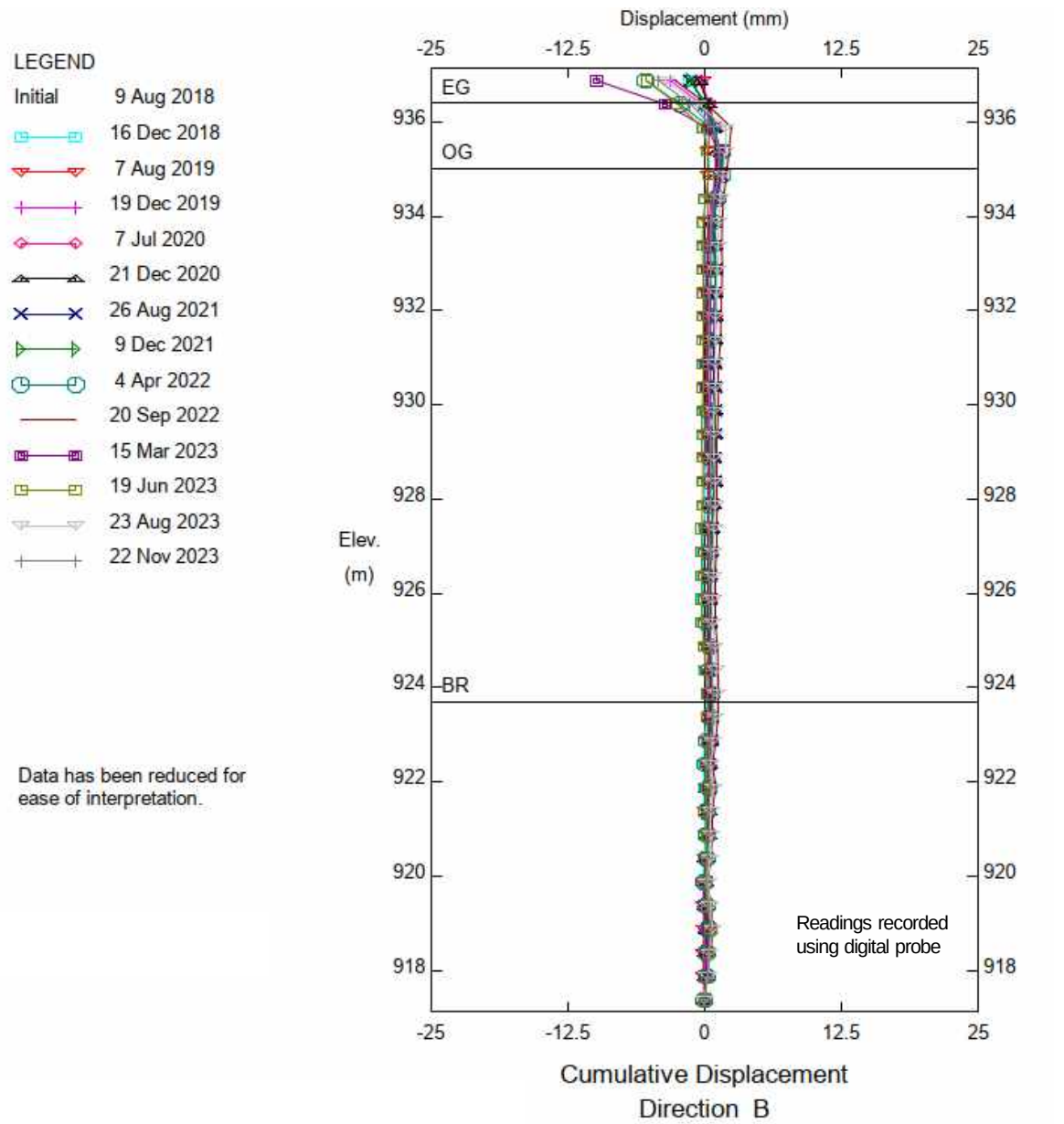
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm









Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

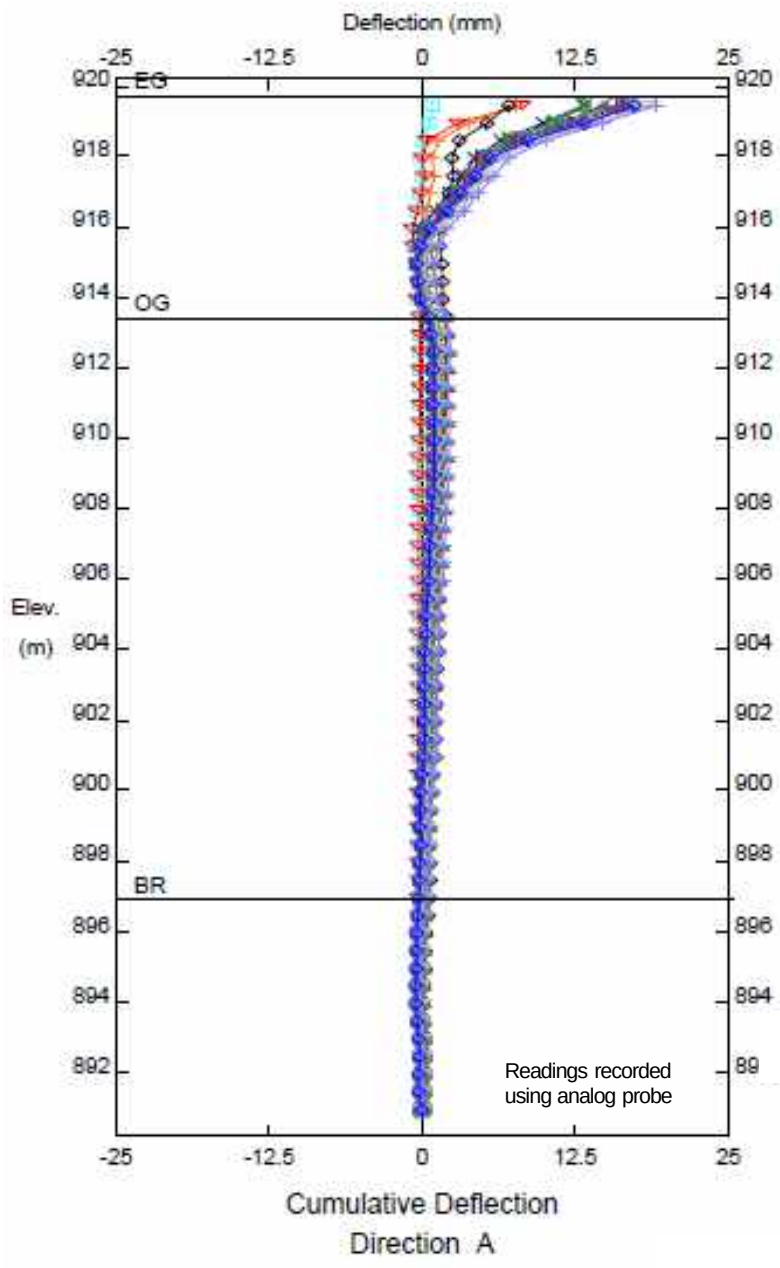
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

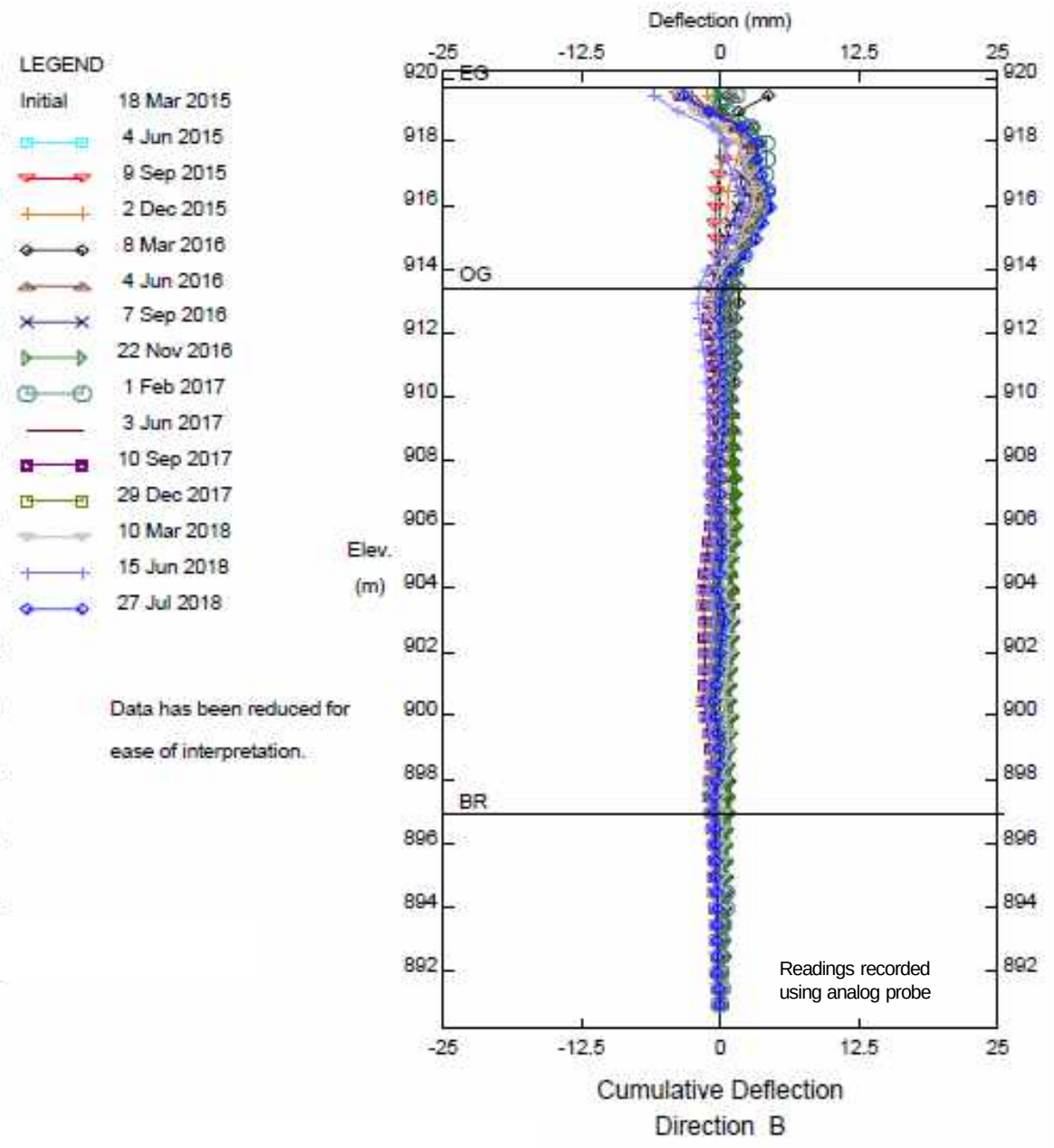
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

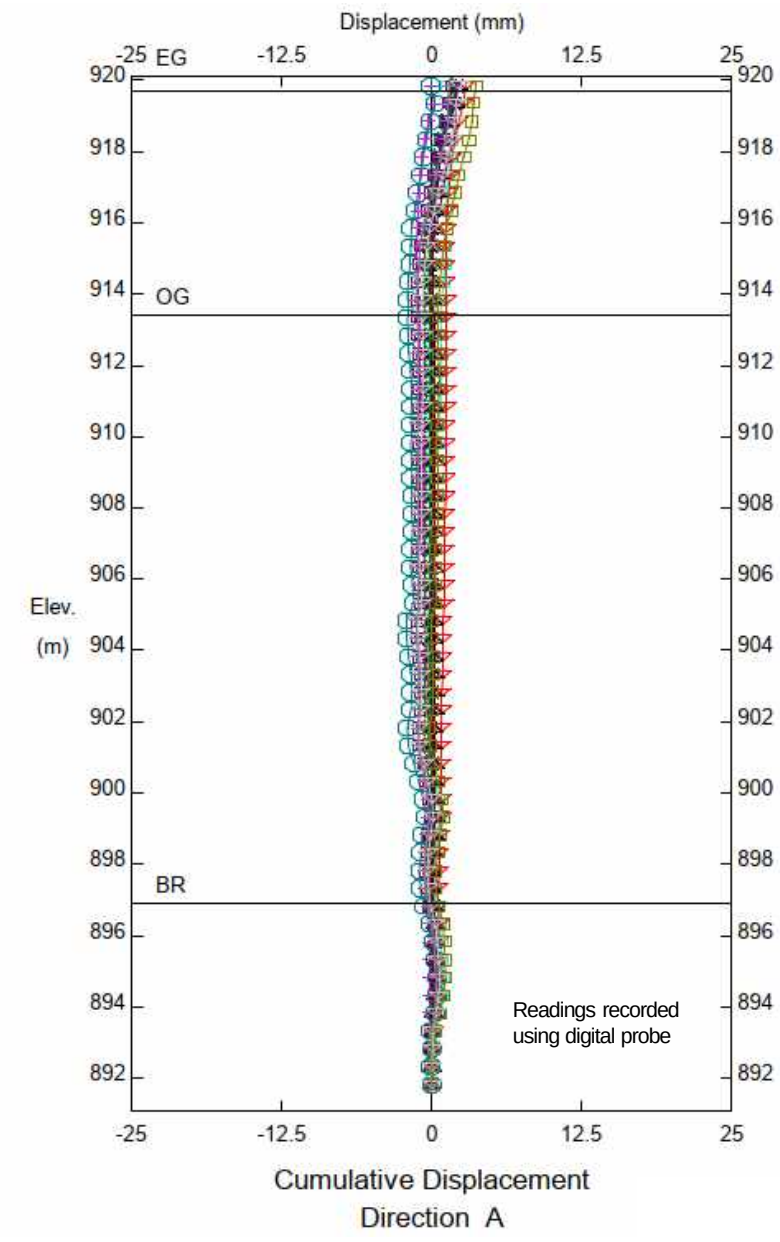
TITLE
SLOPE INCLINOMETER SI15-18
MAIN EMBANKMENT

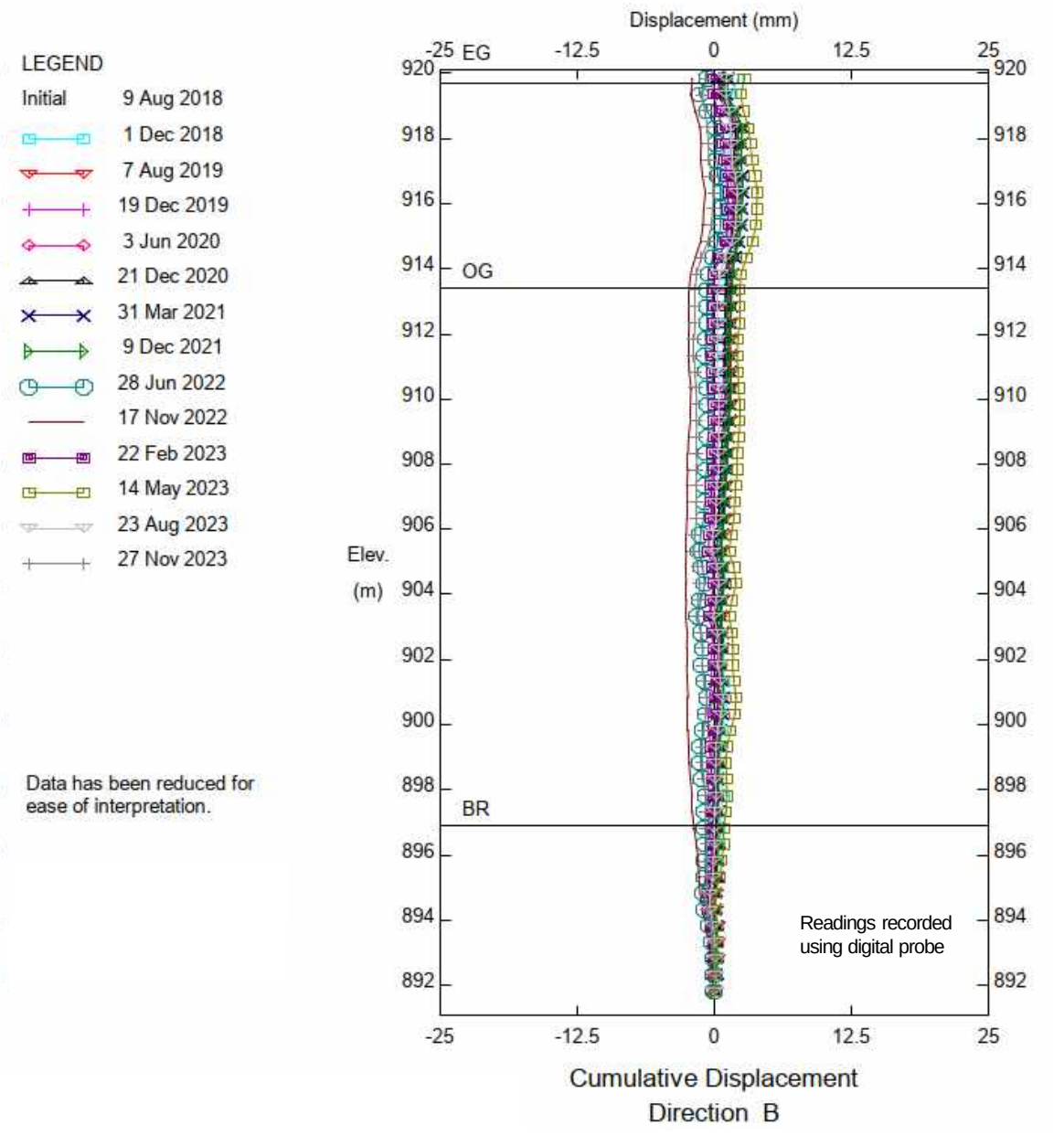
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm









Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

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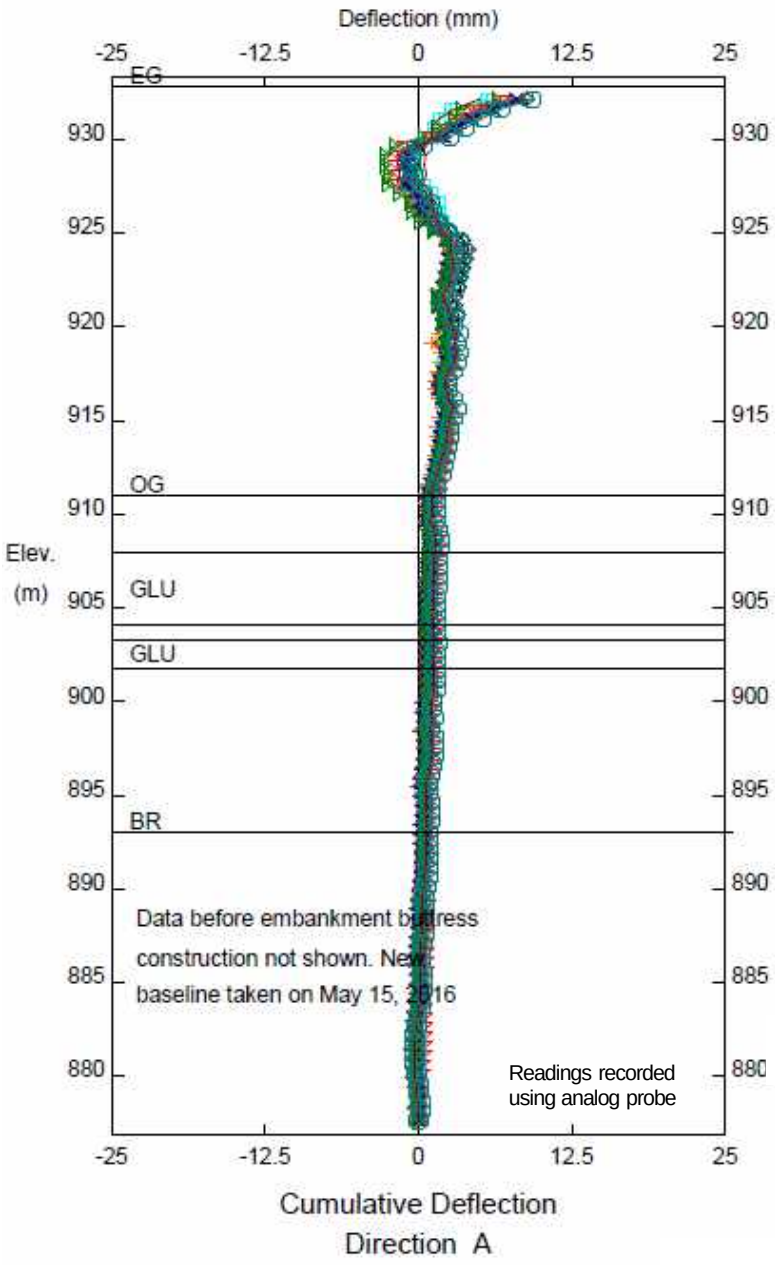
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-17
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B7

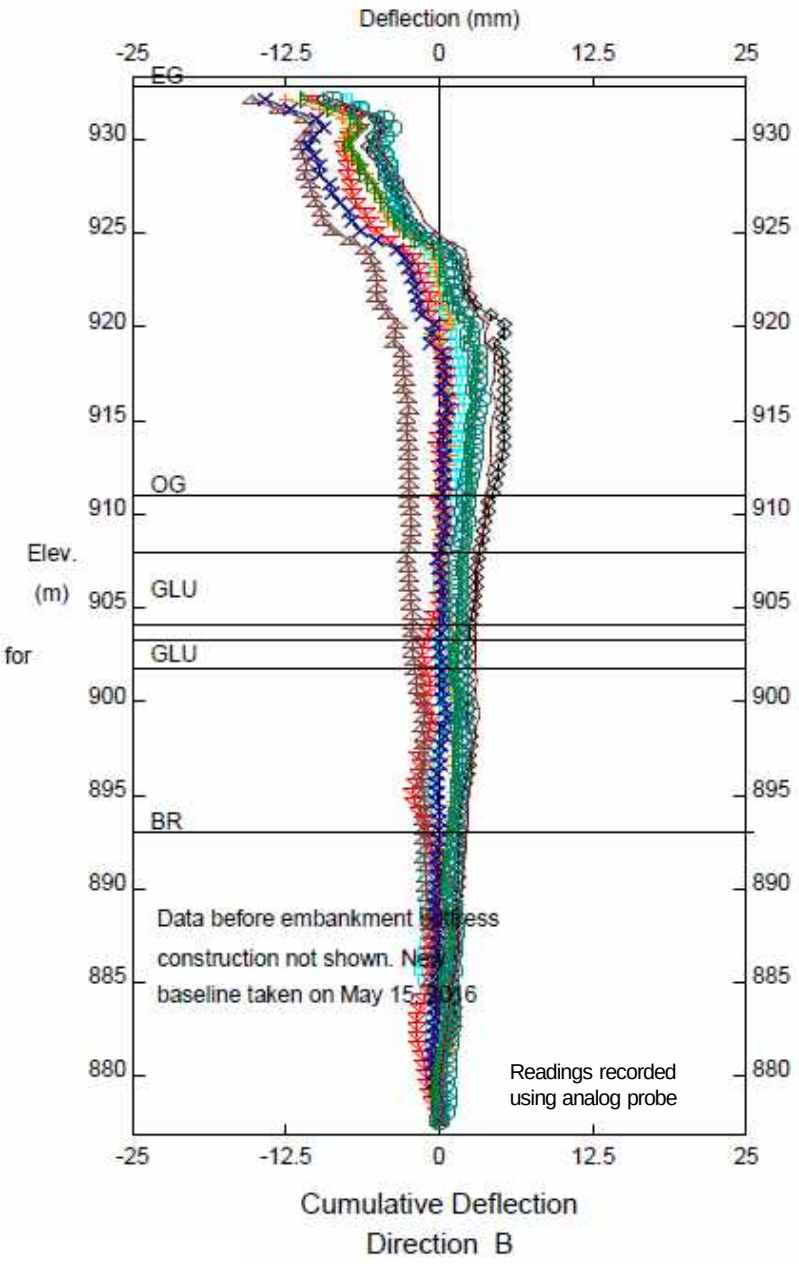
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm



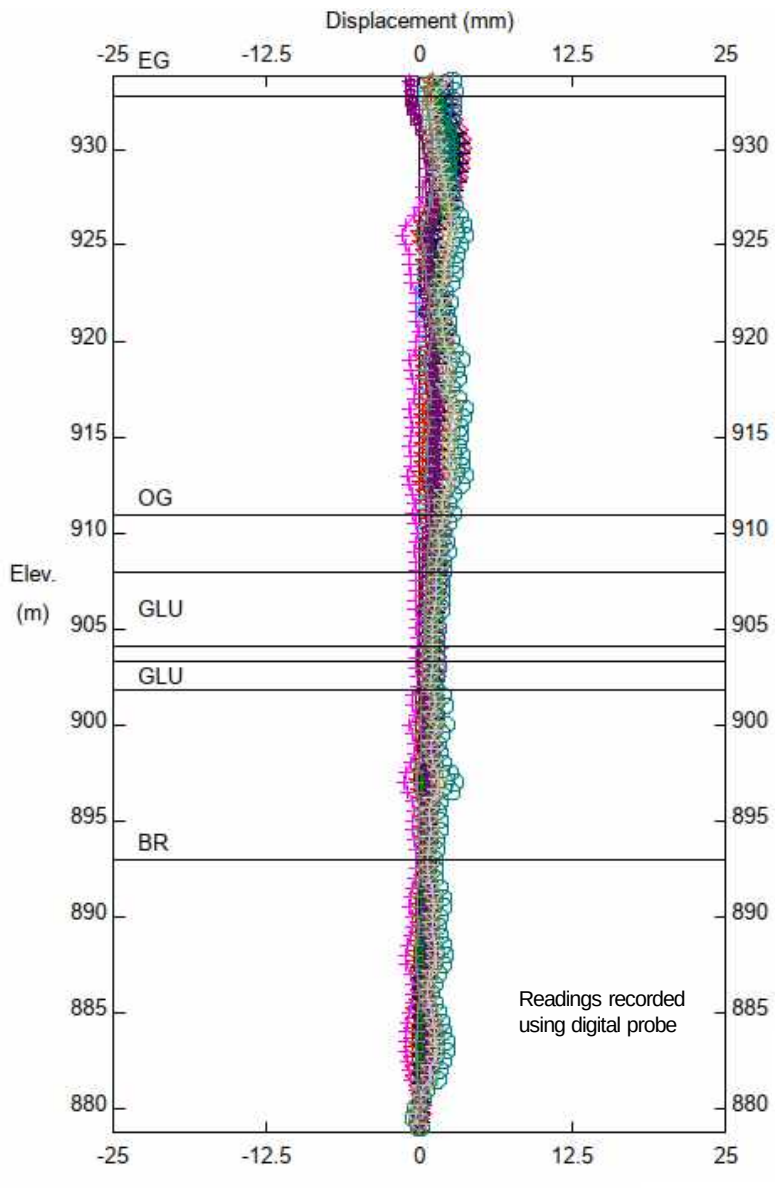
Cumulative Deflection
Direction A



Data has been reduced for ease of interpretation.



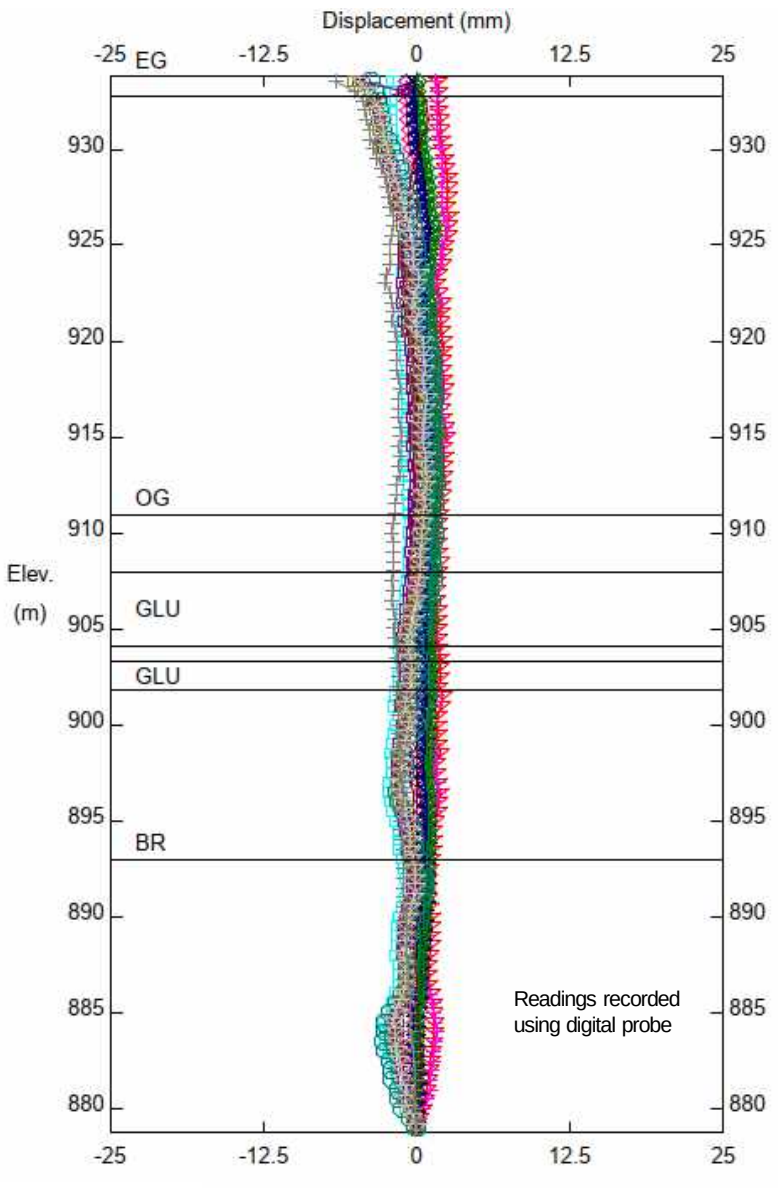
Cumulative Deflection
Direction B



Cumulative Displacement
Direction A



Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction B

Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

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MOUNT POLLEY MINING CORPORATION

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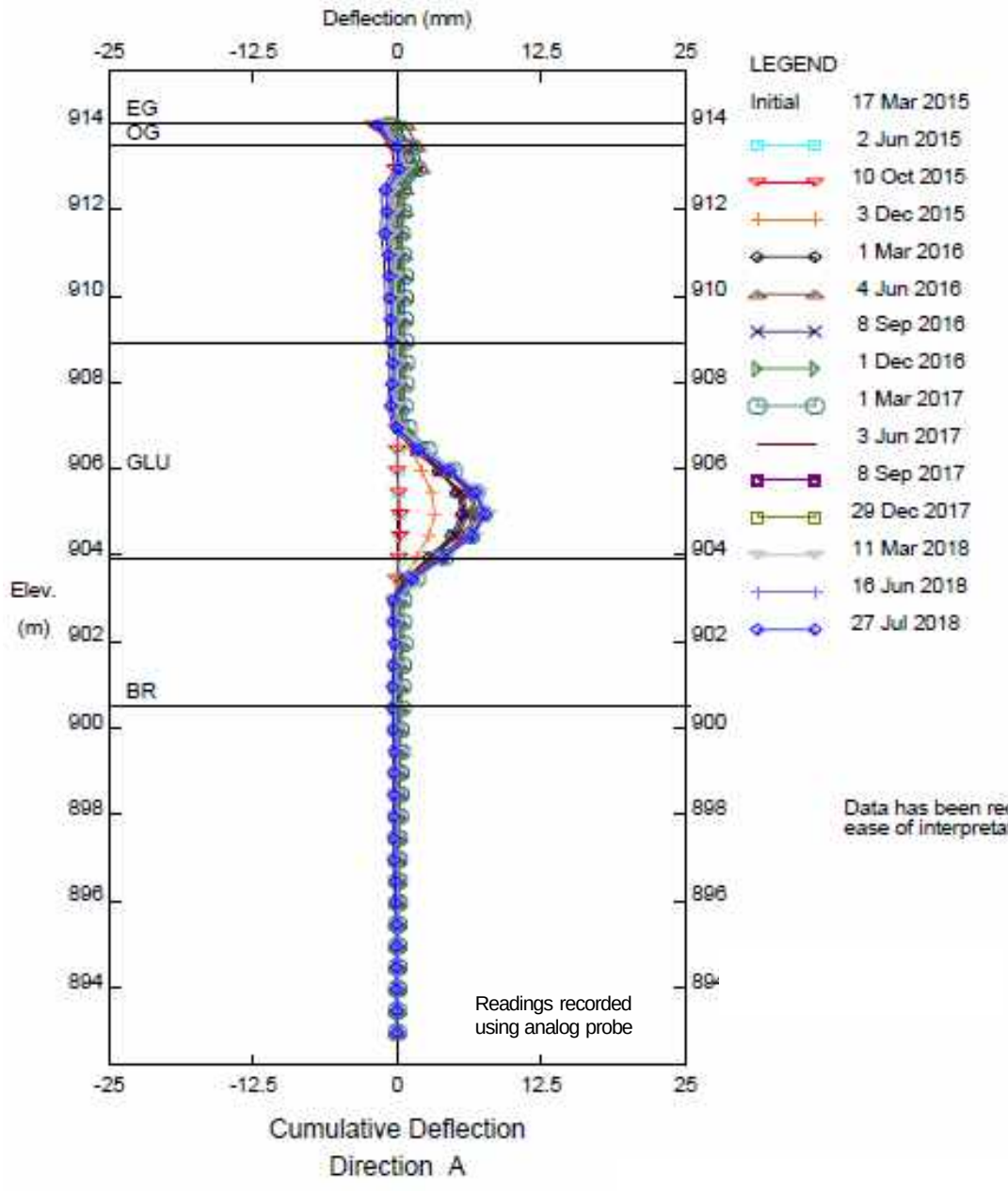
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

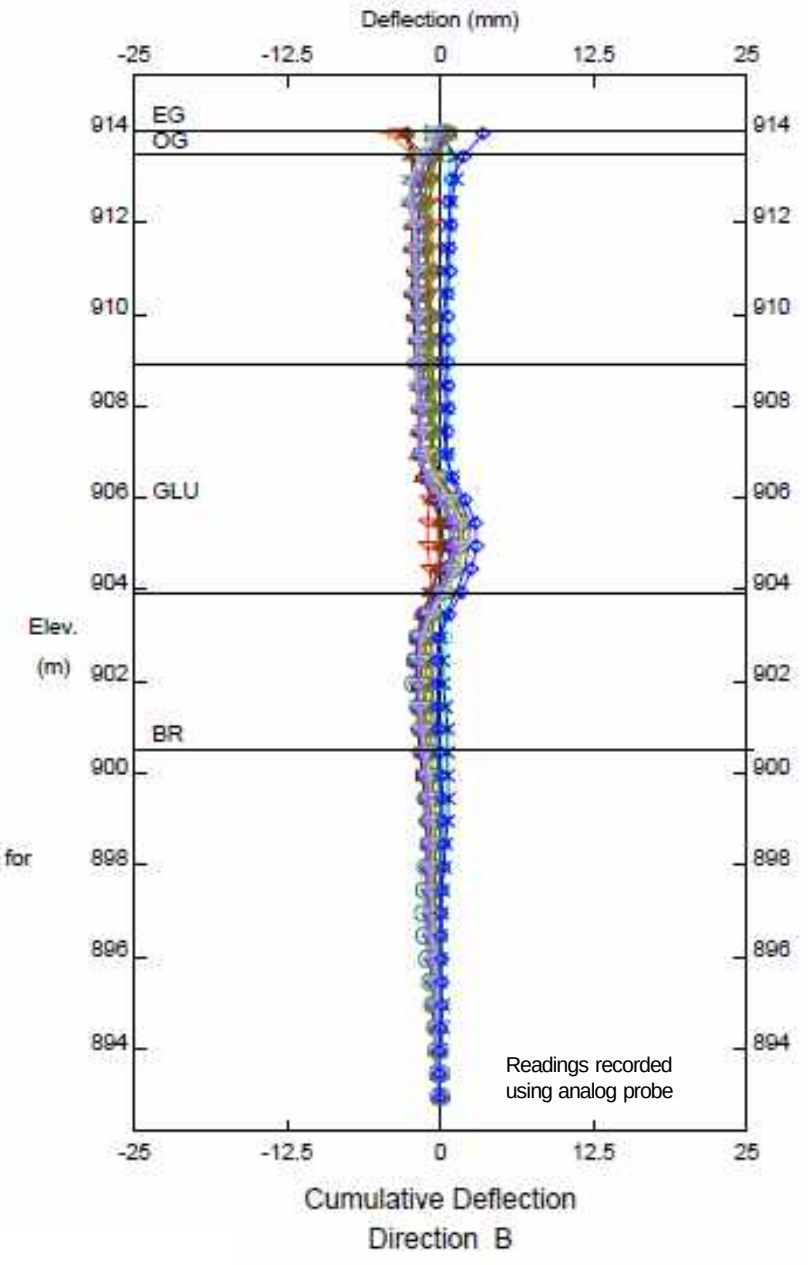
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

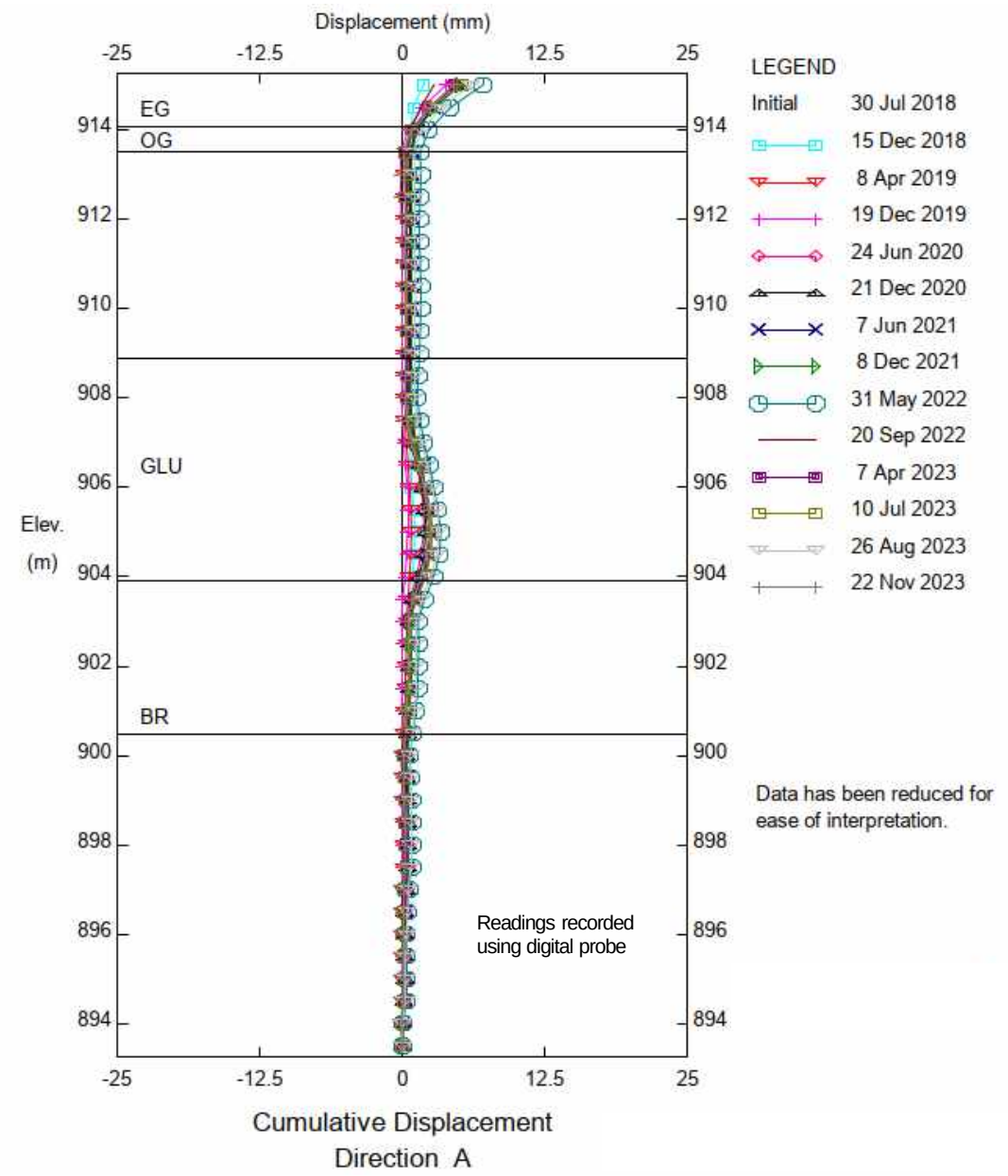
TITLE
SLOPE INCLINOMETER SI15-15
MAIN EMBANKMENT

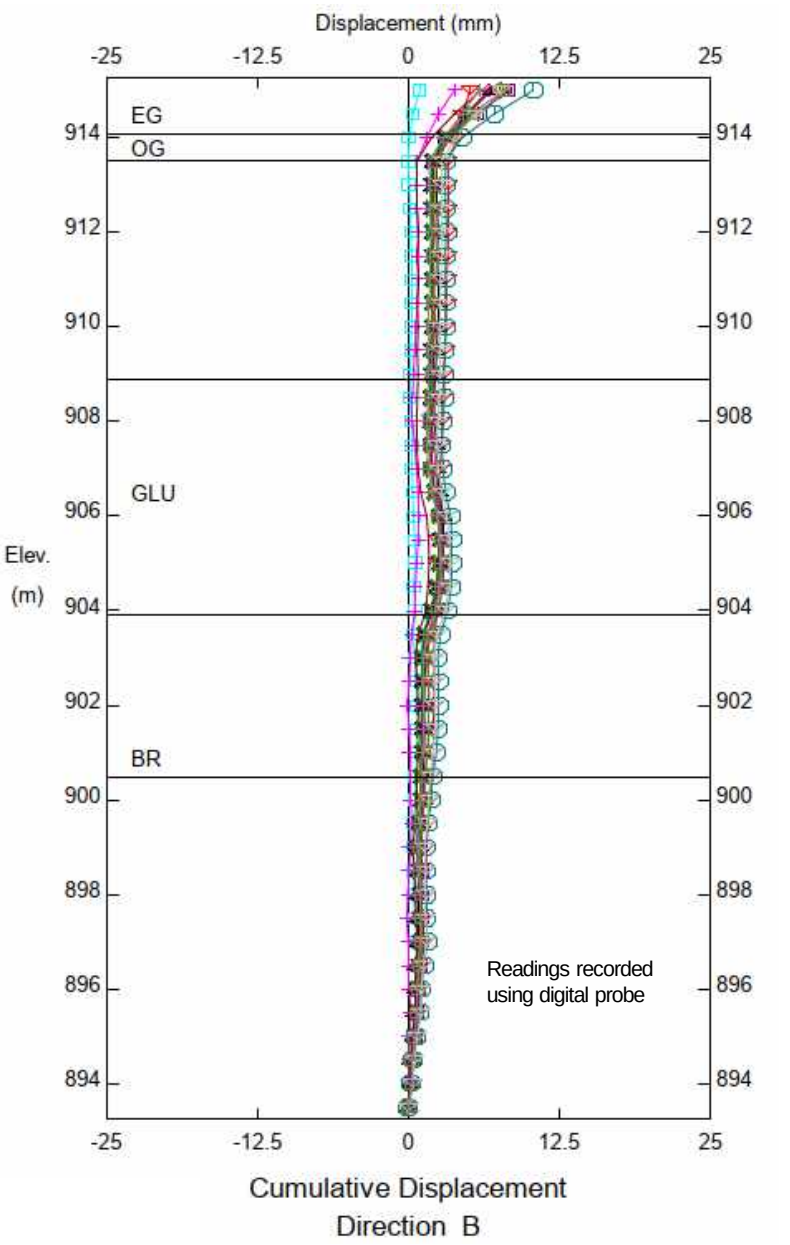
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm









Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

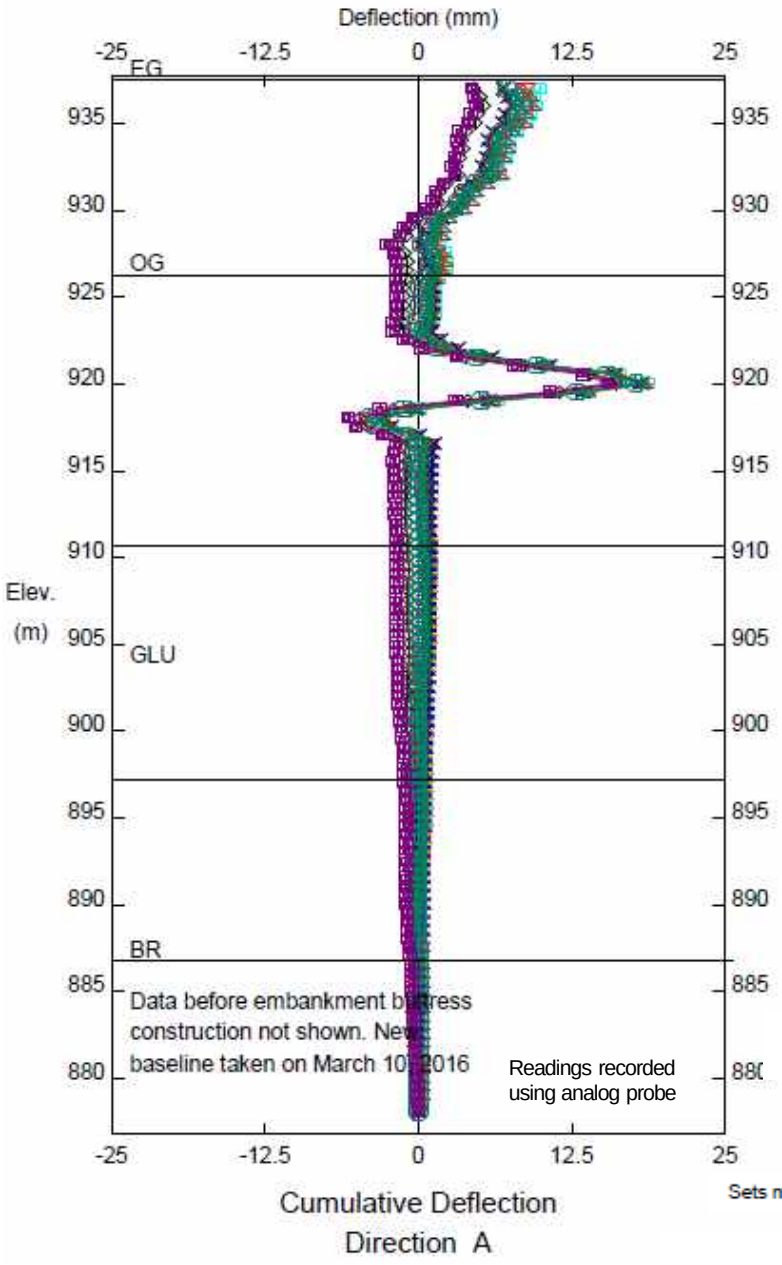
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-14
MAIN EMBANKMENT

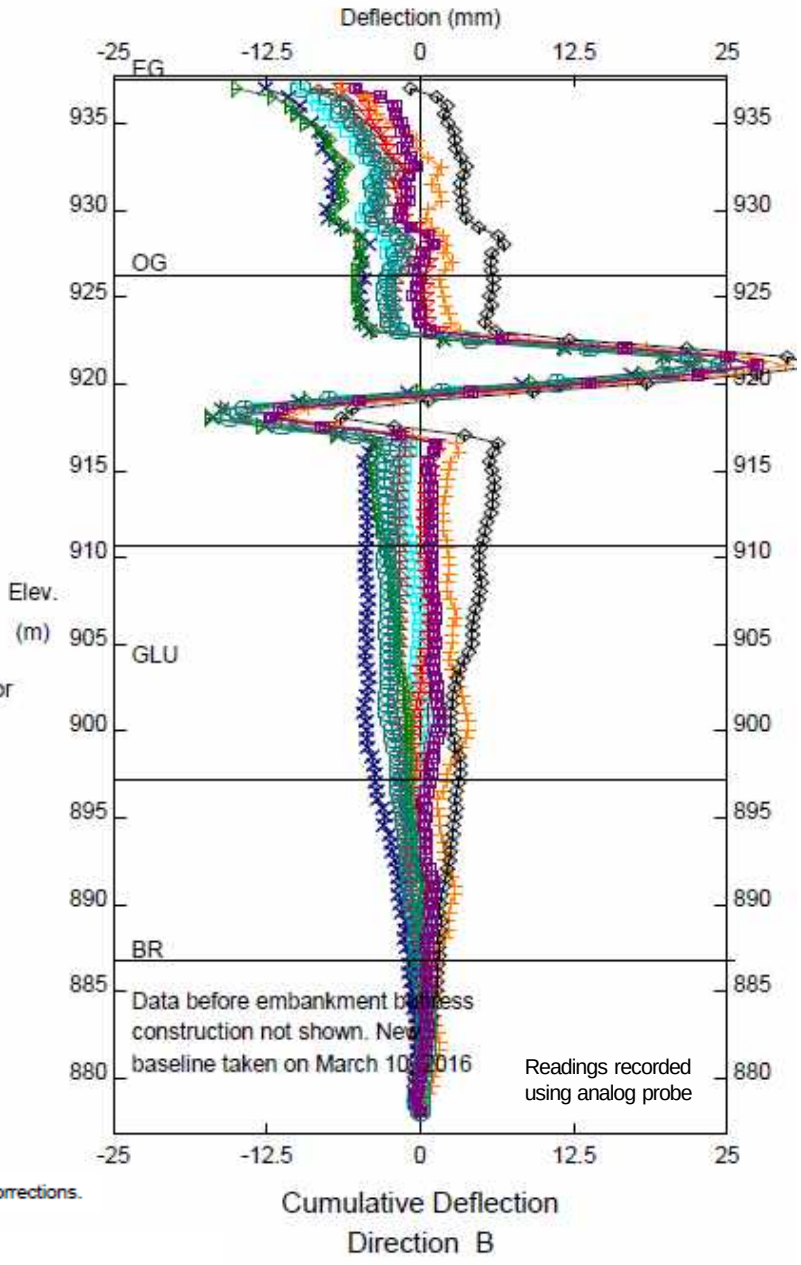
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm
0

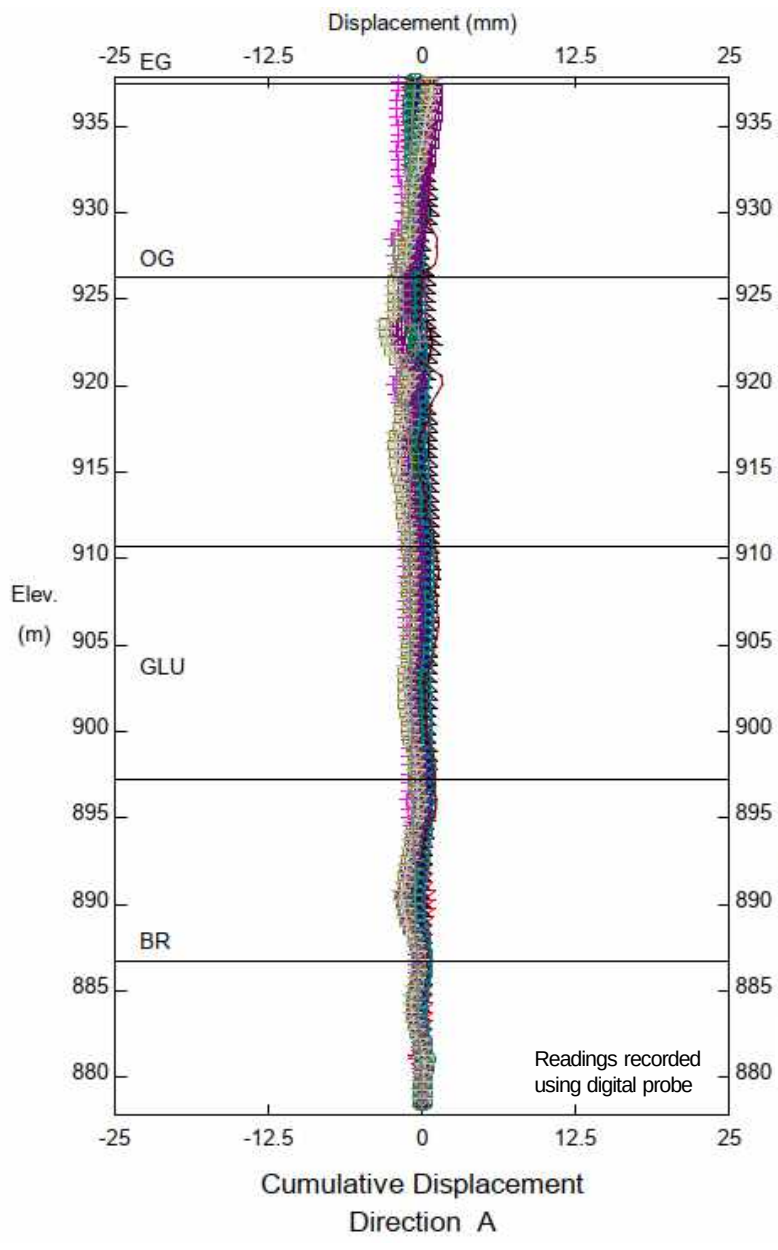


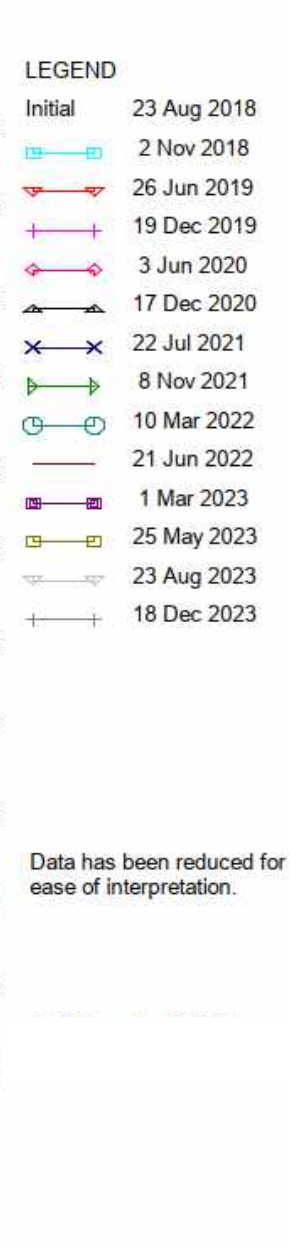


Data has been reduced for ease of interpretation.

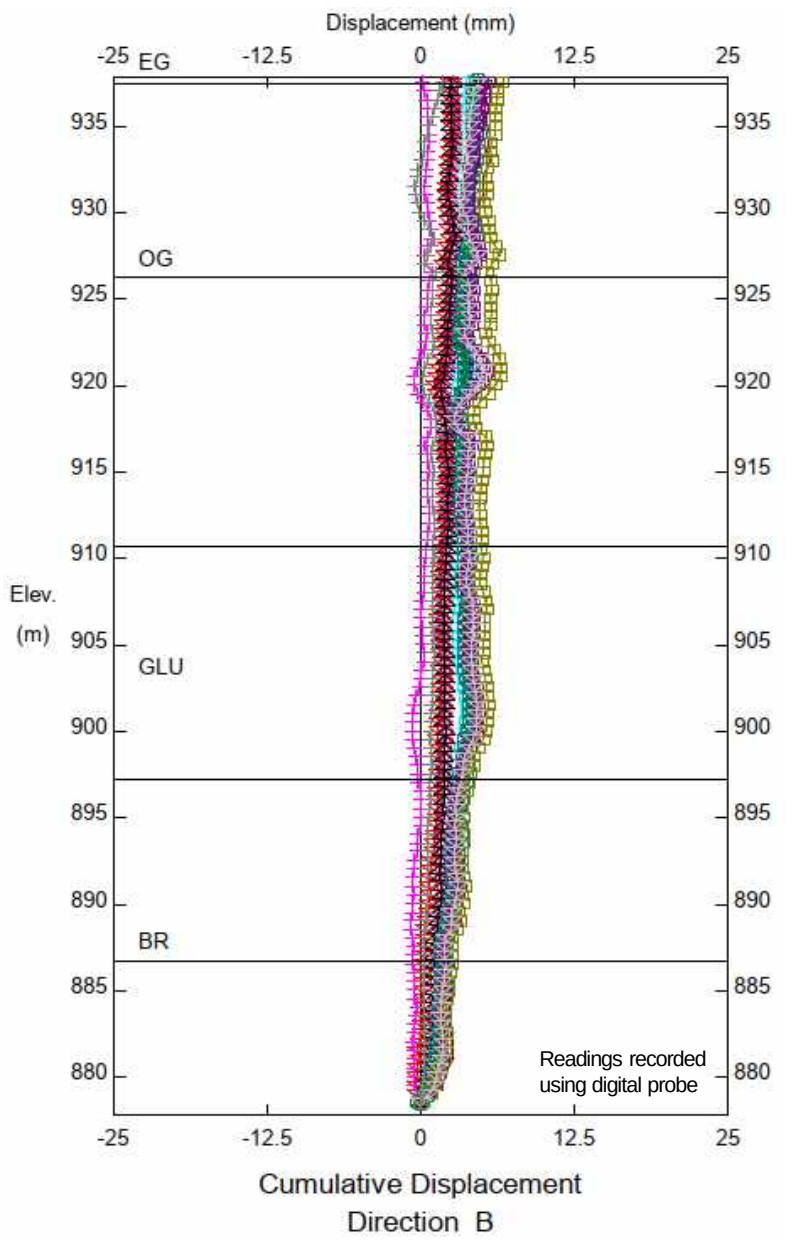


Sets marked * include zero shift and/or rotation corrections.





Data has been reduced for ease of interpretation.



Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

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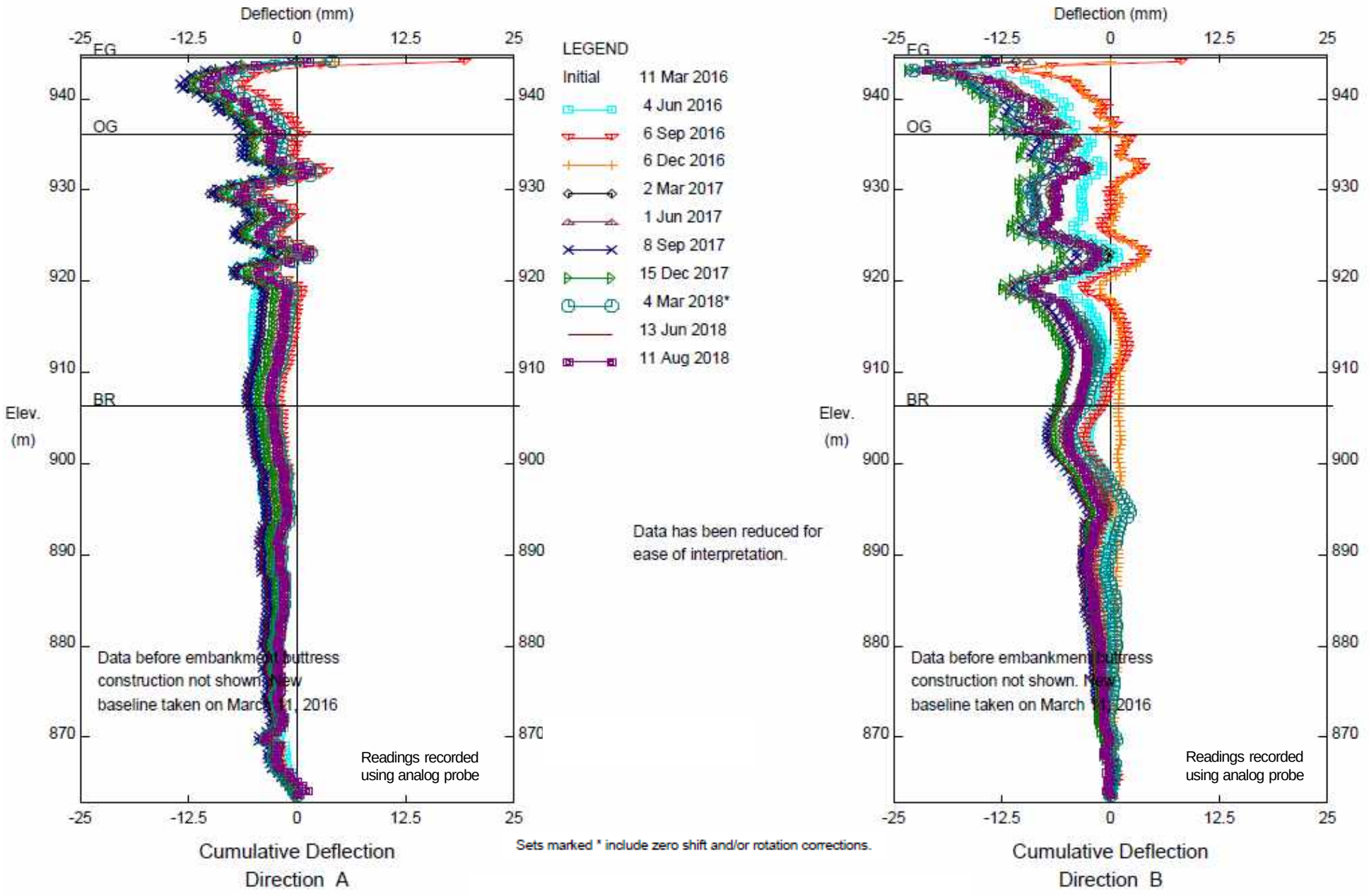
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

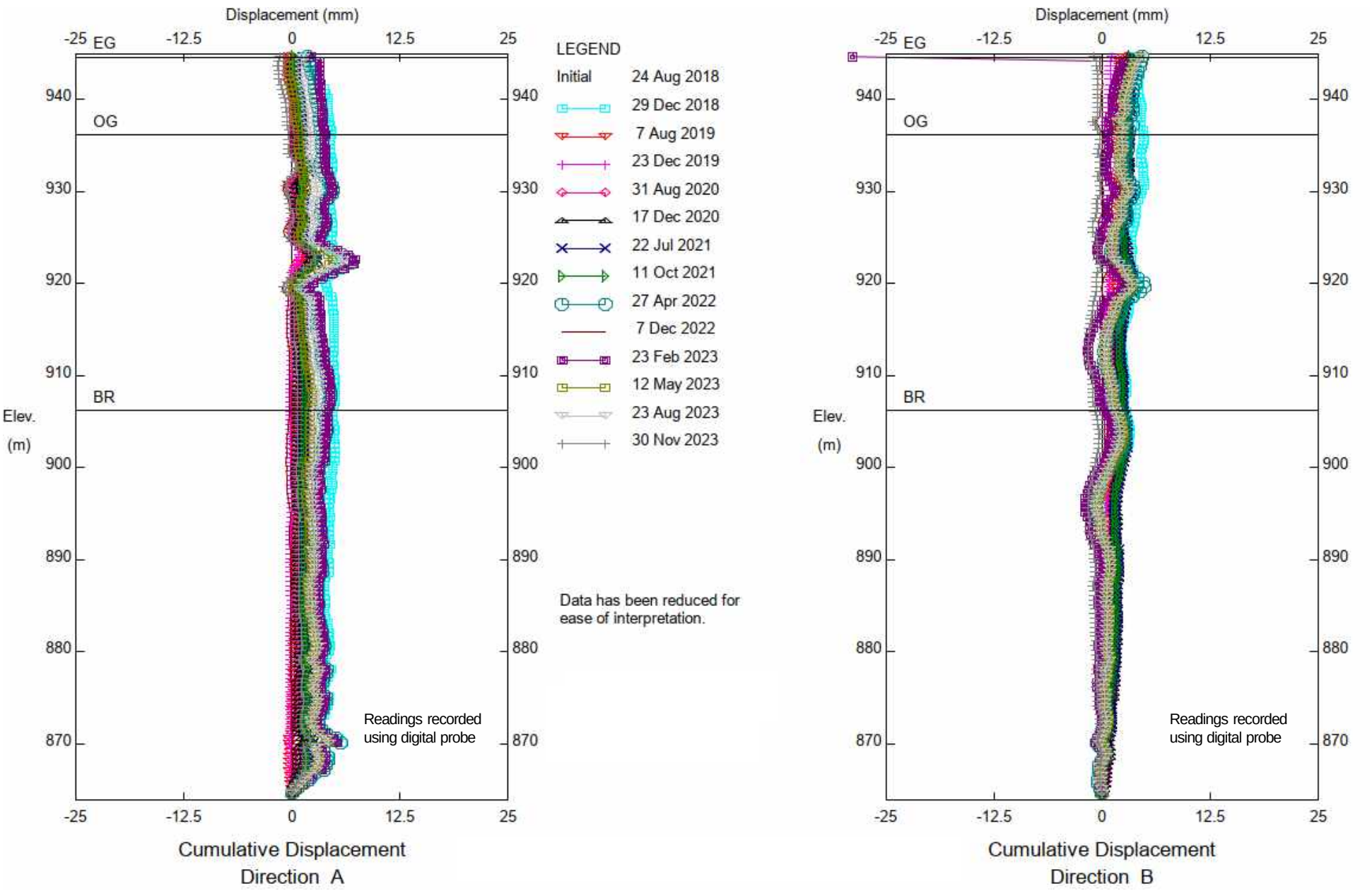
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-12
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm





Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

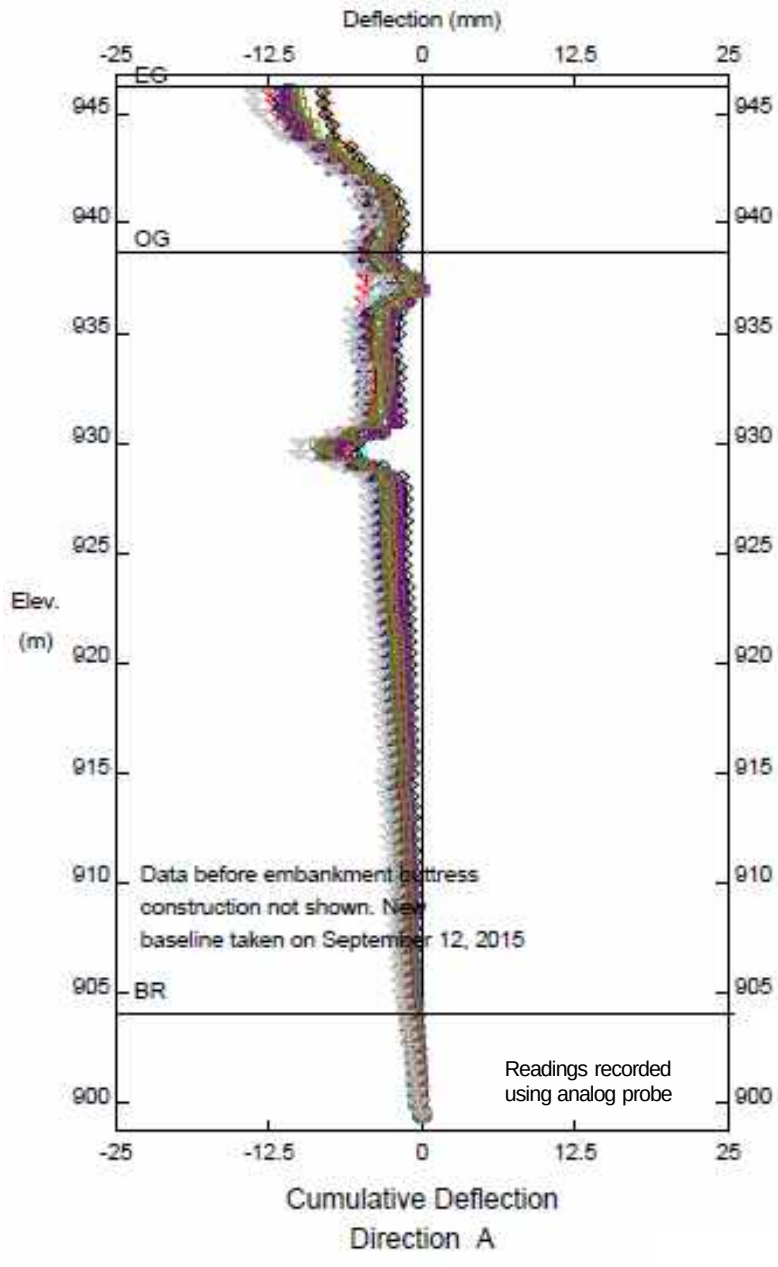
CONSULTANT
wsp

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

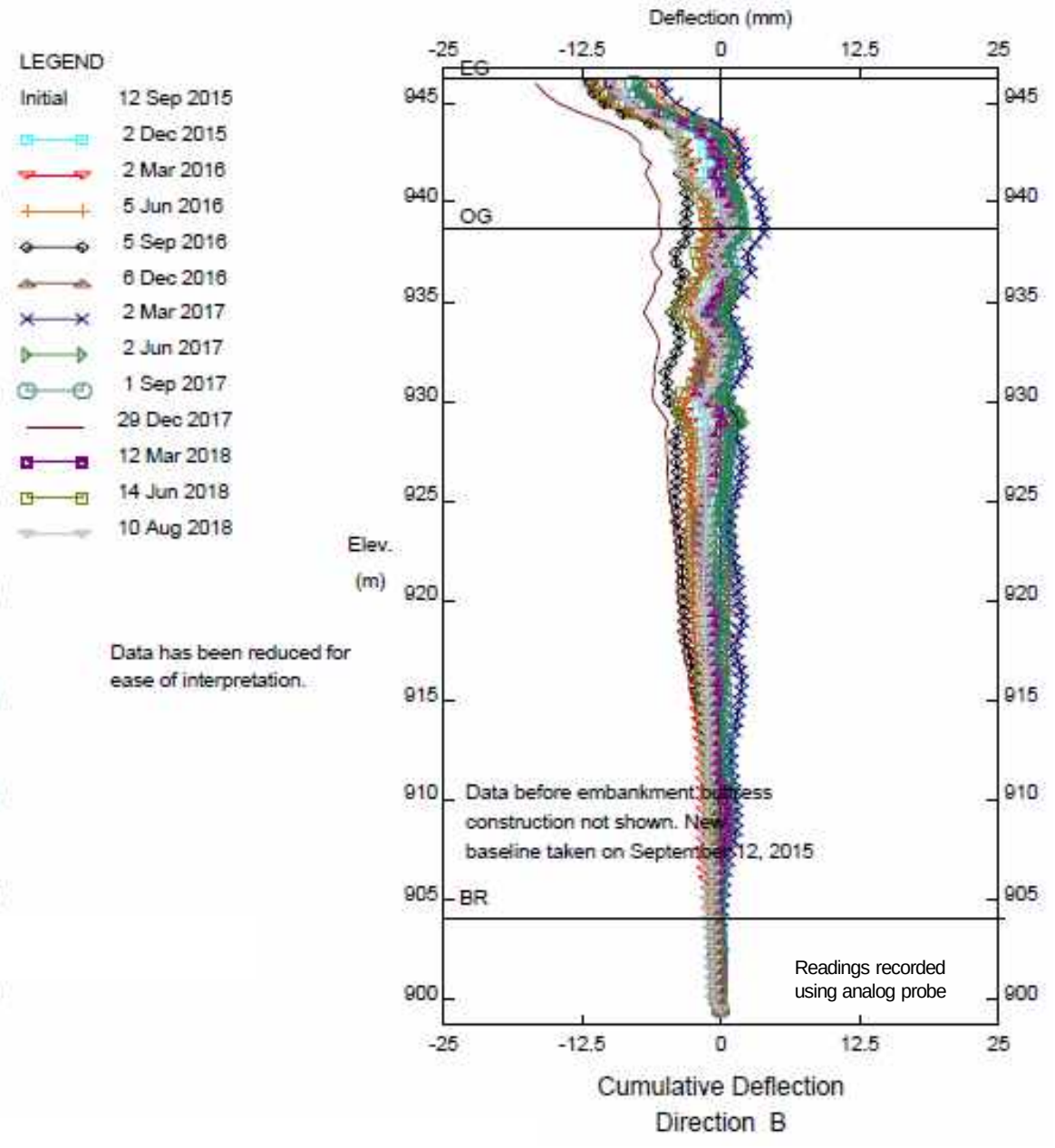
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-10
MAIN EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B11**

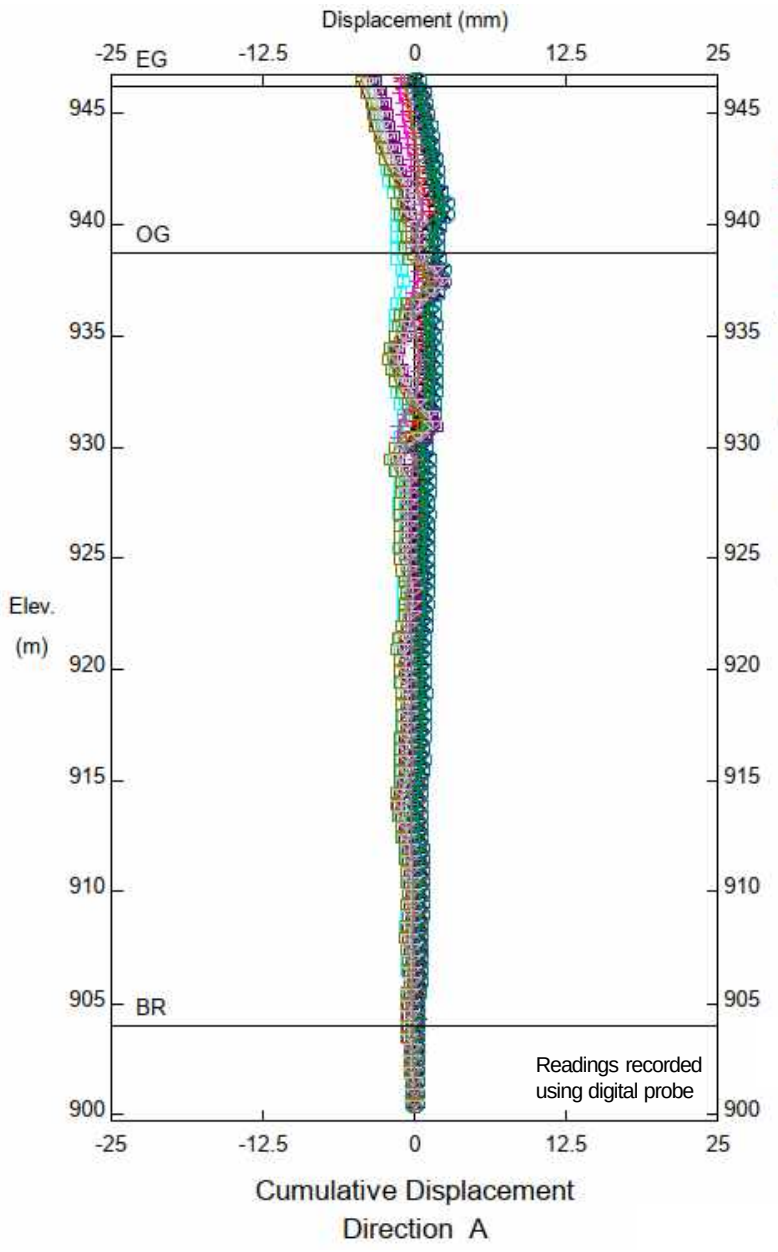


Cumulative Deflection
Direction A

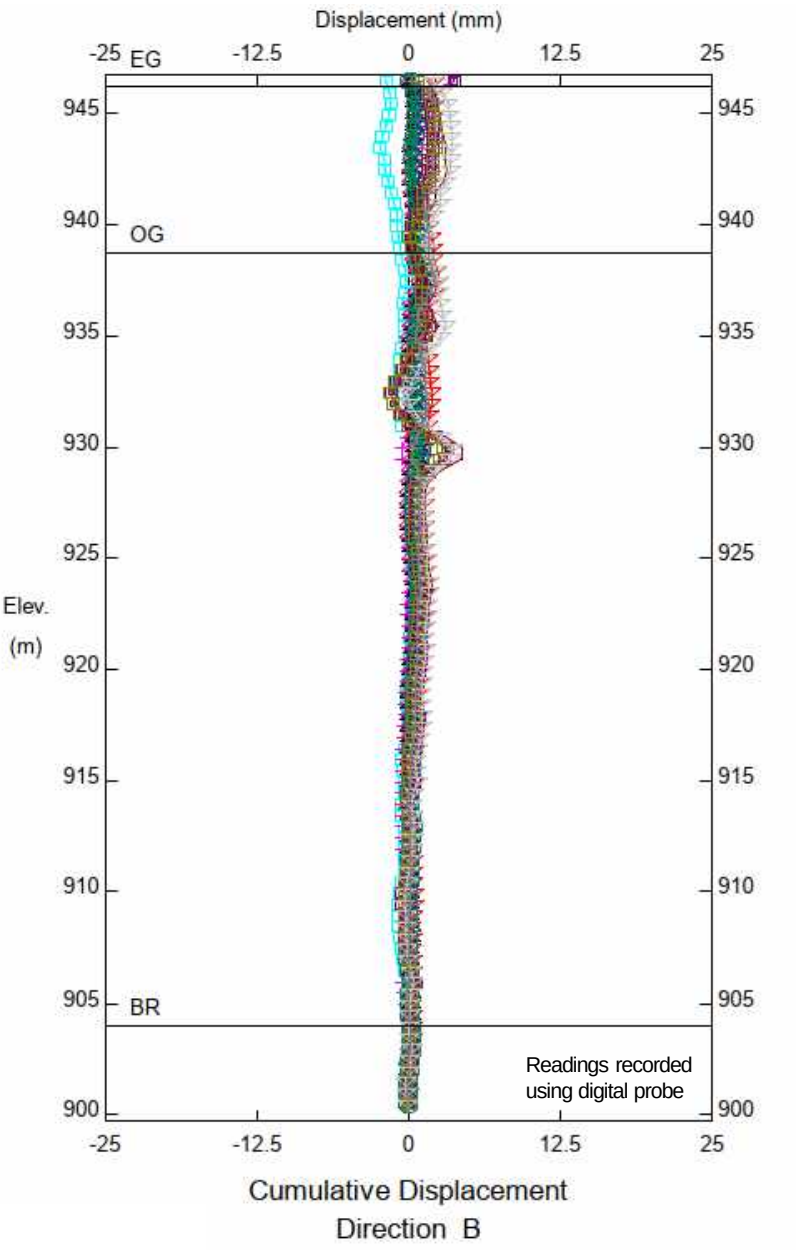


Cumulative Deflection
Direction B

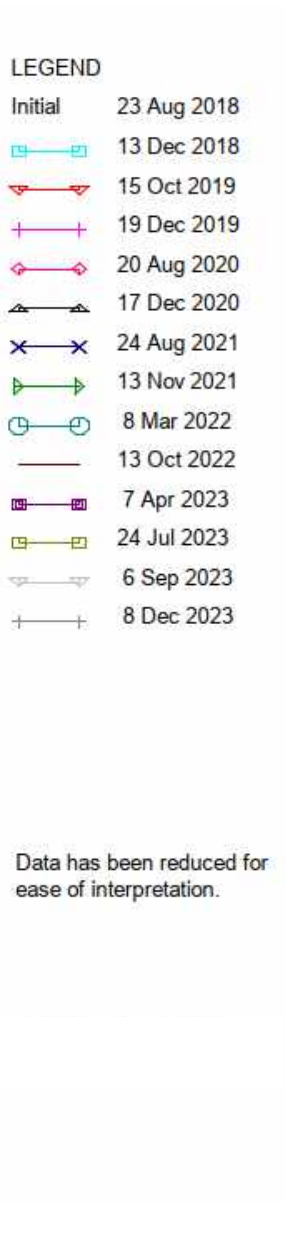
Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction A



Cumulative Displacement
Direction B



Data has been reduced for ease of interpretation.

Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

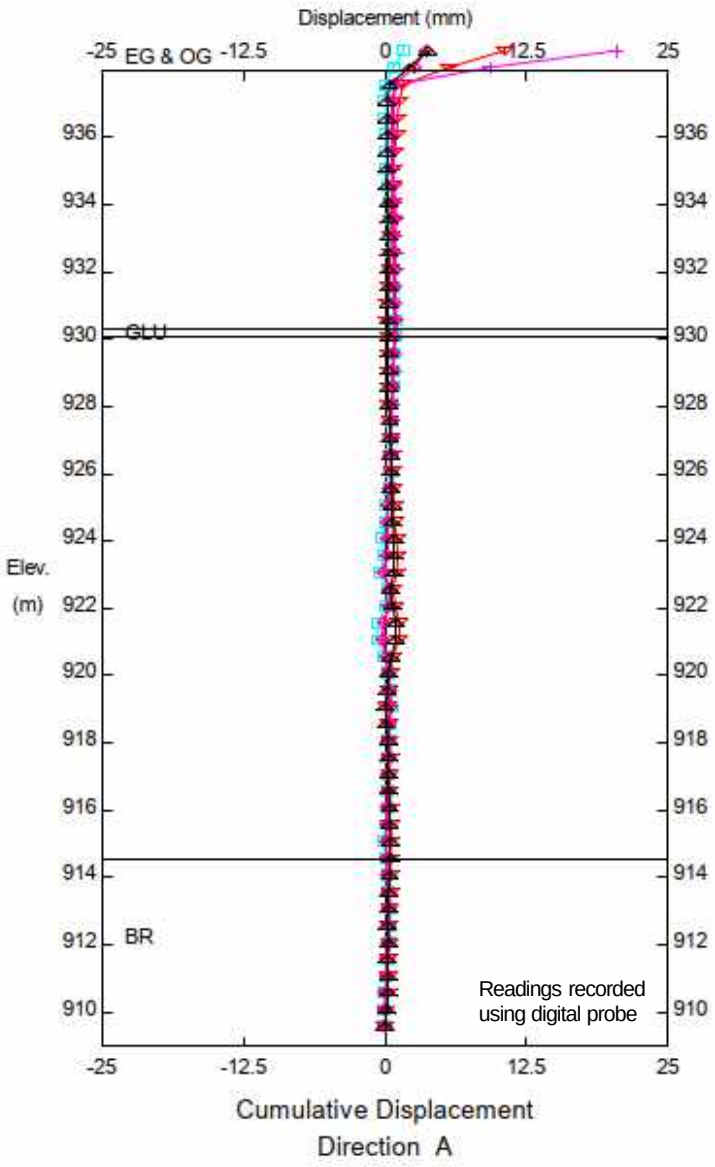
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

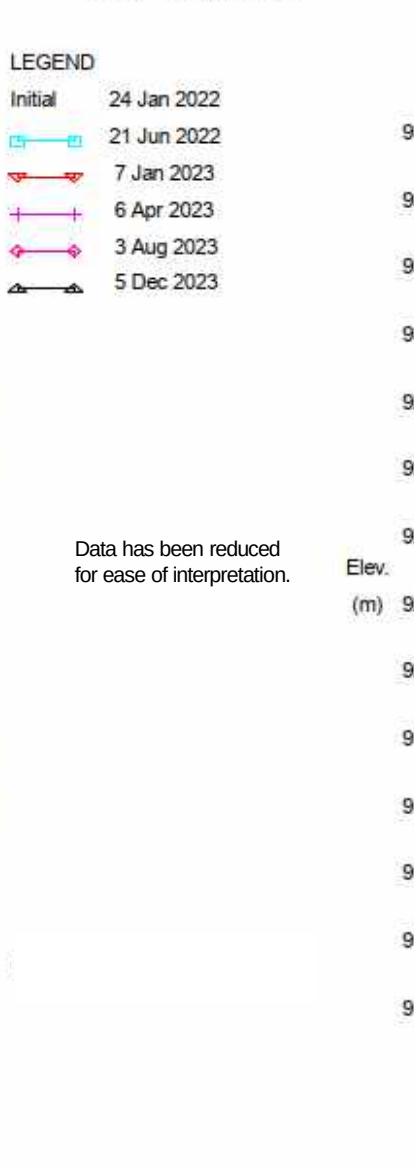
TITLE
SLOPE INCLINOMETER SI15-09
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B12**

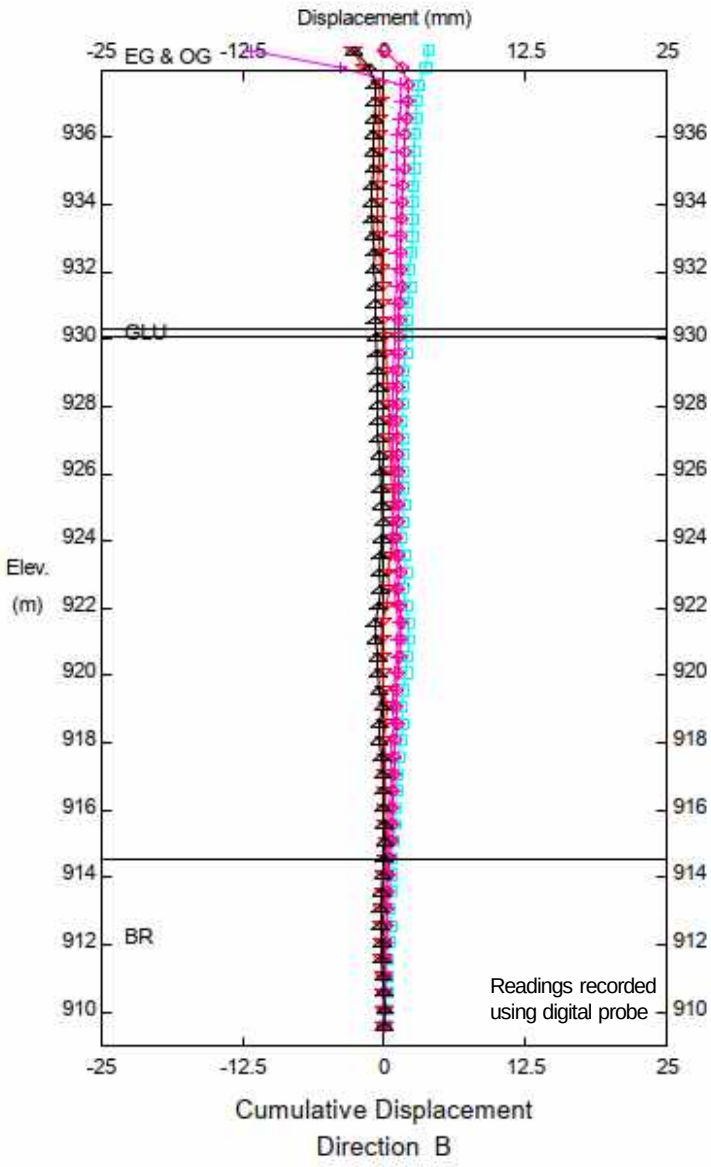
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
0 25 mm

WSP Canada Inc.





Data has been reduced for ease of interpretation.



Note:
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

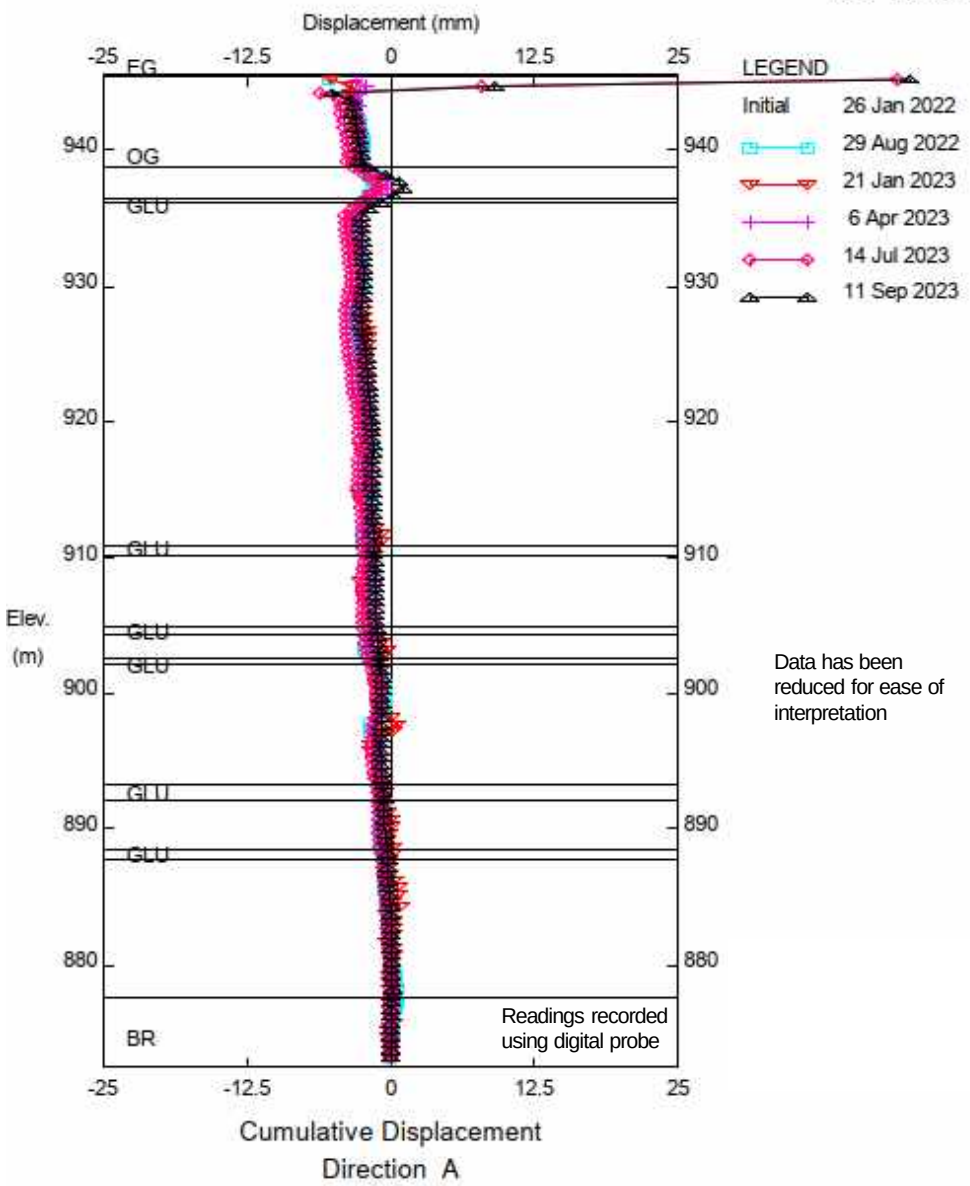
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

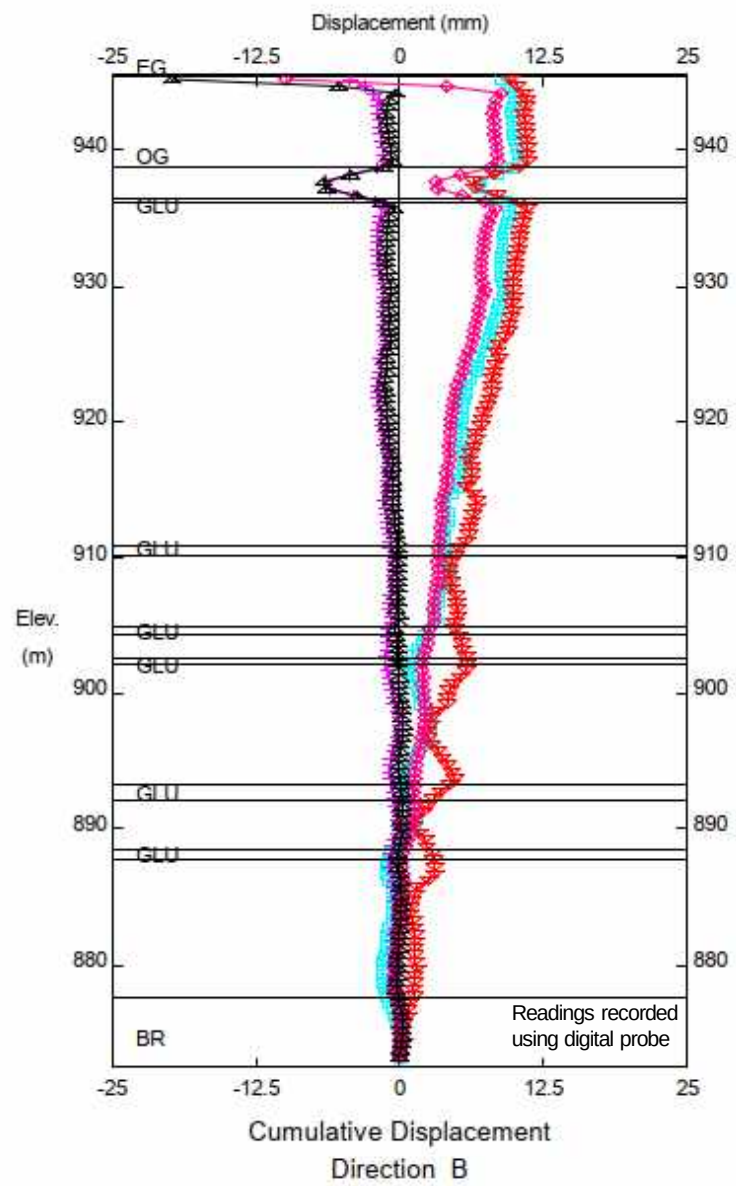
TITLE
SLOPE INCLINOMETER SI21-06
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
0 23 mm

WSP Canada Inc.





Note:
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

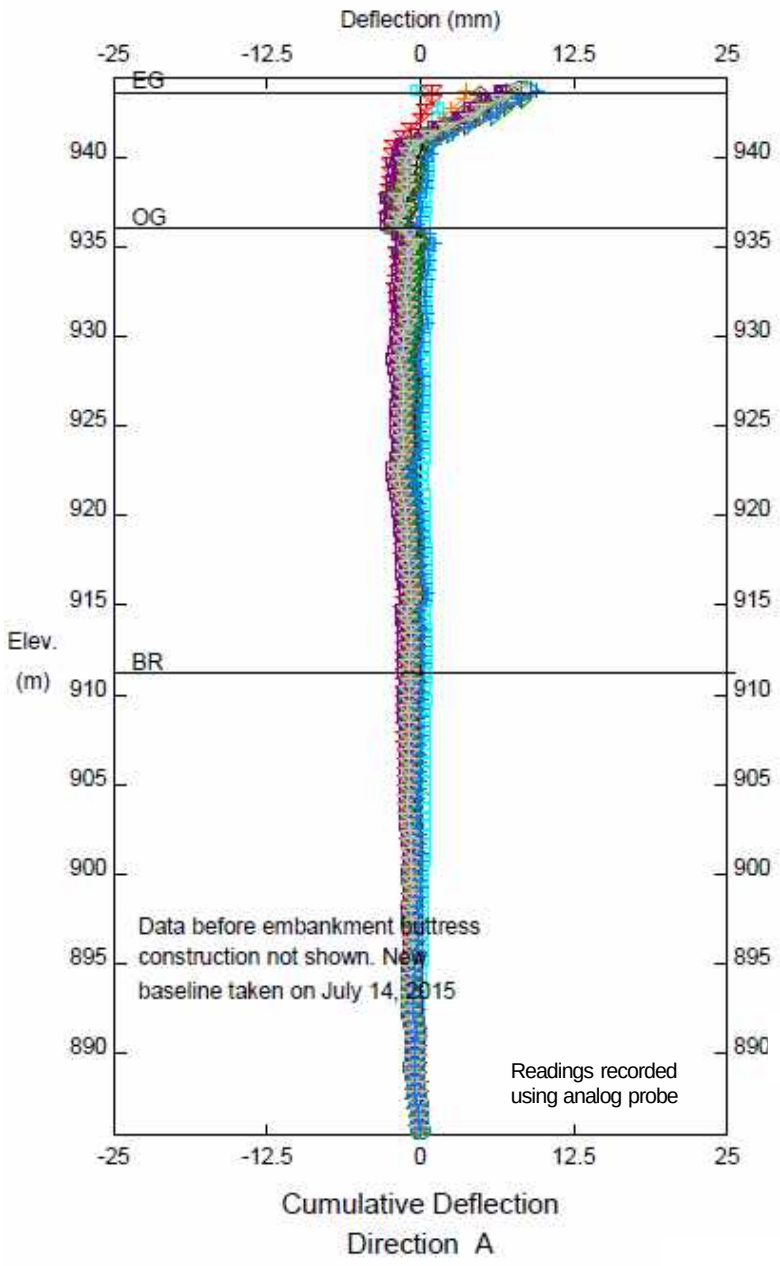
CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI21-05
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
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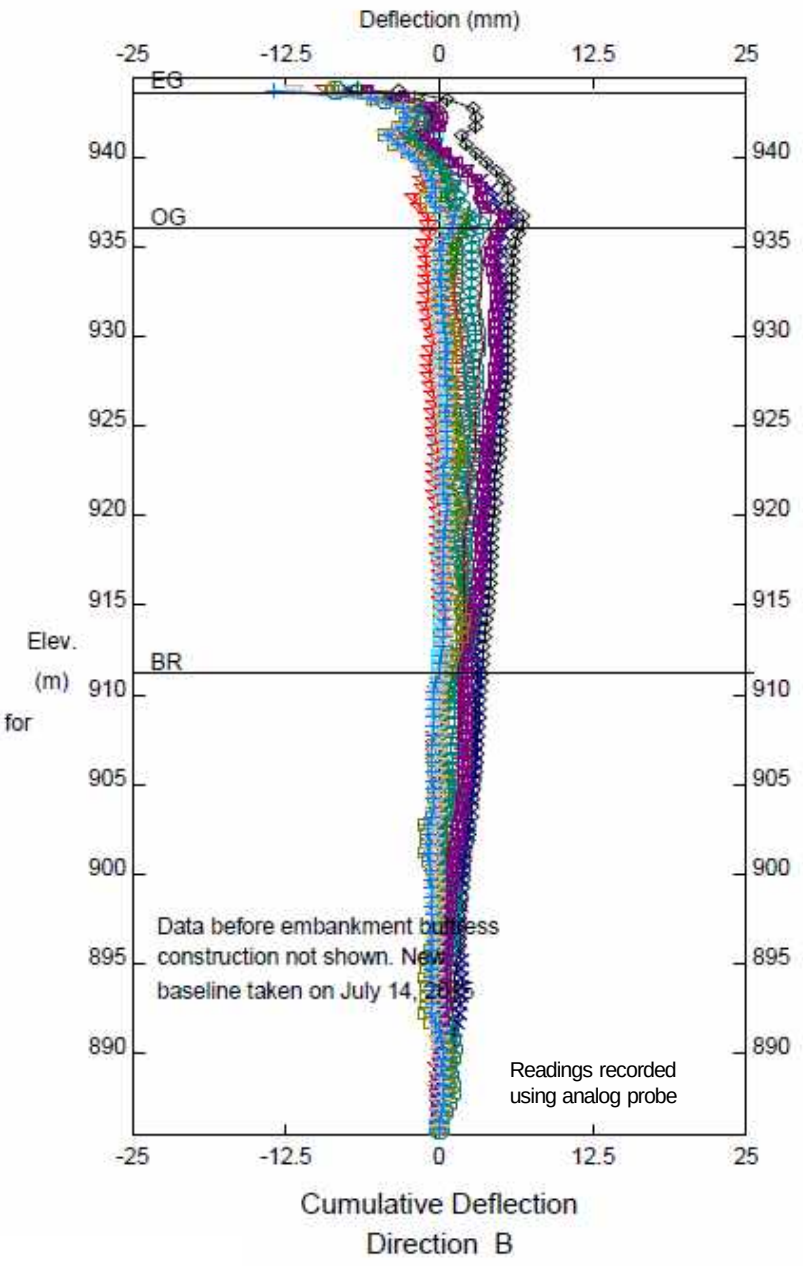


Cumulative Deflection
Direction A

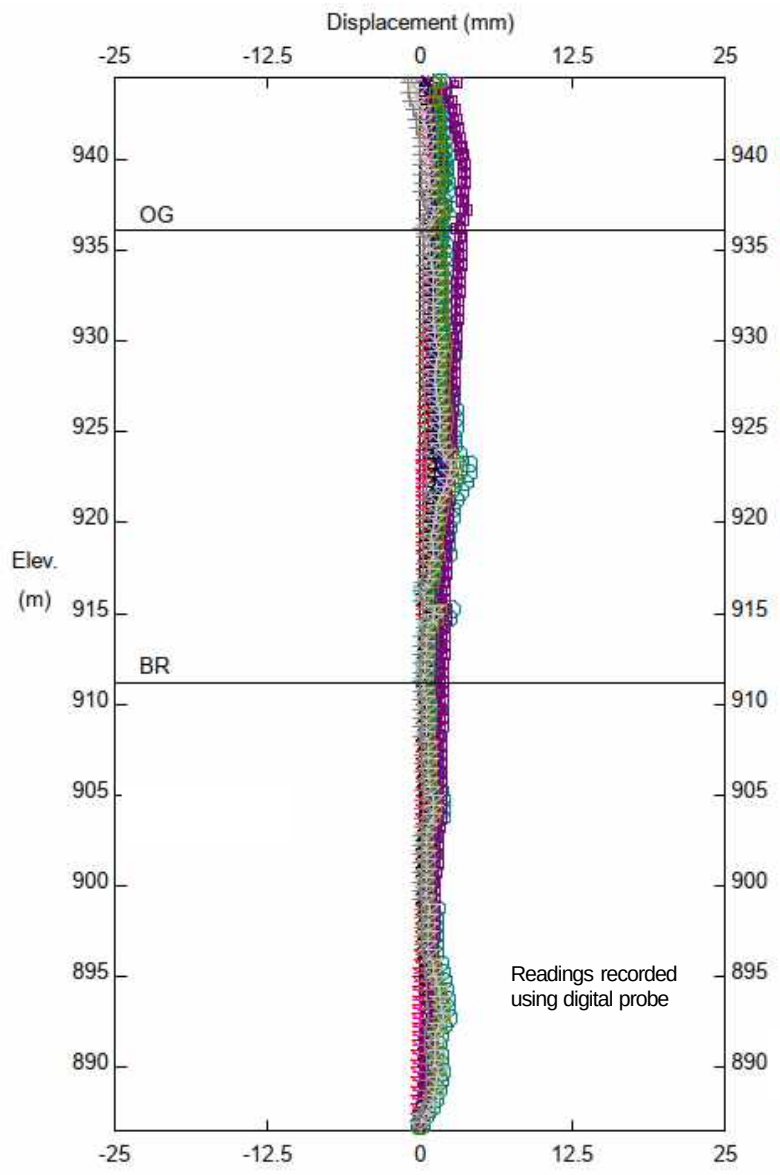
LEGEND

Initial	14 Jul 2015
	1 Sep 2015
	2 Dec 2015
	2 Mar 2016
	5 Jun 2016
	8 Sep 2016
	6 Dec 2016
	16 Mar 2017
	2 Jun 2017
	2 Sep 2017
	31 Dec 2017
	2 Mar 2018
	10 Jun 2018
	22 Jul 2018

Data has been reduced for ease of interpretation.



Cumulative Deflection
Direction B

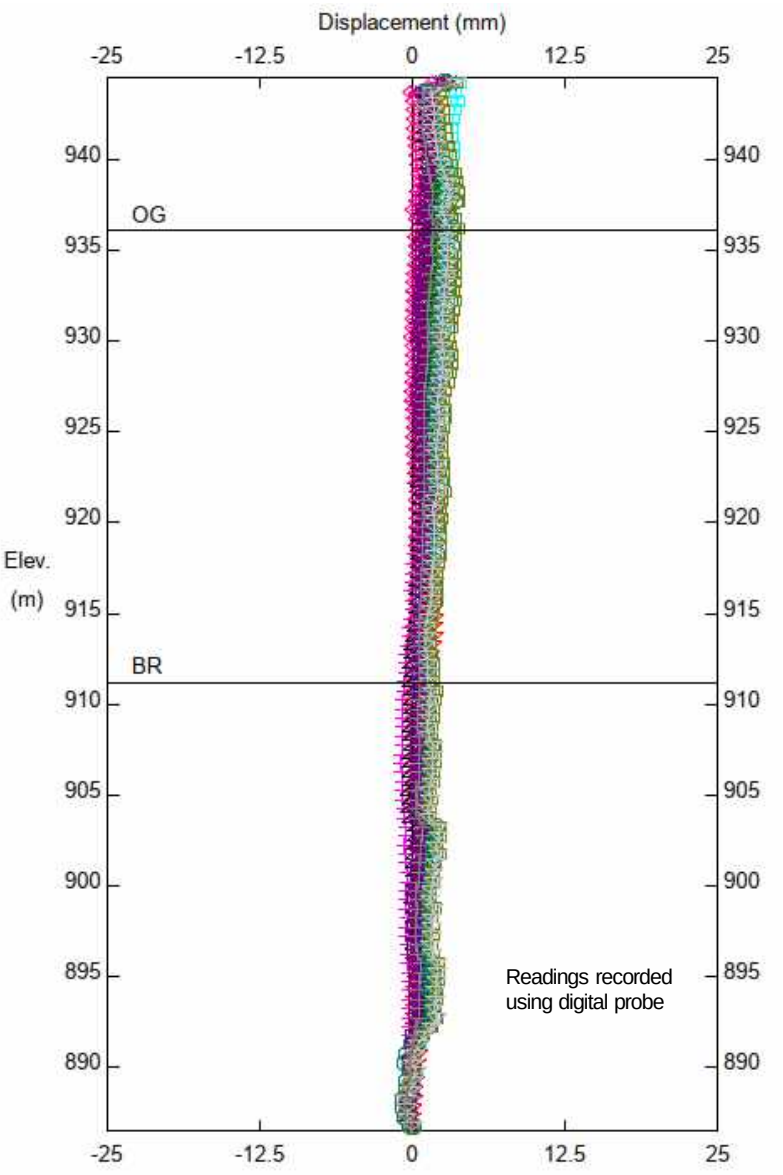


Cumulative Displacement
Direction A

LEGEND

Initial	6 Aug 2018
	10 Dec 2018
	18 Jun 2019
	5 Dec 2019
	4 Jun 2020
	16 Dec 2020
	5 May 2021
	7 Dec 2021
	26 Apr 2022
	11 Dec 2022
	30 Jan 2023
	4 May 2023
	21 Aug 2023
	11 Dec 2023

Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction B

Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

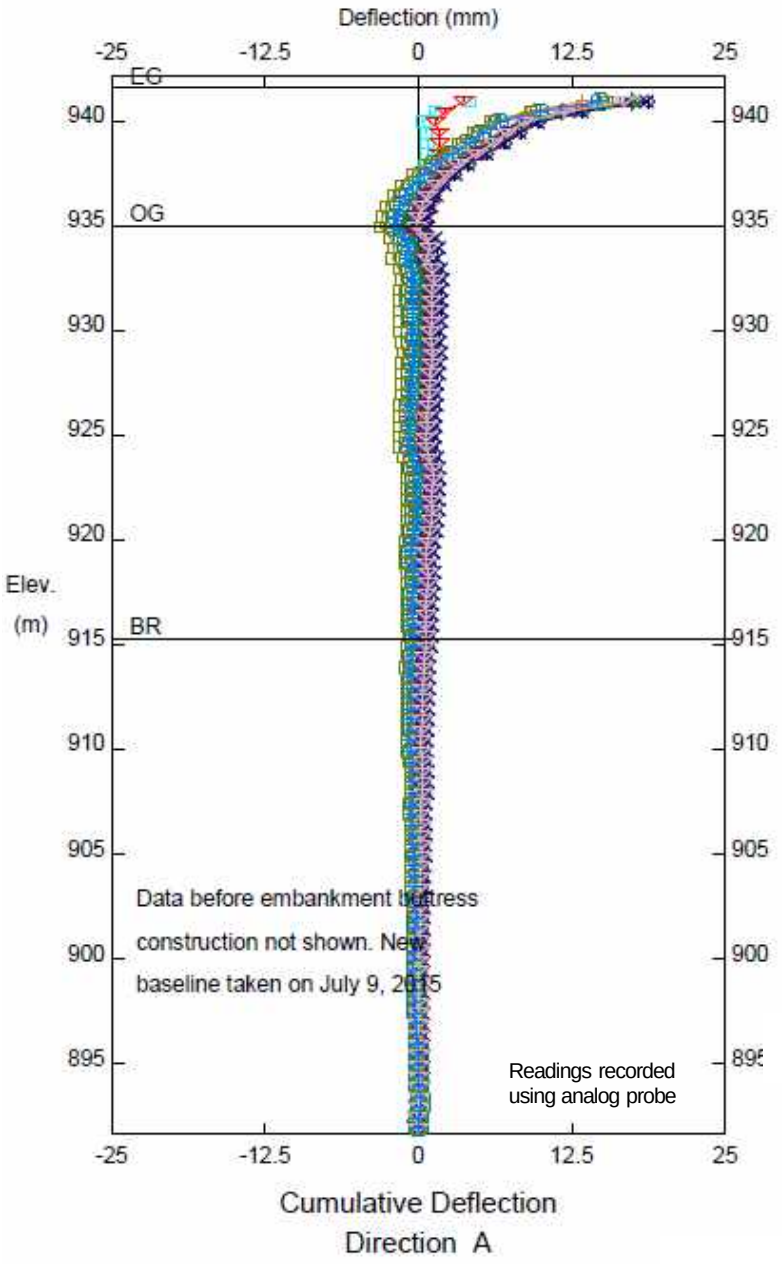
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

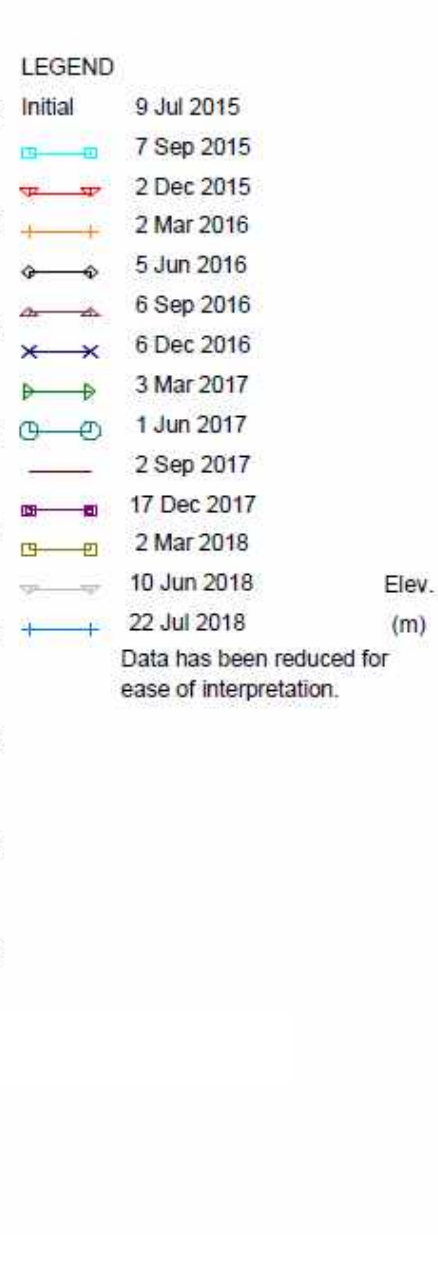
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

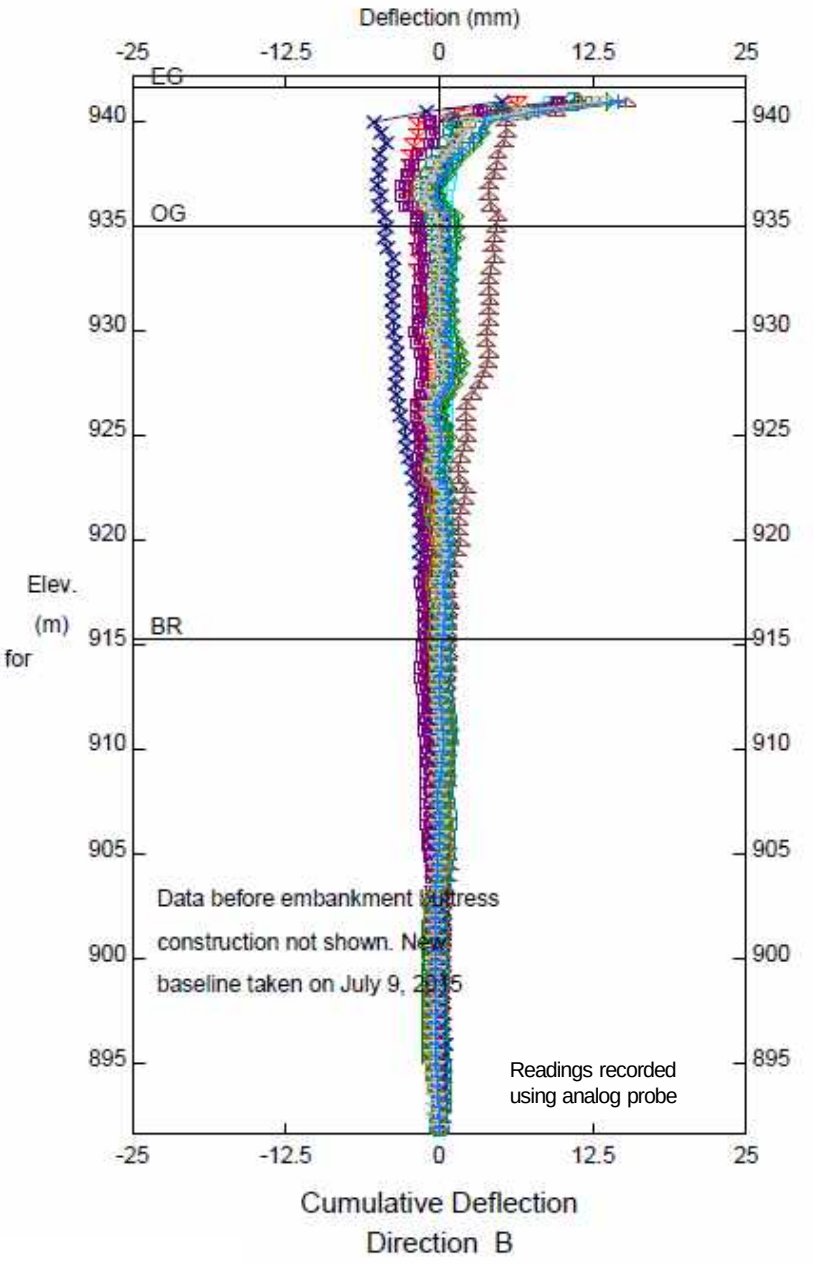
TITLE
SLOPE INCLINOMETER SI15-08
PERIMETER EMBANKMENT

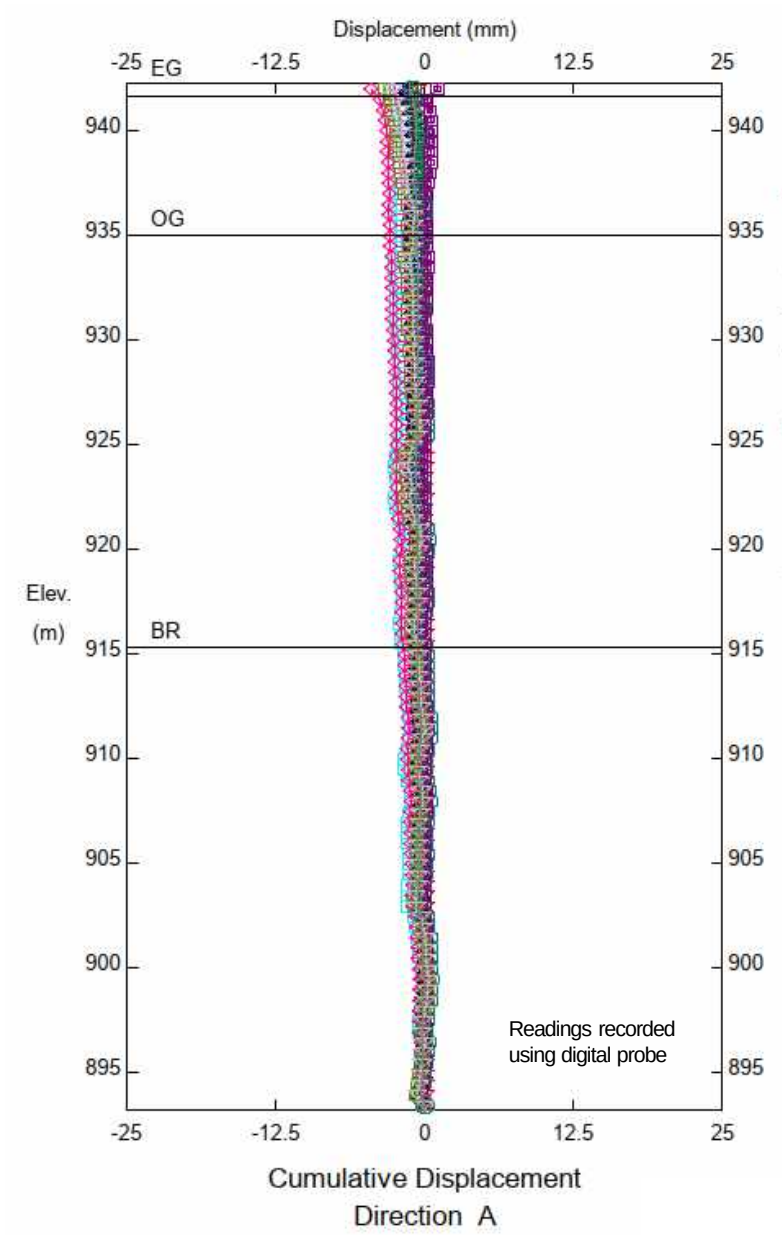
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B15

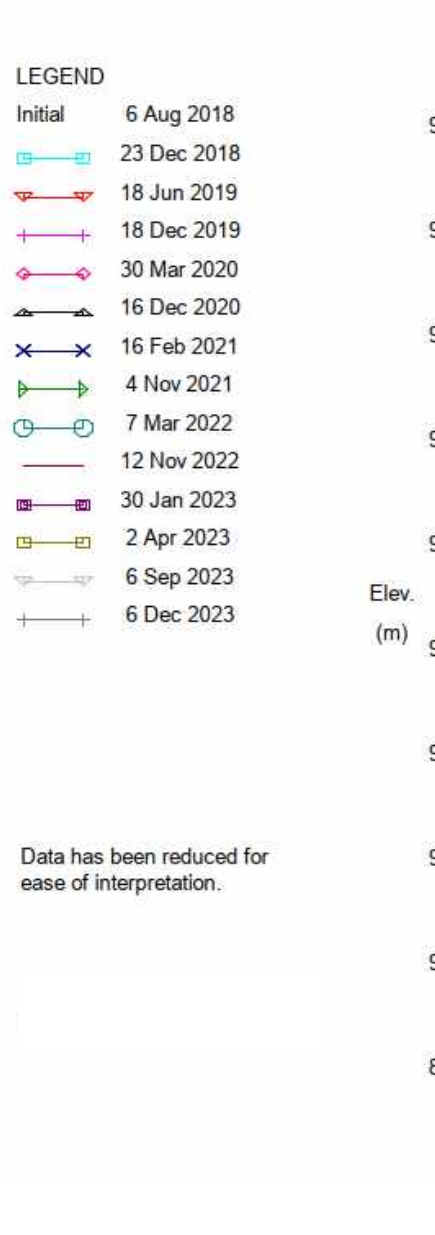
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

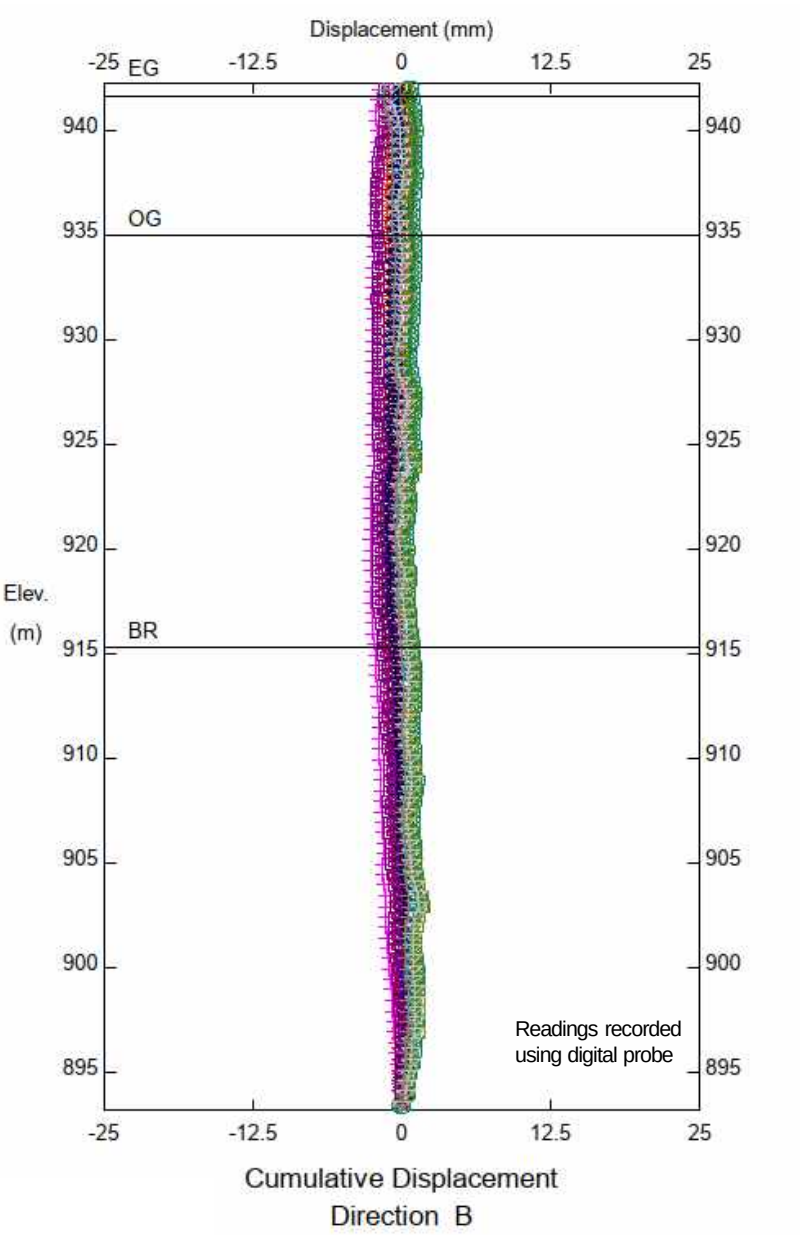












Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

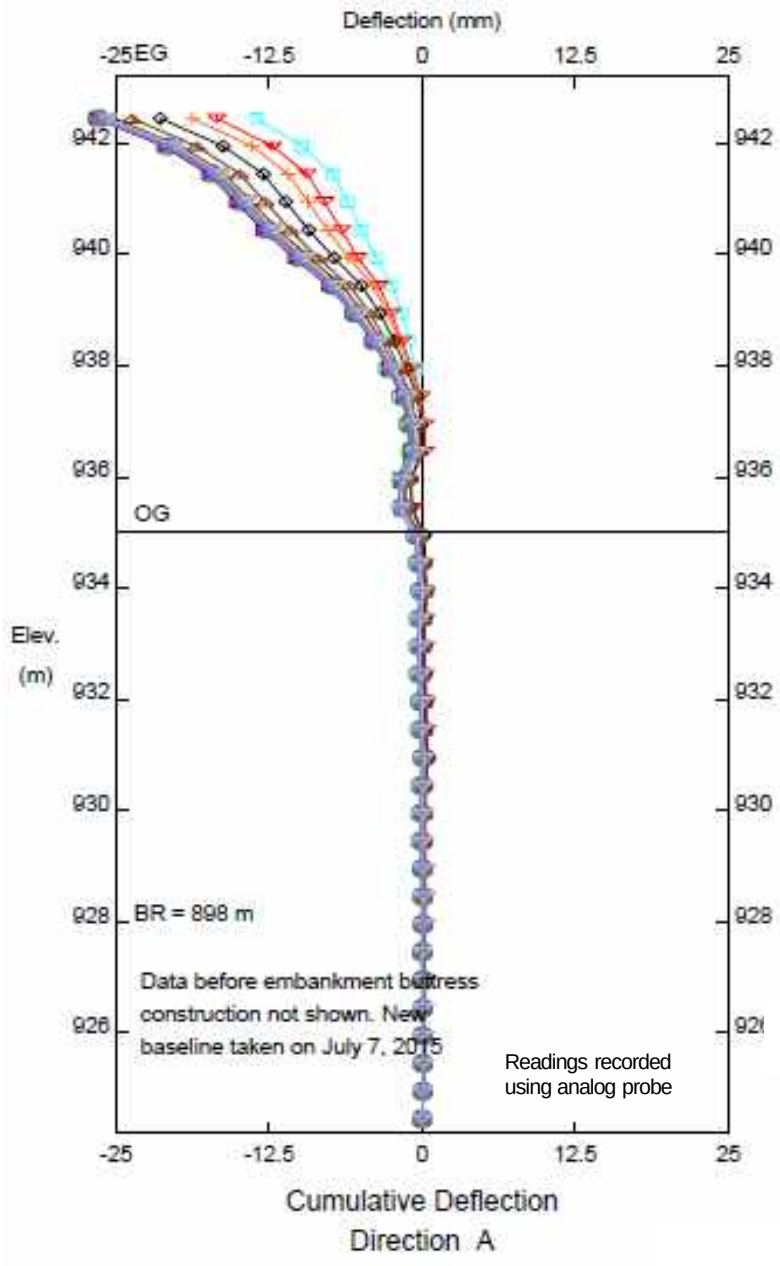
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

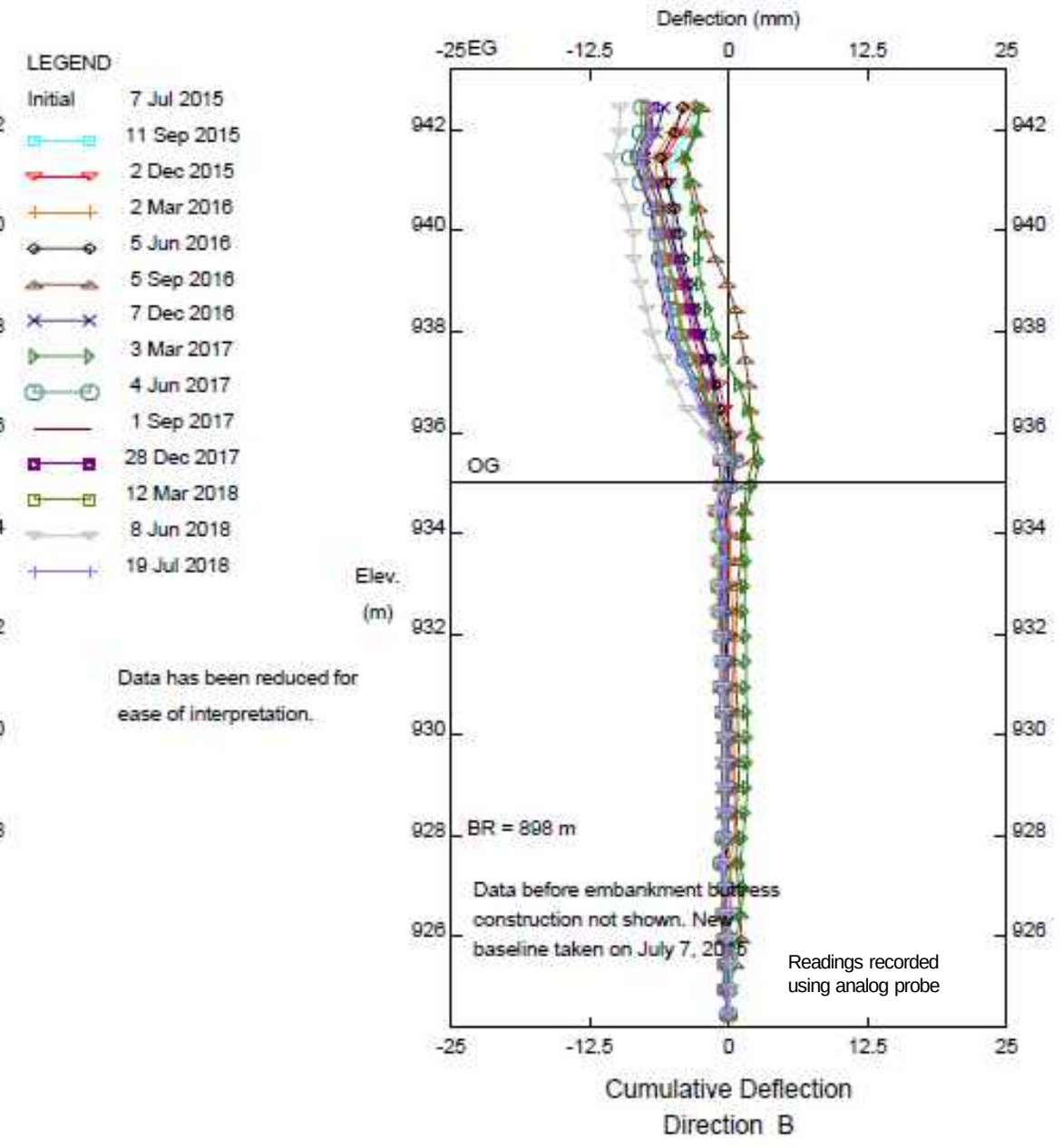
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

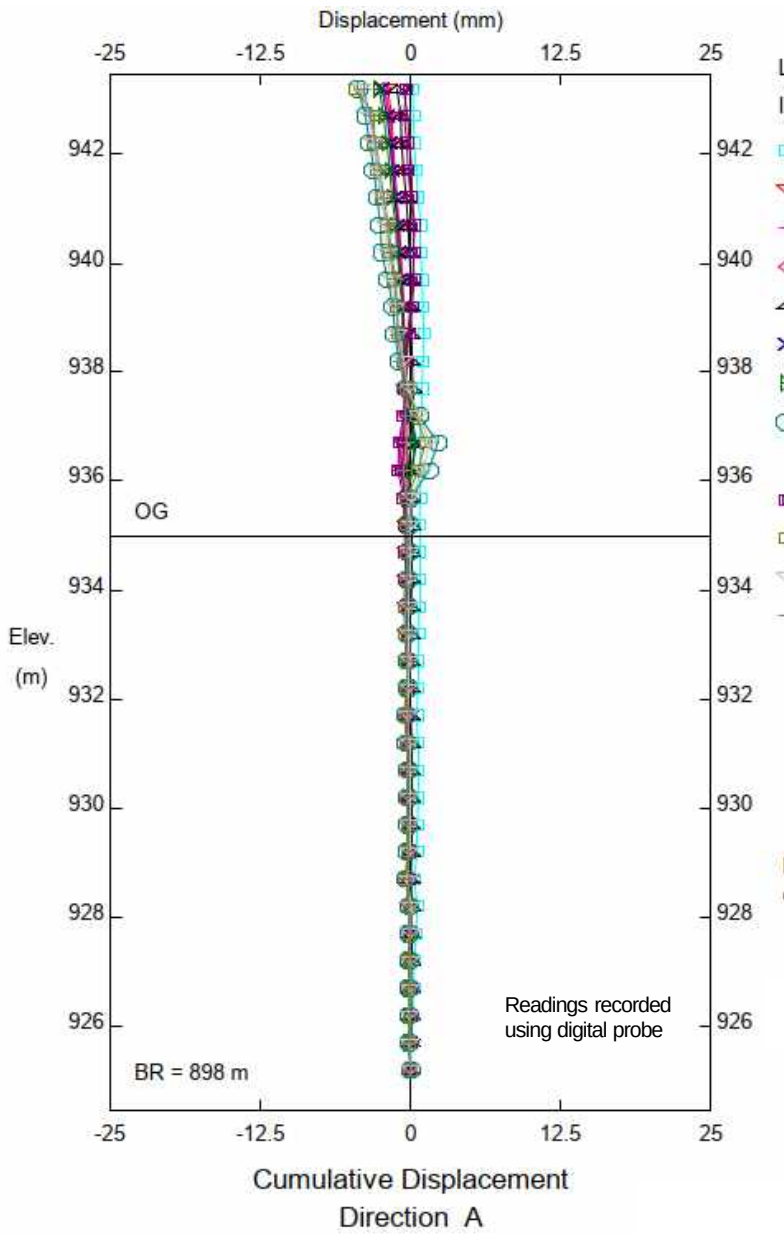
TITLE
SLOPE INCLINOMETER SI15-07
PERIMETER EMBANKMENT

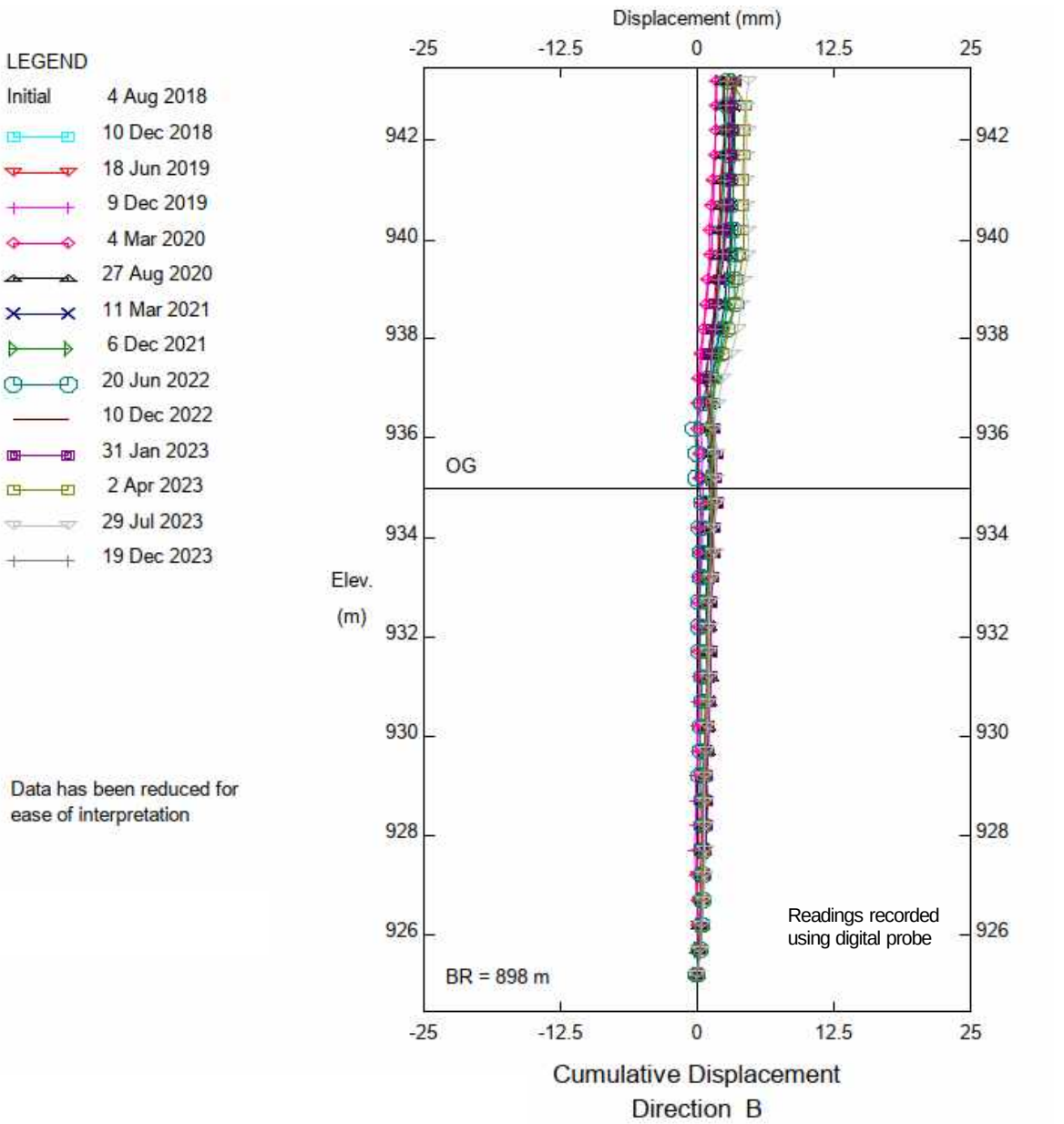
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B16

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B









Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

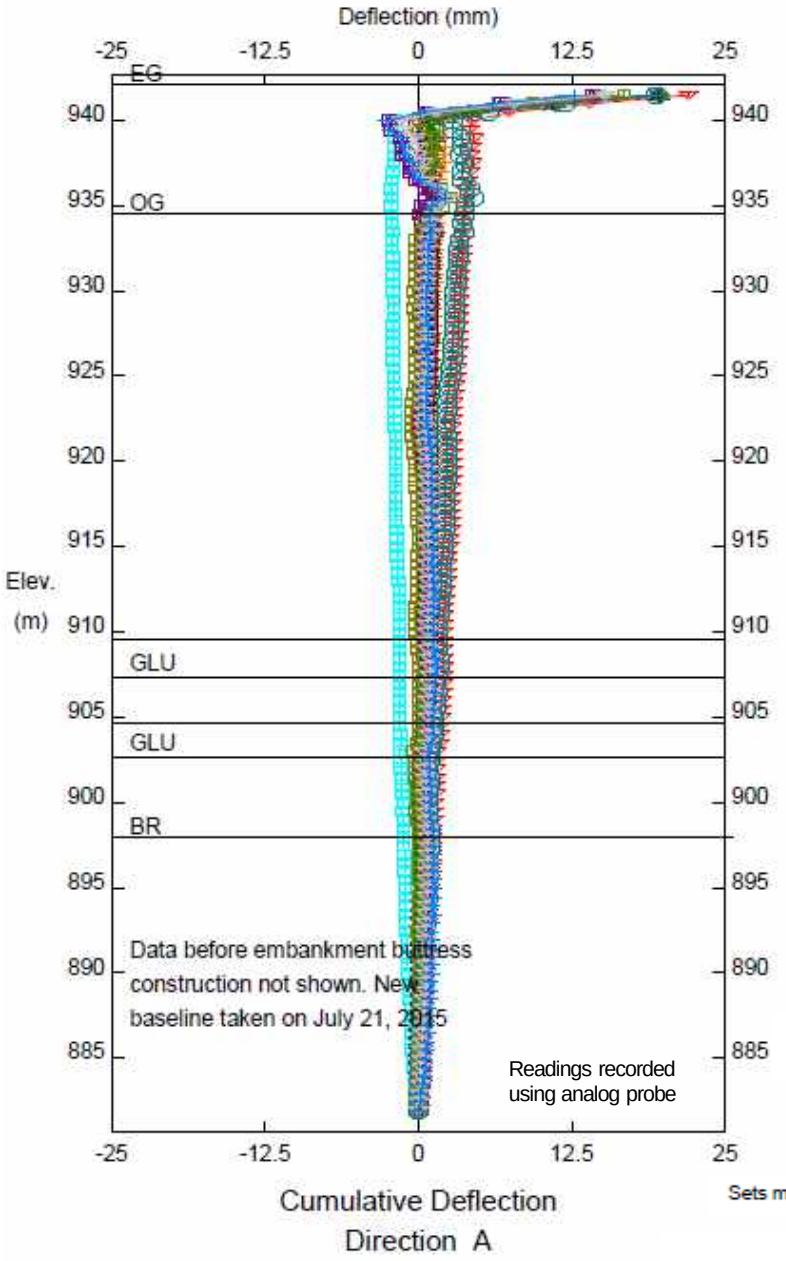
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

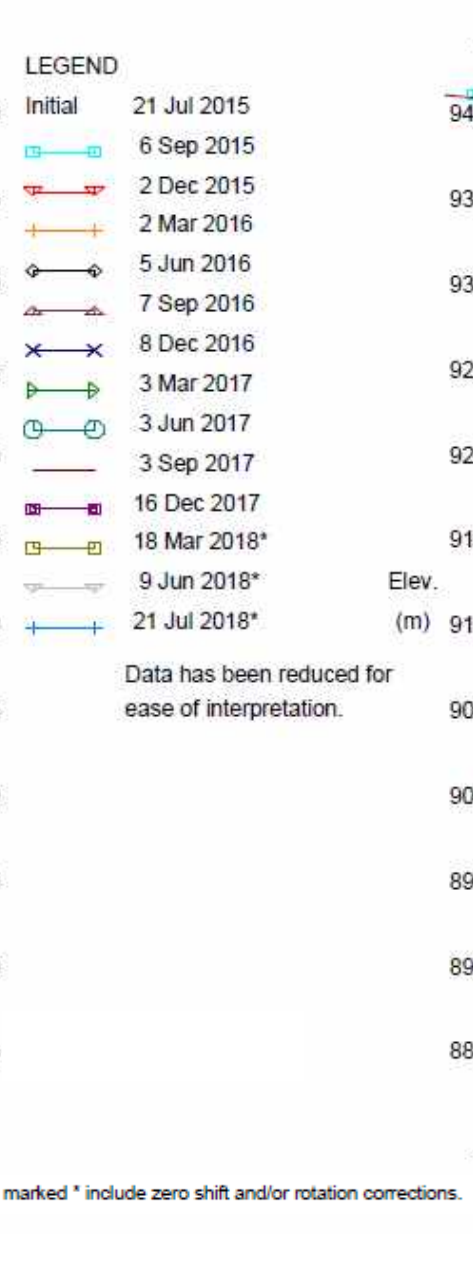
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

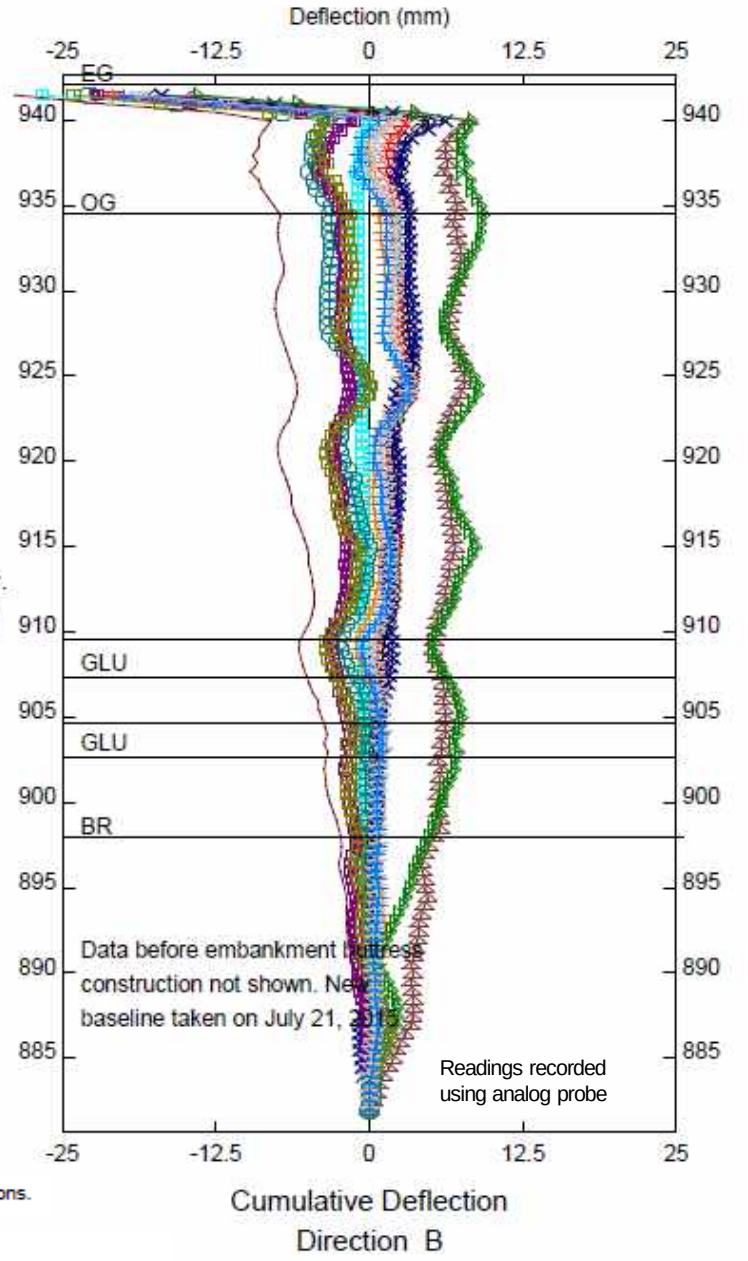
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PERIMETER EMBANKMENT

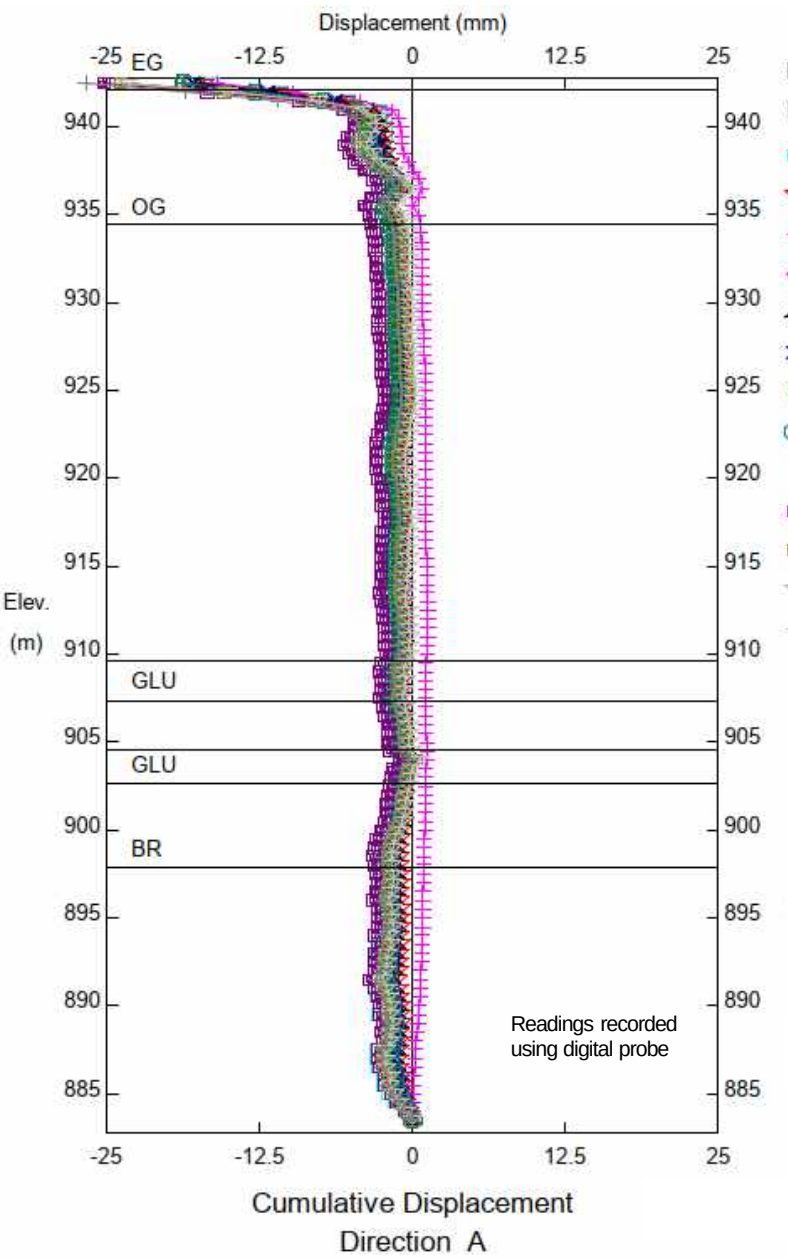
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B17**

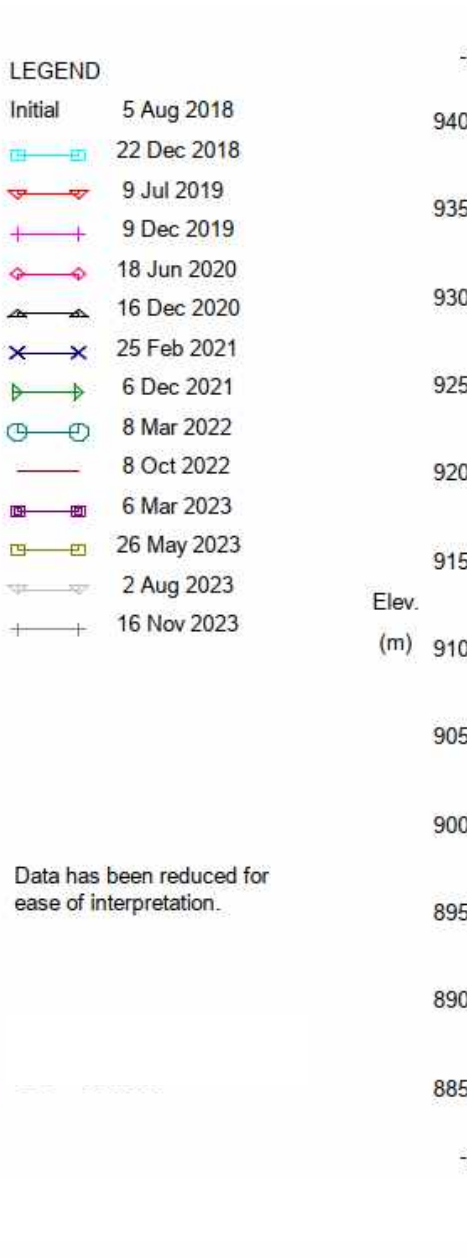
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm

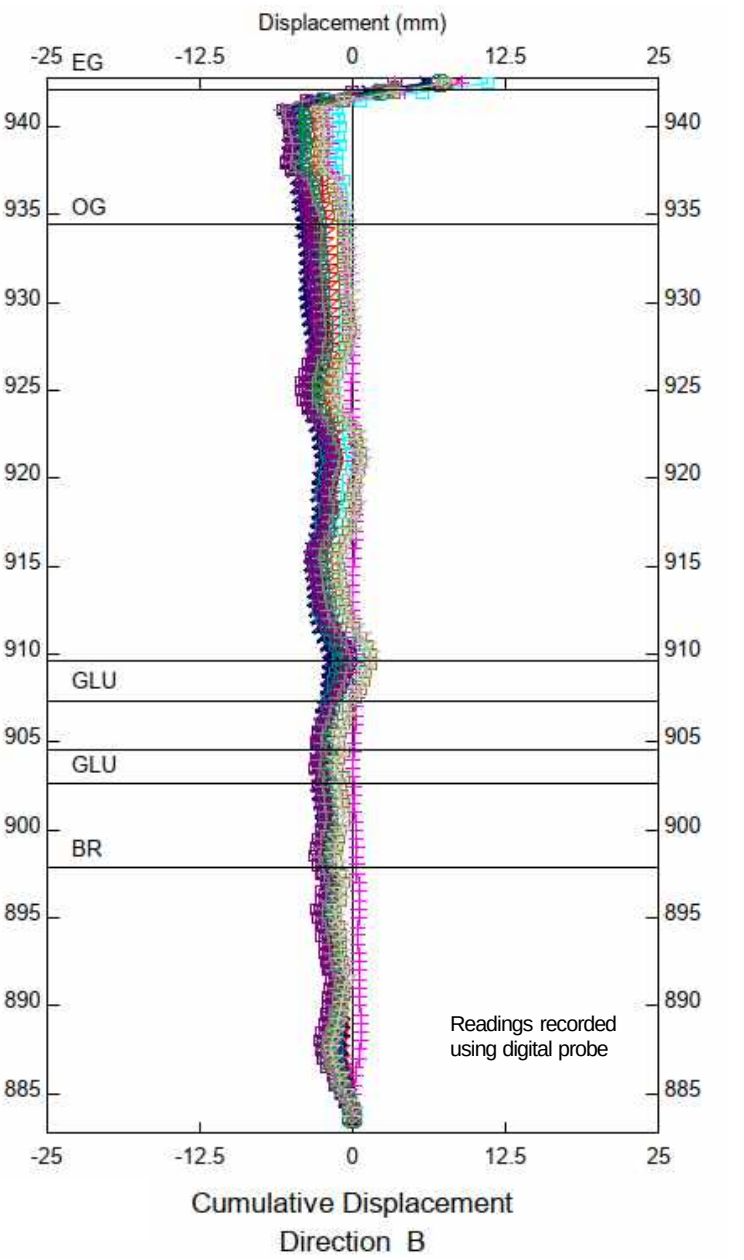












Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

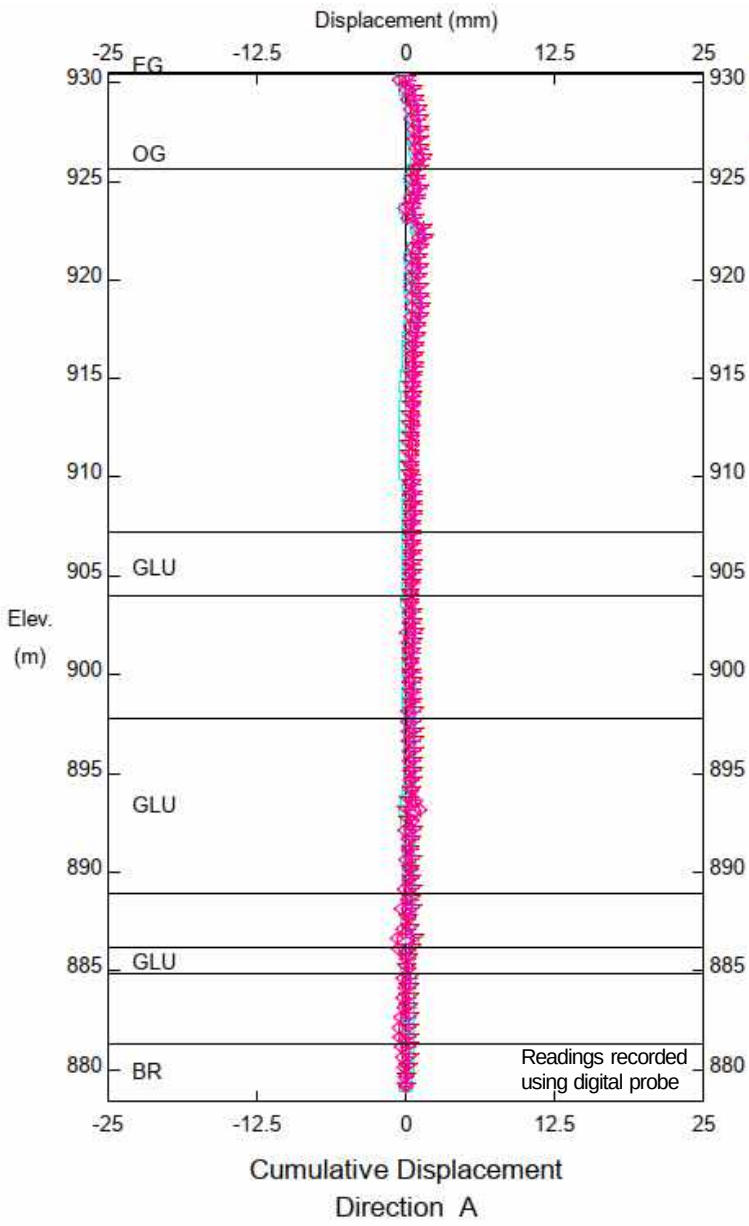
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

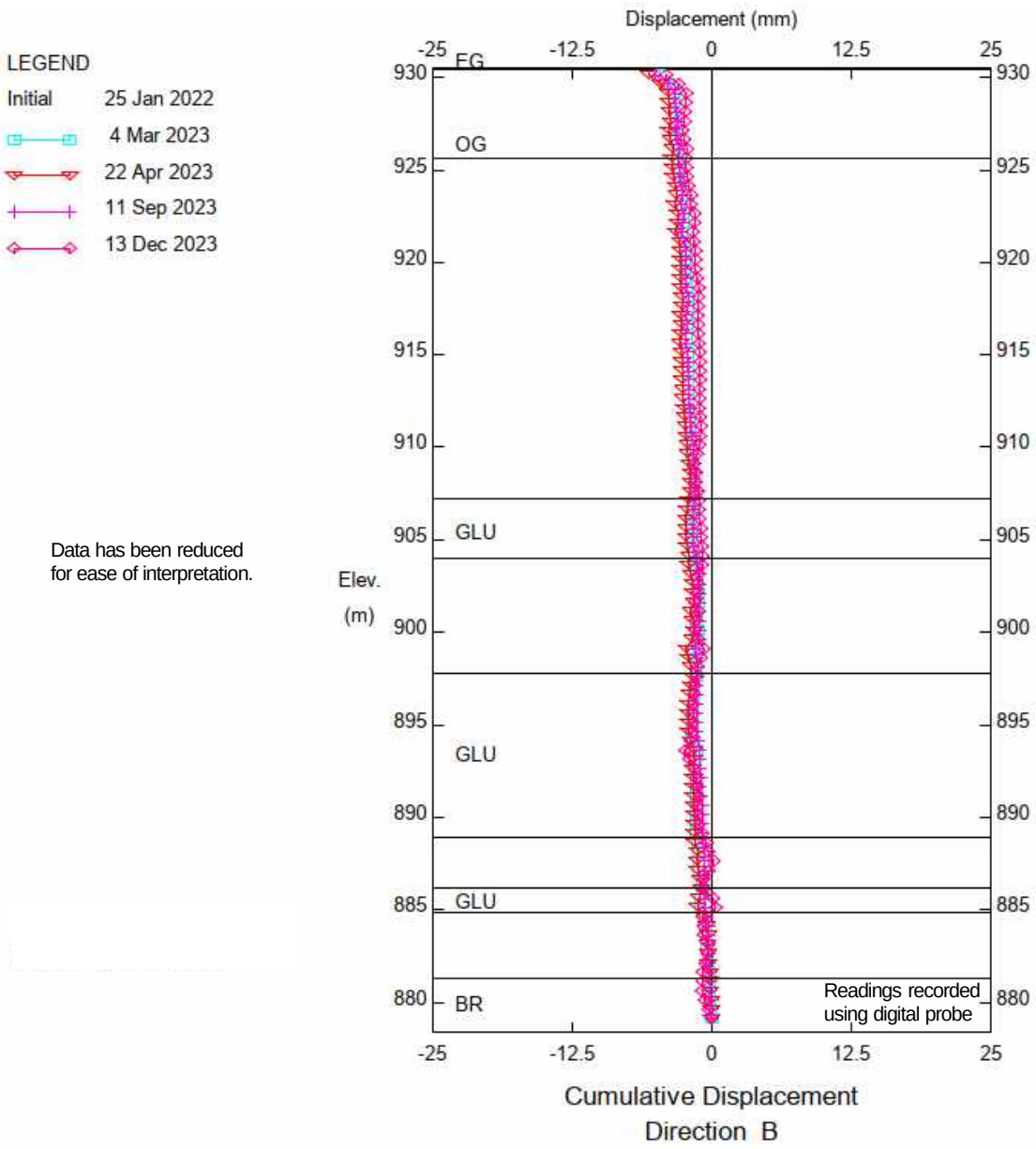
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-06
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B18

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm





Data has been reduced
for ease of interpretation.

Note:
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

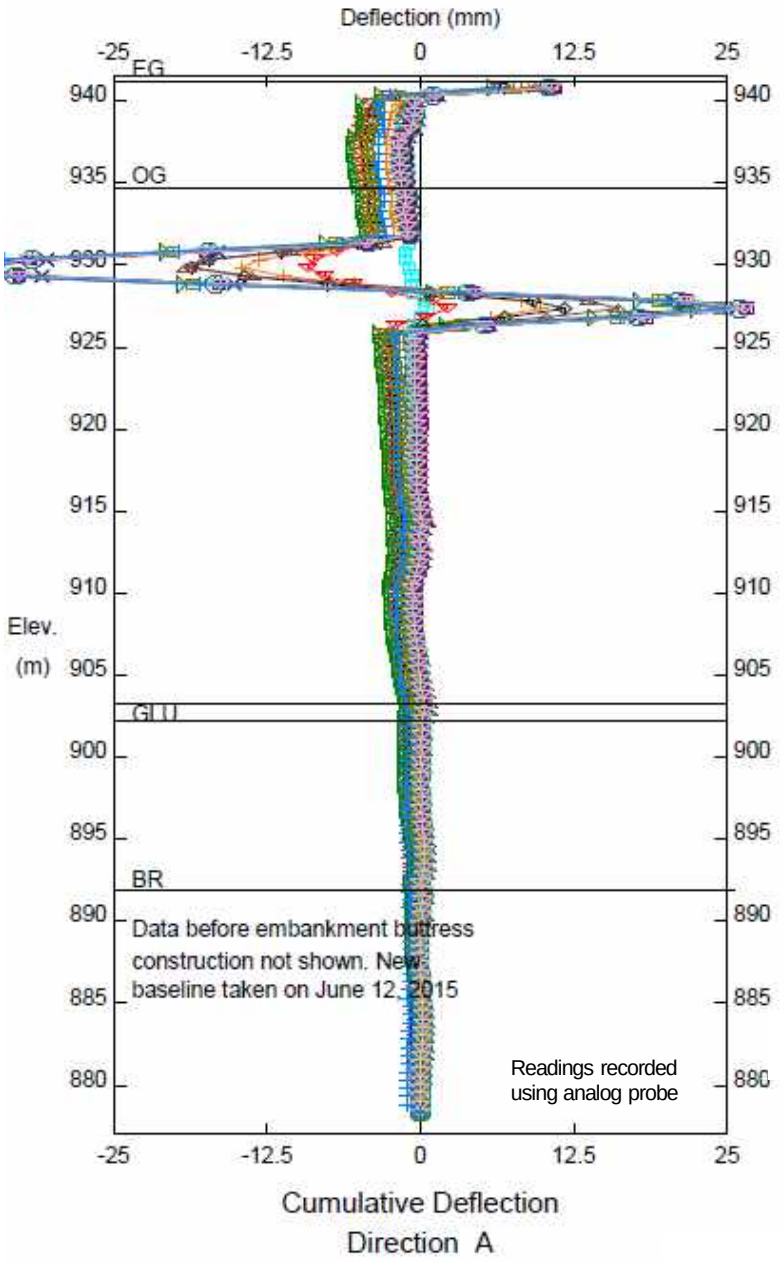
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

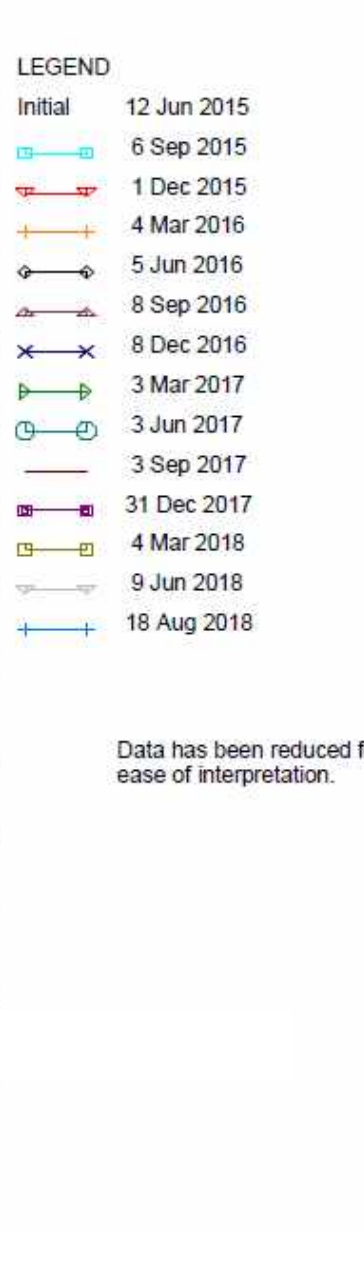
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI21-03
PERIMETER EMBANKMENT

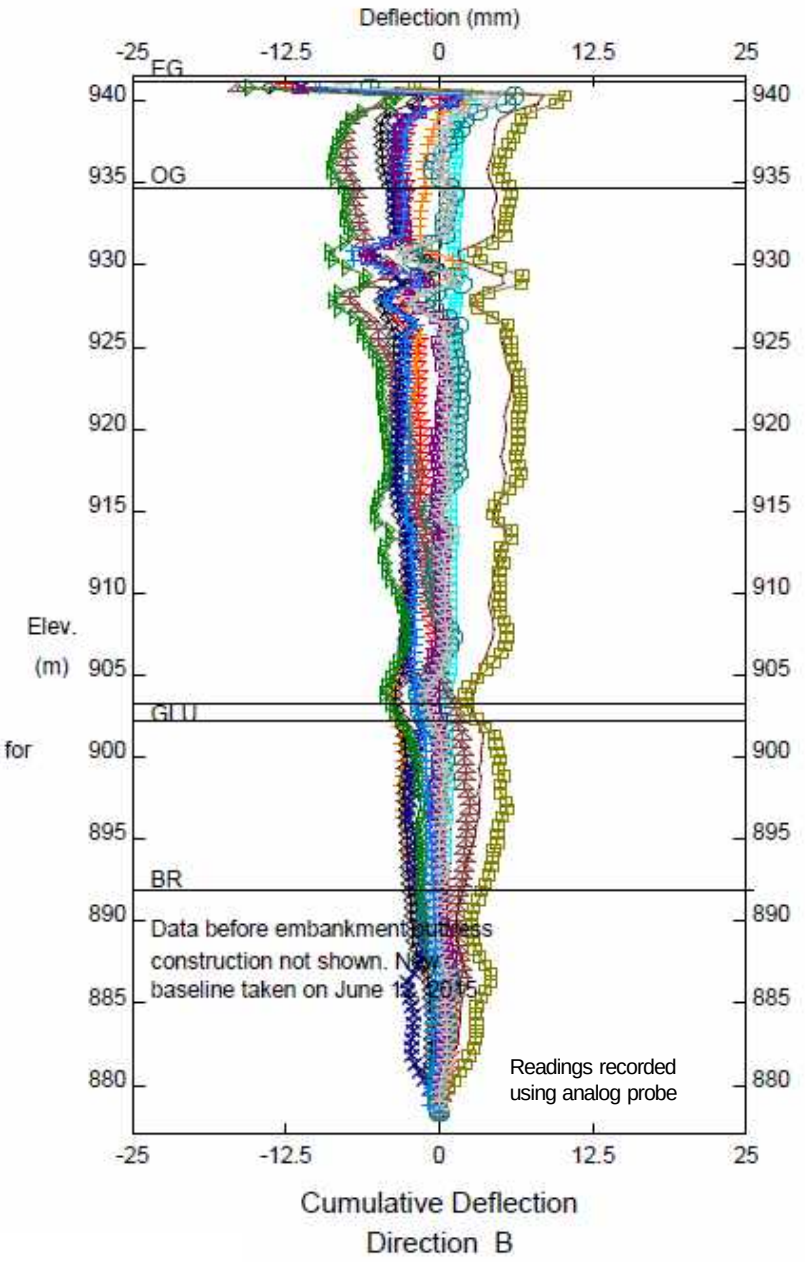
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B19

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm





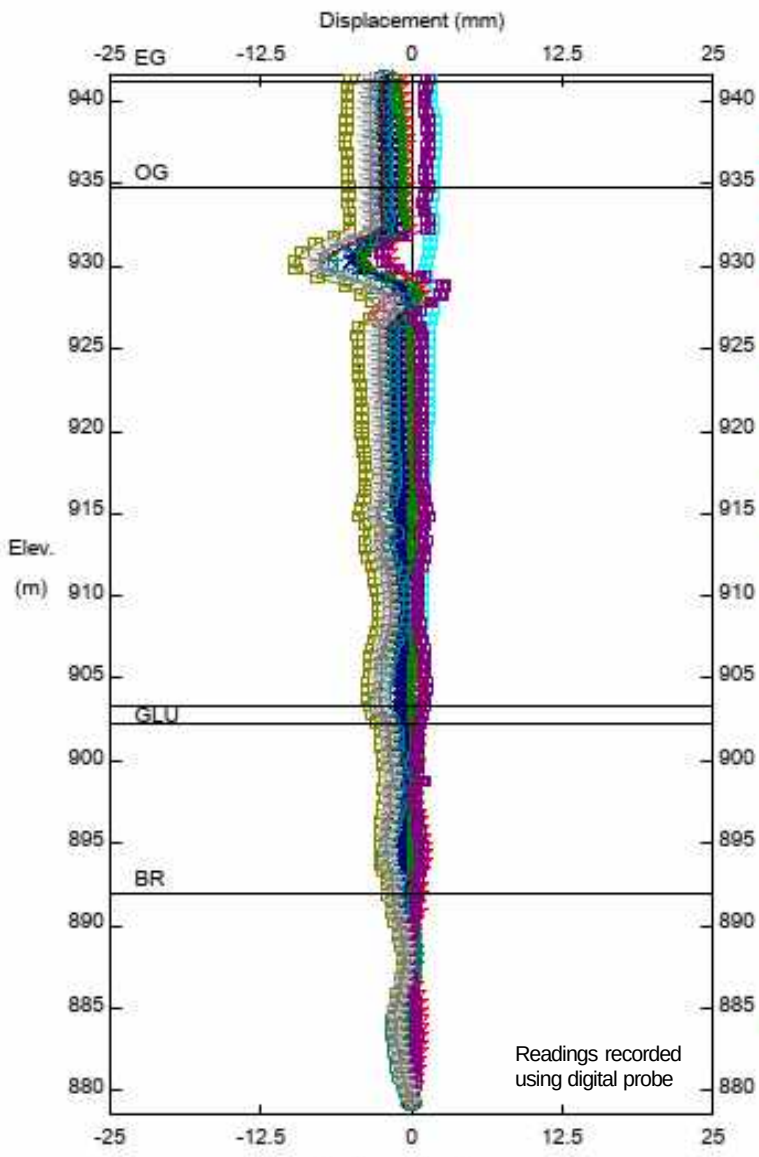
Data has been reduced for ease of interpretation.



Cumulative Deflection
Direction A

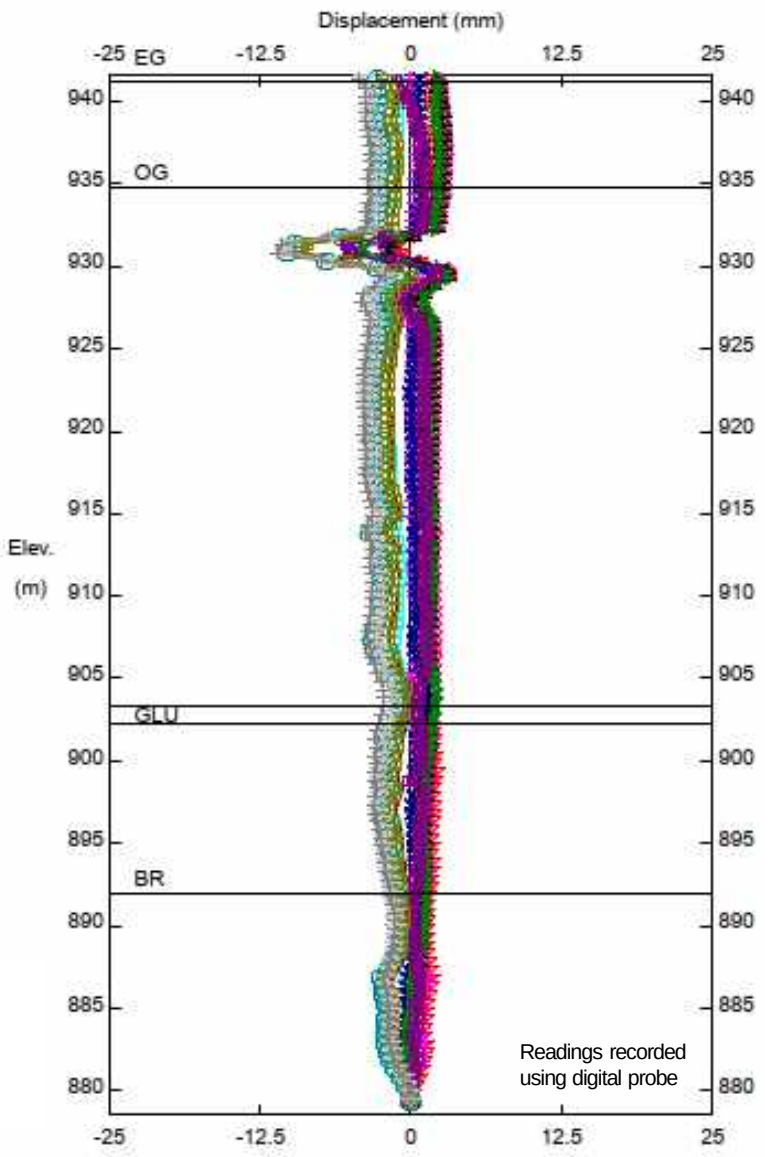
Cumulative Deflection
Direction B

WSP Canada Inc.





Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction A

Cumulative Displacement
Direction B

Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

Instrumentation Monitoring, Inclinometer SI15-05
Mount Polley Mining Corporation

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

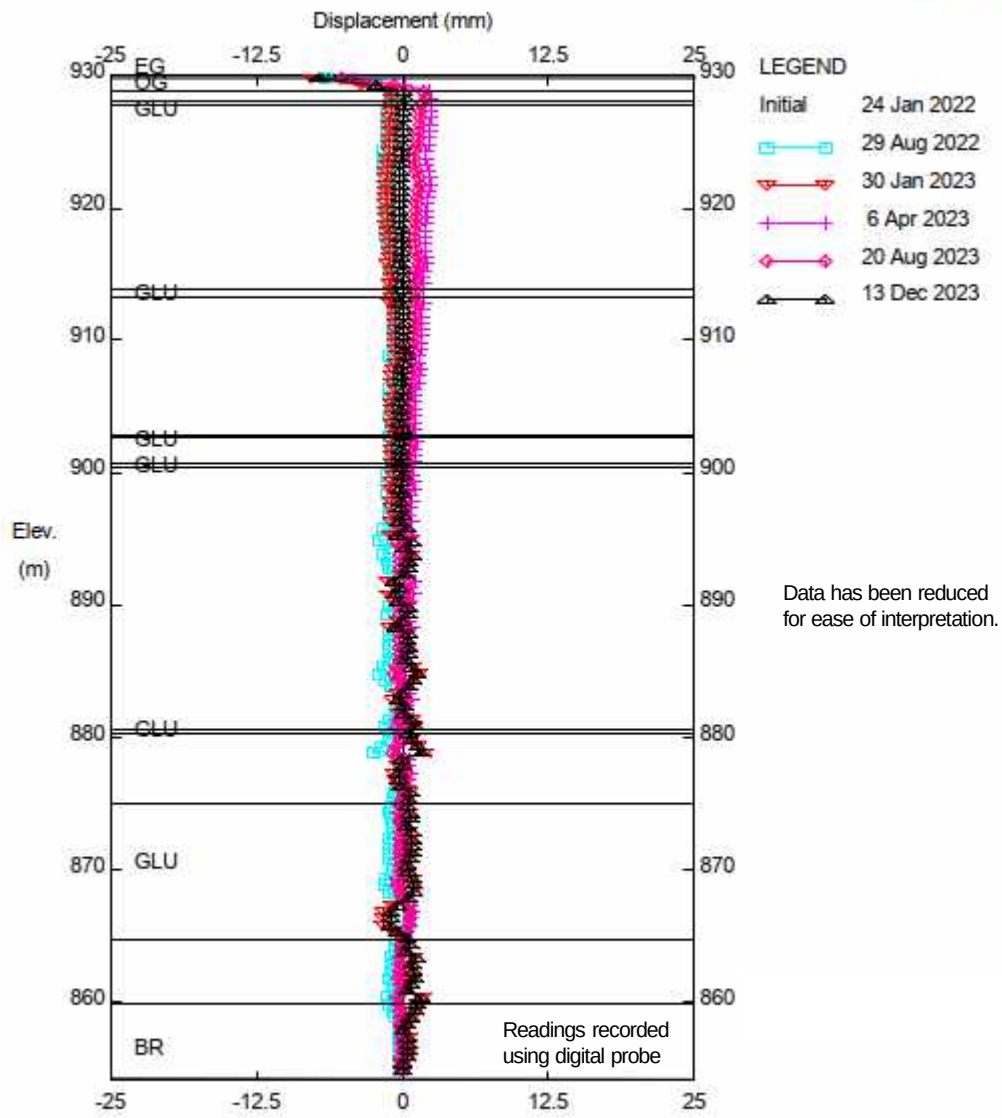
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

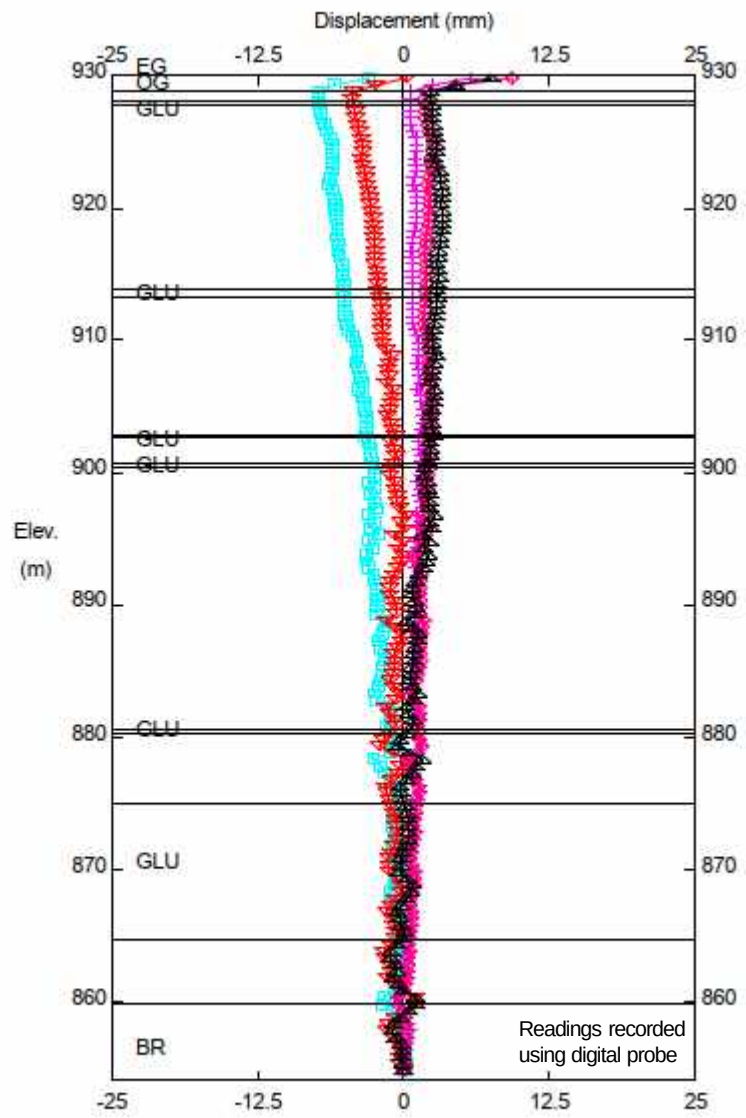
TITLE
SLOPE INCLINOMETER SI15-05
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B20

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm

WSP Canada Inc.





Note:
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

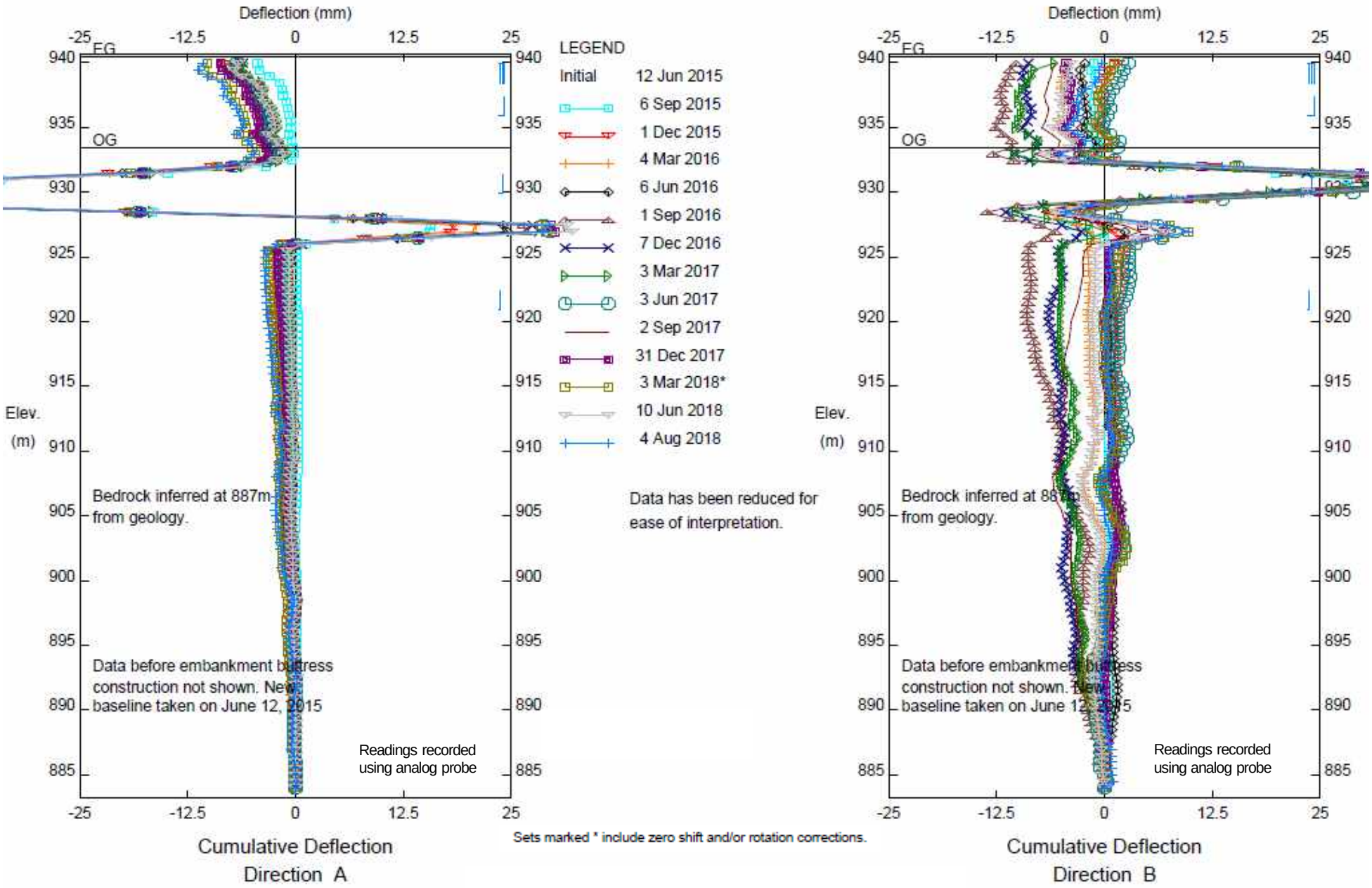
CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

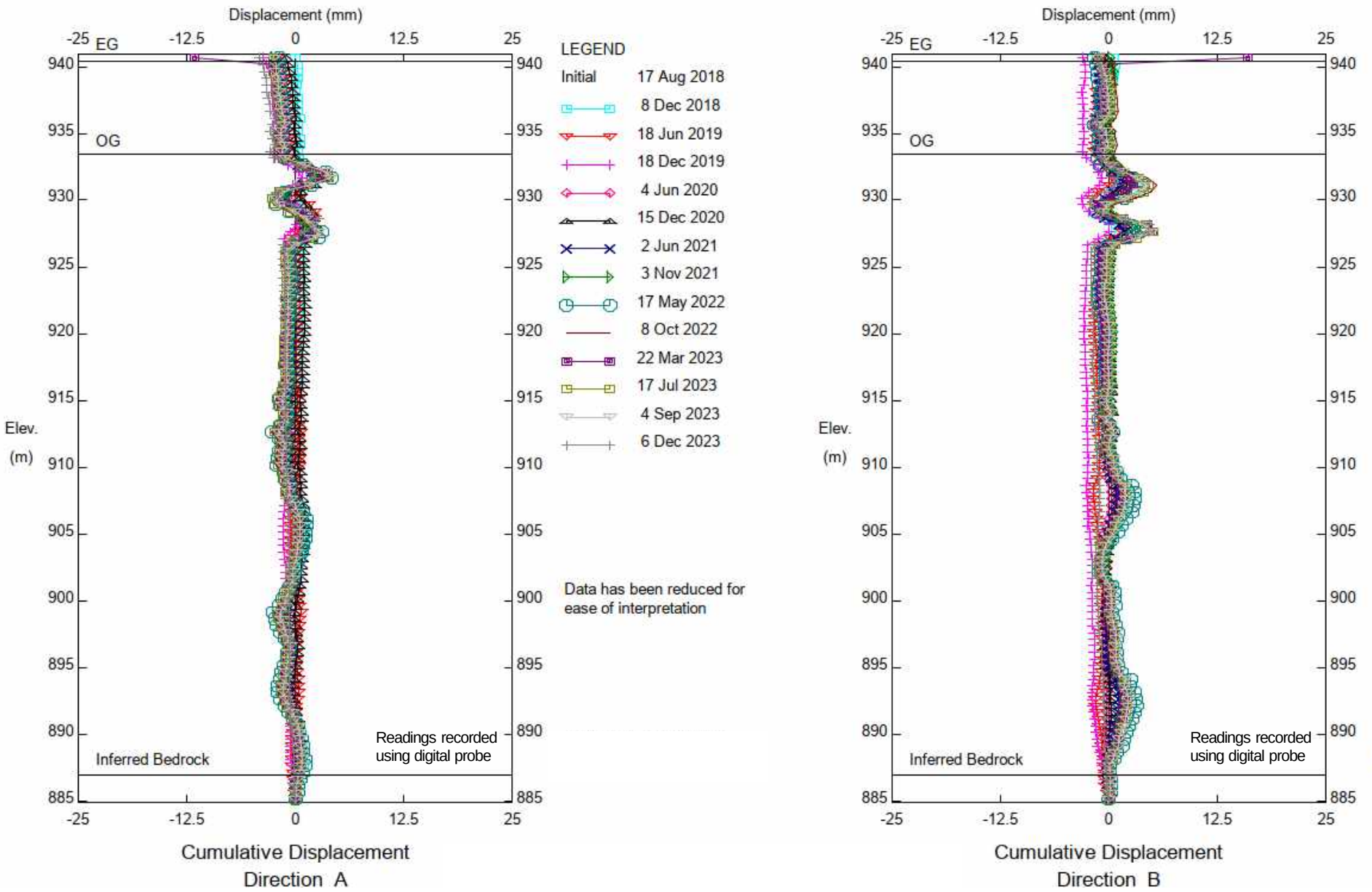
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI21-02
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B21**



Sets marked * include zero shift and/or rotation corrections.



Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

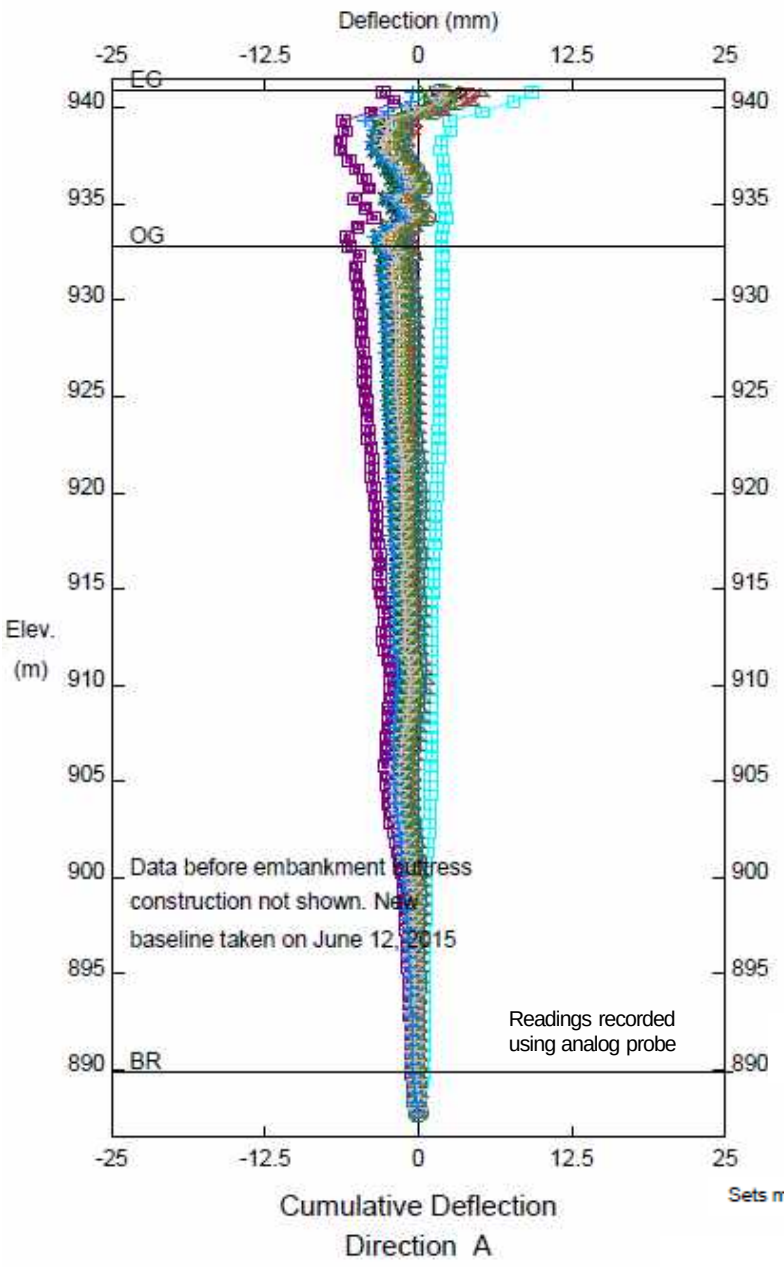
CONSULTANT
wsp

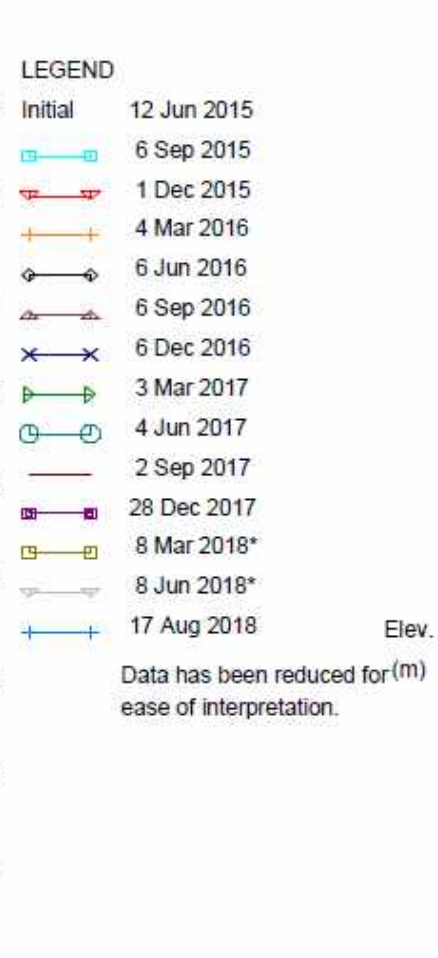
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

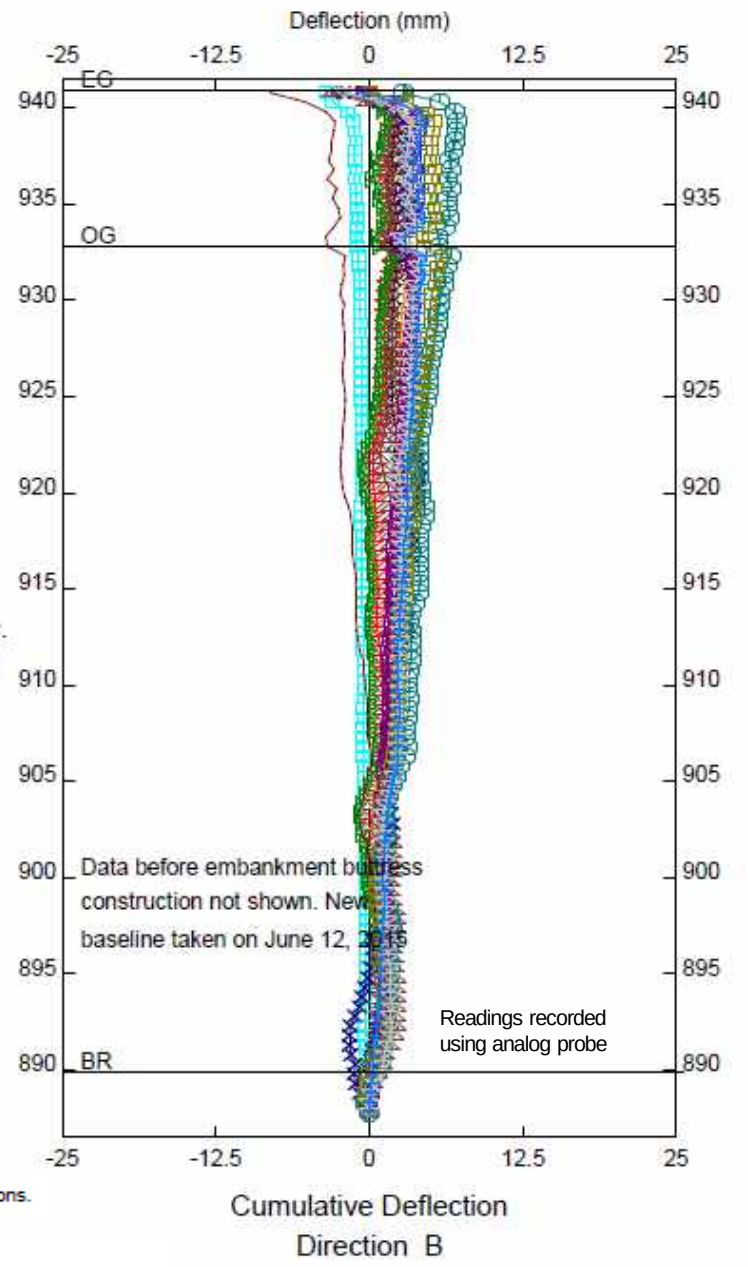
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-04
PERIMETER EMBANKMENT

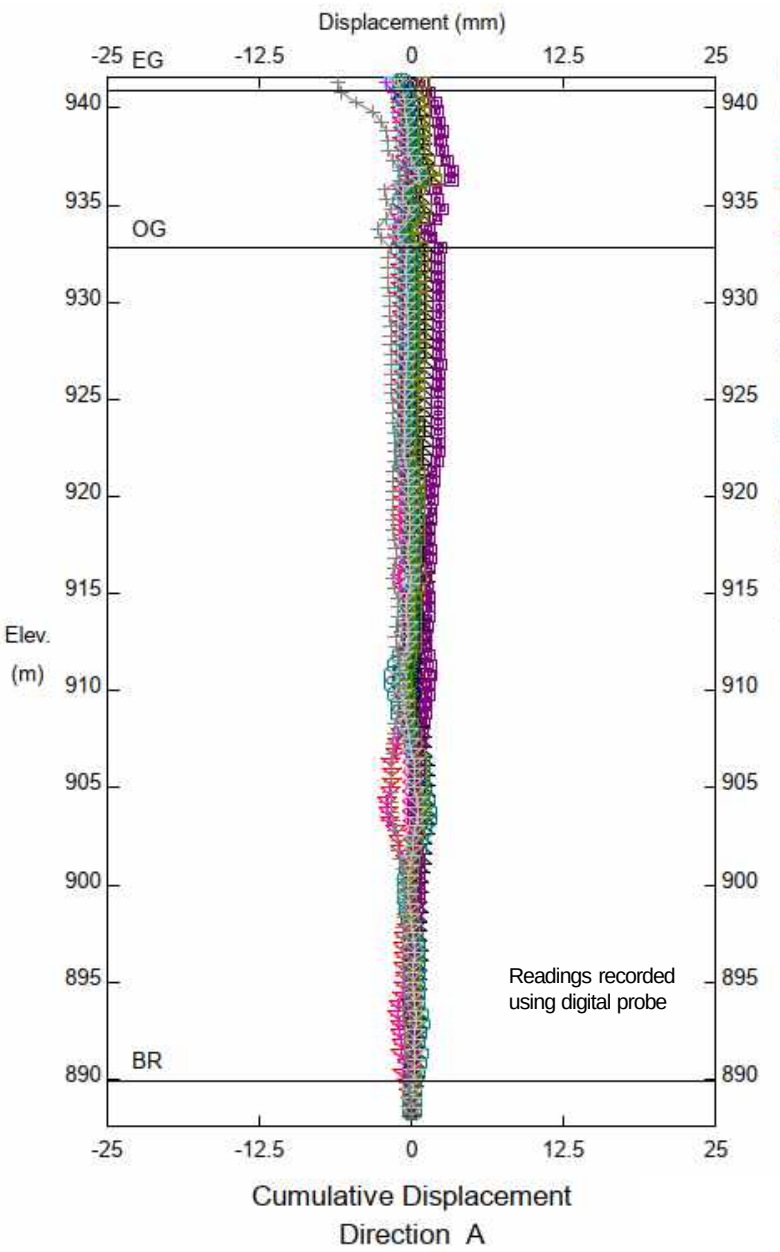
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B22

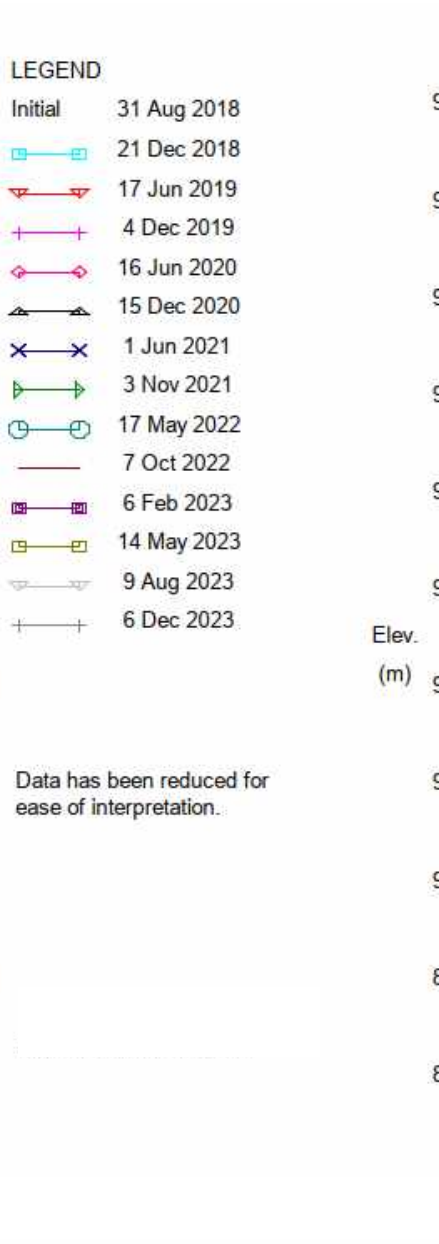


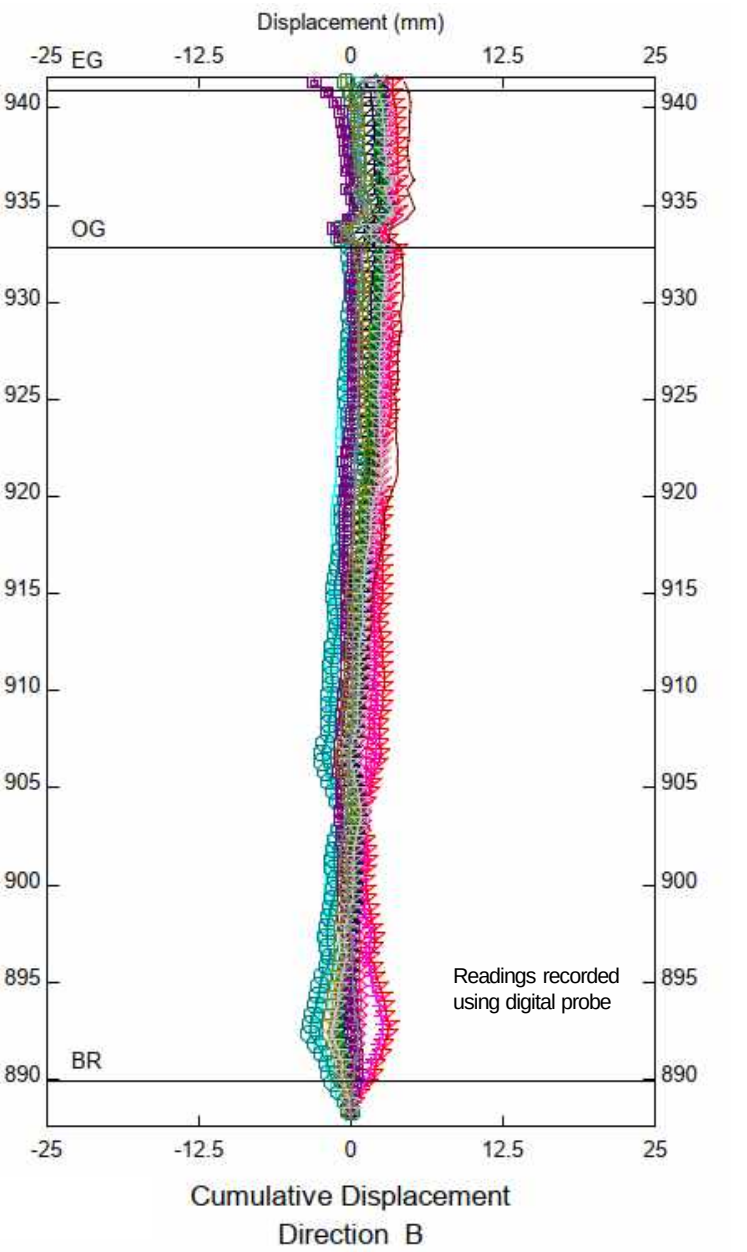




Sets marked * include zero shift and/or rotation corrections.







Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

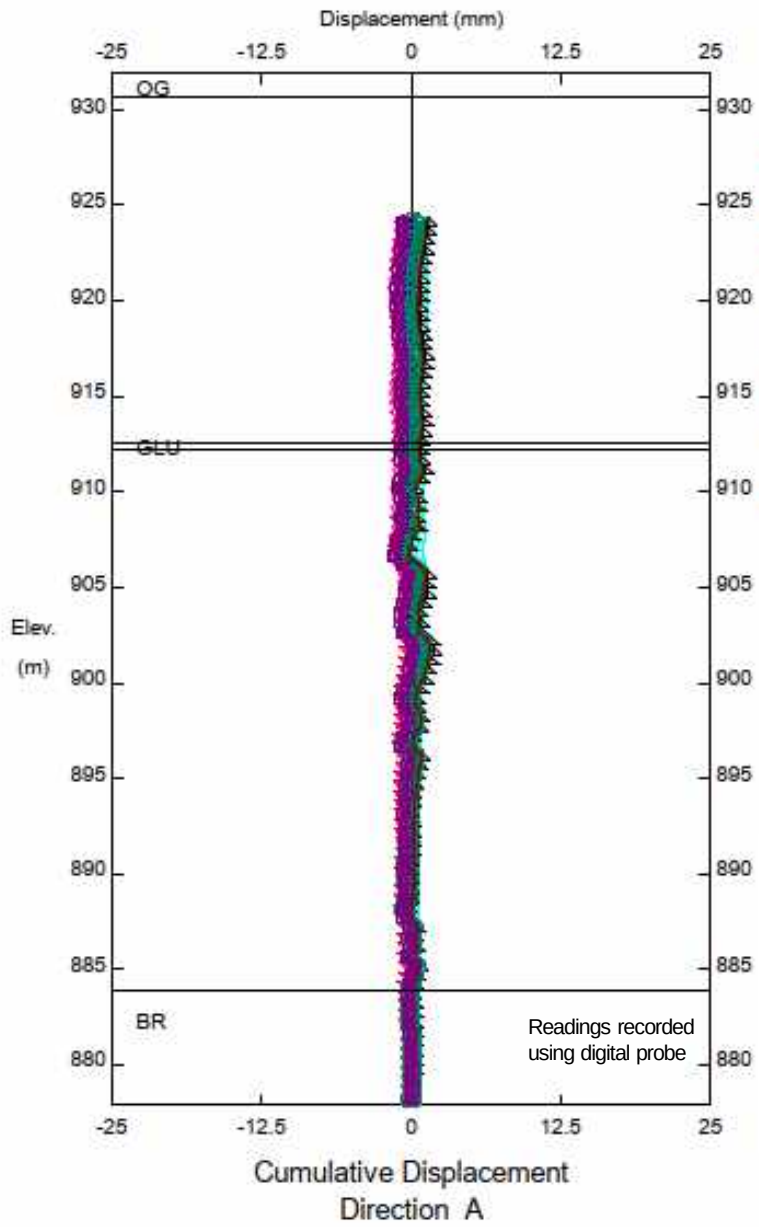
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-03
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm

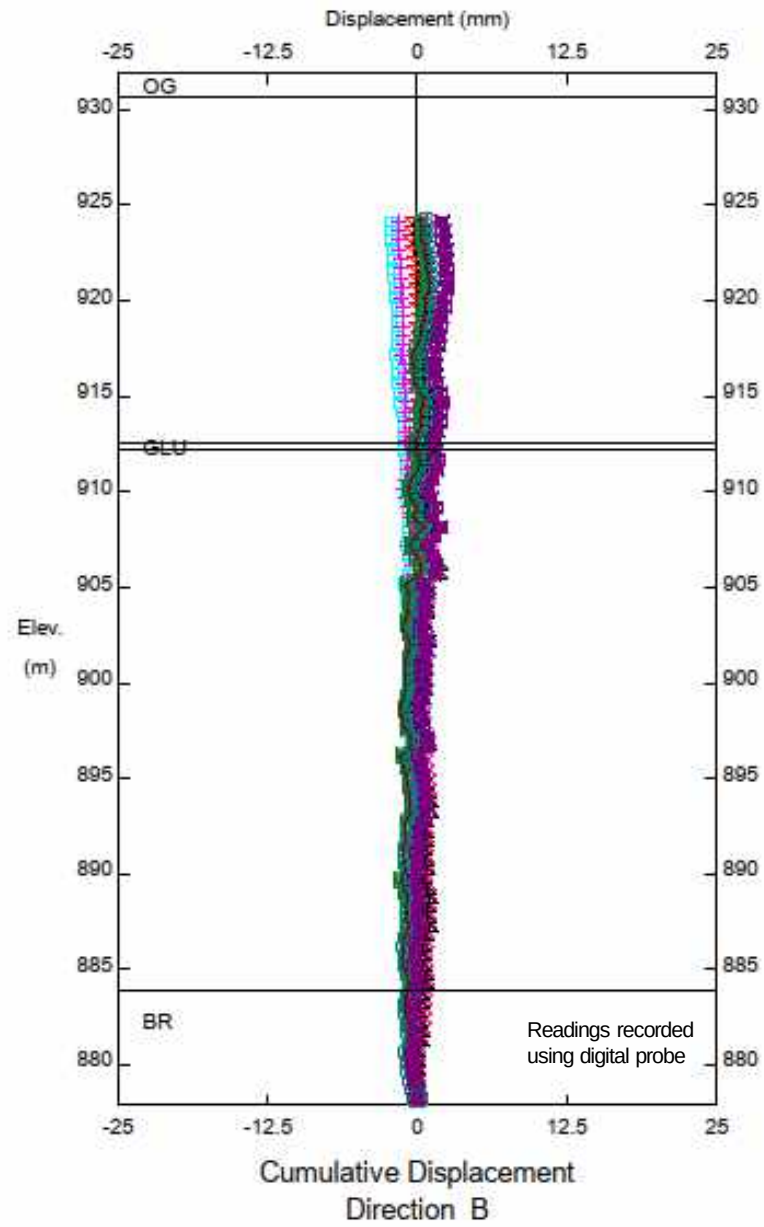


Cumulative Displacement
Direction A

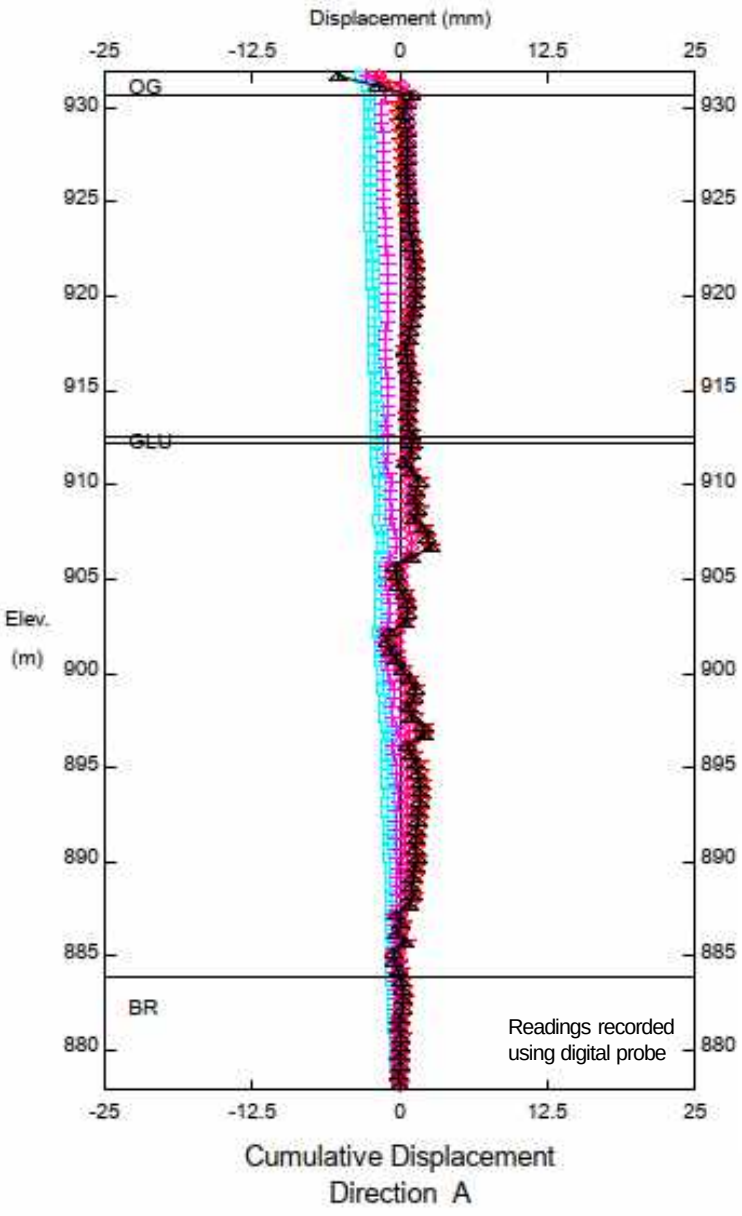
LEGEND

Initial	24 Jan 2022
	14 Mar 2022
	29 Mar 2022
	11 Apr 2022
	25 Apr 2022
	20 Jun 2022
	5 Jul 2022
	19 Jul 2022
	3 Aug 2022
	30 Aug 2022
	12 Sep 2022

Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction B

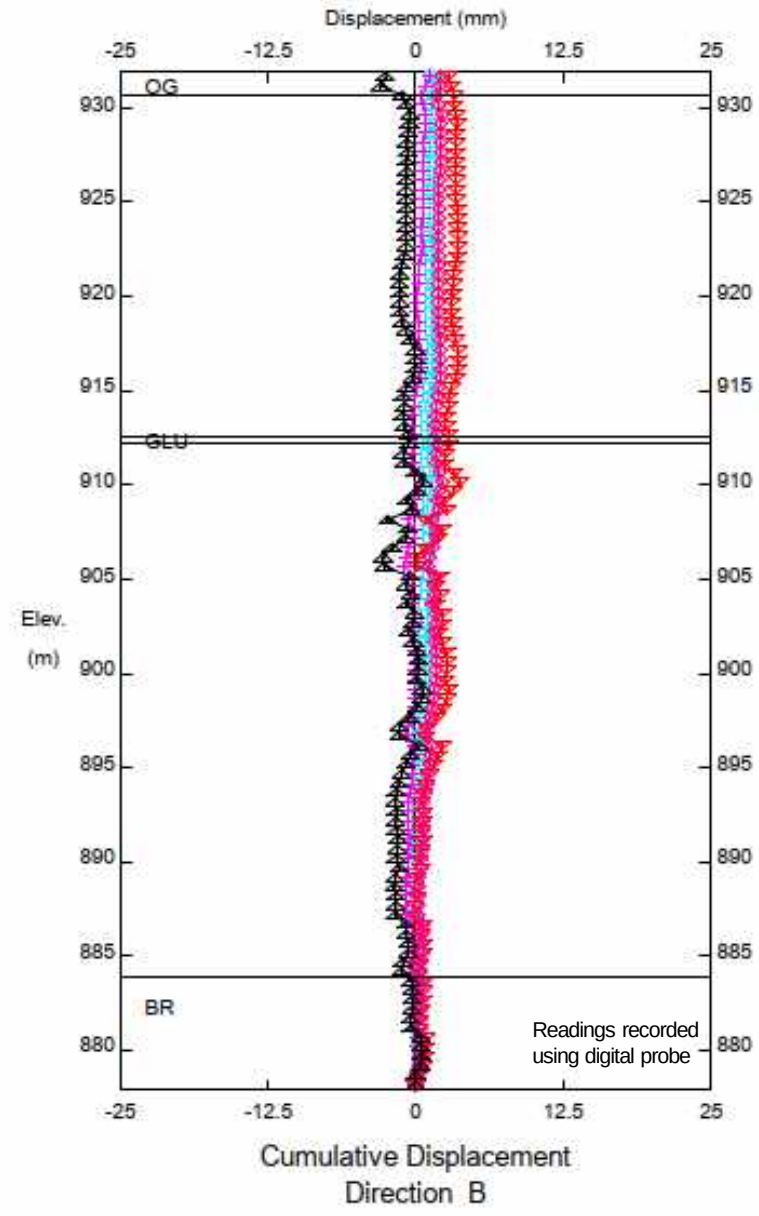


Cumulative Displacement
Direction A

LEGEND

Initial	26 Sep 2022
	12 Oct 2022
	19 Jan 2023
	22 Mar 2023
	25 May 2023
	6 Dec 2023

Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction B

Note:
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

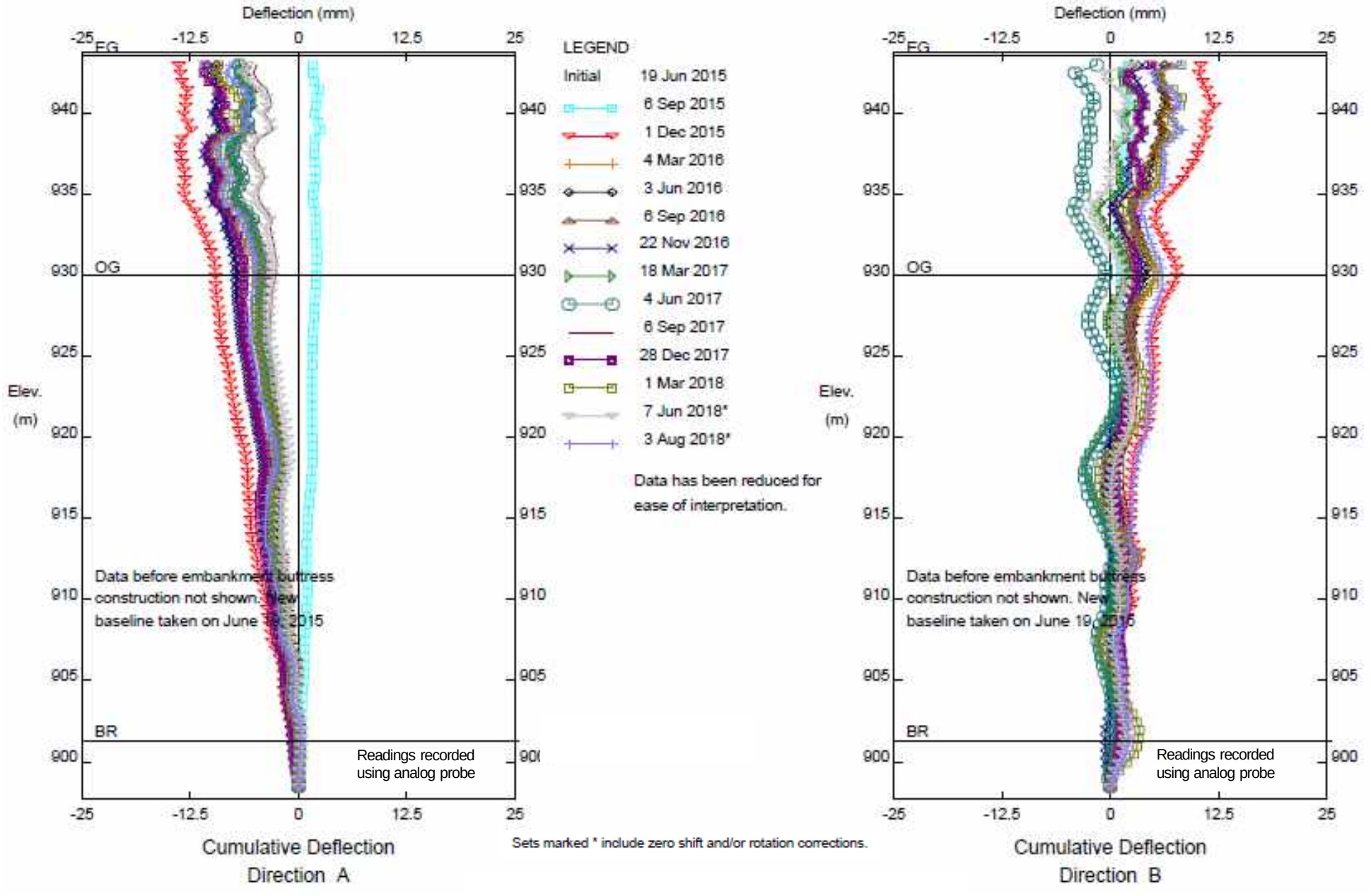
CONSULTANT
wsp

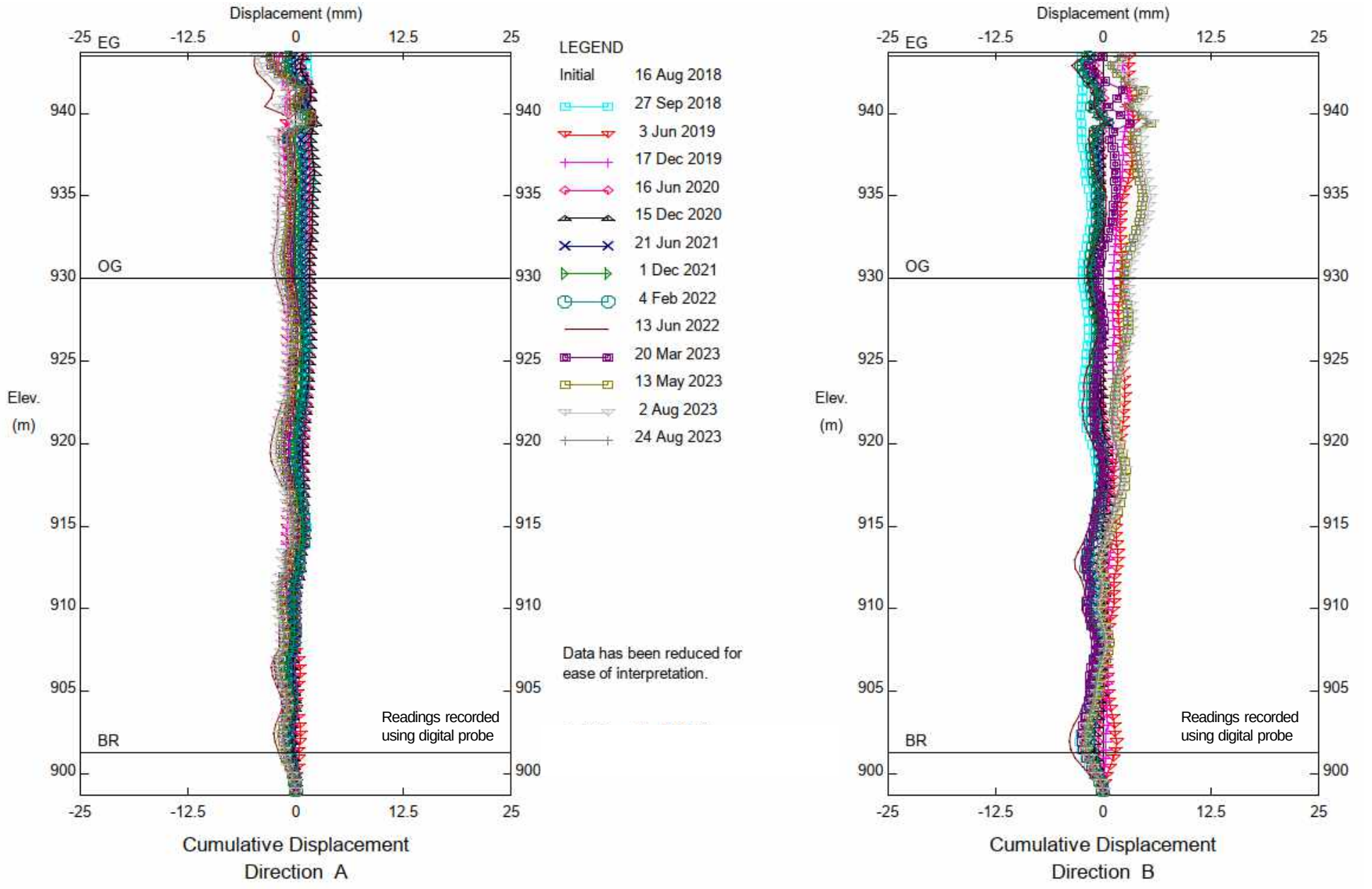
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI21-01
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B24**





Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

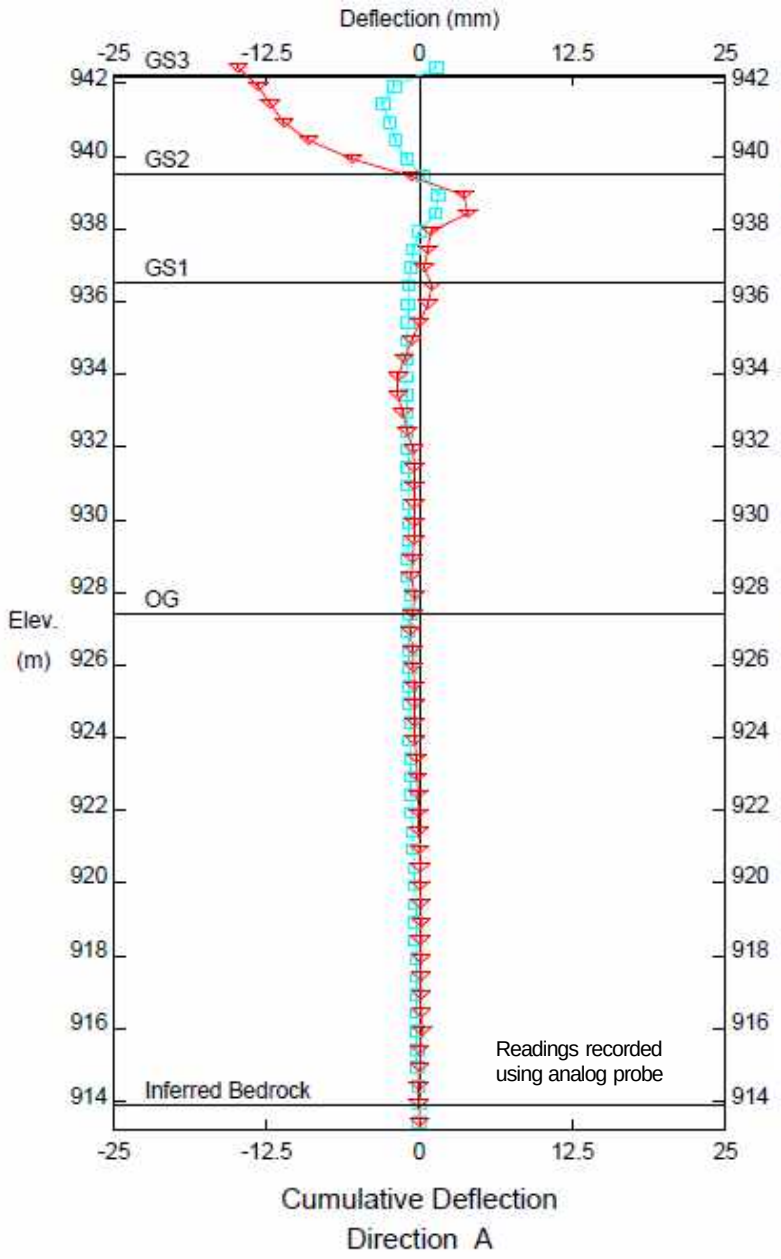
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-26
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B25

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B



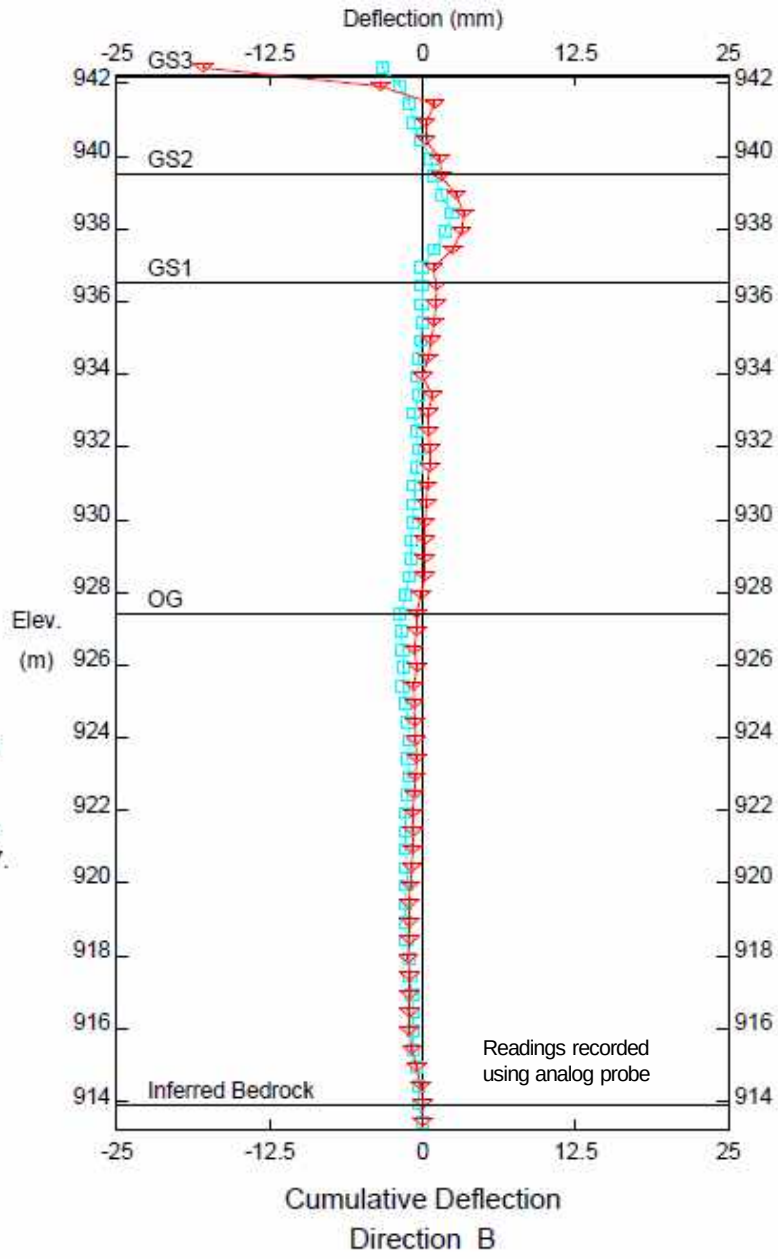
LEGEND

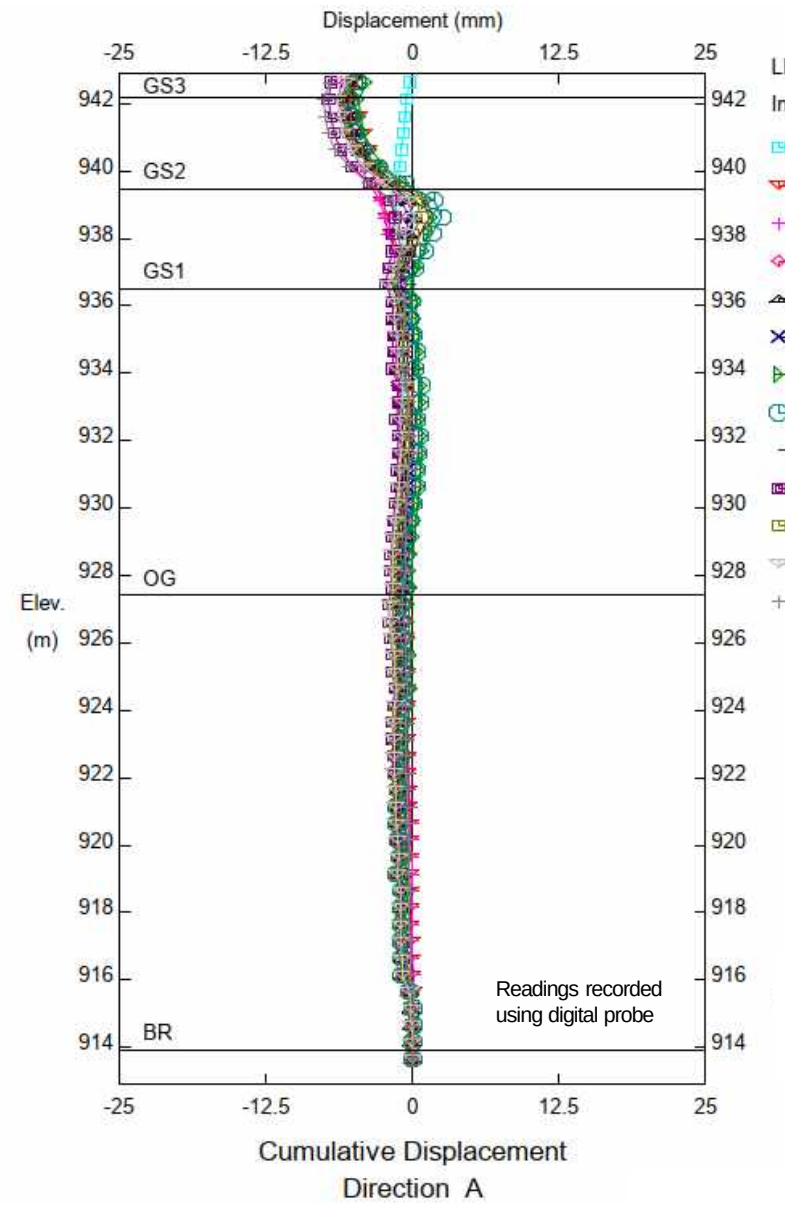
Initial	14 Nov 2017
	31 Dec 2017
	25 Jul 2018

Data has been reduced for ease of interpretation.

Inclinometer raised from 936.49 m to 939.49 m on 19 August 2017.

Inclinometer raised from 939.49 m to 942.23 m on 14 November 2017.

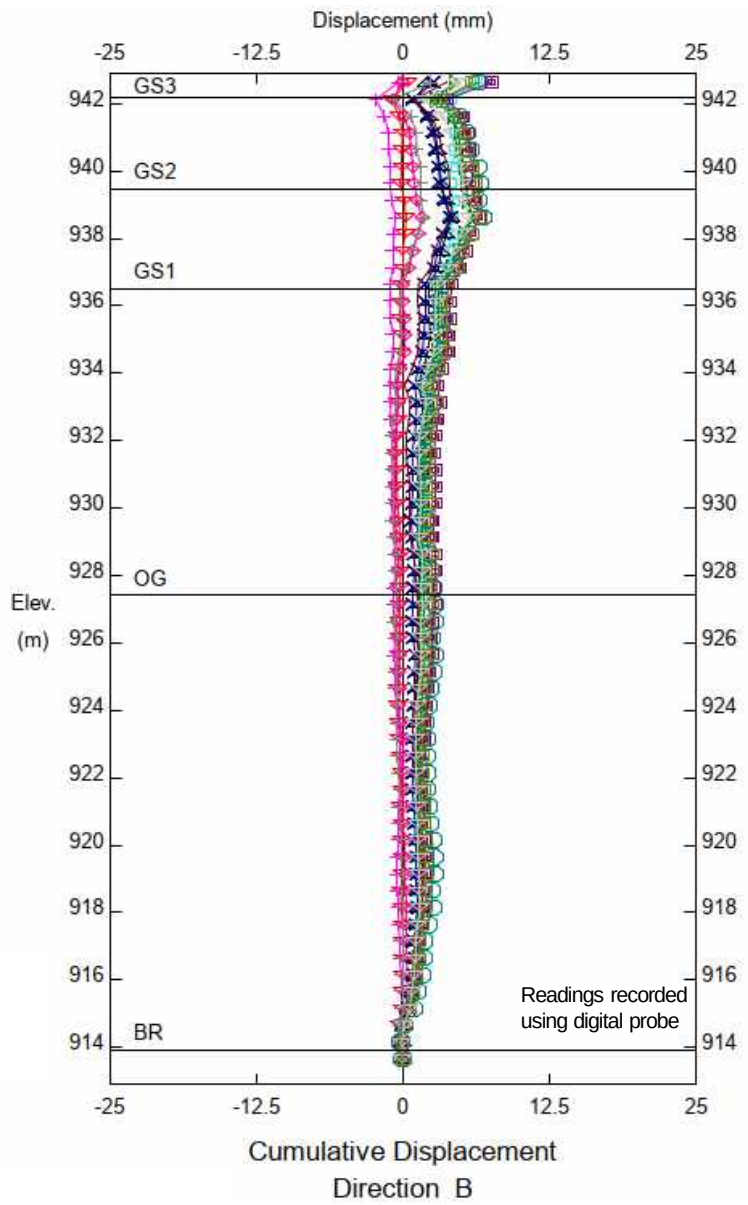




LEGEND

Initial	3 Aug 2018
	20 Dec 2018
	2 Jul 2019
	3 Dec 2019
	29 Jun 2020
	15 Dec 2020
	21 Jun 2021
	20 Oct 2021
	13 Jun 2022
	5 Oct 2022
	1 Apr 2023
	31 May 2023
	4 Sep 2023
	14 Dec 2023

Data has been reduced for ease of interpretation.



Note:
GS: Ground Surface
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

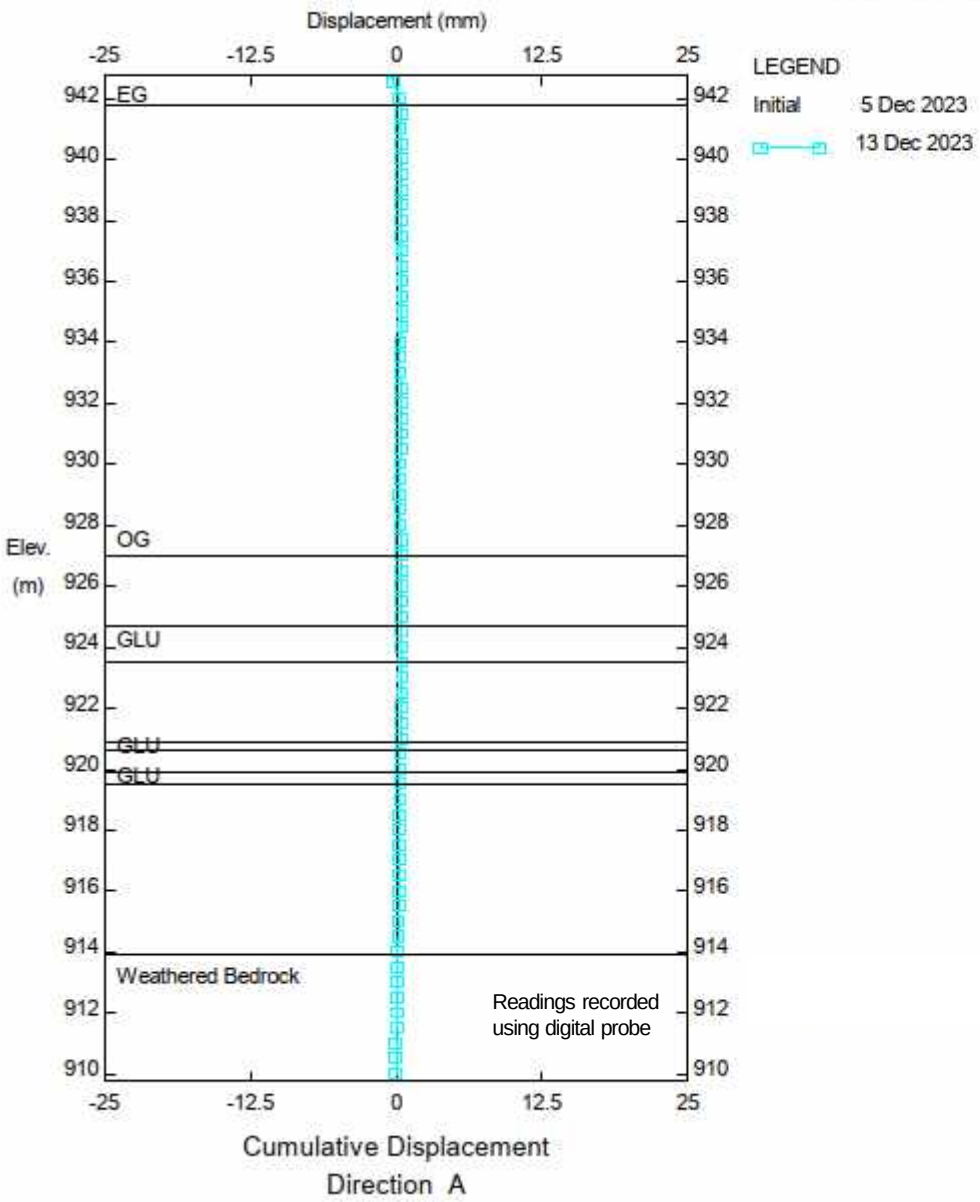
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

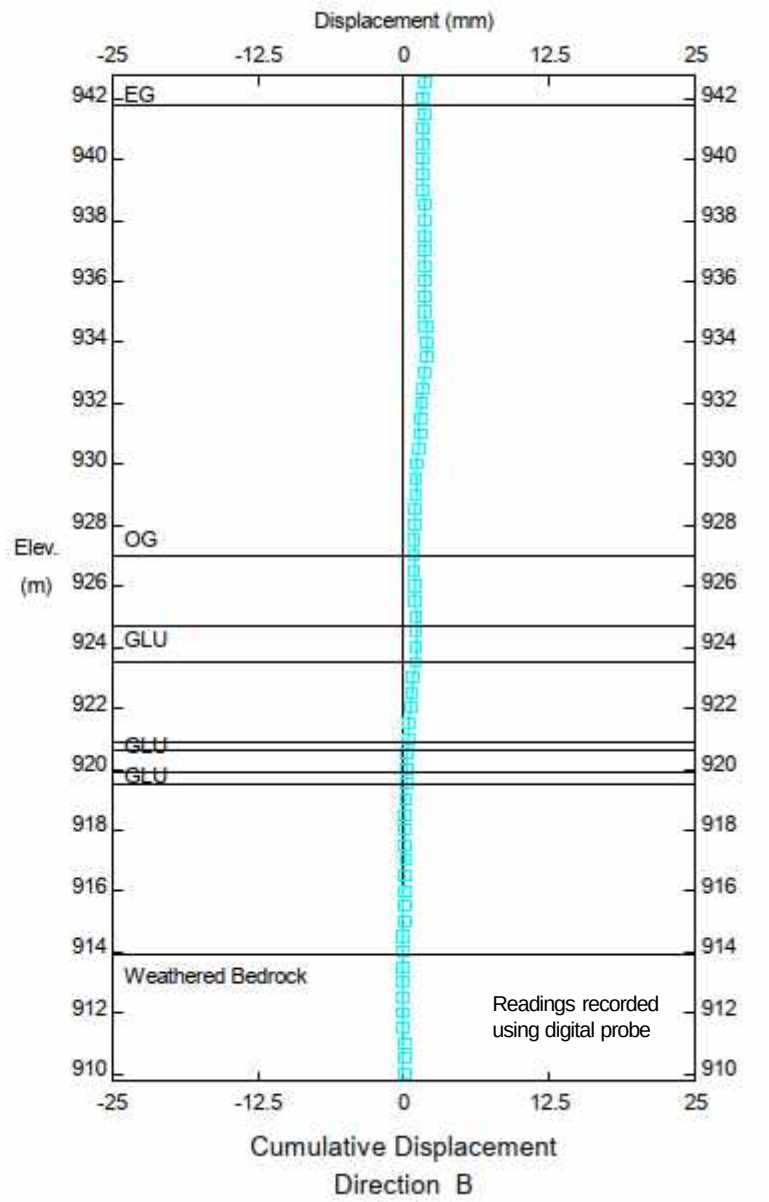
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI16-06
PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B26**

WSP Canada Inc.





Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

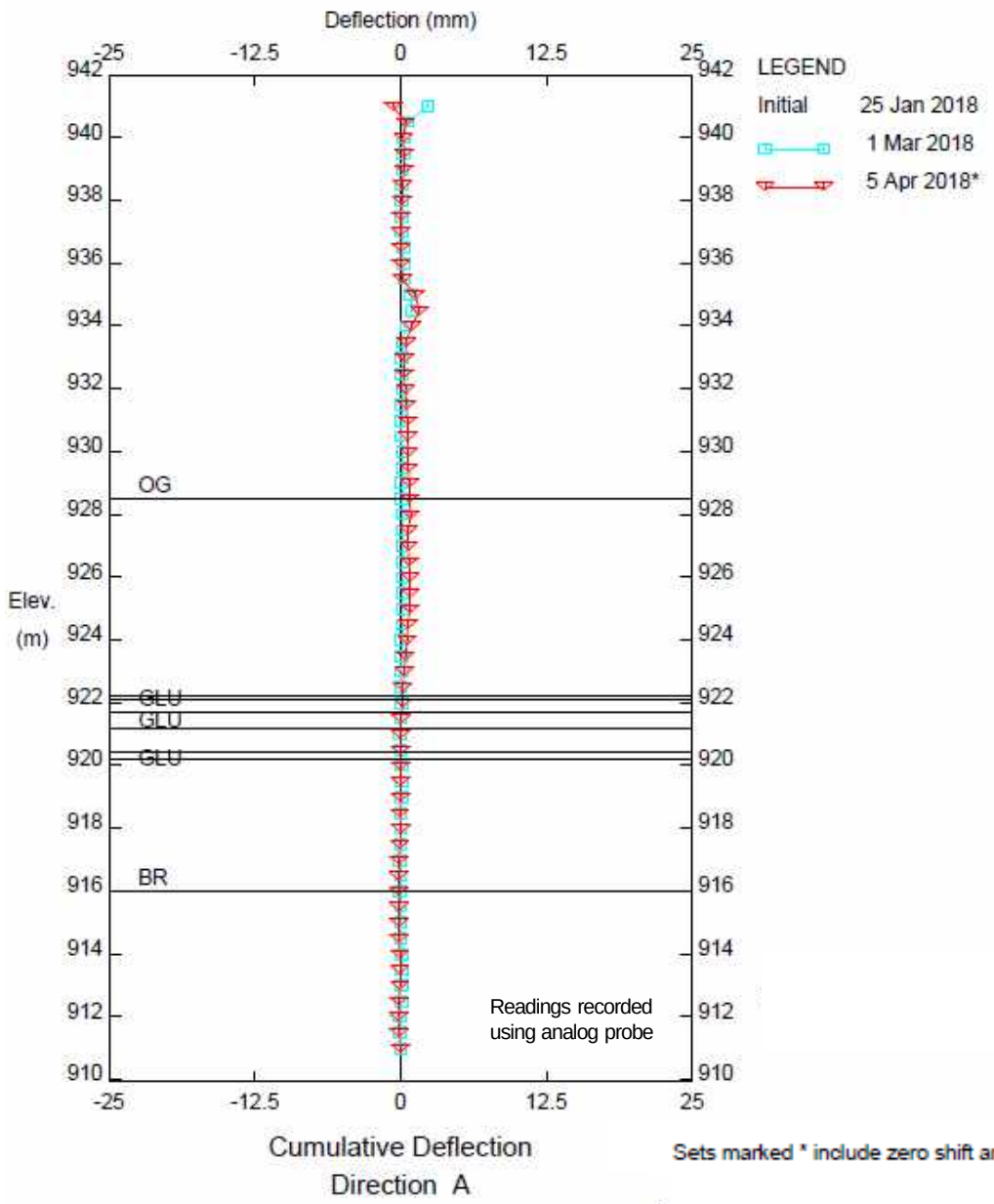
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

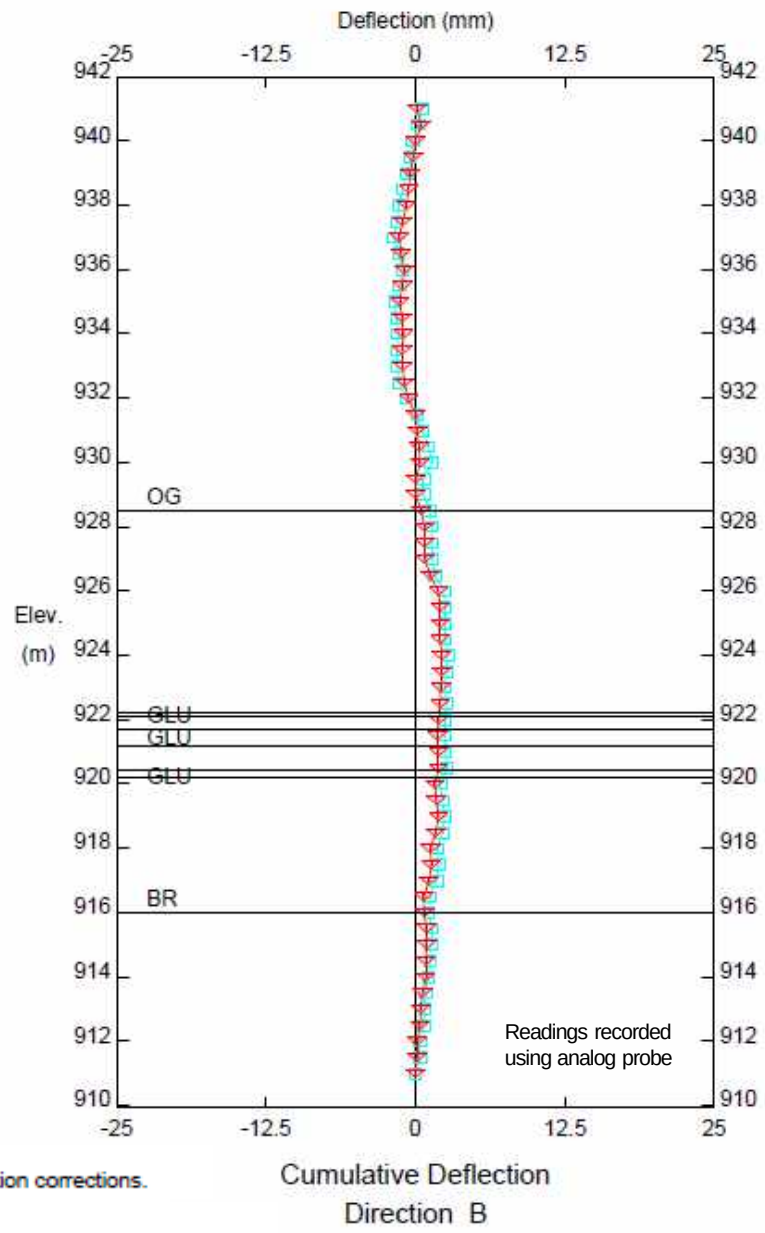
TITLE
SLOPE INCLINOMETER SI23-10
PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B27**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

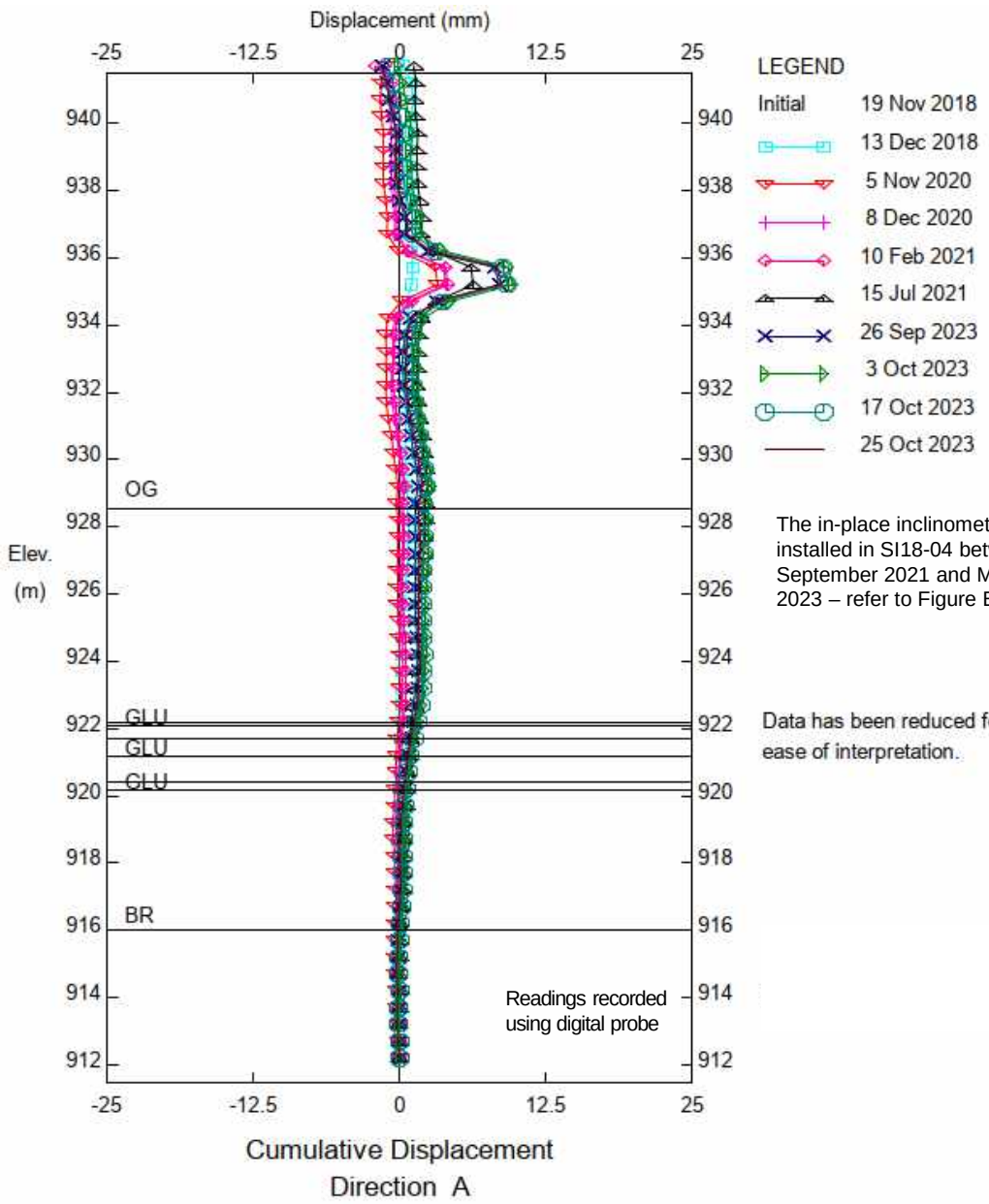


Cumulative Deflection
Direction A



Cumulative Deflection
Direction B

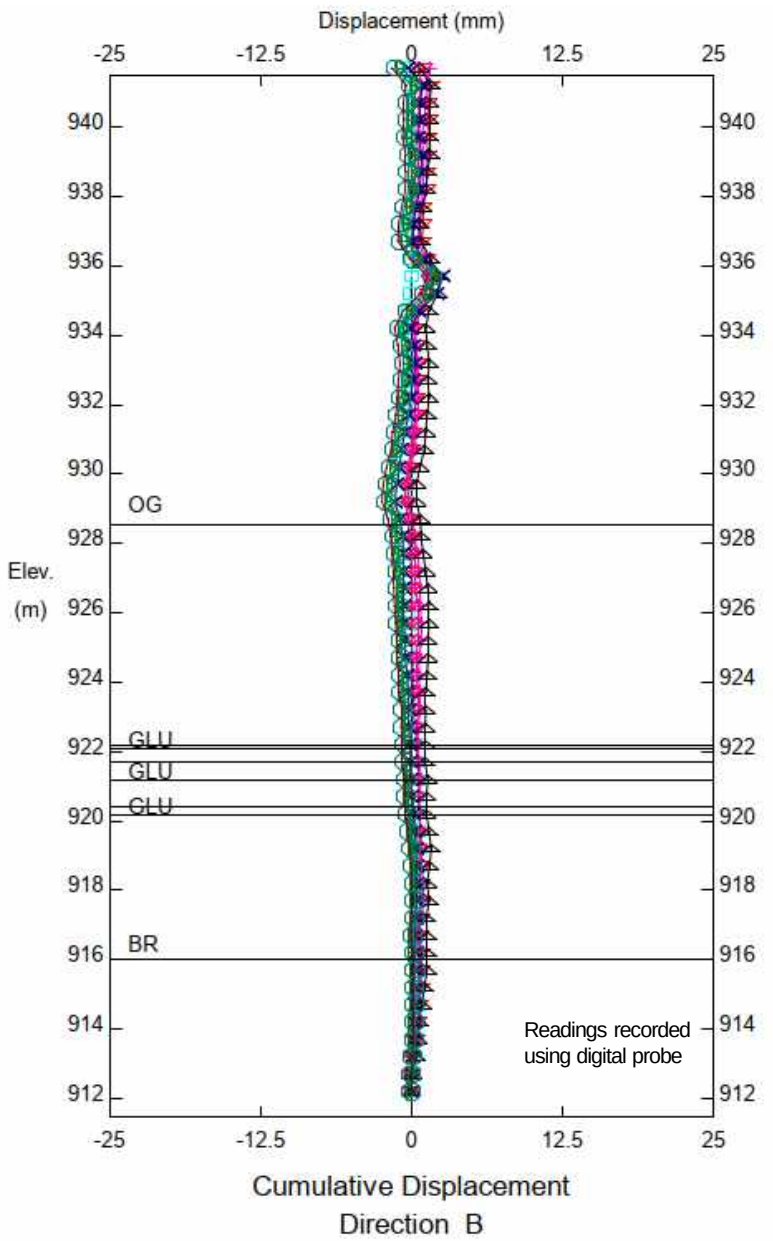
Sets marked * include zero shift and/or rotation corrections.



Cumulative Displacement
Direction A

The in-place inclinometer was installed in SI18-04 between September 2021 and May 2023 – refer to Figure B30.

Data has been reduced for ease of interpretation.



Cumulative Displacement
Direction B

Notes:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

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MOUNT POLLEY MINING CORPORATION

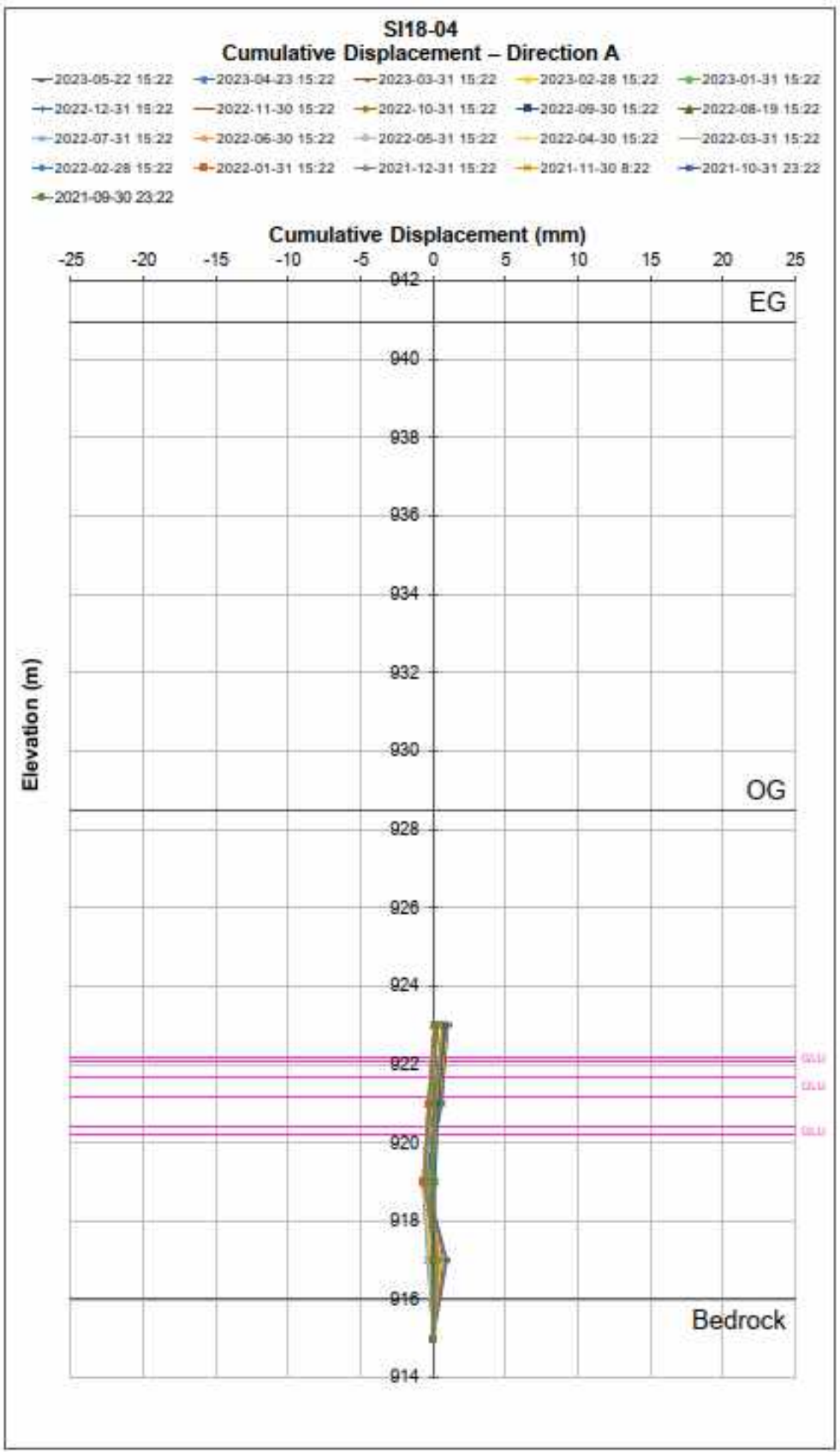
CONSULTANT
wsp

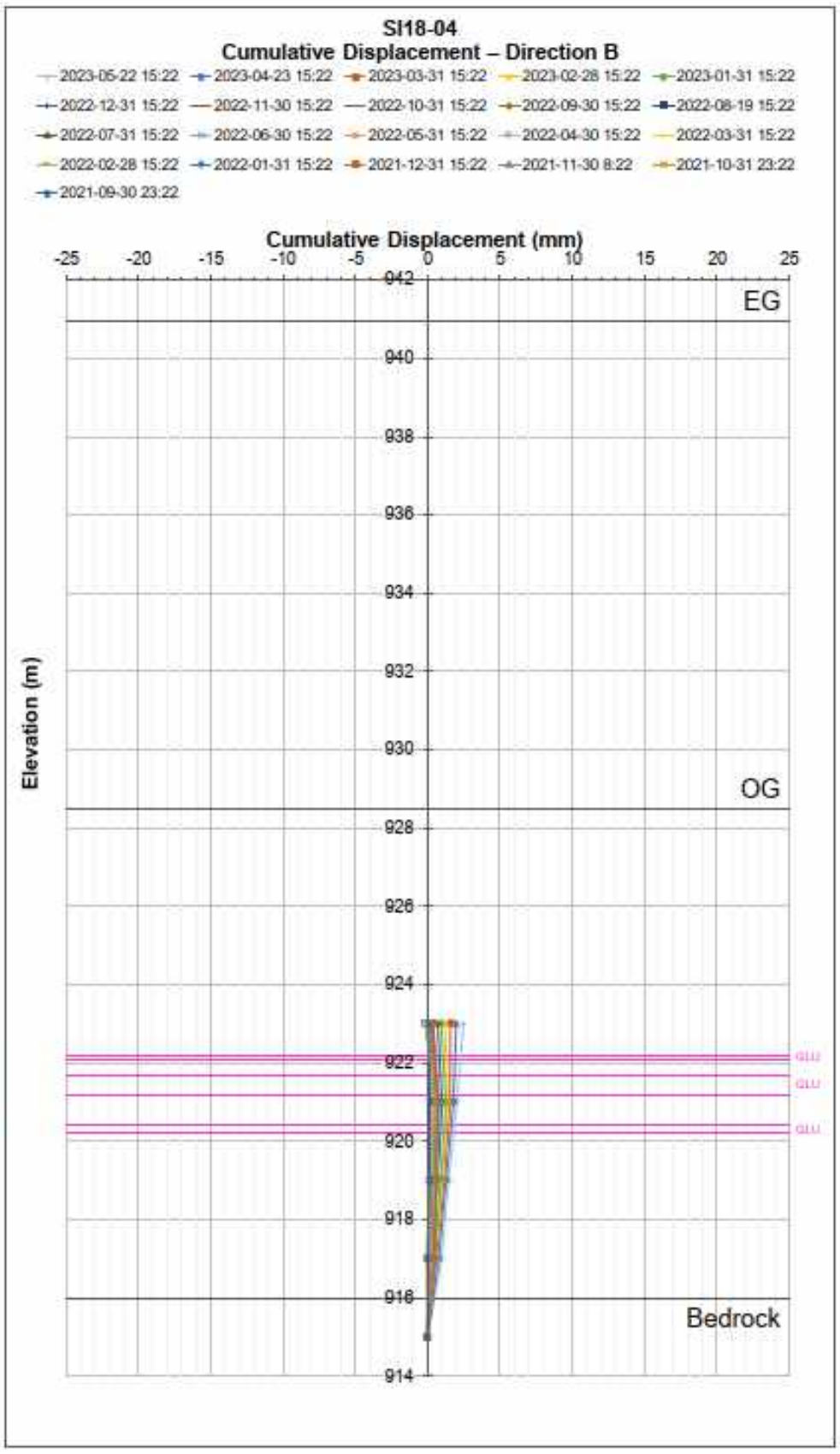
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI18-04
PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B28





Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

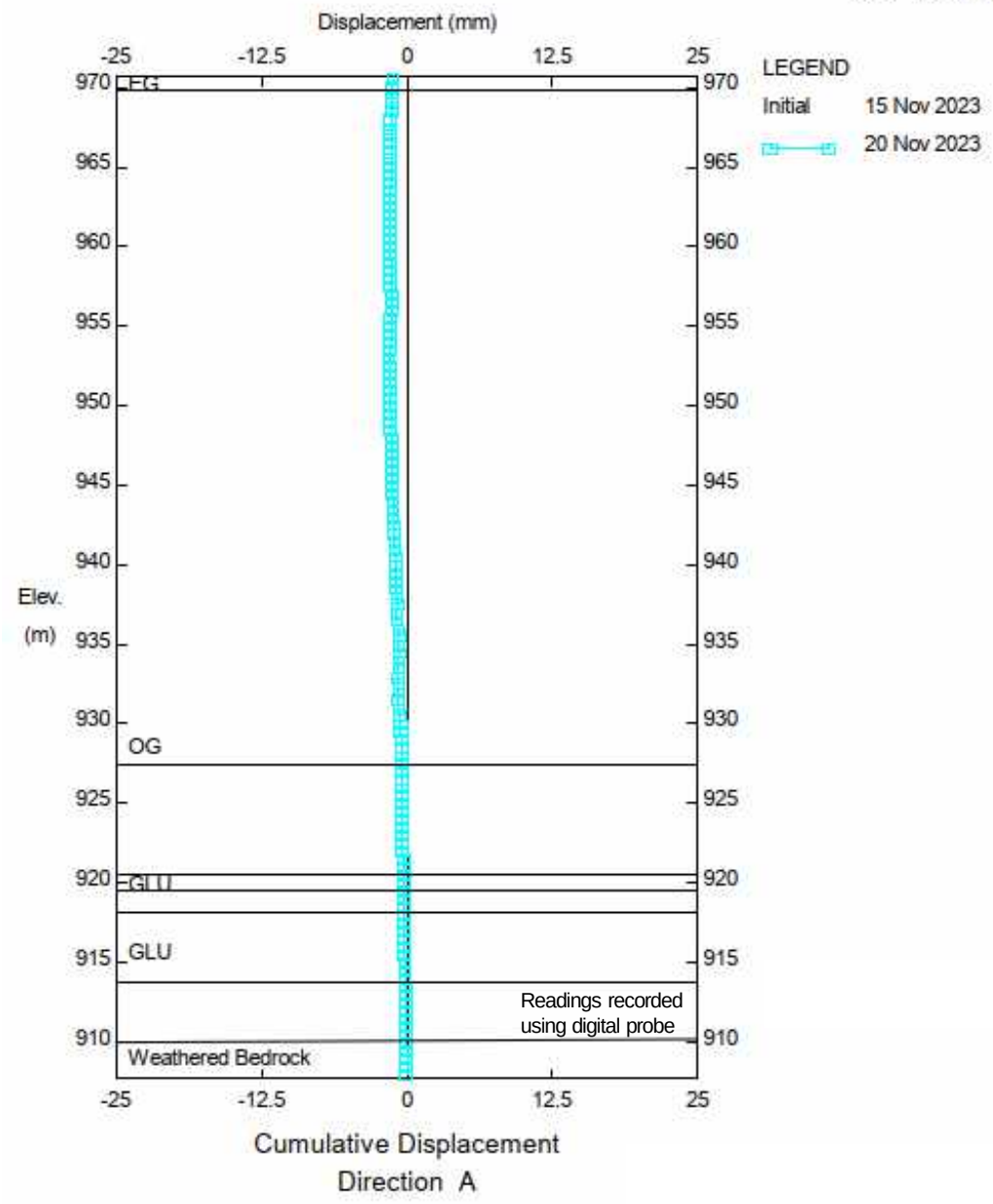
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

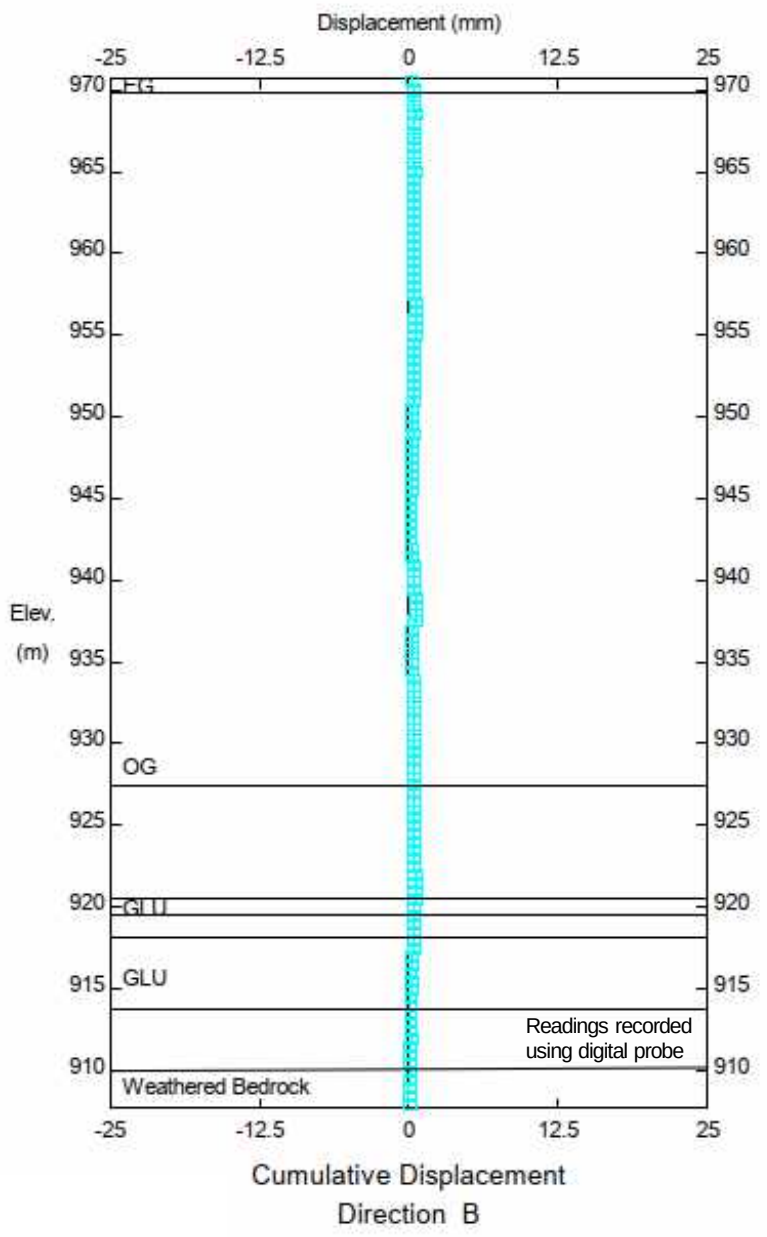
TITLE
IN-PLACE INCLINOMETER SI18-04 (SEPTEMBER 2021 to MAY 2023)
PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B29**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

WSP Canada Inc.





Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

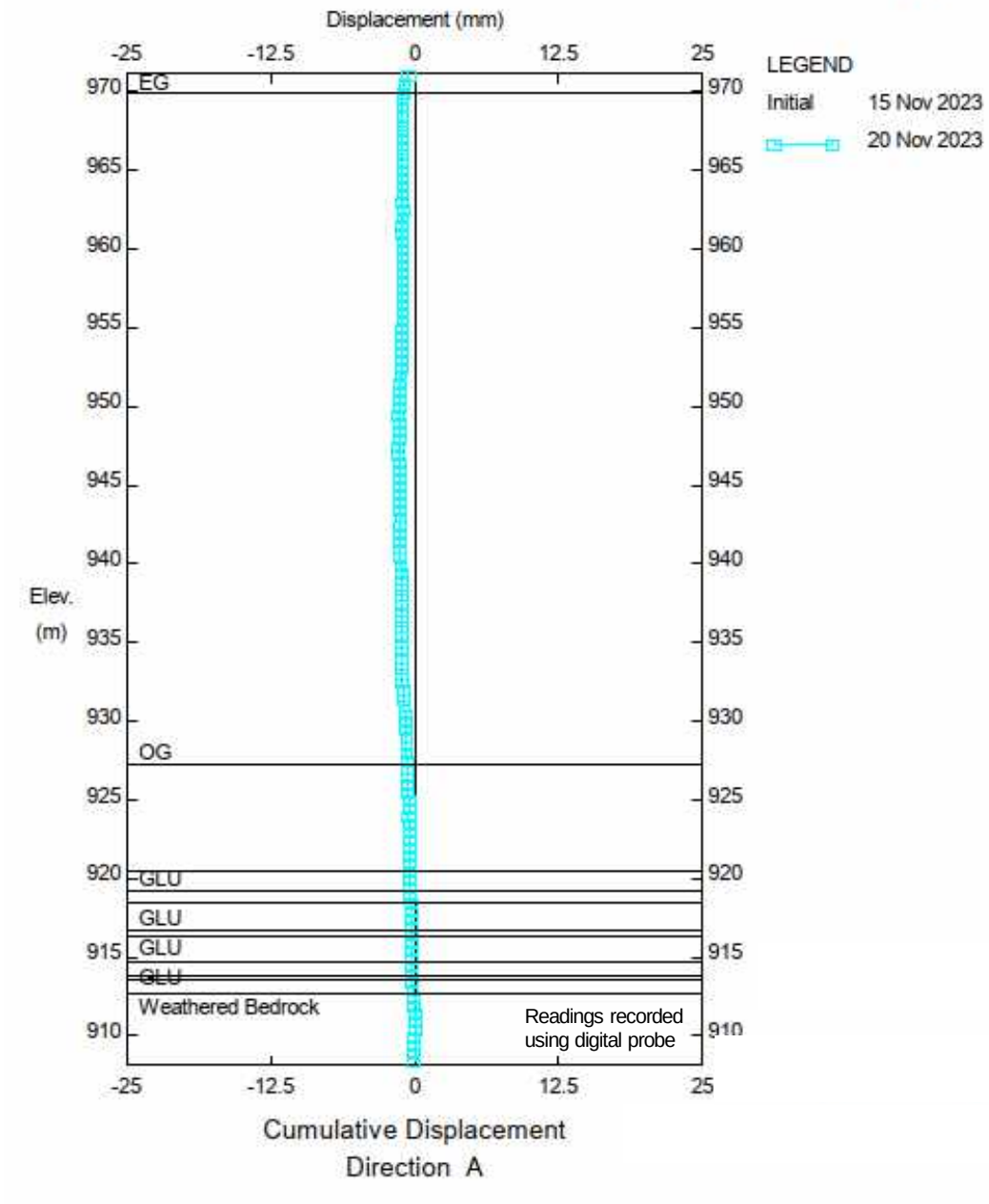
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

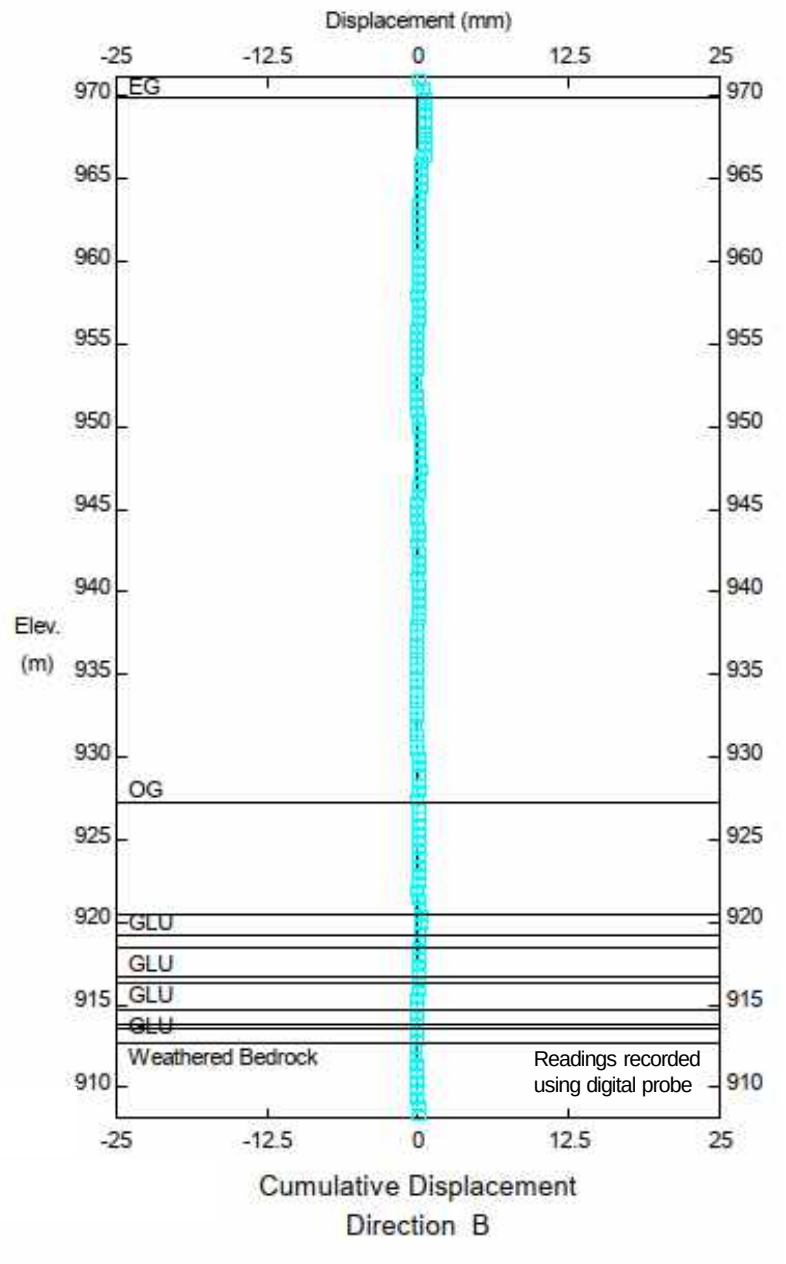
TITLE
SLOPE INCLINOMETER SI23-02
PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B30**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

WSP Canada Inc.





Note:
EG: Existing Ground
OG: Original Ground
GLU: Glaciolacustrine Unit

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

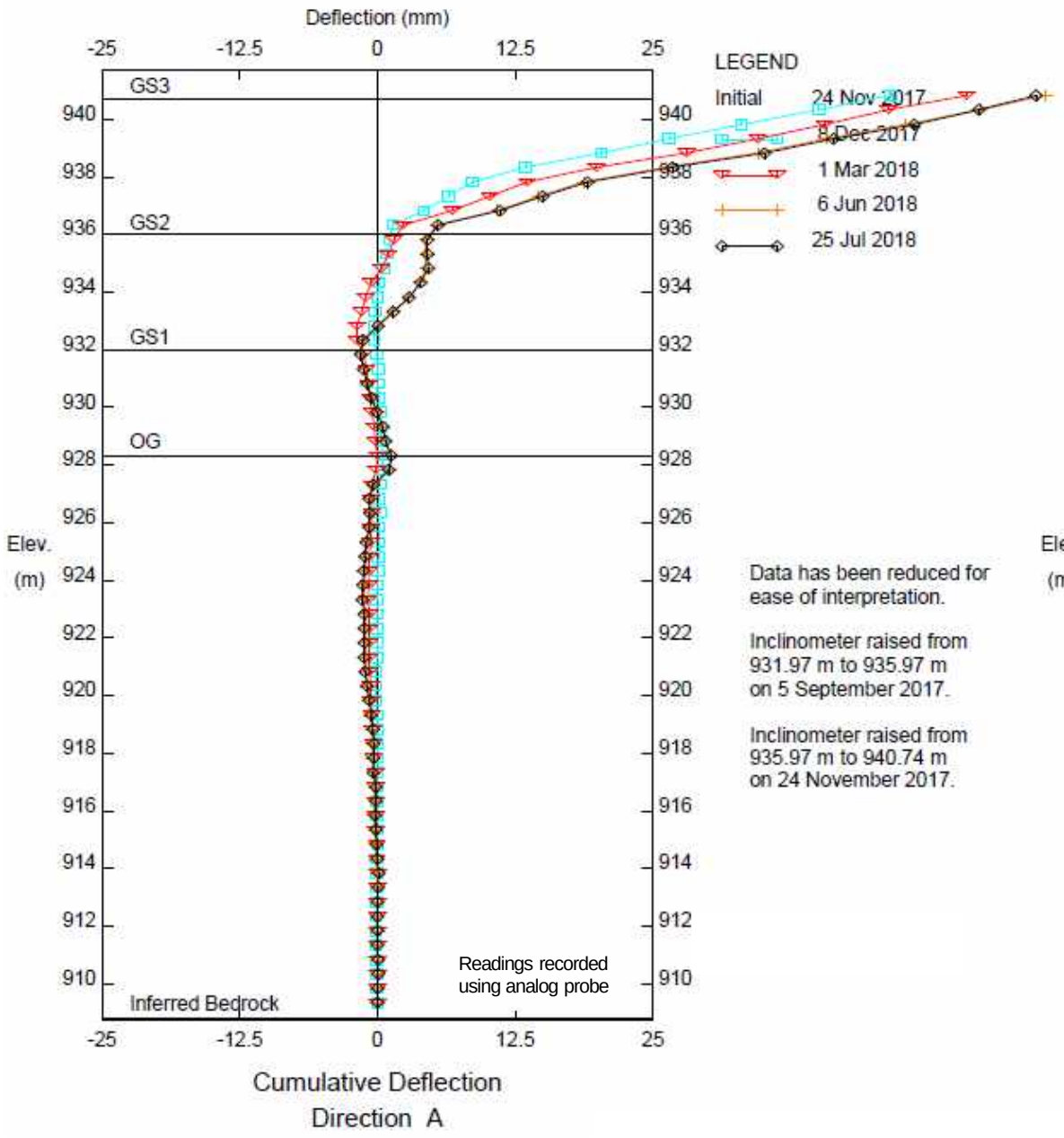
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

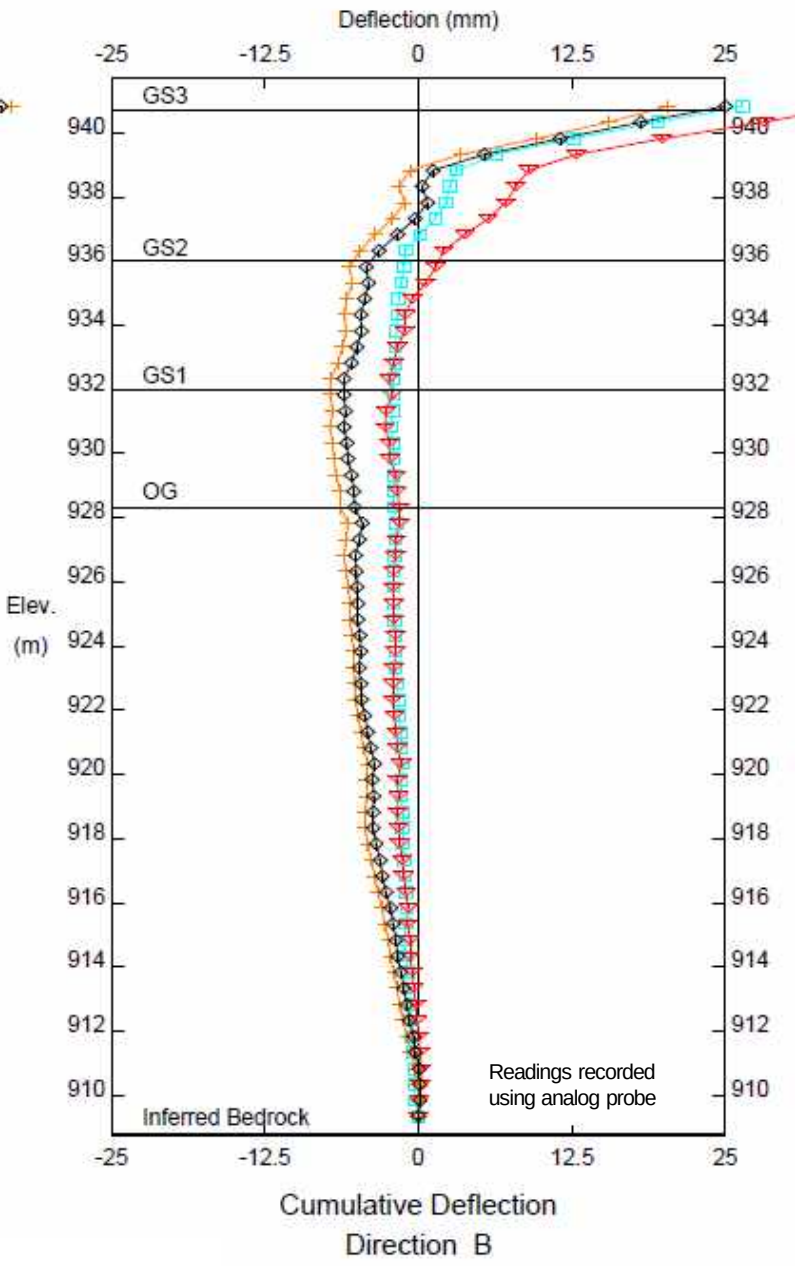
TITLE
SLOPE INCLINOMETER SI23-01
PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B31**

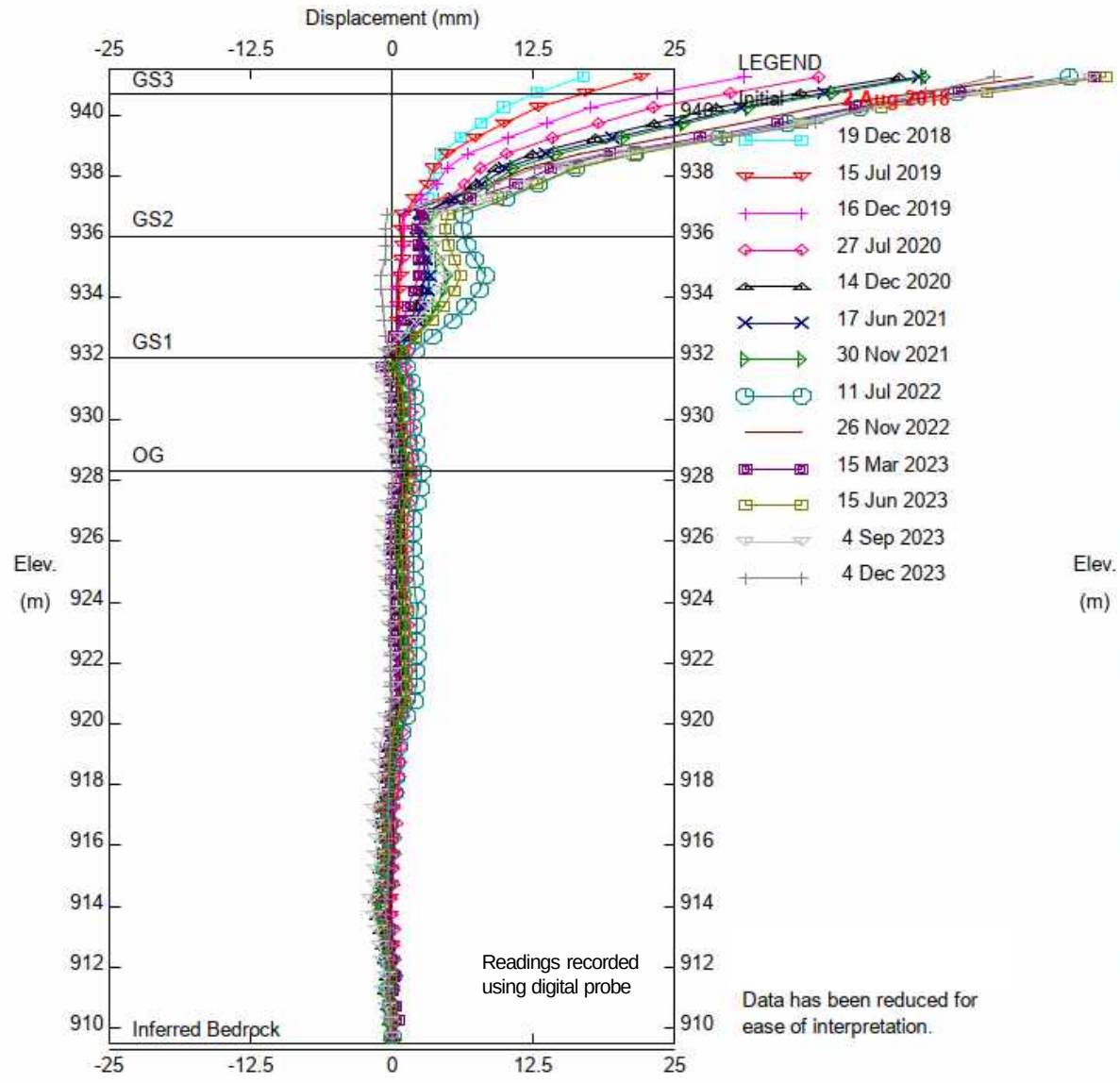
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm



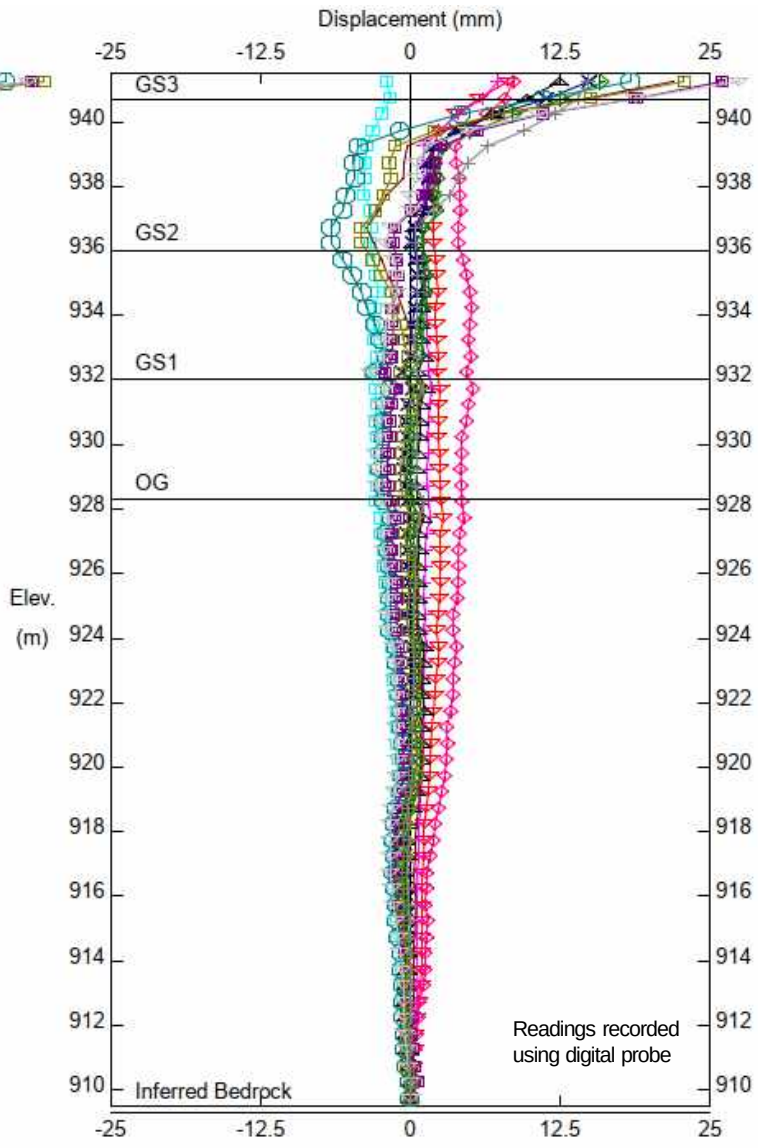
Cumulative Deflection
Direction A



Cumulative Deflection
Direction B



Cumulative Displacement
Direction A



Cumulative Displacement
Direction B

Note:
GS: Ground Surface
OG: Original Ground

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

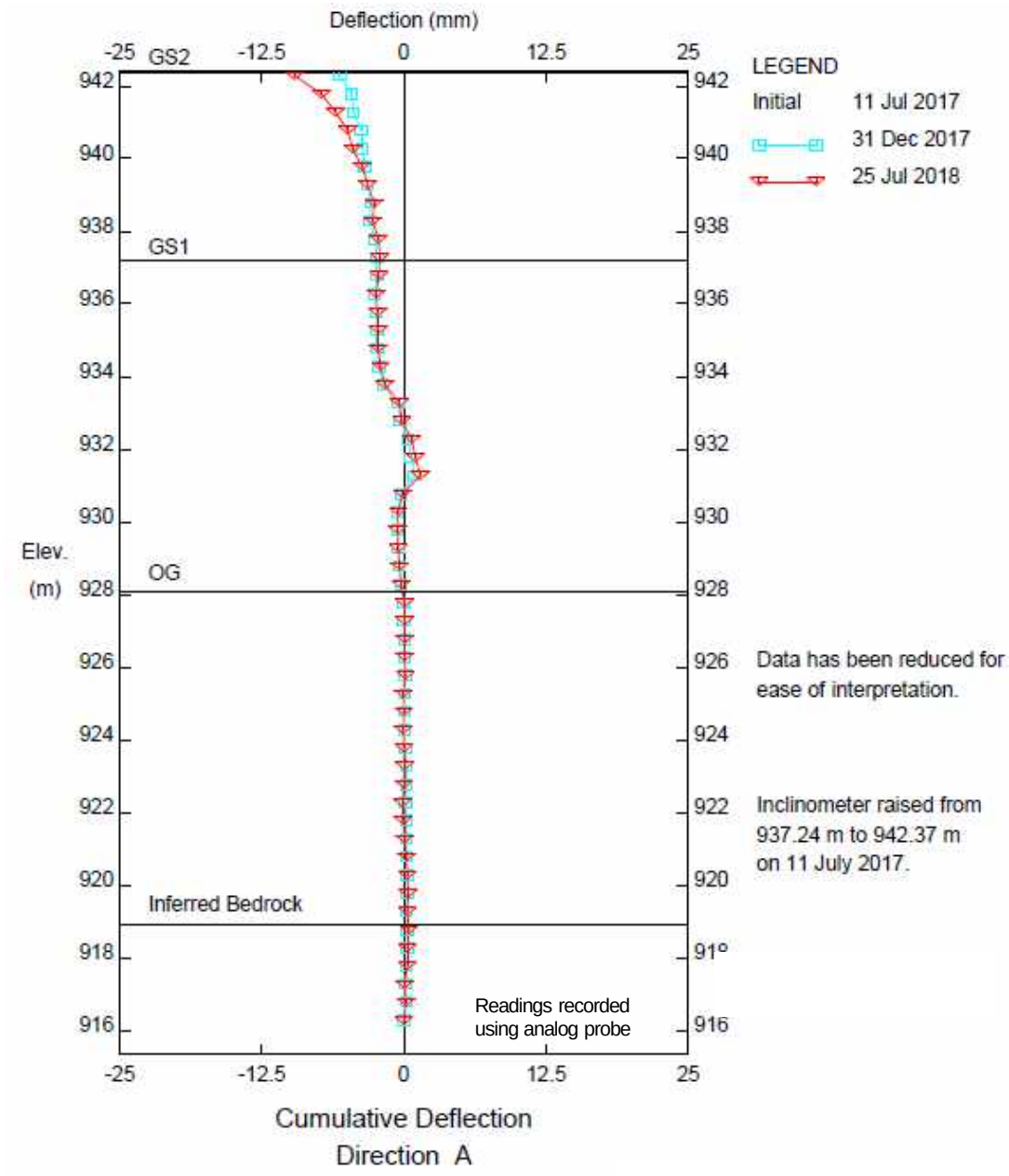
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

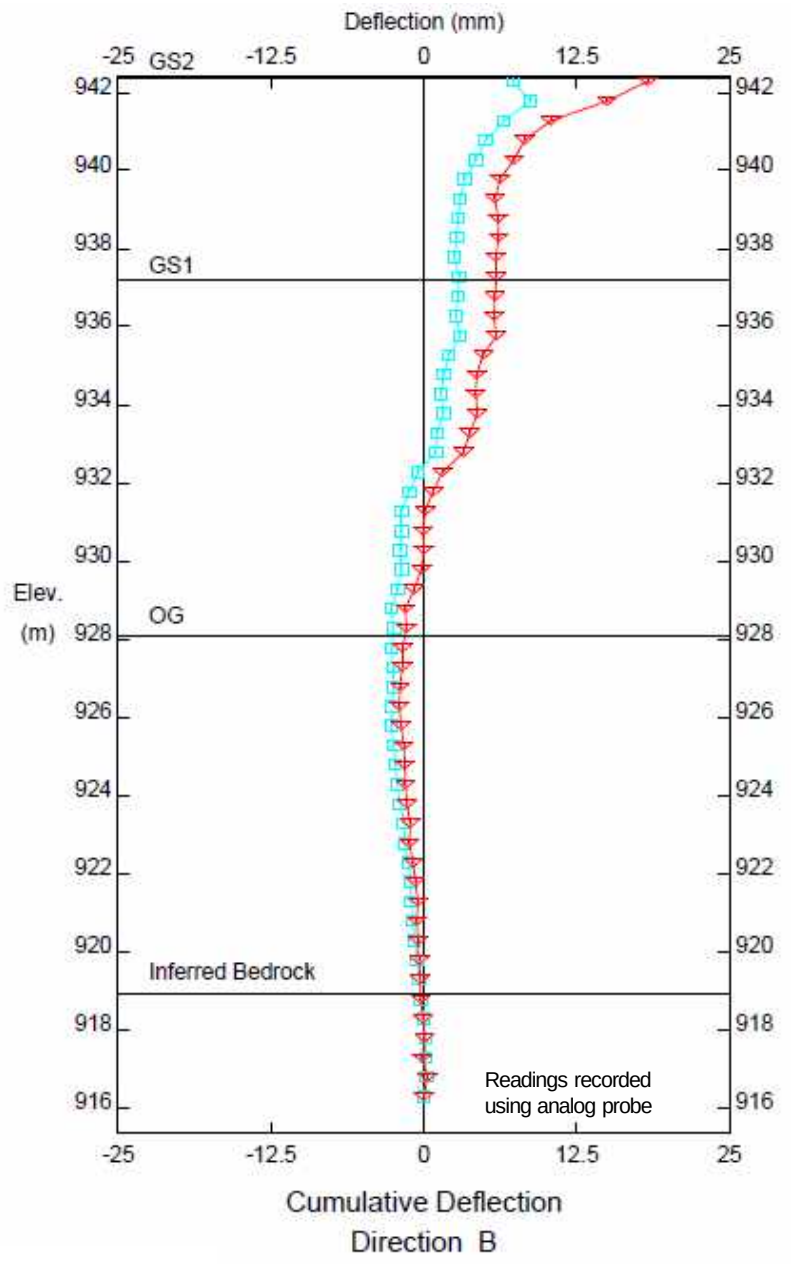
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

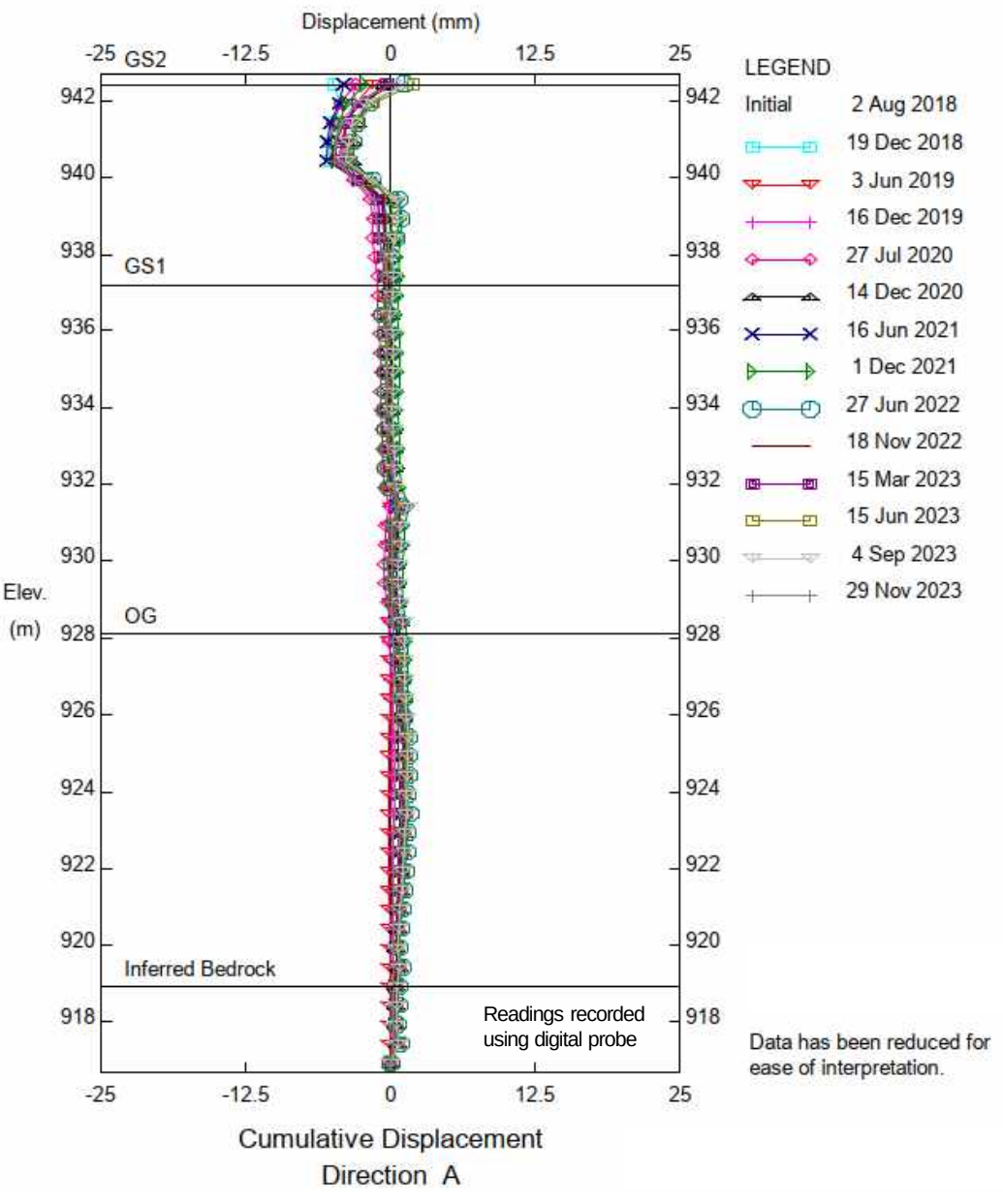
TITLE
SLOPE INCLINOMETER SI16-03
PERIMETER EMBANKMENT AT CORNER 1

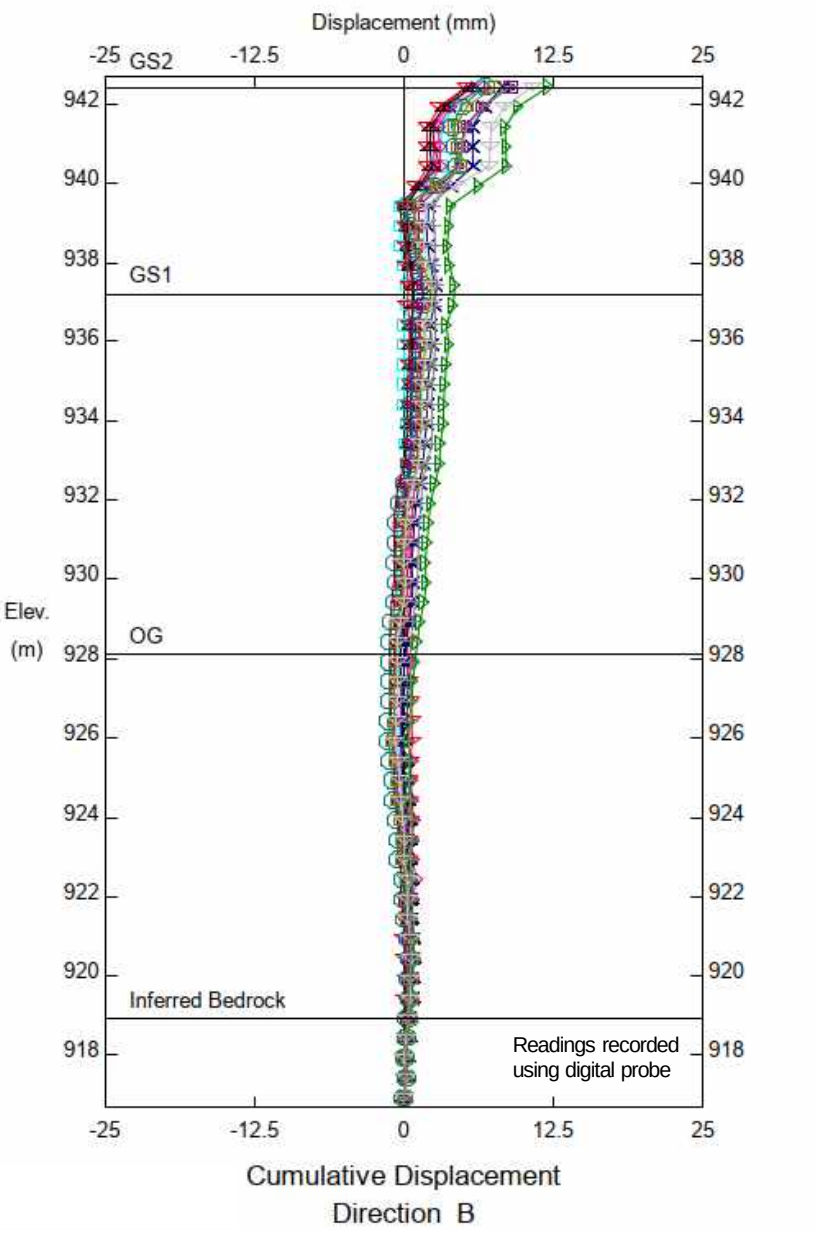
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B32

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm









Note:
GS: Ground Surface
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

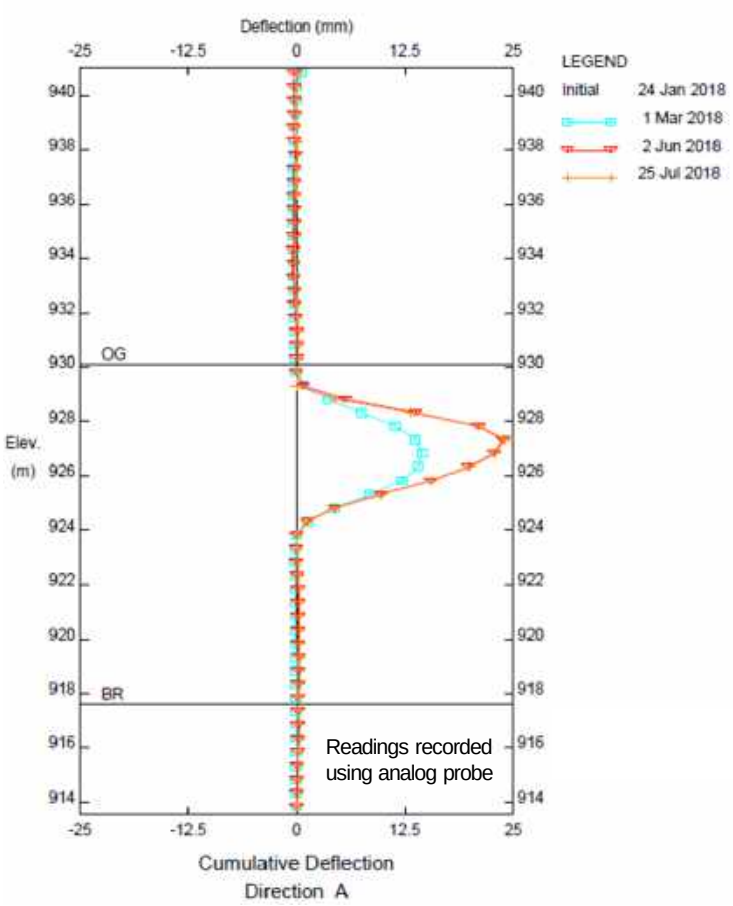
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

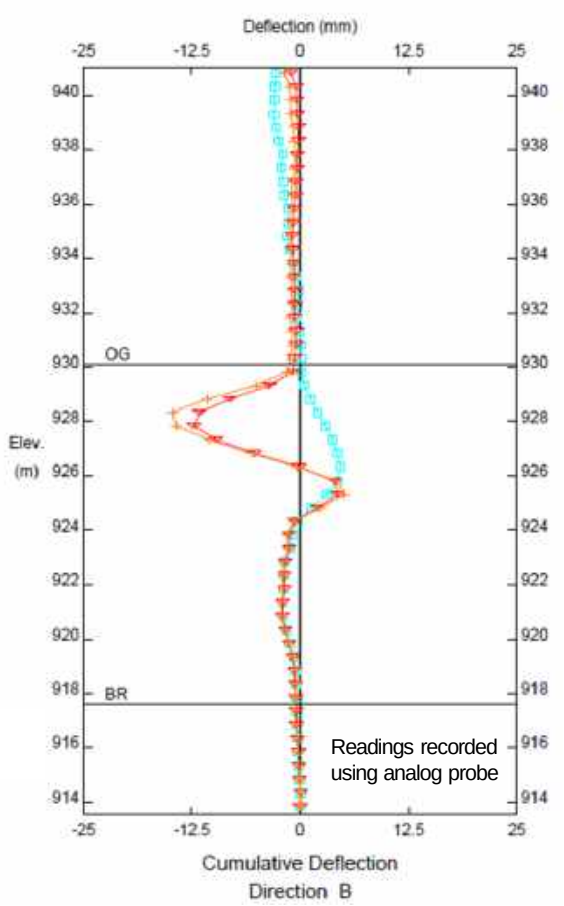
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

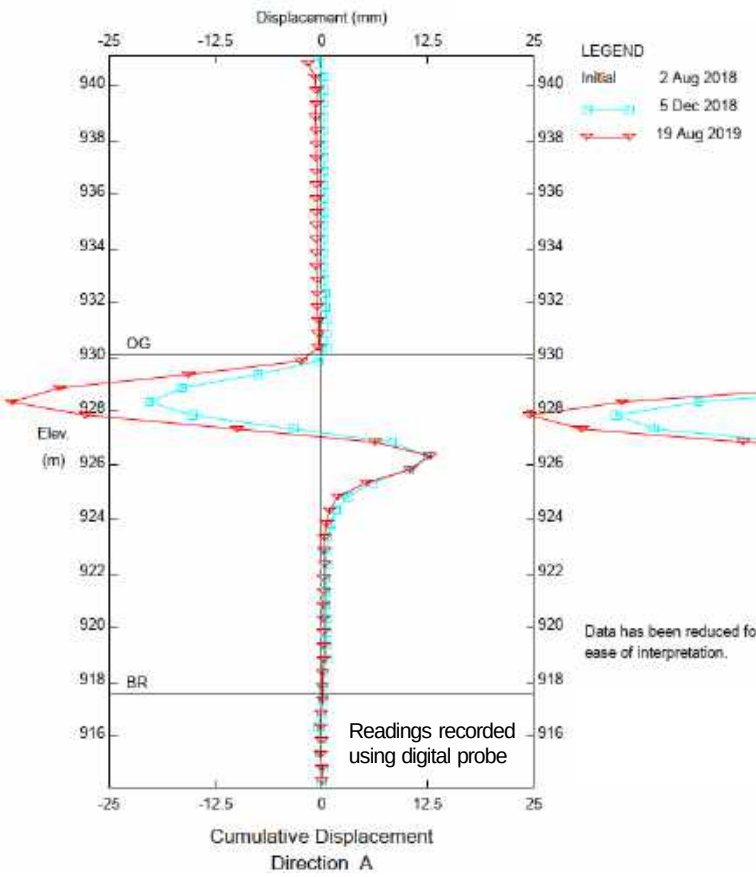
TITLE
SLOPE INCLINOMETER SI16-01
PERIMETER EMBANKMENT AT CORNER 1

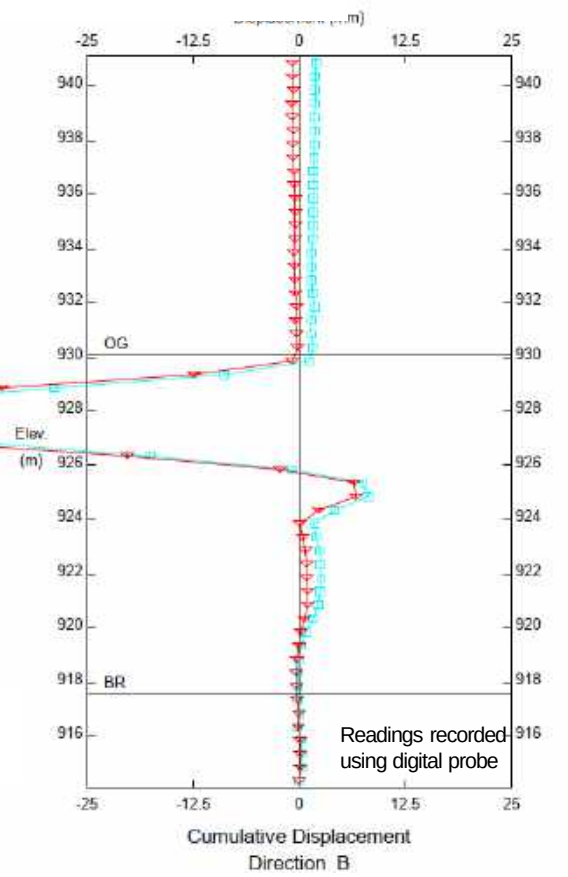
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B33**

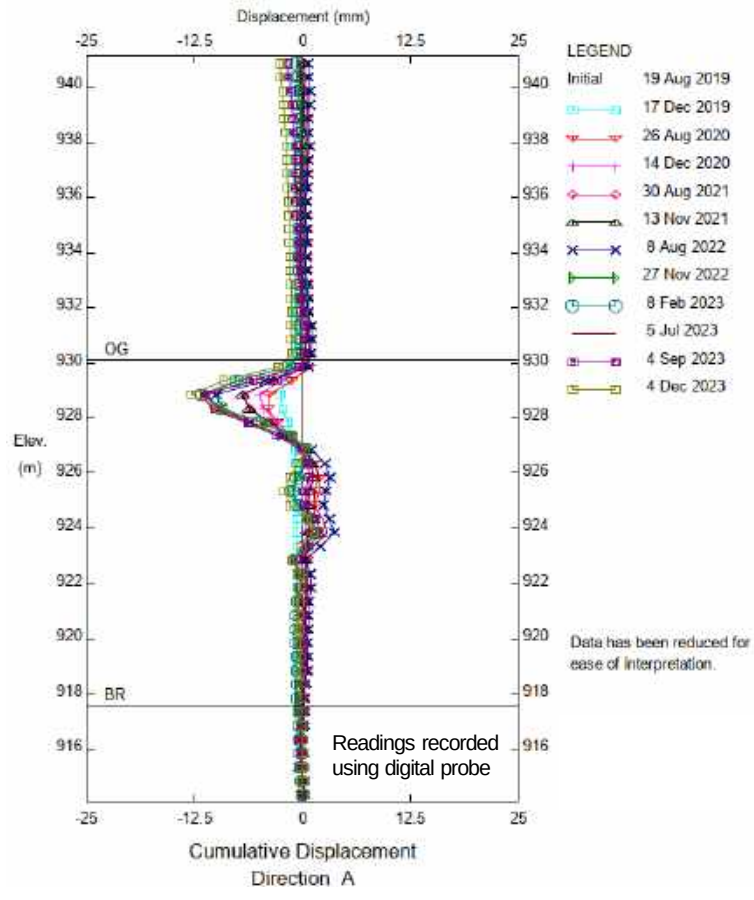
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
0 20 mm

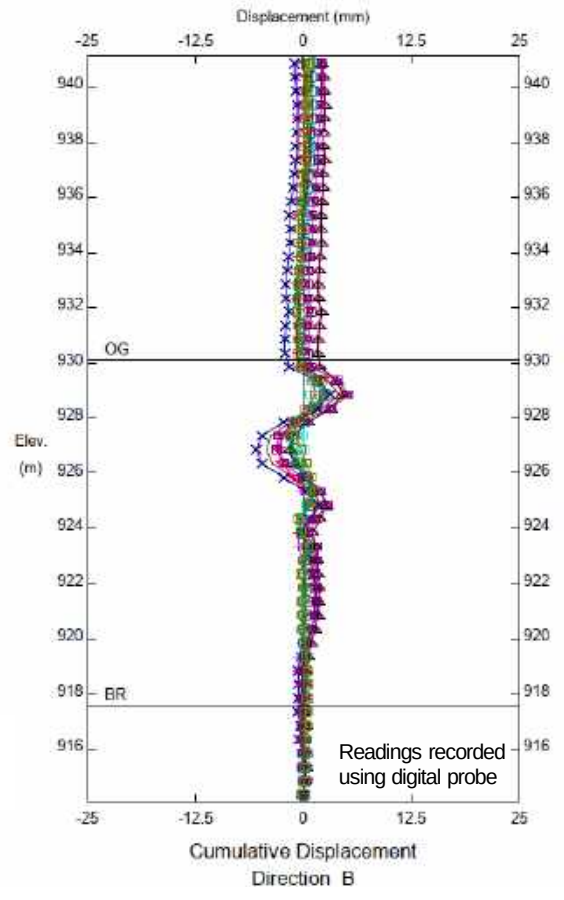












Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

wsp

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

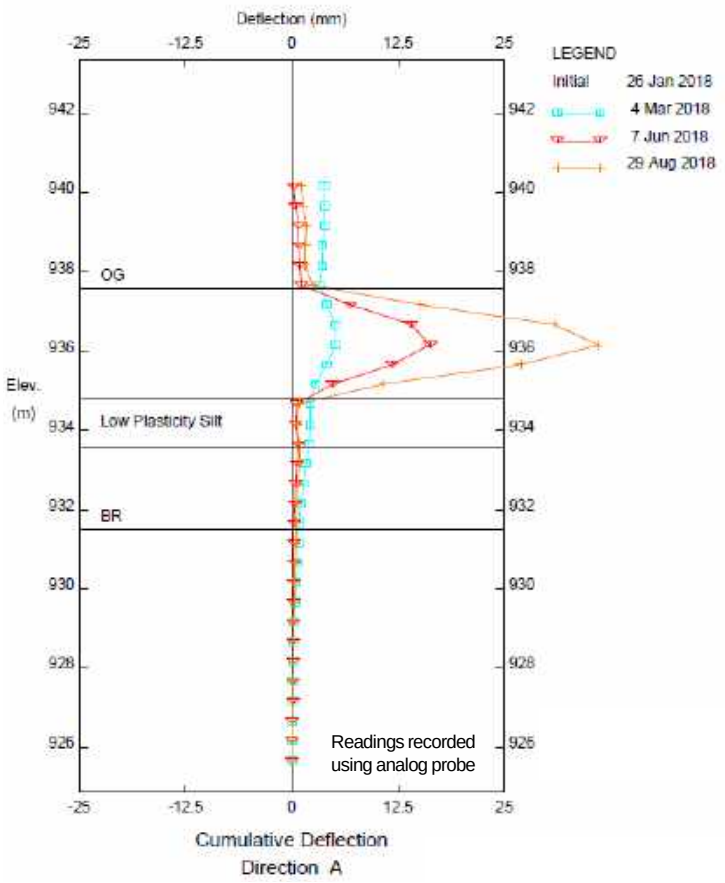
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

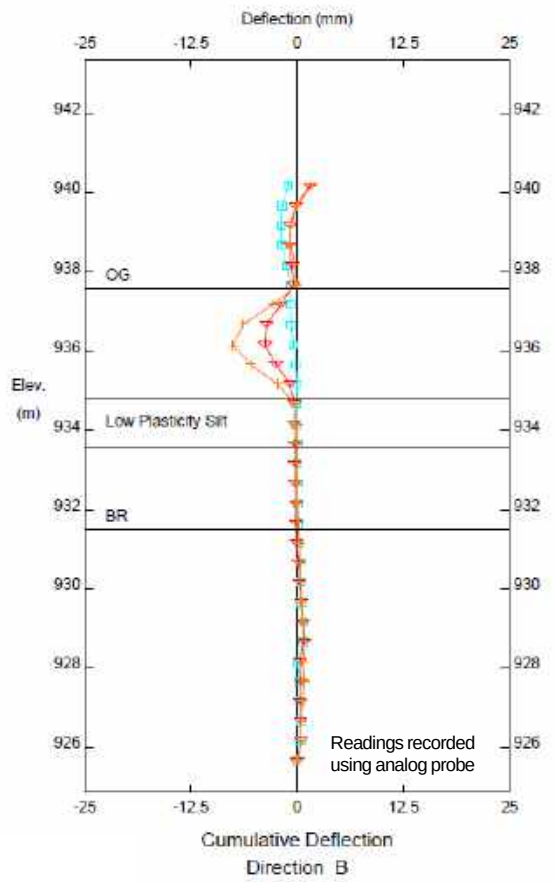
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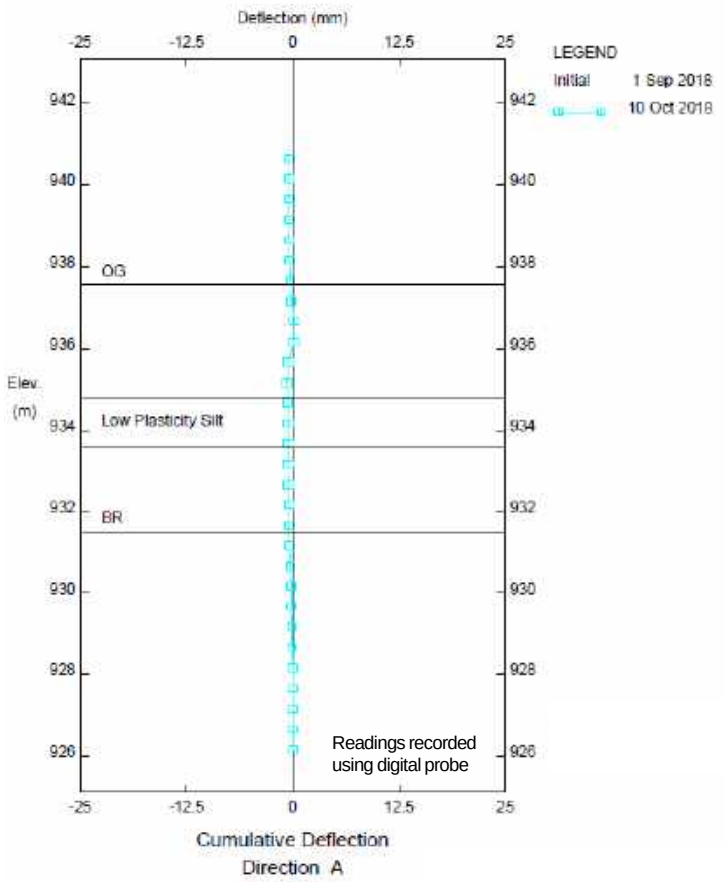
SLOPE INCLINOMETER SI18-01
PERIMETER EMBANKMENT AT CORNER 1

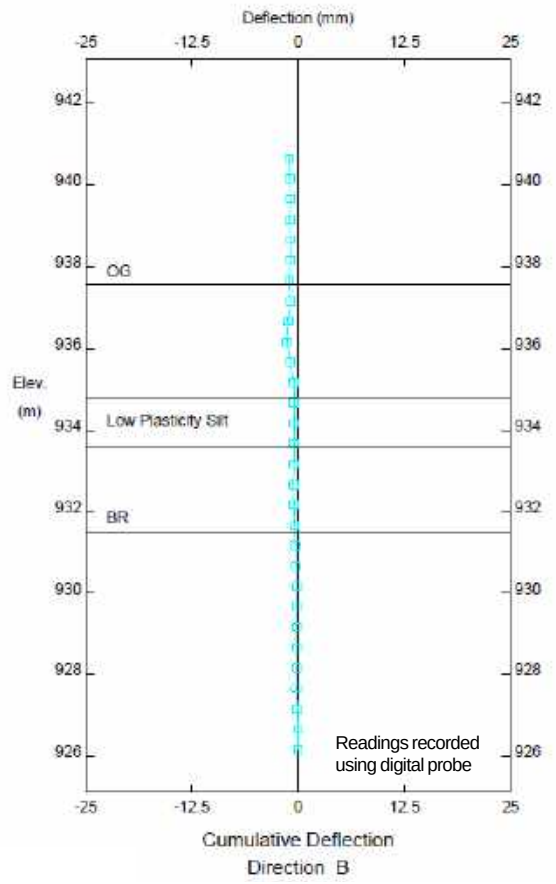
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B34**

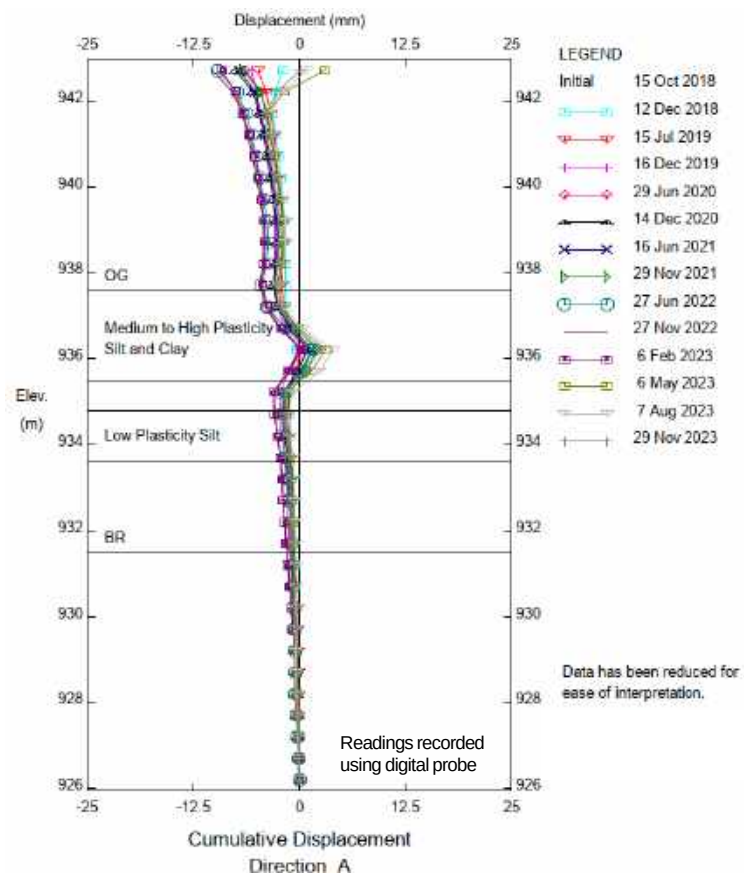
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

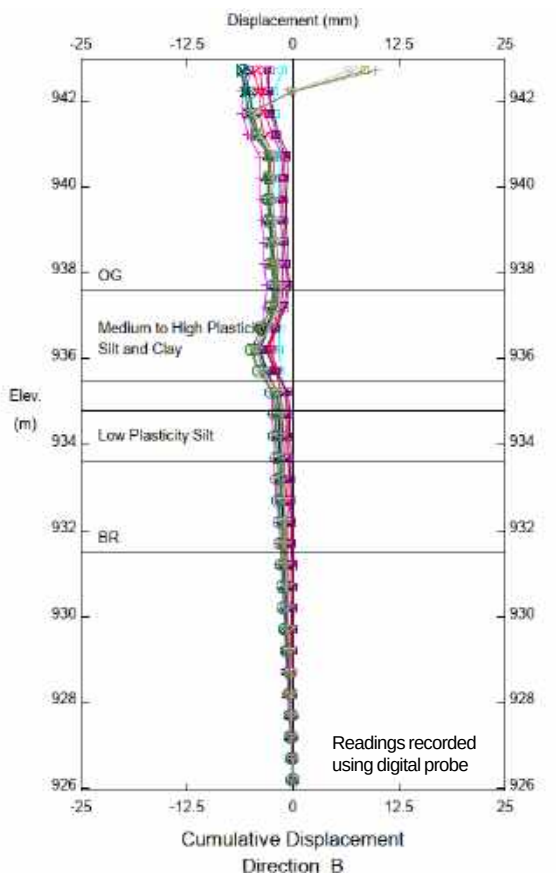












Note:
EG: Existing Ground
OG: Original Ground
BR: Bedrock

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

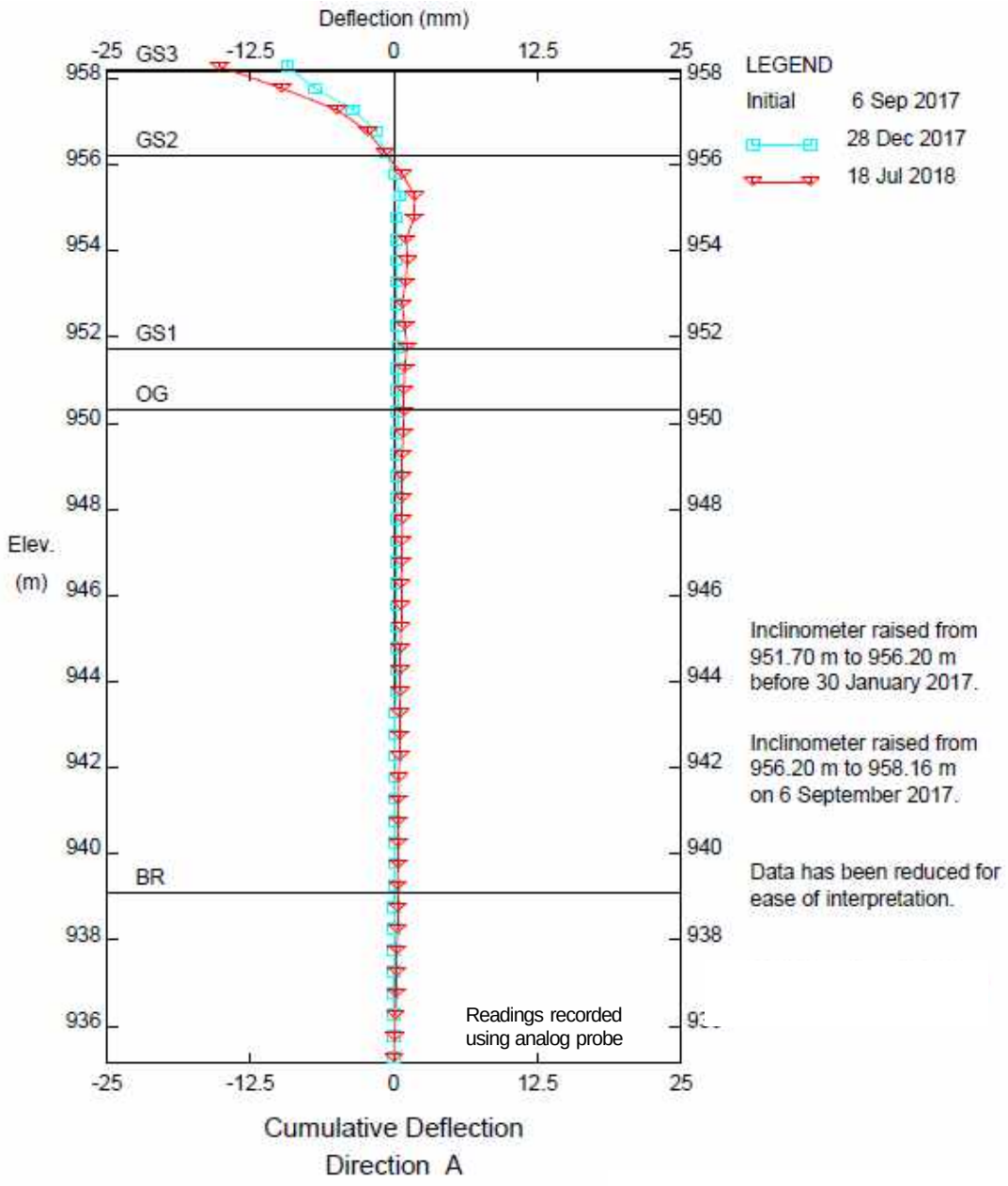
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

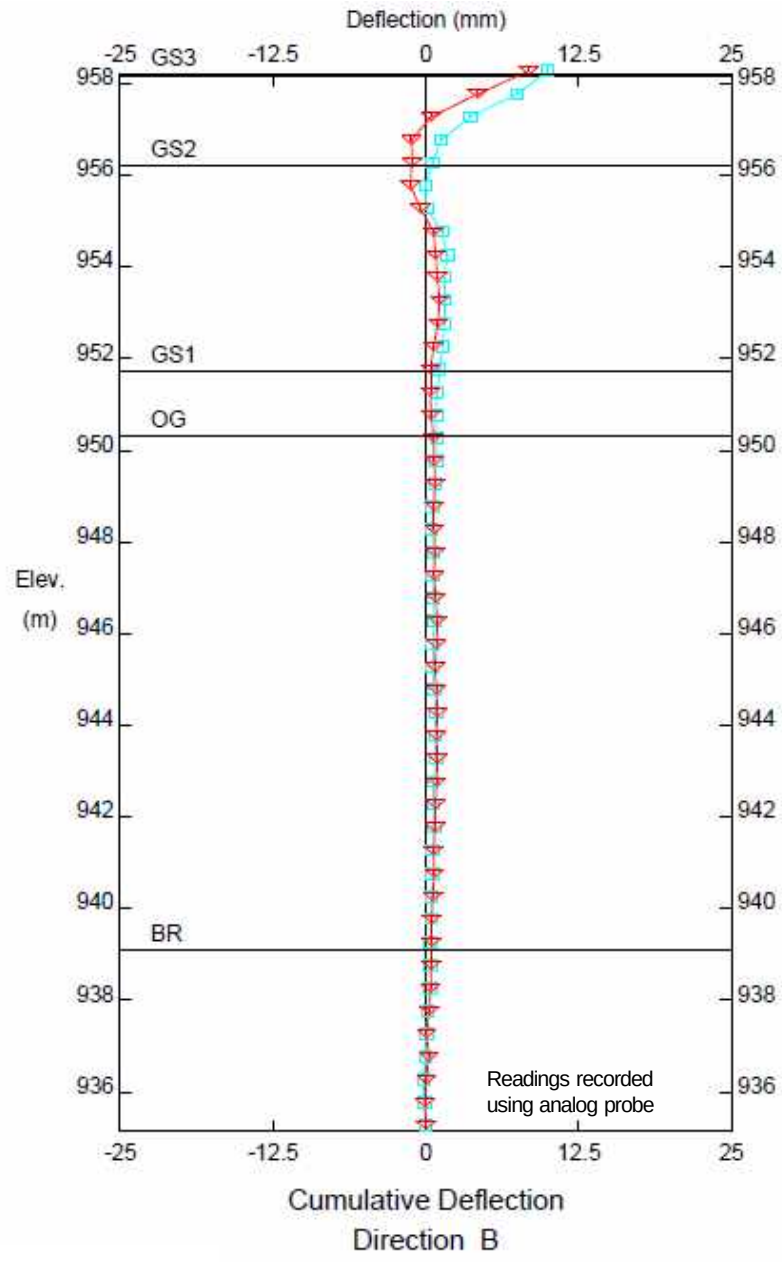
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

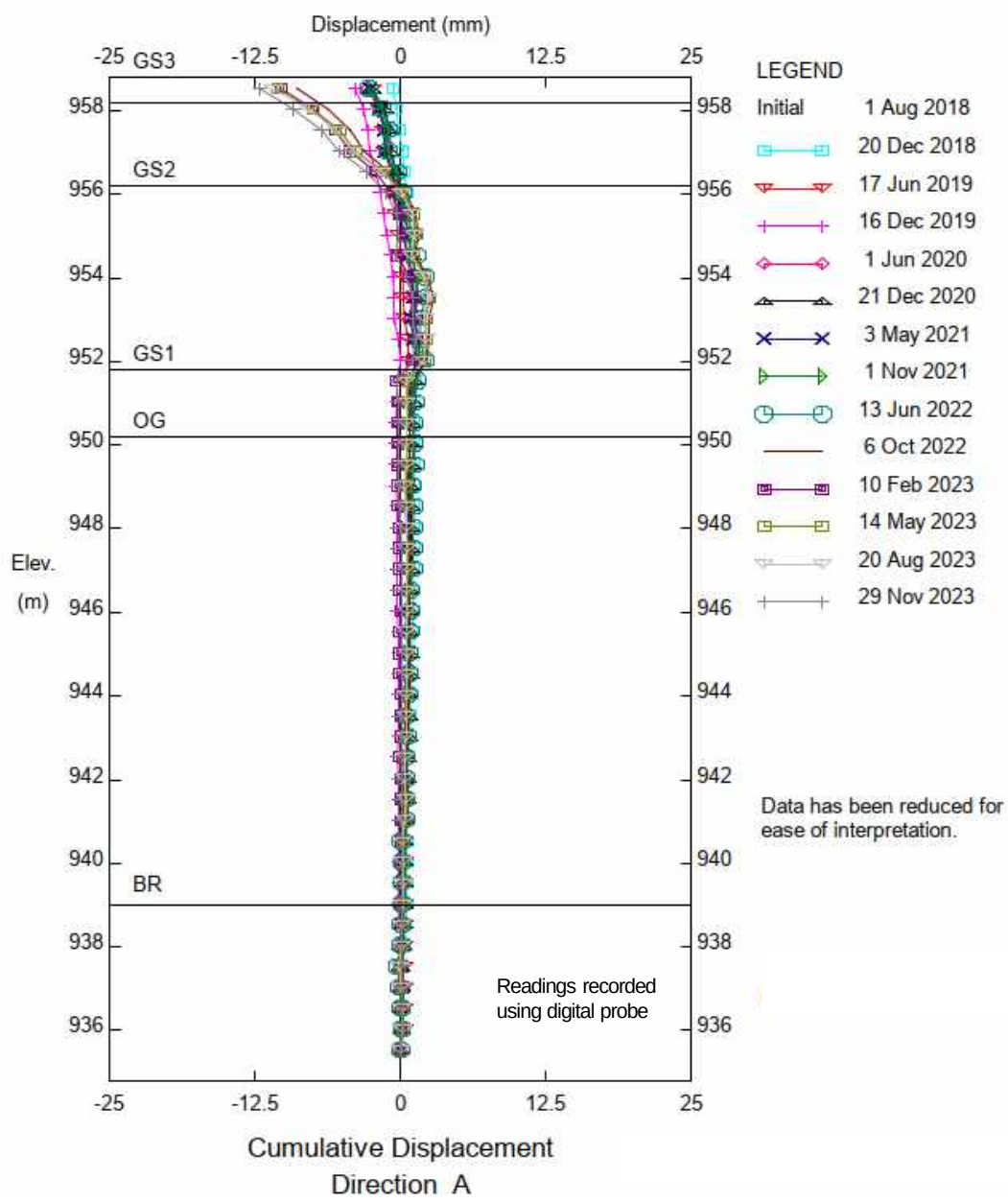
TITLE
SLOPE INCLINOMETER SI18-03
PERIMETER EMBANKMENT AT CORNER 1

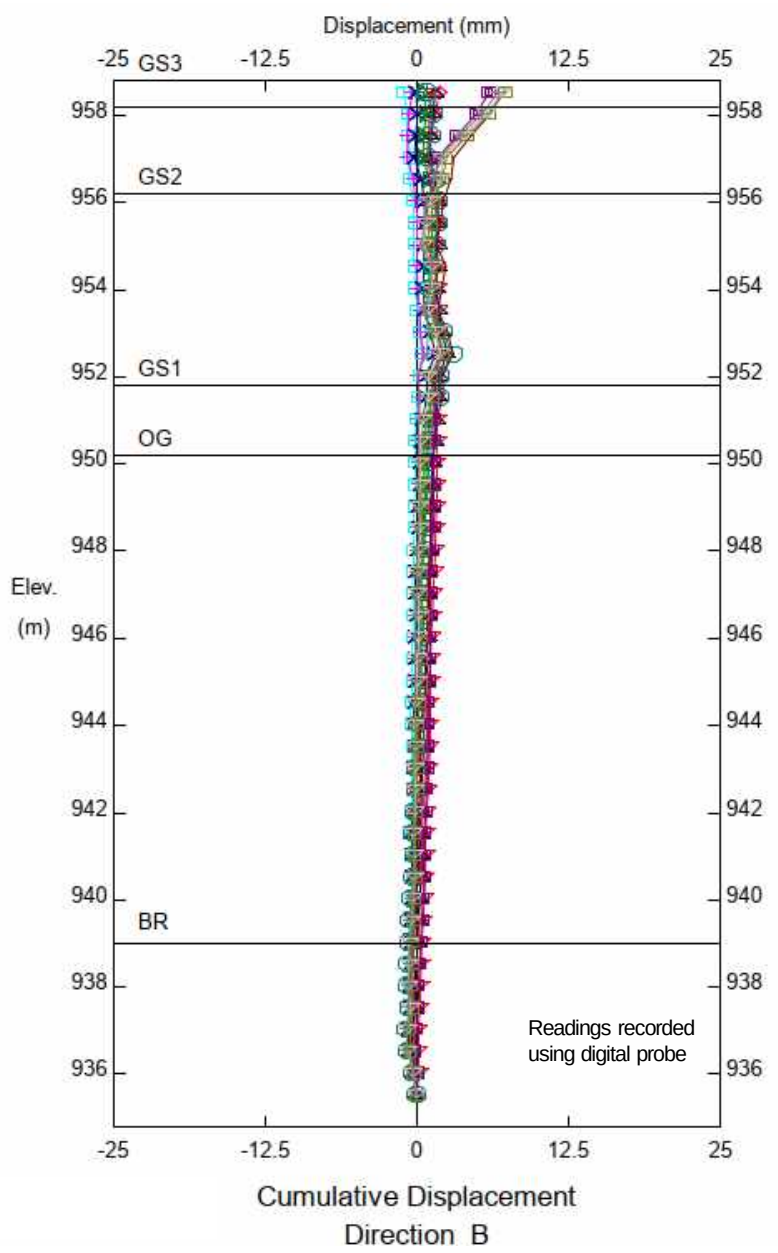
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B35**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm









Note:
GS: Ground Surface
OG: Original Ground
BR: Bedrock

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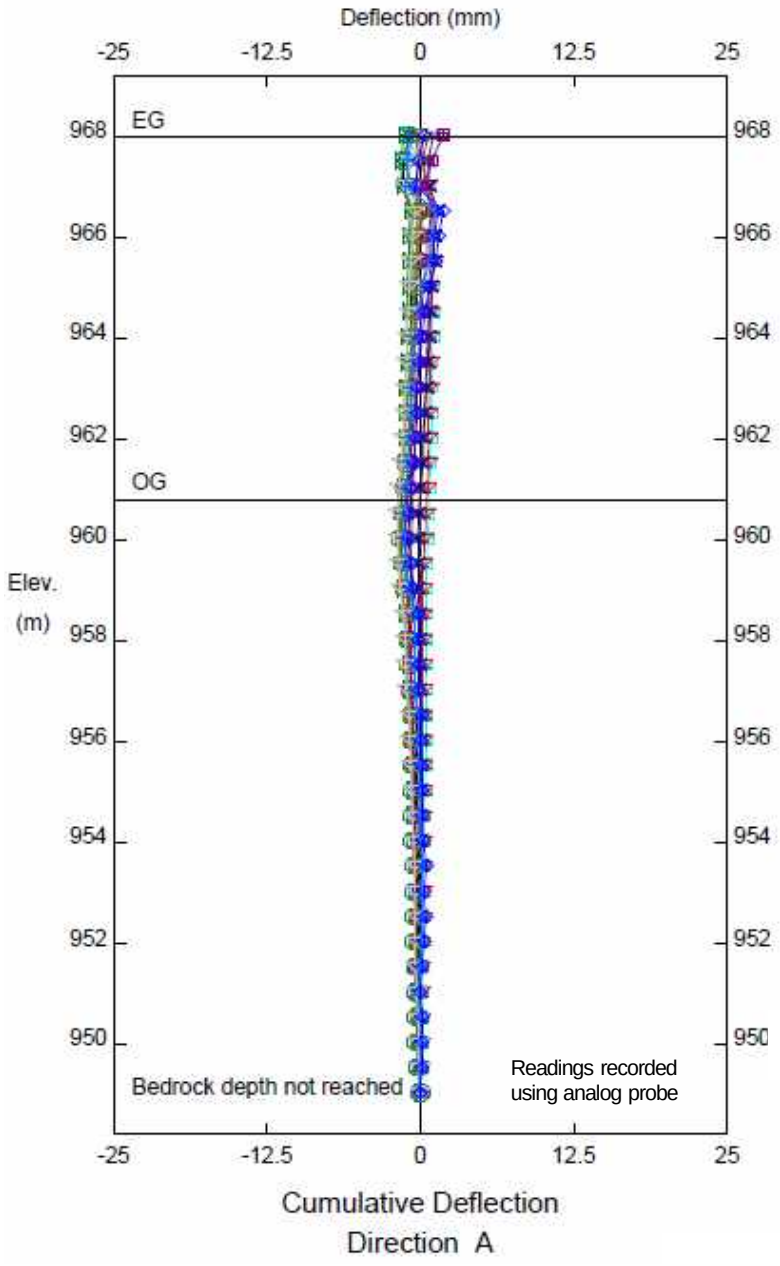
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

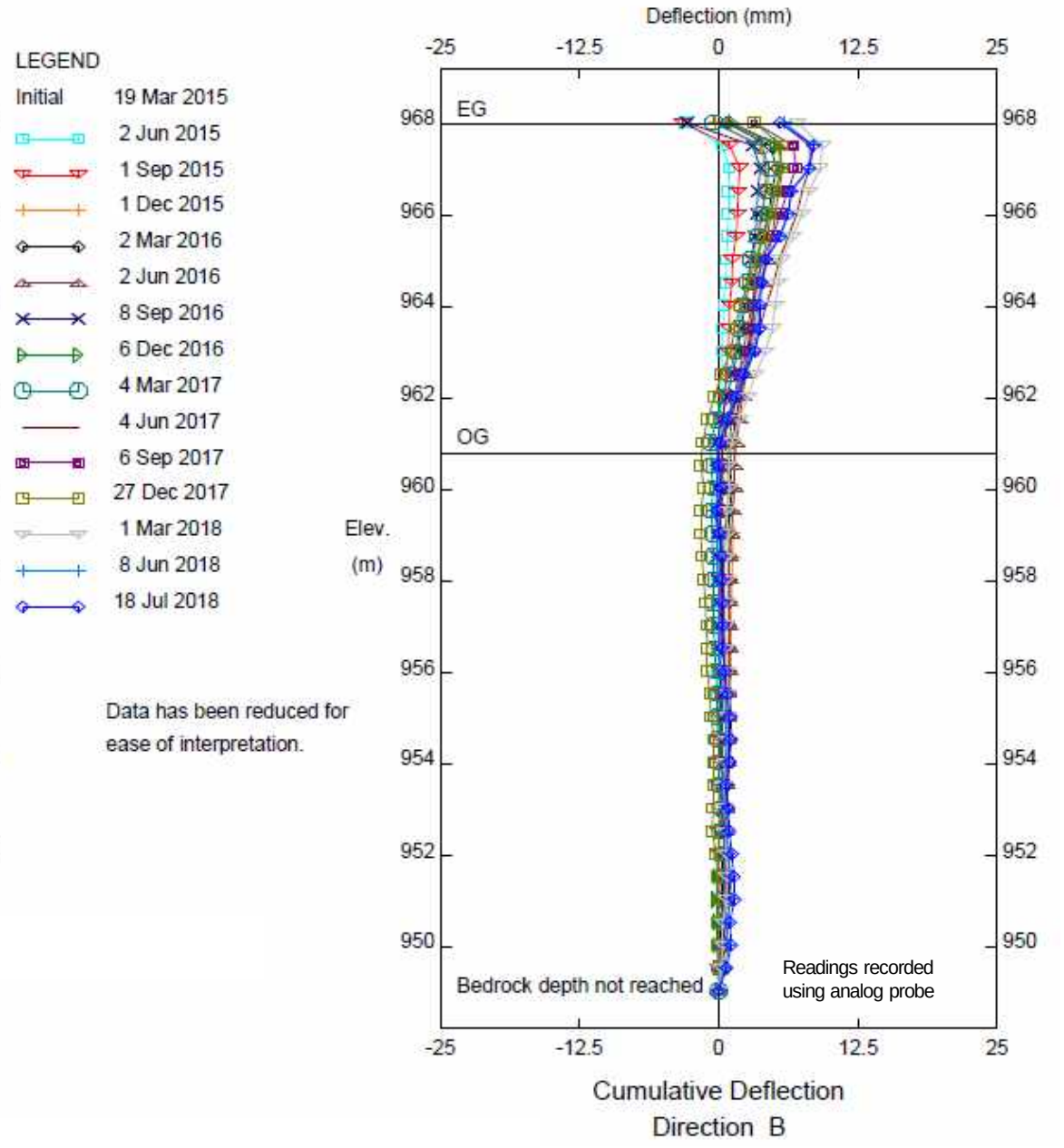
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-02
PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B36

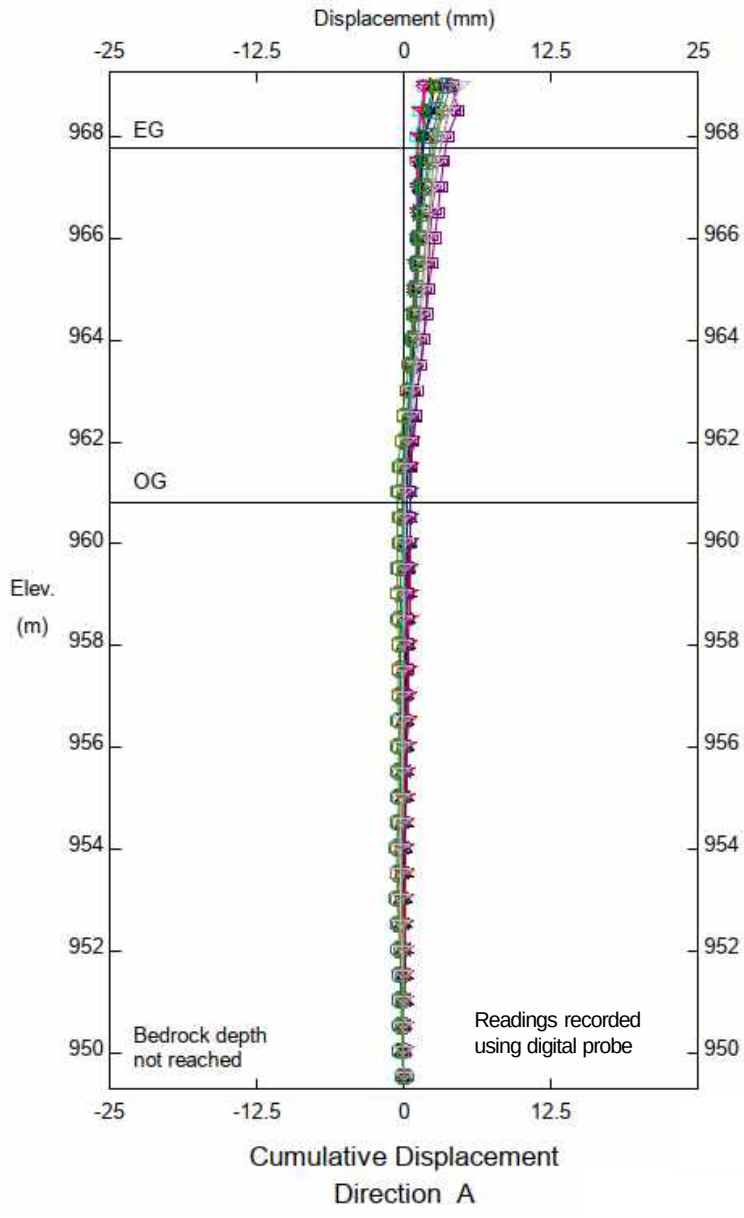
IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

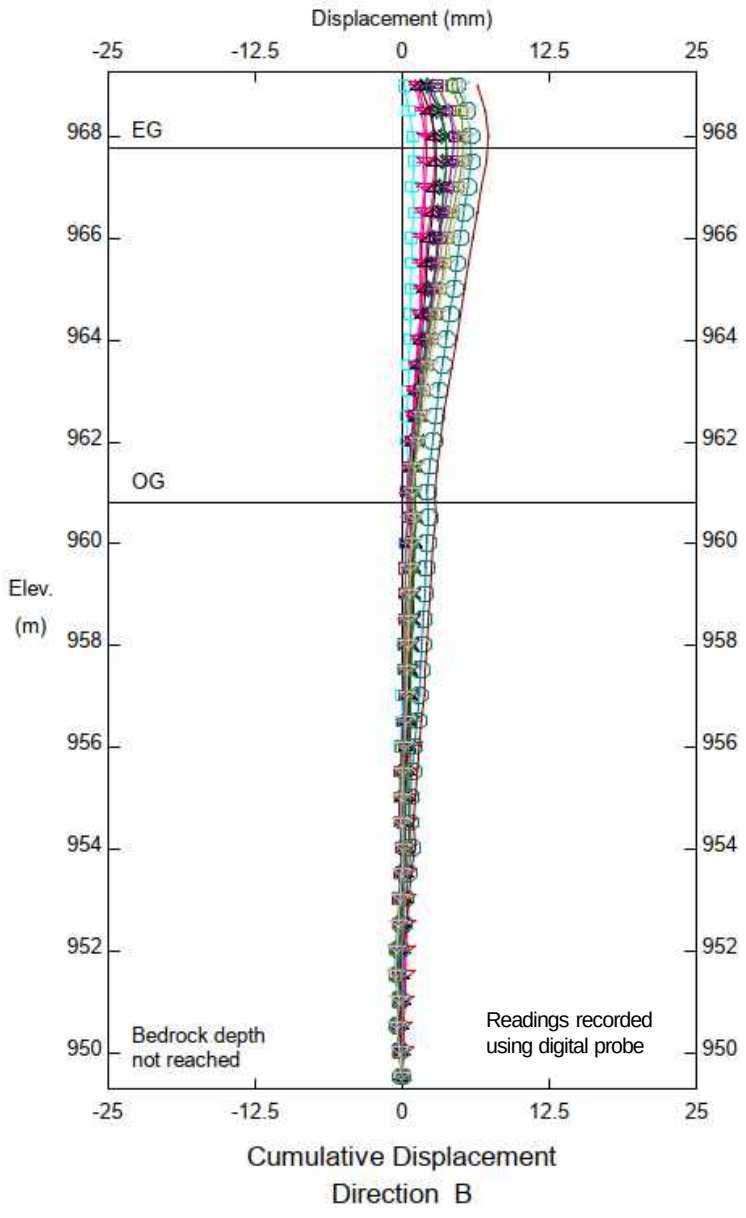


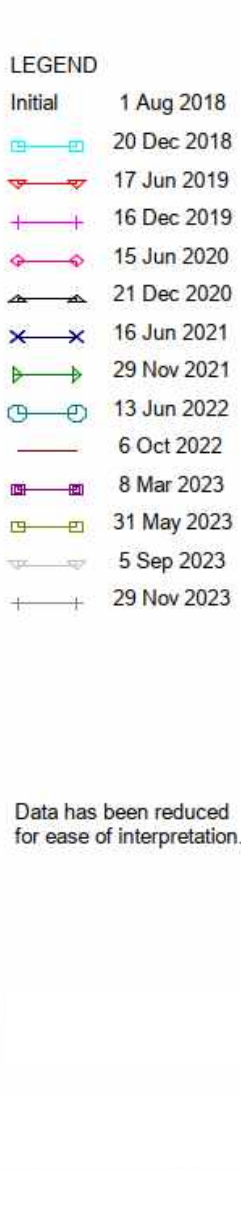


Data has been reduced for ease of interpretation.

WSP Canada Inc.







Data has been reduced for ease of interpretation.

Note:
EG: Existing Ground
OG: Original Ground

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YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

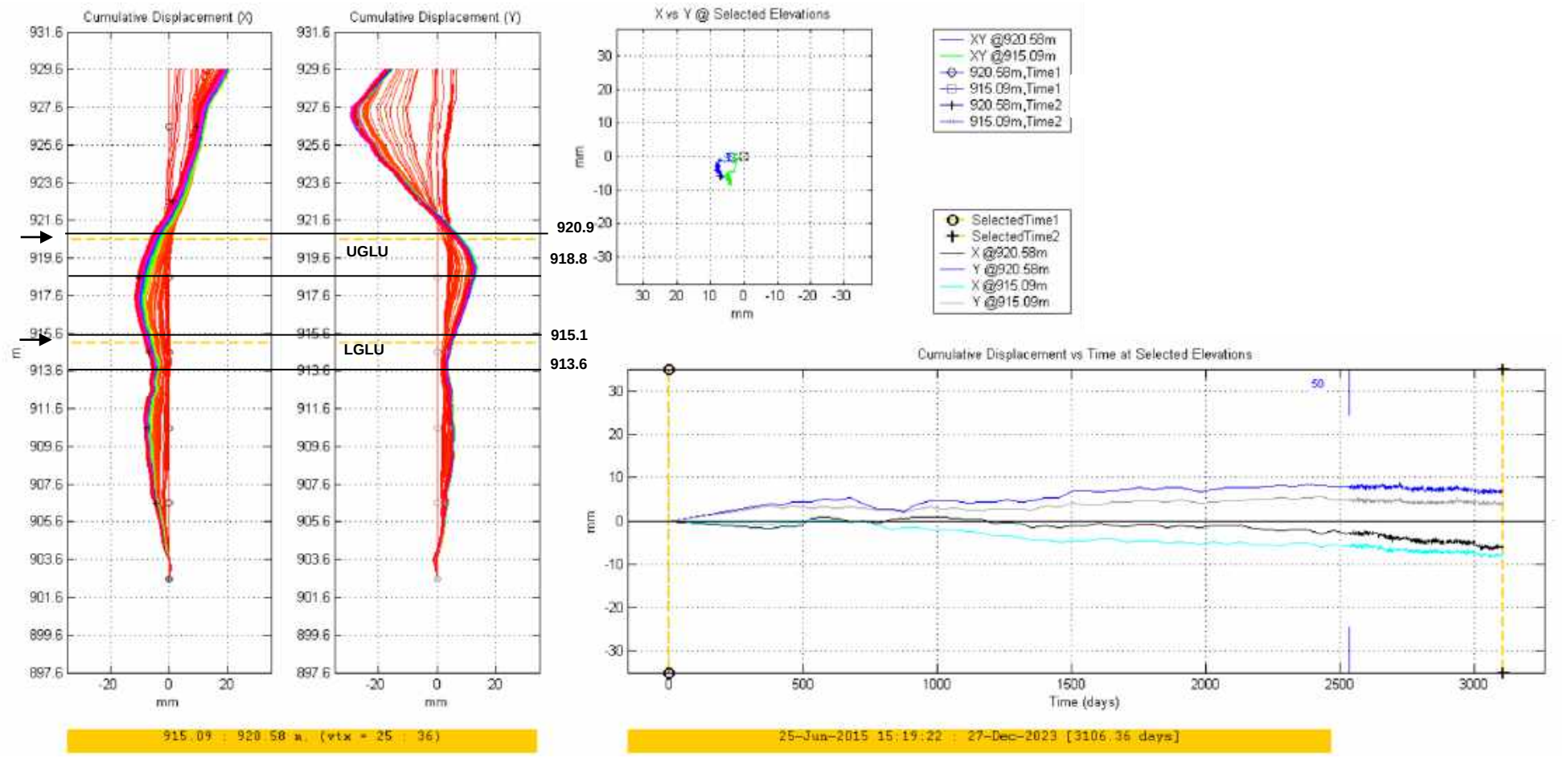
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SLOPE INCLINOMETER SI15-01
PERIMETER EMBANKMENT

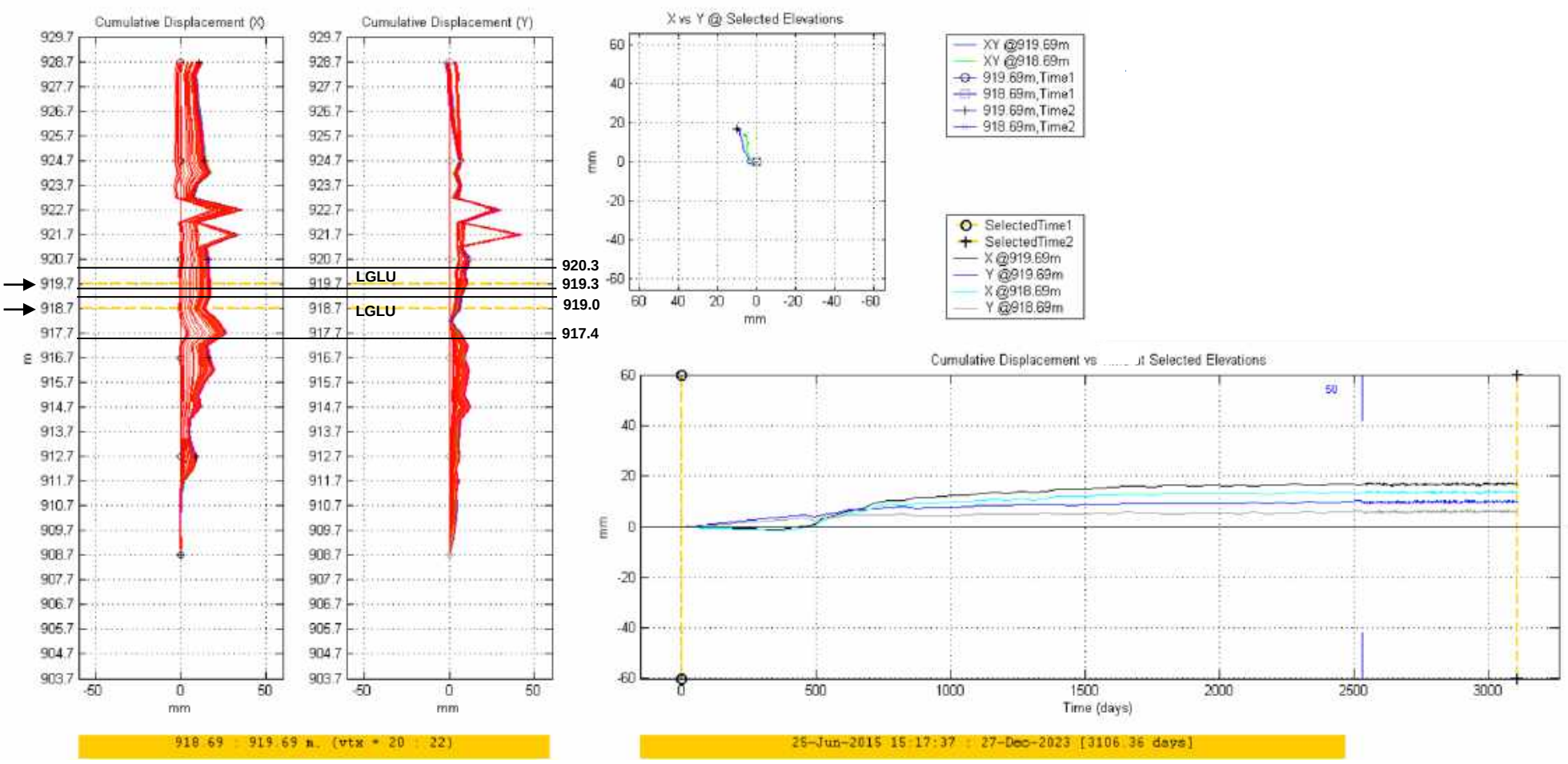
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B37**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm

SAA15-01



SAA15-02



UGLU: Upper Glaciolacustrine Unit

LGLU: Lower Glaciolacustrine Unit

NOTES:

1. Displacement shown is relative to baseline reading on 25 June 2015.
2. SAA15-01 downstream direction perpendicular to dam crest has an azimuth of 47° East of North.
3. SAA15-02 downstream direction perpendicular to dam crest has an azimuth of 7° East of North.
4. Data is reduced; shows only every 50th frame of data for the first 80% of time, then shows all data.

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PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

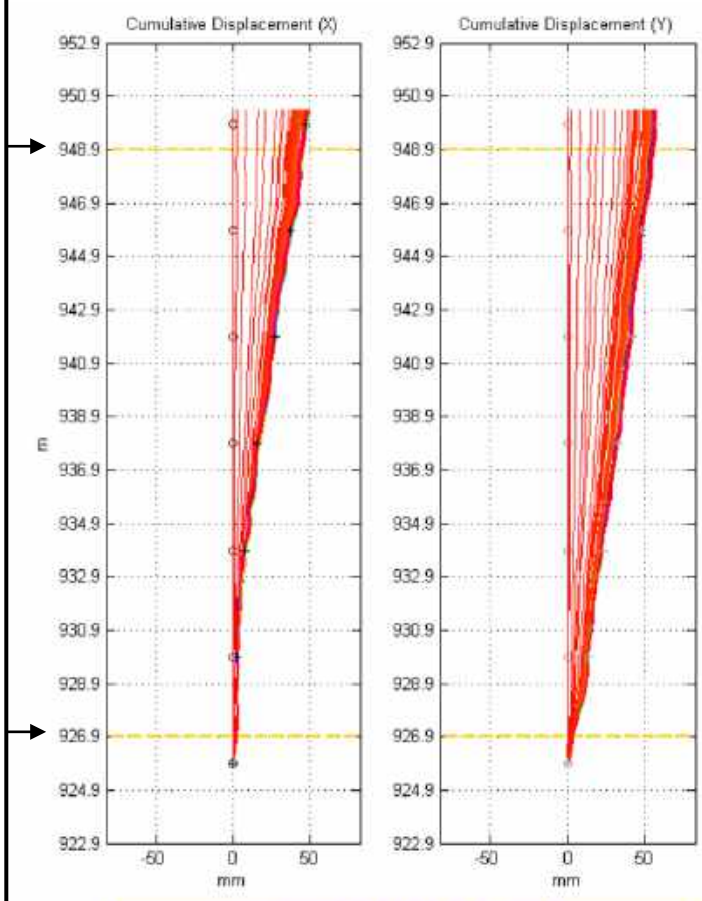
TITLE

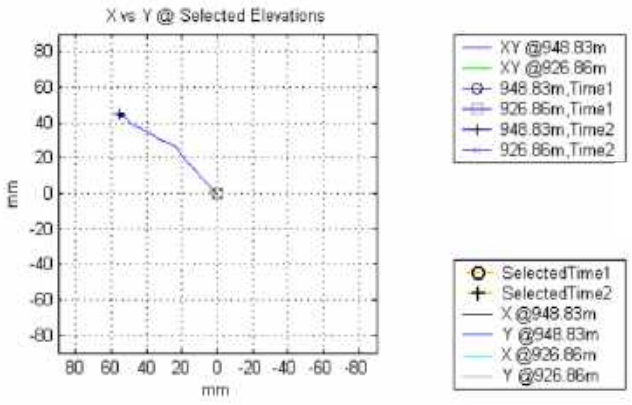
SHAPE ACCELERATION ARRAYS SAA15-01 AND SAA15-02 PERIMETER EMBANKMENT AT CORNER 1

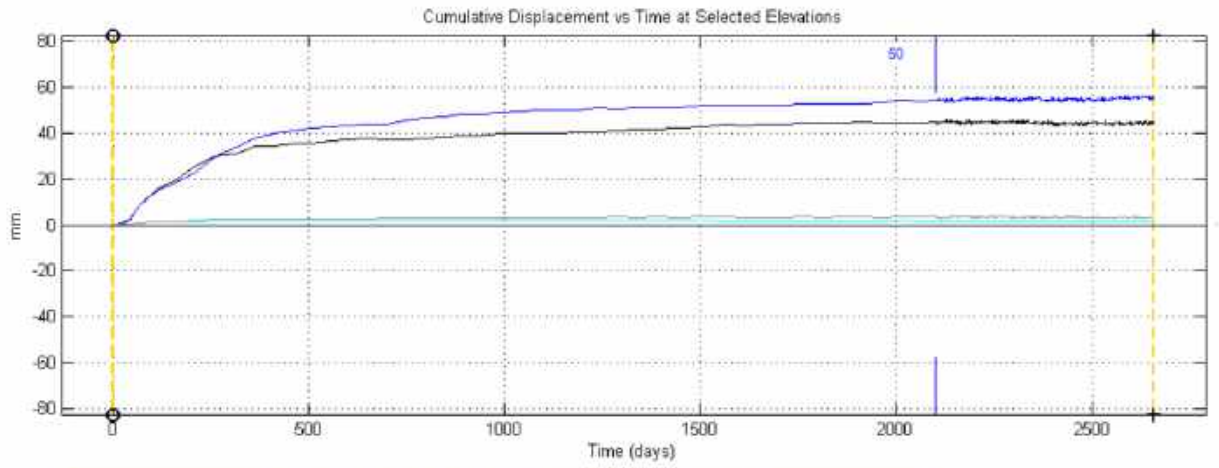
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**B38**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
20 mm

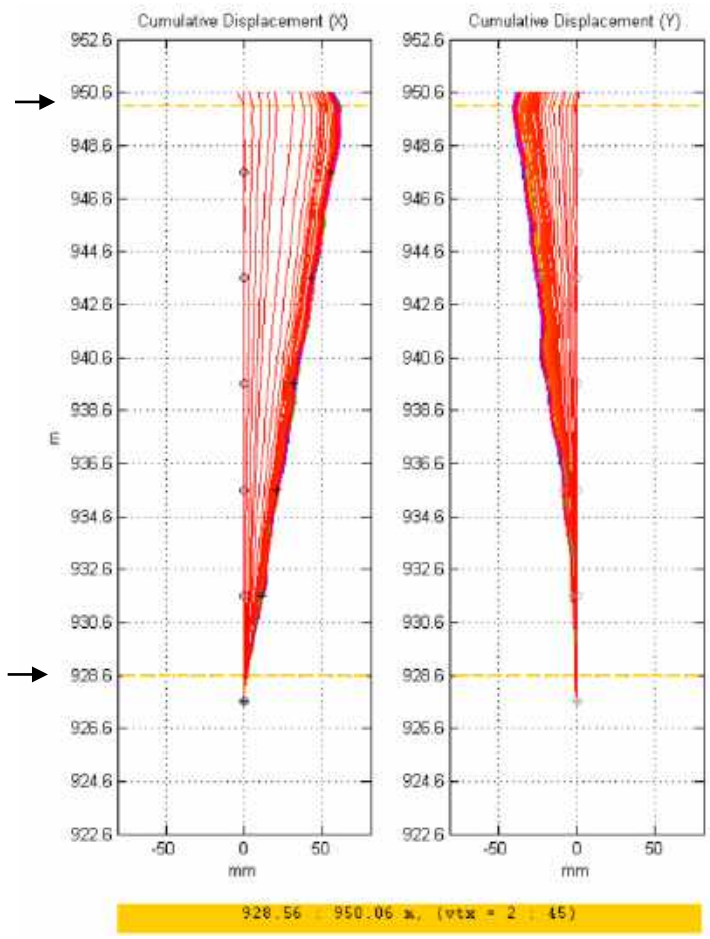
SAA16-01

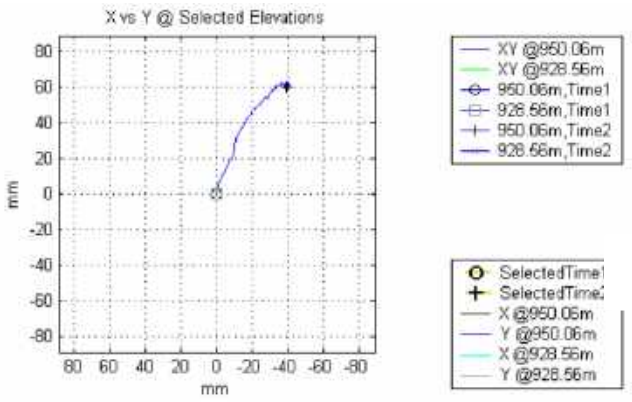


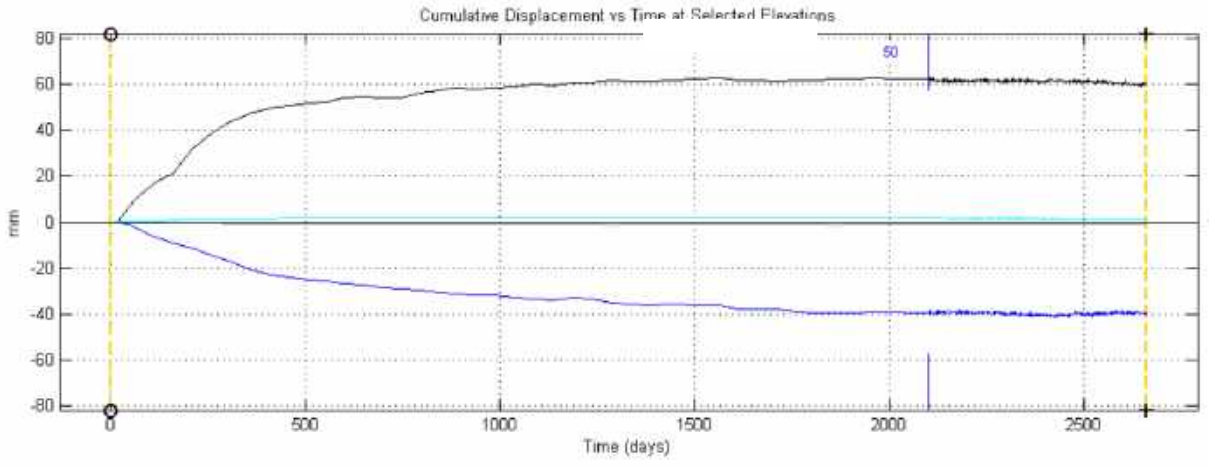




SAA16-02







NOTES:

1. SAA16-01 and SAA16-02 grouted in place on 8 September 2016. First reading 15 September 2016.
2. SAA16-01 downstream direction perpendicular to dam crest has an azimuth of 47° East of North.
3. SAA16-02 downstream direction perpendicular to dam crest has an azimuth of 7° East of North.
4. Data is reduced; shows only every 50th frame of data for the first 80% of time, then shows all data.

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PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

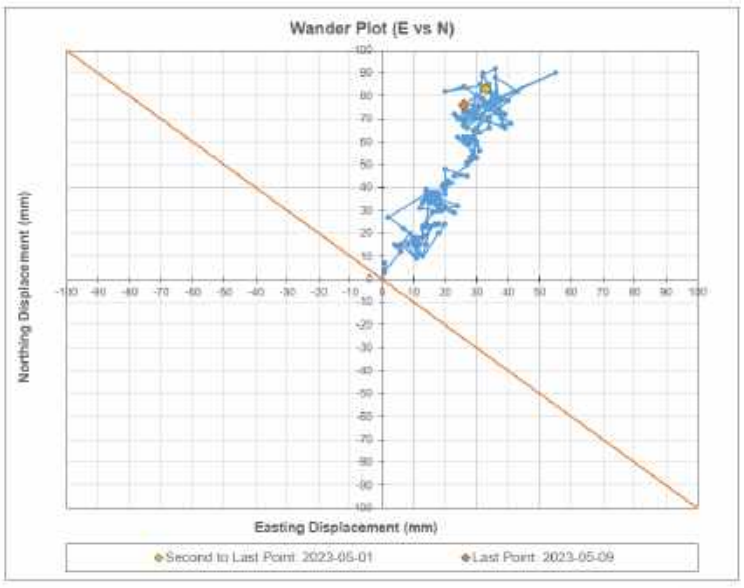
PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
SHAPE ACCELERATION ARRAYS SAA16-01 AND SAA16-02
PERIMETER EMBANKMENT AT CORNER 1
CUT-OFF WALL

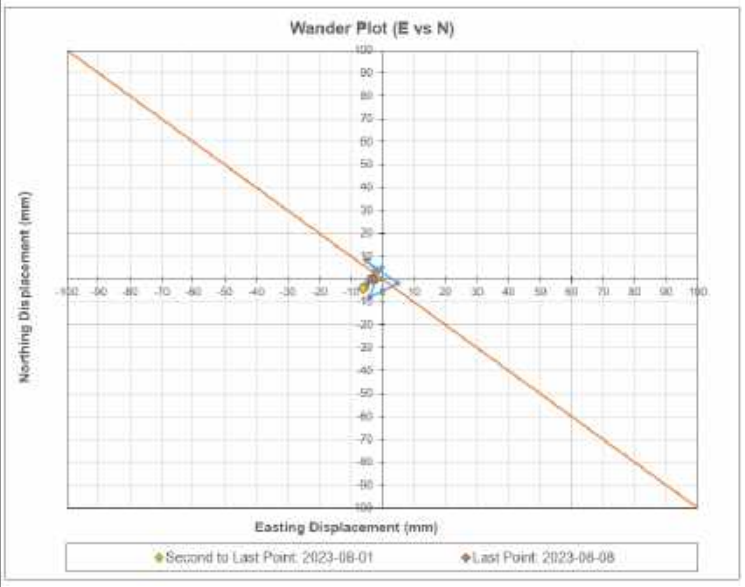
PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B39

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25 mm

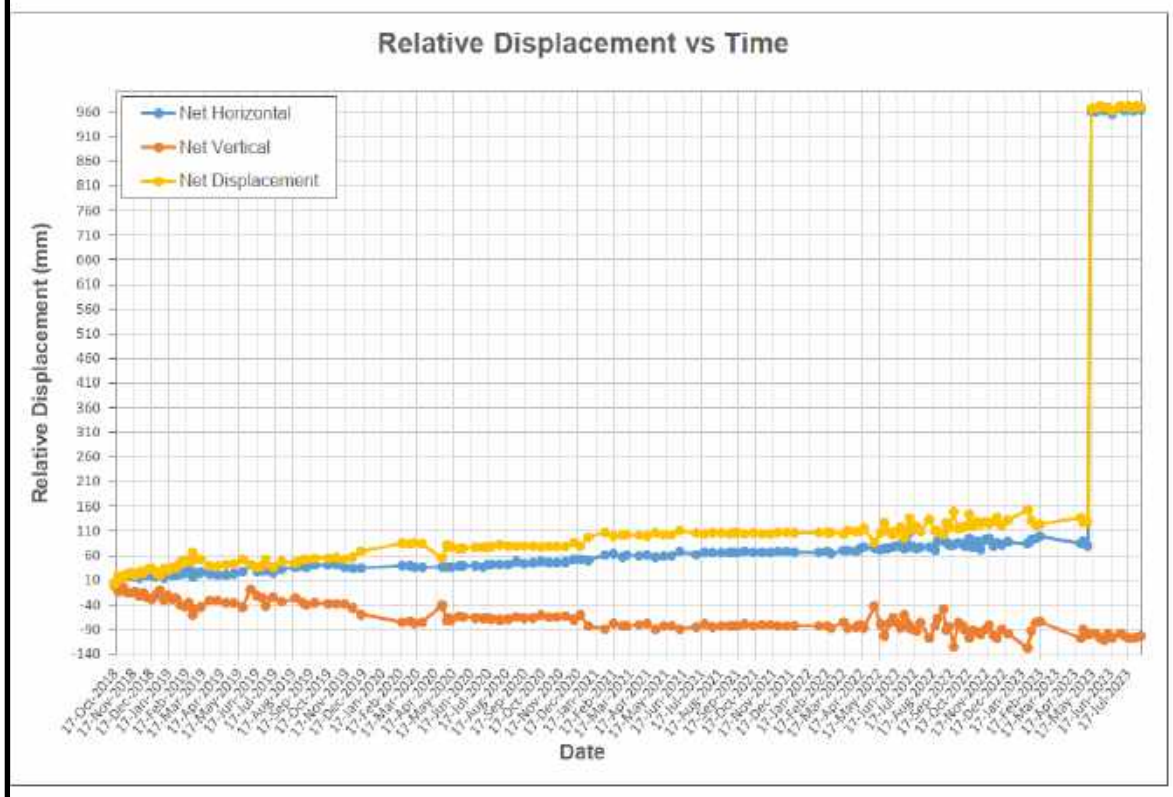
SM18-01 (October 17, 2018, to May 9, 2023)[5]



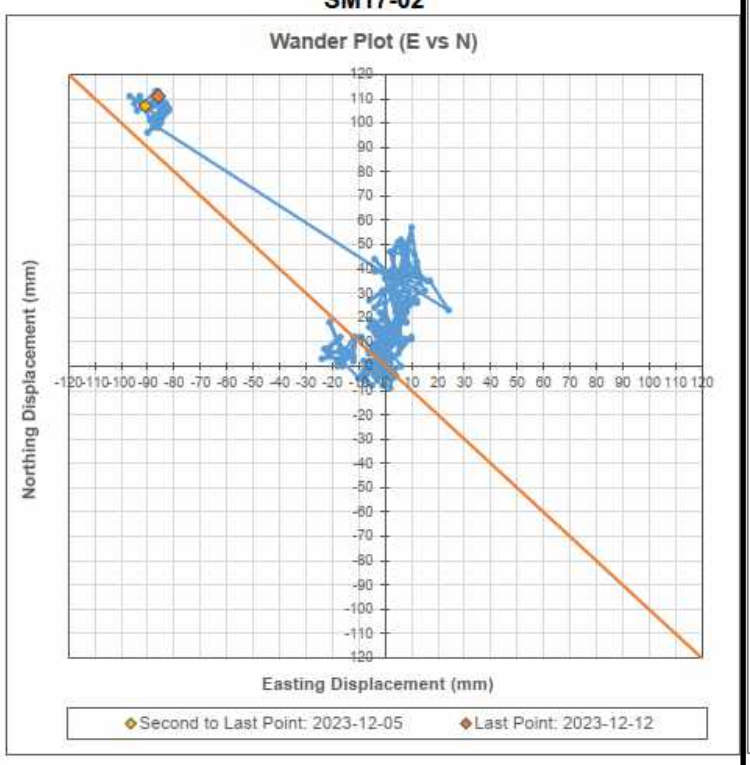
SM18-01 (May 15, 2023, to August 8, 2023)[5]



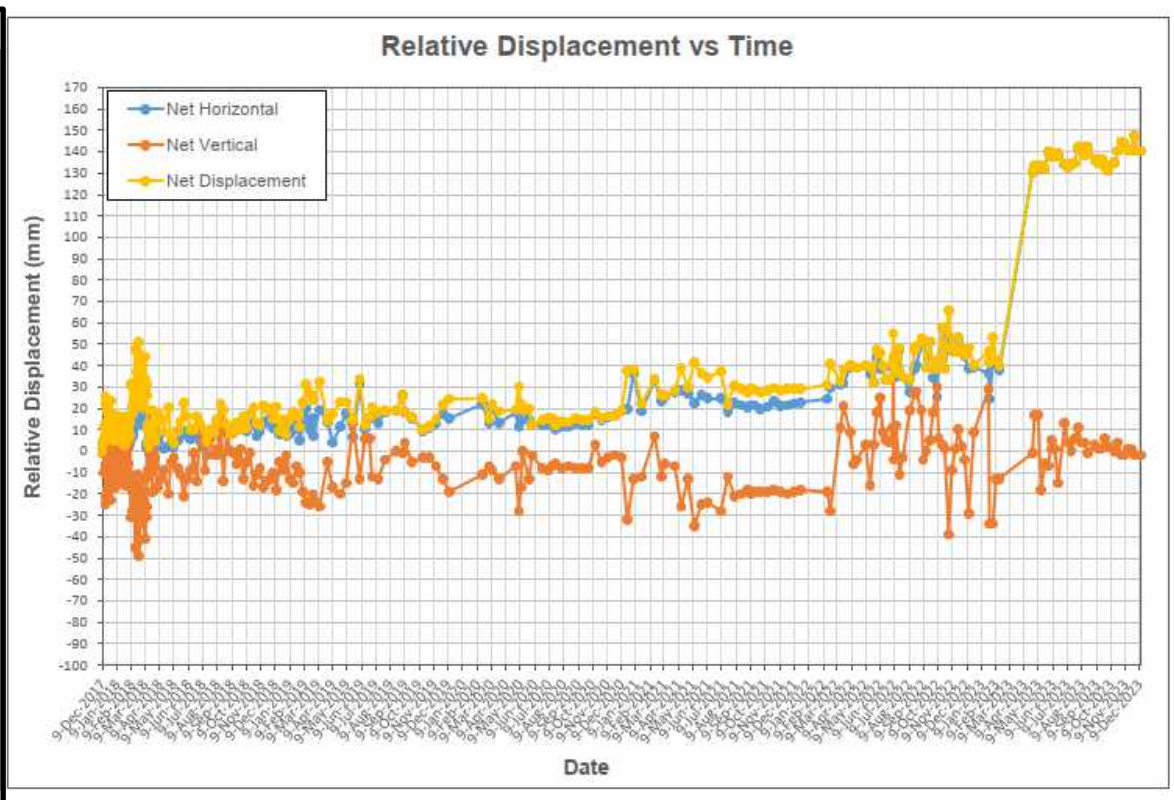
First Reading: 17 October 2018
Last Reading: 08 August 2023



SM17-02



First Reading: 10 December 2017
Last Reading: 12 December 2023



NOTES:

1. Monument SM17-01 was decommissioned on October 14, 2018, prior to placement of rockfill to raise the Corner 1 Embankment crest.
2. Monument SM18-01 was installed during placement of rockfill to raise the embankment to about El. 968 m. October 2018 initial reading was selected based on interpreted movement attributed to construction.
3. Monument SM18-01 was decommissioned in September 2023 prior to placement of rockfill to raise the Corner 1 Embankment crest to El. 970 m.
4. Monument SM17-02 was struck by an equipment between the readings of February 16, 2023, and April 27, 2023.
5. Monument SM18-01 was struck by an equipment between the readings of May 9, 2023, and May 15, 2023.
    1. Northing Displacement (Cumulative): 10 mm
    2. Easting Displacement (Cumulative): 983 mm
    3. Established a new baseline reading from May 15, 2023, for all the data onwards until decommissioning in September 2023.

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YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

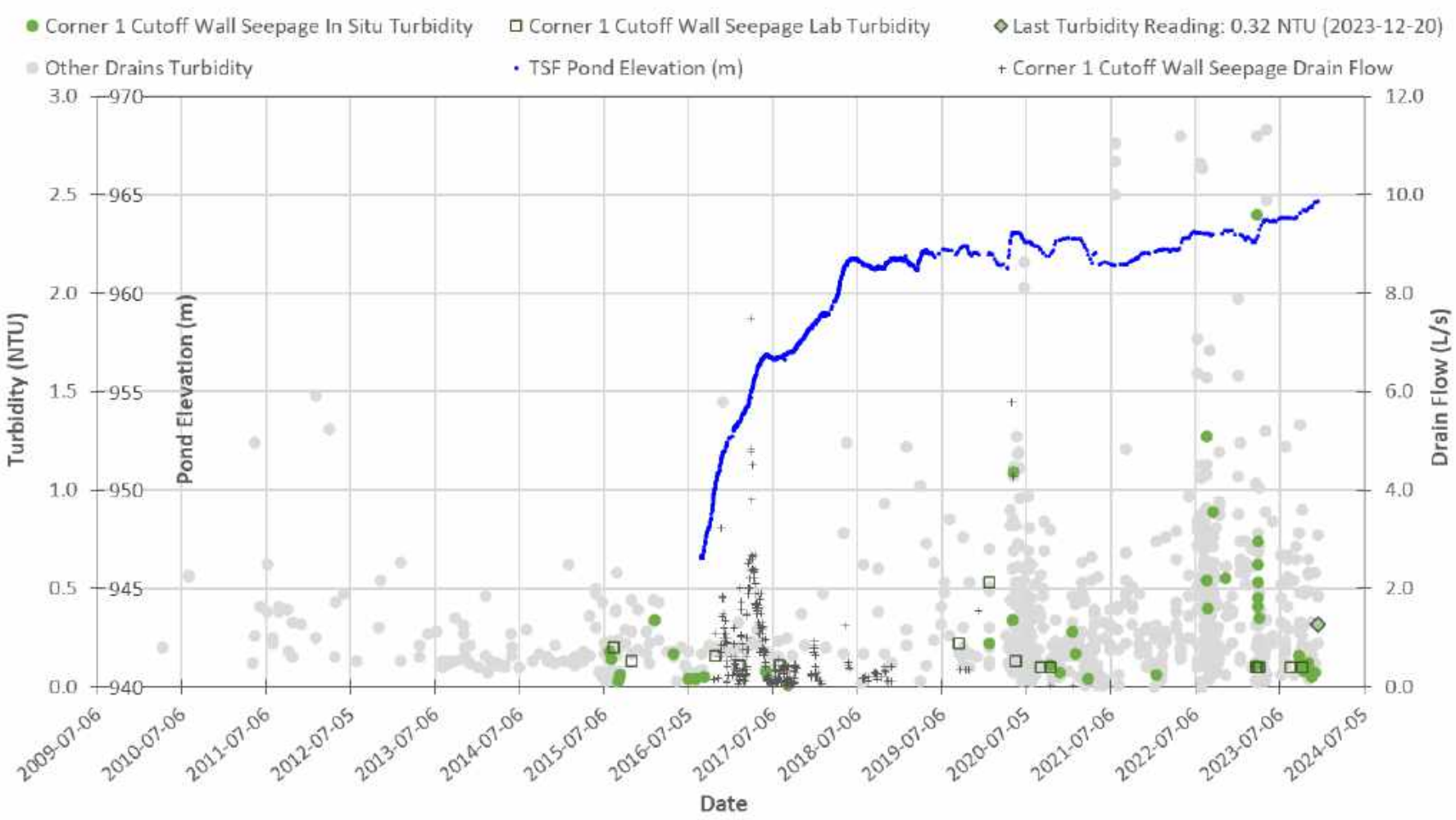
TITLE
SURVEY MONUMENTS SM18-01 AND SM17-02 PERIMETER EMBANKMENT AT CORNER 1

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	52300/52391/009	0	B40

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
23 mm

APPENDIX C

Turbidity and Drain Flow Data



NOTE:

1. No readings greater than 3.0 NTU measured in the year of 2023.

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YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

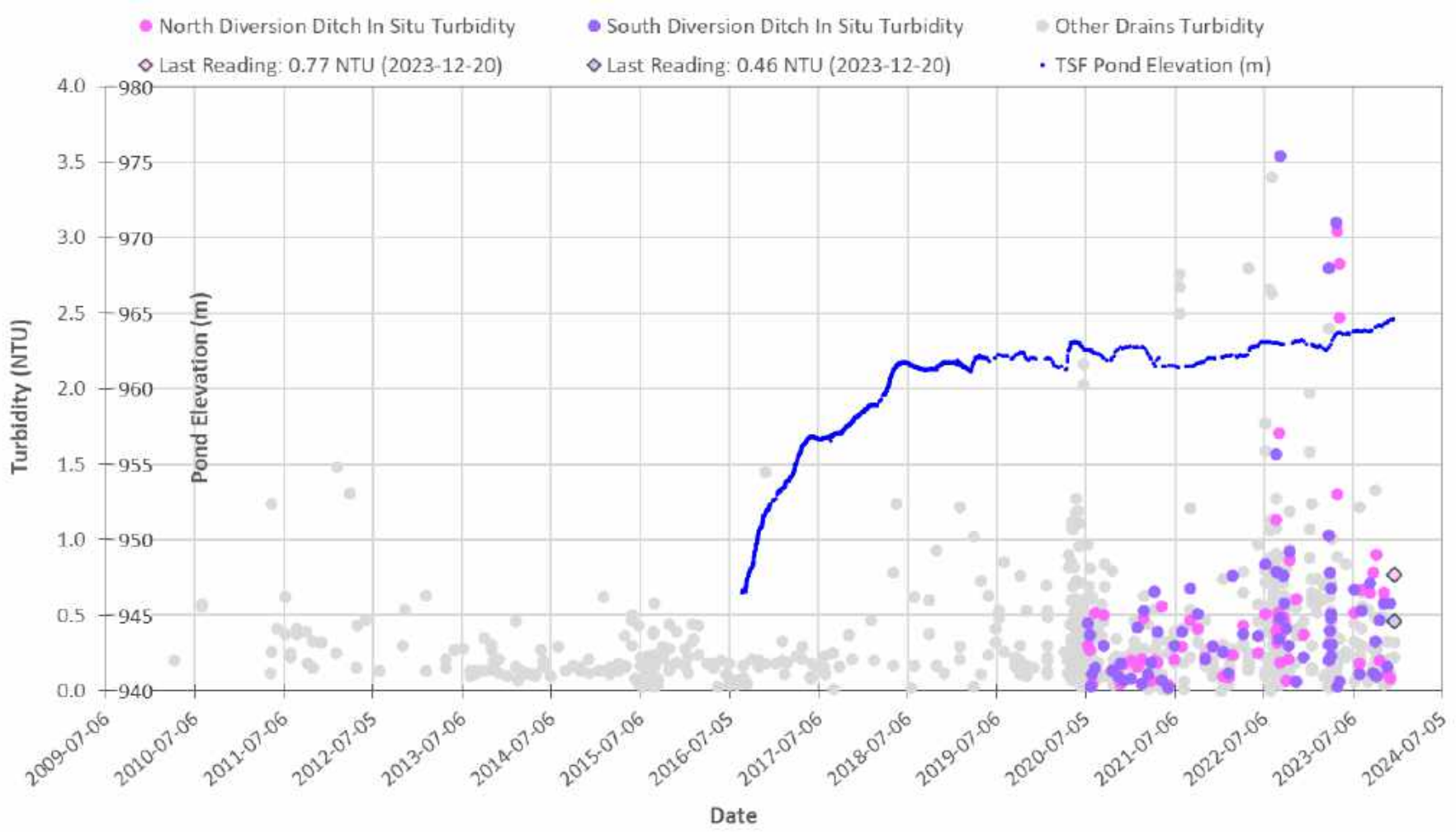
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

TURBIDITY & DRAIN FLOW
CORNER 1 CUTOFF WALL SEEPAGE DRAIN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**C1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



NOTE:

1. Following are the readings greater than 4.0 NTU:

North Diversion Ditch (In-Situ): x22 readings:
Turbidity (NTU):4.6 to 154.4.
Dates: March 23, 2023, to April 27, 2023.

South Diversion Ditch (In-Situ): x8 readings:
Turbidity (NTU):4.7 to 14.7.
Dates: March 23, 2023, and April 12 to 25, 2023.

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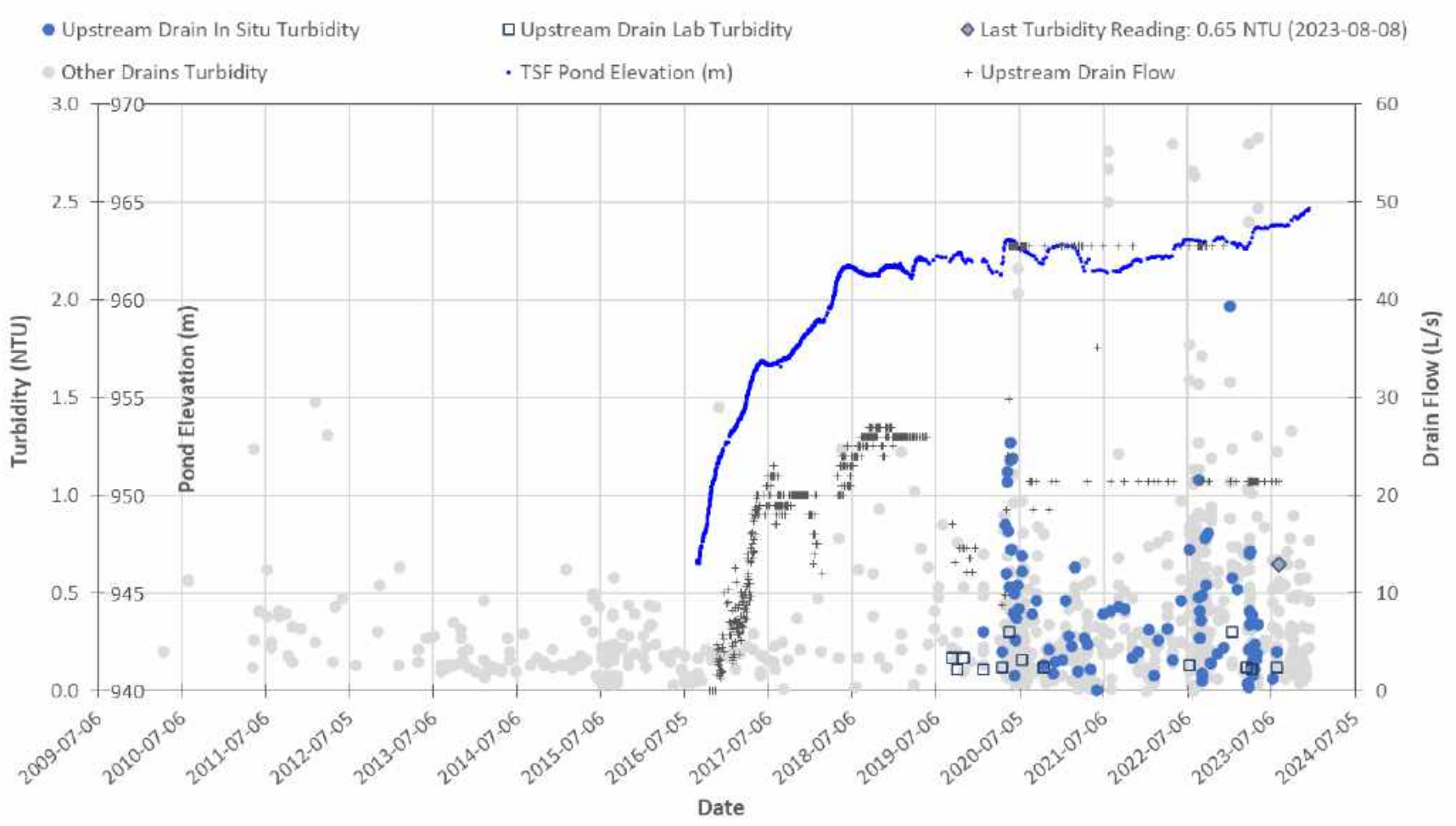
YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
TURBIDITY
NORTH & SOUTH DIVERSION DITCHES

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**C2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



NOTES:

1. No readings greater than 3.0 NTU measured in the year of 2023.
2. The Corner 1 upstream drain flow is visually estimated.

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PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

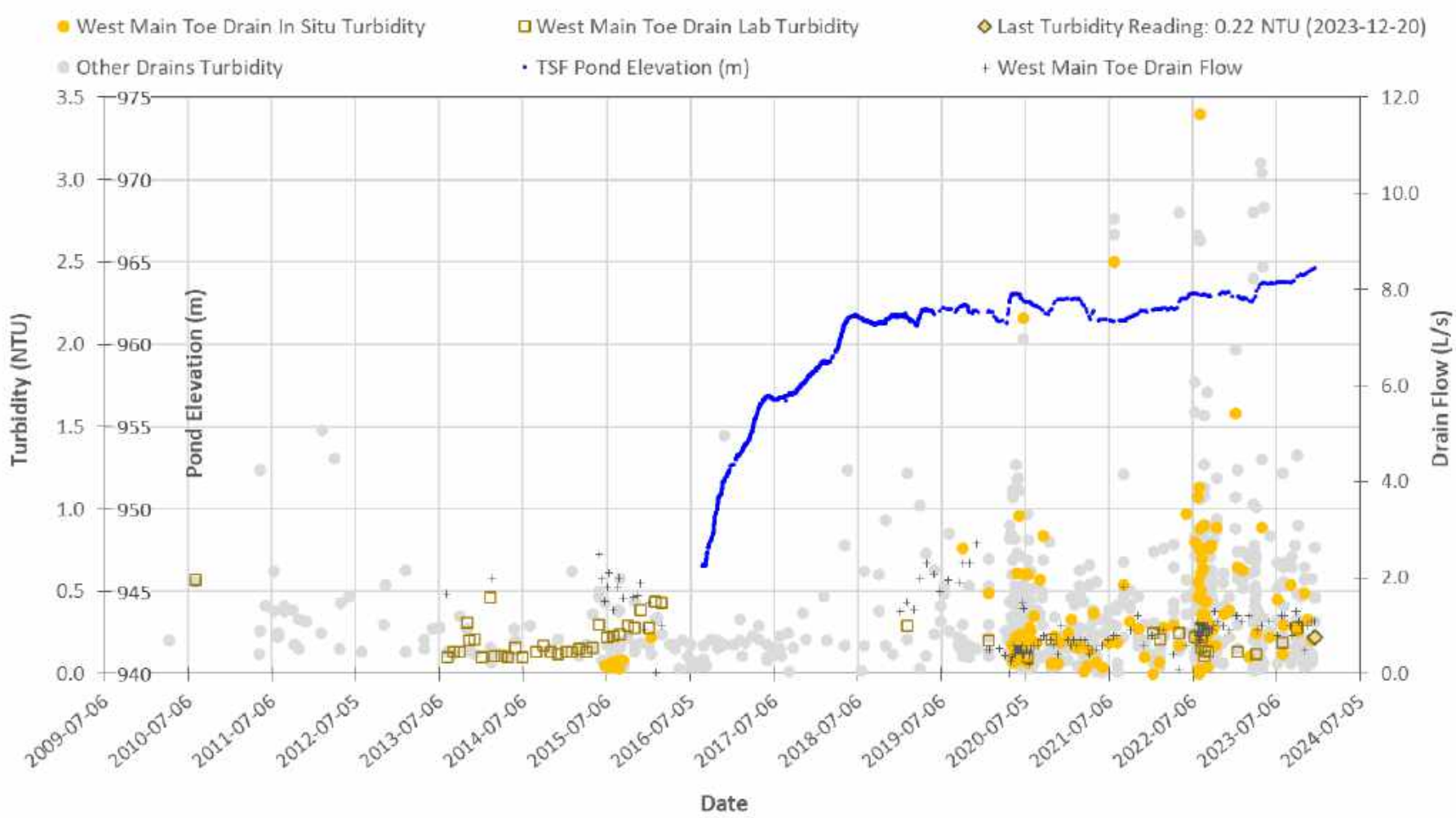
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

TURBIDITY & DRAIN FLOW
CORNER 1 UPSTREAM DRAIN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**C3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



NOTE:

1. No readings greater than 3.5 NTU measured in the year of 2023.

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PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

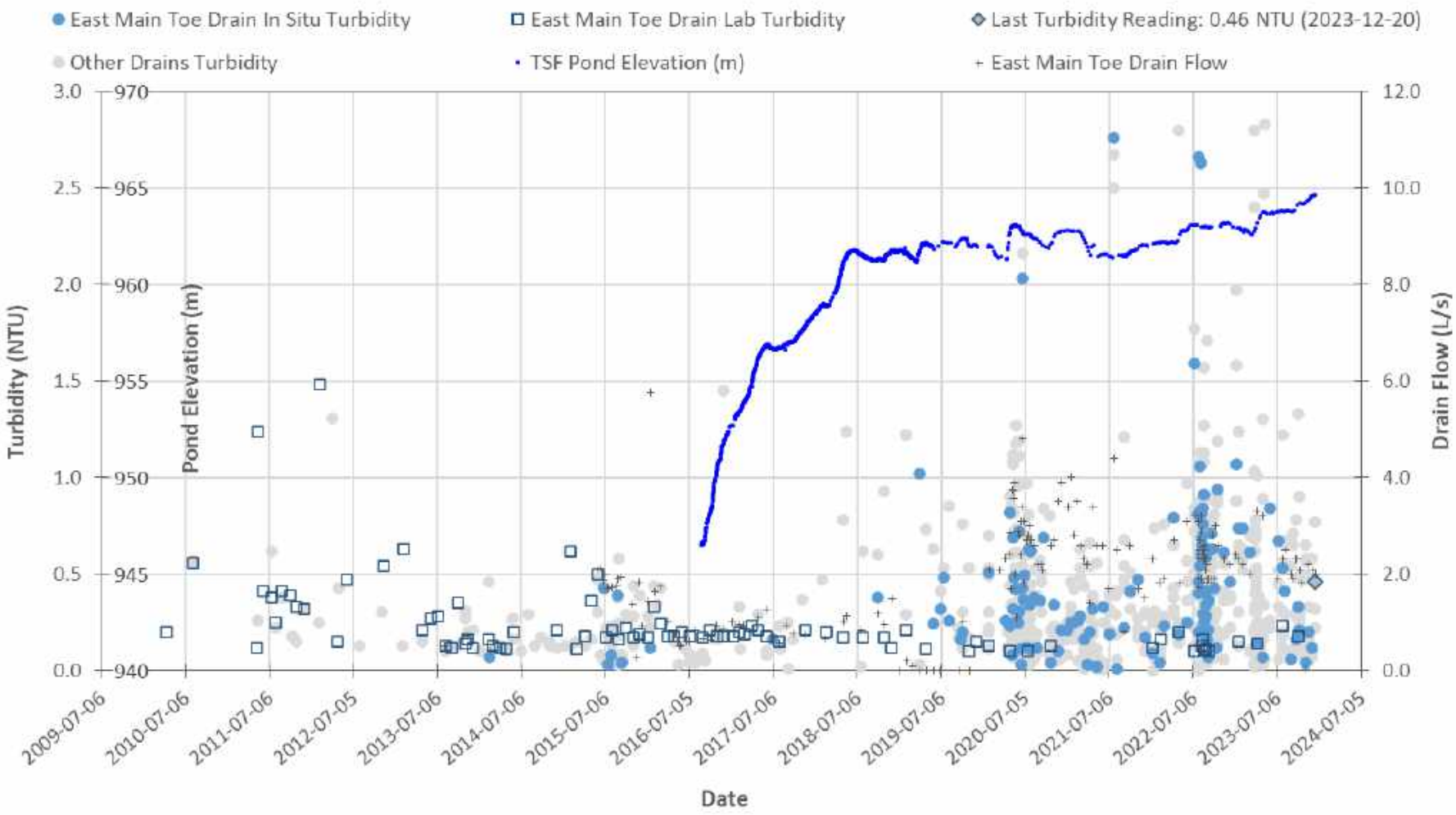
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

TURBIDITY & DRAIN FLOW
WEST MAIN EMBANKMENT TOE DRAIN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**C4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



NOTE:

1. No readings greater than 3.0 NTU measured in the year of 2023.

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CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

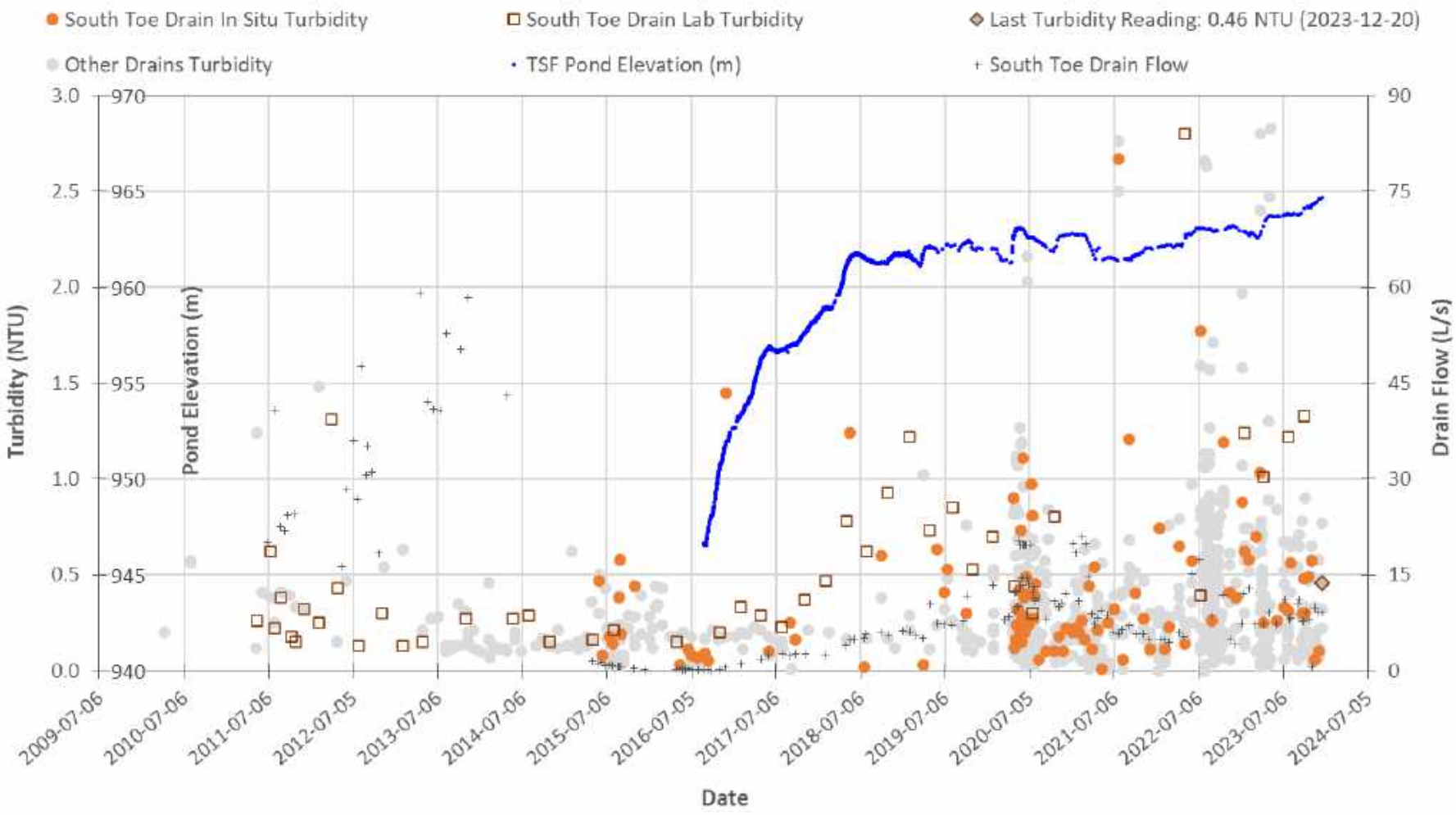
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

TURBIDITY & DRAIN FLOW
EAST MAIN EMBANKMENT TOE DRAIN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**C5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



NOTE:

1. No readings greater than 3.0 NTU measured in the year of 2023.

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MOUNT POLLEY MINING CORPORATION

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YYYY-MM-DD	2024-03-25
PREPARED	Y. JANI
DESIGNED	Y. JANI
REVIEWED	R. GARRITSEN
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

TURBIDITY & DRAIN FLOW
SOUTH EMBANKMENT TOE DRAIN

PROJECT NO.	PHASE/TASK/DOC.	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**C6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

APPENDIX D

Dam Safety Inspection Photographs

Photograph 1: (October 4, 2023)

Construction of the abutment at Corner 4.
Looking northwest from about Sta. 0+400.





Photograph 2: (October 4, 2023)

Construction of the abutment at Corner 4.
Looking southeast from about Sta. 0+340.

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 1 & 2
CORNER 4 ABUTMENT

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D1**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 3: (October 4, 2023)

View along the crest of the South Embankment. Looking southeast from about Sta. 0+900.





Photograph 4: (October 4, 2023)

View along the crest of the South Embankment. Looking northwest from about Sta. 1+200.

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PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 3 & 4
SOUTH EMBANKMENT CREST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D2**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 5: (October 4, 2023)

View along the crest of the South Embankment. Looking northwest from about Sta. 1+300.





Photograph 6: (October 4, 2023)

View along the crest of the South Embankment. Looking northwest from about Sta. 1+550 (Corner 3).

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CONSULTANT

wsp

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PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 5 & 6
SOUTH EMBANKMENT CREST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D3**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



Photograph 7: (October 4, 2023)

Panoramic view of the bench and tailings beach upstream of the South Embankment and Main Embankment. Looking northwest from about Sta. 1+650.



Photograph 8: (October 4, 2023)

Tailings deposition upstream of the South Embankment. Looking north from about Sta. 0+900.

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MOUNT POLLEY MINING CORPORATION

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PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 7 & 8
SOUTH EMBANKMENT TAILINGS BEACH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D4**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



Photograph 9: (October 4, 2023)

View along the toe of the South Embankment. Looking southeast from about Sta. 0+550. Vegetation still growing along the downstream toe (2021DSI-05).



Photograph 10: (October 4, 2023)

View along the toe of the South Embankment. Looking northwest from about Sta. 1+500. Vegetation still growing along the downstream toe (2021DSI-05).

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 9 & 10
SOUTH EMBANKMENT TOE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D5**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 11: (October 4, 2023)

Downstream slope of the South Embankment. Looking southeast from about Sta. 0+600.





Photograph 12: (October 4, 2023)

Downstream slope of the South Embankment. Looking northwest from about Sta. 1+350.

CLIENT MOUNT POLLEY MINING CORPORATION

CONSULTANT wsp

YYYY-MM-DD	2024-03-25
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 11 & 12
SOUTH EMBANKMENT DOWNSTREAM SLOPE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D6**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



Photograph 13: (October 4, 2023)

View along the crest of the Main Embankment. Looking northeast from about Sta. 2+200.



Photograph 14: (October 4, 2023)

View along the crest of the Main Embankment. Looking southwest from about Sta. 2+200.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-03-25
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DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
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PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 13 & 14
MAIN EMBANKMENT CREST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D7**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm



Photograph 15: (October 4, 2023)

View along the crest of the Main Embankment. Looking northeast from about Sta. 2+500.



Photograph 16: (October 4, 2023)

View along the crest of the Main Embankment. Looking southwest from about Sta. 2+500.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 15 & 16
MAIN EMBANKMENT CREST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



Photograph 17: (October 4, 2023)

Panoramic view of the tailings beach upstream of the Main Embankment. Looking northwest from about Sta. 2+200.



Photograph 18: (October 4, 2023)

Tailings discharge pipeline extended on an upstream berm along the Main Embankment. Looking southwest from about Sta. 1+900.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT

YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 17 & 18
MAIN EMBANKMENT TAILINGS BEACH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D9**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 19: (October 4, 2023)

Downstream slope of the Main Embankment. Looking northeast from about Sta. 1+800.





Photograph 20: (October 4, 2023)

Downstream slope of the Main Embankment. Looking southwest from about Sta. 2+700 (near Corner 2).

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 19 & 20
MAIN EMBANKMENT DOWNSTREAM SLOPE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 21: (October 4, 2023)

View of the downstream slope of the Main Embankment and crest of the Main Embankment buttress. Looking southwest from about Sta. 2+100.





Photograph 22: (October 4, 2023)

Shallow ravelling and erosion observed along the downstream slope of the Main Embankment (2023DSI-04). Looking northwest from about Sta. 1+700.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
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APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 21 & 22
MAIN EMBANKMENT BUTTRESS AND DOWNSTREAM SLOPE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D11**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 23: (October 4, 2023)

View of the Main Embankment Seepage Collection Pond. Looking northeast from about Sta. 2+000.





Photograph 24: (October 4, 2023)

Downstream slope and toe of the Main Embankment buttress. Looking southwest from about Sta. 2+200.

CLIENT MOUNT POLLEY MINING CORPORATION

CONSULTANT wsp

YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 23 & 24
MAIN EMBANKMENT BUTTRESS AND SEEPAGE COLLECTION POND

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D12**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 25: (October 4, 2023)

Downstream slope of the Main Embankment buttress. Looking north from about Sta. 2+500.





Photograph 26: (October 4, 2023)

Main Embankment buttress crest and downstream slope. Looking southwest from about Sta. 2+500.

CLIENT MOUNT POLLEY MINING CORPORATION

CONSULTANT wsp

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

TITLE
PHOTOGRAPHS 25 & 26
MAIN EMBANKMENT BUTTRESS AND DOWNSTREAM SLOPE

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D13**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



Photograph 27: (October 4, 2023)

View along the crest of the Perimeter Embankment. Looking northwest from about Sta. 2+800.



Photograph 28: (October 4, 2023)

View along the filter and transition zones of the Perimeter Embankment. Looking northwest from about Sta. 2+900.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 27 & 28
PERIMETER EMBANKMENT CREST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D14**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



Photograph 29: (October 4, 2023)

View along the crest of the Perimeter Embankment. Looking southeast from about Sta. 3+600.



Photograph 30: (October 4, 2023)

View along the upstream fill of the Perimeter Embankment. Looking northwest from about Sta. 3+600.

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 29 & 30
PERIMETER EMBANKMENT CREST

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D15**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



Photograph 31: (October 4, 2023)

View along the crest of the Perimeter Embankment at Corner 1. Looking northwest from about Sta. 4+000.



Photograph 32: (October 4, 2023)

View along the crest of the Perimeter Embankment at Corner 1. Looking southeast from about Sta. 4+400.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 31 & 32
PERIMETER EMBANKMENT CREST AT CORNER 1

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D16**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

Photograph 33: (October 4, 2023)

Construction of the Perimeter Embankment near Corner 5. Looking west from about Sta. 4+800.





Photograph 34: (October 4, 2023)

Overview of the Corner 5 Abutment. Looking northeast from about Sta. 5+000. Rockfill berm located immediately upstream of the embankment (2023DSI-01).

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 33 & 34
PERIMETER EMBANKMENT CREST AND CORNER 5 ABUTMENT

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D17**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A



Photograph 35: (October 4, 2023)

Tailings deposition upstream of the Perimeter Embankment at Corner 1. Looking northwest from about Sta. 4+100.



Photograph 36: (October 4, 2023)

Tailings deposition upstream of the Perimeter Embankment at Corner 1. Looking west from about Sta. 4+200.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
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PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 35 & 36
PERIMETER EMBANKMENT AT CORNER 1 TAILINGS BEACH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D18**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

Photograph 37: (October 4, 2023)

Downstream slope and buttress of the Perimeter Embankment. Looking southeast from about Sta. 3+400.





Photograph 38: (October 4, 2023)

Downstream slope of the Perimeter Embankment. Perimeter Embankment Till Borrow Pond in the background. Looking northwest near Sta. 3+300.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 37 & 38
DOWNSTREAM SLOPE OF PERIMETER EMBANKMENT

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D19**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 39: (October 5, 2023)

View along the crest of the Perimeter Embankment buttress. Looking southeast near Sta. 3+200.





Photograph 40: (October 5, 2023)

View along the crest of the Perimeter Embankment buttress. Looking southeast near Sta. 3+700.

CLIENT

MOUNT POLLEY MINING CORPORATION

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PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
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APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 39 & 40
PERIMETER EMBANKMENT BUTTRESS

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D20**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 41: (October 5, 2023)

Perimeter Embankment Till Borrow Pond and Water Treatment Plant. Looking southeast.





Photograph 42: (October 5, 2023)

Downstream slope of the Perimeter Embankment buttress. Looking southeast from about Sta. 3+500.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 41 & 42
PERIMETER EMBANKMENT BUTTRESS AND TILL BORROW POND

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D21**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A

Photograph 43: (October 5, 2023)

Erosion of sandy tailings on the downstream slope of the Perimeter Embankment buttress at Corner 1 (2018DSI-06).





Photograph 44: (October 5, 2023)

Erosion of sandy tailings on the downstream slope of the Perimeter Embankment buttress at Corner 1 near inclinometer SI16-03 (2018DSI-06).

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
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APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 43 & 44
PERIMETER EMBANKMENT BUTTRESS AT CORNER 1

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D22**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm

Photograph 45: (October 4, 2023)

Downstream slope of the Perimeter Embankment at Corner 1. Perimeter Embankment Till Borrow Pond and Perimeter Embankment buttress in the background. Looking southeast from about Sta. 4+200.





Photograph 46: (October 4, 2023)

Perimeter Embankment buttress at Corner 1. Looking northeast from about Sta. 4+200.

CLIENT

MOUNT POLLEY MINING CORPORATION

CONSULTANT

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PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
REVIEWED	G. PIZARRO-SALA
APPROVED	G. PIZARRO-SALA

PROJECT

MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE

PHOTOGRAPHS 45 & 46
PERIMETER EMBANKMENT BUTTRESS AT CORNER 1

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D23**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
0 25 mm

Photograph 47: (October 4, 2023)

Clean water diversion ditch is partially obstructed by vegetation from Corner 4 to Corner 5 (2018DSI-02).





Photograph 48: (October 4, 2023)

Longitudinal cracks were covered with soil along the sidewall of the clean water diversion ditch near Corner 4 (2021DSI-03).

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
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YYYY-MM-DD	2024-03-25
PREPARED	R. GARRITSEN
DESIGNED	R. GARRITSEN
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APPROVED	G. PIZARRO-SALA

PROJECT
MOUNT POLLEY MINE TAILINGS STORAGE FACILITY
2023 DAM SAFETY INSPECTION REPORT

TITLE
PHOTOGRAPHS 47 & 48
CLEAN WATER DIVERSION DITCH

PROJECT NO.	PHASE/TASK	REV.	FIGURE
CA0020527.4505	**52300/52391/009**	**0**	**D24**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI A
25 mm



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APPENDIX 5-8: Recalibration of the Groundwater Flow Model for the Springer/Cariboo Open Pit and Predictions of Hydrogeological Conditions Near the Pits at Closure – Mount Polley Mine, BC

TECHNICAL MEMORANDUM

DATE May 22, 2024 **Reference No.** CA0020527.4505-040-TM-Rev0-31441

TO Mount Polley Mining Corporation

CC Jacqueline Foley and Jesse Maddaloni

FROM Arianna Piazza and Don Chorley **EMAIL arianna.piazza@wsp.com; don.chorley@wsp.com**

RECALIBRATION OF THE GROUNDWATER FLOW MODEL FOR THE SPRINGER/CARIBOO OPEN PIT AND PREDICTIONS OF HYDROGEOLOGICAL CONDITIONS NEAR THE PITS AT CLOSURE – MOUNT POLLEY MINE, BC

1.0 INTRODUCTION

This technical memorandum presents the results of the groundwater model recalibration for the Springer/Cariboo Pit Lake at the Mount Polley Mine that is operated by the Mount Polley Mining Corporation (MPMC). This review was made in support of the Springer Expansion Permit Amendment Application that is currently being prepared for the site. The objective of the assessment is to update the model calibration (i.e., recalibration). The recalibration will improve model predicted groundwater conditions in the vicinity of the pit crest and south of the Spinger Pit in response to pit dewatering and seasonal changes in recharge after 2016, the last time the model was calibrated. Following model recalibration, the model was then used to predict groundwater conditions near the pits during closure.

The analysis presented in this memorandum builds on that which was completed by Golder Associates Ltd. (Golder; now WSP Canada Inc. [WSP]) in 2010 for the ultimate configuration of the Springer Pit that assumed no tailings/waste rock deposition in the pit (Golder 2010). It also builds on the analysis completed between 2014 and 2016 as part of mine water management that assumed the presence of tailings/waste rock in the pit (Golder 2014, 2015a, 2016) and on the model calibration check that was conducted in 2023 (WSP, 2024a). These analyses used a numerical groundwater model that considered hydrogeological data available at the time, and in particular the hydrogeological investigations that were conducted along the southwest wall of the Springer Pit in the spring of 2015 (Golder 2015b). The updated analysis presented in this memorandum considers hydrogeological and hydrologic data collected at the site, specifically groundwater elevations through 2023 (WSP, 2023, 2024b) and mine as-builts information from 2016 to 2023 provided by MPMC.

2.0 REVIEW OF MPMC HYDROGEOLOGICAL AND MINE DATA SINCE 2016

2.1 Water Levels

Water level monitoring data for the period 2016 to 2023 were collected as part of the groundwater monitoring program for the Mount Polley mine and were compiled and summarized in the annual monitoring reports by WSP (WSP 2023, 2024b). Groundwater monitoring has been ongoing at the mine site since 1995 with the objective of monitoring the direction, quantity, and quality of groundwater seepage near mine facilities (MPMC, 2019).

Groundwater levels were measured, at a minimum, semi-annually on approximately the same day of the year, and sometimes more frequently, in monitoring wells to detect changes in groundwater flow directions. Pressure transducers were also installed at GW12-2a and GW12-2b to record changes in pressures every hour. A barologger installed at GW12-2a records barometric pressure at the same frequency, allowing for correction of pressure transducer data for barometric changes. Water levels in Springer and Cariboo Pits were also reported usually once a month from 2016 to 2022, with a few short periods of increased frequency of measurements for the Springer Pit Lake. Figure 1 shows the location of the monitoring wells considered in this assessment. Figure 2 presents the water level data collected from 2015 to 2023 in monitoring wells located in the vicinity of the Springer Pit Lake and water level in the Springer Pit Lake and Cariboo Pit Lake. Key observations for select locations are summarized below.

Wells GW15-1a/b and GW15-2a/b

The available data indicate that hydraulic heads in wells GW15-1a/b and GW15-2a/b, immediately southwest of the Springer Pit crest, have been rising in response to the increases in the pit lake level between December 2015 and June 2016. The Springer pit lake reached an elevation of approximately 1037 metres above seal level (masl) in June 2016. Between January and June 2016, the water level elevation in the Springer Pit Lake was above the hydraulic heads in these four wells. These hydraulic head measurements indicate that, during this period, exfiltration of Springer Pit Lake water had likely occurred while the pit lake elevation was above 1025 masl. Following the aggressive drawdown of the Springer Pit Lake starting in June 2016, hydraulic heads in these four monitoring wells also declined, limiting the time period when the exfiltration of the pit lake occurred. As the Springer pit lake level progressively declined starting in 2017, water levels in these four wells remained above the elevation of the Springer Pit Lake. However, nested wells GW15-1a/b, the closest to the pit crest, appear to have a strong connection with the pit lake as the water level in both wells mimics the elevation of the pit lake until it drops below 1005 masl in February 2018. As the pit lake level continues to decline, the shallow well GW15-1b becomes dry (bottom of the well screen is at 1002 masl) and the water level in the deep well GW15-1a continues to drop and remains approximately 5 m above the pit lake level. Water level in wells GW15-2a/b remained at approximately 1020 masl, and they did not appear to be influenced by changes in the Springer Pit Lake water level after it dropped below 1010 masl.

Wells GW12-2a/b and GW16-6a/b

The hydraulic head measured in monitoring wells GW12-2a/b located approximately half-way between the crest of the Springer Pit and Bootjack Lake to the west was observed to gradually rise between December 2015 and June 2016 as the water level in the pit lake rose; in June 2016, when the pit lake reached its maximum elevation of 1037 masl, the hydraulic head in the shallow well GW12-2b was approximately 19 m below the elevation of the pit lake. Water levels in these two wells remained relatively constant and above the Springer Pit Lake elevation, when it dropped below 1010 masl in January 2017. Water levels in these two wells also remained above the water level elevation of the Bootjack Lake (987 masl) indicating that a groundwater divide between the Springer Pit and Bootjack Lake remains in the area of GW12-2(a,b) and GW15-2(a,b). This groundwater divide results in groundwater flow both towards the east and west from the groundwater divide. This is also confirmed by available monitoring data from wells GW16-6a/b, located south of the Springer Pit crest and approximately 120 m from Bootjack Lake that showed that water levels in these two wells remained constant and above the water levels in the Springer Pit and Bootjack Lake for the monitoring period (2017-2023).

Overall, the available data indicate that exfiltration from the Springer Pit might have occurred for a short period between January and June 2016, when the Springer Pit Lake elevation was above 1025 masl. From June 2016 to December 2023, following drawdown of the pit lake, the hydraulic heads in wells close to the Springer Pit crest have remained above the pit lake level, indicating that no exfiltration has likely occurred after this period.
The hydraulic head at wells GW12-2a/b has remained below the pit lake level until January 2017, when the lake level dropped below 1010 masl, indicating the presence of a groundwater divide between the Springer Pit and Bootjack Lake.



Legend

Monitoring Well

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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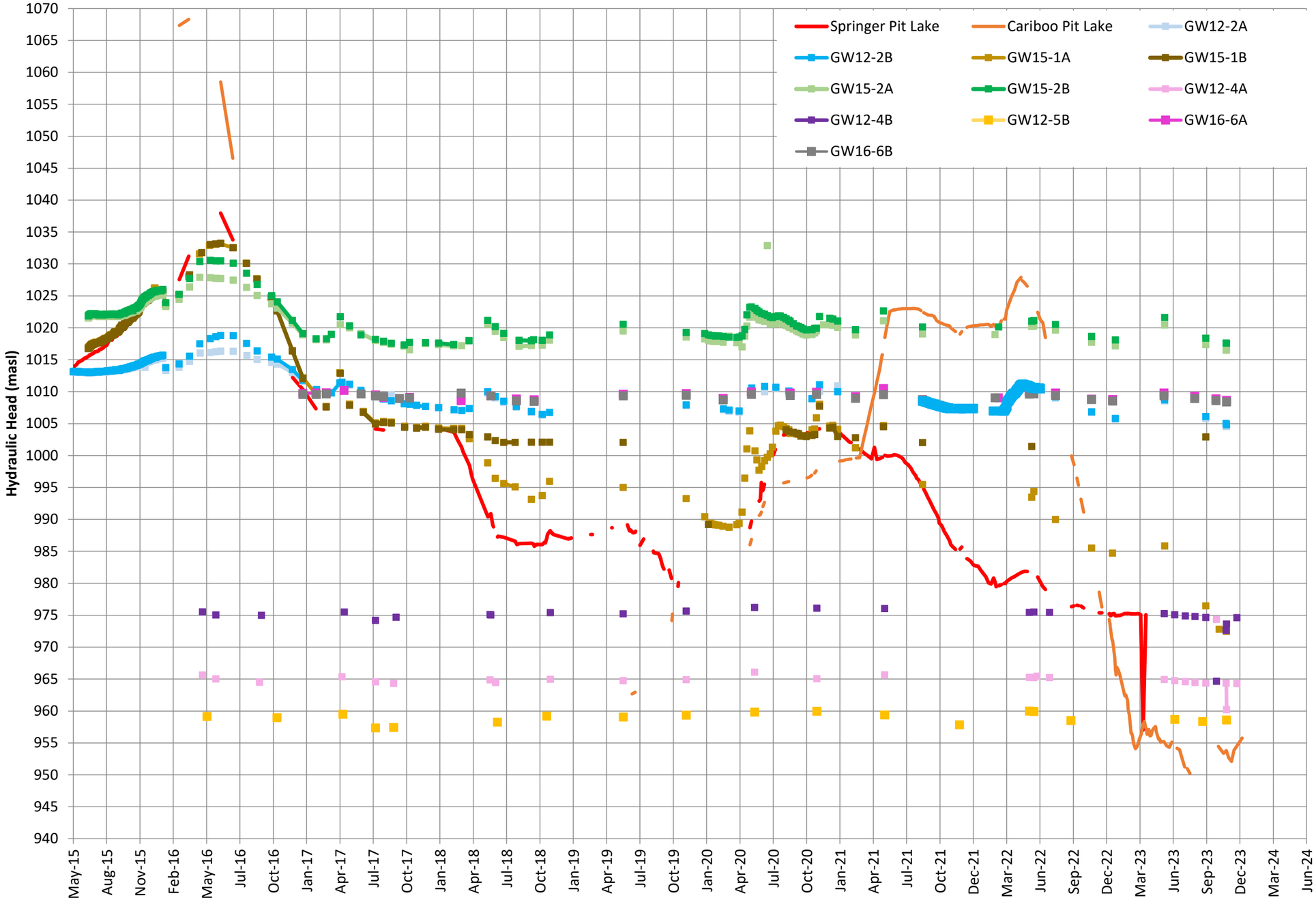
PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
SITE PLAN

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1**



CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
SPRINGER PIT LAKE LEVEL AND HYDRAULIC HEADS IN MONITORING WELLS (2015-2023)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**2**

2.2 Climate and Recharge to Groundwater

Climate information for the mine site was obtained from the Climate Baseline Update Report (WSP, 2022). MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and directions (1997 to 2003). In 2012, this station was replaced with two stations: one near the Mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall. Details of these stations are provided in Table 1.

Table 1: Local Climate Stations for the Mount Polley Mine

Station Name	Northing (m N)[1]	Easting (m E)[1]	Elevation (masl)[2]	Data Type	Period of Record
Mill Site Weather Station	5822420	592495	1,118	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	R, T, RH, SR, E, WS	2012-2021[3]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	R, T, RH, SR, E, WS	2012-2021[3]

1) UTM Coordinate system – Zone 10U.

2) Elevation for on-site climate stations measured with handheld GPS device.

3) Station still in operation.

TSF = tailings storage facility; masl = metres above sea level.

R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation; E = Evaporation; WS = Wind Speed; WD = Wind Direction.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically taken during the melt phase. The details of these snow course stations are provided in Table 2.

Table 2: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[1]	Easting (m E)[1]	Approximate Elevation (masl)[2]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

1) UTM Coordinate system - Zone 10U.

Elevation for on-site climate stations measured with handheld GPS device.

masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.

The site experiences high summer precipitation due to storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and achieves its maximum in March, reducing to 0 mm in April. Average annual precipitation at the site is estimated to be 612 mm.

Groundwater recharge due to the infiltration of precipitation at ground surface was estimated as a percentage of total precipitation recorded at the MPMC climate stations. In 2018, researchers from the University of Victoria and Simon Fraser University modeled recharge over British Columbia using both the HELP (Hydrologic Evaluation of Landfill Performance) and a global hydrologic model (PCR-GLOBWB). These studies projected that, for current climate conditions over much of British Columbia, recharge is about 30% of precipitation under natural watershed conditions (Forstner et al. 2018). Based on the type of land cover and recharge estimates included in a previous assessment (Golder, 2016), groundwater recharge was estimated to be approximately 30% of total precipitation, or 183 mm/y, in the site area. An increase in recharge to groundwater is anticipated to occur during the freshet period (April-June) following melting of the snowpack accumulated during the winter months. Water levels in the monitoring wells show an increase of up to 2–3 m starting in April.

2.3 Springer and Cariboo Pit Mine Progression 2016-2023

On September 20, 2023, MPMC provided the mine as-builts for the Springer Pit and Cariboo Pit for the following stages:

- January 2016 (file "*1601-Contour.dxf*"): at this stage the bottom of the Springer Pit is at 935 masl and the bottom of the Cariboo Pit is at 1050 masl.
- January 2017 (file "*1701-Contour.dxf*"): at this stage the bottom of the Springer Pit is at 935 masl and the bottom of the Cariboo Pit deepens at 1023 masl, expanding toward north and west.
- January 2018 (file "*1801-Contour.dxf*"): at this stage the bottom of the Springer Pit is still at 935 masl and the bottom of the Cariboo Pit is at 979 masl.
- January 2019 (file "*1901-Contour.dxf*"): at this stage the bottom of the Springer Pit is still at 935 masl and the bottom of the Cariboo Pit is at 979 masl.
- December 2021 (file "*2112-Contour.dxf*"): at this stage the bottom of the Springer Pit is still at 935 masl and the bottom of the Cariboo Pit is at 979 masl. No changes from previous stage.
- January 2023 (file "*2301-Contour.dxf*"): at this stage the separation between the two pits is a small ridge between the two pits at 1003 masl and the pit bottom 923 masl in the area of the Cariboo Pit.
- September 2023 (file "*230920-Pit.dxf*"): at this stage the separation between the two pits is a small ridge between the two pits at 965 masl and the pit bottom 923 masl in the area of the Cariboo Pit.

The as-built information outlined above was used to update the existing groundwater model to represent groundwater conditions between 2016 and 2023. In addition to the information above, MPMC provided the mine development plan from 2023 to 2031 to the end of mine life. The final configuration of the Springer and Cariboo pit (file "*Sp-6 v4 topomerge.dxf*") was also reviewed as part of this assessment to ensure that the current extent of the groundwater model was still adequate to simulate groundwater conditions to the end of mine life for model predictions during operations and closure.

3.0 GROUNDWATER MODEL RE-CALIBRATION

The details of the numerical hydrogeological model that was developed for the area adjacent to the Springer Pit have been documented in Golder Associates Ltd. (2010, 2014, 2015abc, 2016 and 2024a). These details are not repeated in this memorandum, except for the description of additional model modifications that were implemented to include changes in mine settings since the end of 2022 (model calibration check, WSP, 2024a). The numerical hydrogeological model was re-calibrated to groundwater conditions that existed immediately prior to the formation of the Springer Pit Lake (2014) and during mining operations between 2015 and 2023, described in Section 2.3. The calibration process involved refining the numerical model parameters to achieve the desired degree of correspondence between the model simulation results and the observations of the groundwater flow system (BC ENV, 2012), while reasonably representing the conceptual understanding of groundwater conditions described in previous assessments. The following section presents the calibration approach and metrics, calibration targets, and results of calibration.

3.1 Groundwater Model Update

Based on the review of the information described in Sections 2.0 and 2.3, the existing groundwater model was modified as follows:

- The Springer and Cariboo pit mine progression was implemented in the updated model based on the pit as-builts provided by MPMC (see Section 2.3) to simulate effects on groundwater conditions up to September 2023.
- Water levels in the pit lakes were assigned to the model based on the available monitoring data up to September 2023, as presented in Figure 2.

The remaining model settings and hydrogeological parameters that resulted from previous model calibration in 2016 were not modified and were used as initial parameters for model recalibration, which is the purposes of the current assessment.

3.2 Approach and Calibration Targets

Previous model calibration considered calibration targets and hydrogeological data collected in the existing monitoring wells, as follows:

- **Dewatered Conditions:** steady state calibration to hydraulic heads measured in mid-2014 in the pre-2015 monitoring wells installed near the Springer Pit and corresponding estimates of groundwater inflow to this pit, prior to the formation of the pit lake.
- **July 2015 Pit Lake Conditions:** steady state calibration to hydraulic heads measured in July 2015 in the pre-2015 monitoring wells and new monitoring wells installed in 2015 (i.e., the conditions when the Springer Pit Lake level was approximately 1017.2 masl).
- **Transient Pit Lake Conditions:** the hydraulic head data collected following the installation of the 2015 series wells until late January 2016 was used to conduct additional model calibration that simulated transient groundwater conditions over that period.

Previous model calibration stages were re-evaluated for model re-calibration purposes. The transient pit lake simulations were extended to September 2023.

During calibration, the model was run repeatedly and the model input parameters (hydraulic conductivity, storage properties, recharge) were iteratively adjusted until there was reasonable agreement between predicted and observed hydraulic heads, groundwater flow directions and groundwater flow rates to the slope seepage collection system. Parameter adjustments considered the conceptual understanding of groundwater conditions and were limited to the range of measured data, or, where no site-specific data were available, were limited to the published range of values for similar lithologies.

Quantitative and qualitative evaluation of model predictions against measured observations was conducted during calibration. Qualitative metrics included an evaluation of the patterns of groundwater flow based on predicted hydraulic head contours. Quantitative metrics included comparisons of measured to predicted hydraulic heads (spatial distribution differences), seepage rates and the calculation of the following calibration statistics for hydraulic head:

- Root Mean Squared Error (RMSE) and normalized RMSE (nRMSE): RMSE is a statistical measure of the mean difference between the predicted and measured hydraulic head (h) (i.e., residual head). The nRMSE is the RMSE divided by the range of observed hydraulic head values and is commonly expressed as a percentage. Normalized errors are typically more appropriate to use in areas of high relief and gradients, to account for significant variation in hydraulic head elevations (BC ENV, 2012). Generally, nRMSE under 10% is considered acceptable for model calibration, and a value of less than 5% is considered very good (BC ENV, 2012).

$$RMSE = \sqrt{\frac{1}{n}\sum_{i=1}^{n} h_{predicted} - h_{measured}}$$

$$nRMSE = \frac{RMSE}{max\ h_{measured} - min\ h_{measured}}$$

- Calculation of the mean absolute error (MAE) and normalized mean absolute error (nMAE) to get an estimate of the average difference between measured and predicted hydraulic heads.

$$MAE = \frac{1}{n}\left|\sum_{i=1}^{n} h_{predicted} - h_{measured}\right|$$

$$nMAE = \frac{MAE}{max\ h_{measured} - min\ h_{measured}}$$

The following sets of information were used as calibration targets to assess the overall steady-state and transient model calibration, as follows:

- Hydraulic heads measured between 2014 and 2023 at 15 observation points located within the model domain. The locations of the monitoring wells and hydraulic head values are presented on Figure 1.
- Observed groundwater inflow into the Springer Pit in 2014, as described in previous assessment (Golder, 2016).

- Visual inspection of the predicted hydraulic head contours and groundwater flow patterns compared to observations and the conceptual understanding of the groundwater regime in the model domain.

The following time steps were selected for these simulations if predicted conditions still reasonably matched observed conditions, based on available water level data:

- **May 2014**: groundwater conditions observed in the pre-2015 monitoring wells installed near the Springer Pit and corresponding estimates of groundwater inflow to this pit, prior to the formation of the pit lake (dewatered conditions).
- **July 2015**: groundwater conditions observed in July 2015 in the pre-2015 monitoring wells and new monitoring wells installed in 2015, when the Springer Pit Lake level was approximately 1017.2 masl.
- **June 2016**: groundwater conditions when the Springer Pit Lake reaches its maximum elevation (1037.9 masl).
- **November 2018**: groundwater conditions when the Springer Pit Lake is dewatered to 986 masl.
- **November 2019**: groundwater conditions when the Springer Pit Lake reaches its lowest elevation (980 masl) and Cariboo Pit Lake is at 995 masl.
- **May 2021**: groundwater conditions when the Springer Pit Lake is at 999 masl and the Cariboo pit lake is at 1015.8 masl.
- **June 2022**: groundwater conditions when the Springer Pit Lake is at 982 masl and the Cariboo pit lake is at 1025.4 masl.
- **September 2023**: groundwater conditions when the Springer Pit Lake is at 952 masl and the Cariboo has been mined to 923 masl (no pit lake present).

3.3 Results of Model Re-Calibration

The following section presents the results of the hydrogeological model re-calibration, including a comparison of measured to predicted static hydraulic head, transient changes in groundwater levels and groundwater inflow to the Springer Pit. As described in this section, the model is reasonably well calibrated to groundwater conditions between 2014 and 2023 with a good reproduction of hydraulic heads and gradients across the model domain. Therefore, the calibrated model is considered suitable to support prediction of future conditions (groundwater inflow/seepage rates into and out of the ultimate pit lake at closure).

The applied hydraulic conductivity values and recharge rates outlined in the following section provided a reasonable approximation of the flow regime based on the available data for the model domain. Although additional localized adjustments in recharge and hydraulic properties could be made to improve the match between measured and predicted values used as calibration targets, such localized improvements are not considered warranted at the model scale needed to assess future groundwater conditions in the vicinity of the ultimate pit lake at closure.

3.3.1.1 Calibrated Hydraulic Parameters

The calibrated hydraulic conductivity (K) values for each of the hydro stratigraphic units and the calibrated recharge values from precipitation are presented in Table 3. The spatial distribution of hydraulic conductivity is shown in Figure 3.

Table 3: Calibrated Hydraulic Properties Assigned to the Hydrogeological Model

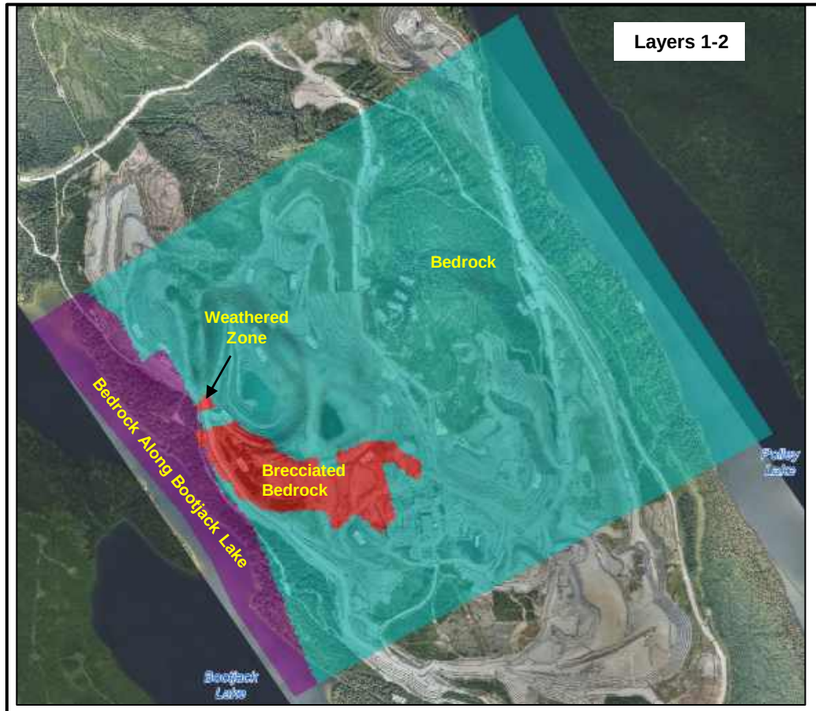
Hydro Stratigraphic Unit	Depth	Horizontal Hydraulic Conductivity (m/s)	Anisotropy Ratio* (-)	Specific Storage (1/m)	Specific Yield (-)
Bedrock	0-40 m (Layers 1-2)	1×10^{-6}	1	1×10^{-7}	0.001
	40-100 m (Layers 3–5)	$\underline{1 \times 10^{-7}}$	1	1×10^{-7}	0.0001
	100-150 m (Layers 6–7)	8×10^{-8}	1	1×10^{-7}	0.0001
	150–350 m (Layers 8–10)	1×10^{-8}	1	1×10^{-7}	0.0001
	Below 350 m (Layers 11–13)	5×10^{-9}	1	1×10^{-7}	0.0001
Bedrock Along Bootjack Lake	0–40 m (Layers 1–2)	$\underline{3 \times 10^{-7}}$	$\underline{5}$	1×10^{-7}	0.001
	40-150m (Layers 3–7)	$\underline{3 \times 10^{-8}}$	$\underline{5}$	1×10^{-7}	0.0001
Brecciated Bedrock	0–40 m (Layers 1–2)	$\underline{5 \times 10^{-6}}$	1	1×10^{-7}	0.001
Springer Pit South Weathered Zone (GW15-01)	0–60 m Layers 1–4)	$\underline{5 \times 10^{-6}}$	1	1×10^{-7}	0.001

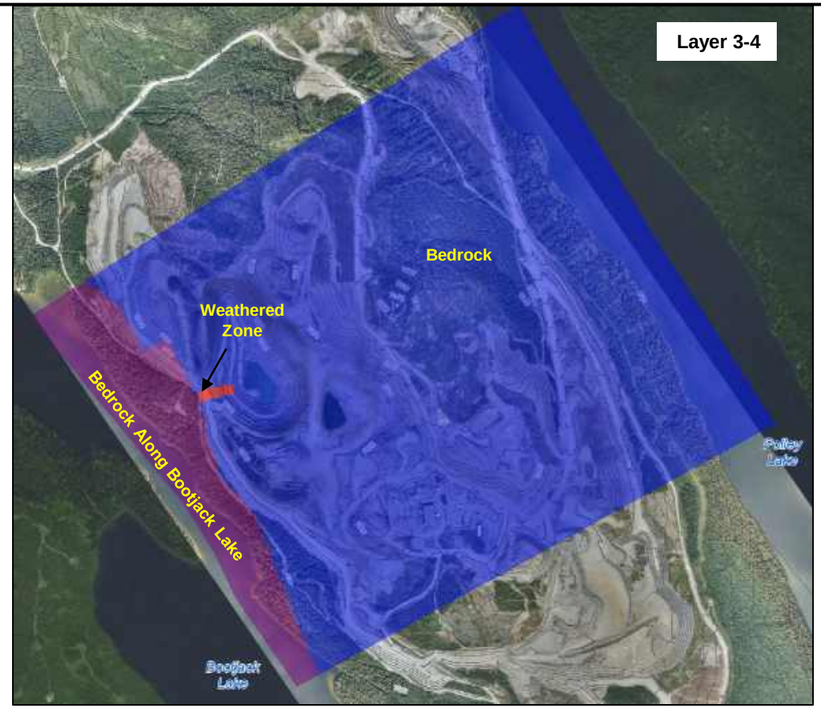
Time period	Recharge (mm/y)
July to March	180
<u>April to June</u>	220

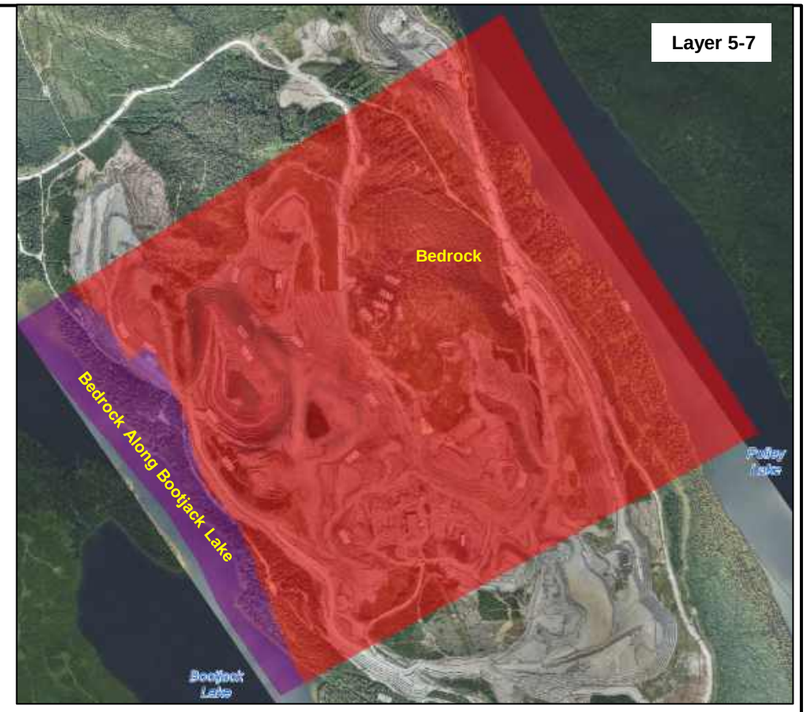
m/s = metres per second; m = metres; mbgs = metres below ground surface; mm/y = millimetres per year.

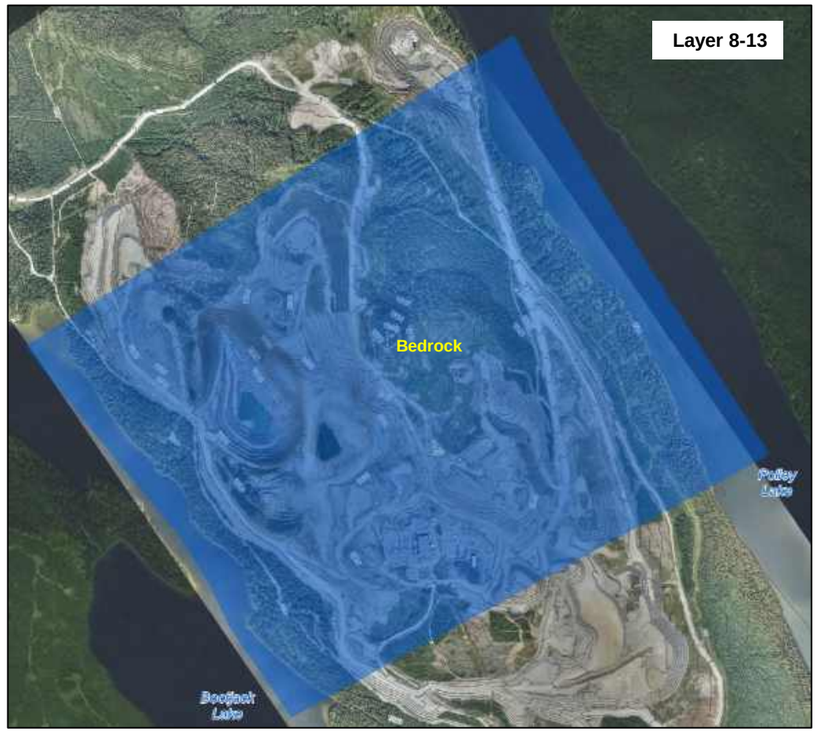
*Anisotropy Ratio is defined as the ratio between Vertical and Horizontal Hydraulic Conductivity.

Underlined values were modified from previous calibration (Golder, 2016).









Hydrostratigraphic Units and their Hydraulic Conductivity Values

- Bedrock 0-40 m (1×10^{-6} m/s)
- Bedrock 40-100 m (1×10^{-7} m/s)
- Bedrock 100-150 m (8×10^{-8} m/s)
- Bedrock below 150 m (5×10^{-9} m/s to 1×10^{-8} m/s)
- Bedrock Along BJ Lake (3×10^{-7} m/s to 3×10^{-8} m/s)
- Breccia/Weathered Zone (5×10^{-6} m/s)

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SPRINGER PIT GROUNDWATER MODEL UPDATE

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APPROVED	JF

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CALIBRATED HYDRAULIC CONDUCTIVITY

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Modifications made to the hydrogeological model during the calibration process are presented in the bullets below and summarized in Table 4. Hydraulic parameter values were changed within the measured range in test data to improve the ability of the model to match measured hydraulic head and hydraulic gradients across the model domain; to match inflow observed in the dewatered Springer Pit; and to match the water level response to the dewatering and refilling of the Springer Pit Lake.

- Based on transient model simulations, the previous hydraulic conductivity distribution in the vicinity of the Springer Pit Lake did not correctly reproduce changes in hydraulic gradients to the refilling and dewatering of the Springer Pit Lake in near-pit wells. Therefore, the hydraulic conductivity of the bedrock unit was varied in the vicinity of the Springer and Cariboo pit in consideration of the observed groundwater levels and geology information as follows:
  - The shallow, more permeable bedrock between the pit crest and monitoring well GW15-01A/B that was considered more weathered was reduced in width and extended at depth up to Layer 4 (60 m depth) and its hydraulic conductivity was increased to 5×10^{-6} m/s, based on testing. This modification helped improve the match between observed and simulated response to the refilling and dewatering of the Springer Pit and the hydraulic gradient in this area.
  - The zone of the brecciated bedrock extending along the southwest portion of the Springer pit and south of the Cariboo Pit was modified based on geological mapping (Wafforn, 2013), to reduce the connection between the area of GW15-02 and the Cariboo Pit Lake. With the previous configuration, the dewatering of this lake and subsequent mining of the pit was influencing the water levels in this well too strongly. The hydraulic conductivity of this zone was increased to 5×10^{-6} m/s to improve the ability of the model to reproduce the response of water levels to refilling and dewatering of the Springer Pir Lake in GW15- 02A/B.
- The hydraulic conductivity of the bedrock at depth between 40 m and 100 m was decreased to 1×10^{-7} m/s. This change generally provided a better reproduction of hydraulic heads in deeper monitoring wells and the hydraulic gradients in the north and central portion of the model domain.
- The zone characterized with lower hydraulic conductivity around monitoring well GW12-2 was extended along the Bootjack Lake based on geological mapping (Wafforn, 2013) to improve the match between observed and simulated hydraulic heads in monitoring well GW16-6A/B and to better reproduce the hydraulic gradient and the groundwater divide observed between the Springer Pit and the Bootjack Lake. For the same purpose, an anisotropy of 5 (horizontal K 5 times greater than vertical K) was implemented in this zone.
- Recharge from precipitation was increased by approximately 20% from average value only for the period from April to June to better represent the increase in recharge following melting of the snowpack during the Freshet period. This change in recharge better represented the observed response of water levels in monitoring wells across the model domain during this period.

These model changes are summarized in the table below. All the other parameters were not modified from previous assessment.

Table 4: Hydrogeological Model Parameter Value Comparison and 2024 Modifications

Item	2016 Model Value	2024 Model Value
K value - Shallow bedrock between the pit crest and GW15-01A/B	3×10^{-6} m/s	5×10^{-6} m/s
K value - Zone of the brecciated bedrock extending along the southwest portion of the Springer pit and south of the Cariboo Pit	2×10^{-6} m/s	5×10^{-6} m/s
K value - Bedrock at depth between 40 m and 100 m	2×10^{-7} m/s	1×10^{-7} m/s
Anisotropy - Zone characterized with lower hydraulic conductivity around monitoring well GW12-2	Anisotropy – 1	Anisotropy – 5
Recharge from precipitation was increased by approximately 20% from average value based on climate data	October to April	April to June

3.3.1.1 Measured Versus Predicted Hydraulic Head and Inflow

Figures 4, 5, 7, 8, 9 and 10 show a comparison of measured versus predicted hydraulic heads for the different stages considered for model calibration along with a 1:1 reference line for comparison (points which fall on this 1:1 line would indicate that the predicted hydraulic head exactly matches the measured hydraulic head). Figure 6 shows observed and predicted hydraulic heads in representative monitoring wells for transient pit lake conditions between 2015 and 2023.

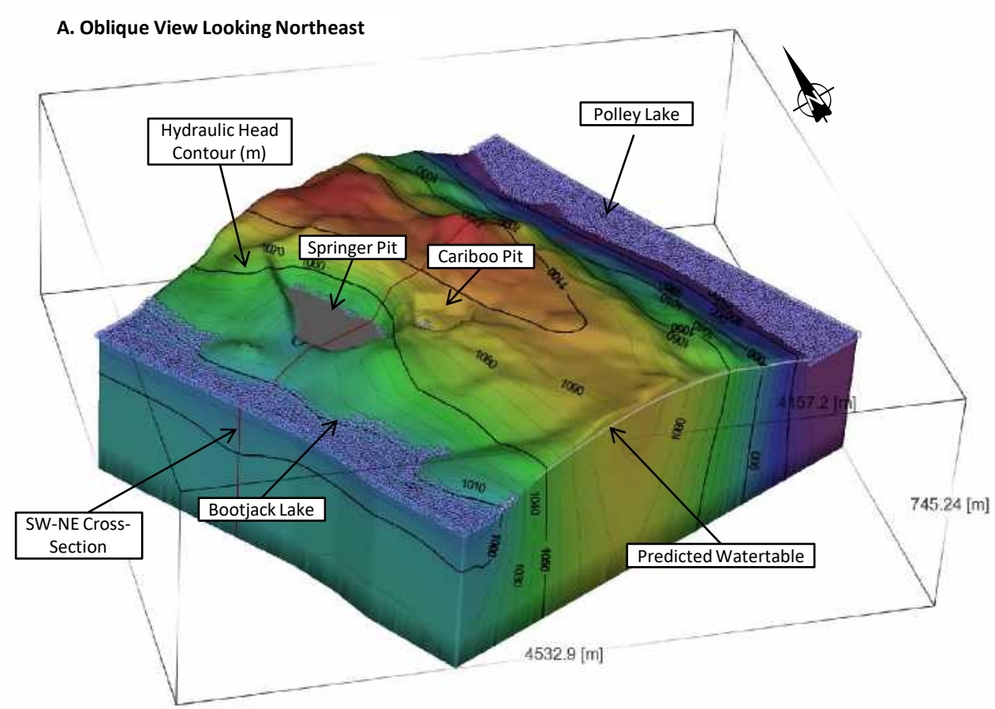
Overall, a reasonable match between measured and predicted hydraulic heads was obtained for all the stages considered. For dewatered conditions (Figure 4) and Pit Lake conditions up to June 2016 (Figure 5), when the pit lake reaches its maximum elevation of 1037 masl, the model-predicted hydraulic heads matched the hydraulic heads measured in the monitoring wells reasonably well. The normalized root-mean-square (nRMSE) error, which considers the scale of head variation across the model domain, was less than 6% for the dewatered conditions and less than 5% and 8% for the Pit Lake conditions for July 2015 and June 2016, respectively. The model can reproduce the water level response to the refilling of the pit lake in the near-pit monitoring wells and in the ones locates between the Springer Pit and the Bootjack Lake, as shown in Figure 6. Following the dewatering of the Springer Pit Lake starting in June 2016, the model still reasonably reproduces the response to this change in the monitoring wells located immediately south near the pit crest, as shown in Figure 6. The model underestimates the drawdown in the vicinity of the pit crest, immediately west of the pit in the area of monitoring wells GW15- 01a/b, and slightly overestimates it farther south of the pit crest, in the area of wells GW15-2a/b. In the area between the Springer Pit and the Bootjack Lake the model is therefore conservative in that it predicts a higher seepage from the pit lake than observed under these conditions. Predicted hydraulic heads in monitoring wells GW16-6a/b located further south of the Springer Pit are accurately represented by the model. Therefore, calibration stages selected to verify model calibration following June 2016 showed that predicted hydraulic heads are in agreement with observed hydraulic heads, as shown in Figures 6 through 9. For snapshots in time between November 2018 and September 2023, the weighted RMS error is between 8% and 10%, which is below or equal to the 10% limit considered acceptable by the BC Guidelines for Groundwater Modelling (BC ENV, 2012).
The mean error ME and mean absolute error MAE between measured and predicted hydraulic heads were approximately 0.06 m and 4.6 m, respectively, over all the stages considered. This indicates that model-predicted hydraulic heads were on average slightly higher than measured data (by approximately 0.06 m), and overall, data was on average within 4.6 m of the measured values.

Groundwater conditions between the Springer Pit Lake and Bootjack Lake both when the pit lake level is high or very low are reasonably represented by the model in the area of monitoring wells GW12-2a/b and GW16-6a/b and the model is predicting the presence of the observed groundwater divide in this area. The model also predicts similar seasonal fluctuations in monitoring wells due to changes in recharge during the freshet period, due to snowmelt.

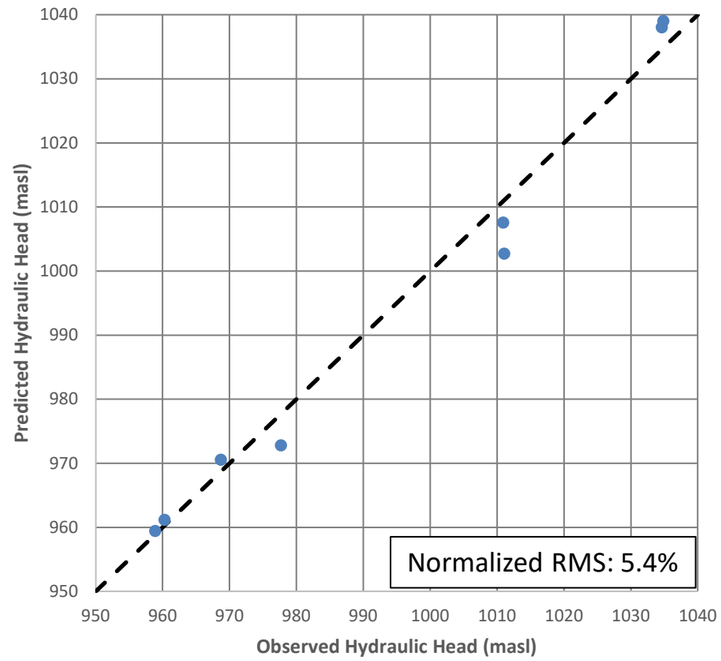
Maps showing the calibration residuals in hydraulic head (i.e., difference between the model calculated hydraulic head and observed hydraulic head for all well data used for model calibration) for each calibration stage are presented in Attachment 1. The largest residuals are mostly in nested wells GW15-01a/b and GW15-2a/b when the pit lake is dewatered or the water level is low, with predicted hydraulic heads mostly 5 m to 20 m lower than observed heads, depending on the calibration stage. These discrepancies could be related to localized variations in hydraulic properties of the bedrock close to the pit crest which could be highly weathered or anisotropic and these conditions are difficult to reproduce with the groundwater model. However, as discussed in this section, the model tends to overpredict the influence of the pit lake on groundwater levels southwest of the pit crest, providing conservative estimates of seepage from the pit lake for future conditions.

The model-predicted groundwater inflow to the Springer Pit in the Dewatered Conditions scenario (May 2014) was approximately 900 m^3/day (165 USgpm), which is within the range of inflows estimated for this pit by MPMC (600 to 1600 m^3/day, Golder, 2014 and 2016).

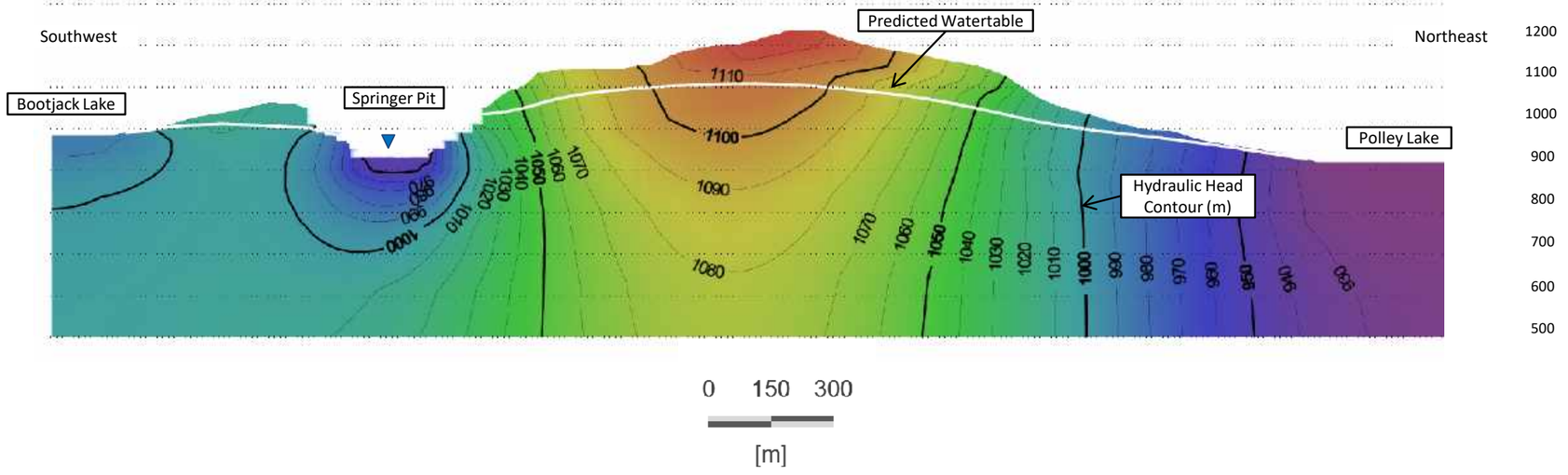
A. Oblique View Looking Northeast



C. Comparison of Predicted vs. Observed Hydraulic Heads



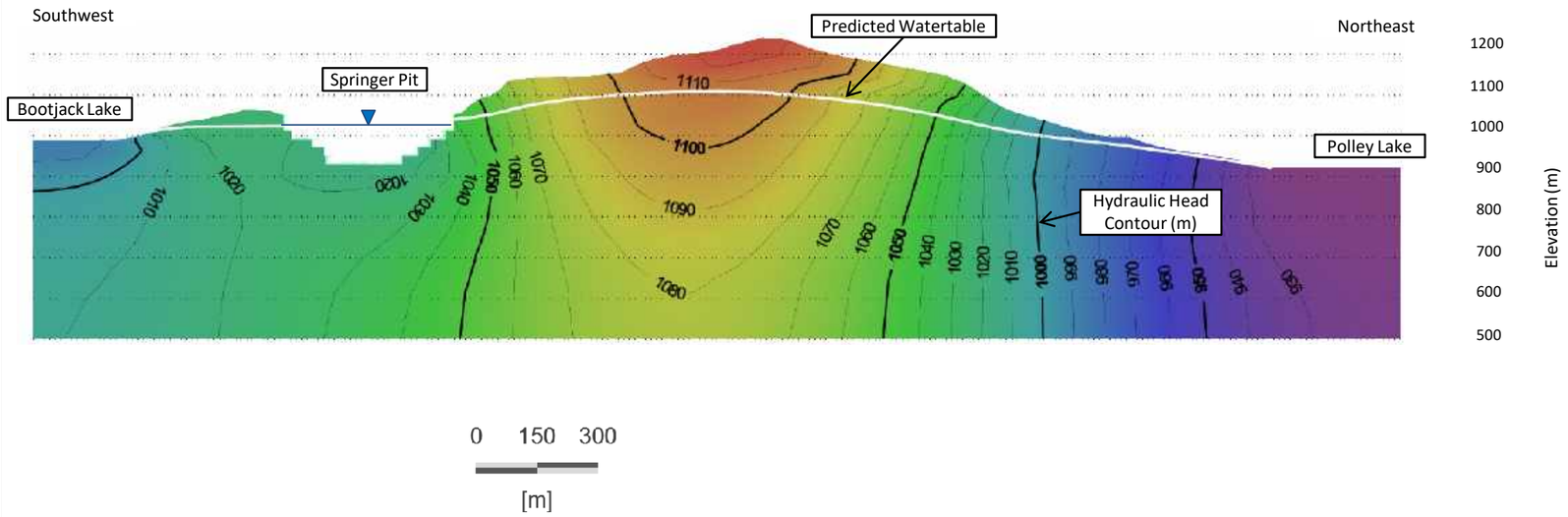
B. SW-NE Cross-section



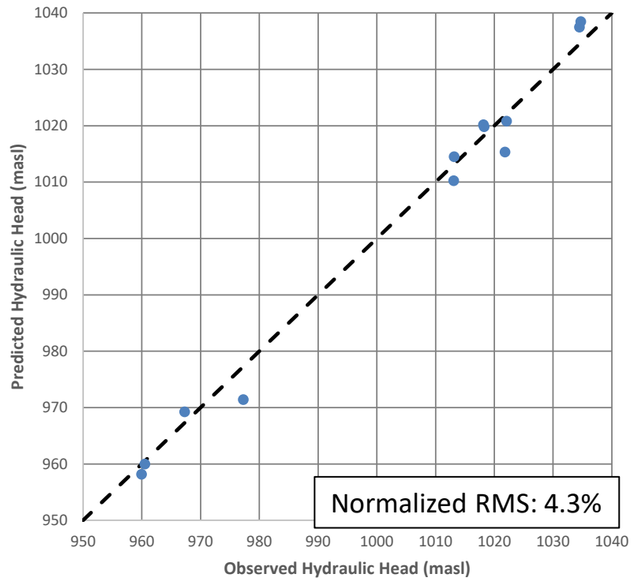
Notes:
Distances are in meters

CLIENT	MOUNT POLLEY MINING CORPORATION
PROJECT	SPRINGER PIT GROUNDWATER MODEL UPDATE
CONSULTANT	wsp
YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF
TITLE	GROUNDWATER MODEL CALIBRATION DEWATERED CONDITIONS (2014)
PROJECT NO.	CA0020527.4505 31400
REV.	0
FIGURE	4

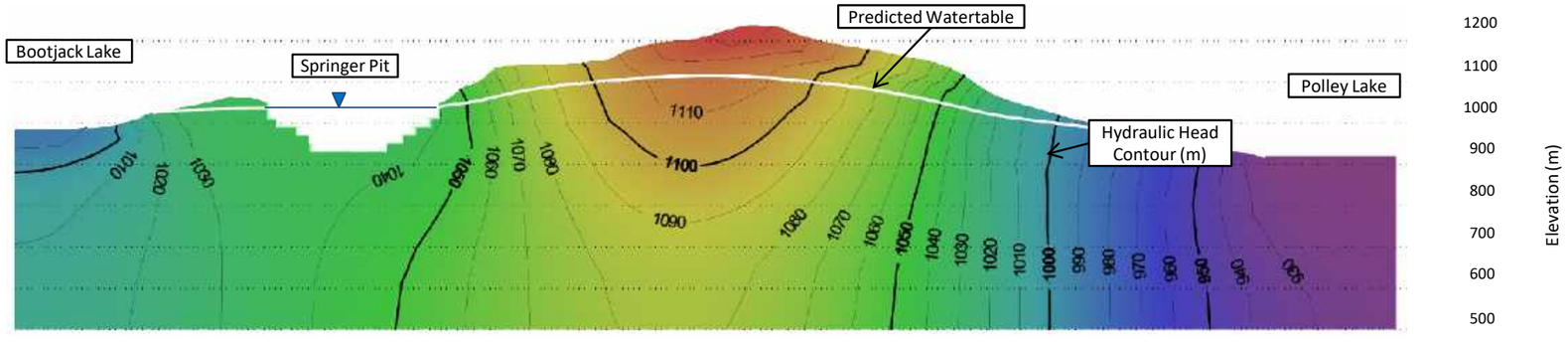
A. Pit Lake Conditions July 2015 (SW-NE Cross-section) – Pit Lake at 1017.2 masl



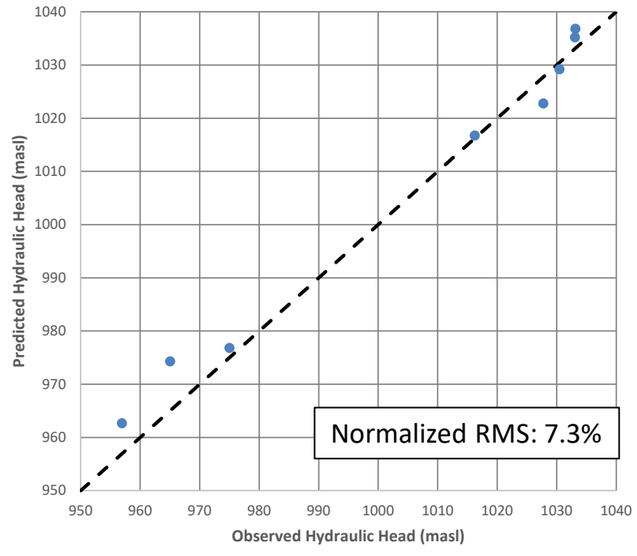
B. Comparison of Predicted vs. Observed Hydraulic Heads (July 2015)



C. Pit Lake Conditions June 2016 (SW-NE Cross-section) – Pit Lake at 1037.97 masl



D. Comparison of Predicted vs. Observed Hydraulic Heads (June 2016)



Notes:
Distances are in meters

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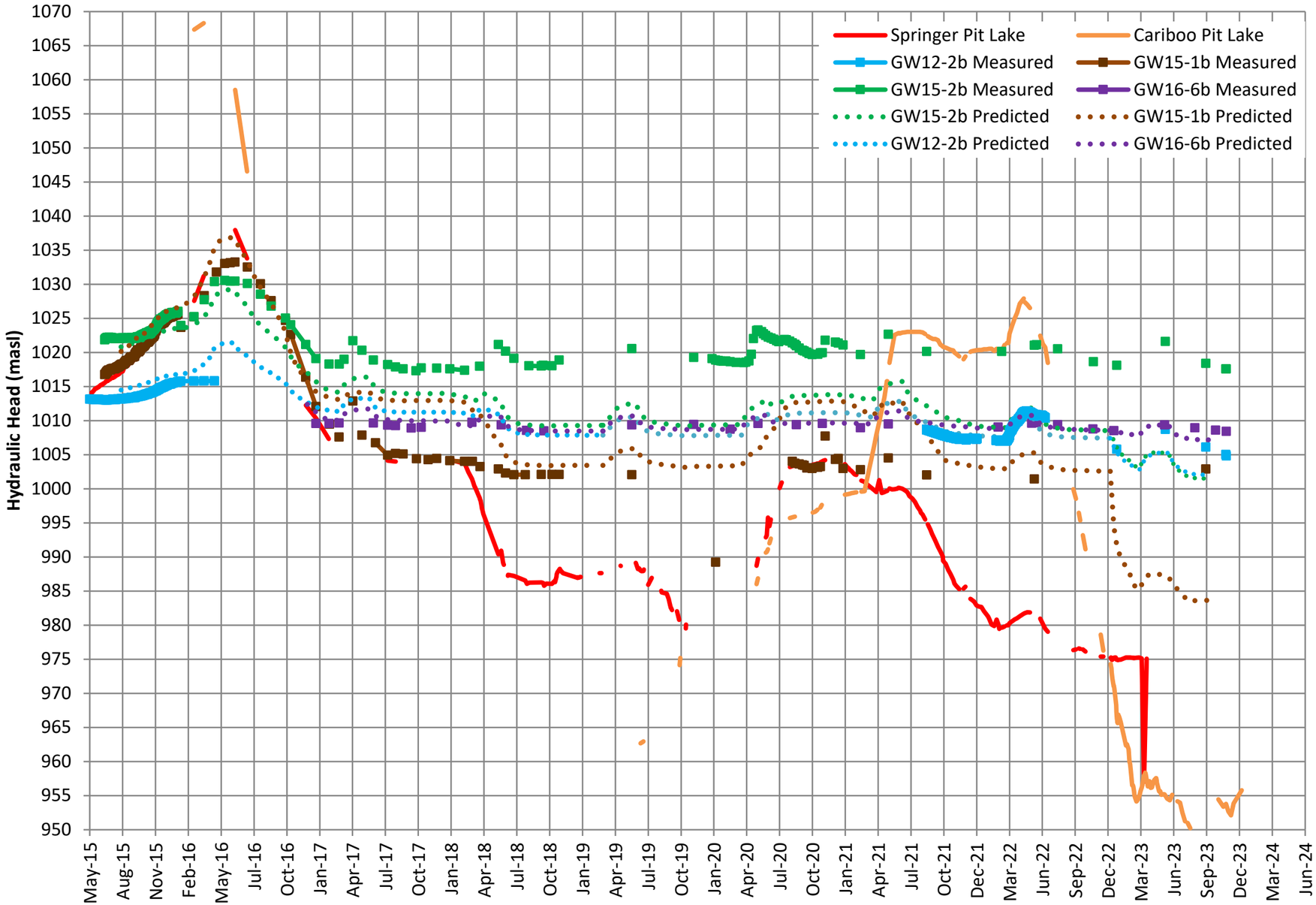
PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (JULY 2015 AND JUNE 2016)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**5**



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MOUNT POLLEY MINING CORPORATION

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

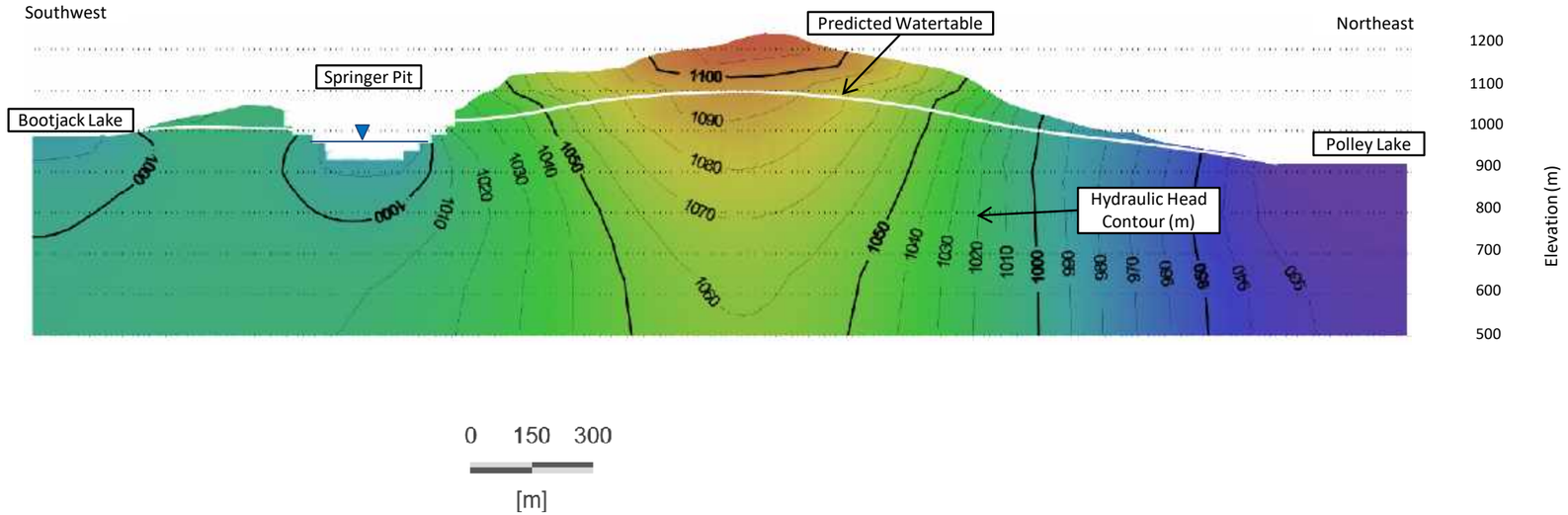
CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

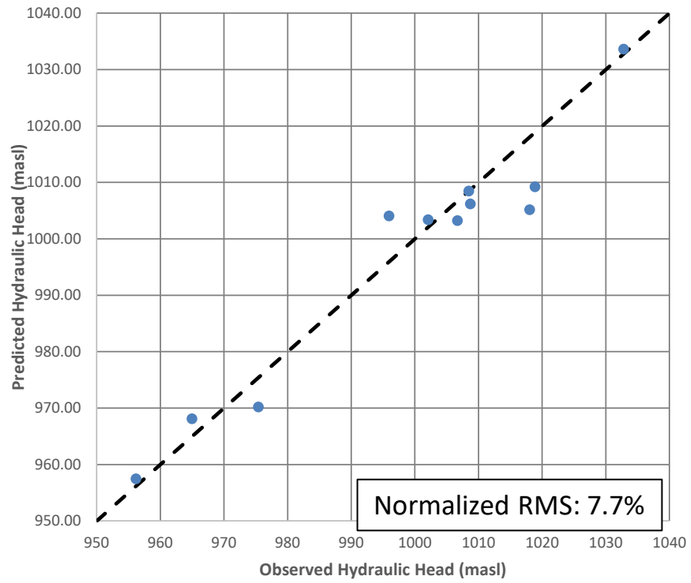
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GROUNDWATER MODEL CALIBRATION
TRANSIENT PIT LAKE CONDITIONS (2015-2023)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**6**

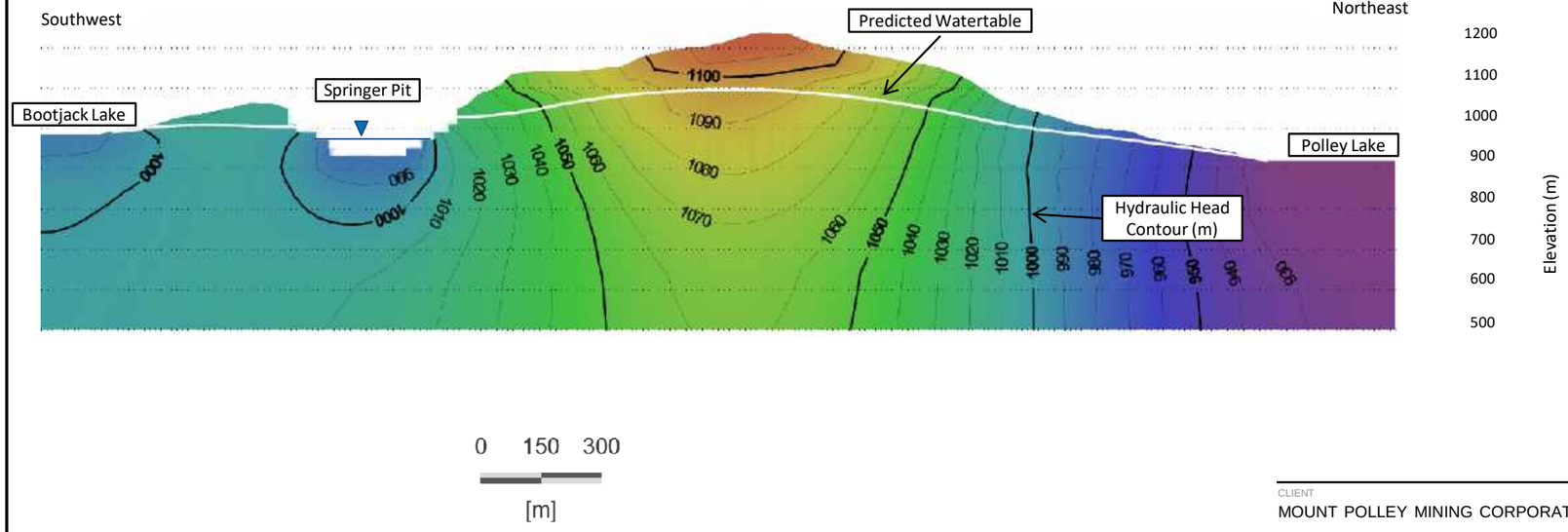
A. Pit Lake Conditions November 2018 (SW-NE Cross-section) – Pit Lake at 988 masl



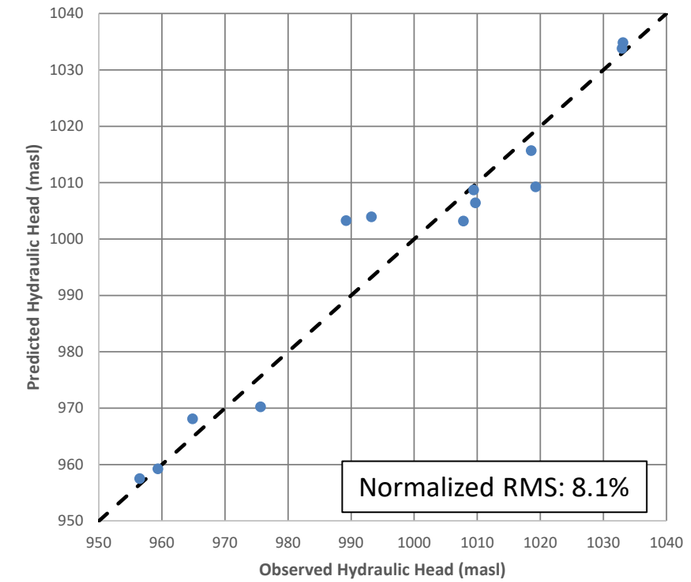
B. Comparison of Predicted vs. Observed Hydraulic Heads (November 2018)



C. Pit Lake Conditions November 2019 (SW-NECross-section) – Pit Lake at 983 masl



D. Comparison of Predicted vs. Observed Hydraulic Heads (November 2019)



Notes:
Distances are in meters

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

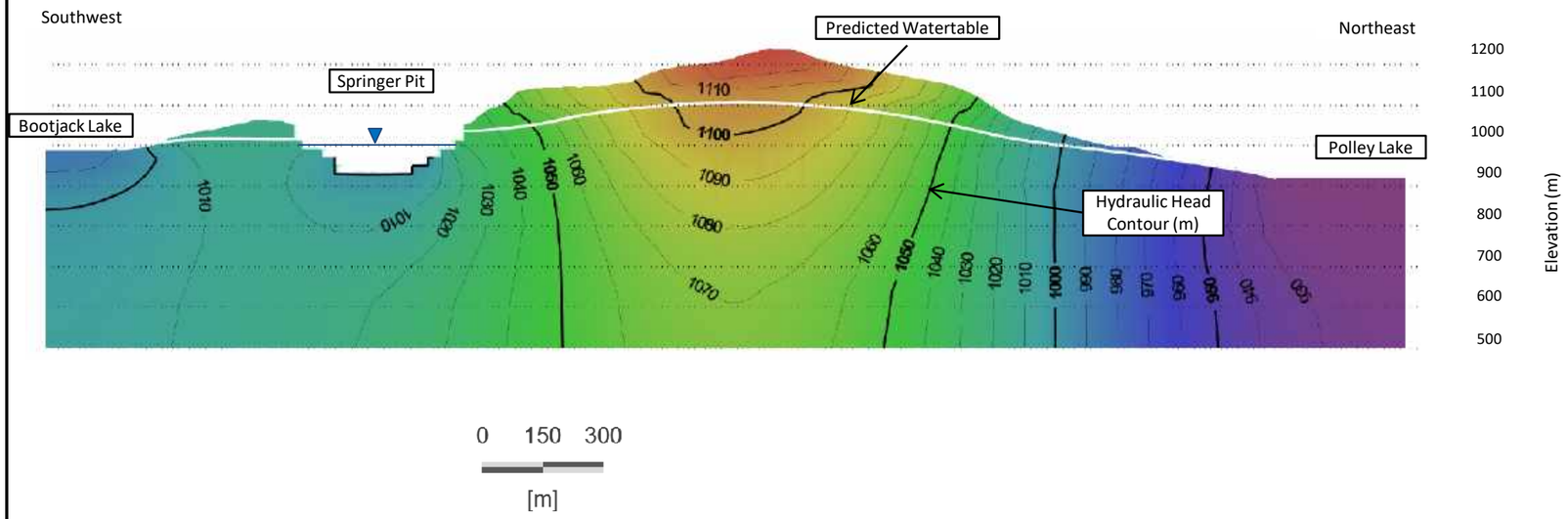
CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

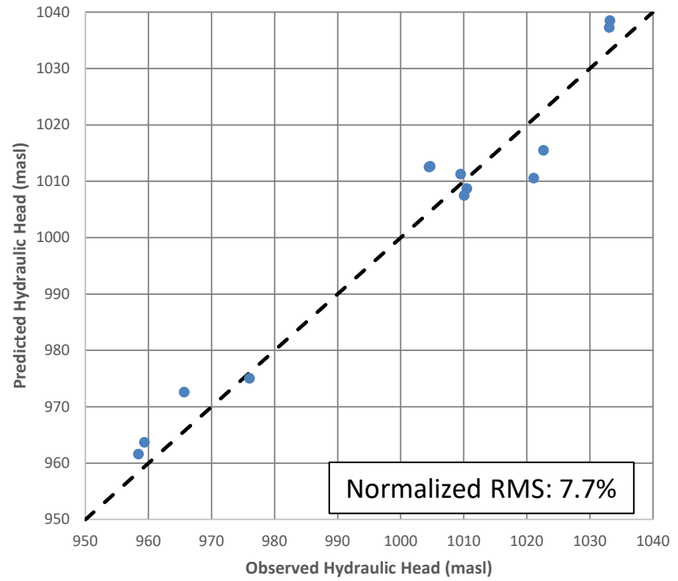
TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (NOVEMBER 2018 AND NOVEMBER 2019)

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**7**

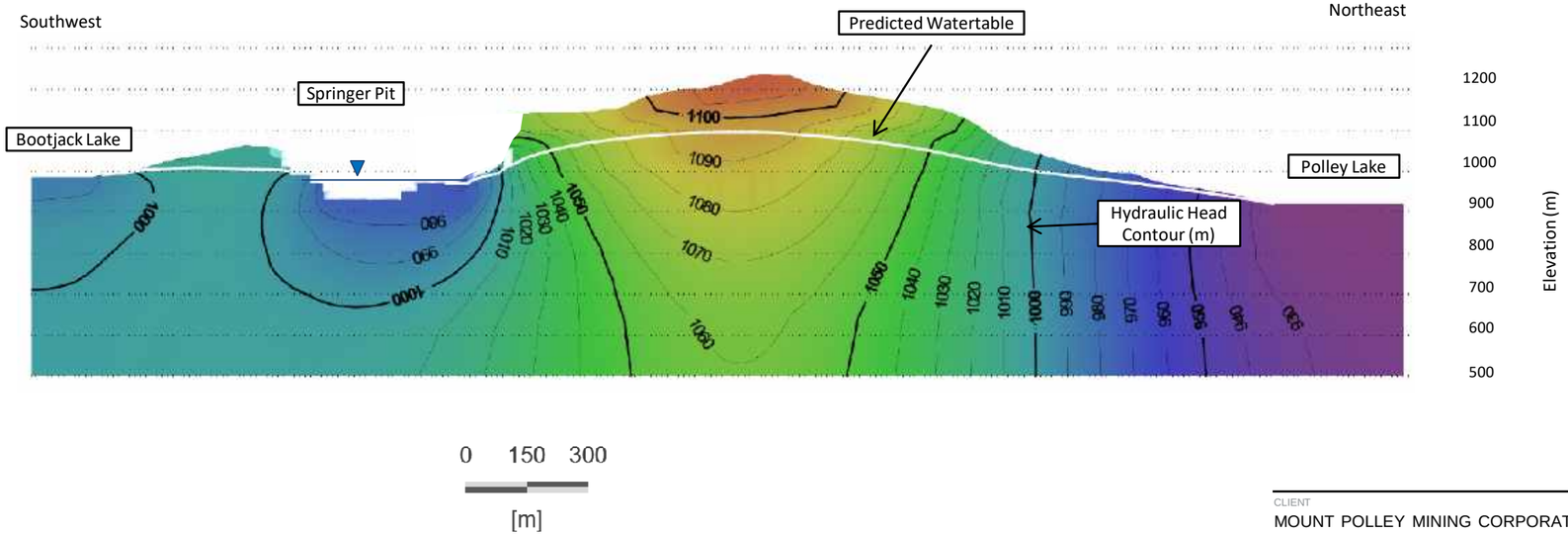
A. Pit Lake Conditions May 2021 (SW-NE Cross-section) – Pit Lake at 999.7 masl



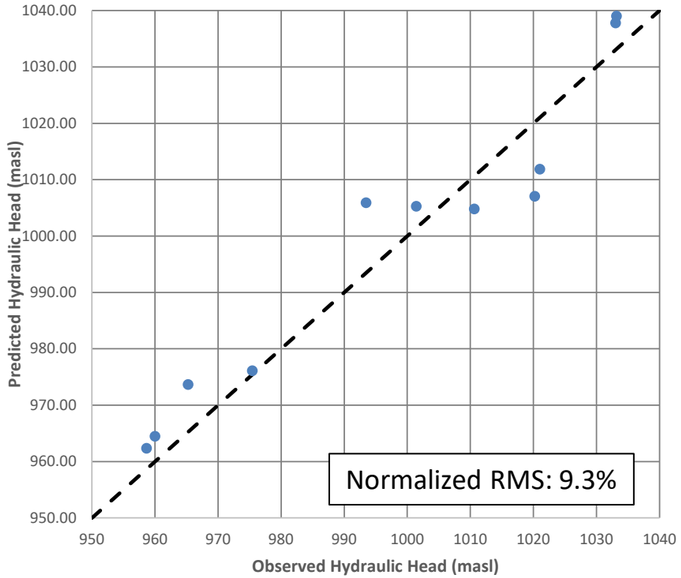
B. Comparison of Predicted vs. Observed Hydraulic Heads (May 2021)



C. Pit Lake Conditions June 2022 (Cross-section) – Pit Lake at 981 masl



D. Comparison of Predicted vs. Observed Hydraulic Heads (June 2022)



Notes:
Distances are in meters

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

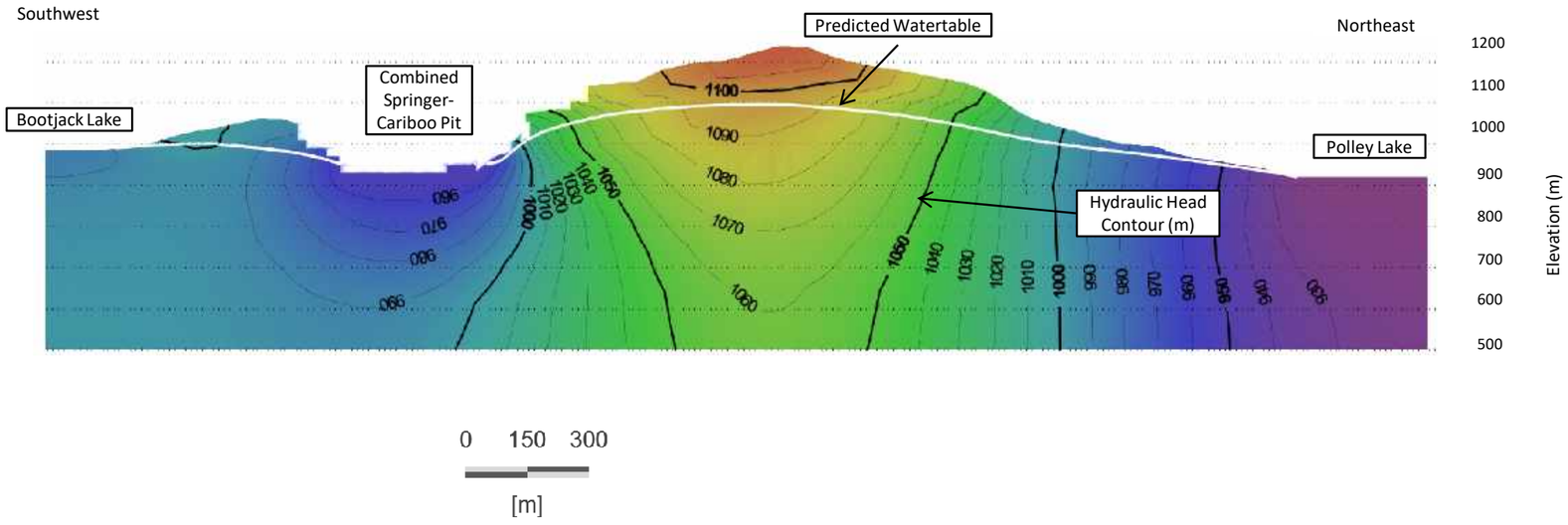
YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (MAY 2021 AND JUNE 2022)

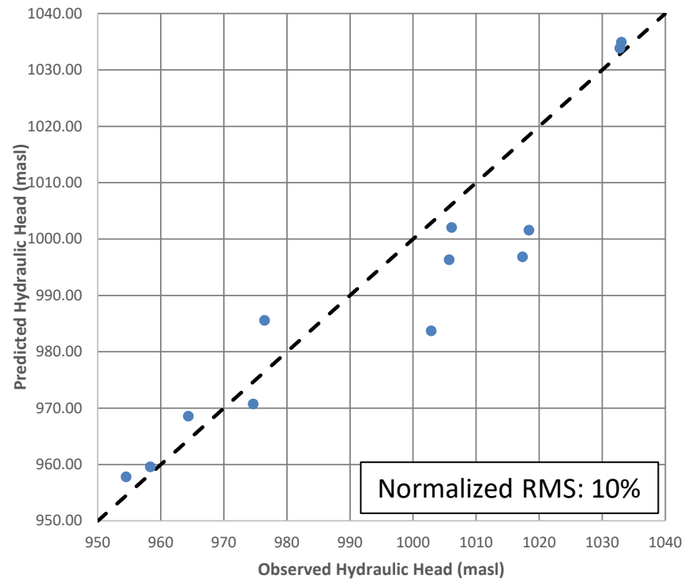
PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**8**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

A. September 2023 (SW-NE Cross-section) – Dewatered Pit



B. Comparison of Predicted vs. Observed Hydraulic Heads (September 2023)



Notes:
Distances are in meters

CLIENT	MOUNT POLLEY MINING CORPORATION
PROJECT	SPRINGER PIT GROUNDWATER MODEL UPDATE
CONSULTANT	wsp
YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF
TITLE	**GROUNDWATER MODEL CALIBRATION PIT LAKE CONDITIONS (SEPTEMBER 2023)**
PROJECT NO.	CA0020527.4505 31400
REV.	0
FIGURE	**9**

3.4 Limited Sensitivity Analysis

The calibrated model is considered to provide representative estimates of current groundwater conditions in the model domain, and these estimates are herein referred to as the Base Case scenario. However, as input parameters to the model are subject to some uncertainty, actual current groundwater conditions (groundwater levels and flow) might differ from what is computed by the model for the Base Case scenario. Following model calibration, the sensitivity of the predicted groundwater flow conditions to reasonable variations in model input parameters was assessed by conducting a limited sensitivity analysis, based on results of previous assessment (Golder, 2016). The results of this analysis provide the input parameter ranges that will reasonably bracket potential future effects on groundwater conditions within the model domain during closure.

The sensitivity analysis was conducted by means of additional steady-state and transient model simulations. In these simulations, selected model input parameters were varied over ranges that reflected their potential range of uncertainty, based on the previous assessment. The estimated hydraulic conductivity of the bedrock and recharge from precipitation were considered to have the highest degree of uncertainty, primarily because of the high variability that these parameters might have within the model domain and the expected high sensitivity of the model results on these parameters.

The model sensitivity simulations were run with the following changes to simulate two uncertainty scenarios:

- Upper Bound scenario: hydraulic conductivity of bedrock increased by a factor of 2 relative to Base Case values and recharge increased to 50% of total annual precipitation.
- Lower Bound scenario: hydraulic conductivity of bedrock decreased by a factor of 2 relative to Base Case values and recharge decreased to 20% of total annual precipitation.

The upper and lower bound range for hydraulic conductivity of the bedrock and recharge were considered reasonable based on the available data.

Table 5 summarizes the results of the uncertainty scenarios, presenting the computed groundwater inflow to the Springer Pit when dewatered and the nRMS for hydraulic head through all the calibration stages relative to the Base Case scenario. Both Lower Bound and Upper Bound scenarios resulted in a poorer calibration in terms of hydraulic head. However, the computed groundwater inflow to the Springer Pit was at both extremes of the observed range, therefore still reasonable. Based on these results, the parameter ranges utilized in the two sensitivity scenarios are considered reasonable for bracketing the range in potential effects on groundwater conditions within the model domain during closure.

Table 5: Results of Sensitivity Analysis

Alternate Scenario	Parameter	Groundwater Inflow to Springer Pit (May 2014) (m^3/d)	nRMS (%)
Base Case	Calibrated Model	900	4.3 to 10
Upper Bound	K of bedrock x 2, recharge 50% of total annual precipitation	1,600	4.6 to 12.3
Lower Bound	K of Vashon Drift / 2, recharge decreased by 20%	550	10.8 to 16.8

4.0 SEEPAGE PREDICTIONS DURING CLOSURE

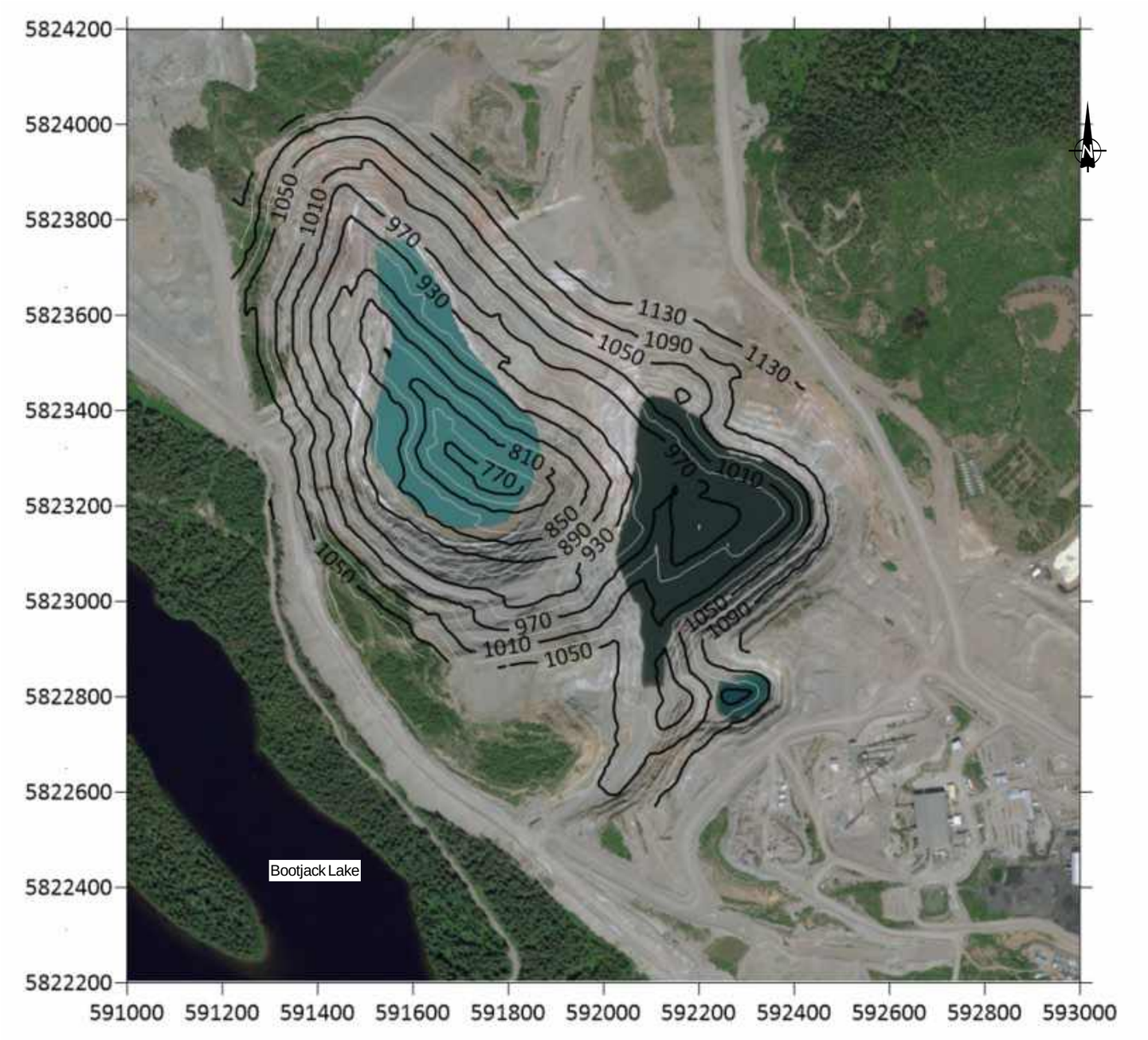
The calibrated hydrogeological model was used to simulate groundwater conditions near the Springer/Cariboo Pit during closure. These predictions are herein referred to as the Base Case predictions. The following sections describe the model modifications and assumptions used for model predictions. Uncertainty in the predicted groundwater inflows resulting from the uncertainty in model input parameters is based on the limited sensitivity analysis discussed in Section 3.4.

4.1 Method

For the closure predictions, the following assumptions were made, based on information currently available on the closure plan:

- The combined Springer/Cariboo Pit will be mined to the ultimate depth of approximately 763 masl, based on the ultimate pit shape provided by MPMC (file “Sp-6 v4 topomerge.dxf”). Topographic contours representing the ultimate configuration of the Springer/Cariboo Pit are shown in Figure 10.
- The Springer/Cariboo Pit will be allowed to flood. The spillway elevation for this pit lake is approximately 1050 masl (Figure 10).
- Potentially Acid Generating (PAG) materials will be placed in the Springer/Cariboo Pit up to an elevation of approximately 1028 m. Similarly to the previous assessment, in these model simulations, it was assumed that the PAG materials that will be placed in the Springer/Cariboo Pit will have a hydraulic conductivity significantly higher than the surrounding rock mass, and thus offer no resistance to seepage entering or exiting the pit lake.
- Tailings will not be deposited in the Springer Pit/Cariboo Pit.

The model mesh and boundary conditions were modified to incorporate the extent of the ultimate Springer/Cariboo Pit and a sequence of steady-state simulations was completed to predict groundwater inflow/outflow to the Springer/Cariboo Pit Lake for different stages of pit flooding during closure. The stages ranged from a fully dewatered pit to progressively higher lake levels at approximate 20 to 50 m intervals, up to the expected maximum lake (spillover point) elevation of 1050 masl. For each simulation, the specified head boundaries were modified in the hydrogeological model to reflect the specified stage of flooding. This involved removing the constraints restricting the inflow of water and applying a specified head equivalent to the pit lake level to the pit nodes only where they occur below the simulated lake level elevation. This allows water to both enter or exit the pit lake based on the predicted hydraulic heads surrounding the Springer/Cariboo Pit.



Legend

Topographic Contour (masl)

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC
AutoCad drawing was provided by MPMC in file Sp-6 v4 topomerge.dxf.dxf

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
ULTIMATE CONFIGURATION OF SPRINGER AND CARIBOO PIT

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B
25mm

4.2 Results

Table 6 presents the predicted groundwater inflow and outflow rates during flooding of the Springer/Cariboo Pit for the Base Case predictions and for the two sensitivity scenarios. These predictions consider only groundwater flow to the open pit for the simulated pit lake elevation, and do not include potential inputs from direct precipitation within the footprint of the pit and/or surface water run-off (if not diverted) from the pit walls and from the surrounding areas. These surface water inputs are usually incorporated outside of the hydrogeological model in the Water Balance Model (WSP, 2023). Figure 11 and Figure 12 present hydrogeological conditions predicted by the calibrated model (Base Case) for the ultimate configuration of the Springer/Cariboo Pit when fully dewatered and at increased pit lake levels up to the spillway elevation of 1,050 m.

Table 6: Predicted Seepage Quantities for the Ultimate Configuration of the Springer/Cariboo Pit Lake

Springer-Cariboo Pit Lake Elevation (m)	Base Case		Upper Bound		Lower Bound	
	Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)		Groundwater Flow (m^3/day)	
	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake	Into the Lake	Out of the Lake
760	640	-	1120	-	420	-
800	640	-	1120	-	420	-
850	640	-	1110	-	420	-
900	630	-	1090	-	410	-
940	620	-	1080	-	410	-
960	610	-	1040	-	400	-
980	580	-	980	-	390	-
1000	520	-	850	-	360	-
1020	430	20	690	60	320	<10
1030	390	90	620	200	300	30
1040	360	200	560	440	280	80
1050	330	360	510	780	270	150

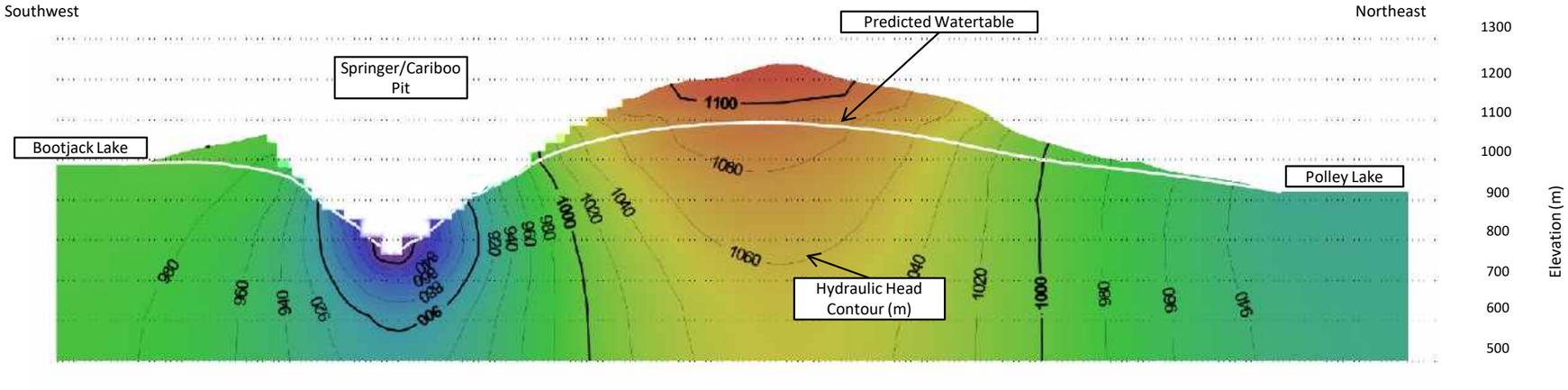
Model results indicated that when the Springer/Cariboo Pit is at the ultimate configuration and is fully dewatered, the groundwater inflow to the pit is between approximately 420 m^3/day and 1,120 m^3/d. When fully dewatered, the combined pit would act as strong groundwater sink that would reverse groundwater flow between Bootjack Lake and the pit such that the seepage from Bootjack Lake to the underlying bedrock would occur. As the pit lake level is raised, the groundwater seepage into the pit lake was predicted to gradually decrease to between approximately 270 m^3/day to 510 m^3/d once the spillway elevation of 1,050 m is reached.

In addition, as the pit lake level increases between 1,020 m and 1,030 m elevation, seepage in the range of 20 m^3/d to 200 m^3/d from the Springer/Cariboo Pit Lake into the subsurface was predicted to occur. This seepage was found to gradually increase when the pit lake reaches the spillover elevation of 1,050 m (between 150 m^3/day and 780 m^3/d). At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from the pit and recharge to groundwater occurring towards the southwest.

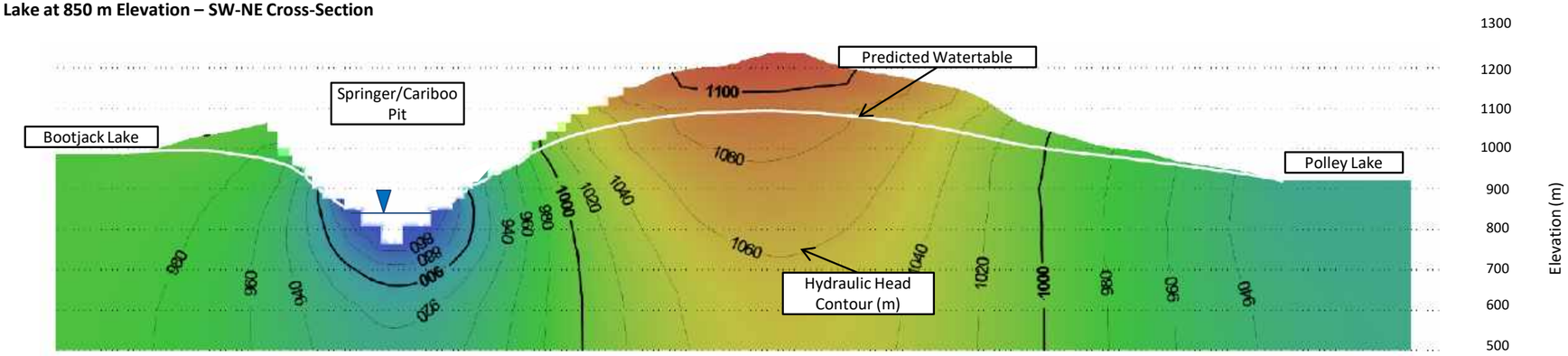
When compared to previous model predictions (Golder, 2016), updated average predicted inflow and outflow into and out of the pit lake are generally lower than previous estimates (between 10% and 45%), These differences are mainly due to the changes in hydraulic properties in the vicinity of the pit following model recalibration (i.e. reduction in hydraulic conductivity of the bedrock between 40 and 100 mbgs and changes to the brecciated bedrock) and to a lesser degree to the changes between the two simulated ultimate pits. While the updated ultimate pit is deeper and wider than the pit simulated in 2016, predicted flows are lower because of the reduced hydraulic conductivity of the units that are intersected by the ultimate pit.

The hydrogeological model was also used to estimate seepage pathways from the pit lake predicted for the conditions representing the pit lake at the spillway elevation (1050 masl) for the Base Case scenario, as presented in Figure 13. Particle tracking analyses indicate that seepage from the combined Springer/Cariboo Pit Lake when it reaches the spillover elevation is predicted to report to the northern portion of Bootjack Lake over an area of approximately 290 m by 1,200 m, approximately 1 km upstream of the outlet of Bootjack Lake. The advective travel times from the pit lake to the Bootjack Lake are estimated to be between approximately 3 months to less than one year, because of the relatively low transport porosity for bedrock (0.01 to 0.001 based on literature values presented in Guimera and Carrera, 2000), moderate permeability of shallow bedrock, and short travel distance (approximately 200 m from pit crest to Bootjack Lake). Updated seepage pathways when the pit lake reaches spillover elevation are very similar to previous estimates (Golder, 2016).

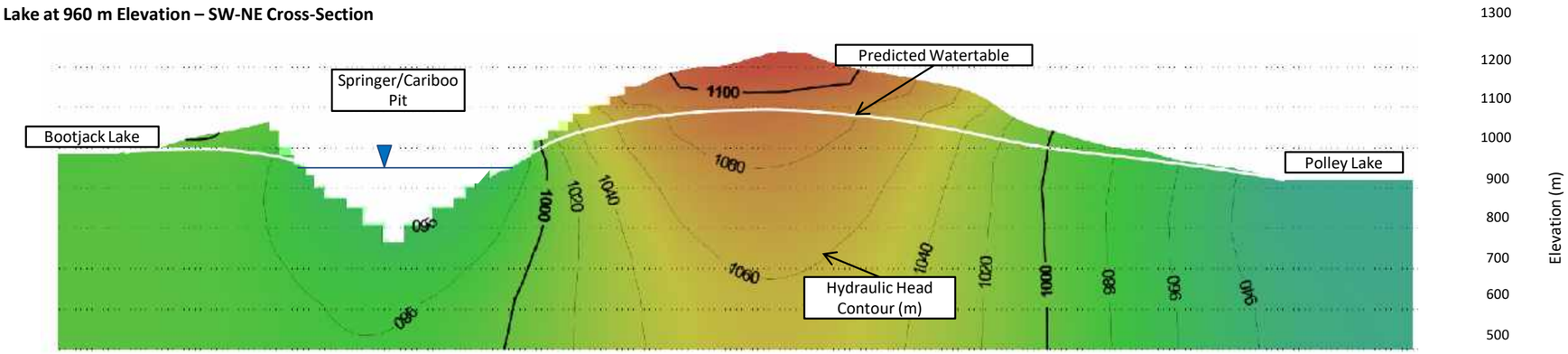
A. Pit Lake at 760 m Elevation (Dewatered Pit) – SW-NE Cross-Section



B. Pit Lake at 850 m Elevation – SW-NE Cross-Section



C. Pit Lake at 960 m Elevation – SW-NE Cross-Section



0 150 300

[m]

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

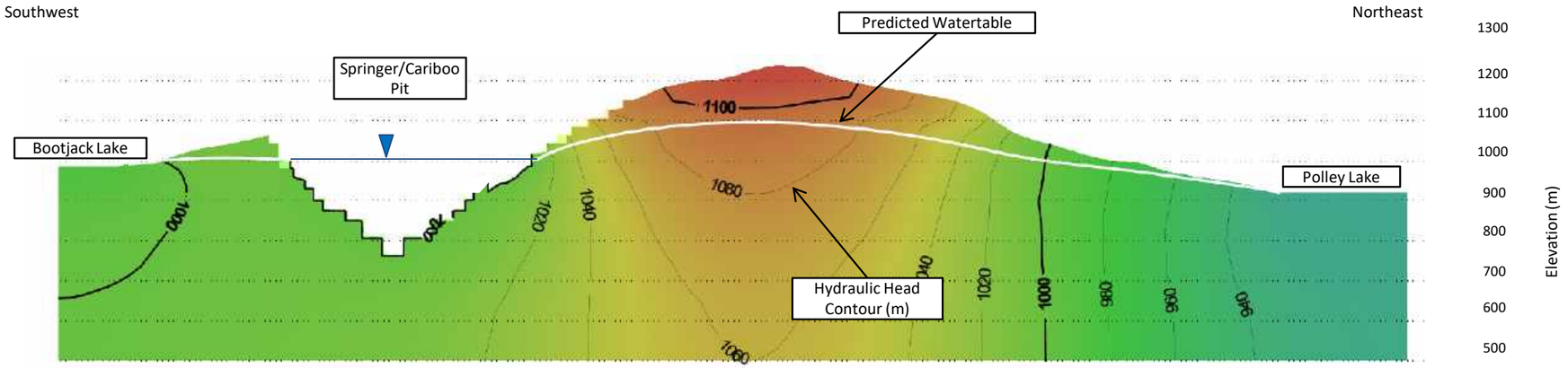
CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

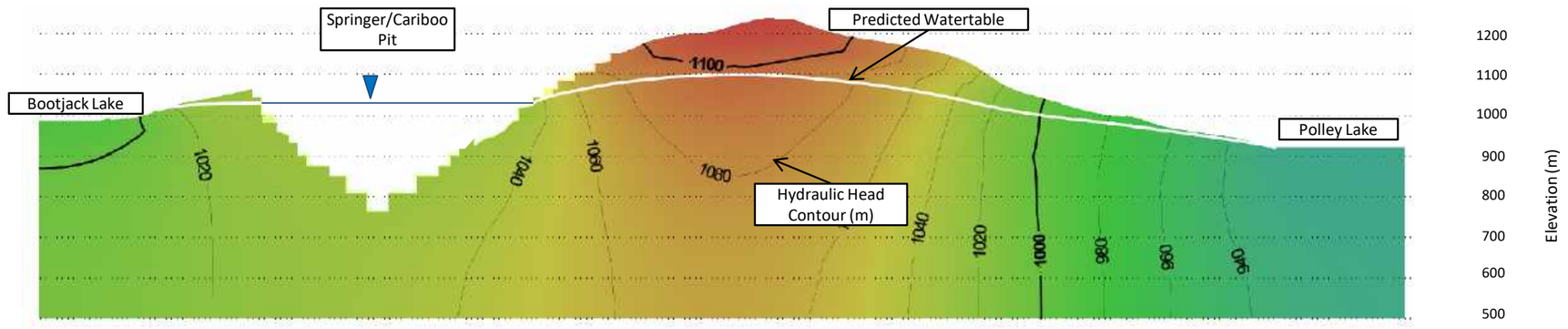
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PROJECT NO. CA0020527.4505 | 31400 | REV. 0

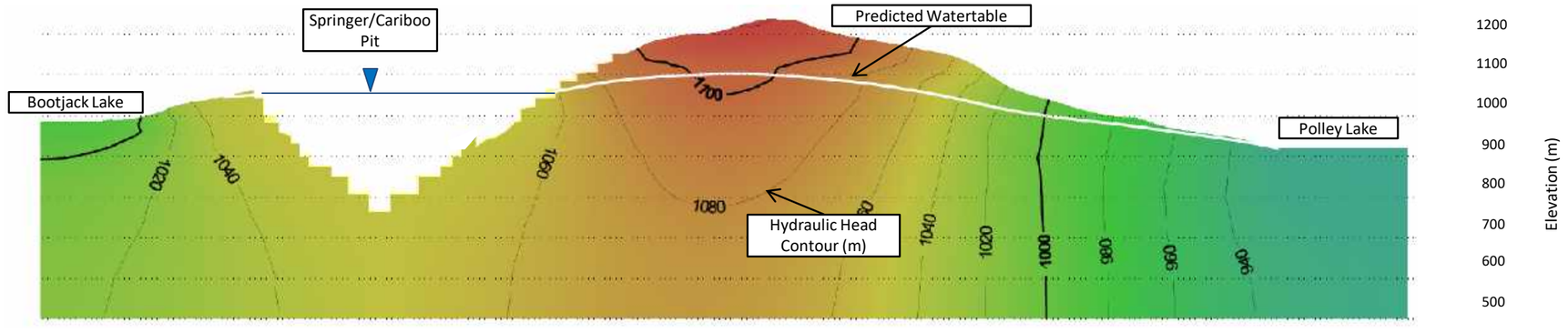
A. Pit Lake at 1000 m Elevation – SW-NE Cross-Section



B. Pit Lake at 1030 m Elevation – SW-NE Cross-Section



C. Pit Lake at 1050 m Elevation (Spillover) – SW-NE Cross-Section



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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

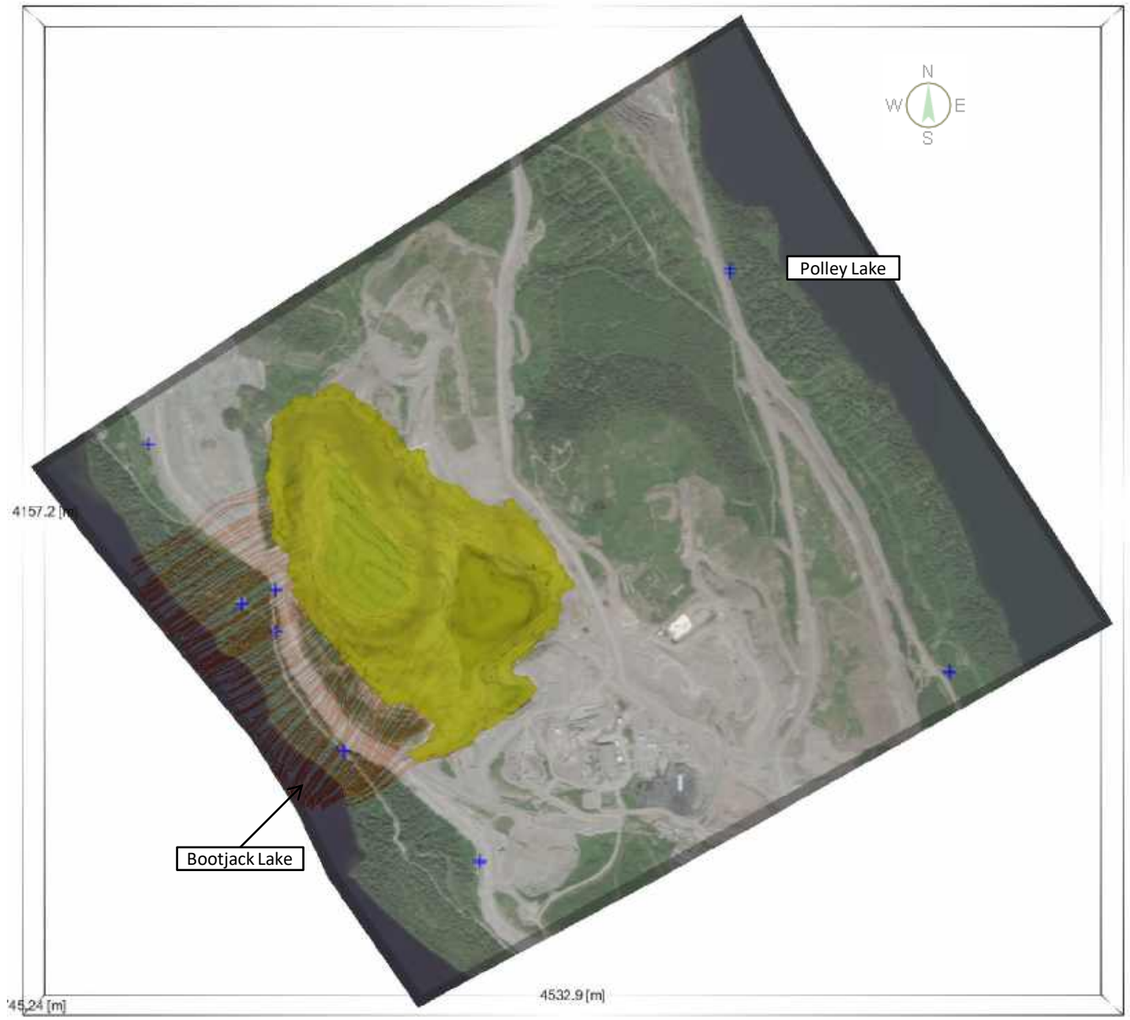
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YYYY-MM-DD	2024-05-22
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REVIEWED	DWC
APPROVED	JF

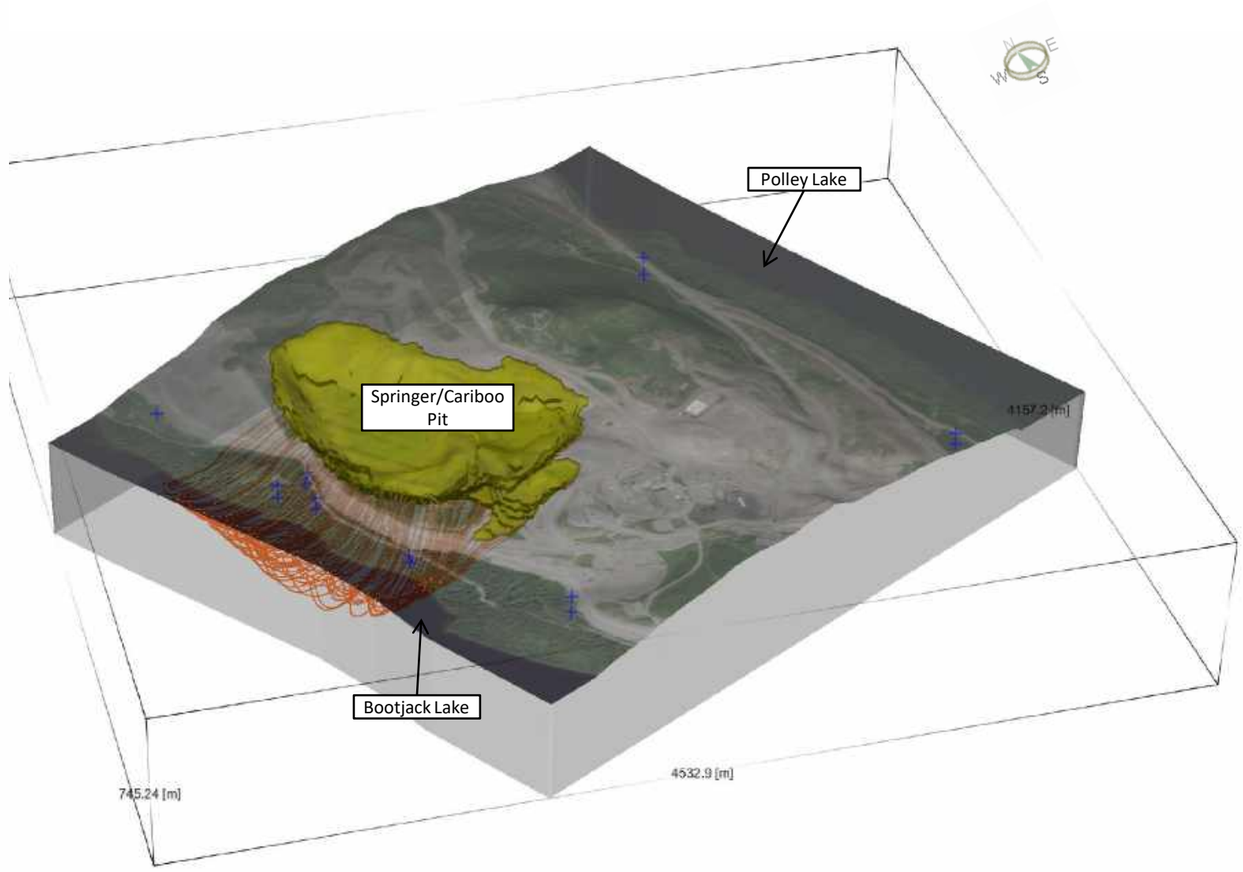
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PREDICTED HYDROGEOLOGICAL CONDITIONS PIT LAKE FROM 1000 M TO 1050 M (SPILLOVER) BASE CASE

PROJECT NO. CA0020527.4505 | 31400 | REV. 0

A. Map View



B. Oblique View Looking Northeast



Legend

- Predicted Pathlines from Pit Lake
- Monitoring Well

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PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

CONSULTANT

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

TITLE
PREEDICTED SEEPAGE PATHWAYS SPILLOVER ELEVATION (1050 MASL) BASE CASE

PROJECT NO. CA0020527.4505 | 31400 | REV. 0

5.0 SUMMARY AND CONCLUSIONS

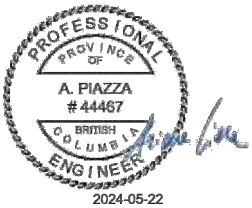
The existing groundwater model built for closure conditions at the Springer/Cariboo Pit Lake (Golder, 2016) was updated to reflect changes in mine settings since 2016 including the pit configuration and water levels in pit lakes up to 2023. Model calibration was refined based on hydrogeological data collected since 2016 in the mine monitoring wells within the groundwater model domain. Results of this assessment are presented as follows:

- Available water level data indicate that exfiltration from the Springer Pit may have occurred in the period between January and June 2016, when the Springer Pit Lake elevation was above 1025 masl. From June 2016 to December 2022, following drawdown of the pit lake, the hydraulic heads in wells close to the Springer Pit crest have remained above the pit lake level, indicating that exfiltration has not likely occurred after this period. The hydraulic head at wells GW12-2a/b and GW16-6a/b has remained below the pit lake level until January 2017, when the lake level dropped below 1010 masl, inferring the presence of a groundwater divide between the Springer Pit and Bootjack Lake.
- The model was successfully recalibrated for different stages in time between 2014 and 2023. The recalibrated model can adequately reproduce groundwater conditions for each of the stages considered and capture observed increases and decreases in the hydraulic heads in near-pit monitoring wells following refilling and dewatering of the Springer Pit Lake (Figures 4 to 9). Groundwater conditions between the Springer Pit Lake and Bootjack Lake both when the pit lake level is high or very low are reasonably represented by the model in the area of monitoring wells GW12-2a/b and GW16-6a/b and the model is predicting the presence of an observed groundwater divide in this area. The model also predicts similar seasonal fluctuations in monitoring wells due to changes in recharge during the freshet period, following snowmelt.
- The recalibrated model was used to simulate groundwater conditions near the Springer/Cariboo Pit during closure, based on the ultimate configuration of the combined Springer/Cariboo Pit. The model mesh and boundary conditions were modified to incorporate the extent of the ultimate Springer/Cariboo Pit and a sequence of steady-state simulations was completed to predict groundwater inflow/outflow to the Springer/Cariboo Pit Lake for different stages of pit flooding during closure (from dewatered pit to spillover elevation). When fully dewatered (Figure 11), the combined pit would act as strong groundwater sink that would reverse groundwater flow between Bootjack Lake and the pit such that the seepage from Bootjack Lake to the underlying bedrock would occur (groundwater inflow to the pit would between approximately 420 m^3/day and 1,120 m^3/d). As the pit lake level is raised (Figures 11 to 13), the groundwater seepage into the pit lake was predicted to gradually decrease to between approximately 270 m^3/day to 510 m^3/d once the spillway elevation of 1,050 m is reached. As the pit lake level increases between 1,020 m and 1,030 m elevation, seepage in the range of 20 m^3/d to 200 m^3/d from the Springer/Cariboo Pit Lake into the subsurface was predicted to occur, increasing between 150 m^3/day and 270 m^3/d when the pit lake reaches the spillover elevation of 1,050 m. At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from the pit and recharge to groundwater occurring towards the southwest. When compared to previous model predictions (Golder, 2016), updated average predicted inflow and outflow into and out of the pit lake are generally lower than previous estimates (between 10% and 45%), These differences are mainly due to the changes in hydraulic properties in the vicinity of the pit following model recalibration.
- Particle tracking analyses (Figure 13) indicate that seepage from the combined Springer/Cariboo Pit Lake when it reaches the spillover elevation would report to the northern portion of Bootjack Lake over an area of approximately 290 m by 1,200 m, approximately 1 km upstream of the outlet of Bootjack Lake. The advective travel times from the pit lake to the Bootjack Lake are estimated to be between approximately 3 months to less than one year.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum. We trust that the above information is sufficient for your needs at this time. Should you have any questions or require clarification, please contact the undersigned at 604-296-4200.

WSP Canada Inc.





Arianna Piazza, P.Eng.
Principal Hydrogeologist

Don Chorley, P.Geo.
Senior Hydrogeology Specialist

AP/DWC/ar/ah

Attachment 1: Model Residuals

https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/040-tm-31441-gw model springer recalibration memo/rev0/ca0020527.4505-040-tm-rev0-31441-gw model springer recalibration memo 22may_24.docx

Engineers & Geoscientists BC Permit #1000200

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WSP Canada Inc., 2023. *2022 Annual Groundwater Monitoring Report – Mount Polley Mine*. Prepared for Mount Polley Mining Corporation. Reference No. 23590671-019-R-Rev0-31491, dated 29 March 29, 2023.

WSP Canada Inc., 2024a. *Update of the Groundwater Flow Model for the Springer Open Pit and Review of Model Calibration – Mount Polley Mine*. Technical Memorandum prepared for Mount Polley Mining Corporation. Reference No. 23590671-099-R-Rev0-31441, dated January 15, 2024.

WSP Canada Inc., 2024b. *2023 Annual Groundwater Monitoring Report – Mount Polley Mine*. Prepared for Mount Polley Mining Corporation. Draft Report in preparation.

STUDY LIMITATIONS

This technical memorandum was prepared for the exclusive use of Mount Polley Mining Corporation (MPMC). The assessment was performed according to current professional standards and practices in the groundwater field and has been made using historical and technical data obtained from the sources noted within this technical memorandum. Except where specifically stated to the contrary, the information contained in this memorandum (including reports, information and data) was provided to WSP by others and has not been independently verified or otherwise examined by WSP to determine its accuracy or completeness. WSP has relied in good faith on this information and does not accept responsibility for any deficiency, misstatements or inaccuracies contained in the report as a result of omissions, misinterpretation and/or fraudulent acts of the persons interviewed or contacted, or errors or omissions in the reviewed documentation.

The services performed as described in this technical memorandum were conducted in a manner consistent with the level of care and skill normally exercised by other members of the engineering and science professions currently practising under similar conditions, subject to the time limits and financial and physical constraints applicable to the services. Hydrogeological investigations and the development of conceptual and numerical site models are dynamic and inexact sciences. They are dynamic in the sense that the state of any hydrological system is changing with time, and in the sense that the science is continually developing new techniques to evaluate these systems. They are inexact in the sense that subsurface conditions are not known between the specific investigation locations, and there is invariably a lack of complete information both spatially and temporally about the geological and hydrogeological conditions. The validity and accuracy of the conceptual model depends on the amount of data available relative to the degree of complexity of the geologic formations, the site area hydrogeology, and on the quality and degree of accuracy of the data utilized it in its development. Therefore, every conceptual model is a simplification of reality and the model described in this technical memorandum is not an exception.

The content of this report is based on information collected during the study, our present understanding of the site area conditions, the assumptions stated in this report, and our professional judgement in light of such information at the time of this report. This technical memorandum provides a professional opinion and, therefore, no warranty is expressed, implied, or made as to the conclusions, advice and recommendations offered in this report. This technical memorandum does not provide a legal opinion regarding compliance with applicable laws. With respect to regulatory compliance issues, it should be noted that regulatory statutes and the interpretation of regulatory statutes are subject to change.

The findings and conclusions of this technical memorandum are valid only as of the date of the report. If new information is discovered in future work, or if the assumptions stated in this technical memorandum are not met, WSP should be requested to re-evaluate the conclusions of this technical memorandum, and to provide amendments as required.

The information, recommendations and opinions expressed in this technical memorandum are for the sole benefit of MPMC. No other party may use or rely on this technical memorandum or any portion thereof without WSP's express written consent. The technical memorandum, all plans, data, drawings and other documents as well as all electronic media prepared by WSP are considered its professional work product and shall remain the copyright property of WSP, who authorizes only MPMC to make copies of the report, and only in such quantities as are reasonably necessary for the use of the technical memorandum by those parties. MPMC may not give, lend, sell, or otherwise make available the technical memorandum or any portion thereof to any other party without the express written permission of WSP, except as required by law. MPMC acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore MPMC cannot rely upon the electronic media versions of WSP's technical memorandum or other work products.

ATTACHMENT 1

Model Residuals

A. May 2014 – Dewatered Pit



B. July 2015 – Pit Lake at 1017.2 masl



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

CLIENT
MOUNT POLLEY MINING CORPORATION

CONSULTANT
wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
MAY 2014 AND JULY 2015

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-1**

A. June 2016 – Pit Lake at 1037.97 masl



B. November 2018 – Pit Lake at 983 masl



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
JUNE 2016 AND NOVEMBER 2018

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-2**

A. November 2019 – Pit Lake at 983 masl



B. May 2021 – Pit Lake at 999.7 masl



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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wsp

YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
NOVEMBER 2019 AND MAY 2021

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-3**

A. June 2022 – Pit Lake at 981 masl



B. September 2023 – No Pit Lake



Legend

Residual (Simulated – Observed) - m

- -20 to -15
- -15 to -10
- -10 to -5
- -5 to 0
- 0 to 5
- 5 to 10
- 10 to 15
- 15 to 20

Notes:
Distances are in metres
Orthophoto is from 2021 and was provided by MPMC

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YYYY-MM-DD	2024-05-22
PREPARED	AP
DESIGNED	AP
REVIEWED	DWC
APPROVED	JF

PROJECT
SPRINGER PIT GROUNDWATER MODEL UPDATE

TITLE
RESULTS OF MODEL CALIBRATION
RESIDUALS MAP
JUNE 2022 AND SEPTEMBER 2023

PROJECT NO.		REV.	FIGURE
CA0020527.4505	31400	0	**1-4**

APPENDIX 5-9: Near Field Dispersal Model Verification

TECHNICAL MEMORANDUM

DATE 27 March 2023 **Reference No.** 23590671-017-TM-Rev0-31242

TO Mathieu O'Leary
Mount Polley Mining Corporation

CC Don Parsons

FROM Steve Mitchell, Alison Snow and Lee Nikl **EMAIL** **Steve.Mitchell@wsp.com; Alison.Snow@wsp.com; Lee.Nikl@wsp.com**

2022 VERIFICATION OF NEAR-FIELD MODELLING IN QUESNEL LAKE FOR MOUNT POLLEY MINE

1.0 INTRODUCTION

This memorandum provides an update to the previous near-field model validation that was presented in the memorandum entitled "2021 Verification of Near-Field Modelling in Quesnel Lake – Mount Polley Mine" (WSP Golder 2022). For brevity, only the results of the updated model validation are presented, because the methods are the same as those described in the previous memoranda (Golder 2016, 2018, 2019, 2020, 2021, and WSP Golder 2022).

In brief, near-field dilution was calculated using measured water quality data at "end-of-pipe", in ambient Quesnel Lake water, and at the boundary of the initial dilution zone (IDZ) in Quesnel Lake. While this method can lead to large variations in calculated dilution factors on a parameter-by-parameter basis, it is the only validation method available that does not entail adding a tracer chemical to the effluent. Adding a tracer, especially one that might introduce colour to the lake, was not considered for this study because local stakeholders have expressed a strong desire to avoid adding chemicals to Quesnel Lake.

Dilution factors were calculated using Equation 1:

$$DF = \frac{[C_{eff}]-[C_{amb}]}{[C_{IDZ}]-[C_{amb}]} \quad \text{[Equation 1]}$$

where:

C_{eff} = concentration in the effluent from the water treatment discharge (HAD-3)

C_{amb} = concentration in ambient lake water (QUL-2a)

C_{IDZ} = concentration in lake water at the boundary of the IDZ (QUL-5)

2.0 DILUTION FACTORS AT THE INITIAL DILUTION ZONE OF QUESNEL LAKE

The updated model validation includes all applicable data collected in 2022. During this time, discharge was started and ceased on the dates listed in Table 2-1. All treated water during the period of discharge was directed from the water treatment plant (WTP) to Quesnel Lake directly through the pipeline and diffusers.

Table 2-1: Start and Cease Dates of Discharge from the Water Treatment Plant

Start Dates	Cease Dates
1 January	10 June
22 June	31 December

Water quality was measured at locations that enabled dilution factors to be calculated on 10 occasions during the present validation period (Figure 1 and Table 2-1). The calculated median dilution factors were at least 81 on days when discharge was active (Table 2-2). These values confirm the model prediction that the minimum dilution factor at the boundary of the IDZ would range from approximately 40 to well above 100. The calculated dilution factors based on the 2022 monitoring data (Table 2-3 to Table 2-8) are consistent with the model prediction and indicate that the model prediction was conservative (cautionary).

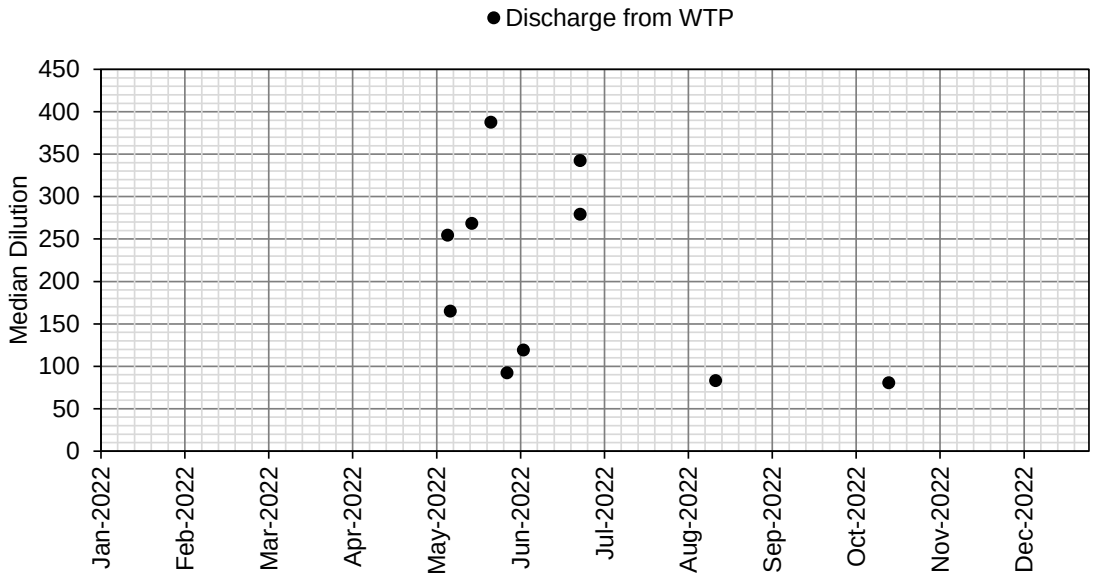


Figure 1: Calculated Dilution Factors at the Initial Dilution Zone Based on 2022 Monitoring Data

Table 2-2 : Calculated Dilution Factors at the Initial Dilution Zone

Discharge Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Dilution Factor						
			Total Dissolved Solids	Nitrate	Sulphate	Total Manganese	Total Molybdenum	Total Selenium	Median Dilution
HAD-3 – Hazeltine Discharge	Maximum at QUL-57, QUL-58 or QUL-59, near water surface, mid-depth or near lakebed[a]	2022-05-09	88	40	255	-[b]	408	372	255
HAD-3 – Hazeltine Discharge		2022-05-10	71	40	259	18	362	347	165
HAD-3 – Hazeltine Discharge		2022-05-18	1,504	41	241	155	296	356	268
HAD-3 – Hazeltine Discharge		2022-05-25	-[b]	40	230	3,036	388	497	388
HAD-3 – Hazeltine Discharge		2022-05-31	19	36	136	49	229	157	92
HAD-3 – Hazeltine Discharge		2022-06-06	137	32	96	120	139	119	119
HAD-3 – Hazeltine Discharge		2022-06-27	-[a]	41	279	85	510	531	279
HAD-3 – Hazeltine Discharge		2022-08-16	46	28	83	-[b]	98	93	83
HAD-3 – Hazeltine Discharge		2022-10-19	67	30	81	-[b]	106	106	81
HAD-3 – Hazeltine Discharge	Maximum at QUL-57, QUL-58 or QUL-59, above or below thermocline or above, below, or within plume[a]	2022-06-27	-[a]	42	342	168	658	581	342

(a) See Table 2-2 to Table 2-8 for specific station names.

(b) Dilution factors were not calculated when the effluent concentration was lower than the ambient concentration, or when the maximum concentration measured at the edge of the initial dilution zone was lower than the ambient concentration.

Note: Dates are presented as yyyy-mm-dd.

Table 2-3 : Calculated Dilution Factors for Total Dissolved Solids at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	824	82	88
HAD-3 – Hazeltine Discharge	QUL-57-S	2022-05-10	824	84	71
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	825	74	1504
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-25	826	64	-[c]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-31	827	114	19
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	828	79	137
HAD-3 – Hazeltine Discharge	QUL-57-B	2022-06-27	831	72	-[c]
HAD-3 – Hazeltine Discharge	QUL-57-MID	2022-08-16	838	90	46
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-10-19	848	85	67
HAD-3 – Hazeltine Discharge	QUL-58-AP	2022-06-27	831	73	-[c]

(a) Dilution factors were calculated using the maximum initial dilution zone total dissolved solids concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (73.5 mg/L) from the QUL-2a station.

(c) Dilution factors were not calculated when the effluent concentration was lower than the ambient concentration, or when the maximum concentration measured at the sampling location was lower than the ambient concentration.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; AP = Above Plume.

Table 2-4 : Calculated Dilution Factors for Nitrate at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-MID	2022-05-09	3.6	0.13	40
HAD-3 – Hazeltine Discharge	QUL-59-MID	2022-05-10	3.7	0.13	40
HAD-3 – Hazeltine Discharge	QUL-58-MID	2022-05-18	3.7	0.13	41
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-25	3.8	0.13	40
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	3.8	0.14	36
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	3.8	0.16	32
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	4.0	0.14	41
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	4.4	0.19	28
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	4.8	0.2	30
HAD-3 – Hazeltine Discharge	QUL-58-AP	2022-06-27	4.0	0.13	42

(a) Dilution factors were calculated using the maximum initial dilution zone nitrate concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient nitrate concentration (0.040 mg-N/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

N = nitrogen; IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; AP = Above Plume.

Table 2-5 : Calculated Dilution Factors for Sulphate at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	483	7.7	255
HAD-3 – Hazeltine Discharge	QUL-57-S	2022-05-10	483	7.6	259
HAD-3 – Hazeltine Discharge	QUL-58-MID	2022-05-18	485	7.8	241
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-25	486	7.9	230
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	486	9.3	136
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	487	10.8	96
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	490	7.5	279
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	498	11.7	83
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	507	12	81
HAD-3 – Hazeltine Discharge	QUL-58-MP	2022-06-27	490	7.2	342

(a) Dilution factors were calculated using the maximum initial dilution zone sulphate concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient sulphate concentration (5.8 mg/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; MP = Middle of Plume.

Table 2-6 : Calculated Dilution Factors for Total Manganese at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	0.11	0.0015	-[c]
HAD-3 – Hazeltine Discharge	QUL-57-MID	2022-05-10	0.11	0.0076	18
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	0.11	0.0024	155
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-25	0.11	0.0017	3,036
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-31	0.11	0.0039	49
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	0.11	0.0026	120
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-06-27	0.11	0.0029	85
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	0.11	0.0016	-[c]
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	0.1	0.0017	-[c]
HAD-3 – Hazeltine Discharge	QUL-59-AP	2022-06-27	0.11	0.0023	168

(a) Dilution factors were calculated using the maximum initial dilution zone total manganese concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (0.0017 mg/L) from the QUL-2a station.

(c) Dilution factors were not calculated when the effluent concentration was lower than the ambient concentration, or when the maximum concentration measured at the sampling location was lower than the ambient concentration.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; AP = Above Plume.

Table 2-7 : Calculated Dilution Factors for Total Molybdenum at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	0.16	0.00075	408
HAD-3 – Hazeltine Discharge	QUL-59-S	2022-05-10	0.16	0.00079	362
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	0.16	0.0009	296
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-25	0.16	0.00077	388
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	0.16	0.0011	229
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	0.16	0.0015	139
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	0.16	0.00069	510
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	0.17	0.0021	98
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	0.19	0.0021	106
HAD-3 – Hazeltine Discharge	QUL-58-MP	2022-06-27	0.16	0.0006	658

(a) Dilution factors were calculated using the maximum initial dilution zone total molybdenum concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (0.00036 mg/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MP = Middle of Plume.

Table 2-8 : Calculated Dilution Factors for Total Selenium at the Initial Dilution Zone

Discharged Condition	Sample Location at the Boundary of the Initial Dilution Zone	Date	Effluent Concentration (mg/L)	IDZ Concentration (mg/L)	Dilution Factor[a, b]
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-09	0.041	0.00023	372
HAD-3 – Hazeltine Discharge	QUL-57-MID	2022-05-10	0.041	0.00024	347
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-18	0.041	0.00024	356
HAD-3 – Hazeltine Discharge	QUL-58-S	2022-05-25	0.042	0.0002	497
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-05-31	0.042	0.00039	157
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-06	0.042	0.00048	119
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-06-27	0.043	0.0002	531
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-08-16	0.046	0.00062	93
HAD-3 – Hazeltine Discharge	QUL-58-B	2022-10-19	0.049	0.00059	106
HAD-3 – Hazeltine Discharge	QUL-58-MP	2022-06-27	0.043	0.0002	581

(a) Dilution factors were calculated using the maximum initial dilution zone total selenium concentrations from samples collected at various depths at the QUL-5 station.

(b) Dilution factors were calculated using the median ambient total dissolved solids concentration (0.00012 mg/L) from the QUL-2a station.

Note: Dates are presented as yyyy-mm-dd.

IDZ = initial dilution zone; S = Surface; B = Bottom; MID = Mid-depth; MP = Middle of Plume.

3.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions, please contact the undersigned.

WSP Canada Inc.



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STUDY LIMITATIONS

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APPENDIX 5-10: Long Term Far Field Diffuser Modelling

TETRA TECH EBA

TECHNICAL MEMO

ISSUED FOR USE

To:	Lyn Anglin, Imperial Metals Colleen Hughes, Mount Polley Mining Corporation	**Date:**	June 27, 2016
c:	Mike Herrell, Golder Associates	**Memo No.:**	001
From:	Daniel Potts, Tetra Tech EBA	**File:**	704-WTR.WTRM03015-01
Subject:	Mt. Polley Long Term Far Field Diffuser Modelling		

1.0 INTRODUCTION

Following the August 4, 2014 failure of its Tailings Storage Facility (TSF), Mount Polley Mine (the Mine) suspended operations. The failure of the TSF necessitated a new water management strategy, and in December 2015 the Mine was approved for short-term discharge of treated effluent into Quesnel Lake through two diffusers at a depth of approximately 50 m. For the present work, Tetra Tech EBA was retained to assess the potential long-term effects of continued discharge through these diffusers, currently installed.

1.1 Previous Related Work

Tetra Tech EBA previously completed several field and modelling studies related to water quality in Quesnel Lake.

- **Quesnel Lake Water Column Observations and Modelling** (Tetra Tech EBA, 2015a): Tetra Tech EBA was retained to perform both field measurements and numerical analyses to develop a predictive model that evaluated the fate of the suspended particulate material in Quesnel Lake and the turbidity resulting from that material.
- **Bathymetry Analysis and Volume Balance** (Tetra Tech EBA, 2015b): Tetra Tech EBA assessed the overall volume balance of the TSF failure event, giving consideration to all available sources of data, both on land and within Quesnel Lake.
- **Dilution Modelling at Potential Outfalls in Quesnel Lake** (Tetra Tech EBA, 2015c): Tetra Tech EBA was retained to assess the performance of proposed outfall designs in Quesnel Lake, particularly the long-term far field performance.

Golder Associates (Golder) conducted near-field modelling using CORMIX and conceptual outfall design (Golder, 2015a).

1.2 Objectives

The present work was undertaken in support of Mount Polley Mining Corporation (MPMC) in its application for a long-term permit for discharge into Quesnel Lake. This memorandum will be incorporated into a long-term Technical Assessment Report (TAR) as an appendix. The objectives of the present work were as follows:

- Assess the potential for dilution in Quesnel Lake under two preliminary “bookend” discharge scenarios, with consideration of long-term buildup over a decade.

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- Assess the potential for dilution in Quesnel Lake under three "detailed" discharge scenarios, with consideration of long-term buildup during the period of resumed mining operations.

1.3 Limnology Background Discussion

Quesnel Lake is a long, narrow fjord lake reaching from the Cariboo Mountains into the Interior Plateau of BC. Its average and maximum depths are 157 and 511 m, respectively, making it the deepest fjord-type lake in the world (Laval et al, 2008). It has a surface area of about 266 km^2 and a volume of 42 km^3. With a mean annual outflow of 128 m^3/s through the Quesnel River, the lake has an average hydraulic residence time of 10 years. At the west end of the lake, a contraction and sill at Cariboo Island partially separates the main body of the lake from the so-called "West Basin," which represents 8.6% and 2.3% of Quesnel Lake's surface area and volume, respectively. The West Basin's average and maximum depths are 43 and 107 m, respectively.

In temperate lakes, the temperature of the surface water passes through 4°C, the temperature of maximum density, twice annually in a well-understood cycle. Summer warming produces a layer of warm, buoyant water at the surface of a lake. The temperature difference, and thus density difference, between this layer and the cooler water beneath creates a resistance to mixing which stabilizes or stratifies the lake. In the fall, the surface layer cools, reducing the density difference between surface and deeper waters, until the stratification is overcome by wind-induced mixing. This mixing typically involves the entire water column and is commonly referred to as "fall overturn." Under winter conditions, cooling of the entire lake continues until the surface is less than 4°C, at which point a reverse winter stratification appears: a cold, buoyant surface layer overlies a warmer (closer to 4°C) deep layer. In the spring, warming of the surface layer leads up to "spring overturn" when, again, the stratification is overcome by wind-induced mixing. Continued warming of the surface layer re-forms the summer stratification and completes the annual cycle. These mixing episodes have previously been observed in Quesnel Lake in December and April. See, for example, thermistor data presented in Potts (2004) and in Laval et al (2012).

In temperate lakes deeper than about 100-200 m, the seasonal overturn cycle is complicated by high-pressure effects. The temperature of maximum density decreases with pressure, to approximately 3°C at a depth of 500 m. This means that seasonal overturn events can only involve the upper 100-200 m of the water column and deeper water is only renewed or displaced by subtle three-dimensional dynamics. For more discussion and numerous references, refer to Potts (2004) and Laval et al (2012). The main body of Quesnel Lake is subject to these effects. The West Basin of Quesnel Lake, however, with a maximum depth of just over 100 m, follows the normal seasonal overturn cycle for temperate lakes.

The three largest inflows to the lake are east of the sill, whereas Quesnel River flows out of the western tip of the West Basin, meaning that nearly all of the hydraulic throughput of the lake must pass through the West Basin. Based on an average annual outflow of 128 m^3/s, the West Basin's average residence time is about 90 days.

The sill separating the West Basin and the main body of the lake has a maximum depth of 35 m and forks around Cariboo Island. Wind setup and internal waves, or seiches, between the upper and lower layers in the water column cause two-layer exchange flow over the sill following strong wind events. Using temperature measurements, Potts (2004) estimated the rate of exchange flow to be on the order of 1500 m^3/s, which dwarfs the river outflow by an order of magnitude. This exchange is frequent enough and large enough to fully replace the water in the cool, deeper layer in 6-8 weeks (Laval et al, 2008), although the duration of individual exchange events is on the order of hours to a few days.

The key physical drivers of the lake are meteorological fluxes, wind, and rivers. Meteorological fluxes create the seasonal stratification and are dominated by shortwave and longwave radiation and evaporative heat transfer (Potts, 2004; Laval et al, 2012). Wind events are responsible for the seiche activity which can result in upwelling of cold water at the western tip of the lake and exchange flows across the sill (Laval et al, 2008) as well as episodic

deep water renewal (Laval et al, 2012). Rivers also influence circulation and deep water renewal, but to a lesser degree (Laval et al, 2012).

2.0 METHODS

2.1 Model Overview

Tetra Tech EBA used the EPA Visual Plumes UM3 model, embedded in the three-dimensional hydrodynamic model H3D, to evaluate the behaviour of an outfall plume in Quesnel Lake. UM3 is a numerical dilution model for outfall discharge into marine and freshwater environments, and is one of the models included in the Visual Plumes software. The model, developed and distributed by the US Environmental Protection Agency, is an accepted standard for determining environmental impacts from effluent discharge through an outfall. Tetra Tech EBA previously developed a three-dimensional hydrodynamic model of Quesnel Lake in order to describe the behaviour of the suspended material introduced to the lake after the August 4, 2014 TSF failure event. H3D is a three-dimensional hydrodynamic model that has been shown to accurately simulate the effects of tide, wind, river flow, density and time variability in receiving water bodies (Stronach et al., 1993). The Quesnel Lake implementation of the model was developed to simulate the temperature, turbidity, and total dissolved solids regime of the lake. The model is described in the report “Quesnel Lake Water Column Observations and Modelling” (Tetra Tech EBA, 2015a) including validation to historical data and simulation of the lake after the 2014 TSF failure event. The model grid for Quesnel Lake is shown in **Figure 2.1**, with diffuser locations and river inflow and outflow points labelled.

The existing hydrodynamic model of Quesnel Lake does not take into account pressure effects on water’s equation of state. Therefore, it does not reproduce the deep-water renewal processes of the main body of the lake. These processes are, however, inconsequential to the objectives of the present work focused in the West Basin, and generally only affect circulation in water bodies deeper than about 100-200 m.

For outfall assessments, the PLUMES UM3 code was integrated into H3D such that all of the simulated time-varying properties of velocity and density could have the appropriate influence on near-field plume behaviour, and the far-field behaviour could be simulated in a realistic manner. The UM3 model is valid in the near-field when boundary effects do not occur within the near-field, and when the plume dynamics do not cause significant recirculation in the receiving environment. The existing Quesnel Lake model resolution is relatively large (75 x 75 m at the diffuser location) in order to simulate the entire lake. As the point of interest for dilution modelling is 100 m from the outfall, the grid resolution is not suitable for near-field modelling. Near-field dilution is discussed in Golder (2015a) as well as Appendix H of the TAR; Golder used the CORMIX suite of near-field models to design and evaluate diffuser options. The salient difference between the long-term three dimensional approach (H3D-PLUMES) and the near-field approach (CORMIX) is the possibility of building up a background concentration of effluent in the three-dimensional model of the lake, reducing diffuser effectiveness regardless of near-field hydraulic performance.

Warm water is less dense than cool water, so a warm plume encountering the cool bottom waters of a lake is typically buoyant. On the other hand, given similar temperatures, a plume with higher suspended and dissolved solids than the receiving water will sink. The total dissolved solids (TDS) concentrations in the effluent (on the order of 1000 mg/L) are sufficient to overcome approximately 10°C worth of buoyancy. Therefore, the plume may tend either to sink or to rise, depending on its temperature and TDS concentration as well as those of the ambient water. The modelling method chosen is able to respond to these competing processes, including the background buildup of TDS and seasonal changes in effluent and lake temperature.

2.2 Representation of Effluent Characteristics

For modelling purposes, the diffuser effluent and receiving water were represented with the following properties: temperature, total suspended solids (TSS), TDS, and a dye tracer. Density was derived from temperature and TDS

by Chen and Millero's lake-specific equation of state (1986) at zero pressure, and modified for TSS using an assumed solids density of 2650 kg/m^3.

To enable a determination of the degree of effluent dilution achieved at a given point in the lake, the effluent was assigned a dye tracer concentration of 1.0, while the lake's other inflows were assigned a dye concentration of 0.0. The units of measurement for the dye can be interpreted as "m^3 of effluent per m^3 of sample." The dye was modelled as an inert, massless, soluble component. The dilution ratio can be calculated from the dye concentration at a given point; for example, a dye concentration of 0.01 represents 1 part effluent mixed with 99 parts ambient water – a dilution of 99:1.

In the "detailed" scenarios, selenium was added to the list of scalar constituents simulated.

2.3 Initial Conditions

The water temperature profile in the hydrodynamic model was initialized using the 26 November 2015 observation made by the Mine at QUL-66a (see **Figure 2.1**). This conductivity-temperature-depth (CTD) profile showed a nearly-homogeneous water column with temperature ranging from 5.7°C at the surface to 5.0°C at the maximum depth of the cast (90 m). Below 90 m, the initial temperature throughout the lake was assumed as 4.0°C.

For the "bookend" scenarios, the initial concentrations of TSS and TDS were taken as 1.5 and 78 mg/L, respectively, throughout the lake. These values were average measurements from sites near Hazeltine Creek mouth (Golder, 2015a). For the "detailed" scenarios, initial TSS was kept at 1.5 mg/L; however, initial TDS was adjusted to 69 mg/L and the initial selenium concentration was set to 0.00014 mg/L to match measurements east of Cariboo Island (values provided by Golder).

In all scenarios, the initial dye concentration was zero, to represent the absence of effluent.

2.4 Diffuser Discharge Hydrographs and Properties

The purpose of modelling the "bookend" scenarios was to provide preliminary estimates of dilution in Quesnel Lake before input data were available for a more detailed analysis. The defining characteristic of each of the two scenarios is the assumed hydrograph and properties of the discharge through the diffusers. The two "bookend" scenarios, Option 1 and Option 2, are described below.

The purpose of modelling the "detailed" scenarios was to provide best estimates of the resulting water quality in Quesnel Lake under a statistical range of predicted water quality in the discharge, from 5th to 95th percentile concentrations. The discharge characteristics for the "detailed" scenarios are described below.

2.4.1 Option 1 "Bookend" Discharge

Option 1 used a steady simulated flow rate of 0.33 m^3/s (10.4 Mm^3/yr). The steady flow represents discharge through a pipeline, bypassing the sedimentation ponds, and thus excluding any flow contribution from the lower reaches of Hazeltine Creek. Discharge was simulated beginning on 1 December 2005, to match the season that the Mine's discharge began under their short term discharge permit (1 December 2015). **Section 2.6.1** justifies the selection of 2005-2015 as the simulation period. The total simulated volume of effluent discharged from 1 December 2005 to 31 December 2015 was 105 Mm^3.

The temperature of the effluent was based on estimated monthly average temperatures at end of pipe, provided by Golder and consistent with the 2015 TAR (Golder, 2015a), and varied between 0.0 and 17.5°C. The TDS concentration in the effluent was assumed to be 1000 mg/L, based on the 75th percentile concentration in Springer Pit predicted by the Updated TAR Model (Golder, 2015b). Consistent with the Environmental Management Act

permit, the TSS concentration in the effluent was assumed to be 15 mg/L. As there was no mixing with Hazeltine Creek, the dye concentration was a constant 1.0. **Figure 2.2** illustrates the diffuser discharge hydrograph and properties for Options 1 and 2.

2.4.2 Option 2 "Bookend" Discharge

For the Option 2 scenario, the discharge is assumed to pass through the sedimentation ponds, thus mixing with water from Hazeltine Creek. Since the capacity of the diffuser system is 0.60 m^3/s, the treatment plant was assumed to shut down whenever the Hazeltine Creek flow exceeded 0.27 m^3/s. The discharge through the diffusers was therefore defined as indicated in **Table 2.1**, below. The total simulated volume of effluent discharged from 1 December 2005 to 31 December 2015 was 80 Mm^3, which is 76% of the total discharge in Option 1.

Table 2.1: Discharge Definition for Option 2

When Hazeltine Creek Base Flow Was	The Discharge Was
Less than 0.27 m^3/s,	Hazeltine Creek base flow plus 0.33 m^3/s of effluent.
Between 0.27 and 0.60 m^3/s,	Hazeltine Creek base flow only.
Greater than 0.60 m^3/s,	Exactly 0.60 m^3/s of Hazeltine Creek base flow.

The temperature and other properties of the effluent were assumed to be the same as in Option 1. Properties of the combined effluent and Hazeltine Creek discharge were calculated according to the proportion of flow from each source (**see Figure 2.2**). The properties of the Hazeltine Creek base flow are described in **Section 2.7**, below.

2.4.3 "Detailed" Scenario Discharges

The three "detailed" scenarios used discharge flow rates representing average-year hydrology at the mine site. The discharge was a mixture comprised of up to three streams at any given time, coming from the Perimeter Embankment Till Borrow Pond, Springer Pit, and Hazeltine Creek. The flow rates and concentrations of TDS and selenium for each of these streams were provided digitally to Tetra Tech EBA by Golder. Effluent flows are mingled with Hazeltine Creek flows from the simulation start until the end of November 2017, at which time a pipeline is assumed to be commissioned. A bypass conveying flows from Springer Pit is active from May 2016 to May 2017, inclusive, at which time the dewatering of Springer Pit is projected to be completed. For the concentrations of TDS and selenium, three time series were provided, corresponding to 5^{th}-percentile, median, and 95^{th}-percentile predictions of Golder's probabilistic water quality model (see Appendix D of the TAR). In this context, the 95^{th}-percentile water quality predictions are relatively high values which are exceeded in only 5% of the model cases.

The discharge temperatures were estimated from the monthly temperatures of Hazeltine Creek and the effluent, discussed above, and combined in proportion to the respective flow rates. The TSS concentrations in Hazeltine Creek and the effluent were both assumed to be a constant 5.0 mg/L, matching the average concentration observed in Hazeltine Creek (sample location HAC-12) after the water treatment plant became operational (data provided by MPMC). The simulated dye concentration was 1.0 in the effluent streams, and was diluted appropriately when the discharge included water from Hazeltine Creek.

Figure 2.3 shows the discharge characteristics for the 5^{th}-percentile, median, and 95^{th}-percentile water quality "detailed" scenarios. Flow rates are presented as a total for the two diffusers.

2.5 Diffuser Physical Characteristics

The physical characteristics of the diffusers were modelled based on the information shown in drawings 101 through 105 in "HDPE PIPELINE - TEMPORARY DISCHARGE TO QUESNEL LAKE," issued for record and sealed 13 November 2015. There are two diffusers, installed at depths of 45 and 50 m below the water surface. Each diffusers has two ports spaced 15 m apart, each 0.20 m (8 inches) in diameter, which angle up at 45° above the bed slope. The diffuser ports are approximately 1 m above the lake bed.

Although changes to the existing diffuser configuration may be considered for future operations, only the existing configuration was assessed by the modelling described in this memo.

2.6 Meteorological Inputs

One advantage of running a continuous simulation over a decade is the opportunity to see the effects of variable hydrologic and meteorological inputs year by year. Rather than constructing an artificial set of inputs by means of statistics, Tetra Tech EBA chose to use surrogate historical periods to represent the potential future conditions. This approach preserves the linkages between winds, temperatures, and precipitation that would be lost under a stochastic approach.

Meteorological inputs were chosen differently for the "bookend" scenarios than for the "detailed" scenario. The "bookend" runs aimed to make basic assumptions about effluent flow and assess long term buildup under a range of environmental conditions. By contrast, the "detailed" run aimed to make a best estimate of the discharge and assess long term buildup under unfavourable environmental conditions.

2.6.1 Inputs for "Bookend" Scenarios

For the "bookend" scenarios, a surrogate historical decade of hydrologic and meteorological inputs was used to simulate the natural range of environmental conditions, while the effluent flow was held constant. Selection of the most appropriate historical decade was based primarily on winds, which are the strongest driver of mixing in Quesnel Lake, and are therefore the dominant influence over long term buildup. Wind energy is most effective at mixing the lake during the spring and fall overturn processes, which typically happen during the April-May-June and October-November-December periods, respectively.

In keeping with the modelling completed for the short-term discharge permit, wind and other meteorological inputs to the model were derived from the Williams Lake Airport (YWL) records. The period of record at YWL runs from 1961 to present. This period was screened for wind mixing energy by evaluating the root-mean-square (RMS) wind speeds during the two sensitive periods for overturn: April-May-June and October-November-December. The decade with the greatest variation in wind mixing energy was 2006-2015. This decade was therefore selected for the "bookend" models.

Other meteorological parameters of interest are temperature and precipitation, which influence stratification and flow through the lake, respectively. Temperatures were characterized by calculating the average temperature during the expected summer stratification period – May through October. Precipitation was characterized using an annual total. Since river flows are significantly influenced by snow pack, the precipitation for a given year was totaled between September 1st of the preceding year and August 31st to account for winter accumulation.

Table 2.2 below summarizes the variability of wind mixing energy, summer temperatures, and annual precipitation in the decade chosen for the "bookend" simulations. Each parameter is described in terms of its variation from the mean over the period of record at YWL. For example, in 2013 the RMS wind speed in the sensitive periods was 13% lower than average, summer temperatures were 1.1°C warmer than average, and precipitation was 2% less than average.

Table 2.2: Variability in Meteorological Conditions during "Bookend" Decade

Yearly Variation In			
Year	**Windiness**	**Summer T (°C)**	**Precipitation**
2005	0%	-0.2	24%
2006	-1%	0.7	-16%
2007	-7%	-0.1	0%
2008	-6%	-0.1	15%
2009	-2%	0.7	-1%
2010	9%	0.2	-15%
2011	0%	-0.6	24%
2012	1%	0.2	-7%
2013	-13%	1.1	-2%
2014	4%	1.2	18%
2015	2%	1.3	-5%

2.6.2 Inputs for "Detailed" Scenarios

For the "detailed" scenarios, the buildup of effluent in the lake was assessed in relatively unfavourable environmental conditions. Maximum buildup of effluent in the lake would be expected when the least amount of wind energy is available for mixing. The year with the lowest wind energy was 2013, so this year was selected for the "detailed" scenarios. Since the simulations require multi-year duration, the hydrologic and meteorological inputs from 2013 were repeated, or looped, to extend the input period.

Results from the Option 1 "bookend" scenario confirmed that, as expected, the greatest increase in background effluent concentrations in the lake occurred in 2013 (see **Section 3.2**).

2.7 Hydrologic Inputs

The West Basin of Quesnel Lake, into which the diffusers discharge, is at the "downstream" end of the Lake, meaning that the hydraulic throughput of the Lake must all pass through the West Basin. Quesnel River, which flows out of the West Basin, has an annual average flow rate of 128 m^3/s. Based on this flow rate, the average hydraulic residence time of the West Basin is about 90 days.

The major rivers flowing into Quesnel Lake are Horsefly River, Mitchell River, and Niagara Creek. Numerous smaller streams enter the lake as well, including Hazeltine Creek. Inflows to the Quesnel Lake model were represented using the three major rivers, with flows from the lesser streams lumped together with the most appropriate major rivers, following the methods of Potts (2004). Potts's methods predict average monthly inflows to Quesnel Lake, based on historically gauged catchments within and surrounding the Quesnel Lake watershed. To account for yearly differences in precipitation, the average monthly inflows in each year were scaled up or down according to the year's variance in precipitation, as shown in **Table 2.2** above. For example, monthly inflows for 2006 were scaled down from the average by 16%.

For the major rivers, temperatures were taken as the average monthly temperatures measured by Potts (2004). TSS in the Horsefly and Mitchell Rivers was assumed to be 1.5 mg/L, matching the initial condition in the Lake, while TSS in Niagara Creek was taken as 81 mg/L, a value derived from the observations of James (2004). All three major rivers were assumed to have TDS and selenium concentrations matching the initial concentrations in the Lake for the respective runs.

Despite its very small annual average flow rate of approximately 0.24 m^3/s, Hazeltine Creek was included in the "bookend" scenarios as a distinct inflow since estimated flows were available. The flow rate for Hazeltine Creek was derived from synthetic data created by SNC-Lavalin, extrapolated from the gauge location to the creek mouth by a ratio of catchment areas. For simulation years in which the synthetic data had gaps, the gaps were filled by inserting data from other years with similar annual precipitation; for example, gaps in 2014 data were filled with values from the same dates in 1991 (precipitation year totals 516.8 and 518.1 mm, respectively, at YWL). For the "detailed" scenarios, Hazeltine Creek was not included as a distinct inflow to avoid conflict with the monthly flows provided by Golder.

Average monthly temperatures for Hazeltine Creek were taken from MPMC (2009). For the "bookend" scenarios, TSS and TDS were assumed to be 3.3 and 81 mg/L, respectively (Golder, 2015a). For the "detailed" scenarios, TSS was assumed to be 5.0 mg/L, matching the average concentration observed in Hazeltine Creek (sample location HAC-12) after the water treatment plant became operational (data provided by MPMC). TDS and selenium concentrations were assumed to be 247 and 0.001 mg/L, respectively, matching baseline water quality values provided by Golder.

The outflow from the Quesnel Lake model was managed using a weir-type condition to represent Quesnel River's stage-discharge relationship.

Tetra Tech EBA validated the model's hydrology by comparing the simulated lake level against observed lake level at the Water Survey of Canada gauge near Likely from 2006 to 2014. The observed lake level varies 2.4 m in an average year, with a mean lake level of 0.8 m gauge; the simulated lake level varies 2.0 m in an average year with a mean level of 0.9 m gauge. This validation demonstrates that the weir-type outflow condition and the estimated inflows reasonably reproduce the natural rise and fall of the lake level. This degree of agreement is adequate for the present purpose, considering the scarcity of input data and the relatively small influence of hydrology on the model's predictions of long term effluent buildup.

2.8 Sources of Uncertainty

Table 2.3 lists sources of uncertainty in the predictions of water quality in Quesnel Lake stemming from the modelling approach and assumptions described above. Comments are provided describing how the uncertainty is addressed and what bias may be expected in the model's predictions.

Table 2.3: Uncertainty Analysis for Long Term Water Quality Predictions in Quesnel Lake

Source of Uncertainty	How Uncertainty is Addressed in Modelling	Expected Bias to Predicted Water Quality in Quesnel Lake
Future meteorological conditions.	Conditions from past years are used as surrogate data to represent future conditions.	No bias expected; however, random extremes or a changing climate could influence future outcomes.
Wind speed and direction over Quesnel Lake.	Wind speeds are assumed to match those measured at YWL; wind direction is rotated locally so that the dominant wind direction aligns with the lake's axis.	No bias expected; validations done in previous work support these assumptions as making the best use of the available data.
Hydrology in Quesnel Lake catchment area.	Average monthly inflows to the lake are modified by a factor for each year, based on precipitation at YWL.	No bias expected to long-term water quality; short-term variability (days to months) may be underestimated.
Coarseness of hydrodynamic model's horizontal resolution.	Complete mixing implicitly assumed in the model cell where EPA Plumes places the plume; results are reported only outside a 1-cell radius around the diffusers.	Dilution may be overestimated in the few cells closest to the diffusers; no bias expected in the far field.
Effluent flow rates in "bookend" scenarios.	High flow rates assumed, subject to simple rules.	Predictions biased toward worse water quality.
Effluent flow rates in "detailed" scenarios.	Monthly flow rates were provided by Golder as best estimates of average future conditions.	No bias expected to long-term water quality; short-term variability (days to months) may be underestimated.
Effluent temperatures and Hazeltine Creek temperatures, which strongly influence plume density.	Average monthly temperatures were applied in the model.	No bias expected to long-term water quality; short-term variability (days to months) may be underestimated.
Effluent quality in "bookend" scenarios.	Constant concentrations were assumed.	Variability due to effluent quality is not reflected.
Effluent quality in "detailed" scenarios.	Model included daily variation in concentrations, predicted at three probabilistic levels (5^{th}, 50^{th} and 95^{th} percentiles).	The 5^{th} and 95^{th} percentile predictions are expected to bias the predicted lake water quality downwards and upwards, respectively.

In general, the uncertainties described above were addressed in ways that resulted in the best estimate of long-term far field water quality. This was the primary objective of the modelling effort.

The corollary of this approach is that short-term variability and near-field dilution were lower priorities for modelling. For example, short-term variability due to effluent temperatures and flow rates is not reflected in the model due to the use of monthly averages for these parameters. Furthermore, near-field dilution (within a few cells of the diffuser) may be overestimated due to the coarseness of the model's horizontal resolution.

3.0 RESULTS

This section presents the results of the modelling introduced above. First, some example maps and sections are presented to orient the reader to the model's capabilities. Next, the results of the "bookend" scenarios are presented and discussed; and finally the results of the "detailed" scenarios are presented and discussed.

3.1 Example Model Outputs

Figures 3.1 and 3.2 show some examples of model output from the "bookend" scenarios. These examples facilitate discussion of some important model dynamics and set the background for further results presentation.

Figure 3.1 shows a snapshot of the West Basin condition on 12 August 2010 in the Option 1 scenario simulation. The main panel is a plan view or map showing most of the West Basin, with black line contours showing depth at 25-m intervals. The colour scheme represents dilution of the effluent as computed from the dye concentration in the model. The colour shown in each model cell represents the worst (lowest) dilution in the water column at that location and at the snapshot time.

For regulatory purposes, an initial dilution zone (IDZ) is commonly defined as a 100-m radius around the point of discharge. The horizontal resolution of the model is approximately 75 m at the diffuser location. To represent the IDZ, therefore, a 1-cell buffer has been applied around diffuser cells. The buffer was applied as a post-processing step and did not affect model dynamics. In the plan view, dilution within this IDZ has been blanked (light grey). In **Figure 3.1**, the worst dilution outside the IDZ is in the yellow cells southeast of the diffusers, in the range of 20:1 to 30:1.

The inset in **Figure 3.1** shows a cross-section of the West Basin at the diffuser location (see dashed red line on the map), viewed as if looking northwest. The diffusers are marked on the left slope of the lake bottom. The black line contours are temperature, at varying intervals chosen for visual effect. Colours represent dilution again, on the same colour scale as on the map. This section illustrates a strong temperature stratification in the West Basin, typical of summer conditions. The warm effluent discharging into the cool, deep ambient water is buoyant despite its TDS concentration, and the plume rises to approximately 20 m depth (yellow band above diffusers). The IDZ is not blanked on the inset.

Figure 3.2 shows a snapshot of the West Basin condition on 5 November 2014 in the Option 2 scenario simulation. The main panel is identical to **Figure 3.1** in its layout. The worst dilution outside the IDZ is in the yellow cells northeast of the diffusers, again in the range of 20:1 to 30:1.

The inset in **Figure 3.2** shows a longitudinal cross-section of the West Basin along its thalweg (path of greatest depth – see dashed red line on the map), viewed as if looking northeast. The diffusers are marked with dashed circles where the section passes them. At this point in the simulation, the summer temperature stratification has weakened significantly, and wind events can cause internal waves with vertical amplitudes in the tens of metres. These seiches draw the plume back and forth along the long axis of the basin, and can result in "re-dosing," where water carrying moderately-diluted effluent is drawn back past the diffusers to receive a second "dose" of effluent. The highest concentrations of effluent are off the section line and therefore do not appear in the inset.

3.2 Results from "Bookend" Scenarios

The objective of the "bookend" scenarios was to evaluate the capacity for dilution in Quesnel Lake, under a long-term discharge through a range of hydrologic and meteorological conditions. **Figure 3.3** provides time series of dilution for Option 1 (red; steady effluent flows) and Option 2 (black; effluent mixing with Hazeltine Creek). The vertical axis is dilution ratio on a log scale, with smaller numbers (worse water quality) towards the top. The dots

mark the lowest dilution in the model domain, outside the IDZ, from data archived at 24-hour intervals. The bold solid lines are 30-day moving averages of the worst dilution (dots). The fine dotted lines are 30-day moving averages of the worst dilution *at the water surface*. The 30-day moving averages were computed because some constituents, such as selenium, are subject to guidelines defined in those terms.

In Option 1, the worst predicted dilution was 23:1, occurring in summer while the plume was buoyant and subject to trapping under the thermocline. The example model output shown in **Figure 3.1** corresponds to this point in the Option 1 simulation: that is, the red dot at 12 August 2010 in **Figure 3.3** represents the 23:1 dilution in the worst yellow cell in **Figure 3.1**.

In Option 2, the worst predicted dilution was 27:1, occurring in fall with stratification weakening and significant seiche activity leading to local re-dosing. The example model output shown in **Figure 3.2** corresponds to this point in the Option 2 simulation: that is, the black dot at 5 November 2014 in **Figure 3.3** represents the 27:1 dilution in the worst yellow cell in **Figure 3.2**.

Simulated dilution in Option 2 is generally better than in Option 1 for two reasons. First, the Option 2 discharge was only 76% of the Option 1 volume, so there is less total buildup of effluent in the basin. Second, Option 2 involved mixing the effluent with Hazeltine Creek base flow, pre-diluting the effluent as well as affecting density.

To aid understanding of the circulation dynamics, Tetra Tech EBA computed a mass balance of the effluent in the West Basin for the Option 1 simulation. **Figure 3.4** presents a time series of the terms of the mass balance: cumulative effluent discharge, cumulative effluent exited via Quesnel River, cumulative effluent exited over the sill into the main body of the lake, and instantaneous effluent content of the West Basin. At any time, the cumulative effluent discharge must equal the sum of the other three terms. The Option 1 discharge was 0.33 m^3/s, or about 10.4 Mm^3/year. The buildup of effluent in the West Basin reached a quasi-steady state within 2 years. After this time, the West Basin generally contained about 3.5 to 6 Mm^3 of effluent (thick black line), or roughly half a year's worth of discharge. Of the remaining effluent, about 80% was transported out the Quesnel River, and 20% was exchanged over the sill into the main body of the lake. Exchange over the sill was episodic and occurred most often in late fall, whereas transport out Quesnel River was continuous and had its maximum rate during spring overturn (May and June). After steady state was reached, the only differences year-to-year were due to environmental conditions. The year with the greatest buildup of effluent was 2013, measured as the change in West Basin effluent content from 31 December to 31 December. Therefore, 2013 was deemed the worst year of the simulated decade in terms of effluent buildup.

3.3 Results from "Detailed" Scenarios

The objective of the "detailed" scenarios was to evaluate the capacity for dilution in Quesnel Lake, under a long-term discharge of varying properties estimated to represent discharge from the resumed operations of the Mine. **Figure 3.5** provides time series of dilution for discharges with 5th percentile (black), median (blue), and 95th percentile (red) estimated water quality. The layout of the figure is very similar to that of **Figure 3.3**, with dots representing instantaneous values at 24-hour intervals, and lines representing 30-day moving averages. The worst predicted dilutions occur in early summer, when the plume is buoyant, in the years 2018 through 2020. In these years the pipeline is in use, meaning that the effluent is not pre-diluted by Hazeltine Creek.

Examination of model outputs at hourly intervals (not shown) revealed that variations can occur at time scales as short as 3-6 hours. These variations could be due to changes in wind, solar heating, and internal waves in the lake. Instantaneous worst dilutions appearing in the simulations may not reflect daily averages, which are generally used for effects assessment. Therefore, data archived at hourly intervals were combined to produce daily-average worst dilutions during the critical periods of the "detailed" scenarios. **Table 3.1** lists the worst instantaneous dilutions found

at 24-hour intervals (midnights) beside the corresponding worst daily averages and worst 30-day averages, for the three water quality scenarios.

The "detailed" scenarios included selenium as a specific water quality parameter. **Figure 3.6** presents time series of the predicted selenium concentrations. The baseline Quesnel Lake concentration, 0.00014 mg/L, is indicated with a faint grid line, as is the British Columbia Ministry of Environment (MoE) 30-day average guideline of 0.002 mg/L (MoE, 2014). Similar to dilution, the worst selenium concentrations outside the IDZ were archived at 24-hour intervals. The thick lines plotted in **Figure 3.6** represent 30-day moving averages of these concentrations. The fine dotted lines represent 30-day moving averages of worst selenium concentrations *at the water surface*. **Table 3.1** also lists the worst 30-day average selenium concentrations for each scenario.

Table 3.1: Worst Conditions Predicted in "Detailed" Scenarios

Water Quality Scenario	Worst Instantaneous Dilution at Midnight	Worst Daily-Average Dilution	Worst 30-Day Average Dilution	Worst 30-Day Average Selenium Concentration (mg/L)
5th Percentile	24:1	23:1	38:1	0.0009
Median	26:1	28:1	39:1	0.0010
95th Percentile	27:1	28:1	40:1	0.0015

The worst predicted dilutions occur in the 5th-percentile water quality scenario. Worst dilutions generally occurred in summer when the plume was buoyant and was trapped below the thermocline. The 5th-percentile scenario had lesser TDS concentrations, and was therefore more buoyant in summer and more affected by the trapping dynamic, leading to worse predicted dilutions during the summer period. However, the worst predicted selenium concentrations occurred in the 95th-percentile scenario. The higher selenium concentrations in the effluent outweighed the slightly better dilutions generally achieved.

4.0 CONCLUSIONS

Tetra Tech EBA used a hydrodynamic model of Quesnel Lake in combination with the EPA Visual Plumes UM3 model to simulate water quality in Quesnel Lake with long-term discharge of mine water from the existing diffusers near the mouth of Hazeltine Creek.

Two "bookend" scenarios were simulated, with constant discharge characteristics and variable environmental conditions. Results from these scenarios indicated that:

- The worst water quality outside the IDZ typically occurs in summer when the effluent plume is buoyant and gets trapped below the thermocline;
- Buildup of background effluent concentration in the West Basin of Quesnel Lake reaches a quasi-steady state within 2 years, and this state represents approximately half a year's worth of discharge; and
- The strength of the wind during spring and fall overturn periods is the most significant environmental factor for long-term buildup.

Three "detailed" scenarios were simulated, with relatively unfavourable environmental conditions and varying discharge characteristics representative of resumed operations at the Mine. Results from these scenarios indicated that:

- The worst predicted daily-average dilution outside the IDZ would range from 23:1 to 28:1, depending on the concentration of TDS in the effluent;
- The worst predicted 30-day average dilution outside the IDZ would range from 38:1 to 40:1, depending on the concentration of TDS in the effluent;
- The worst predicted selenium concentration outside the IDZ would range from 0.0009 to 0.0015 mg/L, depending on the concentrations of selenium and TDS in the effluent; and
- Higher TDS and selenium concentrations in the effluent led to higher selenium concentrations outside the IDZ, despite an improvement in summer dilution due to reduced buoyancy of the effluent plume.

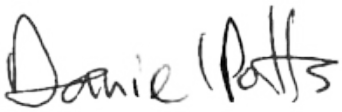
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This report and its contents are intended for the sole use of Mount Polley Mining Corporation and their agents. Tetra Tech EBA Inc. does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than Mount Polley Mining Corporation, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this report is subject to the terms and conditions stated in Tetra Tech EBA's Services Agreement. Tetra Tech EBA's General Conditions are attached to this memo.

6.0 CLOSURE

We trust this technical memo meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech EBA Inc.



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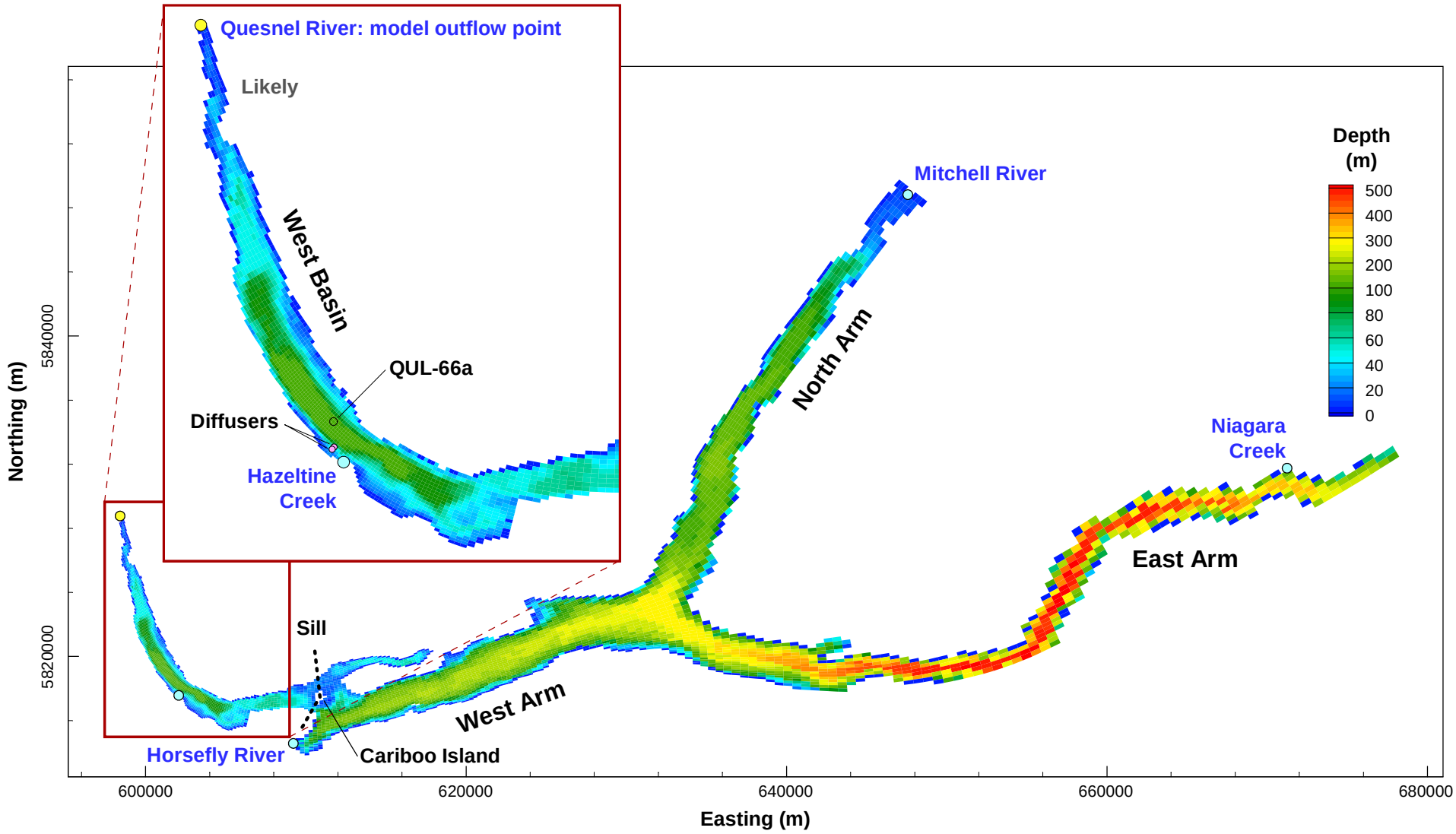
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Tetra Tech EBA, 2015b. Bathymetry Analysis and Volume Balance. Prepared for MPMC, May 2015.

Tetra Tech EBA, 2015c. Dilution Modelling at Potential Outfalls in Quesnel Lake. Memorandum #005 to MPMC, May 2015. Appendix F to TAR submitted to MPMC, May 2015.

FIGURES

Figure 2.1 Quesnel Lake Hydrodynamic Model Bathymetry
Figure 2.2 Diffuser Discharge Properties for Bookend Scenarios
Figure 2.3 Diffuser Discharge Properties for Detailed Scenarios
Figure 3.1 Option 1 “Bookend” Scenario Example Model Output: Dilution – Plan and Section
Figure 3.2 Option 2 “Bookend” Scenario Example Model Output: Dilution – Plan and Section
Figure 3.3 Simulated Dilution in Quesnel Lake “Bookend” Decadal Runs Options 1 and 2
Figure 3.4 Option 1 “Bookend’ Scenario Effluent Volume Balance
Figure 3.5 Simulated Dilution in Quesnel Lake “Detailed” Scenario Runs
Figure 3.6 Simulated Selenium in Quesnel Lake “Detailed” Scenario Runs



NOTES

Horizontal model resolution varies as shown, with higher resolution in the West Basin and West Arm, and lower resolution in the North and East Arms.

Modelled inflowing and outflowing rivers are labelled. The inset of the West Basin shows the diffuser locations.

STATUS
ISSUED FOR USE

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QUESNEL LAKE DIFFUSER MODELLING

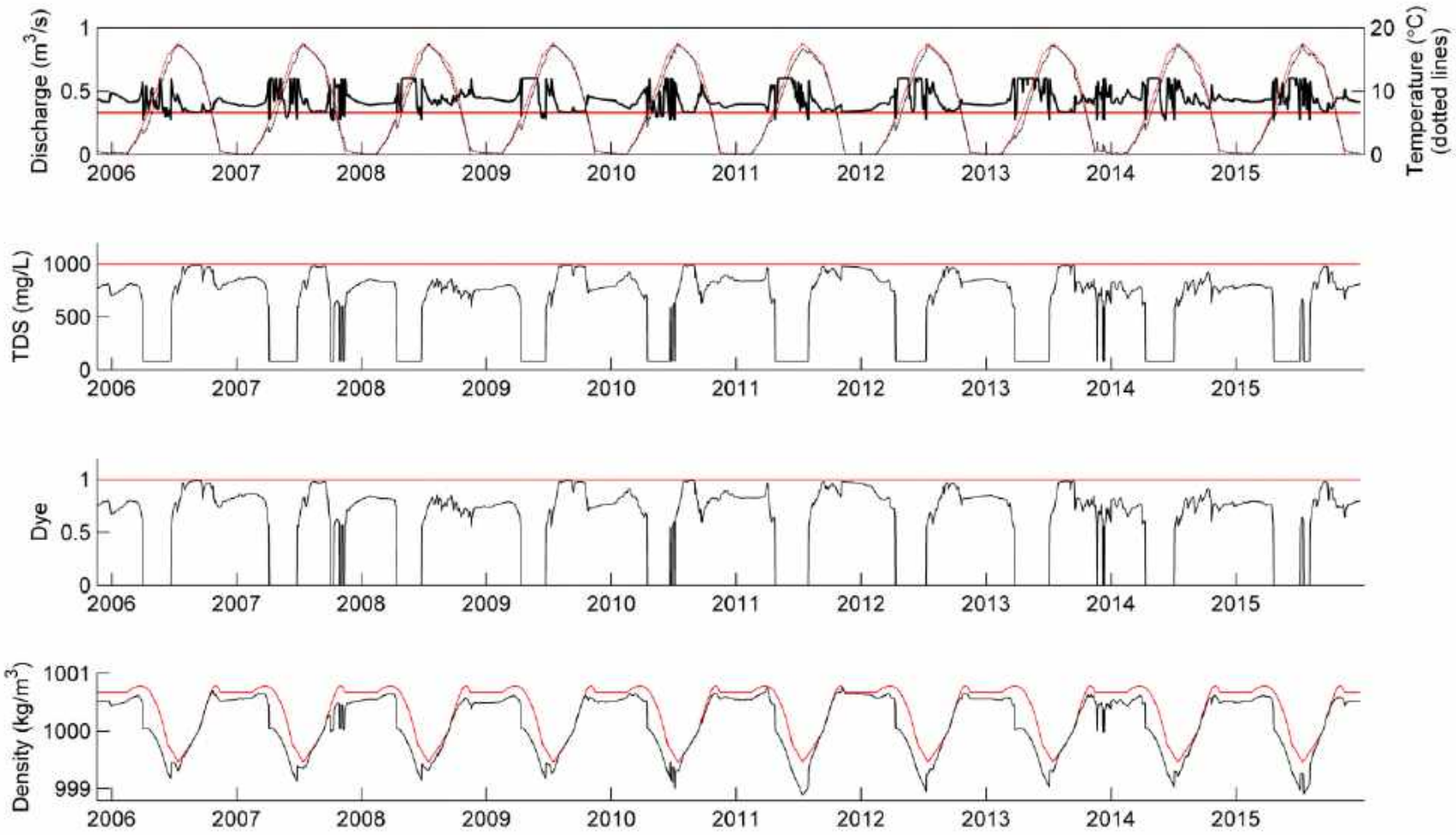
Quesnel Lake Hydrodynamic Model Bathymetry

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PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

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DATE: May 16, 2016

Figure 2.1



NOTES

Legend:

Option 1
Option 2

STATUS
ISSUED FOR USE

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QUESNEL LAKE DIFFUSER MODELLING

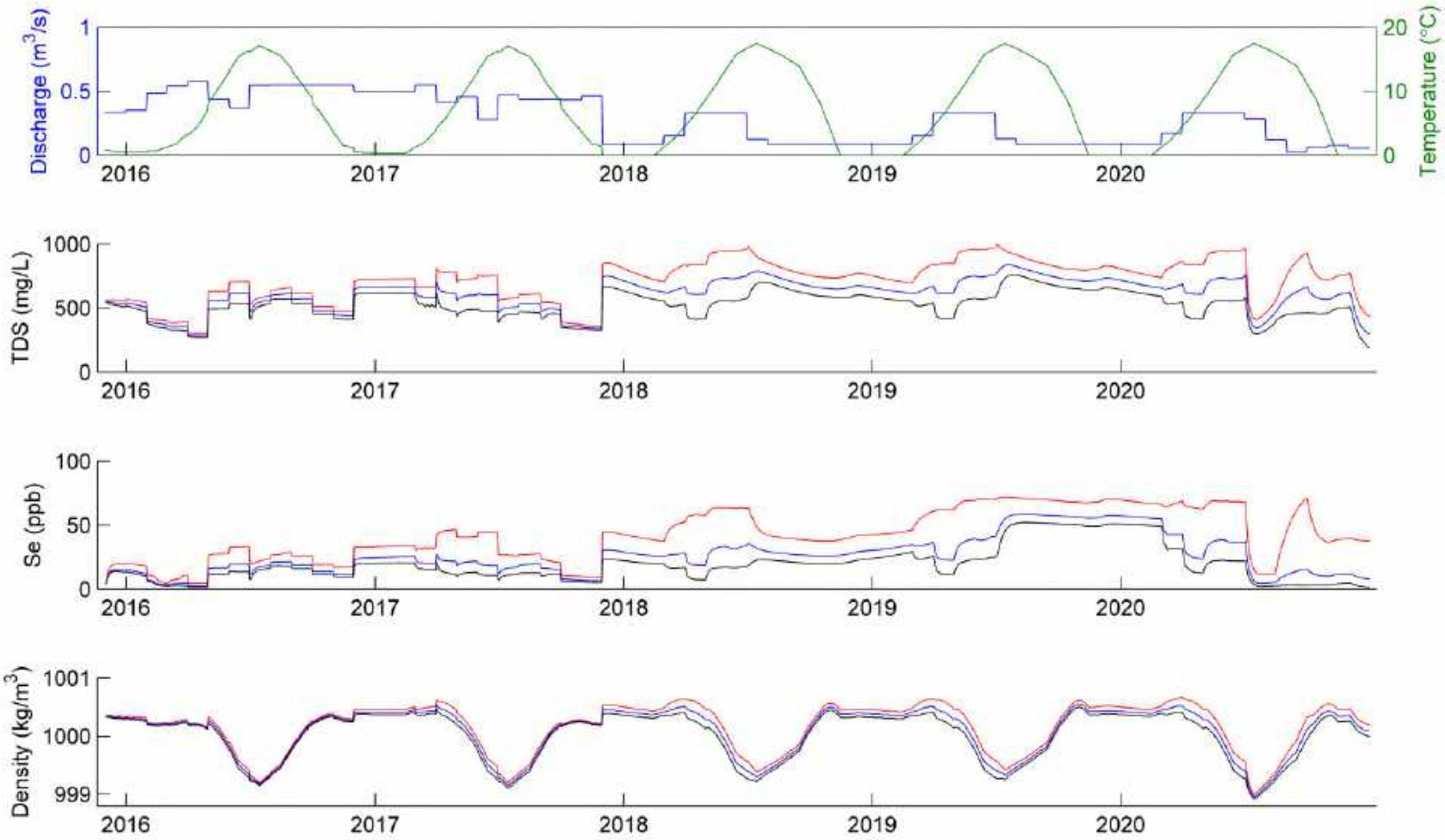
Diffuser Discharge Properties for "Bookend" Scenarios

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WTRM03015	DP	JAS	JAS	0

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Figure 2.2



NOTES

Legend:

- 95th Percentile WQ
- Median WQ
- 5th Percentile WQ

STATUS
ISSUED FOR USE

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QUESNEL LAKE DIFFUSER MODELLING

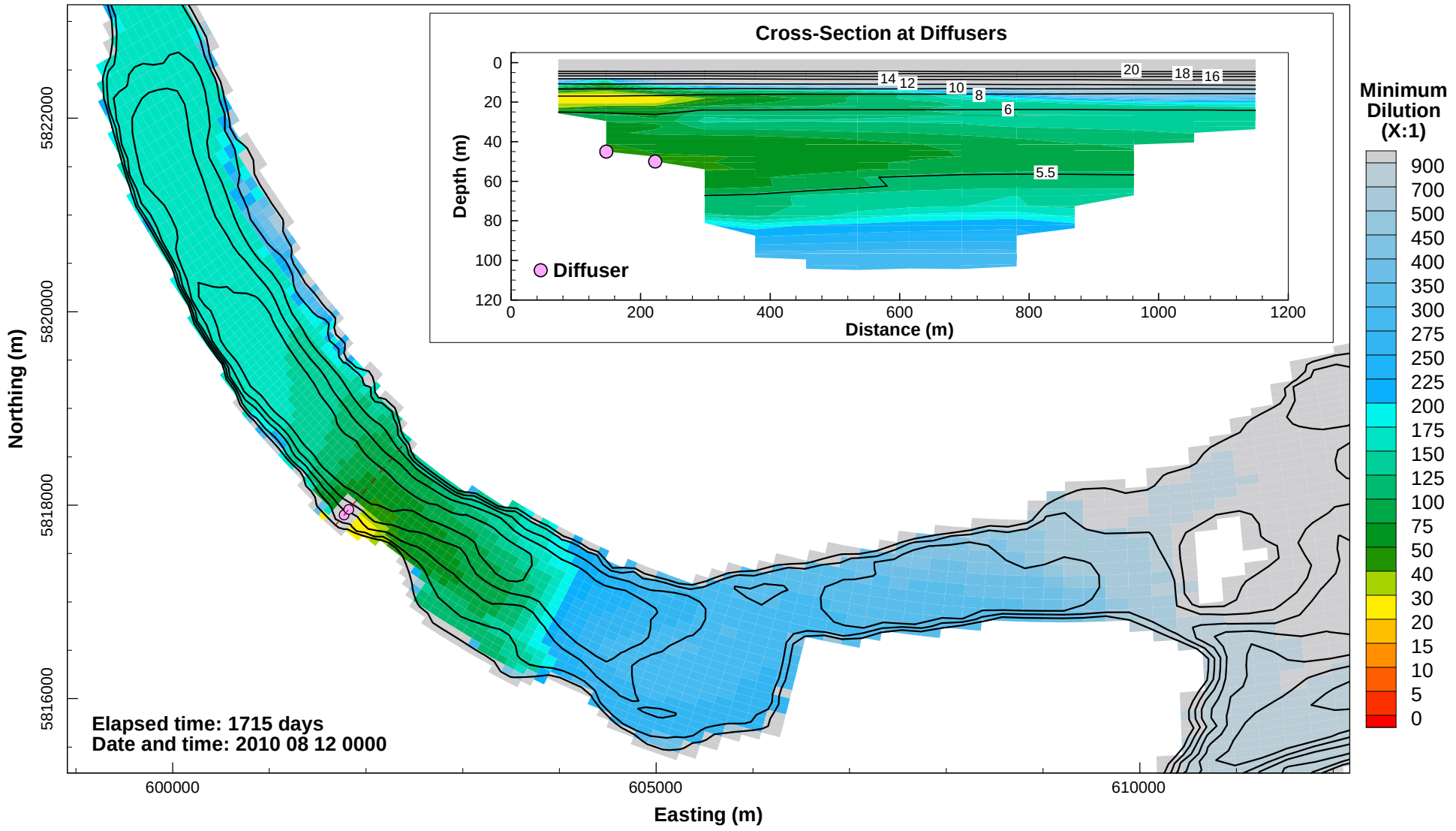
Diffuser Discharge Properties for "Detailed" Scenarios

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WTRM03015	DP	JAS	JAS	0

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Figure 2.3



NOTES

Effluent flow rate: 0.33 m^3/s.

Plan view shows minimum dilution at any depth, with bathymetric line contours @ 25 m.
Section view shows dilution across West Basin, with temperature line contours.

STATUS
ISSUED FOR USE

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QUESNEL LAKE DIFFUSER MODELLING

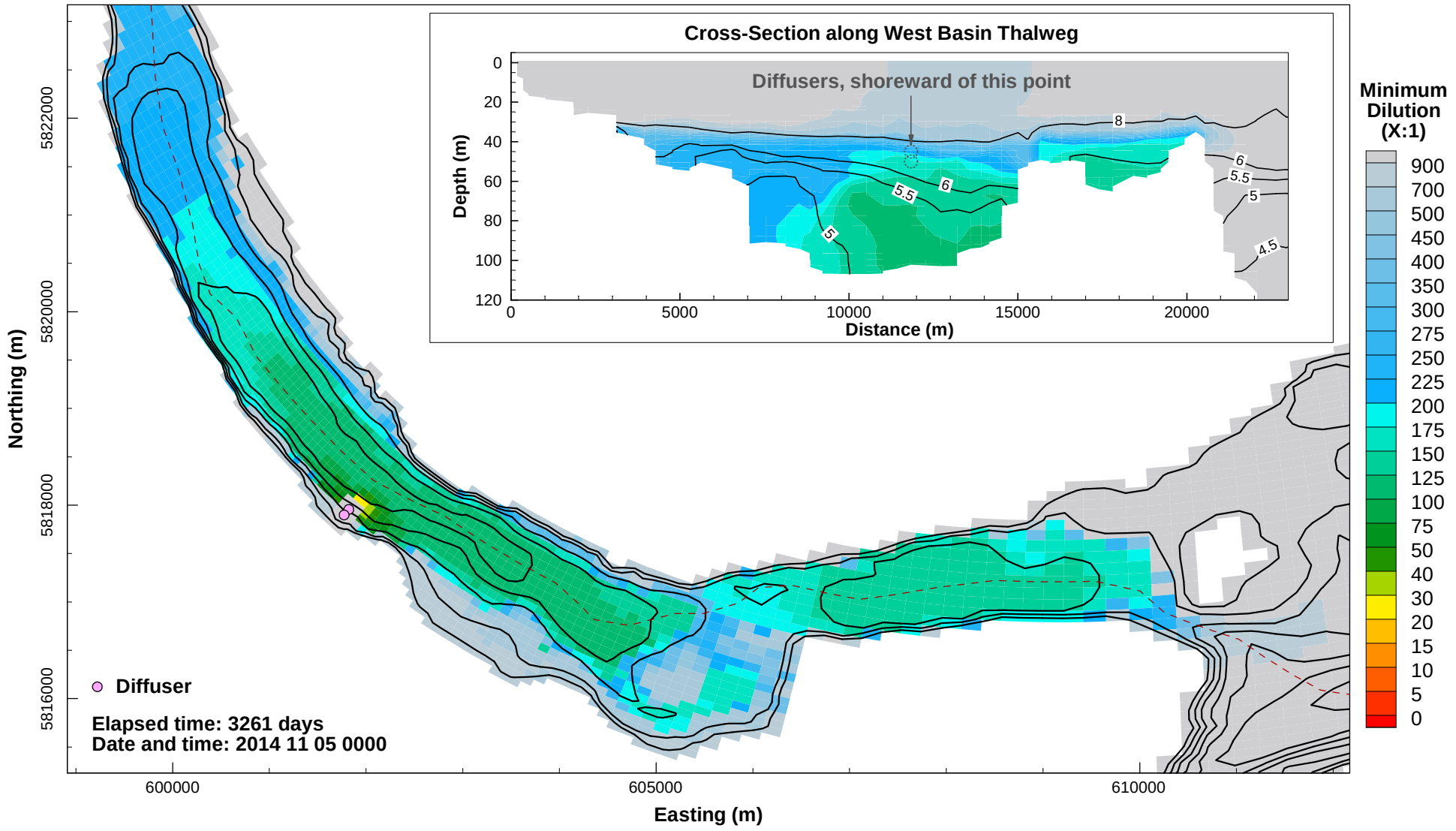
Option 1 "Bookend" Scenario Example Model Output: Dilution - Plan and Section

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.1



NOTES

Effluent flow rate: max 0.33 m^3/s, details per Option 2.

Plan view shows minimum dilution at any depth, with bathymetric line contours @ 25 m.
Section view shows dilution across West Basin, with temperature line contours.

STATUS
ISSUED FOR USE

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QUESNEL LAKE DIFFUSER MODELLING

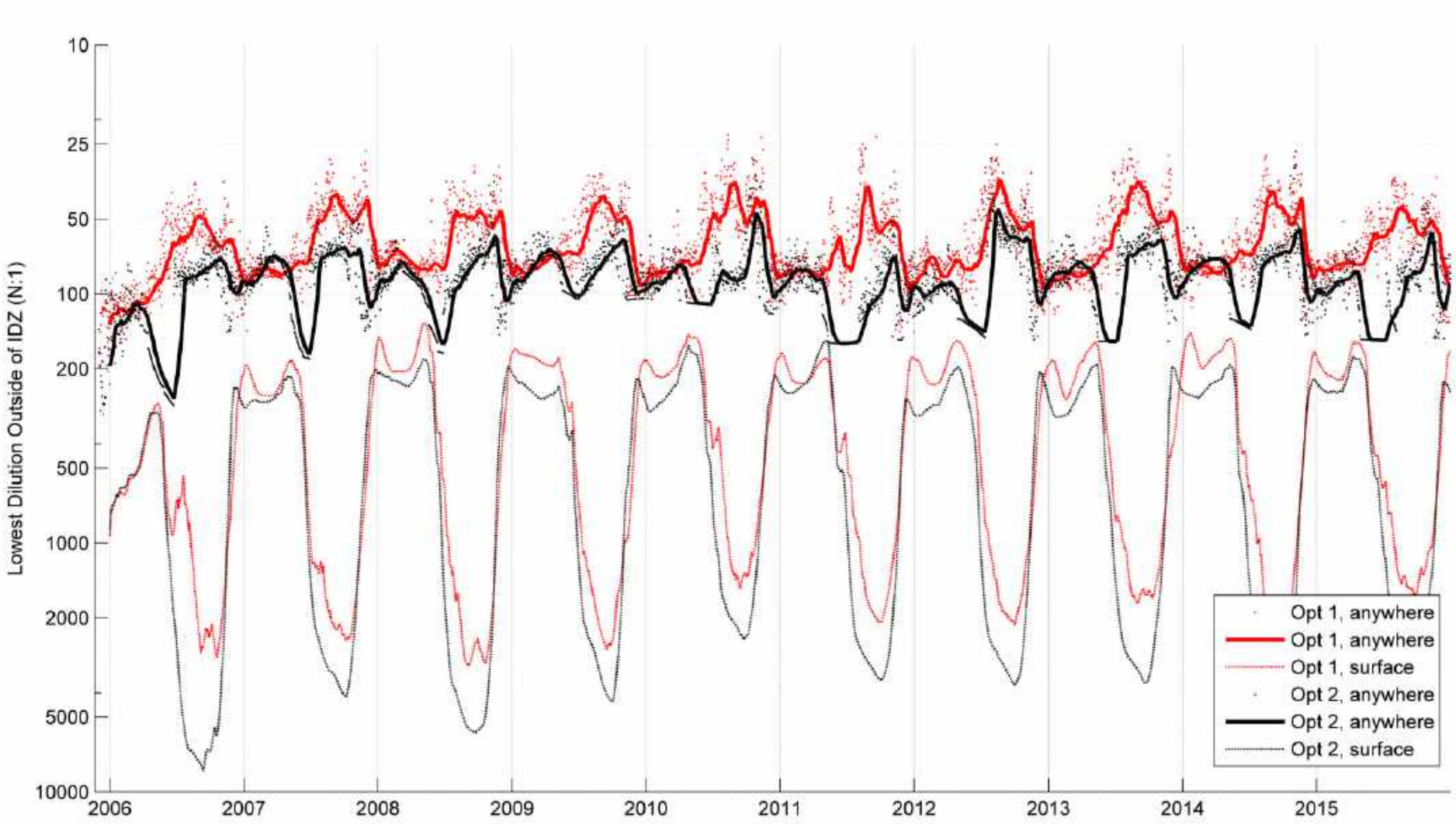
Option 2 "Bookend" Scenario
Example Model Output:
Dilution - Plan and Section

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PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.2



NOTES

Dots represent daily snapshot values.
Lines represent 30-day moving average.

Effluent flow rate: 0.33 m^3/s, details per Option.

STATUS
ISSUED FOR USE

CLIENT
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QUESNEL LAKE DIFFUSER MODELLING

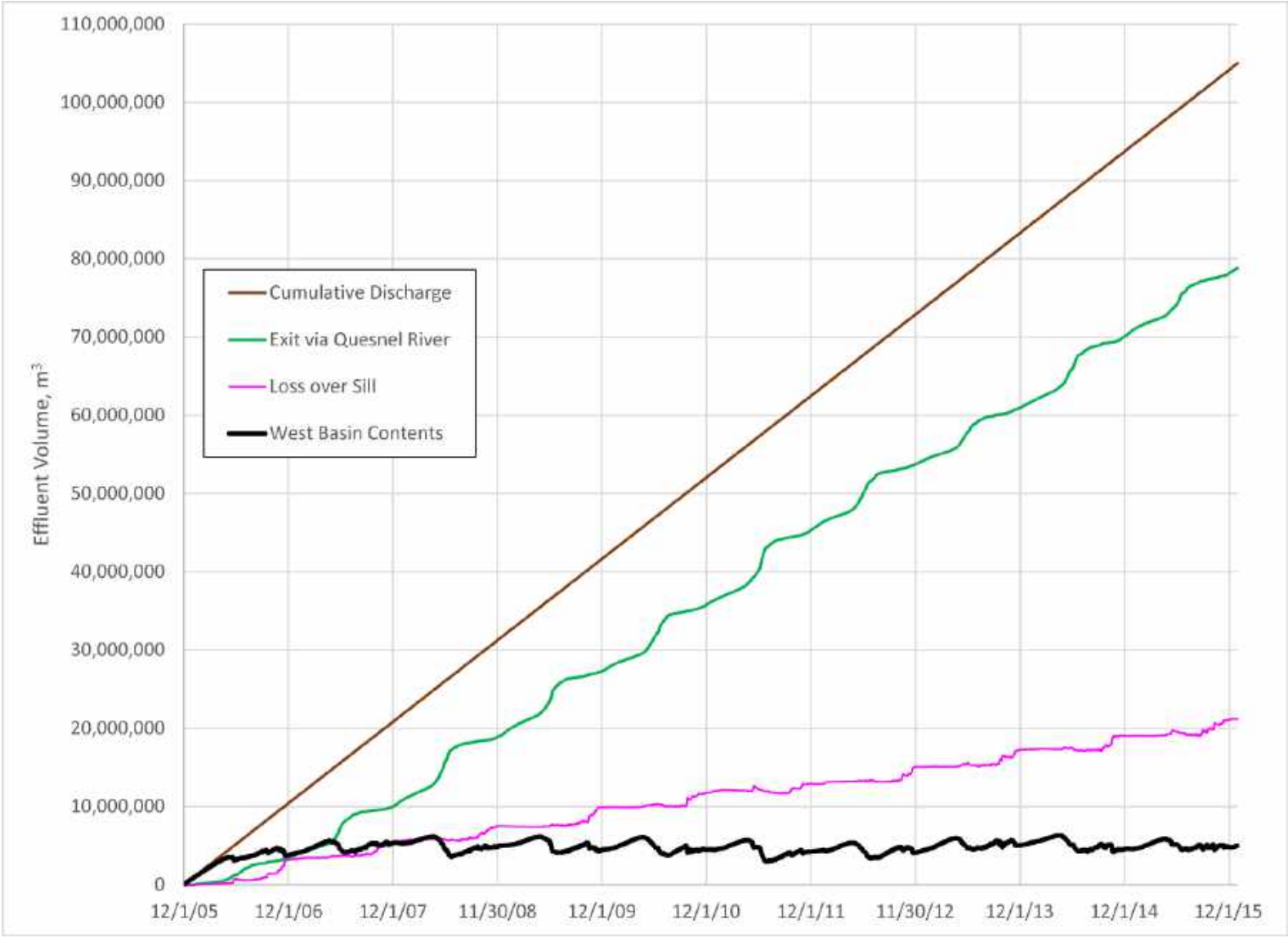
Simulated Dilution in Quesnel Lake "Bookend" Decadal Runs Options 1 and 2

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

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DATE: June 8, 2016

Figure 3.3



NOTES

Effluent flow rate: 0.33 m^3/s.
Effluent TDS: assumed 1000 mg/L, constant.

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QUESNEL LAKE DIFFUSER MODELLING

Option 1 "Bookend" Scenario Effluent Volume Balance

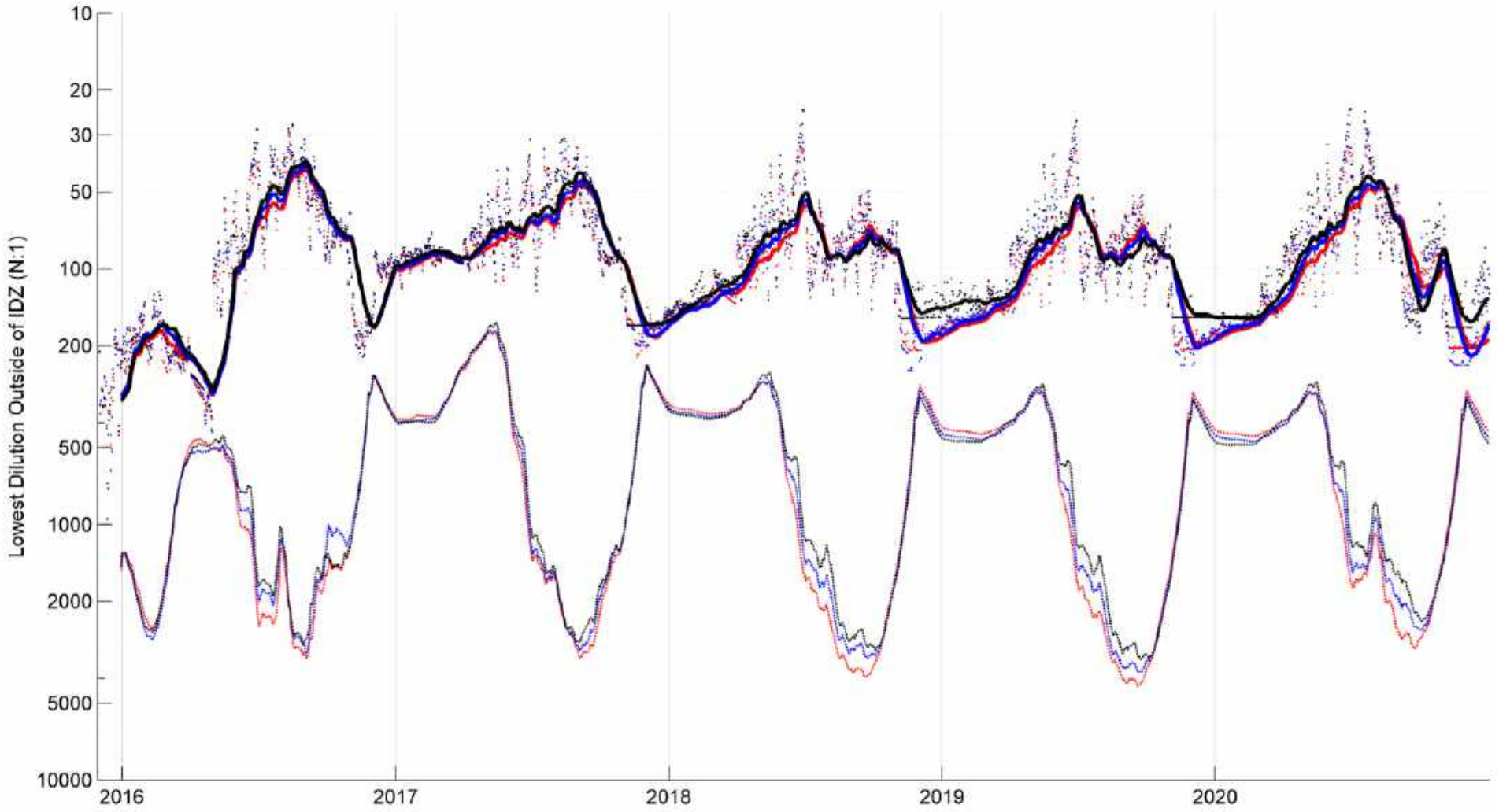
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WTRM03015	DP	JAS	JAS	0

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Figure 3.4

STATUS
ISSUED FOR USE



NOTES

Dots represent daily snapshot values.
Lines represent 30-day moving average.

95th Percentile WQ
surface
worst pt
Median WQ
surface
worst pt
5th Percentile WQ
surface
worst pt

STATUS
ISSUED FOR USE

CLIENT
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QUESNEL LAKE DIFFUSER MODELLING

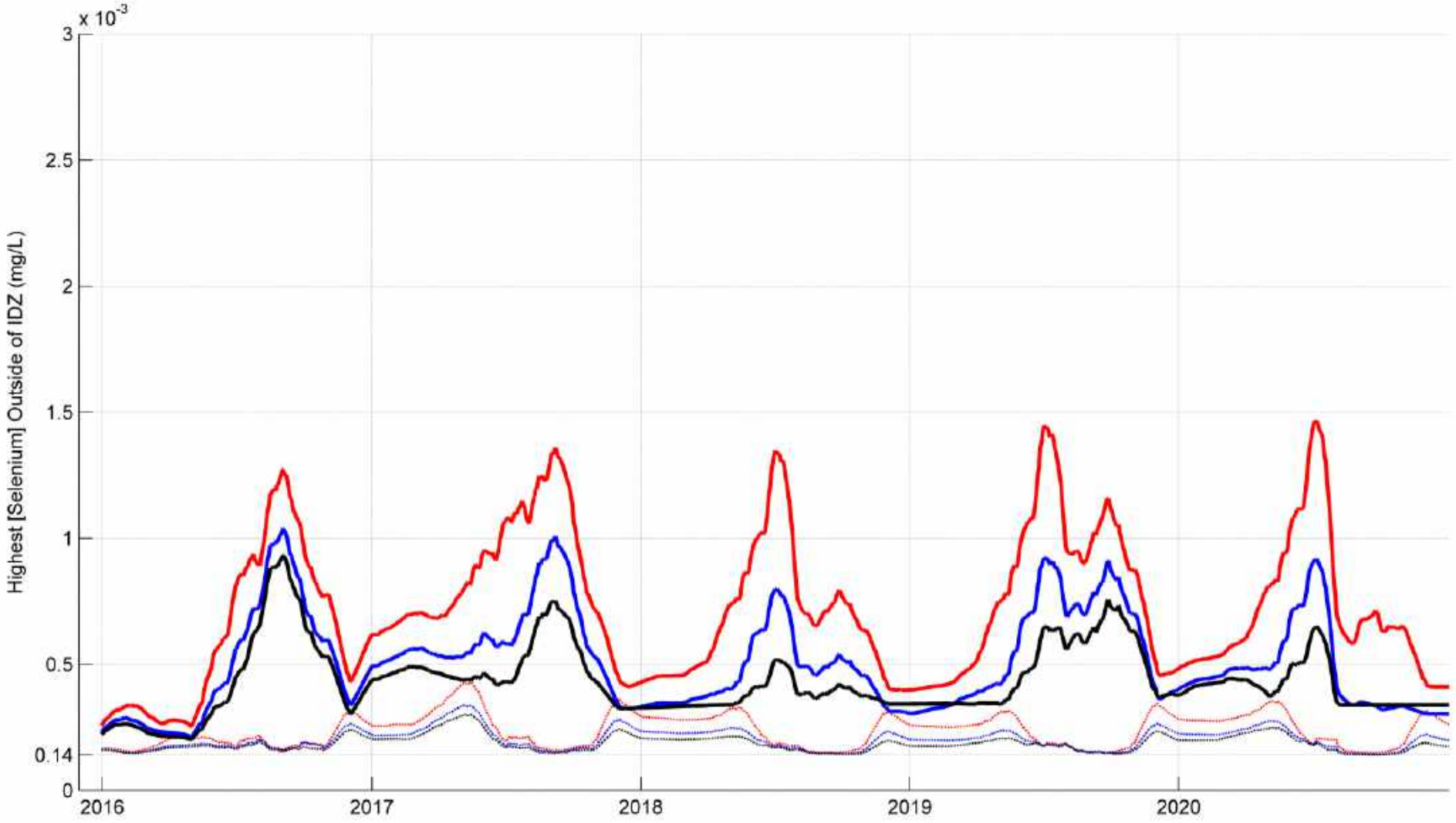
Simulated Dilution in Quesnel Lake "Detailed" Scenario Runs

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

OFFICE	DATE
Tetra Tech EBA - VANC	June 8, 2016

Figure 3.5



NOTES

Lines represent 30-day moving average.

95th Percentile WQ
surface
Median WQ
surface
5th Percentile WQ
surface

STATUS
ISSUED FOR USE

CLIENT
MPMC

QUESNEL LAKE DIFFUSER MODELLING

Simulated Selenium in Quesnel Lake "Detailed" Scenario Runs

TETRA TECH EBA

PROJECT NO.	DWN	CKD	APVD	REV
WTRM03015	DP	JAS	JAS	0

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Figure 3.6

APPENDIX A
TETRA TECH EBA'S GENERAL CONDITIONS

GENERAL CONDITIONS

HYDROTECHNICAL

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Electronic files submitted by Tetra Tech EBA have been prepared and submitted using specific software and hardware systems. Tetra Tech EBA makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

3.0 STANDARD OF CARE

Services performed by Tetra Tech EBA for the Report have been conducted in accordance with the Services Agreement, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Report. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Report.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of Tetra Tech EBA.

4.0 ENVIRONMENTAL AND REGULATORY ISSUES

Unless expressly agreed to in the Services Agreement, Tetra Tech EBA was not retained to investigate, address or consider, and has not investigated, addressed or considered any environmental or regulatory issues associated with the project.

5.0 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with Tetra Tech EBA with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for Tetra Tech EBA to properly provide the services contracted for in the Services Agreement, Tetra Tech EBA has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

6.0 INFORMATION PROVIDED TO TETRA TECH EBA BY OTHERS

During the performance of the work and the preparation of this Report, Tetra Tech EBA may have relied on information provided by persons other than the Client.

While Tetra Tech EBA endeavours to verify the accuracy of such information, Tetra Tech EBA accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

7.0 GENERAL LIMITATIONS OF REPORT

This Report is based solely on the conditions present and the data available to Tetra Tech EBA at the time the Report was prepared.

The Client, and any Authorized Party, acknowledges that the Report is based on limited data and that the conclusions, opinions, and recommendations contained in the Report are the result of the application of professional judgment to such limited data.

The Report is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present at or the development proposed as of the date of the Report requires a supplementary investigation and assessment.

It is incumbent upon the Client and any Authorized Party, to be knowledgeable of the level of risk that has been incorporated into the project design, in consideration of the level of the hydrotechnical information that was reasonably acquired to facilitate completion of the design.

The Client acknowledges that Tetra Tech EBA is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

8.0 JOB SITE SAFETY

Tetra Tech EBA is only responsible for the activities of its employees on the job site and was not and will not be responsible for the supervision of any other persons whatsoever. The presence of Tetra Tech EBA personnel on site shall not be construed in any way to relieve the Client or any other persons on site from their responsibility for job site safety.

APPENDIX 6-1: Effluent Quality Screening Table

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2015-12-01	2016-06-18	2018-01-10	2018-06-12	2021-02-09	2015-12-03	2015-12-07	2015-12-15	2015-12-22	2015-12-29	2016-01-05	2016-01-07	2016-01-12	2016-01-18	2016-01-19	2016-01-26	2016-02-01	2016-02-09	2016-02-15	2016-02-22	2016-02-24	2016-02-29
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	-	1179	1378	1308	1248.4	-	1294	1154.9	1226.4	1175	1206.3	1185.6	1257.2	1188.6	1181.3	1162.2	1170.6	1168.2	1067.7	1159.6	1186	1183.4
pH	pH units	-	6.37	8.158	7.42	7.39	6.77	6.93	6.9	7.74	7.6	8.1	7.7	7.61	7.56	7.73	7.78	7.79	7.72	7.23	6.94	7.56	7.6	7.74
Turbidity	NTU	-	2.00	0.53	2.76	0.45	1.6	2.34	2.22	1.27	1.08	1.13	1.34	1.65	1.65	1.34	1.02	2.27	1.25	1.51	1.33	1.76	0.83	1.92
Temperature	C	-	2.5	17.8	1.886	13.7	3.466	2.6	3.5	3.156	2.288	2.4	1.622	1.878	2.081	2.028	1.861	2.303	2.366	2.024	3.126	2.63	4.4	2.815
Dissolved oxygen	%	-	-	-	-	101.9	-	-	-	-	-	-	92.9	-	-	-	-	-	93.4	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	9.42	-	-	-	-	-	-	12.91	-	-	-	-	-	12.74	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	-	-	-	-	-	72.6	70.7	75.6	76.4	75.1	67	64.9	66	61.2	62.8	62.2	64.3	63.2	64.9	63.9	64.2	65.2
Specific conductivity	uS/cm	-	-	-	-	-	-	1260	1200	1200	1230	1200	1220	1200	1200	1200	1200	1180	1150	1200	1160	1180	1200	1200
pH	pH units	-	-	-	-	-	-	7.38	7.28	7.6	7.63	7.52	7.58	7.52	7.56	7.34	7.6	7.52	7.26	7.5	7.48	7.41	7.53	7.41
Total suspended solids	mg/L	30	-	-	-	-	-	13.9	8.2	7.6	6.4	11.9	7.5	12.2	20	7	10.1	13.2	8.7	16.5	<3.0	5	8	3.1
Turbidity	NTU	-	-	-	-	-	-	2.55	1.78	0.64	0.58	0.99	0.89	0.85	1.46	1.15	1.03	0.86	1.29	1.64	1.36	1.55	1.04	1.23
Hardness, as CaCO3	mg/L	-	-	-	-	-	-	599	566	546	561	550	544	559	543	547	556	555	529	560	521	542	543	558
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	-	-	-	-	-	928	872	929	872	872	819	842	840	894	885	866	859	832	821	885	886	876
Dissolved organic carbon	mg/L	-	-	-	-	-	-	2.68	2.19	2.54	2.81	2.51	2.1	2.26	2.3	2.47	2.52	2.43	2.86	2.73	3.13	2.92	2.83	2.67
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	-	-	-	-	-	7.13	7.33	7.78	7.34	7.25	7.43	7.92	7.6	8.38	8.31	7.69	8.13	8.17	7.92	7.92	7.92	8.18
Nitrate + nitrite	mg-N/L	-	-	-	-	-	-	7.17	7.37	7.82	7.38	7.29	7.47	7.96	7.63	8.42	8.34	7.72	8.16	8.2	7.95	7.95	7.96	8.22
Nitrite	mg-N/L	0.78	-	-	-	-	-	0.0349	0.0393	0.0417	0.0369	0.0397	0.039	0.0384	0.0333	0.0319	0.0322	0.0314	0.029	0.0326	0.0322	0.0357	0.0407	0.0362
Total ammonia	mg-N/L	1.3	-	-	-	-	-	0.0521	0.0481	0.072	0.0885	0.0829	0.0568	0.0447	0.0668	0.0466	0.052	0.0492	0.0654	0.0788	0.155	0.115	0.116	0.0802
Dissolved phosphorus	mg-P/L	-	-	-	-	-	-	0.003	0.0027	0.003	0.003	<0.0020	0.0026	0.0023	0.0029	0.0025	0.0027	0.0026	0.0038	0.0028	0.0033	0.0035	0.0045	<0.0020
Total phosphorus	mg-P/L	0.09	-	-	-	-	-	0.0053	0.0038	0.0036	0.005	0.0052	0.0064	0.0061	0.0067	0.0063	0.008	0.0103	0.0056	0.0054	0.0062	0.0064	0.0058	0.0044
Orthophosphate	mg-P/L	-	-	-	-	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	-	-	-	-	-	7.09	7.29	8.05	7.31	7.48	7.35	7.76	7.44	7.94	8.23	8.32	8.1	7.8	8.12	8.09	8.18	8.04
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	-	-	-	-	-	186	175	168	173	169	166	172	165	166	170	170	161	171	158	167	166	172
Chloride	mg/L	-	-	-	-	-	-	33	25.9	19.3	20.8	18.8	21.9	18.5	22.9	19.3	16.8	16.4	17.1	19.5	19.6	20.7	20.6	21.4
Fluoride	mg/L	17	-	-	-	-	-	0.24	0.31	0.37	0.39	0.4	0.33	0.42	0.38	0.39	0.43	0.34	0.35	0.39	0.34	0.33	0.32	0.33
Magnesium	mg/L	-	-	-	-	-	-	32.7	31.3	30.5	31.6	31.2	31.6	31.4	31.6	32	31.7	31.9	31	32.2	30.6	30.7	31.1	31
Potassium	mg/L	-	-	-	-	-	-	8.37	8.55	9.33	10.3	10	9.57	9.43	10.3	10.7	10.5	9.47	9.65	10.6	9.52	8.8	9.27	9.16
Sodium	mg/L	-	-	-	-	-	-	48.8	44.4	43.6	50.7	50.1	43.9	42.6	45.7	47.7	47	42.3	43.4	47.9	43.6	41.4	45.9	46.3
Sulphate	mg/L	1100	-	-	-	-	-	535	526	525	533	516	527	544	527	531	528	493	512	544	503	514	517	535
Total Metals																							
Aluminum	mg/L	-	-	-	-	-	-	1.15	1.12	0.775	0.463	0.683	0.787	0.623	0.774	0.74	0.485	0.866	0.669	0.728	0.573	0.81	0.651	0.739
Antimony	mg/L	-	-	-	-	-	-	0.00086	0.00101	0.00112	0.00108	0.00133	0.00133	0.00128	0.00123	0.00137	0.00131	0.00117	0.00121	0.00128	0.00113	0.00109	0.00111	0.00114
Arsenic	mg/L	0.028	-	-	-	-	-	0.00063	0.00054	0.00056	0.00056	0.00069	0.00064	0.00056	0.00055	0.0006	0.00056	0.00051	0.00047	0.00052	0.00047	0.00046	0.00046	0.00055
Barium	mg/L	-	-	-	-	-	-	0.0644	0.0635	0.0624	0.0532	0.0539	0.0713	0.0546	0.0576	0.0593	0.0607	0.0564	0.0548	0.0551	0.0615	0.0568	0.0542	0.0661
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	0.17	0.163	0.172	0.171	0.173	0.168	0.168	0.171	0.168	0.157	0.152	0.155	0.159	0.131	0.139	0.134	0.161
Cadmium	mg/L	-	-	-	-	-	-	0.0000694	<0.000050	0.0000177	<0.000050	<0.000040	0.0000268	<0.000040	0.000027	0.0000322	0.0000312	0.0000254	0.0000229	0.0000325	0.0000241	<0.000045	0.0000454	0.0000681
Calcium	mg/L	-	-	-	-	-	-	185	178	164	170	170	162	169	164	166	168	166	158	168	154	167	161	202
Chromium	mg/L	0.004	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	0.00021	0.00022	0.00019	0.00019	0.00019	0.00019	0.00017	0.0002	0.00019	0.00018	0.00016	0.00016	0.00016	0.0002	0.00022	0.00021	0.00025
Copper	mg/L	0.033	-	-	-	-	-	0.00461	0.00412	0.00403	0.00326	0.0038	0.00425	0.00374	0.0035	0.00385	0.00365	0.00442	0.00466	0.00419	0.00536	0.00597	0.00564	0.00668
Iron	mg/L	1	-	-	-	-	-	0.047	0.059	<0.030	<0.030	<0.030	<0.030	<0.030	0.033	<0.030	<0.030	0.05	<0.030	<0.030	<0.030	0.054	<0.030	0.032
Lead	mg/L	-	-	-	-	-	-	0.00013	0.000073	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0089	0.009	0.0101	0.0095	0.0104	0.0102	0.0111	0.0124	0.0129	0.0126	0.0123	0.0118	0.0121	0.0118	0.0117	0.0109	0.0117
Magnesium	mg/L	-	-	-	-	-	-	32.4	32.1	31.1	32	31.8	31.4	31.5	31.6	33.2	31.6	32	31.4	32.2	31	32	31.3	37.9
Manganese	mg/L	3.4	-	-	-	-	-	0.18	0.139	0.12	0.209	0.242	0.165	0.106	0.155	0.128	0.112	0.078	0.0883	0.135	0.139	0.116	0.115	0.153
Mercury	mg/L	-	-	-	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050
Molybdenum	mg/L	0.36	-	-	-	-	-	0.155	0.147	0.141	0.152	0.154	0.155	0.148	0.147	0.157	0.15	0.134	0.139	0.149	0.134	0.14	0.147	0.166
Nickel	mg/L	-	-	-	-	-	-	0.00073	0.00076	0.00063	0.00063	0.00063	0.00081	0.00056	0.0007	0.00066	0.00069	0.00065	0.00063	0.00059	0.00071	0.00073	0.0007	0.00082
Potassium	mg/L	-	-	-	-	-	-	8.49	8.96	9.7	9.15	10.6	12	9.4	10.6	11	10.7	9.41	9.84	10.8	9.62	9.62	9.53	11
Selenium	mg/L	0.075	-	-	-	-	-	0.0274	0.029	0.0302	0.0295	0.0309	0.0307	0.0281	0.0297	0.0326	0.0321	0.0307	0.0314	0.031	0.0284	0.0303	0.0307	0.0395
Silicon	mg/L	-	-	-	-	-	-	4.85	4.89	4.85	4.82	4.74	4.66	4.64	4.55	4.42	4.22	4.25	4.25	4.25	4.24	4.49	4.37	5.23
Silver	mg/L	0.00024	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	-	-	-	-	-	50.5	47.2	46	45.2	53.1	56	42.8	47.4	49.3	46.3	42.9	44.5	49.6	44.1	45.2	47.7	56.1
Strontium	mg/L	-	-	-	-	-	-	3.1	3.21	2.9	3.06	2.81	2.88	2.77	2.49	2.65	2.47	2.34	2.37	2.49	2.16	2.34	2.48	2.78
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	0.011	<0.010	<0.010	0.012	0.011	0.02	0.013	0.012	<0.010	<0.010	<0.010	0.013	<0.010	0.015	0.014	0.013	0.012
Uranium	mg/L	-	-	-	-	-	-	0.000896	0.00112	0.00136	0.00137	0.00153	0.000925	0.00128	0.000865	0.00118	0.0014	0.00121	0.00117	0.00111	0.000969	0.00093	0.000896	0.000999
Vanadium	mg/L	-	-	-	-	-	-	0.00073	0.00075	0.00087	0.00077	0.00092	0.00084	0.00072	0.00066	0.00071	0.00072	0.00074	0.00074	0.00072	0.00074	0.00084	0.00072	0.00091
Zinc	mg/L	0.059	-	-	-	-	-	0.0076	0.0057	0.0046	0.0043	0.0044	0.0083	0.0077	0.0084	0.0051	0.005	0.0056	0.0058	0.0062	0.0062	0.0066	0.0067	0.0081

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2015-12-01	2016-06-18	2018-01-10	2018-06-12	2021-02-09	2015-12-03	2015-12-07	2015-12-15	2015-12-22	2015-12-29	2016-01-05	2016-01-07	2016-01-12	2016-01-18	2016-01-19	2016-01-26	2016-02-01	2016-02-09	2016-02-15	2016-02-22	2016-02-24	2016-02-29
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	-	-	-	-	-	0.0937	0.0666	0.0746	0.0986	0.109	0.0799	0.0751	0.0849	0.0968	0.0647	0.0741	0.0811	0.0889	0.0683	0.0724	0.0773	0.0675
Antimony	mg/L	-	-	-	-	-	-	0.00076	0.00098	0.00108	0.00106	0.00119	0.00129	0.00127	0.00123	0.00132	0.00129	0.00122	0.0012	0.00127	0.00112	0.00107	0.00109	0.00103
Arsenic	mg/L	-	-	-	-	-	-	0.00051	0.00045	0.0004	0.00055	0.00048	0.00043	0.00041	0.00045	0.00043	0.00041	0.00037	0.00037	0.00044	0.00042	0.00037	0.00034	0.00037
Barium	mg/L	-	-	-	-	-	-	0.0644	0.063	0.0614	0.0601	0.0515	0.0571	0.0546	0.0573	0.0599	0.0582	0.059	0.0542	0.0548	0.062	0.0561	0.0543	0.0569
Beryllium	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	-	-	-	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	-	-	-	-	-	0.151	0.143	0.156	0.152	0.153	0.161	0.147	0.146	0.149	0.145	0.148	0.139	0.144	0.119	0.121	0.122	0.133
Cadmium	mg/L	0.00034	-	-	-	-	-	0.0000481	<0.000060	0.0000271	<0.000050	<0.000030	0.0000303	<0.000040	0.0000318	0.0000262	0.0000329	0.0000304	0.0000208	0.0000203	0.0000294	<0.000045	0.0000445	0.000045
Chromium	mg/L	-	-	-	-	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	-	-	-	-	-	0.00019	0.00018	0.00017	0.0002	0.00016	0.00014	0.00016	0.00019	0.00018	0.00017	0.00015	0.00016	0.00016	0.0002	0.00019	0.00019	0.0002
Copper	mg/L	-	-	-	-	-	-	0.00348	0.00297	0.00309	0.00327	0.00299	0.00271	0.00288	0.00278	0.00306	0.00296	0.00281	0.0032	0.00303	0.00386	0.00353	0.00379	0.00396
Iron	mg/L	0.35	-	-	-	-	-	<0.030	0.078	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.089	<0.030	<0.030
Lead	mg/L	-	-	-	-	-	-	0.000055	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	-	-	-	-	-	0.0087	0.0092	0.01	0.0095	0.0102	0.0101	0.01	0.0118	0.0127	0.0123	0.0129	0.0116	0.0126	0.0116	0.011	0.011	0.0104
Manganese	mg/L	-	-	-	-	-	-	0.17	0.132	0.114	0.235	0.227	0.13	0.104	0.148	0.118	0.109	0.0772	0.0848	0.131	0.136	0.107	0.115	0.126
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	-	-	-	-	-	0.147	0.14	0.138	0.139	0.149	0.143	0.136	0.139	0.145	0.14	0.138	0.132	0.14	0.128	0.132	0.14	0.142
Nickel	mg/L	-	-	-	-	-	-	0.00065	0.00073	0.00053	0.00072	0.00059	0.00063	<0.00050	0.00051	0.00063	0.00067	0.00056	0.00056	0.00059	0.00063	0.00063	0.00057	0.00064
Selenium	mg/L	-	-	-	-	-	-	0.0269	0.0285	0.0299	0.0304	0.0298	0.0298	0.0299	0.0294	0.0336	0.0313	0.0306	0.0295	0.0308	0.0278	0.029	0.0307	0.0325
Silicon	mg/L	-	-	-	-	-	-	4.8	4.71	4.81	4.84	4.64	4.63	4.68	4.54	4.27	4.22	4.23	4.19	4.25	4.23	4.36	4.35	4.32
Silver	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	-	-	-	-	-	3	3.08	2.84	2.98	2.73	2.81	2.67	2.46	2.54	2.4	2.47	2.3	2.42	2.12	2.24	2.41	2.47
Thallium	mg/L	-	-	-	-	-	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	-	-	-	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	-	-	-	-	-	0.011	<0.010	<0.010	0.012	0.011	0.021	0.012	0.012	<0.010	<0.010	<0.010	0.013	<0.010	0.015	0.013	0.012	0.011
Uranium	mg/L	-	-	-	-	-	-	0.000635	0.000827	0.00112	0.00121	0.0013	0.000734	0.00101	0.000658	0.000943	0.00123	0.00101	0.000953	0.000904	0.00084	0.000739	0.000745	0.000749
Vanadium	mg/L	-	-	-	-	-	-	0.00052	0.0006	0.00066	0.00073	0.00067	0.00057	0.00059	0.00053	0.00054	0.00057	0.00063	0.00059	0.00057	0.00065	0.00052	0.00061	0.00063
Zinc	mg/L	-	-	-	-	-	-	0.0072	0.005	0.0043	0.0041	0.0042	0.0059	0.0062	0.0064	0.0044	0.005	0.0055	0.005	0.0058	0.0054	0.0059	0.0058	0.0061

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-03-02	2016-03-08	2016-03-15	2016-03-23	2016-03-29	2016-04-04	2016-04-11	2016-04-13	2016-04-19	2016-05-05	2016-05-10	2016-05-17	2016-05-24	2016-05-31	2016-06-07	2016-06-14	2016-06-20	2016-06-23	2016-06-27	2016-06-29	2016-07-06	2016-07-13
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1149.4	1107.1	1128.6	1254	1127	1161	1211	1215	1252	1175	1211	1172	1213	1228	1216	1228	1215	1228	1215	-	1217	1215
pH	pH units	-	7.8	7.89	7.46	7.434	7.459	7.433	7.639	7.565	7.457	7.274	7.277	7.414	7.384	7.331	7.397	7.346	8.297	8.345	8.248	-	8.244	8.236
Turbidity	NTU	-	1.1	5.35	1.9	1.35	3.02	0.76	0.72	1.09	1.37	1.96	0.5	0.5	0.21	0.7	0.36	0.39	1.05	2.61	1.82	-	0.77	0.41
Temperature	C	-	2.591	3.336	3.264	4.6	6.1	8.6	8.8	7.8	10.5	10	9.9	12.6	12.2	13.3	14.9	12.3	14.4	13	15.6	-	16.3	16.7
Dissolved oxygen	%	-	75.3	-	-	-	-	-	-	-	-	-	-	-	-	-	112.3	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	9.85	-	-	-	-	-	-	-	-	10.1	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	64	64.8	70.7	62.6	78.5	80.8	82.4	80.1	81.5	37.5	41.2	40.9	41.3	42.2	42.5	42.6	50.9	49.6	47.9	49.1	47.7	48.4
Specific conductivity	uS/cm	-	1220	1190	1220	1260	1150	1180	1230	1210	1250	1200	1190	1170	1170	1210	1180	1210	1200	1190	1200	1180	1200	1170
pH	pH units	-	7.38	7.47	7.62	7.57	7.44	7.71	7.85	7.67	7.52	7.22	7.48	7.4	7.4	7.64	7.45	7.61	8.05	8	7.98	7.98	7.89	8.01
Total suspended solids	mg/L	30	6.1	4.9	14.2	8.6	5.2	9	4.9	7.2	4.7	3	4.5	9.1	16.5	3.8	1.9	5.9	2.9	3.6	1.3	1.1	1.3	1.1
Turbidity	NTU	-	1.13	1.84	1.13	0.78	1.59	1.33	1.11	1.01	1.19	0.79	0.61	0.88	1.59	0.55	0.73	0.82	1.36	1.98	0.94	1.63	0.73	0.67
Hardness, as CaCO3	mg/L	-	567	577	584	598	604	590	640	670	655	505	527	490	508	530	504	517	514	509	534	518	531	499
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	911	879	906	939	897	856	692	949	978	910	891	903	920	880	826	909	925	930	946	928	904	874
Dissolved organic carbon	mg/L	-	2.84	3.21	3.15	3	3.75	4	4.43	4.21	3.65	2.63	2.27	2.36	2.38	2.29	2.48	2.24	2.74	2.25	2.32	2.59	2.26	2.37
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	8.53	8.72	8.78	9.47	7.77	7.7	8.71	9.51	8.43	8.79	8.66	8.51	8.75	8.55	8.8	9.01	8.73	8.57	8.84	9.03	8.15	8.51
Nitrate + nitrite	mg-N/L	-	8.56	8.76	8.81	9.49	7.78	7.72	8.72	9.53	8.46	8.85	8.73	8.57	8.82	8.61	8.87	9.08	8.82	8.66	8.93	9.13	8.23	8.59
Nitrite	mg-N/L	0.78	0.0341	0.0305	0.0212	0.0238	0.0155	0.0123	0.0166	0.0198	0.0247	0.0615	0.0629	0.0621	0.0618	0.0649	0.0712	0.0715	0.0891	0.0944	0.0958	0.0974	0.0829	0.0797
Total ammonia	mg-N/L	1.3	0.0739	0.0624	0.0576	0.0351	0.0755	0.0522	0.022	0.0606	0.0985	0.144	0.146	0.111	0.132	0.126	0.105	0.168	0.169	0.188	0.171	0.177	0.122	0.119
Dissolved phosphorus	mg-P/L	-	0.003	0.0024	<0.0020	0.0025	<0.0020	0.0023	<0.0020	0.0024	0.003	0.0035	<0.0020	<0.0020	<0.0020	<0.0020	0.0026	0.0026	0.0074	0.0061	0.0057	0.0039	0.0025	0.0028
Total phosphorus	mg-P/L	0.09	0.0076	0.007	0.0092	0.005	0.0123	0.0081	0.0129	0.0161	0.0089	0.0058	0.003	0.007	0.0063	0.0053	0.005	0.0041	0.0135	0.0165	0.0121	0.0151	0.01	0.0056
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0039	0.0042	0.0016	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	8.35	8.6	8.67	10.2	8.15	8.06	8.66	9	8.83	8.95	8.97	8.81	9.21	9.07	9.02	8.96	9.04	9.24	9.1	8.91	9.27	9.19
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	175	175	181	184	190	185	199	208	205	152	161	147	154	162	153	156	157	154	163	158	161	153
Chloride	mg/L	-	24.4	23	17.9	19.3	15.8	15.6	14.1	14.4	14.8	21.2	19	18.2	19.5	20.3	19	19.7	12.5	12	12.3	12.8	11.5	11.9
Fluoride	mg/L	17	0.32	0.27	0.3	0.28	0.25	0.24	0.27	0.31	0.31	0.41	0.452	0.42	0.46	0.49	0.5	0.51	0.65	0.63	0.65	0.67	0.6	0.63
Magnesium	mg/L	-	31.7	33.9	32.3	33.5	31.2	31.4	35	36.8	34.5	30.4	30.5	29.6	29.9	30.2	29.9	31	29.9	30.1	30.9	30.3	31.1	28.5
Potassium	mg/L	-	9.27	7.77	7.26	8.21	4.57	4.56	3.46	3.28	3.95	14.2	14.7	13.5	14.8	14.9	15.5	15.6	17.4	16.7	16.7	16.7	17	15.5
Sodium	mg/L	-	45.5	41.4	39	40.7	31.4	30.6	24.5	22.9	30.9	58.6	57.5	56.3	56.1	55.3	56	55.4	60.1	59	58.2	59.5	57.8	53.9
Sulphate	mg/L	1100	541	512	530	545	506	504	553	595	559	542	524	528	545	539	551	566	550	537	551	559	507	533
Total Metals																							
Aluminum	mg/L	-	0.629	0.858	0.638	0.586	0.572	0.517	0.407	0.445	0.487	0.573	0.549	0.624	1.16	0.551	0.501	0.61	0.118	0.191	0.102	0.117	0.0476	0.0504
Antimony	mg/L	-	0.00108	0.00078	0.00085	0.00092	0.00051	0.00049	0.00042	0.00044	0.0005	0.00172	0.00173	0.00149	0.00171	0.00173	0.00168	0.00169	0.00159	0.00178	0.00162	0.00181	0.00169	0.00153
Arsenic	mg/L	0.028	0.00044	0.00045	0.00049	0.00058	0.00041	0.00043	0.00045	0.00049	0.00053	0.00043	0.00049	0.00044	0.0006	0.00047	0.00049	0.00052	0.00096	0.00096	0.00089	0.00085	0.00085	0.00072
Barium	mg/L	-	0.0598	0.0569	0.0494	0.0523	0.0437	0.0438	0.046	0.0466	0.0453	0.0594	0.0571	0.0589	0.0645	0.0648	0.0588	0.0662	0.0666	0.0621	0.0626	0.0635	0.0643	0.0589
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000078	<0.000050	<0.000050
Boron	mg/L	-	0.151	0.106	0.126	0.109	0.108	0.094	0.088	0.102	0.112	0.147	0.159	0.136	0.156	0.148	0.136	0.153	0.134	0.141	0.146	0.148	0.146	0.138
Cadmium	mg/L	-	0.0000517	0.000047	0.0000578	0.000051	0.0000788	0.0000753	<0.00010	0.0000883	0.0000755	<0.000020	<0.000010	<0.000020	0.0000085	0.0000061	0.0000088	<0.000015	<0.000010	<0.000015	<0.000010	0.000007	0.0000227	0.0000054
Calcium	mg/L	-	172	174	179	184	191	186	190	201	193	151	161	155	152	165	152	157	156	152	167	156	160	157
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00022	0.00024	0.00022	0.00019	0.00032	0.00034	0.00042	0.00047	0.00037	0.00015	0.00015	0.00012	0.00013	0.00011	<0.00010	0.00011	0.00013	0.0002	0.00014	0.00015	0.0001	<0.00010
Copper	mg/L	0.033	0.00533	0.00706	0.00763	0.00683	0.0118	0.0229	0.0144	0.0166	0.0132	0.00362	0.0024	0.00217	0.00305	0.0019	0.00168	0.00205	0.00421	0.00519	0.0151	0.00612	0.00338	0.00308
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	0.038	0.045	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	0.056	0.112	0.066	0.074	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000516	<0.000050	<0.000050	<0.000050	0.000069	<0.000050	0.000069	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0113	0.0091	0.0094	0.0106	0.0057	0.0048	0.0046	0.0052	0.0057	0.0172	0.0188	0.0154	0.0181	0.0184	0.0161	0.017	0.0146	0.0151	0.0174	0.017	0.0177	0.0165
Magnesium	mg/L	-	31.9	34	32.3	34.5	31.9	32.5	33.8	38.5	32.7	30.8	31.6	30.5	30.2	30.8	30.1	30.7	30.1	29.8	32.3	29.7	31.3	29.4
Manganese	mg/L	3.4	0.142	0.137	0.116	0.0959	0.117	0.12	0.102	0.109	0.123	0.0387	0.0461	0.0389	0.0427	0.0407	0.0301	0.0386	0.0432	0.0495	0.0422	0.0414	0.0281	0.0262
Mercury	mg/L	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-	<0.0000050	<0.0000050
Molybdenum	mg/L	0.36	0.155	0.138	0.152	0.164	0.139	0.136	0.138	0.134	0.139	0.171	0.178	0.168	0.177	0.171	0.172	0.186	0.157	0.181	0.174	0.174	0.165	0.172
Nickel	mg/L	-	0.00075	0.00061	0.00068	0.00066	0.00091	0.00158	0.00097	0.00113	0.001	0.00066	0.00059	0.00065	0.00067	0.00063	0.00056	0.00065	0.00075	0.00074	0.00072	0.00071	0.00085	<0.00050
Potassium	mg/L	-	9.46	7.95	7.35	8.5	4.62	4.49	3.36	3.27	3.98	13.7	15	13.9	15.2	15.4	15.7	16.6	18.1	16.7	16.9	16.9	17.6	16.3
Selenium	mg/L	0.075	0.0329	0.0326	0.0367	0.0374	0.0324	0.0373	0.0448	0.049	0.0421	0.0371	0.0376	0.0356	0.0358	0.0384	0.0334	0.036	0.0368	0.0376	0.0359	0.0356	0.0372	0.0324
Silicon	mg/L	-	4.25	4.41	4.37	4.22	4.9	4.89	4.8	5.29	4.84	3.48	3.81	3.58	3.61	3.66	3.65	3.64	3.88	4.04	4.13	3.81	3.75	3.6
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	46.8	43.2	39.7	41.8	32.1	31.4	23.9	23.4	31.3	57.3	58.8	57.6	58.4	57.2	57.7	60.4	62.5	60.4	63	60.1	61.2	57.1
Strontium	mg/L	-	2.59	2.1	2.56	2.72	2.42	2.33	2.46	2.61	2.64	2.68	2.75	2.45	2.56	2.52	2.56	2.69	2.31	2.64	2.68	2.58	2.45	2.47
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013	<0.000010	<0.000010	0.000014	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00026	<0.00010
Titanium	mg/L	-	0.012	0.018	0.017	0.016	0.016	0.017	0.018	0.015	0.017	0.012	0.019	0.012	<0.010	<0.010	0.024	<0.010	0.01	0.017	<0.010	<0.010	<0.010	0.01
Uranium	mg/L	-	0.000764	0.000685	0.00127	0.000981	0.00138	0.00144	0.00163	0.00153	0.00166	0.000566	0.00074	0.000717	0.000808	0.000601	0.000742	0.0007	0.00113	0.00127	0.00117	0.00123	0.00117	0.00118
Vanadium	mg/L	-	0.00082	0.00072	0.00075	0.00088	0.00083	0.00087	0.00081	0.00086	0.00097	0.00174	0.0007	0.00059	0.00085	0.0008	0.00075	0.00104	0.00125	0.00133	0.00117	0.00105	0.00103	0.00101
Zinc	mg/L	0.059	0.0064	0.0065	0.0067	0.0069	0.0074	0.0125	0.0047	0.0064	0.0061	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-03-02	2016-03-08	2016-03-15	2016-03-23	2016-03-29	2016-04-04	2016-04-11	2016-04-13	2016-04-19	2016-05-05	2016-05-10	2016-05-17	2016-05-24	2016-05-31	2016-06-07	2016-06-14	2016-06-20	2016-06-23	2016-06-27	2016-06-29	2016-07-06	2016-07-13
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.085	0.0679	0.0683	0.0629	0.0739	0.0826	0.091	0.0792	0.0723	0.0945	0.0481	0.0744	0.0809	0.0651	0.0773	0.24	0.0306	0.0271	0.0276	0.0264	0.0259	0.0253
Antimony	mg/L	-	0.00104	0.00075	0.00079	0.00091	0.0005	0.00044	0.00041	0.00043	0.00051	0.00165	0.00167	0.00147	0.00162	0.0017	0.00165	0.00166	0.00172	0.0017	0.00159	0.0017	0.00172	0.00151
Arsenic	mg/L	-	0.00037	0.00035	0.00038	0.00042	0.00032	0.00032	0.00041	0.00036	0.00041	0.00046	0.00034	0.00034	0.00037	0.00035	0.00043	0.00041	0.00087	0.00087	0.00088	0.00078	0.00081	0.00073
Barium	mg/L	-	0.0595	0.0563	0.0492	0.0506	0.0441	0.0434	0.0461	0.0455	0.0452	0.0591	0.0578	0.0576	0.0634	0.0618	0.0599	0.064	0.0644	0.0601	0.0622	0.062	0.0651	0.0594
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.134	0.1	0.107	0.099	0.101	0.085	0.083	0.091	0.107	0.142	0.143	0.128	0.14	0.134	0.126	0.138	0.139	0.137	0.14	0.137	0.137	0.124
Cadmium	mg/L	0.00034	0.0000513	0.0000464	0.0000563	0.0000498	0.0000905	0.0000708	<0.00010	0.0000851	0.0000802	<0.000020	<0.000010	<0.000010	0.0000085	<0.0000050	0.0000053	<0.000010	<0.000015	<0.000010	<0.000010	0.0000061	0.0000081	0.000009
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00019	0.00019	0.00022	0.00018	0.00028	0.00032	0.00041	0.00045	0.00035	0.00014	0.00014	0.0001	0.00012	0.00011	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00391	0.0042	0.00527	0.00459	0.00803	0.00939	0.0109	0.0117	0.00925	0.00166	0.00181	0.00121	0.00141	0.00129	0.00122	0.00107	0.00157	0.00146	0.00154	0.00187	0.00165	0.00174
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.06	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0109	0.0098	0.0089	0.0107	0.0058	0.0048	0.0048	0.0051	0.0056	0.0174	0.0186	0.0154	0.0177	0.0175	0.0153	0.0164	0.0159	0.0153	0.0168	0.016	0.0175	0.0163
Manganese	mg/L	-	0.138	0.128	0.113	0.0943	0.112	0.118	0.102	0.106	0.12	0.0393	0.0448	0.0372	0.0403	0.0395	0.0296	0.0347	0.0371	0.0438	0.0341	0.0323	0.0165	0.0173
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.148	0.132	0.137	0.165	0.133	0.131	0.132	0.127	0.138	0.169	0.164	0.166	0.173	0.169	0.169	0.182	0.164	0.175	0.162	0.164	0.163	0.16
Nickel	mg/L	-	0.00059	0.00052	0.00062	0.00057	0.00083	0.00096	0.00086	0.001	0.00093	0.00064	0.00051	0.00076	0.00072	0.00069	0.00069	0.00051	0.00059	0.00065	0.0006	0.00066	0.00063	<0.00050
Selenium	mg/L	-	0.0334	0.0335	0.0365	0.0368	0.0316	0.0348	0.0459	0.0489	0.0448	0.0368	0.0384	0.0341	0.0362	0.0371	0.0339	0.0349	0.0384	0.0383	0.0335	0.0357	0.0361	0.032
Silicon	mg/L	-	4.2	4.3	4.31	4.12	4.75	4.8	4.9	5.23	4.98	3.41	3.7	3.33	3.36	3.51	3.55	3.61	3.67	3.67	3.8	3.64	3.77	3.5
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.53	2.03	2.39	2.77	2.43	2.25	2.46	2.56	2.67	2.66	2.65	2.43	2.51	2.51	2.53	2.64	2.51	2.6	2.54	2.5	2.48	2.37
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	0.012	0.018	0.016	0.015	0.014	0.016	0.018	0.015	0.016	0.012	0.019	0.011	<0.010	<0.010	0.024	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.000616	0.000534	0.00107	0.000885	0.00127	0.00134	0.00157	0.00143	0.00162	0.000469	0.000583	0.000632	0.000615	0.000518	0.000696	0.000627	0.00118	0.00123	0.00111	0.00118	0.00117	0.00113
Vanadium	mg/L	-	0.00058	0.0006	0.00063	0.00053	0.00064	0.00072	0.00065	0.00069	0.00081	0.00075	0.00057	<0.00050	0.00053	0.00061	0.00067	0.00073	0.00088	0.00088	0.00086	0.00089	0.00084	0.00084
Zinc	mg/L	-	0.0061	0.0051	0.0058	0.006	0.0063	0.0068	0.0037	0.0051	0.0056	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-07-18	2016-07-20	2016-07-25	2016-08-02	2016-08-10	2016-08-17	2016-08-23	2016-08-30	2016-09-06	2016-09-13	2016-09-19	2016-09-22	2016-09-27	2016-09-29	2016-10-03	2016-10-11	2016-10-18	2016-10-24	2016-11-01	2016-11-08	2016-11-15	2016-11-22
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	-	1176	1208	-	1228	1238	1232	1218	1196	1225	-	-	1233	1217	1194.1	1222	1247	1227	1221	1224	1227	1224
pH	pH units	-	-	8.366	8.151	-	8.109	8.077	8.169	8.12	8.073	8.052	-	-	7.961	7.93	7.89	7.997	7.882	7.965	7.963	8.064	8.016	8.065
Turbidity	NTU	-	-	0.84	0.77	-	0.2	0.27	0.4	0.49	0.25	0.31	-	-	0.51	1.16	0.86	0.52	1.23	1.31	1.02	1.69	0.81	1.14
Temperature	C	-	-	17.1	18	-	18.9	19.2	17.4	16.5	14.9	14.8	-	-	13.5	12.8	13.178	11.5	11.7	10.9	9.9	9.8	8.7	7.8
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	104.9	-	-	-	-	-	93	-	-	-	-	-	-	107.8
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	9.3	-	-	-	-	-	9.72	-	-	-	-	-	-	11.39
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	51.4	49.4	51.2	51.7	50	54.2	52.2	51.9	51.3	52.2	50.9	51.7	50	70.4	51	52.4	52.1	51.9	52.5	52.5	52.3	52.6
Specific conductivity	uS/cm	-	1200	1200	1200	1190	1200	1200	1200	1200	1170	1180	1180	1170	1160	1200	1120	1130	1150	1130	1180	1160	1160	1170
pH	pH units	-	7.91	7.85	7.81	7.53	7.88	7.85	7.85	7.9	7.89	7.85	7.78	7.79	7.8	7.79	7.79	7.84	7.87	7.84	7.77	7.83	7.88	7.87
Total suspended solids	mg/L	30	<1.0	<1.0	<1.0	1.1	1.5	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.4	<1.0	1.7	1.3	1.1
Turbidity	NTU	-	0.51	0.68	0.46	0.88	0.29	0.25	0.27	0.26	0.29	0.33	0.63	0.43	0.44	0.48	0.46	0.53	1.04	1.09	0.87	0.84	0.82	0.63
Hardness, as CaCO3	mg/L	-	504	513	518	528	529	513	505	482	489	484	500	484	505	507	478	481	500	481	494	494	510	490
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	900	902	919	899	948	895	962	956	942	931	925	942	898	902	944	925	932	882	888	925	910	896
Dissolved organic carbon	mg/L	-	2.37	2.26	2.64	2.5	2.34	2.36	2.34	2.19	2.18	1.76	2.05	1.93	1.93	1.97	1.92	2.16	1.97	2.11	2.01	1.98	2.11	2
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	8.92	8.72	8.6	8.87	9.04	8.73	8.78	9.2	9.51	8.99	9.34	9.1	8.72	8.74	9.16	8.83	8.96	8.82	8.72	8.94	8.72	8.7
Nitrate + nitrite	mg-N/L	-	9	8.79	8.68	8.93	9.1	8.8	8.85	9.27	9.58	9.08	9.43	9.18	8.77	8.8	9.21	8.88	9.01	8.87	8.77	8.98	8.76	8.73
Nitrite	mg-N/L	0.78	0.0842	0.0734	0.0756	0.0628	0.0633	0.0639	0.064	0.0673	0.0706	0.0874	0.0953	0.0821	0.0583	0.0608	0.0534	0.0577	0.0492	0.0521	0.0501	0.045	0.0348	0.0354
Total ammonia	mg-N/L	1.3	0.117	0.111	0.11	0.115	0.112	0.109	0.117	0.141	0.136	0.108	0.0955	0.0795	0.0639	0.0489	0.0376	0.0275	0.0294	0.0311	0.0269	0.0198	0.0149	0.0125
Dissolved phosphorus	mg-P/L	-	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0029	<0.0020	<0.0020	<0.0020	0.0036	0.0028	0.0031	0.0034	0.0052	0.0057	0.0046	0.0062	0.0041	0.0048
Total phosphorus	mg-P/L	0.09	0.0044	0.0049	0.0049	0.0032	<0.0020	<0.0020	<0.0020	0.0036	0.0056	0.0025	0.0031	0.0037	0.0046	0.0051	0.0056	0.0064	0.0058	0.0086	0.0168	<0.010	0.0067	0.0046
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	0.0025	0.0028	0.0022	0.0017	0.001	0.002
Total nitrogen	mg/L	-	9.12	8.58	9.02	9.08	8.96	9.03	8.93	8.68	8.82	9.15	8.96	9.35	8.77	9.13	8.81	8.88	8.57	8.93	8.61	9.01	8.86	8.61
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	152	157	158	159	163	154	151	149	148	149	147	149	145	152	147	146	151	145	150	151	154	151
Chloride	mg/L	-	12.4	12.1	12.1	12.4	12.8	12	12.4	13	13.4	12.7	13	12.5	11.9	12.3	12.6	12.7	12.7	12.3	12.5	12.4	12.2	12.4
Fluoride	mg/L	17	0.66	0.64	0.64	0.64	0.67	0.62	0.7	0.69	0.69	0.7	0.65	0.64	0.58	0.65	0.63	0.7	0.68	0.62	0.64	0.64	0.61	0.64
Magnesium	mg/L	-	30.1	29.6	29.8	31.7	29.7	30.9	31.1	26.8	29.1	27.3	32.3	27.1	28	31.1	27.1	28	29.5	29.1	28.8	28.7	30.3	27.4
Potassium	mg/L	-	17	16.7	16.6	17.2	16.6	18.3	18.3	16.6	16.8	16.7	17.3	16.3	15.6	18	15.5	17	16.7	16.8	16.7	16.7	16.7	16.1
Sodium	mg/L	-	57.3	59.7	57.7	60.4	58	63	62.2	58	59.2	59	65.2	53.8	56.4	60.7	54.2	60.2	60.6	58.6	58.7	58.2	57.9	58.2
Sulphate	mg/L	1100	558	544	536	552	558	540	544	568	589	555	575	559	533	540	568	553	559	548	544	557	542	545
Total Metals																								
Aluminum	mg/L	-	0.043	0.0602	0.0424	0.0699	0.0347	0.036	0.034	0.0333	0.0359	0.0447	0.0431	0.0416	0.0374	0.0444	0.0388	0.0456	0.0565	0.0942	0.0635	0.0739	0.0646	0.0525
Antimony	mg/L	-	0.00169	0.00186	0.00177	0.00176	0.00176	0.00167	0.00191	0.00188	0.00174	0.00181	0.00178	0.00178	0.00168	0.00173	0.0018	0.0018	0.00184	0.00182	0.00178	0.00182	0.00208	0.00178
Arsenic	mg/L	0.028	0.0009	0.00092	0.00085	0.00096	0.00084	0.00094	0.00098	0.00094	0.00089	0.00089	0.00102	0.00098	0.00094	0.00103	0.00097	0.00104	0.00095	0.00111	0.00111	0.00117	0.0011	0.00106
Barium	mg/L	-	0.0648	0.0672	0.0645	0.0695	0.066	0.063	0.0737	0.066	0.0646	0.0659	0.0668	0.0656	0.0663	0.0675	0.0641	0.0635	0.0576	0.0615	0.064	0.0673	0.0639	0.0644
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.146	0.136	0.142	0.142	0.146	0.141	0.146	0.151	0.141	0.152	0.153	0.147	0.14	0.138	0.161	0.134	0.157	0.147	0.144	0.15	0.154	0.149
Cadmium	mg/L	-	<0.000015	0.0000096	0.0000107	<0.000015	<0.000020	<0.000020	<0.000015	0.0000124	<0.000025	0.00001	<0.000015	<0.000020	<0.000015	0.0000177	<0.000015	<0.000020	<0.000015	<0.000020	<0.000020	0.000011	<0.000020	<0.000045
Calcium	mg/L	-	156	159	155	158	164	151	158	146	148	154	153	157	154	155	149	151	151	147	155	153	155	154
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	0.00012	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.00289	0.00437	0.00332	0.00446	0.00262	0.0025	0.00283	0.00291	0.00294	0.00348	0.00338	0.00378	0.004	0.00351	0.00338	0.00395	0.00452	0.00621	0.00536	0.00608	0.00544	0.00583
Iron	mg/L	1	<0.030	0.037	0.033	0.041	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	0.061	0.039	0.039	0.035	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000072	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0169	0.0155	0.0171	0.0163	0.0174	0.0167	0.0152	0.0173	0.0161	0.017	0.0179	0.0167	0.0162	0.0173	0.0169	0.0169	0.0153	0.016	0.0173	0.0167	0.0176	0.0172
Magnesium	mg/L	-	30.5	30.3	29.4	31	30.8	29.8	32.5	26.7	29.5	29.2	30.1	30.3	30	31.1	28.5	29.4	27.6	29.1	29.9	30	30.7	29.2
Manganese	mg/L	3.4	0.0214	0.0226	0.0188	0.021	0.0138	0.013	0.015	0.0173	0.0217	0.0283	0.0191	0.0178	0.0164	0.0171	0.0179	0.0171	0.0129	0.0159	0.0139	0.0117	0.00995	0.0103
Mercury	mg/L	-	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	0.36	0.175	0.178	0.175	0.171	0.184	0.167	0.18	0.17	0.172	0.181	0.175	0.18	0.19	0.187	0.176	0.172	0.171	0.174	0.173	0.179	0.184	0.176
Nickel	mg/L	-	0.00056	0.00058	0.00072	0.00066	0.00099	0.00069	0.00063	0.00057	0.00059	0.00061	0.00066	0.00061	0.00089	0.00112	0.00069	0.00061	0.00061	0.00055	0.00061	0.00055	0.00052	0.00057
Potassium	mg/L	-	17.4	17	16.7	18.1	17	17.9	19	17.1	17	17.8	18.3	17.6	17.1	17.7	16.3	17.1	15.9	16.5	16.9	17.6	17.3	16.7
Selenium	mg/L	0.075	0.0332	0.0353	0.0355	0.036	0.0355	0.0349	0.0406	0.0338	0.0355	0.0389	0.037	0.0349	0.0365	0.0378	0.0356	0.0348	0.0345	0.0345	0.0348	0.0362	0.0349	0.0361
Silicon	mg/L	-	3.68	3.77	3.63	3.77	3.67	3.75	3.87	3.75	3.85	4.12	3.96	3.9	3.99	4.09	3.74	4.15	3.99	4.11	4	4.27	4.11	4.16
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	59.3	61.7	58.8	64.4	59.6	61.3	64.3	59.7	59.5	63.1	63	58.9	60.7	60.8	57.8	63.3	57.9	59.8	60.8	61.7	62.7	61.9
Strontium	mg/L	-	2.64	2.58	2.56	2.57	2.61	2.45	2.62	2.45	2.49	2.54	2.52	2.64	2.63	2.64	2.6	2.53	2.52	2.44	2.52	2.51	2.6	2.47
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000012	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	0.00037	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0002	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	0.01	0.011	0.011	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00118	0.0013	0.00121	0.00117	0.00125	0.00119	0.00122	0.00123	0.00125	0.00124	0.00123	0.00125	0.00115	0.00119	0.00131	0.00128	0.00127	0.00129	0.0013	0.00127	0.00132	0.00129
Vanadium	mg/L	-	0.00104	0.00108	0.00101	0.0011	0.00097	0.00108	0.00117	0.00106	0.00102	0.00109	0.00128	0.00121	0.00111	0.00132	0.00115	0.0012	0.00109	0.00119	0.00119	0.0012	0.00122	0.00117
Zinc	mg/L	0.059	<0.0030	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	0.0056	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-07-18	2016-07-20	2016-07-25	2016-08-02	2016-08-10	2016-08-17	2016-08-23	2016-08-30	2016-09-06	2016-09-13	2016-09-19	2016-09-22	2016-09-27	2016-09-29	2016-10-03	2016-10-11	2016-10-18	2016-10-24	2016-11-01	2016-11-08	2016-11-15	2016-11-22
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.0258	0.0266	0.0249	0.0246	0.0291	0.0267	0.0223	0.0262	0.0233	0.0228	0.0257	0.0207	0.0197	0.0221	0.0178	0.0191	0.0182	0.0177	0.0174	0.0174	0.0157	0.0155
Antimony	mg/L	-	0.00164	0.00178	0.00176	0.00168	0.00174	0.00171	0.00173	0.00177	0.00172	0.00174	0.00164	0.00169	0.00166	0.0016	0.00175	0.00168	0.00179	0.00182	0.00174	0.00178	0.00166	0.00174
Arsenic	mg/L	-	0.00082	0.00084	0.00082	0.00082	0.00087	0.00094	0.00095	0.00087	0.00089	0.00083	0.00092	0.00078	0.00081	0.00088	0.00087	0.00094	0.00097	0.00104	0.00099	0.00106	0.00093	0.00101
Barium	mg/L	-	0.0639	0.0644	0.0639	0.0641	0.0645	0.0661	0.07	0.0664	0.0636	0.0646	0.0642	0.063	0.0624	0.0659	0.0612	0.062	0.0607	0.0595	0.0629	0.0662	0.0604	0.0645
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.137	0.132	0.133	0.132	0.138	0.137	0.136	0.139	0.134	0.138	0.138	0.133	0.151	0.129	0.157	0.124	0.149	0.14	0.132	0.147	0.14	0.136
Cadmium	mg/L	0.00034	<0.000015	0.000014	0.0000139	<0.000010	<0.000030	<0.000020	<0.000015	0.0000126	<0.000025	0.0000139	<0.000015	<0.000010	0.0000133	0.0000177	<0.000015	<0.000020	<0.000015	<0.000020	<0.000020	<0.0000050	<0.000025	<0.000045
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00183	0.00199	0.00196	0.00203	0.00176	0.00193	0.00138	0.0017	0.0018	0.00216	0.00233	0.00216	0.00197	0.00212	0.00207	0.00229	0.00266	0.00276	0.00303	0.00286	0.00285	0.00326
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0163	0.0152	0.0167	0.0156	0.017	0.0173	0.0151	0.0169	0.0159	0.0162	0.0169	0.0175	0.0148	0.0169	0.0166	0.017	0.0152	0.0155	0.0161	0.0166	0.0159	0.0169
Manganese	mg/L	-	0.0141	0.0145	0.0144	0.0145	0.00887	0.00909	<0.00010	0.00428	0.0093	0.0153	0.0153	0.00807	0.00406	0.0106	0.0116	0.011	0.0103	0.00943	0.00927	0.00654	0.00507	0.00546
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.164	0.167	0.164	0.16	0.182	0.162	0.171	0.169	0.17	0.169	0.182	0.175	0.175	0.181	0.171	0.164	0.171	0.165	0.163	0.167	0.174	0.165
Nickel	mg/L	-	0.00055	0.00052	0.00063	0.0006	0.0006	0.0006	0.00053	<0.00050	0.00053	0.00054	0.00059	<0.00050	<0.00050	0.00112	0.00055	0.00059	0.0006	<0.00050	0.00054	0.00052	<0.00050	0.00051
Selenium	mg/L	-	0.0325	0.0334	0.0377	0.0361	0.0355	0.0373	0.039	0.0327	0.035	0.0375	0.0371	0.033	0.0311	0.0346	0.0335	0.0341	0.0342	0.0351	0.0343	0.0329	0.0334	0.0355
Silicon	mg/L	-	3.57	3.64	3.65	3.65	3.59	3.84	3.67	3.67	3.78	3.78	3.88	3.53	3.73	3.8	3.62	3.92	3.81	3.86	3.72	3.91	3.75	3.9
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.49	2.53	2.54	2.51	2.62	2.5	2.53	2.5	2.49	2.44	2.63	2.55	2.45	2.61	2.52	2.47	2.55	2.43	2.45	2.43	2.54	2.41
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	0.011	<0.010	0.012	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00113	0.00126	0.00117	0.00114	0.00124	0.00117	0.00117	0.00122	0.00123	0.00116	0.00114	0.00122	0.00125	0.00117	0.0013	0.00123	0.00127	0.00126	0.00121	0.00122	0.00124	0.00122
Vanadium	mg/L	-	0.00081	0.00091	0.00086	0.00093	0.00088	0.00096	0.00093	0.00089	0.00092	0.00097	0.001	0.00081	0.00072	0.00085	0.00079	0.00087	0.00096	0.00097	0.00097	0.00094	0.00093	0.00101
Zinc	mg/L	-	<0.0030	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0042	0.0065	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-11-29	2016-12-06	2016-12-14	2016-12-20	2016-12-28	2017-01-03	2017-01-09	2017-01-10	2017-01-17	2017-01-19	2017-01-26	2017-01-30	2017-02-01	2017-02-07	2017-02-14	2017-02-21	2017-03-01	2017-03-07	2017-03-14	2017-03-21	2017-03-27	2017-03-30
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1224	1224	-	1229	1247	1210	1205	1214	1222	1216	1223	1241	1234	1220	1242	1217	1221	1232	1214	1207	1223	1167
pH	pH units	-	8.013	8.035	-	8.023	7.976	8.063	8.089	7.819	8.131	8.088	7.74	7.291	7.391	8.031	7.616	7.501	7.414	7.339	7.445	7.466	7.458	7.471
Turbidity	NTU	-	1.52	6.74	-	0.52	1.09	2.52	1.88	1.18	2.38	2.79	0.63	1.29	1.18	1.21	0.99	3.8	1.91	3.28	1.94	1.63	4.35	1.33
Temperature	C	-	7.6	4.9	-	3.6	3.8	2.8	2.6	2.6	3	2.5	3.3	4.2	2.5	2.7	3.9	3.3	2.6	3.5	3.2	2.8	4.1	3.6
Dissolved oxygen	%	-	-	123.5	-	-	-	112.1	-	-	-	-	-	-	106.1	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	14.06	-	-	-	13.81	-	-	-	-	-	-	13.31	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	52.2	53.2	53.7	53.2	53.4	53.1	50.6	52	53.1	53	50.5	45.4	45.5	51.7	49	48.3	46.3	46.8	46.7	47.3	46.2	45.8
Specific conductivity	uS/cm	-	1200	1200	1200	1200	1170	1180	1170	1170	1150	1180	1170	1180	1160	1200	1180	1140	1060	1150	1180	1150	1150	1120
pH	pH units	-	7.88	7.92	7.85	7.88	7.86	7.87	7.89	7.83	7.87	7.83	7.58	7.45	7.38	7.85	7.52	7.62	7.42	7.39	7.49	7.61	7.42	7.38
Total suspended solids	mg/L	30	1.3	1.7	<1.0	<1.0	<1.0	3.5	1.9	1.2	3.5	2.6	5.5	8.4	7.8	1.7	8.6	7.9	11.1	9.3	10.7	7.1	7.7	10.3
Turbidity	NTU	-	0.83	1.16	0.46	0.43	0.55	2.16	2.43	1.27	2.61	2.05	0.61	0.81	1.23	0.9	1.14	1.59	1.97	2.01	1.43	1.22	1.69	1.44
Hardness, as CaCO3	mg/L	-	481	527	450	472	477	490	512	508	465	485	526	478	481	506	474	534	473	491	492	454	461	464
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	896	874	918	900	909	882	868	887	869	845	891	876	860	932	902	904	876	870	881	844	878	886
Dissolved organic carbon	mg/L	-	2.05	2.07	2.02	1.86	1.78	1.92	2.15	1.9	1.94	1.93	1.86	2.16	1.82	2.54	1.85	1.78	2.16	1.76	1.92	1.84	1.63	1.59
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	8.67	8.76	8.7	8.84	8.59	8.57	8.9	9.02	8.61	8.49	8.76	8.92	8.72	8.88	8.45	8.48	8.74	8.32	8.4	8.54	8.52	7.85
Nitrate + nitrite	mg-N/L	-	8.7	8.8	8.74	8.87	8.62	8.6	8.94	9.04	8.64	8.51	8.79	8.94	8.75	8.9	8.48	8.51	8.76	8.34	8.42	8.57	8.53	7.87
Nitrite	mg-N/L	0.78	0.0341	0.0325	0.0379	0.0311	0.0291	0.0349	0.0351	0.0258	0.0276	0.0223	0.0305	0.0253	0.0281	0.0238	0.0283	0.0299	0.021	0.0217	0.02	0.0224	0.0162	0.015
Total ammonia	mg-N/L	1.3	0.0143	0.0144	0.0152	0.0337	0.0162	0.0205	0.0157	0.0125	0.0148	0.0128	0.0213	0.0214	0.0215	0.0248	0.0236	<0.0050	0.0197	0.0197	0.0219	0.0129	0.0096	0.0106
Dissolved phosphorus	mg-P/L	-	0.0058	0.0044	0.0046	0.0049	0.0041	0.0066	0.0041	0.0055	0.0052	0.0061	0.004	0.0038	0.0029	0.0052	0.0029	0.0031	0.0023	0.0029	0.003	0.0031	0.0023	<0.0020
Total phosphorus	mg-P/L	0.09	0.0051	0.0074	0.0041	0.0057	0.0051	0.0102	0.0066	0.0057	0.01	0.0089	0.0048	0.011	0.0039	0.0078	0.0049	0.003	0.004	<0.0020	0.0024	0.0036	0.0039	0.0023
Orthophosphate	mg-P/L	-	0.0022	0.0015	0.0021	0.0023	0.0019	0.0032	0.0026	0.0026	0.0027	0.0032	<0.0010	<0.0010	<0.0010	0.0029	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	8.81	8.67	8.8	8.82	8.51	8.72	8.88	8.52	8.65	8.48	8.84	8.68	8.71	8.8	9.01	9.01	8.75	8.73	8.45	8.42	8.61	8.31
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	149	164	136	146	147	150	159	155	141	151	158	148	150	154	143	162	143	149	149	135	144	142
Chloride	mg/L	-	12.3	12.5	12	12.6	11.8	11.8	12.3	12.4	12.1	11.9	14.3	18.7	18.2	12.3	15.5	15.9	18.2	17.5	17.4	17.1	17.3	16.6
Fluoride	mg/L	17	0.63	0.65	0.63	0.65	0.64	0.65	0.62	0.63	0.65	0.64	0.62	0.51	0.52	0.64	0.56	0.54	0.51	0.5	0.51	0.55	0.5	0.49
Magnesium	mg/L	-	26.6	28.8	26.5	25.9	26.6	27.8	28.1	29.7	27.7	26.6	32	26.4	25.5	29.8	28.6	31.6	28.5	28.9	29.1	28.5	24.4	26.4
Potassium	mg/L	-	15.2	17	15.3	15.5	15.2	16.4	16.1	16.5	13.8	15.7	16.9	15.5	15.8	16	15.3	17.1	15.5	15.1	15.2	15.2	14.8	14.7
Sodium	mg/L	-	54.6	59.6	55.7	53.4	56.4	59.2	59.8	61	58	58	64.5	56.6	55.7	60.3	57.9	63	57.8	58.2	59	59.6	55.4	56.2
Sulphate	mg/L	1100	540	546	539	550	536	537	554	563	537	528	548	558	540	550	526	530	540	528	524	534	537	493
Total Metals																							
Aluminum	mg/L	-	0.0725	0.0575	0.0614	0.036	0.039	0.139	0.11	0.0855	0.144	0.103	0.531	0.887	1.07	0.0832	0.797	1.27	1.33	1.36	1.38	1.11	0.966	1.08
Antimony	mg/L	-	0.00165	0.00178	0.00179	0.00178	0.0017	0.00178	0.00183	0.00179	0.00187	0.00176	0.00173	0.00169	0.00193	0.00181	0.00166	0.00175	0.00167	0.00177	0.00175	0.00173	0.00162	0.00159
Arsenic	mg/L	0.028	0.00124	0.00117	0.00113	0.00116	0.00119	0.00127	0.00117	0.00124	0.00118	0.00128	0.00093	0.00064	0.0007	0.00121	0.00075	0.0009	0.00077	0.00082	0.00081	0.00077	0.00066	0.00071
Barium	mg/L	-	0.0637	0.061	0.0638	0.0624	0.0618	0.0612	0.0644	0.0629	0.0589	0.0666	0.0611	0.0577	0.0613	0.0601	0.0554	0.0609	0.0536	0.0592	0.061	0.0571	0.0576	0.0566
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.145	0.15	0.144	0.144	0.144	0.145	0.169	0.165	0.154	0.131	0.163	0.159	0.167	0.15	0.157	0.171	0.161	0.152	0.162	0.162	0.171	0.157
Cadmium	mg/L	-	<0.000035	<0.000030	0.0000198	<0.000030	<0.000040	<0.000030	<0.000040	<0.000040	<0.000035	<0.000030	<0.000040	<0.000040	<0.000030	<0.000030	0.0000215	<0.000050	<0.000055	<0.000060	<0.000050	<0.000080	<0.000060	<0.000060
Calcium	mg/L	-	149	162	161	159	154	154	168	166	156	155	163	152	164	159	148	165	144	144	152	149	151	147
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00015	0.0001	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.00591	0.00605	0.00551	0.00535	0.00613	0.0101	0.00864	0.00738	0.00982	0.00881	0.0054	0.00473	0.0046	0.00773	0.00506	0.00632	0.0053	0.0052	0.00604	0.0056	0.00487	0.00568
Iron	mg/L	1	0.039	0.033	<0.030	<0.030	<0.030	0.092	0.067	0.047	0.087	0.058	<0.030	<0.030	<0.030	0.033	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000092	<0.000050	<0.000050	<0.000050	<0.000050	0.000051	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0167	0.0175	0.017	0.0154	0.0157	0.0152	0.0161	0.0163	0.0156	0.0137	0.0167	0.0156	0.0182	0.0161	0.0149	0.0169	0.0152	0.0153	0.0152	0.0161	0.02	0.0151
Magnesium	mg/L	-	31.3	30.2	29	30.2	28.1	28.6	30.1	30.6	30.6	27.8	31	28.3	29.2	30.9	29.6	31.8	29.3	28.8	30	28.4	27.3	28.3
Manganese	mg/L	3.4	0.00797	0.00748	0.0115	0.00699	0.00721	0.0241	0.00902	0.00767	0.00907	0.00778	0.00847	0.00971	0.00768	0.00789	0.00622	0.0074	0.00645	0.00691	0.00824	0.00778	0.00801	0.0112
Mercury	mg/L	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	-	-	-	-	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.36	0.169	0.184	0.179	0.176	0.176	0.179	0.186	0.184	0.178	0.174	0.178	0.175	0.19	0.179	0.171	0.185	0.168	0.172	0.167	0.174	0.162	0.169
Nickel	mg/L	-	0.00058	0.00051	0.00058	0.00051	<0.00050	0.00056	0.0006	0.00055	0.00051	0.00057	0.00053	0.00055	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	17.6	16.6	17.6	16.2	16.9	16.5	16.2	16.8	16.2	15.7	16.6	16	16	16.5	15.5	16.8	15.5	15	15.9	15.1	15.3	15.3
Selenium	mg/L	0.075	0.0368	0.0363	0.0376	0.0333	0.0371	0.037	0.0379	0.0356	0.0362	0.0356	0.0366	0.036	0.0369	0.0353	0.0349	0.0372	0.0354	0.0357	0.0359	0.0337	0.033	0.0355
Silicon	mg/L	-	4.31	4.29	4.22	3.93	4.05	4.26	4.6	4.34	4.37	4.1	4.32	4.31	4.34	4.3	4.02	4.35	4.11	4.2	4.43	4.11	4.33	4.28
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	63.9	60	66.2	61.7	62.4	61.1	64.7	63.6	62.7	56.7	62.3	60	60.1	63.7	60.4	63.8	59.8	60	61.5	59.2	55.7	59
Strontium	mg/L	-	2.33	2.59	2.5	2.46	2.38	2.44	2.58	2.51	2.46	2.41	2.44	2.38	2.58	2.49	2.36	2.55	2.38	2.4	2.34	2.32	2.25	2.27
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00119	0.00139	0.00136	0.00129	0.00131	0.00141	0.0014	0.00134	0.00139	0.00127	0.00127	0.000852	0.001	0.00141	0.00106	0.00123	0.00108	0.00102	0.00118	0.00102	0.000928	0.000914
Vanadium	mg/L	-	0.00149	0.00112	0.00126	0.00116	0.00121	0.0015	0.00142	0.00132	0.00145	0.00136	0.00129	0.00108	0.00112	0.00136	0.00113	0.00127	0.00106	0.00108	0.00119	0.00116	0.00105	0.00114
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	0.0053	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2016-11-29	2016-12-06	2016-12-14	2016-12-20	2016-12-28	2017-01-03	2017-01-09	2017-01-10	2017-01-17	2017-01-19	2017-01-26	2017-01-30	2017-02-01	2017-02-07	2017-02-14	2017-02-21	2017-03-01	2017-03-07	2017-03-14	2017-03-21	2017-03-27	2017-03-30
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.0158	0.0139	0.0132	0.0135	0.012	0.0132	0.0123	0.0128	0.0115	0.0106	0.141	0.0719	0.0406	0.0173	0.113	0.112	0.0962	0.128	0.136	0.031	0.0748	0.0765
Antimony	mg/L	-	0.00163	0.00179	0.00163	0.00169	0.00171	0.00173	0.00174	0.00165	0.00146	0.00164	0.0017	0.00165	0.0017	0.00171	0.00157	0.00166	0.00161	0.00159	0.0017	0.00161	0.0016	0.00152
Arsenic	mg/L	-	0.001	0.00097	0.00109	0.00097	0.00109	0.00109	0.00111	0.00112	0.00091	0.00104	0.00067	0.00038	0.00041	0.00112	0.00046	0.00046	0.00042	0.00044	0.00042	0.00039	0.00038	0.00038
Barium	mg/L	-	0.0565	0.0616	0.0611	0.0552	0.0621	0.0606	0.0601	0.0603	0.0575	0.0582	0.0626	0.0548	0.0598	0.0563	0.0564	0.0597	0.053	0.0556	0.0574	0.0559	0.0559	0.054
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.138	0.148	0.135	0.136	0.139	0.151	0.146	0.147	0.139	0.136	0.15	0.143	0.151	0.146	0.143	0.152	0.149	0.164	0.15	0.13	0.14	0.138
Cadmium	mg/L	0.00034	<0.000035	<0.000025	<0.000030	<0.000030	0.0000198	<0.000015	<0.000040	<0.000030	<0.000015	<0.000020	<0.000040	<0.000040	<0.000040	<0.000030	0.0000233	<0.000025	0.0000466	<0.000065	<0.000050	<0.000050	0.0000562	<0.000060
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00293	0.00338	0.00377	0.00355	0.00403	0.0038	0.00453	0.00441	0.004	0.00401	0.00276	0.00208	0.00205	0.00471	0.0023	0.00263	0.00201	0.00235	0.00229	0.00234	0.00305	0.00233
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000089	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0161	0.0169	0.0159	0.0158	0.0148	0.0168	0.0153	0.0154	0.016	0.0148	0.0158	0.0151	0.0156	0.0153	0.0153	0.0164	0.0155	0.0165	0.0148	0.0142	0.0153	0.0144
Manganese	mg/L	-	0.00457	0.0051	0.00508	0.00493	0.00518	0.00475	0.00533	0.00508	0.00456	0.00485	0.00537	0.00543	0.00571	0.00554	0.00553	0.00615	0.00557	0.00634	0.00731	0.0072	0.00719	0.00832
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.167	0.181	0.159	0.155	0.157	0.175	0.17	0.165	0.16	0.171	0.177	0.17	0.167	0.171	0.161	0.18	0.162	0.169	0.159	0.173	0.161	0.163
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0352	0.0229	0.0327	0.034	0.0342	0.0377	0.0304	0.0341	0.0348	0.0334	0.038	0.0351	0.0343	0.0332	0.0334	0.0346	0.034	0.0362	0.0345	0.0354	0.0336	0.0333
Silicon	mg/L	-	3.95	3.89	3.75	3.73	3.71	3.96	3.45	3.99	3.88	3.8	4.14	4.05	3.94	4.08	3.78	3.92	3.75	3.97	3.95	3.91	3.86	3.9
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.34	2.58	2.31	2.37	2.27	2.44	2.4	2.33	2.25	2.38	2.45	2.3	2.32	2.4	2.27	2.5	2.28	2.33	2.28	2.37	2.2	2.21
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00118	0.00134	0.00122	0.00122	0.00138	0.00136	0.00129	0.00122	0.00121	0.00128	0.00123	0.000684	0.000613	0.00136	0.000869	0.000935	0.000808	0.00077	0.000856	0.000761	0.000634	0.000693
Vanadium	mg/L	-	0.00087	0.00091	0.00092	0.00094	0.001	0.001	0.00106	0.00108	0.00097	0.00093	0.00105	0.00084	0.00082	0.00106	0.00096	0.00098	0.00087	0.00084	0.00089	0.00088	0.00095	0.00089
Zinc	mg/L	-	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2017-06-06	2017-06-13	2017-06-20	2017-06-27	2017-07-04	2017-09-19	2017-09-21	2017-09-26	2018-01-09	2018-01-30	2018-01-31	2018-02-06	2018-02-13	2018-02-20	2018-03-01	2018-03-08	2018-03-15	2018-03-20	2018-03-27	2018-04-03	2018-04-10	2018-04-17
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1338	1347	1359	1344	1363	1444	1434	1450	1365.6	1280.8	1295.4	1408.6	1432.6	1397.2	1359.1	1495	1398	1111.1	1100	1181.1	1183.4	905.7
pH	pH units	-	7.652	7.612	7.61	7.59	7.538	7.6	7.9	7.4	7.09	7.35	7.46	7.48	7.54	7.69	7.39	7.312	7.42	7.21	7.5	7.55	7.39	7.4
Turbidity	NTU	-	0.5	0.53	1.49	0.86	0.71	0.54	0.52	0.64	0.33	3.19	2.23	0.04	2.94	1.91	1.77	1.67	2.33	2.97	2.67	3.18	3.34	4.16
Temperature	C	-	15.2	15.1	15.5	17.1	16.9	11.9	12.1	12	4.055	2.179	2.085	1.616	1.513	1.327	2.072	2.7	2.1	3.064	1.5	3.311	3.939	3.382
Dissolved oxygen	%	-	104.7	-	-	-	-	-	-	-	89	-	-	-	94.5	103.2	92.8	105	-	92.9	-	-	93.1	95.9
Dissolved oxygen	mg/L	-	9.28	-	-	-	-	-	-	-	11.59	-	-	-	13.13	14.48	12.74	12.28	-	12.44	-	-	12.17	12.74
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	99.7	86.5	83.2	76.1	77.8	104	105	88.4	107	73	67.6	69.3	73.9	54.4	62.4	63.8	60.9	91.5	85.6	75.7	78.6	78.5
Specific conductivity	uS/cm	-	1320	1290	1330	1280	1290	1410	1380	1390	1340	1260	1220	1370	1400	1440	1400	1420	1340	1090	974	1120	1150	899
pH	pH units	-	7.9	7.96	7.99	7.77	7.87	7.94	7.97	7.93	7.7	7.77	7.86	7.85	7.54	7.72	7.52	7.72	7.91	7.94	8	7.95	8.06	8.02
Total suspended solids	mg/L	30	4.4	3.5	4	3.7	4.7	4.9	3.1	2.6	8	12.2	10.5	5.7	6.2	8.2	11.4	7.7	11.6	7.5	10.5	7.3	8.2	7.3
Turbidity	NTU	-	0.62	0.59	0.82	0.64	1.13	0.59	0.56	0.65	1.19	1.62	2.19	1.55	1.69	1.81	2.02	1.6	2.51	3.55	3.24	2.63	3.13	3.06
Hardness, as CaCO3	mg/L	-	695	642	617	617	621	758	768	675	685	582	612	612	583	547	540	572	551	536	474	559	536	394
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	1120	1020	1040	1070	1100	1210	1170	1130	1070	975	964	1030	1080	1120	1060	1080	1010	821	784	867	903	674
Dissolved organic carbon	mg/L	-	3.86	3.6	3.28	3.31	2.74	2.77	3.08	2.75	2.23	2.45	2.56	3.63	4.56	5.15	5.03	4.71	5.42	4.14	4.08	4.37	4.89	3.97
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	10.1	10.4	10	9.89	9.3	8.76	8.32	8.37	10.9	9.94	9.9	9.82	7.83	9.4	12.5	10.8	9.54	7.54	6.96	8.65	7.28	6.23
Nitrate + nitrite	mg-N/L	-	10.1	10.5	10.1	9.98	9.35	8.84	8.38	8.46	11	10	9.99	9.97	7.94	9.55	12.9	11	9.74	7.68	7.06	8.82	7.4	6.31
Nitrite	mg-N/L	0.78	0.065	0.0836	0.0898	0.0907	0.0454	0.0757	0.0658	0.0873	0.0821	0.0939	0.0952	0.15	0.117	0.156	0.331	0.268	0.192	0.137	0.103	0.173	0.116	0.0807
Total ammonia	mg-N/L	1.3	0.123	0.131	0.104	0.128	0.0609	0.113	0.1	0.07	0.176	0.336	0.324	0.398	0.26	0.333	1.01	0.794	0.46	0.32	0.344	0.604	0.414	0.339
Dissolved phosphorus	mg-P/L	-	0.0023	0.0029	<0.0020	0.0022	<0.0020	<0.0020	0.0021	<0.0020	0.0027	0.0023	0.002	0.0023	0.0027	0.0027	0.0024	0.0022	0.0036	0.004	0.0031	0.0028	0.0024	0.0038
Total phosphorus	mg-P/L	0.09	0.0027	0.0034	0.0037	<0.0020	<0.0020	0.0031	<0.0020	0.0036	0.0045	0.0043	0.0046	0.0044	0.0043	0.0069	0.0087	0.0063	0.0084	0.0099	0.0083	0.0061	0.0086	0.0087
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	10.2	10.9	10.7	10.1	9.48	8.8	8.51	8.78	11.5	10.9	11.3	10.2	8.47	10.1	13.7	11.6	10.3	7.93	7.54	9.61	8.58	6.73
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	216	194	191	190	195	239	245	215	216	180	189	193	184	165	166	175	168	170	144	173	164	116
Chloride	mg/L	-	13.5	15.8	17.4	19	18.6	16.2	16.3	20.6	15	17.8	21	26.3	26.6	33.4	31.7	33.6	31.3	17.6	15.9	22.7	22.2	14.9
Fluoride	mg/L	17	0.44	0.46	0.54	0.6	0.5	0.59	0.55	0.66	0.57	0.51	0.53	0.6	0.74	0.77	0.71	0.64	0.63	0.42	0.29	0.42	0.43	0.21
Magnesium	mg/L	-	38	38.4	33.8	34.5	32.4	39.4	38.1	33.4	35.2	32.1	34	31.7	29.9	32.8	30.4	32.8	31.8	26.8	27.8	31.2	30.5	25.5
Potassium	mg/L	-	3	7.23	9.52	12	7.84	3.94	3.99	10.8	2.67	8.08	10.9	12.8	14.2	20.5	18.9	17.7	17.1	5.9	3.57	9.52	9.49	2.59
Sodium	mg/L	-	33.7	41.4	48	55	43.8	48.8	47.9	60	36.5	51.6	62.1	69.8	76.8	107	85.9	88.9	81.6	37.3	30	53.3	52.8	19.6
Sulphate	mg/L	1100	604	586	603	604	619	718	683	644	620	562	570	611	634	651	613	633	593	469	421	484	476	364
Total Metals																								
Aluminum	mg/L	-	0.443	0.462	0.697	0.69	0.761	0.656	0.606	0.679	0.812	1.08	1.16	1.08	1.29	0.0982	1.28	1.29	1.08	0.967	1.13	1.16	1.18	0.899
Antimony	mg/L	-	0.00135	0.00139	0.00154	0.00166	0.00134	0.00107	0.001	0.00115	0.00191	0.0017	0.00175	0.00179	0.00156	0.00169	0.00221	0.00209	0.00204	0.0018	0.00112	0.00174	0.00153	0.0015
Arsenic	mg/L	0.028	0.00082	0.00098	0.00104	0.00114	0.001	0.00102	0.00093	0.00086	0.00072	0.00099	0.00094	0.0008	0.00079	0.00054	0.00145	0.00138	0.00084	0.0009	0.00082	0.0008	0.00072	0.00063
Barium	mg/L	-	0.0452	0.0568	0.0542	0.0541	0.0511	0.0405	0.0418	0.0526	0.0433	0.05	0.051	0.0628	0.0597	0.0675	0.0712	0.065	0.089	0.0548	0.051	0.0605	0.068	0.0461
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.184	0.191	0.207	0.242	0.187	0.252	0.246	0.251	0.343	0.225	0.224	0.23	0.277	0.171	0.292	0.277	0.217	0.233	0.137	0.166	0.191	0.118
Cadmium	mg/L	-	0.0000924	<0.00011	<0.000085	<0.000080	<0.000085	<0.00010	<0.000075	<0.000060	<0.00015	<0.00012	<0.00015	<0.00012	<0.00015	<0.000070	<0.000070	<0.000090	<0.000070	<0.00020	<0.000085	<0.00020	<0.000065	<0.00011
Calcium	mg/L	-	202	213	188	197	199	225	239	219	225	183	184	192	209	152	189	202	178	177	145	162	157	140
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00028	0.00024	0.00017	0.00015	0.00013	0.00012	0.00012	0.00012	0.00026	0.00021	0.00019	0.00016	0.00011	0.0001	0.00024	0.0002	0.0002	0.00024	0.00026	0.00026	0.00029	0.00037
Copper	mg/L	0.033	0.0109	0.0104	0.00962	0.00788	0.00701	0.00794	0.00685	0.00595	0.00916	0.0103	0.00881	0.0069	0.00522	0.00284	0.0108	0.00688	0.00612	0.0105	0.0109	0.0115	0.00971	0.0128
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.034	0.032	<0.030	0.041	0.04
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.006	0.0092	0.0094	0.012	0.01	0.0075	0.0083	0.012	0.008	0.0114	0.0127	0.0133	0.0122	0.0133	0.0151	0.0143	0.0122	0.0069	0.0053	0.0083	0.009	0.0032
Magnesium	mg/L	-	34.3	38	33.1	34.6	33.4	39.1	37	34.5	36.5	33.1	31.2	32.9	31.5	28.7	33.9	36.2	30.9	28.7	26.5	28.9	28.5	26.4
Manganese	mg/L	3.4	0.0945	0.0796	0.057	0.0498	0.0474	0.0566	0.0492	0.0569	0.0912	0.0719	0.0629	0.0722	0.0444	0.0409	0.0656	0.0771	0.0707	0.0729	0.093	0.0809	0.0783	0.08
Mercury	mg/L	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.14	0.164	0.154	0.171	0.164	0.17	0.176	0.178	0.169	0.182	0.188	0.196	0.233	0.21	0.205	0.221	0.203	0.126	0.103	0.151	0.155	0.106
Nickel	mg/L	-	0.00063	0.00071	0.00061	0.00065	0.00054	0.00052	0.00052	0.00058	0.0007	0.00057	0.00057	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057	0.0007	0.00085	0.00166	0.00066
Potassium	mg/L	-	2.92	6.95	9.23	11.4	7.93	3.87	3.7	10.9	2.8	8.46	9.83	13.2	15.2	21.2	18	17.1	18.5	5.57	3.33	8.64	8.77	2.54
Selenium	mg/L	0.075	0.0481	0.0489	0.0453	0.0434	0.0432	0.0414	0.0389	0.04	0.0534	0.0437	0.0439	0.0401	0.0328	0.037	0.044	0.0429	0.0376	0.0364	0.0364	0.0448	0.0374	0.0415
Silicon	mg/L	-	5.92	5.82	5.38	5.6	5.38	6.77	6.74	6.52	7.9	6.14	5.37	5.79	5.91	4.64	5.32	5.37	5.16	5.53	5.73	5.07	5.38	5.18
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	31.6	43	46.7	55.7	45.1	49.1	46	61.4	38.4	53.9	60.9	75.7	81.4	96	91.4	92.6	86.5	41	29.1	50.6	53.3	21.3
Strontium	mg/L	-	2.76	2.77	2.7	2.79	3.12	4.2	4.37	3.66	3.9	2.37	2.24	2.56	4.09	2.13	2.05	2.35	2.11	2.24	1.48	1.56	2.41	1.44
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000022	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00035	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.0023	0.00194	0.00206	0.00183	0.00174	0.00264	0.00259	0.00197	0.00287	0.0021	0.00178	0.00163	0.00146	0.000814	0.00161	0.00148	0.00133	0.00208	0.00179	0.00165	0.00139	0.00122
Vanadium	mg/L	-	0.00112	0.00124	0.00121	0.00138	0.00119	0.00119	0.00107	0.00113	0.00154	0.00152	0.00149	0.00143	0.00117	0.00136	0.00143	0.00138	0.00151	0.00145	0.00146	0.00163	0.00121	0.00145
Zinc	mg/L	0.059	0.0034	0.0044	0.0059	0.0038	0.0037	0.0049	0.0056	0.0053	0.008	0.0057	0.0058	0.005	0.0054	0.0049	0.0052	0.005	0.0042	0.0046	0.0035	0.0045	<0.0030	0.0045

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2017-06-06	2017-06-13	2017-06-20	2017-06-27	2017-07-04	2017-09-19	2017-09-21	2017-09-26	2018-01-09	2018-01-30	2018-01-31	2018-02-06	2018-02-13	2018-02-20	2018-03-01	2018-03-08	2018-03-15	2018-03-20	2018-03-27	2018-04-03	2018-04-10	2018-04-17
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.349	0.238	0.121	0.103	0.115	0.117	0.103	0.104	0.132	0.101	0.14	0.0604	0.098	-	0.139	0.0837	0.0977	0.0976	0.102	0.106	0.0925	0.971
Antimony	mg/L	-	0.00145	0.00151	0.00156	0.00157	0.00128	0.00099	0.00095	0.00116	0.00192	0.00166	0.00182	0.0018	0.00147	0.00196	0.0019	0.00187	0.00188	0.00166	0.00113	0.00165	0.00149	0.00126
Arsenic	mg/L	-	0.00097	0.001	0.001	0.00111	0.00091	0.00096	0.00091	0.00072	0.00056	0.0008	0.00073	0.00054	0.00056	0.00078	0.00133	0.00116	0.00052	0.00083	0.00063	0.00054	0.00073	0.00057
Barium	mg/L	-	0.0498	0.0572	0.0555	0.0579	0.0494	0.0433	0.0435	0.0528	0.0394	0.0489	0.0545	0.0564	0.0514	0.0642	0.063	0.0674	0.0783	0.0594	0.0552	0.063	0.0702	0.0457
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.203	0.175	0.201	0.199	0.174	0.242	0.22	0.22	0.315	0.207	0.216	0.217	0.236	0.192	0.226	0.219	0.196	0.175	0.117	0.149	0.183	0.107
Cadmium	mg/L	0.00034	0.000111	<0.00012	<0.00010	0.0000745	<0.000080	<0.00010	<0.000085	<0.000060	0.000123	<0.00012	<0.00011	<0.00025	<0.00010	<0.00010	<0.000070	<0.000080	<0.000080	<0.000080	<0.000070	<0.000080	<0.000070	<0.000070
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00029	0.00024	0.00017	0.00016	0.0001	0.00011	0.00011	0.00012	0.00022	0.00018	0.00017	0.00014	<0.00010	<0.00010	0.00021	0.00019	0.00016	0.00019	0.00024	0.00023	0.00024	0.00038
Copper	mg/L	-	0.00929	0.00738	0.00559	0.00478	0.00416	0.0054	0.00487	0.0044	0.00523	0.00399	0.00545	0.00274	0.00199	0.00422	0.00503	0.00374	0.00315	0.00442	0.00518	0.0052	0.00326	0.0135
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.078
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000106	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0069	0.0082	0.0103	0.0115	0.0097	0.0077	0.0086	0.0115	0.0072	0.0109	0.0117	0.0134	0.0121	0.0162	0.0146	0.0123	0.0128	0.0062	0.0041	0.0091	0.0076	0.0034
Manganese	mg/L	-	0.102	0.0752	0.0557	0.0504	0.0411	0.0535	0.0489	0.0542	0.0826	0.0683	0.0614	0.0617	0.0414	0.0393	0.0625	0.0749	0.0679	0.0716	0.0938	0.0806	0.0781	0.0797
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.154	0.159	0.152	0.159	0.156	0.171	0.172	0.167	0.144	0.183	0.182	0.207	0.199	0.25	0.198	0.198	0.179	0.127	0.108	0.146	0.149	0.0937
Nickel	mg/L	-	0.0007	0.00065	0.00058	0.00056	0.00052	0.00051	0.0005	0.00055	0.0006	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00056	0.00058	<0.00050	0.00064
Selenium	mg/L	-	0.0475	0.0511	0.0441	0.0422	0.0422	0.0408	0.0383	0.04	0.0593	0.0426	0.0477	0.0373	0.031	0.0389	0.0402	0.0396	0.0371	0.032	0.0364	0.0397	0.0399	0.0397
Silicon	mg/L	-	5.68	5.54	5.61	5.45	5.05	6.32	6.11	6.22	7.85	5.76	5.79	5.09	5.13	4.79	4.71	5.07	4.87	5.17	5.37	5.18	5.17	5.02
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.97	2.87	2.73	2.65	3.04	4.45	4.48	3.62	3.92	2.34	2.45	2.71	3.67	2.63	1.92	2.14	2.03	2.27	1.57	1.69	2.22	1.23
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00153	0.0021	0.00199	0.00191	0.00163	0.00267	0.00257	0.00183	0.00249	0.00189	0.00137	0.00133	0.00132	0.000967	0.0012	0.00128	0.00108	0.00198	0.0015	0.00154	0.00125	0.00117
Vanadium	mg/L	-	0.0011	0.00117	0.00113	0.00121	0.001	0.00114	0.00104	0.00094	0.00127	0.00125	0.0013	0.00098	0.00094	0.00133	0.00111	0.00111	0.00123	0.00126	0.00122	0.00126	0.00096	0.00131
Zinc	mg/L	-	0.003	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	0.003	0.0037	<0.0080	0.0037	0.0056	0.0031	<0.0030	0.0044	<0.0030	0.0034	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	0.0048

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-04-24	2018-05-01	2018-05-03	2018-05-08	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-31	2018-06-04	2018-06-05	2018-06-07	2018-06-14	2018-06-18	2018-06-21	2018-06-27	2018-07-02	2018-07-10	2018-07-17	2018-07-24	2018-08-07
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	929.1	1001.1	1132.4	1249.3	1284	1284.3	1282.5	1286.5	1283.4	-	1386.6	1303.5	1339	1301	1257.9	1301	1305.9	1238	1241.2	1213	1276	1298.3
pH	pH units	-	7.37	7.19	7.1	7.52	7.36	7.24	7.27	7.27	7.38	-	7.52	7.48	7.987	7.374	7.29	7.29	7.62	7.29	7.72	7.51	7.7	7.88
Turbidity	NTU	-	2.94	2.64	3.63	0.53	1.02	2.18	1.4	5.45	1.96	-	0.1	0.13	1.69	0.93	0	0.02	1.27	1.6	0.63	0.71	0.26	0.39
Temperature	C	-	5.428	8.001	9.459	11.526	10.191	10.164	10.294	10.344	10.209	-	14.729	14.45	14	14.5	15.35	18.8	16.651	15.625	18.759	20.9	18.7	20.343
Dissolved oxygen	%	-	93.8	-	-	93.9	-	-	-	-	-	-	-	92.2	-	-	-	-	98.5	100.8	101.1	-	-	-
Dissolved oxygen	mg/L	-	11.81	-	-	10.17	-	-	-	-	-	-	-	9.37	-	-	-	-	9.57	9.99	9.39	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	72.7	71.8	69.6	64.4	69.5	68.1	67.5	67.1	70.3	66.6	62.6	59.2	64.7	51.9	47.1	48	49.7	48.9	47.1	51	52.3	55.4
Specific conductivity	uS/cm	-	918	1060	1100	1230	1270	1280	1290	1290	1260	1360	1370	1340	1240	1310	1280	1250	1260	1260	1260	1290	1310	1290
pH	pH units	-	7.99	8.01	7.83	7.6	7.84	7.82	7.77	7.74	7.79	7.71	7.54	7.95	7.9	7.9	7.77	7.56	7.74	7.84	7.57	7.54	7.6	7.75
Total suspended solids	mg/L	30	9.1	8.1	6.1	6.3	5.9	5.5	7	9.8	10.5	3.9	3.9	5.7	4.4	5.1	4.8	9.8	7	5.8	4.7	4.3	3.2	3
Turbidity	NTU	-	3.47	2.44	2.32	1.93	1.46	1.52	1.91	2.48	2.4	0.8	1.25	0.84	1.6	1.04	1.05	0.64	0.95	1.1	0.64	0.75	0.69	0.54
Hardness, as CaCO3	mg/L	-	490	538	596	647	647	643	653	649	643	589	584	570	599	508	494	492	502	486	473	489	476	554
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	697	840	878	1010	1040	1070	1080	922	1030	1070	984	997	1120	977	988	958	934	966	976	988	943	1030
Dissolved organic carbon	mg/L	-	3.67	3.61	3.4	3.11	3.47	3.15	3.14	3.07	3.05	2.96	3.26	3.58	3.53	3.77	3.27	3.87	2.92	2.6	2.62	2.46	2.33	2.22
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.68	5.45	5.67	6.14	6.32	6.31	6.32	6.3	6.22	7.02	7.27	7.14	6.77	6.97	7.01	6.97	6.85	6.81	6.72	6.56	6.7	6.46
Nitrate + nitrite	mg-N/L	-	5.71	5.47	5.7	6.17	6.35	6.34	6.35	6.32	6.25	7.11	7.37	7.24	6.87	7.08	7.11	7.07	6.94	6.89	6.8	6.64	6.79	6.56
Nitrite	mg-N/L	0.78	0.0306	0.0219	0.0231	0.0297	0.0307	0.0284	0.0297	0.0272	0.0282	0.0877	0.0984	0.104	0.105	0.107	0.105	0.0979	0.0913	0.0845	0.0776	0.0827	0.0847	0.0929
Total ammonia	mg-N/L	1.3	0.187	0.0803	0.061	0.0675	0.0397	0.0402	0.038	0.0393	0.0393	0.0157	0.0184	0.0161	0.0183	0.0127	0.0102	0.0162	0.0278	0.0215	0.0204	0.0332	0.0222	0.0308
Dissolved phosphorus	mg-P/L	-	0.0025	0.0029	0.0026	<0.0020	0.0031	0.0031	0.0033	0.0036	0.0032	0.0028	0.0031	0.003	0.0038	0.0023	<0.0020	0.0021	<0.0020	<0.0020	0.0037	0.0023	<0.0020	<0.0020
Total phosphorus	mg-P/L	0.09	0.0068	0.0072	0.0094	0.0056	0.0067	0.0058	0.0064	0.0048	0.0053	0.0071	0.0084	0.0061	0.01	0.0068	0.0046	0.0051	0.0046	0.0048	0.0024	0.0086	0.0051	0.0049
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	0.0011	0.0012	0.001	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	5.57	6	6.21	6.91	6.82	7.47	5.58	6.82	6.87	6.52	7.03	7.33	7.29	7.38	6.6	7.37	6.9	7.19	6.68	6.53	6.93	6.9
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	153	166	184	201	198	198	203	201	199	186	183	178	188	158	154	154	157	150	149	156	150	180
Chloride	mg/L	-	15.8	13.6	13.5	14.7	13.8	15.1	15.6	15.8	13.8	22.5	24.9	25.5	19	26.1	26.7	26.1	27.2	25.7	25.4	23.7	25.4	25.5
Fluoride	mg/L	17	0.2	0.26	0.29	0.39	0.49	0.46	0.46	0.45	0.49	0.62	0.68	0.67	0.78	0.68	0.69	0.7	0.68	0.69	0.65	0.73	0.76	0.75
Magnesium	mg/L	-	26	29.9	33	35.1	36.8	36.1	35.6	35.6	35.3	30.1	30.7	30.3	31.4	27.3	26.5	25.9	26.8	26.9	24.5	24.2	24.8	25.2
Potassium	mg/L	-	2.03	2.22	2.63	3.38	4.05	4.01	4.28	4.31	3.92	10	12.3	13.4	14.2	16.7	16.5	16.5	17.1	18.5	16.6	17.3	17.5	17
Sodium	mg/L	-	18.2	20.5	24.2	28.2	33.2	32.5	31.3	32	31	65.5	72.1	73.1	77.3	79.4	78.6	79.3	79	81.4	75.5	74.2	78.9	84.2
Sulphate	mg/L	1100	382	462	517	599	621	621	623	623	617	630	633	606	587	564	568	551	579	547	555	538	580	584
Total Metals																								
Aluminum	mg/L	-	1.07	1.07	1.11	1.09	0.759	0.796	1.03	1.14	1.34	0.643	0.775	0.758	0.338	0.872	0.922	0.775	0.938	0.972	0.796	0.783	0.598	0.648
Antimony	mg/L	-	0.00085	0.00076	0.00079	0.00082	0.0008	0.00082	0.0008	0.00081	0.00089	0.00129	0.00129	0.00142	0.00142	0.0016	0.0016	0.00166	0.00169	0.00165	0.00174	0.00172	0.00181	0.00165
Arsenic	mg/L	0.028	0.00045	0.00034	0.00048	0.0004	0.00049	0.00046	0.00052	0.0005	0.00054	0.00097	0.00106	0.00108	0.00153	0.00162	0.00145	0.00151	0.00147	0.00143	0.00159	0.00136	0.00135	0.00156
Barium	mg/L	-	0.0369	0.037	0.0353	0.0416	0.0433	0.0433	0.0447	0.0435	0.0454	0.0513	0.0557	0.052	0.057	0.0598	0.0572	0.0567	0.057	0.0561	0.0654	0.0576	0.0596	0.0726
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.092	0.098	0.104	0.136	0.131	0.129	0.132	0.131	0.134	0.179	0.164	0.175	0.163	0.175	0.177	0.174	0.172	0.176	0.175	0.166	0.19	0.198
Cadmium	mg/L	-	<0.00010	0.000129	<0.00015	<0.00030	0.00037	0.000356	0.000385	0.000375	0.000384	<0.00017	<0.00031	<0.00014	0.000157	<0.00018	<0.000080	<0.000090	<0.00010	<0.000090	<0.000090	<0.00011	<0.000065	<0.00010
Calcium	mg/L	-	138	169	182	204	225	222	221	222	224	198	181	177	184	164	159	162	168	155	158	160	169	176
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00041	0.00068	0.00066	0.00335	0.00383	0.00372	0.00393	0.00383	0.00404	0.00045	0.00036	0.00029	0.00032	0.00016	0.00011	0.00011	0.00012	0.00012	0.00013	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.0153	0.0201	0.0235	0.209	0.185	0.173	0.204	0.216	0.282	0.0136	0.0114	0.00912	0.0168	0.00579	0.00515	0.00459	0.00439	0.00426	0.00502	0.00403	0.0041	0.00412
Iron	mg/L	1	0.038	0.031	0.036	<0.030	<0.030	<0.030	0.056	<0.030	0.033	<0.030	<0.030	<0.030	0.065	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0034	0.0046	0.0048	0.0077	0.0091	0.0087	0.009	0.009	0.0093	0.0111	0.0105	0.0113	0.0113	0.0121	0.0114	0.0116	0.0126	0.0116	0.0128	0.0138	0.0134	0.0129
Magnesium	mg/L	-	24.1	30.2	33.8	34.3	38.3	37.1	39	38	39.7	32	31.4	29.1	30.6	29.1	27.5	27.3	28.3	27.4	28.4	25.7	27	25.8
Manganese	mg/L	3.4	0.0823	0.111	0.111	0.255	0.299	0.291	0.301	0.295	0.306	0.151	0.132	0.109	0.128	0.0782	0.0624	0.0597	0.0681	0.0678	0.0719	0.0611	0.061	0.0595
Mercury	mg/L	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.36	0.106	0.141	0.145	0.145	0.145	0.143	0.145	0.146	0.148	0.211	0.206	0.204	0.218	0.219	0.202	0.212	0.216	0.206	0.207	0.21	0.219	0.208
Nickel	mg/L	-	0.00077	0.00107	0.00116	0.00348	0.00394	0.00409	0.00415	0.00401	0.00425	0.00096	0.00098	0.00088	0.001	0.00072	0.00057	0.00064	0.00055	0.00052	0.00065	0.00052	0.00055	<0.00050
Potassium	mg/L	-	2.11	2.31	2.53	3.58	4.24	4.15	4.24	4.18	4.32	10.6	12.2	12.8	13.4	17.6	16.8	17.8	17.2	17.6	18.7	18.2	17.6	16.9
Selenium	mg/L	0.075	0.0391	0.0543	0.0572	0.0513	0.0562	0.0571	0.0549	0.0553	0.0582	0.0419	0.0415	0.0411	0.0386	0.0381	0.0402	0.0386	0.0357	0.0398	0.0415	0.0351	0.0404	0.0375
Silicon	mg/L	-	5.19	5.53	5.1	5.38	5.68	5.75	5.73	5.74	5.94	5.27	5.33	4.96	5.38	4.68	4.68	4.52	4.64	4.45	4.96	4.65	4.77	5.1
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	19.2	21.7	24	27.9	33	32.3	33.4	32.9	34.5	67.9	71.9	70.8	77.8	83.3	81.5	81.6	79.4	81.8	84.2	74.2	81.9	83.5
Strontium	mg/L	-	1.81	2.42	2.45	2.9	3.34	3.36	3.34	3.39	3.34	2.59	2.34	2.23	2.17	1.94	1.87	1.91	1.93	1.86	1.86	1.91	2.02	1.71
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000021	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00092	0.00125	0.00135	0.00121	0.0013	0.00123	0.0012	0.00122	0.00142	0.00207	0.00167	0.00153	0.00204	0.00117	0.00115	0.00107	0.00112	0.00112	0.00114	0.00115	0.00124	0.0013
Vanadium	mg/L	-	0.001	0.00097	0.00096	0.0007	0.00064	0.0006	0.00066	0.00063	0.00077	0.0014	0.00145	0.00133	0.00159	0.00161	0.0014	0.00145	0.00151	0.00139	0.00144	0.00148	0.00142	0.00191
Zinc	mg/L	0.059	0.0059	0.0068	0.007	0.0232	0.0254	0.0249	0.0308	0.0262	0.0274	0.007	0.0054	0.0044	0.006	0.0031	0.0031	<0.0030	<0.0030	<0.0030	0.0034	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-04-24	2018-05-01	2018-05-03	2018-05-08	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-10	2018-05-31	2018-06-04	2018-06-05	2018-06-07	2018-06-14	2018-06-18	2018-06-21	2018-06-27	2018-07-02	2018-07-10	2018-07-17	2018-07-24	2018-08-07
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.0944	0.116	0.0876	0.101	0.0645	0.0539	0.0568	0.0667	0.063	0.0824	0.0693	0.0795	0.141	0.0975	0.0901	0.0613	0.1	0.0891	0.71	0.0867	0.103	0.116
Antimony	mg/L	-	0.00091	0.00075	0.00073	0.0008	0.00075	0.00078	0.00078	0.0008	0.00076	0.0012	0.00128	0.00134	0.00137	0.0015	0.0016	0.0016	0.00151	0.00156	0.0016	0.00148	0.00168	0.00154
Arsenic	mg/L	-	0.00034	0.00022	0.00028	0.00029	<0.00070	<0.00060	<0.00050	<0.00060	<0.00050	0.00079	0.00091	0.00109	0.00136	0.00135	0.00132	0.00134	0.0014	0.00133	0.00131	0.00113	0.0013	0.00143
Barium	mg/L	-	0.0389	0.0357	0.0363	0.04	0.0409	0.0409	0.0385	0.0384	0.0399	0.0494	0.0551	0.0549	0.0579	0.0577	0.0571	0.0563	0.0562	0.0579	0.0549	0.0578	0.0658	0.072
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.098	0.092	0.098	0.117	0.121	0.122	0.122	0.123	0.121	0.161	0.159	0.153	0.152	0.165	0.147	0.169	0.155	0.141	0.156	0.175	0.163	0.179
Cadmium	mg/L	0.00034	<0.000085	<0.00015	<0.00014	0.000299	0.000376	0.000387	0.00037	0.000366	0.000377	<0.00020	<0.00031	<0.00014	<0.00015	<0.00014	<0.000085	<0.00010	<0.000090	<0.00016	<0.00010	<0.00011	<0.000070	0.000086
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00036	0.00062	0.00064	0.00332	0.00388	0.00383	0.00378	0.00382	0.00381	0.00041	0.00036	0.00028	0.00025	0.00014	0.00011	0.0001	0.00011	0.0001	0.0001	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00604	0.00854	0.00929	0.0884	0.0855	0.0832	0.0822	0.083	0.088	0.00702	0.00602	0.00498	0.00942	0.00301	0.00346	0.00278	0.00312	0.00289	0.0039	0.00236	0.00237	0.00528
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.004	0.0046	0.0049	0.0081	0.009	0.009	0.0089	0.0089	0.009	0.0103	0.0107	0.0107	0.0114	0.0114	0.0113	0.0118	0.0115	0.0109	0.0118	0.0128	0.0109	0.0124
Manganese	mg/L	-	0.0791	0.106	0.113	0.244	0.277	0.271	0.308	0.284	0.271	0.14	0.13	0.11	0.121	0.0713	0.0617	0.0578	0.0647	0.0667	0.0603	0.0558	0.0575	0.0573
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.103	0.128	0.148	0.141	0.142	0.143	0.15	0.149	0.147	0.201	0.204	0.202	0.221	0.202	0.196	0.196	0.198	0.2	0.194	0.189	0.204	0.197
Nickel	mg/L	-	0.00056	0.0009	0.00102	0.00336	0.00404	0.004	0.004	0.00393	0.00397	0.00096	0.00087	0.00078	0.0008	0.00062	0.00061	0.00054	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0456	0.0522	0.0554	0.0553	0.0532	0.0525	0.0515	0.0522	0.0525	0.044	0.0395	0.0401	0.0383	0.0362	0.0366	0.0383	0.0355	0.038	0.0361	0.0342	0.0374	0.0365
Silicon	mg/L	-	5.03	4.85	4.76	5.26	5.63	5.46	5.42	5.46	5.44	5.18	4.93	4.63	5.05	4.41	4.42	4.38	4.47	4.16	4.38	3.98	4.56	4.81
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.71	2.24	2.52	3.03	2.99	3.04	3.12	3.25	3.04	2.5	2.38	2.28	2.22	1.93	1.81	1.8	1.84	1.84	1.74	1.79	2	1.8
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.000855	0.00111	0.00124	0.00101	0.00119	0.00106	0.00104	0.00101	0.00119	0.00183	0.00157	0.00133	0.00197	0.00102	0.000928	0.000964	0.000905	0.000888	0.00106	0.00106	0.00111	0.00122
Vanadium	mg/L	-	0.00074	0.00073	0.00069	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00107	0.00113	0.00115	0.00135	0.00114	0.00126	0.00117	0.00126	0.0012	0.00122	0.00099	0.0012	0.00161
Zinc	mg/L	-	<0.0030	0.004	0.0044	0.0186	0.0218	0.0222	0.0217	0.0218	0.0217	0.0051	0.0043	0.0035	0.0034	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-08-16	2018-08-21	2018-08-28	2018-09-04	2018-09-10	2018-09-17	2018-09-25	2018-10-02	2018-10-04	2018-10-09	2018-10-16	2018-10-18	2018-10-23	2018-10-30	2018-11-06	2018-11-13	2018-11-20	2018-11-27	2018-12-04	2018-12-06	2018-12-11	2018-12-18
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1525	1272	1318.4	1280	1292.8	1305.5	1332	1349.5	1385.3	1353.1	1407.4	1407.5	1367.5	1345.7	1132.5	1226.4	1346	1189.5	1242.8	1269	1385.3	1385.3
pH	pH units	-	7.46	7.51	7.43	7.34	7.49	7.14	7.338	7.34	6.92	7.13	7.1	7.32	7.33	7.69	7.21	7.39	7.635	7.09	7.52	7.66	7.4	7.32
Turbidity	NTU	-	0.35	0.22	0.61	0.25	1.63	0.93	1.25	1.27	1.34	1.42	0.2	0.62	1.07	1.78	2.01	3.53	1.04	0.6	2.34	1.46	3.14	2.02
Temperature	C	-	18.4	17.4	15.64	14.803	13.877	13.106	11.9	8.231	7.827	7.002	6.886	7.221	6.503	6.268	4.673	4.034	3.5	3.414	2.583	4.1	3.834	3.368
Dissolved oxygen	%	-	-	-	95	95.9	-	90.8	-	-	-	93.4	96.4	92.5	-	-	-	94.7	-	-	95.1	-	92	96.3
Dissolved oxygen	mg/L	-	-	-	9.41	9.67	-	9.5	-	-	-	11.29	11.67	11.12	-	-	-	12.35	-	-	12.89	-	12.05	12.78
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	51	49.9	49.9	47.1	43.4	43.3	45.2	48.8	55.7	75.3	83.8	86.2	69	54.2	64.7	81.3	80.6	73.2	71	75.9	73.8	62.2
Specific conductivity	uS/cm	-	1310	1340	1360	1330	1340	1310	1290	1300	1280	1350	1330	1350	1360	1330	1110	1300	1320	1240	1220	1300	1330	1360
pH	pH units	-	7.66	7.68	7.74	7.59	7.58	7.33	7.51	7.33	7.48	7.96	7.77	7.76	7.73	7.59	7.35	7.46	7.9	7.8	7.68	7.52	7.54	7.58
Total suspended solids	mg/L	30	4	5.5	4.1	5.6	4.9	5.1	4.1	5.1	4.6	4.8	5.1	4.9	4.1	4.6	6.5	5.8	6.2	7.6	7.8	7	9.9	9.2
Turbidity	NTU	-	0.74	0.68	0.8	0.75	1.07	1.32	0.87	0.88	1.32	0.85	0.96	0.91	1.18	1.61	2.41	1.56	1.45	2.24	3.33	2.07	2.37	2.64
Hardness, as CaCO3	mg/L	-	514	487	519	521	482	507	476	482	505	594	655	633	568	550	498	584	588	565	566	575	616	565
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	1020	1040	796	1020	958	909	1030	1040	982	1070	1030	1080	1100	993	865	1010	1020	998	954	993	884	1000
Dissolved organic carbon	mg/L	-	1.97	2	2.11	3.56	2.27	1.75	2.13	2.57	1.79	2.15	2.2	2.54	7.54	3.39	3.86	3.78	4.33	3.52	4.05	4.55	3.98	4.01
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	6.43	6.6	6.28	6.5	6.52	6.11	6.43	6.6	6.1	5.24	4.9	4.56	5.68	6.52	5.92	5.61	5.93	5.9	5.34	5.51	5.6	6.75
Nitrate + nitrite	mg-N/L	-	6.51	6.69	6.37	6.6	6.63	6.22	6.53	6.69	6.17	5.3	4.94	4.59	5.73	6.58	5.95	5.64	5.97	5.94	5.38	5.55	5.64	6.81
Nitrite	mg-N/L	0.78	0.0852	0.0974	0.0968	0.106	0.111	0.107	0.103	0.0859	0.0737	0.0536	0.0411	0.0329	0.0489	0.06	0.0349	0.0311	0.0381	0.0425	0.041	0.0336	0.0401	0.0608
Total ammonia	mg-N/L	1.3	0.0352	0.0212	0.034	0.0227	0.0498	0.0545	0.0419	0.0568	0.0504	0.035	0.0234	0.0196	0.0289	0.0481	0.0324	0.0252	0.0279	0.0444	0.0401	0.0482	0.0436	0.0477
Dissolved phosphorus	mg-P/L	-	0.0023	<0.0020	0.0032	0.0029	<0.0020	<0.0020	0.0031	0.0034	0.003	0.004	0.0026	0.0034	0.0026	0.0025	0.0022	0.0025	0.0036	0.0027	0.0023	0.0031	0.0025	0.0037
Total phosphorus	mg-P/L	0.09	0.0044	0.0051	0.009	0.0096	0.0068	0.003	0.0067	0.0053	0.006	0.0067	0.0041	0.0052	0.007	0.0049	0.0056	0.0078	0.0111	0.0103	0.0097	0.0082	0.0094	0.0118
Orthophosphate	mg-P/L	-	0.0012	<0.0010	0.0017	0.0021	<0.0010	<0.0010	0.0014	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0014	0.0014	0.0013	<0.0010	0.0016	0.0021	<0.0010	<0.0010
Total nitrogen	mg/L	-	6.72	6.69	6.66	6.58	6.51	6.57	6.63	6.69	6.54	5.7	4.99	5.02	5.97	6.77	6.28	5.98	6.33	6.44	5.96	5.87	5.67	7.29
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	166	159	175	174	161	170	159	160	164	192	214	204	182	177	157	184	189	180	184	182	200	183
Chloride	mg/L	-	25.6	26.4	26.7	27.4	28.8	27.4	27.5	28.2	25.7	20.5	18.5	17.1	21.9	28.3	20.8	17.6	17.8	19.9	17.9	19	19.5	24.2
Fluoride	mg/L	17	0.76	0.77	0.73	0.73	0.69	0.7	0.72	0.72	0.65	0.64	0.71	0.67	0.69	0.6	0.37	0.5	0.6	0.49	0.51	0.5	0.67	0.63
Magnesium	mg/L	-	24.5	21.7	20	21.1	19.7	20	19.3	20.1	23.4	27.6	29.4	29.8	27.6	26.4	26	30.4	28.2	28.1	26.1	29.2	28.3	26
Potassium	mg/L	-	18.3	17.8	17.3	20.5	18.8	18.9	18	18.3	16.7	13.4	10.5	11	14.9	18.2	10.9	8	9.48	10.4	8.06	9.22	10.4	12
Sodium	mg/L	-	87.5	84.2	81.6	90.1	87.7	85	82.2	81	82.5	69	58.1	61.9	72	87.6	54.6	51.6	56.9	59	48.7	55.3	64	71.7
Sulphate	mg/L	1100	582	589	597	593	606	569	595	608	594	595	670	608	605	617	499	596	580	571	534	568	630	610
Total Metals																							
Aluminum	mg/L	-	0.79	0.978	0.832	0.765	0.897	0.852	0.889	1.01	0.971	1.01	0.8	0.868	0.889	1.01	1.15	1.07	0.993	1.11	1.25	1.29	1.25	1.52
Antimony	mg/L	-	0.00164	0.0016	0.00148	0.00158	0.00161	0.00172	0.00159	0.00159	0.00137	0.00117	0.00095	0.00105	0.00121	0.00138	0.00092	0.00078	0.00086	0.00088	0.00081	0.00084	0.00096	0.00101
Arsenic	mg/L	0.028	0.00173	0.00177	0.0017	0.00139	0.00171	0.00173	0.00172	0.00185	0.00171	0.00148	0.00095	0.00102	0.00145	0.00154	0.00091	0.00075	0.00103	0.00107	0.00085	0.00087	0.00119	0.0013
Barium	mg/L	-	0.0893	0.0873	0.0878	0.0885	0.0859	0.0672	0.0615	0.062	0.0567	0.0556	0.0436	0.0478	0.0523	0.0594	0.053	0.047	0.0521	0.0495	0.0462	0.0451	0.0486	0.0548
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.176	0.181	0.175	0.177	0.164	0.156	0.157	0.19	0.184	0.208	0.214	0.215	0.206	0.206	0.134	0.174	0.175	0.167	0.158	0.184	0.213	0.161
Cadmium	mg/L	-	<0.00010	<0.000085	0.000105	<0.000080	<0.000055	<0.000080	<0.000095	<0.000080	<0.00015	<0.00013	<0.000095	<0.00015	<0.00012	<0.00011	<0.00012	<0.00015	<0.00011	<0.00012	<0.00015	<0.00015	<0.00014	<0.00010
Calcium	mg/L	-	164	158	163	159	171	144	158	164	165	200	207	204	185	183	154	193	194	183	187	188	207	182
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	0.00011	0.00013	0.00012	0.00012	0.00012	0.00012	0.00014	0.00016	0.00016
Copper	mg/L	0.033	0.00455	0.00496	0.00453	0.00403	0.00417	0.00321	0.00341	0.00373	0.00437	0.00638	0.00605	0.0066	0.0056	0.00371	0.0093	0.00897	0.0084	0.00757	0.0104	0.00949	0.0114	0.0139
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.047	0.032
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00013	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0114	0.0108	0.0092	0.0093	0.01	0.0079	0.0089	0.0096	0.0091	0.0089	0.0079	0.0088	0.0092	0.011	0.007	0.0071	0.0077	0.0071	0.0064	0.0073	0.0083	0.0072
Magnesium	mg/L	-	24.8	21.9	20.7	18.6	21.5	18	20.2	20.9	22.5	29.8	27.6	29.2	27.3	27.3	24.6	30.2	29.6	30.2	25.5	28.7	27.8	25.7
Manganese	mg/L	3.4	0.072	0.055	0.0634	0.0551	0.0544	0.0477	0.0543	0.054	0.0701	0.0667	0.055	0.0591	0.0596	0.0632	0.0684	0.0564	0.0705	0.0667	0.0599	0.0863	0.0767	0.0808
Mercury	mg/L	-	-	-	<0.0000050	<0.0000050	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	<0.0000050
Molybdenum	mg/L	0.36	0.23	0.205	0.215	0.213	0.244	0.22	0.212	0.219	0.203	0.205	0.179	0.175	0.209	0.222	0.161	0.157	0.17	0.171	0.148	0.165	0.205	0.199
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	0.00056	<0.00050	0.00052	0.00052	0.00053	<0.00050	0.00056	0.0006	0.00059	0.00054
Potassium	mg/L	-	17.3	17.8	16.4	17.6	21.1	17.7	18.2	19.2	16.3	14.3	9.66	9.91	14.4	18.7	10.1	8.37	9.73	10.7	7.64	8.32	10.2	12.2
Selenium	mg/L	0.075	0.0376	0.0382	0.0362	0.0427	0.038	0.0418	0.0407	0.0389	0.0377	0.033	0.0268	0.0258	0.0356	0.0404	0.0354	0.0368	0.038	0.0407	0.0362	0.0385	0.0371	0.0447
Silicon	mg/L	-	5.13	5.35	5.59	5.97	6.01	5.9	5.77	5.78	5.78	6.02	6.14	6.34	5.84	5.78	5.22	6.01	5.95	5.73	5.52	6.3	6.46	5.68
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000020	<0.000010	<0.000020	<0.000010	<0.000010	<0.000010	0.000018	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	84	81.4	83	86.6	93.7	84.1	87.9	86.1	77.6	74.6	57.2	60.2	72.2	88.7	52.8	48.6	57.8	63.1	50.1	58.3	64.6	74.2
Strontium	mg/L	-	1.8	1.64	1.56	1.58	1.64	1.64	1.63	1.93	2.09	3.84	4.98	5	3.44	2.49	1.69	3.74	3.3	2.8	2.6	2.97	3.68	2.18
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000020	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.0013	0.00116	0.00121	0.00103	0.000904	0.000962	0.00103	0.00103	0.00118	0.00147	0.00165	0.00159	0.00142	0.00111	0.0011	0.00141	0.00157	0.00124	0.00126	0.00135	0.00148	0.00121
Vanadium	mg/L	-	0.00268	0.00318	0.0029	0.00331	0.00337	0.00299	0.00277	0.00243	0.00222	0.00185	0.00114	0.0011	0.00154	0.00169	0.00128	0.00105	0.0012	0.00154	0.00131	0.00134	0.00171	0.00189
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0037	0.0047	0.0062	0.0048	<0.0030	0.0034	0.0058	0.0153	0.0044	0.0042	0.0045	0.0043	0.0036

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-08-16	2018-08-21	2018-08-28	2018-09-04	2018-09-10	2018-09-17	2018-09-25	2018-10-02	2018-10-04	2018-10-09	2018-10-16	2018-10-18	2018-10-23	2018-10-30	2018-11-06	2018-11-13	2018-11-20	2018-11-27	2018-12-04	2018-12-06	2018-12-11	2018-12-18
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.101	0.105	0.0797	0.0873	0.0652	0.0836	0.11	0.0753	0.0828	0.0897	0.105	0.118	0.0968	0.0892	0.136	0.178	0.119	0.138	0.128	0.168	0.142	0.148
Antimony	mg/L	-	0.00167	0.00161	0.00157	0.00161	0.00156	0.00155	0.0015	0.0015	0.00144	0.00107	0.00095	0.00099	0.00123	0.00131	0.00093	0.0009	0.00096	0.00095	0.00082	0.0008	0.00095	0.00108
Arsenic	mg/L	-	0.00155	0.0015	0.00154	0.00112	0.0015	0.00153	0.00155	0.00166	0.00149	0.00121	0.00087	0.00099	0.00128	0.00136	0.00071	0.00058	0.0009	0.00069	0.00058	0.00062	0.00076	0.00076
Barium	mg/L	-	0.0904	0.0911	0.0893	0.0988	0.0785	0.0716	0.0619	0.0581	0.0562	0.0555	0.046	0.0479	0.0534	0.0577	0.0548	0.0464	0.0526	0.0527	0.0457	0.0471	0.0466	0.0574
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.163	0.16	0.158	0.154	0.16	0.148	0.158	0.155	0.177	0.186	0.21	0.199	0.182	0.197	0.124	0.161	0.155	0.153	0.145	0.147	0.182	0.152
Cadmium	mg/L	0.00034	<0.000070	<0.000060	<0.00020	<0.000080	0.0000392	<0.000060	<0.00010	<0.000080	<0.000080	<0.000085	<0.00011	<0.00015	0.000106	<0.00012	<0.00011	0.0000998	<0.000095	<0.00010	<0.000090	<0.00012	<0.00015	<0.00010
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.0001	<0.00010	0.0001	0.0001	0.00012	<0.00010	0.00014
Copper	mg/L	-	0.00181	0.00201	0.00216	0.00198	0.00176	0.00154	0.00174	0.00167	0.00153	0.00244	0.00332	0.00339	0.00282	0.00214	0.00464	0.00504	0.004	0.00352	0.00429	0.00432	0.00403	0.00441
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0112	0.0098	0.01	0.0098	0.0096	0.009	0.0089	0.0094	0.0093	0.0081	0.0081	0.0085	0.0091	0.0105	0.007	0.0072	0.0071	0.0071	0.0066	0.0069	0.0077	0.0072
Manganese	mg/L	-	0.0554	0.0496	0.0609	0.0572	0.0501	0.0491	0.0519	0.0497	0.0036	0.04	0.0537	0.0569	0.0554	0.0619	0.0669	0.0543	0.0507	0.0615	0.0618	0.0811	0.0699	0.0773
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.222	0.214	0.228	0.223	0.223	0.231	0.205	0.217	0.226	0.19	0.18	0.185	0.219	0.22	0.164	0.176	0.179	0.17	0.168	0.161	0.191	0.205
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0384	0.0363	0.036	0.0398	0.0394	0.0392	0.0402	0.0393	0.037	0.0325	0.0263	0.0268	0.0368	0.04	0.0357	0.0344	0.036	0.0374	0.035	0.0357	0.0366	0.0411
Silicon	mg/L	-	4.79	4.93	5.34	5.64	5.53	5.54	5.32	5.36	5.3	5.6	5.97	5.98	5.56	5.52	4.87	5.46	5.22	5.17	5.4	5.57	5.43	5.12
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.8	1.71	1.77	1.64	1.52	1.62	1.62	1.93	2.39	3.59	5.33	5.25	3.55	2.35	1.74	3.87	3.43	2.8	2.84	2.94	3.69	2.34
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00123	0.000963	0.00107	0.000841	0.000792	0.000733	0.000915	0.00083	0.00112	0.00146	0.00164	0.0017	0.00131	0.000918	0.000983	0.00145	0.00151	0.00122	0.00128	0.00142	0.00136	0.00123
Vanadium	mg/L	-	0.00209	0.00248	0.0025	0.003	0.00288	0.00265	0.00237	0.00201	0.00153	0.00127	0.00104	0.00103	0.00124	0.00133	0.0008	0.00087	0.00101	0.00114	0.00106	0.00111	0.00126	0.00157
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.003	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-12-27	2019-01-02	2019-01-08	2019-01-15	2019-01-22	2019-01-29	2019-02-05	2019-02-12	2019-02-19	2019-02-21	2019-02-26	2019-03-11	2019-03-12	2019-03-14	2019-03-19	2019-03-26	2019-03-26	2019-04-02	2019-04-04	2019-04-10	2019-04-16	2019-04-23
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1351.4	1429.8	1395.2	1415.1	1410.9	1475.5	1359.4	1364	1414.7	1430.1	1404.2	1426.5	1437	1386	1379	919.5	918.3	817.5	848	965.9	1058.1	1097
pH	pH units	-	7.58	7.4	7.44	6.97	7.21	7.16	7.25	7.23	6.75	7.17	7.16	7.05	6.9	7.15	6.88	7.13	7.32	7.3	7.35	7.4	6.78	7.4
Turbidity	NTU	-	1.94	1.76	1.87	2.41	2.18	2.46	2.26	1.08	2.17	2.26	4.3	3.4	1.96	4.51	1.71	4.11	2.53	4.14	0.97	5.15	1.54	1.76
Temperature	C	-	2.338	2.751	2.342	4.6	3.721	4.577	0.972	7.6	3.43	4.329	1.591	3.266	2.894	4.345	4.267	4.141	3.606	4.361	4.4	5.626	7.447	8.274
Dissolved oxygen	%	-	94.1	-	-	94.8	90.6	91.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	12.84	-	-	12.16	11.9	11.76	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	58.5	69.5	73.5	72.4	52.8	71.2	54.8	42.6	45.7	43	43.8	44.3	42.8	38.5	35.5	81.2	81.5	79.4	74.8	83.1	86.6	77.1
Specific conductivity	uS/cm	-	1320	1370	1380	1360	1390	1370	1430	1300	1360	1320	1360	1420	1400	1340	1320	931	917	806	811	983	1080	1010
pH	pH units	-	7.68	7.8	7.5	7.76	7.49	7.75	7.54	7.55	7.44	7.57	7.5	7.27	7.31	7.63	7.42	7.73	7.73	7.52	7.81	7.57	7.74	7.74
Total suspended solids	mg/L	30	18.5	7.2	8.9	8.5	10.7	8.5	5.4	7.3	8.3	5.2	6.5	8	7.3	6.8	6.4	5.3	4.9	5.6	5.5	6.1	6.2	5.3
Turbidity	NTU	-	1.02	1.75	2.14	1.24	1.41	1.51	1.65	1.09	4.39	2.16	1.64	2.11	2.01	2.05	1.6	2.01	2.06	1.84	1.27	1.89	2.03	1.53
Hardness, as CaCO3	mg/L	-	575	617	615	592	533	626	559	513	565	490	515	543	539	478	532	398	430	390	433	479	557	564
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	1040	1100	1050	1060	1020	1100	1030	1060	1100	1050	1100	1070	1070	1030	1050	676	673	518	632	725	785	805
Dissolved organic carbon	mg/L	-	4.7	3.65	3.71	4.06	5.79	4.18	5.12	5.26	5.46	5.68	6.47	5.71	5.89	6.2	6.42	4.56	4.52	4.73	4.93	4.34	1.3	4.76
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	6.16	5.43	6.01	5.44	6.2	5.43	6.13	6.5	6.28	6.51	6.35	6.66	6.41	6.21	6.22	4.34	4.15	4.34	4.49	4.48	5.67	5.91
Nitrate + nitrite	mg-N/L	-	6.22	5.48	6.05	5.5	6.28	5.49	6.24	6.63	6.45	6.67	6.53	6.81	6.56	6.39	6.38	4.35	4.16	4.34	4.49	4.48	5.67	5.91
Nitrite	mg-N/L	0.78	0.063	0.0531	0.0399	0.0594	0.0833	0.061	0.113	0.136	0.165	0.16	0.173	0.147	0.148	0.173	0.162	0.0159	0.0124	<0.0050	<0.0050	<0.0050	<0.0050	0.0075
Total ammonia	mg-N/L	1.3	0.0362	0.0613	0.0525	0.0386	0.0335	0.0373	0.036	0.0386	0.0466	0.048	0.0507	0.0437	0.0431	0.0379	0.0288	0.0194	0.0217	0.019	0.0273	0.015	0.0157	0.0131
Dissolved phosphorus	mg-P/L	-	0.0035	0.003	0.0023	0.0022	0.003	0.0029	0.0027	0.0041	0.0038	0.0031	0.0027	0.0024	0.0025	0.0026	0.0029	0.0021	<0.0020	0.0034	0.0028	<0.0020	0.0058	0.0025
Total phosphorus	mg-P/L	0.09	0.0086	0.0079	0.0171	0.0138	0.0109	0.011	0.0134	0.0121	0.012	0.0183	0.0125	0.0195	0.017	0.007	0.0073	0.0083	0.0074	0.0082	0.0039	0.0046	0.0081	0.0058
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	6.62	5.75	5.66	5.53	6.82	5.68	6.5	6.77	6.87	7.1	6.75	6.74	6.6	6.52	6.43	4.39	4.51	4.6	4.67	4.52	6.07	6.19
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	187	202	201	195	177	209	185	170	186	163	170	180	178	159	175	121	132	120	133	148	177	173
Chloride	mg/L	-	24.6	24.5	23.9	21.2	25.1	22.8	27.3	29.7	30.2	31.4	31.8	34.8	34.2	35	36.5	13.8	12.8	10	10.2	10.2	10.7	11.1
Fluoride	mg/L	17	0.66	0.59	0.61	0.68	0.67	0.69	0.74	0.74	0.72	0.76	0.78	0.67	0.67	0.8	0.74	0.26	0.25	0.17	0.16	0.28	0.26	0.24
Magnesium	mg/L	-	26	27.3	27.3	25.8	21.9	25.3	23.4	21.3	24.5	20.2	21.9	22.8	22.9	19.8	23	23.6	24.1	22.1	24.3	26.3	27.9	32.2
Potassium	mg/L	-	11.6	10.2	8.71	9.29	11.2	9.36	12.3	14.9	16.5	15	14.1	15.6	16.1	14.6	18.5	3.52	3.25	2.02	2.11	2.09	2.48	2.56
Sodium	mg/L	-	74.2	75.2	63.2	73.7	79.3	70.6	85.9	93.4	97.5	88	93	96.3	97.4	94	107	27	25.4	14.5	16.2	18.5	19.2	21
Sulphate	mg/L	1100	631	631	684	620	602	652	634	640	619	642	625	640	619	621	626	375	367	324	335	436	467	443
Total Metals																								
Aluminum	mg/L	-	1.2	1.12	1.42	1.13	0.934	1.13	1.19	1.09	1.19	0.838	1.12	1.51	1.47	1.43	1.2	0.652	0.709	0.804	0.662	1	1.07	0.898
Antimony	mg/L	-	0.00106	0.00087	0.00089	0.00082	0.00096	0.00093	0.00105	0.00123	0.00111	0.00112	0.00109	0.00109	0.00118	0.00113	0.00132	0.00038	0.0004	0.00029	0.00032	0.00037	0.00038	0.00037
Arsenic	mg/L	0.028	0.00122	0.00092	0.00085	0.00119	0.00113	0.00111	0.00143	0.00166	0.00144	0.00128	0.00138	0.00142	0.00134	0.00186	0.00131	0.00039	0.0004	0.00027	0.0004	0.0004	0.0004	0.00047
Barium	mg/L	-	0.0512	0.0527	0.0485	0.0514	0.0542	0.0498	0.0484	0.0549	0.0483	0.0499	0.051	0.0469	0.0531	0.0496	0.0496	0.0326	0.032	0.0285	0.0303	0.0306	0.0315	0.0306
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.173	0.199	0.209	0.191	0.162	0.207	0.171	0.144	0.149	0.146	0.155	0.144	0.142	0.159	0.128	0.088	0.089	0.06	0.058	0.112	0.106	0.084
Cadmium	mg/L	-	<0.00015	<0.00011	0.0000823	<0.00020	<0.00011	<0.00013	<0.00011	<0.000090	<0.00015	<0.000095	<0.00020	<0.00011	<0.00010	<0.00020	<0.000075	<0.00010	<0.00011	0.0000786	<0.000080	<0.00015	<0.00010	<0.000080
Calcium	mg/L	-	187	197	206	180	189	207	177	171	173	177	174	164	180	170	168	129	129	121	133	152	175	166
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0007	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00014	0.00017	0.00014	0.00011	0.00011	0.00015	0.00011	0.0001	0.00015	0.00014	0.00015	0.00012	0.00012	0.00013	0.00012	0.00023	0.00023	0.00013	0.00015	0.00013	0.00012	0.00013
Copper	mg/L	0.033	0.0075	0.00608	0.00685	0.00766	0.00531	0.00677	0.00568	0.00525	0.006	0.00722	0.00591	0.00547	0.00579	0.00495	0.00527	0.00956	0.0101	0.0109	0.00963	0.00999	0.0101	0.0103
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000068	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0077	0.008	0.0075	0.006	0.0062	0.0063	0.0055	0.0057	0.0057	0.0055	0.0056	0.0057	0.0059	0.0061	0.006	0.003	0.0029	0.0025	0.0026	0.0035	0.0035	0.0036
Magnesium	mg/L	-	24.5	26.8	28.4	24.5	22.6	26.8	22.9	21.4	21.7	21.3	22.1	20.4	24.1	21.6	20.5	21.7	20.7	21.4	24	26.7	29.4	31.2
Manganese	mg/L	3.4	0.0739	0.136	0.109	0.0776	0.0753	0.107	0.0826	0.0862	0.0932	0.089	0.1	0.0894	0.0979	0.0815	0.0753	0.105	0.103	0.0518	0.0533	0.0528	0.0561	0.0563
Mercury	mg/L	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.213	0.205	0.188	0.178	0.21	0.218	0.234	0.269	0.25	0.25	0.244	0.249	0.266	0.264	0.281	0.0869	0.0836	0.0694	0.0773	0.0943	0.107	0.108
Nickel	mg/L	-	0.00052	0.00059	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00061
Potassium	mg/L	-	11	9.56	8.47	8.75	11.2	9.95	11.7	15.1	13.2	15	14.3	13	17.1	15.8	16.1	3.58	3.31	2.02	2.05	2.13	2.54	2.6
Selenium	mg/L	0.075	0.0423	0.0337	0.0361	0.0349	0.0397	0.0341	0.0388	0.044	0.0453	0.0443	0.0442	0.0414	0.0425	0.0443	0.0404	0.0262	0.0261	0.0308	0.0305	0.0344	0.0428	0.042
Silicon	mg/L	-	6.03	6.01	6.45	5.96	5.82	6.37	5.67	5.35	5.29	5.38	5.09	5.04	5.37	5.15	4.78	5.73	5.72	5.09	5.22	5.55	5.25	5
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	75.5	72.3	66	68.5	79	72.2	84.3	99.7	89.9	99.4	96	83	101	106	97.4	26	24.1	15.2	16	19.1	20.9	21.5
Strontium	mg/L	-	3.06	2.98	3.79	3.26	2.2	3.91	2.55	1.75	1.58	1.64	1.56	1.54	1.65	1.56	1.53	1.46	1.56	1	1.27	2.14	2.21	1.83
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00131	0.00147	0.00163	0.00132	0.000964	0.00141	0.00103	0.000763	0.000765	0.000715	0.000759	0.000785	0.000751	0.000647	0.000644	0.000861	0.000884	0.000818	0.000765	0.00112	0.00126	0.0011
Vanadium	mg/L	-	0.00236	0.00171	0.00159	<0.0030	0.00236	0.00204	0.00229	0.0028	0.00242	0.00231	0.00228	0.00224	0.00249	0.00315	0.00257	0.00096	0.00091	0.00067	0.00074	0.00068	0.00068	0.00066
Zinc	mg/L	0.059	0.0041	0.0044	0.0057	0.0051	0.0061	0.0052	<0.0030	0.0074	<0.0030	<0.0030	<0.0030	0.0038	0.0041	<0.0030	0.0034	0.004	0.0044	0.0037	0.0037	0.005	0.0046	0.0036

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2018-12-27	2019-01-02	2019-01-08	2019-01-15	2019-01-22	2019-01-29	2019-02-05	2019-02-12	2019-02-19	2019-02-21	2019-02-26	2019-03-11	2019-03-12	2019-03-14	2019-03-19	2019-03-26	2019-03-26	2019-04-02	2019-04-04	2019-04-10	2019-04-16	2019-04-23
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.147	0.142	0.146	0.133	0.138	0.135	0.0741	0.0819	0.0871	0.0684	0.107	0.0939	0.0915	0.121	0.0996	0.0763	0.089	0.114	0.123	0.125	0.177	0.0967
Antimony	mg/L	-	0.00103	0.00091	0.00081	0.00083	0.00084	0.00089	0.00101	0.00114	0.00111	0.00113	0.00108	0.00108	0.00112	0.00124	0.00129	0.00036	0.00037	0.0003	0.00038	0.00034	0.00039	0.00035
Arsenic	mg/L	-	0.00084	0.00068	0.00059	0.00072	0.00076	0.00081	0.00087	0.00097	0.00089	0.00078	0.00079	0.00073	0.00072	0.00092	0.00085	0.00029	0.00027	0.00023	0.00054	0.00025	0.00029	0.0005
Barium	mg/L	-	0.054	0.0535	0.047	0.0529	0.0512	0.0502	0.0485	0.0514	0.0537	0.051	0.049	0.0508	0.0502	0.0461	0.0511	0.0341	0.034	0.0276	0.0313	0.0309	0.0339	0.0308
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.175	0.18	0.173	0.186	0.142	0.195	0.151	0.141	0.14	0.137	0.138	0.128	0.127	0.129	0.116	0.076	0.084	0.052	0.051	0.097	0.096	0.074
Cadmium	mg/L	0.00034	<0.00011	<0.00015	0.0000956	<0.00020	<0.00016	<0.00015	<0.00014	<0.00010	<0.000095	<0.00011	<0.00013	<0.000095	<0.00010	0.000177	<0.000090	<0.000090	<0.000095	<0.000065	<0.000070	<0.00015	<0.00010	<0.00010
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00013	0.00018	0.00013	0.0001	<0.00010	0.00014	0.0001	<0.00010	0.00014	0.00012	0.00013	0.00011	0.00011	<0.00010	<0.00010	0.0002	0.00021	0.00012	0.00012	0.00012	0.00011	0.00012
Copper	mg/L	-	0.00319	0.00298	0.00307	0.0031	0.00273	0.00265	0.00248	0.00237	0.00221	0.0025	0.00251	0.00251	0.00238	0.00196	0.00258	0.00572	0.00609	0.00645	0.00613	0.00546	0.00589	0.00597
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0073	0.008	0.0069	0.0063	0.0055	0.0064	0.0055	0.0057	0.0051	0.0051	0.0054	0.0058	0.0057	0.0055	0.006	0.003	0.0032	0.0024	0.0026	0.0034	0.0037	0.0034
Manganese	mg/L	-	0.0715	0.14	0.106	0.0781	0.0682	0.103	0.0798	0.0803	0.099	0.0879	0.0969	0.0944	0.0887	0.0671	0.0819	0.105	0.104	0.0492	0.0521	0.0512	0.055	0.0541
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.206	0.218	0.184	0.184	0.178	0.209	0.236	0.243	0.254	0.234	0.242	0.256	0.254	0.248	0.292	0.0855	0.0913	0.0714	0.0771	0.0905	0.104	0.0979
Nickel	mg/L	-	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0383	0.0353	0.0408	0.0335	0.0359	0.035	0.0421	0.043	0.0433	0.0408	0.0445	0.041	0.0397	0.0434	0.0405	0.0304	0.0312	0.0295	0.031	0.037	0.0429	0.0455
Silicon	mg/L	-	5.39	5.9	6.03	5.93	4.99	5.75	5.33	5.02	5.09	5	4.84	4.74	4.69	4.48	4.79	5.06	5.34	4.78	5.01	5.29	4.91	4.81
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.95	3.25	3.71	3.49	1.84	3.73	2.57	1.68	1.73	1.57	1.56	1.55	1.5	1.57	1.62	1.46	1.62	1.07	1.26	2.03	2.14	1.68
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00115	0.00142	0.0015	0.00124	0.000799	0.00128	0.000904	0.000747	0.000615	0.000612	0.000639	0.000581	0.000519	0.00054	0.000482	0.000793	0.000876	0.000788	0.000771	0.00108	0.00127	0.00104
Vanadium	mg/L	-	0.00203	0.0016	0.00136	0.00169	0.00192	0.00167	0.002	0.00231	0.00204	0.00197	0.00191	0.00199	0.00202	0.00212	0.00233	0.00072	0.00072	0.00055	0.00057	0.00053	0.00054	0.0006
Zinc	mg/L	-	<0.0030	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-04-30	2019-05-02	2019-05-08	2019-05-15	2019-05-21	2019-05-28	2019-06-04	2019-06-11	2019-06-18	2019-07-09	2019-07-15	2019-07-16	2019-07-23	2019-07-30	2019-08-06	2019-08-13	2019-08-20	2019-08-27	2019-09-03	2019-09-10	2019-09-17	2019-09-24
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1183.3	1220	1250.6	1241.8	1243	1298.1	1354.4	1403.9	1445.4	1354.3	1194.3	1355.6	1163.2	1286.5	1281.6	1334.2	1331.1	1298	1344.2	-	1155	1115
pH	pH units	-	7.26	7.2	7.23	6.9	7.37	7.1	7.43	7.51	7.29	7.12	7.4	7.44	7.13	7.42	7.18	7.2	6.97	7.12	7.15	-	7.09	7.46
Turbidity	NTU	-	1.63	1.11	1.51	1.55	0.72	1.39	0.89	0.75	0.86	2.22	2.97	0.08	1.94	2.56	2.12	0.78	0.84	0.62	1.71	-	2.99	0.99
Temperature	C	-	8.264	8.2	10.612	14.28	15	15.972	16.58	15.304	18.411	16.45	16.431	16.821	16.509	16.481	17.361	17.606	16.263	15.7	16.961	-	12.398	11.6
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	86.6	93.6	70	57	72.1	80.6	79.4	86	88.4	97.4	97.6	96.5	97.6	104	106	87.8	91.3	72.5	72	65.6	74.9	88.6
Specific conductivity	uS/cm	-	1170	1190	1180	1240	1270	1300	1340	1410	1350	1320	1170	1190	1150	1230	1240	1340	1320	1290	1290	1320	1120	1080
pH	pH units	-	7.86	7.58	7.71	7.77	7.95	7.93	7.9	7.96	8.07	8.1	7.97	8.06	7.76	7.99	8.14	8.06	8.15	7.9	8.03	7.63	7.67	7.94
Total suspended solids	mg/L	30	7.1	8.4	6.4	4.1	5.5	3.6	2.5	3.6	2.9	7.6	5	3.2	6.8	5.5	8.4	4.7	4	2.5	4.4	3.1	5.3	5.8
Turbidity	NTU	-	1.51	1.57	1.58	1.32	1.43	1.06	0.55	0.57	0.41	1.14	1.47	1.24	1.53	1.11	1.11	0.79	0.74	0.51	0.64	0.57	1.55	1.27
Hardness, as CaCO3	mg/L	-	660	611	531	526	595	607	642	660	746	720	641	573	554	601	657	592	631	614	559	617	530	563
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total dissolved solids	mg/L	-	942	971	925	924	956	1030	1080	1060	1150	1060	947	912	926	1090	999	1050	1090	918	1070	1100	908	919
Dissolved organic carbon	mg/L	-	4.03	4.42	4.47	5	4.34	3.7	3.65	3.18	3.34	4.16	4.37	4.67	5.17	3.67	3.68	3.19	2.67	2.49	2.38	2.39	4.6	4.23
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	6.06	6.37	6.45	6.11	6.54	6.09	5.8	6.99	8.08	8.2	6.72	6.46	6.09	5.76	5.57	5.16	5.44	5.56	5.31	5.83	5.48	6.15
Nitrate + nitrite	mg-N/L	-	6.07	6.38	6.5	6.18	6.58	6.14	5.84	7.03	8.11	8.22	6.74	6.48	6.11	5.77	5.58	5.18	5.46	5.58	5.33	5.86	5.49	6.16
Nitrite	mg-N/L	0.78	0.0124	0.0061	0.0509	0.0733	0.0452	0.0528	0.0388	0.0324	0.0306	0.0235	0.0183	0.0172	0.013	0.0131	0.0129	0.018	0.0185	0.013	0.0206	0.0274	0.0133	0.0112
Total ammonia	mg-N/L	1.3	0.0146	0.018	0.0088	0.0189	0.0399	0.0388	0.0189	0.0314	0.0379	0.0198	0.0184	0.0221	0.0221	0.0166	0.0143	0.0251	0.0273	0.0351	0.0348	0.0452	0.04	0.0261
Dissolved phosphorus	mg-P/L	-	0.0022	0.0024	0.0027	0.0021	<0.0020	0.0043	0.0028	0.0031	<0.0020	0.0037	0.0025	<0.0020	0.0024	<0.0020	0.0023	<0.0020	<0.0020	<0.0020	0.0022	<0.0020	<0.0020	0.0027
Total phosphorus	mg-P/L	0.09	0.0081	0.0256	0.0067	<0.0020	0.0047	0.0044	0.0049	0.0092	0.0072	0.0081	0.0067	0.0094	0.0065	0.0056	0.0032	0.0079	0.0032	0.0082	0.0091	0.0053	0.0059	0.0048
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0023
Total nitrogen	mg/L	-	6.1	6.6	6.53	6.79	7.28	6.25	6.28	7.16	40.1	8.6	6.98	33.7	6.73	6.14	5.9	5.54	5.79	5.9	27.7	5.77	5.53	6.22
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	211	191	164	167	187	191	207	207	238	224	203	180	169	188	211	189	199	195	176	192	164	169
Chloride	mg/L	-	11.6	11.5	18.4	21.6	17.5	19.3	19.2	18	16.7	12.5	13.6	13.6	12.9	13.8	13.1	16.4	16.5	20.6	21	22.9	18.2	16.5
Fluoride	mg/L	17	0.35	0.36	0.46	0.46	0.39	0.54	0.54	0.55	0.59	0.39	0.37	0.33	0.3	0.4	0.47	0.54	0.57	0.59	0.57	0.7	0.45	0.37
Magnesium	mg/L	-	32.6	32.4	29.3	26.8	31	31.3	30.2	34.5	36.7	39.1	32.5	30.2	32.3	32.2	31.3	29.1	32.4	30.8	29	33.7	29	34
Potassium	mg/L	-	2.64	2.73	6.57	10.2	8.11	8.01	8.07	7.34	7.15	5.31	3.7	3.47	3.34	3.9	4.1	6.29	7.19	9.69	10.2	11.6	6.62	5.39
Sodium	mg/L	-	26.3	24	46.2	59.9	48.3	53.7	53.5	54.1	52.7	41	29.8	28.7	26.8	32.5	30.8	44.6	50.5	66.5	65	76.3	43.6	41.5
Sulphate	mg/L	1100	535	546	550	521	520	598	614	653	676	603	537	516	488	565	567	600	614	595	558	600	500	536
Total Metals																							
Aluminum	mg/L	-	1.07	1.01	0.917	0.866	0.868	0.855	0.575	0.642	0.543	0.845	0.762	0.631	0.836	0.853	0.868	0.686	0.786	0.673	0.709	0.718	0.652	0.896
Antimony	mg/L	-	0.00044	0.00049	0.00058	0.0008	0.00072	0.00071	0.00071	0.00063	0.00065	0.00058	0.00048	0.00052	0.00049	0.00057	0.00059	0.00077	0.00079	0.001	0.00098	0.00105	0.0007	0.00066
Arsenic	mg/L	0.028	0.00058	0.00064	0.00079	0.00105	0.00088	0.00091	0.00088	0.00098	0.00085	0.001	0.00073	0.00082	0.00073	0.00091	0.00074	0.00114	0.00112	0.00168	0.00177	0.00187	0.0009	0.00086
Barium	mg/L	-	0.0347	0.0338	0.0416	0.0504	0.0517	0.0496	0.0451	0.0436	0.0441	0.0425	0.0437	0.0441	0.0418	0.0401	0.0406	0.0383	0.0344	0.0404	0.0366	0.0368	0.0423	0.0394
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.138	0.127	0.109	0.112	0.113	0.147	0.168	0.19	0.167	0.138	0.117	0.101	0.092	0.157	0.153	0.162	0.176	0.149	0.156	0.158	0.11	0.108
Cadmium	mg/L	-	<0.00015	<0.00020	<0.000085	<0.000090	<0.00011	<0.00010	<0.00013	<0.00020	<0.00010	<0.00011	<0.000090	<0.00018	<0.000080	<0.00020	<0.00015	<0.00013	<0.00010	<0.00015	<0.000055	<0.000080	<0.000090	<0.00010
Calcium	mg/L	-	198	212	165	165	199	194	202	227	224	198	189	191	173	210	202	194	194	188	174	191	167	171
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00013	0.00013	0.00012	0.00011	0.00012	0.00012	0.00024	0.00013	0.00016	0.00013	0.00013	0.00014	0.00011	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00013
Copper	mg/L	0.033	0.00981	0.00942	0.00805	0.00791	0.00887	0.00732	0.00547	0.00568	0.00651	0.0108	0.011	0.0113	0.0116	0.00855	0.00846	0.00636	0.00598	0.00592	0.00511	0.00523	0.00958	0.0101
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0045	0.0041	0.0053	0.0063	0.0056	0.0068	0.007	0.0074	0.0066	0.0051	0.0044	0.0034	0.0046	0.0057	0.0053	0.0064	0.0067	0.008	0.0079	0.0091	0.0061	0.005
Magnesium	mg/L	-	31.4	33.6	29.9	24.5	30.7	31.6	28.8	33.9	34.4	37.7	33.5	32.9	28.3	32.1	32.1	30.1	30.4	27.2	26	29.6	29	30.3
Manganese	mg/L	3.4	0.0623	0.0628	0.0596	0.0561	0.0551	0.0696	0.0701	0.0937	0.0898	0.0807	0.0645	0.0667	0.054	0.0492	0.0422	0.0515	0.0599	0.0575	0.0556	0.0772	0.0581	0.0656
Mercury	mg/L	-	-	-	<0.0000050	-	-	-	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	<0.0000050	-	-	-	-	-
Molybdenum	mg/L	0.36	0.115	0.122	0.147	0.187	0.175	0.177	0.17	0.167	0.174	0.156	0.124	0.132	0.117	0.137	0.149	0.175	0.172	0.23	0.21	0.221	0.154	0.167
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	0.00053	<0.00050	0.00061	0.00058	<0.00050	<0.00050
Potassium	mg/L	-	2.67	2.49	6.6	9.48	7.68	7.92	7.5	6.93	6.29	4.96	3.51	3.54	3.22	4.07	3.95	6.21	6.67	10.2	9.45	11.2	6.4	5.06
Selenium	mg/L	0.075	0.0446	0.0418	0.0453	0.0437	0.0459	0.0421	0.0392	0.0466	0.0466	0.0496	0.0398	0.0406	0.0382	0.0377	0.0394	0.0383	0.0366	0.0402	0.04	0.0393	0.036	0.0376
Silicon	mg/L	-	5.4	5.03	4.77	4.28	5.43	5.48	5.09	5.63	4.84	5.62	5.32	5.49	5.09	5.71	5.55	5.52	5.41	5.45	5.63	5.38	5.53	5.64
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	23.9	24.8	46.5	58.9	48.3	51.4	50.4	54.8	47.6	42.9	30.6	28.2	25.6	34.7	33	44.8	47.7	65.3	65.3	72.2	42.9	36.9
Strontium	mg/L	-	2.72	3.01	2.01	1.69	2.2	2.71	2.99	2.89	2.99	2.28	2.24	2.22	1.72	2.67	2.85	2.91	2.91	2.77	2.34	2.19	1.9	2.35
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00155	0.00152	0.00111	0.000802	0.00121	0.00151	0.00158	0.00166	0.00205	0.00194	0.00147	0.00154	0.0013	0.00166	0.00179	0.00189	0.00196	0.00148	0.00157	0.0017	0.00129	0.0014
Vanadium	mg/L	-	0.00065	0.00077	0.00091	0.00118	0.00107	0.00092	0.00094	0.00092	0.00088	0.00115	0.00094	0.00118	0.00102	0.0013	0.0009	0.00138	0.00137	0.00226	0.00235	0.00235	0.00163	0.00146
Zinc	mg/L	0.059	0.0047	0.0051	0.0031	0.0031	<0.0030	0.0033	0.0037	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0032	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-04-30	2019-05-02	2019-05-08	2019-05-15	2019-05-21	2019-05-28	2019-06-04	2019-06-11	2019-06-18	2019-07-09	2019-07-15	2019-07-16	2019-07-23	2019-07-30	2019-08-06	2019-08-13	2019-08-20	2019-08-27	2019-09-03	2019-09-10	2019-09-17	2019-09-24
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.127	0.126	0.12	0.106	0.127	0.13	0.0834	0.121	0.13	0.151	0.13	0.0976	0.131	0.126	0.126	0.166	0.139	0.134	0.117	0.137	0.127	0.141
Antimony	mg/L	-	0.00045	0.00044	0.00061	0.00077	0.00067	0.00062	0.00074	0.00064	0.00069	0.00054	0.00048	0.00049	0.00048	0.00054	0.00057	0.00074	0.00077	0.00098	0.00102	0.00104	0.0007	0.00056
Arsenic	mg/L	-	0.00052	0.00053	0.00079	0.00103	0.00085	0.00093	0.00086	0.00093	0.00094	0.00095	0.00061	0.00065	0.00066	0.00078	0.00072	0.00109	0.00117	0.0015	0.00174	0.00172	0.00085	0.00077
Barium	mg/L	-	0.0362	0.0347	0.0428	0.0553	0.0547	0.0439	0.0483	0.0474	0.0489	0.0469	0.047	0.0475	0.0399	0.0423	0.0401	0.0375	0.0376	0.0402	0.0376	0.0391	0.043	0.0392
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.126	0.115	0.105	0.098	0.105	0.148	0.167	0.168	0.158	0.12	0.111	0.106	0.087	0.134	0.144	0.151	0.156	0.15	0.15	0.13	0.107	0.112
Cadmium	mg/L	0.00034	<0.00011	<0.00012	<0.000085	<0.00010	<0.00016	<0.00011	<0.00014	<0.00013	<0.00020	<0.00022	<0.000090	<0.000080	<0.000070	<0.00012	<0.00010	<0.00013	0.000102	<0.00015	<0.000070	<0.00011	<0.000080	<0.000050
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00012	0.00012	0.00011	0.00012	0.0001	0.00011	<0.00010	0.00014	0.00012	0.00013	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011
Copper	mg/L	-	0.00554	0.00548	0.0045	0.00466	0.00471	0.00449	0.00366	0.0043	0.00527	0.00706	0.00684	0.00707	0.00735	0.00557	0.00554	0.00432	0.00409	0.00336	0.00314	0.00343	0.00592	0.00682
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0043	0.0045	0.0055	0.0062	0.0057	0.0063	0.007	0.0071	0.0069	0.0051	0.0043	0.0043	0.0038	0.005	0.0056	0.0063	0.007	0.0081	0.0081	0.0082	0.0057	0.0052
Manganese	mg/L	-	0.0646	0.0673	0.0485	0.0533	0.0433	0.0582	0.0477	0.0872	0.0953	0.0705	0.0564	0.0552	0.0457	0.037	0.0362	0.0455	0.0561	0.0515	0.0466	0.0762	0.0547	0.0623
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.113	0.111	0.151	0.177	0.16	0.16	0.168	0.171	0.184	0.155	0.12	0.125	0.13	0.138	0.143	0.175	0.182	0.225	0.221	0.222	0.155	0.146
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00075	0.00056	<0.00050	0.00057
Selenium	mg/L	-	0.0437	0.046	0.0495	0.0435	0.0438	0.0447	0.0368	0.0466	0.0493	0.0516	0.038	0.0413	0.0407	0.0391	0.0358	0.0373	0.0362	0.0386	0.0389	0.0411	0.04	0.0394
Silicon	mg/L	-	5.33	5.04	4.57	4.17	4.8	5.09	5.08	5.47	5.09	5.22	5.05	5.23	5.09	5.43	5.5	5.18	5.49	5.13	5.13	5.42	5.45	5.67
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	3.02	2.98	2.13	1.62	2.17	2.54	2.88	3.02	3.12	2.38	2.15	2.15	1.91	2.46	2.87	2.84	3.12	2.67	2.46	2.26	1.86	2.05
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium	mg/L	-	0.00151	0.00152	0.0011	0.000762	0.00109	0.00131	0.00145	0.00182	0.00204	0.00194	0.00145	0.00152	0.00138	0.00173	0.00177	0.00184	0.00165	0.00142	0.00154	0.00164	0.00133	0.00132
Vanadium	mg/L	-	0.00057	0.00054	0.00075	0.001	0.00087	0.00077	0.00087	0.00083	0.00095	0.00093	0.00082	0.00087	0.00073	0.00078	0.00074	0.00135	0.00129	0.00195	0.00213	0.00224	0.00152	0.00128
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-10-01	2019-10-08	2019-10-15	2019-10-22	2019-10-30	2019-11-05	2019-11-13	2019-11-19	2019-11-26	2019-12-03	2019-12-10	2019-12-18	2019-12-27	2020-01-02	2020-01-15	2020-01-21	2020-02-03	2020-02-11	2020-02-18	2020-02-25	2020-03-03	2020-03-10
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1227.7	1265.8	1183	1348.3	1239.8	1285.5	1242.7	1000.2	1181.7	1268	-	1278.5	1249	1230	1224	1268	1306.5	1279.1	1294.1	1287.2	1278.5	1225
pH	pH units	-	7.53	6.78	7.52	6.79	7.08	6.72	7.09	7.47	7.08	7.41	-	7.11	7.51	7.72	7.86	7.67	7.13	7.24	7.12	6.83	7.08	7.69
Turbidity	NTU	-	2.07	1.78	1.78	2.67	3.25	1.87	2.99	4.96	2.97	1.8	-	1.73	1.85	1.44	2.27	3.47	1.94	2.07	2.1	1.7	1.62	1.39
Temperature	C	-	8.949	8.932	9.6	6.486	6.965	6.652	7.91	3.277	4.144	7.5	-	3.339	3.9	3.8	3.5	4.1	2.957	3.085	3.156	3.781	3.448	3.9
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	85.3	88.5	86.6	85.2	89.2	86.9	92.8	82.8	87.7	89.6	91.6	88.8	89.5	87.8	77.9	76.9	88.5	88	92.2	90.9	86.1	78.4
Specific conductivity	uS/cm	-	1220	1160	1220	1250	1190	1190	1190	971	1130	1220	1260	1290	1300	1260	1290	1280	1250	1230	1250	1240	1280	1270
pH	pH units	-	8.04	7.84	7.86	7.83	7.84	7.71	7.96	7.91	7.82	7.81	7.86	7.93	8	7.92	7.85	7.79	7.72	7.92	7.75	7.72	7.63	7.69
Total suspended solids	mg/L	30	8.2	7.4	8.7	17.4	8.9	10.1	9.9	6.9	6.2	6.8	8.4	6.4	6	7	5.9	6.8	5.2	5.5	8.2	10.4	7.9	5.9
Turbidity	NTU	-	1.42	1.14	1.95	2.7	1.79	1.69	2.25	2.13	1.79	1.48	1.78	1.09	1.48	1.48	2.2	2.38	1.77	1.62	1.68	1.71	1.37	0.97
Hardness, as CaCO3	mg/L	-	605	613	588	581	614	547	568	433	531	624	649	607	679	627	611	578	546	631	550	563	591	522
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	597	546	586	-	-	-	-	-	-
Total dissolved solids	mg/L	-	899	937	965	947	925	783	963	742	848	987	1000	951	1000	969	966	967	985	952	976	1010	962	975
Dissolved organic carbon	mg/L	-	3.54	3.21	2.84	3.29	3.18	3.44	3.29	5.41	4.4	3.25	2.63	2.69	2.47	2.87	3.15	3.19	2.88	2.75	2.62	3.75	3.12	4.7
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.67	6.01	5.67	5.54	5.38	5.19	5.09	5.17	5.48	5.24	5.41	5.29	5.18	5.33	6.03	5.7	5.51	4.7	4.61	4.35	4.88	5.11
Nitrate + nitrite	mg-N/L	-	5.68	6.04	5.68	5.55	5.39	5.2	5.1	5.18	5.48	5.25	5.42	5.31	5.19	5.34	6.04	5.72	5.52	4.71	4.61	4.35	4.88	5.11
Nitrite	mg-N/L	0.78	0.0101	0.023	0.0103	0.016	0.0108	0.0118	0.0138	0.0059	0.0088	0.0102	0.0131	0.0137	0.0121	0.0152	0.016	0.0186	0.0101	0.0055	0.0062	<0.0050	<0.0050	<0.0050
Total ammonia	mg-N/L	1.3	0.0175	0.0139	0.0177	0.0256	0.0218	0.0228	0.0313	0.0304	0.0321	0.0263	0.0328	0.0393	0.0411	0.051	0.0993	0.0691	0.0449	0.0454	0.0394	0.0455	0.0361	0.0361
Dissolved phosphorus	mg-P/L	-	0.0023	<0.0020	<0.0020	0.0022	0.0031	0.0026	<0.0020	<0.0020	0.0023	<0.0020	<0.0020	0.0029	0.0022	0.0029	0.0042	0.0038	0.0026	0.0034	0.003	0.0022	0.0038	0.0032
Total phosphorus	mg-P/L	0.09	0.0046	0.0049	0.0048	0.0205	0.0051	0.0046	0.0141	0.0161	0.0168	0.0095	0.0155	0.0105	0.0058	0.0204	0.0209	0.0205	0.0157	0.0184	0.0145	0.0167	0.0114	0.008
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.003
Total nitrogen	mg/L	-	6.25	6.45	6.04	6.06	5.38	5.49	5.23	5.64	5.91	5.11	5.46	5.91	5.76	5.87	6.29	6.36	5.94	5.19	5.04	4.65	5.26	5.48
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	189	192	183	181	193	171	176	132	161	195	205	190	218	201	193	178	170	201	176	176	184	160
Chloride	mg/L	-	17.1	19	17.9	18.5	16.9	15.9	21	16	14.2	15.8	15.8	16.2	16.5	16.5	17.5	17.8	16.9	16.8	16.6	17.2	18.9	18.5
Fluoride	mg/L	17	0.33	0.42	0.45	0.5	0.46	0.5	0.5	0.29	0.36	0.51	0.59	0.59	0.59	0.57	0.566	0.586	0.559	0.566	0.623	0.591	0.583	0.552
Magnesium	mg/L	-	32.2	32.2	31.8	31.3	31.9	29.3	31.1	25.3	31.4	33.1	33.5	32.5	32.6	30.6	31.3	32	29.4	31.1	27.2	29.7	31.8	30.1
Potassium	mg/L	-	6.2	5.93	6.61	5.91	5.28	5.45	5.2	3.42	4.45	5.92	6.32	6.36	7.3	6.93	8.37	9.49	7.13	8.43	7.16	7.97	9.74	8.16
Sodium	mg/L	-	43.8	42	48.2	45	39.8	43	44	25.4	38.4	46.3	49.7	51.5	55.7	58.6	58.9	64.5	56.7	61.9	55.1	58.9	68.3	62.6
Sulphate	mg/L	1100	514	578	546	564	553	534	548	410	495	568	591	584	578	603	600	580	580	566	577	570	577	562
Total Metals																								
Aluminum	mg/L	-	1.29	0.889	1.14	1.52	1.18	1.06	1.17	1.03	0.984	1.11	1.18	1.26	1.17	1.02	0.826	0.96	0.963	1.21	1.16	1.23	1.1	0.961
Antimony	mg/L	-	0.0007	0.00067	0.00081	0.00072	0.00063	0.00067	0.00068	0.00043	0.00059	0.00075	0.00078	0.00084	0.00083	0.00082	0.00088	0.00089	0.00081	0.0008	0.00087	0.00088	0.00089	0.00084
Arsenic	mg/L	0.028	0.00103	0.001	0.0014	0.00105	0.00081	0.00091	0.00098	0.0006	0.00073	0.00104	0.00108	0.00129	0.00114	0.00142	0.00182	0.00185	0.0013	0.00146	0.00154	0.00153	0.00158	0.00146
Barium	mg/L	-	0.0378	0.035	0.0365	0.0354	0.0351	0.0307	0.0331	0.0295	0.0324	0.034	0.033	0.0343	0.0321	0.0332	0.0349	0.033	0.0341	0.0325	0.0316	0.0323	0.0324	0.0355
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.112	0.128	0.123	0.127	0.125	0.123	0.14	0.073	0.101	0.144	0.158	0.151	0.164	0.164	0.133	0.126	0.136	0.154	0.161	0.158	0.133	0.137
Cadmium	mg/L	-	<0.000085	<0.000090	<0.00023	<0.000060	<0.00010	<0.000090	<0.00010	<0.000060	<0.000085	<0.00013	<0.00013	<0.00020	<0.00015	<0.000120	<0.000130	<0.000200	<0.000100	<0.000115	<0.000175	0.000178	<0.0000750	<0.0000950
Calcium	mg/L	-	176	189	196	184	184	176	175	153	169	190	189	198	202	188	169	185	176	175	189	182	166	177
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00016	0.00015	0.0002	0.00019	0.00016	0.00018	0.0002	0.00016	0.00019	0.00025	0.00025	0.00032	0.00032	0.00034	0.00045	0.00045	0.00039	0.0004	0.00039	0.0004	0.00045	0.00046
Copper	mg/L	0.033	0.0126	0.00823	0.00933	0.0101	0.00903	0.00929	0.0127	0.0119	0.0123	0.0142	0.0151	0.0191	0.0177	0.02	0.0322	0.0336	0.022	0.0242	0.0252	0.0252	0.0281	0.0272
Iron	mg/L	1	<0.030	<0.030	<0.030	0.052	<0.030	<0.030	<0.030	0.035	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.067	0.042	0.033	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000062	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0056	0.006	0.0066	0.0064	0.0057	0.0057	0.0062	0.0039	0.0053	0.0069	0.0076	0.008	0.0082	0.0083	0.0082	0.0076	0.0071	0.0078	0.0078	0.0074	0.0084	0.0091
Magnesium	mg/L	-	31.4	30.5	33.5	31.1	28.2	28.2	29.9	24.8	30.6	32.5	32.7	34.9	31.4	30.8	29.8	30	29.8	30	30.4	31	30.1	30
Manganese	mg/L	3.4	0.0772	0.0746	0.0854	0.0958	0.0835	0.086	0.106	0.0702	0.0887	0.108	0.11	0.123	0.122	0.146	0.165	0.145	0.121	0.124	0.123	0.124	0.139	0.153
Mercury	mg/L	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-
Molybdenum	mg/L	0.36	0.161	0.162	0.182	0.158	0.161	0.157	0.167	0.108	0.143	0.176	0.173	0.203	0.194	0.205	0.212	0.21	0.198	0.199	0.209	0.205	0.212	0.21
Nickel	mg/L	-	0.00065	0.00071	0.00096	0.00088	0.00083	0.00088	0.00087	0.0006	0.00077	0.00096	0.00101	0.00109	0.00115	0.00116	0.0014	0.00144	0.00125	0.00126	0.00118	0.00127	0.00133	0.00137
Potassium	mg/L	-	5.89	5.38	7.29	5.98	5	4.9	5.26	3.45	4.6	5.62	6.23	6.76	6.96	7.11	7.96	8.27	7.2	7.23	8.03	7.82	8.65	8.66
Selenium	mg/L	0.075	0.037	0.0384	0.0372	0.0369	0.0355	0.0343	0.0336	0.032	0.0385	0.0388	0.0379	0.0409	0.0377	0.0368	0.0392	0.0407	0.0337	0.036	0.0331	0.0337	0.0349	0.0354
Silicon	mg/L	-	5.86	6.07	5.45	5.79	5.76	6.02	5.52	6.14	6.22	5.94	6.61	6.43	6.18	5.94	5.74	5.78	5.64	5.75	5.6	5.58	5.32	5.38
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	43.2	38.2	50.7	47.3	38.8	42.9	44.8	26.5	37.1	45.8	49.6	55.1	52.6	55.5	60.8	64.5	54.8	56.2	57.2	60.3	67.7	63.2
Strontium	mg/L	-	1.99	2.23	2.36	2.34	2.34	2.2	2.44	1.4	1.89	2.62	2.69	2.94	2.89	2.72	2.06	2.09	2.43	2.56	2.7	2.66	2.27	2.1
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010	<0.000010
Tin	mg/L	-	0.00011	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00154	0.00148	0.00167	0.00165	0.00159	0.00156	0.00183	0.0011	0.00147	0.00192	0.00211	0.00204	0.00218	0.00204	0.00203	0.0019	0.00202	0.00206	0.00215	0.00211	0.00202	0.00196
Vanadium	mg/L	-	0.00152	0.0014	0.00205	0.00155	0.00114	0.00134	0.00134	0.00097	0.00113	0.00136	0.00131	0.00156	0.00155	0.00153	0.00186	0.002	0.00161	0.00158	0.0016	0.00162	0.00169	0.00159
Zinc	mg/L	0.059	0.0038	<0.0030	0.0033	<0.0030	0.0038	0.0031	0.0061	<0.0030	0.0031	0.0044	0.0173	0.0042	0.0039	0.0045	0.0045	0.0046	0.0042	0.0069	0.0039	0.004	0.0039	0.0042

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2019-10-01	2019-10-08	2019-10-15	2019-10-22	2019-10-30	2019-11-05	2019-11-13	2019-11-19	2019-11-26	2019-12-03	2019-12-10	2019-12-18	2019-12-27	2020-01-02	2020-01-15	2020-01-21	2020-02-03	2020-02-11	2020-02-18	2020-02-25	2020-03-03	2020-03-10
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.13	0.164	0.139	0.165	0.165	0.151	0.185	0.17	0.168	0.142	0.145	0.182	0.16	0.13	0.131	0.186	0.153	0.233	0.176	0.154	0.136	0.121
Antimony	mg/L	-	0.00067	0.00067	0.00076	0.00077	0.00059	0.00069	0.00067	0.00046	0.00054	0.00075	0.00079	0.00077	0.00082	0.00084	0.00086	0.00088	0.00076	0.00078	0.00083	0.00081	0.00081	0.00083
Arsenic	mg/L	-	0.00086	0.0009	0.00106	0.00087	0.00063	0.00075	0.00077	0.00049	0.00058	0.00073	0.0008	0.00081	0.0009	0.00097	0.00128	0.00137	0.00091	0.00102	0.00102	0.00096	0.00123	0.00103
Barium	mg/L	-	0.0389	0.0402	0.0358	0.0374	0.0355	0.0327	0.0316	0.0339	0.0325	0.0362	0.0339	0.0332	0.0367	0.0328	0.0345	0.0364	0.0342	0.0328	0.0298	0.0312	0.0325	0.0336
Beryllium	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.101	0.121	0.102	0.13	0.132	0.132	0.136	0.064	0.094	0.135	0.161	0.144	0.155	0.143	0.124	0.105	0.137	0.166	0.154	0.151	0.145	0.11
Cadmium	mg/L	0.00034	<0.00015	<0.000085	<0.00011	<0.000090	0.0000759	<0.000095	<0.00020	<0.000070	<0.00010	<0.00012	<0.00011	0.0000663	<0.00015	0.00011	<0.000160	<0.0000950	<0.000100	<0.000120	<0.000100	0.000127	<0.0000450	<0.000110
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00136	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00014	0.00013	0.00015	0.00016	0.00016	0.00016	0.0002	0.00013	0.00019	0.00024	0.00025	0.00027	0.00032	0.00037	0.00038	0.00043	0.00034	0.00038	0.00034	0.00037	0.00043	0.00044
Copper	mg/L	-	0.00604	0.00499	0.00444	0.00433	0.00475	0.00474	0.00576	0.0071	0.00671	0.00615	0.00643	0.0068	0.0075	0.00761	0.0111	0.0115	0.00836	0.00912	0.00818	0.00789	0.00969	0.0103
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0056	0.0057	0.007	0.0061	0.0059	0.006	0.0063	0.0035	0.0052	0.0071	0.0073	0.0068	0.0075	0.0072	0.0076	0.0076	0.0073	0.009	0.0081	0.0078	0.0082	0.0071
Manganese	mg/L	-	0.071	0.0722	0.0745	0.0911	0.0925	0.0897	0.101	0.0637	0.088	0.108	0.113	0.118	0.122	0.14	0.137	0.141	0.119	0.127	0.116	0.119	0.145	0.147
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.159	0.153	0.167	0.176	0.14	0.153	0.16	0.11	0.147	0.174	0.181	0.177	0.187	0.22	0.226	0.222	0.18	0.189	0.198	0.193	0.208	0.198
Nickel	mg/L	-	0.00064	0.00063	0.00071	0.00072	0.00074	0.00086	0.00084	0.00059	0.00071	0.00092	0.00095	0.00102	0.00118	0.001	0.00124	0.00135	0.00111	0.00113	0.00108	0.00121	0.00135	0.00126
Selenium	mg/L	-	0.0345	0.0376	0.0398	0.0394	0.033	0.0375	0.033	0.0301	0.0422	0.0395	0.0433	0.0407	0.0358	0.0362	0.0432	0.0401	0.0349	0.03	0.0308	0.031	0.0366	0.0344
Silicon	mg/L	-	4.98	5.41	5.35	5.33	5.24	5.73	5.27	5.12	5.42	5.78	6.09	5.61	5.4	5.05	5.26	5.1	5.22	5.72	5.3	4.95	5.2	4.89
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2	2.43	2.24	2.55	2.26	2.2	2.33	1.32	1.85	2.65	2.73	2.69	2.92	2.87	2.2	2.09	2.43	2.64	2.63	2.6	2.2	2.05
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00148	0.0016	0.00161	0.00164	0.00161	0.00162	0.0017	0.00104	0.00133	0.00188	0.00211	0.0021	0.00207	0.00209	0.00175	0.00196	0.00214	0.00226	0.00212	0.00205	0.00189	0.00189
Vanadium	mg/L	-	0.00136	0.00126	0.00142	0.00124	0.00111	0.00117	0.00118	0.00078	0.00101	0.00118	0.00118	0.00127	0.00143	0.00134	0.00154	0.00168	0.00136	0.00148	0.0013	0.00137	0.00158	0.00142
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-03-17	2020-03-24	2020-03-31	2020-04-07	2020-04-14	2020-06-02	2020-06-09	2020-06-16	2020-06-24	2020-06-29	2020-07-07	2020-07-14	2020-07-28	2020-08-04	2020-08-11	2020-08-18	2020-08-25	2020-08-31	2020-09-08	2020-09-16	2020-09-22	2020-09-28
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1313	1250	1298	1226	1112	1329	1212	1286	1382	1466	1235	1098	1188	1229	1209	1452	1083.7	1176	1330.2	1196.1	1224.5	1212.6
pH	pH units	-	7.29	7.67	7.31	7.65	7.42	7.59	7.49	7.32	7.51	7.58	7.15	7.56	7.41	7.39	7.35	7.28	7.32	7.23	7.3	7.25	7.15	7.15
Turbidity	NTU	-	2.01	0.086	2.14	2	2.59	1.46	1.76	1.05	0.94	0.96	1.76	1.69	1.01	0.88	1.53	1.16	1.59	0.88	1.92	0.82	2.2	1.2
Temperature	C	-	4.614	6.4	4.289	3.1	4.1	12.4	16.7	12	14.8	13.8	14	14.4	17	17.06	16.1	16.579	15.281	14.3	15.825	13.999	16.662	11.852
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	104	111	107	94.8	91.3	106	105	107	112	112	107	104	105	104	95.8	104	91.9	78.3	90.8	74	72.8	79.5
Specific conductivity	uS/cm	-	1260	1290	1240	1210	1110	1410	1260	1340	1370	1460	1280	1120	1260	1350	1340	1390	1330	1220	1300	1180	1210	1190
pH	pH units	-	7.95	7.89	7.76	7.7	7.58	7.75	7.97	7.86	7.89	7.96	7.93	7.84	7.89	8	7.95	7.94	7.81	7.59	7.64	7.74	7.88	7.7
Total suspended solids	mg/L	30	9	6.5	7.5	6.3	12.3	8	11.2	7.8	6.8	5.2	6.5	7.9	6.4	4.6	4.9	6.7	6.3	6.2	5.7	9	6.8	8.6
Turbidity	NTU	-	1.24	1.11	1.08	1.19	2.06	1.4	1.32	1.31	0.94	1.2	1.69	2	0.82	0.79	0.75	0.82	1.17	1.03	0.92	1.02	1.34	0.79
Hardness, as CaCO3	mg/L	-	617	585	564	544	558	774	667	702	746	798	676	594	668	682	686	760	768	655	648	538	532	574
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	568	613	-	568	-	-	-	760	739	760	635	570	647	680	684	730	645	586	638	684	551	572
Total dissolved solids	mg/L	-	980	988	934	921	853	1050	1040	1080	1190	1200	1040	966	1520	1010	1130	1170	1090	1070	1070	961	976	955
Dissolved organic carbon	mg/L	-	3.32	2.67	2.83	2.86	3.32	3.74	3.53	3.43	3.6	3.01	3.77	4.5	4.2	3.42	3	2.96	3.27	3.38	3.34	3.42	3.89	3.4
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	4.69	4.68	4.76	3.58	4.42	6.55	5.26	5.12	5.07	5.03	4.43	4.39	5.04	5.5	5.35	5.84	5.31	5	5.42	4.4	4.46	4.3
Nitrate + nitrite	mg-N/L	-	4.7	4.69	4.77	3.58	4.42	6.56	5.26	5.12	5.08	5.05	4.43	4.4	5.05	5.51	5.36	5.84	5.32	5.02	5.44	4.42	4.47	4.31
Nitrite	mg-N/L	0.78	0.0064	<0.0050	<0.0050	0.0051	<0.0050	0.008	0.0055	0.0075	0.0162	0.0181	0.0074	0.0054	0.0099	0.0094	0.0153	0.0097	0.0128	0.0146	0.0143	0.0152	0.0066	0.0101
Total ammonia	mg-N/L	1.3	0.0293	0.0346	0.04	0.0328	0.0283	0.0343	0.0313	0.0309	0.0362	0.0392	0.0301	0.0152	0.051	0.032	0.0325	0.0313	0.035	0.0522	0.0376	0.0368	0.0472	0.0366
Dissolved phosphorus	mg-P/L	-	0.0044	0.0024	0.0023	0.0034	0.0025	<0.0020	0.0023	0.0024	0.0029	<0.0020	<0.0020	0.0022	0.0029	<0.0020	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	0.0031	0.0033	0.0025
Total phosphorus	mg-P/L	0.09	0.0083	0.0104	0.0207	0.0086	0.0083	0.005	0.0085	0.0034	0.0044	0.0106	0.0093	0.0059	0.0039	0.0098	0.0047	0.0038	0.003	0.0142	0.003	0.0036	0.005	0.0034
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0017	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	4.8	4.96	5.16	4.02	4.89	7.47	6.09	5.73	5.44	5.43	4.77	4.83	5.29	5.61	5.95	6.42	5.7	5.54	5.62	4.96	4.77	4.65
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	197	184	177	174	177	248	212	223	240	260	218	188	216	218	220	246	252	208	204	170	163	181
Chloride	mg/L	-	15.8	12.8	13.2	15.8	18	10.6	10.1	10.9	11.4	11.9	10.8	10.4	11.4	12.8	12.5	12.4	12.4	12.9	13.8	14.3	14.8	13.5
Fluoride	mg/L	17	0.575	0.591	0.566	0.53	0.472	0.47	0.353	0.396	0.515	0.556	0.449	0.376	0.408	0.51	0.525	0.582	0.545	0.465	0.512	0.452	0.442	0.435
Magnesium	mg/L	-	30.6	30.6	29.5	26.5	28	37.4	33.4	35.3	35.5	36.6	32.2	30.2	31.4	33.4	33.4	35.6	33.5	32.7	33.7	27.8	30.4	29.9
Potassium	mg/L	-	7.48	5.61	5.23	7.33	7.12	3.81	3.26	3.12	3.48	3.64	3.04	2.76	3.24	3.89	3.79	4.17	4.61	5.29	4.89	5.9	6.42	5.27
Sodium	mg/L	-	57.1	48.9	42.9	54.5	51.4	36.4	30.9	30.2	35.2	37.7	31.7	28	30.1	34.6	34.9	34.9	35.6	38	38	34.7	43	36.8
Sulphate	mg/L	1100	574	569	542	525	518	661	564	633	683	715	601	504	562	659	640	659	625	562	631	545	546	560
Total Metals																								
Aluminum	mg/L	-	0.898	0.859	0.956	0.976	1.16	1.1	1.08	1.1	0.815	0.93	1.08	1.16	0.931	0.919	1.08	0.93	0.891	0.95	0.957	1.01	1.02	1.04
Antimony	mg/L	-	0.00075	0.00066	0.00056	0.00071	0.00062	0.0006	0.00054	0.00055	0.00055	0.00063	0.00053	0.00044	0.00053	0.00053	0.00056	0.00055	0.00053	0.00054	0.00052	0.0005	0.00051	0.0005
Arsenic	mg/L	0.028	0.0013	0.00114	0.00087	0.00132	0.00102	0.00069	0.00064	0.00062	0.00061	0.00068	0.00068	0.00072	0.00075	0.0007	0.00085	0.00081	0.0008	0.00098	0.00083	0.00103	0.00108	0.00096
Barium	mg/L	-	0.0336	0.0321	0.0331	0.0321	0.0326	0.0366	0.0307	0.0328	0.0319	0.033	0.0323	0.0343	0.0347	0.0366	0.0353	0.034	0.0382	0.0423	0.0406	0.0411	0.0399	0.0413
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.16	0.186	0.175	0.139	0.123	0.145	0.139	0.165	0.167	0.176	0.143	0.1	0.124	0.131	0.164	0.17	0.142	0.11	0.139	0.124	0.116	0.13
Cadmium	mg/L	-	<0.000115	<0.000110	<0.000110	0.000109	<0.000100	0.000211	<0.000210	<0.000220	<0.000205	0.000229	<0.000220	<0.000150	<0.000125	<0.000150	<0.000150	<0.000115	<0.000120	<0.000120	<0.000100	<0.0000350	<0.0000850	<0.0000800
Calcium	mg/L	-	177	195	187	180	166	253	226	245	240	245	202	178	205	216	218	235	203	182	200	218	171	180
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00038	0.00028	0.00026	0.00045	0.00058	0.0004	0.00032	0.00035	0.00033	0.00033	0.00031	0.00025	0.00021	0.00018	0.00015	0.00014	0.00013	0.00014	0.00012	0.00012	0.00015	0.0001
Copper	mg/L	0.033	0.0228	0.0161	0.0145	0.0282	0.0784	0.0179	0.0145	0.0125	0.00995	0.0105	0.0118	0.014	0.0107	0.00894	0.00891	0.00831	0.00949	0.0151	0.011	0.0169	0.0146	0.0141
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	0.032	<0.030	<0.030	<0.030	0.125	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0074	0.0074	0.0068	0.0072	0.008	0.008	0.0065	0.0073	0.0076	0.008	0.0066	0.0049	0.0062	0.0079	0.0076	0.0082	0.0068	0.0072	0.0069	0.0076	0.0075	0.0076
Magnesium	mg/L	-	30.7	30.5	29.3	29.1	28.6	37.8	32.9	36.1	33.8	36.1	31.9	30.2	32.6	34	34.1	34.7	33.7	32.3	33.5	34	30.2	29.9
Manganese	mg/L	3.4	0.133	0.144	0.124	0.128	0.141	0.206	0.16	0.183	0.19	0.198	0.166	0.15	0.143	0.122	0.0947	0.0972	0.0892	0.0772	0.084	0.0675	0.102	0.0556
Mercury	mg/L	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	<0.0000050	-	-	-	-	<0.0000050	-	-
Molybdenum	mg/L	0.36	0.194	0.168	0.158	0.181	0.17	0.16	0.158	0.17	0.169	0.172	0.149	0.122	0.153	0.169	0.171	0.168	0.161	0.163	0.16	0.207	0.167	0.154
Nickel	mg/L	-	0.00105	0.00088	0.00075	0.00131	0.00132	0.0009	0.00079	0.00079	0.00077	0.00087	0.00074	0.00064	0.00059	0.00088	0.00058	<0.00050	0.00062	0.00064	0.00054	0.00063	0.00061	0.00061
Potassium	mg/L	-	7.42	5.7	5.25	7.71	7.05	3.41	2.99	3.24	3.23	3.5	2.98	2.93	3.6	3.63	4.11	3.71	4.35	5.44	5.11	6.05	6.2	5.39
Selenium	mg/L	0.075	0.033	0.0289	0.0269	0.0287	0.0289	0.0479	0.0432	0.0453	0.0402	0.0413	0.0364	0.0369	0.0455	0.0461	0.0533	0.0496	0.044	0.0409	0.0426	0.04	0.0366	0.0385
Silicon	mg/L	-	6.11	6.35	5.82	5.58	5.41	5.46	5.59	5.81	5.9	6.16	5.8	5.68	5.59	5.4	6.08	6.03	5.36	5.08	6.04	5.2	4.82	5.23
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	59.9	48.8	41.7	57.4	52.3	34.8	28.8	32.7	33.7	37.5	32	27.1	32.5	34.1	36.7	38.2	35.2	38	38.7	41.1	44.6	37.3
Strontium	mg/L	-	2.69	3.09	2.81	2.3	2	3.29	2.9	3.26	3.5	3.54	3.08	2.2	2.5	3.21	3.22	3.4	3.15	2.45	2.95	2.72	2.12	2.57
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00209	0.00222	0.002	0.00185	0.00165	0.00279	0.00233	0.00265	0.00288	0.00294	0.00242	0.00165	0.0019	0.0021	0.00216	0.00237	0.00216	0.00183	0.00204	0.00155	0.00182	0.0018
Vanadium	mg/L	-	0.00137	0.00107	0.001	0.00144	0.00116	0.00088	0.00085	0.00088	0.00093	0.00075	0.00079	0.00087	0.00088	0.00088	0.00088	0.00076	0.00079	0.00099	0.0009	0.00109	0.00097	0.00088
Zinc	mg/L	0.059	0.0049	0.0046	0.0049	0.0051	0.0056	0.007	0.0058	0.0057	0.0053	0.0079	0.0042	0.0039	<0.0030	0.0034	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-03-17	2020-03-24	2020-03-31	2020-04-07	2020-04-14	2020-06-02	2020-06-09	2020-06-16	2020-06-24	2020-06-29	2020-07-07	2020-07-14	2020-07-28	2020-08-04	2020-08-11	2020-08-18	2020-08-25	2020-08-31	2020-09-08	2020-09-16	2020-09-22	2020-09-28
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.144	0.149	0.163	0.142	0.137	0.178	0.14	0.12	0.115	0.0974	0.133	0.149	0.0869	0.103	0.0916	0.141	0.137	0.118	0.125	0.101	0.111	0.107
Antimony	mg/L	-	0.00074	0.00061	0.00061	0.00073	0.00065	0.00056	0.00056	0.00056	0.00057	0.00059	0.00051	0.00049	0.00052	0.00058	0.0005	0.0006	0.00046	0.00052	0.00053	0.00049	0.00048	0.0005
Arsenic	mg/L	-	0.00093	0.00085	0.00064	0.00092	0.00066	0.00065	0.0005	0.00049	0.00055	0.00058	0.00058	0.00058	0.00062	0.00087	0.00073	0.0007	0.00072	0.00085	0.00076	0.0009	0.00092	0.00082
Barium	mg/L	-	0.0339	0.0316	0.0331	0.0329	0.0315	0.0366	0.0327	0.0326	0.0344	0.0356	0.0312	0.0312	0.0321	0.036	0.0359	0.0353	0.0414	0.042	0.0414	0.0402	0.0426	0.0418
Beryllium	mg/L	-	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.154	0.171	0.154	0.135	0.115	0.146	0.125	0.135	0.171	0.166	0.138	0.104	0.113	0.147	0.144	0.171	0.161	0.112	0.143	0.095	0.097	0.13
Cadmium	mg/L	0.00034	<0.0000650	<0.0000900	<0.000105	<0.0000650	<0.000180	<0.000135	<0.000220	<0.000210	0.000205	<0.000230	<0.000240	<0.000185	<0.000130	<0.000205	<0.000110	<0.000130	<0.000110	0.0000889	<0.000100	<0.0000550	<0.000150	<0.0000900
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00034	0.00027	0.00024	0.00039	0.00056	0.00037	0.00029	0.00029	0.0003	0.00029	0.00027	0.00025	0.00017	0.00017	0.00012	0.00014	0.00012	0.00012	0.0001	0.0001	0.00013	<0.00010
Copper	mg/L	-	0.0094	0.00799	0.00623	0.00988	0.0256	0.00831	0.00748	0.00609	0.00538	0.00509	0.00632	0.00798	0.00589	0.00477	0.00489	0.00663	0.00703	0.0103	0.00792	0.0125	0.0106	0.00999
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0076	0.0071	0.0067	0.0085	0.0067	0.0075	0.006	0.0066	0.0081	0.0078	0.006	0.0049	0.006	0.0071	0.0068	0.0085	0.0076	0.0071	0.0069	0.0065	0.0064	0.0075
Manganese	mg/L	-	0.135	0.137	0.121	0.124	0.127	0.204	0.15	0.167	0.182	0.179	0.155	0.142	0.107	0.0924	0.0718	0.0943	0.0834	0.0703	0.0766	0.0612	0.101	0.0521
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.203	0.169	0.147	0.186	0.174	0.169	0.146	0.155	0.171	0.177	0.149	0.136	0.16	0.173	0.169	0.171	0.146	0.162	0.174	0.147	0.162	0.152
Nickel	mg/L	-	0.00109	0.00081	0.00073	0.00119	0.00138	0.00084	0.00072	<0.00050	0.00064	0.00059	0.00063	0.00057	<0.00050	0.00083	0.00058	0.00053	0.00075	0.00056	0.00054	0.00061	0.00062	0.0006
Selenium	mg/L	-	0.0291	0.0295	0.0277	0.0313	0.0287	0.0542	0.0401	0.0415	0.0453	0.0422	0.0379	0.0365	0.0436	0.055	0.0464	0.0504	0.0412	0.0397	0.0402	0.0402	0.0362	0.0382
Silicon	mg/L	-	5.15	5.72	5.22	5.28	4.91	5.24	5.05	4.94	5.74	5.42	5.48	4.87	5.14	5.35	5.09	5.88	5.38	4.98	5.57	4.37	4.84	5.01
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.88	3	2.71	2.37	2.06	3.58	2.99	3.14	3.54	3.83	3.15	2.37	2.65	3.2	3.22	3.6	3.06	2.58	2.89	2.13	2.08	2.48
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00207	0.00227	0.002	0.0019	0.00164	0.00267	0.00228	0.00258	0.0028	0.00288	0.00214	0.00178	0.00174	0.00214	0.00192	0.00208	0.00198	0.0018	0.00181	0.00142	0.00168	0.00156
Vanadium	mg/L	-	0.00118	0.00096	0.00077	0.00117	0.001	0.00076	0.0007	0.0007	0.00072	0.00074	0.0007	0.00075	0.00057	0.00062	0.00067	0.00066	0.00061	0.00071	0.00069	0.00076	0.0008	0.00077
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-10-06	2020-10-13	2020-10-20	2020-10-27	2020-11-04	2020-11-11	2020-11-17	2020-11-24	2020-12-01	2020-12-08	2020-12-15	2020-12-21	2020-12-29	2021-01-05	2021-01-12	2021-01-19	2021-01-26	2021-02-04	2021-02-16	2021-02-23	2021-03-02	2021-03-09
Parameter																								
Field Parameters																								
Specific conductivity	uS/cm	-	1216	1264.5	1071.1	1328.9	895.6	1119	1319.1	1241	1349.4	1317.8	1175	1334.1	1373.3	1296.9	1176	1202.4	1221.9	1213.5	1206.3	1290.3	1149	1185.5
pH	pH units	-	7.26	7.11	7.58	7.19	7.27	7.58	7.1	7.64	7.56	7.28	7.43	7.46	7.65	7.31	7.62	7.25	7.26	7.52	7.07	6.81	7.51	7.15
Turbidity	NTU	-	2.56	1.94	3.08	3.17	4.63	1.94	2.84	1.05	2.43	1.3	0.93	1.69	1.17	0.86	0.94	1.3	1.96	1.69	2.12	1.38	0.8	1.54
Temperature	C	-	12.399	9.321	5.068	4.804	5.725	3.5	5.696	5	3.511	3.956	5.8	3.912	3.49	3.489	5.6	3.585	3.392	3.772	2.778	3.219	4.2	4.28
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	96	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	12.68	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	79.1	93.4	84.6	89.8	79.6	75.5	89.7	105	98.3	98	92.3	98	105	104	90.8	79.5	86.8	97.9	82.5	87.8	91.4	78.6
Specific conductivity	uS/cm	-	1170	1190	1070	1140	865	1150	1320	1280	1310	1240	1230	1230	1300	1240	1170	1120	1160	1230	1130	1190	1160	1140
pH	pH units	-	7.63	7.89	7.73	7.74	7.68	7.76	7.68	7.65	7.94	8.04	7.92	7.91	7.99	7.95	7.75	7.67	8	7.9	7.94	7.87	7.79	7.62
Total suspended solids	mg/L	30	10.3	4.3	7.7	10.5	9.3	6.9	8.2	7.2	8.4	7.3	10.4	8.2	9.1	6.3	6.2	6.1	6.8	6.7	7.5	8	9.8	11.8
Turbidity	NTU	-	0.81	0.69	1.46	1.4	1.75	1.92	1.41	1.03	1.2	1.14	2.16	1.22	1.16	1.43	1.33	1.31	1.22	1.07	1.82	1.91	1.26	1.7
Hardness, as CaCO3	mg/L	-	585	614	540	577	419	601	670	706	756	672	634	722	654	640	554	528	622	655	601	574	588	534
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	552	631	547	582	422	619	636	692	658	682	651	664	681	639	573	541	645	634	614	598	604	592
Total dissolved solids	mg/L	-	1020	878	834	944	642	874	997	1020	1080	1040	976	969	998	982	910	854	878	876	867	902	889	842
Dissolved organic carbon	mg/L	-	3.29	3.36	4.43	3.86	4.54	4.21	3.39	2.94	2.52	2.48	2.85	3.27	2.59	2.68	2.72	2.53	2.64	2.64	2.05	2.97	2.91	2.6
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	3.63	4.38	5.24	4.55	3.55	4.95	5.46	6.13	6.27	6.13	5.46	5.58	5.41	5.61	4.98	5.46	4.61	4.94	3.88	3.72	3.81	4.28
Nitrate + nitrite	mg-N/L	-	3.64	4.38	5.24	4.56	3.55	4.96	5.46	6.14	6.28	6.14	5.47	5.58	5.41	5.62	4.98	5.47	4.61	4.94	3.88	3.72	3.81	4.29
Nitrite	mg-N/L	0.78	0.0089	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0072	<0.0050	0.0059	<0.0050	0.0105	<0.0050	<0.0050	0.0084	<0.0050	0.0076	<0.0050	0.0056	0.0059	<0.0050	<0.0050	0.0104
Total ammonia	mg-N/L	1.3	0.0343	0.0227	0.016	0.0221	0.0136	0.0208	0.0178	0.0329	0.0334	0.0295	0.0354	0.0349	0.0412	0.0414	0.0385	0.0386	0.0381	0.0508	0.0432	0.0508	0.0436	0.0425
Dissolved phosphorus	mg-P/L	-	0.0021	<0.0020	<0.0020	<0.0020	<0.0020	0.002	0.0031	<0.0020	0.0021	<0.0020	0.0023	<0.0020	0.0039	0.0039	0.0039	0.0028	0.002	0.0024	<0.0020	<0.0020	<0.0020	0.0021
Total phosphorus	mg-P/L	0.09	0.0033	0.0028	0.0037	0.0054	0.0059	0.0047	0.0039	0.0031	0.0032	0.0046	0.0048	0.0066	0.0064	0.0073	0.0042	0.0053	0.0048	0.0032	0.0053	0.0049	0.004	0.0057
Orthophosphate	mg-P/L	-	0.0021	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	4	4.86	5.77	4.95	3.96	5.11	5.84	6.31	6.41	6.2	5.88	5.68	5.56	5.76	5.39	5.81	4.9	5.41	4.31	4.01	4.09	4.7
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	187	200	170	182	129	186	212	227	241	216	200	228	207	208	175	166	200	206	191	182	188	167
Chloride	mg/L	-	13.8	12.9	11.3	12.4	8.9	9.61	10.3	9.75	10.1	10.7	11.3	9.48	8.95	8.97	11.4	12.2	11.6	12.6	12.8	13.4	13.2	13.6
Fluoride	mg/L	17	0.493	0.443	0.286	0.342	0.239	0.292	0.409	0.397	0.422	0.448	0.389	0.481	0.515	0.522	0.452	0.439	0.455	0.455	0.475	0.473	0.532	0.42
Magnesium	mg/L	-	28.5	28.2	28.1	29.9	23.4	33.2	33.8	33.6	37.3	32.3	32.6	37	33.4	29.4	28.4	27.5	29.9	34.1	30.1	29	28.9	28.5
Potassium	mg/L	-	5.32	4.7	3.48	4.03	2.01	2.56	2.71	3	3.16	3.6	3.95	4.52	3.98	4.14	4.83	5.18	5.07	5.85	5.26	5.12	5.08	5.29
Sodium	mg/L	-	35.5	33.2	24.3	31	15.5	21.6	24.7	26.4	31.1	33.1	33.8	40.9	36.1	34.2	37.8	38.7	38.6	43.9	41.6	41.9	40.4	41.7
Sulphate	mg/L	1100	561	547	464	507	378	539	603	612	619	617	551	585	614	590	535	513	531	542	510	547	546	514
Total Metals																								
Aluminum	mg/L	-	1.07	0.985	1.13	1.18	1.22	1.18	1.23	0.963	1.08	1.34	1.68	1.22	1.04	1.08	1.2	1.31	1.51	1.2	1.45	1.46	1.35	1.63
Antimony	mg/L	-	0.00047	0.00046	0.00041	0.00041	0.00028	0.00036	0.0004	0.00045	0.0004	0.00052	0.00049	0.00049	0.00047	0.00056	0.0006	0.0006	0.00062	0.0006	0.00061	0.00059	0.00064	0.00058
Arsenic	mg/L	0.028	0.00084	0.00084	0.0005	0.00054	0.00039	0.00039	0.00042	0.00049	0.00057	0.0007	0.00077	0.00088	0.00077	0.001	0.00096	0.00102	0.001	0.00095	0.00099	0.0009	0.00088	0.00095
Barium	mg/L	-	0.0365	0.0387	0.0376	0.0382	0.0292	0.0354	0.0332	0.0364	0.035	0.0392	0.0363	0.0354	0.036	0.0373	0.0376	0.0379	0.0393	0.04	0.0399	0.0377	0.0378	0.0406
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.14	0.151	0.089	0.112	0.064	0.08	0.117	0.144	0.133	0.142	0.146	0.157	0.165	0.151	0.139	0.115	0.145	0.141	0.158	0.169	0.16	0.127
Cadmium	mg/L	-	0.0000814	<0.000110	<0.0000650	<0.0000700	<0.0000750	<0.000145	<0.000130	<0.000155	<0.000150	<0.000170	<0.000135	<0.000140	<0.000155	<0.000140	<0.000110	<0.000135	0.0000972	<0.000130	<0.000120	0.000128	<0.000140	<0.000100
Calcium	mg/L	-	177	200	173	183	130	192	199	218	208	216	207	210	219	202	180	169	204	202	197	192	193	185
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00012	0.00011	0.00013	0.00016	0.00012	0.00076	0.00034	0.00021	0.0002	0.00022	0.00022	0.00023	0.00022	0.00023	0.00023	0.00024	0.00023	0.00025	0.00029	0.00026	0.00027	0.00025
Copper	mg/L	0.033	0.0136	0.013	0.0128	0.0135	0.0121	0.0575	0.0288	0.0162	0.0137	0.0138	0.0139	0.0143	0.0122	0.0147	0.0142	0.0156	0.0201	0.0134	0.0306	0.0166	0.0194	0.0166
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	0.044	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0072	0.0067	0.005	0.0054	0.0028	0.005	0.0052	0.0061	0.0056	0.0064	0.0066	0.0065	0.0072	0.0071	0.0068	0.0067	0.0074	0.0076	0.0074	0.0073	0.008	0.007
Magnesium	mg/L	-	26.6	32	27.7	30.4	23.4	33.9	33.7	36	33.9	34.7	32.6	33.8	32.6	32.8	30	29	32.9	31.4	29.7	28.7	29.6	31.7
Manganese	mg/L	3.4	0.0586	0.0681	0.0646	0.0859	0.042	0.116	0.103	0.111	0.115	0.123	0.139	0.157	0.152	0.152	0.14	0.146	0.137	0.178	0.138	0.17	0.147	0.168
Mercury	mg/L	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.143	0.15	0.128	0.144	0.0916	0.144	0.148	0.146	0.154	0.158	0.162	0.171	0.166	0.166	0.176	0.171	0.187	0.208	0.197	0.184	0.197	0.175
Nickel	mg/L	-	0.0005	<0.00050	<0.00050	0.00052	<0.00050	0.00143	0.00088	0.00068	0.00051	0.00054	0.00061	0.00058	<0.00050	0.00062	0.00068	0.00064	<0.00050	<0.00050	0.0008	0.00074	0.00082	0.00067
Potassium	mg/L	-	5.26	4.82	3.58	4.02	2.02	2.42	2.5	2.89	2.88	3.72	3.66	3.9	3.7	4.42	5.14	5.05	5.28	5.13	5.22	5.09	5.04	5.52
Selenium	mg/L	0.075	0.034	0.0344	0.0391	0.0349	0.0304	0.0525	0.0515	0.0471	0.0484	0.0445	0.0416	0.0428	0.0394	0.0401	0.0446	0.0451	0.0387	0.0378	0.0358	0.0339	0.035	0.0396
Silicon	mg/L	-	4.77	5.5	5.56	5.71	5.32	6.16	6.06	6.6	5.73	6.25	6.01	6.32	6.64	6.38	6.15	5.6	5.94	6.32	5.77	6.02	5.76	6.09
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000014	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	38.2	35	24.7	30.7	15	21	24.1	28.5	28.1	35.4	34.3	35.5	32.1	36.9	41.3	39.8	39.4	40.9	39.8	38.2	39.2	42.3
Strontium	mg/L	-	2.53	2.66	1.79	2.31	1.41	2.32	3.02	3.17	2.98	3.25	2.7	2.76	2.94	2.68	2.16	1.73	2.5	2.34	2.26	2.58	2.48	1.94
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.0018	0.00171	0.0013	0.00148	0.000859	0.00109	0.00154	0.00175	0.00179	0.00186	0.00187	0.0021	0.0021	0.00218	0.00196	0.00194	0.00211	0.00203	0.00194	0.00208	0.00226	0.00186
Vanadium	mg/L	-	0.00085	0.00088	0.00079	0.00065	0.00074	0.00062	0.00053	0.00062	0.00074	0.0009	0.00088	0.0009	0.00091	0.00102	0.0012	0.00119	0.00126	0.00122	0.00126	0.0011	0.0012	0.0012
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	0.0033	0.0033	0.0087	0.0077	0.0066	0.0065	0.0056	0.0054	0.0054	0.0056	0.0047	0.0034	0.0034	0.0037	0.0034	0.0043	0.0037	0.0044	0.0031

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2020-10-06	2020-10-13	2020-10-20	2020-10-27	2020-11-04	2020-11-11	2020-11-17	2020-11-24	2020-12-01	2020-12-08	2020-12-15	2020-12-21	2020-12-29	2021-01-05	2021-01-12	2021-01-19	2021-01-26	2021-02-04	2021-02-16	2021-02-23	2021-03-02	2021-03-09
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.106	0.114	0.11	0.122	0.102	0.116	0.136	0.132	0.132	0.13	0.142	0.201	0.166	0.169	0.139	0.135	0.14	0.138	0.142	0.146	0.127	0.123
Antimony	mg/L	-	0.00052	0.00046	0.00038	0.0004	0.0003	0.0004	0.00042	0.00044	0.00043	0.00051	0.00048	0.00053	0.00049	0.00054	0.00062	0.0006	0.00062	0.00057	0.00063	0.00058	0.00058	0.00055
Arsenic	mg/L	-	0.00075	0.00064	0.0004	0.00042	0.0002	0.00026	0.00027	0.00028	0.00037	0.00036	0.00039	0.00062	0.00052	0.00064	0.0006	0.00057	0.00053	0.00058	0.00054	0.00052	0.00051	0.00048
Barium	mg/L	-	0.037	0.0394	0.038	0.038	0.0284	0.035	0.0358	0.0345	0.0362	0.0363	0.0348	0.037	0.0356	0.035	0.0376	0.0406	0.0385	0.0425	0.0398	0.0389	0.0372	0.0385
Beryllium	mg/L	-	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.00100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.129	0.125	0.083	0.107	0.065	0.084	0.112	0.135	0.144	0.127	0.136	0.146	0.149	0.133	0.118	0.106	0.137	0.13	0.133	0.153	0.146	0.117
Cadmium	mg/L	0.00034	0.0000599	<0.0000750	<0.0000650	<0.0000700	<0.0000600	0.000139	<0.000130	<0.000140	<0.000230	<0.000135	<0.000150	<0.000215	<0.000160	<0.000135	<0.000110	<0.000130	0.0000517	<0.000200	<0.000125	<0.000145	<0.000140	<0.000115
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	0.00011	0.00014	<0.00010	0.00073	0.00033	0.00021	0.00022	0.00018	0.0002	0.00026	0.00021	0.00021	0.00022	0.00022	0.00021	0.00028	0.00029	0.00026	0.00025	0.00024
Copper	mg/L	-	0.0095	0.00946	0.00813	0.00837	0.00636	0.0225	0.0119	0.00825	0.00737	0.00674	0.00625	0.00772	0.00659	0.00727	0.00774	0.00818	0.00863	0.00784	0.0134	0.00748	0.00887	0.00789
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0072	0.0064	0.0047	0.0052	0.0029	0.0056	0.0057	0.0063	0.0064	0.0066	0.007	0.007	0.0072	0.0066	0.0069	0.007	0.0074	0.0076	0.0073	0.0076	0.0075	0.0069
Manganese	mg/L	-	0.0586	0.0615	0.0649	0.0848	0.04	0.12	0.106	0.103	0.117	0.123	0.135	0.164	0.153	0.141	0.138	0.141	0.133	0.191	0.142	0.169	0.151	0.157
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.151	0.145	0.123	0.135	0.09	0.131	0.139	0.137	0.138	0.163	0.15	0.168	0.156	0.158	0.18	0.177	0.176	0.204	0.182	0.183	0.182	0.176
Nickel	mg/L	-	0.00056	<0.00050	<0.00050	<0.00050	<0.00050	0.00133	0.00086	<0.00050	0.00072	0.00059	0.0006	0.00103	0.00062	0.00056	0.00062	0.00065	<0.00050	<0.00050	0.00064	0.00063	0.00066	0.00058
Selenium	mg/L	-	0.0292	0.0312	0.0364	0.0335	0.0297	0.0608	0.0591	0.048	0.0521	0.0431	0.042	0.043	0.0374	0.0403	0.0371	0.0381	0.0358	0.0349	0.0345	0.0331	0.0358	0.0368
Silicon	mg/L	-	4.75	4.67	5.12	5.3	4.89	6.53	5.98	6	6.14	5.82	6.07	6.25	5.85	5.84	5.44	5.23	5.52	5.98	5.6	5.79	5.54	5.41
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.56	2.63	1.81	2.27	1.5	2.24	2.94	3.11	3.11	3.11	2.7	2.88	2.97	2.66	2.1	1.78	2.35	2.48	2.32	2.45	2.38	1.79
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	0.00029	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00162	0.00159	0.00122	0.00138	0.000836	0.00105	0.00148	0.00174	0.00189	0.00196	0.00171	0.00208	0.00218	0.00212	0.00194	0.00172	0.00191	0.00184	0.00174	0.00183	0.00186	0.0017
Vanadium	mg/L	-	0.00068	0.00063	0.00059	0.00058	<0.00050	0.00051	<0.00050	0.00053	0.00061	0.00068	0.00078	0.00091	0.00075	0.00082	0.00107	0.00109	0.00101	0.00116	0.00102	0.00103	0.00097	0.00099
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0075	0.0061	0.0053	0.0055	0.0046	0.0034	0.0038	0.0035	<0.0030	<0.0030	<0.0030	0.0031	<0.0030	0.0033	0.0031	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-03-16	2021-03-23	2021-03-29	2021-04-06	2021-04-13	2021-04-20	2021-04-27	2021-05-04	2021-05-11	2021-05-19	2021-05-25	2021-06-02	2021-06-08	2021-06-15	2021-06-22	2021-06-23	2021-06-29	2021-07-06	2021-07-13	2021-07-21	2021-07-27	2021-08-03
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1165.1	1158.8	1119.4	1130.4	1076.6	822	945	943.1	1063.1	1146.6	1180	1232	1233.6	-	1158	1187	1091	1166.9	1161	1312.7	1120.1	1297
pH	pH units	-	7.08	6.95	7.36	6.91	7.37	7.57	6.92	7.42	7.37	7.42	7.41	7.12	7.8	-	7.52	7.57	7.33	7.73	7.4	7.47	7.31	7.23
Turbidity	NTU	-	1.33	1.31	1.84	1.52	1.61	3.31	2.25	3.75	1.47	1.08	2.45	1.41	1.39	-	1.45	1.03	1.01	1.25	0.64	0.55	0.7	0.21
Temperature	C	-	3.635	4.743	5.314	5.421	5.183	5.815	6.91	8.414	9.967	10.935	12.675	13.643	12.951	-	17.037	17.282	21.279	20.095	19.814	18.87	17.907	19.193
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	78.6	90.6	91.7	101	96.1	78.9	90	78.8	89.1	94.5	104	104	107	112	91.7	90.9	82.1	89	89.6	84.5	83.3	85
Specific conductivity	uS/cm	-	1110	1110	1130	1150	1050	787	899	913	1040	1140	1180	1160	1210	1290	1180	1170	1110	1140	1160	1110	1110	1150
pH	pH units	-	7.76	7.62	8.05	8.01	7.9	7.65	7.76	7.88	8.01	8.04	8.09	8.14	8.11	8.04	7.9	7.91	7.96	8.11	7.85	7.99	7.94	8.03
Total suspended solids	mg/L	30	6.4	11.5	9.8	10.7	9.4	12.7	3.7	7.3	6.4	5.8	7.6	6.9	6.1	7.7	7.3	7.2	5.2	7	6.4	4.6	14	6.4
Turbidity	NTU	-	1.01	1.28	1.61	1.33	1.09	2.63	2.18	1.63	1.28	1.14	1.07	1.29	1.28	1.1	1.04	1.07	1.24	0.92	0.9	0.66	0.7	0.74
Hardness, as CaCO3	mg/L	-	567	559	586	514	503	389	463	524	496	597	591	598	603	704	565	553	545	585	541	502	508	550
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	532	545	550	519	507	388	464	465	499	587	663	575	624	686	572	576	530	541	562	521	528	520
Total dissolved solids	mg/L	-	833	825	846	817	733	564	659	689	784	876	910	957	994	1050	909	927	858	858	919	893	922	917
Dissolved organic carbon	mg/L	-	3.16	2.59	2.9	3.11	2.97	4.2	4.62	4.6	4.71	4.26	4.15	3.89	3.55	3.55	2.8	2.61	2.57	2.39	3.72	5.85	4.59	4.55
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	4.56	3.84	3.49	3.69	3.9	3.18	3.5	3.69	4.54	4.87	4.75	4.34	4.6	4.36	3.88	3.97	3.86	3.44	3.51	3.46	3.31	3.43
Nitrate + nitrite	mg-N/L	-	4.56	3.84	3.49	3.7	3.9	3.18	3.5	3.69	4.54	4.88	4.76	4.34	4.61	4.37	3.89	3.98	3.88	3.45	3.52	3.47	3.32	3.44
Nitrite	mg-N/L	0.78	<0.0050	<0.0050	<0.0050	0.0072	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0158	0.0068	0.0059	0.0136	0.0103	0.0134	0.0138	0.0161	0.0147	0.014	0.0127	0.0142	0.0122
Total ammonia	mg-N/L	1.3	0.0357	0.0248	0.0213	0.018	0.019	0.0186	0.0175	0.0134	0.0152	0.021	0.0194	0.0195	0.0177	0.0231	0.0136	0.0166	0.0167	0.0144	0.0197	0.026	0.0226	0.0307
Dissolved phosphorus	mg-P/L	-	<0.0020	0.0024	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0024	0.0041	0.0023	0.0023	<0.0020	0.0027	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	0.0034	0.0025	0.0034
Total phosphorus	mg-P/L	0.09	0.0031	0.004	0.0036	0.0034	0.0039	0.0071	0.0042	0.0028	0.0044	0.004	0.0063	0.0046	0.0056	0.0043	0.0049	0.003	0.0032	0.006	0.0034	0.0032	0.0043	0.0033
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012
Total nitrogen	mg/L	-	4.76	3.89	3.9	3.99	4.19	3.43	3.79	3.88	4.9	5.34	5.08	4.87	4.97	4.77	4.06	4.33	4.06	4.1	3.65	3.67	3.73	3.74
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	175	176	185	160	160	122	143	164	157	188	186	185	189	224	178	174	172	185	171	156	158	174
Chloride	mg/L	-	13.3	12	11.2	11.6	11.1	8.85	8.02	7.89	8.55	7.82	7.18	9.08	7.96	7.74	8.55	8.76	9.2	9.28	9.06	9.6	9.34	9.81
Fluoride	mg/L	17	0.397	0.441	0.444	0.455	0.378	0.239	0.267	0.238	0.363	0.343	0.438	0.425	0.429	0.466	0.392	0.418	0.455	0.489	0.495	0.48	0.433	0.489
Magnesium	mg/L	-	31.5	29	30.2	27.9	25.2	20.5	25.7	27.7	25.2	30.9	30.8	33.1	31.9	35.2	29.3	28.9	28.1	30	27.6	27.2	27.7	28
Potassium	mg/L	-	5.09	4.36	4.56	3.88	3.57	1.92	2.14	1.97	2.09	2.6	2.5	2.6	2.69	2.7	3.52	3.77	3.65	3.74	3.4	4.01	4.13	4.13
Sodium	mg/L	-	44.5	35.6	36.5	33.2	28.3	14.8	16.3	16.8	18.3	22.6	23.8	25.5	24.7	29.6	32.3	31.6	30.3	33.3	30.1	33.1	33.9	31.2
Sulphate	mg/L	1100	499	505	478	487	450	322	392	400	478	529	550	526	590	594	517	535	508	522	559	513	492	532
Total Metals																								
Aluminum	mg/L	-	1.25	1.26	1.29	1.23	1.37	1.25	1.21	1.19	1.1	1.06	1.24	1.15	1.09	1.1	1.06	1.12	0.882	1.12	1.17	0.994	1.06	1.02
Antimony	mg/L	-	0.0006	0.00052	0.0005	0.00046	0.00045	0.0003	0.00035	0.00037	0.00041	0.00043	0.00046	0.00042	0.00043	0.00045	0.00057	0.00059	0.00059	0.0006	0.00064	0.00069	0.0007	0.0007
Arsenic	mg/L	0.028	0.00097	0.00081	0.00073	0.00071	0.00077	0.00041	0.00045	0.00041	0.00054	0.00067	0.00068	0.0006	0.0006	0.00078	0.00092	0.00096	0.00097	0.00103	0.00103	0.00115	0.00113	0.00113
Barium	mg/L	-	0.0391	0.0336	0.0346	0.0314	0.0338	0.0269	0.0286	0.0285	0.0295	0.0325	0.0333	0.0332	0.0338	0.0344	0.0354	0.0362	0.0358	0.0357	0.0363	0.0357	0.0377	0.035
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.114	0.142	0.153	0.151	0.14	0.076	0.075	0.075	0.09	0.108	0.116	0.114	0.136	0.145	0.138	0.137	0.128	0.139	0.169	0.148	0.151	0.153
Cadmium	mg/L	-	<0.000135	<0.0000900	0.0000987	<0.000110	<0.000100	<0.0000700	<0.000140	0.0000403	<0.0000800	<0.000110	<0.000135	0.0000926	0.0000703	<0.000130	<0.0000950	0.0000706	<0.000115	<0.0000850	0.0000545	<0.0000900	<0.0000850	0.0000478
Calcium	mg/L	-	166	172	177	165	158	121	146	144	156	185	209	179	198	219	180	181	170	171	177	163	165	163
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00024	0.00017	0.00016	0.00017	0.00015	0.00015	0.00013	0.00012	0.00013	0.00012	0.00014	0.00014	0.00015	0.00016	0.00012	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	0.033	0.0133	0.0128	0.0119	0.00976	0.0112	0.0124	0.0133	0.0121	0.0104	0.00997	0.0123	0.00997	0.00963	0.00917	0.0101	0.0104	0.00746	0.00801	0.00723	0.00746	0.0083	0.00796
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	0.075	0.046	0.042	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0066	0.0061	0.0056	0.006	0.0059	0.0031	0.003	0.0035	0.0044	0.005	0.0056	0.0053	0.0059	0.0068	0.0059	0.006	0.006	0.0061	0.0068	0.0064	0.0071	0.0066
Magnesium	mg/L	-	28.6	28.1	26.3	26	27.4	20.8	24.1	25.7	26.7	30.3	34.3	31.1	31.4	33.7	29.8	30.1	25.7	27.7	29.2	27.7	28.1	27.4
Manganese	mg/L	3.4	0.165	0.111	0.0988	0.115	0.09	0.0483	0.052	0.0472	0.0567	0.0666	0.0806	0.0789	0.0888	0.0996	0.0757	0.0921	0.0419	0.0537	0.0326	0.0374	0.0434	0.0416
Mercury	mg/L	-	-	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum	mg/L	0.36	0.18	0.16	0.157	0.145	0.125	0.0987	0.105	0.107	0.122	0.126	0.129	0.122	0.137	0.139	0.162	0.162	0.163	0.164	0.165	0.175	0.175	0.176
Nickel	mg/L	-	0.00067	0.00067	0.00059	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00057
Potassium	mg/L	-	5.6	4.06	3.96	3.56	3.63	2.04	2.08	2.06	2.16	2.36	2.62	2.51	2.75	2.81	3.41	3.58	3.63	3.62	3.49	3.87	4.27	3.96
Selenium	mg/L	0.075	0.0407	0.0304	0.0281	0.0279	0.0297	0.0288	0.0375	0.037	0.0423	0.0445	0.0451	0.0425	0.0433	0.0418	0.0421	0.0434	0.0429	0.0394	0.0402	0.0402	0.0401	0.0375
Silicon	mg/L	-	5.9	5.61	5.4	5.72	5.78	5.5	5.41	5.27	5.15	4.81	4.87	4.4	4.38	4.97	4.89	4.91	4.96	5.32	5.56	5.41	5.63	5.5
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	42.1	35.5	31.8	30.6	30.7	15.5	15.9	16.5	19.4	22.2	25.5	23.4	24	28.4	30.6	31.3	30.5	33	30.8	32.9	35	33.7
Strontium	mg/L	-	1.71	2.37	2.25	2.4	1.86	1.34	1.62	1.68	2.39	2.73	2.98	2.82	3.13	3.05	2.46	2.41	2.12	2.44	2.65	2.18	2.13	2.28
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00176	0.00186	0.00176	0.00184	0.00166	0.000919	0.00112	0.00107	0.00135	0.00164	0.00174	0.00173	0.00193	0.00212	0.00193	0.00208	0.00185	0.00199	0.00222	0.00204	0.00198	0.00213
Vanadium	mg/L	-	0.00121	0.00102	0.001	0.00104	0.0011	0.0009	0.00073	0.00072	0.00062	0.00075	0.00074	0.00068	0.00063	0.00094	0.001	0.00101	0.00108	0.00111	0.00111	0.0013	0.0013	0.0012
Zinc	mg/L	0.059	0.0032	<0.0030	0.0038	<0.0030	<0.0030	<0.0030	<0.0030	0.0034	0.004	0.0048	0.0058	0.0042	0.0046	0.0045	0.0033	0.0037	<0.0030	<0.0030	0.0033	0.0031	<0.0030	<0.0030

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-03-16	2021-03-23	2021-03-29	2021-04-06	2021-04-13	2021-04-20	2021-04-27	2021-05-04	2021-05-11	2021-05-19	2021-05-25	2021-06-02	2021-06-08	2021-06-15	2021-06-22	2021-06-23	2021-06-29	2021-07-06	2021-07-13	2021-07-21	2021-07-27	2021-08-03
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.124	0.125	0.126	0.133	0.119	0.104	0.122	0.114	0.127	0.165	0.216	0.177	0.223	0.234	0.21	0.231	0.222	0.237	0.226	0.219	0.192	0.187
Antimony	mg/L	-	0.00058	0.00051	0.00052	0.00042	0.00045	0.00026	0.00031	0.00034	0.00038	0.00043	0.00041	0.00043	0.00044	0.00044	0.00057	0.00054	0.00057	0.00057	0.00058	0.00067	0.00067	0.00066
Arsenic	mg/L	-	0.00056	0.0005	0.00051	0.00046	0.00045	0.00024	0.0003	0.00034	0.00044	0.00055	0.00064	0.0006	0.00056	0.0006	0.00079	0.00083	0.00082	0.00095	0.00092	0.00107	0.00105	0.00096
Barium	mg/L	-	0.0357	0.035	0.0387	0.0306	0.0319	0.0251	0.0273	0.0311	0.0286	0.0327	0.0323	0.0329	0.0333	0.0337	0.0352	0.0352	0.0358	0.0363	0.035	0.0358	0.0375	0.0372
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.107	0.141	0.152	0.143	0.13	0.068	0.07	0.068	0.086	0.105	0.107	0.104	0.128	0.145	0.119	0.134	0.138	0.151	0.15	0.132	0.129	0.146
Cadmium	mg/L	0.00034	<0.0000950	0.0000737	<0.000105	0.0000535	0.0000535	0.0000341	<0.0000700	<0.000110	<0.0000700	<0.0000850	<0.0000850	<0.000150	<0.0000750	0.0000679	<0.0000850	<0.0000950	<0.0000850	<0.000125	<0.0000750	<0.0000900	<0.0000850	<0.000150
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00022	0.00016	0.0002	0.00017	0.00013	0.00011	0.00011	<0.00010	0.00011	0.00012	0.00012	0.00013	0.00013	0.00014	0.00011	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00711	0.00748	0.00685	0.00531	0.00612	0.00601	0.00692	0.00689	0.00596	0.00644	0.00707	0.0066	0.00614	0.00564	0.00579	0.00585	0.00528	0.00461	0.00432	0.00564	0.00539	0.00509
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0066	0.0064	0.0069	0.0057	0.0055	0.003	0.0032	0.0033	0.0042	0.0052	0.0051	0.0046	0.0058	0.0062	0.0057	0.0065	0.0062	0.0061	0.0064	0.0061	0.0062	0.0066
Manganese	mg/L	-	0.148	0.109	0.11	0.116	0.0872	0.0438	0.0506	0.0475	0.053	0.0616	0.0739	0.0769	0.0851	0.0916	0.0658	0.082	0.0432	0.0401	0.0264	0.0358	0.0391	0.0386
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.188	0.156	0.152	0.132	0.138	0.0854	0.0987	0.103	0.119	0.13	0.125	0.124	0.129	0.158	0.158	0.156	0.16	0.165	0.166	0.172	0.172	0.162
Nickel	mg/L	-	<0.00050	0.00055	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.036	0.0311	0.0277	0.0278	0.0306	0.0303	0.0382	0.0376	0.0422	0.0441	0.0454	0.0406	0.0368	0.0449	0.0407	0.0396	0.0415	0.0374	0.0414	0.0411	0.0393	0.0386
Silicon	mg/L	-	5.35	5.71	5.57	5.41	5.59	5.06	5.33	4.82	5.12	4.59	4.2	3.98	3.94	4.74	4.67	5.07	5.04	5.17	5.2	5.12	5.23	5.09
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.78	2.13	2.42	2.28	2.03	1.25	1.62	1.76	2.34	2.86	2.74	2.94	3.03	3.24	2.35	2.38	2.11	2.6	2.62	2.17	2.11	2.29
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00154	0.00153	0.00186	0.00158	0.00144	0.00082	0.000936	0.0011	0.00125	0.00143	0.00152	0.00156	0.00176	0.0018	0.00193	0.00183	0.00178	0.00188	0.00195	0.00192	0.00185	0.00192
Vanadium	mg/L	-	0.00099	0.00094	0.00102	0.00075	0.00081	0.00064	0.00056	0.00052	0.00051	0.00055	0.00057	0.00056	0.00052	0.00058	0.0009	0.00082	0.00103	0.00099	0.00091	0.00117	0.00115	0.00108
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0032	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-08-10	2021-08-17	2021-08-24	2021-08-30	2021-09-08	2021-09-14	2021-09-15	2021-09-16	2021-09-20	2021-09-28	2021-10-04	2021-10-12	2021-10-18	2021-10-26	2021-10-27	2021-11-02	2021-11-09	2021-11-18	2021-11-25	2021-12-02	2021-12-07	2021-12-14
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1116	1128.1	1098.8	1029	1090.9	1118	1117.1	1090.1	1063	1021	1075.7	1030	1032	1029.7	1033.8	1076.7	1042	1165.9	1180.4	1152	1095	1118
pH	pH units	-	7.06	7.46	7.51	7.33	7.32	7.72	7.52	7.52	7.2	7.54	7.85	7.65	6.91	7.68	7.64	7.61	7.87	7.55	7.53	7.07	6.89	6.93
Turbidity	NTU	-	0.98	1.1	1.59	0.88	1.12	0.58	1.38	1.03	1.31	1.14	1.99	2.57	4.13	4.1	4.64	3.11	2.34	1.54	2.23	2.1	1.59	1.63
Temperature	C	-	17.928	16.761	15.646	16.1	14.647	13.678	12.624	11.429	10.752	11.6	9.778	6.9	7.118	6.345	6.542	5.257	5.9	5.873	4.121	3.978	2.537	3.279
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	81.8	83.4	79.4	83.8	86.5	85.7	98.6	97.4	81.7	94.6	93.5	81.4	91.8	86.2	84.3	87.9	95.6	98.9	106	107	85.6	94.6
Specific conductivity	uS/cm	-	1120	1080	1090	1100	1100	1080	1100	1090	1100	1080	1060	1020	1040	1080	1070	1050	1040	1060	1080	1050	1050	1110
pH	pH units	-	7.99	7.91	7.96	7.99	7.98	8.07	8.09	8.09	8.1	8.1	8.11	8.01	8.04	8.08	7.99	8.07	7.88	7.78	7.91	7.83	7.66	8.02
Total suspended solids	mg/L	30	6.8	7.7	8	5.5	2.1	3.6	11.2	4	4.8	4.6	4.8	5.1	5.2	6.1	7.2	6.6	6.4	8.2	7.2	5.8	7.1	8.7
Turbidity	NTU	-	0.64	0.7	0.71	0.65	0.64	0.71	0.65	0.79	1.43	1.11	2.17	1.93	3.65	2.78	2.55	2.81	2.12	2.09	1.41	3.22	1.65	1.13
Hardness, as CaCO3	mg/L	-	518	511	533	504	501	507	470	466	524	506	519	475	492	471	472	493	499	549	593	568	504	530
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	548	529	528	542	519	514	542	545	490	530	508	466	508	476	458	485	519	568	576	540	498	524
Total dissolved solids	mg/L	-	915	911	872	1050	858	937	929	993	818	873	794	794	815	784	772	832	780	703	800	620	785	830
Dissolved organic carbon	mg/L	-	4.47	4.36	4.63	2.79	3.47	2.87	2.32	2.34	2.49	2.58	3.23	3	3.08	3.09	3.46	3.24	4.5	4.99	4.71	4.13	5.62	4.98
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	3.39	3.05	3.18	3.2	3.08	3.06	3.06	3.16	3.05	3.21	2.96	3.29	2.56	3.1	2.86	2.74	2.88	3.74	3.19	2.86	3.51	3.08
Nitrate + nitrite	mg-N/L	-	3.4	3.06	3.19	3.21	3.09	3.07	3.07	3.17	3.06	3.22	2.96	3.29	2.56	3.1	2.86	2.74	2.88	3.74	3.19	2.86	3.52	3.09
Nitrite	mg-N/L	0.78	0.0141	0.015	0.0106	0.0088	0.0088	0.0146	0.0063	0.0063	0.0066	0.0064	0.0057	<0.0050	0.0025	<0.0050	<0.0050	<0.0050	<0.0050	0.0029	0.0031	0.0043	0.0078	0.0065
Total ammonia	mg-N/L	1.3	0.0208	0.0186	0.0176	0.0154	0.013	0.0116	0.0114	0.0129	0.0111	0.0127	0.0126	0.0157	0.0174	0.0156	0.0139	0.0107	0.0104	0.0248	0.0341	0.045	0.0176	0.0216
Dissolved phosphorus	mg-P/L	-	0.0062	0.0031	<0.0020	0.0059	0.0073	0.0023	0.0032	0.0031	<0.0020	<0.0020	0.0027	0.0032	0.0029	0.0036	<0.0020	0.0024	0.0022	<0.0020	0.0022	<0.0020	0.0022	0.0022
Total phosphorus	mg-P/L	0.09	0.0037	0.005	0.0024	0.0048	0.0042	0.0042	0.0078	0.0108	0.005	0.005	0.0054	0.0083	0.0103	0.0092	0.0088	0.0086	0.0082	0.0038	0.003	0.0034	0.0048	0.0048
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0017	0.0011
Total nitrogen	mg/L	-	3.56	3.42	3.54	3.56	3.29	3.24	3.23	3.27	3.27	3.3	3.23	3.52	2.82	3.47	3.03	3.09	3.11	4.36	3.76	3.37	3.84	3.1
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	161	161	166	159	160	158	146	146	163	159	164	151	156	146	147	157	160	171	190	184	158	168
Chloride	mg/L	-	9.69	9.58	9.17	8.84	8.02	7.88	8.06	8.22	7.83	8.27	7.95	8.7	7.48	8.26	8.53	8.3	7.13	10.4	9.12	8.94	10.5	10.1
Fluoride	mg/L	17	0.515	0.5	0.42	0.441	0.455	0.46	0.468	0.45	0.513	0.535	0.544	0.461	0.488	0.396	0.41	0.478	0.42	0.294	0.333	0.476	0.364	0.468
Magnesium	mg/L	-	28.2	26.5	28.8	25.9	24.7	27.3	25.7	24.7	28.4	26.5	26.7	23.8	24.9	25.9	25.4	24.6	24.2	29.7	28.8	26.4	26.5	26.9
Potassium	mg/L	-	4.26	4.09	4.57	4.22	4	4.28	4.15	4.14	4.1	3.74	4.38	4.24	4.41	4.61	4.67	4.37	3.91	3.84	3.57	3.11	3.97	3.75
Sodium	mg/L	-	35.3	32.7	36.2	34.4	33.3	36.2	32.5	32.3	34.5	31.6	34.8	32.8	33	34.9	32.7	32.5	28.8	32.7	34.9	34.4	33.6	35.6
Sulphate	mg/L	1100	525	515	486	492	503	489	494	490	476	498	465	461	441	459	468	488	478	473	494	490	470	498
Total Metals																								
Aluminum	mg/L	-	1.19	1.14	1.05	1.02	0.652	0.67	0.699	0.656	0.765	0.631	0.625	0.685	0.694	0.707	0.792	0.646	0.64	1.22	0.974	1.14	1.16	1.26
Antimony	mg/L	-	0.00065	0.0007	0.0007	0.0007	0.00065	0.00065	0.00067	0.0007	0.00064	0.00068	0.00066	0.0006	0.0006	0.00059	0.00058	0.00058	0.00059	0.0005	0.00047	0.00048	0.00058	0.00057
Arsenic	mg/L	0.028	0.00113	0.00118	0.0013	0.00134	0.00115	0.00113	0.00116	0.00116	0.00114	0.00116	0.00116	0.00132	0.00121	0.00123	0.00121	0.00138	0.0011	0.00083	0.00075	0.00073	0.00091	0.00085
Barium	mg/L	-	0.0377	0.0356	0.0384	0.0396	0.0363	0.0369	0.0362	0.0348	0.0376	0.0362	0.0368	0.0411	0.039	0.0387	0.0399	0.0375	0.0371	0.0353	0.0341	0.0308	0.0342	0.034
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.16	0.17	0.144	0.153	0.151	0.149	0.155	0.158	0.15	0.145	0.148	0.098	0.12	0.105	0.097	0.11	0.134	0.107	0.144	0.149	0.124	0.135
Cadmium	mg/L	-	<0.0000650	<0.0000800	<0.000140	<0.000145	<0.000125	<0.0000800	<0.000125	<0.000125	<0.0000850	<0.000145	<0.0000850	<0.0000900	<0.0000800	<0.000130	<0.000100	<0.000100	<0.000110	0.0000748	0.0000879	0.000089	<0.0000950	<0.0000750
Calcium	mg/L	-	172	167	166	169	165	164	172	174	153	167	161	146	161	146	142	152	164	174	184	170	159	167
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00014	0.0002	0.00021	0.00022	0.00028	0.00021	0.00016	0.00015	0.00013	0.00016	0.00014	0.00012
Copper	mg/L	0.033	0.00805	0.0092	0.00981	0.0116	0.0121	0.0123	0.0128	0.0126	0.015	0.0141	0.0154	0.0222	0.0261	0.0327	0.0458	0.0374	0.0219	0.0131	0.01	0.009	0.0127	0.0115
Iron	mg/L	1	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.031	0.058	0.045	0.066	0.132	0.158	0.125	0.188	0.099	0.088	0.04	0.035	0.085	<0.030	0.037
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000062	0.000067	0.000058	0.000082	<0.000050	<0.000050	<0.000050	0.000096	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0073	0.0072	0.0071	0.0068	0.0068	0.0064	0.0068	0.0067	0.0063	0.0063	0.0065	0.006	0.0062	0.0059	0.0065	0.0066	0.0062	0.0053	0.0064	0.0061	0.0061	0.0065
Magnesium	mg/L	-	28.8	27.2	27.7	29.2	26.1	25.5	27.4	26.9	26.2	27.5	25.8	24.7	25.7	27.2	25	25.6	26.7	32.4	28.2	28	24.5	26
Manganese	mg/L	3.4	0.0417	0.0413	0.0471	0.0429	0.0423	0.0437	0.0458	0.0452	0.043	0.0431	0.0479	0.0574	0.0467	0.062	0.0559	0.0531	0.0513	0.0802	0.0616	0.0665	0.0642	0.0615
Mercury	mg/L	-	<0.0000050	-	-	-	<0.0000050	-	<0.0000050	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.187	0.181	0.171	0.17	0.16	0.166	0.173	0.176	0.16	0.156	0.175	0.174	0.176	0.154	0.166	0.165	0.156	0.137	0.166	0.159	0.173	0.195
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	0.00056	0.00051	0.00053	0.00054	0.00057	0.00055	0.00061	0.00062	0.0007	0.00072	0.00087	0.00093	0.00073	0.00069	0.00054	0.0006	0.00065	<0.00050	0.00053
Potassium	mg/L	-	4.36	4.12	4.4	4.47	4.19	4.21	4.33	4.18	4.19	3.97	3.96	4.49	4.28	4.77	4.85	4.67	3.87	3.86	3.35	3.06	3.91	3.69
Selenium	mg/L	0.075	0.0371	0.0369	0.0384	0.037	0.0348	0.0332	0.0351	0.0348	0.0346	0.0342	0.0338	0.0346	0.0309	0.0359	0.0311	0.0296	0.0334	0.0327	0.0285	0.0252	0.0359	0.0299
Silicon	mg/L	-	6.06	5.76	5.53	5.84	5.78	5.43	5.76	5.44	6.14	5.75	5.51	4.91	5.37	5.17	4.82	5.08	5.7	5.81	5.71	6	5.93	6.21
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	0.000011	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	37	33.2	39.5	37.1	34.5	32.9	37.4	35.5	33	32.7	34.6	33.5	31.2	33.7	33.1	33.6	30.6	32.3	31	32.4	32.4	36.1
Strontium	mg/L	-	2.24	2.45	2.11	2.13	1.9	2.13	2.15	2.12	2.06	2.04	2.13	1.54	1.98	1.59	1.6	1.86	1.99	1.97	3.39	3.69	2.19	3.44
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00206	0.00215	0.00211	0.00211	0.00205	0.00205	0.00194	0.00195	0.00206	0.00211	0.00207	0.00172	0.00182	0.00187	0.00173	0.00172	0.0019	0.00158	0.00185	0.00185	0.00183	0.00205
Vanadium	mg/L	-	0.00134	0.00126	0.00142	0.0015	0.00132	0.0014	0.0013	0.00129	0.00132	0.00139	0.0014	0.00177	0.00143	0.00145	0.00169	0.0014	0.00135	0.00105	0.00095	0.00099	0.00126	0.00103
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	0.0031	0.0034	0.004	0.004	0.0037	0.0038	0.0042	0.0037	0.0039	0.004	0.0039	0.0034	0.0035	0.0097	0.0032	0.0062

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-08-10	2021-08-17	2021-08-24	2021-08-30	2021-09-08	2021-09-14	2021-09-15	2021-09-16	2021-09-20	2021-09-28	2021-10-04	2021-10-12	2021-10-18	2021-10-26	2021-10-27	2021-11-02	2021-11-09	2021-11-18	2021-11-25	2021-12-02	2021-12-07	2021-12-14
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.234	0.241	0.211	0.239	0.231	0.264	0.235	0.226	0.215	0.228	0.23	0.178	0.198	0.186	0.18	0.177	0.185	0.121	0.131	0.129	0.131	0.138
Antimony	mg/L	-	0.00071	0.00066	0.00069	0.00068	0.00066	0.00063	0.00065	0.00067	0.00063	0.00061	0.00066	0.00062	0.00054	0.00058	0.00054	0.00059	0.00055	0.0005	0.00049	0.00042	0.00056	0.00054
Arsenic	mg/L	-	0.00123	0.00108	0.00119	0.00105	0.00114	0.00109	0.00106	0.00106	0.00103	0.00095	0.00109	0.00106	0.00096	0.00104	0.00102	0.00094	0.00087	0.00057	0.0005	0.00048	0.00055	0.00046
Barium	mg/L	-	0.0366	0.0352	0.0385	0.036	0.035	0.04	0.0362	0.0348	0.0381	0.0345	0.0381	0.0353	0.0373	0.0371	0.0361	0.0353	0.035	0.0354	0.0354	0.0318	0.033	0.0321
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.148	0.157	0.141	0.148	0.151	0.147	0.138	0.138	0.149	0.137	0.133	0.096	0.122	0.092	0.095	0.118	0.126	0.114	0.137	0.13	0.117	0.129
Cadmium	mg/L	0.00034	<0.0000650	<0.0000800	<0.0000700	<0.0000700	<0.000100	<0.0000800	<0.0000550	<0.0000650	<0.0000650	<0.000120	<0.0000900	<0.0000650	<0.0000750	<0.0000650	<0.0000800	<0.0000950	<0.0000850	0.0000727	0.0000873	0.0000636	<0.000140	<0.0000800
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00014	0.00012	<0.00010	0.00014	0.00012	0.00012	0.00012	0.0001
Copper	mg/L	-	0.00506	0.00534	0.00598	0.00634	0.0072	0.00779	0.00691	0.00712	0.00797	0.00764	0.00806	0.0102	0.0127	0.0141	0.0174	0.0156	0.0113	0.00751	0.00624	0.00505	0.0074	0.00611
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.0069	0.0066	0.0072	0.0064	0.007	0.0062	0.0062	0.0059	0.0062	0.0066	0.0056	0.0059	0.0062	0.006	0.0062	0.0058	0.0053	0.0062	0.0064	0.0058	0.0066
Manganese	mg/L	-	0.0369	0.0357	0.0437	0.0353	0.0357	0.041	0.0372	0.0374	0.0357	0.0381	0.0429	0.0477	0.0393	0.0506	0.0462	0.0462	0.0442	0.078	0.0612	0.0646	0.0652	0.0585
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.176	0.171	0.179	0.174	0.16	0.167	0.16	0.162	0.148	0.154	0.179	0.149	0.166	0.164	0.161	0.171	0.154	0.133	0.165	0.163	0.156	0.193
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	0.00055	<0.00050	<0.00050	0.00055	<0.00050	0.00069	0.00062	0.00055	0.00059	0.00065	0.00065	<0.00050	0.00059	0.00054	<0.00050	0.00056	<0.00050
Selenium	mg/L	-	0.0402	0.0359	0.0354	0.034	0.0374	0.0338	0.0318	0.0333	0.0332	0.0326	0.0342	0.0359	0.0326	0.0358	0.0311	0.0318	0.0319	0.0346	0.0297	0.0273	0.0358	0.0286
Silicon	mg/L	-	5.49	5.44	5.26	5.32	5.58	5.55	5.46	5.37	5.17	5.18	5.55	4.62	4.86	4.75	4.16	4.75	5.17	5.72	5.83	5.85	5.46	5.91
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.18	2.33	2.07	2.22	1.99	2.07	2.19	2.12	2.08	2.02	2.02	1.48	1.93	1.57	1.52	1.91	2	1.92	3.39	3.85	2.07	3.4
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00197	0.002	0.00199	0.0021	0.00207	0.002	0.00183	0.00183	0.00175	0.00189	0.00189	0.00178	0.00183	0.00167	0.00158	0.00176	0.00178	0.00151	0.00179	0.00179	0.00176	0.00185
Vanadium	mg/L	-	0.0012	0.00106	0.00125	0.0012	0.00118	0.00118	0.00114	0.00115	0.00112	0.00102	0.00118	0.00111	0.00098	0.00106	0.00109	0.00104	0.00096	0.00086	0.00075	0.0007	0.00097	0.00085
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-12-21	2021-12-29	2022-01-05	2022-01-11	2022-01-18	2022-01-25	2022-02-01	2022-02-08	2022-02-15	2022-02-22	2022-03-01	2022-03-08	2022-03-15	2022-03-22	2022-03-29	2022-04-05	2022-04-12	2022-04-20	2022-04-26	2022-05-03	2022-05-09	2022-05-10
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1161.7	1162	1073	1151.4	1100	1044	1051	1049	1101	1016	1101	1141	1194.9	1139.2	944	975	925	1027.6	873	906	899	948
pH	pH units	-	7.4	6.55	7.71	7.23	7.57	7.74	7.8	7.56	7.63	7.58	7.64	7.61	7.51	7.44	7.3	7.42	7.67	7.47	7.48	7.53	7.4	7.62
Turbidity	NTU	-	1.42	1.26	0.86	1.23	1.82	1.3	1.96	1.57	1.16	1.94	1.78	1.88	1.4	1.76	2.49	1.58	1.72	2.73	1.32	3.81	2.93	2.86
Temperature	C	-	3.721	1.125	3.7	2.617	2.445	4.2	4.4	3.184	6.2	5.2	2.569	4.334	5.004	6.71	4.736	5.48	6.4	7.276	6.436	8.117	6.945	7.8
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																							
Total alkalinity, as CaCO3	mg/L	-	106	112	89.2	99.2	94	89.2	87.8	97.1	106	98.6	107	112	112	107	93.7	91.6	90.3	92.1	84.1	88.6	77.4	86.2
Specific conductivity	uS/cm	-	1120	1150	1040	1140	1090	1070	1080	1070	1080	1020	1080	1150	1190	1100	907	975	949	1050	872	895	899	951
pH	pH units	-	8.13	7.66	7.7	7.79	7.8	7.68	7.75	7.86	7.68	8.07	7.98	7.97	7.94	7.87	7.61	7.95	8.02	8.05	7.93	8.17	8.04	7.98
Total suspended solids	mg/L	30	7.3	6.9	9.6	9.5	12.4	6.1	5.5	4.9	7	7.9	12.4	8.2	8.2	6.4	15.3	7.3	8.4	9.2	11.5	13.1	9.5	19.2
Turbidity	NTU	-	1	1.81	1.18	0.84	2.28	1.2	0.66	2.12	1.17	2.14	2	1.49	1.17	2.09	2.52	2.12	1.78	1.44	2.5	2.74	3.06	3.34
Hardness, as CaCO3	mg/L	-	544	589	565	548	508	493	495	493	531	511	550	561	569	603	433	512	462	504	443	423	474	528
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	509	548	590	519	519	491	492	552	527	539	558	631	584	541	420	471	479	518	432	437	473	524
Total dissolved solids	mg/L	-	826	896	852	926	850	784	830	806	806	773	818	904	890	820	669	683	732	753	678	596	718	775
Dissolved organic carbon	mg/L	-	2.68	2.63	3.48	2.59	2.54	4.16	3.84	3.34	4.55	4.6	5.01	4.63	3.26	8.01	5.08	5.31	4.47	4.33	6.34	8.81	5.78	7.61
Nutrients and Biological Indicators																							
Nitrate	mg-N/L	34	2.97	2.83	2.57	3.42	2.76	3.41	3.05	2.74	2.7	2.58	2.71	2.26	2.15	2.22	2.11	2.12	2.08	2.36	2.08	2.56	2.84	3.44
Nitrate + nitrite	mg-N/L	-	2.97	2.84	2.57	3.42	2.76	3.41	3.05	2.74	2.7	2.58	2.71	2.26	2.15	2.22	2.11	2.12	2.08	2.36	2.08	2.56	2.84	3.44
Nitrite	mg-N/L	0.78	<0.0050	0.0056	<0.0050	<0.0050	0.0057	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total ammonia	mg-N/L	1.3	0.0208	0.0233	0.0212	0.03	0.0206	0.0213	0.02	0.0199	0.0181	0.0151	0.0179	0.0209	0.0185	0.0124	0.0078	0.0111	0.0064	0.0067	<0.0050	0.005	0.0075	<0.0050
Dissolved phosphorus	mg-P/L	-	0.003	<0.0020	0.0021	<0.0020	<0.0020	0.0023	<0.0020	0.0032	0.0034	0.0032	0.0046	0.0028	0.0025	<0.0020	0.004	0.0022	0.0038	<0.0020	<0.0020	0.0026	0.0064	0.0021
Total phosphorus	mg-P/L	0.09	0.0047	0.0051	0.0044	0.0046	0.0054	0.0055	0.0048	0.0063	0.0044	0.0068	0.0054	0.0052	0.0042	0.0026	0.0061	<0.0020	0.0052	0.0034	0.0049	0.0109	0.0022	0.0061
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	0.0014	0.0023	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	0.001	0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	3.12	2.91	2.96	3.65	3.11	3.42	3.04	3.12	2.89	2.85	2.83	2.58	2.39	2.31	2.62	2.58	2.46	2.84	2.54	3.15	3.31	4.17
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																							
Calcium	mg/L	-	174	194	181	174	163	154	156	157	171	163	177	179	185	195	138	161	148	162	139	132	147	166
Chloride	mg/L	-	9.68	9.59	8.96	10.8	9.95	10.6	10.1	10.1	9.7	10	10.5	8.77	11.2	12	9.79	10.2	7.94	9.29	7.58	3.04	7.18	5.31
Fluoride	mg/L	17	0.473	0.576	0.446	0.452	0.483	0.465	0.462	0.498	0.529	0.487	0.582	0.555	0.568	0.49	0.326	0.348	0.352	0.353	0.269	0.322	0.239	0.271
Magnesium	mg/L	-	26.5	25.4	27.5	27.5	24.6	26.3	25.7	24.6	25.3	25.2	26.2	27.6	26	28.1	21.5	26.7	22.5	24.1	23.2	22.8	25.9	27.6
Potassium	mg/L	-	3.43	3.46	3.71	4.3	3.51	3.96	3.61	3.63	2.93	2.99	2.77	2.36	2.02	2.15	1.81	1.75	1.73	1.98	1.66	1.93	1.79	1.79
Sodium	mg/L	-	36.1	38.3	38.2	38.3	32.8	33.9	34.2	34.1	30.8	31.3	31	31.6	28.7	27.4	17.4	20.8	17.8	19.5	16.6	14.9	14.1	14.7
Sulphate	mg/L	1100	532	526	464	508	492	481	474	496	512	477	503	520	545	510	402	415	412	442	372	387	381	426
Total Metals																							
Aluminum	mg/L	-	0.919	1.16	1.07	0.858	1.11	0.995	0.929	1.1	1	1.26	0.926	0.814	0.815	1.29	1.05	1.14	0.993	1.06	0.838	0.453	1.13	1.11
Antimony	mg/L	-	0.00051	0.00049	0.00054	0.00058	0.00054	0.00057	0.00061	0.00062	0.00047	0.00053	0.00043	<0.00100	<0.00050	0.00028	0.00025	0.00026	0.00029	0.00034	<0.00050	0.00038	0.00038	0.0004
Arsenic	mg/L	0.028	0.00077	0.00094	0.00094	0.00087	0.00089	0.00085	0.0008	0.00105	0.00078	0.00092	0.00079	<0.00100	<0.00050	0.00048	0.00038	0.00041	0.00043	0.00045	<0.00050	0.00057	0.00036	0.00051
Barium	mg/L	-	0.0301	0.0303	0.0322	0.0343	0.0318	0.0335	0.032	0.031	0.0279	0.0302	0.0307	0.0316	0.0251	0.0257	0.0252	0.0252	0.0258	0.0265	0.0224	0.027	0.0287	0.0292
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000200	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000500	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.159	0.186	0.198	0.159	0.161	0.131	0.158	0.18	0.19	0.186	0.176	0.204	0.246	0.201	0.137	0.129	0.122	0.142	0.098	0.07	0.054	0.059
Cadmium	mg/L	-	<0.0000650	<0.0000800	<0.0000900	<0.0000950	<0.000110	<0.0000850	<0.0000750	<0.000100	<0.000100	<0.0000900	0.000108	0.000116	0.000108	<0.000120	<0.0000850	<0.0000700	<0.0000800	<0.0000650	0.0000776	0.0000458	0.0000738	<0.0000800
Calcium	mg/L	-	163	179	190	162	165	152	156	177	170	172	180	202	193	176	133	148	153	165	141	136	150	167
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00100	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00014	0.00014	0.00013	0.00018	0.00012	0.00016	0.00013	0.00014	0.00013	0.00014	0.00014	<0.00100	<0.00050	0.00031	0.0002	0.00022	0.0002	0.00022	<0.00050	0.00018	0.00016	0.00014
Copper	mg/L	0.033	0.00854	0.0102	0.00926	0.00914	0.0103	0.0114	0.011	0.0122	0.00969	0.0115	0.0087	0.00722	0.00524	0.0073	0.00848	0.00833	0.0097	0.00873	0.00904	0.0178	0.013	0.0151
Iron	mg/L	1	0.032	0.039	<0.030	<0.030	0.041	0.057	0.034	0.05	0.032	<0.030	0.034	<0.100	<0.050	<0.030	<0.030	<0.030	0.043	<0.030	0.071	0.118	0.069	0.062
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000500	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	0.000054	<0.000050	<0.000050
Lithium	mg/L	-	0.0061	0.007	0.0073	0.0066	0.0065	0.0055	0.0065	0.0068	0.0063	0.0065	0.0057	<0.0100	0.0058	0.0051	0.0035	0.0039	0.0039	0.0045	<0.0050	0.0033	0.003	0.0034
Magnesium	mg/L	-	24.7	24.5	28.2	27.8	25.9	27	24.9	26.6	24.9	26.7	26.3	30.8	24.9	24.7	21.3	24.6	23.6	25.8	19.4	23.6	23.9	26.1
Manganese	mg/L	3.4	0.0653	0.0732	0.0734	0.111	0.0692	0.0908	0.0696	0.0736	0.0749	0.0705	0.0778	0.146	0.148	0.128	0.0724	0.0825	0.0669	0.0772	0.0468	0.0533	0.0448	0.0461
Mercury	mg/L	-	-	-	-	-	-	-	-	-	<0.0000050	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.187	0.19	0.201	0.186	0.169	0.166	0.179	0.184	0.161	0.172	0.149	0.14	0.123	0.12	0.0965	0.106	0.114	0.126	0.101	0.114	0.114	0.118
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	0.00055	<0.00050	0.00057	0.00054	0.00064	0.00054	0.00055	<0.00050	<0.00500	<0.00250	<0.00050	0.00061	<0.00050	<0.00050	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	3.4	3.35	3.66	4.3	3.44	3.86	3.59	3.57	2.88	3.22	2.73	2.49	1.96	2	1.74	1.88	1.76	2	1.37	1.96	1.77	1.76
Selenium	mg/L	0.075	0.0275	0.0276	0.0297	0.0343	0.0288	0.032	0.0311	0.0312	0.0254	0.0294	0.0275	0.0247	0.0207	0.0246	0.0308	0.0359	0.0361	0.0411	0.0308	0.0428	0.0432	0.0477
Silicon	mg/L	-	6.35	6.58	6.76	6.2	6.44	6	5.99	6.6	6.44	7.06	7.41	7.06	6.26	6.22	6.42	6.08	5.56	5.7	4.8	5.22	4.92	5.06
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000100	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	34	36.4	37	39.2	32.8	34.5	32.7	35.7	31.7	34.8	32.1	35	27.7	25.3	18.8	21.3	17.7	21.2	13.6	15.9	13.3	14.4
Strontium	mg/L	-	3.94	4.28	4.14	2.68	3.41	2.41	2.97	3.7	4.04	3.95	4.59	5.04	4.73	4.12	2.64	2.84	2.72	3.08	2.33	1.7	1.66	1.96
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000100	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00100	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00207	0.00232	0.00197	0.00207	0.00186	0.00176	0.00191	0.00196	0.00188	0.00185	0.00195	0.00185	0.00161	0.00148	0.00103	0.00108	0.00127	0.00132	0.000986	0.0012	0.00112	0.00126
Vanadium	mg/L	-	0.00086	0.00094	0.001	0.00113	0.00117	0.00122	0.00127	0.00118	0.00093	0.00105	0.00091	<0.00500	<0.00250	0.00054	0.00052	0.00054	0.00076	0.00058	<0.00250	0.00078	0.00072	0.00068
Zinc	mg/L	0.059	0.0035	0.0038	0.0038	0.0033	0.0036	<0.0030	0.0031	0.0038	0.0057	0.0048	<0.0030	<0.0300	<0.0150	0.0033	<0.0030	0.003	<0.0030	<0.0030	<0.0150	0.0032	0.0031	0.0037

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2021-12-21	2021-12-29	2022-01-05	2022-01-11	2022-01-18	2022-01-25	2022-02-01	2022-02-08	2022-02-15	2022-02-22	2022-03-01	2022-03-08	2022-03-15	2022-03-22	2022-03-29	2022-04-05	2022-04-12	2022-04-20	2022-04-26	2022-05-03	2022-05-09	2022-05-10
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.14	0.143	0.152	0.119	0.116	0.11	0.121	0.151	0.0254	0.146	0.16	0.136	0.12	0.128	0.126	0.116	0.126	0.115	0.118	0.167	0.103	0.161
Antimony	mg/L	-	0.00053	0.00051	0.00054	0.00058	0.0005	0.00056	0.00059	0.00063	0.00048	0.00045	0.00038	0.0003	<0.00050	0.00028	0.00023	0.0003	0.00027	0.00032	<0.00050	0.00036	0.00036	0.00038
Arsenic	mg/L	-	0.0005	0.00053	0.00053	0.00057	0.00048	0.00052	0.00054	0.00056	0.00104	0.00049	0.00048	0.00051	<0.00050	0.00031	0.00024	0.00024	0.00027	0.0003	<0.00050	0.0004	0.00027	0.00031
Barium	mg/L	-	0.0311	0.0303	0.033	0.0338	0.0302	0.0315	0.0313	0.0312	0.0284	0.0281	0.0286	0.0284	0.026	0.0272	0.0253	0.0263	0.0257	0.0255	0.0266	0.026	0.0272	0.0294
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.187	0.19	0.164	0.148	0.146	0.126	0.152	0.163	0.18	0.16	0.13	0.166	0.234	0.208	0.122	0.12	0.104	0.113	0.105	0.062	0.055	0.062
Cadmium	mg/L	0.00034	<0.0000900	<0.0000900	<0.000110	<0.0000850	<0.0000850	<0.0000800	0.000086	<0.0000800	<0.0000900	<0.0000800	0.000111	0.000125	0.00016	0.000101	<0.0000800	<0.0000750	<0.0000750	<0.0000850	0.0001	<0.0000700	<0.0000650	<0.0000650
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00012	0.00011	0.00012	0.00016	0.00011	0.00014	0.00011	0.00011	0.00011	0.0001	0.00014	0.00019	<0.00050	0.0003	0.00019	0.0002	0.00018	0.00019	<0.00050	0.0001	0.00011	0.00011
Copper	mg/L	-	0.00534	0.005	0.00542	0.00555	0.00528	0.00609	0.00603	0.00591	0.0105	0.00572	0.00557	0.00396	0.00378	0.00431	0.00517	0.0048	0.00624	0.00518	0.00595	0.00962	0.00671	0.00769
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.050	<0.030	<0.030	<0.030	<0.030	<0.030	<0.050	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000250	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.0074	0.007	0.0065	0.0061	0.0059	0.0062	0.0068	0.0063	0.0062	0.0063	0.0065	0.005	0.0053	0.0042	0.0037	0.0037	0.0041	<0.0050	0.0031	0.0029	0.0032
Manganese	mg/L	-	0.0695	0.0696	0.071	0.107	0.0652	0.0865	0.071	0.072	0.0735	0.0637	0.0835	0.136	0.161	0.135	0.0729	0.0785	0.0639	0.073	0.0531	0.0464	0.0407	0.0423
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.195	0.2	0.202	0.203	0.162	0.166	0.174	0.176	0.162	0.156	0.141	0.126	0.118	0.12	0.0952	0.122	0.108	0.122	0.102	0.108	0.109	0.113
Nickel	mg/L	-	0.00052	<0.00050	<0.00050	0.00052	<0.00050	0.00053	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0284	0.0294	0.0303	0.0338	0.0284	0.032	0.0305	0.0281	0.0257	0.0265	0.0277	0.0299	0.0221	0.0272	0.029	0.0336	0.0357	0.0395	0.0335	0.0439	0.0442	0.0485
Silicon	mg/L	-	6.53	6.64	6.08	6.04	6.04	5.78	6.06	6.26	6.64	6.42	6.39	7.11	6.06	6.4	5.79	5.66	5.37	5.34	5.3	5.04	4.55	4.81
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	4.27	4.56	3.86	3.08	3.33	2.45	3	3.54	4.25	3.61	4.41	4.71	4.64	4.43	2.67	3.18	2.6	3.12	2.33	1.65	1.64	1.9
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00212	0.0019	0.0019	0.0019	0.00172	0.00172	0.00172	0.00173	0.00189	0.00156	0.00171	0.000978	0.00153	0.00136	0.000939	0.000937	0.00116	0.00126	0.000951	0.00114	0.00093	0.00111
Vanadium	mg/L	-	0.00082	0.00078	0.0009	0.0009	0.00083	0.00097	0.0011	0.001	0.0008	0.00083	0.00059	<0.00050	<0.00250	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00250	0.00051	0.0005	0.00051
Zinc	mg/L	-	<0.0030	<0.0030	0.0039	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0034	<0.0030	<0.0030	<0.0030	<0.0050	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0050	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023

Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-05-17	2022-05-18	2022-05-25	2022-05-31	2022-06-06	2022-06-06	2022-06-07	2022-06-09	2022-06-23	2022-06-27	2022-07-06	2022-07-12	2022-07-19	2022-07-26	2022-08-03	2022-08-09	2022-08-15	2022-08-16	2022-08-28	2022-08-31	2022-09-06	2022-09-13
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1094	1095	1170	1209.3	-	1113.3	1019	1140	1021.7	1027.8	1082	1102	1203	1088.8	1095	1127.1	1141.2	1110.1	1242	1133	1108	1075.1
pH	pH units	-	7.67	7.57	8.09	7.65	-	7.47	7.41	7.46	7.42	7.5	7.44	7.73	7.33	7.82	7.98	7.47	7.61	7.63	7.68	7.66	7.77	7.8
Turbidity	NTU	-	1.56	1.58	1.86	3.42	-	4.06	3.94	3.09	2.55	6.6	1.86	3.39	4.16	0.64	1.53	3.64	2.26	2.79	3.28	2.2	1.74	1.06
Temperature	C	-	10.214	8.8	11.3	14.022	-	13.459	12.9	13.9	12.498	16.376	15.684	16.291	17.124	18.317	17.364	16.978	16.645	16.933	15.338	17.39	14.588	12.812
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	88.9	88.1	88.7	90.3	-	79	81	79.3	85.1	92.2	92.2	93.8	80	85.2	78.6	86.3	79.8	81.5	89.8	85.3	83.9	80.6
Specific conductivity	uS/cm	-	1090	1120	1250	1210	-	1100	1090	1010	1040	1030	1200	1100	1080	1070	1110	1100	1110	1110	1250	1170	1070	1080
pH	pH units	-	7.97	8.08	8.03	8.15	-	7.74	7.74	7.84	8.06	8.16	8.09	8.18	7.92	8.09	8.11	8.04	7.98	8.05	7.87	8.1	8.02	8.04
Total suspended solids	mg/L	30	9.9	11.5	3.2	25.8	16.5	56.9	16.5	10.8	9.3	9.1	9	12.4	7.7	3.6	1.3	8.5	4.5	9.4	9.1	5.4	3.6	2.4
Turbidity	NTU	-	2.07	1.69	0.89	4.39	-	5.38	6.51	7.1	2.4	3.56	2.12	3.66	1.12	1.04	0.77	3.58	2.5	0.92	1.89	1.17	1.16	0.74
Hardness, as CaCO3	mg/L	-	563	600	556	622	-	526	508	483	482	491	540	519	504	490	500	518	520	541	625	566	490	515
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	626	604	625	634	-	525	508	502	495	511	509	558	498	510	497	534	504	502	621	575	518	509
Total dissolved solids	mg/L	-	869	945	904	914	-	877	882	796	807	787	793	852	827	902	982	884	852	868	1020	946	914	803
Dissolved organic carbon	mg/L	-	6.07	7.89	5.1	8.98	-	4.75	5.04	5.79	6.79	7.32	5.8	6.97	4.46	4.37	3.37	5.65	5.32	4.62	3.8	4.61	3.2	3.66
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.05	5.13	5.56	5.42	-	4.57	4.38	4.17	4.59	4.17	5.07	4.62	4.82	5.01	5.06	4.68	5.03	4.82	5.83	5.44	4.92	5.02
Nitrate + nitrite	mg-N/L	-	5.05	5.13	5.57	5.44	-	4.6	4.4	4.18	4.61	4.17	5.09	4.64	4.83	5.03	5.08	4.7	5.05	4.84	5.85	5.45	4.93	5.03
Nitrite	mg-N/L	0.78	<0.0050	<0.0050	0.0097	0.0166	-	0.0278	0.0192	0.0109	0.02	<0.0100	0.0166	0.0168	0.0147	0.0233	0.0254	0.0191	0.0189	0.0158	0.018	0.013	0.0108	0.0122
Total ammonia	mg-N/L	1.3	0.0082	0.0106	0.0161	0.022	-	0.0292	0.0218	0.0157	0.0156	0.0131	0.0214	0.0306	0.0267	0.0401	0.0402	0.0456	0.0342	0.0334	0.0382	0.0378	0.0289	0.0333
Dissolved phosphorus	mg-P/L	-	0.0034	<0.0020	0.0023	<0.0020	-	<0.0020	<0.0020	0.0062	0.0034	0.003	0.0044	0.0037	<0.0020	0.0022	<0.0020	0.0023	<0.0020	<0.0020	0.0032	0.0064	0.0022	0.0026
Total phosphorus	mg-P/L	0.09	0.0071	0.0045	0.0072	0.011	-	0.0119	0.0141	0.0103	0.011	0.0072	0.0076	0.0116	0.0041	0.0064	0.0069	0.006	0.0077	0.0075	0.0112	0.0083	0.0083	0.0042
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	5.5	5.08	5.8	5.95	-	4.9	4.81	4.42	5.29	4.68	5.2	4.97	5.16	5.68	5.65	5.53	5.54	5.45	6.07	5.58	5.44	5.36
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	173	186	181	194	-	164	158	148	148	151	168	160	155	150	153	158	158	166	192	175	146	158
Chloride	mg/L	-	5.88	5.92	3.63	7.31	-	9.36	9.37	10.8	11.2	10	10.7	7.2	9.17	7.53	6.8	10.4	8.41	8.25	8.6	8.39	7.73	7.95
Fluoride	mg/L	17	0.296	0.354	0.397	0.467	-	0.366	0.362	0.314	0.334	0.222	0.352	0.37	0.38	0.404	0.424	0.398	0.484	0.416	0.418	0.439	0.361	0.403
Magnesium	mg/L	-	31.8	32.8	25.2	33.5	-	28.4	27.5	27.6	27.2	27.6	29.4	29.1	28.4	28.1	28.7	29.9	30.6	30.8	35.4	31.3	30.4	29.2
Potassium	mg/L	-	2.07	2.09	2.17	2.73	-	3.27	2.99	2.95	3.27	3.02	3.3	3.48	3.47	3.57	3.84	4.35	4.24	4.2	4.36	4.2	4	3.7
Sodium	mg/L	-	17.9	18.5	18.3	24.5	-	27.9	24.9	24.2	27.8	24.8	28.4	31	30	33	34.2	37.7	36	34.4	35.9	35.4	34.7	32.6
Sulphate	mg/L	1100	520	526	559	590	-	513	488	444	460	432	480	492	485	501	498	516	499	494	582	552	495	494
Total Metals																								
Aluminum	mg/L	-	1.09	1.14	0.108	1.14	-	1.73	1.49	1.34	1.22	1.22	1.2	0.954	0.894	0.65	0.179	1.22	0.734	0.617	0.876	0.558	0.525	0.271
Antimony	mg/L	-	0.00043	0.0004	0.00045	0.00058	-	0.0007	0.0006	0.0006	0.00066	0.00063	0.00065	0.00076	0.00093	0.00096	0.00108	0.00088	0.00097	0.00095	0.00076	0.00079	0.00102	0.00102
Arsenic	mg/L	0.028	0.00062	0.00059	0.00069	0.00078	-	0.00113	0.00098	0.00084	0.001	0.00094	0.00087	0.00121	0.0012	0.00118	0.00135	0.00118	0.00122	0.0012	0.00118	0.00113	0.00102	0.001
Barium	mg/L	-	0.0379	0.0339	0.0368	0.0458	-	0.0484	0.0447	0.0418	0.0416	0.0424	0.0433	0.0486	0.0507	0.0543	0.0626	0.0552	0.0593	0.0567	0.0549	0.057	0.063	0.0636
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.077	0.079	0.101	0.112	-	0.105	0.102	0.09	0.1	0.091	0.086	0.124	0.112	0.113	0.134	0.136	0.127	0.125	0.126	0.117	0.124	0.121
Cadmium	mg/L	-	<0.000135	0.000129	0.000218	0.000212	-	0.000176	0.000152	0.0000801	<0.000105	<0.0000950	<0.0000800	<0.0000950	0.000164	<0.0000800	<0.000150	<0.0000950	<0.0000950	<0.000100	<0.0000850	<0.0000750	<0.0000850	<0.0000550
Calcium	mg/L	-	198	189	193	199	-	163	158	155	153	155	153	171	150	155	151	163	152	151	192	175	157	156
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00134	0.00245	0.00636	0.00587	-	0.00359	0.00293	0.00172	0.00034	0.00028	0.00023	0.00032	0.0002	0.0002	0.00022	0.00029	0.00021	0.00022	0.00032	0.00024	0.00018	0.00014
Copper	mg/L	0.033	0.0129	0.0136	0.0325	0.0373	-	0.036	0.0292	0.018	0.0131	0.0131	0.0113	0.0177	0.00948	0.0101	0.0108	0.0119	0.012	0.0103	0.0116	0.0101	0.0102	0.00723
Iron	mg/L	1	0.07	0.062	0.09	0.132	-	0.323	0.135	0.07	0.053	0.035	0.039	0.096	<0.030	<0.030	0.037	0.086	0.062	0.039	0.121	0.06	0.049	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	0.000058	-	0.000122	0.000078	<0.000050	<0.000050	<0.000050	<0.000050	0.000054	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000059	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0042	0.0053	0.0051	0.0063	-	0.0061	0.0056	0.0067	0.0056	0.0048	0.0052	0.0068	0.0059	0.0067	0.0067	0.0073	0.0068	0.0069	0.0079	0.0068	0.0072	0.007
Magnesium	mg/L	-	32	32.2	34.8	33.2	-	28.7	27.7	28	27.5	30.1	30.9	31.9	30.1	29.9	29.2	30.9	30.2	30.4	34.5	33.5	30.7	29
Manganese	mg/L	3.4	0.111	0.144	0.269	0.271	-	0.235	0.202	0.157	0.15	0.144	0.141	0.177	0.12	0.118	0.108	0.146	0.108	0.111	0.18	0.118	0.0805	0.0691
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.127	0.119	0.13	0.139	-	0.149	0.148	0.142	0.167	0.163	0.159	0.184	0.178	0.194	0.193	0.204	0.198	0.2	0.214	0.195	0.188	0.196
Nickel	mg/L	-	<0.00050	0.0008	0.00174	0.00198	-	0.00151	0.00118	0.00086	0.00054	0.00057	<0.00050	0.00058	0.00051	0.00053	0.00057	<0.00050	0.00054	0.00051	0.00062	0.0005	<0.00050	0.00051
Potassium	mg/L	-	2.05	1.99	2.47	2.89	-	3.29	2.96	2.68	3.16	3.22	3.31	3.78	3.62	3.8	3.92	4.33	4	4.01	5.02	4	3.86	3.82
Selenium	mg/L	0.075	0.0564	0.0561	0.0612	0.0629	-	0.0522	0.0519	0.0506	0.048	0.0469	0.0527	0.053	0.0505	0.0489	0.0508	0.0473	0.0504	0.0501	0.0599	0.0544	0.0529	0.0474
Silicon	mg/L	-	4.83	4.71	5.73	6.18	-	6.26	5.72	5.46	5.4	5.38	6.11	6.46	5.72	5.82	5.95	6.49	6.37	6.22	6.81	6.24	6.09	5.79
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	19.9	18	21.7	26	-	28.1	26.2	23.4	26.3	27.2	29.3	34.2	33.1	34.3	36.6	37.4	35.6	35.4	38.8	34	34.3	32.6
Strontium	mg/L	-	2.6	2.36	2.16	2.07	-	1.63	1.65	1.43	1.42	1.47	1.49	1.38	1.35	1.47	1.46	1.62	1.55	1.58	1.96	1.76	1.77	1.64
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	-	0.0181	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00131	0.0013	0.0014	0.00169	-	0.00177	0.00165	0.00136	0.00182	0.00173	0.00162	0.00221	0.00206	0.00223	0.00234	0.00214	0.00224	0.00219	0.0024	0.00222	0.00232	0.00239
Vanadium	mg/L	-	0.00091	0.00088	0.00084	0.00117	-	0.00185	0.00124	0.00095	0.00116	0.00106	0.00106	0.00184	0.00133	0.00143	0.00165	0.00162	0.00165	0.00154	0.0015	0.00138	0.00137	0.00124
Zinc	mg/L	0.059	0.0045	0.0064	0.0121	0.0119	-	0.0086	0.0064	0.0036	<0.0030	0.0051	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-05-17	2022-05-18	2022-05-25	2022-05-31	2022-06-06	2022-06-06	2022-06-07	2022-06-09	2022-06-23	2022-06-27	2022-07-06	2022-07-12	2022-07-19	2022-07-26	2022-08-03	2022-08-09	2022-08-15	2022-08-16	2022-08-28	2022-08-31	2022-09-06	2022-09-13
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.155	0.158	0.0284	0.194	-	0.153	0.132	0.106	0.162	0.143	0.145	0.222	0.171	0.195	0.108	0.19	0.224	0.234	0.222	0.216	0.231	0.152
Antimony	mg/L	-	0.00037	0.00038	0.00041	0.00055	-	0.00065	0.00061	0.00056	0.00066	0.00061	0.00063	0.00077	0.00086	0.00094	0.00099	0.00087	0.00092	0.0009	0.00074	0.00083	0.00095	0.001
Arsenic	mg/L	-	0.00045	0.00045	0.00061	0.00071	-	0.0009	0.00084	0.00081	0.00097	0.00074	0.00073	0.00093	0.00099	0.00103	0.00127	0.00096	0.00111	0.00106	0.00094	0.0011	0.00101	0.00101
Barium	mg/L	-	0.0328	0.033	0.0348	0.044	-	0.0446	0.0404	0.0405	0.0414	0.0393	0.0424	0.0431	0.0485	0.0529	0.0549	0.0528	0.0572	0.0543	0.0591	0.057	0.065	0.0651
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.076	0.075	0.086	0.092	-	0.103	0.097	0.08	0.1	0.08	0.091	0.12	0.114	0.114	0.138	0.127	0.125	0.13	0.123	0.111	0.117	0.122
Cadmium	mg/L	0.00034	<0.000110	0.000125	0.000184	<0.000245	-	0.000134	<0.000140	<0.000110	<0.0000950	<0.000100	<0.0000850	<0.0000800	<0.0000800	<0.0000850	<0.0000800	<0.0000900	<0.0000800	<0.0000800	<0.0000600	<0.0000750	0.0000502	<0.0000600
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00123	0.00245	0.00556	0.00552	-	0.00298	0.00263	0.00166	0.00033	0.00023	0.00022	0.00021	0.00016	0.00018	0.00016	0.00018	0.00015	0.00016	0.00022	0.00018	0.00013	0.00014
Copper	mg/L	-	0.0071	0.00779	0.0239	0.0146	-	0.00852	0.00887	0.00827	0.00687	0.00667	0.00662	0.00707	0.00534	0.00654	0.00695	0.00514	0.00602	0.00602	0.00517	0.00613	0.00713	0.0073
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	-	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.062	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0039	0.0044	0.0049	0.0054	-	0.0058	0.0056	0.0048	0.0052	0.0047	0.0052	0.0067	0.0065	0.0061	0.0067	0.0071	0.007	0.0071	0.0072	0.0067	0.0066	0.007
Manganese	mg/L	-	0.104	0.145	0.228	0.265	-	0.212	0.189	0.162	0.148	0.128	0.126	0.142	0.109	0.111	0.0847	0.128	0.0827	0.0958	0.149	0.103	0.069	0.0726
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.122	0.12	0.117	0.125	-	0.151	0.148	0.135	0.164	0.157	0.175	0.19	0.192	0.194	0.19	0.196	0.196	0.188	0.226	0.192	0.169	0.181
Nickel	mg/L	-	0.0006	0.0008	0.00143	0.00158	-	0.00102	0.00099	0.00073	0.00052	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	0.00051	0.00052
Selenium	mg/L	-	0.0542	0.0555	0.055	0.0609	-	0.0504	0.0507	0.0469	0.0491	0.0496	0.0521	0.0486	0.0493	0.0502	0.0506	0.0517	0.0522	0.0539	0.0555	0.0494	0.0504	0.0488
Silicon	mg/L	-	4.38	4.79	4.99	5.45	-	4.9	5.24	5.39	5.13	5.14	5.66	5.75	5.58	5.71	6.19	6.12	5.97	6.09	5.99	5.42	5.75	5.45
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	2.3	2.26	2.03	2.03	-	1.67	1.64	1.39	1.39	1.41	1.52	1.44	1.41	1.51	1.42	1.56	1.48	1.52	1.87	1.83	1.62	1.58
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00119	0.00116	0.00137	0.00166	-	0.0017	0.00154	0.00128	0.00177	0.00155	0.00157	0.00204	0.00198	0.00204	0.0022	0.0021	0.00204	0.0021	0.00238	0.0021	0.00208	0.00217
Vanadium	mg/L	-	0.00054	0.00053	0.0006	0.00069	-	0.00071	0.00073	0.0007	0.00088	0.00082	0.00088	0.00103	0.00104	0.00116	0.00137	0.00121	0.00129	0.00129	0.00113	0.0012	0.00121	0.00124
Zinc	mg/L	-	<0.0030	<0.0030	0.0094	0.0062	-	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-09-20	2022-09-27	2022-10-04	2022-10-11	2022-10-18	2022-10-19	2022-10-25	2022-11-01	2022-11-08	2022-11-15	2022-11-24	2022-11-30	2022-12-06	2022-12-13	2022-12-20	2022-12-28	2023-01-03	2023-01-10	2023-01-17	2023-01-25	2023-01-31	2023-02-07
Parameter																							
Field Parameters																							
Specific conductivity	uS/cm	-	1103.3	1102.4	1102.8	1076	1059	1129.8	1074.5	1108	1341	1129.6	1088	1114	1101	1124	1196	1182	1152	1152	1124	1169	1135	1153
pH	pH units	-	7.5	7.38	7.69	7.41	7.75	7.05	7.75	7.65	7.2	7.62	7.64	7.37	7.81	7.8	7.58	7.73	7.45	7.39	7.68	7.85	7.33	7.5
Turbidity	NTU	-	1	2.12	2.26	1.31	1.23	2.03	1.73	3.67	4.46	3.5	2.91	3.77	3.46	1.5	3.38	8.5	4.61	3.06	3.58	4.73	4.41	3.91
Temperature	C	-	12.177	13.44	12.241	11.07	9.785	9.154	6.153	5.218	2.322	3.646	3.153	1.423	1.378	1.703	2.06	2.21	2.799	2.706	2.661	2.827	1.139	2.799
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conventional Parameters																								
Total alkalinity, as CaCO3	mg/L	-	77.6	77	84.2	87	74.4	74.7	71.8	75.2	80.5	83	73.3	72.5	62.7	56.7	45	41.4	56.2	71.3	63.4	60.7	52.8	64.3
Specific conductivity	uS/cm	-	1090	1130	1100	1090	1080	1080	1120	1080	1130	1070	1020	1050	1090	1120	1170	1180	1100	1100	1120	1110	1160	1080
pH	pH units	-	8.03	8.09	7.96	8.06	8.05	8.05	8.04	7.95	7.89	7.76	8	7.8	7.86	7.73	7.77	7.65	7.77	7.95	7.86	7.99	7.87	7.78
Total suspended solids	mg/L	30	3.7	8.8	3.3	6.5	4	2.7	4	5	5.6	6.1	6.5	5	7.5	6.7	6.7	13.6	7	5.7	11.5	8.7	7.8	5.1
Turbidity	NTU	-	1.08	1.24	0.64	1.01	1.21	1.42	1.11	1.5	1.49	3.99	1.56	2.27	3.14	1.42	1.12	1.07	1.71	1.15	1.09	2.34	5.01	3.76
Hardness, as CaCO3	mg/L	-	509	502	545	536	527	531	530	494	505	528	506	473	434	436	428	448	431	479	443	452	431	473
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	551	594	519	529	545	507	537	510	535	542	510	477	490	480	421	470	482	492	448	465	458	478
Total dissolved solids	mg/L	-	798	852	893	773	810	855	868	870	820	814	772	832	797	851	868	858	805	848	851	829	880	803
Dissolved organic carbon	mg/L	-	3.64	3.64	2.88	3.46	4.11	3.59	2.93	2.4	4.47	4.76	4.15	3.28	4.7	4.58	4.83	6	7.26	5.08	4.8	4.67	4.8	4.86
Nutrients and Biological Indicators																								
Nitrate	mg-N/L	34	5.05	5.28	4.92	4.91	5.88	4.93	5.38	5.26	5.09	5.5	4.81	4.76	4.03	3.41	2.67	2.8	3.44	4.19	3.61	3.48	3.61	3.62
Nitrate + nitrite	mg-N/L	-	5.06	5.29	4.94	4.92	5.88	4.94	5.38	5.26	5.09	5.51	4.82	4.78	4.06	3.45	2.73	2.88	3.5	4.22	3.67	3.56	3.72	3.68
Nitrite	mg-N/L	0.78	0.0107	0.0099	0.0161	0.01	0.0059	0.0064	0.0055	<0.0050	<0.0050	0.0097	0.0108	0.0163	0.0318	0.0394	0.0625	0.076	0.057	0.0315	0.0584	0.0811	0.112	0.0656
Total ammonia	mg-N/L	1.3	0.0292	0.0273	0.0313	0.0107	0.0129	0.0138	0.0117	0.0131	0.0169	0.0259	0.0297	0.0453	0.0956	0.127	0.214	0.226	0.158	0.0912	0.155	0.196	0.271	0.228
Dissolved phosphorus	mg-P/L	-	0.0036	<0.0020	<0.0020	<0.0020	0.0033	0.0021	0.0025	0.0026	0.0033	0.0024	0.0022	0.0028	0.0038	0.0029	0.0037	0.0038	0.0034	0.0033	0.0038	0.0029	0.0032	0.0033
Total phosphorus	mg-P/L	0.09	0.0061	0.0044	0.0031	0.0061	0.0064	0.0056	0.0088	0.0086	0.0091	0.0074	0.0091	0.0078	0.0119	0.01	0.0123	0.0126	0.0093	0.0098	0.0138	0.0121	0.0122	0.01
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0015	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	5.53	5.82	5.16	5.11	5.42	5.5	5.75	5.93	5.62	5.7	5.1	4.95	4.38	3.98	3.22	3.38	4.13	4.76	4.16	3.83	4.3	4.34
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Major Ions																								
Calcium	mg/L	-	155	154	167	164	162	161	163	151	154	161	155	144	134	139	135	145	134	149	139	144	138	149
Chloride	mg/L	-	8.32	9.48	8.34	8.37	9.82	8.43	8.97	8.44	9.13	9.28	9.44	8.69	10.8	12.8	14.9	16.1	13.3	10	12	12.4	15	12.6
Fluoride	mg/L	17	0.415	0.361	0.385	0.446	0.357	0.36	0.414	0.323	0.373	0.391	0.372	0.408	0.488	0.552	0.577	0.653	0.463	0.409	0.51	0.601	0.57	0.517
Magnesium	mg/L	-	29.6	28.6	31	30.6	29.8	31.3	29.9	28.4	29.3	30.5	28.9	27.6	24.1	21.7	22	21	23.4	25.9	23.3	22.4	21.1	24.5
Potassium	mg/L	-	3.6	3.77	3.43	3.42	3.23	3.53	3.45	3.4	3.73	3.68	3.3	3.88	6.59	7.98	12	12.8	8.28	5.69	7.78	9.57	11	8.3
Sodium	mg/L	-	31.6	33.8	34	33.2	32.1	34.6	33.6	33	33.2	34.8	32	35.3	44.5	49.3	64.7	67.3	52.8	40.6	47.8	57.3	60.4	54.8
Sulphate	mg/L	1100	501	510	494	498	572	479	495	476	499	508	488	493	506	525	549	562	492	482	479	523	520	505
Total Metals																								
Aluminum	mg/L	-	0.533	0.946	0.635	0.599	0.626	0.585	0.635	0.109	0.704	0.82	0.725	0.54	0.722	0.649	0.723	0.855	0.543	0.594	0.835	0.308	0.666	0.576
Antimony	mg/L	-	0.00102	0.00106	0.001	0.00104	0.001	0.00099	0.00102	0.00097	0.00099	0.00099	0.001	0.00106	0.00116	0.00118	0.00126	0.00141	0.00115	0.00114	0.00127	0.00119	0.00122	0.00104
Arsenic	mg/L	0.028	0.00113	0.0011	0.0011	0.00106	0.00109	0.00106	0.00106	0.0012	0.00116	0.00118	0.00136	0.00131	0.00171	0.00188	0.00232	0.00205	0.00171	0.00149	0.00166	0.00181	0.00195	0.0016
Barium	mg/L	-	0.0714	0.0662	0.0627	0.0691	0.0644	0.0623	0.0644	0.0626	0.0614	0.0606	0.0646	0.0565	0.0588	0.061	0.0628	0.0647	0.0562	0.0518	0.052	0.0549	0.0545	0.0555
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.116	0.124	0.117	0.108	0.127	0.112	0.132	0.15	0.137	0.147	0.137	0.147	0.136	0.124	0.119	0.114	0.118	0.13	0.118	0.124	0.113	0.116
Cadmium	mg/L	-	<0.0000600	<0.000150	<0.0000650	<0.0000600	<0.0000650	0.0000319	<0.000130	<0.0000650	<0.0000800	<0.0000750	<0.000130	<0.0000650	<0.0000450	<0.0000450	<0.0000450	<0.0000600	<0.0000550	<0.0000650	<0.0000600	<0.0000500	<0.0000450	<0.0000550
Calcium	mg/L	-	170	181	157	161	164	156	165	155	163	165	153	145	153	150	131	152	153	153	139	147	149	154
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00018	0.0002	0.00016	0.00016	0.00017	0.00015	0.00019	0.00023	0.00025	0.00026	0.00023	0.00015	0.00021	0.00016	0.00018	0.00025	0.00018	0.00017	0.00016	0.00025	0.00017	0.0002
Copper	mg/L	0.033	0.01	0.00958	0.0098	0.00964	0.00986	0.00953	0.011	0.0123	0.0115	0.012	0.0138	0.00959	0.00916	0.00805	0.00673	0.00766	0.00819	0.00996	0.008	0.00813	0.00708	0.00779
Iron	mg/L	1	0.047	0.044	0.048	0.045	0.045	0.047	0.071	0.123	0.099	0.101	0.14	0.033	0.141	0.078	0.108	0.178	0.114	0.07	0.085	0.159	0.098	0.092
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000053	0.000054	0.000071	0.000071	0.000081	0.000058	0.000093	0.000096	0.000065	0.000053	<0.000050	0.000053	<0.000050	0.00007	<0.000050
Lithium	mg/L	-	0.0071	0.0074	0.0076	0.0066	0.0067	0.0074	0.0071	0.0074	0.0076	0.0076	0.0069	0.0072	0.009	0.0094	0.0096	0.0098	0.0083	0.0077	0.0075	0.0084	0.0082	0.0073
Magnesium	mg/L	-	30.8	34.5	30.9	30.9	32.9	28.6	30.3	30	31.2	31.5	31.2	28	26.1	25.5	22.9	22.1	24.2	26.7	24.5	23.7	20.8	22.7
Manganese	mg/L	3.4	0.0767	0.0913	0.0742	0.0749	0.0699	0.0714	0.084	0.0925	0.104	0.118	0.0833	0.0748	0.0644	0.0616	0.0822	0.0719	0.0591	0.0696	0.0718	0.0746	0.0533	0.0777
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.187	0.186	0.176	0.187	0.167	0.181	0.174	0.166	0.187	0.189	0.174	0.173	0.196	0.199	0.227	0.263	0.197	0.19	0.191	0.212	0.202	0.178
Nickel	mg/L	-	0.00052	0.0006	0.00068	0.00051	0.00056	0.00051	0.00058	0.00064	0.00062	0.00064	0.00062	<0.00050	0.00076	<0.00050	<0.00050	<0.00050	<0.00050	0.0005	<0.00050	<0.00050	<0.00050	<0.00050
Potassium	mg/L	-	3.73	3.83	3.59	3.47	3.37	3.38	3.44	3.53	3.61	3.69	3.23	3.93	6.98	8.37	12.1	13.1	8.22	5.43	8.11	9.19	10.5	8.5
Selenium	mg/L	0.075	0.0514	0.0514	0.0487	0.0512	0.0528	0.0498	0.0476	0.0494	0.052	0.0513	0.0467	0.0467	0.0389	0.0356	0.0306	0.0331	0.0369	0.0422	0.0379	0.0346	0.035	0.035
Silicon	mg/L	-	5.77	5.84	6.25	5.87	6.02	5.82	6.08	6.22	6.17	7.06	6.74	6.17	6.19	5.37	5.29	5.88	5.58	5.95	5.86	5.68	5.37	5.11
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	34.2	38.2	34.5	32.9	39.2	30.8	35	33.5	33.4	36.2	35	36.5	45.1	51.1	67.3	74.7	55	42	49.4	55.1	62.4	54
Strontium	mg/L	-	2.02	1.87	2.04	2.23	1.87	1.79	1.58	1.5	1.86	1.58	1.79	1.96	1.75	1.88	1.45	1.71	1.79	2.08	2.05	2.3	2.03	2.37
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	0.0104	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.0023	0.00237	0.00227	0.00227	0.00226	0.00235	0.00237	0.00229	0.00237	0.00249	0.00268	0.00243	0.00214	0.0017	0.00117	0.00113	0.00181	0.00223	0.0019	0.00165	0.0012	0.00182
Vanadium	mg/L	-	0.00131	0.00151	0.00139	0.00142	0.00147	0.00136	0.00149	0.00154	0.00147	0.00149	0.00177	0.00132	0.00179	0.00182	0.00226	0.00274	0.00226	0.00177	0.00206	0.0023	0.00228	0.00188
Zinc	mg/L	0.059	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0093	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Appendix 6-1
Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2022-09-20	2022-09-27	2022-10-04	2022-10-11	2022-10-18	2022-10-19	2022-10-25	2022-11-01	2022-11-08	2022-11-15	2022-11-24	2022-11-30	2022-12-06	2022-12-13	2022-12-20	2022-12-28	2023-01-03	2023-01-10	2023-01-17	2023-01-25	2023-01-31	2023-02-07
Parameter																								
Dissolved Metals																								
Aluminum	mg/L	0.75	0.19	0.166	0.194	0.194	0.178	0.191	0.176	0.0063	0.163	0.154	0.155	0.137	0.146	0.148	0.152	0.123	0.108	0.132	0.215	0.0546	0.119	0.126
Antimony	mg/L	-	0.00093	0.001	0.00106	0.001	0.00105	0.00102	0.00098	0.00094	0.00092	0.00093	0.00102	0.001	0.00106	0.00121	0.0012	0.00131	0.00105	0.00108	0.00112	0.00113	0.00125	0.00109
Arsenic	mg/L	-	0.00098	0.00094	0.00096	0.001	0.00101	0.00106	0.00091	0.00102	0.00088	0.00089	0.0009	0.001	0.00122	0.00132	0.00155	0.00125	0.00136	0.0011	0.00105	0.00163	0.00147	0.00124
Barium	mg/L	-	0.0631	0.0639	0.0617	0.0647	0.0638	0.0649	0.0617	0.0587	0.0606	0.0561	0.0544	0.0516	0.056	0.0518	0.0587	0.0578	0.053	0.0488	0.0496	0.0496	0.0514	0.0506
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.122	0.122	0.119	0.128	0.121	0.117	0.13	0.12	0.132	0.13	0.143	0.136	0.122	0.128	0.121	0.105	0.1	0.121	0.106	0.11	0.111	0.117
Cadmium	mg/L	0.00034	<0.0000700	<0.0000650	<0.000125	<0.0000550	<0.000110	<0.0000700	<0.000135	<0.0000600	<0.0000600	<0.0000800	0.0000332	<0.0000650	<0.0000550	<0.0000500	<0.0000350	<0.0000400	<0.0000400	<0.0000550	<0.0000600	<0.0000400	<0.0000600	<0.0000650
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00013	0.00014	0.00013	0.00011	0.00013	0.00013	0.00013	0.00014	0.00017	0.00017	0.00011	0.00012	0.0001	<0.00010	0.00012	0.0001	<0.00010	0.00012	0.00012	0.00011	<0.00010	0.00011
Copper	mg/L	-	0.00628	0.00557	0.00577	0.00564	0.00622	0.00612	0.00591	0.00661	0.0057	0.00488	0.00556	0.00528	0.00399	0.00356	0.00288	0.00221	0.00343	0.00453	0.0041	0.00283	0.00269	0.00258
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000055	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.007	0.0072	0.0064	0.007	0.007	0.0076	0.0073	0.0071	0.0069	0.0072	0.0074	0.008	0.0093	0.0106	0.01	0.0076	0.0072	0.0076	0.008	0.0089	0.0076
Manganese	mg/L	-	0.066	0.0781	0.0637	0.0608	0.0564	0.0596	0.073	0.0798	0.0963	0.108	0.0664	0.0673	0.0553	0.0541	0.0745	0.0623	0.0519	0.0646	0.0658	0.0676	0.0465	0.0696
Mercury	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.166	0.18	0.178	0.178	0.18	0.178	0.172	0.16	0.178	0.183	0.176	0.167	0.165	0.188	0.22	0.222	0.179	0.185	0.187	0.186	0.2	0.178
Nickel	mg/L	-	<0.00050	0.00057	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00056	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00092
Selenium	mg/L	-	0.0499	0.0476	0.0496	0.0514	0.0489	0.0512	0.045	0.0477	0.0491	0.0484	0.0436	0.045	0.0379	0.0371	0.0259	0.0312	0.0326	0.0423	0.0356	0.0297	0.0322	0.0346
Silicon	mg/L	-	5.37	5.44	5.58	5.55	5.37	5.64	5.9	5.94	5.83	6.53	5.96	5.81	5.4	5.28	4.78	5.11	5.18	5.48	5.32	5	4.73	4.85
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	1.74	1.75	2.17	2.21	1.88	1.8	1.55	1.47	1.82	1.56	1.73	1.83	1.56	1.78	1.39	1.52	1.71	2.01	2	2.07	1.96	2.37
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00224	0.0023	0.00215	0.00221	0.00218	0.00225	0.00225	0.00215	0.00227	0.0023	0.00238	0.00232	0.00191	0.00157	0.00111	0.000964	0.00144	0.0021	0.00161	0.0015	0.00125	0.00172
Vanadium	mg/L	-	0.00114	0.00113	0.00135	0.00124	0.00124	0.0013	0.00116	0.00117	0.00118	0.00115	0.00116	0.00116	0.00136	0.00153	0.00182	0.00206	0.00177	0.00148	0.00166	0.00171	0.00188	0.00158
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0067	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2023-02-14	2023-02-21	2023-02-28	2023-03-07	2023-03-14	2023-03-21	2023-03-23	2023-03-27
Parameter										
Field Parameters										
Specific conductivity	uS/cm	-	1119	1139	1117	-	1147	1103	1077	1015
pH	pH units	-	7.25	7.8	7.71	-	7.85	7.53	7.56	7.44
Turbidity	NTU	-	1.82	2.75	2.6	-	2.52	10.74	5.28	9.69
Temperature	C	-	3.804	1.203	1.383	-	1.774	3.508	3.902	2.748
Dissolved oxygen	%	-	-	-	-	-	-	-	-	-
Dissolved oxygen	mg/L	-	-	-	-	-	-	-	-	-
Conventional Parameters										
Total alkalinity, as CaCO3	mg/L	-	89.3	88.8	86.6	99.2	64.8	77.4	81.7	92.4
Specific conductivity	uS/cm	-	1230	1130	1100	1160	1120	1100	1050	1000
pH	pH units	-	8.02	8.06	7.88	8.1	7.69	7.86	7.81	7.9
Total suspended solids	mg/L	30	6.5	4.9	3.1	5	6.1	15.3	9.9	14.2
Turbidity	NTU	-	1.61	2.54	1.8	1.3	1.1	3.85	3.91	8.8
Hardness, as CaCO3	mg/L	-	516	555	511	532	430	466	451	458
Hardness, as CaCO3 from total Ca/Mg	mg/L	-	516	561	531	480	444	471	460	492
Total dissolved solids	mg/L	-	884	876	826	848	903	920	797	770
Dissolved organic carbon	mg/L	-	2.38	2.9	4.22	6.37	4.33	8.09	5.33	8.79
Nutrients and Biological Indicators										
Nitrate	mg-N/L	34	3.92	3.97	4.39	3.6	3.44	3.18	3.15	3.3
Nitrate + nitrite	mg-N/L	-	3.94	3.97	4.39	3.65	3.53	3.25	3.2	3.33
Nitrite	mg-N/L	0.78	0.0186	<0.0050	<0.0050	0.0542	0.093	0.0686	0.0482	0.027
Total ammonia	mg-N/L	1.3	0.0366	0.0212	0.0636	0.104	0.169	0.104	0.0754	0.0346
Dissolved phosphorus	mg-P/L	-	0.002	0.0037	0.0037	<0.0020	0.0025	0.0028	0.003	0.0044
Total phosphorus	mg-P/L	0.09	0.0062	0.0094	0.0085	0.0112	0.0114	0.0304	0.0194	0.0252
Orthophosphate	mg-P/L	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Total nitrogen	mg/L	-	4.07	4.16	4.8	4.3	4.36	4.12	4.07	4.3
Dissolved organic carbon	ug/L	-	-	-	-	-	-	-	-	-
Major Ions										
Calcium	mg/L	-	163	173	156	169	138	149	144	145
Chloride	mg/L	-	8.91	7.21	7.52	10.5	13.2	13.7	11.7	8.47
Fluoride	mg/L	17	0.466	0.414	0.416	0.499	0.549	0.467	0.498	0.435
Magnesium	mg/L	-	26.4	29.9	29.6	26.6	20.8	22.7	22.2	23.3
Potassium	mg/L	-	3.28	2.93	2.97	6	7.01	5.37	4.64	3.22
Sodium	mg/L	-	30.8	31.4	31.7	46.4	52.9	41.9	37.1	26.7
Sulphate	mg/L	1100	505	519	503	501	502	494	472	451
Total Metals										
Aluminum	mg/L	-	0.818	0.504	0.487	0.568	0.431	0.925	0.996	1
Antimony	mg/L	-	0.00091	0.00089	0.00104	0.00111	0.00119	0.00101	0.00087	0.00068
Arsenic	mg/L	0.028	0.00118	0.00116	0.00132	0.00155	0.00175	0.00134	0.00124	0.00105
Barium	mg/L	-	0.0462	0.0465	0.0461	0.0502	0.0516	0.0566	0.0518	0.051
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.139	0.148	0.148	0.128	0.116	0.121	0.11	0.098
Cadmium	mg/L	-	<0.0000500	<0.0000950	<0.0000700	0.0000412	<0.0000650	<0.0000700	<0.0000750	<0.0000750
Calcium	mg/L	-	161	178	165	152	142	150	146	156
Chromium	mg/L	0.004	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.00016	0.00017	0.00019	0.00016	0.00017	0.00025	0.00029	0.0004
Copper	mg/L	0.033	0.00804	0.00952	0.0111	0.00795	0.00808	0.00846	0.00891	0.0182
Iron	mg/L	1	0.067	0.066	0.066	0.074	0.113	0.154	0.184	0.347
Lead	mg/L	-	<0.000050	<0.000050	0.000055	0.000052	0.000052	0.000066	0.000062	0.000112
Lithium	mg/L	-	0.0072	0.0075	0.007	0.0079	0.0079	0.0077	0.0068	0.0061
Magnesium	mg/L	-	27.8	28.4	29	24.5	21.8	23.4	23.3	25
Manganese	mg/L	3.4	0.0821	0.0714	0.0912	0.06	0.0538	0.0636	0.0697	0.0827
Mercury	mg/L	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.36	0.174	0.168	0.181	0.178	0.19	0.165	0.155	0.148
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00053	0.00063	0.00066
Potassium	mg/L	-	3.49	2.86	3.1	5.51	7.31	5.55	4.8	3.45
Selenium	mg/L	0.075	0.0394	0.04	0.0437	0.0351	0.0323	0.0328	0.0323	0.0328
Silicon	mg/L	-	6.22	5.64	6.28	5.58	5.16	5.33	5.56	6.13
Silver	mg/L	0.00024	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium	mg/L	-	33	30	31.4	43.1	56.7	42.9	38.7	28.4
Strontium	mg/L	-	3.23	3.42	2.86	3.12	2.77	2.98	2.91	2.81
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	0.0101	0.0164
Uranium	mg/L	-	0.00278	0.00274	0.00282	0.00225	0.00192	0.00179	0.00185	0.00172
Vanadium	mg/L	-	0.00138	0.00128	0.00148	0.00151	0.00185	0.00148	0.00151	0.00164
Zinc	mg/L	0.059	0.0031	0.0038	0.0063	0.003	0.0032	<0.0030	0.003	0.0035

Table 6-1: Surfacewater Quality Screening at Effluent Locations from 2015 to 2023
Mount Polley Mine

Location Type			HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3	HAD-3
Station	Unit	Permit Limit	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge	HAD-3 - Treated Water Discharge
Date			2023-02-14	2023-02-21	2023-02-28	2023-03-07	2023-03-14	2023-03-21	2023-03-23	2023-03-27
Parameter										
Dissolved Metals										
Aluminum	mg/L	0.75	0.135	0.14	0.129	0.139	0.114	0.108	0.125	0.134
Antimony	mg/L	-	0.00092	0.0009	0.00095	0.00096	0.0011	0.00099	0.00082	0.0006
Arsenic	mg/L	-	0.0007	0.00096	0.00101	0.00111	0.00136	0.00072	0.00078	0.00076
Barium	mg/L	-	0.0437	0.043	0.0436	0.0484	0.048	0.0485	0.0464	0.039
Beryllium	mg/L	-	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100	<0.000100
Bismuth	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Boron	mg/L	-	0.141	0.129	0.15	0.117	0.114	0.101	0.097	0.089
Cadmium	mg/L	0.00034	0.0000414	<0.0000800	0.0000482	<0.0000650	<0.0000700	<0.0000650	<0.0000700	<0.0000600
Chromium	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt	mg/L	-	0.0001	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper	mg/L	-	0.00351	0.0041	0.005	0.00308	0.00293	0.00286	0.00317	0.00516
Iron	mg/L	0.35	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Lead	mg/L	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium	mg/L	-	0.0071	0.0066	0.0068	0.007	0.0076	0.0072	0.0067	0.0056
Manganese	mg/L	-	0.0758	0.0675	0.084	0.0553	0.0477	0.0553	0.0609	0.0673
Mercury	mg/L	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	-	0.172	0.162	0.171	0.179	0.176	0.162	0.146	0.132
Nickel	mg/L	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Selenium	mg/L	-	0.0392	0.0375	0.0435	0.0337	0.031	0.0317	0.0312	0.0308
Silicon	mg/L	-	5.45	5.61	5.88	5.2	4.74	4.91	4.83	5.2
Silver	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Strontium	mg/L	-	3.29	3.48	2.73	3.35	2.59	3	2.75	2.54
Thallium	mg/L	-	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Tin	mg/L	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium	mg/L	-	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100	<0.0100
Uranium	mg/L	-	0.00255	0.00257	0.00262	0.0021	0.00174	0.00158	0.00176	0.00159
Vanadium	mg/L	-	0.00104	0.00101	0.00118	0.00116	0.00139	0.00103	0.0009	0.00074
Zinc	mg/L	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Bolded values indicate concentration exceeds the permit limit.

- = no limit or no data; °C = degrees Celsius; µs/cm = microsiemens per centimetre; µg/L = micrograms per litre; $CaCO_3$ = calcium carbonate; mg/L = milligrams per litre; mV = millivolts; NTU = Nephelometric Turbidity Units.

APPENDIX 7-1: Comprehensive Environmental Monitoring Plan (CEMP)

Mount Polley Mining Corporation

an Imperial Metals company
Box 12 • Likely, BC V0L 1N0 • T 250.790.2215 • F 250.790.2613

Comprehensive Environmental Monitoring Plan 2019

Submitted to:

Ministry of Environment and Climate Change Strategy
Environmental Protection Division
South Interior Region – Cariboo

Prepared by:

Mount Polley Mining Corporation
Environmental Department

Box 12, Likely BC
V0L 1N0

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Date: October 31, 2019

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Appendix B – Detailed Study Designs for CEMP Components
Appendix C – Sample of Monthly Monitoring Schedule
Appendix D – Site Matrix
Appendix E – Declarations of Competency

ACRONYMS

°C	degrees Celsius
µm	micrometer
µS/cm	micro Siemens per centimetre
ADP	Annual Discharge Plan
AERR	Annual Environmental and Reclamation Report
ARD	acid rock drainage
BC	British Columbia
CALA	Canadian Association of Laboratory Accreditation
CCS	Central Collection Sump
CEMP	Comprehensive Environmental Monitoring Plan
cm	centimetre(s)
COPC	constituents of potential concern
CRM	certified reference material
CRP	Conceptual Remediation Plan
CSM	Conceptual Site Model
CSR	Contaminated Sites Regulation
DFO	Fisheries and Oceans Canada
DGT	diffusive gradients in thin-film
DQO	data quality objectives
EEM	Environmental Effects Monitoring
EMA	*Environmental Management Act*
EMP	Environmental Monitoring Plan
EMPR	Energy, Mines, and Petroleum Resources
ENV	Ministry of Environment and Climate Change Strategy
ERA	Ecological Risk Assessment
Golder	Golder Associates Ltd.
ha	hectares
HHRA	Human Health Risk Assessment
IDZ	initial dilution zone
km	kilometre(s)
km^2	square kilometre(s)
LOR	limit of reporting
LTWM	long term water management
m^3/s	cubic metres per second
masl	metres above sea level
MDL	method detection limit
Minnow	Minnow Environmental Inc.
mL	millilitre(s)
ML	metal leaching
mm	millimetre(s)
MPMC	Mount Polley Mining Corporation
MDMER	Metal and Diamond Mining Effluent Regulations
PAG	potentially acid-generating

PAO	Pollution Abatement Order
PEEIAR	Post-event environmental impact assessment report
PETBP	Perimeter Embankment Till Borrow Pond
PLC	Public Liaison Committee
QA	quality assurance
QC	quality control
RCP	Reclamation and Closure Plan
RPD	relative percent difference
SCIB	Soda Creek Indian Band
SFS	Society for Freshwater Science
SOP	standard operating procedure
SWL	static water level
TAR	Technical Assessment Report
TOR	terms of reference
TSF	Tailings Storage Facility
TSS	total suspended solids
WaterSmith	WaterSmith Research Inc.
WLIB	Williams Lake Indian Band
WM	work method
WTP	water treatment plant

1 INTRODUCTION

The Mount Polley Mine is located eight kilometres (km) southwest of Likely and 56 km (100 km by road) northeast of Williams Lake, British Columbia (BC; Figure 1.1). On November 29, 2015, Mount Polley Mining Corporation (MPMC), which operates the mine, received an amendment to Permit 11678 (herein referred to as the Permit) issued by the BC Ministry of Environment and Climate Change Strategy (ENV; previously known as the Ministry of Environment) pursuant to the *Environmental Management Act* (EMA; SBC 2003, Chapter 53) for a short-term water management strategy to discharge treated mine effluent into Quesnel Lake via Hazeltine Creek. The most recent amendment of the Permit was granted April 7, 2017 for a long-term water management strategy to discharge treated mine effluent directly to Quesnel Lake. Section 3.2 of the amended Permit requires MPMC to develop and implement a Comprehensive Environmental Monitoring Plan (CEMP) for the Mount Polley Mine site and surrounding receiving environment that combines pre-existing monitoring programs into an integrated plan as follows:

> *"The Permittee must continue to develop, submit, and implement an ongoing Comprehensive Environmental Monitoring Plan (CEMP) to evaluate the effects of mining-related activities on the physical, chemical, and biological characteristics of Hazeltine Creek, Edney Creek, Bootjack Lake, Morehead Creek, Polley Lake, Quesnel Lake, Quesnel River, and associated riparian and upland areas.*
>
> *The CEMP will consolidate and integrate all of the pre-existing monitoring programs that are being conducted in the vicinity of the mine site and include, at minimum, surface water (quality and quantity), groundwater (characterization and interactions with surface water), sediments, soils, periphyton, phytoplankton, benthic invertebrates, zooplankton, fish, floodplain and upland vegetation, and wildlife.*
>
> *The CEMP must at minimum address a three year time span, as well as at a minimum include all sampling sites, frequency of sampling, variables to be analysed, method detection limits, sampling methods, sample analysis methods, and data analysis methods."*

The June 23, 2016 version of the CEMP was approved in the April 7, 2017 Permit amendment. Subsequently, in 2017, MPMC submitted several versions of a CEMP to ENV for review, however, a plan for 2017 was not approved. This CEMP covers the 2018 to 2020 time period and was developed based on the approved updated Terms of Reference (TOR) included as Appendix A. Based on the requirements of the permit, the next CEMP will be submitted in March 2020.

This CEMP is a unique and integrated monitoring plan that has been developed to capture a number of independent and interdependent monitoring programs, including; site monitoring, water discharge, *Metal and Diamond Mining Effluent Regulations* (MDMER) requirements, and Tailings Storage Facility (TSF) embankment breach response and remediation. Monitoring programs are normally developed by requirements of sector-specific regulations (e.g., MDMER of the federal *Fisheries Act* [Government of

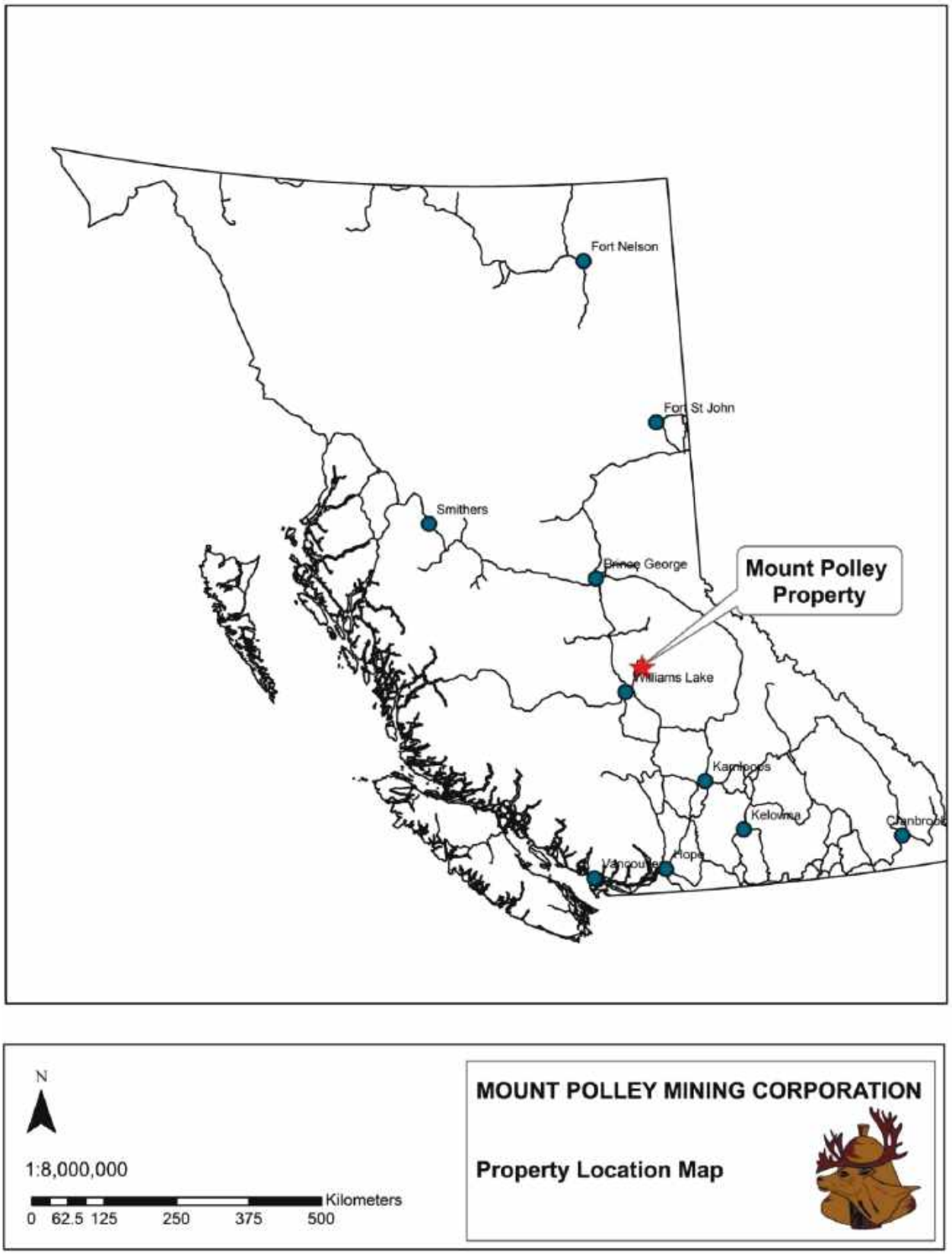


Figure 1.1 Mount Polley Mine property location

Canada 2018]) or by conditions in a permit with a specific monitoring plan that ties together permit-required and MDMER-required monitoring. As there is no ENV Technical Guidance document for this type of plan, this CEMP has been developed through an extensive consultative process that encompasses a number of permitting and other regulatory processes. Through these efforts, it has been suggested by various parties that all of the monitoring programs (e.g., water discharge monitoring, MDMER, TSF embankment breach response, etc.) be combined into one overarching program that takes advantage of the broader data set. This integrated monitoring plan offers the additional benefit of facilitating more efficient monitoring plan review by regulatory agencies, First Nations, and stakeholders. A constraint on this CEMP is where there are specific programs compelled by regulation such as the Environmental Effects Monitoring (EEM) Program that is required under the MDMER. In such instances, transparency of objectives and best efforts will be required to consolidate these different programs to the extent possible.

The CEMP is structured as follows:

- **Section 1:** Describes the CEMP objectives, a brief summary of the monitoring programs that have been integrated into the CEMP, and regulatory requirements.
- **Section 2:** Provides an overview of the integration of the various environmental monitoring programs being undertaken at the mine. Conceptual Site Models (CSMs) for the mine site and the TSF breach affected areas have also been provided, along with further details of the monitoring plans that have been integrated into the CEMP.
- **Section 3:** Provides an overview of First Nations and Stakeholders.
- **Section 4:** Provides a summary of the mine operations and the receiving environment.
- **Section 5:** Describes the environmental management practices in place, including water management.
- **Section 6:** Describes all monitoring components, including climate, surface water, hydrology, groundwater, contact water, seepage water, effluent, sediment quality, benthic invertebrate, plankton and chlorophyll *a*, periphyton, fish, wildlife, amphibian and reptile, soil, soil invertebrate, vegetation, and biosolids.
- **Section 7:** Describes the process for CEMP revisions and updates, along with a summary of changes made since the approved plan was submitted on June 23, 2016.
- **Section 8:** Summarizes relevant components of the post-TSF breach reclamation and remediation plans and interactions with CEMP components.
- **Section 9:** Provides an overview of the reporting of CEMP results.
- **Section 10:** Provides an overview of the future outlook.

The appendices attached to the CEMP are summarized below:

- **Appendix A:** Approved CEMP TOR (April 28, 2017).
- **Appendix B:** Contains the Detailed Study Designs for CEMP components, as referenced in document.
- **Appendix C:** Sample of Monthly Monitoring Schedule, which is a sample of the monthly environmental monitoring schedule provided to environmental department staff.

- **Appendix D:** Site Matrix, which describes all water sample locations in the CEMP, including site descriptions, site locations, access or safety concerns, and rationale for monitoring.
- **Appendix E** Declarations of Competency forms for Qualified Professionals contributing to the CEMP

1.1 OBJECTIVES

As specified in the Permit, the CEMP describes monitoring activities intended to support the evaluation of the potential for effects of mine-related activities on the physical, chemical, and biological characteristics of Bootjack Lake and Morehead Creek in the Springer Pit area, the Hazeltine and Edney Creek drainages, Polley Lake, Quesnel Lake, and Quesnel River, and associated riparian and upland areas. Specifically, the CEMP objectives are:

1. To evaluate if pollution[1] is occurring in the receiving environment as a result of the existing water discharge or mine-related activities;
2. To evaluate the environmental impacts of the August 2014 TSF embankment breach, to inform the rehabilitation plan, as well as to evaluate the effects of mitigation measures that are implemented as part of the rehabilitation strategy;
3. To integrate, to the extent feasible, the requirements of the MDMER; and
4. To inform reclamation and closure (*Mines Act* Permit M-200).

This CEMP includes monitoring of: effluent, surface water, groundwater, sediment, periphyton, plankton, benthic invertebrates, and fish in the aquatic environments; and soil, floodplain and upland vegetation, and wildlife in the terrestrial environments. Specific objectives for individual monitoring program components are stated in the subsequent sections. Supporting summary tables and maps are also provided.

Since the original integration of these plans and submission of the CEMP on March 31, 2016, many iterations of the CEMP have been reviewed, revised, and submitted in 2016 and 2017. Pre-existing monitoring plans that were integrated into the initial CEMP and have subsequently been revised within CEMP revisions (instead of individually) are:

- The *Monitoring Plan for Discharge of Treated Effluent to Quesnel Lake via Hazeltine Creek* (MPMC 2016a);
- The *Annual Monitoring Plan* for surface water and groundwater (MPMC 2015a);
- The *Biological Monitoring and Lake Sampling Plan* (MPMC 2015b); and
- The *Post-TSF Breach Monitoring Plan – 2015 Revision 1* (MPMC 2015c), which references the *Post Breach Fish Tissue Collection Plan – 2015* (MPMC 2015d) and the *Sampling and Analysis Plan: Detailed Site Investigation and Human Health and Ecological Risk Assessment* (Golder 2015a).

[1] Pollution as defined in the BC EMA (S.1(1)) means "*…the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment*".

Previous results were used to inform and structure this version of the CEMP and are summarized below in their respective sections or provided in Appendix B, as appropriate. A summary of results along with a discussion is provided in each relevant section. Throughout the CEMP, references are made to semi-x monitoring. This refers to monitoring that occurs twice per unit time, for example semi-annual monitoring indicates twice per year, and semi-monthly monitoring indicates twice per month.

It is expected that monitoring will be updated from time to time, consistent with an adaptive monitoring program (see Section 2.3). When changes are made to the monitoring, this amended plan (or relevant replacement pages) will be resubmitted to the Director and MPMC's Implementation Committee.

Work plans will be developed for all future monitoring programs and submitted to the ENV at least 30 days prior to commencing the program. These programs will be developed by a Qualified Professional (QP) and will consider linkages and dependencies with existing programs using previous data and review of the CSMs, which are presented in Section 2.2.

2 INTEGRATION OF MONITORING ACTIVITIES

The CEMP integrates environmental monitoring programs being carried out at the mine to meet multiple requirements which have different drivers and, therefore, objectives. Figure 2.1 shows the linkage between these drivers and associated monitoring objectives, as well as the resulting monitoring components that addresses those objectives. Further discussion is provided on these linkages in the sections following.

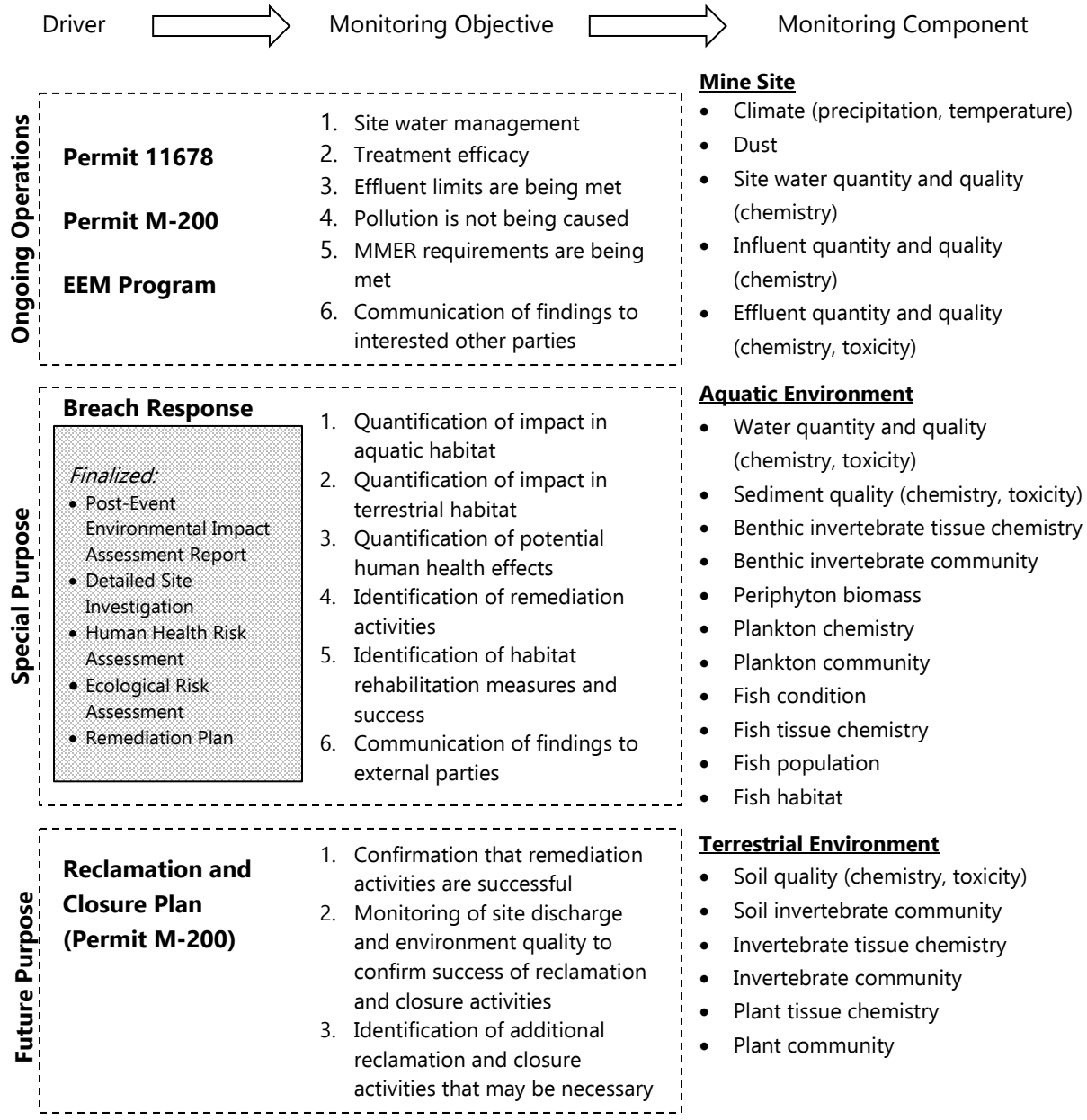


Figure 2.1 CEMP integration framework

2.1 MONITORING DRIVERS AND OBJECTIVES

There are three different drivers for current monitoring activities: ongoing operations, the TSF embankment breach response (special purpose program distinct from normal mine operations monitoring), and reclamation and closure planning (future purpose; note that some progressive reclamation has been done to date). These drivers and their associated monitoring objectives are described below. Previous monitoring results are continually reviewed to inform and structure the monitoring as well.

2.1.1 ONGOING OPERATIONS

Mount Polley Mine is an operational facility that is governed by provisions of the provincial EMA and *Mines Act* and the federal MDMER (a sector-specific regulation of the *Fisheries Act*). These permits and regulations contain specific requirements for on-going monitoring of site activities and downstream aquatic receiving environments. The objectives of ongoing operations monitoring are to:

1. Evaluate and plan for site water management.
2. Evaluate treatment efficacy to provide information for the ongoing management of the water treatment system installed at the time.
3. Verify that effluent limits are being met.
4. Verify that pollution is not being caused.
5. Verify that MDMER requirements are being met.
6. Communicate the findings to all interested parties.

Monitoring in accordance with conditions contained within BC *Mines Act* Permit M 200 is also summarized in the CEMP. This monitoring is only described in the CEMP for completeness purposes. Monitoring is summarized and future changes will be presented in CEMP revisions, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A). This permit requires monitoring for metal leaching and acid rock drainage (ML/ARD) characteristics, water quality of on-site contact water (Section 6.11), and water quality of seeps from open pits and waste rock piles (Section 6.10). Permit M-200 also contains conditions related to reclamation and closure planning and monitoring. Results of monitoring conducted under the M-200 permit will continue to be reported annually, along with the monitoring results directed under the CEMP, in a combined AERR (Annual Environmental and Reclamation Report) that is submitted to ENV and the BC Energy, Mines, and Petroleum Resources (EMPR; formerly Ministry of Energy and Mines). Refer to Section 9 for information on reporting associated with the CEMP.

MPMC is also subject to the conditions of the BC *Water Sustainability Act* (which replaced the *Water Act* in 2016) that includes provisions related to sediment and erosion control and working around water. MPMC holds conditional water licences and is subject to Order 76930-40 following the TSF embankment breach, both of which were issued under the former *Water Act*.

2.1.2 SPECIAL PURPOSE

On August 4, 2014, a foundation failure of the Mount Polley TSF perimeter embankment occurred. ENV issued a Pollution Abatement Order (PAO) that specified the need for specific impact studies and monitoring to address impacts of the breach event, inform remedial measures, and evaluate changes over time. These studies are referred to as "special purpose" studies (now primarily monitoring) because they relate to a unique event with program objectives that differ considerably from an operating mine. The objectives of the special purpose monitoring are to:

1. Monitor and assess impact to aquatic habitat.
2. Monitor and assess impact to terrestrial habitat.
3. Monitor and assess potential human health risks.
4. Identify remediation activities needed to address identified impacts.
5. Identify habitat rehabilitation measures and related works as well as the success of those works.
6. Communicate findings of the impact assessment and ongoing monitoring to external parties.

2.1.3 FUTURE PURPOSE

As an operating mine, MPMC is required to plan for eventual closure. Reclamation and closure monitoring takes place after the closure plan is implemented. Although progressive reclamation and reclamation research have already been initiated at the site, the Reclamation and Closure Plan (RCP) continues to be refined during operations in preparation for closure and is not yet finalized. However, in the context of a CEMP, future monitoring needs are appropriate to start considering. Because this CEMP is intended to be an adaptive plan, these will be updated as reclamation and closure planning progresses and greater certainty of locations, measurement endpoints, etc. are available.

The objectives of the future monitoring program are to:

1. Confirm that mine site reclamation activities are successful in achieving their stated objectives.
2. Monitor site discharge quality and receiving environment quality as appropriate to confirm that reclamation and closure works have been successful in preventing pollution and that discharges are compliant with applicable requirements.
3. Identify additional reclamation and closure activities that may be necessary.

Additional and more specific objectives will be developed as the reclamation and closure planning process progresses.

2.2 MONITORING COMPONENTS AND CONCEPTUAL SITE MODEL

Figure 2.2 provides an overview of the Mount Polley Mine, in particular the CEMP study areas along with their respective monitoring components. Figure 2.3 and Figure 2.4 show greater detail of the TSF area and the mine site, respectively, of the sources of mine-contact water to the surrounding aquatic receiving environment and areas of ground disturbance. The measurement endpoints are detailed in the applicable sections later in this plan.

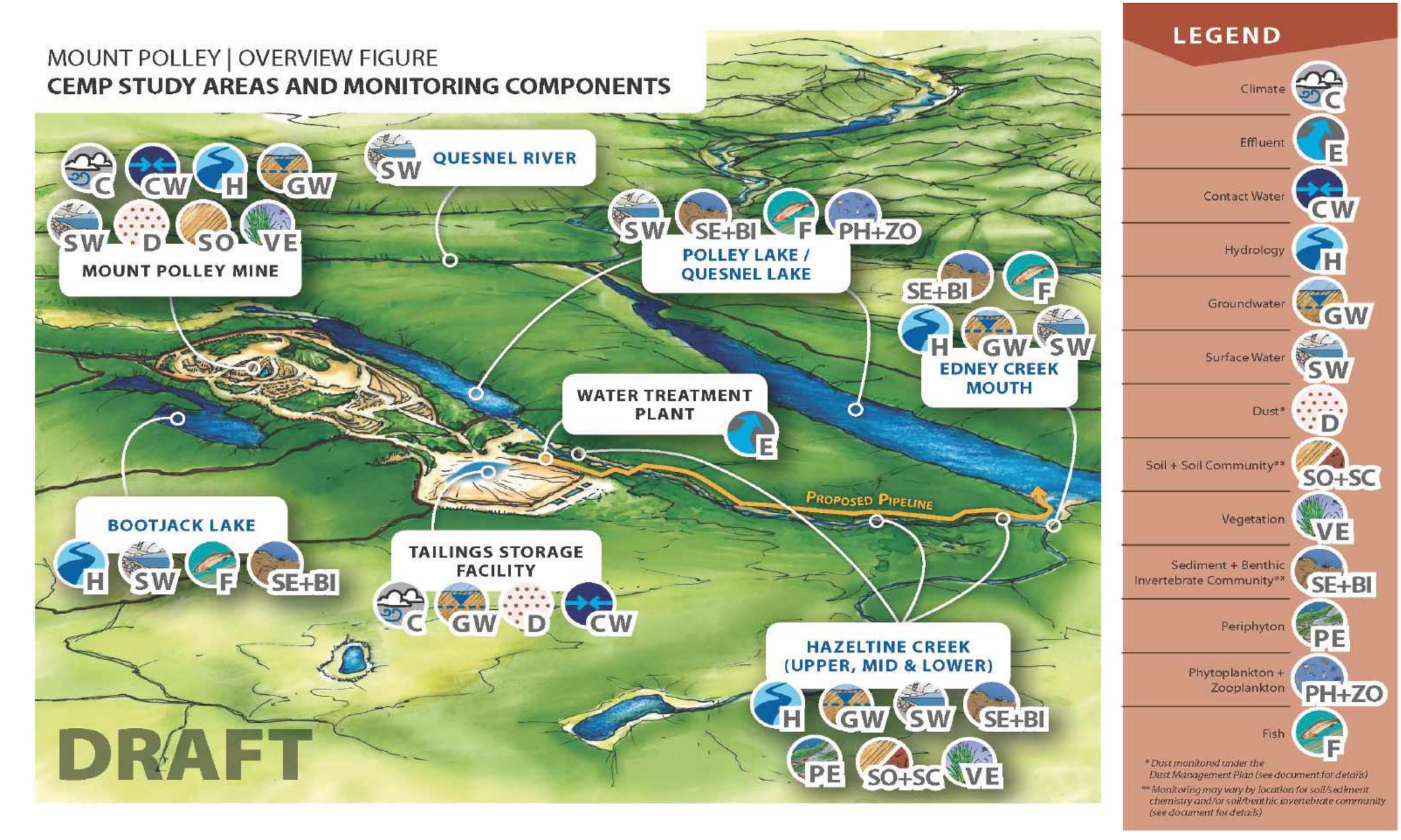


Figure 2.2 CEMP Study Areas and Monitoring Components

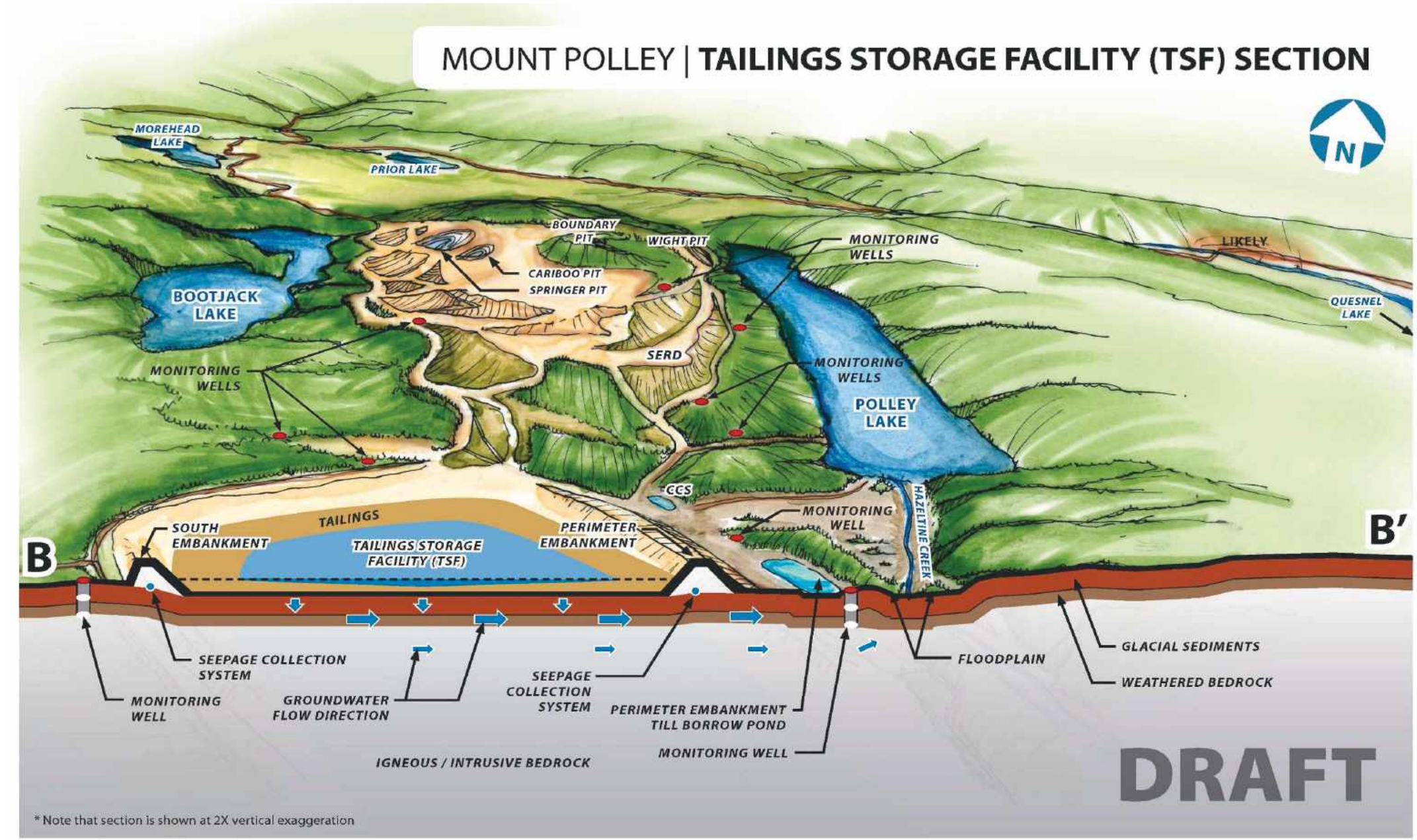


Figure 2.3 Tailings Storage Facility Section

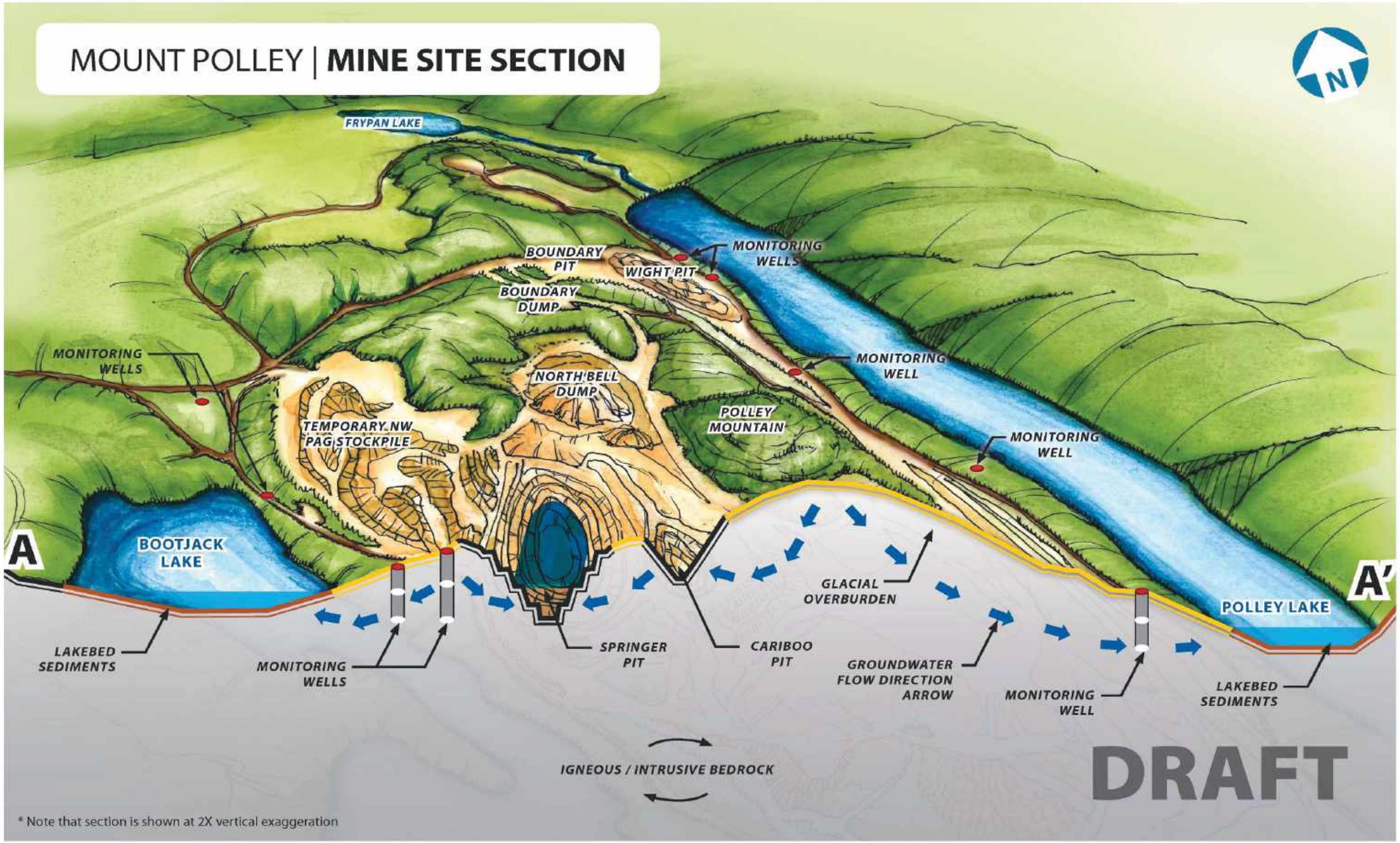


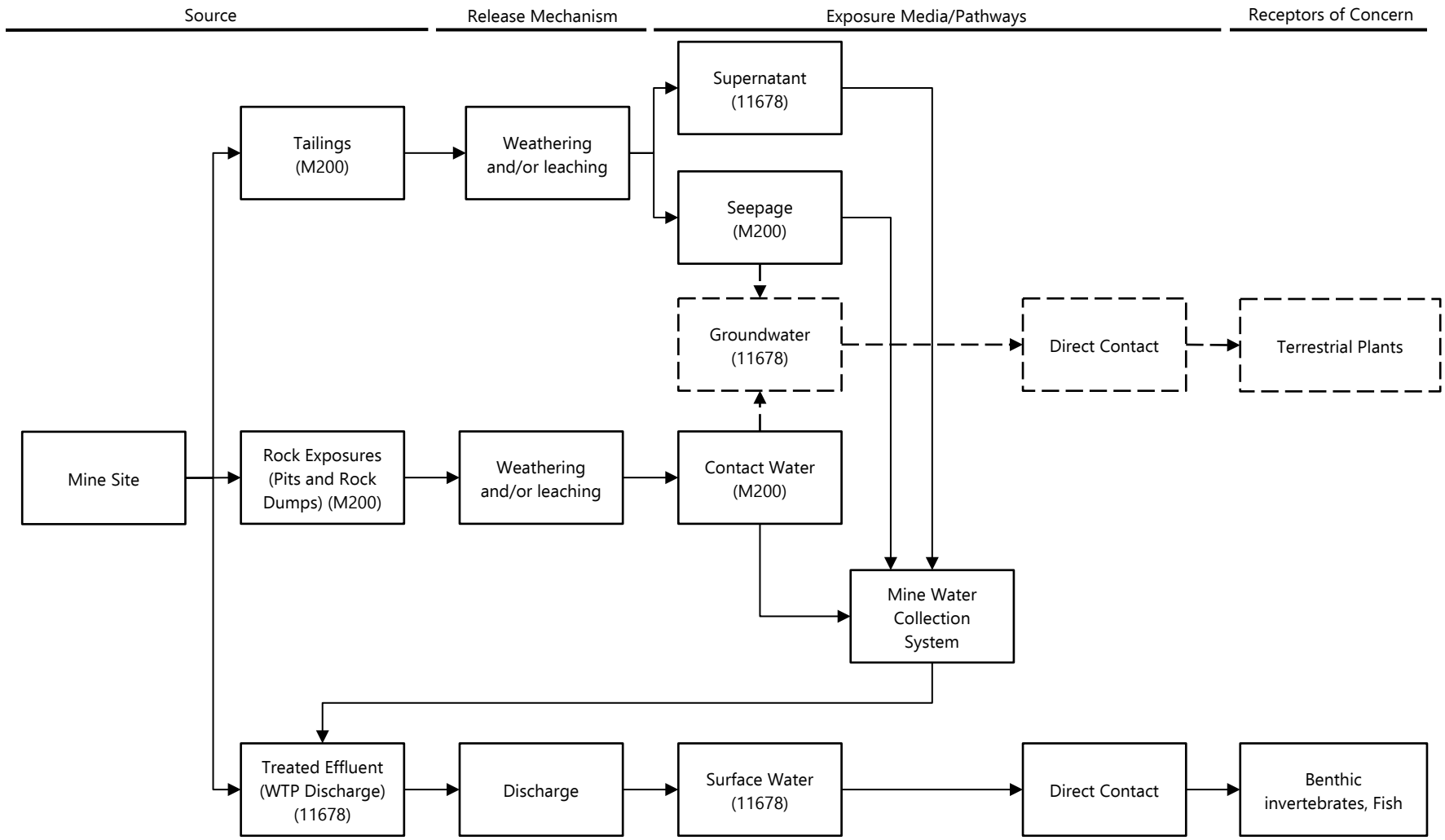
Figure 2.4 Mine Site Section

A CSM helps provide the basis for selecting appropriate monitoring components and suitable locations for those measurements. A CSM provides a graphical articulation of the understanding upon which the CEMP is based including movement of substances, pathways by which organisms (receptors) might become exposed to and interact with those substances in the environment. CSMs are often used in risk assessments to communicate similar concepts; however, in this CEMP, the focus of the study on specific constituents of potential concern (COPCs) has not been an objective because the monitoring program includes broader purposes and will include, for example, the full commercial analytical package for elemental analysis (frequently called "metals analysis"). Groups of substances that will be analyzed for, however, are those related to the potential sources. A CSM specific to the mine site was developed and is shown in Figure 2.5. A CSM for the TSF breach affected areas was developed for the Ecological Risk Assessment (ERA; Golder 2017) and is shown in Figure 2.6.

As discussed in Section 2.1.1, the mine has ongoing operational monitoring needs that centre on permit compliance that include management of site water and ultimately treated water discharges. The mine also needs to address disturbed ground through dust management in the short term. The measurable characteristics or components that contribute information to the stated monitoring objectives can then be identified as variables such as: precipitation and temperature (i.e., climate); dust; mine contact water, groundwater, and surface water quantity and quality; and influent and effluent quantity and quality. These are considered "Site" monitoring components (Figure 2.1). This information contributes to understanding the site water balance, function of site water collection systems, and management of the water treatment plant (WTP; e.g., capacity and treatment efficacy). This information is also useful in understanding the groundwater and seepage flow pathways to Bootjack and Polley lakes.

Ongoing operational activities at the site also have the potential to influence aquatic receiving environments related to effluent discharges. Under the long-term water management plan effluent is discharge from the WTP to Quesnel Lake. Relevant monitoring components for "Aquatic Habitat" include receiving water and sediment chemistry and toxicity, as well as biotic (e.g., plankton, benthos, fish) communities and tissue chemistry as summarized in Figure 2.1.

Following the TSF embankment failure in 2014, the environmental monitoring program was expanded to either incorporate additional monitoring components or increase the frequency of sampling. Many of the same existing operational monitoring components applied to this program and others were added. Additional measurements, related to physical impacts from the event, were collected to contribute to the Post-event Environmental Impact Assessment Report (PEEIAR) and to contribute to the Human Health Risk Assessment (HHRA) and the ERA. This "special purpose" monitoring information is relevant to the Remediation Plan for which an annotated table of contents has been submitted to ENV. As noted in the Risk Monitoring Considerations section of the ERA, further sample collection and evaluation of monitoring data will be done to further refine toxicity reference values for wildlife and confirm bioavailability of copper continues to be low and does not present a risk to wildlife.



Notes:
Solid lines indicate pathways that are likely to be complete or operative.
Dotted lines indicate pathways that are likely to be incomplete or inoperative.

Figure 2.5 Conceptual Site Model for the mine site

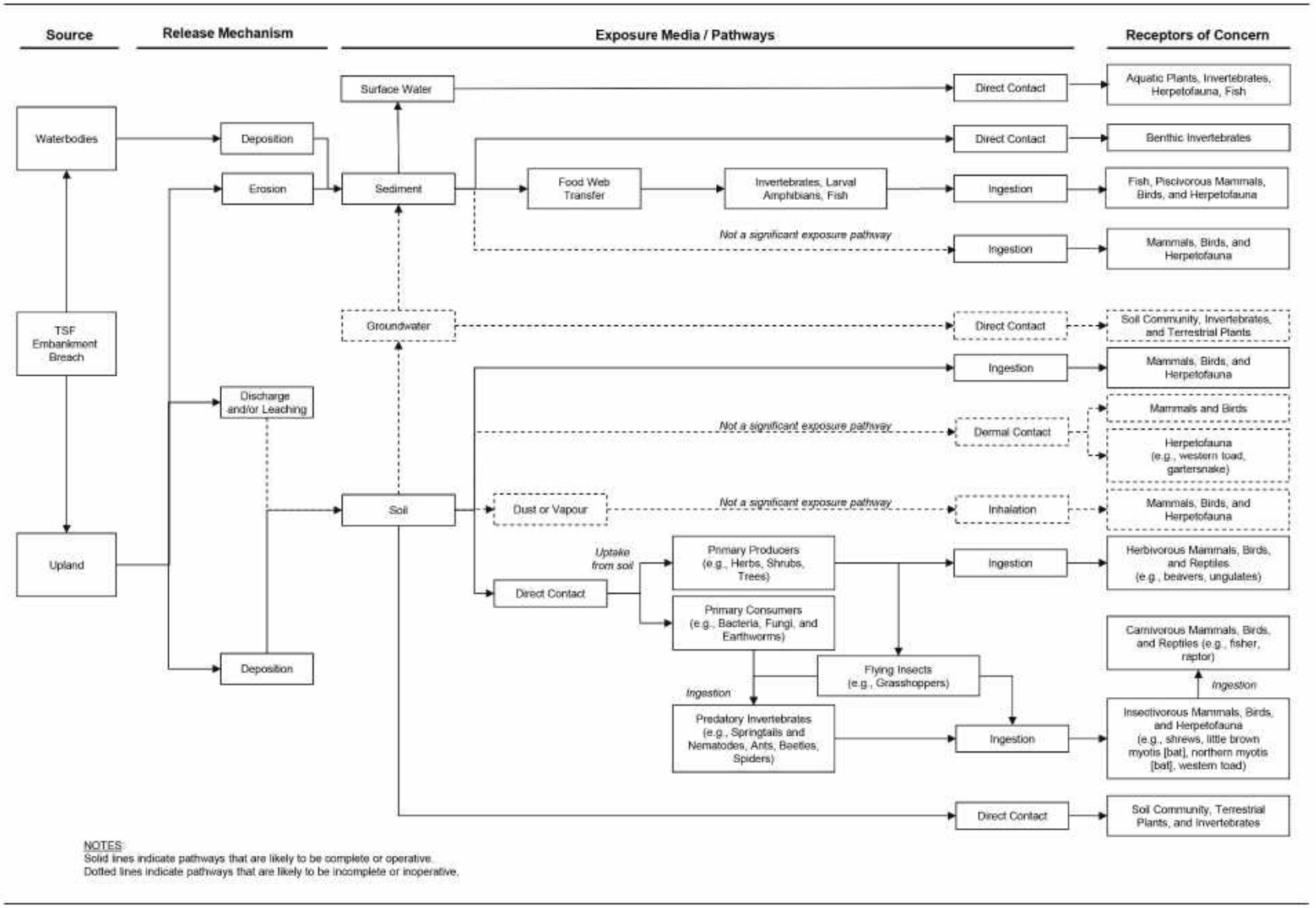


Figure 2.6 Conceptual Site Model for TSF breach affected areas, as developed for the ERA (from Golder 2017)

2.3 Adaptive Management Framework

The CEMP will be adaptive based on the results of ongoing operational and special purpose monitoring (illustrated in Figure 2.7) and based on the developing RCP. The adaptive framework recognizes that studies and monitoring can lead to new information that should be used to inform future monitoring. The framework provides feedback of this new information into the decision-making process that links monitoring and management actions that may need to be implemented to keep MPMC in compliance. For example, more immediate management actions may need to be undertaken in response to pre-defined triggers for unexpected changes in condition. The progressive implementation of the adaptive management framework will also include an annual review of the monitoring program to determine the potential need for revisions to planned sampling and analysis tasks. This review could include cessation of monitoring components that data show may no longer be necessary, or increase of monitoring based on changing conditions or monitoring results. Recommendations for monitoring related to the findings of post-breach-related studies have been included in this CEMP with the intention of forecasting monitoring that may be undertaken in the next three years. Monitoring for a specific year will be verified in monitoring program work plans following the adaptive management framework.



Figure 2.7 Adaptive Management Framework

3 FIRST NATIONS AND STAKEHOLDERS

3.1 FIRST NATIONS ENGAGEMENT

First Nations with recognized claimed traditional territory for the Mount Polley Mine are the T'exelc (Williams Lake Indian Band; WLIB) and the Xatśūll First Nation (Soda Creek Indian Band; SCIB). In 2011 and 2012, MPMC executed Participation Agreements with the WLIB and the SCIB, respectively. Through these respective Participation Agreements, Implementation Committees were formed to facilitate open dialogue between each of the First Nations and MPMC, providing a formalized and regular venue to discuss environmental, social, and economic matters related to mine development, operation, reclamation, and closure (e.g., mine updates, permitting, environmental protection, reclamation, employment opportunities, and potential joint ventures). Meetings with the WLIB have taken place since March 16, 2012 and since July 19, 2012 with the SCIB. Effective October 18, 2012, Joint Implementation Committee meetings have been held with representatives from MPMC, the WLIB, and the SCIB, replacing the previous MPMC/SCIB and MPMC/WLIB Implementation Committee meetings. Joint Implementation Committee meetings are held at minimum quarterly, but typically more frequently. These meetings and associated documentation (TOR, minutes, and action items) provide a well-defined, constructive forum in which issues, reviews, and comments relating to the current and anticipated future operations of the Mount Polley Mine may be discussed. This CEMP and the AERR will be provided in their current form to the SCIB and the WLIB for review, and discussion regarding any comments or concerns will be facilitated through the Joint Implementation Committee.

3.2 PUBLIC LIAISON COMMITTEE

The Public Liaison Committee (PLC) for the Mount Polley Mine was formed in 1999, and meetings have been maintained through the operating years of the Mine. Meetings were historically scheduled in conjunction with updates on proposed developments and projects, with a minimum frequency of one meeting per year. An annual PLC meeting became a requirement of the Permit in 2013 and quarterly meetings became a requirement in 2015. The PLC is intended to provide an opportunity for MPMC to share information about mine activities and the results of monitoring programs with its members, and for members to share such information with their respective membership. The PLC does not replace or diminish the use of other communication procedures that MPMC will use regularly to inform the public, including but not limited to: public meetings, newsletters, emails, and internet websites. The PLC is seen as a medium to add value to parties with interest in the Mount Polley Mine, including, but not limited to: MPMC and its personnel, the public and public interest groups, local communities, First Nations, and regulators.

3.3 COMMUNICATION PLAN

The Permit requires a Communication Plan between MPMC and the WLIB, SCIB, Cariboo Regional District, and the Community of Likely to be in place. The original Communication Plan was submitted to the Director (ENV Statutory Decision Maker) on March 20, 2016 and was approved by the Director on May 11, 2016. The amended Permit required that an updated Communication Plan be submitted by June 30, 2017. The final Communication Plan was submitted to ENV on March 20, 2016.

4 MOUNT POLLEY MINE PROJECT OVERVIEW

4.1 PROJECT HISTORY

Mount Polley Mine, operated by MPMC (a wholly-owned subsidiary of Imperial Metals Corporation), is an open pit copper/gold mine with an underground component, and has the capacity to process 20,000 to 22,000 tonnes per day (tpd) of ore. The Mount Polley property covers 18,892 hectares (ha), which consist of seven mining leases totaling 2,007 ha, and 43 mineral claims encompassing 16,855 ha, as of March 2018.

Clearing of the site and construction of the entire facility began in 1995, with the mill being commissioned in June 1997. In May 1997, the Mine received an ENV (known as the Ministry of Water, Land and Air Protection at that time) Effluent Permit, issued under the provisions of the provincial EMA. This permit authorized the discharge of concentrator tailings, mill site runoff, mine rock runoff, open pit water, and septic tank effluent to a tailings impoundment. Approval of the "Mount Polley Mine Reclamation and Closure Plan" by the EMPR resulted in the issuance of Permit M-200 in July 1997. The first full year of mining and milling at Mount Polley Mine took place in 1998. The mine suspended operations in October 2001 due to low metal prices, then reopened in December 2004 with mill production commencing again in March 2005. A summary of Permit 11678 amendments is provided in Table 4.1.

Table 4.1 Summary of Permit 11678 amendments

Date	Scope of Amendment
30-May-1997	Original permit
20-Oct-1997	Amended authorized tailings discharge rate (10,000 tpd increase)
12-Jun-1998	Amended reporting requirements
08-Sep-1999	Amended monitoring requirements
01-Feb-2000	Amended authorized tailings discharge rate (4,500 tpd increase)
07-Feb-2002	Approval to discharge effluent from the PESCP and MESCP; approval to store TSF supernatant and Mine Site contact water in the Cariboo and Bell Pits
04-May-2005	Amended authorized tailings discharge rate (5,000 tpd increase); discharge of groundwater to Polley Lake; updates to reference analytical procedures and monitoring program
17-Apr-2009	Amended monitoring, water level and supernatant characteristic requirements for the Cariboo and Bell Pits
07-Nov-2012	Approval to discharge to Hazeltine Creek
07-Jun-2013	Sulphate guidelines
09-Jul-2015	Tailings discharge to the Springer Pit
29-Nov-2015	Approval to discharge to Hazeltine Creek
04-Apr-2016	Discharge of additional tailings to the Springer Pit
09-Sep-2016	Hazeltine Creek discharge total suspended solids limit change
07-Apr-2017	Approval to discharge directly to Quesnel Lake

Notes: tdp: tonnes per day; PESCP: Perimeter Embankment Seepage Collection Pond; MESCP: Main Embankment Seepage Collection Pond; TSF: Tailings Storage Facility

As a result of a foundation failure of the perimeter embankment of the TSF on August 4, 2014 (see Section 2.1.2), the mine was placed in care and maintenance until August 5, 2015, when restricted operations under a short-term permit commenced. This restricted operations permit allowed processing of up to 4 million tonnes of ore over a one-year period, with tailings deposition into the Springer Pit.

The Mount Polley Mine became subject to the MDMER on April 10, 2014, following a planned discharge of mine effluent into Hazeltine Creek. The MDMER are also applicable to the long-term discharge approved for the Mount Polley Mine.

4.2 CURRENT OPERATIONS

MPMC was granted full restart permits on June 23, 2016 and has been operating at full capacity since June 27, 2016. The Mount Polley Mine site includes a crusher and mill (includes office spaces), a TSF, waste rock disposal sites, seepage collection ponds, haul roads, access roads, and various small buildings and storage areas (Figure 4.1). Concentrate is transported by truck from the site to the Port of Vancouver, where it is shipped to smelters overseas.

4.3 ENVIRONMENT

4.3.1 TOPOGRAPHY AND CLIMATE

The Mount Polley property is located on the eastern edge of the Fraser Plateau physiographic sub-division, characterized by rolling topography and moderate relief. Elevations range from 920 metres above sea level (masl) at Polley Lake to 1266 masl at the summit of Mount Polley. Volcanic rocks generally underlay this part of the plateau with inclusions of intrusive rocks. Most of the area is covered by a deposit of unconsolidated till which contains fluvial, lacustrine, and colluvial deposits. Some patches of organic soils are present in poorly drained areas (i.e., wetlands). The property is located in an alkali porphyry copper-gold deposit hosted in the Central Quesnel Belt along the Intermontaine Belt of BC.

The site is located within the Interior Cedar Hemlock biogeoclimatic zone. Local forests consist of Western red cedar, Douglas-fir, hybrid spruce, and subalpine fir, with a lesser presence of trembling aspen, black cottonwood, and paper birch. Much of the area has been harvested in commercial logging operations and is also used for cattle grazing.

Average annual precipitation in the study area is 670 millimetres (mm). Precipitation typically occurs as snowfall from November through March, with an average maximum of snowpack of 178 mm snow water equivalent occurring at the end of March (Golder 2015b). Average monthly temperatures at the Mount Polley Mine range from -6.0 degrees Celsius (°C) in January to 15.3°C in July and August (MPMC 2016b). Prevailing winds are from the north-north-east and from the south-south-west near the TSF, and from the northwest (and to a lesser extent the southeast) near the mill, with a predominance of winds designated as calm (below 3 metres per second; Golder 2015b).

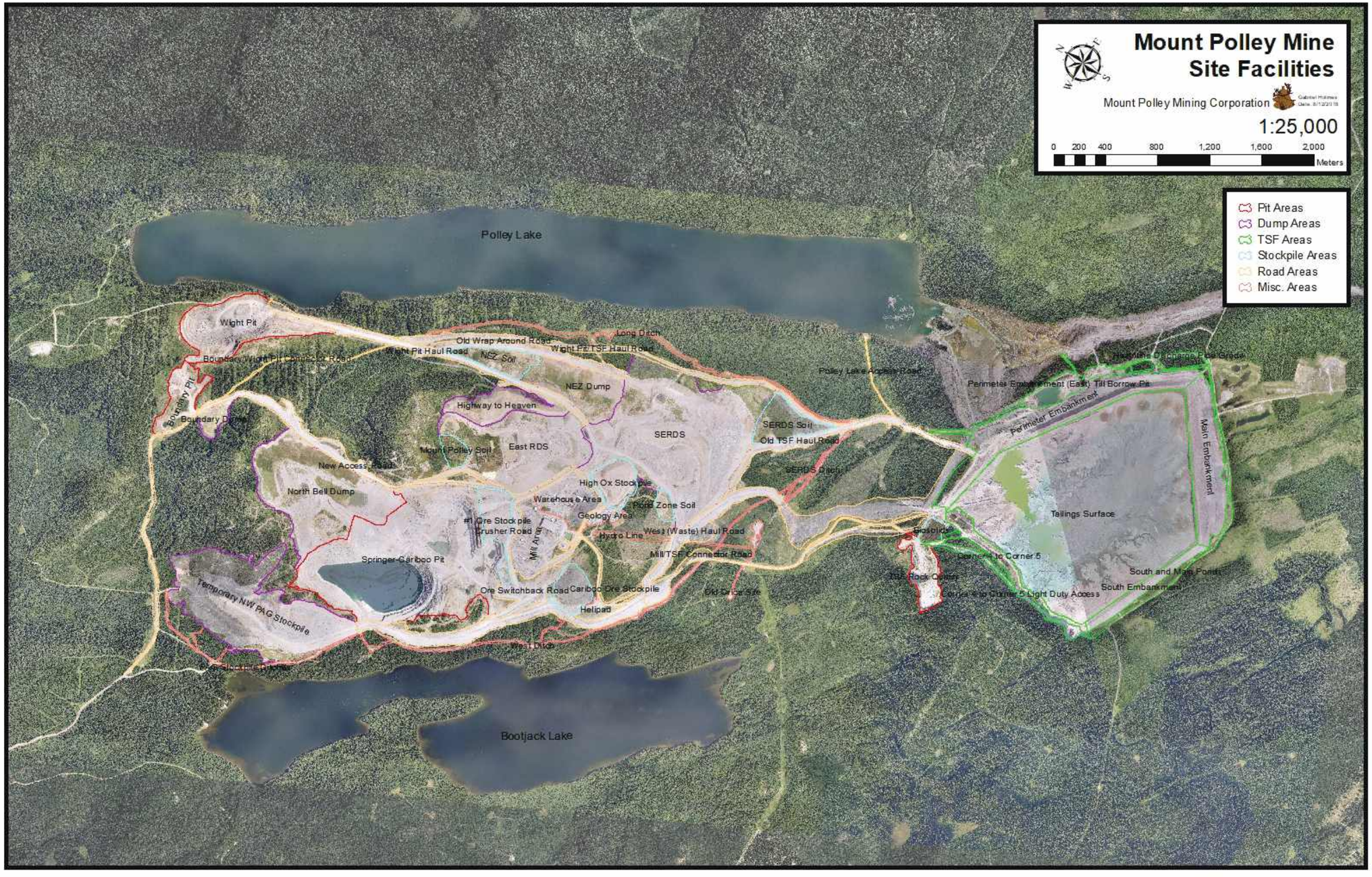


Figure 4.1 Mount Polley Mine site facilities

4.3.2 HYDROGEOLOGY

The groundwater flow at the site occurs primarily in the bedrock units in response to recharge from precipitation in the area between Polley Lake and Bootjack Lake. Flow in the overburden is less significant due to its limited thickness and discontinuous nature. Prior to mining, the water table at the site generally followed the surface topography, but the water table was deeper below the topographic heights and shallower in the low areas. At that time, the direction of groundwater flow was inferred to be from the top of the ridge between the Polley Lake and the Bootjack Lake towards the low lying areas associated with these lakes northeast and southwest from the ridge.

Mine dewatering has altered the groundwater flow pattern at the site, with the open pit and underground workings acting as sinks for groundwater flow. Mine dewatering lowered the water table elevation and created radial patterns of groundwater flow towards these facilities. Following the formation of the pit lake in the Cariboo Pit, seepage from this pit started to provide a contribution to groundwater inflow to the Springer Pit. At present, Springer Pit and Cariboo Pit continue to act as groundwater sinks. The currently available information suggests that some seepage from the Springer Pit lake towards Bootjack Lake occurred when the pit lake level exceeded 1030 m elevation in 2016 (Golder 2016b).

4.3.3 DRAINAGE AND HYDROLOGY

The mine is located on the divide of two sub-watersheds within the Quesnel Lake watershed. Quesnel is a large, deep fjord lake with a surface area of 255 square kilometres (km^2), and is composed of East, West, and North Arms. It is the deepest fjord-type lake in the world, with a maximum depth of more than 511 m in the East Arm (Laval et al. 2008). The West Basin is a shallower (113 m maximum depth) portion of the west arm that is demarcated in the east by a shallow sill near Cariboo Island that is approximately 35 m deep (Laval et al. 2008). The lake drains to the west via the Quesnel River to the Fraser River. The Horsefly River, Mitchell River, and Niagara Creek are the main tributaries to Quesnel Lake, entering from east of the sill.

The western watershed, which includes drainage from Bootjack Lake, Trio Lake, and Morehead Lake, discharges to Quesnel River via Morehead Creek and drained approximately 60% of the Mount Polley area prior to mine construction.

The eastern watershed includes Polley Lake (surface area of 3.8 km^2), which discharges to the east via Hazeltine Creek and then to the western arm of Quesnel Lake. The Hazeltine Creek and Edney Creek watershed areas at Quesnel Lake are currently approximately 30.2 km^2 and 87.4 km^2, respectively. Approximately 10.5 km^2 that historically reported to this watershed is now within the mine contact water runoff collection system catchment.

Bootjack Creek is a small tributary that previously flowed into Hazeltine Creek downstream of Polley Lake. Following the TSF embankment breach, Bootjack Creek was re-routed to Polley Lake; fish access is currently restricted. Historically, Bootjack Lake (surface area of 1.2 km^2) discharged into Hazeltine Creek via Bootjack Creek, but in 1913 a dam was constructed at the south end of Bootjack Lake and the flow direction was reversed in order to direct water into Morehead Lake for hydropower production. This resulted in 14 km^2

being diverted from the Hazeltine Creek catchment. The Morehead Creek watershed, including the Bootjack Lake catchment area, is approximately 11.2 km^2. Approximately 2.3 km^2 that historically reported to this watershed is now within the mine contact water runoff collection system catchment.

Pre-mining watersheds are shown in Figure 4.2. In general, the hydrology of the Mount Polley area is snowmelt driven, with the majority of annual runoff occurring in April and May during snowmelt (i.e., freshet; Knight-Piésold 2014).

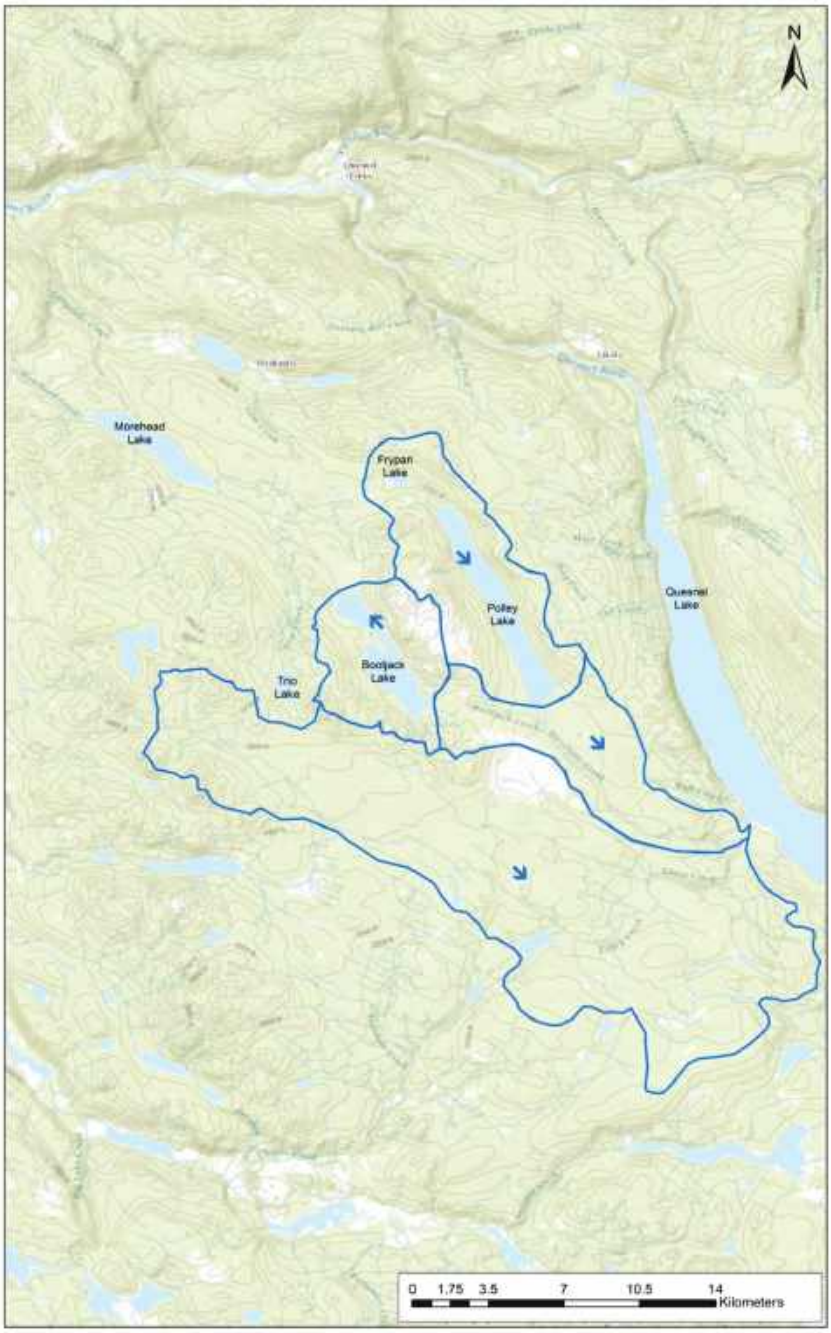


Figure 4.2 Mount Polley area pre-mining watersheds

5 ENVIRONMENTAL MANAGEMENT

5.1 WATER MANAGEMENT

To protect natural watercourses from mine-influenced contact water from roads, haul roads, waste rock piles, and other Mine areas, water is collected in a system of ditches and sumps located around the Mine site. Based on site water management objectives, site contact water is either pumped directly to the TSF or reports to the gravity-driven sections of the West Ditch or Long Ditch, the latter two of which both flow to the Central Collection Sump (CCS). Water in the CCS is currently allowed to overflow to the Perimeter Embankment Till Borrow Pond (PETBP) where it is pumped to the WTP or can be returned to the TSF. Pumping infrastructure also exists at the CCS such that it can be directed to the TSF. Water from the TSF is primarily pumped to the Mill via the Booster Station to meet process requirements, but can also be diverted to the CCS. A map of water collection infrastructure, including site collection ditches (including flow direction) and sumps, is shown in Figure 5.1. All water, primarily rain and snow melt, ultimately reports to the PETBP from which it is pumped to the WTP. At the time of writing, any contact water that requires temporary storage on site (i.e., when flows exceed those able to be treated and discharged) is pumped to the TSF. Tailings and process water from the Mill reports by gravity from the Mill to the TSF.

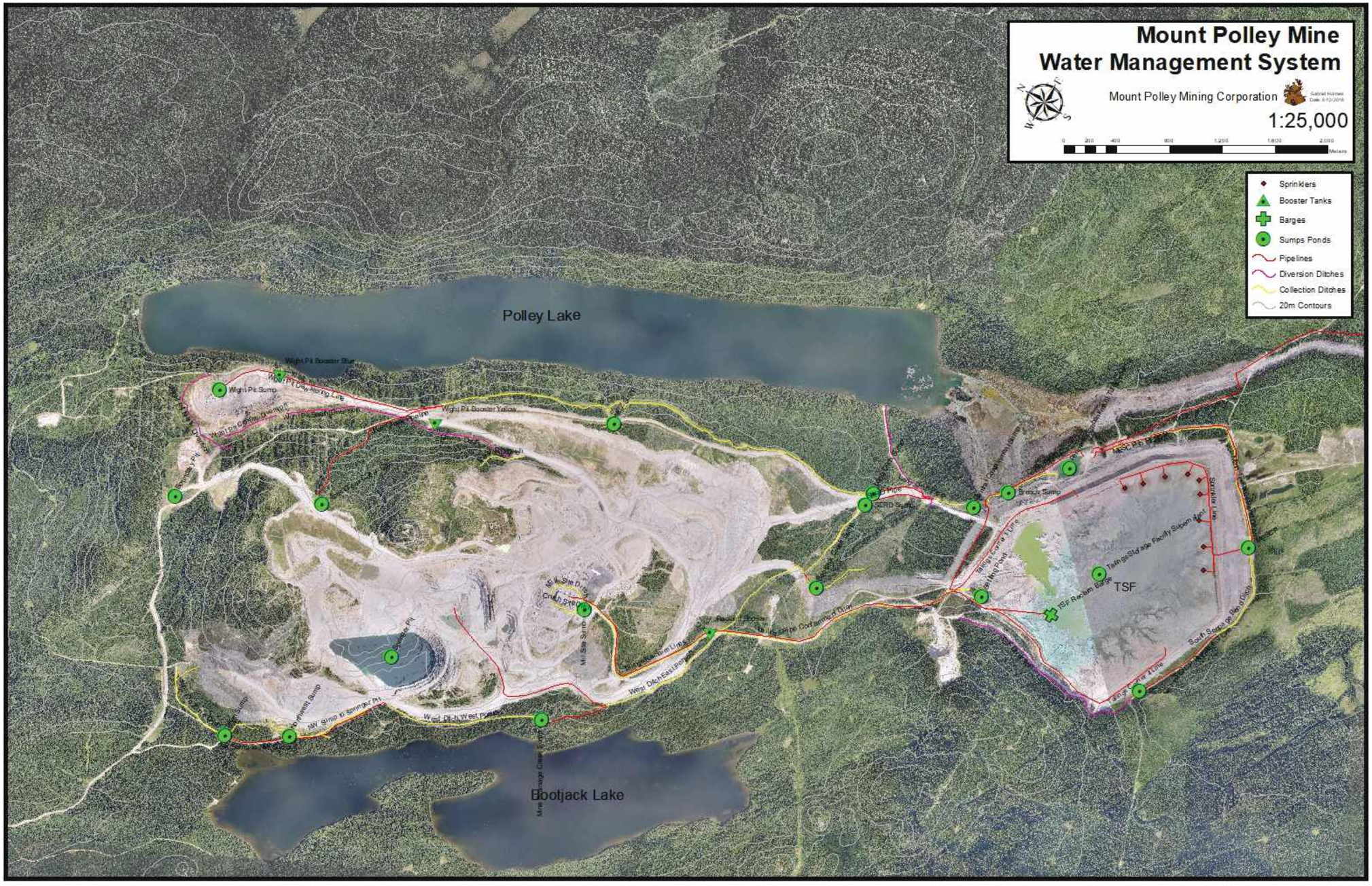
The Mount Polley site has a positive water balance, and a permit for a long-term water discharge system was received on April 7, 2017. Treatment is conducted for removal of suspended solids and associated metals using a Veolia ACTIFLO® system, which is described in detail in Section 5.1.2. Under the long-term water management strategy, treated mine effluent is discharged to Quesnel Lake via a direct pipeline to the submerged diffusers installed in the lake. A continuous discharge of up to 0.6 m^3/s, with an annual average of 0.33 m^3/s is currently permitted until December 31, 2022.

5.1.1 ANNUAL DISCHARGE PLAN

Permit 11678 requires the yearly submission of an Annual Discharge Plan (ADP). The intent of the plan is to identify the specific sources and quantities of water that will be discharged; however, the discharge system (which is described in Section 5.1.2) at Mount Polley is not designed to be able to solely discharge from specific sources and it is not realistic for MPMC to estimate the volumes of precipitation that will occur from year to year. The overall water management at the mine is described in detail in the Long-Term Water Discharge Technical Assessment Report (TAR) that was submitted to ENV October 17, 2016 (Golder 2016e).

5.1.2 DISCHARGE SYSTEM

The WTP sources water from the PETBP. During treatment, the feed water of the WTP undergoes suspended solids removal using Veolia ACTIFLO® water treatment technology. The WTP doses the raw water with coagulant to a tank where a polymer is injected to create floc particles. Microsand is added to ballast the flocculants, which move on to another tank that allows them to swell and mature. The water flows to the next stage, which uses lamella to clarify the water and promote fast settling of the microsand ballasted sludge. The clarified water is discharged and the sludge is separated from the microsand, which is reused.


Mount Polley Mine
Water Management System
Mount Polley Mining Corporation
1:25,000
Sprinklers
Booster Tanks
Barges
Sumps Ponds
Pipelines
Diversion Ditches
Collection Ditches
20m Contours
Polley Lake
Bootjack Lake
TSF
Wight Pit Sump
Wight Pit Booster Yellow
Wight Pit Booster Blue
Wight Pit Discharge Line
Wight Pit Control Diversion
Wight Pit Diversion Ditch
Springer Pit
Springer Pit Sump
Springer Pit Discharge Line
Springer Pit Booster
Springer Pit Control Diversion
Springer Pit Diversion Ditch
Springer Pit Collection Ditch
Springer Pit Booster Line
Springer Pit Booster Pump
Springer Pit Booster Sump
Springer Pit Booster Discharge Line
Springer Pit Booster Control Diversion
Springer Pit Booster Diversion Ditch
Springer Pit Booster Collection Ditch
Springer Pit Booster Pump Line

An on-line turbidity meter measures the turbidity every ten seconds, where the WTP human-machine interface calculates the total suspended solids (TSS) using a calibrated factor based on a site-specific correlation between turbidity and TSS for the treated effluent. If the calculated on-line TSS is greater than 13 mg/L for 10 minutes, or greater than 14 mg/L instantaneously, an alarm sounds to alert the operator and the WTP automatically goes into recirculation mode and ceases discharge.

Treated water from the WTP is discharged, by gravity, to Quesnel Lake via a pipeline (installed as of November 2017) connected to two submerged diffusers. Effluent discharge to the Hazeltine Creek channel ceased as of September 30, 2017.

5.2 Sediment and Erosion Control Management Plan

MPMC has developed a RCP that has been submitted to EMPR under the *Mines Act* Permit M-200. This plan includes several Environmental Management Plans including a Sediment and Erosion Control Plan.

5.3 Invasive Plant Management Plan

MPMC developed an Invasive Plant Management Plan in 2010 and has regularly updated this plan to include newly disturbed areas and to follow the Cariboo Regional District Strategic Plan for Invasive Plant Management. This plan is included in the RCP.

5.4 Dust Management Plan

MPMC maintains a Dust Management Plan that is also included in the RCP.

5.5 Project Environmental Monitoring Plans

MPMC develops a project specific Environmental Monitoring Plans (EMPs) for any development project that has potential to impact the environment. The requirement for these EMPs is outlined in the Erosion and Sediment Control Plan (Section 5.2).

5.6 Waste Management

MPMC recognizes the value of responsible waste management and recycling. MPMC Recycling and Waste Management Awareness presentations are given to Mount Polley employees annually and MPMC promotes several recycling programs for used materials including waste oil, scrap steel, batteries, plastic pails, electronic waste, light bulbs and associated fixtures, paper, cardboard, and beverage containers. Waste management information is also presented to employees and contractors during site orientation. Each year, Mount Polley donates the funds generated by its beverage container recycling program to local charities.

In the course of its ongoing operations, Mount Polley utilizes potentially hazardous chemicals, reagents, and other products. Sumas Environmental Services Ltd. routinely removes and disposes of these waste products in an environmentally safe manner compliant with all relevant waste management legislation. Products removed include: aerosol cans; contaminated gasoline and diesel; waste oil (in drums); waste oil filters; waste grease fuel or oil soaked rags, debris, and floor dry; and leachable liquid toxic waste, such as

glycol/anti-freeze mix. The site waste oil tanks are emptied and the oil removed from site by a third party contractor. MPMC is registered (BCG-01559) with the ENV under the *Hazardous Waste Regulation* for generation and temporary storage of these materials.

5.7 INCIDENT REPORTING

All non-compliance incidents are reported to the Director or to Emergency Management BC. All incidents are recorded and tracked, and are included in the AERR. As outlined in the Communication Plan (see Section 3.3) and required by Section 2.5 of the permit, incidents or emergencies that have the potential to have adverse impacts on the environment will be reported to the SCIB, WLIB, Cariboo Regional District and community of Likely.

5.8 INSPECTIONS

MPMC Environmental Department staff conduct weekly inspections on the site with a focus toward regulatory compliance and waste management (Section 5.6). These inspections are documented and communicated regularly to the site management and their respective departments. Guidance is provided by the Environmental Department for proper internal reporting and follow-up. The goal of these inspections is to provide all departments the capability to engage in proper environmental management practices and open lines of communication with the Environmental Department.

6 MONITORING

The subsections below outline general procedures at MPMC for scheduling of environmental monitoring and data review and management. Field methods, laboratory analysis, data quality control and objectives, as well as data analysis methods are included in the following sections with their respective monitoring components. Note that frequencies may change due to weather conditions or construction work and will be dependent on accessibility and, most importantly, safety of the field crews. Declarations of Competency for relevant Qualified Professionals are provided in Appendix E.

6.1 SCHEDULING

To coordinate sampling and schedule all planned monitoring, as per the CEMP, MPMC prepares internal monthly sampling schedules. An example monthly sampling schedule has been included as Appendix C.

6.2 FIELD METHODS

Monitoring procedures that will be used in carrying out the CEMP are consistent with the *BC Field Sampling Manual for Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment, and Biological Samples* (2013 or most recent version, herein referred to as the "BC Field Sampling Manual"; MoE 2013a). As appropriate, monitoring procedures will also be consistent with the *Metal Mining Technical Guidance for Environmental Effects Monitoring* (Environment Canada 2012) and the *Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators* (MoE 2012). MPMC's procedures are also consistent with applicable sections of the *British Columbia Environmental Laboratory Manual* (MoE 2015), such as sample collection and preservation requirements.

Quality assurance/quality control (QA/QC) methods will follow procedures outlined in the *MPMC Environmental Department QA/QC Manual* (most recent version: MPMC 2016c, herein referred to as the "QA/QC Manual", developed for the Mount Polley Mine. This manual provides detailed Standard Operating Procedures (SOPs) and Work Methods (WMs) of the protocols for environmental monitoring at MPMC and is a requirement of the Permit (April 7, 2017: Section 3.8). Procedures described in the manual are consistent with the BC Field Sampling Manual (MoE 2013a). The QA/QC Manual is reviewed and updated as appropriate (at minimum annually) to reflect changes to the ENV procedures and recommendations, and industry best practices. Should the manual be updated, the ENV Environmental Protection Division will be notified within 30 days of implementation as required by the Permit.

The QA/QC Manual protocols include collection of samples by trained personnel using standardized procedures, and use of field notebooks and chain of custody forms for sample documentation and tracking. These protocols are summarized for the different CEMP monitoring components below, where appropriate.

6.3 LABORATORY ANALYSIS

Sample analysis will be conducted at a laboratory registered for the designated parameter under the *Environmental Data Quality Assurance Regulation*. MPMC will participate in QA audits as required by the regulation.

6.4 Data Quality Review and Data Management

A data quality review of results will be conducted, including screening of laboratory QA/QC data, sample integrity issues, detection limits achieved, and metadata accuracy, as well as potential outliers/extreme values. This information will be catalogued in the MPMC sample tracking spreadsheets and the laboratory is contacted if any problem is identified. Water, soil, sediment, and tissue chemistry data as well as weather station data will be uploaded into the MP-5 database using files generated by the analytical laboratory. Accompanying field data will be manually entered and uploaded into the MP-5 database. Original laboratory-produced results files are filed on the MPMC network by date, and are linked to the data stored in the MP-5 database. Field data undergo a QC screening prior to upload and parameter restrictions are in place to reduce the likelihood of a typographical or laboratory reporting error being uploaded.

Non-chemistry data, including toxicity testing results, benthic invertebrate and plankton taxonomy data, and hydrology data (logger downloads and FlowTracker exports) are filed according to year and site on the MPMC network.

6.5 Climate Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.5.1 Section Authors and Study Component Design Professionals

This section was written by MPMC and is guided by Section 3.6 of the Permit (April 7, 2017).

6.5.2 Monitoring Objectives

The objective of the climate monitoring program is to track site weather data to support maintenance of the site water balance, water flow and accumulation predictions, and the design of water management infrastructure. Climate data are also considered important basic site characterization information that inform a number of other activities, such as reclamation revegetation prescriptions or building snow load requirements. Climate monitoring is also required under the Permit Section 3.6 (April 7, 2017).

6.5.3 Monitoring Overview

MPMC maintains two automated HOBO weather stations. Both stations are connected via telemetry allowing real time viewing of weather conditions. Four snow course sites are located around the mine site to target different exposure conditions. Table 6.1 provides an overview of the climate monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.1 shows monitoring locations of the meteorological monitoring locations.

Table 6.1 Climate monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
Weather Station #1	N/A	Continuous monitoring weather station beside tree plots near Mill Site	Logged every 5 minutes	Temperature, wind speed and direction, solar radiation, relative humidity, rainfall	N/A
Weather Station #2	N/A	Continuous monitoring weather station adjacent to the TSF	Logged every 5 minutes	Temperature, wind speed and direction, solar radiation, relative humidity, rainfall	N/A
JCP	N/A	Snow course site located east of the start of the Long Ditch in a clearing	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A
Weather Station #1	N/A	Snow course site located near Weather Station #1	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A
PAG Stockpile	N/A	Snow course site located beside the NW sump	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A
TSF	N/A	Snow course site located near Weather Station #2, near the TSF	End of month and after major snowfall and melting events	Snow depth, snow volume	N/A

Notes: N/A: not applicable, TSF: tailings storage facility, JCP: Joe's Creek Pipe, PAG: potentially acid generating; NW: Northwest

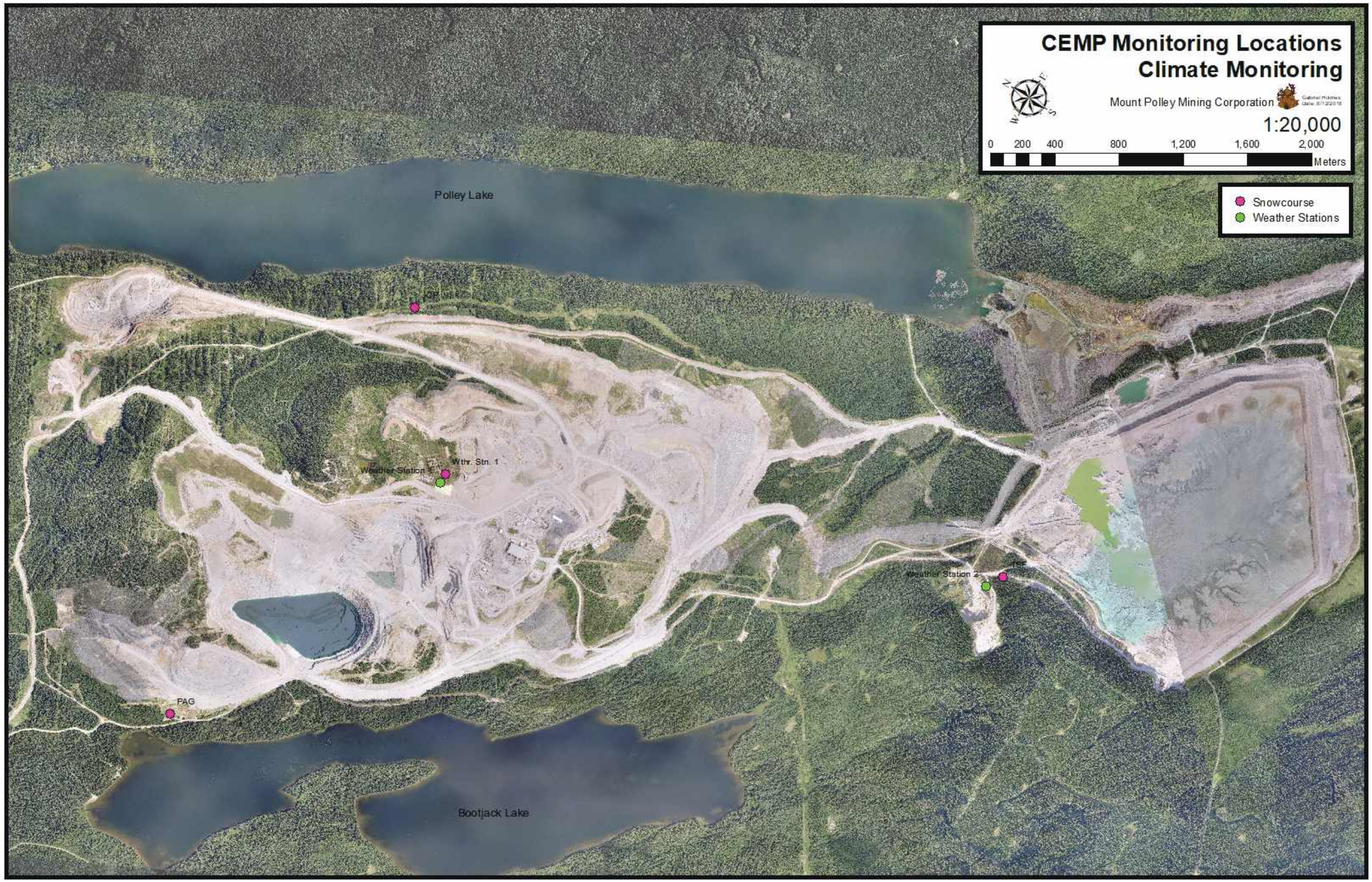


Figure 6.1 CEMP monitoring locations: Climate monitoring

6.5.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Meteorological monitoring will occur as per the SOPs and WMs for Meteorological Data Collection and Snowpack Measurements in the QA/QC Manual. There are two automated HOBO weather stations located on the mine site that continuously record wind speed and direction, precipitation, solar radiation, relative humidity, and temperature. Evaporation is calculated based on data collected from these stations. The data are downloaded from the automated weather stations monthly or as required by remote radio telemetry. If necessary, data are also stored for 30 days on the weather logger and can be downloaded manually using a data shuttle.

The snowpack measurement method will change in 2018 to align with the *Snow Survey Sampling Guide* written by ENV (MoE 2016). A workshop will be given to the Environmental Staff at first snowfall in fall 2018. The SOP and WM for Snowpack Measurements will be updated at this time and submitted to ENV for review.

Table 6.2 is a summary of previous climate monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.2 Summary of climate monitoring

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Two weather stations collect temperature, wind speed and direction, solar radiation, and precipitation data. Snowpack data was collected at four representative snow course sites. The weather and snow course stations are situated to encompass the topographical and geographic range of the mine site.	N/A	N/A
Summary of findings	Weather data collected were compared to site averages. Evaporation was calculated using measured parameters.	N/A	N/A
Recommendations for 2018-2020 monitoring	The snowpack measurement method will be changed to align with the *Snow Survey Sampling Guide*. The program will otherwise continue unchanged because the two current weather stations and snow course sites provide adequate information for the conditions on site.	N/A	N/A

Notes: N/A – not applicable

6.5.5 Data Quality Control, Objectives, and Review

Data ranges are set in the MP-5 database to detect erroneous data collected during station malfunctions. Weather station data that are erroneous (e.g., sensor malfunctions) will be investigated.

6.5.6 Laboratory Analysis

No laboratory analysis is required for climate monitoring.

6.5.7 Data Analysis and Reporting

Climate statistics, including mean, minimum, and maximum temperature, will be calculated and reviewed monthly. Daily evaporation is calculated using the Penman-Monteith equation for open water in the WaSIM software (developed by Cranfield University), based on data collected from the weather stations and site-specific factors, such as weather station elevation. These data are reported annually in the AERR.

6.6 Surface Water Monitoring

Surface water monitoring is characterised below into the following locations: Hazeltine Creek, streams and creeks adjacent to the mine site (receiving environment of the mine site), Bootjack Lake, Polley Lake, Edney Creek, Quesnel Lake, and Quesnel River.

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.6.1 Section Authors and Study Design Professionals

The mine site environmental monitoring was developed during the Environmental Assessment process in 1995, which included input from several QPs. For the purpose of the CEMP, MPMC will continue to monitor with the understanding that this program is well-established to monitor any mine-related effects. The mine site monitoring described below was written by MPMC.

6.6.2 Monitoring Objectives

The objective of water chemistry monitoring in Hazeltine Creek is to evaluate the Hazeltine Creek aquatic environment following the TSF embankment breach and track changes to the aquatic environment over time and/or as a result of implementation of rehabilitation and sediment and erosion control work.

The objective of water chemistry monitoring in streams and creeks adjacent to the mine site, as well as Bootjack Lake and Polley Lake, is to identify water quality changes in waterbodies that run through or are adjacent to the mine site to assess efficacy of the mine water management systems and to stimulate applicable management actions.

The objective of water chemistry monitoring in Polley Lake, Quesnel Lake, and Quesnel River is to support ongoing evaluation of water chemistry following the TSF embankment breach in the downstream environments.

The objective of water chemistry monitoring in Quesnel Lake at the boundary of the initial dilution zone (IDZ) is to verify that the discharge of treated effluent is not causing an exceedance of the applicable ambient BC Water Quality Guidelines at the edge of the IDZ, as required by the Permit, and to verify the discharge model, as described in the ADP.

Monitoring of the far-field receiving environment in Quesnel Lake in the West Basin will be carried out downstream and upstream (for reference) of the mouth of Hazeltine Creek for the verification of the discharge model as described in the ADP.

6.6.3 MONITORING OVERVIEW

Table 6.3 summarizes the parameters analysed for surface water quality. The lake field parameters are measured at each sampling depth and for each limnological profile (excluding Secchi depth, which is taken from the surface of each lake sampling point). Table 6.4 provides an overview of the surface water monitoring. The location "Mine Site" refers to the streams and creeks adjacent to the mine site. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.2 shows monitoring locations of the surface water sampling locations.

Table 6.3 Surface water chemistry parameters

Parameter	LOR	Unit
Field Parameters - Lake		
pH	-	pH
Specific conductance	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Dissolved oxygen	-	%, mg/L
Secchi depth	-	m
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L
EEM Parameters		
Mercury (Hg)-Total	0.000005	mg/L

Notes: LOR: Limit of Reporting; EEM: Environmental Effects Monitoring

Table 6.4 Surface water monitoring overview

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Mine Site	W1	E225084	Morehead Creek	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W4a	E298551	North Dump Creek below Wight Pit Road	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W5	E208039	Bootjack Creek Above Hazeltine Creek	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W8	E216743	NE Edney Creek Tributary	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W8Z	E223292	SW Edney Creek Tributary	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W10	E291209	Lower Edney Creek (upstream of breach impact)	Semi-annually[1]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W12	E216744	6 km Creek at Road	Quarterly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Mine Site	W20	E297070	W20 Creek Tributary to Bootjack Lake	Semi-annually	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Edney Creek	EDC-01	E303014	Lower Edney Creek (remediated reach)	Semi-annually[1]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-10	E303010	Upper Hazeltine Creek at Polley Lake outlet	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-13	E304810	End of Reach 1 in Hazeltine Creek	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-14	pending	Middle Hazeltine Creek upstream of the canyon	Monthly[2]	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-05a	E304510	Upper Hazeltine Creek at Gavin Lake FSR Bridge	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Hazeltine Creek	HAC-08	E303013	Lower Hazeltine Creek at Ditch Road Bridge	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Hazeltine Creek	HAC-01c	E303953	Lower Hazeltine Creek outflow to Quesnel Lake	Monthly	Surface	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Bootjack Lake	B1	E207975	Bootjack Lake deepest area at north end	Semi-annually[3]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
Bootjack Lake	B2	E215897	Bootjack Lake deepest area at south end	Semi-annually[3]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
				Three times annually [10]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Bootjack Lake	B4	E216744	Bootjack Lake (potential zone of influence from seepage from Springer Pit)	For closure only[5]	For closure only[5]	For closure only[5]	-
Polley Lake	P1	E207974	Polley Lake deepest area at north end	Spring overturn, twice in summer, fall overturn, once under ice[6]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
Polley Lake	P2	E207975	Polley Lake deepest area at south end	Spring overturn, twice in summer, fall overturn, once under ice[6]	Surface (0 m), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
				Monthly[4]	Limnological profile	Field parameters - lake	BC WQG - AL
				Three times annually [10]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-58	E304876	Quesnel Lake discharge IDZ	Four times annually[7, 11, 12]	Limnological profile, If plume detected: middle of plume (MP), 5 m above (AP), 5 m below plume (BP) If plume not detected: surface (S), 1 m above thermocline (AT) and 1 m below thermocline (BT) OR mid-depth if no thermocline (MID), bottom (B)	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals, EEM parameter (total mercury)[8]	BC WQG - AL
Quesnel Lake	QUL-57	E304874	Quesnel Lake IDZ	Four times annually[7, 11, 12]	Limnological profile, sample depths as for QUL-58	Field parameters - lake	BC WQG - AL
Quesnel Lake	QUL-59	E304875	Quesnel Lake IDZ	Four times annually[7, 11, 12]	Limnological profile, sample depths as for QUL-58	Field parameters - lake	BC WQG - AL
Quesnel Lake	QUL-18	E303019	Quesnel Lake far-field, downstream of Hazeltine Creek	Four times annually[7, 11]	Limnological profile, 0 m, 20 m, 50 m, 100 m[9]	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-2a	E303020	Quesnel Lake far-field, upstream of Hazeltine Creek (reference)	Four times annually[7, 11]	Limnological profile, 0 m, 20 m, 40 m, 60 m	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals, EEM parameter (total mercury)[8]	BC WQG - AL

Location	Station Name	EMS Code	Description	Frequency	Depths	Parameters Measured	Guidelines
Quesnel Lake	QUL-ZOO-1	E306455	Quesnel Lake in centre of West Basin (zooplankton station)	Three times annually [10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL
Quesnel Lake	QUL-ZOO-7	E306456	Quesnel Lake near Cariboo Island (reference zooplankton station)	Three times annually [10, 11]	Limnological profile, surface	Field parameters - lake, physical tests, anions and nutrients, DOC, total and dissolved metals	BC WQG - AL

Notes: [1] In June and October due to access; [2] May to November only due to restricted access in winter; [3] At spring overturn and late summer; [4] Between spring and fall overturn; [5] Monitoring will depend on closure conditions; [6] if ice and weather conditions meet safety requirements; [7] Taken at evenly spaced time series plus or minus one month; [8] Total mercury will be collected at MID or BT for QUL-58 and at 40 m for QUL-2a as part of EEM four times per year (no less than 1 month apart). Parameter only reported to MDMER; [9] QUL-18 is approximately 110 m deep. 100 m sample depth is collected for historical consistency; [10] Taken in conjunction with plankton sampling (see Section 6.14); [11] When sampling is less frequent than monthly, sampling at Quesnel Lake operational surface water monitoring stations (as identified in Table 6.6) will be undertaken when effluent discharge to Quesnel Lake is discharging. In the event of an unexpected shutdown of the water treatment plant, reasonable efforts will be made to re-sample within the timeframe of the quarterly or other specified time period sampling upon restart of effluent discharge to Quesnel Lake; [12] Samples will be taken at HAD-3 on the same day as samples collected from QUL-57, -58, and -59.

DOC: dissolved organic carbon; BC WQG: British Columbia Water Quality Guidelines; AL: aquatic life; FSR: Forest Service Road; EEM: Environmental Effects Monitoring; IDZ: initial dilution zone

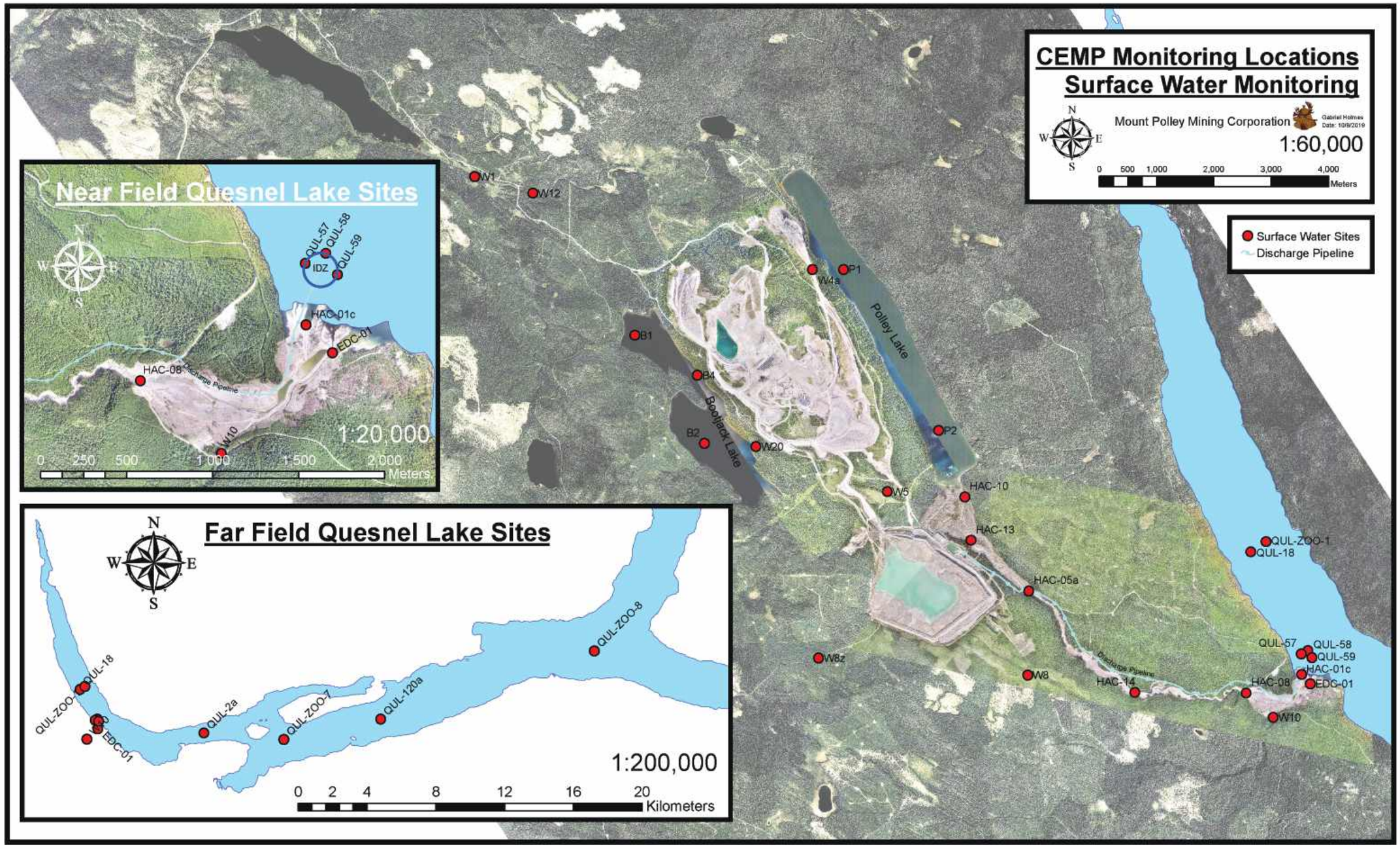


Figure 6.2 CEMP monitoring locations: Surface water monitoring

6.6.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Field parameter collection, sample collection, preparation, and shipping will be conducted following the SOPs and WMs for the associated field meters, Surface Water Quality Monitoring and Lake Water Monitoring, as appropriate as described in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.6.3. Limnological profiles of field parameters will be conducted where described in Table 6.4.

For the edge of the IDZ sampling, limnological profiles of field parameters (specific conductance, temperature, and turbidity) will be carried out in an attempt to identify the location of the plume from the outfall (i.e., direction of flow). MPMC is committed to spending a reasonable level of effort and time to detect the plume and direction of flow. The reasonable level of effort and time will vary depending on the health and safety risks associated with the weather conditions and season. Vertical profiles of field measurements and water chemistry samples will be taken at the inferred centerline of the plume at the edge of the IDZ (station QUL-58).

A plume dispersion model was developed by Golder for the nearfield (i.e., in the vicinity of the IDZ), and a hydrodynamic model of Quesnel Lake has been developed and calibrated by Tetra Tech EBA to predict effluent transfer throughout the West Basin of Quesnel Lake and potential for buildup (Golder 2015b). Monitoring at the near-field station, along with monitoring of other Quesnel Lake receiving environment stations, will be used to verify the near-field and lake-wide hydrodynamic models. It should be noted that the nearfield and the hydrodynamic models, as described in the Long Term Water Management Plan, serve as the basis for the Trigger Response Plan incorporated into the 2018 ADP.

Table 6.5 is a summary of previous surface water monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.5 Summary of surface water monitoring

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Monitoring included streams adjacent to the mine site to determine if there are any changes in water quality. Bootjack and Polley lakes were monitored as receiving environment of the mine. Bootjack Lake was monitored to evaluate potential for exfiltration from Springer Pit. The monitoring sites in Bootjack Lake were moved to two deeper monitoring locations in 2017, as described in the 2016 AERR. For the discharge receiving environment, Quesnel Lake and Quesnel River were monitored.	Post-breach monitoring overlapped with operational monitoring in Polley Lake, Quesnel Lake, and Quesnel River. Monitoring occurred at sites selected to capture major inputs and mixing of Hazeltine Creek. Supplemental sampling of 3 stations flowing into Hazeltine Creek in the Polley Flats area was undertaken to support a geochemical conceptual model in 2016 (SRK and Minnow 2016).	N/A
Summary of findings	The results for the creeks and lakes from 2016-2017 identified no significant trends. No indication of exfiltration from the Springer Pit was found in Bootjack Lake.	Results from Quesnel River show no indications of further effects post-breach since 2016. The 2016 and 2017 results showed that the lower sedimentation pond was effective at decreasing the TSS concentration of Hazeltine Creek. The modelling concluded that 93 to 99% of copper was organically complexed and generally not bioavailable.	N/A
Recommendations for 2018-2020 monitoring	A summary of all changes from the 2016 CEMP is provided in Section 6.6.4.1.	A summary of changes from the 2016 CEMP is provided in Sections 6.6.4.1 and 6.6.4.2.	N/A

Notes: AERR: Annual Environmental and Reclamation Report; N/A: not applicable; TSS: total suspended solids

6.6.4.1 OPERATIONAL MONITORING

Table 6.6 summarizes all changes in operational surface water monitoring form the 2016 CEMP.

Table 6.6 Operational monitoring changes since the 2016 CEMP

Sample Site(s)	Change from 2016 CEMP	Purpose/Justification
W1	Reduced frequency from monthly to quarterly	W1 monitors water quality in Morehead Creek, the outflow of Bootjack Lake. As of time of writing, Springer Pit water level is below 990 masl and no indication of exfiltration from the Springer Pit was found in Bootjack Lake. The monitoring frequency will be reviewed by a QP if Bootjack Lake shows any mine-related changes in the future.
W10	Reduced frequency from monthly to semi annually (in June and October)	The monitoring of this site overlaps with Post-Breach Monitoring as it acts as a reference location for the remediated section of Edney Creek. The reduced frequency aligns with frequency of EDC-01 (see Section 6.6.4.2).
W20	Reduced frequency from quarterly to semi-annually	This creek is not directly influenced by mine activities as mine-affected water is diverted away from this creek catchment. Less intense monitoring is required. The frequency will be reviewed by a QP if Bootjack Lake water quality shows any mine-related changes.
QUL-58	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	Monitoring As per the ADP, QUL-58 monitoring is for model verification.
QUL-57	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	As per the ADP, QUL-57 monitoring is for model verification.
QUL-59	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	As per the ADP, QUL-59 monitoring is for model verification.
QUL-18	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month)	As per the ADP, QUL-18 monitoring is for model verification.
QUL-2a	Reduced frequency from monthly to 4 times per year (taken at evenly spaced time series plus or minus one month) Considered Quesnel Lake reference site	As per the ADP, QUL-2a monitoring is for model verification and is now considered the Quesnel Lake reference site.

Sample Site(s)	Change from 2016 CEMP	Purpose/Justification
QUL-120a	Reduced from seasonally to semi-annually (taken at evenly spaced time series plus or minus one month) No longer considered Quesnel Lake reference site	As per the ADP, QUL-120a monitoring is for model verification.
QUR-1	Continuous monitoring removed	Continuous monitoring was conducted at this site from August 12, 2014 to May 30, 2016. In consultation with ENV, given the lack of variation in the results, continuous monitoring was deemed to be no longer necessary.
QUR-11	Removed	This site is regularly monitored by the provincial and federal government agencies with financial support from MPMC. An annual side-by-side sample will be collected by MPMC at the request of the regulator.
P1, P2	Reduced sampling from monthly to spring overturn, twice in summer, fall overturn, and once in winter under ice Change in sampling depths	The monitoring of these sites overlap with Post-Breach Monitoring. The reduction in monitoring frequency (both sampling and limnological profiles) is because the water quality in Polley Lake appears to be stable. If changes are observed in water quality reflecting breach- or mine-related impacts, frequency of monitoring will be reviewed by a QP. These sample depths align with pre-breach monitoring as agreed upon with ENV staff biologist.
B1, B2	Reduced monitoring of limnological profile from semi-monthly to monthly Change in sampling depths	The reduction in monitoring frequency is because the water quality in Bootjack Lake appears to be stable. If changes are observed in water quality reflecting mine-related impacts, frequency of monitoring will be reviewed by a QP. These sample depths align with pre-breach monitoring as agreed upon with ENV staff biologist.

Notes: CEMP: Comprehensive Environmental Monitoring Plan; masl: meters above sea level; QP: Qualified Professional; ADP: Annual Discharge Plan

6.6.4.2 POST-BREACH MONITORING

Table 6.7 summarizes all changes in operational surface water monitoring form the 2016 CEMP.

Table 6.7 Post-breach monitoring changes since the 2016 CEMP

Sample Site(s)	Change from 2016 CEMP	Purpose/Justification
HAC-13	Reduced from weekly to monthly	This site used to be upstream of the Hazeltine Creek Discharge and was monitored under the EEM. Currently, this site monitors water quality in Hazeltine Creek after Reach 1. Monitoring frequency has been reduced to align with other Hazeltine Creek samples.
HAC-14	Added	This site was added to monitor effects of remediation activities on Hazeltine Creek water quality. The frequency aligns with other Hazeltine Creek samples.
HAC-12	Removed	In consultation with ENV (C. Danyluk, personal communication, February 8, 2018), this site has been removed as it is no longer necessary with the connection of the pipeline from the WTP to the diffusers.
HAC-01c	Added	This site represents Hazeltine Creek water quality before entering Quesnel Lake. The frequency aligns with other Hazeltine Creek samples.
EDC-01	Reduced from monthly to semi-annually	No significant trends have been identified at EDC-01. Because of reduced site access in winter and stable water quality, sampling frequency has been reduced to semi-annually.

Notes: CEMP: Comprehensive Environmental Monitoring Plan; EEM: Environmental Effects Monitoring; ENV: BC Ministry of Environment and Climate Change Strategy; WTP: Water Treatment Plant

6.6.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all surface water monitoring (i.e., operational, post-breach, reclamation) is summarized in Table 6.8.

Table 6.8 Water chemistry QC sample frequencies for surface water monitoring

QC Samples	Frequency
Duplicate samples	10% of surface water samples
Equipment blanks	Monthly per piece of equipment (when used)
Trip blanks	Twice per month
Field blanks	Twice per month
Filter blanks	Quarterly
Deionized water blanks	Annually
Laboratory replicate[1]	Annually

Note: [1] Split sample

For results greater than five times the method detection limit (MDL), a relative percent difference (RPD) will be used to identify differences between original and duplicate samples. These data quality objectives (DQOs) are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

6.6.6 Laboratory Analysis

Samples will be submitted to and processed by a Canadian Association of Laboratory Accreditation (CALA) accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.6.7 Data Analysis and Reporting

In Hazeltine Creek, data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, maximum, and 95th percentile values over the period of interest) and evaluation of any spatial (e.g., down the creek) and temporal changes or trends. Results will also be compared to the BC aquatic life WQGs.

In the other surface water monitoring sites, statistical analysis will be carried out to compare data to reference sites and to assess trends over time. Results will also be compared to the BC aquatic life WQGs.

6.7 Hydrology Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.7.1 Section Authors and Study Design Professionals

This section was written by MPMC, and is guided by Section 3.4 of the Permit (April 7, 2017).

6.7.2 MONITORING OBJECTIVES

The objective of hydrological monitoring in Hazeltine Creek is to characterize the hydrology of the Hazeltine Creek system, assess fish habitat (only in reaches accessible to fish), interpret water quality and water balance, and evaluate changes over time as rehabilitation works are carried out and system recovery occurs (e.g., establishment of riparian vegetation).

The objective of hydrological monitoring in Edney Creek is to characterize the hydrology of Edney Creek in the remediated section, asses fish habitat, interpret water quality, and evaluate changes over time as rehabilitation works are carried out and system recovery occurs (e.g., establishment of riparian vegetation).

The objective of the hydrological monitoring of the streams and creeks that run through or adjacent to the mine site is to characterize the hydrology of the drainages, interpret water quality, and evaluate any changes over time.

6.7.3 MONITORING OVERVIEW

MPMC maintains eight hydrology stations as required by the Permit. Table 6.9 provides an overview of the hydrology monitoring. No large changes have been made from the 2016 CEMP, but wording has been changed to more align with the wording in Section 3.4 in the Permit. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.3 shows monitoring locations of the hydrology monitoring locations.

Staff gauges will be benchmarked (calibrated) once per year between June 15 and August 31, as defined by the Permit. Staff gauge readings will be recorded during water chemistry sampling events at the associated stations and each manual flow measurement. Note that there is currently no staff gauge installed at station W4a (North Dump Creek), as it is a very low flow creek; however, as recommended by WaterSmith Research Inc. (WaterSmith; Appendix K in MPMC 2016e), MPMC will endeavor to install a staff gauge at this location that provides adequate information. Continuous stage monitoring equipment (pressure transducers) will be installed at hydrometric locations specified in Table 6.9 during non-freezing conditions.

Manual flow gaugings will be conducted at all sites during high, moderate, and low flows in non-freezing conditions. These measurements will be conducted at minimum three times per year for validation of the stage-discharge rating curves. If stage-discharge stability is not demonstrated, the frequency of monitoring will be increased to five times per year during the non-freezing period (across the spectrum of high to low flows) to meet Resources Information Standards Committee Grade A standards for hydrometric monitoring (MoE 2009). Due to site characteristics and difficult operating conditions, often the sites meet Grade B/C standards. MPMC will continue to work with a QP to move toward meeting Grade A standards for all hydrological stations. A stage discharge curve that encompasses the non-freezing period flows will be maintained for all hydrological stations with staff gauges.

Table 6.9 Hydrology monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
H4	-	Upper Hazeltine Creek at Polley Lake outlet	Continuous[1]	Water head pressure, temperature	N/A
			Weekly (daily during high runoff periods)	Stage (staff gauge)	Permit 11678
			Monthly[1]	Manual flow gauging	
H1	-	Upper Hazeltine Creek hydrometric station (at Gavin Lake FSR Bridge)	Continuous[1]	Water head pressure, temperature	Permit 11678
			Monthly[1]	Stage (staff gauge)	
			Monthly[1]	Manual flow gauging	
H2	-	Lower Hazeltine Creek hydrometric station (downstream of the Ditch Road Bridge)	Continuous[1]	Water head pressure, temperature	Permit 11678
			Monthly[1]	Stage (staff gauge)	
			Monthly[1]	Manual flow gauging	
W1b	E291449	Morehead Creek	Water quality sample and when flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated)	
W4a	E298551	North Dump Creek below Wight Pit Road	Monthly[1]	Manual flow gauging	Permit 11678
W5	E208039	Bootjack Creek Above Hazeltine Creek	Water quality sample and when flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate, and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated); only when sufficient flow	

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
W12	E216744	6 km Creek at Road	Water quality sample; when flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated)	
H3	-	Lower Edney Creek	Continuous[1]	Water head pressure, temperature	N/A
			When flows are measured[1]	Stage (staff gauge)	Permit 11678
			High, moderate and low flows[1]	Manual flow gauging (3 time/year; 5 times if rating curve stability not demonstrated)	

Notes: [1] In non-freezing conditions; N/A: not applicable

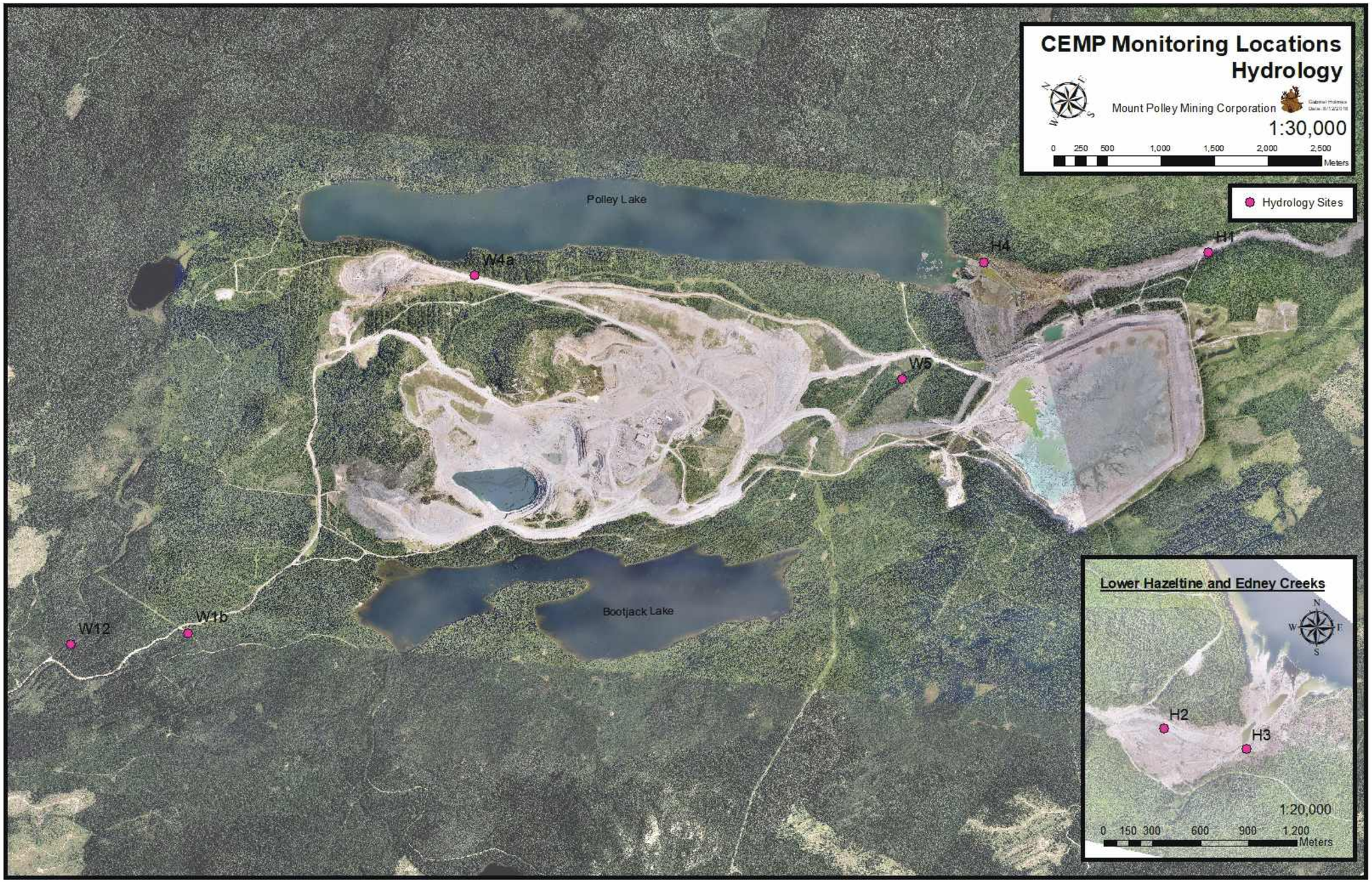


Figure 6.3 CEMP monitoring locations: Hydrology monitoring

6.7.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Hydrological monitoring will be conducted as per the SOPs and WMs for Hydrological Monitoring (which includes installing and downloading continuous loggers) and Benchmarking, as well as the specific WM for operating the FlowTracker acoustic Doppler velocity meter.

Note that some streams do not flow year-round; if there is no flow and a sample or measurement cannot be taken as scheduled, the attempt will be documented in the field notebook.

To verify the accuracy of established rating curves (i.e., confirm that the channel morphology at the station and outflow control point have not changed) and, where possible, extend the upper and lower bounds of the curves, manual flow gaugings will be taken according to Table 6.9 in non-freezing conditions. Manual flow monitoring requirements will be re-evaluated each year, following refinement of the stage-discharge rating curves.

Table 6.10 is a summary of previous hydrology monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.10 Summary of hydrology monitoring and findings

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	W1b, W5, and W12 were established prior to 2014. W4a was established in 2014. More detail for each site is provided in Section 6.7.4.1.	H1 and H2 hydrology sites were established in 2015, when channeling of Hazeltine Creek was completed. H4 hydrology site was established in 2016 in the remediated section of upper Hazeltine Creek. H3 hydrology site in the remediated section of Edney Creek was established in 2015. More detail of each station is provided in Section 6.7.4.2.	N/A
Summary of findings	Manual measurements were used to confirm and refine rating curves.	Manual measurements confirmed the rating curves for H1, H2, and H3. Increased manual measurements for H4 will confirm the ratings curve.	N/A

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	Post-Breach	Reclamation
Recommendations for 2018-2020 monitoring	Manual measurements will be collected to confirm the rating curves. One hydrology station is not configured for staff gauge and its establishment will be explored.	Continuous monitoring of levels will continue using the established rating curve. Manual measurements will be collected to confirm the rating curves.	N/A

Notes: N/A: not applicable

6.7.4.1 Operational Monitoring

Table 6.11 summarizes the operational hydrology sites. Flows around the MPMC site are freshet driven; therefore, many hydrology stations are low flow during the rest of the year and cannot be measured. No continuous monitoring devices are installed at these sites due to the very low flow nature of the creeks.

Table 6.11 Summary of operational hydrology sites

Site	Comment
W1b	Site W1b was established in 2012. Benchmarking of this station has occurred annually. In 2016, WaterSmith made significant changes to the site and a new stage-discharge curve was developed. MPMC will continue to conducted manual measurements to confirm the rating curve.
W4a	Site W4a was established downstream, and replaced site W4 in 2014. Only manual bucket flow measurements are recorded from a constructed pipe weir at this site and will continue until recommendations for installation of a staff gauge are explored.
W5	Site W5 at Bootjack Creek was re-established in 2008. Benchmarking of this station has occurred annually. A new staff gauge was installed in 2016 by WaterSmith and a new stage-discharge curve was developed. MPMC will continue to conducted manual measurements to confirm the curve.
W12	Site W12 was established in 1990. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. MPMC will continue to conducted manual measurements to confirm the curve.

Notes: WaterSmith: WaterSmith Research Inc.; MPMC: Mount Polley Mining Corporation

6.7.4.2 Post-Breach Monitoring

Table 6.12 summarizes the post-breach hydrology sites.

Table 6.12 Summary of post-breach monitoring hydrology sites

Site	Comment
H1	Site H1 was established in upper Hazeltine Creek in 2015. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the rating curve.
H2	Site H2 was established in upper Hazeltine Creek in 2015. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the rating curve.
H3	Site H3 was established in the remediated area of lower Edney Creek in 2015. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the curve.
H4	Site H4 was established in upper Hazeltine Creek at the Polley Lake Weir in 2016. Benchmarking of this station has occurred annually. A new stage-discharge curve was developed in 2016. A continuous monitoring device will be installed at this station to provide continuous water head pressure measurements during non-freezing periods. In addition, MPMC will continue to conducted manual measurements to confirm the curve.

Notes: MPMC: Mount Polley Mining Corporation

6.7.5 Data Quality Control, Objectives, and Review

The FlowTracker has built in error messages associated with measurements that are outside of set QC bounds, and reports an International Standard Calculation error and statistical (US Geological Survey calculation) error output following each discharge measurement as a QC measure.

Benchmarking, as described above and as per the protocol in the QA/QC Manual, will occur annually between June 15 and August 31 as per the Permit, or as described by the Permit.

Routine monitoring includes inspections of equipment, including stilling wells and loggers (e.g., to identify sedimentation inside the stilling well or debris build up in logger ports). Identification of potential station changes or issues also occurs through data analysis when data are inconsistent or unusual in comparison with previously collected data.

6.7.6 Laboratory Analysis

No laboratory analysis is required for hydrology monitoring.

6.7.7 Data Analysis and Reporting

Data analysis will include building and validating the stage-discharge rating curves, as well as production of annual hydrographs. These will be presented in the AERR.

6.8 GROUNDWATER MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.8.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC.

6.8.2 MONITORING OBJECTIVES

The primary objective of the groundwater monitoring program on the mine site is to determine the direction, volume, and quality of groundwater flow from the mine site and other disturbed areas to receiving environment.

6.8.3 MONITORING OVERVIEW

Groundwater monitoring wells around the mine site are installed in the area around the TSF, the Springer Pit, downstream of waste rock dumps and haul roads, and in other areas on or surrounding the mine. The monitoring program was developed on the recommendation of the groundwater program review by Golder conducted in March 2016. This review was submitted to ENV on March 31, 2016. An annual review of the groundwater monitoring program was also conducted by Golder in March 2017 and was submitted as Appendix F in the 2017 AERR (MPMC 2018). Recommendations from the 2017 review have been incorporated into the monitoring program outlined below. Sampling events at times of maximum and minimum hydrologic conditions to account for seasonal variability will be conducted when appropriate (i.e., spring and late summer/fall). Static water level (SWL) of all wells will be monitored on the same day at minimum once annually to allow for comparison across the site.

Groundwater monitoring wells were also installed along the Hazeltine Creek in 2015 and 2016. From Golder (2017), groundwater "was not screened for the terrestrial risk assessment because wildlife do not consume groundwater". Monitoring of surface water in Hazeltine Creek captures the potential effects of groundwater discharged to the Hazeltine Channel system (Golder 2017; see Section 6.6). No further monitoring is planned at these groundwater wells.

Table 6.13 summarizes the parameters analysed for groundwater quality. Table 6.14 provides an overview of the groundwater monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.4 shows monitoring locations of the groundwater sampling locations.

Table 6.13 Groundwater chemistry parameters

Parameter	LOR	Unit
Field Parameters		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L

Parameter	LOR	Unit
Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Notes: LOR: Limit of Reporting

Table 6.14 Groundwater monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
GW96-2a	E229681	Tailings Impoundment East Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-2b	E229682	Tailings Impoundment East Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-3a	E229683	Tailings Impoundment SE Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW96-4a	E229685	Tailings Impoundment SW Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW96-4b	E229686	Tailings Impoundment SW Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW96-7	E229690	SE Sed Pond Well	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-1a	E242385	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-1b	E242384	Tailings Impoundment West Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW00-2a	E242387	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-3a	E242389	Tailings Impoundment West Well (deep)	Annually[1]	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly[1]	SWL	N/A
GW00-3b	E242388	Tailings Impoundment West Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
95-R-5	E229695	Lower SERDS Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW05-01	E258923	Wight Pit/Polley Lake Interface Well	Quarterly[2]	Field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-1a	E291210	Below Temporary PAG Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-1b	E291211	Below Temporary PAG Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-2a	E291212	Below SERDS (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW11-2b	E291213	Below SERDS (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-1a	E291969	NW of Temporary PAG Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-1b	E291970	NW of Temporary PAG Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-2a	E291971	Springer Pit Well (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous	SWL (level logger installed in well)	N/A
GW12-2b	E291972	Springer Pit Well (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous	SWL (level logger installed in well)	N/A
GW12-3a	E291973	Below Waste Haul Road (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-3b	E291974	Below Waste Haul Road (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-4a	E291976	Below NEZ Dump (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-4b	E291977	Below NEZ Dump (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-5a	E291978	Below Wight Pit Road (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW12-5b	E291979	Below Wight Pit Road (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW14-1	E301973	Groundwater well at New Orica Site	Quarterly[2]	Field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW15-1a	E303210	Springer Pit Well North (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous[3]	SWL (level logger installed in well)	N/A
GW15-1b	E303211	Springer Pit Well North (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Continuous[3]	SWL (level logger installed in well)	N/A
GW15-2a	E303212	Springer Pit Well South (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Weekly	SWL (if required under the Springer Pit Response Plan)	N/A

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
GW15-2b	E303213	Springer Pit Well South (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Weekly	SWL (if required under the Springer Pit Response Plan)	N/A
GW16-1a	E308529	Below SERDS (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-1b	E308530	Below SERDS (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-2a	E308531	Tailings Impoundment North Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-2b	E308532	Tailing Impoundment North Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-3a	E308533	Tailings Impoundment SE Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-3b	E308534	Tailings Impoundment SE Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-4a	E308535	Tailings Impoundment S Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-4b	E308536	Tailings Impoundment S Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-5a	E308537	Tailings Impoundment W Well (deep)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
			Quarterly	SWL	N/A
GW16-5b	E308538	Tailings Impoundment W Well (shallow)	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-6a	E308539	West of Cariboo Pit (deep)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-6b	E308540	West of Cariboo Pit (shallow)	Quarterly	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-7	E308541	Between Wight Pit and Polley Lake	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG
GW16-8	E308542	Between Wight Pit and Polley Lake	Semi-annually	SWL, field parameters, physical tests, anions and nutrients, dissolved metals	CSR Schedule 3.2 AL Standards; BC WQG

Notes: [1] Wells show stable chemistry. If an unexpected change in SWL is observed, well water will be sampled; [2] Wells provide domestic water for personnel; BC WQG – British Columbia water quality guideline; SWL: static water level; CSR: Contaminated Sites Regulations; AL: aquatic life; [3] Leveloggers have been removed from GW15-1a and 1b as wells are dry. Leveloggers will be reinstalled once water is above well screen.

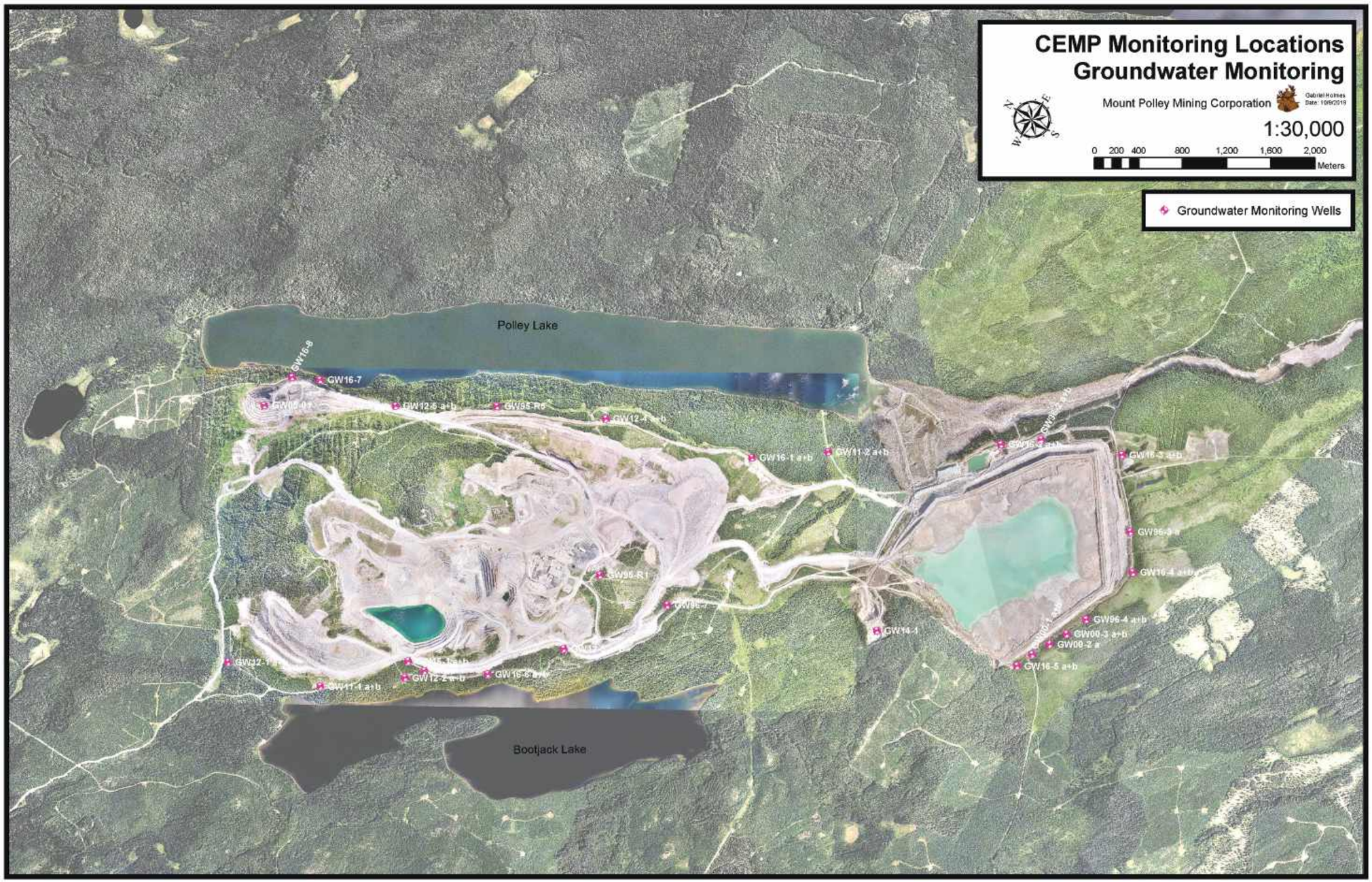


Figure 6.4 CEMP monitoring locations: Groundwater monitoring

6.8.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

As outlined in the SOPs, groundwater monitoring involves use of an automated depth to water meter to measure SWL and a submersible pump powered by a generator for sampling. These protocols also require routine inspections of the well housing.

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Groundwater Monitoring and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.8.3.

Table 6.15 is a summary of previous groundwater monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.15 Summary of groundwater monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Groundwater locations in both shallow and deep bedrock downstream of mine activities. Higher frequency monitoring occurred at wells near the Springer Pit in 2015, 2016, and 2017 because the pit water level was above 1025 masl. Dredging of the Springer Pit commenced in 2017, and the water level in the pit is less than 1000 masl at the time of writing.	An updated groundwater program was implemented for the ERA (Golder 2017). Wells installed in 2015 were resampled and additional wells were installed along the creek in 2016. Groundwater was analyzed for dissolved metals, TSS, pH, anions, nutrients, hardness and acidity.	N/A
Summary of findings	Monitoring of the groundwater wells near the Springer Pit showed exfiltration from the Springer Pit towards Bootjack Lake occurred during 2016. This exfiltration was reversed after the Springer Pit was dewatered, which was confirmed by continued monitoring of these wells. No groundwater leakage from Springer Pit to Bootjack Lake in 2107 was inferred based on the levels measured. No significant changes to groundwater quality were identified in the 2017 annual groundwater review (MPMC 2018).	Although copper was the primary metal of concern in the tailings outwash material deposited in Hazeltine Creek, groundwater copper concentrations were lower than the CSR standard. Other substances that exceeded CSR standards are believed to be associated with natural conditions and were not derived from the tailings.	N/A
Recommendations for 2018-2020 monitoring	New groundwater wells were drilled at the end of 2016 as per recommendations in the Groundwater Program Review. These wells were incorporated into the current program in 2017. One pair of wells was removed due to likely contamination and were replaced (see Golder 2016c). See Section 6.8.4.1 for more detail on the recommendations for future monitoring.	No further sampling is planned for groundwater in Hazeltine Creek. If the water quality declines in the creek, monitoring of these wells will be reviewed and considered.	N/A

Notes: masl: metres above sea level; CSR: Contaminated Sites Regulation; ERA: ecological risk assessment; TSS: total suspended solids

6.8.4.1 OPERATIONAL MONITORING

The monitoring frequencies of the Springer Pit wells were decreased from monthly to quarterly due to the ongoing dewatering at Springer Pit, which has resulted in a significant drop in water levels in some of these wells. For example, dataloggers have been removed from GW15-1a and b as these wells are now dry (J. Foley, personal communication, August 10, 2018). According to J. Foley, "due to the ongoing dewatering at Springer Pit, Golder would consider it acceptable to move to quarterly monitoring, if groundwater is present within the wells." Once dewatering stops and the pit is refilled, consideration to move back to monthly monitoring for a period of time will be given.

A further change to the recommendations put forth in Appendix F of MPMC (2018) is that "quarterly groundwater monitoring should continue at GW16-6 a and b, but semi-annual monitoring can be completed at the remaining GW16 well series. Note that some of the remaining 2016 well series (other than GW16-6 a/b) were monitored one to three times in the 2017 calendar year" (J. Foley, personal communication, August 10, 2018).

6.8.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all the groundwater monitoring is summarized in Table 6.16.

Table 6.16 Water chemistry QC sample frequencies for groundwater water monitoring

QC Samples	Frequency
Duplicate samples	10% of groundwater samples
Equipment blanks	Quarterly per piece of equipment (when used)
Trip blanks	Quarterly/semi-annually[1]
Field blanks	Quarterly/semi-annually[1]

Notes: [1] Quarterly for quarterly groundwater samples, semi-annually for semi-annual groundwater samples (i.e., six per year)

For results greater than five times the MDL, an RPD will be used to identify differences between original and duplicate samples. These DQOs are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

6.8.6 LABORATORY ANALYSIS

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC for chemistry samples, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.8.7 Data Analysis and Reporting

Data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, maximum, and 95th percentile values over the period of interest) and evaluation of water chemistry or water level changes and/or trends. Groundwater chemistry will be compared to the Schedule 3.2, Column 3 (Aquatic Life) standards in the ENV Contaminated Sites Regulation (CSR) under the EMA, and BC WQGs per Technical Guidance 15 (MOE 2017a). These data will also be used by a third party qualified professional for the three-year groundwater monitoring program review, and updates to hydrogeological models, including the Springer Pit groundwater model. Hazeltine Creek groundwater data will be used to support the geochemical characterization of materials in the Hazeltine Creek corridor.

6.9 Contact Water Quality Monitoring

Monitoring in this subsection falls under BC *Mines Act* M-200 and is only described here for completeness. Monitoring is summarized and changes will be presented in the CEMP, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A).

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.9.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.9.2 Monitoring Objectives

The objective is to monitor trends in contact water quality on site, including runoff and mill process water, specifically at locations that represent the WTP source water. These data are applied to understand trends in site water chemistry and inform water management planning, including water discharge strategies.

6.9.3 Monitoring Overview

Table 6.17 summarizes the parameters analysed for contact water quality. Table 6.18 provides an overview of the contact water monitoring. Figure 6.5 shows monitoring locations of the contact water sampling locations.

Table 6.17 Contact water chemistry parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Notes: LOR: Limit of Reporting

Table 6.18 Contact water monitoring overview

Station Name	EMS Code	Description	Drainage	Inspection Frequency	Sample Frequency	Parameters Measured	Guidelines	Permit[1]
E1a	E225309	TSF Supernatant	Tailings slurry, seepage collection ponds	Daily	Quarterly[2]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
Long Ditch	-	Long Ditch	East RDS, NEZ Dump, SERDS, Wight Pit dewatering	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
SERDS Ditch	-	SERDS Ditch	SERDS, West Ditch, MDC Sump	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E13	-	NW Sump	Temporary NW PAG Stockpile	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E14	-	Mine Drainage Creek Sump	Upper Mine Drainage Creek, West Ditch	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E15	-	Bootjack Creek Culvert Sump	TSF Haul Road, Upper Bootjack Creek	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E17	-	9km Sump	Temporary NW PAG Stockpile	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E4	-	Main Embankment Seepage Collection Pond	MTD, STD, Main Embankment foundation drains	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
E18	-	Central Collection Sump	Long Ditch, SERDS Ditch	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
East MTD	-	East Main Toe Drain	East TSF Main Embankment toe drain	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
West MTD	-	West Main Toe Drain	West TSF Main Embankment toe drain	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
STD	-	South Toe Drain	TSF South Embankment toe drain	Monthly	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	BC *Mines Act* Permit M-200
Gavin's Ditch	-	-	Undisturbed area east of Polley Mountain	Semi-annually	Semi-annually[3]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	Permit 11678[4]
TSF Clean Water Diversion	-	-	Undisturbed area west of TSF	Semi-annually	Semi-annually[3]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	Permit 11678[4]
Wight Pit Clean Water Diversion	-	-	Undisturbed area north of Wight Pit	Semi-annually	Semi-annually[3]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A	Permit 11678[4]

Notes: [1] Permit regulating the sample; [2] When reclaim water is sourced from TSF; [3] In spring and fall, coinciding with ditch inspections; [4] Under Section 2.4.1 of Permit 11678, surface runoff from undisturbed areas must be diverted away from mine workings. These clean water ditches are monitored to ensure water quality is maintained; N/A: not applicable; TSF: Tailings Storage Facility; PAG: potentially acid generating

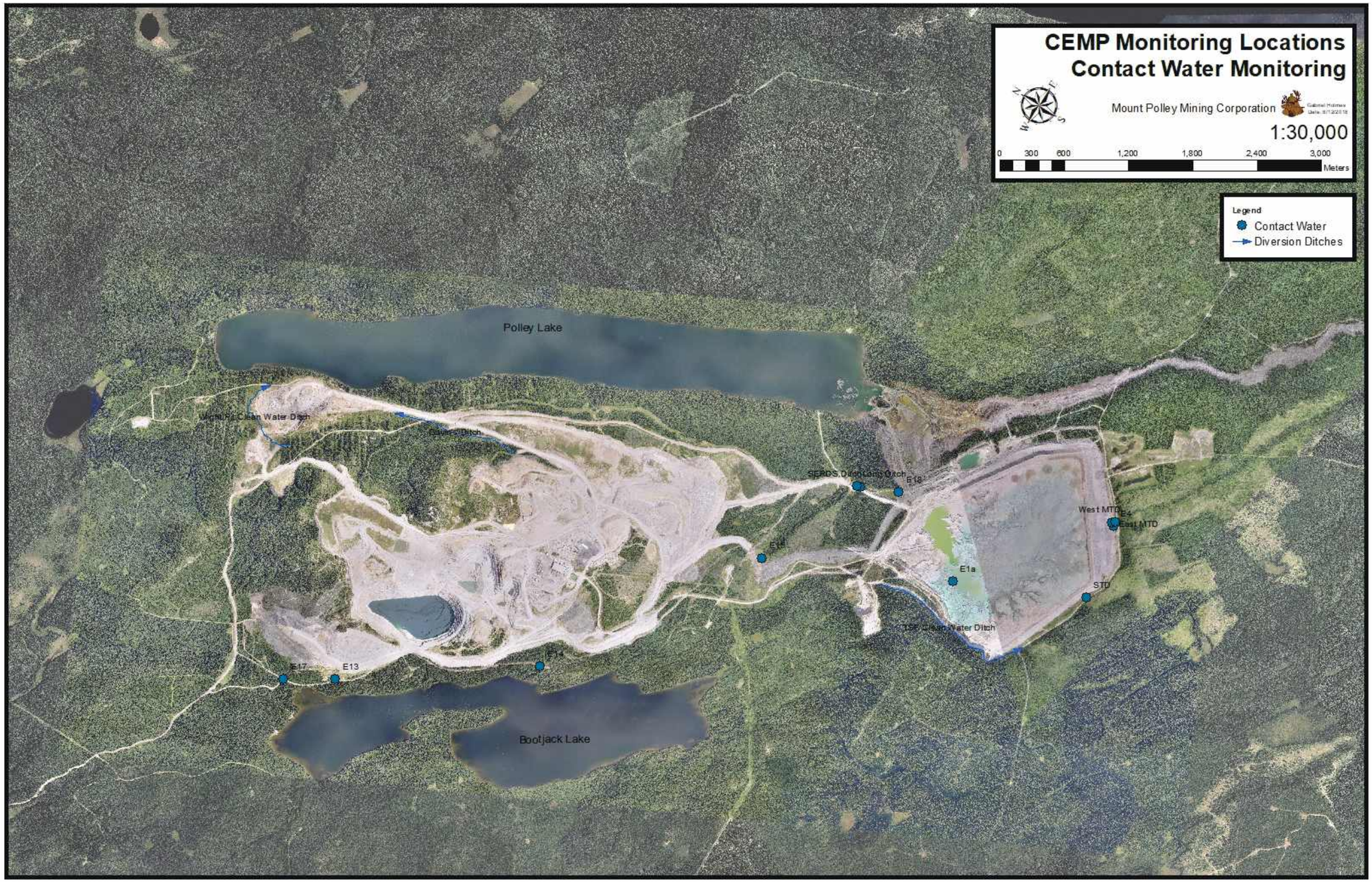


Figure 6.5 CEMP monitoring locations: Contact water monitoring

6.9.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Surface Water Quality Monitoring, and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.9.3.

Table 6.19 is a summary of previous contact water monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.19 Summary of contact water monitoring and findings

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Sumps that collect and temporarily store water as well as ditches that convey water from many different sources were monitored.	N/A	N/A
Summary of findings	There were no notable trends in 2017 contact water monitoring that suggested the monitoring program needs to be changed.	N/A	N/A
Recommendations for 2018-2020 monitoring	The Springer Pit Sump (E11) is no longer representative of the pit lake water quality and has not been the source of influent for the WTP since 2016. Tailings supernatant (E1a) is also not the source for the WTP. Therefore, these sites has been removed from monitoring under the Permit; E11 continues to be monitored under the *Mines Act* Permit M-200 (see Section 6.10).	N/A	N/A

Notes: N/A: not applicable; WTP: Water Treatment Plant

6.9.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all contact water monitoring is summarized in Table 6.20. For results greater than five times the MDL, an RPD will be used to identify differences between original and duplicate samples. These DQOs are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

Table 6.20 Water chemistry QC sample frequencies for contact water monitoring

QC Samples	Frequency
Duplicate samples	10% of contact water samples
Trip blanks	Combined with surface water QC schedule
Field blanks	Combined with surface water QC schedule

6.9.6 Laboratory Analysis

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.9.7 Data Management and Analysis

Data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, maximum, and 95th percentile values over the period of interest). These data, including spatial and temporal trends in relation to mine features and their geochemistry, will be used in long-term water management planning (Section 5.1).

6.10 Seep Monitoring

Monitoring included in this subsection fall under BC *Mines Act* Permit M-200 and is only described here for completeness. Monitoring is summarized and changes will be presented in the CEMP, but changes to this monitoring are subject to BC *Mines Act* Permit M-200 and not Section 7 in the CEMP or Section 5 in the CEMP TOR (Appendix A).

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.10.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.10.2 Monitoring Objectives

An important component in determining and monitoring long-term chemical stability of drainage from the pits and waste rock dumps is water quality monitoring. The seep sampling is conducted under the BC *Mines Act* Permit M-200.

6.10.3 MONITORING OVERVIEW

Under the BC *Mines Act* Permit M-200 seepage monitoring program, monitoring of waste rock dump seepages is conducted under a bi-annual seep survey program of all waste rock dumps on site, with representative seeps being monitored more frequently when possible (numerous seeps stop flowing during dry periods). Table 6.21 summarizes the parameters analysed for seepage water quality. A list of dumps and pits that are sampled, along with the representative sample locations, is provided in Table 6.22 and Table 6.23, respectively. Figure 6.6 shows monitoring locations of the seepage sampling locations.

Table 6.21 Seepage water chemistry parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Notes: LOR: Limit of Reporting

Table 6.22 Seep monitoring overview

Waste Rock Dump	Representative Sample	Representative Sample Frequency	Parameters Measured	Guidelines
North Bell Dump	Joe's Creek Pipe	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Boundary Dump	Boundary Seep 2	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
East RDS	-	-	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
NEZ Dump	NEZ Seep 1	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Waste Haul Road	Mine Drainage Creek Culvert	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Temporary NW PAG Dump	PAG Seep 15	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
TSF Haul Road	-	-	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
SERDS	SERD Seep 13	Quarterly	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A

Table 6.23 Pit seepage monitoring overview

Pit	Station Name	Sample Frequency	Parameters Measured	Guidelines
Cariboo Pit	E8	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Wight Pit	E10	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Springer Pit	E11	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
Boundary Pit	Boundary Pit	Semi-annually[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A

Notes: [1] When pit is not storing water from other sources on site

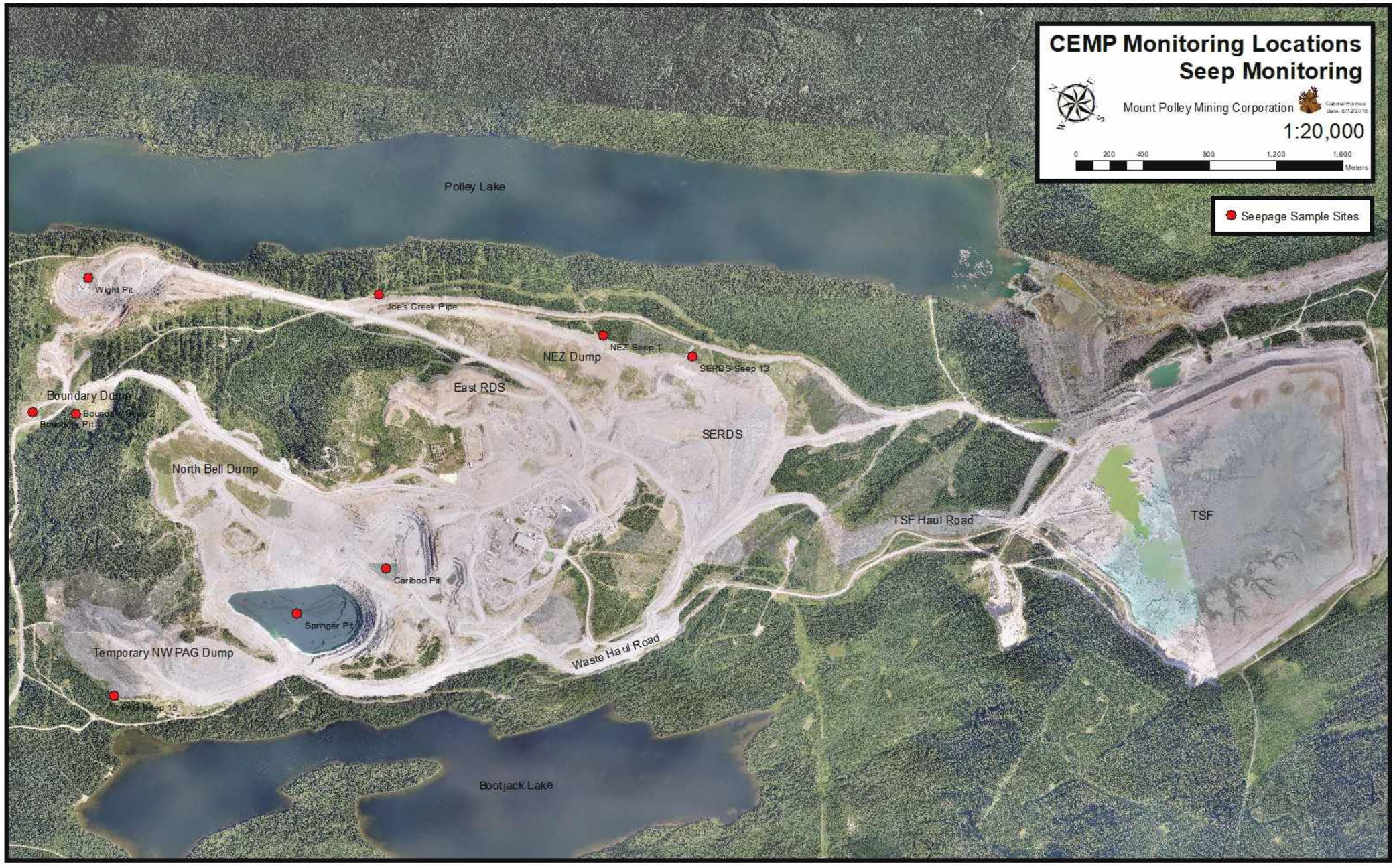


Figure 6.6 CEMP monitoring locations: Seep monitoring

6.10.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Surface Water Quality Monitoring, and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed as described in Section 6.10.3.

Table 6.24 is a summary of previous seep monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.24 Summary of seep monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	N/A	N/A	Seeps were sampled at the toe of waste rock piles and from pits that are not storing water from other locations.
Summary of findings	N/A	N/A	The results are used to inform long-term planning for reclamation and closure. It has been identified that two seeps from the NEZ Dump have elevated metal concentrations. See Section 6.10.4.1 for more detail.
Recommendations for 2018-2020 monitoring	N/A	N/A	The program will continue unchanged because bi-annual monitoring (i.e., in spring and fall) captures representative conditions.

Notes: N/A: not applicable; NEZ: North-East Zone

6.10.4.1 RECLAMATION AND CLOSURE MONITORING

NEZ Seep 1 and NEZ Seep 2 have elevated metal concentrations compared to other seeps on site. To address this, research into the source of the elevated metals has been launched, as well as possible treatment options. A new collection system for these two seeps has been constructed to isolate the water from the mine site collection infrastructure; this water will be pumped to the mill for the short-term while the research is conducted.

6.10.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. A combined QC schedule for all seep monitoring is summarized in Table 6.25.

Table 6.25 Water chemistry QC sample frequencies for seep monitoring

QC Samples	Frequency
Duplicate samples	10% of seep monitoring samples
Trip blanks	Quarterly/Semi-annually[1]
Field blanks	Quarterly/Semi-annually[1]

Notes: [1] Quarterly for quarterly sampling events; semi-annually for semi-annual sampling events

For results greater than five times the MDL, an RPD will be used to identify differences between original and duplicate samples. These DQOs are the same as the RPDs used by the lab. If one or both results are less than five times the MDL, a difference between original and duplicate samples greater than two times the MDL is used to identify differences. Blanks in which any parameters exceed the reported MDL will be flagged.

6.10.6 Laboratory Analysis

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

6.10.7 Data Analysis and Reporting

Collection of this data is used in long-term effluent water quality predictions. These results are presented in the AERR and are applied to understand long-term ML/ARD potential, develop site source terms, and inform water management planning.

6.11 Effluent Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.11.1 Section Authors and Study Design Professionals

This section was written by MPMC.

6.11.2 MONITORING OBJECTIVES

The objective of the effluent monitoring program is to verify the water chemistry complies with the applicable regulatory limits at the point of discharge (MDMER Schedule 4 and the Permit limits in Table 6.26; see Section 1.2.3 in the Permit), and that the discharge flow rate does not exceed the permitted rates of a maximum of 52,000 m^3/day and an annual average of 29,000 m^3/day (see Section 1.2.1 in the Permit). The influent is also sampled to allow for analysis of treatment efficacy.

6.11.3 MONITORING OVERVIEW

The flow rate, temperature, and TSS of the effluent will be continuously monitored and recorded in the Veolia WTP HMI. MPMC may consider less frequent sampling (MDMER minimum is quarterly) if the monthly mean concentrations of parameters are <10% of the MDMER guidelines for 12 months, as described Section 13 (1) of the MDMER. To make this change if these conditions are met, MPMC will follow the process outlined in Section 7. Table 6.27 summarizes the parameters analysed for effluent quality and Table 6.28 provides an overview of the effluent monitoring. Further details of monitoring sites, including site access descriptions, access or safety concerns, and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.7 shows monitoring locations of the effluent sampling locations. Reporting of the monitoring data is outlined in Section 9.

Table 6.26 Permit 11678 and MDMER Schedule 4 treated effluent compliance limits for direct discharge to Quesnel Lake

		Permit Limit		MDMER Schedule 4: Authorized Limits	
Constituent	**Units**	**Interim [1]**	**Final [2]**	**MAX Monthly Mean**	**MAX Grab Sample**
Non-Metal Constituents					
pH	pH	6.0 - 9.5	6.0 - 9.5	6.0 - 9.5	6.0 - 9.5
Total Suspended Solids	mg/L	15 (mean)/30 (max)		15	30
Total Sulphate	mg/L	720	1,100	-	-
Total Ammonia	mg/L (as N)	0.41	1.21	-	-
Total Nitrate	mg/L (as N)	9.7	34	-	-
Total Nitrite	mg/L (as N)	0.78		-	-
Total Phosphorus	mg/L	0.09		-	-
Fluoride	mg/L	17			
Cyanide [3]	mg/L	-		1	2
Radium 226 [4]	Bq/L	-		0.37	1.11
Total Metals					
Arsenic	mg/L	0.0034	0.028	0.5	1
Chromium	mg/L	0.0011	0.004	-	-
Copper	mg/L	0.012	0.033	0.3	0.6
Iron	mg/L	1		-	-
Lead	mg/L	-		0.2	0.4
Manganese	mg/L	3.4		-	-
Molybdenum	mg/L	0.36		-	-
Selenium	mg/L	0.06	0.075	-	-
Silver	mg/L	0.00024		-	-
Zinc	mg/L	0.059		-	-
Dissolved Metals					
Aluminum	mg/L	0.75		-	-
Cadmium	mg/L	0.00034		-	-
Iron	mg/L	0.35		-	-
Acute Toxicity Testing Results					
96h LC50 Rainbow Trout	Mortality in 100% effluent	50%		-	LC50 >100%
48h LC50 *D. magna*		50%		-	LC50 >100%

Notes: [1] Maximum discharge limits until toxicity testing on final effluent concentrations is conducted; [2] Maximum discharge limits applicable after ENV is satisfied that toxicity testing demonstrates that the final effluent will not cause mixture toxicity. This requirement has been met; [3] MDMER requirement only; if cyanide is not used in the mining/milling process, then it does not have to be analysed. Since cyanide is not used in the mining/milling process at Mount Polley, the effluent is not analysed for cyanide; [4] MDMER requirement only; if 10 consecutive samples show radium 226 as less than 0.037 Bq/l then frequency of sampling for radium 226 can be reduced to once a quarter. This has been satisfied, and radium 226 analysis is currently conducted quarterly.

Table 6.27 Effluent chemistry parameters

Parameter	LOR	Unit
Field Parameters - General		
pH	-	pH
Conductivity	-	µS/cm
Temperature	-	°C
Turbidity	-	NTU
Physical Tests		
Conductivity	2	µS/cm
Hardness (as $CaCO_3$)	0.5	mg/L
pH	0.1	pH
Total Suspended Solids	1	mg/L
Total Dissolved Solids	10	mg/L
Turbidity	0.1	NTU
Anions and Nutrients		
Alkalinity, Total (as $CaCO_3$)	1	mg/L
Ammonia, Total (as N)	0.005	mg/L
Chloride (Cl)	0.5	mg/L
Fluoride (F)	0.02	mg/L
Nitrate and Nitrite (as N)	0.003	mg/L
Nitrate (as N)	0.001	mg/L
Nitrite (as N)	0.005	mg/L
Total Nitrogen	0.03	mg/L
Orthophosphate-Dissolved (as P)	0.001	mg/L
Phosphorus (P)-Total Dissolved	0.002	mg/L
Phosphorus (P)-Total	0.002	mg/L
Sulfate (SO_4)	0.3	mg/L
Organic / Inorganic Carbon		
Dissolved Organic Carbon	0.5	mg/L

Notes: LOR: Limit of Reporting

Parameter	LOR	Unit
Total and Dissolved Metals		
Aluminum (Al)	0.003	mg/L
Antimony (Sb)	0.0001	mg/L
Arsenic (As)	0.0001	mg/L
Barium (Ba)	0.0001	mg/L
Beryllium (Be)	0.0001	mg/L
Bismuth (Bi)	0.00005	mg/L
Boron (B)	0.01	mg/L
Cadmium (Cd)	0.000005	mg/L
Calcium (Ca)	0.05	mg/L
Chromium (Cr)	0.0005	mg/L
Cobalt (Co)	0.0001	mg/L
Copper (Cu)	0.0005	mg/L
Iron (Fe)	0.03	mg/L
Lead (Pb)	0.00005	mg/L
Lithium (Li)	0.001	mg/L
Magnesium (Mg)	0.1	mg/L
Manganese (Mn)	0.0001	mg/L
Molybdenum (Mo)	0.00005	mg/L
Nickel (Ni)	0.0005	mg/L
Potassium (K)	0.05	mg/L
Selenium (Se)	0.00005	mg/L
Silicon (Si)	0.1	mg/L
Silver (Ag)	0.00001	mg/L
Sodium (Na)	0.05	mg/L
Strontium (Sr)	0.0002	mg/L
Thallium (Tl)	0.00001	mg/L
Tin (Sn)	0.0001	mg/L
Titanium (Ti)	0.01	mg/L
Uranium (U)	0.00001	mg/L
Vanadium (V)	0.0005	mg/L
Zinc (Zn)	0.003	mg/L

Table 6.28 Effluent monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
E19	E305050	WTP influent	Weekly[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals	N/A
HAD-3	E304230	WTP treated effluent	Continuous[1]	TSS (calculated), temperature, flow rate	Permit 11678
			Weekly[1]	Field parameters, physical tests, anions and nutrients, DOC, total and dissolved metals, radium 226[2], total mercury[3]	Permit 11678; MDMER; EEM
			Monthly	Acute toxicity tests: - Rainbow trout: *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Rainbow Trout* (Reference Method EPS1/RM/13) - Daphnia Magna: *Biological Test Method: Reference Method for Determining Acute Lethality of Effluents to Daphnia magna* (Reference Method EPS1/RM/14) - or most recent methods, as per MDMER	Permit 11678; MDMER[4]
			Semi-annually[5]	Chronic toxicity tests: - Biological Test Method: *Toxicity Tests Using Early Life Stages of Salmonid Fish* (Rainbow Trout) (Reference Method EPS 1/RM/28) - Invertebrate species: *Biological Test Method: Test of Reproduction and Survival Using the Cladoceran Ceriodaphnia dubia* (Report EPS 1/RM/21) - Plant species: *Biological Test Method: Test for Measuring the Inhibition of Growth Using the Freshwater Macrophyte, Lemna minor* (Reference Method EPS 1/RM/37) - Algal species: *Biological Test Method: Growth Inhibition Test Using Freshwater Alga Selenastrum capricornutum* (Report Method EPS 1/RM/25)	MDMER

Notes: [1] Only when discharging; [2] MDMER requirement only; if 10 consecutive samples show radium 226 as less than 0.037 Bq/l then frequency of sampling for radium 226 can be reduced to once a quarter. This has been satisfied and radium 226 analysis is currently conducted quarterly; [3] EEM requirement only; can be discontinued if concentration is less than 0.10 µg/L in 12 consecutive samples. This has been satisfied and mercury analysis has been discontinued; [4] MDMER June 2018 Part 2 Division 2 16 (1): frequency may be reduced to quarterly if discharge is determined not to be acutely lethal for 12 consecutive months; [5] Chronic/sub-lethal toxicity tests are conducted semi-annually for 3 years. MDMER June 2018 Schedule 5, 6 (1-3): after 3 years, frequency will be increased to once per calendar quarter on the sub lethal species whose results of sub lethal tests produce the lowest geometric mean, taking into account the inhibition concentration that produces a 25% effect or effective concentration of 25%; N/A: not applicable; TSS: total suspended solids; DOC: dissolved organic carbon; MDMER: Metal and Diamond Mining Effluent Regulations; EEM: Environmental Effects Monitoring

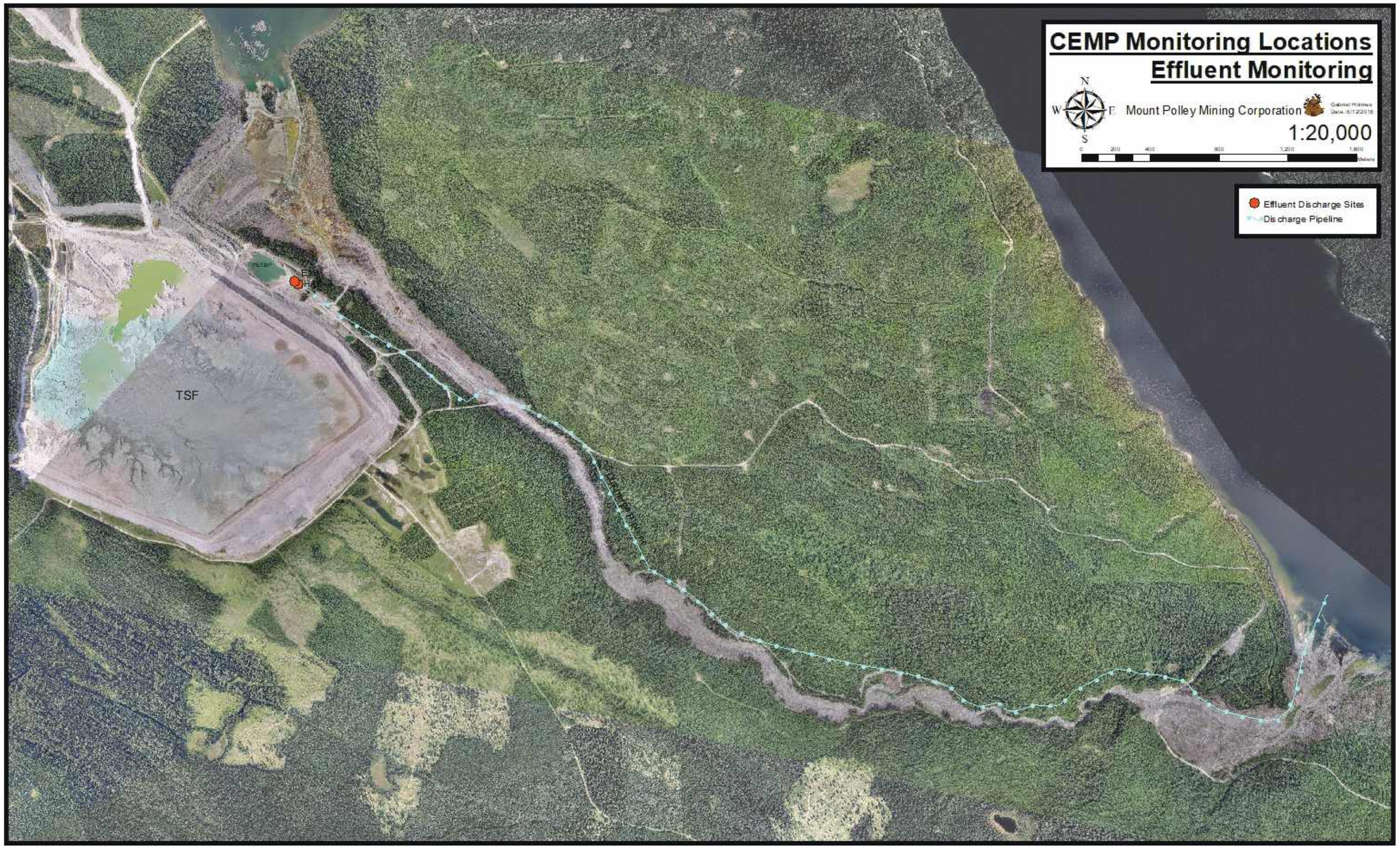


Figure 6.7 CEMP monitoring locations: Effluent monitoring

6.11.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following the SOPs and WMs for Surface Water Quality Monitoring, and use of associated field meters in the QA/QC Manual. These procedures include use of lab-verified clean or appropriately rinsed sampling bottles and steps to reduce risk of sampling contamination. *In-situ* parameters will be measured when samples for chemistry are collected. Water samples will be analyzed for the parameters described in Section 6.11.3.

Table 6.29 is a summary of previous effluent monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.29 Summary of effluent monitoring and findings

Summary of Monitoring and Findings	**Monitoring Objective**		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Discharge monitoring included the influent and treated effluent.	N/A	N/A
Summary of findings	All samples were at or below permit limits for the treated effluent in 2017; in 2016, the majority of samples were at or below the permit limits. When samples did not meet permit limits, ENV was notified and an investigation into the cause was undertaken. Comparing the influent concentrations to treated effluent concentrations verified reduction in parameters interest. See Section 6.11.4.1 for more details.	N/A	N/A
Recommendations for 2018-2020 monitoring	Monitoring of the influent (E19) will be increased from monthly to weekly to align with monitoring of HAD-03 for better efficiency analysis of the WTP.	N/A	N/A

Notes: N/A: not applicable; ENV: Ministry of Environment and Climate Change Strategy; WTP: water treatment plant

Should there be an extreme weather event or equipment failure in the WTP that could affect water quality in the effluent, MPMC has the ability to request rush analysis from the analytical lab (ALS). MPMC maintains an Emergency Response Plan for the effluent discharge as required by the MDMER and the Permit.

6.11.4.1 OPERATIONAL MONITORING

Figure 6.8 shows total copper concentrations and Figure 6.9 shows TSS in the influent (E19) and effluent (HAD-03) in 2017. No exceedances were recorded in 2017 in the effluent.

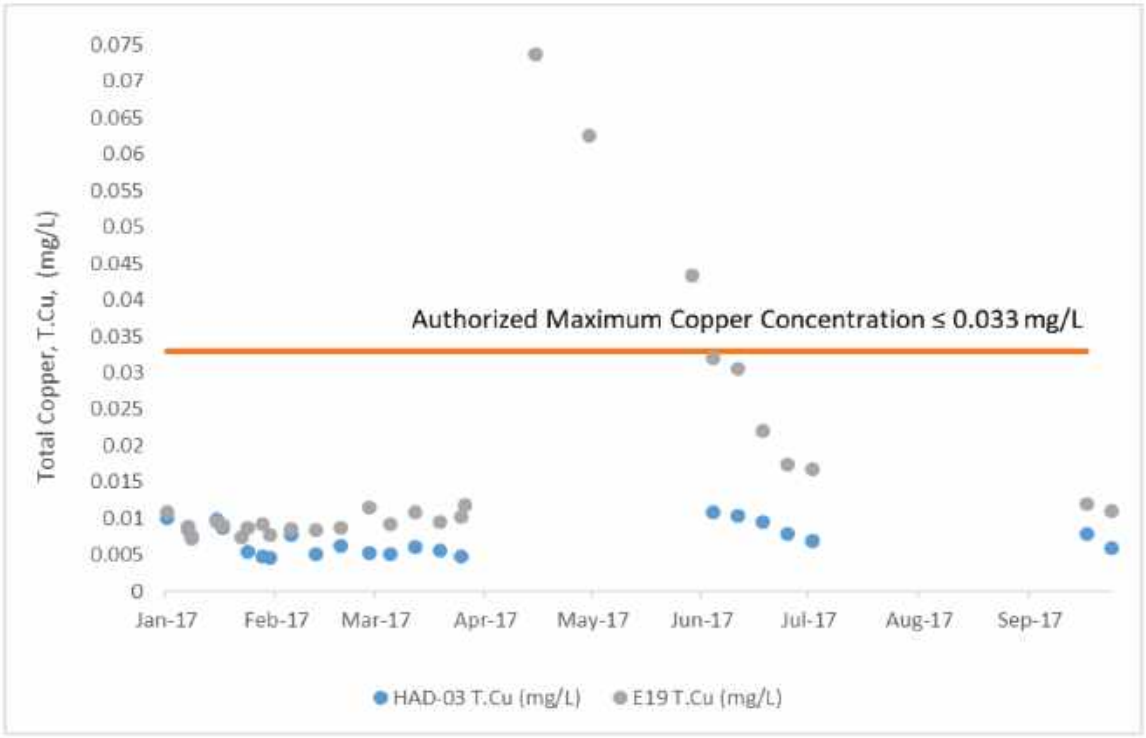


Figure 6.8 Total suspended solids concentrations in influent (E19) and effluent (HAD-03) in 2017

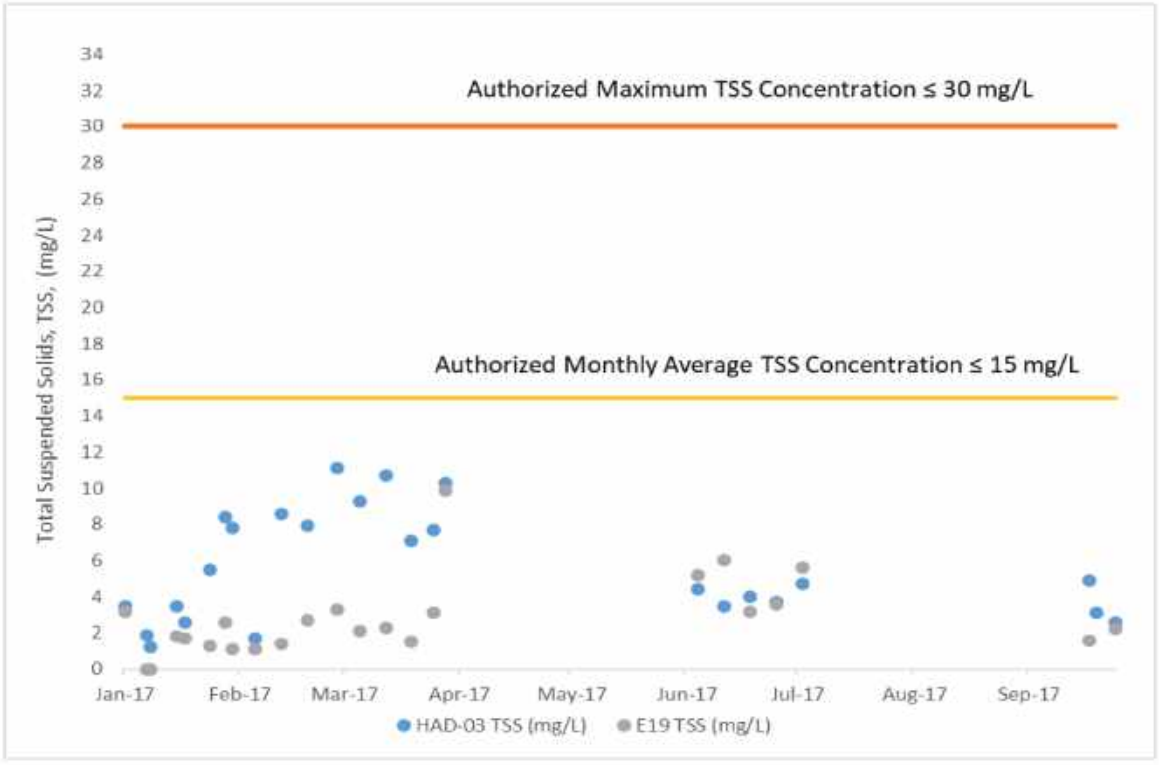


Figure 6.9 Total copper concentrations in influent (E19) and effluent (HAD-03) in 2017

MPMC conducts acute toxicity tests monthly for LC50 Rainbow trout and LC50 *Daphnia magna*. Under the new MDMER, *D. magna* is now a compliance parameter. MPMC will continue to conduct these acute lethality tests as required.

MDMER has changed the frequency of acute toxicity tests for effluent discharge. In accordance with Part 2, Division 2, paragraph 16 (1), acute lethality tests at the final discharge point (HAD-3) will become quarterly if the effluent is determined to be non-lethal for 12 consecutive months (Government of Canada 2018). Effluent at HAD-3 since discharge has started (December 2015) has been shown to be non-lethal.

MPMC has conducted chronic toxicity tests on the effluent discharge since December 7, 2015 on a quarterly and semi-annual basis. Under MDMER requirements, after three years (after December 2018 at HAD-3), the chronic toxicity tests results will be reviewed by a QP and will be streamlined to one test only. This test will be based on the most sensitive organism to the effluent according to historical geometric means and will be tested quarterly. The reduction of frequency from the 2016 CEMP for the chronic toxicity tests, as described in Table 6.28, aligns with the MDMER, as no actionable effects have been recorded at HAD-03 and the MDMER protocol is established to characterise the impacts on the most sensitive aquatic life.

6.11.5 Data Quality Control, Objectives, and Review

For water chemistry, QC samples will be collected as a component of the monitoring program as per the MPMC QA/QC Manual. Effluent monitoring samples are combined in the surface water QC schedule (see Section 6.6.5), as laid out in Table 6.8.

6.11.6 Laboratory Analysis

Samples will be submitted to and processed by a CALA accredited analytical laboratory, typically ALS Environmental Inc. in Burnaby, BC for chemistry samples and Nautilus Environmental in Burnaby, BC for toxicity testing, where standard testing procedures will be used as specified in the most recent editions of the *BC Environmental Laboratory Manual* (MoE 2015) and the MDMER (where applicable; i.e., discharge water toxicity testing).

Laboratory precision will be assessed on the basis of laboratory duplicate results and laboratory accuracy will be assessed using certified reference materials (CRMs) and matrix spikes. Potential laboratory contamination will be assessed using a DQO of ≤ 2 times the laboratory MDL in laboratory method blank results.

QC monitoring for toxicity testing will be carried out at the laboratory, as per the test methods, with requirements to meet criteria such as test organism health history, and control acceptability. Uncertainty associated with test results will be described by the standard deviation around the mean and/or the confidence limits around the point estimate.

6.11.7 Data Analysis and Reporting

Data analysis and interpretation for reporting purposes will include calculation of summary statistics (e.g., mean, minimum, max, and 95th percentile values over the period of interest) and screening of results

against applicable regulatory benchmarks (see Table 6.26). Screening will include evaluation of results at the treated effluent discharge against MDMER and the Permit limits. Alerts are set up in the MP-5 database so that MPMC Environmental Department staff receives an email if specified benchmarks are exceeded.

6.12 SEDIMENT QUALITY MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.12.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow Environmental Inc. (Minnow). The detailed study design is provided in Appendix B.1. Golder prepared the study design for selecting an alternate reference lake for Polley Lake (Appendix B.7).

6.12.2 MONITORING OBJECTIVES

As outlined in Appendix B.1, the objectives of sediment quality monitoring are to:

- "Evaluate the influence of mine activities on the receiving environments (e.g., Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic life by applying a variety of interpretive tools";
- "Provide data to support exposure assessment as part of the ERA and HHRA";
- "Provide supporting information for benthic invertebrate community monitoring"; and,
- "Advance technical understanding of the stability or mobility and potential bioavailability of metals and metalloids in lake sediments affected by the TSF Breach".

6.12.3 MONITORING OVERVIEW

Sediment quality monitoring under the CEMP is proposed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 perimeter embankment failure; and
3) Monitoring of response to reclamation activity following the perimeter embankment failure.

An overview of the proposed sediment quality monitoring program is provided in Table 2 and Figures 5 and 6 of Appendix B.1. Sediment quality monitoring is focused on Polley Lake, Hazeltine Creek, and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake). Table 3 in Appendix B.1 summarizes the analytes and laboratory reporting limits for the sediment quality monitoring program.

The monitoring program is divided into lake monitoring and creek monitoring and will include physical and chemical characterisation of deposited sediments. Sediment quality sampling will be supported by

measurements of temperature, dissolved oxygen, pH, and specific conductance near the sediment-water interface at all sampling stations. Some additional monitoring of the stability and potential bioavailability of metals associated with sediments impacted by the TSF Breach may be undertaken (e.g., deployment of Diffusive Gradients in Thin Films [DGT] devices to monitor labile metal concentrations; toxicity testing using *Hyalella azteca*). More detail is provided in Appendix B.1.

6.12.4 High-Level Monitoring Design Description

Appendix B.1 provides a summary of sediment monitoring history previously conducted in the vicinity of the mine in the surrounding lakes and creeks, including baseline, and pre- and post-breach monitoring. The sample collection methods are also summarized in Appendix B.1 for lake sediment sampling, creek sediment sampling, and DGT sampling. A study design for evaluating alternate reference lakes for Polley Lake is provided in Appendix B.7.

6.12.5 Data Quality Control, Objectives, and Review

Appendix B.1 summarizes the QAQC program for the sediment monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. As described in Appendix B.1, "comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD <40% for concentrations that are >5 times the detection limit, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective detection limits." See Appendix B.1 for more details.

6.12.6 Laboratory Analysis

Chemical analyses will be completed at a CALA accredited analytical laboratory and will include moisture content, pH, particle size distribution, total organic carbon (TOC), total nitrogen, total sulphur, and total metal concentrations, as summarized in Table 3 in Appendix B.1.

Toxicity testing will be conducted at a CALA accredited testing laboratory using a 10 day test of the survival and growth of *Chironomus dilutus.* DGT analysis is described in detail in Appendix B.1 in Section 4.3.

6.12.7 Data Analysis and Reporting

As described in Appendix B.1, data will be provided to the QP and summarized by calculating mean, median, standard deviation, standard error, minimum, maximum, 5^{th} percentile, and 95^{th} percentile for each analyte for all replicated data. Appendix B.1 describes how "sediment quality data will then be evaluated in comparison to British Columbia Working Sediment Quality Guidelines for the protection of aquatic life (WSQGs; MOE 2017b) and reference concentrations. Reference 95^{th} percentile values will be used to screen exposed-area mean concentrations to efficiently identify analytes with concentrations that are beyond the range of reference.

"The overall interpretation of sediment quality data will include integration of a weight-of-evidence that includes other components of the MPMC CEMP (e.g., benthic invertebrate community data). Thus, within

the CEMP, sediment quality data interpretation will specifically include the integration of data on sediment quality, the results of specialized evaluations (e.g., DGT results), and the results of bio-assessment (e.g., sediment toxicity testing and benthic invertebrate communities).

"An interpretive report based on the sediment quality data will be prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an Appendix and will include the data quality review, the results of the screening against BCWSQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots."

6.13 BENTHIC INVERTEBRATE MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.13.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow. The detailed study design is provided in Appendix B.2. Golder prepared a study design for selecting an alternate reference lake for Polley Lake (Appendix B.7).

6.13.2 MONITORING OBJECTIVES

As outlined in Appendix B.2, the objectives of benthic invertebrate monitoring are to:

- "Evaluate the influence of Mount Polley Mine activities on benthic invertebrate communities, productivity, and tissue quality in receiving environments (e.g., Polley Lake, Hazeltine Creek, Edney Creek, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic life (e.g., through assessment of benthic invertebrate community and productivity endpoints, and comparison of benthic tissue quality results to available guidelines; MoE 2014) and to aquatic ecosystem health by providing supporting information for the assessment of potential effects to higher trophic levels (e.g., fish and fish habitat quality; Section 6.16)"; and,
- "Provide data to support exposure assessment as part of the ERA and HHRA."

Benthic invertebrate community monitoring is also required as part of EEM under the MDMER. The objective of the MDMER EEM benthic invertebrate monitoring identified in Appendix B.2 is to "evaluate whether there are effects to benthic invertebrate community characteristics between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012)."

6.13.3 MONITORING OVERVIEW

Benthic invertebrate monitoring under the CEMP is designed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 TSF embankment breach; and
3) Monitoring of the response to reclamation activity following the TSF embankment breach.

An overview of the proposed benthic invertebrate monitoring program is provided in Table 3 of Appendix B.2, and includes benthic invertebrate community, productivity, and tissue quality. Benthic invertebrate monitoring is focused on Polley Lake, Hazeltine Creek, lower Edney Creek, Quesnel Lake, and associated reference areas (Figures 6 and 7 of Appendix B.2). Table 4 in Appendix B.2 summarizes the analytes and laboratory reporting limits for the benthic invertebrate monitoring program. The sampling frequency at this time is once every three years.

6.13.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Appendix B.2 provides a summary of benthic invertebrate monitoring history previously conducted in the vicinity of the mine in the surrounding lakes and creeks, including baseline, and pre- and post-breach monitoring. The sample collection methods are also summarized in Appendix B.2 for community and productivity sampling, and tissue quality sampling. A study design for evaluating alternate reference lakes for Polley Lake is provided in Appendix B.7.

6.13.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Appendix B.2 summarizes the QAQC program for the benthic invertebrate monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. As stated in Appendix B.2, "for benthic invertebrate tissue quality samples, comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD <25% for concentrations that are >5 times the detection limit, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective detection limits.

"For benthic invertebrate community samples, reanalysis for quality control endpoints (organism sorting efficiency, subsampling precision and accuracy error, and taxonomic identification error) will be performed on 10% of samples, and results of quality control measures will be evaluated relative to pre-established DQOs." See Appendix B.2 for more details.

6.13.6 LABORATORY ANALYSIS

As described in Appendix B.2, "taxonomic identification of benthic invertebrate community samples will be completed by a qualified laboratory certified under the Taxonomic Certification Program of the Society for Freshwater Science (SFS). Benthic invertebrate tissue quality samples will remain frozen until overnight shipment on ice with completed COCs to ALS Environmental, Burnaby BC, which is an analytical laboratory accredited by the CALA."

6.13.7 DATA ANALYSIS AND REPORTING

As described in Appendix B.2, data will be provided to the QP and summarized by calculating mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile for each endpoint for all replicated data. Data analysis will be completed for each monitoring component (community, productivity, and tissue quality). More detail for each monitoring component is provided in Section 4.5 of Appendix B.2.

As stated in Appendix B.2, "an interpretive report based on the benthic invertebrate data will be prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an appendix and will include the date quality review, the results of the screening against BCWQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots."

6.14 PLANKTON AND CHLOROPHYLL *A* MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.14.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC.

6.14.2 MONITORING OBJECTIVES

The objective of phytoplankton and zooplankton monitoring at lake stations is to assess potential changes in plankton community abundance and diversity, as well as temporal and special changes in zooplankton metal concentrations. Chlorophyll *a* sampling will be conducted and analyzed to provide support data that can be interpreted with other biological monitoring and water chemistry data in a broader analysis of lake productivity.

This monitoring will be conducted to aid in assessing lake productivity following the TSF embankment breach (Post-Breach Monitoring: Polley Lake and Quesnel Lake) and to identify any changes related to the chemistry of the discharged treated effluent (Operational Monitoring: Quesnel Lake).

6.14.3 MONITORING OVERVIEW

Table 6.30 summarizes the parameters analysed for plankton and chlorophyll *a* monitoring. Chlorophyll *a*, phytoplankton taxonomy and biomass, and zooplankton taxonomy and metal tissue samples will continue to be collected concurrently with water chemistry samples (including field parameters) three times per year to capture early and late growing seasons as outlined in Table 6.31. Growing seasons were determined after monthly sampling was conducted in 2015; data analysis of zooplankton community is presented in Golder (2016d). Further details of monitoring sites, including site access descriptions, access or safety concerns,

and a brief rationale for monitoring, is provided in the Site Matrix in Appendix D. Figure 6.10 shows monitoring locations of the plankton and chlorophyll *a* sampling locations.

Table 6.30 Plankton and chlorophyll *a* parameters

Parameter	LOR	Unit
Taxonomy		
Phytoplankton	-	-
Zooplankton	-	-
Total Metals in Tissue		
Aluminum (Al)	2	mg/kg
Antimony (Sb)	0.01	mg/kg
Arsenic (As)	0.02	mg/kg
Barium (Ba)	0.05	mg/kg
Beryllium (Be)	0.01	mg/kg
Bismuth (Bi)	0.01	mg/kg
Boron (B)	1	mg/kg
Cadmium (Cd)	0.005	mg/kg
Calcium (Ca)	20	mg/kg
Chromium (Cr)	0.005	mg/kg
Cobalt (Co)	0.05	mg/kg
Copper (Cu)	0.02	mg/kg
Iron (Fe)	0.1	mg/kg
Lead (Pb)	3	mg/kg
Lithium (Li)	0.02	mg/kg
Magnesium (Mg)	0.5	mg/kg
Manganese (Mn)	2	mg/kg
Molybdenum (Mo)	0.05	mg/kg
Nickel (Ni)	0.02	mg/kg
Potassium (K)	0.2	mg/kg
Selenium (Se)	10	mg/kg
Silicon (Si)	20	mg/kg
Silver (Ag)	0.05	mg/kg
Sodium (Na)	0.05	mg/kg
Strontium (Sr)	20	mg/kg
Thallium (Tl)	0.05	mg/kg
Tin (Sn)	0.02	mg/kg
Titanium (Ti)	0.002	mg/kg
Uranium (U)	0.1	mg/kg
Vanadium (V)	0.002	mg/kg
Zinc (Zn)	0.1	mg/kg
Plant Pigments (Water)		
Chlorophyll *a*	0.01	µg

Notes: LOR: Limit of Reporting

Table 6.31 Plankton and chlorophyll *a* monitoring overview

Station Name	EMS Code	Description	Frequency	Parameters Measured	Guidelines
P2	E307975	Polley Lake deepest area at south end	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
B2	E215897	Bootjack Lake deepest area at south end	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
QUL-ZOO-1	E306455	Quesnel Lake zooplankton station at Hazeltine	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A
QUL-ZOO-7	E306456	Quesnel Lake zooplankton station at Horsefly	Three times between June 15 and September 15, at least 30 days apart	Chlorophyll *a*, Phytoplankton taxonomy and biomass Zooplankton metals, taxonomy, and biomass	N/A

Notes: N/A: not applicable; IDZ: initial dilution zone

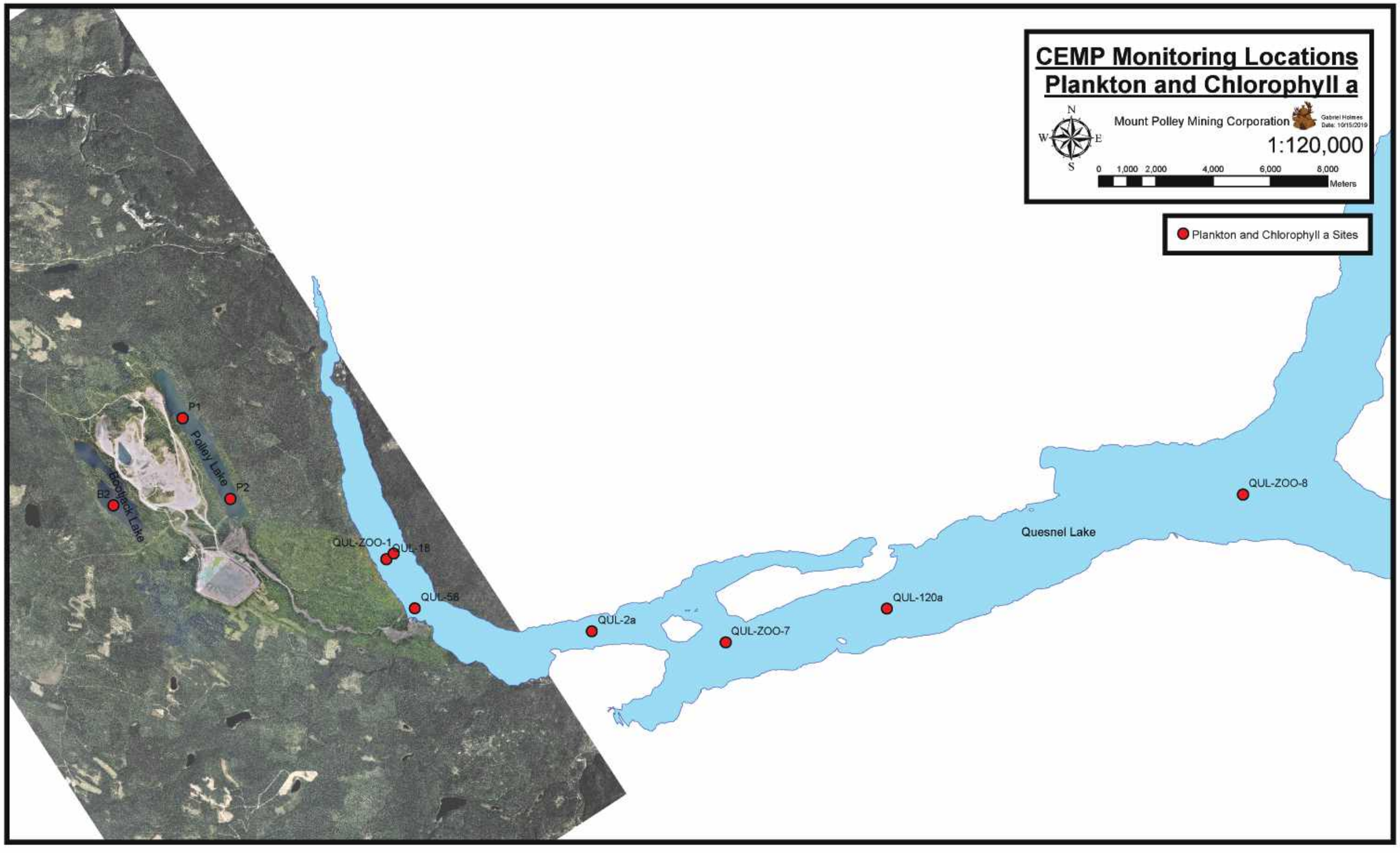


Figure 6.10 CEMP monitoring locations: Plankton and chlorophyll *a* monitoring

6.14.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Sample collection, preparation, and shipping will be conducted following procedures outlined in the SOPs and WMs on Lake Water Monitoring and Zooplankton Sampling in the MPMC QA/QC Manual.

In brief, sampling at all stations will be conducted as follows:

- Zooplankton samples:
  - will be collected using 50 µm mesh nets with a mouth diameter ≥0.5 m, and equipped with a flow meter. In 2019, for stations previously sampled with a 150-µm mesh net, samples will be collected with both a 50- and a 150-µm mesh net to enable an assessment of the difference between the two net mesh sizes and to facilitate comparison with historical data.
  - will be collected using a modified horizontal tow.
  - for taxonomy/biomass will be transferred to a Nalgene container and preserved with buffered formalin.
  - for tissue chemistry will consist of a composite of multiple tows to achieve a minimum required tissue mass for analysis (i.e., 1.5 g).
- Phytoplankton samples
  - will be collected as a depth-integrated sample. Water will be collected from at least four discrete depths at each station (surface, one-third Secchi depth, two-thirds Secchi depth, total Secchi depth), with a grab sampler (e.g., Kemmerer, Van Dorn) or with a length of flexible tubing modified for this purpose, with or without a peristaltic pump.
  - will be collected as surface and depth-integrated samples in 2019 to allow for an assessment of the difference between the two methods and to facilitate comparison with historical data.
  - for Chlorophyll *a* analysis will be transferred to a container wrapped in aluminum foil.
  - for taxonomy/biomass will be preserved with Lugol's solution

One replicate will be collected in each of June and August, and five replicates will be collected during the July sampling event, and samples for zooplankton and phytoplankton will be collected on the same day for each lake. Secchi depth and *in situ* water-chemistry supporting data will be collected concurrently at each station.

Table 6.32 is a summary of previous plankton and chlorophyll *a* monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable. Monitoring for plankton and chlorophyll *a* overlaps with operational monitoring in Quesnel Lake, as described in Section 6.14.2.

Table 6.32 Summary of plankton and chlorophyll *a* monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	Plankton (phyto and zoo) taxonomy and chlorophyll *a* sampling frequency was semi-annually in 2016 and 2017 (June/July and August) at two stations in Polley Lake and three stations in Quesnel Lake. Some sampling events were missed in 2017 due to safety concerns.		N/A
Summary of findings	Zooplankton and phytoplankton results will be analysed in the three-year interpretive report (see Section 9.4) and recommendations for changes may be made, if required, in this report. Some chlorophyll *a* data were collected prior to the TSF breach. Results from 2013 – 2017 are shown in Section 6.14.4.1.		N/A
Recommendations for 2017-2020 monitoring	The sampling program outlined in Table 6.31 will be repeated annually.		N/A

Notes: N/A: not applicable

6.14.4.1 POST-BREACH MONITORING

Figure 6.11 shows chlorophyll *a* data collected from Polley Lake from 2013 – 2017. Data from P2 will continue to be collected to analyse potential trends.

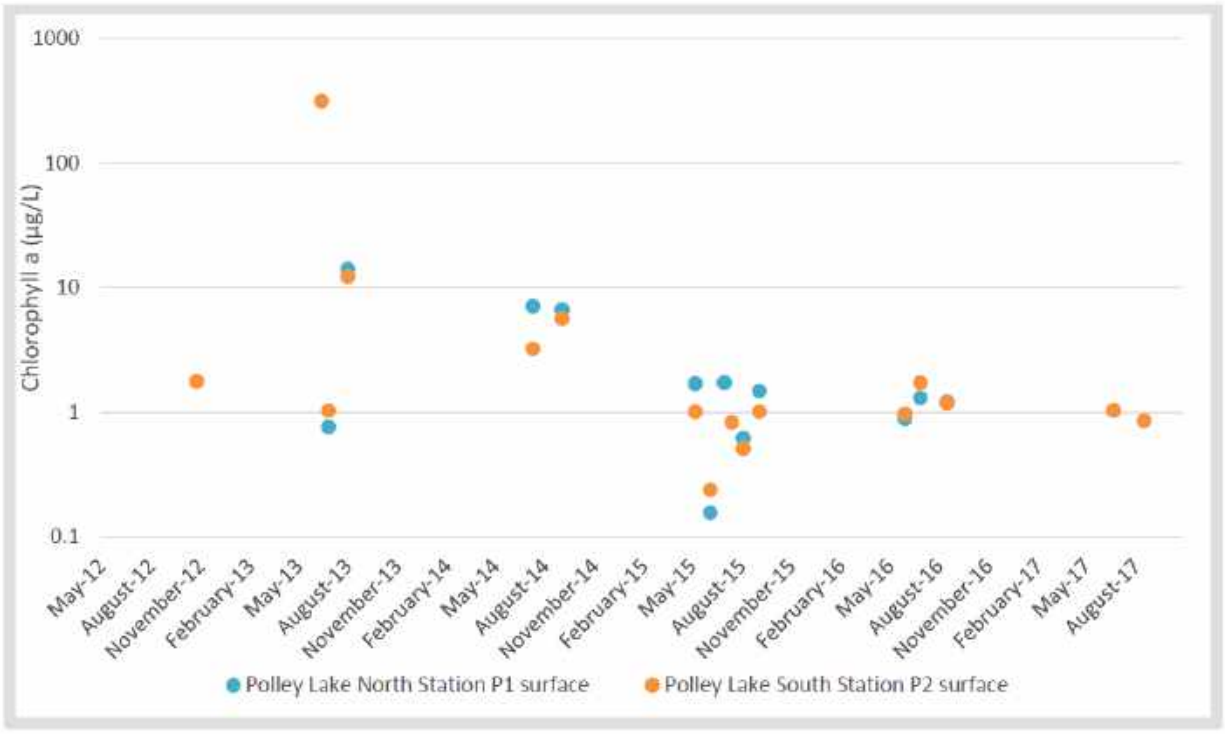


Figure 6.11 Chlorophyll *a* data collected from Polley Lake from 2013 - 2017

6.14.5 Data Quality Control, Objectives, and Review

QA/QC procedures will consist of re-analysis of 10% of phytoplankton and zooplankton taxonomy samples, and analysis of a duplicate metals sample for tissue chemistry once annually. For taxonomy, replicate counts should meet the DQO of within 20% of the original count. For metals, the RPD data quality of greater than 40% for concentrations greater than or equal to five times the MDL will be used to identify differences between original and duplicate samples for metals.

6.14.6 Laboratory Analysis

Plankton taxonomy samples will be shipped to the following laboratories for processing[2]:

- Biologica environmental Services Ltd., Victoria, BC: plankton taxonomy.
- ALS Environmental Inc., Burnaby, BC[3] – chlorophyll *a* and zooplankton tissue chemistry.

6.14.7 Data Analysis and Reporting

Statistical analysis will be carried out to evaluate trends over time by comparing results with data collected annually. In Quesnel Lake, near-field data will be compared with far-field and reference data to evaluate

[2] No accreditation program exists for plankton taxonomy

[3] Accredited by the Canadian Association of Laboratory Accreditation (CALA)

potential mine impact and spatial trends. These data will also be used to assess implications for lake productivity and fish populations.

6.15 PERIPHYTON MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.15.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow. The detailed study design is provided in Appendix B.3.

6.15.2 MONITORING OBJECTIVES

As outlined in Appendix B.3, the objectives of periphyton monitoring are to:

- "Evaluate the influence of mine activities (related to mine operations, the TSF breach, and/or rehabilitation activities) on Hazeltine Creek (the creek receiving environment directly influenced by mine activity) and lower Edney Creek (a creek environment directly influenced by the TSF breach)";
- "Serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (benthic invertebrates and fish; Sections 6.13 and 6.16, respectively)";
- "Provide supporting information for the assessment of benthic invertebrate tissue quality, benthic invertebrate community condition, and fish habitat productivity"; and,
- "Provide data to support exposure assessment as part of the ERA and HHRA".

Periphyton monitoring will include assessment of productivity, community composition, and tissue quality, with comparison to previous and/or reference conditions, to applicable guidelines (i.e., chlorophyll *a*; MoE 2018), and to literature-based criteria (or classification ranges) for productivity.

6.15.3 MONITORING OVERVIEW

Periphyton monitoring under the CEMP is proposed to meet the combined needs of:

1) Operational monitoring (including the previous discharge of treated effluent to Hazeltine Creek);
2) Monitoring of the impact of the 2014 TSF breach; and
3) Monitoring of the response to reclamation activity following the TSF breach.

An overview of the proposed periphyton monitoring program is provided in Table 1 and Figure 4 of Appendix B.3. Periphyton monitoring is focused on Hazeltine Creek and lower Edney Creek with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek

and lower Hazeltine Creek). Table 2 in Appendix B.3 summarizes the analytes and laboratory reporting limits or the periphyton monitoring program.

6.15.4 High-Level Monitoring Design Description

Appendix B.3 provides a summary of periphyton monitoring history previously conducted in the vicinity of the mine in the surrounding creeks, including pre- and post-breach monitoring. The sample collection methods are also summarized in Appendix B.3 for biomass and chlorophyll *a* sampling, community sampling, and tissue quality sampling.

6.15.5 Data Quality Control, Objectives, and Review

Appendix B.3 summarizes the QAQC program for the periphyton monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. As stated in Appendix B.3, "comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD < 25% for concentrations that are > 5 times the detection limit, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective detection limits. Specific QC sampling and associated reporting will for tissue quality and periphyton productivity endpoints be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). QC reporting will also be requested of the laboratory performing taxonomic analysis of the periphyton community samples, including organism enumeration checks for a minimum of 10% of samples." See Appendix B.3 for more details.

6.15.6 Laboratory Analysis

The laboratory responsible for the physical or chemical analyses will be accredited by the CALA for these analyses.

6.15.7 Data Analysis and Reporting

For all replicated data (typically based on a sample size of five or eight stations per area), data will be provided to the QP and summarized by calculating mean, median, standard deviation, minimum, and maximum for each analyte. Data analysis will be completed for each monitoring component (productivity, community, and tissue quality). More detail for each monitoring component is provided in Section 4.5 of Appendix B.3.

As outlined in Appendix B.3, "an interpretive report based on the periphyton monitoring data will be prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an appendix and will include the data quality review, the results of the screening against BCWSQG and other guidelines or classification schemes, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots."

6.16 FISH MONITORING

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.16.1 SECTION AUTHORS AND STUDY DESIGN PROFESSIONALS

This section was written by MPMC, and is a summary of the study design provided by Minnow. The detailed study design is provided in Appendix B.4.

6.16.2 MONITORING OBJECTIVES

As outlined in Appendix B.4, the objectives of fish monitoring are to:

- "Evaluate the influence of Mount Polley Mine activities on fish communities, populations, and tissue quality in receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions";
- "Determine potential implications to aquatic ecosystem health and human health (e.g., relative to available fish tissue quality guidelines [MoE 2014; CFIA 2015])";
- "Provide data to support exposure assessment as part of the ERA and HHRA"; and,
- "Document fish habitat utilization in creek and lake areas that were physically impacted by the TSF breach (most notably Hazeltine Creek and the lower segment of Edney Creek), thereby documenting the effectiveness of fish habitat rehabilitation efforts".

From Appendix B.4, the objective of the MDMER EEM fish monitoring is to "evaluate whether there are differences in population endpoints (survival, growth, and reproduction) of sentinel fish species between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012)." Evaluation of selenium in fish tissues is also triggered under the MDMER on the basis of current selenium concentrations in effluent.

6.16.3 MONITORING OVERVIEW

Fish monitoring under the CEMP is designed to meet the combined needs of:

1) Operational monitoring (including the discharge of treated effluent to Quesnel Lake);
2) Monitoring of the impact of the 2014 TSF embankment breach; and
3) Monitoring of the response to remediation following the TSF embankment breach.

As previously indicated, fish monitoring includes fish tissue quality monitoring, sentinel fish population monitoring, fish habitat characterization and fish usage monitoring, and fish community monitoring. An overview of the proposed fish monitoring program is provided in Table 8 and Figures 5 and 6 of Appendix B.4. Table 9 in Appendix B.4 summarizes the fish tissue analytes and laboratory reporting limits for the fish monitoring program.

6.16.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Appendix B.4 provides a summary of fish monitoring history previously conducted in the vicinity of the mine in the surrounding creeks, including baseline monitoring, and pre- and post-breach monitoring. The sample collection methods and monitoring are also summarized in Appendix B.4 for tissue sampling, sentinel fish population monitoring, fish community monitoring, and fish habitat characterization and usage monitoring.

In addition to the monitoring outlined in Appendix B.4, visual spawning surveys of upper Hazeltine Creek to evaluate the success of re-introduction of spawning access by Polley Lake rainbow trout, and at the mouth of Hazeltine/Edney Creek to confirm access to that stream reach following a monitoring program developed in conjunction with the Habitat Remediation Working Group (HRWG). The surveys consisted of two field staff walking the bank of the creek channel and documenting visual observations of species, life stage, and behaviour of fish in the creek, and in lower Hazeltine/Edney, the presence of redds was noted. In upper Hazeltine Creek 25 surveys were conducted through the 2018 ice-free period and in the Hazeltine/Edney Creek mouth, 12 surveys were conducted. Spawning surveys were conducted in Hazeltine/Edney again in 2019.

6.16.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Appendix B.4 summarizes the QAQC program for the fish monitoring plan. It includes specific QA/QC protocols, including collection of QC samples and collection of replicate samples to allow for statistical calculations and to capture within-area variability. For fish tissue samples, comparisons between duplicate samples will be made by calculating the RPD between concentrations of paired duplicates. If the RPD <25% for concentrations that are >5 times the detection limit, then the duplicate sample results will be considered acceptable. Specific QC samples will include laboratory blanks, laboratory replicates, and laboratory accuracy samples (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). The QC sample results will be assessed as part of the data quality review. See Appendix B.4 for more details.

6.16.6 LABORATORY ANALYSIS

All chemical analyses will be completed by a laboratory that is accredited by CALA, and will be required to include specific QC samples and report associated results.

6.16.7 DATA ANALYSIS AND REPORTING

Catch-per-unit-effort and summary statistics for meristic measurements taken in the field will be calculated. Although community and population data is collected during every phase or component of the fish monitoring program, the sample size will be defined by the study objectives and may be insufficient to address corollary questions. For example, the sample size required for tissue quality analyses (n = 8) is not large enough to support formal contrasts of population endpoints. To this end, evaluation of fish community data will rely on qualitative comparisons, and conclusions regarding fish populations will be supported by non-lethal measurements and sampling under the MDMER EEM (with larger sample size), as described in Appendix B.4. Analysis methods for the MDMER EEM fish population data, as described in Appendix B.4 will be "consistent with EEM technical guidance (Environment Canada 2012). Summary statistics, including mean, median, minimum, maximum, standard deviation, standard error, and sample

size, will be calculated for fish age, fork length, total length, body weight, condition, liver weight, gonad weight, and fecundity; calculations will be completed according to species and area. All data sets will be assessed for normality and equality of variance in order to determine the suitability of parametric statistical procedures. An effect on the fish population will be evaluated for each of these measures and is defined as a statistically significant difference between the effluent-exposed area and the reference area (Environment Canada 2012). For each endpoint, statistically significant differences between effluent-exposed and reference areas (by species and sex) will be assessed using ANOVA, Analysis of Covariance (ANCOVA), or non-parametric equivalents, as appropriate, following technical guidance (Environment Canada 2012).

"For the fish tissue data sets, statistical comparisons of age, length, weight, and concentrations of metals in fish tissues (n = 8) will be completed among years and locations. The sample size, mean, median, standard deviation, standard error, minimum, maximum, 5^{th} percentile, and 95^{th} percentile will be calculated for each analyte. Means will be calculated using the Kaplan-Meier (K-M) method. The standard deviation and the median for each analyte will also be calculated using the K-M method. When a standard deviation cannot be estimated (i.e., when an analyte has a high proportion of censored values), it will be reported as "not calculated".

"Results of the fish habitat characterizations for Upper Hazeltine, Lower Hazeltine, and Lower Edney creeks will be summarized, along with fish usage results, according to season (spring, summer, and fall) and year. Fish habitat characterization measures will be summarized by season, reach, and area (rehabilitated and reference), with summary statistics (mean and standard deviation) calculated for all numerical parameters."

More detail for each monitoring component is provided in Section 4.5 of Appendix B.4.

An interpretive report based on the fish monitoring data was prepared to be integrated into the AERR for the Mount Polley Mine that is prepared annually by MPMC (see Section 9.3). The interpretive report will provide all data in an appendix and will include the data quality review, the results of the screening against BCWQGs, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

With respect to the spawning surveys, rainbow trout were observed spawning in upper Hazeltine Creek, confirming that the fish were successfully re-introduced to the reconstructed channel. A majority of spawning activity occurring from May 10 to 25, 2018, when 488 rainbow trout redds were counted, and emergence of young-of-year trout began in late June (Minnow 2019). In 2018, rainbow trout, longnose sucker and redside shiner were observed lower Hazeltine/Edney (Minnow 2019) and in fall 2019, sockeye salmon were observed using the reconstructed habitat (data will be reported in 2020).

6.17 WILDLIFE MONITORING

Wildlife monitoring described below includes observational monitoring and monitoring using wildlife cameras. A study design for wildlife monitoring in the Hazeltine Creek corridor will be provided in 2020. This subsection will be updated accordingly.

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.17.1 Section Authors and Study Design Professionals

This section was written by MPMC (wildlife observations) and Golder (tissue collection and food chain model – related to follow up tasks for the ERA).

6.17.2 Monitoring Objectives

The current objective of the wildlife monitoring is to document the presence of mammals and birds using or migrating through the mine site and adjacent areas. This information is used for land use planning and to monitor the potential for effects of mine-related activities on animals in the area.

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017).

6.17.3 Monitoring Overview

Operational Monitoring - Wildlife occurrences will be recorded throughout the year by MPMC Environmental Department staff, and by other MPMC employees and contractors, when possible. Observations will include wildlife sightings and evidence of wildlife, such as tracks and droppings. Documentation will include the date, initials of the observer, location of the observation, wildlife observed, and comments (such as size of group, sex, or activity of an animal).

Data files from wildlife cameras installed in three locations (Hazeltine Creek, Mine Site, Reference site) are downloaded and reviewed monthly. Any changes to the location of the cameras are documented. Details including frequency of use by wildlife near each camera and variety of wildlife are documented. These details will be included in the AERR.

Supplemental Tasks - A tiered approach was been recommended, as outlined in Appendix B.5. Only Tasks 1A, 2A, 2B and 3 will be undertaken as part of the current CEMP. If risks are found to be unacceptable at the end of Step 2, further investigation following the proposed tiered approach described in Appendix B.5 will be conducted, which may include a development of a study design.

6.17.4 High-Level Monitoring Design Description

Table 6.33 is a summary of previous wildlife monitoring undertaken and includes recommendations for future monitoring. Further rationale is provided in the following sub-sections, if appropriate, and is referenced in the table where applicable.

Table 6.33 Summary of wildlife monitoring and findings

Summary of Monitoring and Findings	Monitoring Objective		
	Operational	**Post-Breach**	**Reclamation**
Previous monitoring undertaken	General wildlife observations (animals, scat, and tracks) documented.	N/A	N/A
Summary of findings	734 observations of wildlife were documented in 2017.	N/A	N/A
Recommendations for 2018-2020 monitoring	General wildlife observations will continue to be made per Permit requirements. A study design for wildlife monitoring in the Hazeltine Creek corridor will be provided in 2020.	Reconnaissance-level field surveys to support updated food chain modelling for potential bioaccumulation in wildlife.	N/A

Notes: N/A: not applicable

6.17.4.1 Operational Monitoring

This section will be updated when a study design is submitted in 2020.

6.17.4.2 Post-Breach Monitoring

In 2018, a reconnaissance-level survey was undertaken to support an update of the food chain model first presented in the ERA. Soil sampling is presented in Section 6.19, soil invertebrate sampling in Section 6.20, and vegetation monitoring in Section 6.21. An additional component considered in the food chain model was flying insects.

Samples of flying invertebrates (bees/wasps [order Hymenoptera], moths [order Lepidoptera], and crickets/grasshoppers [order Orthoptera]) were collected from the impacted area and background areas. Information about the tissue chemistry of this important food item for insectivorous birds and bats was not previously available in Golder (2017). The samples were collected through a combination of manual foraging and trapping. Manual foraging generally involved surveying flowering plants for bees or the ground surface for grasshoppers and using a sweep net to capture target invertebrates. Moths were predominantly collected using black light traps. Terrestrial invertebrate trapping was conducted using methods adapted from the RISC guidelines for terrestrial arthropod inventory (RIC 1998), guidance from the Biological Survey of Canada (Marshall et al. 1994; Danks 1996) and the US Department of Agriculture (Schauff 1998). Terrestrial invertebrate trapping methods employed on the Site included malaise traps, black light traps, pan/window traps and Berlese funnels.

Irrespective of the specific capture method, the following steps consistent with the *BC Field Sampling Manual* (BC ENV 2013) were followed to process the flying invertebrate samples:

- Samples were collected using nitrile gloves and transferred to clean Ziploc bags.
- Flying invertebrates of the same order from a single sample location (limited to 25 meters squared [m2]) were composited.
- Flying invertebrates were left in sample containers stored at ambient temperature overnight to allow samples to depurate.
- Flying invertebrate samples were rinsed using DI water and blotted dry with lint-free wipes before being transferred to clean Ziploc bags.
- Samples were transferred to a freezer to kill the invertebrates.
- Samples were kept frozen until they were submitted to the laboratory for analysis.

The invertebrate tissue samples were submitted for analysis of metals and moisture content, and the data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.7.

6.17.5 Data Quality Control, Objectives, and Review

Wildlife observations data will undergo a QC screening prior to upload to the network.

Twelve duplicate flying invertebrate samples were collected and laboratory QC samples consisted of duplicates, method and equipment blanks, and certified reference materials. RPDs exceeded DQOs for most metals in at least one duplicate sample. A higher variability in flying invertebrate samples is expected because the field duplicates are not splits of a composite—they are two composites of different individual organisms. In terms of copper, RPDs of 58 and 86% were noted in two of twelve duplicate pairs for wet weight concentrations and in one of twelve (RPD = 50%) of dry weight concentrations For vanadium, RPDs of 65 to 126% were noted in three of twelve duplicate sample pairs for wet weight concentrations and in zero of twelve duplicate sample pairs for dry weight. The data were considered reliable and suitable for there intended purpose

6.17.6 Laboratory Analysis

Laboratory analyses of the invertebrate tissue samples were undertaken by a CALA-accredited laboratory.

6.17.7 Data Analysis and Reporting

Number of wildlife observations will be tabulated and reported in the AERR.

The flying insect chemistry data (Golder 2019a) and updated food chain model (Golder 2019b) were submitted to ENV as an attachment to the 2018 Annual Report.

The wildlife food chain model presented in the ERA (Golder 2017) provided screening-level risk estimates for receptors exposed to copper and vanadium (the only contaminants of concern identified in the ERA),

which were based on calculated area-weighted hazard quotients (HQs) of <1 to 2.8, and a maximum HQ of 5.1 (for masked shrew in the Polley Flats area). Although the HQs were considered not to represent an unacceptable risk to wildlife, the food chain model was refined in 2018 by:

- Adding bats (*Myotis* sp.) as a receptor.
- Improving the quality of information with respect to tissue concentrations in invertebrates and plants by expanding the existing bioaccumulation sampling (as part of the reconnaissance-level survey conducted in 2018).
- Replacing the conservative assumption that flying insects have the same tissue concentrations as soil-dwelling insects by collecting site-specific data (as part of the reconnaissance-level survey conducted in 2018).
- Refining the toxicity reference values (i.e., the denominator in the HQ) to consider more than a highly conservative threshold

Revised screening-level risk estimates resulted in lower HQs. Screening-level HQs were <1 for all receptors except robin, shrew, and bat exposed to copper. The aggregate area-weighted HQs for those three receptors ranged from 1.0 to 1.7, and the maximum observed HQ for a sub-area was 2.1 for robin in the Polley Flats area. When a refined TRV was used to provide an additional level of protection to listed species, no HQs greater than 1 were identified and therefore, risks to wildlife associated with copper and vanadium in soils at the site are considered to be acceptable.

6.18 Amphibian and Reptile Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.18.1 Section Authors and Study Design Professionals

This section was written by Golder. The detailed study design concept is provided in Appendix B.6. Note that Appendix B.6 is a study design concept; a study design may be submitted at a later date depending on results of a preliminary review (Steps 1 and 2 as outlined in Figure 1 in Appendix B.6).

6.18.2 Monitoring Objectives

The study design concept in Appendix B.6 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.6, the objectives of amphibian monitoring will be to "continue the risk assessment process by proceeding through tiers to the point needed to support an informed risk management decision". More detail is provided in Appendix B.6.

6.18.3 Monitoring Overview

A tiered approach has been recommended, as outlined in Appendix B.6. Only Steps 1 and 2 will be completed as part of the current CEMP, with Step 1 undertaken in 2018. If risks are found to be unacceptable

at the end of Step 2, further investigation following the proposed tiered approach described in Appendix B.6 will be conducted, which may include a development of a study design.

6.18.4 High-Level Monitoring Design Description

In 2018, Step 1 of the study design concept was undertaken, specifically, a hazard evaluation. Existing soil, sediment and surface water chemistry data were screened for different habitat units against a conservative amphibian-specific screening value, as follows:

1. Review of existing guidelines: the purpose of the review was to determine if existing guidelines, criteria or standards contained sufficient amphibian-specific data to allow their use as a screening value for this assessment.
2. Derivation of screening values: the existing guidelines were determined to be unsuitable for the amphibian hazard assessment, and therefore screening values were developed through the review of scientific literature. Toxicity testing data were compiled, an uncertainty analysis was conducted on the compiled data, and safety factors were applied as applicable to mitigated identified uncertainties.
3. Application of derived screening values to site data: site monitoring data for water, sediment and soils were compared to the screening values for water and hydric soils/sediment.

6.18.5 Data Quality Control, Objectives, and Review

The study was a desktop review of guideline derivation documents and scientific literature.

6.18.6 Laboratory Analysis

No laboratory analysis were undertaken as part of the amphibian hazard assessment.

6.18.7 Data Analysis and Reporting

The amphibian hazard assessment (Golder 2019c) was submitted to ENV as an attachment to the 2018 Environmental and Reclamation Report (the "2018 Annual Report"), prepared in fulfillment of *Mines Act* permit M-200, and *Environmental Management Act* permit 11678. In summary, a toxicity reference value of 0.018 mg/L dissolved copper was derived for evaluating hazards associated with surface water, and 800 mg/kg copper for evaluating hazards associated with hydric soils or sediment. The available surface water and soil data for the Mount Polley site were compared to these conservative screening values, and overall, there was no evidence that environmental concentrations were routinely or notably higher than those screening value on a site-wide basis. Hazards to amphibians as a result of exposure to soil or surface water are considered to be low under these circumstances.

6.19 Soil Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description;

data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.19.1 Section Authors and Study Design Professionals

This section was written by Golder, and the detailed study design concept is provided in Appendix B.5.

6.19.2 Monitoring Objectives

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.5, the objective of soil monitoring will be to "refine site-specific relationships between copper concentrations in soil and copper concentrations in various soil invertebrate and plant tissues". More detail is provided in Appendix B.5.

6.19.3 Monitoring Overview

Monitoring of soil stockpiles on the mine site for reclamation and closure is outlined in the Soil Management Plan included in the RCP. It is covered under BC *Mines Act* Permit M-200.

In 2018, Task 1A of the study design concept was undertaken, specifically, a reconnaissance-level sampling program.

6.19.4 High-Level Monitoring Design Description

Operational Sampling - Monitoring of soil stockpiles on the mine site for reclamation and closure is outlined in the Soil Management Plan included in the RCP. It is covered under BC *Mines Act* Permit M-200.

Supplemental Sampling - Soil samples were collected from 69 locations (co-located with tissue samples – described in Sections 6.20 and 6.21) to refine the exposure estimate for post-breach rehabilitated areas. The soil chemistry data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.

Each sample was a composite of three aliquots of soil collected from within a 5 m radius of the tissue sample. The aliquots were collected from the top 20 cm of soil using a hand shovel, and then homogenized in a stainless-steel bowl prior to transfer to clean, laboratory-supplied 125-mL, glass sample jars with Teflon™ lined lids. Samples were kept on ice in a cooler after collection and kept cool until submitted to ALS for analysis of metals and pH.

6.19.5 Data Quality Control, Objectives, and Review

Supplemental soil sampling was undertaken using methods consistent with those used for the HHRA and ERA. Eight field duplicates were collected and laboratory QC consisted of duplicates, method blanks and matrix spike recovery. Copper and vanadium (the metals of interest for the food chain model) met the field DQOs. The soil sample results met the laboratory DQOs for precision, accuracy, method blanks, duplicate sample analysis and matrix spike recovery, with the exception of a method blank that had a detected

concentration of copper. This could be a potential bias in samples that are near the limit of reporting but was not an issue in the current samples because all copper results were substantially higher than detection limits. Overall, the data were considered representative and suitable for their intended use.

6.19.6 Laboratory Analysis

Laboratory analyses were undertaken by a CALA-accredited laboratory.

6.19.7 Data Analysis and Reporting

The results of the reconnaissance survey (Golder 2019a) were submitted to ENV as an attachment to the 2018 Annual Report. Data from the 2018 soil sampling were integrated with the relevant historical data to update the soil concentrations used in the food chain model. All samples were compared to the applicable CSR standards, and an overview of those findings is provided below for each of the different rehabilitated areas that were sampled in Tables 1 through 3. Overall, the results of the soil chemistry were consistent with results from previous sampling in those areas and no new contaminants of concern were identified. The use of the soil chemistry data is further discussed in Section 17 (vis-à-vis the food chain model update).

6.20 Soil Invertebrate Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.20.1 Section Authors and Study Design Professionals

This section was written by Golder, and the detailed study design concept is provided in Appendix B.5.

6.20.2 Monitoring Objectives

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.5, the objectives of soil invertebrate monitoring will be to:

- "Focus on establishing a long-term trend analysis of soil invertebrate community rather than to support a multitude of pair-wise comparisons that would have limited value for making site management decisions";
- "Refine site-specific relationships between copper concentrations in soil and copper concentrations in various soil invertebrate tissues"; and,
- "Improve the quality of data with respect to tissue concentrations in invertebrates, particularly for flying insects."

6.20.3 Monitoring Overview

In 2018, Task 2A of the study design concept was undertaken, specifically, a reconnaissance-level sampling program.

6.20.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Additional sampling was conducted to improve the spatial coverage of soil invertebrate samples, and to obtain sufficient samples of each main invertebrate type from the range of soil concentrations present at the site. Invertebrate (i.e., ants, beetles, spiders and worm) samples were collected through a combination of manual foraging and trapping. Manual foraging involved surveying the ground surface and searching below woody debris. Sampling was conducted if sufficient volume of soil invertebrates were noted or if a larger soil invertebrate (e.g., a large beetle) was found.

Terrestrial invertebrate trapping was conducted using methods adapted from the RISC guidelines for terrestrial arthropod inventory (RIC 1998), guidance from the Biological Survey of Canada (Marshall et al. 1994; Danks 1996) and the US Department of Agriculture (Schauff 1998). These documents guided the selection of the trapping method, locations of samples, sampling design and trapping protocols. Terrestrial invertebrate trapping methods employed on the Site included pitfall traps and Berlese funnels. Irrespective of the specific capture method, the following steps consistent with the *BC Field Sampling Manual* (BC ENV 2013) were followed to process the soil invertebrate samples:

- Samples were collected using nitrile gloves and transferred to either clean, laboratory supplied glass jars or clean Ziploc bags.
- Invertebrates of the same order from a single sample location (limited to 25 m^2) were composited.
- Soil invertebrates were left in partially open sample containers stored at ambient temperature overnight to allow samples to depurate.
- Invertebrate samples were rinsed using DI water and blotted dry with lint-free wipes before being transferred to clean Ziploc bags.
- Samples were transferred to a freezer to kill the invertebrates.
- Samples were kept frozen until they were submitted to the laboratory for analysis.

The soil invertebrate tissue samples were submitted for analysis of metals and moisture content, and the data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.

6.20.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Soil invertebrate sampling were undertaken using methods consistent with those used for the HHRA and ERA. Eight field duplicates were collected and laboratory QC consisted of duplicates, method blanks and certified reference materials. RPDs were greater than 50% for most metals in at least one duplicate sample. A higher variability in soil invertebrate samples is expected because the field duplicates are not splits of a composite—they are two composites of different individual organisms. In terms of copper, an RPD of 65% was noted for the wet weight concentration in one duplicate pair, but the dry weight data had an acceptable RPD (48%). There was less variability in copper results than most other metals, and Golder concludes that the data are reliable and suitable for its intended purpose. RPDs of 55 to 106% were noted in four of eight duplicate sample pairs for wet weight concentrations and in two of eight duplicate sample pairs for dry

weight with respect to vanadium. However, this variability does not impact the overall conclusion that vanadium bioaccumulation is limited, nor does it change the conclusion that vanadium risks to wildlife from consumption of dietary items was low. The tissue samples met the laboratory DQOs with respect to copper and vanadium (the parameters of interest for the food chain model).

6.20.6 Laboratory Analysis

Laboratory analyses were undertaken by a CALA-accredited laboratory.

6.20.7 Data Analysis and Reporting

The results of the reconnaissance survey (Golder 2019a) were submitted to ENV as an attachment to the 2018 Annual Report. The use of the soil chemistry data is further discussed in Section 17 (vis-à-vis the food chain model update).

6.21 Vegetation Monitoring

The following sections give a synopsis of the objectives; sample locations along with parameters measured, site description, sampling frequency, and applicable guidelines; a high-level monitoring design description; data quality control, objectives, and review; laboratory analysis; and data analysis and reporting, where applicable.

6.21.1 Section Authors and Study Design Professionals

This section was written by MPMC, and is a summary of the study design concept provided by Golder. The detailed study design concept is provided in Appendix B.5. Note that Appendix B.5 is a study design concept; a study design will be submitted in Q1 2019 after completion of tasks outlined in Figure 2 in Appendix B.5.

6.21.2 Monitoring Objectives

The study design concept in Appendix B.5 focuses on reducing the sources of uncertainty from the terrestrial ERA (Golder 2017). As outlined in Appendix B.5, the objectives of vegetation monitoring will be to:

- "Focus on establishing a long-term trend analysis of plant community rather than to support a multitude of pair-wise comparisons that would have limited value for making site management decisions"; and,
- "Refine site-specific relationships between copper concentrations in soil and copper concentrations in various plant tissues."

More detail is provided in Appendix B.5.

6.21.3 Monitoring Overview

In 2018, Task 2A of the study design concept was undertaken, specifically, a reconnaissance-level sampling program.

6.21.4 HIGH-LEVEL MONITORING DESIGN DESCRIPTION

Samples of the edible portions of plants (were collected following the same approach used in 2015 and 2016. The focus of plant sampling was on rehabilitated areas to increase sample density in these areas and to provide more information about plants growing in soils that have lower copper concentrations than the non-reclaimed areas. The following plant tissue samples were collected in 2018:

- Berry—Berry samples were collected from raspberry [*Rubus occidentalis]*, high bush cranberry [*Viburnum trilobum*], and thimbleberry [*Rubus parviflorus*]) plants that were rooted in soil.
- Leaf—Willow (*Salix* sp.) and alder (*Alnus crispa*) leaf samples were collected from shrubs planted in the impacted area. Only shrubs planted in the floodplain before spring 2016 were sampled. Plants sampled included willow planted in lower Hazeltine Channel in early 2015, above the canyon in late 2015, and in upper Hazeltine Channel late 2015 (near Gavin Lake Bridge).
- Grass— Slender wheatgrass *(Elymus trachycaulus*) samples were collected from a variety of areas. The objective of the sampling was to reduce the uncertainty in the existing soil-to-grass bioaccumulation relationship, and therefore, sampling was limited to a single species which was commonly found across the entire site. Only the edible, above-ground portion of grass was collected.

Sampling methods were consistent with the *BC Field Sampling Manual* (MoE 2013) and consisted of the following steps:

- Plant tissue was hand-picked by field staff using nitrile gloves from an area of 25 m^2 or less. Plant tissue was composited from multiple plants within the area if sufficient volume could not be collected from one plant.
- Plant samples were rinsed using DI water and blotted dry with lint-free wipes before being transferred to clean Ziploc bags.
- Samples were placed in a cooler containing ice until they could be transferred to a freezer for storage prior to shipping to the laboratory for analysis.

The plant tissue samples were submitted for analysis of metals and moisture content, and the data were used, with other data collected as part of the reconnaissance survey, to update the food chain model developed to evaluate the potential for bioaccumulation of metals in wildlife. The food chain model update is described in Section 6.17.

6.21.5 DATA QUALITY CONTROL, OBJECTIVES, AND REVIEW

Vegetation sampling was undertaken using methods consistent with those used for the HHRA and ERA. Five replicate plant samples were collected and laboratory QC consisted of duplicates, method blanks and certified reference materials. Data quality objectives were met for copper and vanadium (the parameters of interest for the food chain model) in vegetation samples for both field and laboratory QC samples.

6.21.6 Laboratory Analysis

Laboratory analyses were undertaken by a CALA-accredited laboratory.

6.21.7 Data Analysis and Reporting

The results of the reconnaissance survey (Golder 2019a) were submitted to ENV as an attachment to the 2018 Annual Report. The use of the soil chemistry data is further discussed in Section 17 (vis-à-vis the food chain model update).

6.22 Biosolids Monitoring

MPMC is in possession of an EMA permit (15968) for the use of biosolids. This permit requires that MPMC retain the services of a qualified professional to develop a monitoring plan for the biosolids application program. MPMC will submit this plan to ENV and EMPR prior to receiving any additional shipments of biosolids to the mine site.

7 CEMP UPDATES AND REVISIONS

When possible, MPMC will provide written notice of planned changes to the CEMP to the ENV Director a minimum of 30 days prior to implementation to allow for review and feedback on the revision. Proposed changes will be shared with First Nations and stakeholders, as per MPMC's Communication Plan (MPMC 2016d). Additionally, changes that occur but are unplanned, such as the collection of additional samples, will be discussed with the ENV Director as soon as possible after the sampling occurs. When changes are made to the monitoring, this amended plan (or relevant replacement pages) will be resubmitted to the Director.

Given the dynamic nature of environmental investigation, rehabilitation, and water management plan development at Mount Polley Mine, it is anticipated that the CEMP will evolve in alignment with site activities and findings, as described in Section 2.3, and will be updated as required. It is anticipated that larger CEMP revisions in response to these activities and findings will be made with consideration of maintaining continuity in spatial and temporal coverage to meet the global objectives of the CEMP, as described in Section 1.1.

As required by the Permit, following the three-year detailed monitoring program interpretive report to the Director, MPMC will submit a summary of proposed changes to the CEMP to the Director by April 30 of that year (one month following the interpretive report deadline). In order to incorporate recommended changes in a timely fashion, MPMC would appreciate feedback on the proposed changes from the ENV by May 31 of that year.

8 RECLAMATION AND REMEDIATION

Rehabilitation of the aquatic and terrestrial receiving environments that were impacted by the TSF embankment breach and associated remediation activities is continuing as outlined in the Rehabilitation Strategy (November 2015 update; MPMC 2015f), as required by the PAO 107461. Under this broader Rehabilitation Strategy:

- Terrestrial rehabilitation works are being conducted as per the *Planning Concepts for Rehabilitation of Terrestrial Ecosystems at Mount Polley* technical memorandum prepared by Golder (2015e). The reclamation and monitoring steps described in this memorandum are based on the TSF embankment breach environmental impact assessment results to date.
- Rehabilitation of aquatic systems is being conducted under guidance of the Habitat Remediation Working Group, which includes representatives of DFO, ENV, the BC Ministry of Forest, Lands and Natural Resource Operations, the SCIB, and the WLIB. This group provides recommendations and feedback on aquatic ecosystem rehabilitation plans developed by MPMC's consultants.

Monitoring associated with the Hazeltine Creek channel rehabilitation construction activity is undertaken under the *Post-Breach Rehabilitation Work Environmental Management Plan* (Golder 2015f), which pertains to monitoring of any construction works and associated construction specifications. While the lower reaches of Hazeltine Creek remain non-fish bearing (with the exception of the lower sedimentation pond), the *MPMC Fish Exclusion and Response Plan* (MPMC 2015f) is in effect. MPMC will conduct monthly visual inspections for fish in the non-fish bearing areas of the creek when the creek is free of snow and ice (in case any fish have evaded the barriers), as well as weekly inspections of fish exclusion structures. The plan outlines response actions in the event that fish are observed.

As Hazeltine Creek is rehabilitated and returned to fish-bearing status, this environmental management plan will be phased out and be replaced by routine monitoring for evaluating performance of the works as a component of the CEMP.

The Habitat Remediation Working Group made up of provincial and federal regulators, qualified professionals and First Nations representatives, agreed upon a monitoring plan for the return of rainbow trout in Hazeltine Creek in 2018. This plan includes week fish surveys, detailed habitat usage surveys, benthic, sediment, water (quality and quantity), and fish tissue sampling. Reporting on these results will be included in the AERR.

The steps in the aforementioned terrestrial rehabilitation plan include establishment of permanent monitoring plots for ongoing assessment, feedback (to inform adaptive management) and demonstration. As terrestrial rehabilitation works progress, monitoring to this end will be implemented.

A Conceptual Remediation Plan (CRP) was submitted to ENV on January 31, 2018 (Golder 2018) and following receipt of comments on the CRP, a Remediation Plan submitted on March 29, 2019 (Golder 2019d). The Remediation Plan identifies remedial options for the sites impacted by the TSF breach, including creek habitats, lake habitats, and terrestrial habitats, as well as proposed monitoring components to verify the success of the planned remediation. The Remediation Plan was approved by ENV on July 3, 2019.

9 REPORTING

9.1 MONTHLY REPORTING

As required by Section 3.9 in the Permit (April 7, 2017) a monthly report will be submitted to the Director in each month that discharge occurs. The report will summarize the volume of treated effluent discharged, a summary of continuous turbidity readings of the treated effluent discharged, and the most recently available water quality results for the effluent discharged, including a summary of acute and/or chronic toxicity testing results.

9.2 QUARTERLY REPORTING

All data and information collected under the CEMP will be provided to the Director, in electronic format, on a quarterly basis or as required by the Permit.

Under the most recent version of PAO 107461 (June 9, 2017) Section 6.0, a quarterly report detailing the implementation status of requirements of the order, a summary of communications with stakeholders and public relating to the breach, and any remediation activities undertaken in Hazeltine Creek, Polley Lake and Quesnel Lake for the previous and upcoming three months must be submitted to the director.

9.3 ANNUAL REPORTING

As required by the Permit Section 3.9, MPMC will continue to submit an AERR on or before March 31 of each year. This report is combined with the Annual Reclamation Report prepared for the EMPR, with the combined document submitted to both agencies. These reports will include the details required by the permit, as well as an analysis of the linkages between program components, where appropriate. MPMC will refer to *Technical Guidance 4, Environmental Monitoring under the Environmental Management Act* such that the ENV's expectations for reporting are achieved.

The AERR will continue to be in a format suitable for public release and will be deposited at the Cariboo Regional District Library as well as submitted to the SCIB and WLIB within 30 days of being submitted to the ENV.

As required by the Permit (April 7, 2017) Section 2.5, MPMC will continue to submit an annual Environmental Emergency Response Plan and will include updated procedures and notification protocols. MPMC will also continue to submit an Annual Discharge Plan on or before April 15 of each year and include the details required by the Permit Section 2.7.

9.4 THREE-YEAR REPORTS

Under the Permit, a detailed monitoring program interpretive report is required every three years with the first report due on March 31, 2019 and every three years thereafter. The March 2019 interpretive report will include data collected in 2016, 2017, and 2018. This report will be completed by one or more qualified professionals and will be more comprehensive than the synoptic review of data presented in the annual reports. It will include recommendations for changes to the CEMP.

In addition, a groundwater monitoring program review including, but not limited to, sampling, well locations, site water balance, interpretation of data trends, and suitable recommendations is required every three years, with the first presented in March 2016. The next report will be submitted on March 31, 2019. Monitoring data and the analysis of those data presented in the report will be reviewed by a third party qualified professional.

10 FUTURE OUTLOOK

This CEMP represents a unique and specialized variation of a typical mine environmental monitoring plan. This plan seeks to integrate all environmental monitoring programs that are carried out on the Mount Polley mine site and in the local area related to:

(a) Ongoing mine operations (including EMA and *Mines Acts* permit requirements and MDMER requirements of the *Fisheries Act*);
(b) TSF embankment breach-related impacts and remediation; and,
(c) Reclamation and closure planning (*Mines Act* permit requirement).

The overall goals of this CEMP are to provide science-based evidence: for evaluation of environmental impacts of mine operations; for evaluation of the effects of any ongoing impacts of, and remediation measures undertaken in response to, the TSF embankment breach; and to inform ongoing reclamation and closure planning. These goals are guided by an intent to return the impacted areas of the mine site and its surroundings to viable and diverse ecosystems that reflect pre-breach land uses, or those identified by Communities of Interest as representing values of importance. These values of importance are identified through ongoing consultation with local Communities of Interest.

Mount Polley fosters a culture of research and innovation. In addition to the extensive monitoring and research work that was undertaken as part of the impact and risk assessments of the TSF embankment breach, there are a number of research projects underway (and several recently completed) that the mine has supported. The results of these projects may contribute directly to improving the mine's understanding of breach impacts (Cuervo et al, 2017; Garris et al, 2018; Byrne et al, 2018), new approaches to remediation, reclamation and closure (McMahen, PhD in progress, UBC; Litke MASc in progress, UBC), and to mitigating environmental impacts of ongoing operations.

With respect to mitigating environmental impacts of ongoing operations and planning for reclamation and closure, Mount Polley is embarking on passive water treatment research and pilot projects to test the suitability of constructed wetland water treatment systems for dispersed water treatment and discharge on the mine site. These research projects will include lab and site testing, monitoring of water quality, vegetation, and microbial communities, and will be reported annually in the AERR or in a technical memo.

As the results of monitoring programs and environmental research projects are generated, analyzed, and interpreted, this CEMP will be reviewed and updated where warranted. MPMC will aim to review the requirements of the CEMP on a quarterly basis and will submit a list of proposed changes based on the review to the Director within 45 days from the end of the quarter.

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Appendix A

CEMP Terms of Reference – 4 July 2017

Mount Polley Mining Corporation

Mount Polley Mining Corporation
an Imperial Metals company

Terms of Reference

Comprehensive Environmental Monitoring Plan – 4 July 2017

1 BACKGROUND AND CONTEXT

Mount Polley Mining Corporation (MPMC) is the owner and operator of the Mount Polley Mine, a property comprising, among other things, a copper-gold mine and mill complex located near Likely, British Columbia (BC).

MPMC is authorized by the BC Ministry of Environment (MoE) to discharge effluent to the land and to surface water from the Mount Polley Mine, subject to the terms and conditions of *Environmental Management Act* (*EMA*) Permit 11678. *EMA* Permit 11678 was originally issued to MPMC by the MoE on 30 May 1997, and has been the subject of numerous amendments since.

As is typical of owners of mines in BC, MPMC undertakes extensive environmental monitoring for a variety of purposes and objectives. In many instances, data collected as part of one monitoring program are beneficial to other programs, even though programs may have been established specifically for unique purposes.

Under Section 3.2 of *EMA* Permit 11678, MPMC is required to implement a Comprehensive Environmental Monitoring Plan (CEMP). In previous versions of *EMA* Permit 11678, MPMC was required to implement a number of individually defined monitoring plans for various aspects of Mount Polley Mine operations to which this MoE authorization was subject. As stated in Section 3.2 of *EMA* Permit 11678, the CEMP is intended to consolidate and integrate all such pre-existing monitoring programs.

2 OBJECTIVES AND DRIVERS

As described in Section 3.2 of *EMA* Permit 11678, the objective of the CEMP is to evaluate the effects of mining-related activities on the physical, chemical and biological characteristics of Hazeltine Creek, Edney Creek, Bootjack Lake, Morehead Creek, Polley Lake, Quesnel Lake, Quesnel River, and associated riparian and upland areas.

Environmental monitoring has the broad objective of verifying that environmental controls are in place that protect the environment and are sufficient to confirm compliance with applicable statutory requirements to which operations are subject. Environmental monitoring also has the broad objective of providing data to support evidence-based communication to parties who might be affected by the Mount Polley Mine.

For the Mount Polley Mine, the main drivers (which govern the objectives) are:

- Regulatory Drivers;
    - Federal (e.g., *Metal Mining Effluent Regulation* [MMER])
    - Provincial (e.g., *EMA, Mines Act*)
- MPMC Commitments:
    - The respective Participation Agreements (PAs) that MPMC have in place with the Soda Creek Indian Band (SCIB; Xatśūll First Nation) and the Williams Lake Indian Band (WLIB).

Subject to the requirements of the various drivers, the CEMP is intended to be an adaptive plan. This means that the CEMP is anticipated to change over time, as it is informed by findings obtained from preceding stages of work.

3 SCOPE AND CONTENT

The scope of the CEMP will be built around the Objectives and Drivers, will provide an appropriate level of scientific robustness, and will utilize provincially and federally acknowledged methodology. It is noted that failing to utilize methods common to the various objectives undermines the value of a comprehensive monitoring program. The scope of the CEMP will not include studies of general research (e.g., academic), nor will it include collection of regional data that are not directly linked to the Objectives and Drivers.

As per Section 3.2 of *EMA* Permit 11678, the scope of the CEMP must be such that it consolidates and integrates monitoring programs that are being conducted in the vicinity of the Mount Polley Mine site. At minimum, the CEMP must consider programs addressing surface water (quality and quantity), groundwater (characterization and interactions with surface water), sediments, soils, periphyton, phytoplankton, benthic invertebrates, zooplankton, fish, floodplain and upland vegetation, and wildlife.

As described in Section 3.2 of *EMA* Permit 11678, the CEMP must address, at minimum, a three-year time span, as well as, at minimum, include all sampling sites, frequency of sampling, variables to be analyzed, method detection limits, sampling methods, sample analysis methods, and data analysis methods.

As noted in the Background and Context of this Terms of Reference, environmental monitoring is a tool used by mining companies (and others) to inform them (and other parties), of the adequacy of their source control efforts. The content of the CEMP will be reflective of its use as such a monitoring tool. The CEMP will serve as the document that provides the context and linkages demonstrating how the monitoring program developed provides an appropriate mechanism by which to meet the Objectives and Drivers of the CEMP. In providing this purpose, the CEMP's content is anticipated to provide: a statement of its objectives; an overview of its subject (the Mount Polley Mine); a discussion of the various components that comprise environmental management in the context of the Mount Polley Mine; presentation of monitoring procedures and considerations (e.g., previous data) specific to each environmental monitoring component; and, an outline for control of the CEMP (e.g., updating and revising) and its reporting outputs.

A comprehensive monitoring plan requires a response framework as the monitoring program is the linkage between monitoring plan design, implementation, and effective use. The level and urgency

of response will have due regard to the level of potential risk to the environment (which includes people). The CEMP response framework will be updated in parallel with the CEMP, or as otherwise appropriate.

4 DEPENDENCIES AND ASSUMPTIONS

The CEMP is intended to support an interdependent program. The dependencies across the monitoring programs will be evaluated with the benefit of a conceptual site model (CSM). The CSM will aid in understanding and addressing the dependencies by allowing a visual representation of release and transport mechanisms (e.g., sources and water flow) and exposure by environmental receptors. The CEMP is predicated on the understanding that people (i.e., humans) are part of the environment. The CEMP response framework will have due regard to linkages and dependencies, and the CSM.

The CSM will be reviewed for dependencies in the context of:

- The Objectives and Drivers and Scope for the CEMP, as described in this Terms of Reference.
- The basal understanding of sources, pathways, contaminants of potential concern (COPC), and receptors.
- An analysis of the linkages between program components, in a tabular format.
    - Linkages will include a rationalization of methods used across program components to make the methodology as consistent as possible.
- Current and planned activities at the Mount Polley Mine site, especially how those activities might impact on the CSM.

The following assumptions guide the continued development and implementation of the CEMP required under Section 3.2 of *EMA* Permit 11678:

- The CEMP is developed, reviewed and revised by Qualified Professionals (QPs), QPs being as defined by the Province of BC (e.g., R.P.Bio.).
    - MPMC notes that there are certain aspects of CEMP scoping (particularly in defining the objectives and drivers), where a QP is not necessary. For example, the reasonable study questions from members of the public are outside of the domain of expertise for a QP who would develop a CEMP; however, the scientific approach by which those questions would be answered are within the QP's domain of expertise.
- The CEMP will be based on information that is available, verifiable and can be relied upon by a QP.
- With the exception of regulatory requirements, a pattern of decrease or stasis in environmental condition is a suitable basis for gradual decrease in monitoring locations, frequencies, or parameters.

5 REVISION

The Mount Polley Mine is an operating site, changes to which are anticipated to transpire as development and closure activities co-occur; thus, an adaptive approach is both necessary and appropriate for documents such as the CEMP. Review of the CEMP content is an integral aspect of its effectiveness. In this application, 'effectiveness' means that the CEMP delivers on the regulatory drivers, some of which have rigid statutory obligations (e.g., MMER), satisfies the Objectives and Drivers for the CEMP, and undertakes that work with due regard to financial impact (without limiting the ability to meet the Objectives and Drivers established) and the adaptive nature of the CEMP.

To fulfill the adaptive approach, the CEMP will be reviewed and revised considering data collected in previous years (as interpreted by QPs). Such data will include that collected and interpreted directly under the CEMP, or as may be available from other assessments, studies or reports commissioned by MPMC as relating to the Objectives and Drivers for the CEMP. In the case of the latter, the CEMP will be modified, as appropriate, in consideration of the results and recommendations of such assessments, studies or reports. Based on collected data (and subsequent interpretation by QPs), the CEMP will include rationale for existing monitoring as well as any changes to the monitoring plan. It is anticipated that larger CEMP revisions in response to these activities will be made with consideration of maintaining continuity in spatial and temporal coverage to meet the Objectives and Drivers of the CEMP.

When possible, MPMC will provide written notice of planned changes to the CEMP to the MoE Director a minimum of 30 days prior to implementation to allow for review and feedback on the revision. Such written notice shall describe the planned changes as well as the rationale for the changes, including a summary of relevant data considered.

Under Section 3.2 of *EMA* Permit 11678, MPMC must submit a three-year detailed monitoring program interpretive report and updated CEMP to the MoE Director, for approval, by 31 March 2019, and every three years thereafter. Following the three-year detailed monitoring program interpretive report to the Director, MPMC will submit a summary of proposed changes to the CEMP to the MoE Director by April 30 of that year (one month following the interpretive report deadline).

A key component of the CEMP will be the monitoring program itself. The monitoring program will be designed, reviewed and revised by QPs such that, in their professional opinion, it satisfies the Objectives of the Drivers for the CEMP and allows MPMC to be informed of the adequacy of their source control efforts. Changes to the monitoring program that occur but are unplanned, such as the collection of additional samples, will be formally submitted with the MoE Director as soon as possible after the sampling occurs. Such written notice shall describe the planned changes as well as the rationale for the changes.

Notification of any CEMP or CEMP monitoring program changes must be provided to the MoE Director in writing for approval.

Notwithstanding the above, as per Section 3.2 of *EMA* Permit 11678, the MoE Director may require revisions to the CEMP or monitoring program based on review of monitoring data and/or any other relevant information.

6 CONSTRAINTS AND PROJECT RISKS

In the context of the CEMP and the content of this Terms of Reference, the following constraints and project risks have been identified by MPMC:

- The Mount Polley Mine, and by it, MPMC as owner and operator of the mine, is constrained to comply with applicable laws and statutory requirements.
- The health and safety of persons engaged in the monitoring work is a paramount consideration. Samples that cannot be obtained safely, using practical methods, will not be obtained. Certain seasonal conditions may preclude safe sampling.
- MPMC has voluntarily entered into (respective) PAs with the SCIB and the WLIB. MPMC will honour the respective PAs in full, and expects the SCIB and WLIB to reciprocate. Certain aspects of the CEMP pertain to subjects that fall within the bounds of the PAs.

7 ROLES AND RESPONSIBILITIES

In the context of the CEMP and the content of this Terms of Reference, the following roles and responsibilities are established:

- The MPMC Environmental Superintendent (or designate) will be responsible for implementing the CEMP, and revising it as appropriate.
    - Deliverables will be prepared by, or under the direct supervision of, QPs.
- Monitoring that is part of the CEMP will be coordinated by MPMC.
- All parties' reviewers of technical elements of the CEMP are required to be QPs if they are providing recommendations on the content or implementation of its subject matter.
- Participants involved in the design and review of the CEMP acknowledge that study designs, monitoring methods, and interpretation will be carried out in accordance with federal and provincial laws, policy and guidance.

Appendix B

Detailed Study Designs for CEMP Components

Appendix B - Addendum

Subsequent to the Issuance of the August 2018 CEMP, the following changes were made to study programs described in Appendix B:

Study	Change
Appendix B.1: Diffusive Gradient in Thin Film (DGT) sampling and toxicity testing with *Hyalella azteca*.	Sampling was conducted in 2019 and laboratory results are pending. When received, the data will be reviewed and recommendations for additional sampling, if any, will be presented to ENV in 2020.
Appendix B.2: Replication of tissue samples at Edney Creek location E1	Eight replicates of periphyton and benthic invertebrate tissues for chemistry were collected from E1 in 2019. The results are pending from the analytical laboratory.
Appendix B.4: Monitoring frequency	Monitoring frequencies applicable from 2018 to 2019, will be reviewed following data interpretation and modifications may be made in response to QP recommendations, subject to approval by the Director.
Appendix B.4: Spawning surveys	Visual spawning surveys (counts of adults and redds) were conducted in Upper Hazeltine Creek (2018) and lower Hazeltine/Edney Creek (2018 and 2019) per a monitoring plan developed in conjunction with the Habitat Remediation Working Group.

Appendix B.1

Sediment Monitoring

Minnow Environmental Inc.

Sediment Quality Monitoring Plan

Prepared for:

Mount Polley Mining Corporation
Likely, British Columbia

Prepared by:

Minnow Environmental Inc.
Georgetown, Ontario

June 2018

minnow environmental inc.
A Trinity Consultants Company

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1 INTRODUCTION

1.1 Background

Sediment is an important sink and potential source of metals, metalloids, and nutrients[1] in aquatic environments (e.g., Horowitz 1991; Ingersoll et al. 1997; Simpson and Batley 2016). Sediment quality of receiving environments adjacent to mine sites can be influenced by the direct input of solids as well as by the introduction of dissolved constituents (e.g., metals) into water that subsequently associate with reactive materials on sediment surfaces (e.g., oxides, organic carbon) by surface complexation (Santschi et al. 1990; Stumm and Morgan 1996; Sposito 2004). Sediment also represents a pathway for the exposure of aquatic life to metals and other substances (e.g., nutrients, organic substances). Therefore, sediment quality is an important component of the CEMP.

The influence of the Mount Polley Mine on sediment quality can occur (or, at some locations, has occurred) by several key mechanisms: 1) general mine influence from physical impingement, dustfall, and/or uncontained surface or groundwater flows: 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to December 2017, and directly since January 2018]); 3) the TSF embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Sediment quality in waterbodies adjacent to the Mount Polley Mine has been monitored since baseline investigations in 1989, 1995, and 1996 (Imperial Metals 1990; HKP 1996, 1997). Results of sediment quality monitoring are reviewed in Section 2 and provide context for a CEMP sediment quality monitoring program that is guided by a combination of historical findings, representative locations downstream of Mount Polley Mine operations, representative reference locations, and considerations for a statistically-based design that will facilitate the detection of spatial and temporal differences in addition to providing data to evaluate concentrations relative to effects-based guidelines (e.g., British Columbia Working Sediment Quality Guidelines [BCWSQG]; BCMOE 2017). In addition to sediment quality monitoring required as part of the Mount Polley CEMP, sediment quality monitoring is required to support benthic invertebrate community monitoring conducted as part of Environmental Effect Monitoring (EEM) under the Metal Mining Effluent Regulations (MDMER) of the federal *Fisheries Act*.

The following sections of the CEMP Sediment Quality Monitoring Plan provide the objectives of sediment quality monitoring, a summary of historical sediment quality findings, an overview of the CEMP study design and associated rationale (including sampling locations, replication,

[1] Through the remainder of this section, the term “metals” will be used to include metals, metalloids, and nutrients for ease of communication

frequency, and analytes), and detailed methodology for sediment quality monitoring (quality assurance/quality control [QA/QC], sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting).

1.2 Monitoring Objective

The objective of sediment quality monitoring is to evaluate the influence of Mount Polley Mine activities on receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions, and to determine potential implications to aquatic life by applying a variety of interpretive tools (e.g., Working Sediment Quality Guidelines [BCMOE 2017], biological assessment). Sediment quality monitoring also provides supporting information for benthic invertebrate community monitoring, and to support exposure assessment as part of ecological risk assessment (ERA) and human health risk assessment (HHRA). An additional objective is to advance the technical understanding of the stability or mobility and the potential bioavailability of metals in lake sediments affected by the TSF embankment breach.

2 SUMMARY OF HISTORICAL FINDINGS

Sediment has been monitored in the vicinity of the Mount Polley Mine since 1989, with most of the sediment quality samples collected in Polley Lake, Bootjack Lake, Hazeltine Creek, and Edney Creek (Table 1). Hazeltine Creek and Edney Creek are primarily comprised of erosional habitat, with few locations of sediment deposition. This has made sediment sampling challenging relative to lake environments, and some unconventional methodologies were applied in baseline studies.

Sediment quality sampling in the vicinity of the Mount Polley Mine has spanned four distinct time periods:

1. Baseline monitoring (1989, 1995, 1996);
2. Pre-breach operational monitoring (1999, 2009, 2012);
3. Post-breach operational monitoring (2014, 2015); and
4. Post-breach and post-discharge monitoring (2016).

Data collected prior to the breach were summarized in an Aquatic Environmental Description Report prepared concurrent with an application for water discharge to Polley Lake in 2014 (Minnow 2014), and general findings of the historical sampling, as well as sediment monitoring data collected from 2014 to present, are provided, by sampling area to support the design of the sediment quality monitoring plan.

2.1 Polley Lake

Baseline sediment quality of Polley Lake was characterized by concentrations of a number of metals that were naturally elevated above sediment quality guidelines, including arsenic, chromium, copper, iron, manganese, nickel, and selenium (Minnow 2014). Concentrations of copper, iron, and manganese were particularly elevated, with concentrations naturally exceeding upper sediment quality guidelines (also known as probable effect levels) in some samples (HKP 1996, 1997).

Sediment quality monitoring in Polley Lake during operations but before the TSF embankment breach in 2014 indicated that concentrations of most of the elevated analytes remained similar to baseline. One apparent exception was selenium, which increased from 1.7 – 2.6 mg/kg dry weight (dw) in baseline to 2.5 – 3.7 mg/kg dw in 2009, and 5.0 to 6.9 mg/kg dw in 2012 (Minnow 2014). This increase was considered to be due to uncontrolled surface runoff from a north waste rock dump which reported to Polley Lake via North Dump Creek. This runoff contained elevated concentrations of selenium from 2006 until control in 2009 with the construction of the Long Ditch.

Table 1: History of Sediment Quality Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Report
1989	Polley Lake, Bootjack Lake	Imperial Metals 1990
1995	Polley Lake, Bootjack Lake	HKP 1996
1996	Polley Lake, Bootjack Lake	HKP 1996
1999	Polley Lake, Bootjack Lake	Beak 2000
2009	Polley Lake	Minnow 2011
2012	Polley Lake	Minnow 2013a
2014	Polley Lake, Bootjack Lake, Quesnel Lake	Minnow 2015a
2015	Polley Lake, Bootjack Lake, Quesnel Lake	Minnow 2015b
2016	Polley Lake, Bootjack Lake, Quesnel Lake	Minnow 2016

B) Creeks

Year	Locations	Report
1995	Upper Hazeltine, Lower Hazeltine, Edney	HKP 1996
1996	Upper Hazeltine, Lower Hazeltine, Edney	HKP 1997
1999	Upper Hazeltine, Lower Hazeltine, Edney	Beak 2000
2007	Upper Hazeltine, Lower Hazeltine	Minnow 2009
2009	Upper Hazeltine	Minnow 2011
2010	Upper Hazeltine, Lower Hazeltine	Minnow 2011
2011	Edney	Minnow 2012
2012	Upper Hazeltine, Lower Hazeltine, Edney	Minnow 2013a
2013	Upper Hazeltine	Minnow 2013b
2014	Upper Hazeltine, Lower Hazeltine	Minnow 2015a
2015	Sedimentation Pond	Minnow 2015b
2016	Sedimentation Pond	Minnow 2016

Following the TSF embankment breach, sediment quality monitoring in Polley Lake indicated that concentrations of arsenic, copper, and iron were elevated at one or more monitoring locations relative to guidelines and baseline concentrations (Minnow 2015a). Changes in sediment quality were greatest for copper, with concentrations increasing from a baseline range of 262 – 370 mg/kg dw to 630 – 722 mg/kg dw in September 2014 (Minnow 2015a). Due to very low organic content of the breach-derived materials, sediment organic carbon content was also lower following the breach (Minnow 2015a). Sediment quality monitoring completed in 2015 and 2016 indicated very similar sediment quality from 2014 to 2016 (Minnow 2015b; 2016a; Figures 1 and 2). Evaluation of sediment deposition rates have indicated relatively low rates of sediment deposition in Polley Lake (average 0.66 mm/yr; 15 years for the accumulation of 1 cm of sediment; Minnow 2018). Sediment toxicity testing completed in 2014 and in 2016 indicated no effects to survival or growth of *Chironomus dilutus* and *Hyalella azteca* in standard tests completed on sediments from the Polley Lake basins (the deepest locations of the lake, known as P1 and P2), but a moderate reduction in growth of *H. azteca* at mid-depth areas (Minnow 2015a; Minnow 2017a). The benthic invertebrate community of the two deep basins in Polley Lake showed consistent recovery from 2014 to 2016 to a condition similar to the reference area in terms of density and richness in 2016 (Minnow 2017b). Lastly, a variety of sediment quality investigations conducted to characterize the potential mobility and bioavailability of sediment-associated metals (humidity cell tests, shake flask tests, selective extractions, ratios of simultaneously extracted metals to acid volatile sulphides [SEM/AVS], porewater chemistry, and Diffusive Gradients in Thin Films [DGT] devices) have all supported low mobility and bioavailability of sediment-associated metals (e.g., SRK 2015a,b; Minnow 2015a, 2016c, 2016d, 2017c, 2017d)

2.2 Hazeltine Creek

Baseline sediment quality of Hazeltine Creek was characterized in 1995 and 1996 (HKP 1996, 1997), but the latter included suspected errors (i.e., sampling in 1996 yielded unusually high concentrations of some metals [e.g., up to 2.2% copper] that were not observed in 1995 and have not been observed since). Based on the sampling conducted in 1995 (HKP 1996) and consistency with sampling conducted in 1999 (Beak 2000), concentrations of arsenic, copper, iron, and manganese (although reported as much lower than in 1996) were naturally elevated above lower sediment quality guidelines (Minnow 2014).

Sediment quality monitoring in Hazeltine Creek during operations but before the TSF embankment breach in 2014 indicated that concentrations of most of the elevated analytes remained similar to baseline. One possible exception was selenium, which, despite some uncertainty associated with different sampling methods and locations, had concentrations that were slightly greater than the sediment quality guideline of 2 mg/kg dw (i.e., up to 3.14 mg/kg dw

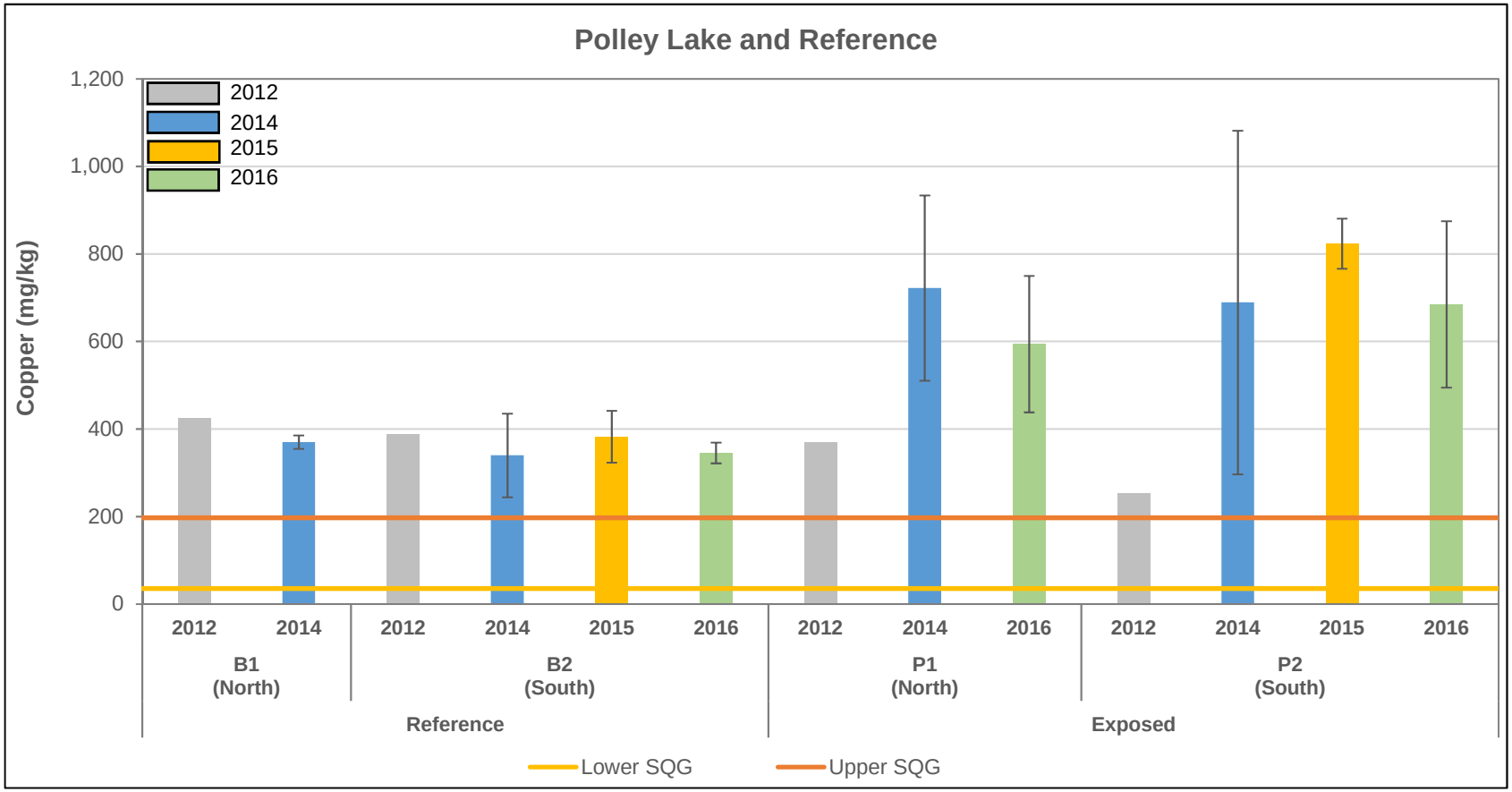


Figure 1: Concentrations of Copper in Polley Lake and Reference Sediment, 2012 to 2016

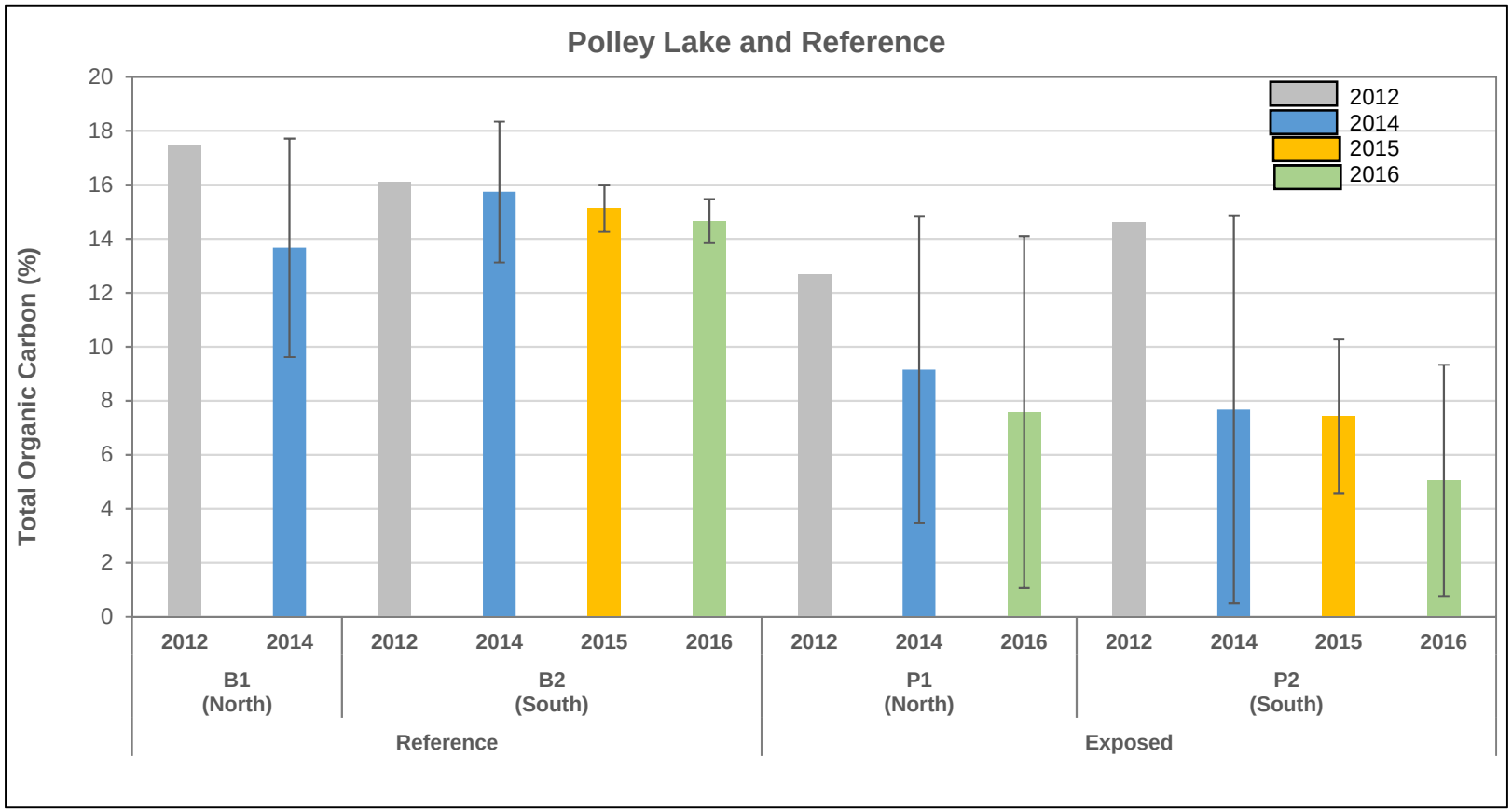


Figure 2: Concentrations of Total Organic Carbon in Polley Lake and Reference Sediment, 2012 to 2016

in a beaver pond in the fall of 2013; Minnow 2014). It is uncertain whether this difference was associated with the uncontrolled surface runoff that occurred from 2006 to 2009 (as described in Section 2.1) or if it was associated with the exclusive availability of fine sediment (that would naturally be expected to have higher metal concentrations) at a beaver pond sampled in 2013.

Following the TSF embankment breach, sediment quality monitoring was conducted in Hazeltine Creek in 2014. This sampling was prior to substantial rehabilitation from 2015 to 2017 and represented breach-material, believed to be mostly tailings. Accordingly, these "sediments" had very low organic carbon content, concentrations of copper and iron greater than upper sediment quality guidelines, and concentrations of arsenic and nickel greater than lower sediment quality guidelines (Minnow 2015a). Sediment quality monitoring of the Hazeltine Creek upper sedimentation pond completed in 2015 and 2016 indicated that concentrations of arsenic and nickel occurred at concentrations greater than reference and lower sediment quality guidelines, and concentrations of copper and iron occurred at concentrations greater than reference and upper sediment quality guidelines (Minnow 2015b; 2016).

2.3 Quesnel Lake

Sediment quality data for Quesnel Lake collected prior to the TSF embankment breach are limited to a few samples collected in the north arm near the mouth of the Mitchell River in 2012. These data documented a mean selenium concentration of 0.37 mg/kg dw (Minnow 2015a).

Following the TSF embankment breach, sediment quality monitoring in Quesnel Lake was completed at impacted areas and reference areas. A total of 121 sediment samples were collected from deep habitat of Quesnel Lake and 60 sediment samples were collected from shallow habitat of Quesnel Lake between 2014 and 2016 to characterize sediment quality (Minnow 2015a, 2015b, 2016). These sediment quality investigations indicated that the majority of breach-derived material was deposited to deep habitat. As with other habitats (i.e., Polley Lake and Hazeltine Creek), the chemical influence of the breach was most evident in copper concentrations greater than reference and upper sediment quality guidelines in impacted areas. Arsenic, iron, and manganese were elevated to concentrations greater than lower sediment quality guidelines, but concentrations of these metals were not elevated relative to reference or far-field concentrations. The influence of the breach was also evident in very low organic carbon content in impacted areas relative to reference. Sediment quality monitoring completed in 2015 and 2016 indicated very similar sediment quality from 2014 to 2016 (Figures 3 and 4; Minnow 2015b; 2016b), although the repositioning of two stations in area PNF in 2016 resulted in higher mean concentrations and lower variability. Some sediment consolidation (i.e., compaction) appears to be occurring in Quesnel Lake. Temporal change is expected to be primarily associated with deposition (i.e., covering of impacted sediment with non-impacted

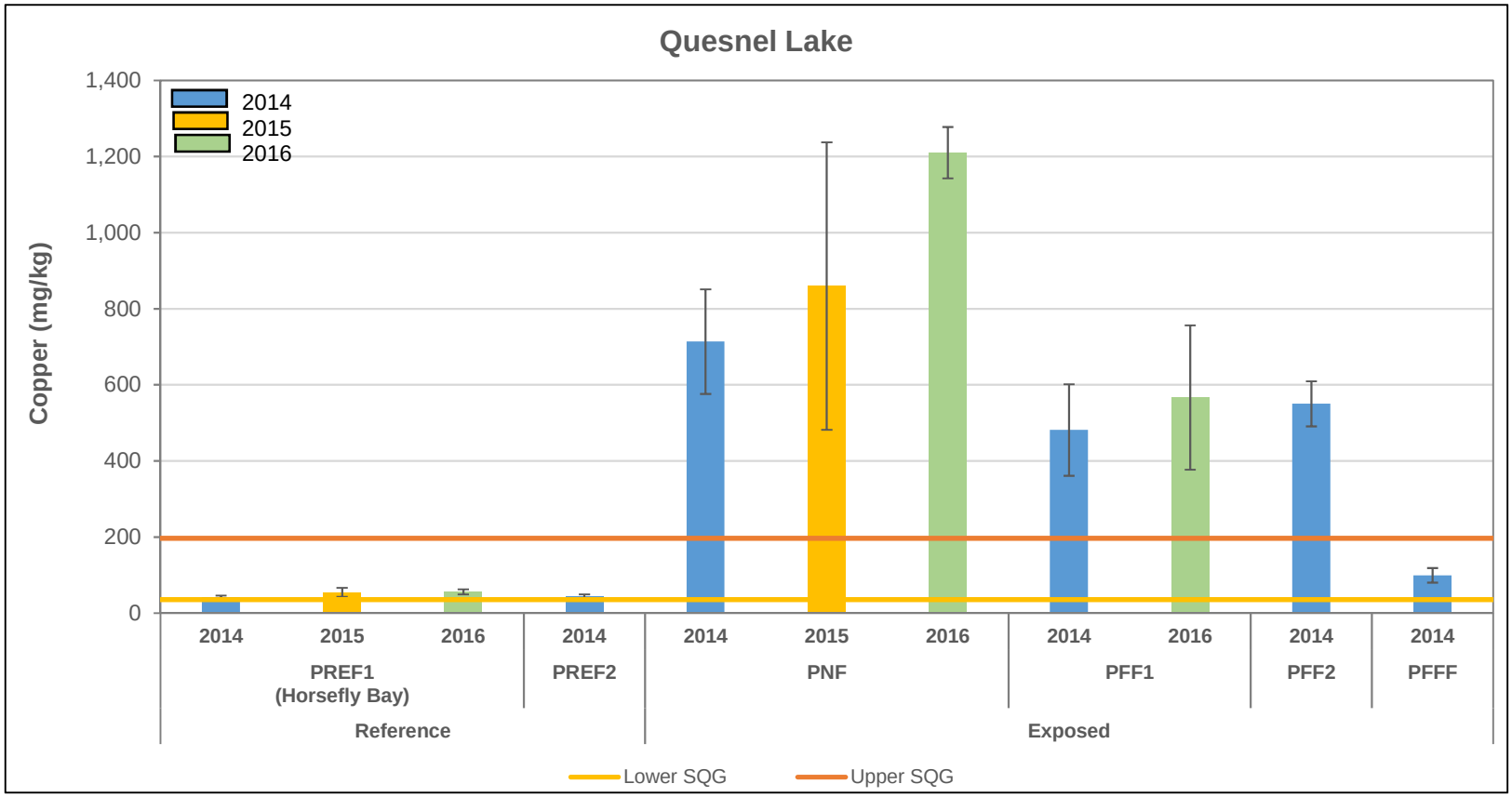


Figure 3: Concentrations of Copper in Quesnel Lake Sediment, 2014 to 2016

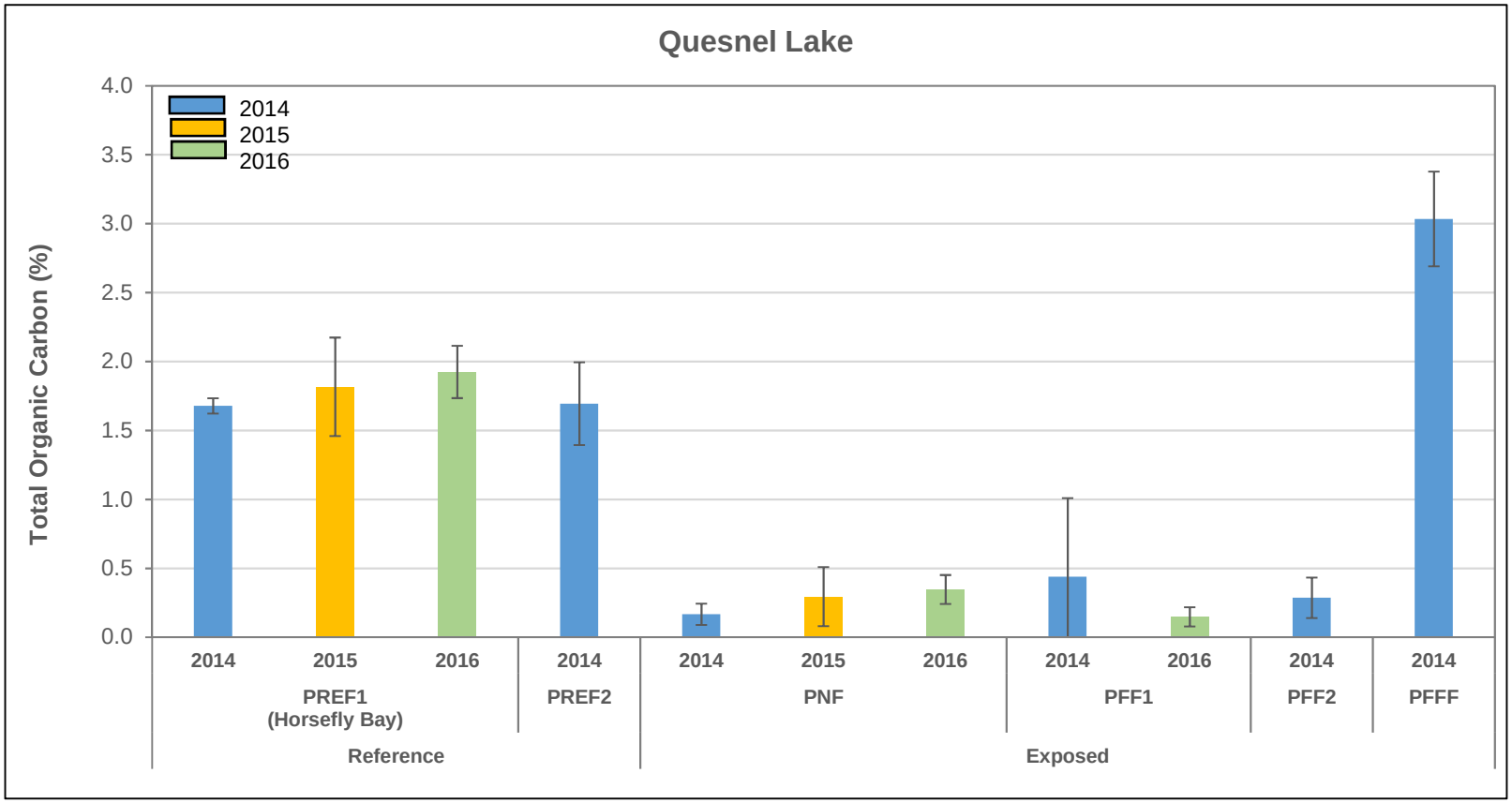


Figure 4: Concentrations of Total Organic Carbon in Quesnel Lake Sediment, 2014 to 2016

sediment), and evaluation of sediment deposition rates have indicated relatively low rates of sediment deposition in Quesnel Lake (range 1.4 to 1.7 mm/yr; 6 to 7 years for the accumulation of 1 cm of sediment; Minnow 2018).

Sediment toxicity testing completed in 2014, 2015, and 2016 indicated no responses to *C. dilutus* survival, but clear reductions in growth (Minnow 2017a). Clear responses to *H. azteca* survival and growth were observed, but *H. azteca* has low site-relevance as it is not present in deep areas of local lakes. Evaluation of relationships between observed responses and sediment quality indicated that combinations of high copper concentrations and low sediment organic carbon content were the best determinants of the observed responses (Minnow 2017a). Despite the observed responses in sediment toxicity tests, benthic invertebrate community monitoring, which is considered to be a measure of greater ecological relevance than toxicity testing (due to the fact that it evaluates in-situ habitat use by site organisms), indicated consistent recovery of organism density and taxon richness from 2014 through 2016. Although these endpoints remain lower than reference and the exposed area communities are not identical to reference, the observed increases are indicative of continued recolonization of these impacted areas. Lastly, a variety of sediment quality investigations conducted to characterize the potential mobility and bioavailability of sediment associated metals (humidity cell tests, shake flask tests, selective extractions, ratios of simultaneously extracted metals to acid volatile sulphides [SEM/AVS], porewater chemistry, and DGT devices) have supported low mobility and bioavailability of sediment-associated metals (e.g., SRK 2015a,b; Minnow 2015a, 2016c, 2017c).

3 STUDY DESIGN OVERVIEW AND RATIONALE

Sediment quality monitoring under the CEMP is designed to meet the combined needs of: 1) operational monitoring (including the discharge of treated effluent to Quesnel Lake); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to reclamation activity following the TSF embankment breach. An overview of the proposed sediment quality monitoring program is provided in Table 2 and Figures 5 and 6. Sediment quality monitoring is focused on Polley Lake, Hazeltine Creek, and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake [and Jacobie Lake in 2018] for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake). In Polley Lake, sediment sampling will focus on the two basins (deepest locations in Polley Lake, representing locations of sediment accumulation/fate), with the deepest location in Bootjack Lake (and Jacobie Lake in 2018) serving as reference. In Quesnel Lake, sediment quality monitoring for MDMER EEM will focus on the area near the point of effluent discharge (per Minnow 2016b) with two reference areas serving as reference (one unaffected by the breach and one affected by the breach but outside of the influence of effluent discharge). Additional sediment sampling in Quesnel Lake will focus on the deep areas that were previously monitored as near-field areas, with concurrent sampling of suitable reference areas. Hazeltine Creek is an erosional creek, and sediment sampling will be opportunistic, focussed on the collection of fines deposited on the declining hydrograph. All sediment quality monitoring includes sediment physical condition and sediment chemistry at all proposed sampling locations, as well as supporting sediment toxicity testing at a subset of areas (Table 2). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) concentrations relative to sediment quality guidelines for the protection of aquatic life (BCMOE). Accordingly, five stations per area are proposed for each to provide replication for the statistical contrasts.

Sediment quality monitoring will include physical and chemical characterization of deposited sediments, including particle size distribution, organic matter content, nutrients, and metals (see Section 4.2 below for greater detail). In accordance with BCMOE (2016) and in consideration that lake samples analyzed at the <63 µm fraction and <2.0 mm fraction yielded similar results (Minnow 2015a), sediment organic matter content, nutrients, and metals will be determined in the <63 µm fraction (silt and clay). Sediment toxicity testing (at Polley Lake, Quesnel Lake deep habitat, and associated references) will focus on larvae of the non-biting midge *Chironomus dilutus*. This organism is an ideal test organism for these sediments due to the ubiquitous presence of Chironomidae in these areas (Minnow 2015a) and the in-benthic habit of these organisms (in contrast to the epi-benthic habitat of other test organisms such as the amphipod

Table 2: Mount Polley CEMP Sediment Quality Monitoring Program Overview

A) Lakes

Water Body	Sampling Area	Type	Components [1]	Replication [2]	Rationale
Polley Lake	POL - P1 (Northwest Basin)	Exposed	C, T	5	immediately adjacent to mine and breach-influenced
	POL - P2 (Southeast Basin)	Exposed	C, T, D	5	immediately adjacent to mine and breach-influenced
Bootjack Lake	BOL - B2 (Southeast Basin)	Reference	C, T, D	5	reference for Polley Lake [3]
Quesnel Lake	QUL - EEMEXP	Exposed	C	5	adjacent to effluent discharge and breach-influenced
	QUL - EEMREF1	Reference	C	5	reference for EEMNF - breach-influenced reference
	QUL - EEMREF2	Reference	C	5	reference for EEMNF - non-breach-influenced reference
	QUL - PNF	Exposed	C, T, D	5	breach-influenced deep habitat
	QUL - PFF1	Exposed	C	5	breach influenced deep habitat
	QUL - PREF1	Reference	C, T, D	5	reference for exposed deep habitat areas of Quesnel Lake

[1] sediment monitoring components: C = chemistry (see Table 3 for analytes), T = toxicity (10-day test of *Chironomus dilutus*), and D = Diffusive Gradients in Thin Films

[2] number of replicate stations within the specified sampling area

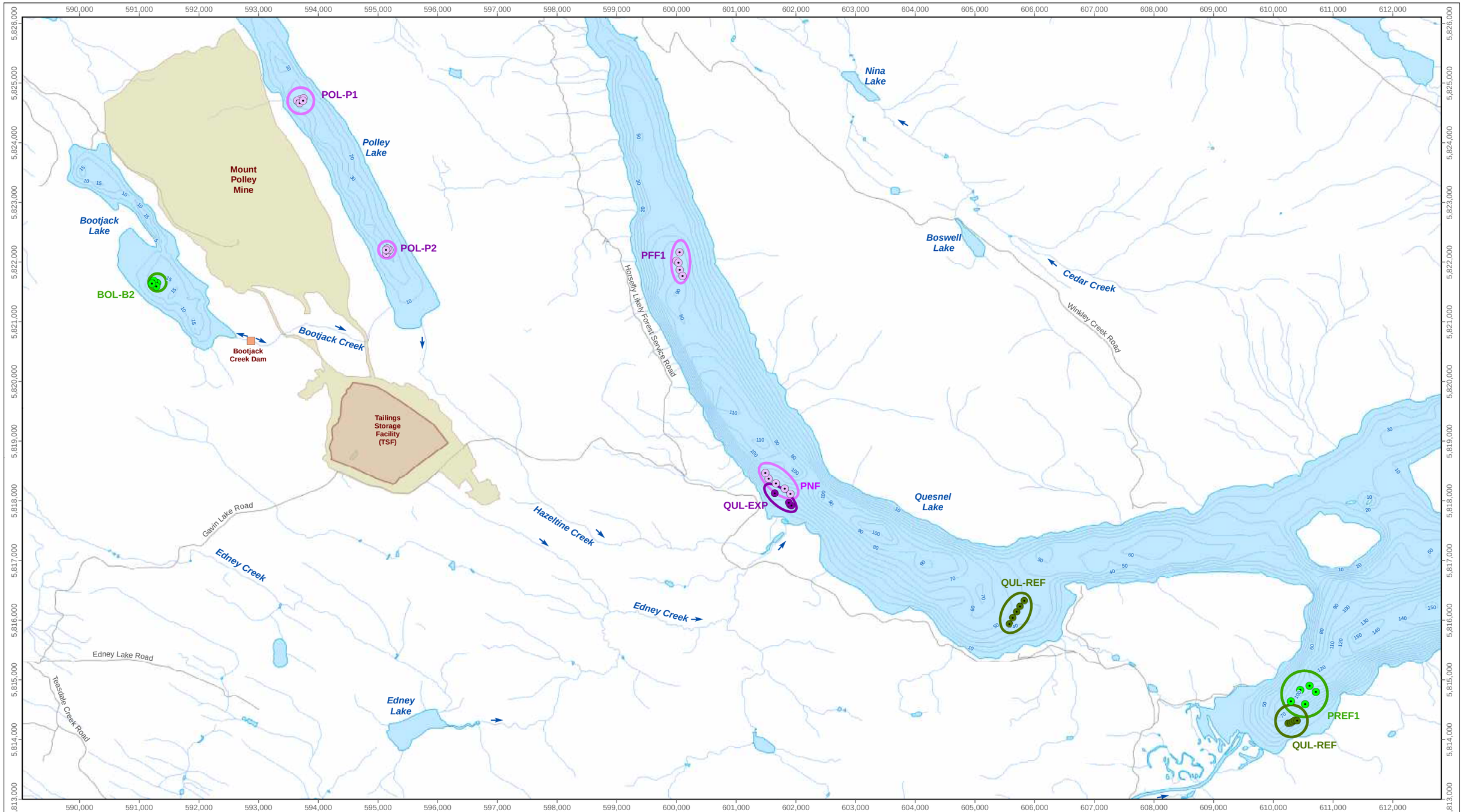
[3] Bootjack Lake is retained as the reference for Polley Lake due to the fact that it has not been notably affected by the mine, there is a long-term dataset available for it, and its watershed includes similar geology to Polley lake. The latter is not true for other potential reference areas.

B) Creeks

Water Body	Sampling Area	Type	Components [1]	Replication [2]	Rationale
Hazeltine Creek	HAC - U	Exposed	C	5	immediately adjacent to mine and breach-influenced
	HAC - D	Exposed	C	5	immediately adjacent to mine and breach-influenced
Edney Creek	EDC - U	Reference	C	5	reference for HAC - U
	EDC - D	Reference	C	5	reference for HAC - D

[1] sediment monitoring components: C = chemistry (see Table 3 for analytes), T = toxicity (10-day test of *Chironomus dilutus*), and D = Diffusive Gradients in Thin Films

[2] number of replicate stations within the specified sampling area



Sediment Quality Monitoring Station

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Sediment Quality Monitoring Area

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Please note: Quesnel Lake bathymetry lines are an approximate representation only and may not precisely delineate accurate depths at larger scales.

0 1 2 4 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U
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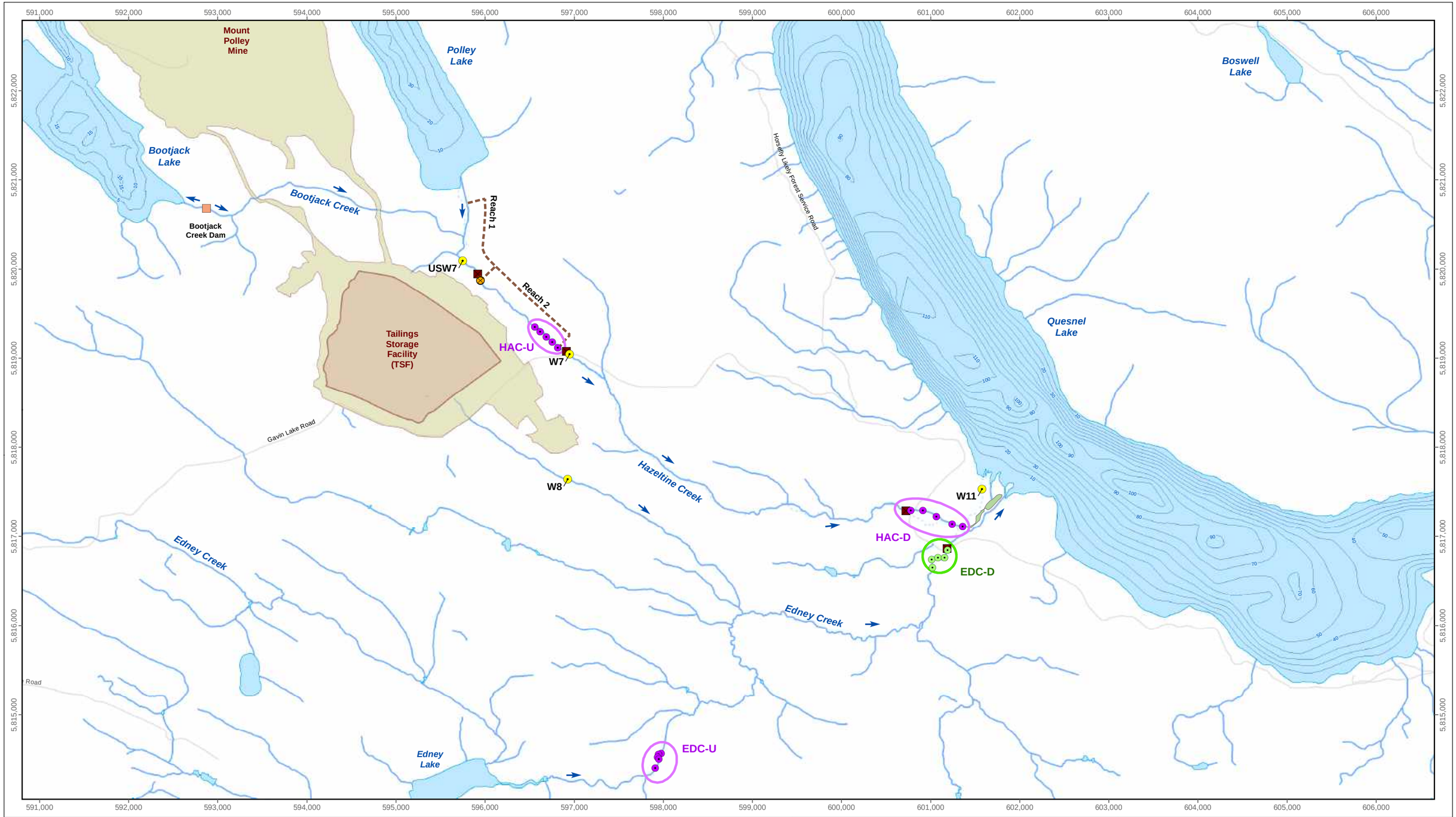
Mount Polley CEMP Sediment Monitoring Locations, Lakes

Date: June 2018
Project 177202.0042

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Figure 5

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\3-Sediment\17-42 Fig 5 CEMP Sediment.mxd



Sampling Locations

- Rehabilitated
- Reference
- Pre-Breach
- Routine Water Quality Station
- Effluent Discharge from 2014 to 2017
- Rehabilited Reaches (Golder 2017a,b)
- Tailings Storage Facility
- Active Mine Operation
- Bootjack Lake Bathymetry (5 m Intervals)
- Quesnel Lake Bathymetry (10 m Intervals)
- Polley Lake Bathymetry (10 m Intervals)
- Historic Watercourse

Note: Sampling Location in 2018 does not need to be exactly in the location identified on the map.

0 0.5 1 2 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Sediment Monitoring Locations, Creeks

Date June 2018
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Figure 6

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\3-Sediment\17-42 Fig 6 CEMP Sediment Monitoring Locations, Creeks.mxd

Hyalella; Wang et al. 2004). Lastly, DGT devices will be deployed above the sediment water interface in areas most impacted by the TSF embankment breach (Polley Lake and Quesnel Lake deep areas) to provide annual feedback on whether there has been any change in the concentrations and/or proportion of labile metals above the sediment water interface (which would be suggestive of the potential instability or the temporal stability of sediment-associated metals).

Sediment quality and toxicity sampling will be supported by measurements of temperature, dissolved oxygen, pH, and specific conductance near the sediment-water interface at all sampling stations. Additional information to be collected includes GPS coordinates of each station and supporting photographs of the sampling location and samples. Some additional monitoring of the stability and potential bioavailability of metals associated with sediments impacted by the TSF embankment breach will be undertaken (e.g., deployment of Diffusive Gradients in Thin Films [DGT] devices to monitoring labile metal concentrations), as recommended by a QP and approved by ENV.

Sediment sampling will be completed in August or September consistent with previous data collections (HKP 1996, 1997; Beak 2000; Minnow 2015a,b; 2016). The frequency of sediment quality monitoring at the federal EEM sampling areas (where sediment is collected to support a benthic invertebrate community survey to evaluate potential effects of effluent discharge) is initially at a prescribed frequency of every three years, subject to modification based on the findings of at least two EEM phases (Environment Canada 2012). The frequency of sediment sampling at the lake areas is also guided by the results of sediment quality monitoring undertaken from 2014 to 2017. Evaluation of sediment deposition rates have indicated relatively low rates of sediment deposition in Polley Lake (average 0.66 mm/yr; 15 years for the accumulation of 1 cm of sediment) and Quesnel Lake (range 1.4 to 1.7 mm/yr; 6 to 7 years for the accumulation of 1 cm of sediment; Minnow 2018). This is consistent with limited change in sediment quality of these lakes which were sampled annually from 2014 to 2016 (e.g., Figures 1 to 4; Minnow 2016). Therefore, sediment sampling in lakes will be completed in 2018 and then every three years concurrent with EEM (2018, 2021, etc.). It is anticipated that a three-year frequency will be sufficient to track recovery associated with the deposition of approximately 2.0 mm of new sediment in Polley Lake and approximately 4.7 cm of new sediment in Quesnel Lake over the three-year period. As sediment samples are composed of the top 3 cm (30 mm) of deposited sediment (to represent exposure to benthic organisms and consistent with technical guidance; BCMOE 2016), this is equivalent to approximately 6.6% and 16% of the sample volume being comprised of new material. Water quality above the sediment water interface will be monitored in 2018-2020, including the deployment of Diffusive Gradients in Thin Films (DGTs). If monitoring of labile metal concentrations using DGT devices indicate increases above the sediment-water

interface, design modification (e.g., changes to monitoring frequency or locations) will be made in response to QP recommendations in future interpretive reports.

The initial frequency of sediment quality monitoring at the creek areas (Hazeltine and Edney Creeks) is annual. This is because post-breach / post-rehabilitation conditions have not been established. Frequency should be reviewed following interpretation of the data collected in 2020, with particular consideration of whether sediment, which is quantitatively rare in these erosional creeks, provides value as an independent monitor given the intensive monitoring of water, periphyton, and benthic invertebrates.

Sediments will be sampled, processed, analyzed, and associated data interpreted using methodology consistent with previous assessment at Mount Polley (e.g., Minnow 2015a,b; 2016), which is also consistent with technical guidance (e.g., Environment Canada 2012; BCMOE 2013, 2016). Detailed methodology is provided in Section 4, including: quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting.

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be performed by qualified field staff experienced in the implementation of sediment quality monitoring programs. Quality assurance and quality control measures will be consistent with requirements outlined in the BC Field Sampling Manual (BCMOE 2013), and will include program review prior to implementation, adequate resources for all field teams including field checklists and field data sheets, the availability and maintenance of clean sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination.

Quality control (QC) samples will be collected to support the sediment quality monitoring program. Five replicate samples (samples from 5 separate stations to represent the sampling area) will be collected from each sampling area in order to capture within-area variability. Specific field QC samples will include duplicates (i.e., splits) collected at a frequency of 10% of the total number of samples to assess field precision as part of the Data Quality Review (DQR; Section 4.4). Duplicate water samples will be collected at a frequency of 10% to assess field precision associated with the water samples that support DGT monitoring. In addition to field QA/QC, any laboratory conducting the physical or chemical analyses will be accredited by the Canadian Association for Laboratory Accreditation (CALA) for these analyses. Specific QC sampling and associated reporting will be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). These results will be assessed as part of the DQR (Section 4.4).

All raw field data will be transcribed from field sheets into an electronic spreadsheet. Data will then checked by a separate individual for data entry errors as part of routine Quality Assurance/Quality Control (QA/QC) procedures.

4.2 Sample Collection Methods

4.2.1 Lakes

Sampling of lake sediments will be consistent with previous monitoring (Minnow 2015a,b; 2016a). In Polley Lake (and the associated reference – Bootjack Lake [and Jacobie Lake in 2018]), sediments will be collected at five replicate stations per area, with sediments for the analysis of total organic carbon, total sulphur, total nitrogen, and metals collected using a Kajak-Brinkhurst corer or a Tech Ops corer in accordance with technical guidance for gravity coring outlined in the BC Field Sampling Manual (BCMOE 2013) and the Metal Mining Technical Guidance for EEM

(Environment Canada 2012). Sediment samples for particle size distribution will be collected using a Petite Ponar grab sampler. Briefly, the KB corer is a gravity corer that collects samples in 2" (5.08 cm) diameter core tubes. Core collection relies on a combination of surface tension within the core and suction supplied by a plunger that seals the top of the core tube after being deployed by a messenger. The Tech Ops corer is a gravity corer that collects samples in 4" (10.16 cm) diameter core tubes. Core collection relies on a combination of surface tension within the core and suction supplied by an automatic seal (plunger assembly) that shuts in response to sampler retrieval (upward pull). Success rates for each of the core devices tend to vary with sampling location in accordance with sediment characteristics and both devices may be used in the program.

Collection of sediment by coring requires careful application and experience to obtain good quality sediment samples (i.e., sediment samples that capture an undisturbed sediment-water interface). During coring, care will be taken to control the rate at which the coring device is lowered, to maintain the corer in a vertical position during descent, and to allow the corer to penetrate the sediment with minimal sediment disturbance. The corer will then be carefully retrieved to surface. At surface, an extruder head-piece will be inserted into the bottom of the core tube to prevent sediment slippage. Core samples will be rejected if there was evidence of slippage, that the core did not penetrate the substrate vertically, or that the sediment-water interface was disturbed within the core. Accepted samples will then be processed by removing the core tube from the corer and using the extruder to push the sediment upwards towards the top of the core tube in a controlled fashion with care taken to minimize suspension of fines. In the event of suspension, momentum will be stopped, allowing the suspended solids to re-settle. Once the sediment is extruded to near the top of the tube, an extrusion collar marked in 1-cm intervals will be carefully aligned on the top of the tube and the sediment will be extruded upwards into the extrusion collar to the 3-cm mark. A core slicer will then be carefully inserted between the tube and the collar to collect the top 3-cm of sediment, which will then be transferred into a 250 mL glass sampling jar labeled with the project number, sample location, and collection date. The procedure will then be repeated twice more (at minimum) in order to provide a composite sample of sufficient volume for the required analyses. All sampling equipment will be rinsed between stations using site water. As indicated above, duplicate (split) sediment samples will be collected at a target frequency of 10% for quality assurance/quality control (QA/QC) purposes (associated composite samples will be composed of twice the number of grabs to support the split samples). In addition, supporting information will be collected at each sampling site as outlined below. Immediately after collection, sediment samples will be placed into a cooler with ice packs, where they will be maintained cool prior to transport to the field laboratory where they will then be transferred to a refrigerator and held until shipment to the analytical laboratory.

Sediment samples for particle size analysis in Polley Lake, Bootjack Lake, and Jacobie Lake will be collected using a stainless steel Petite Ponar grab sampler in accordance with technical guidance outlined in the BC Field Sampling Manual (BCMOE 2013) and the Metal Mining Technical Guidance for EEM (Environment Canada 2012). Briefly, the Petite Ponar is a 6" x 6" (15.24 cm x 15.24 cm) grab sampler with jaws that can be held open by shear-pressure on a spring-loaded pin. The grab sampler is lowered to the substrate at which point shear-pressure is eliminated and the pin springs out. Upon upward pull at the initiation of retrieval, the jaws of the ponar close to grab surficial sediment. As with coring, care must be taken to control the rate at which the ponar is lowered to allow appropriate sediment penetration and to minimize sediment disturbance. The ponar will then be carefully retrieved to surface and each grab will be placed into a plastic tote and observed for completeness and any unusual characteristics. If the sample is deemed acceptable (i.e., the sampler is full to each end and is representative of surface sediment), surficial material to a depth of 3 cm will be transferred to a second tote using a stainless steel spoon, and the remaining sediment discarded. At each station, composite samples of the top 3 cm of surficial sediment of three acceptable grabs will be collected. The sediment within the tote will then be homogenized using a stainless steel spoon and transferred into 250 mL glass sampling jars labeled with the project number, sample location, and collection date. Sampling equipment will be rinsed between stations using site water.

Sediment samples for toxicity testing of *Chironomus dilutus* will also be collected using a Petite Ponar grab sampler. The same methodology as above will be applied, with the exception that, at stations that require both sediment chemistry and toxicity testing, a composite sample will be composed of a minimum of five grabs and will be placed into a 250 mL glass sampling jar for chemical analysis (as above) and another 500 mL jar for toxicity testing. As noted above, all jars will be labelled with the project number, sample location, and collection date.

In Quesnel Lake, all sediment samples (for total organic carbon, total sulphur, total nitrogen, and metals) will be collected using a stainless steel Petite Ponar (15.24 cm x 15.24 cm; 0.023 m^2 sampling area) or a stainless steel standard ponar (22.86 cm x 22.86 cm; 0.052 m^2 sampling area) in accordance with federal and provincial technical guidance (Environment Canada 2012; BCMOE 2013). Attempts to collect sediment from Quesnel Lake by gravity coring have yielded poor success rates due to the substantial depth of sampling (approximately 100 meters) and the non-cohesive nature of the sediment. Samples will be retrieved with the assistance of a coMDMERcial line hauler (Ace Line Hauler - Brutus Plus 40) using methodology consistent with that described above for collection of the Polley Lake (and Bootjack Lake) sediment particle size samples. Composite samples of the top three centimeters of surficial sediment of a minimum of three acceptable grabs (i.e., full to each edge of the sampler) will be collected at stations where toxicity testing is not required, and composite samples of the top three centimeters of surficial

sediment of a minimum of five acceptable grabs (i.e., full to each edge of the sampler) will be collected at stations where toxicity testing is required (Table 2 and Figure 5). Sediment homogenization and transfer to sampling jars will be as described above. All sampling equipment will be rinsed between stations using site water. Duplicate (i.e., split) sediment samples will be collected at a target frequency of 10% for quality assurance/quality control (QA/QC) purposes (associated composite samples will be composed of twice the number of grabs to support the split samples). In addition, supporting information will be collected at each sampling station as outlined below. Immediately after collection, sediment samples will be placed into a cooler with ice packs, where they will be maintained cool prior to transport to the field laboratory where they will be placed in a refrigerator and held until shipment to the analytical laboratory.

Supporting information collected at each of the lake sediment monitoring stations will include GPS (Geographic Positioning System) coordinates, sampling depth, Secchi depth, field meter measurements of temperature, specific conductance, dissolved oxygen and pH, photographs of sediment samples, notes of the presence or absence of aquatic vegetation, and other physical observations (sediment texture, colour, density, etc.). In addition, one full vertical profile of the field meter measurements will collected at one station per area.

4.2.2 Creeks

Hazeltine Creek and the associated reference creek (Edney Creek) are predominantly erosional (HKP 1996, 1997; Minnow 2007) and there are few locations of true sediment deposition. The limited sediment within these creeks tends to wash through during spring freshet and deposit as a thin layer of fines in quiescent areas on the lowering hydrograph. Thus, collection of true sediment (i.e., fines in the silt and clay size category) cannot be completed by conventional grab sampling as applied in lakes (as described above) and typically applied in depositional creeks (i.e., due to the dominant presence of sand, gravel, and cobble). An alternative method will therefore be applied – sampling by spoon. This sampling will target the fine sediment fraction (i.e., silt and clay). Sampling will be undertaken in late suMDMER when low flows support some sediment deposition, even if only as a thin layer over sand, gravel, or cobble. As with lake sampling, sediments will be collected at five replicate stations per area. However, due to the non-uniform nature of sediment deposition in erosional creeks, the actual sampling stations will be determined opportunistically with each field sampling campaign and may vary slightly over time (i.e., a priority will be placed on the quality of the five replicate sediment samples collected within each area rather than the precise location of each sample within each area).

Sediment samples from creeks will be collected using a clean stainless steel spoon. All samples will be collected from wetted sampling stations that support the accumulation of fine materials (i.e., small pools or backwaters). Sampling locations will be approached by foot in a manner that

does not disturb sediment prior to sampling. At locations of sediment deposition, surficial sediment will be carefully collected by slowly placing the spoon on the sediment surface in a manner that minimizes disturbance. The spoon will then be inserted into the sediment to capture sediment to a depth of no greater than 3 cm and moved horizontally to fill the spoon. In reality, the collection depth may be much less than 3 cm, as fines often settle in a thin layer over coarser material (and sampling seeks to avoid coarse material as indicated above). The spoon will then be slowly retrieved to surface to avoid sample washout. The content of the spoon will then be inspected to ensure that it represents fine sediment (i.e., is predominantly silt and clay) and, if accepted, will be placed into a 250 mL glass sampling jar labeled with the project number, sample location and collection date. This procedure will be repeated a minimum of four more times to form a composite sample representative of the sampling station. Sampling equipment will be rinsed between stations using site water. Duplicate sediment samples will be collected at a target frequency of 10% for quality assurance/quality control (QA/QC) purposes (associated composite samples will be composed of twice the number of spoons to support the split samples). In addition, supporting information will be collected at each sampling site as outlined below. Immediately after collection, sediment samples will be placed into a cooler with ice packs, where they will be maintained cool prior to transport to the field laboratory where they will then be transferred to refrigerator and held until shipment to the analytical laboratory.

Supporting information collected at each of the creek sediment monitoring stations will include GPS (Geographic Positioning System) coordinates, average water depth at the sample locations, average sediment depth collected, field meter measurements of temperature, specific conductance, dissolved oxygen and pH, photographs of sediment samples, notes of the presence or absence of aquatic vegetation, and other physical observations (sediment texture, colour, density, etc.).

4.2.3 DGT Sampling

Diffusive Gradients in Thin Films (DGT) sampling devices (DGT model C-LSNX; DGT Research, Lancaster, UK) as described in Minnow (2017a) will be installed in the lower water column at one sediment sampling area in Polley Lake (POL-P2; with an area in Bootjack Lake [BOL-2] as reference) and at one sediment sampling area in Quesnel Lake (QUL-PNF; with an area in Quesnel Lake [QUL-PREF1] as reference; Table 2). Five replicate DGT devices will be placed in exposed areas and three replicates will be placed in reference areas. The purpose of the DGT device monitoring is to provide data on the concentrations of DGT-labile metals above of the sediment-water interface, and most importantly to monitor DGT-labile metals above the sediment-water interface to determine if those concentrations are changing over time. Low and unchanging concentrations of DGT-labile metals would be indicative of stability of metals and metalloids in

lake sediments affected by the TSF embankment breach. Conversely, increasing concentrations of DGT-labile metals would be indicative of instability of metals and metalloids in lake sediments.

The DGT devices will be installed in the lower water column approximately one meter above the sediment surface. This will be achieved by placing a line with anchor and float at each sample location. The DGT devices will be deployed with care (including not touching the DGT window) while wearing metal free disposable nitrile gloves and will be left in place for a total period of 35 to 50 days. Upon retrieval, DGT devices will be handled with care while wearing metal free disposable nitrile gloves. Upon retrieval, each DGT device will be gently rinsed with metal free water (provided by the laboratory) and placed into a labelled glass soil jar with a few drops of metal free water to prevent desiccation. Jars will then be placed into clean Ziploc™ bags and then into a dedicated cooler with ice packs, where they were maintained cool prior to transport.

Supporting information collected at each DGT deployment location will include GPS (Geographic Positioning System) coordinates, sampling depth, field meter measurements of temperature, specific conductance, dissolved oxygen and pH, site photographs (including photographs of the DGT devices), and notes on the presence or absence of any fouling of the DGT devices. Supporting water samples will also be collected from each sampling area, including samples for total and dissolved constituents (including metals), the latter prepared by field filtration using a 0.45 µm syringe filter. Water samples will be placed into a dedicated cooler with frozen ice packs, and kept cool prior to transport to the field laboratory.

4.3 Sample Handling and Laboratory Analysis

At the termination of the field program or at intervals of no more than seven days, sediment samples will be shipped in coolers with ice packs to the analytical laboratory and/or toxicity testing laboratory. Shipment transit time will be less than one day.

Chemical analyses will be completed at an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA) using methods that are consistent with those specified in the British Columbia Environmental Laboratory Manual (BCMOE 2015) and will include moisture content, pH, particle size distribution, total organic carbon (TOC), total nitrogen, total sulphur, and total metal concentrations (Table 3). All analyses except for particle size distribution will be completed on the silt/clay fraction (<63 µm diameter) in accordance with recent recommendations by BCMOE (2016) and because sediment quality characterization conducted in 2014 indicated similar results in <63 µm and <2 mm sediments (Minnow 2015a). Analysis of metals will be based on the BC Strong Acid Leachable Metals digestion (SALM; BCMOE 2016). Analyses of pH will be completed by electrode, particle size analysis will be completed by sieve and pipette, total organic carbon will be completed by combustion and titration (total carbon minus total inorganic carbon), total nitrogen and total sulphur will be completed by combustion, metals

Table 3: Analytes and Laboratory Reporting Limits for Mount Polley CEMP Sediment Quality Monitoring

Analyte	Units	Target LRLs	Concensus DLs [1]	British Columbia Sediment Quality Guidelines [2]	
				Lower	Upper
Physical Tests					
% Sand (2.0mm - 0.063mm)	%	0.1	1	-	-
% Silt (0.063mm - 4um)	%	0.1	1	-	-
% Clay (<4um)	%	0.1	1	-	-
Moisture	%	0.25	1		
pH (1:2 soil:water)	pH	0.1	-	-	-
Nitrogen and Carbon			-		
Total Nitrogen	%	0.02			
Total Organic Carbon	%	0.1	0.05	-	-
Sulphur					
Sulphur	%	200	200	-	-
Metals					
Aluminum	mg/kg	50	100	-	-
Antimony	mg/kg	0.1	0.1	-	-
Arsenic	mg/kg	0.05	0.2	5.9	17
Barium	mg/kg	0.5	1	-	-
Beryllium	mg/kg	0.1	0.1	-	-
Bismuth	mg/kg	0.1	0.1	-	-
Boron	mg/kg	10	5	-	-
Cadmium	mg/kg	0.05	0.05	0.6	3.5
Calcium	mg/kg	50	100	-	-
Chromium	mg/kg	0.5	1	37.3	90
Cobalt	mg/kg	0.1	0.3	-	-
Copper	mg/kg	0.5	0.5	35.7	197
Iron	mg/kg	50	100	21,200 [a]	43,776 [b]
Lead	mg/kg	0.1	0.1	35	91
Lithium	mg/kg	5	-	-	-
Magnesium	mg/kg	10	10	-	-
Manganese	mg/kg	0.2	0.2	460	1,100
Mercury	mg/kg	0.005	0.05	0.17	0.49
Molybdenum	mg/kg	0.1	0.1	-	-
Nickel	mg/kg	0.5	0.8	16	75
Phosphorus	mg/kg	50	10	-	-
Potassium	mg/kg	100	100	-	-
Selenium	mg/kg	0.1	0.1	2	-
Silver	mg/kg	0.05	0.1	0.5	-
Sodium	mg/kg	100	100	-	-
Strontium	mg/kg	0.1	0.1	-	-
Thallium	mg/kg	0.05	0.1	-	-
Tin	mg/kg	0.2	0.2	-	-
Titanium	mg/kg	1	1	-	-
Uranium	mg/kg	0.05	0.05	-	-
Vanadium	mg/kg	0.2	2	-	-
Zinc	mg/kg	1	2	123	315

[1] from Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016)

[2] British Columbia Sediment Quality Guidelines; from British Columbia Working Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BCMOE 2017)

[a] approximately 2%

[b] approximately 4%

will be completed by collision reaction cell inductively coupled plasma – mass spectrometry (ICP-MS [USEPA Method 6020A; USEPA 1998]), and mercury will be completed by cold vapor atomic fluorescence spectrophotometry or atomic absorption spectrophotometry (USEPA Method 245.7; USEPA 2005).

Toxicity testing will be completed at a testing laboratory accredited by CALA. Testing will be completed using a standard 10 day test of the survival and growth of *Chironomus dilutus* (a midge larva; Environment Canada 1997). In accordance with recent recommendations for toxicity testing, test replicates (n = 5) will be field-collected replicates. In addition to the exposed area field replicates and the reference area field replicates, a laboratory control (beach sand in accordance with the standard biological test methods) will also be included (also to be set up with five laboratory replicates).

At the termination of the DGT device collections or at intervals of no more than four days, DGT devices will be shipped in coolers with ice packs to the analytical laboratory. Laboratory analysis of the DGT devices will involve dismantling the devices followed by digestion of the resins to determine total metal concentrations in the resin by ICP-MS (USEPA Method 6020A; USEPA 1998). DGT-labile metal concentrations will subsequently be calculated by the analytical laboratory based on total metal in the resin, mean water temperature during deployment at each area, total deployment time, and manufacturer-supplied peer-reviewed diffusion coefficients, which, in turn, are based on Fick's first law of diffusion (Zhang and Davison 1995; Panther et al. 2014). Supporting water samples will be treated in a manner identical to the routine water quality samples collected as part of the CEMP (Section 6.6).

Each of the laboratories will provide a sample receipt confirmation when the samples are received and logged. These receipts will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. Upon completion of the analyses, each laboratory will provide a data report in Microsoft (MS) Excel™ and as an Adobe Acrobat Portable Document Format (PDF). Reporting will include the results of the laboratory QC sample results.

4.4 Data Quality Review

Upon receipt of sediment quality data and supporting water quality data from the analytical laboratory, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs have been achieved. The DQR will also include an evaluation of differences between duplicate samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the sediment quality data will ensure timely communication with the laboratory should any issues be identified.

Comparisons between duplicate samples will be made by calculating the relative percent difference (RPD) between concentrations between paired duplicates. If the RPD is <40% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping).

4.5 Data Handling, Interpretation, and Reporting

Upon receipt of data from the analytical laboratories, all laboratory data files will be managed by the Mount Polley Mining Corporation (MPMC) Environment Department. In addition, data provided by the primary analytical laboratories as an Electronic Data Deliverable (EDD) will be imported directly into the MPMC's database following completion of the DQR. Following the completion of the DQR, all sediment quality data and supporting data will be managed in Microsoft (MS) Excel™. For all replicated data (typically based on a sample size of five stations per area), data will be provided to the QP and summarized by calculating mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile for each analyte. Sediment quality data will then be evaluated in comparison to British Columbia Working Sediment Quality Guidelines for the protection of aquatic life (WSQGs; BCMOE 2017) and reference concentrations. Reference 95th percentile values will be used to screen exposed-area mean concentrations to efficiently identify analytes with concentrations that are beyond the range of reference. Analytes with concentrations greater than guidelines and reference will be the focus of more detailed interpretation, which may include, as required for data interpretation: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations and/or over time.

WSQGs are numerical criteria that are protective of sediment-dwelling organisms based on long-term exposure. Most British Columbia WSQGs have been adopted from the CCME (CCME 1999) or from Ontario (OMOE 1993) and have two levels – a Lower WSQG (also known as a Threshold Effect Level [TEL] or a Lowest Effect Level [LEL]) and a Higher WSQG (also known as a Probable Effect Level [PEL] or a Severe Effect Level [SEL]). The Lower WSQG is intended to represent a concentration that will protect aquatic life from adverse effects of a toxic substance in most situations (BCMOE 2017). The Upper WSQG is intended to represent a concentration that, if exceeded, will likely cause severe effects on aquatic life (BCMOE 2017). However, WSQGs – even the Upper WSQGs - are often naturally exceeded in mineralized areas, as was the case for copper, iron, and manganese in Polley Lake (Section 2.1). In addition, SQGs were developed based on co-occurring bulk surficial sediment data and biological effect data (CCME 1995). Bulk

sediment chemistry can differ substantially from the <63 µm fraction, and this discrepancy between measurement (<63 µm fraction) and exposure (to bulk sediment to which SQGs are most applicable) should be considered in interpretation as "caution should be used in interpreting the biological significance of chemical concentrations in sediments for different types based on these guidelines" (CCME 1995).

Multivariate statistical tools may also be applied to assist with sediment quality data interpretation. Specifically, ordination techniques such as Principal Components Analysis (PCA), Correspondence Analysis (CA), or Nonmetric Multidimensional Scaling (NMDS) may be applied to assist in the identification of key spatial or temporal differences in sediment chemistry. Perhaps more importantly, these techniques will be used in the analysis of potential physical and/or chemical causes of differences in biological metrics (e.g., benthic invertebrate community condition) as a means of reducing data to focus on a small list of key components for correlation analysis (see Section 6.13 – Benthic Invertebrate Monitoring).

As indicated above, analytes with concentrations greater than guidelines and reference 95th percentile concentrations will be the focus of more detailed interpretation, which may include, as required for data interpretation: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations and/or over time. This will include the following: graphical plots in relation to all guidelines, reference values, and historical values and examination of relationships to physical variables. Plots of the analytes of interest (those greater than SQG and reference) will be prepared in MSExcel. At a sample size of 5, plots will include of each replicate by area. Available guidelines (BCWSQG), reference concentrations, and background concentrations (as available) will be added to the plots as lines to facilitate comparison of concentrations to these benchmarks.

Relationships between the analytes of interest and physical features (i.e., particle size) and other chemical variables (total organic carbon content) will be evaluated using correlation analysis. Spearman correlation (often referred to a Spearman Rank-Order correlation) will be completed. Following the derivation of correlation coefficients, a Bonferroni-type correction (i.e., p-value [0.05] divided by the total number of correlations examined for independent variables) will be applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected p-value of 0.05. Any significant correlations found at the Bonferroni-adjusted p-value or at a p-value of 0.01 will be further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were "leveraged" by outlying points (or groups of points).

Sediment toxicity test results (survival and growth of *C. dilutus*) will be interpreted based on a combination of effect size and statistical contrasts. Results associated with each exposed area will be contrasted against the matched reference area and against the laboratory control. Results will then be evaluated using a stepwise procedure similar to that of Southern California Coastal Water Research Project (SCCWRP) California Sediment Quality Objectives (CASQO; Bay et al. 2014):

1. mean responses (percent survival and growth [dry weight per surviving organism]) will be expressed as a percentage of the mean laboratory control result and the mean field reference result; and

2. results of the statistical contrasts of mean responses in tests of impacted sediment against the laboratory control and the field reference sediment will be compiled.

Results will then be categorized as follows:

1. no unacceptable response is a mean response within 20% of the mean field reference response (i.e., survival or growth were ≥80% of the field reference);

2. a low to moderate response is a mean response of between 20% and 50% of the mean field reference response (i.e., survival or growth were 50% to 80% of the field reference); and

3. a large response is a mean response of >50% of the mean field reference response (i.e., survival or growth were <50% of the field reference).

Low and moderate responses will be distinguished based on whether the results differ significantly from reference (moderate response) or not (low response). Application of a 20% reduction in survival relative to the field reference to define acceptability is consistent with thresholds used elsewhere (e.g., BCMELP 1998; Government of Canada 2010; Bay et al. 2014). If low, moderate, or high responses are observed in sediment toxicity testing, relationships between the effect endpoint (i.e., survival or growth) and sediment quality will be evaluated in consideration of WSQGs, effect thresholds, and the results of correlation analysis. Although it is recognized that a significant correlation or regression does not indicate causation (e.g., Norton et al. 2015), it is desirable to not only characterize the nature of a response (e.g., reduced survival or growth in sediment toxicity tests), but to also obtain evidence of cause. Correlation / regression analyses are commonly applied tools for identifying potential cause (e.g., Norton et al. 2015). Evidence of causation obtained from correlation or regression analysis will be carefully considered in light of the strength, range, and continuity of the relationships as well as mechanistic knowledge/understanding of potential cause.

The overall interpretation of sediment quality data will include integration of a weight-of-evidence that includes other components of the MPMC CEMP (e.g., water quality data, periphyton data for creeks, benthic invertebrate community data for lakes and creeks). Thus, within the CEMP, sediment quality data interpretation will specifically include the integration of data on sediment quality, the results of specialized evaluations (e.g., DGT results), and the results of bio-assessment (e.g., sediment toxicity testing and benthic invertebrate communities).

An interpretive report based on the sediment quality data will be prepared to be integrated into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWSQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.2

Benthic Invertebrate Monitoring

Minnow Environmental Inc.

Benthic Invertebrate Monitoring Plan

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June 2018

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1 INTRODUCTION

1.1 Background

Benthic invertebrates are excellent biomonitors for assessing potential effects of physical and/or chemical habitat changes in aquatic systems (Barbour et al. 1999; Feltmate and Fraser 1999; Beatty et al. 2006). Due to the complexity of benthic invertebrate community structure and known tolerances and sensitivities to sediment and water quality (e.g., Barbour et al. 1999; Mandaville 2002), benthic invertebrate community analysis is typically a highly sensitive bio-monitor. Benthic invertebrate are sessile, therefore evaluation of benthic invertebrate tissue quality can provide an important measure of localized chemical conditions and of spatial extent of an effect, as well as of potential direct or indirect exposure of fish and wildlife to metals, metalloids, and nutrients[1]. Therefore, benthic invertebrate community and tissue quality monitoring is an important component of the Mount Polley CEMP.

The influence of the Mount Polley Mine on benthic invertebrate communities, productivity, and/or tissue quality can occur by several key mechanisms: 1) general mine influence from dustfall and/or uncontained surface or groundwater flows: 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to December 2017, and directly since January 2018]); 3) the TSF embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Reclamation activities in Hazeltine Creek and lower Edney Creek were initiated in 2014 following the TSF embankment breach, and were completed in lower Edney Creek in August 2015 (Golder 2017a). Construction / rehabilitation in areas of upper Hazeltine Creek (Reaches 1 and 2) were completed between July and September of 2016 and 2017, respectively (Golder 2017b,c). Reach 2 of the rehabilitation works encompassed a sampling area established prior to the TSF embankment breach (UHC; Minnow 2009). In lower Hazeltine Creek, initial channel rehabilitation was completed in 2015, and further rehabilitation has yet to be completed in this area of creek. The geomorphology of Hazeltine Creek was drastically altered as a result of the TSF embankment breach such that Fisheries and Oceans Canada considered it not to be fish habitat (Golder 2015a), and the creek was inaccessible to fish from August 2014 (following the breach) until the spring of 2018 when it was reopened as fish habitat.

Benthic invertebrate communities in waterbodies adjacent to the Mount Polley Mine have been monitored since baseline investigations in 1989, 1995, and 1996 (Imperial Metals 1990; HKP 1996, 1997). Benthic invertebrate tissue quality has been monitored since prior to the TSF

[1] Through the remainder of this section, the term “metals” will be used to include metals, metalloids, and nutrients for ease of communication.

embankment breach (2009, 2010, 2012, and 2013; Minnow 2011, 2013a,b). Results of benthic invertebrate community and tissue quality monitoring are reviewed in Section 2 and provide context for a CEMP benthic invertebrate monitoring program that is guided by a combination of historical findings, representative locations downstream of Mount Polley Mine operations, representative reference locations, and considerations for a statistically-based design that will facilitate the detection of spatial and/or temporal differences in benthic invertebrate productivity, community, and/or tissue quality, in addition to providing data to evaluate tissue quality results (i.e., tissue selenium concentrations) relative to effects-based guidelines (e.g., British Columbia Water Quality Guidelines [BCWQG]; BCMOE 2014). In addition to monitoring required as part of the Mount Polley CEMP, benthic invertebrate community monitoring is required as part of Environmental Effect Monitoring (EEM) under the Metal Mining Effluent Regulations (MDMER) of the federal *Fisheries Act*.

The following sections of the CEMP Benthic Invertebrate Monitoring Plan provide the objectives of benthic invertebrate community and tissue quality monitoring, a summary of historical benthic invertebrate findings, an overview of the CEMP study design and associated rationale (including sampling locations, replication, frequency, and analytes), and detailed methodology for benthic invertebrate community and tissue quality monitoring (quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting).

1.2 Monitoring Objective

The objective of benthic invertebrate monitoring is to evaluate the influence of Mount Polley Mine activities on benthic invertebrate communities, productivity, and tissue quality in receiving environments (Polley Lake, Hazeltine Creek, Edney Creek, and Quesnel Lake) in comparison to baseline and/or reference conditions, and to determine potential implications to aquatic life (e.g., through assessment of benthic invertebrate community and productivity endpoints, and comparison of benthic tissue quality results to available guidelines; BCMOE 2014) and to aquatic ecosystem health by providing supporting information for the assessment of potential effects to higher trophic levels (e.g., fish and fish habitat quality; Section 6.16). Benthic invertebrate monitoring also provides data to support exposure assessment as part of the ecological risk assessment (ERA) and human health risk assessment (HHRA). Benthic invertebrate community monitoring is also required as part of Environmental Effect Monitoring (EEM) under the Metal and Diamond Mining Effluent Regulations (MDMER) of the federal *Fisheries Act* (Government of Canada 2018). The objective of the MDMER EEM benthic invertebrate monitoring is to evaluate whether there are effects to benthic invertebrate community characteristics between the area of



Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012a).

2 SUMMARY OF HISTORICAL FINDINGS

Benthic invertebrate community has been monitored in the vicinity of the Mount Polley Mine since 1989, and benthic invertebrate tissue quality has been monitored since 2009. The majority of benthic invertebrate community and tissue quality samples have been collected from Polley Lake, Bootjack Lake, Quesnel Lake, Hazeltine Creek, and Edney Creek (Tables 1 and 2).

Benthic invertebrate community sampling in the vicinity of the Mount Polley Mine has spanned the four distinct time periods listed below:

1. Baseline monitoring (1989, 1995, 1996);
2. Pre-breach operational monitoring (1999, 2007, 2009, 2010, 2012, 2013);
3. Post-breach operational monitoring (2014, 2015); and
4. Post-breach and post-discharge monitoring (2016, 2017).

Benthic invertebrate tissue quality sampling in the vicinity of the Mount Polley has spanned operational time periods only (time periods 2 to 4). Data collected prior to the breach were summarized in a Technical Assessment Report (MPMC 2009) and an Aquatic Environmental Description Report (Minnow 2014a) prepared concurrently with applications for water discharge in 2009 and 2014, respectively. General findings associated with baseline, pre-breach, post-breach operational, and post-breach post-discharge monitoring are summarized, by sampling area, in the following sections.

2.1 Polley Lake

2.1.1 Community

The benthic invertebrate community of Polley Lake during baseline studies (Table 1; 1995 and 1996; HKP 1996, 1997) and pre-breach operational monitoring (1999; Beak 2000) was characterized by a dominance of Chironomidae (midges) and Oligochaeta (worms) in the two deep basins of the lake (P1 and P2). A temporal increase in density and richness at these stations was observed between baseline period and pre-breach operational monitoring, but due to unavailability of detailed sample collection and laboratory methods for baseline studies (e.g., HKP 1996, 1997) the reason for this difference is not clear (Minnow 2014a).

Following the TSF embankment breach, the benthic community in Polley Lake differed dramatically from conditions prior to the breach (1999; Beak 2000) and from reference in both deep basins of the lake (Figure 1). Specifically, no benthic organisms were present in the south basin (POL-P2) indicating an unequivocal impact, and organism density and taxon richness in the

Table 1: History of Benthic Invertebrate Community Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Report
1989	Polley Lake, Bootjack Lake	Imperial Metals 1990
1995	Polley Lake, Bootjack Lake	HKP 1996
1996	Polley Lake, Bootjack Lake	HKP 1997
1999	Polley Lake, Bootjack Lake, Jacobie Lake	Beak 2000
2007	Quesnel Lake	Minnow 2009
2014	Quesnel Lake, Polley Lake, Bootjack Lake	Minnow 2015a
2015	Quesnel Lake, Polley Lake, Bootjack Lake	Minnow 2016b
2016	Quesnel Lake, Polley Lake, Bootjack Lake	Minnow 2016e, 2017a
2017	Quesnel Lake	Minnow 2018a

B) Creeks

Year	Locations	Report
1995	Bootjack Creek, Edney Creek, Edney Creek Tributaries, Hazeltine Creek	HKP 1996
1996	Bootjack Creek, Edney Creek, Edney Creek Tributary, Hazeltine Creek	HKP 1997
1999	Edney Creek, Edney Creek Tributary, Bootjack Creek, Jacobie Creek, Hazeltine Creek, Morehead Creek	Beak 2000
2002	Edney Creek	Morrow/Azimuth 2003
2007	Edney Creek, Edney Creek Tributary, Hazeltine Creek, Whiffle Creek, Bootjack Creek, Cedar Creek	Minnow 2009
2013	Bootjack Creek	Minnow 2014b
2014	Blackwater Creek, Clearwater River, Cariboo River, Quesnel River	Minnow 2015a
2015	Edney Creek, Hazeltine Creek, Cariboo River, Quesnel River	Minnow 2016b
2016	Edney Creek	Minnow 2017a
2017	Edney Creek, Hazeltine Creek, Frypan Creek	Minnow 2018a

Table 2: History of Benthic Invertebrate Tissue Chemistry Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Report
2009	Main Embankment Seepage Pond, Polley Lake	Minnow 2011
2012	Bootjack Lake, Frypan Lake, Main Embankment Seepage Pond, Polley Lake, Quesnel Lake, Trio Lake	Minnow 2013a
2015	Bootjack Lake, Polley Lake, Quesnel Lake	Minnow 2016a
2016	Bootjack Lake, Polley Lake, Quesnel Lake	Minnow 2017b

B) Creeks

Year	Locations	Report
2009	Hazeltine Creek	Minnow 2011
2010	Hazeltine Creek	Minnow 2011
2012	Hazeltine Creek, Edney Creek, North Dump Creek	Minnow 2013a
2013	Edney Creek, Hazeltine Creek, Jacobie Creek, Morehead Creek , Trio Creek	Minnow 2013b
2014	Cariboo River, Blackwater Creek, Clearwater River, Quesnel River	Minnow 2015a
2015	Edney Creek, Hazeltine Creek, Cariboo River, Quesnel River	Minnow 2016a
2016	Edney Creek, Hazeltine Creek	Minnow 2017b
2017	Edney Creek , Hazeltine Creek	Minnow 2018b

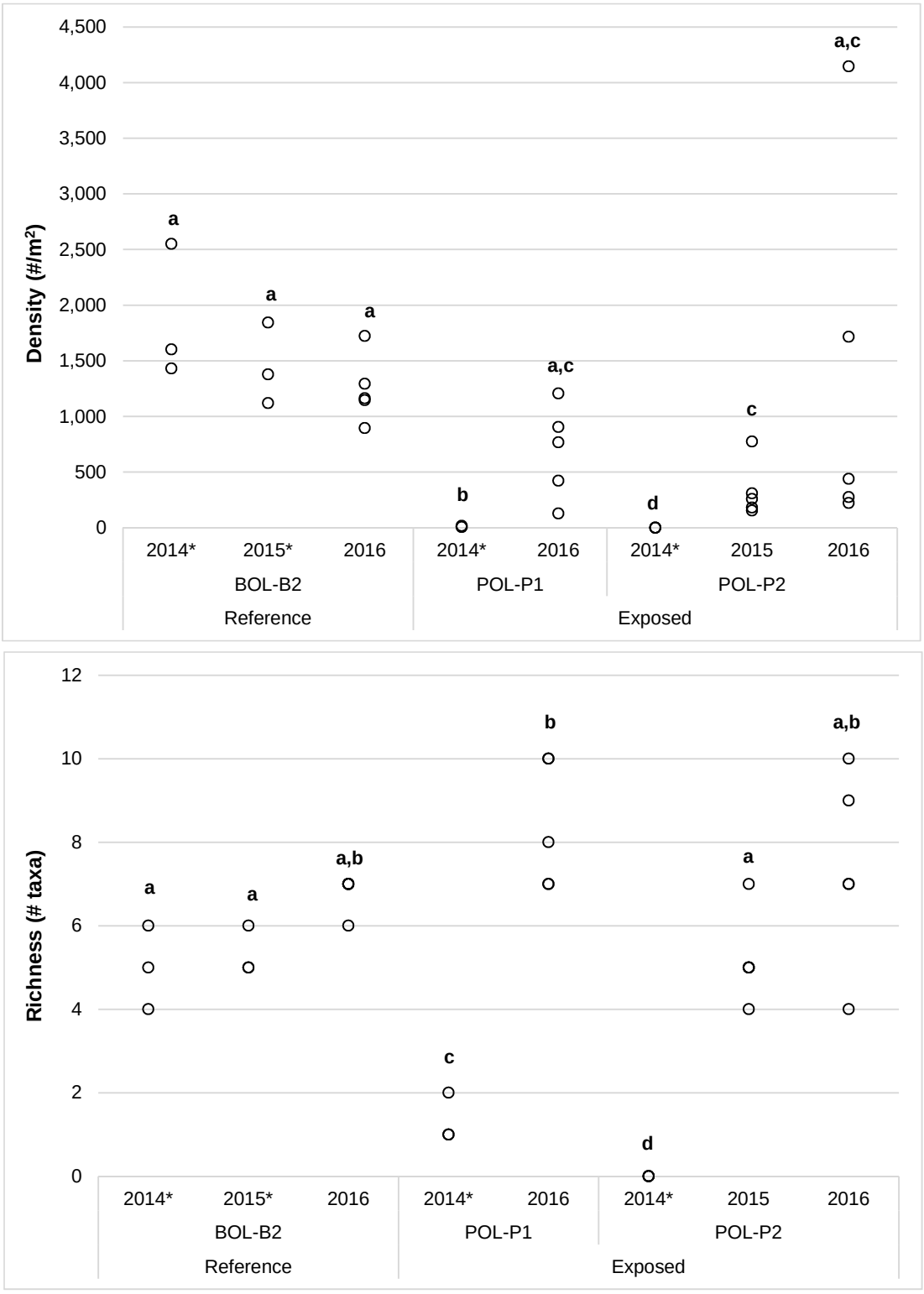


Figure 1: Benthic Invertebrate Community Endpoints in Polley Lake Deep Areas, Mount Polley Mine, 2014-2016 [a]

[a] Values shown beside data points indicate number of stations sharing a similar result. Areas not sharing a letter differed significantly ($p < 0.1$).

* Sample size = 3 indicated by an asterisk, all other sample sizes = 5.

north basin (POL-P1) was also substantially impacted (9 to 17 organisms/m^2; 1 to 2 taxa, respectively) relative to reference (1,431 to 2,551 organisms/m^2; 4 to 6 taxa, respectively) and pre-breach conditions (300 to 614 organisms/m^2; 10 to 15 taxa; Figure 1; Minnow 2015a). Benthic invertebrate community monitoring completed in 2015 and 2016 indicated substantial recovery of the benthic community in both deep basins of Polley Lake relative to 2014 conditions. Organism density (mean = 686 to 1,360 organisms/m^2) and taxon richness (mean = 7.4 to 8.4 taxa) at both areas in 2016 were similar to reference, and density was similar to pre-breach conditions as determined by Before-After/Control-Impact analysis (1999 and 2016; Minnow 2017a). Some differences in community composition relative to reference were observed in 2015 and 2016 (Minnow 2016b, 2017a); however, the primary difference (lower relative proportion of *Chaoborus* in Polley Lake in comparison to reference) was observed prior to the embankment breach (i.e., Beak 2000).

2.1.2 Tissue Quality

Benthic invertebrate tissue quality in Polley Lake was not assessed as part of baseline studies (1989-1996; Table 2). Selenium-specific aquatic environmental monitoring was initiated in 2009 after an uncontrolled surface runoff event from the north waste rock dump which reported to Polley Lake via North Dump Creek (Minnow 2011; see CEMP Sections 6.12 and 6.16). This runoff started in 2006, was controlled in 2009 with the construction of the Long Ditch, and was characterized by elevated concentrations of sulphate and selenium. Mean selenium concentrations observed during pre-breach operational monitoring (2009 and 2012; 6.0 to 7.8 mg/kg dw) were greater than reference and the interim BCWQG of 4 mg/kg dry weight, and were generally similar among sampling years (Figure 2; Minnow 2011, 2013a).

Following the TSF embankment breach, mean benthic invertebrate concentrations of selenium remained significantly higher than the BCWQG and reference, but were significantly lower in 2016 (5.4 mg/kg dw) relative to 2009 and 2012 indicating no breach-related increase (Figure 2; Minnow 2017b). Benthic invertebrate tissue quality investigations following the TSF embankment breach were also focussed on a suite of analytes identified as indicative of the chemical influence of the breach on sediment quality in the receiving environment (Minnow 2015a): Parameters of Interest (POIs: arsenic, copper, iron, manganese, nickel, and zinc), and Indicator Parameters (IPs: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium). Mean concentrations of a number these POIs and IPs were higher than reference in 2015 (manganese, tin, and titanium), in 2016 (arsenic, iron, and vanadium), and in both 2015 and 2016 (copper and molybdenum; Minnow 2016a, 2017a). In particular, mean benthic invertebrate copper concentrations were approximately 5.8 to 6.9 times higher than reference (Figure 3). These results are not unexpected, given that sediment copper concentrations were approximately

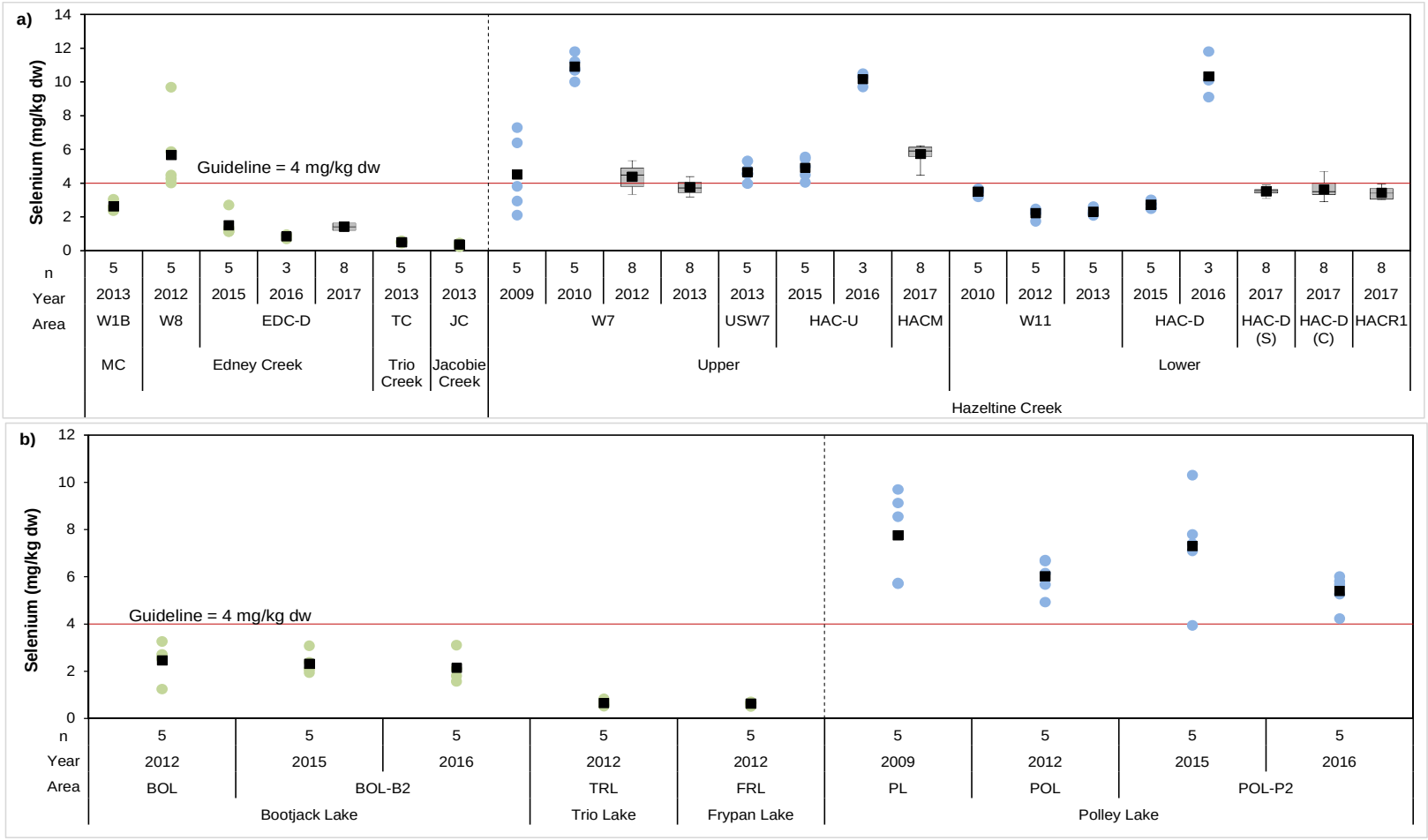


Figure 2: Selenium Concentrations in Benthic Invertebrate Tissue at a) Hazeltine Creek and b) Polley Lake with Associated Reference Areas, Mount Polley, 2009 to 2017

Notes: Dashed line used to separate reference (left side) and exposed (right side) areas. Black squares represent means and whiskers represent minimum and maximum values. Box plots are presented when there are 8 or more samples.
MC = Morehead Creek.
S = Stonefly single taxon sample.
C = Caddisfly single taxon sample.

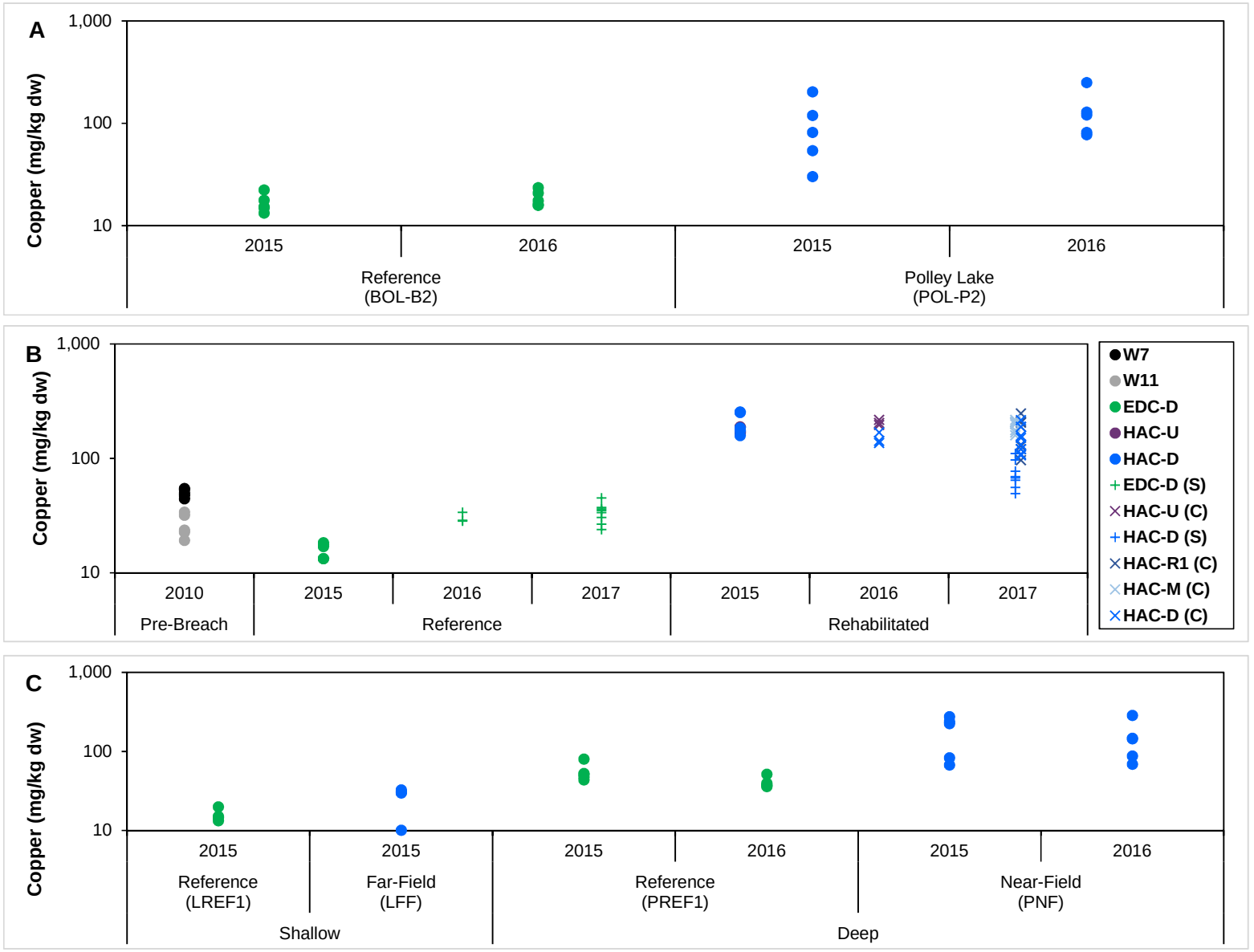


Figure 3: Benthic Invertebrate Tissue Copper Concentrations at A) Polley Lake, B) Hazeltine Creek, C) Quesnel Lake and Associated Reference Areas in the Vicinity of the Mount Polley Mine, 2009 to 2017

Notes: Dots indicate composite-taxa results, + symbols indicate stonefly samples, and × symbols indicate caddisfly observations. For lakes, non-depurated results are shown.

twice reference values (see CEMP Section 6.12). Although whole benthic invertebrate tissue concentrations accurately represent concentrations associated with food for higher trophic level organisms that consume benthic invertebrates, they may not accurately represent metal concentrations in the tissues of benthic organisms due to a known confounding influence of gut content on the determination of tissue metal concentrations in invertebrates, and therefore on the evaluation of potential biological effects associated with these metal concentrations (i.e., Chapman 1985, 2016). Metal concentrations were evaluated in both depurated and non-depurated benthic invertebrate samples in 2016 from Polley Lake in order to minimize the confounding influence of gut content. However, depuration made little difference to results (Minnow 2017a). Due to the uncertainties associated with depositional benthic invertebrate tissue monitoring, and similarities with results of other sampling methods (Diffusive Gradients in Thin Films [DGT] devices), DGTs will be used to monitor temporal changes in labile metal concentrations in Polley Lake (see CEMP Section 6.12).

Ratios of benthic invertebrate tissue metal concentrations to sediment concentration ([benthic invertebrate sample]/[sediment]) are referred to as Biota Sediment Accumulation Factors (BSAFs) and are often used to describe the accumulation of sediment-associated analytes in tissues of ecological receptors (i.e., Burkhard 2009). BSAFs for benthic invertebrate tissues from Polley Lake were generally higher than reference following the TSF embankment breach, however remained stable between 2015 and 2016, as did benthic invertebrate tissue chemistry results (Minnow 2016a, 2017a). The only exception was copper, with BSAF results indicative of greater bioavailability in 2016 versus 2015 (Minnow 2017a). Continued monitoring of potential temporal changes in labile metal concentrations in Polley Lake will be implemented using DGTs, which are not subject to the confounding influences (i.e., gut content) described for benthic invertebrate tissue quality monitoring.

2.2 Hazeltine and Edney Creeks

2.2.1 Community

The benthic invertebrate community of Hazeltine Creek was relatively stable between baseline studies in 1995, 1996 (HKP 1997, 1997), and operational monitoring in 1999 (Beak 2000) and 2007 (Minnow 2009), although unusual methodologies were applied to data collection in the 1996 baseline that appeared to affect results of certain endpoints such as density and the proportions of different taxon groups (MPMC 2009). Overall, benthic communities in both upper and lower Hazeltine Creek (with the exception of 1996 data) had high organism densities (25,000 to 43,000 and 6,000 to 33,000 organisms/m^2, respectively) and taxon richness (36 to 50 and 26 to 46 taxa, respectively) with a high proportion of metal sensitive taxa of the orders Ephemeroptera,

Plecoptera, and Trichoptera (EPT; mayflies, stoneflies, and caddisflies) indicating good ecosystem health (Minnow 2014a).

Monitoring in 2015 following the TSF embankment breach indicated that benthic invertebrate community recovery was incomplete and the community was dominated by pollution tolerant organisms (e.g., blackflies and oligochaete worms), particularly in the upper creek area (Minnow 2016b). In lower Hazeltine Creek, further recovery was documented in 2017, evidenced by taxon richness similar to reference (28 to 40 taxa) and a proportion of sensitive EPT taxa similar to reference and historic conditions despite significantly lower organism density (3,738 to 5,788 organisms/m^2; Figure 4). Productivity monitoring initiated in 2017 corroborated the low organism density, with biomass in lower Hazeltine Creek (0.70 to 2.5 g/m^2 dw) below that of upper Hazeltine Creek (2.9 to 20 g/m^2 dw) and reference (5.5 to 33 g/m^2 dw; Minnow 2018a). In upper Hazeltine Creek, the benthic community documented in 2017 (approximately one year following completion of final rehabilitation activities) was dominated primarily by Trichoptera (caddisflies), and to a lesser degree by Ephemeroptera (mayflies), and Chironomidae. The presence of these sensitive taxa suggests limited chemical effect on recolonization, and total organism abundances similar to reference in 2015 indicate a benthic community supportive of fish habitat productivity (Figure 4; Minnow 2018a).

Similar to Hazeltine Creek, the benthic invertebrate community of Edney Creek was evaluated during baseline studies in 1995, 1996 (HKP 1996, 1997), and during the pre-breach operational time period in 1999 (Beak 2000), 2002 (Morrow/Azimuth 2003), and again in 2007 (Minnow 2009). Benthic invertebrate communities appeared to be relatively stable over this time (with the exception of the 1996 data discussed above), with organism densities of 15,500 to 62,000 organisms/m^2 and taxon richness of 32 to 55 taxa, and a relatively high proportion of metal sensitive EPT taxa (MPMC 2009; Minnow 2014a).

Monitoring following the TSF embankment breach indicated recovery of the benthic invertebrate community between 2015 and 2017 in the rehabilitated area of lower Edney Creek. Specifically, although organism density was lower than reference in 2017 (due mainly to an increase in density at the reference area), taxon richness in 2016 and 2017 was similar to reference (Figure 4), and the relative proportion of Trichoptera increased significantly between 2016 and 2017 while the proportion of Chironomidae decreased, which is indicative of recovery (Minnow 2018a). Initial benthic invertebrate productivity sampling in 2017 indicated that total biomass in the rehabilitated area of lower Edney Creek (0.44 to 3.37 g/m^2 dw) was slightly lower than reference (0.79 to 3.44 g/m^2 dw; Minnow 2018a).

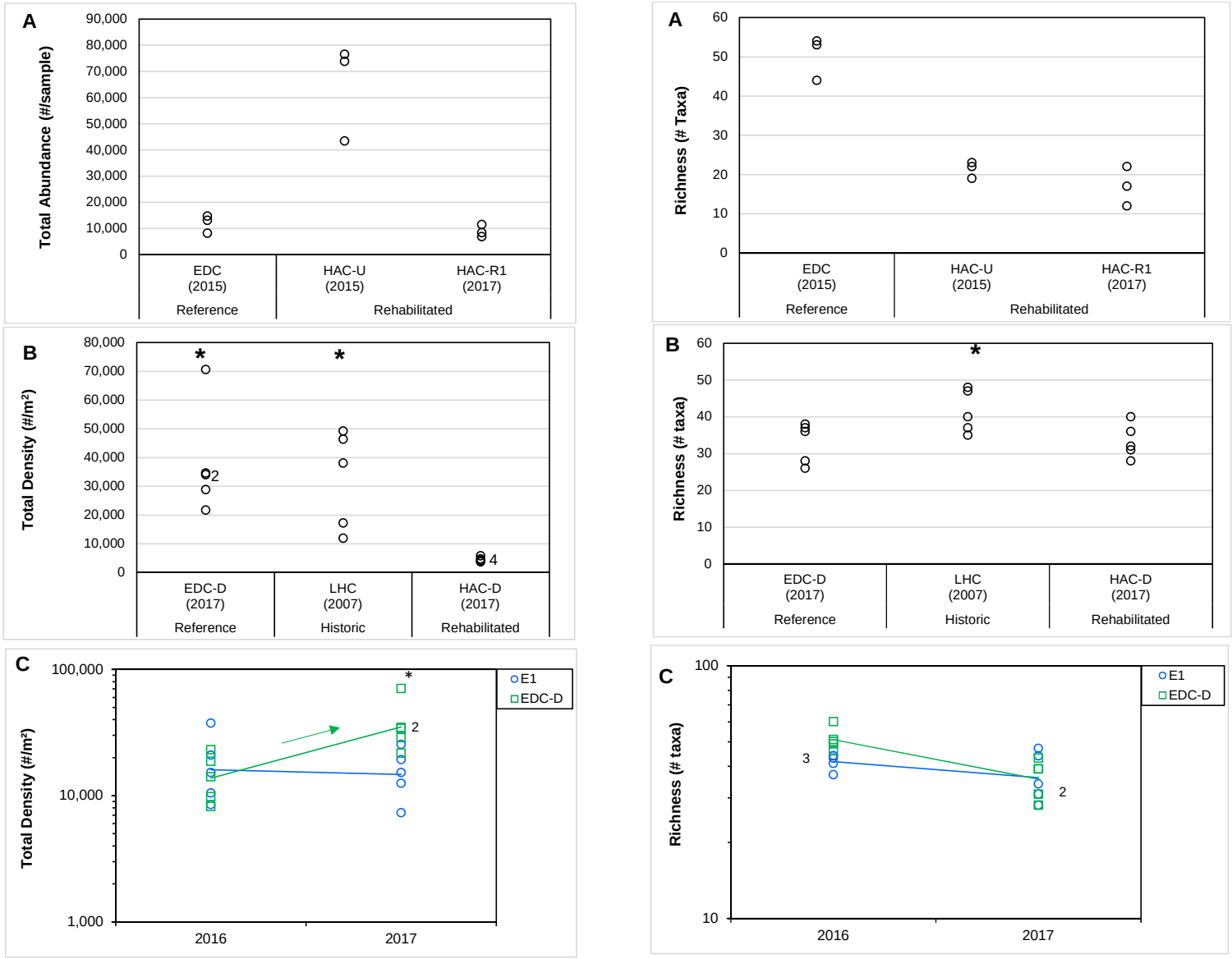


Figure 4: Benthic Invertebrate Community Endpoints for Rehabilitated Areas of A) Upper Hazeltine Creek (Kick-and-Sweep Sampling), B) Lower Hazeltine Creek (250 µm Surber Sampling), C) Lower Edney Creek (250 µm Surber Sampling), and Associated Reference Areas in the Vicinity of the Mount Polley Mine, 2007 to 2017[1]

Notes: For Lower Hazeltine Creek, areas displayed with an asterisk differed significantly from HAC-D (2017, $P < 0.1$). For Lower Edney Creek, statistical comparisons were conducted using a two-way ANOVA with factors Area and Year (* = significant difference ($\alpha = 0.1$) between areas for the given year; ** = significant difference ($\alpha = 0.1$) between areas in 2017 and magnitude of effect is different from ~~2016;~~ ► = significant ($\alpha = 0.1$) year effect ~~for E1~~► = significant ($\alpha = 0.1$) year effect for EDC-D).

[1] Values shown beside data points indicate number of stations sharing a similar result.

2.2.2 Tissue Quality

Benthic invertebrate tissue quality monitoring in Hazeltine Creek was initiated in 2009 as part of the ongoing characterization of selenium incorporation into the aquatic food chain in the vicinity of the Mount Polley Mine. Throughout the pre-breach operational period (2009 to 2013) mean benthic invertebrate tissue selenium concentrations at erosional habitats in upper Hazeltine Creek were higher than the interim BCWQG (4 mg/kg dw; BCMOE 2014) and generally higher than reference, while mean concentrations at erosional habitats in lower Hazeltine Creek were below the BCWQG (Figure 2; Minnow 2011, 2013a,b). In addition, selenium concentrations in benthic invertebrates from exposed erosional habitats were noted to be higher than those from nearby depositional areas (Minnow 2011, 2013b).

Following the TSF embankment breach, data interpretation focused on the POIs and IPs identified in Section 2.1.2 (which included selenium). In 2015 prior to initiation of effluent discharge to Hazeltine Creek, mean tissue concentrations of a number of these POIs and IPs were significantly higher in Hazeltine Creek than reference (arsenic, copper, iron, manganese, nickel, barium, calcium, cobalt, selenium, silver, sodium, strontium, titanium, and vanadium; Minnow 2016a). In addition, concentrations of copper and vanadium were higher in both upper and lower Hazeltine Creek areas relative to pre-breach conditions (3.5 and 8 times for copper, respectively; Figure 3; Minnow 2016a), whereas selenium concentrations were similar to pre-breach conditions (Figure 2). Examination of Bioconcentration Factors (BCFs; which are used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes other than diet; i.e, Arnot and Gobas 2006), indicated suggested that bioavailability did not differ from pre-breach conditions (Minnow 2016a).

Effluent was discharged directly to Hazeltine Creek between December 2015 and November 2017, however Hazeltine Creek was not considered to be fish habitat during this time by Fisheries and Oceans Canada (Golder 2015a) and was inaccessible to fish. Mean selenium concentrations in benthic invertebrates from Hazeltine Creek were higher than the majority of pre-breach results and the BCWQG in 2016 (10 mg/kg dw in both upper and lower Hazeltine Creek; Figure 2; Minnow 2017b), however these tissue concentrations corresponded with elevated mean dissolved selenium concentrations related to the conveyance of effluent that were 143-times higher than reference, and at least 46-times higher than at the same locations prior to the breach (Minnow 2013a, Minnow 2017b). Mean concentrations in 2017 were more similar to pre-breach results and were below the BCWQG in lower Hazeltine Creek (mean = 3.4 to 5.7 mg/kg dw; Figure 2; Minnow 2017b), presumably due to limited effluent discharge in 2017. Tissue concentrations of a number of POIs and IPs at effluent-exposed sampling areas were significantly

higher than reference in 2016[2] (barium, manganese, strontium, titanium), in 2017 (calcium), and in both years (arsenic, cobalt, copper, iron, molybdenum, nickel, selenium, vanadium; Minnow 2017b, 2018b). In particular, copper concentrations during this effluent discharge period (49 to 217 mg/kg dw) were elevated above reference and pre-breach concentrations but were generally similar to 2015 (prior to discharge; 158 to 254 mg/kg dw; Figure 3). Examination of BCFs indicated higher copper bioavailability relative to reference during the effluent discharge period (Minnow 2017b, 2018b), which was consistent with findings of higher labile copper concentration determined by DGTs (Minnow 2017c). Direct effluent discharge to Hazeltine Creek ceased in January 2018 prior to the reopening of upper Hazeltine Creek as fish habitat in spring 2018.

2.3 Quesnel Lake

2.3.1 Community

Benthic invertebrate community data for Quesnel Lake collected prior to the TSF embankment breach are limited to a few samples collected near the mouth of Hazeltine Creek in 2007 (Table 1). These data documented a mean density of approximately 31,100 organisms/m^2 and a mean taxonomic richness of 30 (Minnow 2009).

Benthic invertebrate community monitoring following the TSF embankment breach indicated that impacts to the community in shallow habitats were primarily limited to near-field areas and did not extend to far-field areas (Minnow 2015a). Impacts to the benthic community of the near-field area documented in 2014 included significantly lower mean organism density (159 to 294 organisms/m^2) and taxon richness (5.6 to 10 taxa) than reference (1,400 to 7,900 organisms/m^2 and 19 to 21 taxa, respectively; Minnow 2015a). Further monitoring in 2016 and 2017 confirmed these impacts, and indicated that limited recovery had occurred relative to: 1) a fine substrate reference with aquatic vegetation (2016; Minnow 2017a); and 2) two shallow sandy reference areas which more closely matching the habitat present in the near-field area in 2016 and 2017 (2017; Minnow 2018a). Benthic biomass sampling initiated in 2017 corroborated these results, with significantly lower biomass at the near-field area (mean = 0.28 g/m^2 ww) than reference (mean = 1.0 to 3.6 g/m^2 ww; Minnow 2018a).

Sediment investigations following the TSF embankment breach indicated that the majority of breach-derived material was deposited to deep habitat of Quesnel Lake (Minnow 2015a,b, 2016c). Immediately following the TSF embankment breach (2014), benthic invertebrate communities in deep exposed areas were characterized by particularly low mean organism

[2] Benthic invertebrate tissue quality results reflect single-taxon samples in 2016 and 2017 (caddisflies and/or stoneflies), and composite-taxa samples in 2015.

densities at the exposed near-field (PNF; 39.7 organisms/m^2) and far-field areas (3.4 to 22.6 organisms/m^2) relative to reference (5,840 organisms/m^2), and significantly lower mean taxon richness (0.2 to 2.6 taxa at near-field and far-field areas, 7.8 taxa at reference; Figure 5). Overall, results suggested that the biological effects were breach-related, but it was uncertain whether the effects were physical (due to smothering and/or low dissolved oxygen and low TOC content) or chemical (Minnow 2015a). Monitoring in 2015 and 2016 documented some recovery in mean organism density at the near-field (216 to 588 organisms/m^2 in 2015 and 2016, respectively), and far-field areas (266 organisms/m^2 in 2016; Figure 5), however density remained significantly lower than reference (Figure 5; Minnow 2016b, 2017a). Recovery of taxon richness was also documented (particularly at the near-field area; 4.6 to 6.2 taxa in 2015 and 2016, respectively), although differences in community composition remain (Minnow 2017a). Sediment transplant experiments indicated an increase in organism density and richness in exposed area sediment transplanted to the reference area, suggesting that sediment quality is not prohibitive of re-colonization (Minnow 2016b).

2.3.2 Tissue Quality

Benthic invertebrate tissue quality in Quesnel Lake was not assessed as part of baseline studies (1989-1996) for the Mount Polley mine (Table 2). Monitoring was initiated in 2012 as part of the ongoing characterization of selenium incorporation into the aquatic food chain in the vicinity of the Mount Polley Mine (see Sections 2.1.2 and 2.2.1). Sampling documented mean tissue selenium concentrations below the BCWQG in all areas of Quesnel Lake; 1.7 mg/kg dw near the Hazeltine Creek outlet, and 2.1 mg/kg dw at a reference area in the north arm of the lake (Minnow 2013a).

Following the TSF embankment breach, mean concentrations of all analytes identified as POIs and IPs in benthic invertebrate tissue (see Section 2.1.2) at the exposed shallow and deep areas of Quesnel Lake were similar to reference (including selenium), with the exception of copper which was significantly higher than reference at the deep exposed area in both 2015 and 2016 (147 to 178 mg/kg dw at exposed areas; 40 to 54.9 mg/kg dw at reference; Figure 3; Minnow 2016a, 2017b). As described previously (Section 2.1.2), these elevated benthic invertebrate concentrations could be attributed to higher sediment copper concentrations observed in this area and the confounding influence of gut contents (i.e., Chapman 1985; 2016). BSAFs for copper in the Quesnel Lake deep areas indicated relatively similar bioavailability between the exposed and reference areas (Minnow 2016a, 2017b), which is consistent with results of labile copper concentrations determined by DGTs (Minnow 2016d, Minnow 2017c).

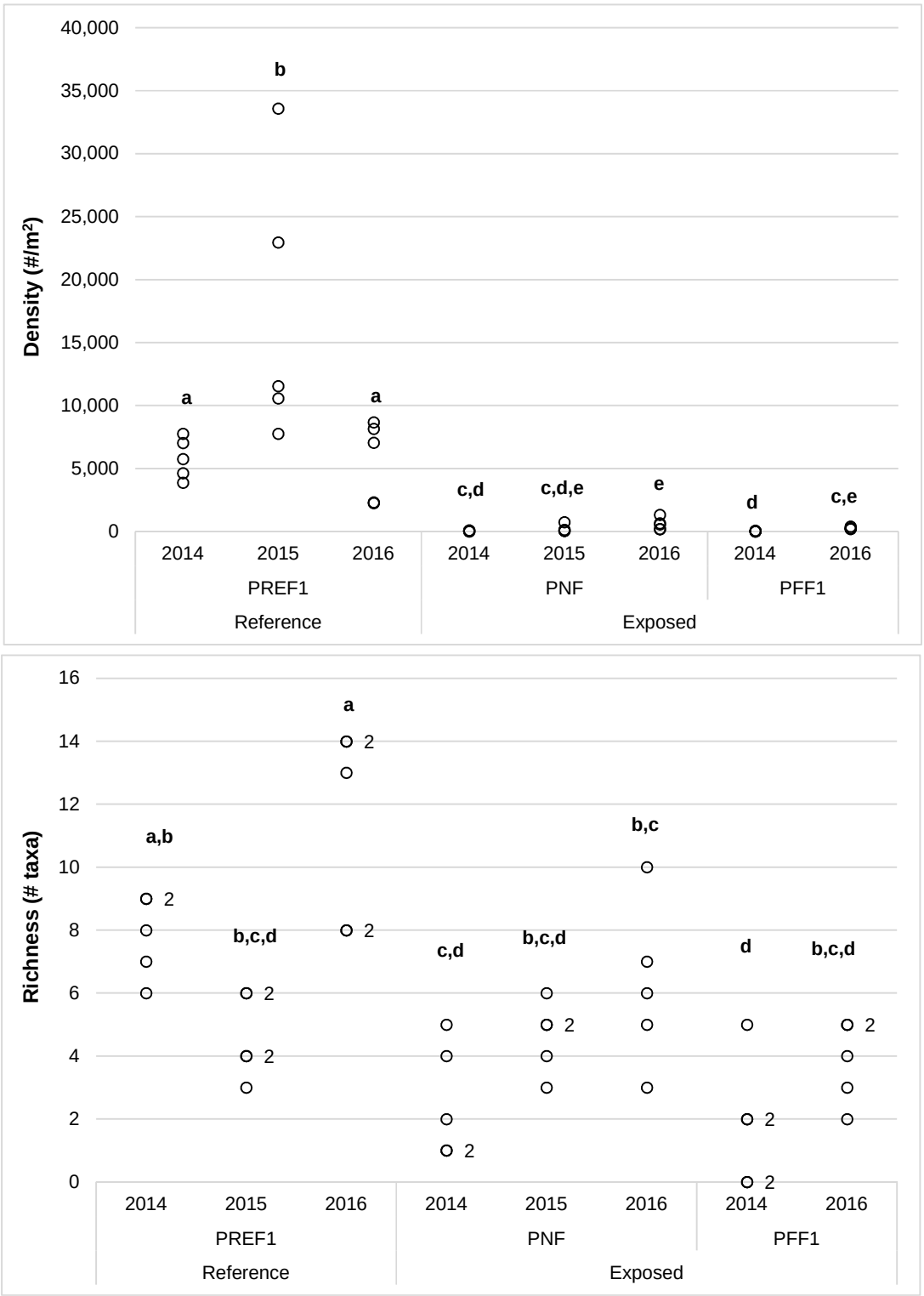


Figure 5: Benthic Invertebrate Community Endpoints in Quesnel Lake Deep Areas, Mount Polley Mine, 2014-2016 [a]

[a] Values shown beside data points indicate number of stations sharing a similar result. Areas not sharing a letter differed significantly ($p < 0.1$).

Note: Sample size = 5.

3 STUDY DESIGN OVERVIEW AND RATIONALE

Benthic invertebrate monitoring under the CEMP is designed to meet the combined needs of: 1) operational monitoring (including the discharge of treated effluent to Quesnel Lake); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to reclamation activity following the TSF embankment breach. An overview of the proposed benthic invertebrate monitoring program is provided in Table 3, and includes benthic invertebrate community, productivity, and tissue quality. Benthic invertebrate monitoring is focused on Polley Lake, Hazeltine Creek, lower Edney Creek, Quesnel Lake, and associated reference areas (Figures 6 and 7).

3.1 Community and Productivity

3.1.1 Lakes

Benthic invertebrate community monitoring in lakes is focused on Polley Lake and Quesnel Lake, with reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for impacted areas of Quesnel Lake; Table 3; Figure 6). In Polley Lake, benthic invertebrate community sampling will focus on the two basins (deepest locations in Polley Lake, representing locations of sediment accumulation/fate, and long-term monitoring locations), with the deepest location in Bootjack Lake serving as reference. In Quesnel Lake, benthic invertebrate community sampling for MDMER EEM will focus on the area near the point of effluent discharge (per Minnow 2016e) with two areas serving as reference (one unaffected by the breach and one affected by the breach but outside of the influence of effluent discharge; Minnow 2018c). Sediment investigations following the TSF embankment breach indicated that the majority of breach-derived material was deposited to deep habitat of Quesnel Lake (Minnow 2015a,b, 2016c), therefore benthic invertebrate community sampling in Quesnel Lake will focus on the deep areas that were previously monitored as near-field and far-field areas, with concurrent sampling of suitable reference areas.

Benthic invertebrate community sampling will be completed in August or September using a petite-ponar, consistent with previous data collections (HKP 1996, 1997; Beak 2000; Minnow 2015a, 2016b,e, 2017a), and with technical guidance (e.g., Environment Canada 2012a; BCMOE 2013, 2016). Detailed methodology is provided in Section 4, including: quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting. Sampling will be supported by sediment quality sampling (see CEMP Section 6.12), measurements of *in situ* water quality near the sediment-water interface (temperature, dissolved oxygen, pH, and specific conductance), water depth, GPS coordinates, and supporting photographs at all sampling stations. Data

Table 3: Mount Polley CEMP Benthic Invertebrate Monitoring Program Overview

A) Lakes

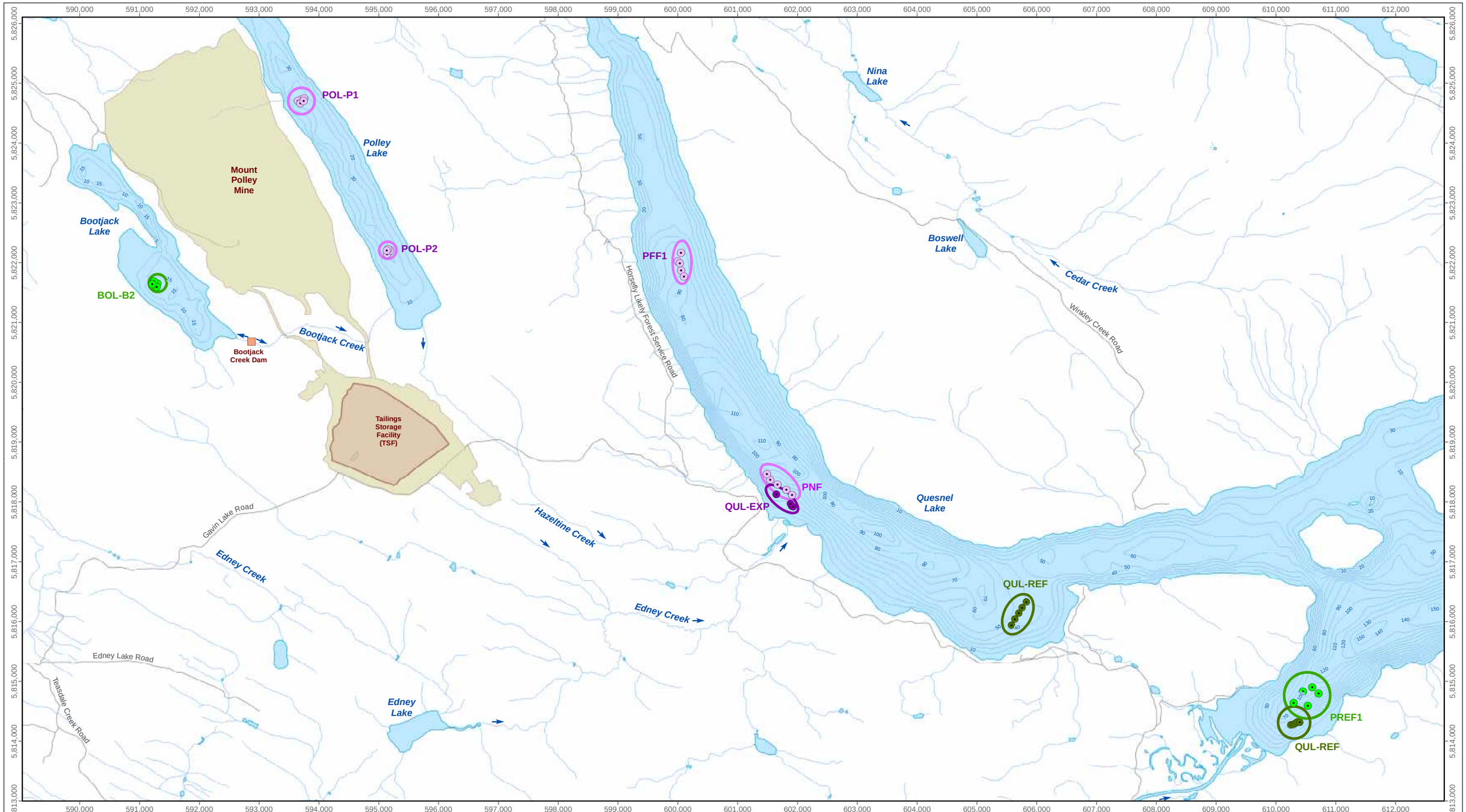
Water Body	Sampling Area	Type	Components [a]	Replication [b]	Rationale
Polley Lake	POL - P1 (Northwest Basin)	Exposed	T	5	immediately adjacent to mine and breach-influenced
	POL - P2 (Southeast Basin)	Exposed	T	5	immediately adjacent to mine and breach-influenced
Bootjack Lake	BOL - B2 (Southeast Basin)	Reference	T	5	reference for Polley Lake
Quesnel Lake	QUL - EEMNF	Exposed	T	5	adjacent to effluent discharge and breach-influenced
	QUL - EEMREF1	Reference	T	5	reference for EEMNF - breach-influenced reference
	QUL - EEMREF2	Reference	T	5	reference for EEMNF - non-breach-influenced reference
	QUL - PNF	Exposed	T	5	breach-influenced deep habitat
	QUL - PFF1	Exposed	T	5	breach influenced deep habitat
	QUL - PREF1	Reference	T	5	reference for exposed deep habitat areas of Quesnel Lake

[a] Core benthic invertebrate monitoring components: T = community taxonomy (Lowest-Practicable-Level).
[b] Number of replicate stations within the specified sampling area.

B) Creeks

Water Body	Sampling Area	Type	Monitoring Frequency	Components [a]	Replication [b]			Rationale
					T	P	C	
Hazeltine Creek	HAC-R1 (Upper, Reach 1)	Exposed	Annual	T,P,C	5	5	8	adjacent to mine and breach-influenced
	HAC-U (Upper)	Exposed	Annual	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
	HAC-D (Lower)	Exposed	Bi-annual [c]	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
Frypan Creek	FPC-R3 (Reach 3)	Reference	2018 only	P, C	-	5	8	reference for upper Hazeltine Creek
Edney Creek	EDC-U (Upper)	Reference	Annual	T,P,C	5	5	8	reference for upper Hazeltine Creek
	E1 (Lower)	Exposed	Bi-annual [c]	T,P	5	5	-	adjacent to mine and breach-influenced
	EDC-D (Lower, unimpacted)	Reference	Bi-annual [c]	T,P,C	5	5	8	reference for lower Hazeltine Creek [d]

[a] Core benthic invertebrate monitoring components: T = community taxonomy (Lowest-Practicable-Level), P = productivity (wet and dry benthic biomass), and C = chemistry (see Table 4 for analytes).
[b] Number of replicate stations within the specified sampling area for a given program component.
[c] Bi-annual indicates sampling will occur every other year for all parameters indicated with the exception of tissue chemistry, which will be monitored annually. The next bi-annual sampling event will occur in 2019.
[d] Lower Edney Creek reference area will be located in an unimpacted area upstream of the breach influence (see Figure 7).



Benthic Invertebrate Monitoring Station

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Benthic Invertebrate Monitoring Area

- Reference Deep
- Exposed Deep
- Reference EEM
- Exposed EEM

Please note: Quesnel Lake bathymetry lines are an approximate representation only and may not precisely delineate accurate depths at larger scales.

0 1 2 4
km

N
W E
S

Projection: North American Datum 1983 UTM Zone 10U
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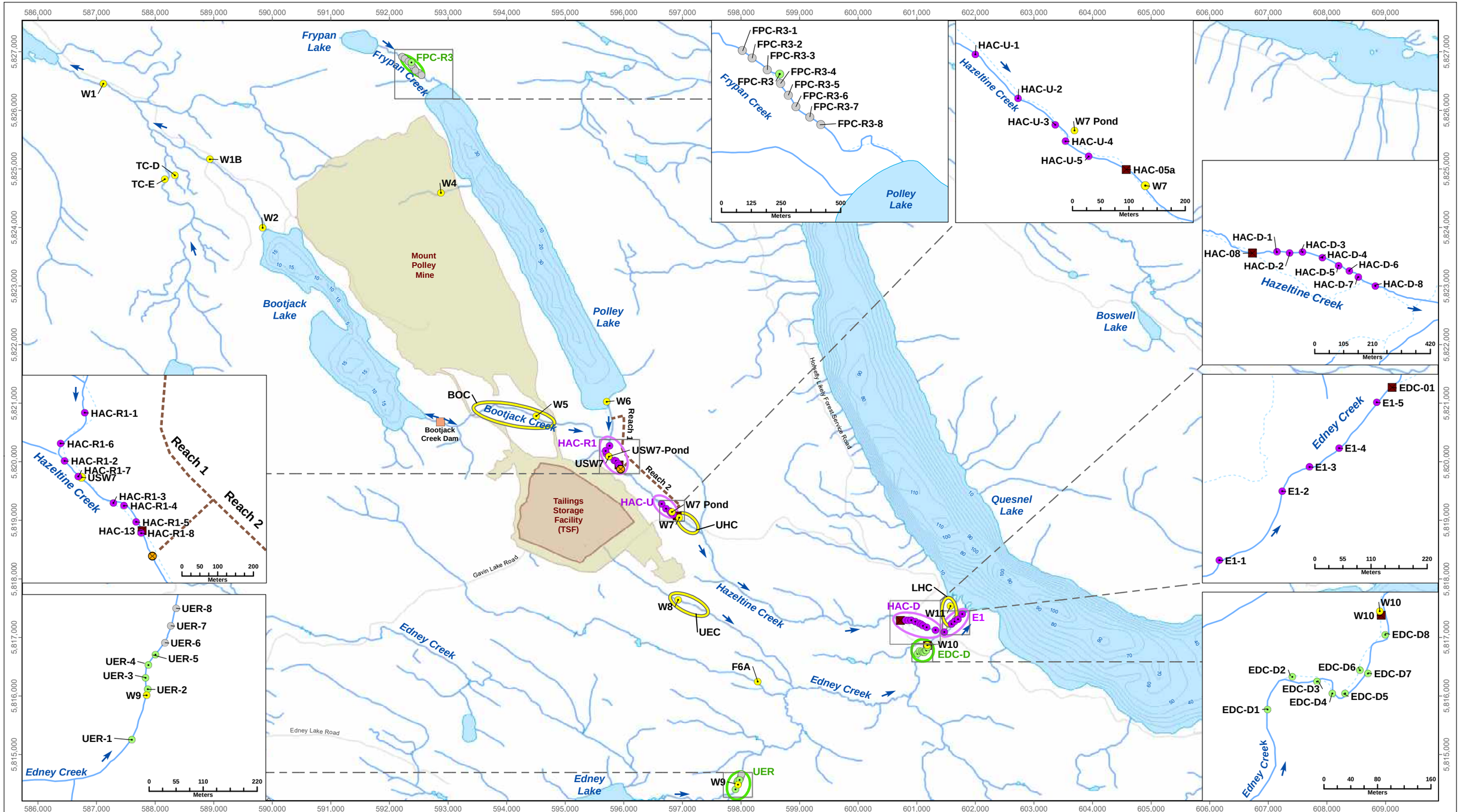
Mount Polley CEMP Benthic Invertebrate Monitoring Location, Lakes

Date: June 2018
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Figure 6

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Benthic Invertebrate Monitoring Station

- Rehabilitated
- Reference
- Pre-Breach (n ≥ 5 at location)
- Conceptual
- Effluent Discharge from 2014 to 2017
- Routine Water Quality Station
- Rehabilited Reaches (Golder 2017a,b)
- Tailings Storage Facility
- Active Mine Operation

Benthic Invertebrate Monitoring Area

- Rehabilitated
- Reference
- Pre-Breach (n ≥ 5 within area)
- Historic Watercourse Pathway

Note: Sampling Location may be adjusted from those shown displayed based on field survey information.

0 1 2 4 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Benthic Invertebrate Monitoring Locations, Creeks

Date June 2018
Project 177202.0042

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Figure 7

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interpretation will be based on a combination of: 1) statistical comparison to previous conditions; and 2) statistical comparison to reference conditions. Accordingly, five stations per area are proposed for each sampling area to provide replication for the statistical contrasts.

The frequency of benthic invertebrate community monitoring at the federal EEM sampling areas in Quesnel Lake (to evaluate potential effects of effluent discharge) is initially at a prescribed frequency of every three years, subject to modification based on the findings of at least two EEM phases (Environment Canada 2012a). Additional benthic invertebrate community sampling in Quesnel Lake and Polley Lake (not associated with EEM) will also initially be completed in 2018 and then every three years concurrent with EEM (2018, 2021, etc.). Based on results of benthic invertebrate community monitoring undertaken from 2014 to 2017 which demonstrated some recovery following the TSF embankment breach (see Section 2 for details), and on low sediment deposition rates documented in Polley Lake and Quesnel Lake (see CEMP Section 6.12), it is anticipated that a three-year frequency will be sufficient to track benthic invertebrate recovery. Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) may be made in response to QP recommendations. These may include further reduction in monitoring frequency if continued recovery of benthic community results relative to reference is demonstrated.

3.1.2 Creeks

Benthic invertebrate community monitoring in creeks is focused on rehabilitated areas of Hazeltine Creek and lower Edney Creek, with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek and lower Hazeltine Creek; Table 3; Figure 7). Benthic invertebrate monitoring in Hazeltine Creek will focus on three areas (Figure 7)[3], including one area in Reach 1 (HAC-R1; where rehabilitation was completed in 2016), one area in Reach 2 (HAC-U; where rehabilitation was completed in 2017), and one area in lower Hazeltine Creek (HAC-D; where initial rehabilitation activities have been completed but additional rehabilitation will be conducted). The locations of sampling areas in upper and lower Hazeltine Creek (HAC-U and HAC-D) are generally consistent with those monitored prior to the TSF embankment breach, as is the location of the upper Edney Creek reference area (UER; Figure 7). Monitoring in lower Edney Creek will focus on one rehabilitated area (E1; where rehabilitation was completed in 2015). Suitable reference areas will be sampled concurrently. In Frypan Creek, the reference sampling area was selected to match habitat

[3] Note that previous creek sampling station locations are presented in Figure 7. These locations may change slightly depending on substrate, water depth, and water velocity. Similarly, conceptual station locations are displayed for Frypan Creek and Upper Edney reference areas, and will be established during the field campaign.

conditions in upper Hazeltine Creek as closely as possible, based on results of preliminary fish habitat assessment and benthic invertebrate monitoring (area selection was based primarily on substrate type and size; Minnow 2018d). The location of all benthic invertebrate community sampling stations will align with those proposed for periphyton monitoring (see CEMP Section 6.15).

Benthic invertebrate community sampling will be completed in August or September using a Hess or Surber sampler[4], consistent with previous data collections (HKP 1996, 1997; Beak 2000; Minnow 2009, 2016b, 2017a, 2018a). Detailed methodology is provided in Section 4. All benthic invertebrate community samples collected from creeks will also be evaluated for benthic invertebrate productivity (biomass; through the documentation of benthic invertebrate community sample weight by the laboratory) for the purposes of relating productivity to the assessment of fish habitat. Sampling at each station will be supported by measures of sampling depth, water velocity, in situ water quality measurements (as outlined in Section 3.1.1), GPS coordinates, notes of the presence of aquatic vegetation/bryophytes on sampled substrate and other physical observations, and supporting photographs of the sampling location and samples. Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (i.e., Frypan Creek and upper Edney reference). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; and 2) statistical comparison to reference conditions. Accordingly, five stations per area are proposed to provide replication for the statistical contrasts.

The initial frequency of benthic invertebrate community and productivity monitoring in Reaches 1 and 2 of upper Hazeltine Creek (and associated reference areas) is annual given the recent disturbance to these rehabilitated areas, and recent reopening of upper Hazeltine Creek as fish habitat to Polley Lake fish. The frequency in rehabilitated areas of lower Hazeltine Creek and lower Edney Creek (and associated reference areas) is every second year because these areas have been undisturbed since 2015 and the benthic community monitoring in these areas has demonstrated recovery (Minnow 2016b, 2017a, 2018a; see Section 2.2). Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) may be made in response to QP recommendations. If results indicate stabilizing benthic communities and productivity during this period, then a reduction of monitoring frequency to every second year will be considered for upper Hazeltine Creek areas. The Frypan Creek reference area will only be sampled in 2018 (Table 3) to provide

[4] If sufficient sampling locations with habitat attributes suitable for Hess/Surber sampling cannot be located (particularly in the recently rehabilitated areas of upper Hazeltine Creek), kick and sweep sampling consistent with CABIN guidance (Environment Canada 2012a) may be implemented instead of Hess/Surber sampling.

comparison for benthic community data from upper Hazeltine Creek following the initial reopening of upper Hazeltine Creek as fish habitat (Minnow 2018e).

3.2 Tissue Quality

Benthic invertebrate tissue quality monitoring is focused on upper and lower areas of Hazeltine Creek, with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and lower Edney Creek for lower Hazeltine Creek; Table 3; Figure 7). Benthic invertebrate tissue quality monitoring in Hazeltine Creek is undertaken to monitor the combined influence of uncontrolled surface runoff from the north dump and downstream influence on Hazeltine Creek (which occurred from 2006 to 2009), the conveyance of mine effluent between December 2015 to December 2017, and the TSF embankment breach. Benthic invertebrate tissue quality monitoring will focus on three areas of Hazeltine Creek, including one area in Reach 1 (HAC-R1) and one in Reach 2 (HAC-U) of upper Hazeltine Creek, and one area in lower Hazeltine Creek (HAC-D). As described in Section 3.1.2, the locations of sampling areas in upper and lower Hazeltine Creek are generally consistent with those monitored prior to the TSF embankment breach (Figure 7). It should be noted that sampling areas HAC-U and HAC-D were previously exposed to the discharge of treated mine effluent (December 2015 to December 2017), whereas HAC-R1 is located upstream of the previous discharge point (Figure 7). As of November 2017, treated effluent is no longer discharged into Hazeltine Creek, and upper Hazeltine Creek has been reopened as fish habitat to Polley Lake fish as of spring 2018.

Benthic invertebrate tissue quality sampling will be completed in August or September concurrent with benthic invertebrate community sample collections described in Section 3.1.2, and will be consistent with previous data collections (Minnow 2011, 2013a,b, 2016a, 2017b, 2018b). Tissue samples collected from each station will include one composite-taxa sample that contains a mixture of taxa that is proportional to biomass at the station, and one single-taxon sample[5] (e.g., a sample of only one taxon). Composite-taxa benthic invertebrate tissue samples are reflective of dietary exposure for fish, and can therefore be used in assessment of fish habitat. Alternatively, single-taxon samples are beneficial for limiting variability associated with different benthic invertebrate taxon composition. The collection of both sample types will ensure temporal comparability with previous data collections which have included both composite-taxa and single-taxon tissue samples (e.g., Minnow 2011, 2013a,b, 2016a, 2017b, 2018b). Tissues will be collected for the analytical determination of moisture content, metals, and mercury (Section 4.3.2). Supporting measures at each station will include *in situ* water quality measurements as outlined

[5] Single-taxon sampling will be completed only if adequate sample material from any one taxon can be collected with a reasonable sampling effort.

above (Section 3.1.1), GPS coordinates, physical observations, and supporting photographs. Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (i.e., Frypan Creek and upper Edney reference areas). Data interpretation for all parameters will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) comparison relative to BCWQG (i.e., tissue selenium concentrations; BCMOE 2014). A replication level of eight samples per area will be used to support the statistical contrasts.

The initial frequency of benthic invertebrate tissue quality monitoring at Hazeltine Creek (and associated reference areas) is annual given the recent disturbance of upper creek areas related to rehabilitation activities, and changes to the effluent exposure status. Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) may be made in response to QP recommendations. If results indicate stabilizing or decreasing benthic tissue concentrations during this period, then a reduction of monitoring frequency to every second year will be considered. The Frypan Creek reference area which is included for comparison with upper Hazeltine Creek will be sampled in 2018 only (see Table 3). Benthic invertebrate tissue quality sampling at this reference area will support rainbow trout tissue quality sampling in these areas only in 2018 following the initial reopening of upper Hazeltine Creek as fish habitat (Minnow 2018e).

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be performed by qualified field staff experienced in the implementation of benthic invertebrate community, productivity, and tissue chemistry monitoring programs. All sample collection, quality assurance and quality control, and laboratory analysis methods will be implemented in accordance with technical guidance (BCMOE 2013, 2015, 2016). Specifically, quality assurance and quality control measures will include program review prior implementation, adequate resources for all field teams including field checklists and field data sheets, the availability and maintenance of clean sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination.

Quality control (QC) samples will be collected to support the benthic invertebrate tissue quality monitoring program. To capture within-area variability, eight replicate composite-taxa and up to eight replicate single-taxa tissue quality samples will be collected from each sampling area. Field duplicate samples (i.e. splits samples of the benthic invertebrate tissue collected from one sampling station) will be collected for 10% of samples to assess field precision as part of the Data Quality Review (DQR; Section 4.4). Duplicate water samples will be collected at a frequency of 10% to assess field precision associated with the water samples that support benthic invertebrate community and tissue quality monitoring. In addition to field QA/QC, the laboratory responsible for chemical analyses will be accredited by the Canadian Association for Laboratory Accreditation (CALA) for these analyses. Specific QC sampling and associated reporting for tissue quality results will be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). Laboratory Reporting Limits (LRLs) will also be evaluated in comparison to targets established by the analytical laboratory.

QC samples to assess field precision (field duplicates) will not be collected for benthic community or productivity monitoring endpoints due to the high inherent natural variability of these parameters. However, composite benthic invertebrate community samples will be collected at all sampling locations to ensure that each sample is representative of the station. Taxonomic identification of benthic invertebrate community samples will be completed by a qualified laboratory certified under the Taxonomic Certification Program of the Society for Freshwater Science (SFS; formerly the North American Benthological Society). Quality control for benthic invertebrate taxonomic analyses will be consistent with federal requirements for metal mining EEM (Environment Canada 2012a). Specific QC sampling and associated reporting will be requested from the taxonomic laboratory, including an assessment of sub-sampling error, sorting

efficiency, and identification accuracy (Environment Canada 2012a, 2014). These results will be assessed as part of the DQR (Section 4.4).

All raw field data will be transcribed from field sheets into an electronic spreadsheet. Data will then checked by a separate individual for data entry errors as part of routine Quality Assurance/Quality Control (QA/QC) procedures.

4.2 Sample Collection Methods

4.2.1 Community and Productivity

Benthic invertebrate sampling in lakes for community analysis will be collected using a stainless steel petite ponar grab sampler, consistent with previous monitoring (e.g., Minnow 2015a, 2016b,d, 2017a, 2018a) and in accordance with provincial and federal technical guidance (i.e., BCMOE 2013; Environment Canada 2012a). Briefly, the petite ponar is a 6" x 6" (15.24 cm x 15.24 cm) grab sampler with jaws that can be held open by shear-pressure on a spring-loaded pin. The grab sampler is lowered to the substrate at which point shear-pressure is eliminated and the pin springs out. Upon upward pull at the initiation of retrieval, the jaws of the ponar close to grab surficial sediment. Care must be taken to control the rate at which the petite ponar is lowered to allow appropriate sediment penetration and to minimize sediment disturbance. The petite ponar will be carefully retrieved to surface and each grab will be placed into a plastic tote and observed for completeness and any unusual characteristics. In Quesnel Lake, samples will be retrieved with the assistance of a commercial line hauler (Ace Line Hauler - Brutus Plus 40). Only high quality, comparable samples will be retained. If the sample is deemed acceptable, the sample will rinsed from the ponar into the tub to ensure the complete removal of all material The sample material will then be placed into a 250 µm mesh sieve bag and sieved free of all material less than 250 µm in diameter. At each station, a composite sample of five acceptable grabs will be collected (0.116 m^2 of bottom area in total) to ensure that each sample is representative of the station. After sieving, the retained material (sample) from the five composited grabs will then be carefully transferred to 1 or 2-L wide mouth plastic jars using a wash bottle while working over a plastic tub to avoid any potential loss of organisms. Any organisms that adhere to the inside of the sieve bag will be retrieved and added to the sample jar. Each jar will receive an internal and external label with the station number, area identifier, project number, date, and the initials of the field personnel. Each sample will be preserved with a 10% buffered formalin solution within six hours of collection to eliminate the potential effects of within-sample predation, which could affect abundance estimates. Sampling will be conducted at five replicate stations in each area (see Table 3).

Supporting information collected at all lake sampling stations will include sediment quality measures (see CEMP Section 6.12), GPS (Geographic Positioning System) coordinates; water depth; *in situ* water quality near the sediment-water interface (temperature, dissolved oxygen, pH, and specific conductance), site and sample photographs, notes of the presence or absence of aquatic vegetation, and other physical observations (sediment texture, colour, density, etc.). In addition, a full vertical profile of the field meter measurements will collected at one station per area. Supporting water samples will also be collected from each sampling area associated with EEM (see Table 3), including samples for total and dissolved constituents (including metals), the latter prepared by field filtration using a 0.45 µm syringe filter. Water samples will be placed into a dedicated cooler with frozen ice packs, and kept cool prior to transport to the field laboratory.

Sampling of benthic invertebrates in creeks for community and productivity analysis will be consistent with previous monitoring (e.g., Minnow 2009, 2016b, 2017a, 2018a), and with technical guidance (BCMOE 2013). A Hess sampler with a 0.1 m^2 diameter and upstream (incurrent) and downstream (excurrent) openings will be used if water depth allows. The incurrent opening will be covered with a mesh to prevent contamination of the sample with organisms from upstream. The excurrent opening will consist of a conical net equipped with 250 µm mesh attached to a removable collection cup that has mesh on the downstream end to allow water to exit. If creek environments are too shallow to accommodate Hess sampling, a Surber sampler (30.5 x 30.5 cm; 0.093 m^2) equipped with 250 µm mesh will be used. Each Hess/Surber sample will be collected by firmly and carefully placing the sampler on undisturbed substrate to a depth of 5 to 10 cm. All cobble and gravel within the sampler area (to a depth of approximately 10 cm) will be scrubbed and the current will be allowed to carry all dislodged organisms into the 250 µm net. The sampler net and collection cup will be rinsed and the contents will be carefully transferred to internally and externally labelled 1 or 2 L wide mouth plastic jars. Any remaining invertebrates found clinging to the sampling equipment will be removed and placed in the sample jar. At each station, one composite sample of three sub-samples (i.e., approximately 0.3 m^2 of creek surface area if a Hess sampler is used, 0.279 m^2 if a Surber sampler is used) will be collected to ensure that each sample is representative of the station. Each sample will be preserved with a 10% buffered formalin solution as described above. Sampling will be conducted at five replicate stations in each area (see Table 3), and each station will be established at a minimum distance of approximately three bankfull widths from adjacent stations, where habitat allows. A concerted effort will be made to

ensure that water velocity, water depth, and substrate characteristics are comparable among sub-samples and among respective stations to minimize natural influences on community variability[6].

Supporting information collected at each creek sampling station will include those parameters listed above for lakes, with the addition of substrate size measurements wherein 100 randomly selected substrate pebbles per station will be measured along their intermediate axis and the percent embeddedness 10% of the pebbles will be recorded, consistent with the CABIN protocol (Environment Canada 2012b). Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (e.g., in Frypan Creek and upper Edney Creek). Water samples will be collected as described above.

4.2.2 Tissue Quality

Benthic invertebrate tissue samples will be collected using a combination of hand picking and kick-and-sweep, consistent with previous monitoring (e.g., Minnow 2011, 2013a,b, 2016a, 2017b, 2018b) and with technical guidance (e.g., BCMOE 2016). Hand picking entails overturning rocks in the streambed and collecting any of benthic invertebrates observed. The kick-and-sweep method involves a field technician moving upstream and across the stream channel (in a zig-zag pattern) while holding a kick net (a net with a triangular opening and a 400 µm mesh bag) immediately downstream, and disturbing the substrate with his or her feet to dislodge benthic organisms into the net (a method modified from the Canadian Aquatic Biomonitoring Network [CABIN] 3-minute travelling kick-and-sweep; Environment Canada 2012b). The net will then be rinsed with water to move all debris and invertebrates to the collection cup at the bottom of the net. The collection cup will be removed and its contents (i.e., invertebrates and debris) will be placed into a plastic tote. Organisms will then be picked free of debris, and transferred into a labeled scintillation vial, without rinsing, to minimize the amount of water in each sample. One composite-taxa sample (containing a mixture of taxa that is proportional to biomass at the station), and one single-taxon sample (containing one taxon only) will be collected at each station. As possible, the taxa selected for the single-taxon samples will be consistent among sampling areas, and consistent with previous monitoring (Minnow 2017b, 2018b). However, single-taxon sampling will only be completed at each station if adequate sample material can be collected with a reasonable sampling effort[7]. Sampling will be conducted at eight replicate stations in each area

[6] If five stations with closely matching habitat attributes cannot be located (particularly in the recently rehabilitated areas of upper Hazeltine Creek), kick and sweep sampling consistent with CABIN guidance (Environment Canada 2012a) may be implemented instead of Hess/Surber sampling.

[7] A reasonable sampling effort will be considered approximately 1 hour per sample. If sample collection is nearly complete within this time frame, additional sampling effort will be applied to complete the sample collection.

(see Table 3). Samples will stored in a cooler containing ice packs for transport to the mine, where they will be frozen.

4.3 Sample Handling and Laboratory Analysis

4.3.1 Community and Productivity

Preserved benthic invertebrate community samples will be stored at room temperature until shipment to the laboratory for taxonomic identification and enumeration. Samples will be shipped with completed Chain-of-Custody (COC) forms immediately after the completion of the field campaign, however there are no recommended hold times for analysis.

Taxonomic identification of benthic invertebrate community samples will be completed by a qualified laboratory using standard methods that incorporate QA/QC measures (e.g., Environment Canada 2012a; 2014). Upon sample receipt, the laboratory will provide a sample receipt confirmation which will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. All samples will be sieved and processed in the laboratory using the same mesh size as used in during field collections (250 µm), with the exception of those collected for MDMER EEM which will be identified and enumerated based on both the 250 µm and 500 µm fractions (Minnow 2018c). If the estimated number of invertebrates in a sample is greater than 600 individuals and the sample is fine and non-clumping, a subsample will be taken using a Marchant Box (Marchant 1989) as described by Environment Canada (2014). Samples (or sub-samples) will then be sorted using a gridded Petri dish under a low power stereo microscope into family/order while maintaining counts (but totals exclude Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera, and any terrestrial drop-ins). All samples will be processed to a minimum 300 organism count, and if 300 organisms have not been reached by the 50th cell of the Marchant Box, then the entire sample will be sorted (i.e., all 100 cells). All sorted organisms will be stored in 80% ethanol by family/order in separate labeled vials and debris will be preserved and labeled separately. Identifications of all insects to the lowest practicable level (LPL; typically genus or species) and non-insects to the genus/species level (where possible, but to a minimum of family level) will be conducted by experienced, certified taxonomists using up-to-date taxonomic keys, comparisons to an externally-verified reference collection, and effort lists compiled by CABIN, SAFIT (Southwest Association of Freshwater Invertebrate Taxonomists), and PNAMP (Pacific Northwest Aquatic Monitoring Partnership). Following identification, representative specimens may be preserved and retained for inclusion in a voucher collection for Mount Polley.

Following taxonomic identification, the wet and dry biomass of total organisms in each sample from creek environments (benthic invertebrate productivity) will be determined. For wet biomass,

samples will be poured through a piece of pre-weighed 212 µm Nitex mesh and dried gently between two pieces of absorbent paper. Each sample will then be weighed to the nearest 0.0001 g, and the weight of the mesh will be subtracted from the total weight to determine total sample wet weight. For dry biomass, wet samples will be then placed on a piece of pre-dried and pre-weighed glass fiber filter before being dried at 160^0F (71°C) for six hours. Following a short period of cooling, samples will be weighed as described above, and total sample dry weight will be calculated.

4.3.2 Tissue Quality

Benthic invertebrate tissue quality samples will remain frozen until overnight shipment on ice with completed COCs to ALS Environmental, Burnaby BC; an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA). Samples will be sent to the laboratory with sufficient time to complete analyses within the recommended sample hold times. Analyses will be completed using methods that are consistent with those specified in the British Columbia Environmental Laboratory Manual (BCMOE 2015). Upon sample receipt, the laboratory will provide a sample receipt confirmation when the samples are received and logged. These receipts will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. Tissue quality samples will be analysed for metals by CRC-ICP-MS (Collision Cell Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/6020A [USEPA 2004]) or HR-ICP-MS (High Resolution Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/ 200.8 [USEPA 1994]), mercury by CVAFS (Cold Vapour Atomic Fluorescence Spectrophotometry; USEPA Method 200.3 [USEPA 1991]/Method 245.7 [USEPA 2001]), and moisture content. The method selected for metals analysis will depend on sample weight, with HR-ICP-MS employed for smaller sample sizes. Tissue quality analytes are provided in Table 4, with the associated target LRLs, detection limit objectives outlined in technical guidance (“consensus detection limits”; BCMOE 2016), and available BCWQG (i.e., selenium; BCMOE 2014). Upon completion of the analyses, the laboratory will provide a data report in Microsoft (MS) Excel™ and as an Adobe Acrobat Portable Document Format (PDF). Reporting will include the results of the laboratory QC sample results.

4.4 Data Quality Review

Upon receipt of all analytical data, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs have been achieved. The DQR will also include an evaluation of differences between duplicate (split) samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the benthic invertebrate monitoring data will ensure timely communication with the laboratory should any issues be identified

Table 4: Target Laboratory Reporting Limits (LRL) and Analytical Methods for Benthic Invertebrate Tissue Quality Analytes

Parameter	Metals in Tissue by HR-ICPMS Micro (USEPA 1991, 1994)		Metals in Tissue by CMC ICPMS (USEPA 1991, 2004)		Consensus DLs [a]	British Columbia Water Quality Guidelines [b]
Units	mg/kg wwt	mg/kg dw	mg/kg wwt	mg/kg dw	mg/kg wwt	mg/kg dw
Aluminum (Al)	1.0	5.0	0.40	2.0	0.40	-
Antimony (Sb)	0.0020	0.010	0.0020	0.010	0.0020	-
Arsenic (As)	0.0060	0.030	0.0040	0.020	0.0050	-
Barium (Ba)	0.010	0.050	0.010	0.050	0.010	-
Beryllium (Be)	0.0020	0.010	0.0020	0.010	0.0020	-
Bismuth (Bi)	0.0020	0.010	0.0020	0.010	0.0200	-
Boron (B)	0.20	1.0	0.20	1.0	-	-
Cadmium (Cd)	0.0020	0.010	0.0010	0.0050	0.0020	-
Calcium (Ca)	4.0	20	4.0	20	2.0	-
Cesium (Cs)	0.0010	0.0050	0.0010	0.0050	-	-
Chromium (Cr)	0.040	0.20	0.010	0.050	0.010	-
Cobalt (Co)	0.0040	0.020	0.0040	0.020	0.0040	-
Copper (Cu)	0.040	0.20	0.020	0.10	0.010	-
Iron (Fe)	1.0	5.0	0.60	3.0	1.0	-
Lead (Pb)	0.010	0.050	0.0040	0.020	0.0040	-
Lithium (Li)	0.10	0.50	0.10	0.50	-	-
Magnesium (Mg)	0.40	2.0	0.40	2.0	2.0	-
Manganese (Mn)	0.010	0.050	0.010	0.050	0.020	-
Mercury (Hg) [c]	0.0010	0.0050	-	-	0.002	-
Molybdenum (Mo)	0.0080	0.040	0.0040	0.020	0.010	-
Nickel (Ni)	0.040	0.20	0.040	0.20	0.010	-
Phosphorus (P)	2.0	10	2.0	10	5.0	-
Potassium (K)	4.0	20	4.0	20	10	-
Rubidium (Rb)	0.010	0.050	0.010	0.050	-	-
Selenium (Se)	0.020	0.10	0.010	0.050	0.020	4.0
Sodium (Na)	4.0	20	4.0	20	2.0	-
Strontium (Sr)	0.020	0.10	0.010	0.050	0.010	-
Tellurium (Te)	0.0040	0.020	0.0040	0.020	-	-
Thallium (Tl)	0.00040	0.0020	0.00040	0.0020	0.0010	-
Tin (Sn)	0.020	0.10	0.020	0.10	0.020	-
Uranium (U)	0.00040	0.0020	0.00040	0.0020	0.0010	-
Vanadium (V)	0.020	0.10	0.020	0.10	0.020	-
Zinc (Zn)	0.20	1.0	0.10	0.50	0.10	-
Zirconium (Zr)	0.040	0.20	0.040	0.20	-	-

[a] From Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016).

[b] British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture (BCMOE 2018).

[c] Method for total mercury analysis will be according to USEPA (1991, 2001).

For benthic invertebrate tissue quality samples, LRLs will be evaluated relative to targets established for the analytes, to "consensus detection limits" (Table 4), and to relevant British Columbia guidelines (i.e., selenium; BCMOE 2014). Comparisons between duplicate samples will be made by calculating the relative percent difference (RPD) of metal concentrations between paired duplicates. If the RPD is <25% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Results for laboratory blanks, precision, and accuracy will be evaluated relative to Data Quality Objectives (DQO) established by the analytical laboratory that performed the analyses. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping). For benthic invertebrate community samples, reanalysis for quality control endpoints (organism sorting efficiency, subsampling precision and accuracy error, and taxonomic identification error) will be performed on 10% of samples, and results of quality control measures will be evaluated relative to pre-established DQOs. Specifically, evaluation of organism sorting efficiency will involve reprocessing previously sorted material from randomly selected samples, and then determining the number of invertebrates that were not recovered during processing of the original sample, and an efficiency of < 10% missed organisms will be considered acceptable. Evaluation of subsampling error provides a measure of analytical accuracy by comparing the numbers of benthic invertebrates recovered between at least two sub-samples, and of analytical precision by comparing sub-sample derived benthic invertebrate community numbers with the densities determined for whole benthic invertebrate community samples. An error of < 20% will be considered acceptable for subsampling accuracy and precision. Evaluation of taxonomic identification error involves an internal quality control audit of taxonomic identification results whereby blind re-enumeration and re-identification of random samples will be performed by an analyst not involved in the original sample processing, and an error of < 5% for this endpoint will be considered acceptable.

4.5 Data Handling and Interpretation

Upon receipt of data from the analytical laboratories, all laboratory data files will be managed by the Mount Polley Mining Corporation (MPMC) Environment Department. In addition, chemical data provided by the primary analytical laboratories as an Electronic Data Deliverable (EDD) will be imported directly into the MPMC's database following completion of the DQR. Following the data quality review described above (Section 4.4), all benthic invertebrate community, benthic invertebrate tissue chemistry data, and supporting data will be managed in Microsoft (MS) Excel™. For all replicated data (typically based on a sample size of five or eight stations per area), data will be provided to the QP for analysis and summarized by calculating mean, median,

standard deviation, minimum, and maximum for each endpoint. Data analysis will be completed for each monitoring component (community, productivity, and tissue quality).

4.5.1 Community and Productivity

Benthic invertebrate communities will be evaluated using metrics of organism density (organisms per m²; grab samples, and Hess/Surber samples) or abundance[8] (organisms per sample; kick-and-sweep samples), taxonomic richness, Simpson's Index of Diversity, Simpson's Index of Evenness (calculated as in Smith and Wilson 1996; Environment Canada 2012a). The Bray-Curtis Index of Dissimilarity will also be used in the evaluation of samples collected for MDMER EEM as per technical guidance (Environment Canada 2012a). These primary indices will be calculated at the LPL of taxonomy for the 250 µm fraction of all samples, with the exception of samples collected for EEM which will be calculated using family-level data for the 500 µm sample fraction (Minnow 2018c). The densities and relative densities of the most abundant taxa will also be calculated (relative densities calculated as the abundance of each respective dominant/indicator taxon relative to the total number of organisms in the sample and expressed as a percentage). Dominant/indicator taxon groups will be defined as those groups representing more than 5% of total organism abundance within each set of areas being compared, or any taxon groups considered to be important indicators of environmental stress. In addition, benthic invertebrate productivity in creeks will also be evaluated using wet and dry total biomass converted to a standard area-based measurement (g/m^2). Summary statistics for all endpoints will be reported by area and year as described above (sample size, mean, median, minimum, maximum, and standard deviation).

Correspondence analysis (CA) or Nonmetric Multidimensional Scaling (NMDS) multivariate ordination methods will be used to further examine benthic invertebrate community structure. These are multivariate ordination methods used to reduce multivariate data into a manageable number of variables and will be applied to assist in the identification of key spatial or temporal differences in benthic invertebrate community (i.e., which stations have distinct benthic communities but also how these benthic communities differ among stations). The results of these multivariate analyses will be incorporated into the comparison of benthic invertebrate indices described below.

Benthic invertebrate community and productivity metrics from exposed areas will be compared to reference results in a control-impact study design, as well as compared temporally to previous monitoring results if data are available. Comparisons will be completed primarily using Analysis

[8] Abundance (as opposed to density) will be calculated only if kick-and-sweep sampling methods are used in creek due to lack of suitable Hess/Surber sampling habitat. See Section 3.1.2 for details.

of Variance (ANOVA) to test for statistically significant differences. For these analyses, the assumptions of normality and homogeneity of variances will be tested on the residuals of the ANOVA model using the Shapiro-Wilk test and Levene's test based on median values, respectively, using a significance level (α) of 0.1. Data will be transformed as necessary to satisfy assumptions of normality and homogeneity of variance. In instances where the residuals of the ANOVA model do not meet the assumptions of normality and homogeneity of variances, a non-parametric Kruskal-Wallis test will be conducted. When the overall results of an ANOVA or Kruskal-Wallis test are significant, differences between specific areas will be evaluated using post-hoc contrasts for ANOVA or Dunn's test for the Kruskal-Wallis test. A Bonferroni correction on the p-values will be used to conserve the overall Type I error rate. Statistical temporal contrasts may also be completed using Two-Way ANOVA (with factors *Area* and *Year*) if data are available for both the exposed and reference areas for all years being evaluated. For the Two-Way ANOVA model, assumptions of normality and homogeneity will be tested on the residuals of the model as described above using the Shapiro-Wilk test and Levene's test based on median values, respectively ($\alpha = 0.05$). Data will be transformed as necessary to satisfy assumptions of normality and homogeneity of variance and if these assumptions are not met, the analysis will be conducted on ranks (equivalent to a non-parametric test). When the interaction between *Area* and *Year* is significant ($\alpha = 0.1$) the following post-hoc contrasts will be conducted, and when the interaction between *Area* and *Year* is not significant, the effect of area and year will be assessed ($\alpha = 0.1$) using the *Area* and *Year* terms in the ANOVA model. Further detailed analyses will be completed as required for data interpretation, and may include graphical comparisons to reference and historical data, and formal spatial statistical contrasts using methods similar to those described above.

If exposed versus reference or temporal differences in benthic invertebrate community and/or productivity results are noted, potential relationships between benthic invertebrate community metrics and physical and chemical conditions of the study areas will be explored using Spearman correlation (often referred to a Spearman Rank-Order correlation). For lake sampling areas, these physical/chemical endpoints may include results of multivariate statistical analyses used to identify key sediment quality parameters (e.g., CA or PCA axis scores; see CEMP Section 6.12). For most areas, correlation analyses will likely only include data from a single year of sampling in order to focus the analysis on differences between rehabilitated and exposed areas relative to reference, rather than on differences among years. Following the derivation of correlation coefficients, a Bonferroni-type correction (i.e., p-value [0.05] divided by the total number of correlations examined for independent variables) will be applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected p-value of 0.05. Any significant correlations found at the

Bonferroni-adjusted p-value or at a p-value of 0.01 will be further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were "leveraged" by outlying points (or groups of points). Although it is recognized that a significant correlation or regression does not indicate causation (e.g., Norton et al. 2015), it is desirable to not only characterize the nature of a response (e.g., differences in benthic invertebrate community), but to also obtain evidence of cause. Correlation / regression analyses are commonly applied tools for identifying potential cause (e.g., Norton et al. 2015). Evidence of causation obtained from correlation or regression analysis will be carefully considered in light of the strength, range, and continuity of the relationships as well as mechanistic knowledge/understanding of potential cause.

4.5.2 Tissue Quality

Data analysis and interpretation of benthic invertebrate tissue quality results will focus on Parameters of Interest (POIs [representing the chemical influence of the TSF embankment breach on sediment quality]: arsenic, copper, iron, and nickel), and on Indicator Parameters (IPs [identified in evaluations of water, soil, or fish tissue quality for Hazeltine Creek]: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium; Golder 2015b, 2016, Minnow 2015a). Benthic invertebrate tissue quality results for these analytes will be compared to available pre-breach data (for selenium only in 2009, 2012 and 2013, and for all analytes in 2010; Minnow 2011, 2013a,b), contrasted between exposed and reference areas, and also compared temporally within exposed areas. In addition, tissue quality results for selenium will be compared to the relevant BCWQG (BCMOE 2014). Detailed analyses and interpretation related to these comparisons will be completed as required, and may include: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations tissue concentrations (control-impact study design using Analysis of Variance [ANOVA]) as described above. Formal statistical temporal and spatial contrasts may also be completed using ANOVA methods similar to those described for benthic invertebrate community data analysis to augment interpretation, where data allows.

Concentrations of the POIs and IPs in benthic invertebrate tissue will also be evaluated relative to concentrations in water. These ratios of concentrations will be calculated as: [tissue sample concentration]/[dissolved water concentration], and are referred to as Bioconcentration Factors (BCFs). BCFs are often used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes other than diet (i.e., Arnot and Gobas 2006), and are applicable to erosional areas where sediment is generally not present. BCFs will be calculated using tissue metal concentrations (dry weight) and mean dissolved metal concentrations in water from each sampling area. Calculated BCFs will then be qualitatively

compared among areas to identify differences in the uptake of metals by benthic invertebrate in areas impacted by effluent discharge and/or the TSF embankment breach.

Additionally, concentrations of POIs and IPs in benthic invertebrates will be evaluated relative to concentrations in periphyton, based on Trophic Transfer Factors (TTFs; the ratio of tissue concentrations in benthic invertebrates relative to concentrations in periphyton (i.e., TTF = [benthic invertebrate sample]/[periphyton sample]). TTFs can be used to generally describe the extent to which the concentration of an analyte increases between lower and higher trophic levels (e.g., Presser and Luoma 2010). TTFs greater than 1 indicate that the analyte is accumulating in benthic invertebrates to a greater extent than would be expected if ingestion of periphyton was the sole source of that analyte to the benthic invertebrates (assuming uptake and excretion of the analyte by the benthic invertebrates are equal). Co-located observations of benthic invertebrate and periphyton tissue chemistry will be used to calculate TTFs for each replicate station. Comparisons of TTFs will then be made between exposed and reference areas as well as with pre-breach results.

An interpretive report based on the benthic invertebrate monitoring data will be prepared for integration into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWQG, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.3

Periphyton Monitoring

Minnow Environmental Inc.

Periphyton
Monitoring Plan

Prepared for:

Mount Polley Mining Corporation
Likely, British Columbia

Prepared by:

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June 2018

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A Trinity Consultants Company

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1 INTRODUCTION

1.1 Background

Periphyton represents an important component of aquatic food webs in creeks, and consists of a complex matrix of organisms. Periphyton generally includes algae, fungi, bacteria, and protozoa attached to submerged substrate (e.g., rocks, bedrock, woody debris). These organisms are representative of the lowest trophic level in running water and take up nutrients such as nitrogen (e.g., nitrate, nitrite) and phosphorus (e.g., ortho-phosphate), as well as other substances dissolved in water (e.g., major ions, metals) to serve physiological functions, which thereby become available via dietary pathways to consumer organisms at higher trophic levels. Periphyton productivity and community characteristics can be influenced by factors such as physical disturbance (i.e., changes to surface water hydrology) and water quality (relating to toxicity or changes in productivity due to nutrient chemistry), and periphyton tissue quality can be influenced by water and/or sediment quality (although the latter is primarily present in suspended form in erosional streams). Therefore, periphyton monitoring is an important tool for both the assessment of creek productivity (through measures of periphyton productivity and community) and the evaluation of the trophic transfer of substances (through measures of periphyton tissue quality), and these monitoring components have been incorporated into the CEMP.

The influence of the Mount Polley Mine on periphyton productivity, community, and tissue quality can occur by several key mechanisms: 1) general mine influence from dustfall and/or uncontained surface or groundwater flows: 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to December 2017, and directly since January 2018]); 3) the TSF embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Reclamation activities in lower Edney Creek and Hazeltine Creek were initiated in 2014 following the TSF embankment breach, and were completed in lower Edney Creek in August 2015 (Golder 2017b). Construction / rehabilitation in areas of upper Hazeltine Creek (Reaches 1 and 2) were completed between July and September of 2016 and 2017, respectively (Golder 2017a,c), with Reach 2 encompassing an upper Hazeltine Creek monitoring area established prior to the TSF embankment breach (W7; Minnow 2009). In lower Hazeltine Creek, initial channel rehabilitation was completed in 2015, and further rehabilitation has yet to be completed.

Periphyton tissue quality in creeks adjacent to the Mount Polley Mine has been monitored since prior to the TSF embankment breach (2010, 2012, and 2013; Minnow 2011, 2013a, 2013b). Periphyton productivity (chlorophyll-a and Ash-Free-Dry-Mass [AFDM]) has been monitored since 2013 (Minnow 2013c, 2018a,b), and periphyton community characteristics have not been

documented in these waterbodies. Results of previous periphyton productivity and tissue quality monitoring are reviewed in Section 2. These results provide context for a periphyton monitoring program that is guided by a combination of available historical findings, representative locations downstream of Mount Polley Mine operations (taking into consideration recent stream rehabilitation activities), representative reference locations, and considerations for a statistically-based design that will facilitate the detection of potential spatial and/or temporal differences in periphyton endpoints (productivity, community, and tissue quality), in addition to providing data to evaluate productivity endpoints (i.e., chlorophyll-a) against provincial water guidelines for the protection of aquatic life (e.g., BCWQG; BCMOE 2018) and literature-based productivity classification values (e.g., Biggs 1996).

The following sections of the CEMP Periphyton Monitoring Plan provide the objectives of periphyton productivity and tissue quality monitoring, a summary of historical periphyton monitoring results, an overview of the CEMP study design and associated rationale (including sampling locations, replication, frequency, and analytes), and detailed methodology for periphyton productivity and tissue quality monitoring (sampling methods, analytical methods, quality control methods, data interpretation, and reporting).

1.1 Monitoring Objectives

The objective of periphyton monitoring in the Mount Polley receiving environment is to evaluate the influence of Mount Polley Mine activities (related to mine operations, the TSF embankment breach, and/or rehabilitation activities) on Hazeltine Creek (the creek receiving environment directly influenced by Mount Polley Mine activity) and lower Edney Creek (a creek environment directly influenced by the TSF embankment breach), and to serve as supporting information for the determination of potential effects to aquatic life at higher trophic levels (benthic invertebrates and fish; Sections 6.13 and 6.16). Periphyton monitoring will include assessment of productivity, community composition, and tissue quality, with comparison to previous and/or reference conditions, to applicable guidelines (i.e., chlorophyll-a; BCMOE 2018), and to literature-based criteria (or classification ranges) for productivity. Periphyton monitoring results also provide supporting information for the assessment of benthic invertebrate tissue quality, benthic invertebrate community condition, and fish habitat productivity, as well as supporting the exposure assessment for the ecological risk assessment (ERA) and human health risk assessment (HHRA).

2 SUMMARY OF HISTORICAL FINDINGS

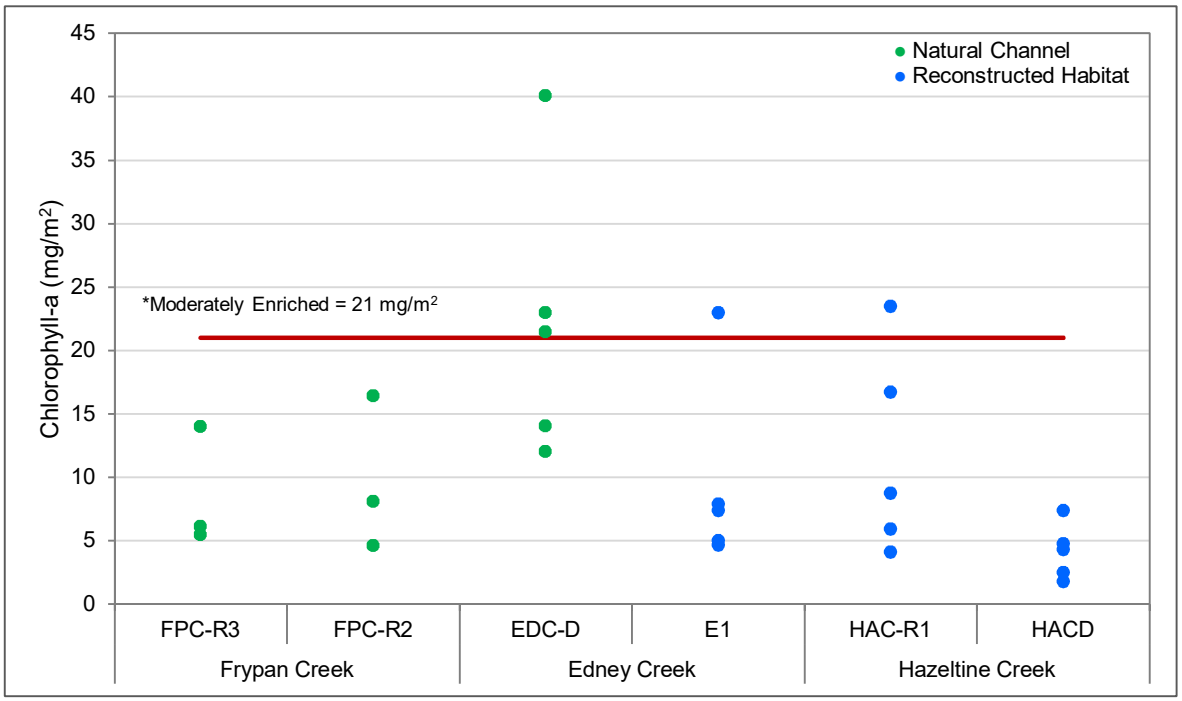
2.1 Productivity

Periphyton productivity monitoring completed during mine operations but before the TSF embankment breach indicated that productivity was low in a creek adjacent to the Mount Polley Mine (Bootjack Creek; 1.42 mg/m^2 of chlorophyll-a; Minnow 2013c) relative to the BCWQG of 100 mg/m^2 (BCMOE 2018). Following the TSF embankment breach, periphyton productivity in rehabilitated areas of upper and lower Hazeltine Creek and lower Edney Creek were also generally low (1.76 to 40.1 mg/m^2 of chlorophyll-a; Minnow 2018a; Figure 1), as evidenced by results well below the BCWQG and generally below chlorophyll-a levels associated with moderately enriched streams (21 mg/m^2; Biggs 1996) despite full sun exposure in these recently rehabilitated areas. Periphyton chlorophyll-a results from these rehabilitated areas following the TSF embankment breach were generally within the range documented in the associated reference areas (4.6 to 40.1 mg/m^2), as was periphyton biomass (AFDM; Figure 1; Minnow 2018a,b).

2.2 Tissue Quality

Periphyton tissue quality has been monitored since 2010 in the vicinity of the Mount Polley Mine (primarily within Hazeltine Creek), with a focus on selenium monitoring relative to reference (Minnow 2011, 2013a,b, 2018c), although additional analytes were included in analyses completed in 2010 (Minnow 2011). Mean periphyton selenium concentrations in upper and lower Hazeltine Creek have shown limited temporal change over the monitoring period, with the most recent results (2017) being similar to, or lower than, concentrations documented prior to the TSF embankment breach (Figure 2).

The inclusion of additional analytes in periphyton tissue quality monitoring continued in 2017 (Minnow 2018d), with tissue quality characterized in three rehabilitated areas of Hazeltine Creek (2 of which were effluent exposed during sample collection), relative to reference (an unimpacted area of lower Edney Creek). Data interpretation of these additional analytes focused on Parameters of Interest (POIs [representing the chemical influence of the TSF embankment breach on sediment quality]: arsenic, copper, iron, and nickel), and on Indicator Parameters (IPs [identified in evaluations of water, soil, or fish tissue quality for Hazeltine Creek]: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium; Golder 2015, 2016, Minnow 2015). Periphyton tissue quality from all rehabilitated Hazeltine Creek areas (both effluent exposed and not exposed) was characterized by copper concentrations that were significantly higher than reference (Figure 3), while concentrations of a number of additional analytes were higher than reference in at least one Hazeltine Creek area (two POIs: arsenic, iron;



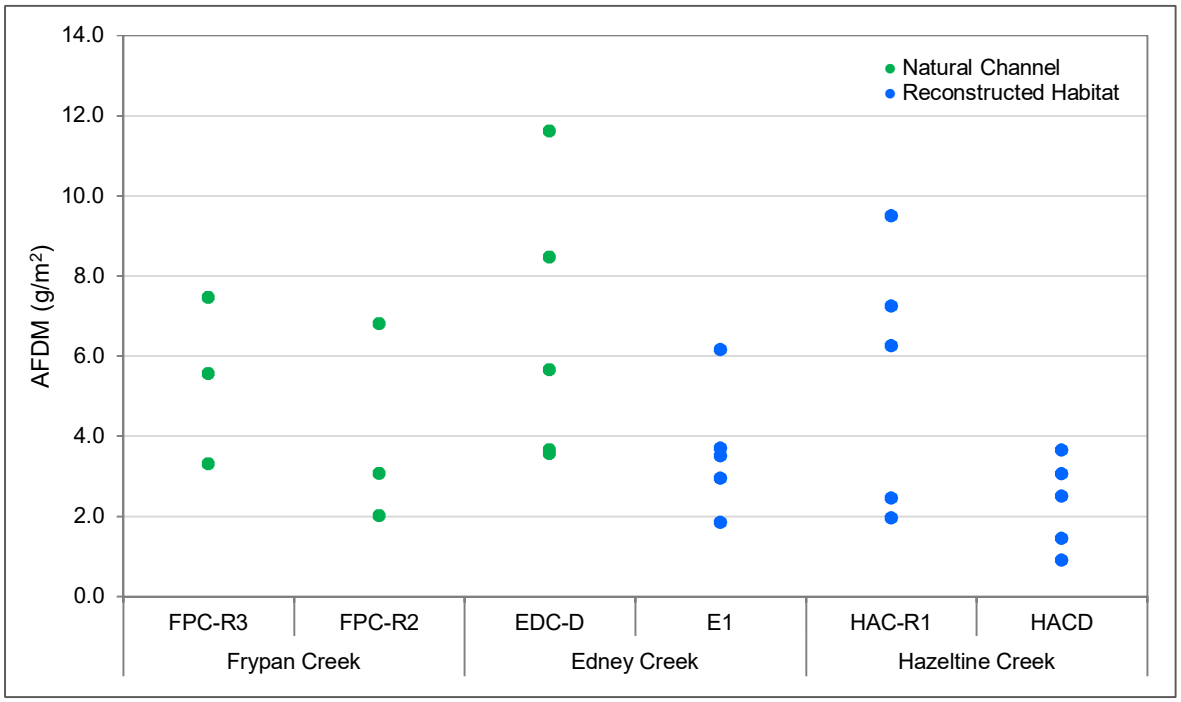


Figure 1: Chlorophyll-a and Ash-Free-Dry-Mass (AFDM) for Frypan, Edney and Hazeltine Creeks, 2017

* Value taken from Biggs 1996

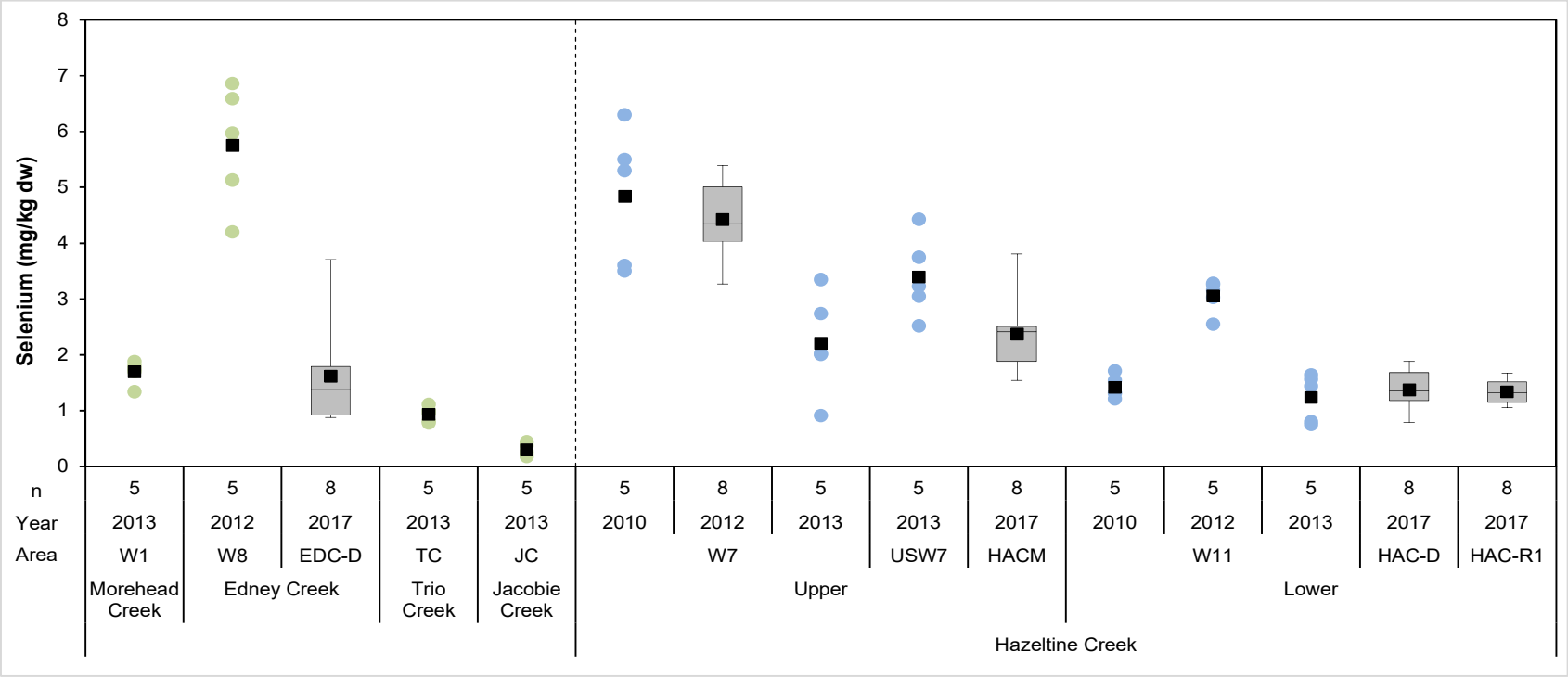
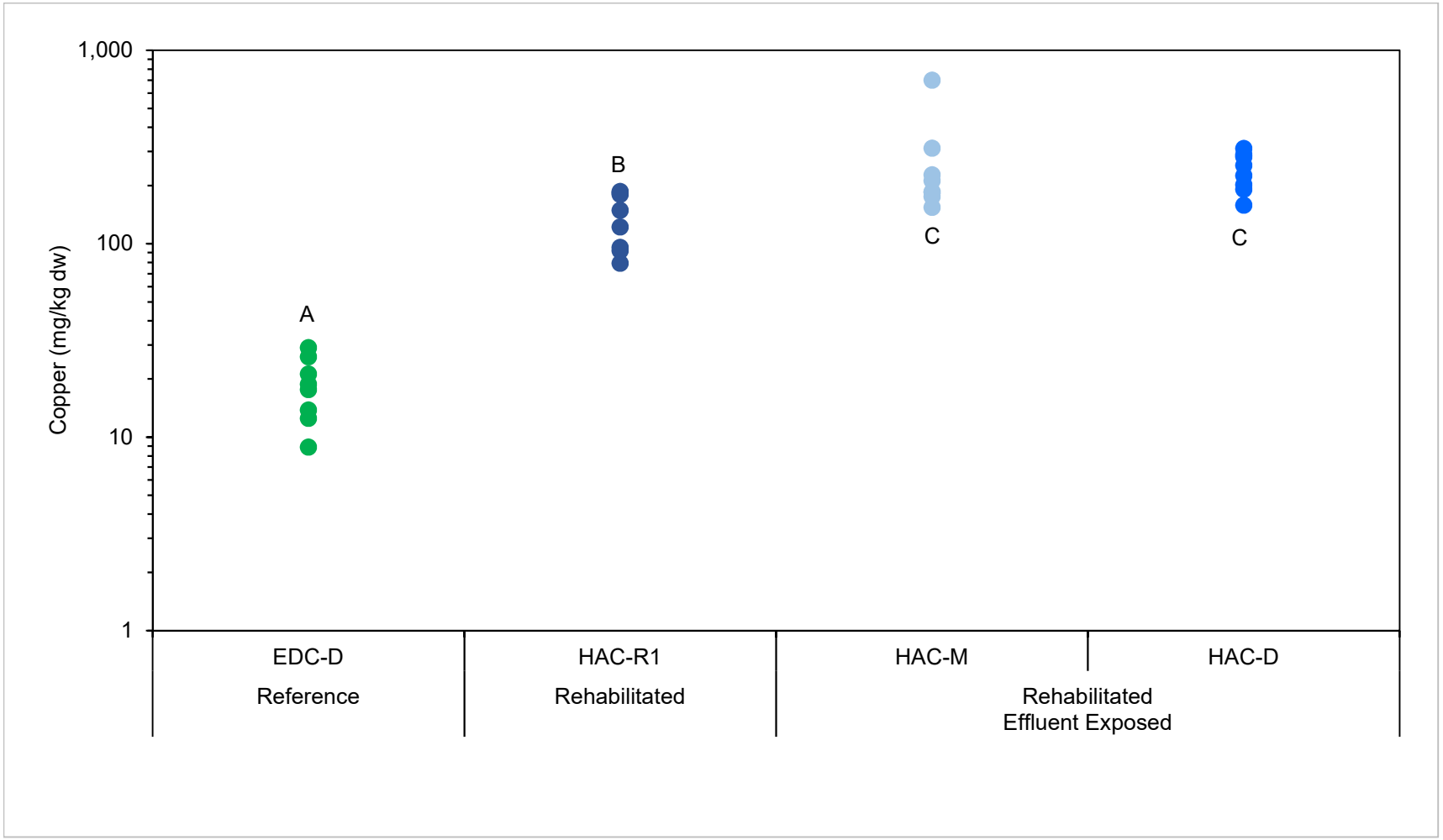


Figure 2: Selenium Concentrations in Periphyton Tissue at Hazeltine Creek with Associated Reference Areas, Mount Polley, 2010 to 2017

Note: Dashed line used to separate reference (left side) and exposed (right side) areas. Black squares represent means and whiskers represent minimum and maximum values. Box plots are presented when there are 8 or more samples.



Note: Groups that share a letter (e.g., AB) are not significantly different from each other.

Figure 3: Periphyton Tissue Copper Concentrations at Rehabilitated and Effluent Exposed (HAC-M, HAC-D), Rehabilitated (HAC-R1), and Reference (EDC-D) Area, Mount Polley Mine, 2017

and six IPs: calcium, cobalt, molybdenum, phosphorus, sodium, and vanadium; Minnow 2018d) These results were consistent with the higher water concentrations of most of these analytes in Hazeltine Creek due to a combination of breach influence and effluent conveyance preceding and during sample collection.

3 STUDY DESIGN OVERVIEW AND RATIONALE

Periphyton monitoring under the CEMP is proposed to meet the combined needs of: 1) operational monitoring (including the previous discharge of treated effluent to Hazeltine Creek); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to reclamation activity following the TSF embankment breach. An overview of the proposed periphyton monitoring program is provided in Table 1 and Figure 4. Periphyton monitoring is focused on Hazeltine Creek and lower Edney Creek with reference areas identified for each mine-influenced sampling area (i.e., upper Edney Creek and Frypan Creek for upper Hazeltine Creek, and an unaffected area of lower Edney Creek for rehabilitated areas of lower Edney Creek and lower Hazeltine Creek; Table 1; Figure 4). As described in Section 1.1, reclamation activities in Hazeltine Creek and lower Edney Creek were initiated in 2014 following the TSF embankment breach, and were completed in lower Edney Creek in August 2015 (Golder 2017b), and in 2016 and 2017 in sections of upper Hazeltine Creek in (Reaches 1 and 2, respectively; Golder 2017a,b). As such, periphyton monitoring in Hazeltine Creek will focus on three areas (Figure 4)[1], including one area in Reach 1 (HAC-R1; where rehabilitation was completed in 2016), one area in Reach 2 (HAC-U; where rehabilitation was completed in 2017), and one area in lower Hazeltine Creek (HAC-D, where initial rehabilitation activities have been completed but additional rehabilitation will be conducted). Monitoring in lower Edney Creek will focus on one rehabilitated area (E1; where rehabilitation was completed in 2015). These sampling areas also align with those proposed for benthic invertebrate community and tissue quality monitoring (see CEMP Section 6.13). It should be noted that sampling areas HAC-U and HAC-D were previously exposed to the discharge of treated mine effluent (December 2015 to December 2017), whereas HAC-R1 is located upstream of the previous discharge point (Figure 4). As of January 2018, treated effluent is no longer discharged into Hazeltine Creek. Concurrent sampling of suitable reference areas will be conducted in lower Edney Creek and Frypan Creek. In Frypan Creek, the reference sampling area was selected to match habitat conditions in upper Hazeltine Creek as closely as possible, based on results of preliminary fish habitat assessment and benthic invertebrate monitoring (area selection was based primarily on substrate type and size; Minnow 2018b).

Periphyton monitoring includes assessment of productivity (chlorophyll-a and AFDM) at all sampling locations. Periphyton community will also be monitored at all locations with the exception of Frypan Creek, which will be sampled in 2018 only for the purposes of comparison of

[1] Note that previous creek sampling station locations are presented in Figure 4. These locations may change slightly depending on substrate, water depth, and water velocity. Similarly, conceptual station locations are displayed for upper Edney Creek and Frypan Creek, and will be established during the field campaign.

Table 1: Mount Polley CEMP Periphyton Monitoring Program Overview

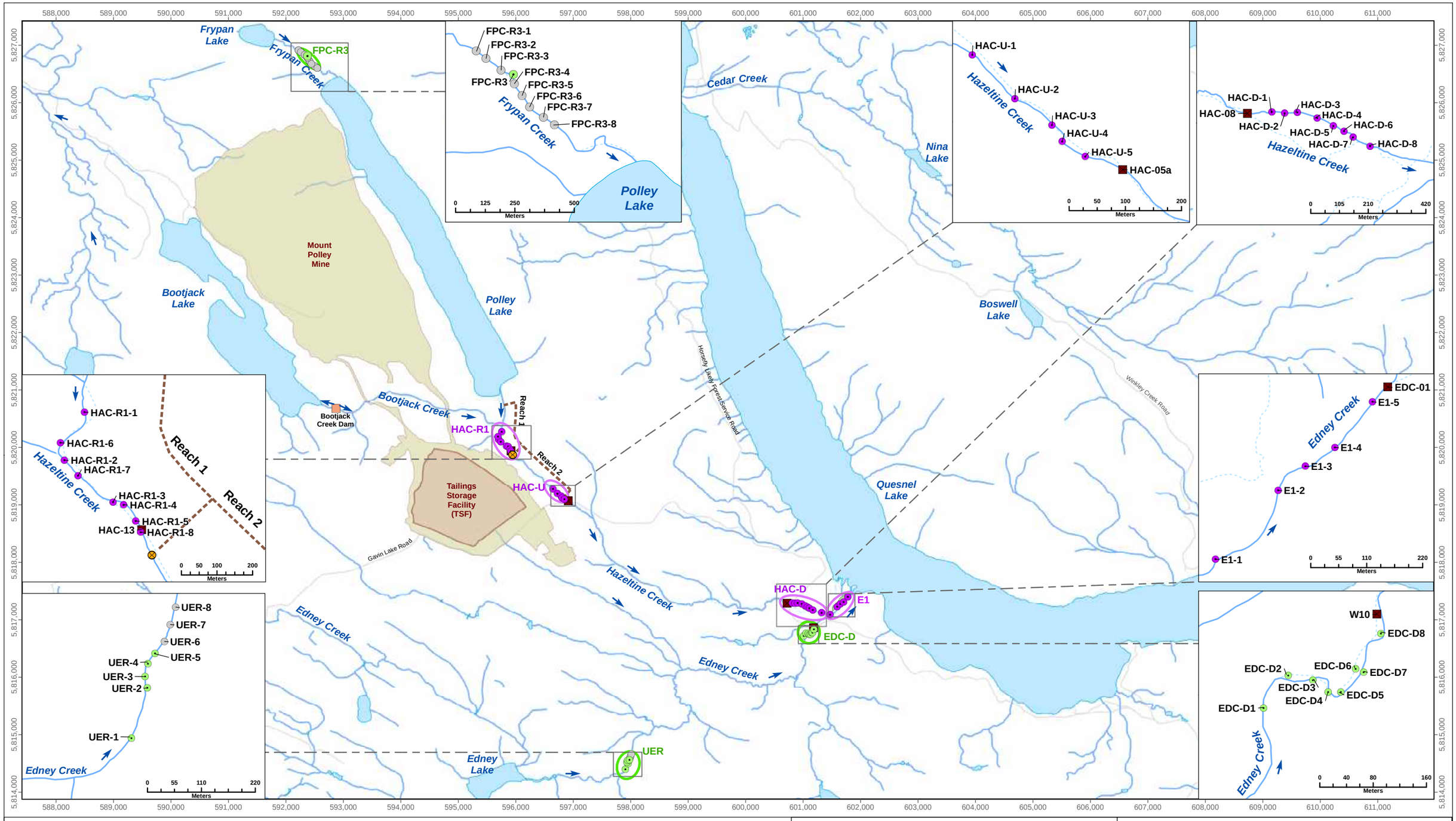
Water Body	Sampling Area	Type	Monitoring Frequency	Components [a]	Replication [b]			Rationale
					T	P	C	
Hazeltine Creek	HAC-R1 (Upper, Reach 1)	Rehabilitated	Annual	T,P,C	5	5	8	adjacent to mine and breach-influenced
	HAC-U (Upper)	Rehabilitated	Annual	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
	HAC-D (Lower)	Rehabilitated	Bi-annual [c]	T,P,C	5	5	8	adjacent to mine, previously effluent-exposed, and breach-influenced
Frypan Creek	FPC-R3 (Reach 3)	Reference	2018 only	P, C	-	5	8	reference for upper Hazeltine Creek
Edney Creek	UER (Upper)	Reference	Annual	T,P,C	5	5	8	reference for upper Hazeltine Creek
	E1 (Lower)	Exposed	Bi-annual [c]	T,P	5	5	-	adjacent to mine and breach-influenced
	EDC-D (Lower, unimpacted)	Reference	Bi-annual [c]	T,P,C	5	5	8	reference for lower Hazeltine Creek [d]

[a] core periphyton monitoring components: T = community taxonomic analysis, P = productivity (chlorophyll-a and Ash-Free-Dry-Mass, see Table 2), C = chemistry (see Table 2 for analytes).

[b] number of replicate stations within the specified sampling area for a given program component.

[c] Bi-annual indicates sampling will occur every other year for all parameters indicated with the exception of tissue chemistry, which will be monitored annually. The next bi-annual sampling event will occur in 2019.

[d] Lower Edney Creek reference area will be located in an unimpacted area upstream of the breach influence (see Figure 4).



Periphyton Monitoring Station
- Rehabilitated
- Reference
- Conceptual

- Effluent Discharge from 2014 to 2017
- Routine Water Quality Station
- Rehabilited Reaches (Golder 2017 a,b)
- Tailings Storage Facility
- Active Mine Operation

Periphyton Monitoring Area
- Rehabilitated
- Reference
- Historic Watercourse Pathway

Note: Sampling locations may be adjusted from those shown displayed based on field survey information.

0 1 2 4 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U
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Mount Polley CEMP Periphyton Monitoring Locations

Date June 2018
Project 177202.0042

minnow environmental inc

Figure 4

Document Path: S:\Projects\177202\177202.0042 - MPMC Fall 2017 Monitoring\Mapping\CEMP\2-Periphyton\17-42 Fig 4 MP PER and BI Creek.mxd

fish habitat productivity (Table 1). Periphyton community monitoring provides a means for evaluating re-establishment of the periphyton community in these recently disturbed areas, and is an additional line of evidence for assessing temporal changes in periphyton productivity. Periphyton tissue quality monitoring, which includes evaluation of concentrations of metals[2] and moisture content, will be included at all sampling locations with the exception of the rehabilitated area of lower Edney Creek (E1; Table 1). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; 3) comparison of productivity results relative to BCWQG and literature-based classification values. Accordingly, five stations per area for the assessment of productivity and community, and eight stations per area for the assessment of tissue quality are proposed to provide replication for the statistical contrasts.

Periphyton monitoring will be supported by measures of sampling depth, water velocity, and *in situ* water quality measurements (temperature, dissolved oxygen, pH, and specific conductance) at each sampling station. Additional information to be collected includes GPS coordinates of each station, notes of the presence of aquatic vegetation/bryophytes on sampled substrate and other physical observations, and supporting photographs of the sampling location and samples. Supporting grab water samples will also be collected during the sampling event in areas where water quality is not routinely monitored by the Mount Polley Mine (e.g., in Frypan Creek and upper Edney Creek).

Periphyton sampling will be completed in August or September consistent with previous data collections (Minnow 2011, 2013a,b, 2018a,b,c,d). The initial frequency of periphyton community, productivity, and tissue quality monitoring at upper Hazeltine Creek (and associated reference areas) is annual given the recent disturbance to these rehabilitated areas, and changes to the effluent exposure status (Table 1). This frequency will enable tracking of recovery in these recently disturbed habitats. The frequency of periphyton community and productivity monitoring in rehabilitated areas of lower Hazeltine Creek and lower Edney Creek (and associated reference areas) is every second year because these areas have been undisturbed since 2015, however the frequency of tissue quality monitoring in lower Hazeltine Creek (and the associated reference area) is annual. Monitoring frequencies will be reviewed following interpretation of data collected in 2020, and design modifications (e.g., changes to monitoring frequency or locations) will be made in response to QP recommendations. If results indicate stable periphyton productivity, community, and tissue quality during this period, then a reduction of monitoring frequency to every second year will be considered for upper Hazeltine Creek areas. The Frypan Creek reference area will only be sampled in 2018 (Table 1) to provide comparison for periphyton biomass and

[2] For simplicity, the term metals is used herein to include metalloids.

tissue quality data from upper Hazeltine Creek following the initial reopening of upper Hazeltine Creek as fish habitat (see CEMP Section 6.16).

Periphyton samples will be collected, processed, analyzed, and the associated data interpreted using methodology consistent with previous assessment at Mount Polley (e.g., Minnow 2011, 2013a,b, 2018a,b,c,d), which is also consistent with technical guidance (e.g., BCMOE 2013, 2016). Detailed methodology is provided in Section 4, including: quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality assessment, and data handling and interpretation.

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be led by qualified field staff experienced in the implementation of periphyton monitoring programs, and all sample collection methods, quality assurance and quality control measures, and laboratory analysis methods will be implemented in accordance with technical guidance (BCMOE 2013, 2015, 2016). Specifically, quality assurance and quality control measures will include program review prior implementation, adequate resources for all field teams including field checklists and field data sheets, the availability (and maintenance) of clean sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination.

Quality control (QC) samples will be collected to support the periphyton monitoring program. Replicate samples will be collected from each sampling area in order to capture within-area variability (samples from 5 and 8 separate stations will be collected to represent the sampling area for productivity/community and tissue quality endpoints, respectively). Specific field QC samples will include duplicates (i.e., splits) of periphyton tissue quality samples collected at a frequency of 10% of the total number of samples to assess field precision as part of the Data Quality Review (DQR; Section 4.4). QC samples to assess field precision (field duplicates) will not be collected for periphyton productivity (chlorophyll-a and AFDM) or community monitoring endpoints due to high the inherent natural variability in these parameters. In addition to field QA/QC, the laboratory responsible for the physical or chemical analyses will be accredited by the Canadian Association for Laboratory Accreditation (CALA) for these analyses. Specific QC sampling and associated reporting will for tissue quality and periphyton productivity endpoints be requested of the analytical laboratory, including reagent blank results, laboratory replicate results, and laboratory accuracy results (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). QC reporting will also be requested of the laboratory performing taxonomic analysis of the periphyton community samples, including organism enumeration checks for a minimum of 10% of samples. These results will be assessed as part of the DQR (Section 4.4).

All raw field data will be transcribed from field sheets into an electronic spreadsheet. Data will then checked by a separate individual for data entry errors as part of routine Quality Assurance/Quality Control (QA/QC) procedures.

4.2 Sample Collection Methods

4.2.1 Biomass and Chlorophyll-a

Periphyton samples for chlorophyll-a analysis and biomass (AFDM) will be collected by selecting five representative submerged rocks from each monitoring station. Representative rocks from each station will be selected from locations with similar habitat (depth, velocity, and substrate characteristics), while attempting to match depth and velocity among periphyton collection stations and areas as closely as possible. Selected rocks (excluding those that are too small, highly angular, or uncharacteristic in surface texture) will be taken to shore. For chlorophyll-a sample collection, a thin acetate template with a 2x2 cm opening in the middle will then be placed firmly on each rock, and the periphyton within this area will be scraped off using a stainless-steel razor blade or scalpel. Sample material from each of the five rocks will then be transferred from the razor blade or scalpel to a large (47 mm) 0.45 µm pore diameter Whatman mixed cellulose ester (MCE) filter paper until a single composite sample of approximately 200 mg to 1 g wet weight is obtained per station. If material collected from the five rocks sampled is insufficient, additional rocks will be sampled from the same area with similar habitat characteristics until the required sample volume is obtained. The filter paper will then be folded and placed into a labeled opaque centrifuge tube. The total surface area sampled at each station (0.002 m^2: 5 x 4 cm^2, or any deviations from this surface area), will be recorded to allow calculation of chlorophyll-a on a unit area basis for comparison to the British Columbia Water Quality Guideline (BCWQG; 100 mg/m^2; BCMOE 2018). The same five rocks sampled for chlorophyll-a analysis (and additional rocks if they were required) will be used to collect separate scrapings for analysis of AFDM. For AFDM sampling, sampling methods will follow those outlined above for chlorophyll-a, however material on the razor blade or scalpel from scraping of each rock will be rinsed into a small pre-labelled plastic jar with additional water added to cover the tissue (as necessary). Sampling will be conducted at five replicate stations in each area (see Table 1). Immediately after collection, all chlorophyll-a and AFDM samples will be placed in a cooler on ice for transport to the mine, where they will be frozen.

4.2.2 Community

Periphyton community samples will be collected from the same five rocks used for chlorohyll-a and biomass sampling whenever possible (and additional rocks if they were required), or from rocks of a similar size collected from the same general location and habitat (depth and velocity). Sample collection methods will be similar to those outlined for chlorophyll-a and AFDM. Briefly, a thin acetate template with a 2x2 cm opening in the middle will be placed firmly on each rock and all of the periphyton within this area will then be removed using a scalpel and/or brush and a squirt bottle filled with site water (BCMOE 2013, 2016; Stevenson and Bahls 2006). The collected

periphyton will then be transferred into a labelled sample jar, and this process will be repeated for the five rocks, resulting in a single composite sample from each station. The total surface area sampled at each station (0.002 m^2: 5 x 4 cm^2, or any deviations from this surface area if additional rocks are sampled) will be recorded. Immediately after collection, the sample will be preserved with Lugol's iodine solution until the sample is the colour of weak tea (approximately 1 mL of Lugol's per 250 mL of sample; BCMOE 2013), and will be mixed gently by inverting the sampling jar. All samples will be stored at room temperature. Sampling will be conducted at five replicate stations in each area (see Table 1).

4.2.3 Tissue Quality

Periphyton samples collected for tissue quality analysis will be collected by scraping periphyton from the surface of rocks using a scalpel until sufficient sample weight for analysis is attained (more than 500 mg wet weight). A minimum of five rocks will be sampled to ensure the sample is representative of the sampling station. Rocks sampled for productivity and community will be used preferentially, plus additional rocks (as necessary) to obtain the required sample weight. Periphyton scrapings will be transferred directly from the scalpel onto the wall of a labeled scintillation vial, without rinsing, to minimize the amount of water in each sample. Sampling will be conducted at eight replicate stations in each area (see Table 1). Samples will be placed in a cooler on ice for transport to the mine, where they will be frozen.

4.3 Sample Handling and Laboratory Analysis

Periphyton productivity (chlorophyll-a and AFDM) and tissue quality samples will remain frozen until overnight shipment on ice to the analytical laboratory. Samples will be sent to the laboratory with sufficient time to complete analyses within the recommended sample hold times (28 days for chlorophyll-a, 6 months for AFDM, 1 year for tissue quality [metals analysis]). Analyses will be completed at an analytical laboratory accredited by the Canadian Association for Laboratory Accreditation (CALA) using methods that are consistent with those specified in the British Columbia Environmental Laboratory Manual (BCMOE 2015). Upon sample receipt, the laboratory will provide a sample receipt confirmation which will be reviewed to ensure that all samples are received and that the analytical requests are properly logged. Analysis of chlorophyll-a will follow procedures adapted from USEPA Method 445.0 (USEPA 1997). Briefly, chlorophyll-a will be determined by routine acetone extraction followed by fluorescence detection using a non-acidification procedure (a method that is not subject to interferences from chlorophyll-b). Determination of total AFDM will follow procedures adapted from APHA Method 10300 C (APHA 2010). Total AFDM will be calculated as the difference between the dried sample weight and the ash weight, both of which will be determined gravimetrically. Dry weight will be determined by drying the sample at 105 °C, and the ash weight will be subsequently determined

by ashing the dried sample at 500 °C. Tissue quality samples will be analysed for metals by CRC-ICP-MS (Collision Cell Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/6020A [USEPA 2004]) or HR-ICP-MS (High Resolution Inductively Coupled Plasma-Mass Spectrometry; USEPA Method 200.3 [USEPA 1991]/ 200.8 [USEPA 1994]), mercury by CVAFS (Cold Vapour Atomic Fluorescence Spectrophotometry; USEPA Method 200.3 [USEPA 1991]/Method 245.7 [USEPA 2001]), and moisture content. The method selected for metals analysis will depend on sample weight, with HR-ICP-MS employed for smaller sample sizes. Periphyton productivity and tissue quality parameters are provided in Table 2, with the associated target laboratory reporting limits (LRLs) and detection limit objectives outlined in technical guidance ("consensus detection limits"; BCMOE 2016). Upon completion of the analyses, the laboratory will provide a data report in Microsoft (MS) Excel™ and as an Adobe Acrobat Portable Document Format (PDF). Reporting will include the results of the laboratory QC sample results.

Periphyton community samples will be stored at room temperature until shipment to the taxonomy laboratory for taxonomic identification and enumeration. Samples will be shipped immediately after the completion of the field campaign, however there are no recommended hold times for analysis. Sample analysis will be completed as follows. Briefly, samples will be homogenized, settled in Ütermohl chambers for 24 h, and all cells within randomly selected fields of view will be enumerated until a minimum count of 300 algal units (1 unit = >1 cell for colonial or filamentous taxa) is reached. Identification will be performed using an inverted phase contrast microscope, and algal taxa will be identified to minimum of genus-level according to the most up-to-date taxonomic references. Periphyton density will be determined using the area sampled, proportion subsampled, and the total area of the selected fields of view. Biomass estimates will be generated for each taxon using taxon-specific biovolume formulae (Hillebrand et al. 1999) for cell measurements, and taxon-specific densities.

4.4 Data Quality Review

Upon receipt of all analytical data, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs have been achieved. The DQR will also include an evaluation of differences between duplicate (split) samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the periphyton monitoring data will ensure timely communication with the laboratory should any issues be identified

Specifically, LRLs will be evaluated relative to targets established for the analytes and to "consensus detection limits" (Table 2), and to relevant British Columbia guidelines (i.e., chlorophyll-a for productivity samples; BCMOE 2018). Comparisons between duplicate samples

Table 2: Target Laboratory Reporting Limits (LRL) and Analytical Methods for Periphyton Productivity and Tissue Quality Analytes

A) Tissue Quality Parameters

Parameter	Metals in Tissue by HR-ICPMS Micro (USEPA 1991, 1994)		Metals in Tissue by CMC ICPMS (USEPA 1991, 2004)		Concensus DLs [a]
Units	**mg/kg wwt**	**mg/kg dw**	**mg/kg wwt**	**mg/kg dw**	**mg/kg wwt**
Aluminum (Al)	1.0	5.0	0.40	2.0	0.40
Antimony (Sb)	0.0020	0.010	0.0020	0.010	0.0020
Arsenic (As)	0.0060	0.030	0.0040	0.020	0.0050
Barium (Ba)	0.010	0.050	0.010	0.050	0.010
Beryllium (Be)	0.0020	0.010	0.0020	0.010	0.0020
Bismuth (Bi)	0.0020	0.010	0.0020	0.010	0.0200
Boron (B)	0.20	1.0	0.20	1.0	-
Cadmium (Cd)	0.0020	0.010	0.0010	0.0050	0.0020
Calcium (Ca)	4.0	20	4.0	20	2.0
Cesium (Cs)	0.0010	0.0050	0.0010	0.0050	-
Chromium (Cr)	0.040	0.20	0.010	0.050	0.010
Cobalt (Co)	0.0040	0.020	0.0040	0.020	0.0040
Copper (Cu)	0.040	0.20	0.020	0.10	0.010
Iron (Fe)	1.0	5.0	0.60	3.0	1.0
Lead (Pb)	0.010	0.050	0.0040	0.020	0.0040
Lithium (Li)	0.10	0.50	0.10	0.50	-
Magnesium (Mg)	0.40	2.0	0.40	2.0	2.0
Manganese (Mn)	0.010	0.050	0.010	0.050	0.020
Mercury (Hg) [b]	0.0010	0.0050	-	-	0.002
Molybdenum (Mo)	0.0080	0.040	0.0040	0.020	0.010
Nickel (Ni)	0.040	0.20	0.040	0.20	0.010
Phosphorus (P)	2.0	10	2.0	10	5.0
Potassium (K)	4.0	20	4.0	20	10
Rubidium (Rb)	0.010	0.050	0.010	0.050	-
Selenium (Se)	0.020	0.10	0.010	0.050	0.020
Sodium (Na)	4.0	20	4.0	20	2.0
Strontium (Sr)	0.020	0.10	0.010	0.050	0.010
Tellurium (Te)	0.0040	0.020	0.0040	0.020	-
Thallium (Tl)	0.00040	0.0020	0.00040	0.0020	0.0010
Tin (Sn)	0.020	0.10	0.020	0.10	0.020
Uranium (U)	0.00040	0.0020	0.00040	0.0020	0.0010
Vanadium (V)	0.020	0.10	0.020	0.10	0.020
Zinc (Zn)	0.20	1.0	0.10	0.50	0.10
Zirconium (Zr)	0.040	0.20	0.040	0.20	-

[a] from Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016).

[b] Method for total mercury analysis will be according to USEPA (1991, 2001).

B) Productivity Parameters

Parameter	Units	Method	LRL
Chlorophyll-a	µg	USEPA 1997	0.02
Ash Free Dry Weight	g	APHA 2010	0.001

will be made by calculating the relative percent difference (RPD) between concentrations between paired duplicates. If the RPD is <25% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Results for laboratory blanks, precision, and accuracy will be evaluated relative to Data Quality Objectives (DQO) established by the analytical laboratory that performed the analyses. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping).

4.5 Data Handling, Interpretation, and Reporting

Upon receipt of data from the analytical laboratories, all laboratory data files will be managed by the Mount Polley Mining Corporation (MPMC) Environment Department. In addition, data provided by the primary analytical laboratories as an Electronic Data Deliverable (EDD) will be imported directly into the MPMC's database following completion of the DQR. Following the DQR, all periphyton data and supporting data will be managed in MS Excel. For all replicated data (typically based on a sample size of five or eight stations per area), data will be provided to the QP and summarized by calculating mean, median, standard deviation, minimum, and maximum for each analyte. Data analysis will be completed for each monitoring component (productivity, community, and tissue quality).

Periphyton productivity (chlorophyll-a and AFDM) results will be converted to a standard area-based measurement (mg/m^2 and g/m^2 for chlorophyll-a and AFDM, respectively), and chlorophyll-a results will be compared to water quality guidelines for the protection of aquatic life (BCWQG = 100 mg/m^2; BCMOE 2018) and to literature-based criteria for moderately enriched streams (21 mg/m^2; Biggs 1996). Periphyton productivity results will also be compared to previous data (where possible), and to reference results. For periphyton community, endpoints including density, taxon richness, diversity indices, and dominant community composition endpoints will be calculated, and compared to reference results. Temporal comparisons of periphyton community results will be made once data are available (2018 represents the first year of periphyton community sample collection). More detailed evaluation of periphyton productivity and community results will include analyses using a control-impact study design. Specifically, Analysis of Variance (ANOVA) will be used to test for differences in periphyton productivity and community endpoints between rehabilitated areas of Hazeltine Creek and lower Edney Creek, and associated reference areas. For these analyses, the assumptions of normality and homogeneity of variances will be tested on the residuals of the ANOVA model using the Shapiro-Wilk test and Levene's test based on median values, respectively, using a significance level (α) of 0.05. Data will be transformed as necessary to satisfy assumptions of normality and

homogeneity of variance as required. In instances where the residuals of the ANOVA model do not meet the assumptions of normality and homogeneity of variances, a non-parametric Kruskal-Wallis test will be conducted. When the overall results of an ANOVA or Kruskal-Wallis test are significant, differences between specific areas will be evaluated using post-hoc contrasts for ANOVA or Dunn's test for the Kruskal-Wallis test. A Bonferroni correction on the p-values will be used to conserve the overall Type I error rate. Further detailed analyses will be completed as required for data interpretation, and may include: graphical comparisons to reference and historical data (if available), graphical plots in relation to guidelines and criteria, and formal statistical temporal and spatial contrasts using methods similar to those described above.

If exposed versus reference or temporal differences in periphyton productivity and community results are noted, relationships between periphyton productivity and community endpoints and supporting water quality will be evaluated using Spearman correlation (often referred to a Spearman Rank-Order correlation). Following the derivation of correlation coefficients, a Bonferroni-type correction (i.e., p-value [0.05] divided by the total number of correlations examined for independent variables) will be applied to minimize the risk of declaring false positive correlations since at least 5% of derived correlations would be expected to occur by chance alone at an uncorrected p-value of 0.05. Any significant correlations found at the Bonferroni-adjusted p-value or at a p-value of 0.01 will be further investigated using scatter plots to determine if a continuous distribution of data was realized (possible causal relationships) or if these relationships were "leveraged" by outlying points (or groups of points). Although it is recognized that a significant correlation or regression does not indicate causation (e.g., Norton et al. 2015), it is desirable to not only characterize the nature of a response (e.g., changes in periphyton productivity or community), but to also obtain evidence of cause. Correlation / regression analyses are commonly applied tools for identifying potential cause (e.g., Norton et al. 2015). Evidence of causation obtained from correlation or regression analysis will be carefully considered in light of the strength, range, and continuity of the relationships as well as mechanistic knowledge/understanding of potential cause.

Data analysis and interpretation of periphyton tissue quality results will focus on Parameters of Interest (POIs [representing the chemical influence of the TSF embankment breach on sediment quality]: arsenic, copper, iron, and nickel), and on Indicator Parameters (IPs [identified in evaluations of water, soil, or fish tissue quality for Hazeltine Creek]: calcium, cobalt, molybdenum, phosphorus, selenium, silver, sodium, titanium, and vanadium; Golder 2015, 2016, Minnow 2015). Periphyton tissue quality results for these analytes will be compared to available pre-breach data (for selenium only [2010, 2012, and 2013]; Minnow 2011, 2013a, 2013b), contrasted between exposed and reference areas, and also compared temporally within exposed areas. Detailed analyses and interpretation related to these comparisons will be completed as required, and may

include: graphical comparisons to reference and historical data, and formal statistical contrasts of exposed versus reference concentrations tissue concentrations as described above

Concentrations of the POIs and IPs in periphyton tissue will also be evaluated relative to concentrations in water. These ratios of concentrations will be calculated as: [tissue sample concentration]/[dissolved water concentration], and are referred to as Bioconcentration Factors (BCFs). BCFs are often used to describe the extent to which an analyte is taken up by an organism from the surrounding environment through exposure routes other than diet (i.e., Arnot and Gobas 2006), and are applicable to erosional areas where sediment is generally not present. BCFs will be calculated using tissue metal concentrations (dry weight) and mean dissolved metal concentrations in water from each sampling area. Calculated BCFs will then be qualitatively compared among areas to identify differences in the uptake of metals by periphyton in areas impacted by effluent discharge and/or the TSF embankment breach. Mean BCFs will also be qualitatively compared between or among years to examine any broad temporal changes in metal accumulation in periphyton tissue at exposed sites. In addition, concentrations of POIs and IPs in periphyton tissue will be used in the evaluation of Trophic Transfer Factors (TTFs) to benthic invertebrates; the ratio of tissue concentrations in benthic invertebrates relative to concentrations in periphyton (i.e., TTF = [benthic invertebrate sample]/[periphyton sample]). TTFs can be used generally to describe the extent to which the concentration of an analyte increases between lower and higher trophic levels (e.g., Presser and Luoma 2010; see CEMP Benthic Invertebrate Section 6.13 for details).

An interpretive report based on the periphyton monitoring data will be prepared for integration into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWQG and other guidelines or classification schemes, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.4

Fish Monitoring

Minnow Environmental Inc.

Fish
Monitoring Plan

Prepared for:

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June 2018

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1 INTRODUCTION

1.1 Background

Fish are important and highly valued aquatic ecosystem components. Fish community composition, fish population characteristics (e.g., survival, growth, and reproduction), and fish tissue quality can be effective monitors of potential biological effects associated with water quality, sediment quality, and/or physical disturbance. Fish tissue quality is also an important measure of potential exposure to metals, metalloids, nutrients[1], and other substances to humans and wildlife that consume fish. Lastly, the use of fish habitat by fish is an important monitor of the physical and chemical quality of aquatic habitat.

The influence of the Mount Polley Mine on fish communities, populations, and/or tissue quality can occur by several key mechanisms: 1) general mine influence on creeks and lakes from physical impingement, dustfall, and/or uncontained surface or groundwater flows; 2) direct discharge of mine effluent to Hazeltine Creek (April to August 2014) and Quesnel Lake (December 2015 to present [via Hazeltine Creek from December 2015 to November 2017, and directly since January 2018]); 3) the Tailings Storage Facility (TSF) embankment breach on August 4, 2014; and 4) reclamation activities following the TSF embankment breach. Potential effects associated with effluent discharge are chemical, while those associated with general mine influence, the TSF embankment breach, and subsequent remediation can be both physical and chemical.

Fish in waterbodies adjacent to the Mount Polley Mine have been monitored historically by the provincial government (Burns and Klein 1973; Lirette and Tredger 1991; Bruce and Slaney 1991) and by the Mount Polley Mine starting with baseline investigations in 1989, 1995, and 1996 (Imperial Metals 1990; HKP 1996a,b,c, 1997a). Results of fish monitoring are reviewed in Section 2 and provide context for a CEMP fish monitoring program (community, population, and tissue quality) that is guided by a combination of historical findings, representative locations downstream of Mount Polley Mine operations, representative reference locations, and considerations for a statistically-based design that will facilitate the detection of spatial and temporal differences. Fish tissue quality monitoring data will also be evaluated relative to guidelines for the protection of aquatic life and/or human health (e.g., the British Columbia Water Quality Guideline for selenium [BCMOE 2014] and the Health Canada guideline for mercury [CFIA 2015]). In addition, fish population monitoring is required as part of Environmental Effects Monitoring (EEM) under the Metal and Diamond Mining Effluent Regulations (MDMER) of the

[1] Through the remainder of this section, the term “metals” will be used to include metals, metalloids, and nutrients for ease of communication.

federal *Fisheries Act* (Government of Canada 2018). The focus of the federal EEM fish survey is to determine if there are effects to sentinel fish population characteristics (e.g., survival, growth, and/or reproduction) associated with the discharge of mine effluent (currently to Quesnel Lake). Lastly, fish habitat characterization and fish usage monitoring serves to document and track the effectiveness of fish habitat that has been reconstructed/rehabilitated following the TSF embankment breach.

The following sections of the CEMP Fish Monitoring Plan provide the objectives of fish monitoring, a summary of historical fish community, population, and tissue quality findings, an overview of the CEMP study design and associated rationale (including sampling locations, replication, frequency, and analytes), and detailed methodology for fish monitoring (quality assurance/quality control, sample collection methods, sample handling and laboratory analysis, data quality review, data handling, interpretation, and reporting).

1.2 Monitoring Objective

The objective of fish monitoring is to evaluate the influence of Mount Polley Mine activities on fish communities, populations, and tissue quality in receiving environments (Hazeltine Creek, Polley Lake, and Quesnel Lake) in comparison to baseline and/or reference conditions, and to determine potential implications to aquatic ecosystem health and human health (e.g., relative to available fish tissue quality guidelines [BCMOE 2014; CFIA 2015]). Fish monitoring also provides data to support exposure assessment as part of post-breach ecological risk assessment (ERA) and human health risk assessment (HHRA). Lastly, fish monitoring documents fish habitat utilization in creek and lake areas that were physically impacted by the TSF embankment breach (most notably Hazeltine Creek and the lower segment of Edney Creek), thereby documenting the effectiveness of fish habitat rehabilitation efforts. The objective of the MDMER EEM fish monitoring is to evaluate whether there are differences in population endpoints (survival, growth, and reproduction) of sentinel fish species between the area of Quesnel Lake exposed to Mount Polley mine effluent and a reference area (Environment Canada 2012). As prescribed by the MDMER, there is no requirement to monitor fish tissue quality under the MDMER because the concentration of mercury in Mount Polley Mine effluent is less than 0.1 µg/L (0.0001 mg/L; Government of Canada 2018).

2 SUMMARY OF HISTORICAL FINDINGS

Fish monitoring in the vicinity of the Mount Polley Mine has been undertaken since 1989, with most of the monitoring conducted in Polley Lake, Bootjack Lake, Hazeltine Creek, and Edney Creek (Table 1). Fish in Quesnel Lake have also been intensively monitored since the TSF embankment breach in August 2014 and following the initiation of effluent discharge to Quesnel Lake in December 2015. Fish monitoring in the vicinity of the Mount Polley Mine has spanned four distinct time periods:

1. Baseline monitoring (1989, 1991, 1995, 1996);
2. Pre-breach operational monitoring (1997, 1998, 1999, 2007, 2009, 2010, 2012, 2013, 2014);
3. Post-breach operational monitoring (2014, 2015); and
4. Post-breach and post-discharge operational monitoring (2016, 2017).

For Polley Lake and Hazeltine Creek, the second time period can be sub-divided into periods of: 1) prior to; 2) during; and 3) after, an uncontrolled surface runoff event from the north waste rock dump which reported to Polley Lake via North Dump Creek. This runoff started in 2006, was controlled in 2009 with the construction of the Long Ditch, and was characterized by elevated concentrations of sulphate and selenium. In addition to the construction of the Long Ditch, Mount Polley initiated selenium-specific aquatic environmental monitoring in 2009.

Fish community, population, and/or tissue quality data collected prior to the breach were summarized in an Aquatic Environmental Description Report prepared concurrent with an application for water discharge to Polley Lake in 2014 (Minnow 2014a). General findings of the historical monitoring, as well as fish monitoring data collected from 2014 to present, are provided in the following sections, by sampling area, to support the design of the CEMP Fish Monitoring Plan.

2.1 Polley Lake

2.1.1 Fish Community / Population

Baseline monitoring in Polley Lake and reference lakes (Bootjack, Trio, Morehead, and Frypan lakes) was conducted in 1989, 1995, and 1996 and documented the presence of rainbow trout, longnose sucker, and redside shiner. Peamouth chub and largescale sucker have also been reported in Bootjack Lake (in 2014 and 2016, respectively). The fish species composition of Polley and Bootjack lakes has remained the same through operational monitoring and following the perimeter embankment breach. Catchability of rainbow trout and longnose sucker in Polley

Table 1: History of Fish Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

A) Lakes

Year	Locations	Endpoints[1]	Report
1989	Bootjack, Morehead	C, P, T[2]	Imperial Metals 1990
1995	Polley, Bootjack	C, P, T	HKP 1996a
1996	Polley, Bootjack	C[3]	HKP 1997a
1999	Polley, Bootjack	C, P, T	Beak 2000
2009	Polley, Bootjack, Trio, Frypan, Quesnel (near Hazeltine Creek)	C, P, T	Minnow 2011
2010	Polley, Quesnel (near Hazeltine Creek and North Arm)	C, P, T	Minnow 2011
2012	Polley, Bootjack, Trio, Frypan, Quesnel (near Hazeltine Creek and North Arm)	C, P, T[4]	Minnow 2013a
2014	Polley, Bootjack, Quesnel (multiple locations)	C, P[5], T	Lirette 2015; Golder 2016
2015	Poley[6], Bootjack, Quesnel (multiple locations), Trio	C, P, T	Golder 2016; Zirnhelt 2016; Zirnhelt and Dolighan 2015
2016	Polley, Quesnel (multiple locations)	C, P, T	Minnow 2016, 2017a,b; Lirette 2017
2017	Polley, Bootjack, Quesnel	C, P, T	Minnow 2018a

[1] C = Community, P = Population, and T = Tissue.

[2] Rainbow trout in Bootjack Lake only.

[3] Recreational angling use survey only.

[4] Selenium concentrations only.

[5] Population estimates only taken at Polley Lake (Lirette 2015).

[6] Rainbow trout collected from Frypan Creek and pooled with samples from Polley Lake.

Table 1: History of Fish Monitoring in Waterbodies in the Vicinity of the Mount Polley Mine

B) Creeks and Rivers

Year	Locations	Endpoints[1]	Report
1989	Upper Hazeltine, Lower Hazeltine, Upper Edney, Lower Edney, Bootjack, Morehead, Lower Morehead, 4K, 6K	C	Imperial Metals 1990
1990	Hazeltine, Bootjack	C, P	Bruce and Slaney 1991
1995	Upper Edney (multiple tributaries)	C, P	HKP 1996b,c
1996	Upper Edney (multiple tributaries)	C, P	HKP 1997a
1997	Upper Edney (multiple tributaries)	C, P	HKP 1997b
1998	Upper Edney (multiple tributaries)	C, P	Beak 1999
2007	Upper Hazeltine, Lower Hazeltine, Upper Edney (NE trib), Reference (Upper Edney [SW trib], Upper Cedar, Lower Whiffle)	C, P	Cariboo Envirotech 2008; Minnow 2009
2009	Upper Hazeltine	C, P, T[2]	Minnow 2011
2010	Upper Hazeltine	T[2]	Minnow 2011
2012	Upper Hazeltine	C, P, T[2]	Minnow 2013a
2013	Upper Hazeltine	T[2]	Minnow 2013b
	Bootjack	C, P	Minnow 2014b
2014	Upper Hazeltine, Horsefly, Quesnel, Soda, Edney	C, T[2]	DWB 2014; Golder 2016
2015	Frypan[3], Quesnel, Edney	C, P, T	DWB 2015; Golder 2016
2016	Edney	C, P	Minnow 2018b
2017	Edney, Quesnel	C, P, T	Minnow 2018a,b

[1] C = Community, P = Population, and T = Tissue.

[2] Selenium concentrations only.

[3] Rainbow trout collected from Frypan Creek and pooled with samples from Polley Lake.

Lake and Bootjack Lake by gill netting has remained reasonably consistent from baseline to the most recent gill netting effort in 2016 (Table 2). More recent hoop netting efforts (adopted as a preferred method as captures are non-lethal) document good catchability of both large-bodied species (Table 2).

After the perimeter embankment breach (August 2014), a barrier was installed at the outlet of Polley Lake preventing Polley Lake fish from accessing Hazeltine Creek. There was a noticeable decline in rainbow trout recruitment post-breach as evident in the smaller relative sizes of the age 1 and 2 cohorts in 2016, and the age 1 to 3 cohorts in 2017 (Figures 1 and 2; Minnow 2017a). The barrier preventing fish from entering Hazeltine Creek from Polley Lake was removed in the early spring of 2018 and recruitment is expected to increase accordingly.

2.1.2 Fish Tissue Quality

Tissue quality of Polley Lake (and Bootjack Lake) fish was evaluated in 1989, 1995, 1996, and 1999[2], providing baseline metal concentrations in muscle and liver tissue of rainbow trout and longnose sucker (Imperial Metals 1990; HKP 1996a, 1997a; Beak 2000). Fish tissue quality monitoring was subsequently undertaken in 2009 in response to the uncontrolled surface runoff event from a north waste rock dump which reported to Polley Lake via North Dump Creek (Minnow 2011). Results of the post-runoff but pre-breach monitoring (2009 to 2012) indicated that selenium concentrations in rainbow trout muscle and ovary tissue[3] were stable, that concentrations in muscle tissue were near the British Columbia water quality guideline (BCWQG; BCMOE 2014), and that concentrations in ovary tissue were below the BCWQG (Figure 3). A decrease in selenium concentrations in rainbow trout muscle and ovary concentrations appeared to occur from 2012 to 2014 (pre-breach; Figure 3). Ovary tissue is the best tissue for evaluating the potential adverse effects of selenium to fish (which are considered the most selenium sensitive organisms; Presser and Luoma 2009; Janz et al. 2010; DeForest et al. 2012; Janz 2012). Concentrations in selenium were also well below the effect threshold of 20 mg/kg dw developed by DeForest et al. (2012). Following the TSF embankment breach, an increase in concentrations of selenium in rainbow trout muscle (to above BCWQG) and ovary (below BCWQG) were observed (Figure 3), but the latter remained below the effect threshold.

Following the TSF embankment breach, fish tissue quality investigations were expanded to focus on a suite of analytes that included selenium and also included metals that: 1) were identified as

[2] Although the 1999 collections occurred after mine startup, the results of the collections were verified against previous data and, based on similar results, were used to augment the baseline database to a sample size of ten fish.

[3] Adult rainbow trout were collected either from Polley Lake or from upper Hazeltine Creek. The latter were adult fish from Polley Lake that had moved into Hazeltine Creek to spawn and are considered indistinct from Polley Lake fish for tissue quality monitoring purposes.

Table 2: Catch-Per-Unit-Effort (CPUE) Data for Rainbow Trout and Longnose Sucker in Polley Lake, 1995 - 2017

Year	Data source	Fishing Method	Effort (h)	Rainbow Trout		Longnose Sucker	
				Catch	CPUE	Catch	CPUE
1995	**HKP (1996a)**	Experimental gill net [a] (0.5" - 4" mesh)	15.72	16	0.0006	37	0.0014
2012	**Minnow (2013a)**	Multiple gill nets [b]	48.42	30	0.0006	68	0.0013
2014	**Lirette (2015)**	Four panel sinking net	15.17	75	0.0031	107	0.0044
		Four panel floating net	15.92	69	0.0027	33	0.0013
		All nets combined	15.50	144	0.0029	140	0.0028
2016	**Lirette (2017)**	Four panel sinking net	15.80	45	0.0018	154	0.0061
		Four panel floating net	15.77	79	0.0032	26	0.0010
		All nets combined	15.79	124	0.0025	180	0.0036
2016	**Minnow (2017b)**	Hoop Net [c]	804	1,737	51.9	2,422	72.4
2017	**Minnow (2018a)**	Hoop Net [c]	20.88	8	9.2	247	285
		Seine Net [d]	-	31	3.1	-	-

[a] CPUE values calculated using reported fishing effort time (15h 43min), and gillnet dimensions (67.5m x 2.35m) (HKP 1996a).
[b] CPUE values calculated as (caught / [ft^2 * h]).
[c] CPUE values calculated as number of fish per trap-day.
[d] CPUE values calculated as number of fish captured per m^2 (Area = 10 m^2).

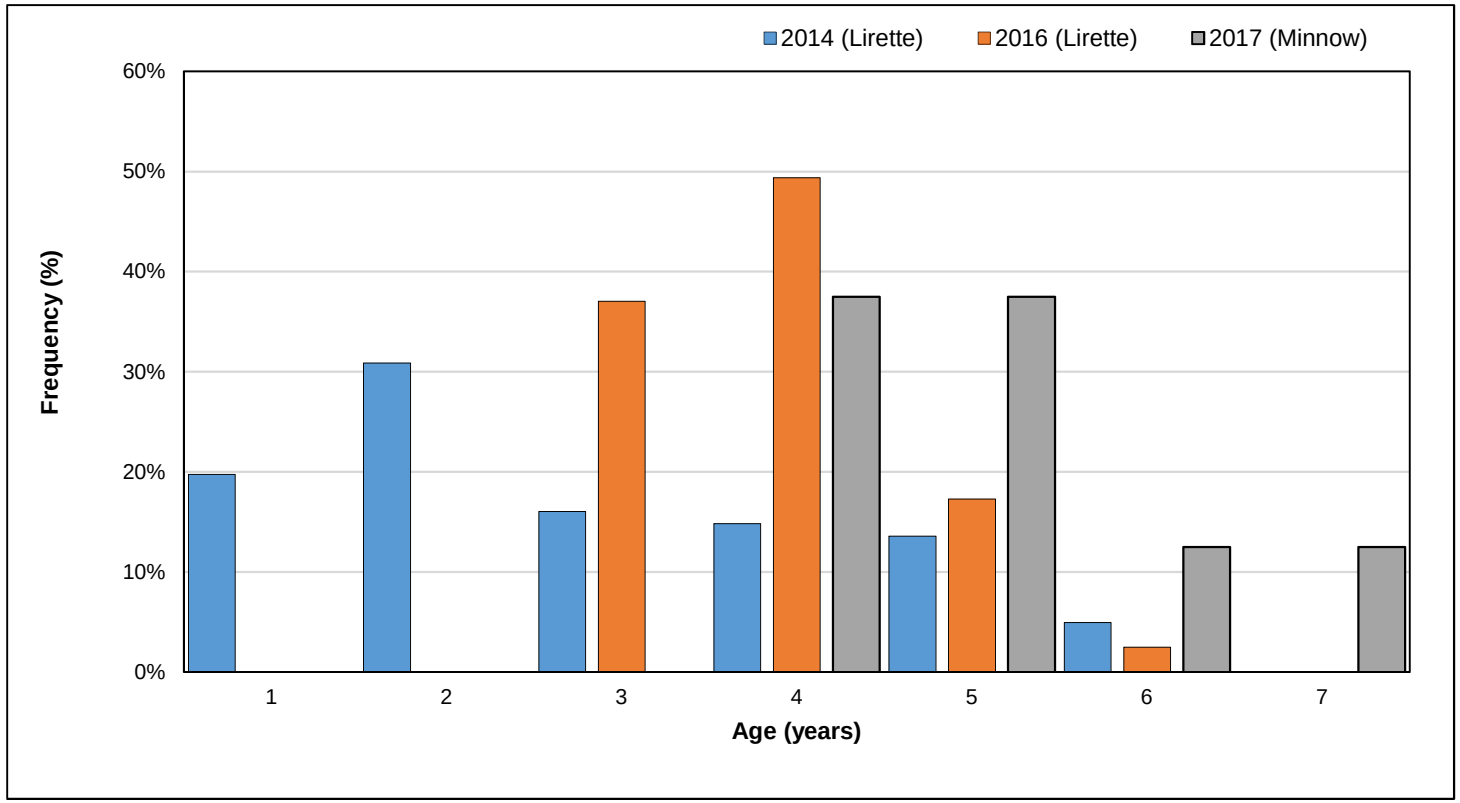


Figure 1: **Rainbow trout age frequency distribution in Polley Lake (data from Lirette 2014 and 2016, and Minnow 2017a)**

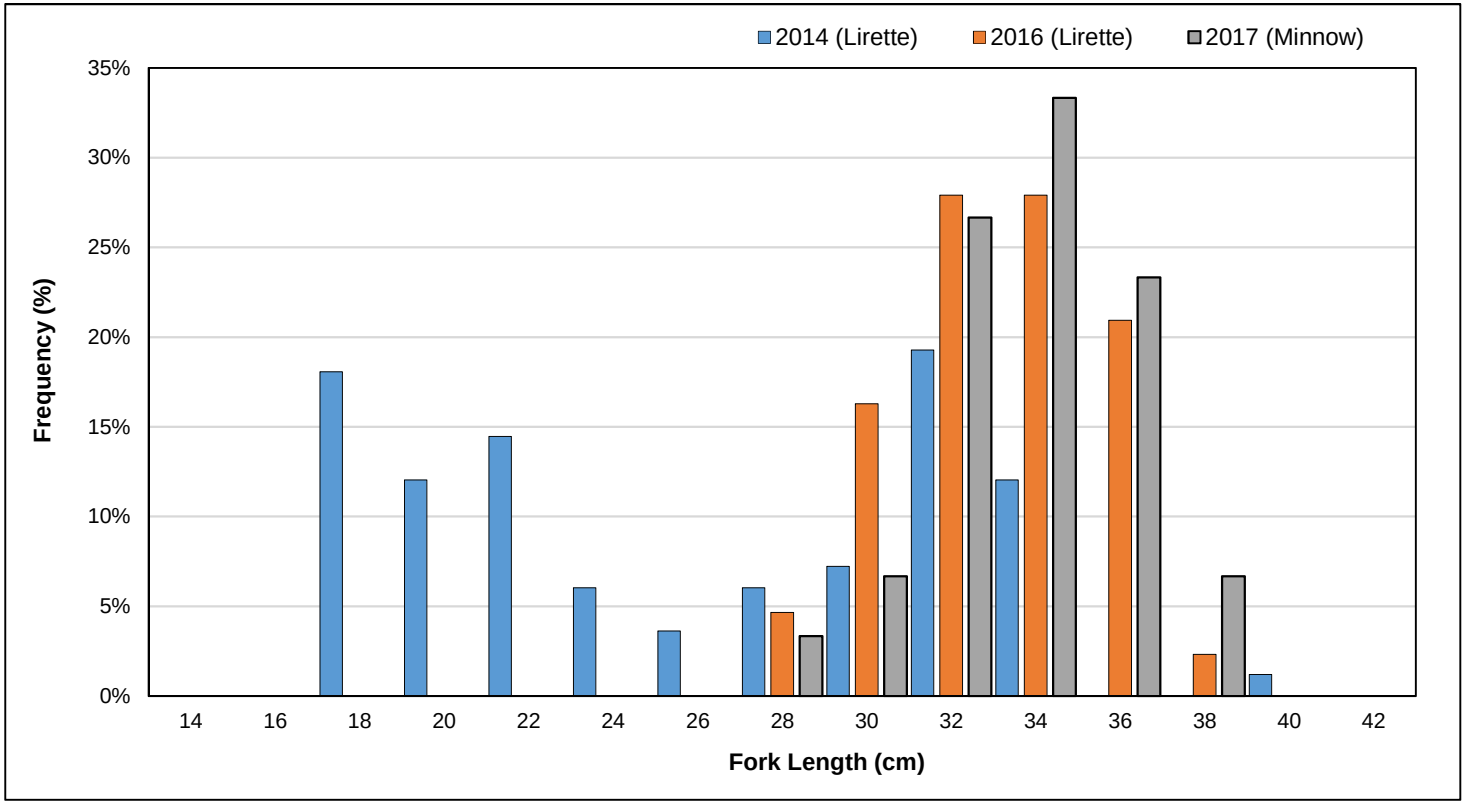


Figure 2: Rainbow trout fork length frequency distribution in Polley Lake (data from Lirette 2014 and 2016, and Minnow 2017a)

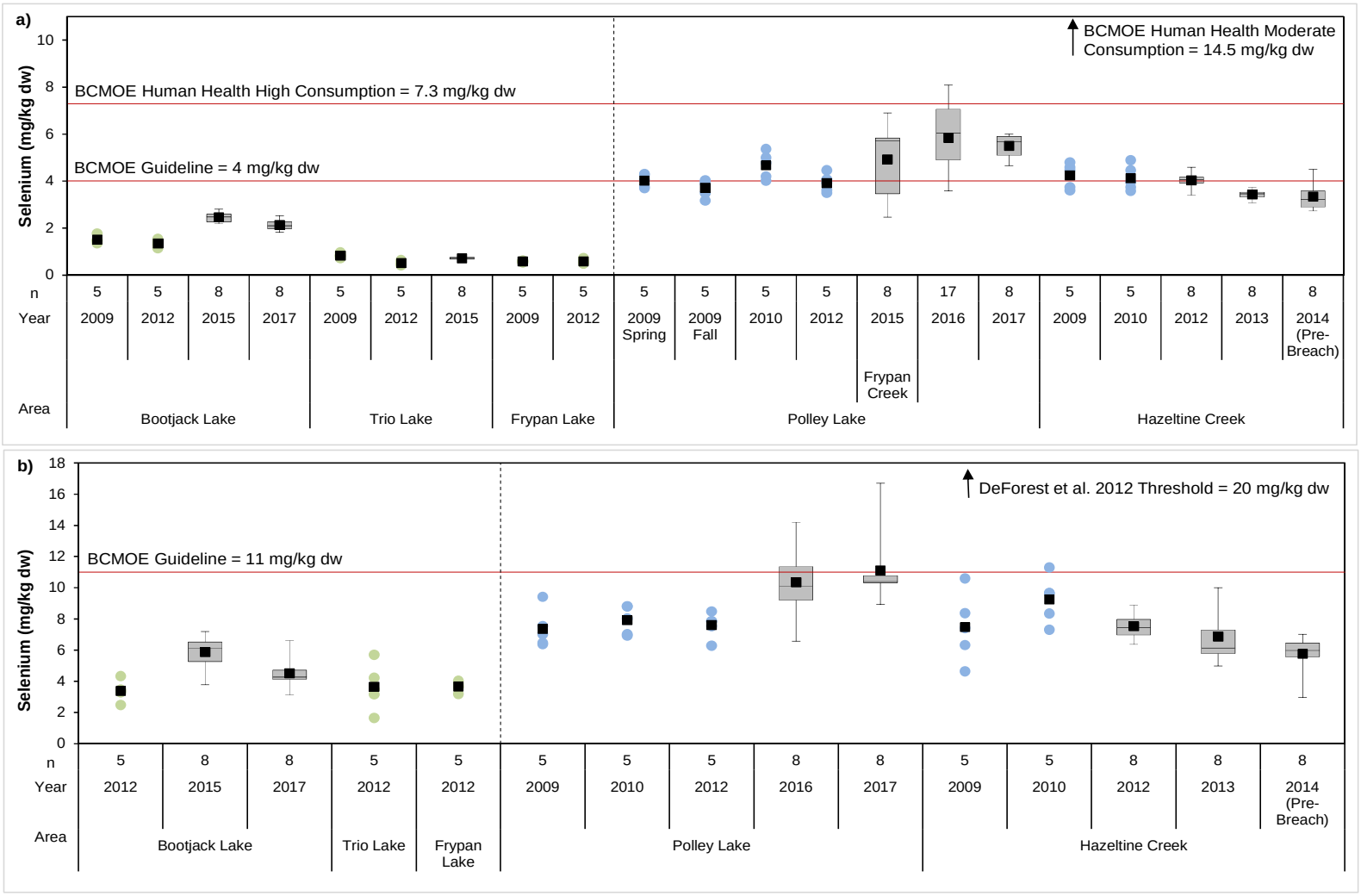


Figure 3: Selenium Concentrations in Rainbow Trout a) Muscle and b) Ovaries from Polley Lake, Hazeltine Creek, and Associated Reference Areas, Mount Polley, 2009 to 2017

Notes: Dashed line used to separate reference (left side) and exposed (right side) areas. Black squares represent means and whiskers represent minimum and maximum values. Box plots are presented when there are 8 or more samples.

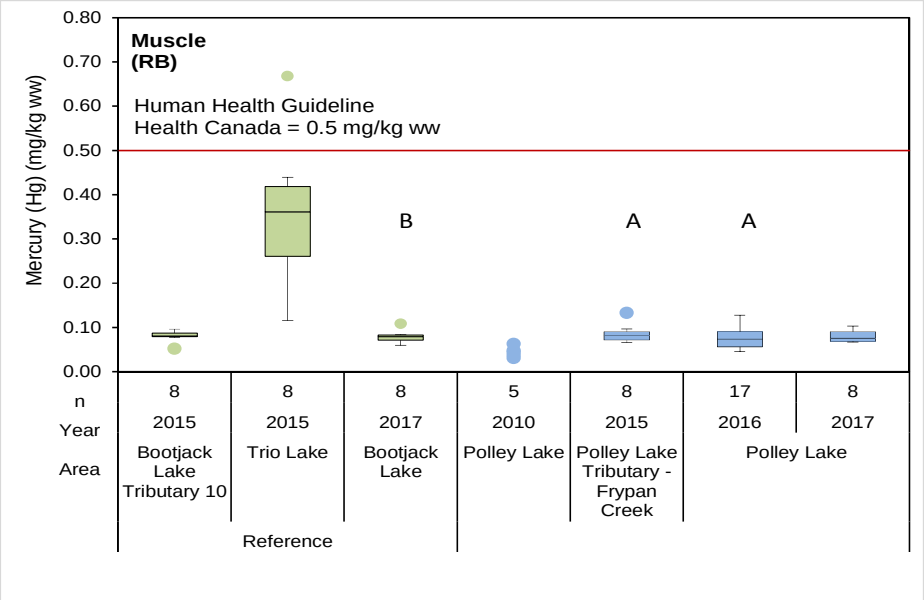
indicative of the influence of the TSF embankment breach on the receiving environment (arsenic, copper, iron [Minnow 2015], molybdenum, phosphorus, selenium [Golder 2015, 2016a]; and/or 2) had tissue quality guidelines (mercury and selenium). Concentrations of mercury and selenium in tissues of rainbow trout and longnose sucker collected in Polley Lake in 2015 to 2017 were lower than guidelines for the protection of human health (Figures 3 and 4), indicating that the fish can be safely consumed at consumption levels typical of the general population (Minnow 2017b, 2018a). Statistical contrasts of concentrations of the expanded suite of analytes in the tissues of Polley Lake fish relative to Bootjack Lake fish showed little agreement in terms of significant differences among species and/or tissues for almost all analytes, nor in the direction of differences when they were observed. This pattern indicates that, if there was any breach-related influence on Polley Lake fish tissue quality, it was minor. In Polley Lake, the only corroborated (reasonably unequivocal) differences were in selenium concentrations in the ovaries of Polley Lake rainbow trout, which were higher than reference and pre-breach in 2016 and 2017, potentially indicative of a breach-related influence (Minnow 2017b, 2018a). The same was not observed in longnose sucker; concentrations in longnose sucker tissues from Polley Lake (2017) were elevated relative to Bootjack Lake (2017), but were significantly lower than selenium concentrations in Polley Lake in 2010. For both species (rainbow trout and longnose sucker), selenium concentrations in ovary tissue were not at levels where adverse effects to fish would be expected (i.e., were not above the effect threshold).

2.2 Hazeltine Creek

2.2.1 Fish Community / Population

The fish community of Upper Hazeltine Creek has been dominated by juvenile rainbow trout during every sampling effort (Table 3). The fish community of Lower Hazeltine Creek (and Lower Edney Creek; both of which flow into Quesnel Lake) included bridgelip sucker, burbot, chinook salmon, coho salmon, kokanee, largescale sucker, longnose dace, longnose sucker, mountain whitefish, northern pikeminnow, peamouth chub, rainbow trout, and redside shiner (Table 3). Most of the fish species documented in Lower Hazeltine Creek or Lower Edney Creek in baseline (1989; Imperial Metals 1990) and in 2007 (Minnow 2009) were also observed in the rehabilitated section of Lower Edney Creek in 2016 and 2017 (Minnow 2018b).

The majority of rainbow trout collected in upper Hazeltine Creek and Edney Creek (79%; SNC-Lavalin 2015) have been young-of-the-year (YOY). In baseline, the density of rearing rainbow trout was 710 fish/100 m^2 and in lower Hazeltine Creek was 325 fish/100 m^2 (Imperial Metals 1990). By comparison, density in Bootjack Creek was 1,500 fish/100 m^2 (Imperial Metals 1990). Sampling in 1991 documented rainbow trout YOY density of 287 to 444 fish/100 m^2 in Hazeltine Creek compared to Bootjack Creek which had a density of 465 fish/100 m^2 (Bruce



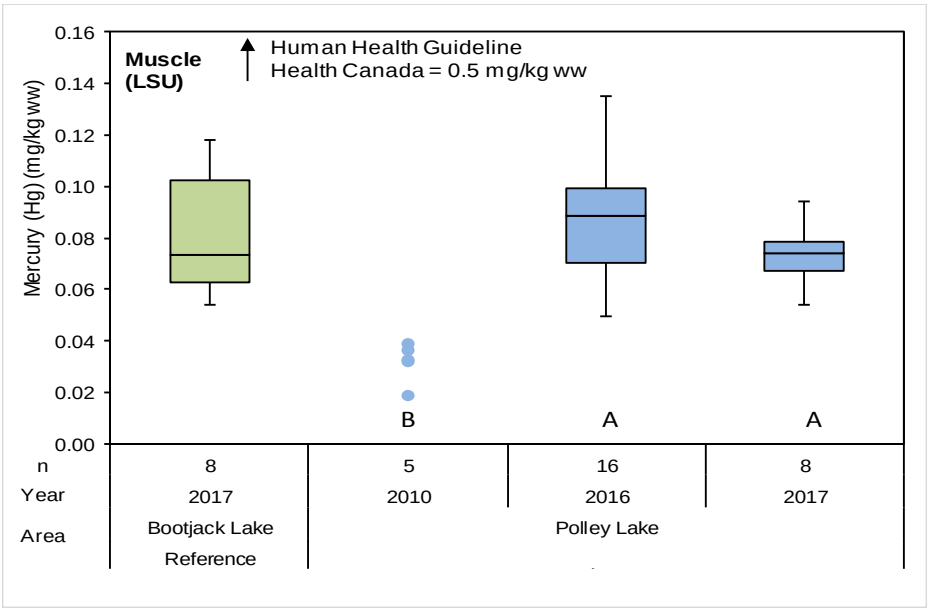


Figure 4: Mercury Concentrations (mg/kg ww) in Muscle Tissue of Fish from Polley Lake (2015 to 2017) Relative to Reference Areas (Bootjack Lake and Trio Lake; 2015 to 2017) and Pre-Breach (Polley Lake; 2010) [a,b,c]

[a] Concentrations in rainbow trout (RB) and longnose sucker (LSU) tissues from Polley Lake (2017) that differed significantly ($p<0.05$) from Bootjack Lake (2017) are denoted by an asterisk (*).

[b] Among-year comparisons were completed for Polley Lake only (2010, 2016 and 2017). The absence of letters (A,B,C) for 2010, 2016, and 2017 indicates no significant difference exists among years. Where significant differences were identified (family-wise $\alpha=0.05$), the years that were not significantly different from each other were assigned a common letter (A,B,C). The year with the greatest mean is assigned "A".

[c] Data summarized as boxplots when sample size was 8 or more; dot plots when sample size was 8 or fewer, or fewer than 8 results were detectable.

Table 3: Summary of Fish Collected in Hazeltine Creek and Associated Reference Areas, Mount Polley, 1989 to 2017

Area	Year	Report	Fishing Method	Bridgelip Sucker	Burbot	Chinook Salmon	Coho Salmon	Kokanee	Largescale Sucker	Longnose Dace	Longnose Sucker	Mountain Whitefish	Northern Pikeminnow	Peamouth Chub	Rainbow Trout	Redside Shiner	Sockeye Salmon	Salmon fry [c]	Juvenile Sucker sp.
Upper Hazeltine Creek	1989	Imperial Metals 1990	minnow trap, electrofishing	-	-	-	-	-	-	-	-	-	-	-	48	-	-	-	-
	1990	Bruce and Slaney 1991	electrofishing	-	-	-	-	-	-	-	-	-	-	-	616	-	-	-	-
	2007	Minnow 2009	electrofishing	-	-	-	-	-	-	-	-	-	-	-	198	-	-	-	-
	2012	Minnow 2013a	electrofishing	-	-	-	-	-	-	-	-	-	-	-	20	-	-	-	-
	2013	Minnow 2013b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	40	-	-	-	-
	2014 [a]	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-
Lower Hazeltine Creek	1989	Imperial Metals 1990	minnow trap, electrofishing	-	-	-	-	-	-	-	-	2	-	-	142	-	8	-	-
	2007	Minnow 2009, Cariboo Envirotech 2008	electrofishing	6	158	38	9	-	9	24	-	-	-	18	96	6	-	-	-
Upper Edney Creek [b]	1989	Imperial Metals 1990	minnow trap, electrofishing	-	-	-	-	-	-	-	-	-	-	-	9	-	-	-	-
	1995	HKP 1996b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	295	-	-	-	-
	1996	HKP 1997a	electrofishing	-	-	-	-	-	-	-	-	-	-	-	435	-	-	-	-
	1997	HKP 1997b	minnow trap, electrofishing	-	-	-	-	-	-	-	1	-	-	-	200	-	-	-	-
	1998	Beak 1999	electrofishing	-	-	-	-	-	-	-	-	-	-	-	156	-	-	-	-
	2007	Minnow 2009, Cariboo Envirotech 2008	electrofishing	-	-	-	-	-	-	-	-	-	-	-	155	-	-	-	-
Lower Edney Creek	1989	Imperial Metals 1990	minnow trap, electrofishing	-	12	16	-	-	-	-	7	3	-	-	24	-	869	-	-
	1995	HKP 1996b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	11	-	-	-	-
	1996	HKP 1996b, 1997a	electrofishing	-	-	-	-	-	-	-	-	-	-	-	158	-	-	-	-
	1997	HKP 1996b, 1997b	electrofishing	-	-	-	-	-	-	-	-	-	-	-	111	-	-	-	-
	1998	Beak 1999	electrofishing	-	-	-	-	-	-	-	-	-	-	-	111	-	-	-	-
	2007	Cariboo Envirotech 2008	unknown	-	-	-	12	-	-	-	-	-	-	-	-	-	-	-	-
	2014	DWB 2014	electrofishing	-	-	-	-	-	-	-	-	-	-	-	52	-	-	-	-
	2015	DWB 2015	electrofishing	-	16	-	-	-	-	11	27	-	18	-	125	4	-	39	-
Lower Edney Creek (Rehabilitated)	2016	Minnow 2018b	minnow trap, electrofishing, hoop net	-	17	6	11	-	4	58	2	8	9	-	245	33	-	-	10
	2017	Minnow 2018b	minnow trap	-	2	-	181	-	-	35	19	-	32	4	66	56	-	-	17
Lower Edney Creek (Reference)	2016	Minnow 2018b	minnow trap, electrofishing	-	4	3	21	-	-	12	-	1	1	-	93	1	-	-	-
	2017	Minnow 2018b	minnow trap	-	-	1	96	3	-	6	-	-	-	-	76	-	-	-	-
Horsefly River	2014 [a]	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-
Lower Whiffle Creek	2007	Minnow 2009	unknown	-	27	-	-	-	-	-	-	-	-	-	118	-	-	-	-
Soda Creek	2014 [a]	Golder 2016	electrofishing	-	-	-	-	-	-	-	-	-	-	-	-	-	30	-	-

[a] Catch numbers are amount of fish retained for tissue analysis, more fish may have been collected.
[b] Upper Edney Creek includes all stations on Upper Edney as well as two tributaries of Edney Creek
[c] Fry could not be identified to species level but suspected to include Coho, Chinook, and Sockeye

and Slaney 1991). In 2007, Upper Hazeltine Creek had a higher density of rainbow trout (400 to 700 fish/100 m^2) compared to the reference area, upper Edney Creek in 2007 (200 to 640 fish/100 m^2; Minnow 2009). Rainbow trout densities in Edney Creek varied considerably over time, with baseline densities of 169 fish/100 m^2 in 1996 and 17 fish/100 m^2 in 1997 (Minnow 2014b).

2.2.2 Fish Tissue Quality

Fish tissue quality evaluations have focussed on lake fish (see above). Adult rainbow trout have been collected from Hazeltine Creek for tissue quality characterization, and the associated data interpretation is integrated with the data for Polley Lake (above) as adult rainbow trout captured in Hazeltine Creek migrate into the creek to spawn.

2.3 Quesnel Lake

2.3.1 Fish Community / Population

The fish community of Quesnel Lake has been well characterized and includes a total of 20 species (Table 4). Prior to the TSF embankment breach, fish monitoring in Quesnel Lake was limited to collections for tissue quality analysis (2009, 2012, and 2014). These collections resulted in the capture of burbot, lake trout, largescale sucker, longnose sucker, mountain whitefish, peamouth chub, and rainbow trout (Table 5). Fish collections, primarily for tissue quality, have been undertaken annually since the TSF embankment breach in 2014, with community composition similar to that documented previously (Table 5). Additional collections for federal Environmental Effects Monitoring (EEM) were undertaken in 2016 (Minnow 2016).

The Mount Polley Phase 1 EEM included a population study of two sentinel species – northern pikeminnow and largescale sucker (with a supporting evaluation of peamouth chub; Minnow 2016). The objective of this monitoring was to determine if exposure to Mount Polley mine effluent (discharged to Quesnel Lake starting in December 2015) has an effect on the survival, growth, or reproduction of sentinel fish populations as compared to reference populations. Some differences in fish population endpoints (i.e., survival and energy use) were observed for northern pikeminnow, largescale sucker, and peamouth chub captured from effluent-exposed versus reference areas (Minnow 2016). However, there was no concordance between the results of comparisons of effluent-exposed populations to the two reference area populations (i.e., the metrics for effluent-exposed populations were often intermediate between the two references) nor among the three species. Overall, it was concluded that fish communities in the effluent-exposed and reference areas were similar and that effluent discharges from the mine were not affecting fish populations or fish health (Minnow 2016).

Table 4: Fish Species Documented in Quesnel Lake

Common Name	Latin Name
Sockeye Salmon	*Oncorhynchus nerka*
Coho Salmon	*Oncorhynchus kisutch*
Chinook Salmon	*Oncorhynchus tshawytscha*
Kokanee	*Oncorhynchus nerka*
Rainbow Trout	*Oncorhynchus mykiss*
Bull Trout	*Salvelinus confluentus*
Lake Trout	*Salvelinus namaycush*
Pygmy Whitefish	*Prosopium coulteri*
Mountain Whitefish	*Prosopium williamsoni*
Lake Whitefish	*Coregonus clupeaformis*
Burbot	*Lota lota*
Largescale Sucker	*Catostomus macrocheilus*
Longnose Sucker	*Catostomus catostomus*
Slimy Sculpin	*Cottus cognatus*
Northern Pikeminnow	*Ptychocheilus oregonensis*
Peamouth Chub	*Mylocheilus caurinus*
Leopard Dace	*Rhinichthys falcatus*
Longnose Dace	*Rhinichthys cataractae*
Redside Shiner	*Richardsonius balteatus*
Lake Chub	*Couesius plumbeus*

Table 5: Summary of Fish Collected in Quesnel Lake, Mount Polley, 2009 to 2017

	Area	Year	Report	Fishing Method	Bull Trout	Burbot	Chinook Salmon	Coho Salmon	Kokanee	Lake Trout	Largescale Sucker	Longnose Dace	Longnose Sucker	Mountain Whitefish	Northern Pikeminnow	Peamouth Chub	Rainbow Trout	Redside Shiner	Sockeye Salmon	Juvenile Sucker sp.
Exposed	Quesnel Lake (near Hazeltine Creek)	2009	Minnow 2011	gill net, angling	-	-	-	-	-	-	-	-	-	-	-	-	5	-	-	-
		2010	Minnow 2011	gill net, angling	-	-	-	-	-	-	-	-	5 [b]	-	-	-	5	-	-	-
		2012	Minnow 2013a	gill net	-	1	-	-	-	7	28	-	9	15	-	41	13	-	-	-
		2014 [a]	Golder 2016	unknown	-	12	-	-	-	51	-	1	1	4	36	1	-	2	-	-
		2015	Zirnhelt and Dolighan 2015, Zirnhelt 2016	gill net, trap net	-	4	-	-	-	10	72	-	-	-	53	18	-	18	-	-
		2016	Minnow 2017b	hoop net	-	16	2	-	-	-	65	20	-	21	123	444	18	33	-	-
		2017	Minnow 2018a	gill net, minnow trap	1	3	-	-	2	-	-	-	-	-	27	-	2	-	1	2
	Quesnel Lake (near Likely) [a]	2014	Golder 2016	unknown	-	1	-	-	10	-	-	-	-	1	7	12	1	-	-	-
		2015	Golder 2016	unknown	-	-	-	-	8	-	-	-	-	-	-	-	8	-	-	-
	Quesnel Lake (Middle) [a,c]	2014	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	-
		2015	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14	-
	Quesnel Lake (West) [a]	2014	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16	-
		2015	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17	-
Reference	Quesnel Lake (North Arm)	2010	Minnow 2011	gill net, angling	-	-	-	-	-	-	-	-	5 [b]	-	-	-	5	-	-	-
		2012	Minnow 2013a	gill net	-	-	-	-	-	-	3	-	-	6	-	-	7	-	-	-
		2014 [a]	Golder 2016	unknown	-	-	-	-	10	-	-	-	-	-	31	2	-	-	13	-
		2015	Zirnhelt and Dolighan 2015, Zirnhelt 2016, Golder 2016	gill net, trap net	-	7	-	-	-	10	39	-	-	-	12	8	-	70	10 [a]	-
		2016	Minnow 2017b	hoop net	-	14	-	-	-	-	23	-	2	2	53	5	-	130	-	-
		2017	Minnow 2018a	gill net	2	-	-	-	1	-	-	-	-	5	-	-	-	-	2	-
	Quesnel Lake (East Arm) [a]	2014	Golder 2016	unknown	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	-
		2015	Golder 2016	unknown	-	7	-	-	-	10	-	-	-	-	-	-	-	-	10	-
	Quesnel Lake (near Horsefly)	2014 [a]	Golder 2016	unknown	-	1	-	-	-	-	-	2	-	-	10	6	-	-	-	-
	Quesnel Lake (Peninsula Bay)	2016	Minnow 2017b	hoop net	2	25	-	1	-	-	100	7	4	63	67	24	1	189	-	-
		2017	Minnow 2018a	gill net	-	-	-	-	1	-	-	-	-	1	-	-	-	-	1	-

[a] Catch numbers are amount of fish retained for tissue analysis, more fish may have been collected, Golder 2016 Summary Report.
[b] Sample presented as longnose sucker but could possibly be largescale sucker.
[c] Potentially exposed.

2.3.2 Fish Tissue Quality

Tissue quality of Quesnel Lake fish was evaluated following the TSF embankment breach in 2014. This monitoring has included 12 fish species and variously included whole body, muscle tissue, liver tissue, Kidney tissue, and ovary tissue samples (Golder 2016; Minnow 2017b, 2018a). Fish tissue quality investigations were focussed on a suite of analytes that included metals that: 1) were identified as potentially indicative of the influence of the TSF embankment breach on the receiving environment (arsenic, cadmium, copper, iron, mercury, molybdenum, phosphorus, selenium, vanadium, and zinc; and/or or 2) had tissue quality guidelines (mercury and selenium).

Concentrations of mercury and selenium in tissues of fish collected in Quesnel Lake from 2015 to 2017 (burbot, kokanee, lake trout, largescale sucker, northern pikeminnow, peamouth chub, redside shiner) were lower than guidelines for the protection of human health in all cases except for mercury in large burbot and lake trout (Table 6; Minnow 2017b, 2018a). Large burbot and large lake trout (greater than approximately 66 cm in length [fork length and total length, respectively]) had mercury concentrations at levels where consumption limitation should be considered in accordance with provincial and federal guidance (e.g., BCMOE 2014; CFIA 2015). Smaller burbot and lake trout, as well as all other species can be safely consumed at consumption levels typical of the general population. There was no evidence that the Mount Polley Mine had any influence on mercury concentrations in burbot or lake trout. Rather, these species are piscivores (eat other fish) and are expected to have naturally higher concentrations of mercury (which is known to biomagnify). Concentrations of selenium in all fish species and tissues collected in Quesnel Lake were below BCWQGs for the protection of aquatic life.

In Quesnel Lake, uncertainty over fish movement between the exposed and reference areas and the absence of pre-breach datasets (of similar species) made interpretation of fish tissue quality results challenging. In Quesnel Lake, the only corroborated (reasonably unequivocal) differences in tissue metal concentrations of fish collected from exposed versus reference areas were higher concentrations of arsenic, cadmium, mercury, and selenium in tissues or whole bodies of northern pikeminnow and/or peamouth chub collected from exposed areas relative to reference areas. However, results of Environmental Effects Monitoring (EEM) undertaken in 2016 indicated that populations of northern pikeminnow and peamouth chub collected at the exposed area had very slightly (but not biologically meaningful) lower condition than reference fish (3.6% lower; Minnow 2016). Accordingly, the few corroborated differences in tissue metal concentrations were not associated with any adverse effect on the health of peamouth chub or northern pikeminnow. In 2017, no corroborated (reasonably unequivocal) temporal changes were identified for northern pikeminnow (whole bodies) collected from Quesnel Lake (relative to 2016; Minnow 2018a). This

Table 6: Comparison of Muscle and Whole Body Samples Collected in Quesnel Lake to Consumption Guidelines for Protection of Human Health or Guidelines for the Protection of Aquatic Life, MPMC, 2015 to 2017

Sample Collection Timing	Area	Species (Species Code)	Tissue	Sample Size	Mercury (Hg) mg/kg ww		Selenium (Se) mg/kg dw				
					Health Canada Human Health (0.5 mg/kg ww)		BCMOE Human Health (Moderate = 14.5 mg/kg dw) (High = 7.3 mg/kg dw)			BCMOE Guideline (4 mg/kg dw)	
					Mean	Frequency > guideline	Mean	Frequency > moderate	Frequency > high	Mean	Frequency > guideline
Fall 2015	near Hazeltine Creek	Burbot (BB)	Muscle	4	0.35	0%	2.8	0%	0%	2.8	0%
		Lake Trout (LT)	Muscle	10	0.22	10%	1.9	0%	0%	1.9	0%
		Largescale Sucker (CSU)	Muscle	8	0.12	0%	3.1	0%	0%	3.1	13%
		Northern Pikeminnow (NSC)	Muscle	7	0.24	0%	2.0	0%	0%	2.0	0%
		Peamouth Chub (PCC)	Whole Body	8	-	-	-	-	-	3.1	13%
		Redside Shiner (RSC)	Whole Body	8	-	-	-	-	-	2.7	0%
	near Likely	Kokanee (KO)	Muscle	8	0.092	0%	2.4	0%	0%	2.4	0%
	East Arm (Reference)	Burbot (BB)	Muscle	7	0.26	14%	2.4	0%	0%	2.4	0%
		Lake Trout (LT)	Muscle	10	0.26	10%	1.6	0%	0%	1.6	0%
	Near Grain Creek (North Arm, Reference)	Largescale Sucker (CSU)	Muscle	8	0.11	0%	1.6	0%	0%	1.6	0%
		Peamouth Chub (PCC)	Whole Body	8	-	-	-	-	-	2.2	0%
		Redside Shiner (RSC)	Whole Body	8	-	-	-	-	-	2.0	0%
Spring 2016	near Hazeltine Creek	Largescale Sucker (CSU)	Muscle	8	0.11	0%	2.8	0%	0%	2.8	0%
		Northern Pikeminnow (NSC)	Whole Body	8	-	-	-	-	-	3.1	0%
		Peamouth Chub (PCC)	Muscle	8	0.24	0%	2.8	0%	0%	2.8	0%
	Near Grain Creek (North Arm, Reference)	Largescale Sucker (CSU)	Muscle	8	0.11	0%	1.6	0%	0%	1.6	0%
		Northern Pikeminnow (NSC)	Whole Body	8	-	-	-	-	-	2.1	0%
		Peamouth Chub (PCC)	Muscle	8	0.15	0%	1.6	0%	0%	1.6	0%
Fall 2017	near Hazeltine Creek	Northern Pikeminnow (NSC)	Whole Body	8	-	-	-	-	-	2.3	0%

Note: ww = wet weight; dw = dry weight.

Indicates mean mercury concentration greater than Health Canada's Human Health concentration for muscle tissue in fish (0.5 mg/kg ww; CFIA 2015).

Indicates mean selenium concentration greater than the BCMOE Human Health guideline for moderate fish consumption (14.5 mg/kg dw; BCMOE 2014).

Indicates mean selenium concentration greater than the BCMOE guideline for muscle tissue or whole body in fish (4 mg/kg dw; BCMOE 2014).

pattern indicates that, if there was any breach-related influence on Quesnel Lake fish tissue quality, it was minor.

2.4 Quesnel River

2.4.1 Fish Community / Population

Fish were sampled in the Quesnel River in 2014, 2015, and 2017, targeting rainbow trout, primarily by angling (Table 7). Other species were captured, including burbot, mountain whitefish, and peamouth chub (Table 7). Rainbow trout that were collected in the Quesnel River in 2017 were of similar age and size to those collected in 2015 (Minnow 2018a).

2.4.2 Fish Tissue Quality

Tissue quality of rainbow trout collected from the Quesnel River in 2015 and 2017 did not exceeded Health Canada's Human Health guideline for mercury (Minnow 2018a). In 2015, selenium concentrations in rainbow trout were below the BCMOE guideline for human health and for the protection of aquatic life, but in 2017, one sample exceeded these guidelines (Minnow 2018a). As observed in Quesnel Lake, no corroborated (reasonably unequivocal) temporal changes were identified for rainbow trout (muscle, liver, and kidney tissue) collected from the Quesnel River in 2017 (relative to 2015; Minnow 2018a).

Table 7: Summary of Fish Collected in Quesnel River, Mount Polley, 2014 to 2017

Area	Year	Report	Fishing Method	Burbot	Mountain Whitefish	Peamouth Chub	Rainbow Trout
Quesnel River	2014	Golder 2016	unknown	-	-	3	12
	2015	Zirnhelt and Dolighan 2015	angling	-	-	-	8
	2017	Minnow 2018a	angling	1	2	-	8

3 STUDY DESIGN OVERVIEW AND RATIONALE

Fish monitoring under the CEMP is designed to meet the combined needs of: 1) operational monitoring (including the discharge of treated effluent to Quesnel Lake); 2) monitoring of the impact of the 2014 TSF embankment breach; and 3) monitoring of the response to remediation following the TSF embankment breach. As previously indicated, fish monitoring includes fish tissue quality monitoring, sentinel fish population monitoring, fish habitat characterization and fish usage monitoring, and fish community monitoring. An overview of the proposed fish monitoring program is provided in Table 8 and Figures 5 and 6.

3.1 Fish Tissue Quality

Fish tissue quality monitoring is focused on Polley Lake and Quesnel Lake, with un-impacted reference areas identified for each mine-influenced sampling area (i.e., Bootjack Lake for Polley Lake, unaffected areas of Quesnel Lake for exposed areas of Quesnel Lake; Table 8; Figures 5 and 6). In Polley Lake, fish tissue quality monitoring is undertaken to monitor the combined influence of general mine proximity, uncontrolled surface runoff from the north dump (2006 to 2009), and influence of the TSF embankment breach. In Quesnel Lake and Quesnel River, fish tissue quality monitoring is undertaken to monitor the combined influence of the TSF embankment breach and the discharge of Mount Polley mine effluent (December 2015 to present). In Polley Lake (and reference), fish tissue quality monitoring will focus on rainbow trout and longnose sucker. Because selenium was elevated in the 2006 to 2009 surface runoff, this monitoring will be focussed on the collection of females in the spring so that ripe ovaries can be collected. The full complement of tissues to be collected will include muscle, liver, kidney, and ovary (Table 8). Scientific consensus is that the best tissues for evaluating the potential adverse effects of selenium to fish (which are considered to be the most selenium sensitive organisms) are ripe ovaries or eggs (Presser and Luoma 2009; Janz et al. 2010; DeForest et al. 2012; Janz 2012). Tissues will be collected for the analytical determination of moisture content, metals, and mercury (Section 4.3). Supporting data will include catch per unit effort, length, weight, and age (see below). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) concentrations relative to fish tissue quality guidelines for the protection of aquatic life and human health (BCMOE 2014; CFIA 2015). A sample size of eight fish per species per area will provide replication for the statistical contrasts. Fish tissue quality monitoring in Polley and Bootjack lakes will be undertaken at an annual monitoring frequency from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

Table 8: Mount Polley CEMP Fish Monitoring Plan Overview

A) Fish Tissue Quality Monitoring [1]

Water Body	Type	Fish Species	Tissues [2,3]	Replication	Frequency [4]	Rationale
Polley Lake	Exposed	RB, LSU	M,L,K,O	8	annual	immediately adjacent to mine and breach-influenced
Bootjack Lake	Reference	RB, LSU	M,L,K,O	8	annual	reference for Polley Lake [5]
Quesnel Lake	Exposed	RB, LT, KO, NSC, PCC	M,L,K,O	8	annual	adjacent to effluent discharge and breach-influenced
	Reference	RB, LT, KO, NSC, PCC	M,L,K,O	8	annual	reference for Quesnel Lake exposed
Quesnel River	Far-Field Exposed	RB	M,L,K,O	8	annual	far-field exposed area near Quesnel Lake outlet

[1] All fish tissues will be evaluated for the following analytes: percent moisture, metals by ICP-MS scan, and total mercury (Table 9).

[2] Fish tissues: M = muscle, L = liver, K = kidney, O = ovary (as available/developed; note that females will only be specifically targeted in Polley and Bootjack lakes).

[3] Except for small bodied fish (PCC and juvenile NSC), which will be submitted whole.

[4] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

[5] Bootjack Lake is retained as the reference for Polley Lake due to the fact that it has not been notably affected by the mine, there is a long-term dataset available for it, and its watershed includes similar geology to Polley lake. The latter is not true for other potential reference areas.

B) Fish Population Monitoring

Water Body	Type	Fish Species	Endpoints	Replication	Frequency [3]	Rationale
Polley Lake	Exposed	RB, LSU	L,W,C [1]	100	annual	immediately adjacent to mine and breach-influenced
Quesnel Lake	Exposed	NSC, RSC	Federal EEM [2]	20 / sex	every 3 years [4]	adjacent to effluent discharge and breach-influenced
	Reference	NSC, RSC	Federal EEM [2]	20 / sex		reference for Quesnel Lake exposed

[1] L = length-frequency distribution (indicative of recruitment and survival), W = weight, C = condition (indicative of overall health / energy storage).

[2] Fish population endpoints prescribed for federal EEM will be applied. These differ for lethal and non-lethal designs as described in Section 4.2.

[3] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

[4] Frequency prescribed for federal EEM.

C) Fish Habitat Characterization and Usage Monitoring

Water Body	Type	Fish Species	Measures	Frequency [5]	Rationale
Upper Hazeltine Creek	Impacted [1]	RB, LSU	Fish habitat characterization [3], fish occupancy and meristics [4]	annual	immediately adjacent to mine and breach-impacted
Lower Hazeltine Creek	Impacted [1]	all / any [2]		every 2 years	breach-impacted
Lower Edney Creek	Impacted [1]	all / any [2]		every 2 years	breach impacted

[1] Impacted by the TSF embankment breach.

[2] A total of 20 fish species have been documented in Quesnel Lake (SNC-Lavalin 2015) and would have access to Lower Hazeltine and Lower Edney creeks.

[3] Fish habitat characterization using methodology applied in 2016 and 2017 (Minnow 2018b), as adapted from Johnston and Slaney 1996.

[4] Fish occupancy as determined by observation (including spawning, and general presence) and by fishing with record of catch/effort and meristic measures (length and weight).

[5] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

D) Fish Community Monitoring

** qualitative fish community data will be collected to support all fish tissue, fish population, and fish habitat usage collections

Water Body	Collection Methods [1,2,3]	Endpoint	Frequency [6]	Rationale
Polley Lake	HN, MT, FT, SN, EF, GN	CPUE [5]	annual	to support fish tissue quality and population monitoring
Bootjack Lake	HN	CPUE [5]	annual	to support fish tissue quality and population monitoring
Quesnel Lake	HN, MT, FT, SN, GN	CPUE [5]	annual	to support fish tissue quality and population monitoring
Upper Hazeltine Creek	MT, FT, SN, EF [4]	CPUE [5]	annual	to support fish population and habitat usage monitoring
Lower Hazeltine Creek	MT, FT, SN, EF [4]	CPUE [5]	every 2 years	to support fish habitat usage monitoring
Lower Edney Creek	MT, FT, SN, EF [4]	CPUE [5]	every 2 years	to support fish habitat usage monitoring
Quesnel River	AG	CPUE [5]		to support fish tissue quality monitoring

[1] In order of preference for non-lethal fish collection methods whenever possible (e.g., hoop netting, minnow trapping, electrofishing).

[2] HN = hoop netting, MT = minnow trapping, FT = fry trapping, SN = seining, EF = electrofishing, GN = gill netting, AG = angling.

[3] Prohibited in waters over twenty degrees Celsius.

[4] Subject to electrofishing prohibition during spawning and incubation periods and in waters below five degrees Celsius.

[5] CPUE = catch per unit effort. For HN, MT, and FT, CPUE will be expressed as catch per unit deployment time; for SN, CPUE will be expressed as catch per unit area; for EF, CPUE will be expressed as catch per unit electroshocking time and per unit area; for GN, CPUE will be expressed as catch per unit net surface area-time; and for AG, CPUE will be expressed as catch per unit of angling effort.

[6] Monitoring frequencies applicable from 2018 to 2010 will be reviewed following data interpretation and modifications may be made in response to QP recommendations.

590,000 595,000 600,000 605,000 610,000 615,000 620,000

5,830,000 5,825,000 5,820,000 5,815,000

Likely

Frypan Lake

Cedar Creek

Horsefly Likely Forest Service Road

Nina Lake

Polley Lake

Mount Polley Mine

Bootjack Lake

Boswell Lake

Winkley Creek Road

Bootjack Creek Dam

Tailings Storage Facility (TSF)

Gavin Lake Road

Hazeltine Creek

Quesnel Lake

Edney Creek

Near Hazeltine Creek

Edney Lake Road

Near Grain Creek

Peninsula Bay

Near Hazeltine Creek

0 2.5 5 10 km

BRITISH COLUMBIA

ALBERTA

Fort Nelson

Fort St. John

Prince George

Mount Polley 592,000 mE 5,822,000 mN

Williams Lake

Vancouver

United States

LEGEND

- Rainbow Trout from Quesnel River for Tissue
- Small Bodied Fish for Tissue and EEM- Reference
- Small Bodied Fish for Tissue and EEM - Exposed
- Exposed Lake
- Reference Lake
- Tailings Storage Facility
- Active Mine Operation

0 1.25 2.5 5 km

N W E S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Fish Monitoring Areas, Lakes and Quesnel River

Date June 2018
Project 177202.0042

minnow environmental inc.

Figure 5

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LEGEND

- Stream Segments Subject to Habitat Characterization and Fish Habitat Use Assessment
- Rehabilited Reaches (Golder 2017a,b)
- Historic Watercourse

0 0.5 1 2
km

N
W E
S

Projection: North American Datum 1983 UTM Zone 10U

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Mount Polley CEMP Fish Monitoring Areas, Creeks

Date June 2018
Project 177202.0042

minnow environmental inc.

Figure 6

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In Quesnel Lake (exposed and reference), fish tissue quality monitoring will focus on sentinel species. Sentinel species were selected on the basis of their trophic position, their status as sportfish or non-sportfish, their typical home range sizes, and the availability of historical tissue quality data. Rainbow trout (to be collected in the Quesnel River near the lake outlet; see below) and lake trout were selected as the sentinel sportfish species to monitor potential changes in tissue quality over time relative to human consumption of sportfish. In 2018, kokanee will also be monitored for this purpose (as there is a dataset from 2014 to which they can be compared). Northern pikeminnow and peamouth chub were selected as sentinel species with small home ranges to monitor potential changes in fish tissue quality associated with the TSF embankment breach and effluent discharge from the perspective of aquatic ecosystem health. Redside shiner may be used as an alternate sentinel species for this purpose depending upon future capture success. Fish species with small home ranges are better monitors of the potential effects of defined point sources (due to the fact that they are more continuously exposed) than fish with larger home ranges (e.g., Environment Canada 2012). The larger bodied fish will be subject to sampling the full complement of tissues, including muscle, liver, kidney, and ovary (Table 8). Ovary will only be sampled when available (i.e., when fully developed in mature females); additional fish will not be targeted and sacrificed to achieve the target sample size for ovary tissues (i.e., it is expected that ovary sample sizes will be less than eight). The small bodied fish (i.e., small northern pikeminnow, peamouth, and/or redside shiner) will be submitted as headless carcasses (as the heads will be submitted for otolith extraction and age determination). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; 2) statistical comparison to reference conditions; and 3) concentrations relative to fish tissue quality guidelines for the protection of aquatic life and human health (for selenium and mercury; BCMOE 2014; CFIA 2015). It is noted that comparison to reference conditions has previously proven to be challenging due to uncertainty over exposure given the large home ranges of the sportfish species and the apparent absence of a strong mine influence (Golder 2016; Minnow 2017b, 2018a). Thus, the greatest utility of fish tissue monitoring is as a temporal monitor and for comparison to available guidelines. A sample size of eight fish per species per area will provide replication for the statistical contrasts. Fish tissue quality monitoring in Quesnel Lake will be undertaken at an annual monitoring frequency from 2018 to 2020 (although, as previously noted, kokanee will only be collected in 2018), and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

In the Quesnel River, rainbow trout were selected as a sentinel sportfish species to monitor potential changes in tissue quality over time. Rainbow trout will be collected in the late summer and will be subject to sampling the full complement of tissues, including muscle, liver, kidney, and ovary (Table 8). As noted above, ovary will only be sampled when available (i.e., when fully

developed in mature females); additional fish will not be targeted and sacrificed to achieve the target sample size for ovary tissues (i.e., it is expected that ovary sample sizes will be less than eight). Data interpretation will be based on a combination of: 1) statistical comparison to previous conditions; and 2) concentrations relative to fish tissue quality guidelines for the protection of aquatic life and human health (BCMOE 2014; CFIA 2015). A sample size of eight fish per species per area will provide replication for the statistical contrasts. Fish tissue quality monitoring in the Quesnel River will be undertaken at an annual monitoring frequency from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

Fish community and population data will be collected to support all fish tissue quality monitoring (as discussed in greater detail below). All collections will be supported by capture records for all species and documentation of effort that will be used to calculate Catch-Per-Unit-Effort (CPUE). All fish selected for tissue quality will be subject to measurement of length, weight (total and fork), and the collection of structures for age determination. Detailed methodology for fish collection, measurement, tissue sample collection, tissue sample processing, sample handling and laboratory analysis, quality control/quality assurance, data quality review, data handling, interpretation, and reporting is provided in Section 4.

3.2 Sentinel Fish Populations

Fish population monitoring is focused on Polley Lake and Quesnel Lake (Table 8; Figures 5 and 6). In Polley Lake, population monitoring is focused on tracking the population structure of rainbow trout. Specifically, with the inaccessibility of Hazeltine Creek (the major spawning and juvenile rearing location for Polley Lake Fish) between August 2014 and spring 2018, recruitment of Polley Lake rainbow trout was substantially diminished for four years (i.e., juvenile fish in Hazeltine were eliminated with the breach in August 2014 and recruitment from Hazeltine was unavailable in 2015, 2016, and 2017). Following the re-opening of Upper Hazeltine Creek in spring 2018, Polley Lake rainbow trout will again have access to the major spawning and rearing habitat and fish population monitoring will document changes in population structure over time (i.e., recovery of age-class balance). Polley Lake fish population monitoring will be conducted by hoop netting in the spring and fall. This non-lethal technique has previously proven effective for the collection of adult rainbow trout, adult longnose sucker, and larger redside shiner. All captured fish will be identified and counted, and all captured rainbow trout will be measured (total length, fork length, and weight) to provide data that can be used to characterize size-frequency distributions indicative of recruitment and survival. In 2018 only, an additional gill netting effort will be completed in the fall using methodology identical to that applied in 2014 and 2016 (Lirette 2015, 2017). This effort will apply experimental gill nets to achieve a high level of comparability to the previous work. The same measurements as noted above will be collected.

As this technique is destructive (lethal), age structures will also be collected and will allow age-frequency distributions to be determined in addition to the size frequency distributions noted above. Summary rainbow trout population metrics (mean age, mean size, size-at-age, and condition [weight-at-length]) as well as community metrics (CPUE, relative species proportions, as discussed in greater detail below) will be calculated and compared between areas (Polley Lake and Bootjack Lake), and over time. A target sample size of 50 (100 preferred) will provide replication for statistical contrasts. Data collected by the two different techniques in 2018 (hoop netting and gill netting) will be compared to determine if the non-destructive technique adequately addresses key questions, in which case future destructive sampling will be considered unnecessary. Fish population monitoring in Polley Lake will be undertaken at an annual monitoring frequency from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

Additional fishing efforts in Polley Lake shoreline areas will be undertaken to monitor the presence and abundance of juvenile rainbow trout. This will serve to monitor the recovery of rainbow trout in Polley Lake and to specifically augment the monitoring of juvenile trout recruitment determined for Upper Hazeltine Creek (as discussed in more detail in Section 3.3 below). Juvenile rainbow trout will be collected from shoreline areas in Polley Lake by minnow trapping, fry trapping, and backpack electrofishing. All captured fish will be identified, recorded, measured (fork length, total length, and weight) and released. Endpoints of CPUE, mean length, mean weight, size-frequency distributions, and condition will be calculated and monitored for comparison over time. Monitoring of juvenile rainbow trout in Polley Lake will be undertaken annually in the fall from 2018 to 2020, and the annual frequency will re-evaluated prior to 2021 based on QP recommendations.

In Quesnel Lake, populations of sentinel fish species (northern pikeminnow and redside shiner) will be monitored to evaluate potential effects associated with Mount Polley mine effluent discharge in accordance with requirements for EEM under the MDMER of the federal *Fisheries Act* (Environment Canada 2012; Government of Canada 2018). The fish population survey will be undertaken using prescribed methodology (Environment Canada 2012) and as described in detail in the Study Design report for the Phase 2 EEM (Minnow 2018c). Briefly, sentinel fish population monitoring in Quesnel Lake will evaluate population health (survival, growth, reproduction, and condition) of the two sentinel species. The study will be completed as a conventional (lethal) design (Environment Canada 2012) and will target 20 mature males and 20 mature females of each of the two sentinel species at the exposed area (near the Mount Polley effluent discharge) and at a reference area (Table 8; Figure 5). Fish collections will be completed by hoop netting and gill netting, and all fish measurements will be completed as prescribed by Environment Canada (2012) and as described in detail in Section 4.2. Quesnel Lake fish population monitoring will be completed in early spring when the sentinel species are fully

developed prior to spawning (McPhail 2007; Barrett and Munkittrick 2010). Northern pikeminnow typically spawn in the spring at a threshold temperature of 12 °C and redside shiner typically spawn in the spring at a threshold temperature of 10 °C (McPhail 2007). Both species typically spawn in flowing water over clean gravel substrates, but can also spawn in lakes. Sentinel fish species (up to the target sample size) will be subject to sacrifice and collection of the following measures prescribed for EEM: fork length, total length, weight, liver weight, gonad weight, and fecundity (Environment Canada 2012). Sentinel fish population endpoints (survival, growth, and reproduction) will be calculated for each species-area combination and statistically contrasted between effluent-exposed and reference areas as prescribed under EEM (Environment Canada 2012) and described in Section 4. Fish population monitoring in Quesnel Lake will be undertaken at the prescribed frequency of once every three years, with next collection in the spring of 2019. As outlined in EEM technical guidance, future frequency can change is response to findings. Detailed methodology for fish collection, measurement, tissue sample measurement, sample handling and laboratory analysis, quality control/quality assurance, data quality review, data handling, interpretation, and reporting is provided in Section 4.

3.3 Fish Habitat Characterization and Usage

Fish habitat characterization and usage monitoring is focused on Hazeltine Creek and lower Edney Creek, both of which were physically impacted by the TSF embankment breach (Table 8; Figure 6). Fish habitat characterization will monitor key characteristics of rehabilitated Hazeltine and Edney creek habitat in order to document recovery. Fish habitat usage monitoring will document the use of these rehabilitated creek habitats by all fish species and life stages, including the specific documentation of spawning and rearing in spring, summer, and fall months (May to October). Fish habitat characterization methods will be similar to those previously applied (Minnow 2018b) which are adapted from Johnston and Slaney (1996) and described in detail in Section 4.2. Fish habitat will be characterized in spring, summer, and fall in relation to the needs of fish that could potentially use the habitat (i.e., Polley Lake fish in the case of Upper Hazeltine Creek and Quesnel Lake fish in the case of Lower Hazeltine creek and Lower Edney Creek), and will include documentation of in-stream barriers and cover, spawning and overwintering habitat, riparian features, channel hydrology, bank condition, and water quality parameters. Fish habitat usage will be determined by a combination of visual observation and fish collection with measurement. Fish habitat usage monitoring will commence in the spring (May) once fish have begun to aggregate for spawning, and will be conducted again in the summer (August), and in the fall (September / October, including when fish are spawning). Fish collections will be completed using hoop netting, minnow trapping, fry trapping, seining, and backpack electrofishing (the latter only when appropriate based on non-spawning/egg incubation periods and when juvenile salmonids are not present). All captured fish will be identified and enumerated, and

fishing efforts will be documented for CPUE or density calculations (see following section). Up to 100 individuals from each collected species will be temporarily retained for length and weight measurements, which will be used to calculate summary statistics of length, weight, condition, and size-frequency distributions that will be monitored over time to document recovery. Fish habitat characterization and fish usage monitoring in lower Hazeltine Creek and lower Edney Creek will be undertaken at frequency of every two years starting in 2019[4], and the frequency will re-evaluated prior to 2021 based on QP recommendations. Detailed methodology for fish collection, fish measurement, quality control/quality assurance, data quality review, data handling, interpretation, and reporting is provided in Section 4.

For Upper Hazeltine Creek, fish collection will also include closed-station electrofishing that will provide the best possible estimate of the density of rearing rainbow trout (using removal calculators as outlined in Section 4). Fish capture data will be utilized to document the production of rainbow trout and any temporal changes therein including comparison to historical estimates (e.g., Minnow 2009). Fish meristic data will be used to calculate summary statistics of length, weight, condition, and size-frequency distributions that will also be compared to historical results (e.g., Minnow 2009). Fish habitat characterization and fish usage monitoring in upper Hazeltine Creek will be undertaken at an annual frequency from 2018 to 2020, and the frequency will re-evaluated prior to 2021 based on QP recommendations. Detailed methodology is provided in Section 4.

3.4 Fish Community

Fish community monitoring is a supporting measure to be determined in association with all fish collections (i.e., fish tissue quality monitoring, fish population monitoring, and fish habitat usage monitoring). Fish community monitoring effort will only be as required to collect the fish needed for these other purposes. Thus, the locations, timing, and frequency of fish community monitoring will be as outlined above (Sections 3.1 to 3.3, inclusive). In association with each fishing effort, all captured fish will be identified and counted. Details of each fishing effort (GPS coordinates, gear type and dimensions, and actual fishing time) will be recorded to provide the most quantitative record of fish community results possible. Specifically, the effort details will be collected to support the expression of CPUE on the basis of time (catch per time), area (catch per area), or the combination of gear-dimension and time (e.g., catch per 100 m net-hour). Interpretation of CPUE data will be based on a combination of: 1) comparison to previous conditions; 2) comparison to reference conditions; and 3) comparison of species proportions temporally and spatially (e.g., has the relative abundance rainbow trout versus longnose sucker

[4] Note that fish habitat characterization and usage monitoring in lower Hazeltine Creek will only be initiated after lower Hazeltine Creek is opened up as fish habitat (i.e., ponds and/or fish fences are removed).

changed over time and/or relative to the reference lake). Detailed methodology for fish collection, quality control/quality assurance, data quality review, data handling, data interpretation, and reporting is provided in Section 4.

4 METHODOLOGY

4.1 Quality Assurance / Quality Control

All sampling will be performed by qualified field staff experienced in the implementation of fish and fish habitat monitoring programs. Quality Assurance/Quality Control (QA/QC) measures will be consistent with requirements outlined in the BC Field Sampling Manual (BCMOE 2013) and the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016). Specific QA/QC measures will include program review prior implementation, adequate resources for all field teams including field checklists and field data sheets, the availability and maintenance of appropriate sampling equipment and sampling containers, and sampling in a manner that minimizes any risk of sample contamination (i.e., for tissue quality samples).

To capture within-area variability and support the tissue quality component of the fish monitoring program, eight replicate tissue chemistry samples will be collected from each sampling area. Fish tissue samples will include muscle, liver, kidney, and ovary tissues (or whole body analysis for smaller fish). Field duplicates (i.e., split samples collected from the same fish tissue) will be collected at a frequency of 10% of the total number of tissue samples to assess field precision, and will be evenly distributed among species and tissue types, to the extent possible. A Data Quality Objective (DQO) of <25% RPD will be applied to the duplicate (i.e., split) QC samples.

All chemical analyses will be completed by a laboratory that is accredited by the Canadian Association for Laboratory Accreditation (CALA), and will be required to include specific QC samples and report associated results. Specific QC samples will include laboratory blanks, laboratory replicates, and laboratory accuracy samples (i.e., matrix spikes, laboratory control samples, and/or certified reference materials). The QC sample results will be assessed as part of the Data Quality Review (DQR; Section 4.4). Laboratory reporting Limits (LRLs) will also be evaluated in comparison to targets established by the analytical laboratory.

Raw field data recorded on field sheets will be transcribed into an electronic spreadsheet and data collected using digital data collection devices will be exported from a geodatabase to electronic spreadsheets. Electronic spreadsheets will be checked by a separate individual for entry errors as part of routine QA/QC procedures.

4.2 Sample Collection Methods

4.2.1 Fish Collection

All fish monitoring will be undertaken under fish collection permits from the British Columbia Ministry of Forests, Lands and Natural Resource Operations (FNLNRO) and all fish monitoring in

waters frequented by salmon (e.g., Quesnel Lake and Quesnel River) will also be undertaken under fish collection permits from Fisheries and Oceans Canada (DFO). All conditions associated with the fish collection permits will be strictly adhered to (including the general prohibition of fishing in waters with temperatures >20°C).

Fish collections will be completed in accordance with applicable technical guidance outlined in the BC Field Sampling Manual (BCMOE 2013), the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016), and/or the Technical Guidance Document for EEM (Environment Canada 2012). A variety of fish collection techniques will be applied to collecting the fish required for the monitoring of fish tissue quality, fish populations, and habitat usage. To the extent possible, preference will be for non-destructive fish collection methods (e.g., hoop nets, minnow traps, fry traps, backpack electrofishing) in order to minimize the potential impact of fish monitoring on fish populations and/or communities. The following fish collection techniques will be used to support the CEMP fish monitoring plan:

- hoop netting;
- gill netting;
- minnow trapping;
- fry trapping;
- seining; and
- backpack electrofishing.

Hoop netting will be applied to the collection of large-bodied fish in lakes as the preferred collection method due to the fact that it is a non-lethal method. Hoop nets ranging in size from 0.6 m diameter, 2 cm stretched mesh to 0.75 m diameter, 3.8 cm stretched mesh with four to eight hoops and leads of approximately 30.5 m in length will be set as appropriate to target the fish required for tissue quality monitoring and fish population monitoring, and will be checked at a minimum frequency of every other day (although daily checks will be most common). The location of each net set will be recorded using a handheld GPS accompanied by notes on the set configuration (depth, lead to shore, trap to shore, etc.) and the time of deployment. Upon collection, the time of collection will be recorded and fish will be identified and counted as they are removed from the trap. Target species will be identified, counted, and then retained or measured (depending on the objective of the monitoring component). Non-target species will be identified, counted, and released at the location of capture. Individuals of the target fish species will be measured as outlined in Sections 4.2.2 and 4.2.3, per requirements of the particular monitoring component of the CEMP Fish Monitoring Plan.

Gill nets will be used as required to support hoop netting for fish tissue collection in lakes, as required, with application minimized and short deployment duration. Gill netting will also be applied in Polley Lake in late summer 2018 as a repeat of previous efforts (Lirette 2015, 2017). As required, gill nets will be set in lakes to collect large-bodied fish, consistent with historical sampling (e.g., Minnow 2018a) and recommendations from the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016). Net size and deployment configuration will be as required to most effectively capture target fish. For example, lake trout will be targeted in Quesnel Lake using a Profundal Index Netting methodology similar to the Summer Profundal Index Netting (SPIN) method (e.g., Jessup and Millar 2011). Fall 2018 gill netting in Polley Lake will employ experimental gill nets (two multi-panel gill nets of mesh size 38, 64, 38, and 89 mm), which will be set overnight. The nets will be set perpendicular to shore, with the smallest mesh orientated closest to shore. Set locations and configurations will be similar to those used in 2014 and 2016 (Lirette 2015, 2017). The location of each gill net set will be recorded using a handheld GPS accompanied by notes on the set configuration and the time of deployment. Check and retrieval times will be recorded and fish will be identified and counted as they are removed from the net. For experimental nets, fish counts will be recorded for each gill net panel. Non-target species will be identified, counted, and released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Minnow traps (galvanized mesh – 42 cm length, 0.6 cm mesh, 2.5 cm diameter opening) will be set in lakes and creeks to capture small-bodied fish and juveniles. Juvenile rainbow trout (1+ or 2+ rainbow trout) will be targeted in Polley Lake. Minnow traps will be baited and will be tied off on shore or set on the substrate and marked with a float. Minnow traps set in creeks will be set so that the openings will be oriented upstream and downstream. Minnow traps will be checked at a minimum frequency of every other day (although daily checks will be most common). The location of each trap will be recorded using a handheld GPS accompanied by notes on the set configuration and the time of deployment. The retrieval time will be recorded and fish will be identified and counted as they are removed from the trap. Non-target species will be enumerated by species and released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Fry traps will be set in selected lakes and creeks (Polley Lake, Hazeltine Creek, Edney Creek, and Frypan Creek) to augment minnow trap catches. Traps will be placed in habitat deemed suitable for juveniles (e.g., in slow flowing water near undercut banks, behind woody debris) and oriented with the closed end angled upstream. Traps will be weighed down on the streambed using small stones and will be checked daily. The location of each trap will be recorded using a

handheld GPS accompanied by notes on the set configuration and the time of deployment. Fry traps will be checked at a minimum frequency of every other day (although daily checks will be most common). The retrieval time will be recorded and fish will be identified and counted as they are removed from the trap. Non-target species will be enumerated by species and released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Seining may also be completed in lakes and creeks to augment catches by other techniques. A 15 m long seine with a 0.3 mm mesh size will be used. The seine net will be pulled through shallow habitats by wading through the sampling area; in deeper areas, a boat may be used to pull one end of the seine (BCMOE 2013). Care will be taken to ensure that the lead line remains in contact with the substrate and the float-line remains at the surface to prevent fish from escaping. The contents of the seine will be brought to shore, and depending catch numbers, may be emptied into a water-filled tote and the seine will be inspected to confirm that all fish are removed. The location of each effort will be recorded using a handheld GPS accompanied by notes regarding habitat features and the area and maximum depth sampled. The date and time will be recorded and fish will be enumerated by species. Non-target species will be released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Open-station and/or closed-station backpack electrofishing will be completed in Polley Lake (along the shoreline) and in creeks. All electrofishing will be completed by an experienced and certified electrofishing team, consisting of a backpack electrofisher operator and one or more netters using electrofisher settings appropriate for the target species (i.e., frequencies and pulse width) and starting with lowest possible power output (voltage and duty cycle). Open stations will be fished by single electrofishing pass in an upstream direction. During open-station electrofishing, the operator will create a series of smooth, zig-zagging sweeps with the anode. Fish will follow the anode; therefore, the operator will move the anode towards the netter, who will net the stunned fish. Closed stations will be created using 3/8” mesh stop nets and care will be taken to ensure that the enclosed habitat is suitable for the potential presence of target fish. The dimensions (length and wetted and bankfull widths) and water depth (average of three measures) of each open and closed station will be measured at equally-spaced transects using a measuring tape and meter stick, respectively. During each closed station electrofishing effort, the electrofisher operator and netter will employ a multiple pass removal method at each station whereby one upstream pass (or “sweep”) of the enclosed reach is repeated three or more times to yield a fish removal pattern (i.e., diminishing catches) that can be used to determine fish density

using removal method equations. Fish captured during each open electrofishing pass or closed station sweep will be placed in separate buckets of aerated water. The location of each effort will be recorded using a handheld GPS accompanied by the start and end times and active electrofishing seconds. The total sampling area will be documented, along with a habitat descriptions that include observations of stream morphology and substrate characteristics, riparian vegetation and relative stream shading, as well as any potential confounding influences or other observations deemed relevant to interpretation of the fish survey data. The fish in each bucket will be enumerated by species. Non-target species will then be released at the location of capture. Depending on the objective of the monitoring component, individual fish of the target species will be measured immediately or retained for measurement as outlined in Sections 4.2.2 and 4.2.3.

Fish will be captured from the Quesnel River by angling (targeting rainbow trout for fish tissue quality monitoring). Angling will be conducted using barbless, single hook lures, and/or flies. The general location of each effort will be recorded using a handheld GPS accompanied by notes on the hooks/lures/flies used, effort duration, and habitat. Captured fish will be identified and counted. Non-target species will be released at the location of capture and target species will be retained or measured. Retained rainbow trout will be measured as outlined in Sections 4.2.2 and 4.2.3, per requirements of the particular monitoring.

All fishing effort data will be recorded on field sheets or digital data collection devices. *In situ* water quality measurements (i.e., temperature, pH, dissolved oxygen, conductivity, and specific conductance) will also be recorded to support fishing efforts.

4.2.2 Fish meristic data

Meristic measurements on fish that will not be retained for lethal sampling will be recorded prior to releasing the fish at their point of capture. Fish retained for lethal sampling will be anesthetized using a clove oil solution or will be euthanized with a decisive blow to the head and spinal severance. Fish will be subjected to measurement of fork length, total length, and body weight (BCMOE 2013). Fork and total length of large-bodied fish will be measured to the nearest millimeter using a measuring board and fork and total length of small-bodied fish will be measured to the nearest 0.1 mm using digital calipers. Fresh body weight will be measured using an analytical balance or a set of Pesola™ spring scales (depending on fish weight). The Pesola™ scales are demarcated at intervals of 1 to 2% of the total scale range, providing an accuracy of plus or minus (±) 0.3% of the fish mass. The Pesola™ spring scale for individual weight measurement will be selected so that the fish weight is near the top of the scale's range to ensure that measurements achieve a resolution near 1%. Northern pikeminnow and redside shiner that will be lethally sampled as part of MDMER/EEM will also undergo an external health assessment

(Environment Canada 2012). Following external health assessment, each fish will be cut open and sex will be recorded. Gonads and liver will be removed for weighing and sampling as required. Tissues will be weighed to the nearest milligram using a portable analytical balance (capable of measurement to 0.001 g). For EEM, whole ovaries from sexually mature females will be placed in individually labelled sample vials and preserved with a 10% buffered formalin solution for determination of fecundity.

Age structures will be retained for all fish collected for fish tissue quality monitoring using available guidance for the best age structure for each species (e.g., Environment Canada 2012). Otoliths will be removed and used as the primary aging structure for all fish species except for sucker. Pectoral fin rays will be removed and used as the primary aging structure for sucker. Scales will also be collected for use as backup structures for age determination. Aging structures will be wrapped in waxed paper, and placed in labelled coin envelopes, which will then be frozen prior to submission to a qualified fish aging laboratory.

4.2.3 Fish Tissue Quality

For large-bodied fish targeted for tissue quality monitoring, tissue quality samples will be collected after meristic measures are collected and will include muscle, liver, kidney, and ovary (the latter as available). For small-bodied fish targeted for tissue quality monitoring (i.e., juvenile northern pikeminnow and peamouth chub), whole body samples will be analyzed for tissue chemistry. Tissue samples (muscle, liver, kidney, and/or ovary) will be removed, weighed to the nearest 0.001 g (±1% precision) using an analytical balance, placed in labelled Whirl-Pak™ bags, and frozen until analysis. All tissue samples will be collected using clean implements (cutting boards, filet knives, and tweezers; BCMOE 2016). Livers and kidneys will be collected whole, whereas approximately 10 to 50 g of boneless, skinless muscle will be collected, and a similar sized ovary sub-sample will be collected when available (or will be collected whole if smaller than this). Duplicate QC samples (i.e., split samples collected from the same fish tissue) will be collected for 10% of tissue samples to assess field precision, and will be evenly distributed among species and collected tissue types, to the extent possible. A DQO of <25% RPD will be applied to the duplicate (i.e., split) QC samples.

4.2.4 Fish Habitat Characterization and Usage

Habitat characterization methods will include those applied in 2016 and 2017 (Minnow 2018b; adapted from Johnston and Slaney 1996). Data will be recorded on field data sheets or using digital data collection devices. The following characteristics will be documented:

- stream dimensions (i.e., wetted and bankfull width, length, and depth) within each habitat unit;

- channel gradient;
- substrate type;
- in-stream barriers and cover;
- the presence/absence of spawning and overwintering habitat;
- riparian features (e.g., vegetation types and canopy cover);
- channel hydrology;
- bank condition; and
- *in situ* water quality.

Habitat characterization methods will be a composite of two standard methods: 1) Reconnaissance Fish Habitat Inventory (RIC 2001); and 2) Level 1 Field Fish Habitat Assessment ("Habitat Unit Assessment"; Johnston and Slaney 1996). Habitat characterization using methods adapted from RIC (2001) will be completed at replicate stations (three per area) and will include include measures of channel dimensions, water velocity, and in situ water quality at each station. Channel dimensions (bankfull width, wetted width, and a minimum of 5 incremental wetted depth measures), will be measured using a tape measure and metre stick. Water velocity will be measured using a portable velocity meter. At each velocity transect, water velocity, wetted depth, and bankfull-wetted depth will be measured at a minimum of five incremental distances (points) along one wetted channel cross-sectional width. Water velocity measurements will be obtained at 60 percent of depth as an estimate of the mean vertical velocity at each measurement point. In situ water quality measures will include temperature, specific conductance, dissolved oxygen, and pH using a calibrated handheld portable field meter. Additional habitat characteristics to be assessed at each station will include description of channel bed features (substrate type, relative proportion of each substrate type, etc.), channel and bank gradient, substrate size, bank stability, riparian vegetation (vegetation types, overhead shading), and in-stream cover (as the relative proportion that each contributed to total creek surface area at each station). Substrate size will be assessed (100 randomly selected rocks per station) for the purpose of monitoring temporal changes in substrate size distribution. Photographs of representative habitat will be taken at each station in each season to further support the habitat descriptions. During each seasonal survey, any unique or significant physical or biological features (e.g., tributaries, groundwater seeps, partial or seasonal fish barriers to fish migration) will be documented, including a brief description of the feature, together with its GPS coordinates. In addition, the GPS coordinates of pools present in the rehabilitated and reference reaches, and physical dimensions of the pools (length, width, and maximum depth) will be recorded.

Habitat assessment using Level 1 Field Fish Habitat Assessment methods ("Habitat Unit Assessment"; Johnston and Slaney 1996) will also be undertaken. At least seven consecutive habitat units (i.e., pool, glide, or riffle) will be identified towards the center of each reach and the dimensions of each habitat unit will be recorded. Specifically, the length, mean width (wetted and bankfull; mean of at least 3 measures), and mean depth (wetted and bankfull; mean of at least 5 measures) will be determined for each habitat unit using a tape measure and meter stick. For pools, the maximum and residual (maximum minus crest depth) wetted depth will also be measured, as well as pool type. A minimum residual depth of 0.2 m is required for classification of a habitat unit as a pool (Johnston and Slaney 1996). Additional habitat characteristics assessed at each habitat unit will include included channel gradient, substrate type, riparian vegetation (vegetation types, growth stage, and canopy cover), in-stream cover, access to off-channel habitat, the number of pieces of large woody debris (LWD) present, and indicators of disturbance.

Fish habitat usage monitoring will document the use of these rehabilitated creek habitats by all fish species and life stages, including the specific documentation of spawning and rearing in spring, summer, and fall months (May to October). Fish habitat usage will be determined by a combination of visual observation and fish collection using techniques described above (hoop netting, minnow trapping, fry trapping, seining, and backpack electrofishing; the latter only when appropriate based on non-spawning/egg incubation periods and when juvenile salmonids are not present). All captured fish will be identified and enumerated, and fishing efforts will be documented for CPUE or density calculations (as described above). Any observations of specific behaviours (e.g., spawning) will be noted.

4.3 Sample Handling and Laboratory analysis

To the extent possible, sample handling and laboratory analyses will be completed in accordance with technical guidance outlined in the BC Field Sampling Manual (BCMOE 2013), the Water and Air Baseline Guidance Document for Mine Proponents and Operators (BCMOE 2016), the Technical Guidance Document for EEM (Environment Canada 2012), and the BC Environmental Laboratory Manual (BCMOE 2015).

At the termination of each field program or at intervals of no more than seven days, fish tissue samples will be shipped in coolers with ice packs and chain-of-custody forms (COCs) to the analytical laboratory. Shipment transit time will be less than one day. Chemical analyses will be completed by a CALA-accredited analytical laboratory and will include moisture content and total metal concentrations (Table 9). Concentrations of mercury and other metals will be analyzed using Cold Vapour Atomic Fluorescence Spectrophotometry (CVAFS; USEPA [United States Environmental Protection Agency] Method 200.3/245.7) and Collision Cell Inductively Coupled

Table 9: Analytes and Laboratory Reporting Limits for Mount Polley CEMP Fish Tissue Quality Monitoring

Analyte	Target LRLs	Units	Consensus DLs [1]	Units	Consensus DLs [1] as dw [2]	Units	Tissue Quality Guidelines
Physical Tests							
Moisture		% ww	1	% ww	-	% ww	-
Metals							
Aluminum	2	mg/kg dw	0.4	mg/kg ww	1.6	mg/kg dw	-
Antimony	0.01	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	-
Arsenic	0.02	mg/kg dw	0.005	mg/kg ww	0.02	mg/kg dw	-
Barium	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Beryllium	0.01	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	-
Bismuth	0.01	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Boron	1	mg/kg dw	-	mg/kg ww	-	mg/kg dw	-
Cadmium	0.005	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	-
Calcium	5	mg/kg dw	2	mg/kg ww	8	mg/kg dw	-
Chromium	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Cobalt	0.02	mg/kg dw	0.004	mg/kg ww	0.016	mg/kg dw	-
Copper	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Iron	3	mg/kg dw	1	mg/kg ww	4	mg/kg dw	-
Lead	0.02	mg/kg dw	0.004	mg/kg ww	0.016	mg/kg dw	-
Lithium	0.5	mg/kg dw	-	mg/kg ww	-	mg/kg dw	-
Magnesium	2	mg/kg dw	2	mg/kg ww	8	mg/kg dw	-
Manganese	0.05	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Mercury	0.005	mg/kg dw	0.002	mg/kg ww	0.008	mg/kg dw	0.5 mg/kg ww [3]
Molybdenum	0.02	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Nickel	0.2	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Phosphorus	10	mg/kg dw	5	mg/kg ww	20	mg/kg dw	-
Potassium	20	mg/kg dw	10	mg/kg ww	40	mg/kg dw	-
Selenium	0.05	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	11 mg/kg dw [4]
Silver	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Sodium	20	mg/kg dw	2	mg/kg ww	8	mg/kg dw	-
Strontium	0.05	mg/kg dw	0.01	mg/kg ww	0.04	mg/kg dw	-
Thallium	0.002	mg/kg dw	0.001	mg/kg ww	0.004	mg/kg dw	-
Tin	0.1	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Titanium	0.2	mg/kg dw	0.06	mg/kg ww	0.24	mg/kg dw	-
Uranium	0.002	mg/kg dw	0.001	mg/kg ww	0.004	mg/kg dw	-
Vanadium	0.1	mg/kg dw	0.02	mg/kg ww	0.08	mg/kg dw	-
Zinc	0.5	mg/kg dw	0.1	mg/kg ww	0.4	mg/kg dw	-

[1] From Water and Air Baseline Monitoring Guidance Document for Mine Proponents and Operators (BCMOE 2016).

[2] Calculated based on a 75% moisture content.

[3] Health Canada guideline for mercury (CFIA 2015).

[4] British Columbia Water Quality Guideline for aquatic life for selenium in fish ovary tissue (BCMOE 2014). Additional guidelines for the protection of aquatic life of 4 mg/dw in fish muscle or whole fish and for the protection of human health at moderate consumption levels (14.5 mg/kg dw for the general population) will also be applied.

Plasma-Mass Spectrometry (CRC-ICP-MS; USEPA Method 200.3/6020A) or High Resolution Inductively Coupled Plasma-Mass Spectrometry (HR-ICP-MS; USEPA Method 200.3/200.8), respectively (USEPA 1991, 1994, 2001, 2004). All samples will be submitted to the laboratory with a chain-of-custody (COC) record, a list of expected Laboratory Reporting Limits (LRLs), and laboratory QA/QC requirements.

Aging structures will be shipped to a qualified fish ageing laboratory, along with a chain-of-custody form (COC), for determination of fish ages. At the fish aging laboratory, samples will be thawed, otoliths extracted from heads if required, and the otoliths and fin rays will be sectioned, mounted on a glass slide using a mounting medium, and then read under a compound microscope using transmitted light. For each structure, age and edge condition will be recorded along with a confidence rating for the age determination. Scales collected as backup structures will only be used as required. Similarly, preserved egg samples will be shipped to a qualified laboratory, along with a chain-of-custody form (COC), for determination of fecundity. Methods for determining fish age and fecundity will be fully consistent with the technical guidance (Environment Canada 2012).

4.4 Data Quality Review

Upon receipt of fish tissue quality data from the analytical laboratory, a Data Quality Review (DQR) will be performed. The DQR will confirm that all requested analyses are complete, and that acceptable LRLs are achieved. The DQR will also include an evaluation of differences between duplicate (i.e., split) samples, as well as the QA/QC data reported by the laboratory. Completion of the DQR promptly following receipt of the tissue quality data will ensure timely communication with the laboratory should any issues be identified.

Comparisons between duplicate samples will be made by calculating the RPD for concentrations measured in paired samples. If the RPD is <25% for concentrations that are >5 times the LRL, then the duplicate sample results will be considered acceptable. Analyte concentrations in laboratory blank samples will be evaluated in relation to their respective LRLs, and the results will be used to identify potential contamination associated with equipment (e.g., cleanliness) and sample collection and handling procedures (e.g., collection, shipping).

4.5 Data Handling, Interpretation, and Reporting

Catch-per-unit-effort (CPUE) and summary statistics for meristic measurements taken in the field will be calculated. CPUE will be calculated for each fish species by fishing method and sampling area. For hoop netting, minnow trapping, and fry trapping efforts, CPUE will be expressed as number of fish per day. For seining, CPUE will be calculated as the number of fish per square metre. CPUE will be calculated as the number of fish per 100 electrofishing seconds for open-

station electrofishing efforts. For closed station electrofishing, density will be determined using removal calculators (i.e., number of fish per unit area determined using Moran-Zippin estimators; Ricker 1971). CPUE for gill netting and angling will be calculated as the number of fish captured per square metre-hour and the number of fish per angler day, respectively.

Although community and population data is collected during every phase or component of the fish monitoring program, the sample size will be defined by the study objectives and may be insufficient to address corollary questions. For example, the sample size required for tissue quality analyses (n = 8) is not large enough to support formal contrasts of population endpoints. To this end, evaluation of fish community data will rely on qualitative comparisons, and conclusions regarding fish populations will be supported by non-lethal measurements and sampling under the MDMER/EEM (with larger sample size), as described in Section 4.2.2 and below. Analysis methods for the MDMER/EEM fish population data will be consistent with EEM technical guidance (Environment Canada 2012). Summary statistics, including mean, median, minimum, maximum, standard deviation, standard error, and sample size, will be calculated for fish age, fork length, total length, body weight, condition, liver weight, gonad weight, and fecundity; calculations will be completed according to species and area. In a lethal design EEM fish survey, detailed statistical analyses will focus on indicators of survival, energy use, and energy storage and will be completed based on guidance from Environment Canada (2012). These indicators include fish age, size-at-age, gonad size relative to body weight, condition, liver size relative to body weight, and fecundity, and egg size relative to body weight (Table 10). In a non-lethal design, histograms will be used to examine length-frequency distributions by species and area, and indicators include fish size and condition. All data sets will be assessed for normality and equality of variance in order to determine the suitability of parametric statistical procedures. An effect on the fish population will be evaluated for each of these measures and is defined as a statistically significant difference between the effluent-exposed area and the reference area (Environment Canada 2012). For each endpoint, statistically significant differences between effluent-exposed and reference areas (by species and sex) will be assessed using ANOVA, Analysis of Covariance (ANCOVA), or non-parametric equivalents, as appropriate, following technical guidance (Environment Canada 2012).

For the fish tissue data sets, statistical comparisons of age, length, weight, and concentrations of metals in fish tissues (n = 8) will be completed among years and locations. Following completion of the DQR, fish tissue quality data will be provided to the QP and summarized according to species, tissue type, and area. The LRL for each analyte and the number of samples below the LRL will be determined. Censored data will be managed using methods described in Helsel (2012), and those used in the R package NADA: Non-detects and Data Analysis for Environmental Data (Lee 2017). Any value below a LRL (i.e., a <LRL result) that exceeds the

Table 10: Survival, Energy Storage, and Energy Use Endpoints for Mount Polley EEM Fish Population Evaluation

Response		Measurement Endpoints [a]	Statistical Procedure
Effects on Fish [a]	Survival	Age	ANOVA[c]
	Energy Use	Size-at-age (body weight against age)	ANCOVA[c,d]
		Relative gonad size (gonad weight against body weight)	ANCOVA[c,d]
	Energy Storage	Condition (body weight against length)	ANCOVA[c,d]
		Relative liver size (liver weight against body weight)	ANCOVA[c,d]
Supporting Response Variables [b]	Energy Use	Relative fecundity (# of eggs/female against body weight)	ANCOVA[c,d]
		Relative egg size (mean egg weight against body weight)	ANCOVA[c,d]

Notes: ANOVA = Analysis of Variance; ANCOVA = Analysis of Covariance; # = number.

[a] Endpoints to be used for determining "effects" as designated by statistically significant differences between effluent-exposed and reference areas.

[b] These analyses are for informational purposes and significant differences between exposure and reference areas are not necessarily used to designate an effect (Environment Canada 2012).

[c] Or appropriate non-parametric equivalent, as required.

[d] For the ANCOVA analyses, the first term in parentheses is the endpoint (dependent variable Y) that is analyzed for an effluent effect. The second term in parentheses is the covariate, X (age, weight, or length).

maximum detected value for that parameter at the given station will be removed. The removal of the poor LRLs does not influence the estimation of the mean or standard deviation, but does influence the overall sample size. The sample size, mean, median, standard deviation, standard error, minimum, maximum, 5th percentile, and 95th percentile will be calculated for each analyte. Means will be calculated using the Kaplan-Meier (K-M) method. The standard deviation and the median for each analyte will also be calculated using the K-M method. When a standard deviation cannot be estimated (i.e., when an analyte has a high proportion of censored values), it will be reported as "not calculated".

Statistical comparisons of age, length, weight, and concentrations of metals in fish tissues will be completed among years and locations. Statistical comparisons among groups will completed using an analysis of variance (ANOVA) if assumptions of normality and homogeneity of variances are met. These assumptions will tested using the Shapiro Wilk's test and Levene's test (α=0.05), respectively. Data will be transformed, as required, to meet these assumptions. If the assumptions cannot be met, the Kruskal-Wallis test will be used. Response variables with censored observations will be compared among groups using the Wilcoxon score test. Specific contrasts will be conducted after an overall significant difference among groups. Bonferroni adjustments to the p-values will be made to maintain the family-wise Type I error rate at α=0.05. A magnitude of difference (MOD) will be calculated for each contrast. For metals for which information is available on accumulation in specific organs (e.g., copper accumulation in fish liver; Grosell 2012), interpretation will focus on the results associated with that organ.

Statistical comparisons of concentrations of mercury in fish tissue will be compared using analysis of covariance (ANCOVA) with fork length as a covariate (as mercury is known to bioaccumulate in fish tissue; e.g., Kidd and Batchelar 2012). The response variable and covariate will be $\log_{10}$-transformed, as required, for analysis. The significance of the interaction term of the ANOVA model will be assessed to compare regression slopes between groups. If the interaction term is not significant (α=0.05) it will be removed and the parallel slope ANCOVA model will be fit. If the fork length is not a significant predictor of mercury concentration in the parallel slope ANCOVA model, it will be removed from the model and comparisons of mercury concentrations between groups will be conducted using a t-test. If the fork length is a significant predictor of mercury concentration in the parallel slope ANCOVA model, comparisons of mercury concentrations between groups will be assessed using the group term of the model. Adjusted means will be reported for the average (geometric mean) fork length from the parallel slope ANCOVA model. A MOD will be calculated for each contrast.

Fish tissue quality data will also be evaluated in comparison to tissue quality guidelines for human health and/or for aquatic ecosystem health (available for mercury and selenium). Tissue quality

guidelines will include the Canadian Food Inspection Agency/Health Canada mercury guideline for the protection of human health (0.5 milligrams per kilogram wet weight [mg/kg ww]; CFIA 2015) and the BC selenium guidelines (BCMOE 2014). Selenium guidelines for BC include guidelines for the protection of human health, which are based on fish consumption levels (7.3 milligrams per kilogram dry weight [mg/kg dw] for subsistence consumers, 14.5 mg/kg dw for the general population, and 75 mg/kg dw for the recommended two servings of fish per week). Selenium guidelines for BC also include guidelines for the protection of aquatic life, which are 4 mg/kg dw in muscle tissue and whole body samples, and 11 mg/kg dw in egg/ovary tissues. Selenium concentrations in fish ovaries will also be compared to the threshold for reproductive effects in eggs and ovaries (20 mg/kg dw; DeForest et al. 2012).

Results of the fish habitat characterizations for Upper Hazeltine, Lower Hazeltine, and Lower Edney creeks will be summarized, along with fish usage results, according to season (spring, summer, and fall) and year. Fish habitat characterization measures will be summarized by season, reach, and area (rehabilitated and reference), with summary statistics (mean and standard deviation) calculated for all numerical parameters. These summarized variables will then be compared to general habitat preferences for relevant fish species. Additionally, recorded habitat measures will also be compared to "optimal" ranges of habitat parameters indicated in Habitat Suitability Index (HSI) models (i.e., suitability index value = 1) or in the literature (where available) for those fish species identified in rehabilitation design criteria and objectives. Specifically, mean results for habitat measures collected in each season at each reach will be compared to the tabulated optimal "habitat suitability criteria" ranges and identified as either meeting or not meeting these criteria. The proportions of habitat measures meeting the habitat suitability criteria in the rehabilitated and reference areas, respectively, will also be compared.

Habitat unit assessment measures will be summarized by habitat unit type within each reach, with mean values calculated for all numerical parameters. Measures will be used to calculate endpoints such as bankfull width to depth ratio, channel complexity, % pool, pool frequency, and LWD pieces per bankfull channel width. These endpoints and other observational measures (presence of off-channel habitat) will then be evaluated relative to diagnostics of salmonid habitat condition modified from Johnston and Slaney (1996), rated as poor, fair, or good. Lastly, quantitative (closed station) data will be used to determine fish density (number of fish per unit area determined using Moran-Zippin estimations; Ricker 1971). The presence and abundance of juvenile rainbow trout in these creeks will be compared to densities previously observed in Edney and Bootjack creeks (Minnow 2014a).

An interpretive report based on the fish monitoring data will be prepared to be integrated into the Annual Environmental and Reclamation Report for the Mount Polley Mine that is prepared

annually by MPMC and submitted to the regulators and other stakeholders by March 31 of the following year. The interpretive report will provide all data in an appendix and will include the DQR, the results of the screening against BCWQGs, and the results of temporal and spatial comparisons. All data interpretation will be summarized in clear text form supported by tables and data plots.

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Appendix B.5

Wildlife, Soil, Soil Invertebrate, and Vegetation Monitoring

Golder Associates Ltd.

TECHNICAL MEMORANDUM

DATE 9 August 2018 **Reference No.** 1894924-025-TM-Rev1-23182

TO Stephen Monninger
Mount Polley Mining Corporation

CC Colleen Hughes

FROM Blair McDonald and Barbara Wernick **EMAIL Blair_McDonald@golder.com; Barbara_Wernick@golder.com**

STUDY DESIGN CONCEPT: TERRESTRIAL COMPONENT FOR THE MOUNT POLLEY MINE COMPREHENSIVE ENVIRONMENTAL MONITORING PLAN – MOUNT POLLEY MINE

1.0 INTRODUCTION

1.1 Purpose of the Study Design Concept

Mount Polley Mining Corporation (MPMC) is preparing a Comprehensive Environmental Monitoring Plan (CEMP) to integrate the environmental monitoring components from a variety of regulatory processes applicable to the Mount Polley Mine into a single document. An Ecological Risk Assessment (the ERA; Golder 2017) was prepared that integrated the available chemical and biological information to provide an overall conclusion about the magnitude and extent of ecological risks associated with the deposit of tailings. The ERA was accepted by the Ministry of Environment & Climate Change Strategy (ENV) on 31 January 2018, contingent on the implementation of additional monitoring in relation to specific areas of uncertainty identified in the ERA. There were several points of uncertainty in the terrestrial ERA with respect to plants, soil invertebrates and wildlife and these are outlined in Table 53 of the ERA. The purpose of this memorandum is to outline the monitoring concept proposed to MPMC to address those terrestrial ERA uncertainties in the CEMP. Contingent on acceptance by ENV, a detailed study design document and specific work instructions will be prepared by Golder as the basis for executing of the CEMP process.

1.2 Scope and Approach of the Risk Assessment

The ERA evaluated the site conditions as they existed in the first few years after the failure of the glacial lacustrine layer beneath the Perimeter Embankment of the Tailings Storage Facility. The terrestrial ERA included the “floodplain” area where the forest and native soils were removed by the debris flow, and the “halo” area where the forest floor was relatively undisturbed but buried to varying depths by scoured material and tailings. Tailings can limit the successful re-establishment of ecological communities because of a variety of chemical and/or physical limitations in the soil (Hossner and Hons 1992). The ERA used a “triad” style approach to evaluate the relative influence of physical issues versus chemical issues for a given receptor group using three different types of information:

- What is the magnitude of the exposure associated with tailings?
- What is the magnitude of effects associated with tailings under controlled experimental conditions?
- What is the magnitude of effects associated with tailings under field conditions?

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Copper was identified as the primary contaminant of concern. The ERA also found that the bioavailability of copper in tailings at the site was low. A low bioavailability does not mean that bioaccumulation was zero as copper has bioaccumulated in different parts of the ecosystem at concentrations that are greater than reference areas. However, the overall conclusion, based on a weight-of-evidence integration of the available information collected over several years, was that risks associated with copper were low, and that the effects associated with nutrient deficiencies and soil structural limitations were likely to be a larger influence on the long-term management goal of reintroducing a biologically diverse, functional and self-sustaining ecosystem. As with any complex risk assessment, there was uncertainty associated with the risk conclusions which were described in the risk assessment.

1.3 Summary of Main Areas of Uncertainty

The study design concept focuses on reducing the main sources of uncertainty described in Table 53 of the ERA. In brief, the main sources of uncertainty in the terrestrial ERA were:

1) Field-based monitoring of the diversity or abundance of plants, soil invertebrates or other parts of the soil ecosystem is valuable in an ecological risk assessment but was not practical in the current application because of the expected variability related to natural successional changes.

2) The ability to quantify the relative influence of copper versus the physical limitations of the soil is important from a theoretical perspective. This would typically be evaluated using controlled experiments. However, further experiment-based studies are not warranted unless there is evidence (from field monitoring) that natural succession is not progressing. It is reasonable to continue refining the site-specific understanding of copper bioaccumulation in plants and soil invertebrates in lieu of further experimental studies while the long-term field monitoring is executed.

3) Risks to wildlife are assessed with a single technique (a food chain model). Conservative assumptions were used in the model. Hazard quotients were less than 1 for eleven of the 15 receptor species evaluated in the model. Further refinement of the wildlife food chain model was requested with respect to the four receptor species that had a hazard quotient greater than 1.

Each of these main sources of uncertainty are addressed in further detail in Section 3.

2.0 BASIS OF DESIGN

Golder understands that MPMC is structuring the CEMP to be a stand-alone document that does not require reviewers to have a detailed understanding of the ERA. A summary of the available data and how those data were evaluated in the ERA (Golder 2017) is provided in this section as context for the specific recommendations in Section 4.

2.1 Plants

Information relevant to plants that was evaluated in the ERA included:

- Concentrations of metals in tailings were lower than numerical standards for the protection of soil invertebrates and plants, except for copper (and marginally, vanadium).
  - For copper, the numerical standard is 150 mg/kg. The 95% upper confidence limit of the mean (UCLM) concentration in untreated tailings was 737 mg/kg. Treatment (scarification, intermixing or transplanting soils) resulted in 95% UCLMs ranging from 197 to 538 mg/kg.
  - For vanadium, the numerical standard is 200 mg/kg. The 95% UCLM vanadium concentration in untreated tailings and the three treatment types were less than the numerical standard. Vanadium was retained as a contaminant of potential concern because the 90th percentile concentration in untreated tailings was marginally greater than the standard (213 mg/kg versus 200 mg/kg).
- A 42-d lodgepole pine (*Pinus contorta*) and bluebunch wheatgrass (*Pseudorogneria spicata*) germination and growth toxicity test was conducted on two representative samples of tailings (Section 3.3.3 of the ERA). Seedling emergence or survival was not impacted, but greater than 20% reductions in growth were observed for both species compared to the performance of a negative control consisting of clean silica sand of a similar grain size. All plants demonstrated some degree of growth over the 42-day exposure, despite copper concentrations ranging from approximately 800 to 1100 mg/kg.
- Multiple lines of evidence in the ERA demonstrated that copper had low bioavailability. The lines of evidence included geochemical modeling and three different chemical surrogate measurements in tailings samples (water soluble fraction; humidity cell and leach tests; physiological-based extraction tests – see Section 3.2.2 of the ERA). The toxicity testing (see above) also included a side-by-side trial where an equivalent concentration of copper was added to clean silica sand (in the form of copper sulphate). The bioavailability of copper from tailings was much lower than copper added to the tailings.
- There were physical effects of tailings on plant growth. The toxicity testing (see above) found that tailings tended to form hard crusts and germination was highest in the surface cracks. The measured bulk densities of tailings, till and lacustrine deposits at the site were greater than values from the literature that correspond to reductions in plant growth. Nutrient levels in the tailings were also limited and in a range that could limit plant growth (see Section 3.2.3.2 of the ERA).
- Plants appeared to bioaccumulate copper, but bioaccumulation factors were less than 1 and the bioaccumulation was concentration-dependent. There were no obvious differences in copper bioaccumulation during the 42-d toxicity testing (see above) between tailings and copper added to soils. There was no consistent pattern where copper concentrations in field-collected plant samples were greater in the impacted areas than in background and/or baseline samples (see Section 3.3.2.2 of the ERA). Copper concentrations were within the range of concentration considered to be adequate for plant growth (see Section 3.3.2.4 of the ERA) despite being collected over a wide range of soil concentrations. Overall, these lines of evidence demonstrate that many plants can control the uptake of copper.

2.2 Soil Invertebrates

The ERA involved fewer lines of evidence for soil invertebrates because: a) the findings of low copper bioavailability from plants would be expected to be consistent for soil invertebrates, and b) the physical alterations to the soil and habitat would be expected to have a more significant effect on soil invertebrates. Further discussion about the overall ecological succession expected at the site is provided below in Section 3.1. Additional information specific to soil invertebrates that was considered in the ERA included:

- There were relatively few soil invertebrates collected in 2015 and 2016. Composite samples were collected for beetles/ants (n = 15), spiders (n = 4), and worms/slugs (n = 8). Between two and four tissue samples of each soil invertebrate type were collected from background areas and the data used in a control chart (i.e., the average ± 2 standard deviations [SD]). There was a high degree of variability between individual samples in a given tissue composite type, but the average concentration of copper in beetle/ant composite samples was higher than the average (+ 2SD) upper limit of the control chart.
- The limited number of worm/slug samples had an average copper concentration that was within the range of copper tissue concentrations from laboratory studies that had the potential for reduced survival, growth or reproduction of soil invertebrates. There was not sufficient data to determine the relationship between soil concentrations and the tissue concentration of specific types of soil invertebrates, and many of the papers that evaluated the critical body residue of copper in soil invertebrates acknowledge that there are many factors that can limit site-specific bioavailability. The available data were thus not definitive that a risk to soil invertebrates is present but did provide a qualitative indicator that monitoring was appropriate.

2.3 Wildlife

Risks to wildlife were evaluated using a food chain model. In brief:

- A total of 15 surrogate species were selected from different feeding guilds (e.g., herbivores, carnivores; Table 1). Species-specific variables such as body weight, ingestion rates, and dietary preferences were adopted from federal risk assessment guidance or other reputable sources.
- Realistic worst-case exposure concentrations were determined for soil, water and the various dietary items, typically based on the 95% upper confidence limit of the mean. Site-specific bioaccumulation models were developed and used to predict tissue concentrations from soil concentrations. Bioaccumulation factors for small mammal tissue concentrations (needed to evaluate risk to carnivores) were taken from the literature.
- Relative bioavailability was used to calculate the dose for the wildlife receptors. Relative bioavailability of copper in water was assumed to be 100%. Relative bioavailability of copper in soil was based on site-specific physiologically-based extraction test (PBET) data. Relative bioavailability of copper in dietary items was assumed to be 40% based on information from the literature.
- The total amount of copper ingested per day was compared to conservative toxicity reference values. The food chain model was run separately for different areas and different soil rehabilitation approaches (i.e., transplanted, scarified or intermixed). A risk estimate for each surrogate species was calculated for the entire study area using area weighting. Risks were also calculated for background areas for context.

- Hazard quotients (HQ) were less than 1 for all receptors exposed to vanadium, and most receptors exposed to copper. HQs were greater than 1 for robin, common nighthawk, olive-sided flycatcher and masked shrew. The aggregate HQs (i.e., the area-weighted HQ for the site as a whole) for those four receptors ranged from 1.7 to 2.8. The maximum observed HQ for an individual subarea was 5.1 for masked shrew in the Polley Flats area.
- A hazard quotient greater than 1 does not mean that there are risks to wildlife. The food chain model used many conservative assumptions which were identified in the terrestrial ERA. HQs were also greater than 1 for olive-sided flycatcher and masked shrew exposed to background copper concentrations.

Table 1: Wildlife receptors evaluated with the food chain model

Receptor Group	Feeding Guild	Surrogate Species
Birds	Herbivore	Dark-eyed junco
	Insectivore	Robin; olive-sided flycatcher; common nighthawk
	Omnivore	Raven
	Carnivore	Northern pygmy owl
	Piscivore	Osprey, great blue heron
Mammals	Herbivore	Meadow vole; mule deer
	Insectivore	Masked shrew
	Omnivore	Deer mouse
	Carnivore	Ermine, fisher
	Piscivore	River otter

3.0 FURTHER CONSIDERATION OF UNCERTAINTY

3.1 Uncertainty Related to Ecological Succession

A “triad” style approach (exposure, experimental effects, field effects) is common in weight-of-evidence because the three different types of information are complementary. A well-designed field study provides a meaningful evaluation of risks because it provides direct information about what is being protected under realistic conditions. However, field studies are not always able to determine the cause of effects (if any are observed) and can be confounded by many different variables. Many of those variables (e.g., weather) are unrelated to the management question being evaluated.

A “triad” approach was used in the terrestrial ERA but it was not possible to assess every terrestrial receptor with a field study. In areas of the site that were subjected to extensive scouring, there was a near-complete loss of natural soils and their related ecological communities (i.e., soil microbes, fungi, invertebrates and plants). Quantitative assessment to establish the magnitude of that physical impact was unnecessary. Field measurement of the structure of the plant or soil invertebrate community was not possible because recolonization and ecological succession had only just started. Nevertheless, field studies are expected to be an important aspect of long-term monitoring because they will help to determine if the soil ecosystem is recovering as expected over time.

3.1.1 Summary of Expected Ecological Succession

An example of ecological succession in a hypothetical plant community is provided in Figure 1. Succession progresses through several distinct phases:

- Early succession is dominated by opportunistic species that have high growth or reproductive output, or some specialized ability to occupy a niche that other species cannot. An example would be an invasive, weedy species with a high output of wind-carried seeds. Species that can grow in nutrient-poor soil because they can convert nitrogen to a useable form (“nitrogen fixation”) would also have an advantage. Mites are an example of a primary colonizer from the soil invertebrate community because they have a high dispersal capacity, can tolerate low nutrient levels, and reproduce quickly (Hagvar et al. 2009).
- Middle succession involves increasing competition for resources (i.e., the limited nutrients that are introduced by the decay of leaf litter from the early stages). An example of the middle stages of succession would be the proliferation of alder which have a similar capacity for nitrogen fixation as grasses, but also the ability to outcompete grasses for moisture and light through root and shoot growth. Examples of invertebrates at this stage include ground-dwelling beetles or ants.
- Late succession continues competition in an increasingly diverse number of niches. At a late succession stage, the humic layer has regenerated through the decay and processing of organic material, and there is an ongoing cycle of nutrients in soils from the activity of microbes, fungi and soil invertebrates. Earthworms and other invertebrates that process organic material would be common. The overall ecological function (e.g., production of biomass, respiration, diversity) in the ecosystem has reached its maximum capacity, and the ecosystem has settled into a dynamic equilibrium.

Golder has identified several examples of natural ecological succession from the literature in Table 2, including recolonization of a landscape after a landslide or retreat of a glacier, or reclamation from non-metal mining such as quarrying.

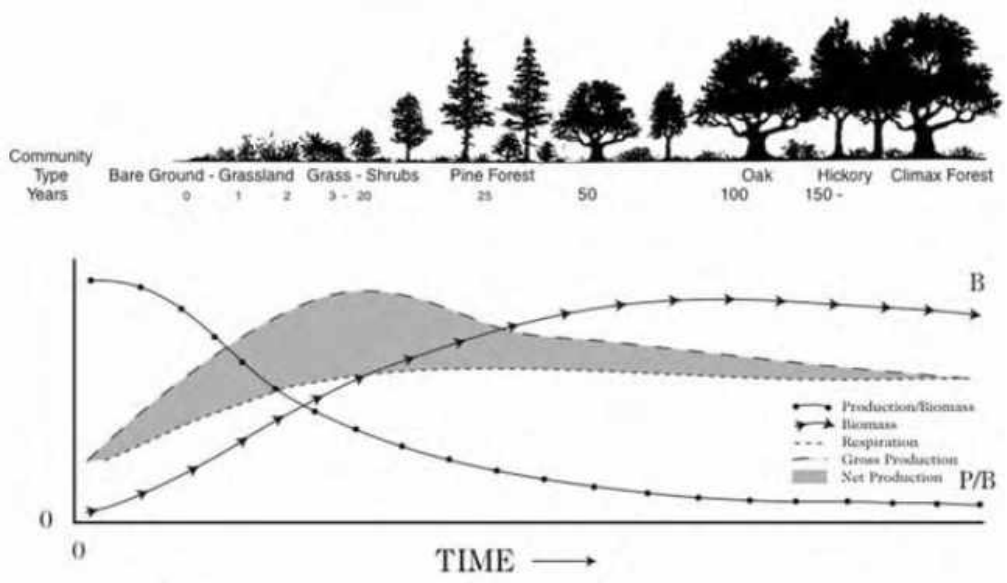


Figure 1: General schematic of vegetative succession over time (from Schneider 2008)

Table 2: Examples of Ecological Succession

Authors	Site Context	Observations
Russell and La Roi (1986)	34-hectare spoil heap of overburden generated from coal mining activities in Rocky Mountain foothills, Alberta.	Vegetative cover limited by coarseness of material and low nutrient levels. Total plant cover is less than 10% despite relatively long length of time since formation of the spoil heap (34 years). Perennial grass and forbs are the dominant species.
Frouz et al. (2008)	Chronosequence of 27 sites on four different coal mine spoil heaps (100+ km^2) in Europe. Total length of time since disturbance was 40 years.	Plant and soil invertebrate communities were assessed. Statistical analysis found that succession was driven by the formation of the humic layer. Sites tended to switch from “no humus” to “humus forming” at roughly 15 years, and from “humus forming” to “humus present” at roughly 25 years.
Miles and Swanson (1986)	Chronosequence of 25 landslides in Oregon. Total length of time since disturbance was 30 years.	Total vegetation cover ranged from 51% (in the primary scar) to 78% (in the primary deposition area). Cover consisted of trees (approximately 50% of the total), shrubs (25% of total) and herbs (25% of total), suggesting that succession had progressed to a mature state.

Authors	Site Context	Observations
Smith et al (1986)	Chronosequence of 49 landslides in Haida Gwaii. Total length of time since disturbance was 150 years. Logged and non-logged areas included for comparison.	Humic layer reformed relatively quickly but had decreased nutrient levels until Year 30. There was a relatively thick cover of red alder (an early colonizing tree species) within 20 years, but the total vegetative cover in the slide areas did not reach the undisturbed areas for 50 years. (For context, a logged area returned to a total cover like the undisturbed area within 20 years).
Gobbi et al. (2006).	Chronosequence of soil invertebrates colonizing a receding terminal glacier moraine. Total length of time was 150 years.	Species richness increased from 2 to 26 genera. Spiders and beetles were the primary colonizers, while ants and centipedes are only present in the older sites. The pattern of succession was consistent with the available information about the habitat preference and life history strategies of each species.

Note: A chronosequence is an ecological study that investigates a set of similar sites that share similar attributes and a similar disturbance but have different ages in order to understand the time-dependent aspects of succession.

3.1.2 Influence of Natural Succession on the Design of the CEMP

Although MPMC has conducted a variety of actions over the last two years to facilitate natural ecological succession, the plant and soil invertebrate community in the area impacted by tailing deposition is likely still in the early, opportunistic stages of recolonization. Further information about the following activities conducted to date can be found in the Conceptual Remediation Plan (Golder 2018):

- Soil manipulation (e.g., scarification to create a “rough and loose” soil material with better physical structure)
- Blending and placement of native topsoils to improve moisture retention and nutrient levels, and to reintroduce native microbes, fungi, seeds and soil invertebrates
- Mounding and placement of coarse woody debris to create preferential microsites where plant recolonization can be accelerated
- Placement of wood chip mulch to increase organic carbon and nutrient levels as the mulch decays
- Riparian planting of native shrubs and conifers
- Seeding of upland areas with a mix of native grasses

The net effect of the original impact and the subsequent rehabilitation effort is that a high degree of variability between areas is still expected because the treated and untreated areas are still in the first few years of succession. The total length of time to reach a mature, dynamic equilibrium is unknown, but likely on the order of 20 to 30 years based on the examples from Table 2. The rehabilitation activities described above would be expected to accelerate and enhance that process. A field study to measure the difference between "control" and "impact" that could separate the relative influence of copper versus physical limitations would be challenging in this early phase. Specifically:

- Comparison to reference is not expected to be practical in the near-term (i.e., one can reasonably conclude that there will be substantive changes between the impacted areas and areas that have not covered with tailings). No suitable reference areas (i.e., an area that has been logged and all vegetation and humic material removed) are currently known.
- Comparison between individual years may not add significant value because differences in weather (e.g., rainfall, snowpack, temperature) would also introduce significant year-to-year variability.

Instead, monitoring of the plant and soil invertebrate community should focus on establishing a long-term trend analysis rather than to support a multitude of pair-wise comparisons that would have limited value for making site management decisions. This would involve:

- **Selecting representative, permanent monitoring plots.** The number of plots will depend on the number of different habitat units to be monitored. These units could be based on copper concentrations, remedial areas, the types of rehabilitation already applied, or other attributes that will influence succession (e.g., slope, moisture content, distance from undisturbed edge).
- **Monitoring each plot in a consistent manner to support analysis of trends over time.** No consensus exists at this time about which specific metrics are needed to monitor progress towards a biologically diverse, functional and self-sustaining ecosystem. Input from other subject matter experts (e.g., mine reclamation specialists) is likely required given that the timelines for monitoring will extend into the mine closure process.
- **Sufficient sampling effort to make informed management decisions.** A defensible trend analysis needs to consider statistical power. Statistical power is influenced by the minimum measurable change and the variability amongst replicates of a given habitat unit. Even if a formal power analysis is not needed, the study design needs a common understanding about how the trend analysis would be used to make future decisions. For example, trend analysis may benefit more from measuring 5 metrics at 50 plots for three years followed by a 5-year hiatus than measuring 10 metrics at 20 plots every year. The 750 measurements in the first option may be more meaningful than the 1,600 measurements in the second option because option 1 provides more spatial coverage and measures inter-year variability.

3.2 Uncertainty about the Relative Influence of Copper on Soil Invertebrates and Plants

The ERA concluded that risks from copper were low, and therefore, further focused investigations to determine the relative influence of copper on soil invertebrates and plants versus physical variables (such as through toxicity testing or greenhouse experiments) were not warranted until there was information from the field monitoring that succession was not progressing towards the long-term management goal of reintroducing a biologically diverse, functional and self-sustaining ecosystem (Table 53 of the ERA). A trend analysis will not provide a definitive check on progress towards this management goal for several years. In the meantime, continued refinement of the site-specific relationships between copper concentrations in soil and copper concentrations in various soil invertebrate and plant tissues is recommended because:

- The presence of sufficient plants or invertebrates for sampling across the range of copper concentrations in soil provides important qualitative evidence (pending confirmation from the trend analysis) that copper is not exerting a significant effect on the survival of soil invertebrates or plants. If areas with the upper range of copper concentrations in soil lack soil invertebrates, or show visual evidence of copper toxicity to plants, it would be a trigger for the more focused investigation (or, could lead directly to supplemental remediation as part of the overall adaptive management strategy).
- Refining the soil-to-tissue relationships provides direct evidence about copper bioavailability and bioaccumulation. This helps to clarify potential differences in copper bioaccumulation between different species or taxonomic groups, and the site-specific relationships can be compared to similar relationships from the scientific literature or other copper-contaminated sites to provide further support to the ERA conclusion that copper bioavailability is relatively low.
- The site-specific bioaccumulation relationships are also used as part of the wildlife food chain model. Some of the existing relationships are based on limited data sets, which have added uncertainty to the results of the food chain model. A more robust relationship between soil and tissue concentrations increases the overall sophistication and future application of the food chain model as part of the CEMP.

3.2.1 Uncertainty in Risk Estimates for Wildlife Species

The food chain model used appropriately conservative assumptions and model parameters consistent with common practices for a screening-level risk assessment.

In terms of risk management decisions, some qualified professionals default to a prescriptive interpretation that any HQ than 1 represents a potential risk that requires further assessment or remediation. Realistically, marginal HQs (e.g., less than 2 or 3) are unlikely to present an unacceptable risk but there is no consensus on a specific threshold between acceptable or unacceptable risk beyond the prescriptive guidance about HQ = 1. The existing HQs are not considered to represent an unacceptable risk but are sufficiently higher than 1 to warrant further refinement of the model to reduce uncertainty. The uncertainty in the HQs generated from the food chain model is the product of the uncertainty in each of the variables used. Not all variables need to be refined. The variables that would benefit most from refinement are:

- Improving the quality of data with respect to tissue concentrations in invertebrates. This can be accomplished by expanding on the bioaccumulation sampling as described in Section 3.2. The food chain model has also conservatively assumed that flying insects have the same tissue concentrations as soil-dwelling insects, which is a data gap that should be addressed by further sampling.

- Refining the toxicity reference values (i.e., the denominator in the HQ). The current toxicity reference value was taken from the ECO-SSL guidance (USEPA 2018) and is based on a conservative “no-observed adverse effect level” from the available literature. This toxicity reference value may be substantially lower than a true “acceptable” concentration that corresponds to low (i.e., not statistically significant) effects on growth or reproduction. A common area for refinement in a wildlife risk assessment is to update the toxicity reference value to reflect an effects-based threshold in lieu of a highly conservative screening threshold.
- Reviewers of the ERA identified the use of relative bioavailability as an uncertainty in the food chain model but did not reach a consensus about whether this issue was significant in terms of the final risk conclusion. There are unresolved differences in professional opinion on this topic which would ideally be addressed as part of the food chain model refinement. Golder notes that ENV has previously accepted the approach used in the current ERA at other sites and believes that further dialogue on this point prior to initiating additional investigation is warranted.

Refinement (or resolution) on these three topics is expected to reduce the overall uncertainty in the food chain model. Golder understands that the refined model would be run for the same subareas and HQs presented for both individual subareas and for the aggregate of the entire study area. Golder also understand that ENV desires that bats (*Myotis* sp.) be added as an additional receptor.

4.0 CONCEPTUAL STUDY DESIGN

4.1 General Approach

A proposed approach to address the remaining areas of uncertainty in the terrestrial ERA is provided in Figure 2. In brief, the following activities are proposed for the remainder of 2018 and the first quarter of 2019:

- Conduct a reconnaissance-level assessment and conduct limited pilot-scale investigation for candidate metrics for inclusion in the long-term trend analysis monitoring of ecological succession.
- Engage stakeholders and subject matter experts in a workshop to review the findings from the reconnaissance-level assessment and to obtain consensus about how a “biologically diverse, functional and self-sustaining ecosystem” will be measured.
- Conduct a one-time supplemental sampling program to refine the current information regarding copper bioaccumulation and relative bioavailability. Refine the toxicity reference values and use all three outputs from the one-time supplemental sampling program to update the food chain model.
- Develop the preliminary design for the trend monitoring in terms of specific metrics, sampling effort, frequency and interpretative approaches and submit for regulatory approval.

At the completion of these four activities, the CEMP will be updated to incorporate the specific design for long-term monitoring of the ecological succession expected to occur over time. The long-term monitoring will need triggers for when ecological succession will be deemed to be insufficient (even if such triggers are narrative). Additional rehabilitation or additional investigation regarding the cause of the insufficient progress would occur if those triggers are exceeded.

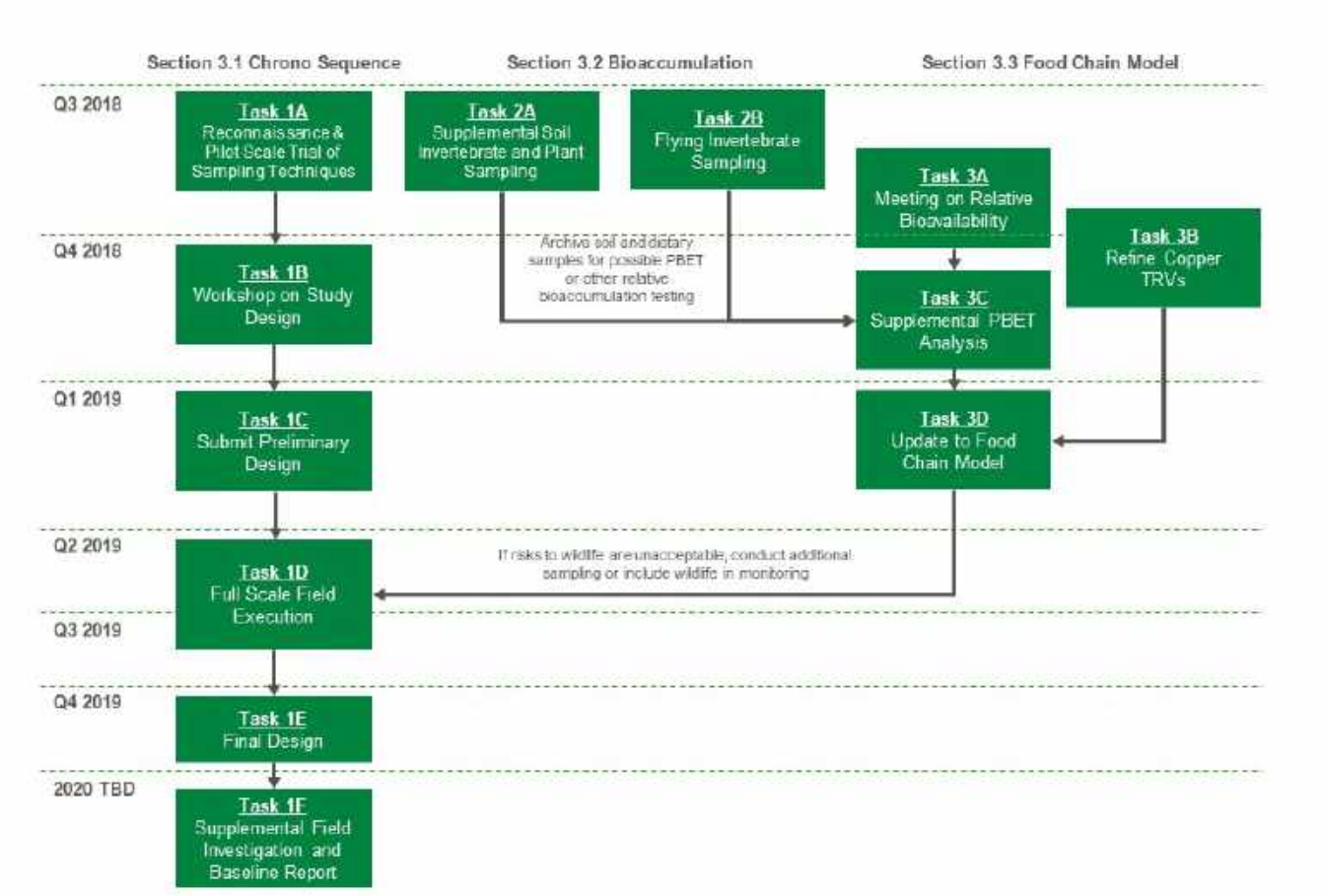


Figure 2: Proposed Approach for the Terrestrial CEMP Component

4.2 Additional Information

4.2.1 Task 1A – Reconnaissance and Pilot-Scale Sampling

There is value in conducting a reconnaissance-level sampling program in the summer of 2018 to provide at least a narrative description (supported by field measurement) of the current state of ecological succession. The reconnaissance-level sampling will focus on:

- Determining the diversity and percent cover of plants in three plots in each of the seven major terrestrial units (Halo; Untreated – Polley Flats; Untreated – Upper Hazeltine; Untreated – Lower Hazeltine; Transplanted; Intermixed; Scarified) for a total of 21 plots.
- Making detailed observations about plant succession in selected locations where additional rehabilitation was conducted (e.g., placement of large woody debris, mounding, placement of mulch).
- Conduct an overall site inspection to identify if there are areas that were subject to additional rehabilitation where no ecological succession appears to be occurring.

- Conducting a standardized bird survey at five locations (for spatial coverage) to document which species are using the available habitat. (Birds are selected for the survey because of the potential that listed species would use the habitat). Habitat monitoring for other wildlife species is not included in the scope of this reconnaissance-level sampling.

Data from the reconnaissance sampling will help to inform the design of the long-term trend analysis. Golder will also use the opportunity to conduct a pilot-scale trial of sampling techniques that could be used to measure other aspects of ecological succession. For example, the future trend analysis (see tasks below) may involve a metric related to soil invertebrate diversity, density or function. The literature describes a wide array of possible sampling techniques (e.g., a soil core to measure the diversity and abundance of mites; a bait-trap to measure the biomass of ants; a pit-fall trap to measure the diversity of ground-dwelling beetles). Golder is using malaise traps, pit-fall traps and Berlese funnels as part of the tissue sampling, any one of which could add value to the design of the long-term monitoring.

4.2.2 Task 1B – Workshop on Design of Trend Analysis

Golder expects that reviewers and stakeholders would comment extensively on the design of the trend analysis, and a variety of technical opinions are expected. There is a wide diversity of possible technical approaches, compounded by an absence of risk assessment guidance on how ecological succession should be monitored.

Golder expects that it will be necessary to draw on regulatory guidance from other relevant Ministries (e.g., Mines, Forestry) where landscape level changes in plant communities are more commonly assessed. For example, BCMOFR/BCMOE (2010) provides guidance on how to assess terrestrial ecosystems, but guidance on measuring successional state is limited to a semi-quantitative assessment that tracks the proportion of early colonizers (‘seral’ species) to later colonizers (‘climax’ species). No specific thresholds for the different states are described and therefore, the site could conceivably remain in a “pioneer” state for 60 or more years. This type of narrative assessment, although described in regulatory guidance, would not add value for site management decisions. Conversely, there are examples of how plant succession is being monitored for mine closure purposes in a quantitative manner (e.g., Highland Valley Copper focuses on plant diversity and functional contribution as a surrogate for the broader ecological succession; Smyth et al. 2016) but no specific thresholds are described beyond “continued progress”.

Golder proposes a one-day workshop where a focused overview of the findings from the reconnaissance-level sampling and tissue sampling can be presented, followed by discussion of relevant examples of risk-based mine closure and monitoring elsewhere in British Columbia. Potential examples where publicly-available information is likely available include the Britannia Mine, the Sullivan Mine, and Highland Valley Copper. It is important to establish at least a preliminary consensus with the regulators about the intended application of this part of the CEMP before effort is expended on the design and costing of specific methods. This workshop is intended to be similar to the Problem Formulation Workshop that helped to build consensus on how the ERA was ultimately executed.

4.2.3 Task 1C – Preliminary Design of Trend Analysis

Golder will develop a preliminary design for the long-term trend analysis based on the reconnaissance sampling, further consideration of relevant examples at other BC mine sites, and input from the reviewers.

4.2.4 Task 1D – Full Scale Field Execution

Golder proposes that the preliminary sampling design would be implemented in the spring and summer of 2019. The scope of this program is currently unknown, pending the outcome of the preliminary design.

4.2.5 Task 1E – Refinement to Design

Conceptually, Golder envisions that the preliminary design might specify a larger number of potential metrics which would be reduced to a final subset based on the data collected in 2019. The intent of the refinement step is to provide a formal check that the preliminary design has been fully optimized in terms of effectiveness and efficiency. A key aspect of optimization is that it is not necessary to continually monitor all aspects of the ecosystem as a conservative, precautionary approach. Instead, the goal is that the CEMP component provides a science-based framework for adaptive management. Adaptive management focuses on monitoring a smaller number of metrics (but monitoring them well) so that there is a clear baseline with pre-defined triggers for when one-time supplemental investigations might become necessary.

4.2.6 Task 1F – Baseline Report

Conceptually, the terrestrial monitoring component will focus on monitoring succession at pre-defined intervals rather than annually. The ERA and its supporting appendices contain information about conditions up to approximately D+3 (disturbance + 3 years). The reconnaissance sampling is effectively an interim snapshot about D+4, and the full field execution would provide the formal baseline that reflects conditions at D+6 (and possibly D+7, if year-to-year variability is included in the study design). Subsequent cycles of the terrestrial monitoring program would then document the ongoing ecological succession at defined intervals post-baseline (e.g., baseline + 2 years, B+5, B+10, B+20).

4.2.7 Task 2A – Soil Invertebrate and Plant Sampling

This task is a standalone activity intended to reduce the uncertainty in the existing site-specific bioaccumulation models (Figure 3) for soil invertebrates and plants. Both models could be improved by obtaining additional co-located soil and tissue samples so that the relationships are not based on composite samples (e.g., separate ‘surface insects’ into ‘ants’, ‘spiders’ and ‘beetles’; separate ‘grass’ into the main species that have been seeded on the site). Conceptually, Golder would target different specific taxa or species emphasizing areas that have not yet been sampled (i.e., the three reclamation treatments). These areas tended to have copper concentrations in the middle of the range bounded by the background and untreated areas. All data (i.e., data from Golder 2017 and data collected in August 2018) will be used to refine the existing bioaccumulation relationships (see Figure 3, below). Note that the total number of tissue samples submitted for analysis will be dependent on the trap effectiveness. A decision on whether the supplemental data are sufficient will be made in light of the uncertainty in the regression equation.

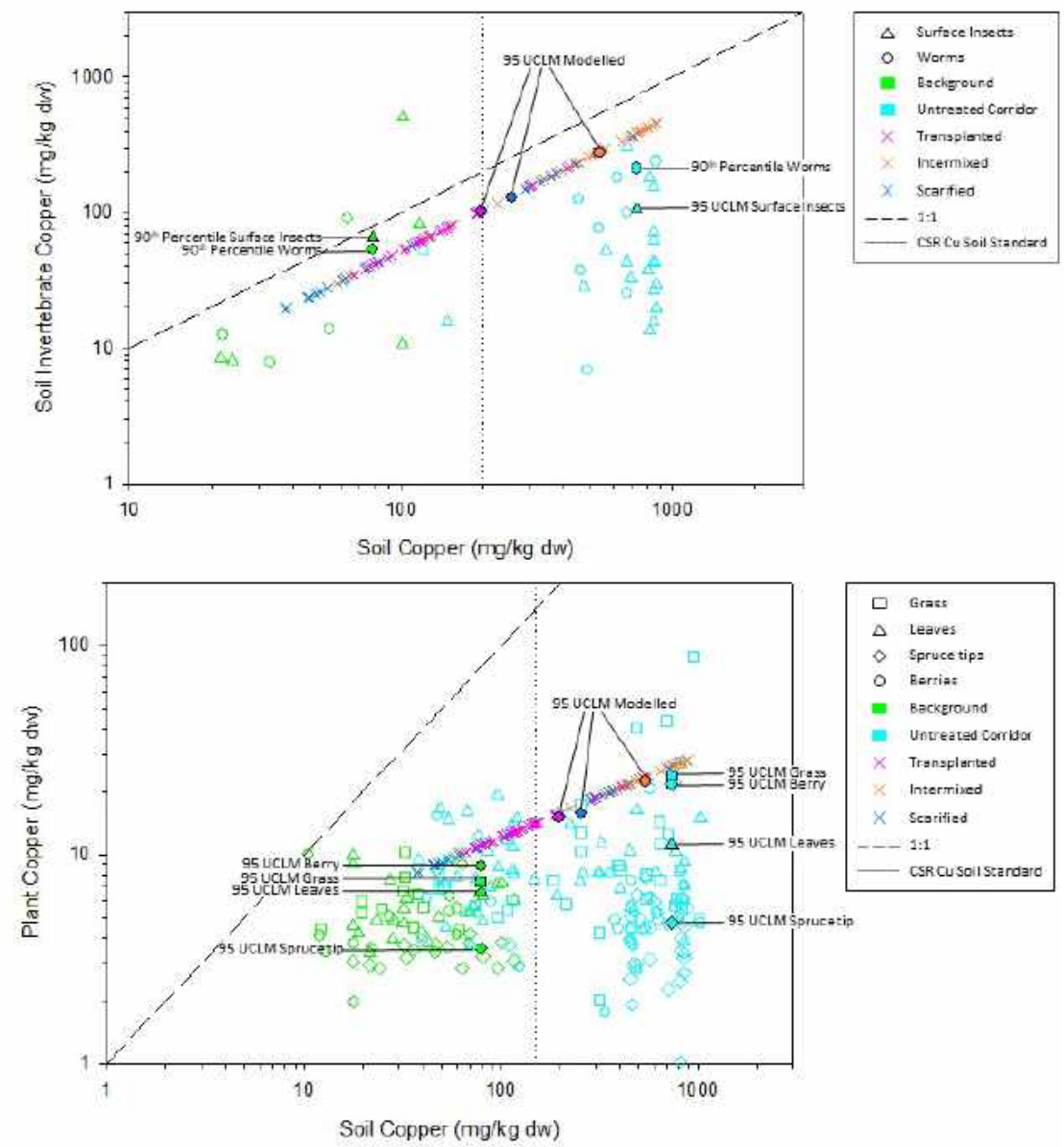


Figure 3: Existing bioaccumulation models for soil invertebrates and plants (from Golder 2017, Appendix F)

4.2.8 Task 2B – Flying Insect Sampling

This task is a standalone activity to address a data gap in the food chain model. Golder will collect flying insects (e.g., moths, flies, flying ants, grasshoppers) using malaise traps with lights. These taxonomic groups reflect the likely dietary items for insectivorous birds and bats. Hand collection with butterfly nets will also be employed. Ideally, sufficient biomass will be collected from a single location to allow for submission of taxa-specific composites (not a composite of all flying insects). Tissue concentrations are not expected to be directly related to local soil concentrations because flying insects are mobile, and therefore, the goal would be to focus on sampling from five broad zones (e.g., Polley Flats, Upper Hazeltine, Lower Hazeltine, Halo, and Background. The goal is to obtain at least seven tissue samples per taxonomic group per area (to allow for the calculation of a 95% upper confidence limit of the mean). The total number of tissue samples submitted for analysis will be dependent on the trap effectiveness.

4.2.9 Task 3A – Meeting on Relative Bioavailability

There was conflicting feedback from technical reviewers about how the food chain model incorporated the relative bioavailability of copper in water, food and dietary items once ingested by different ecological receptors. Golder assumed that copper in water would have a 100% bioavailability relative to the form of copper added to the food used in the original mammalian or avian toxicity test. Site-specific PBET data was used as a surrogate for the relative bioavailability of soil, and information from the literature was used to provide a conservative estimate of the relative bioavailability of copper once incorporated into biological tissues. Similar approaches have been approved by ENV at other sites, including the risk-based management of elevated copper in soils at the Britannia Mine. Relative bioavailability for soil and dietary items has also been evaluated in the risk assessment literature with specific consideration of the potential for differences in gastrointestinal bioavailability between mammals and birds (e.g., Sample et al., 2014; Kaufman et al., 2007).

Golder recommends holding a focused meeting on this specific technical topic with the subject matter experts and ENV. Eliminating relative bioavailability from the food chain model would be demonstrably over-conservative and inconsistent with the scientific principles that influence how an ingested dose is ultimately absorbed by birds and mammals. If the consensus from that meeting is that further quantitative assessment is needed to support the existing approach, it would be completed this fall in Task 3C. Golder proposes to collect archive tissue and soil samples in the summer sampling program (Task 2A) as a precaution (subject to the availability of sufficient tissue mass).

4.2.10 Task 3B – Refinement of Copper TRV

Golder will update the existing toxicity reference values for copper to use a multi-study concentration profile in lieu of the existing point-estimate based TRVs adopted from ECO-SSL. A similar approach has been proposed in the amphibian monitoring component of the CEMP. The development and application of ECx-based toxicity reference values in wildlife food chain model is well-established in the scientific literature (e.g., Allard et al. 2010) and has been adopted by provincial and federal risk assessment guidance manuals (e.g., Environment Canada 2010) as an accepted practice to refine screening-level ERAs.

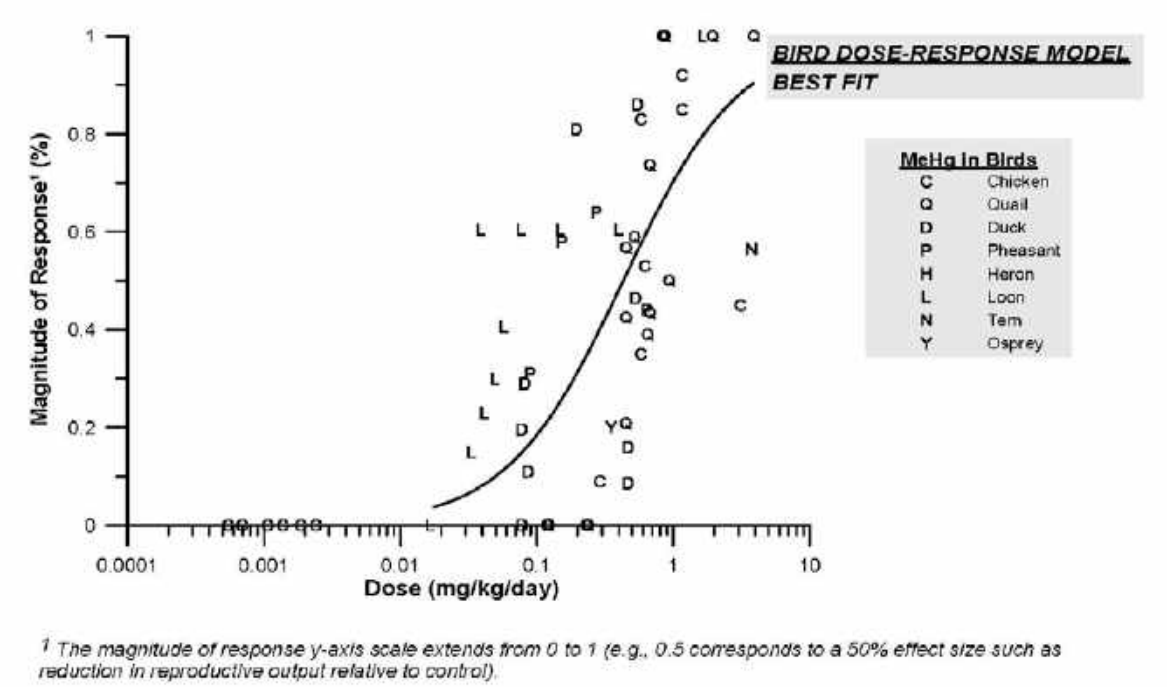


Figure 4: Example of a multi-study concentration response profile (from Environment Canada 2010, courtesy of Azimuth Consulting Group)

4.2.11 Task 3C – Supplemental Bioavailability Analysis

Golder believes that there is sufficient technical support and past precedents for the current use of relative bioavailability in the wildlife food chain model. However, if necessary based on Task 3A, Golder would conduct additional analysis on archived soil, plant and invertebrate tissue samples to provide further information about how bioavailability can be incorporated into the food chain model. Conceptually, relative bioavailability is about establishing a common modifying factor to interpret the total copper concentrations that are established by the chemical analytical laboratory. A focused assessment that involves the same bioavailability analysis on water, soil, food and representative “spiked-food” samples made to duplicate the original approach used in the key toxicology studies from the literature would create a common basis for relative bioavailability in the food chain model.

4.2.12 Task 3D – Update to Food Chain Model

This task is a standalone activity to update the food chain model with the information obtained in Tasks 2A, 2B, 3B, and 3C. Depending on the quantity of information from 2A and 2B, it may be possible to add additional refinement in terms of dietary preferences to more closely reflect how different receptors would be expected to use the site. A bat will also be added as an additional surrogate receptor per ENV’s request. The deliverable for this task would be an update to the existing food chain model report (Appendix F of the ERA).

5.0 SUMMARY

This memorandum describes a proposed approach for the terrestrial component of the CEMP. Not all tiers are recommended for immediate implementation, and there are significant technical and regulatory issues that would need to be resolved as part of the design and execution. Golder recommends that the current CEMP focus on executing the proposed tasks up to the end of Q1 2019. This includes progressing the proposed chrono sequence approach for the long-term CEMP up to the point of submitting a preliminary design for formal ENV approval. The proposed tasks also include activities to reduce the uncertainty in risk estimates to soil invertebrates and wildlife that addresses the content of Table 53 of the ERA.

6.0 CLOSURE

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this technical memorandum.

Please do not hesitate to contact the undersigned if there are questions regarding this memorandum.

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Attachment: Study Limitations

https://golderassociates.sharepoint.com/sites/10023g/documents_1894924/2. issued/025-tm-23182-terrestrialconcept/rev1/1894924-025-tm-rev1-23182-terrestrialdesignconcept_09aug_18.docx

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STUDY LIMITATIONS

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Appendix B.6

Amphibian and Reptile Monitoring

Golder Associates Ltd.

TECHNICAL MEMORANDUM

DATE 9 August 2018 **Reference No.** 1894924-018-TM-Rev1-23182

TO Stephen Monninger
Mount Polley Mining Corporation

CC Colleen Hughes

FROM Blair McDonald and Barbara Wernick **EMAIL Blair_McDonald@golder.com; Barbara_Wernick@golder.com**

STUDY DESIGN CONCEPT: AMPHIBIAN COMPONENT FOR THE MOUNT POLLEY MINE COMPREHENSIVE ENVIRONMENTAL MONITORING PLAN

Introduction

Golder Associates Ltd. (Golder) understands that Mount Polley Mine is preparing a Comprehensive Environmental Monitoring Plan (CEMP) to integrate the monitoring components from a variety of regulatory processes applicable to the mine into a single document. One element of the regulatory process involved the submission of an Ecological Risk Assessment (the ERA; Golder 2017) which integrated the available chemical and biological information to provide an overall conclusion about the magnitude and extent of ecological risks associated with the deposit of tailings. The ERA was accepted by Ministry of Environment & Climate Change Strategy (ENV) on 31 January 2018, contingent on the implementation of additional monitoring in relation to specific areas of uncertainty identified in the ERA. One of the identified areas of uncertainty at the conclusion of the ecological risk assessment (Table 53 of the ERA) was that amphibians were not formally assessed. The ERA identified amphibians and reptiles as a relevant receptor group (Section 2.3.3.4 of Golder 2017) with western toad and common gartersnake identified as possible receptors. Western toad was selected as the receptor of potential concern for the broader amphibian and reptile community because it is also a listed species.

This purpose of this memorandum is to outline the monitoring concept proposed to address the uncertainty associated with the amphibian component for the Mount Polley CEMP. If this concept meets ENV expectations, a detailed study design document and specific work instructions will be prepared by Golder as the basis for executing this component as part of the Mount Polley-led CEMP process.

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Basis of Design

The basis of design consists of a summary of the available data and how those data were evaluated in the ERA, provided for the convenience of the reviewers. Copper and vanadium were retained as the contaminants of potential concern in the terrestrial ERA, and copper was retained as the contaminant of potential concern in the aquatic risk assessment. Although no amphibian-specific toxicity reference values were available, these contaminants of potential concern were selected by comparing the maximum observed concentrations conservative, regulatory-approved standards and guidelines. The maximum observed vanadium concentration was only marginally greater than the generic soil standard, and therefore, copper is expected to be the primary contaminant of potential concern for amphibians. Other data relevant to amphibians were described in Section 3.4 of Golder (2017) and consisted of:

- Substantial numbers of tadpoles were observed in 2015 in pooled water that formed throughout the Hazeltine Creek corridor. These tadpoles were confirmed to be western toad (*Anaxyrus boreas*) which is listed on Schedule 1 of the federal *Species at Risk Act*. More than 75,000 individual western toads (approximately 66,000 tadpoles, 9,000 juveniles, 300 sub-adults and 50 non-breeding adults) were subsequently salvaged from 40 different standing water depressions over a two-month period in 2016 prior to the start of rehabilitation. Long-toed salamanders (*Ambystoma macrodactyllium*) and Columbia spotted frogs (*Rana luteiventris*) were also salvaged (at lower numbers). Golder (2017) concluded that the salvage provided qualitative information that amphibians were able to successfully survive, grow and reproduce despite direct contact with tailings and surface water.
- Tissue samples were collected from three amphibians (species not identified) were collected by ENV in August 2016. Golder was not able to confirm the methods used for sampling, processing or analysis and did not review the certificate of analysis with respect to quality assurance/quality control measures. Tissue concentrations in two samples collected from impacted areas ranged from 56.4 to 871 mg/kg Cu dry weight. A tissue sample collected from Gavin Lake (considered by ENV to be a background area) was 12.4 mg/kg Cu dry weight. Data were compared to literature that indicated that copper tissue concentrations corresponding to a lowest-observed effect concentration (LOEC) or no-observed effect concentration (NOEC) ranged from 60 to 325 mg/kg dw (Attachment F, Appendix J of Golder 2017). The average concentration of the two impacted samples was also considered in the uncertainty analysis for the wildlife food chain model (i.e., would the risk conclusion be different if piscivorous birds and mammals had a diet consisting entirely of amphibians). Beyond these qualitative observations, data were not formally evaluated because methods and quality assurance/quality control practices could not be verified.
- Multiple lines of evidence in the ERA demonstrated that copper had low bioavailability. The lines of evidence included geochemical modeling and three different chemical surrogate measurements in tailings samples (water soluble fraction; humidity cell and leach tests; physiological-based extraction tests – see Section 3.2.2 of Golder 2017). Speciation modelling of copper in water showed most of the dissolved copper in Quesnel Lake water would be bound to carbonates which have lower bioavailability than copper ions (see Section 4.2.1.3 of Golder 2017). Golder concluded that the bioavailability of copper would be unlikely to be high for amphibians if there were multiple lines of evidence showing that copper bioavailability to other receptors was low.

Further Consideration of Uncertainty

The purpose of this section is to expand on the specific uncertainties identified in the ERA to be evaluated by focussed monitoring as outlined in this conceptual design document. Golder (2017; Table 53) provided an overview of the uncertainties to assist with future risk management decisions, but a one or two sentence summary does not necessarily convey sufficient detail to show how the design of the amphibian monitoring is linked to the findings of the ERA.

For amphibians, uncertainty is because of the absence of quantitative risk assessment for amphibians. Notwithstanding the value of the inferences and qualitative observations described above, there was only a limited amount of direct measurement of exposure or effects relevant to amphibians at the time the ERA was undertaken. From a practical perspective, rehabilitation of the riparian areas, and restoration of Hazeltine Creek was ongoing throughout the risk assessment process and therefore the habitat suitability for amphibians was considered low. Moreover, completion of the ERA for other major groups of receptors (e.g., mammals, plants) was needed to determine if further remediation activities, which would further disrupt habitat suitability, was needed to address the residual concentrations of copper in the deposited material. Therefore, Golder (2017) determined that it would be inappropriate to arrive at a risk conclusion at that time without further evaluation.

The ERA found that risks for the major groups of receptors were generally low to moderate (reflecting the low bioavailability of copper in tailings) and therefore, extensive additional intrusive works are less likely. Thus, it is appropriate to now consider a monitoring plan that will contribute to confirming that the risk conclusions for other major groups of receptors are also applicable to amphibians.

Conceptual Approach

The amphibian component is essentially a continuation from the problem formulation already completed (Golder 2017) (which identified amphibians as a relevant receptor). In brief, the proposed approach is to continue the risk assessment process by proceeding through the following tiers to the point needed to support an informed risk management decision. The tiering is described in Figure 1, and consists of the following main tasks:

1) Conduct a hazard evaluation – Screen existing soil, sediment and surface water chemistry data for different habitat units against a conservative amphibian-specific screening value. Eliminate habitat units from consideration if copper concentrations are sufficiently low (i.e., the 90th percentile and 95% upper confidence limit of the mean) that risks are not expected.

2) Conduct an exposure assessment – For those areas that are not screened out in Step 1, compare the distribution of soil (or sediment, or water) concentrations for that area to a multi-study concentration response profile for copper. Areas where the average concentrations (e.g., 95% UCLM) are less than the toxicity reference value (TRV) (e.g., geometric mean of chronic, relevant no-observed effect levels) will be excluded from evaluation. Areas that cannot be excluded will be prioritized according to their potential risks (e.g., based on the degree of overlap between the distribution of concentration data and the response profile).

3) Conduct a laboratory-based effects assessment – The exposure assessment above assumes that copper in tailings is equally bioavailable as the original toxicity test. This is unlikely to be true because the ERA had multiple lines of evidence that showed bioavailability of tailings were low. If Step 2 demonstrates the potential for unacceptable risks, then laboratory-based toxicity testing will be used to establish a site-specific copper TRV and the representative soil, sediment and surface water data will be re-screened. Laboratory testing will likely need to include the physical nature tailings as a variable.

4) Refine the application of the toxicity reference values – The evaluation in Steps 2 and 3 assume that all soils, sediment and surface water are representative of a potential amphibian exposure. There may be portions of the terrestrial zone that are unlikely to be suitable amphibian habitat because of their distance from water, substrates or other factors. Refinement of the screening process from Step 3 to focus on the potential areas of habitat may be considered.

5) Conduct a field-based effects assessment – A field-based effects assessment is not contemplated unless concentrations in relevant amphibian habitats exceed both the literature-based and site-specific TRVs. Field-based measurements focus on comparison of population-level or organism-level endpoints between impacted and reference amphibian habitats. A mesocosm study could also be considered (e.g., transplant amphibian larvae between enclosures established in reference and impacted habitats and measure survival and growth at end of chronic exposure)

6) Integrate toxicity and habitat data in a population model – If a copper concentration response relationship has been established, it could be used in a population model to determine the relative influence of copper and physical stressors in the context of natural stressors (e.g., low precipitation) and habitat quality. This assumes that there is adequate information about the population dynamics of the western toad.

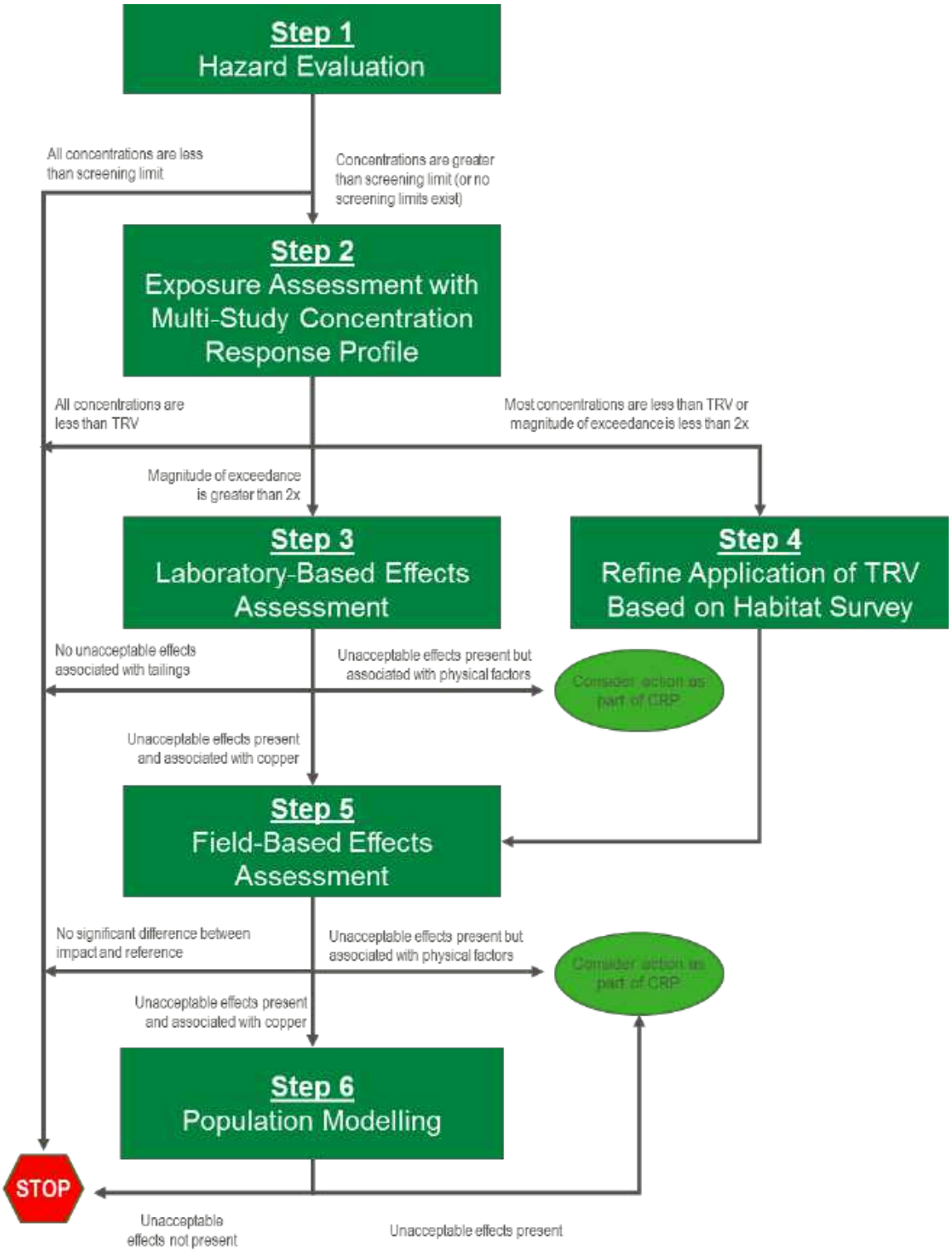


Figure 1: Proposed Tiering for Amphibian CEMP Component

Additional Information

This section expands on each tier in terms of potential sampling activities, levels of effort, and decision criteria. Further expansion of the rationale in the detailed study design is expected based on ENV feedback regarding the approach. The following guidance documents were reviewed as part of the development of this conceptual approach:

- FSCAP. 2016. Module 6: Ecological Risk Assessment for Amphibians on Federal Contaminated Sites. Draft (Not Approved as Guidance).
- Navfac (US Navy, Naval Facilities Engineering Command). 2004. Development of a standardized approach for assessing potential risks to amphibians exposed to sediment and hydric soils. TR-2245-ENV.

These documents provide amphibian-specific risk assessment information that was considered in the context of provincial guidance on conducted detailed ecological risk assessments at contaminated sites.

Step 1: Hazard Evaluation

FSCAP (2016) comment that there are relatively few summaries of amphibian toxicity data that provide generic screening limits. Golder will conduct a brief literature search to seek out amphibian-specific screening limits and review the available environmental quality guidelines to determine the degree to which they are protective of amphibians. The screening limits (if available) will be used to provide an initial evaluation of the soil, sediment and surface water data that is representative of the current-day exposure scenario for amphibians. The purpose of this initial hazard evaluation is to determine if portions of the site can be excluded from the amphibian assessment. An area will be excluded if: a) there is sufficient data to characterize the defined unit; and b) if the 90th percentile and 95% upper confidence limit of the mean concentrations in the unit are less than screening limit. If multiple screening limits are identified, an area will be excluded only if it has concentrations that are less than all limits. If no defensible screening limits are identified, we will proceed directly to Step 2.

Step 2: Multi-study Concentration Response Profile

FSCAP (2016) describe a process for integrating all available literature toxicity data into an overall concentration response profile for each media This “response profile” is then used to derive point-estimate screening limit (i.e., a single “safe” concentration) or effects-based TRVs (e.g., the range of values that correspond to a ECx effect). An example for zinc from FSCAP (2016) is provided in Figure 1.

Golder will develop multi-study concentration response profiles for copper in water and sediment/hydric soils consistent with FSCAP (2016). The overall process involves a literature review (with quality assurance procedures to eliminate unreliable data) consistent with ECO-SSL procedures. The general approach to integrating the literature data into a concentration-effect relationship is like that described by Allard et al. (2010) for wildlife TRVs. The ECO-SSL process is endorsed as a preferred approach in BC risk assessment by Technical Guidance 6 (guidance under the Contaminated Sites Regulation) and wildlife TRVs that consider the entirety of the available literature (instead of a single point estimate) are increasingly common in contaminated sites risk assessments.

Not all data have the same value in the derivation process:

1) Data that fail to meet basic test acceptability criteria (e.g., negative control are not present) will be rejected.

2) More weight will be given to North American species. Many toxicity studies use the African clawed toad (*Xenopus*) as a surrogate, but this species is not native to North America. Removing species that cannot be present at the site is consistent with provincial guidance about establishing site-specific water quality objectives (BCMOE 2013) and is also discussed by FSCAP (2016).

3) More weight will be given to studies that involved measured (instead of nominal) concentrations and/or involved field-collected samples instead of laboratory-spiked samples.

The specific derivation of a screening limit or a TRV is ultimately dependent on the quality and quantity of toxicity data available. It is likely that there will be a wide range of effects associated with a given concentration (e.g., Figure 2, which is for lead), and therefore, a specific derivation rule cannot be proposed at this time. FSCAP (2016) recommends that the data set should be explored to determine if there are significant differences in toxicity profiles for different species, exposure duration, endpoints and life stage. A specific decision about what constitutes an acceptable effect was not proposed by FSCAP (2016), but realistically, screening limits or toxicity reference values that are meant to be protective of western toads would need to reflect a low risk (e.g., EC10 or EC20). Moderate-to-high risk limits (e.g., an EC50-based TRV) may also be derived to help provide further context. Golder will need to consider the totality of the available data and provide a rationale for the TRV proposed. The available soil data will be compared to the TRVs using the same approach as described in Step 1.

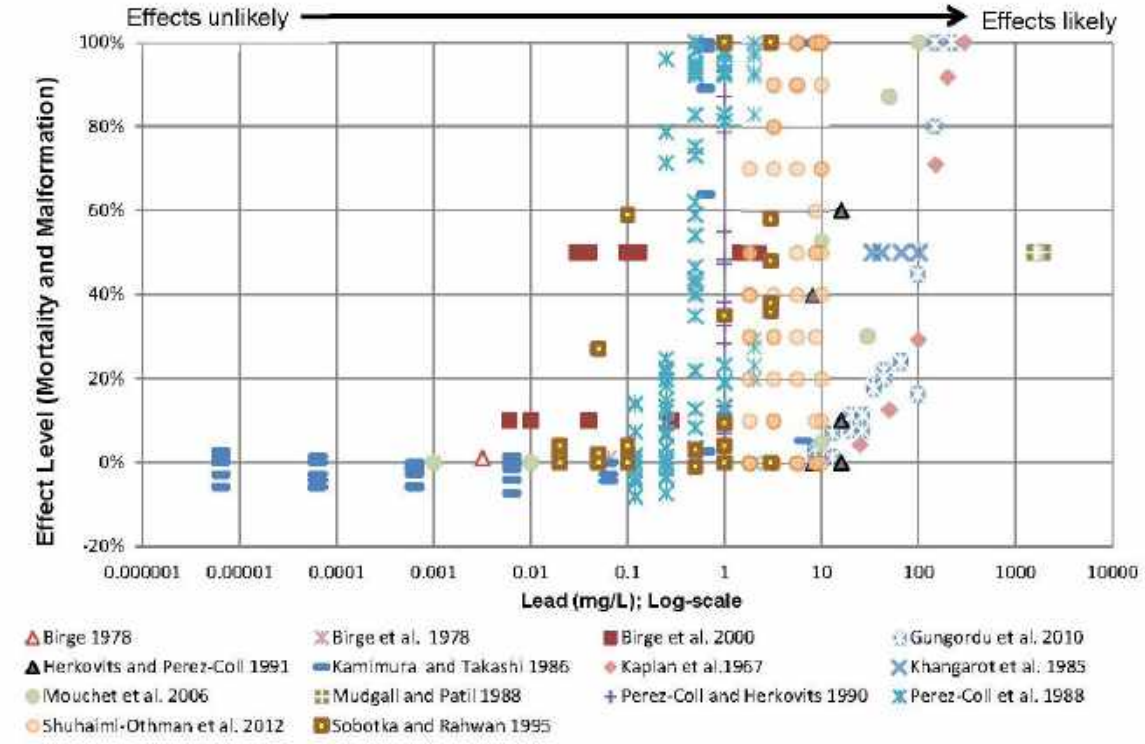


Figure 2: Example of a concentration-response profile (from FSCAP 2016)

Detailed reviewer comments were provided by ENV on May 29, 2018 and a teleconference was held on 9 July 2018 to discuss the conceptual approach and the reviewer comments. Golder understood from the teleconference that a topic of concern relates to how the results from the comparison of soil, sediment and surface water data to the amphibian-specific TRVs would account for amphibian habitat requirements.

Golder notes that there have been many soil samples collected from the site which were considered in the terrestrial risk assessment, and that additional soil sampling is being conducted in August 2018 as part of the supplemental terrestrial monitoring described under separate cover. Nevertheless, it would be a potential gap in the assessment if there were no data available regarding concentrations of copper in soil in areas that are important rearing or feeding habitat for amphibian species. Golder intends to present the data screening from Steps 1 and 2 in a manner that provides context for how the available data helps to inform hazards to amphibians. Specifically, a qualified biologist will provide a summary of habitat requirements for each of the individual amphibian species found in the area and will determine the extent of “high-quality” and “low-quality” habitat using existing information. This desktop-level review will help to place the hazard evaluation from Steps 1 and 2 in context. Further refinement of the hazard assessment based on a detailed habitat survey (Step 4) or a field-based assessment of effects (Step 5) will be considered based on the outcome of Steps 2 and 3.

Step 3: Site-specific Concentration-Response Relationship

A site-specific concentration response could be developed using amphibian toxicity testing in a manner similar to the approaches used for benthic organisms and plants in the ERA. Conceptually, the testing would include:

- Between 5 and 10 field-collected samples with varying copper concentrations that capture the range at which copper would be expected to exert a negative effect (based on Step 2).
- Additional negative controls to evaluate the physical nature of the tailings (e.g., low organic carbon; grain size and shape).
- Inclusion of spiked-copper samples (e.g., silica sand and natural soils spiked with a range of copper concentrations) to evaluate the difference in bioavailability between tailings and the typical literature values.

A detailed design for a laboratory-based toxicity test has not yet been developed, and there would need to be clarification from ENV about how the amphibian toxicity data would be used to make site management decisions before a suitable detailed design could be prepared. Amphibian toxicity testing is not a common approach and there are multiple laboratory-, organism- or sample-related factors that could lead to an unacceptable level of uncertainty in the results. For example:

- Nearly all available standardized protocols (ASTM, USEPA) use *Xenopus* which is not native to North America and it is not clear that this species is appropriate for the current application. Environment and Climate Change Canada (ECCC) is in the process of developing a standardized protocol with a relevant, Canadian species, but Golder understands that there are methodological challenges and organism supply issues yet to be resolved. The status of the draft method is unknown.

- Most standardized protocols are designed for spiked-water applications which would not necessarily provide value to the current application. One exception is NavFac (2004) which describes a method for exposing North American frog and toad tadpoles to field-collected sediment samples for a 10 to 14-day exposure. An ASTM test method is also available for sediment (but it uses *Xenopus*).
- It may be necessary to field-collect test organisms which would not be possible without applicable provincial scientific collection permits and/or federal permits under the Species at Risk Act.

Step 3 could provide value for site management decisions, but there are technical and regulatory issues to be resolved. Further development of a detailed study design for amphibian toxicity testing is not recommended until Step 2 has been completed, and only if there is consensus about how risk management decisions would factor in the possibility of high uncertainty associated with the use of a non-standard toxicity testing method. Ideally, an approved ECCC test method would be available at the time this step would be undertaken.

Step 4: Refinement of the TRV Application

A specific design for this step has not yet been developed. As a default, all soil, surface water and near-shore sediment data will be evaluated in Steps 2 and 3. The general concept for Step 4 is to refine how those TRVs are applied to different areas of the site based on whether the area provides (or will in the future) meaningful habitat for amphibians. The nearshore of the various waterbodies and their immediate riparian zones are likely amphibian habitat and would be included. Conversely, although western toads forage over relatively large areas and can use a range of different habitats (ECCC 2016), portions of the study area that are not suitable habitat for amphibians would then be excluded from the exposure estimates. Step 4 would involve a survey of the impacted area by biologists with specialized amphibian expertise. Areas of the site would be classified according to their suitability as amphibian breeding, hibernation, and foraging habitat (both at present, and in the future). This information would be used to refine how the TRVs are applied (e.g., exclude areas with minimal value to amphibians, and focus on understanding the risks in areas that are key to sustaining the amphibian population).

Step 5: Field-based Effects Assessment

From a risk assessment perspective, field programs provide valuable information because they provide a direct measurement of effects under field conditions. However, in the current application, direct measurement of effects does not necessarily help to differentiate the effects of the residual concentrations of metals associated with tailings from the physical effect of the tailings themselves. The physical alteration of habitat in the impacted areas was substantial, and as a result, a control-impact study design needs to account for the fact that risk management decisions will be different depending on whether the main stressor is physical or chemical.

FSCAP (2016) comments that amphibian risk assessment can incorporate field-based assessments and lists a number of standard methods for conducting field surveys for amphibians. Field assessment would involve a control-impact comparison (similar to the approach used for the benthic taxonomy studies in Quesnel and Polley Lake) and each type of area would preferably involve multiple locations to minimize the effect of natural variability of the risk management outcome. A variety of endpoints could be measured in a control-impact study design (e.g., number of egg masses per unit area; frequency of lesions or malformations per adult; abundance of amphibian larvae per unit catch effort).

Further development of a detailed study design for an amphibian field assessment is not recommended until Step 2 has been completed, and only if there is consensus about how risk management decisions would factor in the possibility of high uncertainty in its outcome. A key question is to determine the number of amphibian breeding sites within the impacted area, and to conduct a baseline survey to confirm that there is an adequate number of potential control sites available in the area. This baseline survey could be conducted as part of Step 4.

Step 6: Population Model

An additional line of evidence in an amphibian risk assessment is to combine the available toxicity and habitat data into a population model. A population model, in this context, simulates the stability of a given local population under a range of future conditions. The model is used to determine if reductions in survival, growth or reproduction from the physical or chemical stressors associated with tailings will impact the population as a whole. An example of a contaminant-habitat population model is provided for context.

Willson et al. (2012) used a population model (at a site unrelated to Mount Polley) to evaluate the impact of mercury on individual toads on the overall viability of population of American toads (*Bufo americanus*). The model simulated the population dynamics of toads to establish a baseline discrete-time model (e.g., how many toads will survive to each successive life-stage based on habitat quality; how big are the toads at reproductive age as a function of food availability; how many eggs will be produced as a function of adult toad size). The effect of mercury on the population was then added to the model as a reduction in the survival, growth and reproduction baseline as a function of mercury concentration. The net effect was a model that simulated how different concentrations of mercury would contribute to the stability of the toad population over time, and to determine which type (and how much) habitat enhancement was needed to off-set the influence of mercury.

In the current application, a model similar to Willson et al. (2012) would provide value by integrating the information from Steps 3, 4 and 5. However, a model like this would only be appropriate if there was evidence that copper was exerting an unacceptable effect which could not be readily remediated. Golder recognizes that habitat compensation to address residual contamination is a policy question that would need to be resolved, particularly for a listed species where the intent is to protect the individuals of the population, not just the population itself. There are also technical limitations to this type of model in terms of the quality and quantity of data available for parameterization. Golder assumes that there would be sufficient species-specific information for western toads because the species is listed and would be a priority for researchers (at least relative to other Canadian amphibians). It may also be reasonable to assume the population variables for western toads are similar to American toads.

Further development of a detailed study design for an amphibian population model is not recommended until Step 2 has been completed, and only if there is compelling evidence that there is a chemical-related impact that would be likely to cause an unacceptable outcome to amphibian populations. In the absence of a chemical-related impact, a model would not necessarily add any value (i.e., a decision to conduct habitat improvement to mitigate a physical stressor does not need to be based on a model).

Summary

This memorandum describes a proposed tiered approach for the amphibian component of the CEMP. Not all tiers are recommended for implementation, and there are significant technical and regulatory issues that would need to be resolved as part of the design and execution of Steps 3 onwards. However, Steps 1 and 2 provide a framework that is similar to a screening-level risk assessment for amphibians, and the process for accomplishing those steps has already been described by draft regulatory guidance (i.e., there is a basis for developing a clear process for those steps).

Golder recommends that Steps 1 and 2 should be completed as part of the current CEMP. No further action would be necessary if risks to amphibians can be shown to be low based on comparison of the relevant soil, surface water and chemistry data to toxicity reference values derived from the available literature. A preliminary review indicates that there will be sufficient data in the literature of suitable quality to support Step 2. If risks are found to be unacceptable at the conclusion of Step 2, further investigation following the tiered approach described in this memorandum may be necessary.

Closure

The reader is referred to the Study Limitations, which follows the text and forms an integral part of this memorandum.

Please do not hesitate to contact the undersigned if there are questions regarding this memorandum.

Golder Associates Ltd.

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Attachment: Study Limitations

https://golderassociates.sharepoint.com/sites/10023g/documents_1894924/2. issued/018-tm-23182-amphibiandesignconcept/rev1/1894924-018-tm-rev1-23182-amphibiandesignconcept_09aug_18.docx

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Study Limitations

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Appendix B.7

Study Design for Developing Reference Conditions for Polley Lake

Golder Associates Ltd.

31 October 2019 Reference No. 1894924-111-L-Rev0-23185

Mr. Don Parsons
Mount Polley Mining Corporation
Box 12
Likely, BC V0L 1N0

STUDY DESIGN FOR DEVELOPING REFERENCE CONDITIONS FOR POLLEY LAKE – MOUNT POLLEY MINE

Dear Mr. Parsons,

Golder Associates Ltd. (Golder) is pleased to provide Mount Polley Mining Corporation (MPMC) with this study design for characterizing reference conditions for Polley Lake. This study design was prepared in response to a condition set by the Ministry of Environment and Climate Change Strategy (ENV) for approval of the Comprehensive Environmental Monitoring Plan (CEMP), specifically:

> *An updated study design must be provided, which includes the monitoring location, frequency, and methods for assessing reference conditions for Polley Lake, and which includes a description of the process for characterizing the relative differences between Bootjack Lake, Polley Lake, and the newly identified reference location.*[1]

1.0 OBJECTIVES

Polley Lake is adjacent to the Mount Polley Mine, and environmental monitoring is undertaken to assess the potential for mining activities to affect biological communities in the lake. At the present time, the reference lake for Polley Lake is Bootjack Lake, on the opposite side of the mine site from Polley Lake. Because there is potential for mine-contact water to enter Bootjack Lake in the future, ENV requested that MPMC identify one or more alternate lakes to function as references and to begin data collection early on to provide temporal and spatial continuity to the program. The purpose of this letter is to provide a decision framework and methods for selecting candidate alternate reference lakes for Polley Lake.

[1] 9 November 2018 letter from D. Hill, ENV, to D. Reimer, MPMC, "Approval of the August 15, 2018 Comprehensive Environmental Management Plan (CEMP) – Mount Polley Mine Permit PE-11678".

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2.0 IDENTIFICATION OF CANDIDATE LAKES

The decision framework for identifying potential candidate reference lakes is illustrated in Figure 1. The primary variables expected to have an influence on hydrodynamics and biological communities in a given lake, and which can be characterized at a desktop level, are: biogeoclimatic zone, size, depth, surrounding land use, and underlying geology. Ideally, reference areas will have as similar characteristics to the exposed area as is reasonably practicable. Once a subset of lakes is identified, collection of sediment and water samples will be needed to select the final candidate reference lake(s).

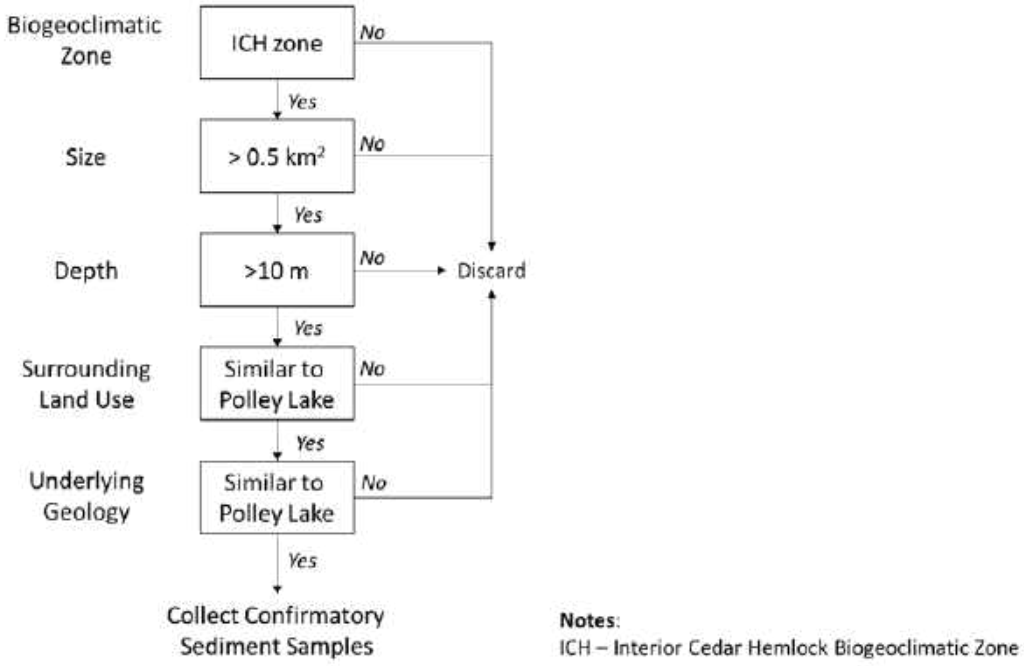


Figure 1: Decision Framework for Selection of Candidate Reference Lakes

Following this approach, Table 1 provides a summary of an initial subset of candidate reference lakes. Jacobie Lake was sampled in 2018 and the results confirm that the underlying geology is likely too dissimilar to Polley Lake to provide a suitable reference. It is also expected that Spanish Lake is unsuitable because it is in a wet subzone (wk2) of the Interior Cedar Hemlock (ICH) zone, has notably different underlying geology (arsenic and selenium is enriched in rocks on the opposite shore of Quesnel Lake), and is subject to mineral exploration and planned mine development (and therefore potential future mine-related activities).

Morehead and Gavin Lakes are both in the moist cool subzone (mk3) of the ICH zone, and Morehead coincides with at least one geological unit (LT_{Nvl}) that is similar to Polley Lake. Geological mapping will be further reviewed to evaluate similarity in the composition of the underlying geology vis-à-vis similarity to be a source of primary metals/metalloids of concern (e.g., copper, selenium, arsenic). However, Morehead Lake receives drainage from Bootjack Lake.

Table 1: Characteristics of Polley Lake and Candidate Reference Lakes

Lake	Elevation (m) [(a)]	Area (km^2) [(a)]	Depth: max (mean) (m) [(a)]	Underlying Geology [(b)]	Biogeoclimatic Zone [(c)]	Activities
Polley Lake	920	3.9	35 (18)	LT_{Nvl}, LT_{MPic}, LT_{Nav}	■ ICHmk3	■ Adjacent to Mount Polley Mine ■ Recreation (camping, fishing)
Bootjack Lake	983	2.6	15	LT_{Nvl}, LT_{Npt}	■ ICHmk3	■ Adjacent to Mount Polley Mine ■ Recreation (camping, fishing)
Jacobie Lake	1,122	0.86	20 (7)	LT_{Npv}, LT_{Nvb}	■ ICHmk3	■ Recreation (camping, fishing)
Morehead Lake	916	2	17	$LT_{Nvl,}$ Qal	■ ICHmk3	■ Recreation (camping, fishing)
Gavin Lake	963	0.94	24	MJ_{Qm}, LT_{Ns}	■ ICHmk3	■ Recreation (camping, fishing)
Spanish Lake	919	4.6	72.5 (29.6)	MLT_{Ns}	■ ICHwk2	■ Mineral exploration ■ Recreation (camping, fishing)

Notes:

(a) Activities, elevation and area identified from various angler and recreational use information websites.

(b) BC Forest Service Biogeoclimatic Ecosystem Classification System (ftp://ftp.for.gov.bc.ca/HRE/external/!publish/becmaps/PaperMaps/field/DHO_HorseflySubunit_Cariboo-ChilcotinResourceDistrict_CaribooRegion__field.pdf).

(c) BC EMPR Geoscience Map 2007-1 Regional Geology of the Mount Polley Area, central British Columbia (http://cmscontent.nrs.gov.bc.ca/geoscience/PublicationCatalogue/GeoscienceMap/BCGS_GM2007-01.pdf).

ICH: Interior Cedar Hemlock.

LT_{MPic}: Hydrothermal altered intrusive carapace holocrystalline monzonitic intrusions and volcaniclastic wall rock.

LT_{Nav}: Pink-white analcime pyroxene+/-olivine basalt breccia, flows and tuffs.

LT_{Npt}: Plagioclase phyric, pyroxene lapilli tuff, breccia and minor flows.

LT_{Npv}: Green and maroon pyroxene porphyry breccias, pyroxene-olivine basalt flows, and crystal-rich sediments.

LTNs: Grey siltstone, normal graded sandstone and cherty shale with pyroxene and plagioclase-rich crystal sandstones.

LTNvb: Massive, coarse polymictic volcanic breccias, graded sandstones, siltstone and rare limestone breccia horizons.

LTNvl: Red-brown, massive, polymictic breccia, feldspar, and hornblende crystal tuff.

MLTNs: Graphitic and quartzose phyllite, shale, siltstone and sandstone.

MJQm: Hornblende-biotite quartz monzonite.

mk3: moist cool zone.

wk2: wet cool zone.

3.0 VERIFICATION OF SUITABLE REFERENCE LAKE

Prior to the 2021 benthic invertebrate sampling program for Polley Lake, five sediment samples will be collected from lakes with similar geology to Polley Lake and analyzed for metals and grainsize distribution. Water samples will be collected from two locations and two depths (surface and depth) and analyzed for metals, hardness, total and dissolved organic carbon, and nutrients. At each of the two sampling locations, field measurements of pH, temperature, dissolved oxygen and conductivity will be recorded at 1 m intervals. Sampling methods (including quality assurance/quality control procedures) as outlined in the CEMP will be followed.

The resulting physico-chemical data will be compared to data from Polley Lake and Bootjack Lake. The comparisons may be made visually using graphs; through screening against sediment quality guidelines; and/or using statistical tests such as principle components analysis (PCA) or non-metric multidimensional scaling NMDS). The specific tests will be determined at the time of analysis, as factors such as variance and distribution (normal/non-normal) of the data and proportion of detectable versus non-detectable concentrations will need to be taken into account.

Sampling of the benthic invertebrate community of the selected lake will be conducted in 2021, along with sampling in Polley Lake.

4.0 CLOSURE

We trust that this letter provides sufficient information for your present needs. If you have any questions, please do not hesitate to contact the undersigned at 604-296-4200.

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

Yours very truly,

Golder Associates Ltd.

ORIGINAL SIGNED

Barbara Wernick, M.Sc., R.P.Bio.
Principal, Senior Environmental Scientist

ORIGINAL SIGNED

Lee Nikl, M.Sc., R.P.Bio.
Principal, Senior Environmental Scientist

BW/LN/lmi/et

Attachment: Study Limitations

https://golderassociates.sharepoint.com/sites/10023g/documents_1894924/2. issued/111-l-23185-studydesignpolleylake/rev0/1894924-111-l-rev0-23185-reference_lake_study_design_31oct_19.docx

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Appendix C

Combined Monitoring Schedule 2019

Mount Polley Mining Corporation

Monitoring Schedule

Task	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday
	31	**1**	**2**	**3**	**4**	**5**	**6**
					No staff on weekend		
Lakes							
Surface Water		Discharge: E19, HAD-3 Surface water sampling: W1, WA (W1 dup), W4a, W5, W8, W8z, W20, W21, Gavin's Ditch, WL (W12 dup), East 12204 (East MTD dup), West MTD, LD, SERD, E1a, ED (E4 dup), **2 ppl; 8**	Surface water sampling: E13, E14, E15, E17, E18, E19a, E20, E21, E22, E23, STD, TB + FB ; JCP, Boundary Seep 2, MDC, SERD Seep 13 **2 ppl; 8 hours**	SERD Seep Survey **2 ppl; 5 hours**			
Reclamation		Seeding/Monitoring as necessary					
Groundwater				GW15-1A/B & GW15-2A/B SWLs			
Hydrology							
Weather		Snowpack/Manual Rain Gauge		Manual Rain Gauge			
Inspections		Mill Potable Water Meter **2 per; 5 hours (winter)**	HAC Fish Spawning Survey **1 per; 6 hours** **2 ppl; 4 hours**	EDC Fish Spawning Survey; Waste Inspection			
Soil/Sediment		ABA (if dumping NAG waste)					
	7	**8**	**9**	**10**	**11**	**12**	**13**
Lakes	P1 (S+P)[1] + PA-B + P2 (S+P)[1] B1 IS+P) + B2 (S+P) + BB-S **2 ppl; 8 hours**						
Surface Water		**DO all locations:** HAC-01c, HAC-13 + HAC-08, HAC-05a, HAC-10 + HAC-J + HAC-10-FB, POF-1, POF-5, CSD Bridge photos Discharge:E19, HAD-3 + HAD-C BAC-01 (Ladies Dry) **2 ppl; 8**	PAG Seep Survey **2 ppl; 5 hours**	East RDS Seep Survey **2 ppl; 5 hours**			
Dustfalls				Dustfalls **2 ppl; 7 hours in winter** **1 per: 4 hours in summer**			
Reclamation	Seeding/Monitoring as necessary						
Groundwater	GW15-1A/B & GW15-2A/B SWLs						
Hydrology	W1b, W5, W12, SERD, H6 **if safe and not frozen**						
Weather	Manual Rain Gauge	snowpack if melting event forecast		Manual Rain Gauge			
Inspections	Waste inspection	Spring/Fall Ditch Inspections	HAC Fish Spawning Survey	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						
	14	**15**	**16**	**17**	**18**	**19**	**20**
Lakes	QUL-ZOO-8 (S+C)[3] + QUL-ZOO-8-FB QUL-ZOO-7 (S+C)[3] QUL-ZOO-1 (S+C)[3]	QUL-58 (S+C)[1] + T.Hg + Ra-226 QUL-57 (C) + QUL-59 (C) QUL-2a (S+C)[1] + T.Hg + Ra-226	QUL-18 (S+C)[1] + QUL-R-50m QUL-120a (S+C)[f] + QUL-ATa-190m				
Surface Water		Discharge: E19, HAD-3 + T.Hg + Ra-226+ toxicity[a, g, h] (100L) BAC-02 (Pit shop sink)		NEZ Seep Survey + DO at all locations: NEZ Samples + 2119 NEZ Seep LD (US NEZ Seep LD dup)+ Martel Sump + NEZ Seep -TB			
Reclamation	Seeding/Monitoring as necessary						
Groundwater	GW15-1A/B & GW15-2A/B SWLs						
Hydrology	H1, H2, H3, H4 **if safe and not frozen**						
Weather	Manual Rain Gauge	snowpack if melting event forecast		Manual Rain Gauge			
Inspections	Waste inspection	Trailer Inventory	HAC Fish Inspection (if ice free)/Fish Spawning	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						
	21	**22**	**23**	**24**	**25**	**26**	**27**
Lakes							
Surface Water		Discharge:E19, HAD-3 BAC-03 (3rd floor mill lunchroom)					
Reclamation	Seeding/Monitoring as necessary						
Groundwater	Quarterly GW: GW 15-1a & 1b GW 15-2a & 2b GW 12-2a + GWL-Ba & GW 12-2b GW96-7 95-R5 **2 ppl; 8 hours**	Quarterly GW: GW95R-1 + Ecoli + GWIER-A GW05-01 + Ecoli GW04-1 + Ecoli GW-Low Flow + GW-Grundfos GW16-6a & 6b **2 ppl; 8 hours**	Bi-annual GW: GW00-1a & 1b GW00-2a GW00-3a & 3b GW96-3a GW96-4a & 4b **2 ppl; 8 hours**	Bi-annual GW: GW96-2a & 2b GW16-4a & 4b GW16-3a & 3b GW16-5a & 5b GW16-2a & 2b **2 ppl; 8**			
Hydrology	W4a, JCP, NW Ditch, H5 (Junction Zone Ditch), STD, MTD, NEZ Seep 1, SERD Seep 13 **if safe and not frozen**						
Weather	Manual Rain Gauge	snowpack if melting event forecast	Check HOBO Link online	Manual Rain Gauge			
Inspections	Waste inspection	HAC Fish Spawning Survey	Pipeline Inspection	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						
	28	**29**	**30**	**31**			
Lakes							
Surface Water		Discharge:E19, HAD-3 BAC-04 (Assay Lab Eyewash)					
Reclamation	Seeding/Monitoring as necessary						
Groundwater	GW15-1A/B & GW15-2A/B SWLs Bi-annual GW: GW11-1a & 1b GW11-2a & 2b GW12-1a & 1b GW12-3a & 3b GW12-4a & 4b **2 ppl; 8 hours**	Bi-annual GW: GW12-5a & 5b GW16-7 & 8 GW16-1a & 1b **2 ppl; 8 hours**	HAC Creek GW	HAC Creek GW			
Hydrology							
Weather	Manual Rain Gauge	snowpack if melting event forecast		Manual Rain Gauge			
Inspections	Waste inspection	Spring/Fall Ditch Inspections	HAC Fish Spawning Survey	EDC Fish Spawning Survey			
Soil/Sediment	ABA (if dumping NAG waste)						

C = cast + secchi
P = profile + secchi
S = sample

Special Sampling:
1) Chlorophyll a, phytoplankton, [zooplankton - POL only] (Jun/Aug)
3) Zooplankton, chlorophyll *a* , phytoplankton, surface sample

QA/QC Sampling:
Field Blank - 2x monthly minimum
Trip Blank - 2x monthly minimum
Equipment Blank KEM2 - monthly; GW - quarterly
Duplicates - 2x monthly minimum

Quarterly Wells (SWL): Complete Q1

~~GW96-1a~~	GW96-2a
GW96-4a	GW16-2a,3a,4a,5a
GW00-1a	GW96-3a
GW00-2a	GW00-3a

Flows:
Purple:Bucket Black: Tracker

Ongoing/When Time:
Crew Training
Battery recycling
Trailer Clean Up/Safety -test PFDs
Wash trucks (in and out)

Seep Sampling:

SERD	WHR
PAG	TSF
BOUNDARY	NBD
EAST RDS	NEZ

Reclamation Activities:
Grass Seeding

QUL Sample Depths (m):

QUL-18	0, 20, 50, 100
QUL-2a	0, 20, 40, 60
QUL-58	If detect plume: Middle of plume (MP) + 5m above (AP) + 5m below (BP) (all sites) If can't detect plume: S, 1m above thermo , 1m below thermo [or MID if no thermo], bottom * write sample depths in field book **4x per year: T.Hg taken at QUL-58 (depth at which plume expected), QUL-2a (close to same depth as QUL-58), & HAD-3 *** write field parameters for each sample taken and indicate if discharging in field book
QUL-55	0, 15, 30
QUL- 42:	0, 10, 20
QUL-120a:	0, 40, 80, 120, 140 well-mixed: 0, 80, 190

BJ + POL Sample Depths (m):
S, 1m above thermo , 1m below thermo [or MID if no thermo], bottom
* write sample depths in field book
** monthly profiles between spring and fall overturns

Toxicity:
a) 96h LC50 RBT, 48h LC50 *D. magna*
b) 7 day ELS RBT
c) 7d C. dubia S&R
d) 7d RBT S&G
e) 30d ELS RBT
f) 30d ELS top-up (100L)
g) 72h algal (MMER)
h) 7 day duckweed (MMER)

Chorophyll *a* :
250ml polyethylene bottle wrapped in aluminum foil

Phytoplanton:
polyethylene bottle, preserved with Lugol solution

Zooplankton taxonomy (1 haul):
Quesnel Lake --> 150µm mesh net to 30m depth (1 tow), preserved with buffered sucrose
Polley Lake --> 50µm mesh net to 28m depth (1 tow), preserved with 85% ethanol

Zooplankton metals:
minimum amount of water, kept frozen, multiple hauls (depending on biomass)
QUL --> 50 µm mesh net minimum amount of water, kept frozen, multiple hauls (depending on biomass)
POL --> 50 µm mesh net minimum amount of water, kept frozen, multiple hauls (depending on biomass)

Special Analyses:
T.Hg - 40ml glass vial with 1x HCl
Ra-226 - 1L plastic with 6x HNO3

Appendix D

Site Matrix

Mount Polley Mining Corporation

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
W1 Morehead Creek	E 587262 N 5826275	1990	Meandering creek with lots of willows and grass, no distinct trail. Large marsh to the North.	Drive to km 4.5 on Bootjack Road to a small opening in the trees, and walk down the bank on the south side for 50 m. Trail and site marked with orange flagging tape.	Radio communication must be used on the Bootjack Road (Channel RR-25). Ensure that vehicle is parked to the side of the road out of the way of traffic. Watch for wildlife. Watch for rotten logs while approaching site. Follow working in/near water procedures.	Downstream of mine impacted area. Provides opportunity to monitor potential changes in POI's in Bootjack Lake.
W1b Morehead Creek	E 588920 N 5825173	2003	Meandering creek that flows under a bridge.	Drive to approx. km 7 on Bootjack Road and turn south onto side road for approx. 90 m until you reach a bridge. Walk down an embankment on the upstream side of the bridge to the creek.	Radio communication must be used on Bootjack Rd (Channel RR-25). Watch for wildlife. Watch your footing when walking down embankment. Follow working in/near water procedures.	Monitoring flow out of Bootjack Lake.
W4a North Dump Creek	E 593152 N 5824689	2014	Small stream that flows under the Wight Pit road through a culvert.	Drive towards the Wight Pit, before entering pit there will be one last runaway lane on the left hand side, park vehicle on right side of the road. The sample site is located over the berm and down an embankment; there is a large log on the hillside to indicate the sample location.	Watch for wildlife. Watch your step while descending the embankment to monitoring location; there are loose rocks. Follow working in/near water procedures.	Downstream of mine impacted areas. Provides opportunity to monitor for non-contained seeps or run-off collection ditches.
W5 Bootjack Creek	E 594481 N 5820782	1990	Small stream runs through culvert	Drive down the TSF haul road towards Polley lake weir, turn left at the central collection sump. Turn left onto deactivated logging road across from SERD outlet pipe. At top of hill, turn right and at the valley in the road park truck. Trail down to the creek is on the upstream side of creek. Site trail is indicated by fallen tree across path.	Contact Pit Shifter prior to entering haul roads. Drive with caution on haul roads and give heavy equipment the right-of-way. Use 2-way radio communication (Channel 5 – Pit Ops 1). Watch for wildlife. Slippery slopes with quite a few willows and one fallen tree. Old logging road can be very rough and muddy, recommend 4X4 or walk in during snowy conditions. Follow working in/near water procedures.	Downstream of mine impacted areas. Provides an opportunity to monitor for seepage from the SERD.
W8 Edney Creek Tributary	E 597005 N 5817606	1995	Small stream with easy access from the road.	Turn S at the old ABR onto a narrow road. Drive for roughly 2 km, until you come to a small stream flowing under road through a culvert. Monitoring site is located on the downstream side of the road.	This road can be very muddy, recommend 4X4 or walk in during snowy conditions. Look for old orange ribbon. Watch for wildlife. Follow working in/near water procedures.	Downstream of mine impacted area. Provides opportunity to monitor for potential seepage from TSF.
W8z Edney Creek Tributary (control)	E 593290 N 5817920	1997	Small creek flows under road through a culvert. Many trees down over stream and many willows.	Drive to Gavin Lake Rd and turn right. Drive a few kms to about km 15 board, just before a junction with a deactivated logging road. The monitoring location is on the right hand side of the road (upstream side of the road) just before the second landing.	Look for pink ribbon. Park to the side of the road. Short steep incline to access the monitoring site. Watch your step; there is not much room near the creek. Watch for wildlife. Follow working in/near water procedures.	Upstream of mine. Allows for monitoring of seasonal variability of surface water.
W10 Edney Creek	E 601183 N 5816862	1995	Lower Edney Creek underneath a bridge.	Turn left onto Gavin Lake Rd. Continue on and turn right on Ditch Rd towards Horsefly. Travel to the second bridge crossing. On the right hand side of the road past the bridge (upstream side of the creek), there is a path down to the creek.	Watch for public traffic on the road and ensure vehicle is parked out of the way. Flows may be high during freshet. Ice can build up on edges of creek in winter conditions. Watch for wildlife. Follow working in/near water procedures.	Outside of mine impacted area. Allows the opportunity to monitor for changes in newly constructed creek downstream and to monitor for seasonal variability.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
W12 6K Creek (Tributary to Morehead Creek)	E 588360 N 5825961	1990	Small stream that enters a marsh at the end of an old overgrown road. Small fish present in the stream.	Drive to km 5.5 on Bootjack Rd., to the chain-up pullout. Walk down old road on the NE side of Bootjack for roughly 150 m.	Radio communication must be used on the Bootjack Rd (Channel RR-25). Ensure that vehicle is parked to the side of the road out of the way of traffic. Watch for wildlife. Follow working in/near water procedures.	Upstream of mine. Allows for monitoring of seasonal variability of surface water.
W20 Un-named Tributary to Bootjack Lake	E 592161 N 5821586	2013	Small creek on the NE side of Bootjack Lake, lots of grass, willow, alder and fallen trees. Creek flows roughly parallel to the West Ditch.	Walk in or boat access only. Drive midway on the West Ditch Rd. between the Booster Station and Mine Drainage Creek Sump. Park and walk W to the creek. Follow creek to the lakeshore. Monitoring location is in the creek channel approx. 15 m from the lakeshore. Look for orange ribbon at monitoring location.	If accessing by boat, follow safe boating SOP. If walking, watch for wildlife. Watch for Devil's Club. Walk with caution, as there are lots of blowdown. Ensure vehicles are parked out of the way. Follow working in/near water procedures.	Downstream of mine impacted area. Provides the opportunity to monitor for any seepage from the west ditch.
E1a Tailings Storage Facility	E 594495 N5819187	1997	TSF Supernatant	Drive along the TAR to the TSF. Enter the TSF near corner 5 and follow road to the barge.	Use radio communication when travelling on haul roads and contact Pit Shifter prior to entering haul roads and TSF area (switch from Channel 5 to Channel 1 (Tailings) when entering TSF area). Give right-of-way to heavy equipment. Follow working in/near water procedures. Watch for slippery surfaces in freezing conditions.	Monitoring supernatant WQ in the TSF.
E11 Springer Pit	E 591701 N 5823327	2011	At bottom of the Springer Pit.	Travel down into the bottom of the Springer pit ramp and the monitoring location is near the pipes coming out of the springer pit.	Contact the Pit Shifter prior to entering and leaving the Springer Pit. Use caution when walking under highwalls.	When not storing water from other sources on site: source terms. When storing water from other sources on site: monitoring for potential discharge.
E19	E 595760 N 5819760	2015	Water Treatment Plant Influent	Travel down the TSF haul road towards corner 2 of the TSF. Approx. half way to corner 2 there is a road on the left that goes to the WTP. Monitoring site is located inside facility at the influent pipe at the main entrance to plant.	Use caution when driving on haul roads; contact the Pit Shifter prior to traveling to and from WTP. Watch for haul trucks on haul roads. Give the right-of-way to heavy equipment and used 2-way radio communication.	Provides ability to monitor efficacy of treatment.
HAD-3	E 595772 N 5823583	2015	Water Treatment Plant Effluent	Travel down the TSF haul road towards corner 2 of the TSF. Approx. half way to corner 2 there is a road on the left that goes to the WTP. Monitoring site is located inside facility at the effluent pipe located by the door that leads to the WTP office.	Use caution when driving on haul roads; contact the Pit Shifter prior to traveling to and from WTP. Watch for haul trucks on haul roads. Give the right-of-way to heavy equipment and used 2-way radio communication.	Compliance point for discharge to environment.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
H1 Hazeltine Creek	E 597030 N 5818978	2015	Mid Hazeltine Creek hydrology station approximately 100 m downstream of Gavin Lake Bridge.	Travel to Gavin Lake Rd and turn left. Cross the Gavin lake bridge and park off to the side. Walk approx. 100 m downstream of the bridge to hydrological monitoring station and is marked with staff gage and metal pipes.	Used caution when driving on TSF haul road. Contact the Pit Shifter prior to traveling on haul roads. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch your footing on loose rocks. Watch for wildlife. Use caution in high flow times. Follow working in/near water procedures. May need hip waders.	To monitor hydrology of mid Hazeltine Creek.
H2 Hazeltine Creek	E 601024 N 5817253	2015	Lower Hazeltine Creek hydrology station.	Travel to the Gavin Lake Rd and turn left. Continue on road until you reach the Ditch Rd, and turn right towards Horsefly. Before the Ditch Road bridge, turn left through the gate. The station is approx. 200m from the gate. Hydrology station is marked with staff gage and metal pipes.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Watch for wildlife. Use caution in high flow times. Follow working in/near water procedures. May need hip waders.	To monitor hydrology of lower Hazeltine Creek.
H3 Edney Creek	E 601538 N 5817123	2015	Edney Creek Hydrology station.	Travel to the Gavin lake Rd and turn left. Continue on road until you reach the Ditch Rd, and turn right towards Horsefly. Drive past the Ditch Road bridge and turn left through the gate. Drive approx. 300 m and the hydrology station is marked with staff gage and metal pipes on the right hand side of the road.	Park vehicle to the side of road. Watch footing when walking to hydrology station – some loose rocks. Use caution in high flow times – do not complete task if flow is too strong. Follow working in/near water procedures. Watch for wildlife. May need hip waders.	To monitor hydrology of Edney Creek.
H4 Hazeltine Creek	E 595892 N 5819997	2015	Upper Hazeltine Creek hydrology station at Polley lake weir..	Drive down the TSF haul road to Polley lake weir. Hydrology station is marked by staff gauge approx. 50 m downstream, of the weir.	Use caution when driving on haul roads, radio contact the Pit Shifter prior to entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times. Follow working in/near water procedures. Watch footing on loose rocks down to the creek. May need hip waders.	To monitor hydrology in upper Hazeltine Creek and out of Polley Lake.
HAC-05a Hazeltine Creek	E 596916 N 5819074	2015	Upper Hazeltine Creek just upstream of Gavin Lake bridge.	Travel as described above to H1. Monitoring location is the upstream side of Gavin Lake bridge.	Used caution when driving on TSF haul road. Radio contact the Pit Shifter prior to entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch your footing on loose rocks. Watch for wildlife. Use caution in high flow times and winter conditions. Follow working in/near water procedures.	Monitor WQ downstream of the effluent discharge - when discharging. To monitor WQ post creek reconstruction - when not discharging.
HAC-08 Hazeltine Creek	E 600723 N5817290	2015	Lower Hazeltine Creek just upstream of Ditch road bridge.	Travel as described above to H2, but instead of turning left before the bridge, drive to the bridge and park to the side. Monitoring location is just upstream of the Ditch road Bridge.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Use caution in high flow times. Use caution in freezing conditions as ice can build up – may need swing sampler in these conditions. Follow working in/near water procedures.	This site was established to monitor WQ below the canyon. As Hazeltine Creek remediation continues there are opportunities to monitor the effect of remediation on the creek.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
HAC-10 Hazeltine Creek	E 595793 N 5820738	2015	Upper Hazeltine Creek monitoring site just downstream of Polley Lake weir.	Travel as described above to H4. Sample location is just downstream of Polley lake weir, from a large rock on the west side bank.	Use caution when driving on haul roads, radio contact the Pit Shifter before entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times and winter conditions. Follow working in/near water procedures.	Monitor the surface WQ of Polley Lake as the water flows out of the lake and into Hazeltine Creek. The data from this site provides quick feedback on important parameters for fish habitat in the creek (pH, DO, and temperature).
HAC-12 Hazeltine Creek upper settling pond	E 601577 N 5817292	2015	Lower Hazeltine Creek monitoring site at diffuser pipes in upper settling pond.	Travel as described above to H2, but drive approx. 500 m past it towards Quesnel Lake. Site is marked with two curved pipes sticking out of the ground.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Use caution in high flow times and icy conditions as ice can build up on edges. Follow working in/near water procedures.	This site currently monitors the quality of the mixture of effluent discharge and Hazeltine Creek water prior to the outflow to Quesnel Lake – when discharging. Site will be removed from the sampling program once discharge pipeline is complete.
HAC-01c Hazeltine Creek outflow	E 601661 N 5817598	2015	Hazeltine Creek outflow to Quesnel Lake.	Travel as described to HAC-12, and then drive towards Quesnel Lake. Monitoring Site is located at the outflow of Hazeltine Creek into Quesnel Lake.	Park vehicle to the side of road. Watch for wildlife. Call km boards on the radio while traveling in both directions. Use caution in high flow times and icy conditions as ice can build up on edges. Follow working in/near water procedures.	Monitor WQ at the mouth Hazeltine creek at Quesnel lake once the discharge pipeline is complete. It will replace HAC-12 as the outflow site when it is removed from the sampling program.
HAC-14 Hazeltine Creek	E 598742 N 5817299	2017	Mid Hazeltine Creek monitoring site above the canyon.	Drive as described to H1, but continue down Gavin Lake road to approx. km 5.5 and turn right on the creek access road. Continue on road for approx. 2 km and turn right at the second road on the right hand side. Monitoring site is located at the bottom of the ramp marked by a red and white stripped flagging tape.	Use caution when driving on haul roads, radio contact the Pit Shifter before entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times and winter conditions as ice can build up on edges of creek. May need snowshoes in winter. Follow working in/near water procedures.	Monitor WQ of Hazeltine creek above the canyon.
POF-5 Polley Flats	E 595682 N 5820174	2017	Drainage from Polley Flats into Hazeltine Creek	Drive as described to HAC-10. Just before the weir, turn right and follow road to the end. Site is on the left hand side towards Hazeltine Creek and is marked with an orange stake at the outflow to Hazeltine Creek.	Use caution when driving on haul roads, radio contact the Pit Shifter before entering area. Give the right-of-way to heavy equipment and used 2-way radio communication. Watch for wildlife. Use caution in high flow times and winter conditions. Follow working in/near water procedures.	Monitor WQ of the drainage from the Polley Flats.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
EDC-01 Edney Creek	E 601811 N 5817445	2015	Lower Edney Creek Sample site approx. 20 m upstream of the flood channel.	Follow travel instructions as described above to H3. Follow Edney Creek downstream towards Quesnel Lake and the monitoring location is approx. 20 m upstream from the flood channel.	Park vehicle to the side of road. Watch footing over loose rocks to the creek. Use caution in high flow times and freezing conditions as ice can build up on edges of creek. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ of Edney Creek post reclamation of the lower section and its input to Quesnel Lake.
B1 Bootjack Lake	E 590049 N 5823528	2001/2007	Bootjack lake north WQ monitoring site	Drive on the Bootjack Forest service road to the Bootjack lake campsite at km 8 on the access road.	Follow Safe Boating SOP. Contact Pit Shifter and Front Gate person when leaving mine site. Call kms on Channel RR-25 on the Bootjack FSR. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ for potential mine influence in Bootjack Lake.
B2 Bootjack Lake	E 591263 N 5821647	2001/2007	Bootjack Lake south WQ monitoring site	Drive on the Bootjack Forest service road to the Bootjack lake campsite at km 8 on the access road.	Follow Safe Boating SOP. Contact Pit Shifter and Front Gate person when leaving mine site. Call kms on Channel RR-25 on the Bootjack FSR. Watch for wildlife. Follow working in/near water procedures.	Monitor water WQ for potential mine influence in Bootjack Lake
P1 Polley Lake	E 593708 N 5824693	2001/2007	Polley Lake north WQ monitoring site	Drive down the TSF haul road to Central collection sump near corner 1. Turn left as if going to the central collection sump but then drive approx. 500 m and then turn right onto Polley lake boat launch.	Follow Safe Boating SOP. Contact the Pit Shifter prior to traveling on Haul roads. Use caution on Haul roads, give the right-of-way to heavy equipment and use 2-way radio communication. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ water quality for potential mine influence in Polley Lake
P2 Polley Lake	E 595348 N 5821863	2001/2007	Polley Lake south WQ monitoring site	Drive down the TSF haul road to Central collection sump near corner 1. Turn left as if going to the central collection sump but then drive approx. 500 m and then turn right onto Polley lake boat launch.	Follow Safe Boating SOP. Contact the Pit Shifter prior to traveling on Haul roads. Use caution on Haul roads, give the right-of-way to heavy equipment and use 2-way radio communication. Watch for wildlife. Follow working in/near water procedures.	Monitor WQ for potential mine influence in Polley Lake
QUR-11 Quesnel River	E 596625 N 5830438	2016	Quesnel River WQ monitoring site at Likely Bridge	Drive on the Likely Highway towards the town of Likely, approx. 30 km from the Bootjack Forest service road. Park in the pullout just before the bridge. Collect water from the bridge using the Kemmerer sampler. Monitoring site is indicated by darker brown coloured post in the middle of the bridge.	Wear reflective PPE, watch for traffic. Use caution in the winter as bridge can get slippery.	This site was established to mirror the Federal Provincial Monitoring site for the outlet of Quesnel Lake that is funded by MPMC. Monitor WQ in Quesnel River.
QUL-2a Quesnel Lake	E 607988 N 5817214	2014	Quesnel Lake post-breach and effluent discharge monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ upstream of diffuser ports in Quesnel Lake.
QUL-120a Quesnel Lake	E 618271 N 5818030	2014	Quesnel Lake background WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor Quesnel Lake WQ at background site.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
QUL-18 Quesnel Lake	E 600795 N 5819749	2014	Quesnel Lake post-breach and effluent discharge monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ downstream of diffuser ports in Quesnel Lake
QUL-58 Quesnel Lake	E 601791 N 5818025	2015	Quesnel Lake effluent discharge monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor the initial dilution zone of the effluent plume in Quesnel Lake. Default WQ monitoring site when not discharging.
QUL-ZOO-1 Quesnel Lake	E 601058 N 5819925	2015	Quesnel Lake zooplankton and WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ and zooplankton community and tissue in the West Basin of Quesnel Lake.
QUL-ZOO-7 Quesnel Lake	E 612469 N 5816656	2015	Quesnel Lake zooplankton and WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ and zooplankton community and tissue near Horsefly River in Quesnel Lake.
QUL-ZOO-8 Quesnel Lake	E 630691 N 5821991	2014	Quesnel Lake zooplankton and WQ monitoring site.	Quesnel Lake is accessed via the boat launch near the effluent discharge (see access description for HAC-12), at Mitchell Bay, or at Cedar Creek (Likely).	Follow Safe Boating SOP. Call the Pit Shifter and Front Gate person when leaving mine site. Use caution when hauling the boat. Watch for wildlife.	Monitor WQ and zooplankton community and tissue background in Quesnel Lake.
Weather Station #1	E 592792 N 5823182	2012	HOBO weather monitoring station.	Drive along the Wight Pit Haul road and turn left onto the road to the Leach Pad. Park beside the leach pad and walk up the grassy hill between the sulphur pile and the research tree plots. Weather station is located at the top of the hill.	Call the Pit Shifter prior to traveling on Haul roads. Give right-of-way to heavy equipment. Watch for wildlife. Use caution near sulphur pile and watch footing walking up hill. Snowshoes may be required in winter.	Monitor wind speed/gust/direction, rain, solar radiation, and min/mean/max temperature continuously for water balance monitoring on site.
Weather Station #2	E 591092 N 5819976	2012	HOBO weather monitoring station.	Drive along light duty road towards the Orica site. Drive up the Orica site road (approx. 30 m) and park slightly off the road as to not block access. The Weather Station is located on top of a small hill on the right hand side of the road.	Call the Pit Shifter prior to traveling on Haul roads. Give right-of-way to heavy equipment. Watch for wildlife. Watch footing walking up hill.	Monitor wind speed/gust/direction, rain, solar radiation, and min/mean/max temperature continuously for water balance monitoring on site.
Snow Course Site: Weather Stn #1	E 592792 N 5823182	1997	Snow course monitoring site.	Follow instructions as described above for Weather Station #1.	Call the Pit Shifter prior to traveling on Haul roads. Give right-of-way to heavy equipment. Use caution when driving in winter conditions. Watch for wildlife. Use caution near sulphur pile and watch footing walking up hill. Snowshoes may be required.	Monitor snowpack-water equivalent for water balance monitoring on site.
Snow Course Site: JCP	E 593632 N 5823895	2012	Snow course monitoring site.	Drive along Wight Pit haul road towards the Wight Pit. Turn right at the third road on the right hand side. Drive up to stream crossing. May need to walk in snowy conditions approx. 100 m to clearing on the left hand side. Snowpack course site is in that clearing.	Call Pit Shifter prior to traveling on haul roads and give right-of-way to heavy equipment. Used Caution when driving in winter conditions. Watch for wildlife. Snowshoes may be required.	Monitor snowpack-water equivalent for water balance monitoring on site.
Snow Course Site: TSF	E 594092	1997	Snow course monitoring site.	Drive as described above to Weather Station #2, but instead of turning at the Orica site, drive past it	Call Pit Shifter prior to traveling on haul roads and give right-of-way to heavy equipment. Used	Monitor snowpack-water equivalent for water balance monitoring on site.

Sampling Site	UTM	Monitored Since	Site Description	Site Location	Access or Safety Concerns	Rationale for Monitoring
	N 5819976			approx. 100 m. Pull over to side of road when a small clearing in the trees is reached on the right hand side. A ditch indicates the site.	Caution when driving in winter conditions. Watch for wildlife. Snowshoes may be required.	
Snow Course Site: PAG	E 590835 N 5823537	2015	Snow course monitoring site.	Drive along haul road towards the PAG dump. Take the small ramp on the left hand side towards the 9k sump. Drive to the NW sump. Site is located up ramp beside the sump.	Call Pit Shifter prior to traveling on haul roads and give right-of-way to heavy equipment. Used Caution when driving in winter conditions. Watch for wildlife. Snowshoes may be required.	Monitor snowpack-water equivalent for water balance monitoring on site.

Notes:
POI – Parameters of Interest
TSF – Tailings Storage Facility
TAR – Tailings Access Road
WQ – Water Quality

Appendix E

Declaration of Competency Forms

Ministry of
Environment and
Climate Change Strategy

Declaration of Competency

The Ministry of Environment and Climate Change Strategy relies on the work, advice, recommendations and in some cases decision making of qualified professionals[1], under government's professional reliance regime. With this comes an assumption that professionals who undertake work in relation to ministry legislation, regulations and codes of practice have the knowledge, experience and objectivity necessary to fulfill this role.

This declaration of competency is collected for the purposes of increasing government transparency and ensuring professional ethics and accountability. It will be disclosed to the public.

1. Name of Qualified Professional BARBARA WERNICK

   Title SENIOR ENVIRONMENTAL SCIENTIST

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: COLLEGE OF APPLIED BIOLOGY (# 1171)

3. Brief description of professional services:

   DEVELOPMENT OF APPROACH TO SELECTION OF REFERENCE LAKES, SUMMARIES OF AMPHIBIAN & TERRESTRIAL STUDY COMPONENTS

Declaration

I declare that I am a qualified professional with the required knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

x BWernick

Print Name: BARBARA WERNICK

Witnessed by:

x L. Nikl

Print Name: Lee Nikl

Date signed: 30 OCTOBER 2019

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably by relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

BRITISH COLUMBIA

Ministry of
Environment and
Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Blair McDonald

   Title Associate, Senior Environmental Scientist

2. Are you a registered member of a professional association in B.C.? ☒ Yes ☐ No

   Name of Association: College of Applied Biology Registration # 1528

3. Brief description of professional services:

   Environmental toxicology and ecological risk assessment

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X [signature]

Print Name: Blair McDonald

Witnessed by:

X [signature]

Print Name: NEIL McQUITTY

Date signed: 29 Oct 19

[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

a) *is registered in British Columbia with a professional association, is acting under that organization's code of ethics, and is subject to disciplinary action by that association, and*

b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

Ministry of Environment and Climate Change Strategy

Declaration of Competency

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1. Name of Qualified Professional Pierre Stecko

   Title Senior Aquatic Scientist

2. Are you a registered member of a professional association in B.C.? ☑ Yes ☐ No

   Name of Association: College of Applied Biology Registration # 1709

3. Brief description of professional services:

   Aquatic environmental assessment, water quality, sediment quality, aquatic ecotoxicology

This conflict of interest disclosure statement is collected under section 26(c) of the *Freedom of Information and Protection of Privacy Act* for the purposes of increasing government transparency and ensuring professional ethics and accountability. By signing and submitting this statement you consent to its publication and its disclosure outside of Canada. This consent is valid from the date submitted and cannot be revoked. If you have any questions about the collection, use or disclosure of your personal information please contact the Ministry of Environment and Climate Change Strategy Headquarters Office at 1-800-663-7867.

Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

Signature:

X 

Print Name: Pierre Stecko

Date signed: October 24 '19

Witnessed by:

X K Batchelar

Print Name: Katharina Batchelar

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Ministry of Environment and Climate Change Strategy

BRITISH COLUMBIA

Declaration of Competency

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Declaration

I am a qualified professional with the knowledge, skills and experience to provide expert information, advice and/or recommendations in relation to the specific work described above.

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[1] *Qualified Professional, in relation to a duty or function under ministry legislation, means an individual who*

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b) *through suitable education, experience, accreditation and knowledge, may reasonably be relied on to provide advice within his or her area of expertise, which area of expertise is applicable to the duty or function.*

APPENDIX 9-1: Surface Erosion Prevention and Sediment Control Plan

Mount Polley Mine
Environmental Management Plan:

Sediment and Erosion Control Management Plan

Last Update: 31 July 2023

Document Revision Control

Rev. No.	Revision	Date	Approved
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1 INTRODUCTION

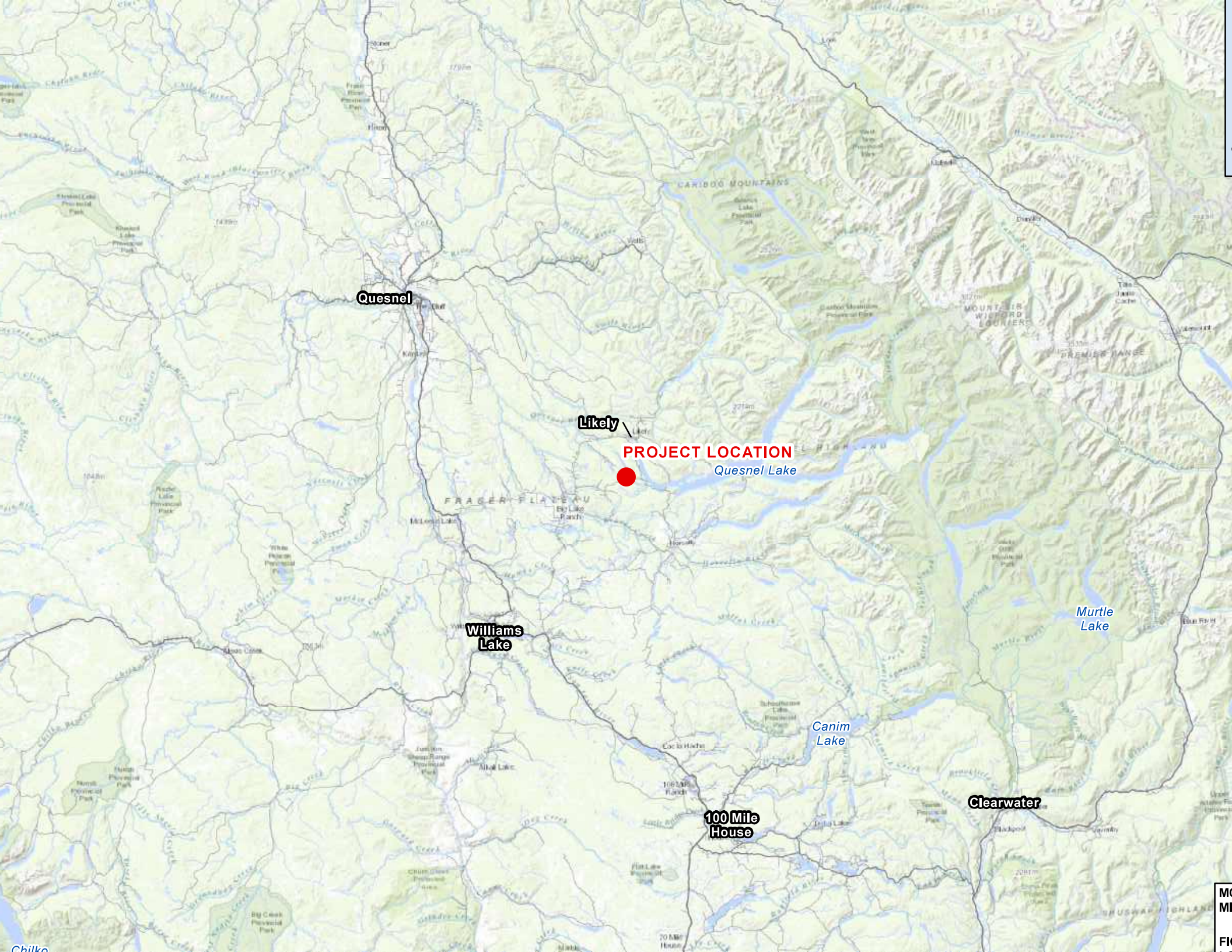
This “Sediment and Erosion Control Management Plan” (the Plan) provides direction for the management of surface erosion at Mount Polley Mine (the Mine). The Plan addresses existing and potential surface erosion impacts associated with mine expansion (construction activities), operation, and decommissioning phases, and applies to all Mount Polley personnel and contractors. The main objective of this Plan is to minimize erosion of surficial sediments and intercept and manage sediment laden water as close to the source as possible. Erosion and sediment control measures and best management practices (BMPs) are incorporated in the Plan as approaches to prevent erosion and the introduction of sediment into natural water bodies and watercourses. Guidelines for monitoring the efficacy of measures in this Plan are also presented.

2 DESCRIPTION OF THE PROJECT

2.1 Project Location

The Mine, operated by Mount Polley Mining Corporation (MPMC, a wholly owned subsidiary of Imperial Metals Corporation), is an open pit copper/gold mine with an underground component located in south-central British Columbia. It is located 8 kilometres (km) southwest of Likely and 56 km northeast of Williams Lake, British Columbia (BC) (refer to Figure 1). The Mount Polley Mine has the capacity to process 20,000 to 22,000 tonnes per day (tpd) of ore when in normal operations. The mine property covers 24,077 hectares (ha), consisting of 7 mining leases totalling 2,007 ha, and 51 mineral claims encompassing 22,070 ha. Mine concentrates are trucked to facilities at the Port of Vancouver, then shipped to overseas smelters or transported by rail to smelters in North America.

The Mine property is located on the eastern edge of the Fraser Plateau physiographic sub-division, characterized by rolling topography and moderate relief. Elevations range from 920 metres above sea level (masl) at Polley Lake to 1266 masl at the summit of Mount Polley.


Quesnel
Likely
PROJECT LOCATION
Quesnel Lake
Williams Lake
Murtle Lake
Canim Lake
100 Mile House
Clearwater
CARIBOO MOUNTAINS
FRASER PLATEAU
MOUNTAINS WILFRID LAURIER
PREMIER RANGE

2.2 Project History

Clearing of the site and construction of the entire facility began in 1995, with the mill commissioned in June 1997. In May 1997, the Mine received a BC Ministry of Environment and Climate Change Strategy (BC ENV) (previously the Ministry of Water, Land and Air) Effluent Permit, *Environmental Management Act* (EMA) Permit 11678 (PE11678)', issued under the provisions of the provincial EMA. This permit authorized the discharge of concentrator tailings, mill site runoff, mine rock runoff, open pit water, and septic tank effluent to a tailings storage facility (TSF). Approval of the original Mount Polley Mine Reclamation and Closure Plan by the BC Ministry of Energy, Mines and Low Carbon Innovation (BC EMLI) (previously Ministry of Energy, Mines and Petroleum Resources) resulted in the issuance of *Mines Act* Permit M–200 in July 1997.

The first full year of mining and milling at the Mine took place in 1998. The mine suspended operations in October 2001 due to low metal prices, then reopened in December 2004, with mill production commencing in March 2005.

The Mine is currently coming out of care and maintenance and entering full operations, having been in care and maintenance since 31 May 2019. The operational period of the mine is planned to extend beyond 30 June 2025, which is the last day of approved discharge under the current version of EMA Permit 11678 (amended 1 December 2022).

2.3 Plan Objectives

The intent of this plan is to provide site-specific sediment and erosion control measures for the activities at the Mount Polley Mine site, including protective measures and guidance to be implemented during all phases of the mine activities, concentrating on construction activities. The sediment and erosion mitigation strategies will follow applicable Best Management Practices (BMPs) along with site-specific measures for water management, and sediment and erosion control during construction. The mitigation measures and strategies outlined in the Plan will assist MPMC in meeting or exceeding the Projects regulatory conditions during mining and construction activities. More specifically, the Plan is intended to prevent or minimize the transport, and deposition of sediments and soil particulates from the mine site into environmentally sensitive areas such as nearby watercourses and affect downstream water quality.

The general approach applied in this document is to reduce sediment sources and minimize contact between sediment sources and water. Where avoidance is not possible, mitigation measures are adopted to reduce erosion. The BC Ministry of Transportation and Infrastructure (MOTI) describes erosion and sediment controls as: (i) erosion control – prevent or minimize the dislodgement of soil particles, and (ii) sediment control – to capture water-borne particles in a controlled manner before undesirable damage is caused (MOTI 2022). Sediment and erosion control measures are, and will continue to be, used during construction, operation, and decommissioning activities at the Mine. Activities that may result in erosion include clearing vegetation and stripping topsoil, stockpiling topsoil, and constructing roads, infrastructure, and tailings and water management structures. Potential hazards from these activities, in the absence of planned mitigation measures, include increased surface erosion from disturbed areas, increased sediment load to downstream receiving environments, and siltation or erosion of downstream watercourses or water bodies.

The main objectives of the Sediment Control and Erosion management plan are:

- Minimize the quantity of contact water by intercepting and/or diverting surface water before it enters a disturbed area with exposed soils or co-mingles with contact water.
- Collect and manage all contact water for treatment before discharge to the environment.
- Allow discharge to the environment if regulatory discharge criteria are met (PE11678).

The following are guidelines applicable to surface erosion prevention and sediment control. These documents may be used as a resource when developing project specific environmental management plans (EMPs) for the Mine.

- "Erosion and Sediment Control Manual", (MOTI 2022).
- "Developing a Mining Erosion and Sediment Control Plan Version 1.0" (BC Ministry of Environment [MoE] 2015).
- "Environmental Best Management Practices for Urban and Rural Land Development in British Columbia" (Draft) (MWLAP 2004).
- "Standards and Best Practices for Instream Works" (MWLAP 2004).
- "Best Management Practices Guide for Storm water: Appendix H Construction Site Erosion and Sediment Control Guide" (Dayton and Knight 1999).
- "Land Development Guidelines for the Protection of Aquatic Habitat" (DFO 1993).

2.4 Roles and Responsibilities

Mine Manager: The Mine Manager will be aware of the Plan and how the proposed or ongoing mining activities could affect soil erosion potential and sediment delivery to adjacent watercourses and water bodies. The Mine Manager is accountable for allocating resources for implementing the measures outlined in the Plan to comply with relevant water quality guidelines and applicable water quality objectives.

Environmental Superintendent: The Environmental Superintendent will be accountable for implementing the requirements of the Plan, including monitoring and reporting activities. The Environmental Superintendent will be aware of and familiar with the relevant legislation and permit requirements listed in Section 2.2 to ensure compliance with the regulatory requirements. Responsibilities of the Environmental Manager include:

- Implementation of the Plan.
- Tracking compliance with provincial and federal legislation and applicable permit conditions.
- Communicating environmental requirements and performance to the Mine Manager.
- Investigating and reporting environmental incidents.
- Developing and implementing strategies to address environmental risks, incidents, and non-compliance situations.

The Environmental Superintendent will use external Qualified Professionals (QP) who have specific expertise in erosion protection and sediment control, as necessary, for implementation or improvement of the Plan.

Employees and Contractors: All employees and contractors involved in the planning, design, and carrying out of site preparation and earthworks at the Mine site will be required to undergo basic training and orientation to become familiar with the contents of the Plan.

3 LEGISLATION AND REGULATIONS

3.1 Legislation

The following lists the federal and provincial regulatory requirements with regards to surface erosion prevention and sediment control. The guidance in the subsequent sections is designed to help works proceed in accordance with these regulations:

- BC *Water Sustainability Act*
- BC *Environmental Management Act*
- BC *Mines Act*
    - Health, Safety and Reclamation Code for Mines in British Columbia (EMLI 2021)
- Canada Fisheries Act
    - Metal and Diamond Mine Effluent Regulation
- Canada *Environmental Protection Act*

3.2 Existing Permits

MPMC has received and is currently operating under the following two permits:

- BC Mines Act Permit M200 (5 May 2023)
- BC Environmental Management Act (EMA) PE11678 (1 December 2022)

Permit M200 contains sections that address sediment and erosion control management for the site and are included in Appendix A.

4 EXISTING SITE CONDITIONS

4.1 Topography

Terrain and geomorphology of the region comprise flat and gently rolling topography with hummock bedrock exposures, dissected by a network of streams and lakes. Surface drainage patterns are influenced by bedrock topography. In the Tailings Storage Facility (TSF) area, the gentle topography and surface expression of the lowland area at the head of the west arm of Quesnel Lake is the result of glacial advance followed by glacial retreat and inundation by meltwater, creating a glacial lake (glaciolacustrine) environment. The regional surficial geology is predominantly the result of erosion and deposition associated with the most recent glaciation.

4.2 Geologic Setting

Volcanic rocks generally underlay this part of the plateau with inclusions of intrusive rocks. Most of the area is covered by a deposit of unconsolidated till which contains fluvial, lacustrine, and colluvial deposits. Some patches of organic soils are present in poorly drained areas (i.e., wetlands). The property is in an alkali porphyry copper-gold deposit hosted in the Central Quesnel Belt along the Intermountain Belt of BC.

4.3 Vegetation

The site is located within the Interior Cedar Hemlock bio geoclimatic zone. Local forests consist of western red cedar, douglas-fir, hybrid spruce, and subalpine fir, with a lesser presence of trembling aspen, black cottonwood, and paper birch. Much of the area was historically harvested in commercial logging operations and was also used for cattle grazing.

4.4 Soils

The regional surficial geology is predominantly the result of erosion and deposition associated with the late Pleistocene (Wisconsinan) glacial episode referred to as the Fraser Glaciation. The stratigraphic sequence identified in the area of the TSF can be generalized in order of increasing depth as follows:

- Fill and anthropogenic materials.
- Till, interpreted as till derived from sediment entrained within the glacial ice and deposited by melting water and ice (ablation till).
- Glaciolacustrine sediments.
- Glaciofluvial sediments.
- Basal till.
- Bedrock.

4.5 Watercourses

The Mine is drained by three main watersheds: Hazeltine Creek (30.2 km^2) at Quesnel Lake, Edney Creek (87.4 km^2) at Quesnel Lake, and Morehead Lake (62.7 km^2) (Figure 2). The Hazeltine Creek watershed includes Polley Lake and conveys all water from Polley Lake, the east side of Mount Polley, and the area surrounding the TSF. The Morehead Creek watershed includes the Bootjack Lake catchment area (11.2 km^2). The regional topography, water bodies, and watersheds are shown in Figure 2.


Morehead Lake
Morehead Creek
Frypan Lake
Grogan Creek
Cedar Creek
WB1
(MOREHEAD CREEK)
MOREHEAD LAKE CATCHMENT AREA
Dow Creek
Nina Lake
Dag Creek
Polley Lake
Bootjack Lake
Mount Polley Mine Site
HAZELTINE CREEK CATCHMENT AREA
Jacobie Lake
Trio Creek
BOOTJACK LAKE CATCHMENT AREA
Trio Lake
Bootjack Creek
Quesnel Lake
H1
(UPPER HAZELTINE)
Raft Creek
H2
(LOWER HAZELTINE)
Hazeltine Creek
H3
(LOWER EDNEY)
EDNEY CREEK CATCHMENT AREA
Gavin Lake
Gavin Creek
Moorhouse Creek
Edney Creek
Fire Lake
Edney Lake
Moorhouse Lake

4.6 Climate

The average annual precipitation in the area is 612 millimetres (mm). Precipitation typically occurs as snowfall from November through March, with an average maximum of snowpack of 185 mm snow water equivalent occurring at the end of March. Average monthly temperatures at the Mine range from -13.1 degrees Celsius (°C) in December to 18.9 °C in July. Prevailing winds are from the northwest near the TSF, and from the southwest (and to a lesser extent from the northwest) near the mill.

4.7 Climate Baseline

The climate baseline for the Mine was updated in 2022 (Golder 2022). A summary of the baseline climate parameters is provided in Table 1 and is described in Golder 2022.

Table 1: Summary of Key Climate Parameters

Parameter	Value
Mean annual total precipitation (mm)	612
1:2-year 24-hour rainfall (mm)	33
1:200-year 24-hour rainfall (mm)	69
Projected annual total precipitation anomaly from baseline for 2050's (%)	+5
Projected annual total precipitation anomaly from baseline for 2080's (%)	+8
Mean annual temperature (°C)	3.9
Average winter season (sub-zero mean monthly temperatures)	November to March
Projected annual air temperature anomaly from baseline for 2050's (°C)	+1.8
Projected annual air temperature anomaly from baseline for 2080's (°C)	+2.7
Mean annual relative humidity (%)	68.1
Mean annual solar radiation (W/m^2)	135
Mean annual shallow lake evaporation (mm)	673
Mean annual potential evapotranspiration (mm)	863
Mean snow water equivalent for the month of March (mm)	185

Note: Statistics are based on reviewed historical records from multiple climate stations and measured and derived data (where applicable).

mm = millimetre; °C = degrees Celsius; W/m^2 = watts per square metre.

4.8 Land Use

Infrastructure at the Mount Polley Mine site includes open pits, an underground mine, a crusher, a mill, and office spaces, a TSF, a water treatment plant (WTP), waste rock disposal areas, collection and settling ponds, a surface water collection system, haul roads, access roads, and storage facilities. The total lease area associated with the Mine is 18,892 hectares (ha).

5 RISK ASSESSMENT

The sediment and erosion controls required are based on associated risk to the environment. Table 2 relates potential sediment sources to the sensitive areas on and surrounding the Mine site and assigns a level of risk based on sensitivity of the receiving environment (receiver size, fish bearing status, etc.) and erosion potential.

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
6 km Creek	- Not fish bearing in upper reaches. - Variable forest buffer.	- Access road. - Junction Zone Ditch or 9 km Sump.	- NW PAG Stockpile soil stockpiles - NW PAG Stockpile/Junction Zone Ditch access roads. - NW Sump.	- Established gravel ditch bottom. - Upstream area mostly covered with waste rock. - Soil stockpiles revegetation. - Two high traffic road crossings.	Medium.
Mine Drainage Creek	- Not fish bearing. - Connected to Bootjack Lake.	- Mine Drainage Creek Sump. - West Ditch.	- Waste Haul Road. - Helipad reclamation parcel. - Crusher Access Road. - Ore Switchback Road. - Cariboo .Stockpile and soil stockpiles. - Pipeline from Springer Pit to water treatment plant.	- Some unarmoured ditch sections. - Some till placed on outer slope of Waste Haul Road. - Active haul traffic on roads (can develop sediment-laden puddles). - Caribou Stockpile soil stockpiles new. - Helipad reclamation parcel revegetating. - Majority of runoff into ditch (including from reclamation and soil stockpile areas) filters through rock haul road. - Water in pipeline to treatment plant contains low total suspended solids.	Medium.
W20 Creek	- Fish bearing (very low productivity). - Variable forest buffer.	- West Ditch. - West Ditch Access Road.	- Light Vehicle Tailings Road. - Waste Haul Road. - Above Waste Haul Road reclamation parcel. - Pipeline from Springer Pit to water treatment plant.	- Ditch armoured - Reclamation parcel revegetating; upstream of Waste Haul Road. - Active haul traffic on roads (can develop sediment-laden puddles). - Water in pipeline to treatment plant contains low suspended solids. - Majority of runoff into ditch filters though rock haul road.	Medium.

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Bootjack Lake	- Fish bearing. - Medium sized receiver. - Variable forest buffer.	- NW Sump. - NW Ditch. - Mine Drainage Creek Sump. - West Ditch. - West Ditch Access Road. - Mine Drainage Creek. - W20 Creek.	- Waste Haul Road. - Helipad reclamation parcel. - Crusher Access Road. - Ore Switchback Road. - Caribou Stockpile and soil stockpiles. - Light Vehicle Tailings Road. - Waste Haul Road. - Above Waste Haul Road reclamation parcel. - Pipeline from Springer Pit to water treatment plant.	- Some unarmoured ditch sections. - Some till placed on outer slope of Waste Haul Road. - Active haul traffic on roads (can develop sediment-laden puddles). - Caribou Stockpile soil stockpiles new. - Reclamation parcels revegetating. - Water in pipeline to treatment plant contains low total suspended solids. - Majority of runoff into ditch filters through rock dumps and rock haul roads.	Medium.
North Dump Creek	- Not fish bearing in upper reaches. - Variable forest buffer.	- Joe's Creek Coffer Dam. - Joe's Creek Pipeline. - Gavin's Ditch (clean water diversion). - Wight Pit Ditch (clean water diversion). - Wight Pit Haul Road.	- North Bell Dump reclamation areas and soil stockpiles. - Access Road. - East Dump reclamation areas and soil stockpiles.	- Joe's Creek Coffer Dam/Pipeline water very low turbidity/suspended solids. - Ditches armoured or have established of have low-erodibility substrates except some potentially erodible sections in Wight Pit Ditch. - East Dump reclamation area in early stages of revegetation. - Varying levels of soil stockpile revegetation (some new). - Two moderate use road crossings.	Medium.
Bootjack Creek	Not fish bearing Connected to Polley Lake.	- Bootjack Creek Sump. - Tailings Access Road Ditch. - SERDS Ditch.	- Tailings Access Road. - Tailings Access Road soil stockpiles. - SERDS access roads. - Southeast Zone soil stockpiles.	- Some erodible ditch sections. - Portion of runoff into ditches filters through waste rock roads/dumps. - Three high use road crossings.	Medium.

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[a]	Erosion Potential Considerations[b]	Risk[c]
Polley Lake	- Fish bearing. - Undergoing rehabilitation. - Sedimentation ponds constructed at outflow.	- Wight Pit Ditch (clean water diversion). - Long Ditch. - North Dump Creek.	- North Bell Dump reclamation areas and soil stockpiles. - Access Road. - NEZ Dump reclamation area and soil stockpile. - East Dump reclamation areas and soil stockpiles. - Tailings Access Road. - Tailings Access Road soil stockpiles. - SERDS access roads. - Southeast Zone/SERDS soils stockpiles.	- Varying levels of revegetation of upstream reclamation areas and soil stockpiles. - Ditches armoured or have established low-erodibility substrates except some potentially erodible sections of Wight Pit Ditch.	Low.
Hazeltine Creek[d]	- Fish bearing. - Undergoing rehabilitation. - Sedimentation ponds constructed at outflow.	- Polley Lake. - Long/SERDS Ditch (combined). - Central Collection Sump. - Perimeter Till Borrow Pit and ditch from Central Collection Sump. - Pipeline from Springer Pit to water treatment plant. - Edney Creek.	- TSF and associated infrastructure. - TSF Perimeter Embankment and PAR soil stockpiles. - TSF Ditch (clean water diversion). - TSF South Toe Drain Ditch. - TSF Main Seepage Pond. - ABR/Main Seepage Pond Ditch.	- High volume water transfers. - Water has time to settle in the TSF and Perimeter Embankment Till Borrow Pit. - Water in pipeline to treatment plant contains low total suspended solids. - Soil stockpiles varying levels of revegetation. - South Till Borrow area revegetation is advanced. - Active TSF construction upstream.	Medium (Risk will increase when the creek returns to fish-bearing status).

Table 2: Mount Polley Sediment and Erosion Control Risk Matrix

Receiving Environment Area	Area Sensitivity	Primary Potential Source(s)	Secondary Potential Source(s)[(a)]	Erosion Potential Considerations[(b)]	Risk[(c)]
Edney Creek	- Fish bearing. - Forest/wetland buffer.	- TSF Ditch (clean water diversion). - TSF South Seepage Pond. - TSF South Toe Drain Ditch. - TSF Main Seepage Pond. - ABR/Main Seepage Pond Ditch. - South Till Borrow reclamation area.	- TSF and associated infrastructure. - South and Main Embankment soil stockpiles.	- Few erodible ditch sections. - Low water volumes managed. - Water seepage ponds contain low turbidity/suspended solids. - New soil stockpiles (early stages of revegetation). - Active TSF construction upstream. - South Till Borrow area revegetation is progressing.	Low.

(a) Secondary sources are potential sources of sediment that are upstream of (i.e., potentially contribute to) primary erosion.

(b) Historic turbidity and total suspended data in relevant water collection infrastructure were considered when assessing erosion potential; water management contingency measures in place across water management system.

(c) Based on combination of area sensitivity and erosion potential.

(d) Sediment and erosion control in Hazeltine Creek beyond the mine footprint related to the Tailings Storage Facility embankment breach is managed under a separate program.

Based on the risk matrix and site conditions, water management works appear to be the largest risk to receiving environment systems, because:

- Reclamation areas and soil stockpiles on site (with the exception of localized active stripping and stockpile locations) have been seeded or inspected to confirm natural revegetation is underway (Appendix B). Site-specific observations from routine reclamation inspections and annual soil stockpile surveys indicate that minimal erosion occurs at these sites.
- Mine site hydrology is snowmelt dominated, and periods of high flow are experienced annually during freshet, meaning that:
    - There is higher potential for in-ditch erosion.
    - There is higher potential for erosion by surface runoff that reports to collection ditches.
    - Risk of an emergency release of water is elevated.
- Collection ditches are located downstream of disturbed areas on site and collect and convey any turbid water that is generated from disturbed areas on site.

6 BEST MANAGEMENT PRACTICES (BMPS)

Best management practices for water and sediment management will be implemented within and around the various construction areas (e.g., roads, tailings embankments, process plant platform, ponds) with the main objective of controlling runoff and seepage from the construction areas at the source, to the extent practicable. BMPs will include:

- Engagement of Qualified Professionals to support the development of specific management plans and update the Plan every 5 years.
- Strive to divert non-contact water around work areas, wherever possible, and convey contact water to the existing contact water system for treatment prior to release.
- Limiting work activities as much as possible to dry weather conditions and covering/ revegetating disturbed areas as quickly as possible after completing work in an area.
- Ensuring that no construction activities take place in, or construction equipment passes through existing watercourses.
- Stockpiling any materials on site as far as possible from watercourses.
- Ensuring that all stockpiles on site with the potential for erosion to a watercourse be covered and/or revegetated to reduce sediment generation.
- Inspecting and maintaining covers and diversion/conveyance ditches on a regular basis.
- Grading the site such that the potential for ponding is minimized.
- Ensuring that extra covers and clean granular materials are available onsite for channel and stockpile maintenance.

The following sections provides general sediment and erosion control guidelines to be followed for future construction projects and/or new surface development on the mine site through the different project phases.

6.1 Pre-project Planning

The BMP guidance documents referenced in Section 3.3 and, when necessary, QPs, are to be consulted to support planning of a specific project. Prior to starting any new construction work, the following should be considered:

- Design of projects to minimize the amount of ground cleared and disturbed.
- Design of projects to minimize disturbance adjacent to receiving environment watercourses and water bodies.
- Planning of works such that areas adjacent to waterways and drainage lines remain undisturbed or protected from erosion for as long as practicable.
- Planning of work to minimize the use of heavy equipment and have equipment conduct work as efficiently as possible.
- Planning of interim water and runoff management strategies to reduce erosion and identify available mitigation techniques if sediment is mobilized.
- Planning of long-term erosion control measures to be implemented after project completion.

- Identification of monitoring and inspection requirements for, during and after the project.
- Design of project criteria, construction plans, and mitigation for stream and other watercourse crossings to meet or exceed all standards and codes established by relevant authorities for the project.

Permitting, notification, and reporting requirements for projects will vary based on their location and proximity to natural water bodies and water. If the project has potential to impact natural watercourses or water bodies (i.e., if the work is outside site contact water collection systems and/or is adjacent to natural waterways), a site-specific environmental management plan (EMP) for project work should be developed. The EMP should include, at minimum:

- A summary of how information requirements, as detailed above, are being implemented.
- Details of drainage patterns over the area, both clean water and potential construction runoff.
- Locations of adjacent environmentally sensitive areas that could be impacted.
- A general outline of the planned work.
- Details of existing or planned erosion and sedimentation control methods to manage construction runoff.
- The location of any existing or planned drainage diversions.
- An inspection and monitoring schedule.
- A revision number and date.

For projects requiring an EMP, appropriate training and awareness to supervisors, workers (employees and contractors) regarding their responsibilities to comply with environmental laws and applicable codes. Workers are to be made aware of the required mitigation measures for a task, in addition to any requirements contained in any public or private approvals and agreement documents.

The following subsections outline additional sediment and erosion control techniques that may be incorporated into planning.

6.1.1 Stabilization and Treatment Methods

Erosion control measures are to be planned and, if required, installed prior to any clearing or earthwork activities. Stabilization measures are put in place to prevent or reduce the mobilization of sediment by stabilizing the source (e.g., exposed soils). Typical erosion control measures that may be used to stabilize areas that have the potential to be sources of sediment to water bodies or watercourses include:

- Seeding or mulching.
- Non-vegetative cover (e.g., gravel or straw).
- Riprap placement.
- Slope modification to reduce erosive energy (e.g., flattening or benching).
- Surface ripping and roughening to promote infiltration.
- Slope drains/chute construction.
- Erosion blankets.

While pro-active stabilization measures are used to minimize the presence of sediment laden water, treatment measures may be necessary when it is not possible to completely prevent the mobilization of sediment. Typical sediment control measures that may be used to manage sediment in contact water include the following:

- Check dams or weir structures.
- Outlet protection.
- Sediment retention ponds, sediment traps and sediment basins.
- Silt fence or similar barrier, such as straw bales.
- Swales.
- Vegetated buffer zones.

6.1.2 Runoff Collection Ditches

Runoff collection ditches may be either temporary or permanent structures. Permanent surface runoff control works should be sized to convey runoff from a 1 in 10 year 24-hour flood flow and to withstand a 1:200-year, 24-hour event without significant damage as per BC ENV Permit 11678.

The design of sections of ditch may depend on topography, excavation material (till or bedrock) and design discharge. Different material gradations or design approaches may be used for armouring depending on site-specific conditions and material availability. Any convergences with other ditches or streams should be armoured.

It is expected, in observance of Permit 11678, that new runoff collection ditches will direct flow to the contact water system and result in treatment at the water treatment plant.

6.2 Construction

Construction should comply with the plans developed in the pre-construction phase (Section 7.1) so that work is conducted in a manner that avoids or minimizes erosion and the discharge of silt, sediment, or other deleterious substances into any watercourse. Changes to the construction plan are to be reviewed by the appropriate Environmental Department and Engineering Department staff prior to implementation to allow sediment and erosion control management plans to be revised accordingly. Monitoring is to be carried out as per Section 7 of this document.

Additional measures recommended for all stages of construction include:

- Monitor weather forecasts for upcoming rainfall or other climatic conditions that may affect the construction works and surrounding environment.
- Suspend work in areas adjacent to natural water bodies or watercourses during heavy precipitation or runoff conditions.
- Follow the project EMP (especially for pumping, diversion, or relocation of water undertaken) and revise it if the project work plan changes.
- Refer to the site Emergency Response Plan in the event of a major incident.

6.2.1 Soil Salvage

Under MPMC's Mines Act Permit M-200, surficial soils are required to be stripped from the areas to be disturbed in advance of construction of works including waste rock dumps, waste or ore stockpiles, and roads. Stockpiles are often required to store salvaged soils for later use in reclamation, and further erosion control considerations apply, in addition to the earthworks project considerations discussed above. Stockpiles should be promptly seeded with an appropriate native seed mixture. If stockpiles have the potential to impact natural watercourses or water bodies, temporary erosion and sediment control measures should be installed and maintained until a vegetative cover is established.

6.3 Post-Construction

When a project is completed, long-term sediment retention and erosion control measures may need to be considered. These measures may include elements of the stabilization and treatment options in Section 6.1.1, as well as:

- Restricting access to areas being rehabilitated.
- Establishing a vegetative cover.
- Armouring areas receiving surface runoff.
- Slope modification to reduce erosive energy, such as flattening or benching.
- Surface ripping and roughening to promote infiltration.
- Diversion berms and drains (to intercept upstream runoff).

Any interim measures should remain in place until long-term controls are established. When monitoring and inspections (as described in Section 7) find long-term measures are sufficient, interim, or temporary erosion and sediment control features may be reclaimed.

6.4 Decommissioning and Reclamation

At closure, MPMC is responsible for leaving the mine site in compliance with all regulations, including site runoff water quality and revegetation to meet end land use and land capability objectives.

Detailed soil application and revegetation plans that include methods for reducing erosion are included in the site Reclamation and Closure Plan.

6.5 Mine Operations

Sediment and erosion control practices for new disturbances at the mine site are to follow the procedures outlined in the previous sections, but measures are also to be implemented and maintained on a site-wide scale.

6.5.1 Collection of Mine Contact Water

Collection of runoff from disturbed areas on site that may impact water quality in the receiving environment is to be carried out across the mine site. Water from these collection systems is conveyed to the PETBP and sent to a treatment plant prior to discharge from the site and is not permitted to be discharged to the environment unless specific regulatory requirements are met. These requirements include maximum allowable total suspended solids and turbidity levels.

The overall operating premise at the Mine is that contact water is captured and conveyed via channels, ditches, and pipelines to a centralized location and treated through the water treatment plant (WTP) prior to discharge to Quesnel Lake via submerged diffuser. The WTP outlet is the primary monitoring point for compliance with PE11678 (location HAD-3). There is a secondary PE11678 monitoring point near the diffuser discharge within Quesnel Lake (Location QUL-58).

6.5.2 Emergency Release of Water

If emergency release of water from the site water collection system should occur, sediment and erosion control materials are to be installed, as required, to avoid the displacement of sediment as water moves over land. These materials are stored in the Environmental C-Can located beside the Leach Pad, and the Environmental Department staff is available to guide proper installation. The Mount Polley Emergency Response Plan and Water Management Inspection Manual outline in more detail response protocol for such events, and Section 7.2 outlines event-based monitoring procedures.

7 ENVIRONMENTAL MONITORING AND REPORTING

Water quality is monitored on-site per the Comprehensive Environmental Monitoring Plan (CEMP) (MPMC 2019) to ensure that the water quality conforms to the EMA permit requirements. Monitoring frequency and location of various water quality parameters are outlined in the CEMP. If water quality exceeds trigger levels for any parameter as listed in Section 7.2 of the EMA permit, MPMC will immediately complete Trigger Response Plan actions as outlined in their Annual Discharge Plan (MPMC 2018).

7.1 Routine Inspections

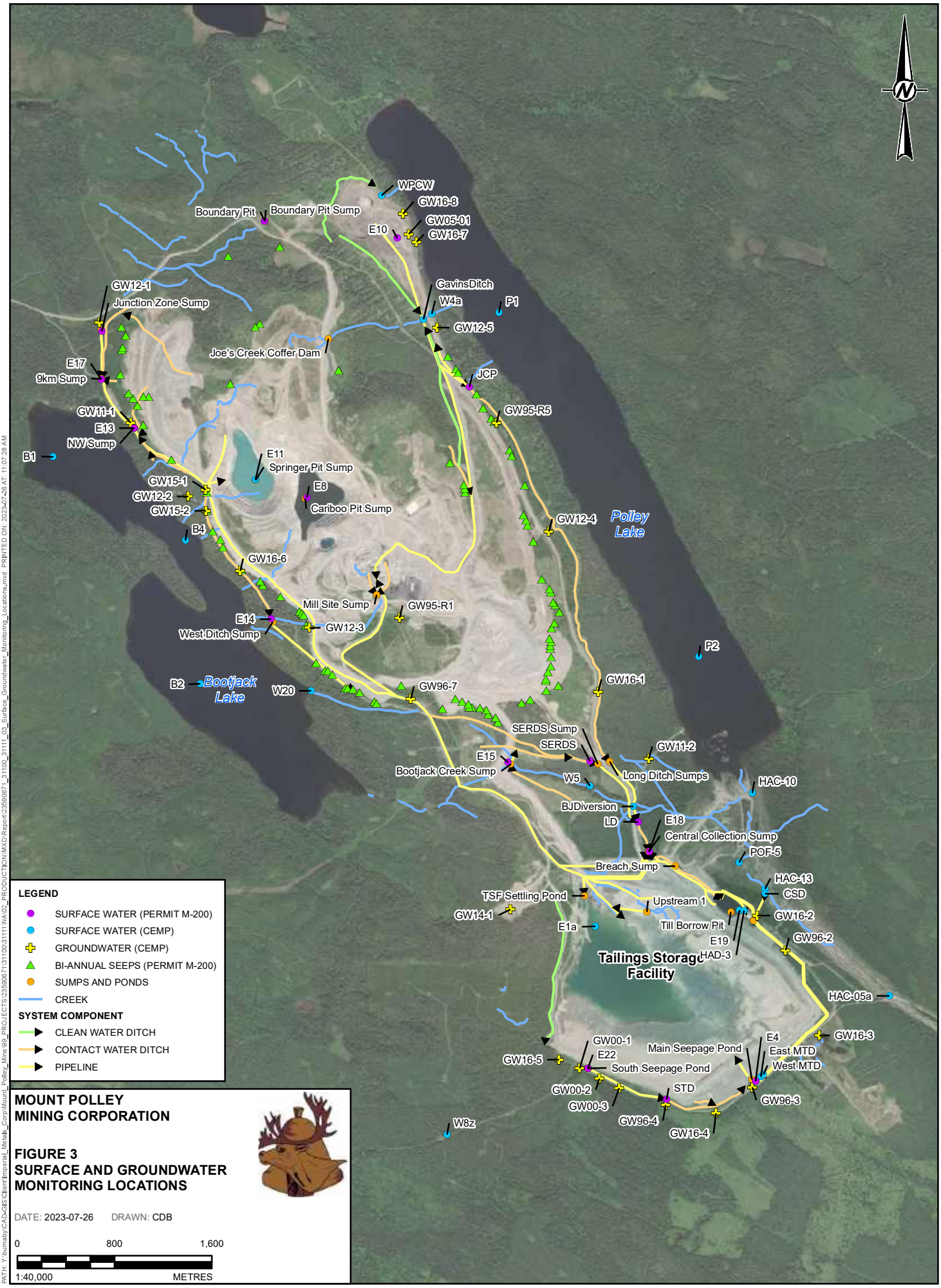
Daily inspections of site water containment infrastructure are completed (refer to the Water Management Inspection Manual, MPMC, 2019 to verify the collection system is working as designed). As per this document, inspections are completed at least once on day shift and night shift during high-risk periods (i.e., freshet). The inspection form template is included as Appendix C. Completed forms are provided to the Environmental Department for review and filing at the end of each seven (7) day set. Note that protocol and triggers are in place for immediate notifications to occur if deficiencies are observed. Daily inspections are the responsibility of Mill Maintenance, and the Environmental and Engineering Departments are responsible for updating the Water Management Inspection Manual, which is a component of the site Operation Maintenance and Surveillance (OMS) Manual.

Inspections of all site water management infrastructure (sumps, ditches, culverts, pipelines, etc.) are completed in spring after freshet and in fall prior to freeze up, as per EMA Permit 11678. This is the responsibility of the Environmental Department. Results are documented in the inspection form (refer to the template provided as Appendix D) and filed internally. Inspection results are used to inform upgrades of water management structures. Noted deficiencies, including areas of erosion or sedimentation, are compiled, and prioritized in a project list which is provided to the Engineering Department to address, based on the identified levels of urgency.

7.1.1 Contact Water Monitoring

Routine monitoring of mine site contact water conveyed through various infrastructure components is conducted as per Mines Act Permit M-200. This sampling program, including sample locations, frequencies, and QA/QC procedures, is detailed in the CEMP, which is regularly updated to account for operational changes at the mine site. All routine samples collected on site are analysed for physical parameters (including total suspended solids and turbidity), anions, nutrients, and total and dissolved metals. Monitoring locations and frequencies (at the time of this update) are shown in Figure 3.

These sample results are included in the annual reporting to BC ENV and BC EMLI. Results from these samples are used, along with inspection results, to identify potential upgrade opportunities for site water conveyance.


WPCW
GW16-8
GW05-01
GW16-7
E10
Boundary Pit
Boundary Pit Sump
GW12-1
Junction Zone Sump
GavinsDitch
W4a
P1
GW12-5
Joe's Creek Coffer Dam
E17
9km Sump
JCP
GW95-R5
GW11-1
E13
NW Sump
B1
E11
Springer Pit Sump
GW15-1
GW12-2
GW15-2
E8
Cariboo Pit Sump
B4
GW12-4
Polley Lake
GW16-6
Mill Site Sump
GW95-R1
E14
West Ditch Sump
GW12-3
P2
B2
Bootjack Lake
W20
GW96-7
GW16-1
SERDS Sump
SERDS
GW11-2
E15
Bootjack Creek Sump
Long Ditch Sumps
W5
HAC-10
BJDiversion
LD
E18
Central Collection Sump
POF-5
Breach Sump
HAC-13
CSD
TSF Settling Pond
GW14-1
Upstream 1
GW16-2
E1a
Till Borrow Pit
E19
GW96-2
HAD-3
Tailings Storage Facility
HAC-05a
GW16-3
GW00-1
E4
GW16-5
E22
Main Seepage Pond
East MTD
South Seepage Pond
West MTD
GW00-2
STD
GW96-3
GW00-3
GW96-4
GW16-4
W8z
LEGEND
SURFACE WATER (PERMIT M-200)
SURFACE WATER (CEMP)
GROUNDWATER (CEMP)
BI-ANNUAL SEEPS (PERMIT M-200)
SUMPS AND PONDS
CREEK
SYSTEM COMPONENT
CLEAN WATER DITCH
CONTACT WATER DITCH
PIPELINE
MOUNT POLLEY
MINING CORPORATION
FIGURE 3
SURFACE AND GROUNDWATER
MONITORING LOCATIONS
DATE: 2023-07-26
DRAWN: CDB
0
800
1,600
1:40,000
METRES
PATH: Y:\burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount_Polley_Mine\99_PROJECTS\23599671\31100\31111\NA\02_PRODUCTION\MXD\Report\23599671_31100_31111_03_Surface_Groundwater_Monitoring_Locations.mxd PRINTED ON: 2023-07-26 AT: 11:07:28 AM

7.1.2 Receiving Environment Monitoring

The Environmental Department conducts water quality monitoring in receiving environment water bodies and watercourses as per MPMC's CEMP, which is required under EMA Permit 11678. Note that chemistry and flow monitoring at a few contact water sites is included under this program, including monitoring related to the permitted effluent discharge. In addition to regular sampling (e.g., monthly, quarterly), a five (5)-week intensive turbidity and total suspended solids monitoring program is conducted in spring and fall in receiving environment streams that could potentially be impacted by erosion from the mine. This includes the following creeks downstream of inflows from runoff diversion ditches:

- North Dump Creek
- Bootjack Creek
- Edney Creek

7.2 Event/Incident Based Monitoring

Results from routine or freshet/fall rainy period monitoring of receiving environment or general observations from carrying out other work at the mine site may indicate increased sedimentation from mine-related sources. Table 3 outlines the triggers for additional monitoring and required follow up actions if elevated suspended sediment levels are observed or measured.

Table 3: Event-based Monitoring Protocol for Receiving Environment Waterways

Trigger	Actions and Responsibilities
Receiving environment waterway or waterbody is observed to have a “cloudy” appearance.	- Observer to report observation to the Environmental Coordinator (or member of the Environmental Department if Environmental Coordinator cannot be reached). - Environmental Coordinator, or their delegate from the Environmental Department, is to carry out in situ monitoring at this site, following the turbidity triggers and associated protocol below.
80-100% of BC Water Quality Guideline for Protection of Aquatic Life for turbidity observed.	- Environmental Technician to notify Environmental Coordinator. - Environmental Technician to organize investigation into the sediment source, with support from the Environmental Coordinator and other relevant workers, depending on the specific scenario. If the investigation indicates this sedimentation is not related to mine activities: - Document the findings. - If any illegal activity is noted, report it accordingly. - Closely monitor this site until conditions have returned to normal or, it is established that the sedimentation will continue. If the investigation indicates that sedimentation is related to mine activities: - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. - Closely monitor the site until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.
100% of BC Water Quality Guideline for Protection of Aquatic Life for turbidity observed.	- Environmental Technician to notify Environmental Coordinator. - Environmental Technician to organize investigation into the sediment source, with support from the Environmental Coordinator and other relevant workers, depending on the specific scenario. If the investigation indicates this sedimentation is not related to mine activities: - Document the findings. - If any illegal activity is noted, report it accordingly. - Closely monitor this site until conditions have returned to normal or, it is established that the sedimentation will continue. If the investigation indicates that sedimentation is related to a mine activity: - Stop any construction or mine activities that may contribute to or exacerbate erosion and sedimentation. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. - Closely monitor the site until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.

A detailed event-based monitoring program for the receiving environment should be included in project EMPs. Table 4 provides recommended protocol to incorporate.

Table 4: Recommended Event-based Monitoring Protocol for a Construction Project

Trigger	Actions and Responsibilities
80-100% of BC Water Quality Guideline for Protection of Aquatic Life* for turbidity observed in scheduled construction monitoring.	- Environmental Monitor to notify Environmental Coordinator and construction supervisor. With support from the Environmental Coordinator and construction supervisor (and any workers they designate), the Environmental Monitor is to: - Inspect all erosion and sediment control works and construction areas to identify the source. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring.
100% of BC Water Quality Guideline for Protection of Aquatic Life* for turbidity observed in scheduled construction monitoring.	- Environmental Monitor to notify Environmental Coordinator and construction supervisor. - Construction supervisor to stop all local construction work. With support from the Environmental Coordinator and construction supervisor (and any workers they designate), the Environmental Monitor is to: - Inspect all sediment and erosion control works and construction areas to identify the source. - Take actions to control the source. - Increase frequency of receiving environment turbidity monitoring. Work is not to recommence until the sediment source is being appropriately managed and turbidity readings return to below the BC Water Quality Guideline.
Rainfall (or snowmelt) ≤ 10 mm/h or 25 mm/d.	During minor rainfall or snowmelt runoff events, the Environmental Monitor is to: - Increase the frequency of receiving environment turbidity monitoring and follow the turbidity triggers and associated protocol above. - Increase the frequency of visual inspections of potential sediment sources (soil stockpiles, sediment ponds, etc.).
Rainfall (or snowmelt) /10 mm/h or 25 mm/d.	During major rainfall or snowmelt runoff events, the Environmental Monitor is to: - Notify the Environmental Coordinator and construction supervisor. - Increase the frequency of receiving environment turbidity monitoring and follow the turbidity triggers and associated protocol above. - Increase the frequency of visual inspections of high-risk areas (soil stockpiles, sediment ponds, etc.). Environmental Coordinator and/or construction supervisor are to consider full work stop in the area based on conditions.

Note: Upstream monitoring site may be used as “background” reference.

7.3 Reporting and Performance

Water management at the Mount Polley site involves the collection of all mine contact water (see Environmental Management Act Permit PE11678 for this requirement). Contact water is conveyed through a series of ditches and collection sumps to the Perimeter Embankment Till Borrow Pond (PETBP) which is an influent source to the Water Treatment Plant (WTP). This WTP is designed for the removal of suspended solids from contact water and treated effluent is discharged to a pipe that conveys treated water to Quesnel Lake for discharge through submerged diffuser. This discharge is regulated by PE11678 and has a primary compliance monitoring location at the WTP outlet (HAD-3) and has a secondary compliance monitoring location in Quesnel Lake near the diffuser discharge (QUL-58).

Given the water management in place and the single, monitored discharge point, and given that this point is regulated by permit, this location and the permit limits provide the best point at which measurement of the ESCP performance, in aggregate, be evaluated.

The effluent permit provides a site- and discharge-specific regulatory discharge standard with which MPMC must comply.

8 REPORTING AND RECORD KEEPING

8.1 Annual Reporting

Site inspections and monitoring activities associated with surface erosion prevention and sediment control during construction, operations, and closure activities will be documented and reported in accordance with the requirements of MPMC's EMA Permit 11678 and Mines Act Permit M-200.

8.2 Incident Reporting

Significant releases of sediment-laden water from onsite disturbed areas will be appropriately characterized concerning extent and loading and reported to Emergency Management BC, with follow up reporting to provincial regulatory agencies as required by regulations and permits. The Environmental Superintendent will review the reports internally to identify necessary improvements in water management procedures.

8.3 Emergency Reporting

In the event that an emergency release of water from the site collection system occurs, the protocol in the Water Management Inspection Manual (MPMC, 2019) outlining responsibilities, notification requirements, documentation (refer to the form in Appendix E), and actions to carry out would apply. One key action is the installation of sediment and erosion control materials and/or structures.

Monitoring associated with an emergency release of water is the responsibility of the Environmental Department, and should include the following:

- Assessment of the spatial extent of the release and if the release reached receiving environment waterways or water bodies.
- Monitoring of water released (visual observations, flow measurements/estimates, field parameters including turbidity, and/or sampling, based on the observed location, conditions and size of the release).
- Monitoring (visual observations, field parameters including turbidity, and sampling) of downstream waterways or waterbodies into which water was released.

Reporting to Emergency Management BC and follow up reporting to provincial regulatory agencies will likely require this information, in addition to the information required to be collected as per the Water Management Inspection Manual (refer to the form in Appendix E).

8.4 Record Keeping

Monitoring data will be entered into an electronic database and have quality control checks completed upon receipt of results. Data will be entered into a standard format that allows for data reporting and analyses. Data and data comparisons will be stored in a single file format for each type or monitoring activity.

9 EVALUATION AND ADAPTIVE MANAGEMENT

9.1 Sampling and Monitoring Data

The CEMP is, at minimum, updated every three years, based on the results of detailed three-year monitoring program interpretive reports. More frequent changes are, however, anticipated to reflect changing site conditions and, as per the mechanisms described in the CEMP, written notice of proposed changes will be provided to the BC ENV. First Nations and stakeholders will also be updated, as per MPMC's Communication Plan. The CEMP is also referenced in the site OMS Manual, which is regularly updated to account for operational changes at the mine site.

Results from monitoring completed as per the CEMP are submitted to the BC ENV quarterly and are also included in the Annual Environmental and Reclamation Report, which is submitted to the BC ENV and BC EMLI annually. The Environmental Superintendent or their designate (the Environmental Coordinator) is responsible for ensuring this reporting is carried out.

9.2 Maintenance and Inspection Reports

As per the Water Management Inspection Manual, supplemental inspections are to be completed by Mill Maintenance, Mine Operations, and the Environmental Department during high-risk periods (i.e., during precipitation and/or snowmelt runoff events), with support from the Engineering Department. Inspection reports from high flow periods provide feedback on the functioning of site water collection systems under conditions when erosion potential is high. Noted deficiencies are incorporated into project planning for continuous improvements along with findings from routine inspections as described above.

An annual inspection was completed in June 2023 to review the existing sediment and erosion control measures that are in place at the mine site. A summary of the 2023 inspection is included in Appendix F.

9.2.1 Collection of Mine Contact Water

Collection of runoff from disturbed areas on site that may impact water quality in the receiving environment is to be carried out across the mine site. Thus, runoff from disturbed areas that potentially contains sediments is not directly released to the environment. Water from these collection systems is stored on site and is not permitted to be discharged to the environment unless specific regulatory requirements are met. These requirements include maximum allowable total suspended solids and turbidity levels, necessitating removal of suspended sediments through active or passive treatment prior to discharge.

To minimize the volume of contact water collected and stored at the site, upstream ditches to divert non-site contact water may be constructed. As water from these works enters the receiving environment, for construction of new diversion ditches, an EMP should be developed and followed for construction, and the guidelines in Sections 6.1 to 6.3 followed.

Inspection and monitoring requirements for site water collection systems and diversion ditches are outlined in Section 7.

9.3 Onsite Plan Review

Construction should comply with the plans developed in the pre-construction phase (Section 6.1) so that work is conducted in a manner that avoids or minimizes erosion and the discharge of silt, sediment, or other deleterious substances into any watercourse. Changes to the construction plan are to be reviewed by the appropriate Environmental Department and Engineering Department staff prior to implementation to allow sediment and erosion control management plans to be revised accordingly. Monitoring is to be carried out as per Section 6 of this document. Actions and maintenance that may be required based on monitoring observations include:

- Correcting deficiencies of the erosion and sediment control measures as soon as they are observed.
- Removal of any sediment and debris accumulation that compromises the effectiveness of the erosion and sediment control measures.
- Implementation of additional stabilization and treatment measures listed in Section 6.1.

Additional measures recommended for all stages of construction include:

- Monitor weather forecasts for upcoming rainfall or other climatic conditions that may affect the construction works and surrounding environment.
- Suspend work in areas adjacent to natural water bodies or watercourses during heavy precipitation or runoff conditions.
- Follow the project EMP (especially for pumping, diversion, or relocation of water undertaken) and revise it if the project work plan changes.
- Refer to the site Emergency Response Plan in the event of a major incident.

9.3.1 Adaptive Management

This Plan is designed to be updated as sediment and erosion control science and BMPs develop over time. It is also designed to be adapted for operational changes and water management needs at the mine site. Continuous improvements that may be carried out include:

- Changes to the design of works to eliminate deficiencies that are noted during inspections and require regular maintenance.
- Implementation of mitigation measures in response to water quality trends noted in the receiving environment.
- Implementation of measures that reduce treatment needs prior to discharging water.
- Implementation of measures to reduce maintenance costs.
- Implementation of measures to reduce environmental risk.

10 QUALIFIED PROFESSIONALS

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

This Erosion and Sediment and Control Management Plan was revised and reviewed by the following qualified professionals:

Andrew McIntosh, M.Eng., CESCL.
Project Manager

Peter W. Morgan, P.Eng.
Engineering Manager-Mine Water

PROFESSIONAL ENGINEER
PROVINCE OF BRITISH COLUMBIA
P. W. MORGAN

July 31, 2023

Engineers & Geoscientists BC Permit #1000200

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APPENDIX A

Permit M-200 (2020) – Erosion and Control Section

Permit No. M-200
Mine No. 1101163
Permit Approving Mine Plan and Reclamation Program
Mount Polley Mining Corporation, Mount Polley Mine
Date: 10 December 2020

8. Sediment and Erosion Control

(a) The Permittee shall implement the Erosion and Sediment Control Plan (Document 42.1).
(b) The Permittee shall ensure that the Erosion and Sediment Control Plan is reviewed annually, and updates reported in the Annual Reclamation Report. Substantive changes shall be provided to the Chief Inspector prior to implementation.
(c) The Permittee shall appropriately characterize any significant releases of sediment-laden water, defined as an unauthorized discharge to the receiving environment, with respect to extent and loading, and report it to the Chief Inspector.
(d) The Permittee shall ensure that the characterization of unauthorized discharges of sediment-laden run-off include, at a minimum, flow, total suspended solids, turbidity, pH, conductivity, temperature, dissolved oxygen, and total and dissolved metals, of both the effluent and the receiving water.

APPENDIX B

Reclamation Revegetation Assessment Form

MOUNT POLLEY RECLAMATION RE-VEGETATION ASSESSMENT FORM

Date: _____ Transect: _____
Assessor(s): _____ Plot: _____
Reclamation Site: _____ Plot Size: _____
Site Conditions (slope position, slope angle, aspect): _____

Ground Surface

Surface Roughening (present, description):	
Coarse Woody Debris (% cover, types):	

Understorey Vegetation

General

% Cover (all species)	
% Cover (invasive species)	
Average Height (m)	
Vigor (0 - 5)	

Species Specific

Species	# Species	% Cover	Height (m)	Vigor (0 - 5)	Planted/Ingress/Invasive

Trees/Shrubs

Species	# Present	Average Height (m)		Vigour (0 - 5)	Planted/Ingress

Wildlife Value

Wildlife Observations:	
Habitat Types Present:	

Comments

(ex. erosion, variation across plot)

APPENDIX C

Daily Water Management Inspection Checklist

Bi-Annual Water Management Infrastructure Inspection Checklist (September 2016)

Location	Initials	Date	OK	Not OK	Photo (Y/N)	Comments/Actions Required
Junction Zone Ditch						
9km Sump						
Junction Zone Seepage Collection Sump						
Northwest Ditch						
Northwest Sump						
West Ditch						
Mine Drainage Creek Sump						
Waste Haul Road Culvert (at MDC)						
Orica Site Settling Pond						
Orica Ditch						
Bootjack Lake Dam						
Bootjack Cr Culverts at TAR						
Bootjack Cr Culverts under Light Vehicle TSF Road						
Bootjack Creek Sump (Upstream)						
Bootjack Creek Sump						
TAR Ditch						
SERDS Ditch						
SERDS Culverts at TSF Road						
SERDS Culverts at TAR						
SERDS Sump						
SERDS Ditch Pipeline						
Wight Pit Clean Water Ditch (N)						
Wight Pit Clean Water Ditch (SW)						
SEZ Ditch						
Gavin's Ditch						
Access Road Culverts						
Joe's Creek Coffer Dam						
Joe's Creek Pipeline						
Long Ditch						
Long Ditch Sump (Upper)						
Long Ditch Pipeline						
Long Ditch Sump (Lower)						
Bootjack Creek Bridge Crossing						
Bootjack Creek Channel						
Mill Site Ditch						
Mill Site Sump						
Crusher Site Ditch						
Tailings Ditch (Mill to Booster Station)						
Tailings Ditch (Booster Station to 5 Corner)						
Tailings Ditch (5 corner to TSF)						
Central Collection Sump						
Breach Sump Ditch						
Perimeter Embankment Till Borrow Pit						
Hazeltine Discharge Pipeline						
Main Seepage Pond						
Ditch below 3 Corner						
South Toe Drain Ditch						
South Seepage Pond						
South Seepage Pond Pipeline						
Borrow Pit Ditch & Settling Pond across from Horsefly-Gavin FSR						
Horsefly-Gavin FSR under permit obligation with MOF (Gavin Lake Road Bridge to W8z)						
TSF Clean Water Ditch						

APPENDIX D

Bi-annual Water Management Infrastructure Inspection Checklist

Daily Water Management Inspection Checklist

Inspector: _____ Date: _____

Shift (Crew, D or N):_____ Weather Conditions (ex. hot, windy): _____

Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes/ Comments
WTP Well		(m)	
WTP Slurry Line		GOOD / ISSUE	
Perimeter Embankment Till Borrow		RED YELLOW BLACK	
CCS		GOOD / ISSUE	
Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
Breach Sump		GOOD / ISSUE	
Weir		GOOD / ISSUE	
Polley Fish Fence (Day Shift)		GOOD / ISSUE	Cleaned? Y / N
SERDS Sump		RED YELLOW BLACK	
Long Ditch Sump (Upper)		RED YELLOW BLACK	
Long Ditch Sump (Lower)		RED YELLOW BLACK	
Long Ditch/SERDS Outflow Pipes		GOOD / ISSUE	
South Seepage Collection Pond		RED YELLOW BLACK	
Main Seepage Collection Pond		RED YELLOW BLACK	
Sprinklers		GOOD / ISSUE	
Lower Hazeltine Pond Water Level		(m)	
TSF Settling Pond		GOOD / ISSUE	
Tailings outflow pipe		GOOD / ISSUE	
TSF Upstream		GOOD / ISSUE	
Cariboo Pit Sump		GOOD / ISSUE	
Springer Pit Lake		GOOD / ISSUE	
Junction Zone Seepage Sump		GOOD / ISSUE	
9K Sump **# Starts** _____		RED YELLOW BLACK	
NW PAG Sump **# Starts** _____		RED YELLOW BLACK	
Mine Drainage Creek Sump		RED YELLOW BLACK	
West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
Springer Pit Dewatering Outflow		GOOD / ISSUE	
Bootjack Creek Sump - Upstream Side		GOOD / ISSUE	
Bootjack Creek Sump		RED YELLOW BLACK	
Wight Pit Water Level		(m)	
Joe's Creek Pipe		GOOD / ISSUE	

Updated November 2, 2016

Is the TSF Generating Dust?

No Minor Moderate Major

Is the Polley Lake Plug Generating Dust?

No Minor Moderate Major

REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING IN FREEZING CONDITIONS

ADDITIONAL COMMENTS/OBSERVATIONS (ex. erosion):

WILDLIFE OBSERVATIONS (include locations):

Daily Water Management Inspection Checklist

*(Controlled Document – **DO NOT COPY**: please ask Environment Department for print out)*

Inspector: _____ Date: _____

Shift: (Crew, D or N) _____ Weather Conditions: (ex. hot, windy, sunny): _____

	Pumps/Pipes/Sumps	Time Checked	Inspection Gauge Readings / Inspection Findings	Pump Notes / Comments
1	Junction Zone Seepage Sump		GOOD / ISSUE	
2	9K Sump # Starts _____		RED YELLOW BLACK	
3	CWTS (Wetland)		GOOD / ISSUE	
4	NW PAG Sump # Starts _____		RED YELLOW BLACK	
5	Mine Drainage Creek Sump		RED YELLOW BLACK	
6	West Ditch Culverts (light vehicle TAR)		GOOD / ISSUE	
7	Booster Station		GOOD / ISSUE	
8	Bootjack Creek Sump – Upstream side		GOOD / ISSUE	
9	Corner 1 Buttress Culverts/Ditch		GOOD / ISSUE	
10	TSF Barge		GOOD / ISSUE	
11	Dredge Outflow Pipe		GOOD / ISSUE	Location:
12	South Seepage Collection Pond		RED YELLOW BLACK	
13	Main Seepage Collection Pond		RED YELLOW BLACK	Percent Full ____%
14	Fish fence at outlet to Quesnel Lake		GOOD / ISSUE	
15	Fish Fences above Gavin Lake Bridge		GOOD / ISSUE	Cleaned? Y / N
16	WTP Well		(m)	
17	WTP Slurry Line		GOOD / ISSUE	
18	Perimeter Embankment Till Borrow Pond		RED YELLOW BLACK	
19	Breach Sump/COW Drain/Upstream Drain		GOOD / ISSUE	
20	CCS		GOOD / ISSUE	
21	Long Ditch Outflow Pipes		GOOD / ISSUE	
22	Long Ditch Sump (Lower)		RED YELLOW BLACK	
23	Long Ditch Sump (Upper)		RED YELLOW BLACK	
24	SERDS Sump		RED YELLOW BLACK	
25	Bootjack Creek Fish Fence		GOOD / ISSUE	Cleaned? Y / N
26	**NEZ Seep Sump**		GOOD / ISSUE	
27	Wight Pit Water Level		(m)	
28	Joe's Creek Pipe		GOOD / ISSUE	
29	**Leachpad LCRS**		(m)	Pumped? Y / N
30	West Ditch Culverts (heavy duty TAR)		GOOD / ISSUE	
31	Bootjack Creek Sump		RED YELLOW BLACK	
32	Mill Site Sump		Pump Hours	

Updated May 25, 2019

Is the TSF Generating Dust? *(Circle one)* No Minor Moderate Major

**REMEMBER TO DRAIN BACK UP DIESEL PUMPS AFTER TESTING FREEZING CONDITIONS **

ADDITIONAL COMMENTS/OBSERVATIONS (EX. EROSION):

NOTE* - Please clean up and report all spills of hydrocarbons or chemicals

WILDLIFE OBSERVATIONS (include locations):

APPENDIX E

Water Release Report Form

Water Management Incident Report Form

Please complete and forward to the Environmental Department.

DATE OF REPORT	
DATE AND TIME INCIDENT DISCOVERED	
NAME(S) OF PERSON/PEOPLE REPORTING INCIDENT	
LOCATION OF INCIDENT	
IS WATER RELEASING TO THE ENVIRONMENT?	
If yes, what time did it start releasing, and at what rate is the water flowing?	
If no, at what rate is it approaching release?	
DESCRIPTION OF HOW/WHY INCIDENT OCCURRED	
HAS THE PROBLEM BEING FIXED? HOW?	
If yes, what time did the water stop releasing to the environment (if released)?	
If no, describe actions being taken to fix problem (record timeline of events).	

DESCRIPTION OF MEASURES TAKEN TO PROTECT ENVIRONMENT (ex. sediment and erosion control materials)	
PREVENTATIVE MEASURES TAKEN TO ENSURE INCIDENT DOES NOT OCCUR AGAIN	
SUPERVISOR NAME	
SUPERVISOR SIGNATURE	
FOLLOW UP REQUIRED?	
Environmental Department: Name: _____ Sign: _____	Comments:

APPENDIX F

Sediment and Erosion Site Inspection – June 2023

Sediment and Erosion Site Inspection – June 2023

WSP was retained by MPMC to undertake a visual inspection of the Long Ditch and West Ditch drainage systems at the Mount Polley mine on 7 June and 8 June 2023. Don Kidd, Senior Engineer, Q.P. P.Eng. undertook the visual inspection of both drainage systems. The visual inspection confirmed that both drainage systems were in good condition, with no ditch erosion evident in the mostly vegetated riprap lined ditches.

Based on the visual inspection the following action items are recommended.

- Undertake bathymetry surveys of SFRD and Central Collection Sumps to confirm that adequate storage is available for the design storm events, and if not undertake dredging works to provide the storage required.
- Provide written documentation of pump capacity required at each sump, based on previous hydraulic modelling work undertaken by WSP (formerly Golder) and confirm that the correct pump and backup capacity is available.
- Where the system has sections of ditch replaced by culverts/pipes, confirm the pipe is sized correctly to convey the design storm event.

Monitoring should be carried out in accordance with project specific EMPs developed as per Section 2.2.3 and regulatory permits and legislation requirements. If the project has the potential to impact natural water courses, and requires an EMP, a designated environmental monitor should oversee the project. The environmental monitor's daily tasks are to be defined in the EMP, and should include:

- Visual inspections of erosion and sedimentation controls.
- Visual inspections of equipment for leaks.
- Visual inspections of spill kits to confirm appropriate supplies are available.
- Visual inspections of potential sedimentation sources, such as soil stockpiles, new disturbances, and active construction areas.
- Monitoring of the weather forecast and current conditions.
- Documentation of the above.

If a project does not have the potential to impact natural water courses, and EMP is not developed, monitoring is still expected and BMPs for sediment and erosion control should still be applied. Inspections should be conducted by a designated qualified member of the Mount Polley Environmental or Engineering Department for the tasks outlined above.

In active construction areas where activities could impact receiving environment water quality, additional monitoring may be required beyond routine sampling described in Section 5.1. Monitoring may include in situ turbidity testing and/or partial or full suite water quality sampling (full suite = parameters listed for routine samples in Section 5.1). Results should be compared against pre-construction data and the BC Water Quality Guidelines for Freshwater Aquatic Life. Downstream monitoring site(s) should be located at a sufficient distance to ensure mixing of construction runoff and ambient stream water. An upstream control site of sufficient distance to be isolated from any construction-related impacts may be monitored simultaneously and compared to downstream monitoring results. Monitoring requirements and sampling frequency depend on the specific project and a monitoring plan should be included in the project EMP.

APPENDIX 9-2: Soil Management Plan

Mount Polley Mining Corporation

an Imperial Metals company
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Environmental Management Plan:

Soil Management Plan

Last Update: January 8, 2016

Document Revision Control

Rev. No.	Revision	Date	Author
0	Original Soil Salvage and Stockpile Protocol	1997	RM
1	Update to reflect site changes	2012	KM
2	Update to reflect site changes and results of site soil stockpile assessment; addressed *Mines Act P*ermit M-200 conditions	March 2014	KM
3	Update of site specific components; added document tracking and formatting to be consistent with other MPMC EMPs	January 2017	KM

1 Introduction

All surficial soil at the Mount Polley Mine (the Mine) identified through soil surveys as being appropriate for plant growth are salvaged and either used immediately in the reclamation program or stored in a suitable manner for future use. This is a requirement of the British Columbia (BC) *Mines Act* and associated BC Health Safety Reclamation Code. In addition, Mount Polley Mining Corporation's (MPMC's) *Mines Act* Permit M-200 contains specific conditions related to soil management that are addressed in this Soil Management Plan (the Plan).

The purpose of this Plan is to outline the procedures to characterize, salvage, store, and apply all suitable growth material in accordance with regulatory requirements and to support reclamation of the Mine site to the desired land capability and end land uses.

2 Soil Handling and Management

The following subsections outline procedures for soil handling and management through the different stages of the mine life at the Mount Polley Mine.

2.1 Soil Characterization

Site-specific soil surveys must be completed for areas scheduled for disturbance by a qualified individual and submitted to the BC Ministry of Energy and Mine (MEM) Chief Inspector for approval. The following survey procedure is recommended and is consistent with soil surveys previously conducted at Mount Polley Mine; however, this methodology may be modified by a qualified individual based on site conditions, existing information, and their experience.

1. Pre-stratify the area according to terrain using aerial photographs. Confirm the stratification is appropriate with a site inspection.

2. Select soil pit locations at representative sites or using a predetermined systematic grid or transect. Soil pit density may range from one pit per half hectare to one pit per two hectares, depending on site variability.

3. Expose the soil profile by machine excavation or hand-dug holes. Existing road cuts and excavations can also be cleaned for use.

4. Describe the soil and site characteristics at each soil profile location as per the BC Ministry of Environment standards and guidance in the "Field Manual for Describing Terrestrial Ecosystems" (MoE, 2010).

5. Sample soils at select, representative sites to provide local soil quality data. Sampling intensity may be adapted based on the level of preexisting soil quality data for the area.

6. Present and interpret the soil survey data in a report and recommend salvage depths for (1) soil appropriate for reclamation, and (2) subsoil which could be used in reclamation with soil amendments or as a subsoil.

For reference, soil and landform inventories completed to date for the Mount Polley Mine include:

- Southeast Dump, Boundary Pit and West PAG Projects (2010)
- Wight Pit Rock Waste Dump Extension Project (2006)

- Southeast Pit Project, Wight Pit to Tailings Pond Road, and Southeast Pit to Tailings Pond Road (2005)
- Northeast Extension Project (2004)
- Springer Pit (2001)
- Baseline Soil Survey and Agricultural Assessment of proposed Tailings Storage Facility, Open Pit, and Waste Rock Dumps (1995).

2.2 Soil Salvage

2.2.1 Salvage Materials and Depths

Material to be salvaged is grouped into four types as described below, which should be stripped and stockpiled separately. Delineation of these materials in the field is to be supported by a qualified individual, as described in Section 2.2, however, some general field guidance is as follows.

1. Non-merchantable woody debris is to be salvaged prior to removing soil and stockpiled for use in reclamation (or immediately used in reclamation, if possible). Small woody debris may be stripped with soil and incorporated into soil stockpiles.

2. Soil appropriate for reclamation should be salvaged to the depth pre-determined in the site-specific survey described in Section 2.1; however, as a general guide, soils are to be salvaged to the effective rooting depth.

3. Underlying subsoil is classified as the material between the soil horizons appropriate for reclamation and the soil parent material.

4. Organic soils from wetlands are recognizable by their black colour and “mucky” texture.

2.2.2 Procedure

A qualified individual representing the Environmental Department should train and oversee equipment operators to ensure salvage operations are completed to the specifications described in this Plan.

Non-merchantable coarse woody debris is to be salvaged first and stockpiled (small woody debris can be mixed in with topsoil piles). Organic matter (grass, plants, chipped woody material, etc.) is to be incorporated into the topsoil piles by salvaging plant materials on the surface with the topsoil. To minimize compaction caused by equipment, use single lift operations rather than repeatedly driving over the surface scraping off thin layers. With a single pass, a bulldozer or backhoe can push the soil into a pile or windrow for storage or for loading into a truck by an excavator or backhoe for transport. If suitable soil is still visible after the initial scraping (this can generally be identified by the presence of roots), another pass will be required to salvage all soil materials appropriate for use in reclamation. Soil inventory and strata delineation information collected prior to salvaging will guide the stripping depths and are to be verified in the field by the Environmental Department representative overseeing salvage operations. Desired volumes of subsoil material are to be stripped in a second lift and stored in separate stockpiles from the topsoil.

Soil should ideally be handled when it is in a loose friable state; operations are to be ceased if the soil is too wet or dry to prevent degradation of its physical structure. If wet soil is sticking to the equipment, wait until the soil has dried. Conversely, if the soil is dry and hard to handle resembling flour, wait until the soil is wetted through precipitation (or active methods, such as sprinkling). In addition, stripping should be ceased in high wind events, if the wind is mobilizing soil as it is being handled. Scheduling stripping work to avoid wet and dry months (e.g., freshet and late summer, respectively) can reduce the risk of having to temporarily stop operations. It is possible to strip in winter months and freezing conditions decrease

compaction of the soil being handled, however, snow should be removed prior to stripping and should not be incorporated into soil stockpiles.

2.3 Soil Stockpiling

When possible, it is preferable for soil to be directly applied for reclamation, allowing microbes and viable seeds to remain in the soil. If this is not possible:

1. Carefully select the storage location because once stockpiled, the soil should not be disturbed again until it is used in final reclamation. Minimize exposure to wind, southwest sun, and water/flooding. To minimize risk of sedimentation of natural water courses, stockpiles should, where possible, be located upstream of site water collection ditches.

2. Stockpile the soil in a manner that maximizes surface area and minimizes soil depth. When possible, the maximum depth should be the height of a pile dumped from a haul truck (~2.5m).

3. Promptly seed stockpiles with the custom MPMC native grasses and forbes blend or, in areas where invasive plant establishment is a concern (i.e., seed sources are present nearby), the custom MPMC aggressive seed mix. Both seed mixes are certified weed free. Revegetation will help to mitigate wind and water erosion, reduce risk of weedy species ingress, and maintain microbial activity.

4. Take a representative sample of the stockpile to assess soil quality, as per the procedure in Appendix A.

5. Place signage on the stockpiles to avoid accidental disturbance.

6. Enter stockpile construction date, soil type, location, and soil volume into the Soil Stockpile Inventory spreadsheet and associated GIS map file. Document seeding in the Environmental Department Reclamation Field Book.

7. Add stockpile locations to site maps and plans for Mine Operations to avoid disturbance or loss of stockpiles.

2.4 Soil Stockpile Inspections

Inspection of soil stockpiles is to be completed annually. For each soil stockpile, the following information should be documented: date; photo number (if a photo is taken); percent vegetation coverage; percent invasive plant coverage; species present; signs of erosion and/or sedimentation; any erosion prevention works; and any additional comments or observations. Where possible, inspections should be completed in the summer months when vegetation is actively growing and easiest to identify.

Results are to be reviewed and any stockpiles exhibiting erosion and/or poor vegetation coverage are to be added to MPMC's bi-annual seeding list for re-seeding in spring or fall when weather conditions are most appropriate for seeding. Alternative options for more significant erosion may be implemented, as per the MPMC Sediment and Erosion Control Plan, such as berms or silt fences. Occurrences of invasive species are to be managed as per MPMC's Invasive Plant Management Plan. If a stockpile has been seeded twice, and still exhibits low vegetation cover, alternative vegetation options can be investigated, including:

- Amending the soil with compost tea or compost;

- Hydroseeding with a mulch/tackifier mixture designed for poor soil and/or steep slopes;

- Installation of horizontally placed logs to act as catch berms and retain moisture;
- Development of a seed mixture specifically designed for poor quality soils;
- Planting with primary successional shrubs. Willow and cottonwood can be planted using bioengineering techniques, such as live stakes and wattles, for additional erosion control.

2.5 Soil Amendment

Recommendations for amendment of soils to be used in reclamation are based on results from a site soil stockpile quality assessment conducted in September 2013, as well as results from ongoing reclamation research and progressive reclamation. Soil amendments may include biosolids and fertilizer, and recommendations for use are detailed in the site Reclamation and Closure Plan. Results from the September 2013 assessment are presented in Appendix B.

If biosolids are used as a soil amendment, they can be mixed with the soil prior to application to ensure thorough mixing and to reduce compaction caused by the dual application of soil followed by biosolids.

2.6 Soil Application

Soil should be replaced to the depths specified for that Mine site unit in the site Reclamation and Closure Plan or research trial design.

To reduce compaction, soil placement should only occur under appropriate moisture conditions. Work should be stopped under wet conditions (i.e., if the soil is sticking to the equipment) and very dry conditions (i.e., if the soil resembles flour). In addition, equipment traffic on the reclamation area should be minimized. This can be done by working systematically and planning access routes so equipment do not have to pass over completed areas, and, if applicable, equipment can do multiple tasks at a time (e.g., site preparation and placing of coarse woody debris).

Site preparation of placed soil should be conducted to create increased microtopography, which reduces erosion and provides more diverse plant microsites, including microsites with improved moisture retention. Site preparation methods are described in detail in Appendix C.

If woody debris is not already incorporated into the soil being placed, it should be applied onto the soil surface concurrently with or following site preparation. Even if woody debris is already in the soil, it may be desirable to place additional coarse woody debris as habitat features or for erosion control. Woody debris can help create more diverse microsites and habitats, retain moisture, contribute to long-term soil organic matter, and improve catch of native seeds. Recommendations for coarse woody debris application are:

- Create occasional pyramids or stacks of multiple pieces of woody debris to create more complex habitat structures and vertical structure.
- Lay logs horizontally across the slope, so they’re more likely to stop the flow of water and erosion. This is especially helpful if logs are placed downslope of depressions to help them retain soil and organic matter.
- Mix tree species of the debris, where possible, as different species decompose at different rates, staggering the release of nutrients for vegetation.

If coarse woody debris is not available or only in small amounts, boulders or rock fragments can be placed in piles and individually. Although rocks are not a source of nutrients over time, similar to woody debris they can increase moisture retention, promote plant microsite diversity, provide habitat, and reduce soil erosion.

Following soil application, the site should be inspected and test pits dug to verify that the target soil depth was achieved across the site (accounting for the variability associated with site preparation).

3 Reporting

The following information will be submitted to the MEM, as well as the BC Ministry of Environment, each year in the MPMC Annual Environmental and Reclamation Report:

- An update of soil management and handling activities, including erosion and sediment control measures, and soil replacement depths on reclamation sites;
- An updated soil stockpile inventory, including stockpile volumes and locations;

MPMC also is required to submit an updated Reclamation and Closure Plan to MEM every five years (at minimum), as well as with all major permit amendment applications for changes to the mine plan. The Reclamation and Closure Plan is to include an updated material balance to verify that sufficient quantities of suitable soil are present to reclaim existing and planned disturbed areas to the recommended prescriptions (i.e., soil depths) for meeting land capability objectives. Contingency options are to be assessed if sufficient volumes of suitable soil may not be available.

4 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Coordinator):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan.
- Be aware of high level mine planning, to ensure that soil characterization and stripping supervision are incorporated into plans.
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including soil baseline characterizations, overseeing stripping operations, annual inspections, seeding, and reporting.
- Ensure that individuals conducting soil characterization surveys, overseeing soil stripping, and inspecting soil stockpiles have appropriate training.
- Ensure that this Plan is routinely updated to reflect changes in site conditions and procedures, and that the revised plan is submitted to MEM in the Annual Environmental and Reclamation Report and/or a Reclamation and Closure Plan update.

Qualified individual overseeing salvage operations (likely an Environmental Technician/Technologist):

- Be knowledgeable of and adhere to all aspects of this Plan.
- Coordinate with and supervise Mine Operations to ensure soil handling and management procedures are followed during stripping operations.

- Maintain an up to date soil stockpile inventory and provide a soil management update in the Annual Environmental and Reclamation Report, as directed by the Environmental Superintendent.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances that will require soil salvaging. Work with that individual to ensure that the soil is characterized prior to stripping and a qualified individual is present to oversee salvage operations.
- Assign appropriate equipment for handling soil.
- Work with the Environmental Superintendent or designate to assign areas for soil to be stockpiled or directly placed.
- Ensure that all material suitable for reclamation is stripped prior to expansion of mine works.

Mine Operations Supervisors:

- Coordinate with the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist).
- Only allow operations to proceed when weather and soil moisture conditions are appropriate.
- Notify the General Foreman and qualified individual overseeing the salvage operation of any concerns that arise and address these concerns prior to proceeding with the work.

Mine Operations Operators:

- Follow instructions from the qualified individual overseeing a salvage operation (likely an Environmental Technician or Technologist) and Mine Operations Supervisors.
- Clarify uncertainties or address any concerns that arise with the Mine Operations Supervisor and/or qualified individual overseeing the salvage operation prior to proceeding with work.

References

Meister, R. 2001. Springer Pit Soil Survey. Prepared for Mount Polley Mining Corporation. April 2002.

Meister, R. 2004. Northeast Extension Project Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. July 13, 2004.

Meister, R. 2005 Southeast Pit Project Wight Pit to Tailings Road Southeast Pit to Tailings Pond Road Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. June 6, 2005.

Meister, R. 2006. Wight Pit Rock Waste Dump Extension Project Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. September 25, 2006.

Meister, R. 2010. Southeast Dump, Boundary Pit and West PAG Projects Soil and Landform Inventory. Prepared for Mount Polley Mining Corporation. October 24, 2010.

MoE (BC Ministry of Environment). 2010. Field Manual for Describing Terrestrial Ecosystems in the Field – 2nd Ed. Land Management Handbook 25. Victoria, British Columbia: Crown Publications Inc.

Appendix A: Soil Stockpile Sampling Procedure

When taking soil chemistry samples from stockpiles, the following procedure is recommended:

1. Take a photo of the stockpile to document characteristics, including size and vegetative cover.

2. For each sample, use a new (clean), plastic sample bag.

3. Collect a composite sample from a minimum of three locations that are representative of the different sections of the stockpile. Record the GPS coordinates for each location.

4. If the stockpile has recently been created (within one year), samples can be collected from the surface. If stockpiles are older, at each sample location dig a profile using a shovel or mini back-hoe to greater than 1m (from all surfaces of the stockpile). Take a sample from 0.1 to 0.2m and 1.0m depths (this encompasses the more biologically active surface soils, as well as less active soils at depth). Ensure that equal volumes are sampled at every location and depth so that the composite is representative. The minimum total sample volume is approximately 500ml.Label each sample with a unique sample ID and the date.

5. Document sample collection in the MPMC Environmental Department Reclamation Field Book, including date, sample ID and description, collector, and any additional relevant observations or details.

6. Store samples in the refrigerator until ready for shipment to the lab (typically ALS Environmental in Burnaby, BC). Ship in coolers with ice packs within the time frame required to meet lab hold times.

7. Request lab analysis for parameters including, but not limited to:

    - Moisture content
    - Texture
    - pH
    - Electrical conductivity
    - Total nitrogen
    - Available phosphorus
    - Organic matter
    - Micronutrients including sulphur and potassium

Appendix B Soil Stockpile Sample Results

Methods

Soil samples were collected on September 3, 2013 from 23 soil stockpiles across the Mount Polley Mine site. At each stockpile three profiles representing variability across the stockpile were dug to greater than 1m with a mini backhoe. Equal volume samples were collected from 0.3m and 1m depths at each of the three locations and all samples from each stockpile were composited in a clean, labeled plastic sampling bag. Samples were stored in a cooler with ice upon collection, and then transferred to a refrigerator for storage until shipping. Samples were shipped in coolers on ice to ALS Environmental in Burnaby, BC, then were subsequently transported to the ALS Environmental Saskatoon laboratory for analysis. Fertilizer recommendations were generated by ALS, using wheat growing at 36 bushels per acre as a proxy.

Results

Results are presented in Tables B. 1 – B.3. General findings based on analytical results are:

- pH has increased from a baseline average of approximately 5.5 to between 6 and 8.
- Soil is deficient in nitrogen.
- Soil has marginal to deficient phosphorus and organic matter levels.
- Soil is marginal to deficient for potassium levels; however, concentrations are similar to levels in baseline soil samples.
- Micronutrients levels are sufficient for copper, iron, manganese, and zinc.
- Micronutrient levels are marginal to deficient for boron and chloride.
- Nutrient loss increases with stockpile storage time.

Soil Amendments

Direct application of stripped soil helps maintain soil microbial communities, native seed viability, and nutrient levels. When using stockpiled soil, incorporation of woody debris and other organic matter and including nitrogen fixing species in revegetation prescriptions are methods for rebuilding deficient nutrient pools. Soil amendments can also be used for improving levels of nutrients in which soil is deficient. Based on laboratory agricultural recommendations for grass cover:

- Average nutrient requirements to meet target nutrient levels of stockpiled soil are: 52 mg/kg of nitrogen, 13 mg/kg of phosphorus, and 19 mg/kg of potassium, which corresponds to a need for 61.9-15.7-22.5 (nitrogen-phosphorus-potassium) fertilizer at 187 kg/ha.
- Average micronutrient requirements to meet target nutrient levels are 0.2 mg/kg of boron and 7 mg/kg of chloride.

MPMC has historically accepted biosolids from Metro Vancouver for use in reclamation. Typical biosolids (Attachment 1) contain sufficient levels of potassium and phosphorus to ameliorate deficiencies identified in the 2013 soil sampling results. Routine biosolids assessment does not test for boron or chloride; however, these results show that in general, metal and anion levels are elevated. Biosolids also contain

an average of 11 mg/kg of Nitrate-N, which provides more than a six-fold increase over the average soil stockpile concentration of 1.7 mg/kg.

These results are to be incorporated into reclamation prescriptions in the MPMC Reclamation and Closure Plan, which include recommendations for use of soil amendments. Recommendations should be supported by site research and mine reclamation best practices, which will provide guidance on when soil amendments are necessary, and what types and quantities to use. This should include long-term considerations, as soil amendments may only provide a short-term nutrient source.

Table B.1 Soil stockpile sample soil characteristic results

Location	Soil Climatic Zone	Texture	pH (1S:2W)	EC (1S:2W - mS/cm)	EC (Calc. Sat Extr - mS/cm)	Salinity Rating	Organic Matter (%)
Mill Site	Dark Gray	Clay Loam	6.8	0.1	0.2	Non Saline	2.2
SERDS	Dark Gray	Clay Loam	6.0	0.1	0.2	Non Saline	4.4
SEZ 2	Dark Gray	Loam	6.5	0.3	0.7	Non Saline	6.4
Perimeter Embankment 1	Dark Gray	Clay Loam	6.4	0.2	0.4	Non Saline	4.4
PAG Dump	Dark Gray	Clay Loam	7.1	0.3	0.7	Non Saline	3.2
NW Sump Road	Dark Gray	Clay Loam	6.2	0.1	0.2	Non Saline	1.7
North Bell Dump Till	Dark Gray	Clay Loam	8.3	0.2	0.4	Non Saline	0.9
Springer North	Dark Gray	Clay Loam	7.9	0.1	0.2	Non Saline	1.0
North Bell Dump Top	Dark Gray	Clay Loam	7.5	0.2	0.4	Non Saline	2.6
Access Road km 12	Dark Gray	Clay Loam	7.6	0.1	0.2	Non Saline	1.5
EAST RDS	Dark Gray	Clay Loam	8.0	0.1	0.2	Non Saline	1.3
Ore Switchback	Dark Gray	Clay Loam	6.9	0.1	0.2	Non Saline	3.6
NEZ Dump	Dark Gray	Clay Loam	7.0	0.2	0.4	Non Saline	2.5
Highway to Heaven	Dark Gray	Clay Loam	6.9	0.2	0.4	Non Saline	2.6
Wight Pit Till	Dark Gray	Clay Loam	7.7	0.3	0.7	Non Saline	0.9
Wrap Around Road	Dark Gray	Clay Loam	7.4	0.2	0.4	Non Saline	1.9
Till Borrow	Dark Gray	Clay Loam	6.6	0.1	0.2	Non Saline	3.3
Perimeter Embankment 2	Dark Gray	Clay Loam	6.2	0.1	0.2	Non Saline	3.8
South Till Borrow	Dark Gray	Clay Loam	6.6	0.1	0.2	Non Saline	5.2
Main Embankment	Dark Gray	Clay Loam	7.5	0.2	0.4	Non Saline	2.2
TSF Corner 1	Dark Gray	Clay Loam	6.9	0.1	0.2	Non Saline	1.6
TRR	Dark Gray	Clay Loam	6.0	0.1	0.2	Non Saline	3.1
Cariboo Stockpile		Sandy Loam	7.5				2.1
AVERAGE			7.0	0.2	0.3		2.7
1995 Test Pits (Average)			5.7		0.2		2.5
1997 Test Pits (Average)			5.3		0.4		4.4
2006 Test Pits (Average)			6.0		0.2		2.8

Table B.2 Soil stockpile sample soil nutrient results

	Soil Test Nutrient Levels (mg/kg)															
Location	**NO_3-N**		**P**		**K**		**SO_4-S**		**Cu**		**Mn**		**Zn**		**B**	
Mill Site	1	Deficient	2	Deficient	79.5	Marginal	12	Sufficient	70	Excess	5.1	Sufficient	0.75	Sufficient	0.2	Deficient
SERDS	1.5	Deficient	>27	Marginal	70.5	Deficient	4	Marginal	1.25	Sufficient	24.7	Excess	1.05	Sufficient	0.2	Deficient
SEZ 2	1.5	Deficient	26.5	Marginal	109.5	Sufficient	>24	Sufficient	82.5	Excess	21.75	Excess	1.6	Sufficient	0.4	Marginal
Perimeter Embankment 1	4.5	Deficient	4	Deficient	53.5	Deficient	19	Sufficient	3.85	Sufficient	55	Excess	0.85	Sufficient	0.2	Deficient
PAG Dump	1	Deficient	13	Marginal	96	Marginal	>21.5	Sufficient	144	Excess	7.4	Sufficient	1.2	Sufficient	0.6	Sufficient
NW Sump Road	1	Deficient	>27	Marginal	91.5	Marginal	5	Marginal	9.8	Sufficient	20.3	Excess	0.85	Sufficient	0.15	Deficient
North Bell Dump Till	1	Deficient	8.5	Deficient	101	Marginal	>21.5	Sufficient	25.5	Excess	5.55	Sufficient	0.7	Sufficient	0.25	Deficient
Springer North	1	Deficient	13.5	Marginal	59	Deficient	3	Deficient	102.5	Excess	5.95	Sufficient	1.1	Sufficient	0.1	Deficient
North Bell Dump Top	2	Deficient	>27	Marginal	75.5	Deficient	>21.5	Sufficient	18.05	Excess	25.95	Excess	0.8	Sufficient	0.15	Deficient
Access Road km 12	1	Deficient	20	Marginal	63	Deficient	3	Deficient	33.35	Excess	6.05	Sufficient	0.6	Marginal	0.1	Deficient
EAST RDS	1	Deficient	3.5	Deficient	45.5	Deficient	4	Marginal	10.4	Sufficient	5.85	Sufficient	0.5	Marginal	0.15	Deficient
Ore Switchback	1.5	Deficient	>27	Marginal	86.5	Marginal	14.5	Sufficient	9.85	Sufficient	21.6	Excess	1.75	Sufficient	0.3	Marginal
NEZ Dump	2.5	Deficient	23.5	Marginal	69.5	Deficient	>21.5	Sufficient	156.5	Excess	7.35	Sufficient	1.7	Sufficient	0.15	Deficient
Highway to Heaven	1	Deficient	13	Marginal	79	Marginal	15.5	Sufficient	92.5	Excess	16.75	Sufficient	0.8	Sufficient	0.15	Deficient
Wight Pit Till	1	Deficient	10	Deficient	60.5	Deficient	>21.5	Sufficient	15.05	Sufficient	4.35	Sufficient	0.85	Sufficient	0.15	Deficient
Wrap Around Road	1	Deficient	8	Deficient	79.5	Marginal	17	Sufficient	60	Excess	6.45	Sufficient	0.85	Sufficient	0.1	Deficient
Till Borrow	1	Deficient	5	Deficient	78.5	Marginal	0.5	Deficient	2.1	Sufficient	16.3	Sufficient	1.1	Sufficient	0.15	Deficient
Perimeter Embankment 2	7.5	Deficient	6.5	Deficient	81.5	Marginal	5.5	Marginal	2.65	Sufficient	7.35	Sufficient	0.8	Sufficient	0.25	Deficient
South Till Borrow	1.5	Deficient	9.5	Deficient	85.5	Marginal	1	Deficient	2.4	Sufficient	65	Excess	0.55	Marginal	0.15	Deficient
Main Embankment	1	Deficient	1	Deficient	76.5	Deficient	12	Sufficient	3.25	Sufficient	12.3	Sufficient	0.4	Marginal	0.15	Deficient
TSF Corner 1	1.5	Deficient	2.5	Deficient	53.5	Deficient	5	Marginal	5.3	Sufficient	14.65	Sufficient	0.3	Marginal	0.1	Deficient
TRR	1	Deficient	9.5	Deficient	54	Deficient	3.5	Deficient	1.25	Sufficient	17.05	Sufficient	2.3	Sufficient	0.3	Marginal
Cariboo Stockpile	<1.0	Deficient	10.1	Marginal	92	Marginal	14.6	Sufficient	491	Excess	910	Excess	93.8	Excess		
AVERAGE	1.7		10.0		75.7		8.2		58.4		55.8		5.0		0.2	
1995 Test Pits (Average)			30.0		73.0				305		778		89		19	
1997 Test Pits (Average)			26.7		99.8											
2006 Test Pits (Average)			27.9		91.0											

Table B.3 Fertilizer recommendations based on soil stockpile sample soil characteristic results

	Fertilizer Recommendations (lbs/ac / kg/ha)											
Location	**N**		**P2O5**		**K2O**		**S**		**B**		**Cl**	
Mill Site	105	117.6	37.5	42	20	22.4	5	5.6	0.25	0.28	17.5	19.6
SERDS	105	117.6	17.5	19.6	15	16.8	0	0	0.25	0.28	7.5	8.4
SEZ 2	105	117.6	17.5	19.6	15	16.8	0	0	0.25	0.28	7.5	8.4
Perimeter Embankment 1	115	128.8	22.5	25.2	55	61.6	12.5	14	0.5	0.56	7.5	8.4
PAG Dump	90	100.8	37.5	42	85	95.2	0	0	0.5	0.56	7.5	8.4
NW Sump Road	105	117.6	22.5	25.2	20	22.4	0	0	0	0	7.5	8.4
North Bell Dump Till	105	117.6	17.5	19.6	20	22.4	7.5	8.4	0.5	0.56	17.5	19.6
Springer North	105	117.6	27.5	30.8	20	22.4	0	0	0.5	0.56	17.5	19.6
North Bell Dump Top	105	117.6	22.5	25.2	85	95.2	12.5	14	0.5	0.56	17.5	19.6
Access Road km 12	100	112	17.5	19.6	20	22.4	0	0	0.5	0.56	7.5	8.4
EAST RDS	105	117.6	17.5	19.6	55	61.6	0	0	0.5	0.56	17.5	19.6
Ore Switchback	105	117.6	37.5	42	85	95.2	7.5	8.4	0.5	0.56	17.5	19.6
NEZ Dump	105	117.6	17.5	19.6	20	22.4	0	0	0.25	0.28	7.5	8.4
Highway to Heaven	100	112	17.5	19.6	55	61.6	0	0	0.5	0.56	17.5	19.6
Wight Pit Till	105	117.6	22.5	25.2	20	22.4	0	0	0.5	0.56	17.5	19.6
Wrap Around Road	105	117.6	27.5	30.8	55	61.6	0	0	0.5	0.56	17.5	19.6
Till Borrow	105	117.6	27.5	30.8	17.5	19.6	0	0	0.5	0.56	17.5	19.6
Perimeter Embankment 2	105	117.6	37.5	42	20	22.4	12.5	14	0.5	0.56	17.5	19.6
South Till Borrow	80	89.6	27.5	30.8	20	22.4	7.5	8.4	0.5	0.56	17.5	19.6
Main Embankment	105	117.6	27.5	30.8	17.5	19.6	12.5	14	0.5	0.56	17.5	19.6
TSF Corner 1	105	117.6	37.5	42	20	22.4	5	5.6	0.5	0.56	17.5	19.6
TRR	105	117.6	37.5	42	85	95.2	7.5	8.4	0.5	0.56	17.5	19.6
Cariboo Stockpile						0						
AVERAGE	103	116	26	29	38	42	4	5	0	0.5	14	16

Appendix C: Site Preparation Methods

Surface roughening is a key element for reducing erosion, retaining moisture, and reducing compaction.

Some approaches that can be used are:

1. Ripping (Figure C.1) is used as a soil roughening technique in areas too large to economically roughen with a backhoe or excavator, and is typically best for dry soils. Ripping breaks up compacted layers of soil. Rip soils when they are dry to permit shattering beneath the surface. Ripping guidelines:
    a. Rip to a depth of ~0.5 to 1m (or as deep as possible given the soil texture and coarse fragments).
    b. Make rips contour to the slope.
    c. The distance between rippers should be equal to the depth ripped.
    d. Lift the ripper from the soil every 3 to 6m to allow for some downslope water drainage. Offset drainage breaks in the ripping rows.

2. Trenching can be used for medium moisture level soils. The easiest method is to use a bull dozer and angle the blade to make “horizontal windrows”. Lift the blade every 3 to 6m to allow for some downslope water drainage. Offset the drainage breaks in the trenches.

3. Mounding (Figure C.1) is typically best for wetter sites and can be carried out on slopes or on flat terrain. Mounding can be done with a backhoe or excavator with a digging bucket to create microbasins for extreme surface roughening as follows:
    a. Start at top/bottom of the slope and work up/down in lines parallel to the contours, depending on site access.
    b. Dig, poke, or push a basin that is ~0.5m deep and has the width of the equipment bucket. This allows the basin to be up to ~1 to 1.5m wide.
    c. Drop the excavated soil on the soil surface adjacent to the basin (on the upslope side if working on a slope).
    d. Create one mound every ~2 to 3m in a random pattern that reduces the ability of water to flow straight downslope. The frequency can be increased or decreased depending on erosion risk associated with the terrain.

4. Mechanical Screefing (Figure C.2) can be applied on level ground or on slopes and can be utilized in snowy conditions, as this technique reduces the likelihood of incorporating snow into the soil. The results are similar to mounding, but shallower. Mechanical screefing can an be done with an excavator with a digging bucket as follows:
    a. Start at top/bottom of the slope and work up/down in lines parallel to the contours, depending on site access.
    b. Push bucket into snow and up to ~0.5m into the underlying soil.
    c. Rake bucket downslope ~1m creating a shallow depression with a shallow downslope berm.
    d. Create one screef every ~2 to 3m in a random pattern that reduces the ability of water to flow straight downslope.



Figure C.1 Mounding (left) and ripping (right) site preparation methods

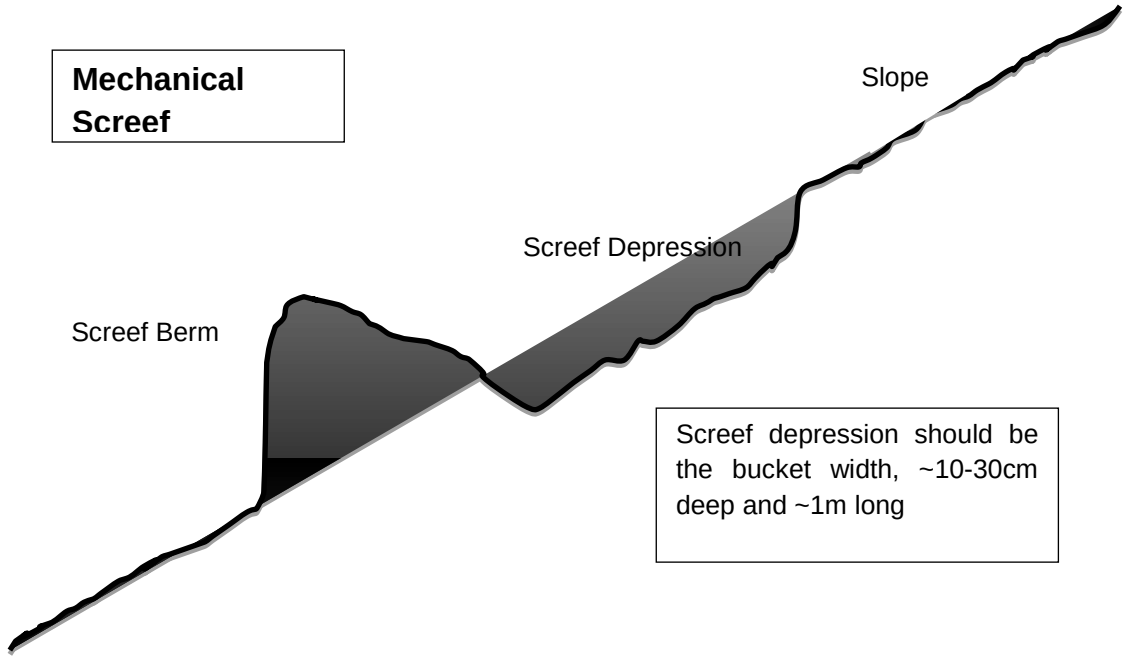


Figure C.2 Mechanical screefing schematic

Attachment 1:
Metro Vancouver Biosolids Composition (2013)

METRO VANCOUVER'S BIOSOLIDS COMPOSITION

	BC Organic Matter Recycling Regulation		Annacis I. WWTP (Routine QC Station)			
			Numbers of Samples Collected	Dewatered Biosolids (Class A)		
				Period:	15-Apr-13	- 15-Oct-13
	Class A Biosolids	Class B Biosolids		Mean	Min	Max
Physical Parameters						
Total Solids (%)			32	26.5	23.4	30.3
Volatile Solids (%)			6	70.3	69.1	72.1
Electrical Conductivity (ds/m)			6	6.07	5.50	6.60
Bulk Density						
pH			6	8.1	7.8	8.4
Macronutrients (mg/kg dw)						
Total Kjeldahl Nitrogen (TKN)			6	52,633	49,400	55,300
Ammonia distillation			6	9,560	9,040	10,100
Nitrate/Nitrite-N			0	0.0	0.0	0.0
Nitrate/Nitrite-N (Available)			5	11.0	11.0	11.0
Phosphorus (Total)			31	24,568	22,600	29,200
Phosphorus (Available)			5	2,680	1,900	3,500
Potassium (Total)			20	1,730	1,550	2,050
Potassium (Available)			5	1,282	1,110	1,470
Calcium (Total)			27	23,756	21,900	25,500
Magnesium (Total)			27	6,132	5,460	6,990
Total Trace Elements (mg/kg)						
Aluminum			27	7,701	6,650	8,730
Arsenic	**75**	**75**	27	5.2	4.0	7.0
Barium			14	318	294	343
Cadmium	**20**	**20**	27	2.4	2.0	3.4
Chromium		**1,060**	27	64	42	99
Cobalt	**150**	**150**	27	4.3	3.7	4.9
Copper		**2,200**	27	894	759	1,030
Iron			27	33,137	28,500	37,600
Lead	**500**	**500**	27	56	36	71
Manganese			27	349	315	395
Mercury	**5**	**15**	27	1.8	1.0	3.2
Molybdenum	**20**	**20**	27	13.9	10.7	19.5
Nickel	**180**	**180**	27	26	18	38
Selenium	**14**	**14**	27	7.0	6.1	9.0
Silver			27	6.8	4.6	9.7
Zinc	**1,850**	**1,850**	27	1312	1090	1550
Bacteriology (MPN/g)						
Fecal Coliform - discrete	**<1,000**		79	125	19	820

APPENDIX 9-3: ML/ARD Management Plan

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Memo

To	Mathieu O'Leary, MPMC	**Client**	Mount Polley Mining Corporation
From	Shauna Litke	**Project**	CAPR002434
Cc	Stephen Day, SRK Don Parsons, Imperial Metals Corporation	**Date**	October 27, 2023

Subject Confirmation of SRK Review of MPMC Metal Leaching and Acid Rock Drainage Management Procedure Manual – October 23, 2023 Update

File name: MPMC_MLARDPlanCover_CAPR002434_FNL_20231027.docx

SRK Consulting (Canada) Inc. confirms it has reviewed the geochemical aspects in the following Mount Polley Mining Corporation (MPMC) authored document and recommendations regarding additional monitoring identified in SRK (2023) were incorporated satisfactorily:

- MPMC ML/ARD Management Procedure Manual – October 23, 2023 update (20231023 – MLARD Management Procedure Manual_V4.pdf, received via email October 26, 2023)

SRK Consulting (Canada) Inc.

PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA S. J. LITKE # 49392

October 27, 2023

This signature is associated with the author's approval to be used in this document; any other use is not authorized.

Shauna Litke, PEng
Senior Consultant (Geochemistry)

Stephen Day, PGeo
Corporate Consultant (Geochemistry)

EGBC Permit to Practice: 1003655

SRK Consulting (Canada) Inc. has prepared this document for Mount Polley Mining Corporation, our client. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this document have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. While SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

References

SRK Consulting (Canada) Inc. 2023. Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock – Springer Deep and WX Zones. DRAFT. Prepared for Mount Polley Mining Corporation: Likely, BC. Project number: CAPR002434. Issued October. 2023.

MOUNT POLLEY MINING CORPORATION
IMPERIAL METALS CORPORATION

ML/ARD MANAGEMENT PROCEDURE MANUAL

OBJECTIVE

The objective of this Metal Leaching/Acid Rock Drainage (ML/ARD) Management Procedure Manual is to provide detail on how ML/ARD potential is considered in material management at the Mount Polley Mine (MPM). This document summarizes all the various procedures and considerations related to ML/ARD potential through mine life processes.

DOCUMENT REVISION HISTORY

This document replaces earlier versions of similar documents that directed ML/ARD Management at MPM in response to *Mines Act* Permit M-200 issued on August 3, 1995. This update reflects requirements outlined in the current M-200 Permit, amended May 3, 2023.

Document Update Summary

Revision Date	Author	Comment
June 30, 2016	Chad Cameron Ben Harding Katie McMahen Luke Moger Ryan Brown Stephen Day (SRK)	Original Document
August 04, 2022	Mathieu O'Leary Gabriel Holmes Aaron Zwiebel (DWB) Shauna Litke (SRK)	Added contacts, water treatment plant waste ML/ARD characterization, QA/QC sampling, and PAG misplacement action plan.
October 23, 2023	Mathieu O'Leary Gabriel Holmes	Updated NPR criterion for Springer Deep and WX Zones, and annual blast fractionation confirmatory sampling.

	Alicia Lalonde (DWB) Shauna Litke (SRK)	

KEY CONTACTS AND QUALIFIED PROFESSIONALS

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Any update to this document is reviewed by a Qualified Professional (QP) in the area of practice of ML/ARD management, as required by *Mines Act* Permit M-200 Condition A.5. Qualified professionals reviewing this document are as follows:

Version	Qualified Professional	Phone	Email
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August 04, 2022	Shauna Litke, PEng (SRK) Stephen Day, PGeo (SRK)	604-235-8542 604-862-4097	slitke@srk.com sday@srk.com
October 23, 2023	Shauna Litke, PEng (SRK) Stephen Day, PGeo (SRK)	604-235-8542 604-862-4097	slitke@srk.com sday@srk.com

BACKGROUND

Metal leaching and acid generation are naturally occurring chemical processes which may have negative impacts on the receiving environment. The potential environmental impact of ML/ARD will depend on their magnitude, the sensitivity of the receiving environment, dilution and/or attenuation, as well as any mitigation measures that are in place.

Metal leaching occurs as a result of weathering of metal-containing minerals (i.e., exposure to water and oxygen), drainage conditions that increase solubility, and flow of water through source materials. Acid generation occurs when minerals containing reduced sulfur (e.g., sulfide and elemental sulfur) are exposed

to the weathering effects of oxygen and water. In iron sulphide minerals (e.g., pyrite) acidity is also generated when ferric iron precipitates. Other minerals in the source rock, primarily calcium and magnesium carbonates can neutralize the acid. ARD occurs when the amount of acid-generation exceeds the ability of the source rock to neutralize this acid. Any surplus acid is entrained in water and can create acidic and metal-containing run-off.

Pre-mining and operational geochemical characterization has shown that ARD potential at MPM is restricted due to the abundance of acid-consuming carbonate minerals compared to acid generating sulphide minerals. In addition, the presence of natural carbonate and oxide copper minerals in the pre-mining weathering zone reinforce the expectation that weathering conditions are dominantly basic. However, due to the potential consequences of acid generation for long term management of the site, Mount Polley Mining Corporation (MPMC) actively manages waste rock based on its ARD potential as described in the following sections.

MPMC has focused on managing potential for ARD due to the link between acid generation and enhanced solubility of copper which is expected to be the primary concern for ML. Selenium leaching has also been identified as occurring at MPM. Selenium is released by oxidation of sulphide minerals, but leaching is not necessarily associated with pH depression. Selenium leaching occurs regardless of whether waste rock is classified as potentially ARD generating (PAG) or non-PAG (referred to as NAG at MPM).

UNDERSTANDING OF THE DISTRIBUTION OF ARD POTENTIAL

Like other alkalic porphyry deposits (e.g., Copper Mountain, Brenda), MPM lacks the strong hydrothermal alteration zoning that is commonly observed in calc-alkalic porphyry deposits (e.g., Highland Valley Copper, Island Copper, Gibraltar). In particular, phyllic alteration is absent at MPM. A common feature of calc-alkalic porphyry deposits is often a pronounced pyritic halo that surrounds the copper mineralization and is associated with phyllic and propylitic alteration. At MPM, discontinuous pyritic zones are present but do not appear to be mineralization halos. MPMC geological staff identified a pyritic zone in the south wall of the Springer Pit which extends into the adjacent Cariboo Pit.

This ML/ARD Management Procedure Manual applies to waste rock and ore stockpiles. Tailings are consistently NAG due to removal of copper sulphides by ore processing.

MANAGEMENT OF PAG ROCK

Best practice for management of PAG rock is subaqueous disposal in a configuration that provides permanent and low maintenance containment. At MPM, this has been implemented by disposing of waste rock in completed open pits that will subsequently fill with water. Mine planning is carried out at MPM such that the open pits have sufficient capacity that PAG material can be re-handled into the open pits and stored subaqueously at closure. The following pits are available for subaqueous disposal (in sequence):

- Cariboo Pit
- Bell Pit
- Pond Zone Pit

- Southeast Zone Pit
- Wight Pit
- Cariboo-Springer Pit.

For the Springer Pit, backfill locations are not currently available. The PAG rock is therefore stockpiled adjacent to the open pit in the Temporary Northwest PAG Stockpile for backhauling to the Cariboo-Springer Pit upon completion of mining.

For the small Pond Zone Pit, low sulfur PAG waste rock is layered with NAG waste rock.

Onset of acidic conditions in waste rock at MPM takes at least decades as shown by humidity cells, and the lack of acidification in the natural exposure of the deposit indicates that flooding of PAG waste rock does not need to be immediate. The current approaches of backfilling into dry pits and stockpiling following by backfilling allows PAG rock to be submerged before it acidifies.

DETERMINATION OF ML/ARD POTENTIAL

Waste rock on site is separated into two categories, NAG and PAG, using Neutralizing Potential Ratio (NPR) defined as:

$$NPR = NP/AP.$$

Acid Potential (AP) (in kg $CaCO_3$/t) is measured from:

- Total sulfur (%) x 31.25

Neutralizing Potential (NP) (in kg $CaCO_3$/t) is measured from total carbonate NP determined from:

- Total carbon (%C) x 83.33.

Due to the dominantly intrusive rock host at MPM, total carbon is an appropriate proxy for carbonate (SRK 2023a).

NPR CRITERION

A site-specific criterion (NPR) of 1.6 was developed by SRK for Springer Deep and WX Zones (SRK 2023b). To derive the NPR*, the stable rate of sulphate release was compared to the relative rate of acid neutralization by calcium and magnesium carbonate minerals, as well as potassium and sodium to account for cation exchange. The data showed a tendency toward consumption of approximately 1.6 moles of calcium, magnesium, sodium, and potassium per mole of sulphate released.

Rock sourced from other zones is defined as PAG when NPR $\leq$ 2.

BLAST FRACTIONATION

SRK was retained by MPMC to refine ABA procedures and understand the specific factors controlling ARD potential at MPM to support mining of the Springer Deep and WX zones. This work has led to the

development of site-specific ABA procedures for these particular geological zones. An excerpt from the summary report provided by SRK (2023b) is included below.

"Mineral partitioning during blasting can have an effect on the classification of waste rock ARD potential since fines tend to be more reactive. If carbonate minerals preferentially partition into the blast fines, the use of a bulk TIC-NP/AP classification factor can lead to misclassification of rock that will probably not generate acid as PAG. The reverse can also occur if sulphide minerals preferentially partition to the fines."

Review of SRK's results of blast fractionation for the Springer Deep and WX Zones showed:

- No difference in levels of total sulfur in the fine and bulk fraction.
- NP (calculated from TIC) was enriched in the fine fraction compared to the bulk fraction.

SRK (2023b) derived a regression for the NP/AP relationship between the fines and the bulk fraction.

An NPR* of 0.7 in the blast hole cuttings is used to determine dig limits for PAG rock because this is equivalent to an NPR* of 1.6 in the blast fines, which is the reactive component in the rock. For all other rock types, an NPR of 2 in the blast hole cuttings will be used to determine dig limits until a relationship is confirmed.

MATERIAL CHARACTERIZATION OVERVIEW

This section provides an overview of characterization procedures.

The MPM program characterizes all material types that will be handled during the mine life. Analysis is completed on site by Mount Polley's LECO™ instrument , allowing MPMC to best manage mine waste by directing it to suitable storage sites, or to construction usage when required (and if deemed suitable).

On each bench, a sample of cuttings is collected from each blast hole and analyzed for total copper, non-sulphide copper, iron, and gold. Areas of ore and waste are identified by interpolation of these assay results and the economic analysis of the resulting metal grades. Ore/waste boundaries are then established based on the calculated mill head values.

In areas which have proven to be consistently NAG on previous adjacent benches in blasthole samples, the waste tonnage in each blast is divided by 40,000 in order to determine the number of ABA samples to be submitted (i.e., one per 40,000 tonnes (t) of waste). However, in areas where PAG has been modelled through either exploration sampling, or results of previous blasthole sampling on other benches, (or where NAG and PAG may coincide), the sample density is doubled to one per 20,000 t. This approach results in greater sampling density in areas of suspected NAG/PAG boundaries, and increases the certainty of defining PAG. Typically structures at MPM are vertically oriented, and relatively continuous. This provides some assurance that blasthole samples from previously mined benches have relevance for determining where additional samples should be taken on new benches.

Any ore that will be stockpiled rather than processed immediately is sampled at a frequency of one (1) per 20,000 t to determine if it is classified as PAG or NAG. Millfeed ore areas are excluded from ABA analysis, as this material is processed through the Mill.

Composite tailings samples are collected and analyzed every month when processing of ore occurs to represent the tonnage of tailings deposited.

Water treatment wastes are quantified monthly and sampled quarterly, with material characterization performed to assess ML/ARD potential and contribute to a material inventory.

As a confirmatory sampling measure, the Environmental Department takes random weekly grab samples from the NAG waste dump when NAG is being dumped and/or used for construction, to verify that material is being appropriately characterized and handled.

In the event that a confirmatory sample or other activities result in the discovery of PAG material in a NAG-designated area, a QP is to be informed without delay, who will dictate the response actions in coordination with site contacts. Mount Polley is permitted to blend pockets of less than 1,000 t of PAG materials with non-PAG materials at a ratio of 20:1, as described in *Mines Act* Permit M-200 Section D.3.(c)(i)(d). If these conditions cannot be met, it may be necessary to remove PAG material from NAG areas.

Water chemistry monitoring of seepage from rock dumps, water treatment plant wastes, and contact water from the site water collection systems is also conducted by the Environmental Department to inform development of geochemical source terms and long-term water quality predictions. Similarly, tailings composites and monthly random drill pulp samples are sent to a third-party laboratory for metals analysis as an additional source of data for site geochemical models.

IN-PIT SEGREGATION

Blasthole Samples:

1. After the production drill has completed and moved away from the hole, the sample may be taken.
2. Using a tube sampler, the Driller will take a representative sample of the cuttings pile.
3. Samples are to be collected in a clean plastic sample bag.
4. The Driller is to complete a Blasthole Sample Tag, tearing off the tag once completed and inserting it into sample bag.
5. The sample bag is to be tied off using ribbon.
6. In the case where multiple composite samples are to be taken from a single hole, the remaining cuttings after the sample are to be removed by the Driller so a clean new pile of cuttings can be formed.
7. Completed samples are to be left on the drill by the Driller. At the end of shift, the Mine Operations Pit Supervisor (or designate) will collect all samples and deliver them to the Bucking Room.

Bucking Room:

1. Each sample is to be transferred from the sample bag to a clean metal tray. The Blasthole Sample Tag is to be kept with the sample.
2. The sample is to be dried at 105°C.
3. The sample is then to be crushed in the Primary Crusher.
4. The sample is then to be crushed in the Fine Crusher.
5. The sample is to be split until the sample size is approximately 200 g.

a. Reject from the sample is to be wasted.

6. The sample is then to be pulverized for 75 seconds.
7. The sample is to be placed in a pouch with the Blasthole Sample Tag stapled to the pouch.
8. If the pouch is a pit sample, it is to be sent to Assay Lab 1. If the sample is an ABA sample, it is to be sent to Assay Lab 2.

Assay Lab 1:

1. The Assay Lab is to run the sample through the atomic absorption analyzer which automatically transfers the copper (CU), non-sulphide copper (CUNS) and iron (FE) values into the LIMS database.
2. The samples for gold analysis are to be fire assayed and analyzed by atomic absorption which automatically transfers the gold (AU) value into the LIMS database.
3. The sample is then to be placed into storage. Pit samples are to be stored for 21 days.

Ore Control Technician 1:

1. Once assays have been entered into the LIMS database, the Ore Control Technician will review the data and roughly determine where in the blast any Mill Feed Ore will be located.
2. Once the Ore Control Technician drafts the Mill Feed Ore locations, the Ore Control Technician will evenly select holes in the non-Mill Feed Ore areas (including materials designated for ore stockpiles) at a ratio of one (1) sample per 20,000 t of rock. This equates to about one for every nine blast holes. Additional samples can be requested whenever additional data is desired for improving understanding of the geological conditions. An example of a sample layout is included as Figure 1.

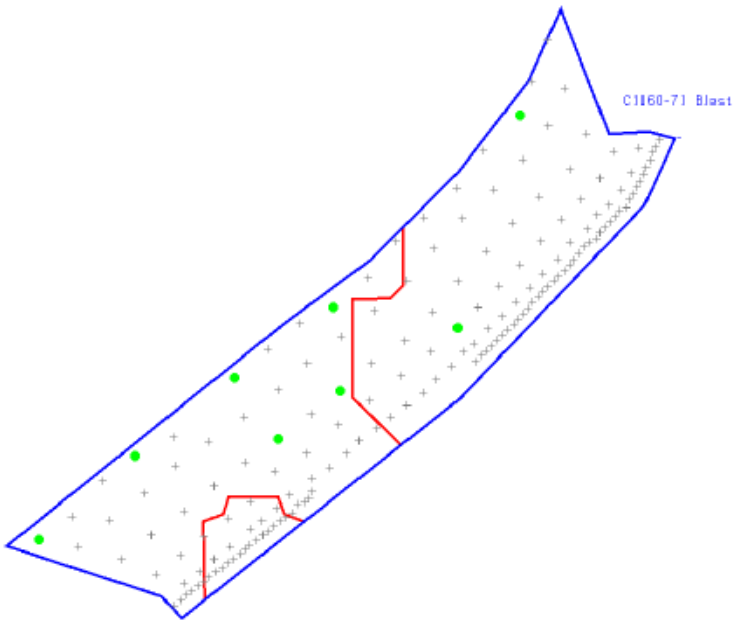


Figure 1: Location of ABA samples (green dots) within a blast. Red polygons denote mill feed ore, remainder is waste. The Ore Control Technician focuses sampling on areas which are designated waste and/or stockpile ore by the blasthole model. Reference blast = 149,173 t.

3. The Ore Control Technician is to then make an Analysis Request with the holes selected to the Assay Lab.

Assay Lab 2:

1. If the Assay Lab receives an Analysis Request, they will retrieve the sample pouch from storage, otherwise the sample will be delivered to the Bucking Room.
2. The Assay Lab will run the sample through the LECO CS230 Carbon Sulfur Analyzer.
3. Once analyzed, the machine transfers the carbon percentage (C%) and the sulfur percentage (S%) to a spreadsheet where NPR, NP and AP are calculated.
4. The NPR, NP, AP, C% and S% are transferred automatically to the LIMS database.
5. The sample is then to be placed into storage. ABA samples are to be stored for 14 days.

Ore Control Technician 2:

1. Once all the assays and ABAs have been entered into the LIMS database, the Ore Control Technician is to review the data and model the blast.
2. Modeling the blast
    a. The software used is MineSight.
    b. The model is based on a 5 metre (m) x 5 m x 12 m block system.
    c. The block closest to the ABA sample will closely match the sample.
    d. The blocks between the samples receive a weighted average of the sample carbon and sulfur grades.
    e. Once each block gets the weighted C% and S%, then the AP, NP and NPR is calculated for each block.
    f. Using the calculated NPR value, the model is to be coded as Ore/NAG/PAG by the Ore Control Technician and the resulting markup design is to be provided to the Surveyor.
3. The Ore Control Technician is responsible for the release of the final ore markup to the Surveyor. An example of a sample layout is included as Figure 2.

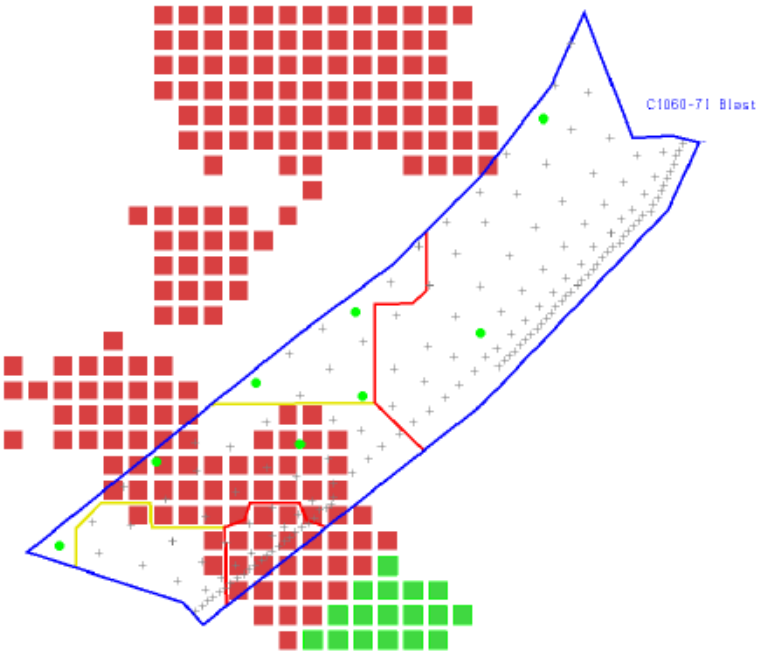


Figure 2. ABA results from samples shown in Figure 1 are used to update the blasthole PAG model item which identifies blocks which meet PAG criteria (red). The Ore Control Technician then marks up the PAG waste (yellow polygon) and the complete ore/waste markup is released to the Surveyor.

Surveyor:

1. The Surveyor will be responsible for the layout all Ore/NAG/PAG, as determined by the Ore Control Technician, in the field.

2. Using four (4) foot stakes spaced approximately 5 m apart, the Surveyor will mark out the contacts using marked placards.

    a. Red Placard = High Grade Ore
    b. White Placard = Super High Grade Ore
    c. Green Placard = Low Grade Ore
    d. Yellow Placard = PAG
    e. Blue Placard = NAG
    f. Pink Ribbon = High Grade Mill Feed Ore

3. Once complete, the Surveyor will print out maps of the area delineating material types for the shovel operator(s), and, if required, provide field verification of material types.

MATERIAL HANDLING

Shovel/Haul Truck Operators:

1. The Shovel Operator will mine the rock, following the contacts laid out by the Surveyor.

2. The Shovel Operator will ensure that all material contained within the contact stakes is routed as described by the markup and that any uncertainty in material classification is resolved by seeking the assistance of either the Pit Supervisor or the Engineering Department.
3. Upon loading a haul truck, the Shovel Operator shall direct the Haul Truck Driver as to the material type being hauled, and destination, using a horn sequence. The Haul Truck Driver will then take the material to the designated area.

IN-PIT MONITORING

Shovel Operator:

The Shovel Operator follows the staking of the Surveyor. Any material marked out as PAG is only to be hauled to approved locations. If a discrepancy is found, the Surveyor is to be called out to verify the material markup.

Pit Supervisor:

Throughout the shift, the Pit Supervisor will check in with the Shovel Operator and confirm the material type being loaded and that the destination is correct.

Haul Truck Driver:

If the Haul Truck Driver is uncertain of the material loaded, the Haul Truck Driver will confirm with the Shovel Operator or the Pit Supervisor.

Ore Control Technician:

The Ore Control Technician is to check Shovel Operator dig faces and confirm that the markup is appropriate and material is being routed appropriately.

Surveyor:

The Surveyor is to verify that material staking is visible and correct.

Environmental Department:

Once a month, the Environmental Department is to send a randomly selected drill hole pulp sample that MPMC analyzed for total sulfur and total carbon at the Assay Lab to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion as an additional source of data to support site geochemical models.

Additionally, the Environmental Department takes water samples from all pit sumps to inform long-term geochemical predictions. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. Monitoring locations and frequencies are regularly updated to reflect site developments and are summarized in the Comprehensive Environmental Management Plan.

TAILINGS MONITORING

Mill Metallurgy

1. The Mill Metallurgy Department is to take a monthly composite sample of the tailings generated through the month.
    - Slurry is to be sampled every two (2) hours and made into a composite for the shift.
    - The shift composite is then to be added to a monthly composite.
    - At the end of the month, the monthly composite is to be given to the Bucking Room and prepared for ABA total sulfur and carbon analysis.
2. The Environmental Department is to send the monthly tailings composite sample to a third-party laboratory (typically ALS Environmental in Burnaby, BC) for element analysis by ICP-MS following aqua regia digestion to provide data for site geochemical modelling.

WATER TREATMENT PLANT WASTE

Environmental Department:

1. Record the value on the waste line totalizer monthly when Water Treatment Plant (WTP) data are downloaded.
2. Collect samples of waste which has exited the WTP quarterly to characterize WTP wastes. Samples shall be taken of material that has exited the sludge line, to the West of the WTP and down-flow from where microsand is cycloned for re-use.
3. Sampling Method for liquid wastes (adapted from MPMC-WORK-002):
    - Record in-situ measures: pH, temperature, conductivity, and turbidity.
    - Take a water sample from the pipe outflow and send for lab analysis corresponding with other contact water samples as described in the Comprehensive Environmental Monitoring Plan, including but not limited to: physical parameters, pH, total and dissolved metals.
4. Sampling method for solid wastes (adapted from MPMC-WORK-016):
    - Take a composite sample of solids from the sludge pile adjacent to the WTP, with samples from at least 5 locations on the pile.
    - Send to an external laboratory for total sulfur, total inorganic carbon, elemental analysis by ICP-MS following aqua regia digestion and shake flask extraction testing to assess the ML/ARD potential of solids.
5. Review and archive lab data in a timely manner for use by personnel responsible for the Annual Reclamation Report.
6. The TSS concentration in wastewater will be used along with the waste line totalizer values to quantify the solids delivered to the TSF. The relationship between total and dissolved metals in the WTP waste line sample will be used to quantify the suspended (filterable) metals in this sample.
7. This information will be included in the MLARD materials inventory, and reported to EMLI in the Annual Reclamation Report as per Code Section 10.5.7 on water treatment wastes and by-products.

NAG Material Monitoring

Environment Department

1. As a confirmatory sampling measure, the Environmental Department is to take ABA grab samples from the NAG Dump and any area where NAG rock is used for construction on a weekly basis, while NAG dumping and/or NAG rock construction is occurring. Sampling will conform with MPMC-SOP-016: ABA and Soil Sampling. Two size fractions (+2 mm and -2 mm) will be analyzed for each sample collected. Sieving to be completed by lab once samples have been collected.
2. To assure data quality, as recommended in the BC Field Sampling Manual, a minimum of one in ten samples will be a duplicate sample, as written in MPMC-SOP-016.
3. Seeps and contact water collected on site are sampled to provide data for site geochemical modelling. Samples are collected as per MPMC-SOP-002: Surface Water Quality Monitoring. The frequency and locations of these monitoring sites are updated regularly to reflect changes to the mine site are summarized in the Comprehensive Environmental Management Plan.

Ore Control

1. As a blast fractionation confirmatory sampling measure, ten samples of blast muck will be collected each year. Blasts to sample will be selected based on mining activities and by targeting a range of sulfur contents.

Response to Finding PAG in NAG Areas

Environmental Department

1. Upon reviewing data indicating PAG material has been found in a NAG area, without delay contact one or more Qualified Professionals listed in this document, and the Pit Supervisor or designate to pass along the relevant data and sampling location.
2. Return to the location where PAG material was discovered and stake the sampling location. Note that material may have been dozed, buried or pushed down the dump face, in which case personnel are to mark as close as possible.
3. At the discretion of Qualified Professionals, undertake additional ABA sampling to assess the prevalence of PAG material.

Pit Supervisor:

1. Discuss NAG/PAG separation with shovel and haul truck operators and investigate the possibility of a loading or dumping mix-up. This is not a punitive activity but meant to identify potential causes and estimate material volume.
2. At the discretion of Qualified Professionals, organize the removal of PAG material from the non-PAG area.

ML/ARD Qualified Professional

1. Work with site contacts to develop an appropriate plan of action to address the situation.
2. If it is not possible to demonstrate that PAG material meets conditions outlined in M-200 Section D.3.(c)(i)(d), it may be necessary to remove recoverable PAG material.

REVIEW OF RESULTS AND PROGRAM EFFICACY

Data collected and corresponding interpretation regarding the ML/ARD program are included in the Annual Environmental and Reclamation Reports (AER and ARR, respectively), due annually to the British Columbia Ministry of Environment and Ministry of Energy and Mines on March 31 of each year, reflective of the previous calendar year. Personnel responsible for the AER/ARR may recommend updates to the ML/ARD program based on operational changes or findings of annual reporting. The AER/ARR include sections on: waste rock characterization and disposal; drainage water quality monitoring; and, updates to long-term predictions (kinetic testing).

REFERENCES

SRK Consulting (Canada) Inc. 2023a. Metal Leaching/Acid Rock Drainage Characterization and Monitoring Program – 2022 Annual Report. Prepared for Mount Polley Mining Corporation. SRK Project Number CAPR002434. March 2023.

SRK Consulting (Canada) Inc. 2023b. Evaluation of Acid-Base Accounting Procedures and the Criterion for Classifying ARD Potential of Waste Rock - Springer Deep and XY Zones. Prepared for Mount Polley Mining Corporation. SRK Project Number CAPR002434. October 2023.

APPENDIX 9-4A: Mine Site Water Management Plan

REPORT

Springer Expansion LOM Plan – Water Management Plan

Mount Polley Mine

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November 18, 2024



Distribution List

Electronic Copy: Mount Polley Mining Corporation

Electronic Copy: WSP Canada Inc.

Executive Summary

Background

The Mount Polley Mine (The Mine, or Site) is a copper-gold mine owned and operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine is located 56 km northeast of Williams Lake, British Columbia. As a result of a foundation failure of the Tailings Storage Facility (TSF) in 2014, mining and milling operations were suspended and MPMC did not have a permitted water discharge. An interim restricted operations M-200 permit application was submitted to regulators on March 20, 2015, and approval to resume operations was received on July 9, 2015. Milling operations resumed on August 4, 2015. Tailings and mine contact water were conveyed to and temporarily stored in the Springer Pit until 2016 when the Tailings Storage Facility was repaired and authorized for use under Mines Act Permit M-200 and *Environmental Management Act* (EMA) Permit 11678.

Also in 2016, MPMC submitted a Technical Assessment Report (TAR) to the British Columbia Ministry of Environment and Climate Change Strategy. The TAR provided details of the proposed Long-term Water Management Plan for the Mine, including the discharge quantity and quality for the operations, closure, and post-closure phases of mine life. It included a technical assessment of the effluent discharge during operations to identify whether or not receiving water uses would be impaired and recommended a preferred discharge approach using an active treatment system and a pipeline discharging treated mine water at depth in Quesnel Lake.

Under Section 1.2.3 of Permit 11678, the “authorized discharge period” for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley Mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life. If market conditions remain favourable and operations occur continuously, the mine would operate beyond June 30, 2025. Approval of this project will be sought through a Joint Application through the Ministry of Energy, Mines, and Low Carbon Innovation (EMLI) and the Ministry of Environment and Climate Change Strategy (BC ENV), with the request to BC ENV being an extension of the discharge period beyond 2025.

This Water Management Plan (WMP) addresses permit requirements for assumed future operations of the site, which at the time of writing are expected to run through March 31, 2031. This WMP also summarizes and discusses predicted water quantity, quality, and treatment during closure (April 1, 2031, through March 31, 2041) and post-closure (April 1, 2041, through March 31, 2131) phases. It should be noted that these dates are expected dates for mining operations; however, as with all mines, such schedules are subject to changes that result from commodity pricing and other factors.

Approach

The timeline for operations and closure has been assumed based on mine planning information available at the time of writing and is subject to change over time. The current Reclamation and Closure Plan (MPMC 2022a) describes the plan for closing the site.

This WMP describes the water management approach for the Site during both operations and closure. The regulatory framework for the Site is described in detail, including a table of concordance outlining how the WMP addresses the Joint Application information requirements. The proposed mine plan is described, including the assumed dates for operation, closure, and post-closure phases for modelling purposes.

Baseline information is summarized for the Site, including geology, climate, hydrology, and the receiving environment water quality (Quesnel Lake discharge via submerged diffuser). A major component of this WMP is a summary of the water balance and water quality models developed for the Mine, including a summary of inputs into these models and a summary of the results. These two models are described in detail in the appended reports (Appendix A and Appendix B). The results of the water balance and quality models provides critical information to define the design basis for water treatment for the site (summarized in this WMP), during operations and during closure/post-closure. An update of treatment technology development for closure/post-closure is also provided.

This WMP also provides discussion regarding remediation of landforms on mine sites during closure and post-closure activities.

Final Design and Technology Development

For the purposes of this revised WMP, the “final design” of the site is defined as the water management infrastructure design in place at closure of the site. During operations, the water management infrastructure (i.e., collection ditches, pipes, sumps, pumps, etc.) will remain in its current configuration. During the remainder of operations, plans will be put in place to develop the final design for water management and treatment into closure and post-closure.

A key component of developing the final design during operations is developing alternative treatment technologies that could be considered for closure of the site. This WMP provides an update on progress on a number of possible treatment technologies included in the water treatment technology inventory.

Study Limitations

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APPENDICES

APPENDIX A
Site-wide Water Balance Model (SWWBM)

APPENDIX B
Site-wide Water Quality Model (SWWQM)

1.0 INTRODUCTION

1.1 Background

The Mount Polley Mine (the Mine, or Site) is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine is located 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake. The Mine location is shown in Figure 1 and the Mine site layout is shown in Figure 5.

MPMC began production at the mine in 1997 and operated until October 2001 when operations were suspended temporarily for economic reasons. In March 2005, the Mine restarted production and it was in continuous operation until August 4, 2014, when a subsurface failure of the Tailings Storage Facility (TSF) foundation resulted in mining and milling operations being suspended. MPMC was subsequently issued with a Pollution Abatement Order (Order #107461) by the BC Ministry of Environment and Climate Change Strategy (BC ENV). Containment infrastructure for collection of drainage from the breached section of the TSF was constructed by September 4, 2014, and all contact water was subsequently directed to and contained within the Springer Pit. This measure was implemented as part of the emergency response and was considered a temporary Water Management Plan to deal with changed conditions arising from the breach.

On July 9, 2015, MPMC was provided approval by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) to return to restricted operations for a one-year period using the Springer Pit for tailings deposition and subject to the conditions stated in the M-200 Permit (Mine No. 1101163). On June 23, 2015, MPMC was provided approval by MEMPR to return to normal operations using the TSF for tailings deposition under an approved four-year mine plan as stated in the M-200 Permit.

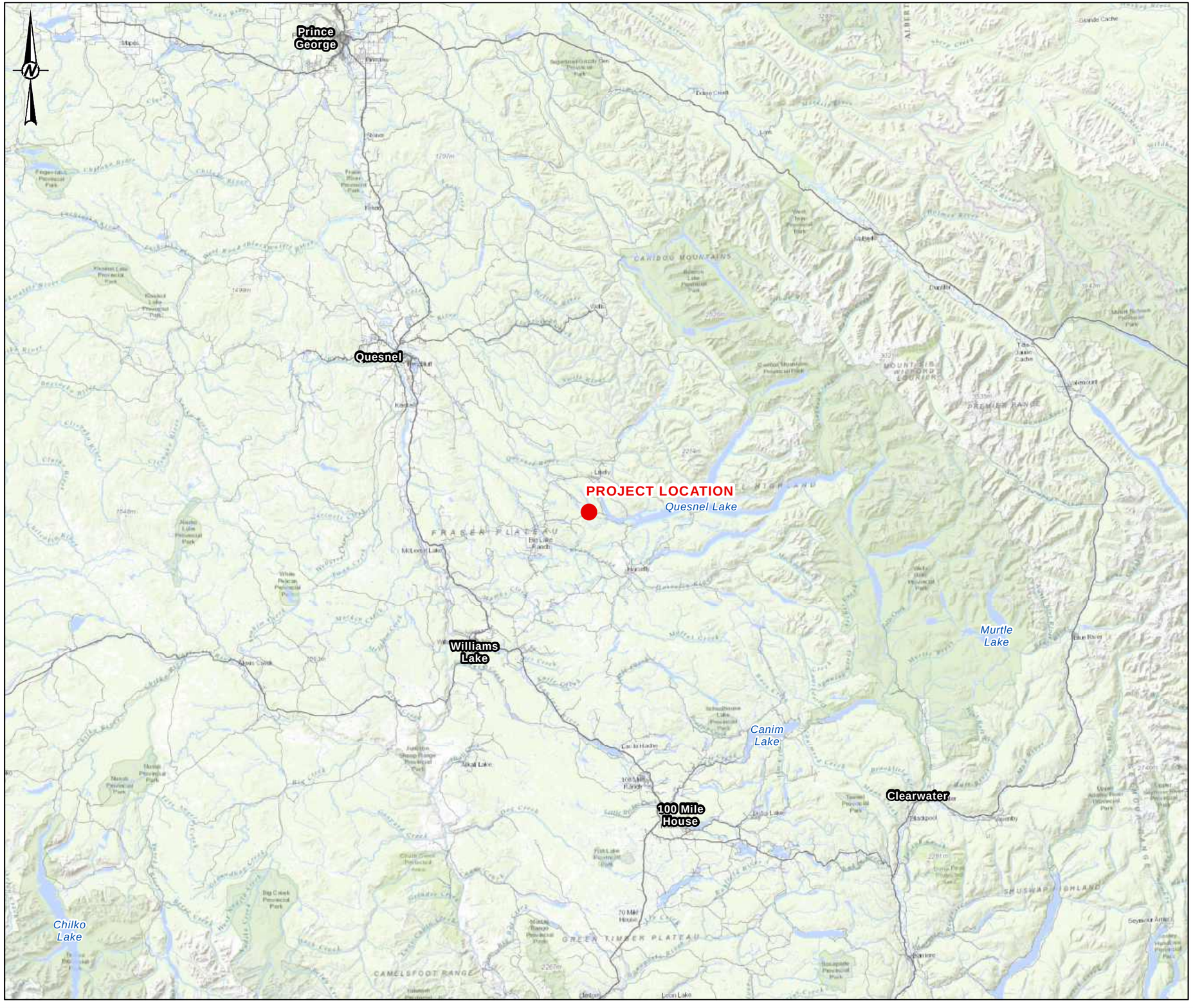
MPMC had been in care and maintenance since May 31, 2019, which resulted in an extension to the operational period needed to develop the permitted Phase 4 Cariboo-Springer Pit. In addition to this, the results of exploration and strong resource prices have provided the basis for an extended life of mine plan that will result in mining activity beyond Phase 4 Cariboo-Springer Pit, to include additional phases that will expand Springer Pit to consolidate Springer and Cariboo pits adding approximately 8 years to the life of the mine.

For the purposes of this WMP, WSP Canada Inc. (WSP) has assumed that the mine will be in operation until March 31, 2031, followed by a closure phase from April 1, 2031, to March 31, 2041, and a post-closure phase from April 1, 2041, to March 31, 2131. It should be recognized that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations. These are only assumed mine phase dates to allow completion of modelling and should not be considered by regulators as static dates.

MPMC has a permit to discharge treated effluent from the Mine under the *Environmental Management Act* (EMA; SBC 2003) as Permit 11678. The permit was issued on May 30, 1997, and most recently amended through a Consent Order on September 18, 2020. An interim extension to Section 1.2.3 of PE-11678 was granted by BC ENV in 2022, allowing the existing discharge to Quesnel Lake to continue until June 30, 2025. The (2022) TAR provided an update on, among other things, receiving environment data and, in aggregate, provided scientific rationale to support the view that the discharge is not causing pollution. Under Section 1.2.3 of Permit 11678, the “authorized discharge period” for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life.

Approval of this project will be sought through a Joint Application through the Ministry of Energy, Mines, and Low Carbon Innovation and the Ministry of Environment and Climate Change Strategy, with the request to BC ENV being an extension of the discharge period beyond 2025.

Section 2.10 of EMA Permit 11678 requires the development of a WMP that addresses future Water Management Plans beyond the end of 2022 and during mining operations. This WMP seeks to provide a practical plan for managing mine water for the proposed life of mine and to do so in a manner that reflects the requirements of Section 2.10 of the permit, based on information available at the time of writing. It also proposes an implementation schedule and revision process for the WMP.



LEGEND

- SITE LOCATION
- ROAD
- WATERCOURSE
- WATERBODY



0 25 50

1:1,250,000 KILOMETRES

REFERENCES

1. INSET MAP DATA OBTAINED FROM GEOBASE®.
2. BASEMAP OBTAINED FROM ESRI. USED UNDER LICENCE, ALL RIGHTS RESERVED.
3. ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM IHS INC.
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
LOCATION OF MOUNT POLLEY MINE

CONSULTANT

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
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1.2 Water Management Approach and Framework

1.2.1 Introduction

This document presents a WMP that addresses water management throughout the future operational, closure, and post-closure phases. This WMP mainly serves to provide support for the joint permit application associated with the proposed Springer Expansion Life of Mine (LOM) Plan.

A Table of Concordance outlining the Joint Application Information Requirements (JAIR) and how this WMP addresses those requirements can be found in Table 1. Sections 1.2 and 1.3 (this report) describe the water management framework, project development process, and the regulatory framework for this document.

A site-wide water balance model (SWWBM) and site-wide water quality model (SWWQM) were developed as part of this WMP (Appendix A and Appendix B) which describe proposed water management quantities and qualities for operations, closure, and post-closure phases of the Mine. A discussion of water treatment during operations and closure/post-closure is also provided, including treatment design bases for these LOM phases.

An additional objective of this WMP is to provide updates on treatment technology development and alternative water treatment strategies that are being explored by MPMC for implementation both in operations and upon closure of the site.

1.2.2 Water Management Approach

The primary approach to water management on site is to separate contact (mine affected) and non-contact (non-mine affected) sources of runoff and seepage. The distinction between the two water sources can be characterized as follows:

- **Contact water:** water that may have come into direct contact with mining or milling activities. This water generally requires management or treatment before release to the environment and is captured by the requirements of PE-11678.
- **Non-contact water:** non-contact water is understood as runoff originating from areas unaltered by mining activity that does not contact mining areas. Such water is not captured under the effluent permit (PE-11678). It is typically diverted to the extent practicable and allowed to discharge directly to the receiving environment.

In 2016, MPMC submitted a TAR (Golder 2016g) describing the water management strategy and configuration for the resumption of normal operations. The main objective of the TAR was to define the water management practices that will help prevent the year-over-year accumulation of contact water at the mine, and to mitigate the potential for unplanned and/or non-compliant releases to the environment. Managing water to prevent a year-over-year accumulation of stored water is also consistent with the advice from the TSF Engineer of Record and from the Independent Engineering Review Panel, both of whom act in roles created under the *Mines Act*. The following strategies were proposed to meet this objective:

- To the extent practicable, reduce the volume of non-contact water collected on site by diverting non-contact water away from mine-impacted areas and from site contact water collection systems.
- Treat and discharge surplus water so that minimal water accumulates from year to year, and infrastructure is in place to store and treat all flows up to a 1-in-10-year 24-hour storm event and withstand all flows up to the 1-in-200-year 24-hour storm event without significant damage.

- Maintain a minimum water volume of 1 million cubic metres (M-m^3) in the TSF for operation of reclaim pumps and a maximum water volume of 1.7 M-m^3, consistent with the Quantitative Performance Objectives for the TSF (Golder 2020b).
- Maintain a minimum of 100 m long tailings beaches at the TSF, consistent with the Quantitative Performance Objectives for the TSF (Golder 2020b).

These strategies assume that there will be minimal storage of contact water on site; however, during freshet (April through June) and storm events, the volume of mine water runoff will exceed the discharge and treatment capacity. Therefore, temporary detention of freshet and storm runoff volume will be necessary to equalize flows prior to discharge.

This WMP, to a large extent, builds on the strategies listed above by validating existing water management practices against applicable regulatory decisions and permit requirements that have come into effect since the TAR was submitted. This has been achieved through a review of the following information:

- Approved and assumed mine plans.
- Water management infrastructure works (e.g., pumps, sumps, channels, ditches).
- Current surface and groundwater monitoring practices.
- Water treatment configuration during operations and closure/post-closure.
- The review of the above information has been facilitated by revisions to the calibrated SWWBM and SWWQM, with appropriate sensitivity to a range of applicable water quality parameters. The water balance and water quality data outputs from the calibrated models have been used to address water management planning for mining operations through closure and post-closure.

1.2.3 Water Management Framework

Figure 2 provides a visual representation of the water management framework used in this WMP, and the subsections that follow the figure describe these concepts in more detail.

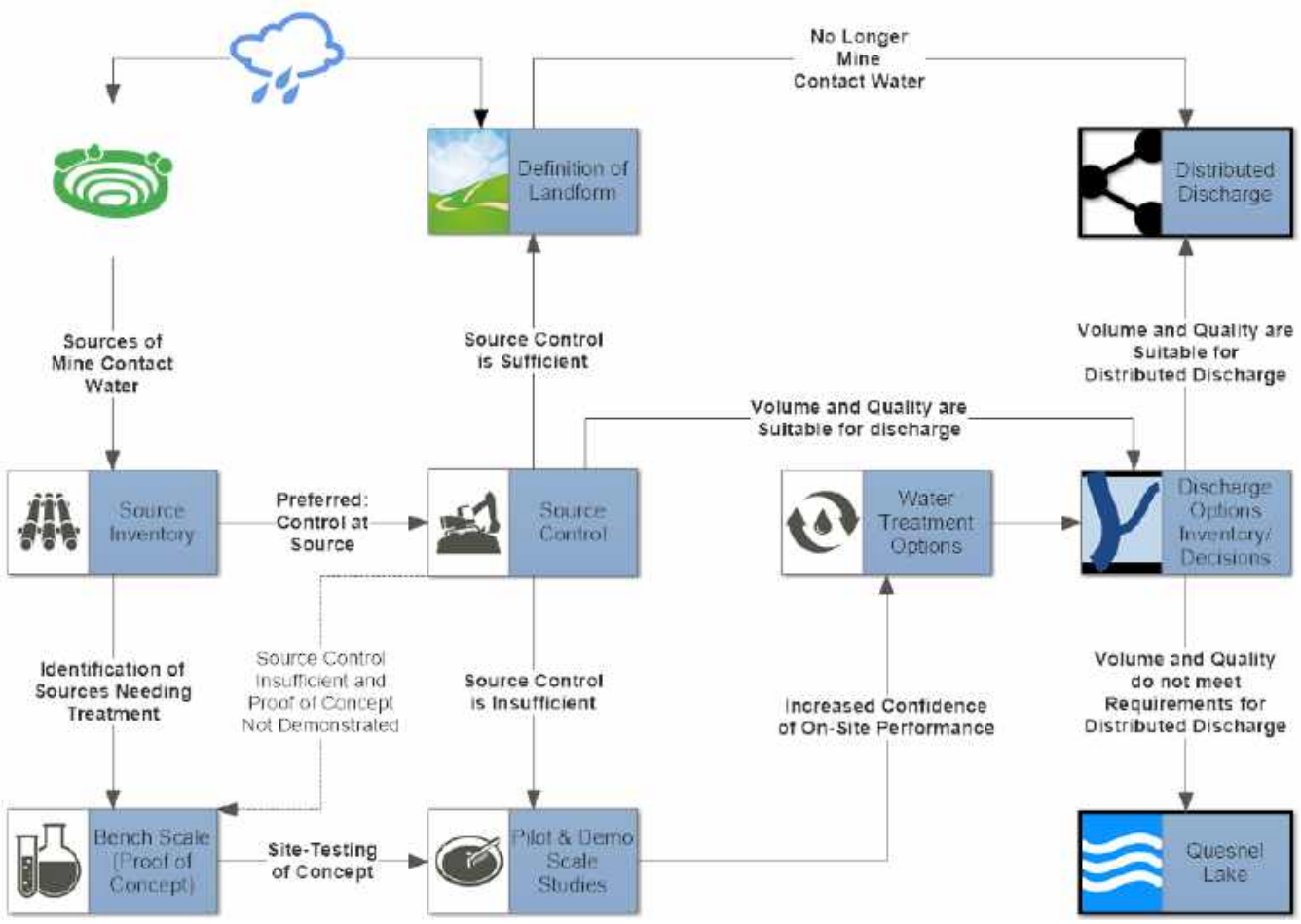


Figure 2: Water Management Plan Framework

Source Inventory

A source inventory has been developed to identify areas of the site that generate contact water. The source inventory includes information on location, modelled or measured flow, modelled or measured water quality, and current on-site collection or discharge locations. This inventory provides a list of sources where water management (i.e., diversion, source control, to other means) or water treatment is required. This has been developed to be a “living database” that will be updated as the Mine layout changes over time, or as the Mine transitions into closure and post-closure.

Source Control

Source control is the preferred approach to managing water quantity and quality. Source control is a preferred option in most waste management hierarchies because it controls risks at their source. Where source control measures are effective in reducing the volumes of mine contact water (i.e., runoff from a reclaimed landform without containing mining materials), then it would be suitable and prioritized for distributed discharge, subject to receiving waterbody or watercourse’s volume and flow capacity. Typically, this latter form of source control would be implemented as part of closure.

Water Treatment

Contact water would require management in accordance with the MPMC's effluent permit and may include treatment using active, passive, or semi-passive technologies. It may also include direct bypass where the water, treated through settling in situ and not through an active treatment system, is found to meet the permit limits.

This is a multi-phase process starting with identifying sources, modelling quantity and quality of water needing treatment, followed by bench-scale, pilot-scale, and demonstration-scale studies to systematically test and demonstrate the viability and feasibility of developed technologies for the Site. The length of time it takes for a specific technology or treatment process to advance from pre-conceptual to the execution stage is typically on the order of years.

Since the TAR was issued, one focus of the water treatment work has been to identify opportunities to treat waters at source through passive or semi-passive treatment options. Passive treatment is being pursued with the desire of it providing a low energy, low-reagent use and therefore low greenhouse gas footprint post-closure treatment method. To that end, several technologies and treatment options have been subject to conceptual level studies and testing trials and updates to this technology development process has been provided in this WMP.

Discharge Inventory

Discharge options for contact water would be decided based on the Best Achievable Technology (BAT; BC ENV 2015) selected, the modelled quantity and quality of treated water expected to be discharged, and the assimilative capacity of the receiving waterbodies. A decision gate would use this information to determine the best choice of discharge options, whether that is a local watercourse or waterbody.

Non-contact water and treated water suitable for distributed discharge would be discharged to site watercourses, subject to volume and quality decision gates and applicable regulatory requirements. The only current permitted treated water discharge under PE-11678 is discharge to Quesnel Lake via submerged diffuser and must show that the concentrations of the water quality parameters in Table 1 of the permit are met at the "Edge of Quesnel Lake Initial Dilution Zone (IDZ)" in Quesnel Lake. This WMP only provides update regarding the Quesnel Lake receiving environment (the assumed discharge location for the remainder of operations); details regarding alternative discharge locations distributed around the Site are discussed in Golder 2020e.

1.3 Regulatory Framework

1.3.1 Overview

This section provides an overview of the applicable regulatory documents and bodies that are relevant to the development of this WMP. The applicable legislation for effluent discharges to aquatic receiving environments in BC includes the provincial EMA, which contains a general prohibition against causing pollution, and the federal *Fisheries Act* (RSC 1985, c. F-14), which contains a general prohibition against the deposit of a deleterious substance into waters frequented by fish (Section 36). What constitutes a deleterious substance is a matter of expert opinion; however, for the purposes of discharges involving a metal mine, which applies to the current effluent discharge permit amendment application, what constitutes a deleterious substance is specifically defined in the Metal and Diamond Mining Effluent Regulations (MDMER; SOR/2002-222).

While this WMP has been prepared in support of MPMC's water management planning and a provincial permit requirement, federal requirements have also been addressed in the evaluations carried out, either through this plan, the 2020 WMP (Golder 2020e), or through the TAR submitted in 2016 (Golder 2016g), because MPMC must comply with both provincial and federal laws.

1.3.2 Environmental Management Act

The EMA is BC's principal pollution control statute with regulations made pursuant to that Act for more specific regulatory purposes. The EMA prohibits causing pollution, and (per subordinate regulation) requires specified dischargers to obtain an effluent discharge permit. Because federal legislation has no effluent permitting system, federal agencies (i.e., Environment and Climate Change Canada and Fisheries and Oceans Canada) utilize the provincial permit process to communicate their specific requirements to the proponent. However, the proponent remains responsible for compliance with the general prohibitions of those federal laws (described further below), notwithstanding the presence of a provincial permit. The amended permit for the effluent discharge falls under the Waste Discharge Regulation (B.C. Reg. 154/2019), pursuant to the EMA.

In the EMA, pollution is defined as "the presence in the environment of substances or contaminants that substantially alter or impair the usefulness of the environment." The common expectations under the EMA are two-fold:

- Acutely lethal conditions should not exist at the point of discharge or within the initial dilution zone (IDZ) of the effluent.
- Chronic sublethal effects should not occur outside of the IDZ. A lack of chronic sublethal effects is reliably predicted when the parameter of concern has a concentration lower than applicable BC ambient water quality guidelines (WQGs) (BC ENV 2016). However, while WQGs are a convenient "first pass" benchmark of pollution, they do not reliably predict the actual presence of pollution. BC ENV offers alternatives to the BC WQGs to provide evidence that pollution has not occurred.

The IDZ is the three-dimensional zone around the point of discharge where mixing of the effluent and the receiving water occurs. For a large waterbody, the IDZ is commonly defined as a cylindrical body of water around the outfall with a lateral radius the lesser of 100 m from the outfall or 25% of the width of the body of water and extending upwards to the surface of the water column. However, the process for delineation of an IDZ is described in BC ENV 2019a and any new discharges would be expected to follow this technical guidance.

1.3.3 Fisheries Act

With respect to the *Fisheries Act*, a deleterious substance is a substance that, if added to water, would degrade, or alter or form part of a process of degradation of that water such that it would likely be rendered deleterious to fish or fish habitat, or the use by humans or fish that frequent that water. The specific properties defining a substance as being deleterious under the parent Act are up to interpretation by experts, except where sector-specific regulations have been developed, such as the MDMER. If a water of a certain quality is determined to be suitable for discharge in accordance with EMA, it is expected (but is also confirmed) that the water is also not a deleterious substance.

Fisheries and Oceans Canada also regulates fish habitat under the *Fisheries Act*. This includes, among other things, provisions for minimum flows; a prohibition against harmful alteration, disruption, or destruction (e.g., such as could occur if a watercourse were overloaded and scoured with too much flow); or the placement of physical structures into fish habitat (e.g., outfall).

1.3.4 Metal and Diamond Mining Effluent Regulations

The MDMER is a sector-specific regulation written under the authority of the *Fisheries Act*. The MDMER includes specific definition of what constitutes a deleterious substance in effluent from a metal mine. The MDMER also contains a requirement to undertake an environmental effects monitoring program. Undertaking an environmental effects monitoring program provides assurances that the technology-based effluent limits specified in the MDMER are sufficient to protect the aquatic receiving environment.

1.3.5 Water Sustainability Act

In BC, legislation of matters relating to the use of surface water and groundwater, and protection of water resources, are governed by the *Water Sustainability Act* (WSA; SBC 2014). The WSA was brought into force on February 29, 2016, replacing the *Water Act*. Five new regulations were introduced under the WSA, consisting of the Water Sustainability Regulation (BC Reg. 32/2023), the Water Sustainability Fees, Rentals and Charges Tariff Regulation (BC Reg. 37/2019), the new Groundwater Protection Regulation (BC Reg. 253/2022), the new Dam Safety Regulation (BC Reg. 32/2023), and the Water Districts Regulation (BC Reg. 38/2016). The Water Sustainability Regulation includes requirements for the licensing, diversion, and use of groundwater and surface water to protect water resources and ecosystems, while the Groundwater Protection Regulation specifically addresses protection of the groundwater resource and identifies requirements for the construction of wells.

MPMC currently holds three surface water licences, specifically:

- 5002458, which authorizes the non-power storage of Hazeltine Creek (500,000 m^3/yr).
- C101763, which authorizes Polley Lake water to be stored (1,000,352 m^3/yr) and used for processing ore (455 m^3/d).
- C111741, which allows Polley Lake water to be used for dust suppression (818 m^3/d) and work camps (36 m^3/d).

With the introduction of the WSA, these licences continue to be valid under the WSA rather than the former *Water Act*.

Section 11 of the WSA requires an authorization for Changes In and About a Stream, which includes a broader definition of “stream” in law than what is commonly understood to be a stream in ordinary use. There are certain activities that are authorized by regulation; however, the need for a written authorization will depend on the specific effluent discharge infrastructure being constructed.

1.4 Table of Concordance

A Table of Concordance serves as the single list of joint information requirements for a *Mines Act* (MA) permit application, issued by the Ministry of Energy, Mines and Low Carbon Innovation, and an effluent discharge permit application under the *Environmental Management Act*, by the Ministry of Environment and Climate Change Strategy. These joint information requirements, and how this WMP addresses those requirements, are listed in Table 1. The WMP and supporting documents are all prepared and/or reviewed by the Qualified Professionals presented in Table 2.

Table 1: Table of Concordance

Joint Application Information Requirements	Requirement Description	Water Management Plan Section
2. Baseline Information		
2.2. Meteorology and Climate	A summary of relevant meteorological and climate information will be provided, based on existing monitoring data. The baseline information will include parameters relevant for the design and construction of the Project, such as precipitation, snowpack, temperature, and evapotranspiration.	Section 3.2.1
2.6. Water Quantity		
2.6.1. Surface Water Quantity	The hydrology baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published hydrological datasets. The baseline information will be summarized from data collection programs already in place.	Section 3.2.2
2.6.2. Groundwater Quantity	The groundwater baseline information for the Project will be provided, with references to existing studies, where applicable, and previously published groundwater datasets. The baseline information will be summarized from data collection programs already in place.	Sections 3.2.3 & 3.2.4
5. Modelling, Mitigation, and Discharges		
5.1. Summary	Qualitative hydrology and water quality assessments of the potential effects of the Project will be provided.	Sections 4.3, 4.4, & 4.6
5.3. Site-wide Water Balance Model	Quantitative model will be updated to reflect new LOM schedule. Updates include revisions to catchment boundaries, storage, and runoff impacted by mine development. Results will include facility level water volume and level projections and estimated discharge quantities from the site. Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	Section 4.3 (SWWBM) & Section 4.6 (WTP-details)
5.4. Surface Water Quality Model	Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	Section 4.4 (SWWQM) & Section 4.6 (WTP-details)

Table 1: Table of Concordance

Joint Application Information Requirements	Requirement Description	Water Management Plan Section
5.6 Mitigation Methods		
5.6.4. Water Treatment	Information/discussions on the anticipated changes to water quantity and quality as informed by the Surface Water Balance and Surface Water Quality Models, and how these predictions relate to the water treatment effectiveness and capacities will be provided. An update on water treatment technology and research development will be provided in the updated Water Management Plan submitted with the Application. This will include an implementation plan and schedule for water treatment technology development.	Sections 4.3 (SWWBM), 4.4 (SWWQM), 4.6.1 (Treatment Design Bases), & 4.6.2 (Treatment Technology Update)
5.6.4.1. Description	A description of the existing water treatment system will be provided in the Application.	Section 4.1 & Section 4.6.1
5.6.4.2. Location	The location of the existing water treatment system will be provided in the Application.	Figure 5 – Mine Site Layout
5.6.4.4. Treatment Effectiveness	Details on the operational efficiency and reliability of the WTP and a model sensitivity scenario that reflects recent operational data will be provided.	Section 4.6.1
5.6.4.6. Influent and Effluent Quality	Predictions for changes to WTP influent volume and quality resulting from the Project will be provided. Additionally, this section will provide details on proposed mitigation, including WTP capacity, performance, and adequacy in mitigating the discharge.	Section 4.6.1 & Section 4.6.2

LOM = Life of Mine; WTP = Water Treatment Plant.

Table 2: Qualified Professionals List

Name	Accreditation and Number	Section of Water Management Plan Responsible For
Gonzalo Donoso	P.Eng., #211694	Sections 3.2, 4.2, 4.3
Lee Nikl	R.P.Bio., #601	Sections 1.3, 3.2, 4.2, 4.4, 4.5
Jesse Maddaloni	P.Eng., #36620	Sections 1.1, 1.2, 1.4, 2.0, 4.1, 4.6, 5.0
Jacqueline Foley	P.L.Geo., #130262	Section 3.2.3

2.0 PROJECT DESCRIPTION AND MINE PLAN

2.1 Approved Mine Plan

On November 6, 2015, MPMC submitted a *Mines Act* Permit M-200 amendment application (MPMC 2015) to mine the Phase 4 Cariboo-Springer Pit. On June 23, 2016, this application was approved by MEMPR, and an amendment to *Mines Act* Permit M-200 was received by MPMC, approving the return to full operations and use of the TSF. The required approval from BC ENV to resume deposition of tailings in the TSF, as required under EMA Permit 11678, was also received on June 23, 2016 (MEMPR 2016).

The approved mine plan included mining and processing (or stockpile) 27.8 Mt of ore from the Phase 4 Cariboo-Springer Pit over a four-year mine life. The approved mine plan also included transferring 5 Mt of tailings from the Springer Pit to the TSF. The TSF was planned to be constructed to a crest elevation of 970 metres (m; Tailings Coordinate Grid and Elevation Datum) to accommodate tailings transfer from the Springer Pit and new tailings.

2.2 Mine Plan Beyond 2023

Beyond 2023 the majority of mining will occur in the Springer and Cariboo Pit which is also the focus of the Springer Expansion LOM plan. The current plan has the life of mine concluding in 2031 then rehandled Potentially Acid Generating (PAG) material is placed back into the pit until end of 2033. The open pit mining operation mines on average 6.1 million tonnes of ore and 7.7 million tonnes of waste per annum (peaking at 35.5 million tonnes in 2025). The Springer Expansion which includes Phase 5, Phase 6, C2, WX will supplement ore production into the year 2031. A Life of Mine planned total material moved is presented in the Table 3 below and shown in Figure 3.

Table 3: LoM Waste Mined (t)

Year	Total Wast Mining by Pit Phase (NAG)							Total Wast Mining by Pit Phase (PAG)					
	C2-B/ Car-RR-NAG	WX-NAG	Springer 4-NAG	Springer 5-NAG	Springer 6-NAG	Un-Prod Waste RH	Spr Talls Dump Fill	C2-B/ Car-RR-NAG	WX-NAG	Springer 4-NAG	Springer 5-NAG	Springer 6-NAG	PAG ReHandle
2024			1,090,714	17,263,779		735,262	1,671,460			233,148	921,548		
2025	2,223,438		278,717	21,627,577		843,869	374,554	340,301		35,350	803,264		
2026				22,028,147		725,000	11,627				386,955		
2027				14,094,795	2,385,013	689,769	18,825				398,216	407,957	
2028				1,476,896	11,813,839	827,026	41,901				732	13,015,868	
2029	840,294	1,999,546			8,114,673	756,210	1,912,244	38,380	12,173			11,060,273	
2030		5,817,474			7,383,626	700,000	9,326		2,869,174			6,503,661	
2031		2,391,839			191,651	841,868	4,110		2,346,898			38,382	22,500,000
2032													30,000,000
2033													21,429,209

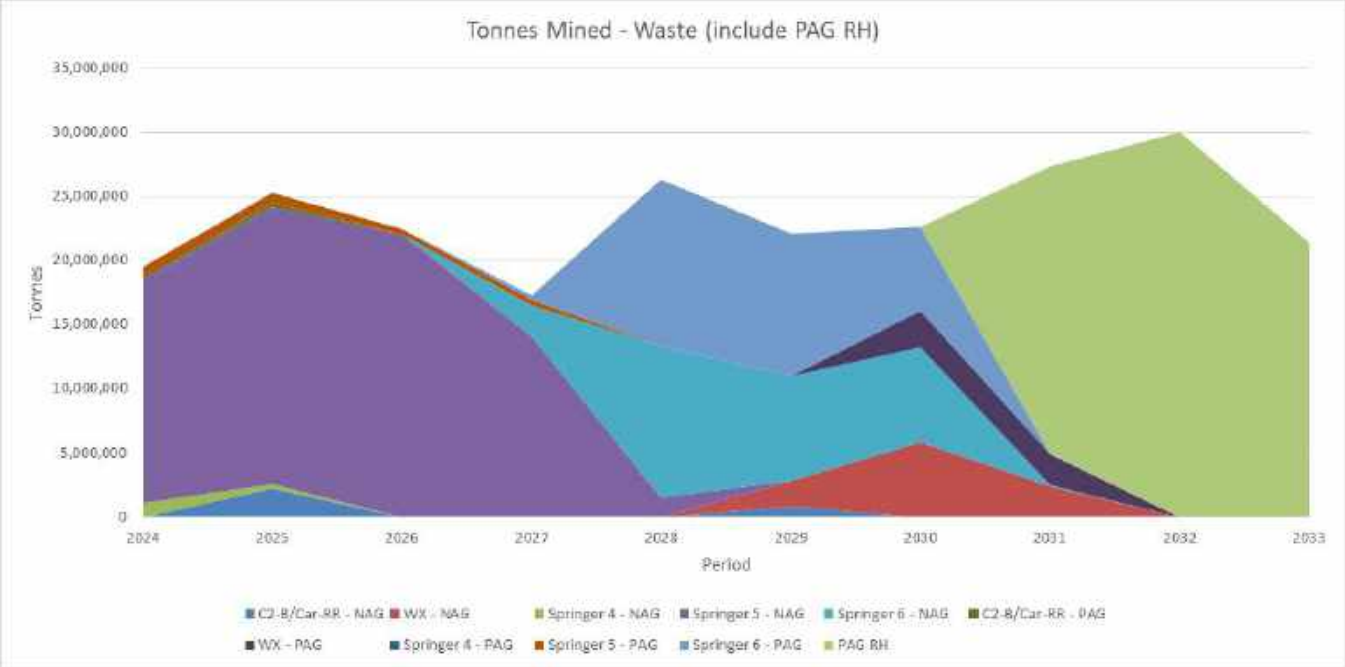


Figure 3: LoM Waste Mined (t)

The ore mined by Pit Phase is presented below in Table 4 and shown in Figure 4.

Table 4: LoM Ore Mined (t)

Year	ORE Above C/O by Pit Phase				
	C2-B/Car-RR	WX	Springer 4	Springer 5	Springer 6
2024			5,733,351	1,326,649	
2025	1,626,030		3,883,659	1,550,312	
2026				5,795,978	
2027				8,131,599	72,751
2028				4,013,289	1,258,489
2029	1,908,094	48,935			550,232
2030		802,009			6,083,558
2031		495,484			1,802,980
2032					
2033					

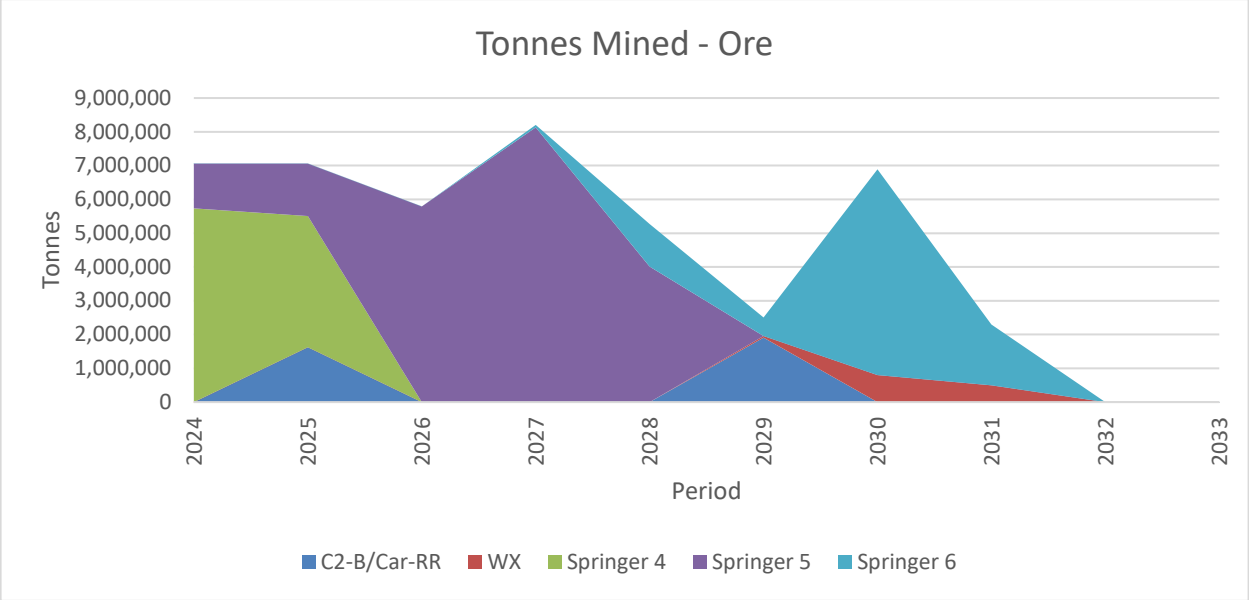


Figure 4: LoM Ore Mined (t)

A summary of the mine development dates for each phase of the LOM plan sub-components is shown in Table 5.

Table 5: Mine Development Schedule

	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Springer 4										
Springer 5										
C2-B/Car-RR										
Springer 6										
WX										
PAG RH										

2.2.1 Surface Disturbances

The expansion of Springer Pit will require little stripping or preparation as the area has been previously disturbed mining the Bell, C2 and Cariboo pits. An inventory of areas disturbed to date, and projection of the land to be disturbed up to the projected end of mine life can be found in the Joint Application for the Springer Expansion application.

2.2.2 Pit Dewatering

The Springer Pit is currently mined to Phase 4 at a depth of 928m from surface. Dewatering from the Springer Pit will require establishing temporary sumps in the mine working usually at the lowest working bench. Electric or diesel pumps will convey water to a large sump located in the Cariboo pit. The Cariboo Pit will be pumped to the West collection ditch and then to the Perimeter Embankment Till Borrow Pond.

2.2.3 Assumptions

For the purposes of this WMP, WSP has assumed that the mine will be in operation for an additional mine life of approximately eight years (i.e., from May 2, 2023, to March 31, 2031). Ore will be processed at an average milling rate of 20,000 tonnes per day (tpd). Tailings from processing the ore will be pumped to the Tailing Storage Facility. Mining of the remainder of Phase 4 Cariboo-Springer Pit will require tailings (approximately 2.75 Mt) currently stored in the Springer Pit to be removed.

The TSF crest elevation is currently 970 m and additional TSF raises will continue beyond 2023 with an interim raise to 974 m planned to start in 2023 and then additional raises to the ultimate crest elevation of 987 m. The available tailings volume capacity for the 987 m crest elevation design is 62.8 Mt (based on a feasibility level design of the TSF to a dam crest elevation of 987 m) of which approximately 5.3 Mt has been used up since the resumption of operations in July 2022.

It has also been assumed that the waste rock generated during assumed future operations will be placed within the same footprint of the existing waste rock dumps and that the footprint of the pits will not significantly increase from the current configuration.

It should be recognized that the mine life duration, the production rate, the design of the mine facilities (e.g., TSF) have been assumed for the purposes of advancing this revised WMP and this will be confirmed or adjusted as part of the detailed mine plan being developed by MPMC. Details of the proposed amendments to the existing mine plan are anticipated to be presented in a *Mines Act* Permit M-200 amendment application.

2.3 Project Description

2.3.1 Project Development Phases

This section provides a description of the forecasted future mining phases associated with the Springer Expansion LOM Plan:

- **Future operational phase:** The Mine has resumed operation since June 2022 under the current EMA Permit 11678. The future operational phase is assumed for the period from May 2, 2023, through March 31, 2031, in line with the Springer Expansion LOM Plan. Future operations are anticipated to include the following:
  - Full mining and milling activities will resume, including deepening of the Cariboo and Springer pits (Phases 5, 6, C2, WX).
  - Tailings will be deposited into the TSF until March 2031 (subject to approvals for dam raises in the interim to 974 m and ultimately to 987 m).
- **Closure phase:** will begin when mining is finished and will include closure and reclamation activities as identified in the Reclamation and Closure Plan (RCP; MPMC 2022a) over the period of April 1, 2031, through March 31, 2041.
- **Post-closure phase:** will begin when the closure period is finished and will continue indefinitely. For the purposes of modelling and this WMP, post-closure has been assumed over the period of April 1, 2041, through March 31, 2131 (100 years including the closure phase). Pit lakes will develop in the combined Springer-Cariboo Pit and Wight Pit.

It should again be noted that these mine phase dates are assumed for the general purpose of modelling and that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations.

2.3.2 Future Operational Phase

Under the future operational phase, tailings from milling operations will be discharged to the TSF from May 2, 2023, through 2031.

Outside of the TSF, mine contact water will either flow or be pumped to the SERDS (via West Ditch) and Long ditches, which flow to the Central Collection System (CCS). Water from the CCS reports by gravity to the PETBP, where it will be treated using the Veolia Actiflo system and discharged through the Quesnel Lake pipeline. When the inflows to the CCS exceed the discharge rate (typically during the freshet period), excess contact water will be pumped to the TSF for temporary detention.

Mine water inflows into the TSF will consist of:

- Water pumped with the tailings slurry.
- Precipitation and runoff into the TSF.
- Excess water pumped from the water management structures for temporary storage in the TSF during freshet and storm events.

Stored water in the TSF is reclaimed to meet process requirements. A minimum water volume of 1 M-m^3 is required to accommodate operation of barge pumps during operations. Makeup water would typically be required during dry years and on occasion during the winter. During these discrete periods, makeup water will be sourced from water collection sumps located in pits or other contact water sites.

2.3.3 Closure Phase and Post-closure

The SWWBM includes projection of water management into the closure and post-closure phases based on the Reclamation and Closure configuration update (MPMC 2022a), with adjusted closure dates to match the Springer Expansion LOM plan. The following objectives of the closure and post-closure phases have been identified:

- Long-term preservation of water quality within and downstream of decommissioned operations.
- Long-term stability of the TSF.
- Removal of all access roads, ponds, ditches, pipelines, structures, and equipment not required following mine closure.
- Long-term stabilization of all exposed materials that are susceptible to erosion.
- Establishment of a self-sustaining vegetative cover consistent with existing forestry, grazing, and wildlife needs.
- Natural integration of disturbed lands into the surrounding landscape and restoration of the natural appearance of the area.

As the closure phase ends and the post-closure phase begins, it is assumed that some catchments will produce non-contact water as areas are successfully remediated, and some sump pumping systems are assumed to be decommissioned to allow overflow from sumps and or pits directly into the environment rather than being pumped into the contact-water system for treatment. More details regarding the closure and post-closure assumptions regarding operating or decommissioned water management components within the mine facilities may be found in the Water Balance Model Report (Appendix A, WSP 2023a).



LEGEND

WATER COLLECTION SYSTEMS

- CLEAN WATER DITCH
- CONTACT WATER DITCH
- PIPELINE

0 600 1,200

1:30,000 METRES

REFERENCES

1. PROJECT IMAGERY OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2019)
2. WATER MANAGEMENT INFRASTRUCTURE INFORMATION PROVIDED BY MOUNT POLLEY MINING CORPORATION (2016)
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT

MOUNT POLLEY MINING CORPORATION

PROJECT

WATER MANAGEMENT PLAN

TITLE

MINE SITE LAYOUT

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
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3.0 BASELINE INFORMATION

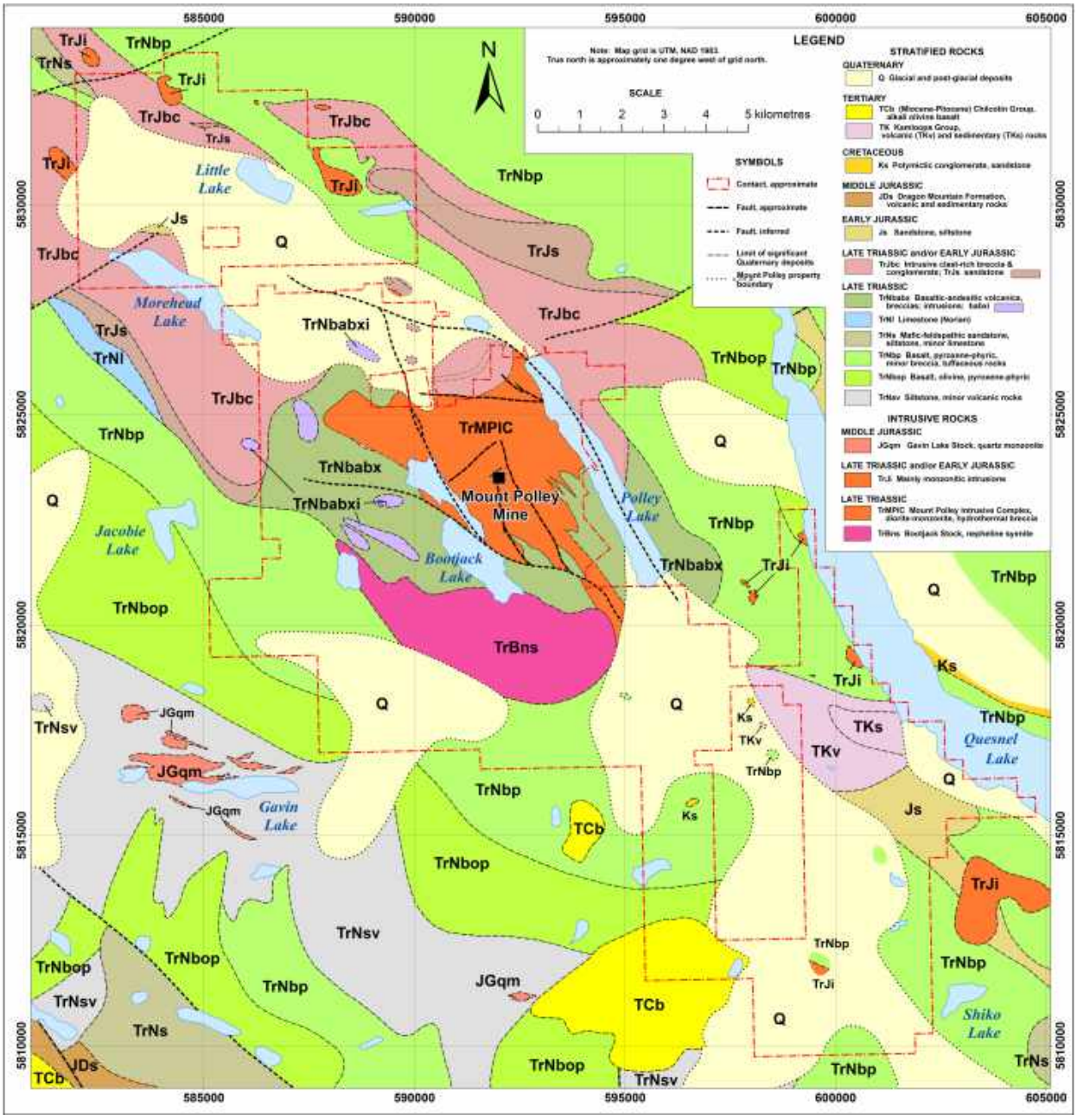
3.1 Geology

An understanding of the regional and local geology and the geochemical characteristics of the different mine materials (e.g., waste rock, ore) aids in developing an understanding of how these materials will weather, and to identify the processes that will control the release of constituents under ambient conditions. The following subsections (adapted from the TAR) provide a summary of the mine geology and geochemical characteristics that were subsequently used to derive the geochemical source terms (refer to Appendix C of the TAR, Golder 2016g; SRK 2015) for inclusion into the site-wide water quality model (refer to Appendix D of the TAR, Golder 2016g). The subsections of Section 3.1 were written by SRK Consulting (Canada) Inc. (SRK).

3.1.1 Regional Geology

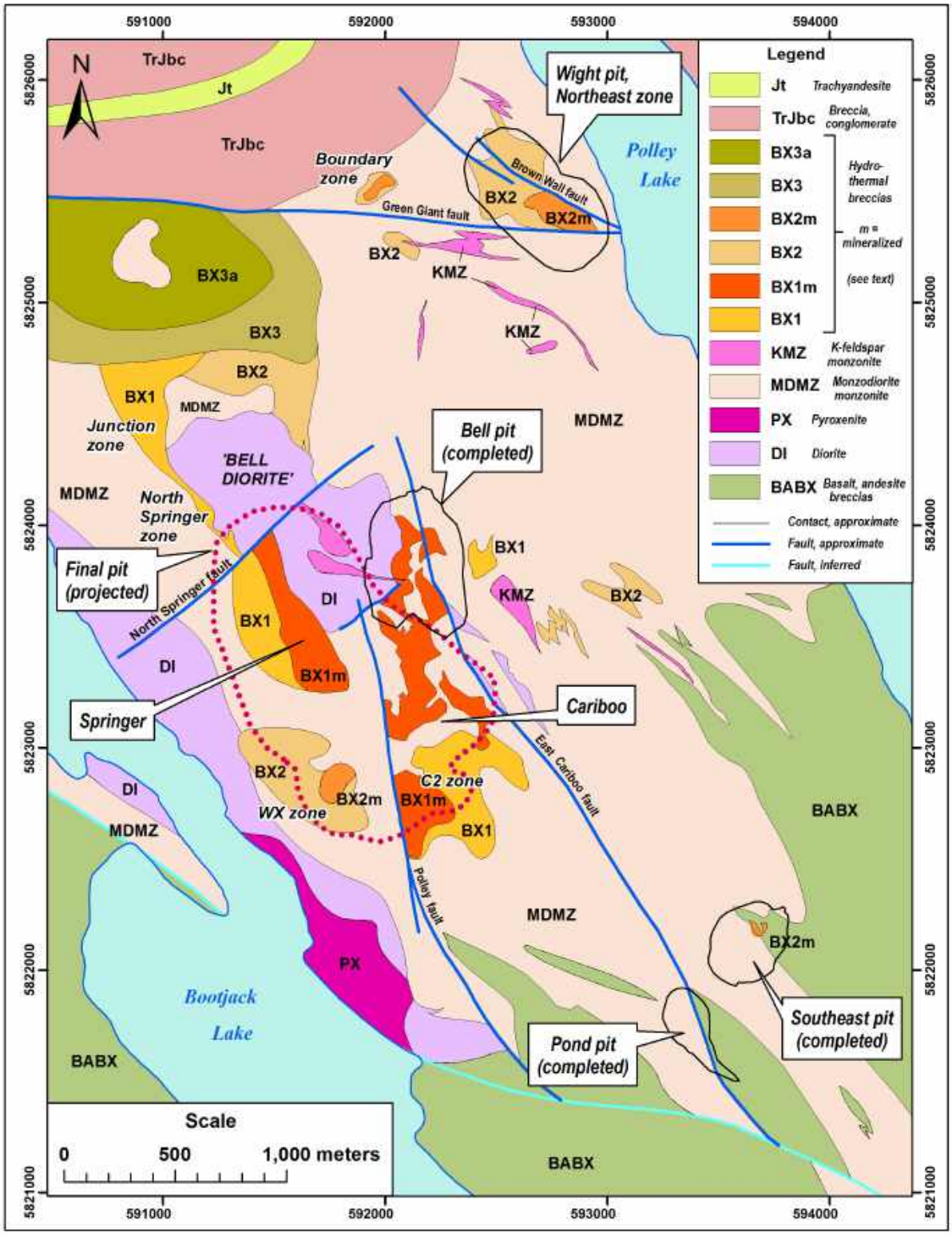
The mine is in Quesnellia, an accreted terrane in the Intermontane Belt of the Canadian Cordillera. Quesnellia is characterized by Triassic to Jurassic volcanic, sedimentary, and mafic to intermediate intrusive rocks formed in a west-facing arc that developed west of the continental margin of ancestral North America. The mine is within the Mount Polley Intrusive Complex (MPIC), situated in the Central Quesnel Belt, a region of Quesnellia roughly between latitudes 51.5° and 53.5°N (Figure 6 and Figure 7). In this area, the arc and a marginal basin immediately to its east were obducted eastwards onto the then continental margin in the late Early Jurassic. Continued crustal shortening in the Middle Jurassic resulted in regional metamorphism and southwest-verging back-folding of the now coupled arc-marginal basin and continental margin assemblages. The mine lies in the core of a broad regional, northwest-trending upright syncline at the western limit of this Middle Jurassic folding. Regional metamorphic grade at the mine is no more than zeolite facies.

Stratified Triassic rocks surrounding the site are assigned to the Nicola Group, the type-area of which is in southern Quesnellia, where the Nicola hosts other porphyry copper deposits such as the Highland Valley, Copper Mountain, and New Afton mines. The arc stratigraphy in the Mount Polley district extends from the Middle and Late Triassic Nicola Group into the Early Jurassic. From the base, the Nicola Group consists of Middle to early Late Triassic sedimentary and minor volcanic rocks, overlain by a thick Late Triassic succession of submarine, trachybasaltic volcanics and related tuffaceous sediments and volcaniclastic breccias. The youngest assemblage, which extended into the Early Jurassic, consists of volcanic, plutonic, and sedimentary rocks representing a more mature stage of arc activity, and more differentiated magmatism, when the MPIC was formed. The youngest arc rocks are polymictic breccia and conglomerate that unconformably overlie the MPIC and are products of late arc uplift and erosion. In the southern part of the Mount Polley property, Nicola Group country rocks are covered by post-accretion units, including outliers of unnamed Cretaceous sandstone and conglomerate, early Tertiary andesitic volcanic and sedimentary rocks of the Kamloops Group, and Miocene-Pliocene basaltic volcanics of the Chilcotin Group.



Source: Rees 2013.

Figure 6: Regional Geology of the Mount Polley Property



Source: Rees 2013.

Figure 7: Simplified Geology of the Mount Polley Intrusive Complex

3.1.2 Deposit Geology

Geological details of the Mount Polley deposit are found in Rees 2013 and the findings are summarized below.

The MPIC hosts the Mount Polley copper-gold porphyry deposit (Figure 6 and Figure 7). It is a Late Triassic magmatic centre approximately 6 km by 4 km, elongated in a north-northwest direction. It consists of alkalic, marginally silica-undersaturated intrusions and magmatic-hydrothermal breccias. The age of the deposit is approximately 205 million years based on uranium-lead isotopic dating; there is close agreement between age determinations from MPIC intrusions and minerals associated with sulphide mineralization. Mineralization occurs in almost all constituent rock types of the MPIC, and thus occurred late in its formation. Nearly all economic mineralization is in breccias, or in mineralized stockwork veins in adjacent wall rock intrusion. Country rocks of the Nicola Group closest to the MPIC are mafic to intermediate volcanic and subvolcanic coherent rocks, and related breccias, and may form components of mineralized hydrothermal breccias in the periphery of the MPIC.

3.1.3 Metal Leaching/Acid Rock Drainage Geochemistry

Details of the characterization of metal leaching/acid rock drainage potential at the mine are provided in Appendix C of the TAR (Golder 2016g). Findings are summarized below.

The Mount Polley deposit is classified as an alkalic porphyry copper-gold deposit. With the exception of the distinctive small Pond Zone skarn deposit, it has been mined from several mineralized zones (Springer, Cariboo, Bell, Southeast, Northeast, Boundary) with common geological features including mainly a monzonitic plutonic host rock, association with breccia bodies in the intrusion, dominantly potassic hydrothermal alteration, lack of pronounced pyrite haloes, enrichment in copper and selenium relative to global norms, pervasive calcite, and natural oxide alteration. As a result, geochemical characteristics are consistent between zones, allowing a site-wide approach to geochemical characterization.

Potentially acid generating (PAG) and non-acid generating (NAG) waste rock materials occur locally as pyrite zones, but NAG rock dominates. Acid rock drainage potential has been used to segregate waste rock, with NAG waste rock being placed in several waste rock disposal sites and PAG waste rock either deposited in completed pits that are projected to flood at the closure of the mine (in accordance with the management practice of subaqueous disposal) or placed in the Temporary NW PAG Stockpile for final subaqueous disposal in the Springer Pit.

Tailings are classified as NAG based on operational monitoring and testing of tailings spilled into Hazeltine Creek in August 2014 (Appendix C of SRK 2015).

The metal leaching/acid rock drainage assessment was used to inform the development of geochemical source terms for use in the SWWQM. Major geochemical source terms were identified as waste rock stockpiles and tailings. Other sources included backfilled waste rock, ore processing, pit walls, ore stockpiles, and the sulphur and magnetite stockpiles. Source terms were mainly developed from conceptual geochemical models, then interpretation of rock geochemical characteristics and seepage data, rather than scale-up of laboratory kinetic test data. The reader is referred to Appendix C of SRK 2015 for details on the derivation of geochemical source terms and to Appendix D of the TAR (Golder 2016g) and Section 4.4 for how these source terms are applied in the model.

3.2 Climate and Hydrology

3.2.1 Climate

The Site is located 56 km northwest of Williams Lake, British Columbia (BC) near the eastern edge of the Fraser Plateau physiographic subdivision, approximately 10 km west of its boundary with the Quesnel Highland subdivision, as defined by Holland (1976).

Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

In 2022, WSP updated the climate baseline data for the Site to include the most recent climate data. The climate of the mine site was characterized in the Baseline Climate Update Report (Golder 2022a) using historical measurements recorded at local climate stations, supported by data collected from five nearby regional Environment and Climate Change Canada (ECCC) climate stations. The baseline climate update report is summarized below, and more details can be found in Golder 2022a.

MPMC has operated climate stations on site since 1995, although the station data records are not continuous. From 1995 through 2012, MPMC maintained one climate station at the Mill Site that measured and recorded rainfall (1997 to 2012), temperature (1995 to 2012) and wind velocity and direction (1997 to 2003). In 2012, this station was replaced with two stations: one near the mill site (WS1) and one adjacent to the TSF (WS2). These new stations measure and record wind speed, relative humidity, solar radiation, temperature, and rainfall.

Five ECCC climate stations: Likely, Spokin Lake, Williams Lake, Barkerville, and Quesnel, were selected to support and extend the long-term climate dataset for the Site due to their proximity to the Site, length of record, elevation range, and concurrent period of record with the local climate stations at the Site. In addition, the ECCC Prince George climate station was added to include an additional station with solar radiation data. Historical records were retrieved from ECCC's Historical Climate Data web server (ECCC 2022a). More recent records were compiled through e-mail correspondence with ECCC staff (ECCC 2022b).

The details of these stations are shown in Table 6. The locations of the mine weather stations are shown in Figure 8.

Table 6: Local and Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[(a)]	Easting (m E)[(a)]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[(b)]
Mill Site Weather Station	5822420	592495	1,118	-	R, T, WS, WD	1995-2012
Weather Station #1 (WS1) [near mill]	5822420	592792	1,171	-	R, T, RH, SR, E, WS	2012-2021[(d)]
Weather Station #2 (WS2) [TSF]	5819955	594059	964	-	R, T, RH, SR, E, WS	2012-2021[(d)]
Likely (1094616)	5828785	599332	724	9	P, R, S, T	1974-1993

Table 6: Local and Regional Climate Stations for the Mount Polley Mine

Station Name (ID)	Northing (m N)[a]	Easting (m E)[a]	Elevation (masl)	Approximate Distance to Site (km)	Data Type	Period of Record[b]
Williams Lake A (1098940)	5781820	564666	940	50	P, R, S, T, RH, SR	1961-2021[d]
Spokin Lake 4E (1097646)	5782274	589827	1,033	40	P, R, S, T	1983-2021[d]
Barkerville (1090660)	5880996	599515	1,283	59	P, R, S, T	1888-2021[c], [d]
Quesnel A[e] (1096630)	5873987	546720	545	80	P, R, S, T, RH	1946-2021[d]
Prince George A (1096450)	5971423	521103	691	163	P, R, S, T, RH, SR	1973-1995

(a) UTM Coordinate system – Zone 10U.

(b) Length of record from start year to end year may not reflect the number of complete years of data.

(c) Provisional data for the period January 2016 to December 2021 were provided by ECCC.

(d) Station still in operation.

(e) Combined record from Quesnel A and Quesnel Airport Auto stations. Stations are located at the same location.

ID = Identification; masl = metres above sea level; km = kilometre; P = Precipitation; R = Rainfall; S = Snowfall; T = Temperature; RH = Relative Humidity; SR = Solar Radiation.

During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically being taken during the melt phase. The details of these stations are provided in Table 7, and their locations are shown in Figure 8.

Table 7: Local Snow Course Sites at the Mount Polley Mine

Station Name	ID	Northing (m N)[a]	Easting (m E)[a]	Approximate Elevation (m)[b]	Period of Record
Snow Course # 1 (near mill)	N/A	5823182	592792	1,171	1997–2010, 2015–current
Snow Course # 2 (near TSF)	N/A	5819976	594092	964	1997–current
Snow Course # 3	N/A	5823895	593632	976	2012–current
Snow Course # 4	N/A	5823537	590835	1,112	2015–current

(a) UTM Coordinate system – Zone 10U.

(b) Elevation for on-site climate stations measured with handheld GPS device.

masl = metres above sea level; N/A = not applicable; TSF = Tailings Storage Facility.



LEGEND

- CLIMATE STATION
- CONTOUR (10m)

0 600 1,200

1:30,000 METRES

REFERENCES

1. CONTOURS AND PROJECT IMAGERY OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2019)
2. CLIMATE AND SNOWCOURSE STATION LOCATIONS OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2016)
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
MOUNT POLLEY CLIMATE AND SNOWCOURSE STATIONS

CONSULTANT

wsp

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
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Air Temperature

Air temperature statistics for the Site were developed using historical data from the nearby ECCC climate station in Likely approximately 9 km northeast of the Site. The historical Likely data set was adjusted to the average elevation of the Mount Polley mine by applying the regional monthly lapse rate (Golder 2022a). Data gaps were infilled using data from the four regional ECCC climate stations in a prioritized sequence and applying the monthly temperature lapse rate to adjust for elevation.

Monthly and annual air temperature statistics for the Site (1974-2021) are presented in Table 8. The estimated mean annual temperature varies between 1.7°C and 6.3°C, with a long-term mean of 3.9°C. Mean monthly temperatures vary between -6.7°C in January and 15.1°C in July. The historical daily maximum and minimum air temperature from the derived long-term data set was 38.1°C in June 2021 (measured at the Site) and -39.8°C in December 1996, respectively.

Table 8: Derived Air Temperature (°C) Statistics for Mount Polley Mine, 1974 to 2021

Month	Temperature (°C)							
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile	Daily Maximum	Daily Minimum
January	-16.0	-6.7	-0.3	-8.7	-6.3	-4.0	11.2	-39.4
February	-13.0	-4.8	0.7	-7.7	-4.3	-2.1	13.6	-35.4
March	-6.7	-1.0	3.2	-2.2	-0.8	0.5	18.4	-32.7
April	-0.7	3.7	12.0	2.8	3.7	4.3	27.5	-16.7
May	5.2	8.5	13.1	7.5	8.3	9.6	33.1	-7.9
June	8.6	12.2	15.5	11.1	12.2	13.2	38.1	-4.9
July	11.8	15.1	21.2	13.3	14.8	16.4	36.0	0.6
August	11.0	14.6	17.1	13.6	14.8	15.7	33.0	-4.1
September	6.8	10.0	14.2	8.7	9.6	11.2	36.3	-7.1
October	0.8	4.1	8.7	3.4	4.1	4.7	31.1	-26.4
November	-13.7	-2.4	2.6	-3.8	-2.1	-0.4	17.3	-36.9
December	-13.7	-6.6	-1.2	-9.5	-5.5	-3.9	11.3	-39.8
Annual	**1.7**	**3.9**	**6.3**	**3.2**	**3.9**	**4.5**	**38.1**	**-39.8**

Precipitation

The MPMC precipitation dataset was extended and infilled using the available data record from the five regional stations as described below to derive a daily and 24-hour long-term synthetic precipitation dataset for the Site. The Likely ECCC Station data were used to extend the precipitation record for the Site given the station's length of record and proximity to the Site.

Precipitation data gap infilling was completed following a priority sequence determined by analyzing measured daily rainfall from April to November for all climate stations; it was assumed that precipitation occurring between December and March occurred as snowfall. The regional climate station priority sequence considered the best-fit measured concurrent daily rainfall correlation (Rainfall Correlation), rainfall ranking correlation (Rainfall Rank), and percentage of time rain was recorded on the same day (Concurrent Daily Rain) between the raw data collected at the MPMC climate stations and each ECCC climate station (Golder 2022a).

A precipitation-elevation orographic factor was applied to adjust the raw precipitation data from the ECCC climate stations used to infill gaps. The adjustment was based on the April-to-November rainfall ranking factor of the raw ECCC climate station and Site rainfall records.

The Site experiences high summer precipitation due to summer storms, with the lowest monthly precipitation occurring in February. Precipitation typically occurs as snowfall starting in November and accumulates until March. Average annual precipitation at the Site is estimated to be 612 mm with a standard deviation of 118 mm. Frequency analyses of the derived long-term precipitation time series for the Site were undertaken to generate the variability in monthly and annual precipitation of the Site. Estimated annual wet and dry precipitation depths for a range of return periods are shown in Table 9.

Table 9: Long-Term Precipitation at the Mount Polley Mine Site

Month[a]	Precipitation (mm)				
	Average	1:200 Year Wet	1:25 Year Wet	1:25 Year Dry	1:200 Year Dry
January	49.4	74.3	66.5	33.2	28.2
February	35.8	54.0	48.3	24.1	20.5
March	29.7	44.7	40.0	20.0	16.9
April	44.7	67.3	60.2	30.1	25.5
May	49.9	75.2	67.2	33.6	28.5
June	70.8	107	95.4	47.7	40.4
July	63.6	95.8	85.7	42.9	36.3
August	50.6	76.2	68.1	34.1	28.8
September	52.3	78.8	70.5	35.2	29.9
October	58.1	87.5	78.2	39.1	33.1
November	49.8	75.0	67.1	33.5	28.4
December	57.6	86.8	77.7	38.8	32.9
Annual Total[b]	**612**	**922**	**825**	**412**	**349**

(a) Wet and Dry Monthly values assumed to follow the same monthly distribution as the Average.

(b) Annual total precipitation depths were rounded to the nearest mm for presentation purposes; therefore, it may appear the sum of the monthly values do not equal the annual total.

Relative Humidity

Relative humidity data are available for the Site from 2019 to 2021 and for ECCC climate stations Quesnel (1953 to 2021) and Williams Lake (1961 to 2021). The MPMC WS1 relative humidity record is more complete than WS2's record; therefore, WS1 data were used for the analysis and infilled with WS2 data where necessary and if available. However, relative humidity data for the Site are insufficient for characterizing long-term climatic conditions of the Site due to the short period of record. Therefore, data from Quesnel and Williams Lake stations were reviewed and analyzed to define a representative relative humidity estimate for the Site. A long-term relative humidity time series for the Site was developed using ECCC Williams Lake A data infilled with ECCC Quesnel A data with an adjustment factor of 1.13 and 1.04 (Golder 2022a).

Statistics for relative humidity are presented in Table 10. Mean annual relative humidity is 68.1%. Monthly mean values vary between 57.7% in April to 82.2% in December. The 25th and 75th percentiles for monthly relative humidity show little variation from the median indicating the Site experiences relatively constant relative humidity on a monthly basis from year to year.

Table 10: Derived Monthly and Annual Relative Humidity Statistics for the Site (1974-2021)

Month	Relative Humidity (%)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	69.2	81.3	90.1	78.9	81.7	84.0
February	65.5	75.0	84.8	72.0	75.6	77.8
March	55.4	64.9	76.2	61.0	64.0	68.3
April	47.9	57.7	69.4	54.9	57.4	60.5
May	45.6	58.1	70.3	54.1	57.8	61.5
June	44.2	60.4	72.4	54.4	60.2	67.7
July	42.2	59.0	72.9	52.6	58.6	65.9
August	48.4	60.2	81.2	55.0	58.8	63.6
September	47.5	66.4	79.1	61.3	66.1	71.3
October	54.3	72.3	86.7	69.7	72.0	76.1
November	61.4	80.1	87.8	77.6	80.4	83.5
December	70.8	82.2	89.3	78.9	82.6	85.0
Annual	**54.4**	**68.1**	**80.0**	**64.2**	**67.9**	**72.1**

Solar Radiation

Solar radiation data are available for the Site from 2001 to 2003 and 2019 to 2021, and for ECCC climate stations Williams Lake (1961 to 2001) and Prince George (1973 to 1995). Solar radiation data for the Site are insufficient for characterizing climatic conditions of the Site due to the short period of record, and as the data recorded in 2001 is incomplete and not concurrent with either ECCC climate station. Solar radiation statistics for the Site were determined from the ECCC Williams Lake data. Missing values were infilled by adjusting the Prince George records by a factor of 1.04 (Golder 2022a).

Statistics for solar radiation for the Site are presented in Table 11. Mean annual solar radiation is 135 W/m^2, with a minimum of 127 W/m^2 and maximum of 148 W/m^2. Mean monthly solar radiation varies between 20 W/m^2 in December to 257 W/m^2 in July following the same seasonal pattern for monthly air temperature. The 25th and 75th percentiles show greatest variation in solar radiation occurs in the summer months when solar radiation is greatest during the year, and less variation in winter months when solar radiation is lowest.

Table 11: Estimated Solar Radiation Statistics for the Site (1974-2001)

Month	Solar Radiation (W/m^2)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	16	27	40	23	27	32
February	37	60	86	54	61	67
March	85	114	152	108	113	123
April	143	180	215	161	179	201
May	196	230	275	214	227	250
June	192	246	302	228	244	267
July	211	257	318	234	258	276
August	158	225	261	211	228	248
September	99	152	188	139	149	168
October	55	79	103	71	79	86
November	23	33	50	28	32	37
December	12	20	27	18	20	23
Annual	**127**	**135**	**148**	**132**	**135**	**140**

Evaporation

Evaporation monitoring data are available for the Site from 2019 to 2021; however, the data are not continuous, and the length of record is not sufficient for characterizing the evaporation conditions at the Site. Therefore, a mathematical model (Morton 1983) was used to calculate evaporation and evapotranspiration (actual and potential) for the Site based on the long-term synthetic records for air temperature, relative humidity, and solar radiation. Evaporation is defined as free water evaporation, or the amount of evaporation from open/free water surfaces (i.e., the water is returned to the atmosphere from lakes, ponds, and watercourses). Potential evapotranspiration (PET) is the water loss that occurs from a vegetated natural surface if there is no deficiency of water in the soil for use by vegetation (Thornthwaite 1948). Actual evapotranspiration (AET) is the water loss that occurs from a vegetated natural surface considering the availability of water in the soil for use by vegetation. Estimated monthly and annual shallow lake evaporation, PET, and AET values are provided in Table 12, Table 13, and Table 14 respectively.

The mean annual shallow lake evaporation rate is estimated to be 673 mm, varying between 606 mm and 762 mm. Mean monthly evaporation rates vary between 0 mm in December to 138 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly evaporation occurs in July when evaporation is greatest, and lowest variation occurs in January and December when evaporation is lowest.

Table 12: Estimated Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Shallow Lake Evaporation (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	4	0	0	1
February	1	7	12	4	7	10
March	24	32	43	29	32	34
April	52	66	79	59	67	72
May	86	105	140	96	102	115
June	95	122	155	110	121	132
July	110	138	173	123	136	153
August	80	115	137	107	113	130
September	37	61	80	54	60	70
October	18	22	28	20	21	23
November	0	4	8	1	4	6
December	0	0	3	0	0	1
Annual	**606**	**673**	**762**	**648**	**663**	**699**

The mean annual PET rate is estimated to be 863 mm, varying between 744 mm and 1022 mm. Mean monthly PET rates vary between 1 mm in December and January to 171 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly PET occurs in July when PET is greatest, and lowest variation occurs in January and December when PET is lowest.

Table 13: Estimated Monthly and Annual PET Statistics for the Site (1974-2001)

Month	Potential Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	10
March	24	41	59	34	42	45
April	68	92	112	83	93	102
May	103	134	178	120	131	149
June	113	150	195	125	155	174
July	124	171	240	151	166	191
August	84	151	199	135	152	174
September	54	89	117	71	89	108
October	17	24	40	20	23	26
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**744**	**863**	**1022**	**815**	**856**	**925**

The mean annual AET rate is estimated to be 399 mm, varying between 319 mm and 449 mm. Mean monthly AET rates vary between 1 mm in December and January to 89 mm in July. The 25th and 75th percentiles indicate that greatest variation in monthly AET occurs in July when AET is greatest, and lowest variation occurs in January and December when AET is lowest. On an annual basis, AET at the Site is less than shallow lake evaporation and PET rates because AET is limited by the availability of water, particularly during the summer months when the air temperature is highest.

Table 14: Estimated Monthly and Annual AET Statistics for the Site (1974-2001)

Month	Actual Evapotranspiration (mm)					
	Minimum	Mean	Maximum	25th Percentile	50th Percentile	75th Percentile
January	0	1	5	0	0	2
February	1	7	11	4	7	9
March	15	18	25	17	18	19
April	16	31	47	26	30	35
May	42	64	84	60	63	68
June	48	80	98	75	80	86
July	61	89	105	83	89	99
August	51	63	78	57	63	69
September	10	23	35	18	22	29
October	11	17	22	16	17	18
November	0	4	9	1	4	6
December	0	1	4	0	0	1
Annual	**319**	**399**	**449**	**370**	**409**	**419**

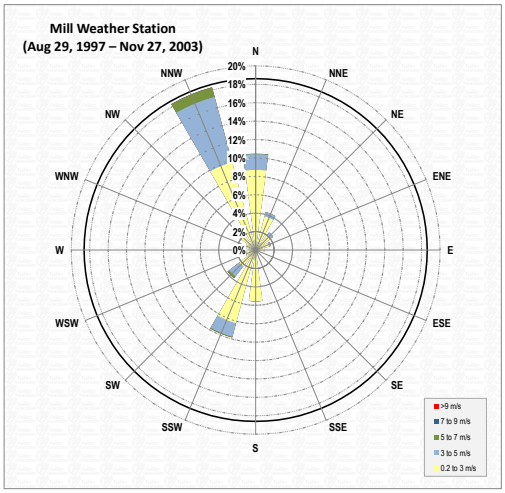
Wind Speed and Direction

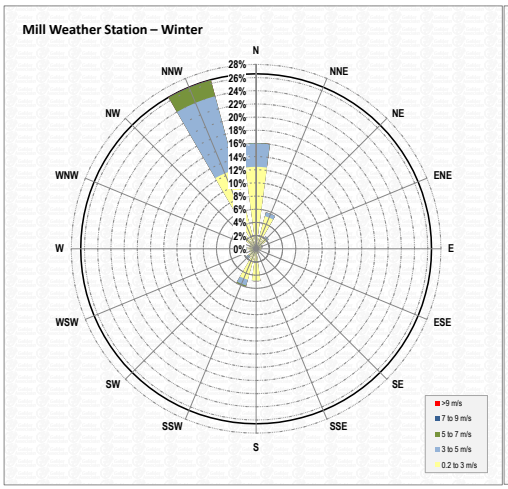
Hourly wind speed and direction data are available for the Site from 1997 to 2003, and daily wind speed data are available from 2019 to 2021; however, the data are not continuous. The hourly wind speed and direction data available from 1997 to 2003 were used to develop wind rose plots. A wind rose depicts the relative frequency of wind from a given direction on a 16-point compass. Each ring on the wind rose represents a frequency of 2% of the data period. The length of the shaded bars on each wind rose petal represents the frequency of wind recorded from a given direction within a defined wind speed range. A wind rose is provided for the period of August 1997 to November 2003, and seasonal wind roses are presented to display seasonal variability in wind patterns, where the seasons have been defined as follows:

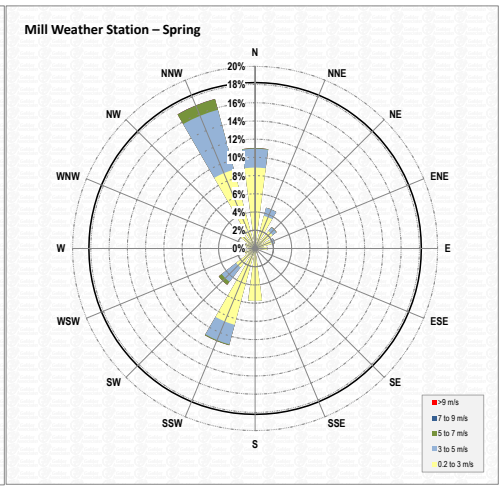
- Winter – December to February
- Spring – March to May
- Summer – June to August
- Autumn – September to November

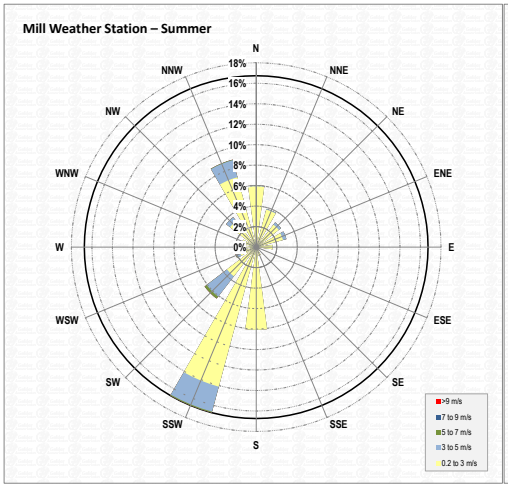
Daily wind data recorded from 2019 to 2021 from WS1 and WS2 were wind speed only, no direction. The period of record for WS2 in 2020 are incomplete and are not included in the analysis. The relative frequency (%) of the magnitude of the daily wind speed data recorded at WS1 for 2019 and 2021 were compared to the relative frequency (%) of wind speed magnitude of the data from 1997 to 2003.

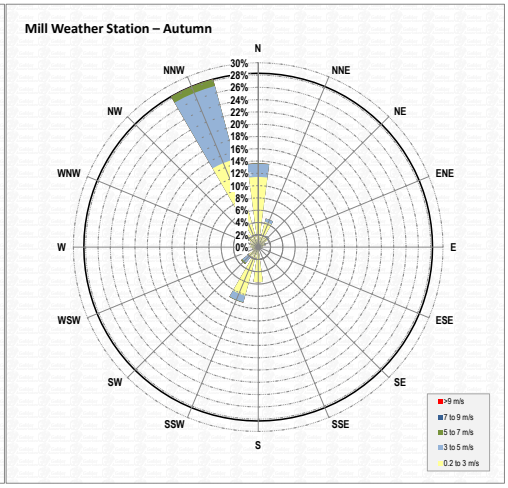
A wind rose plot for the Site depicting the relative frequency of mean hourly wind speed and direction, and the seasonal distribution, between August 29, 1997, and November 27, 2003, is shown in Figure 9.











Spring = March, April, May; Summer = June, July, August; Autumn = September, October, November; Winter = December, January, February.

Figure 9: MPMC Station Monitoring Period and Seasonal Wind Roses – August 29, 1997, to November 27, 2003

Winds measured at the Site typically blew from the north-northwest, north, and south-southwest directions, with minimal winds from the east and the west. The spring, autumn, and winter seasonal wind roses were consistent with the wind rose pattern for the entire monitoring period; however, during the summer months, the majority of winds were from the south-southwest. Similarly, wind speeds in spring, autumn, and winter were generally consistent with the wind rose for the entire monitoring period, while wind speeds in summer were generally lower.

Wind speed measured and seasonal distributions at the Site from 2019 to 2021 were consistent with the relative frequency of wind speed magnitudes and the seasonal distributions recorded between August 29, 1997, and November 27, 2003 (Table 15). It is noted that the data from 2019 and 2021 are daily wind speed rather than hourly wind speed and only the relative frequency (%) of wind speed magnitude was compared.

Table 15: Comparison of Relative Frequency of Wind Speed from Mill Weather Station and Weather Station 1 for the Site

Wind Speed (m/s)	Mill Weather Station August 29, 1997, to November 27, 2003[(a)]	Weather Station 1 January 1, 2019, to December 31, 2021[(b)]
calm	35%	28%
0.2 to 3 m/s	50%	56%
3 to 5 m/s	14%	13%
5 to 7 m/s	2%	3%
7 to 9 m/s	0%	0%
>9 m/s	0%	0%

(a) Recorded as hourly wind speed.

(b) Recorded as daily wind speed.

Snow Cover Properties

Snow cover data at the Site are available monthly from manual measurements from 1997 to 2022, recorded as snow-water-equivalent (SWE). Measurements, although not continuous, are typically recorded at the beginning and end of a month, with the latter being representative of the monthly SWE. Snow cover monthly statistics, reported as SWE, are presented in Table 16. At 50% exceedance, snow begins accumulating in November and achieves its maximum in March, reducing to 0 mm in April. The 5th and 95th percentiles and standard deviation values demonstrate the variability in the amount of SWE at the Site, with March having the greatest variability from year to year.

Table 16: Snow Water Equivalent for the Site (1997-2021)

Month	Number of Measurements	Mean (mm)	Minimum (mm)	Percentile					Maximum (mm)	Standard Deviation (mm)
				5%	25%	50%	75%	95%		
January	22	147	76	88	120	139	164	327	339	56
February	22	182	99	104	131	193	222	338	344	61
March	22	185	0	6	97	198	257	403	411	108
April	21	33	0	0	0	0	81	177	177	58
November	22	17	0	0	0	9	37	72	72	25
December	22	102	32	50	77	101	122	193	196	44

3.2.2 Site Drainage and Surface Hydrology

The Mine is drained by three main watersheds: the Hazeltine Creek (30.2 km^2) at Quesnel Lake, the Edney Creek (87.4 km^2) at Quesnel Lake, and the Morehead Lake (62.7 km^2) watersheds (Figure 10). The Hazeltine Creek watershed includes Polley Lake and conveys all water from Polley Lake, the east side of the Mine, and the area surrounding the TSF. The Morehead Creek watershed includes the Bootjack Lake catchment area (11.2 km^2). The watershed areas listed here exclude the mine, which covers part of the original watersheds.

Both the Hazeltine Creek and the Morehead Creek watersheds were significantly altered by historical (i.e., pre-Mount Polley Mine) water diversions. Bootjack Creek, a small remnant of which now flows into Polley Lake via a constructed diversion channel, historically conveyed water from Bootjack Lake to Hazeltine Creek. In 1913, flow from Bootjack Lake was reversed by miners (not associated with MPMC) damming the east end of Bootjack Lake and digging a new outlet westward to Morehead Creek. Around the same time, a water control structure was also built at the outlet of Polley Lake (Hazeltine Creek), and Hazeltine Creek water was diverted to Bullion Pit to support hydraulic placer mining. Flow from Polley Lake to Hazeltine Creek was restored with the abandonment of mining at Bullion Pit during World War II. However, the flow from Bootjack Lake to Hazeltine Creek was never restored.

Prior to the breach of the TSF, Edney Creek and Hazeltine Creek converged just prior to discharging into Quesnel Lake. The mouths of the two creeks were separated following the breach and interim remediation works. As of late summer, 2020, Edney Creek and Hazeltine Creek have been reconnected, with in-stream habitat features installed, as part of the conclusion of habitat construction works in the lower Hazeltine Creek and Edney Creek area.



LEGEND

- MPMC HYDROMETRIC STATION
- ENVIRONMENT CANADA HYDROMETRIC STATIONS
- WATER CATCHMENT AREA
- CONTOUR (10m)
- ROAD
- WATERCOURSE
- WATERBODY

0 1.6 3.2

1:80,000 KILOMETRES

REFERENCES

1. CONTOURS, ROAD, WATERCOURSE AND WATERBODY DATA OBTAINED FROM CANVEC © DEPARTMENT OF NATURAL RESOURCES CANADA. ALL RIGHTS RESERVED.
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD.
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
MAJOR DRAINAGES AND FLOW MONITORING STATIONS

CONSULTANT

YYYY-MM-DD	2023-12-04
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31100/31191	0	**10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

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PATH: Y:\burnaby\CAD-GIS\Client\Imperial_Metals_Corp\Mount Polley_Mine\99_PROJECTS\23590671\31100\31191\02_PRODUCTION\MXD\Report\23590671_31100_31191_10_MAJOR_DRAINAGE_FLOW_MONITORING.mxd

3.2.3 Pit Groundwater Hydrogeology

In 2016, Golder assessed groundwater flow for the following three open pits at the mine: Springer and Cariboo pits, Wight Pit, and Boundary Pit. The analysis for each pit was described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016g). Hydrogeological assessments for the pits were conducted as part of the TAR to provide estimates of seepage into and out of the pits. Similarly, estimates of seepage into and out of the TSF was also assessed using a three-dimensional model (Golder 2016j).

A provision to update this Water Management Plan and provide an updated seepage assessment is included as part of the revision trigger and frequency table under the implementation plan and schedule in Section 5.0. A review of the existing hydrogeological pit model calibration is ongoing to determine whether existing model parameters remain valid. Based on the results of the pit model review and should any notable difference to parameter concentrations be identified, the hydrogeological parameters will be updated. Updated seepage parameters are not expected to alter the macro water balance results for the site or alter the water treatment quantity design basis; however, this will be confirmed once updated parameters are available. Should recalibration be required, an update to the hydrogeological parameters and associated seepage estimates will be completed in 2024.

The summary below is based on the previous (2016) hydrogeological assessments.

Springer and Cariboo Pits

During closure, the Springer Pit and the Cariboo Pit will be allowed to flood. Once the pit lake level is above approximately 1,028 m elevation, the pit lakes in these two pits will merge and form a single pit lake. The spillway elevation for this pit lake will be approximately 1,050 m elevation. PAG materials will be placed in the combined Cariboo-Springer Pit at closure and stored sub-aqueously to mitigate acid generation and metal leaching, in accordance with standard mine waste handling practices (MEND 2015).

A hydrogeological assessment was conducted to predict the quantity of long-term groundwater seepage from both the Springer and Cariboo pits towards Bootjack Lake for the Phase 4 Cariboo-Springer Pit mine plan (Golder 2016g). The analysis considered placement of waste rock in the pit prior to the pit lake formation. As the pit lake level increases to between 1,020 and 1,030 m elevation, seepage in the range of 10 to 100 m^3/d from the Springer Pit Lake into the subsurface was predicted to occur (Table 17). Seepage was found to gradually increase to approximately 400 m^3/d when the pit lake reaches the spillway elevation of 1,050 m. In the Cariboo Pit, seepage towards the Bootjack Lake of approximately 20 m^3/d was predicted to occur only when the pit lake level approaches 1,050 m elevation. At this elevation, the pit lake was predicted to act as a “flow-through” lake with groundwater recharge occurring from the uplands located northeast from both pits and recharge to groundwater occurring towards the southwest.

Table 17: Predicted Groundwater Flows for the Springer and Cariboo Pits

Pit Lake Elevation (masl)	Springer Pit		Cariboo Pit	
	Groundwater Flow (m^3/d)		Groundwater Flow (m^3/d)	
Base Case	**Into the Lake**	**Out of the Lake**	**Into the Lake**	**Out of the Lake**
880 (dewatered pit)	520	0	600[(a)]	0[(a)]
940	510	0	610	0
960	490	0	610	0
980	460	0	590	0
1,000	420	0	540	0
1,020	320	10	460	0
1,030	300	100	420	0
1,040	280	250	380	0
1,050	270	400	320	20
Upper Bound				
1,050	440	880	500	90
Lower Bound				
1,050	190	220	250	0

(a) These values represent conditions when the Cariboo Pit is fully dewatered (i.e., the base of the Cariboo Pit is at approximately 938 m elevation).

Source: Golder 2016g.

masl = metres above sea level.

Wight Pit

Hydrogeological modelling was carried out for the Wight Pit (Golder 2016g). The results from the hydrogeological model indicate that under steady-state conditions (Table 18), groundwater inflow to the Wight Pit is projected to gradually decrease from 2,600 m^3/d at an elevation of 880 m to 600 m^3/d at an elevation of 926 m (Golder 2016g).

Table 18: Predicted Groundwater Flows for the Wight Pit

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Lake	**Out of the Lake**
Base Case		
880	2,600	0
900	2,500	0
910	2,100	0
920	800	0
926	600	500
Lower Bound		
926	400	300
Upper Bound		
926	700	800

Source: Golder 2016g.

masl = metres above sea level.

Boundary Pit

At present, hydrogeological data specific to the Boundary Pit are not available. However, MPMC indicated that during mining seepage was not observed along the pit walls. This is considered reasonable due to the relatively shallow depth of this pit and depth to water table measured at monitoring wells that were installed near other mine facilities. It is thus considered likely that the water table was located near or below the floor of the Boundary Pit before mining at this location commenced.

Although seepage to the Boundary Pit from the surrounding rock mass is not expected, seepage out of this pit could occur due to water entering the pit via surface water runoff and direct precipitation. An estimate of these potential seepage rates out of the pit was made to provide input to the pit water balance and to characterize a potential seepage pathway originating from this pit (Golder 2016g).

Seepage rates out of the Boundary Pit have been estimated from a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded. The estimated seepage rate from the Boundary Pit when the pit lake level is 5 m above its base (1,073 m) is approximately 59 m^3/d, with a potential range between 35 and 177 m^3/d due to uncertainty in bedrock permeability (Table 19). Seepage outflow is estimated to decrease as the height of water column above the pit bottom decreases as shown in Table 19.

Table 19: Estimated Seepage Outflows from the Boundary Pit

Water Level (masl)	Estimated Groundwater Outflow (m^3/d)		
	Lower Bound	Base Case	Upper Bound
1,068	2	3	10
1,069	6	10	29
1,070	12	20	61
1,071	16	26	79
1,072	32	53	159
1,073	35	59	177

Source: Golder 2016g.

masl = metres above sea level.

3.2.4 Seepage from the Tailings Storage Facility

WSP is currently designing a new upstream drainage system to accommodate the increase in the TSF water elevation (WSP 2023b). The new upstream drain system will capture water within the tailings above 970 m and convey it to the seepage collection system, downstream of the TSF embankment. WSP has estimated the water flows through the upstream drains based on the distance between the pond and the embankment (beach width). Estimation of flows have been made for each embankment:

- S1: South Embankment
- S2: Main Embankment
- S4: Corner 1 Embankment
- S5: Perimeter Embankment

Seepage flows from the TSF (S1 to S5) during operations were estimated using a two-dimensional numerical groundwater flow model to quantify anticipated seepage rates through the embankment and foundation. Seepage analyses were conducted for typical sections of the elevation of 987 m configuration of the South Embankment, Main Embankment, Perimeter Embankment, and Corner 1 Embankment under steady-state conditions. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. Table 20 presents the estimated seepage flow rates through each embankment with dependency on the beach width.

Table 20: Seepage Flow Rates

Beach (m)	Seepage Flow Rate (L/s)			
	S1	S2	S4	S5
0	79	96	81	89
50	39	50	53	46
100	25	32	38	31
200	14	18	23	18
300	9	12	15	13

Note(s): Includes flows through upstream drains and embankment. All flows estimated for the 987 m raise.

The TSF contains both water and tailings. The term TSF water volume is used to describe the total amount of water within the TSF. The term TSF pond is also used, which describes the area of the TSF, mainly near the water surface elevation, where tailings are generally not placed and a water pond forms at the surface, typically with some water depth. The term TSF supernatant pond is also used and refers to the same pond. During operations, a pump barge is placed at the TSF pond to allow suction TSF water for process purposes and placing the pump intake at the pond allows drawing water without drawing tailings. The location of the TSF pond depends on how tailings are placed within the TSF and the pond can be shifted around the TSF through tailings placement. Nearing closure, the TSF pond will be shifted to a specific location within the TSF.

The progressive location of the TSF pond will depend on operational decisions during the deposition of tailings; thus, the change in beach widths have been assumed consistent for each embankment. Based on estimates of the TSF water volume and satellite imagery of the pond location since restart of operation in 2016, an estimation of embankment beach width has been made for different TSF water volume amounts. The estimates are provided in Table 21, which outline a conservative scenario, in terms of seepage flow quantities.

Table 21: Tailings Beach Width

TSF Water Volume (m^3)	Beach Width (m)			
	S1	S2	S4	S5
0	300	300	300	300
1,500,000	300	300	300	300
2,500,000	200	200	200	200
3,000,000	100	100	100	100
5,500,000	0	0	0	0

The model uses both Table 20 and Table 21 presented above to calculate the beach width and consequently the seepage flow rates through the embankments during operations. For every time step the model calculates the TSF water volume and consequently the beach width, and finally the seepage flow rate.

Starting from four months into closure (August 1, 2031), the TSF water volume reduces to 0.25 M-m^3 within two months due to the construction of the closure TSF spillway. This is estimated to increase the seepage flow rate on the perimeter embankment close to corner 1, as the TSF pond will be pushed to that corner. For modelling purposes, it is considered that the seepage flow rate in Table 22 will be in effect 6 months after the end of the operation phase and throughout the closure and post-closure phases.

Table 22: Tailings Beach Width at Last Year of Operation and Closure

Flow Rate (L/s)			
S1	S2	S4	S5
70	0	0	0

Note: Values start 6 months after end of operation. Maximum capacity of TSF water volume is limited to 250,000 m^3.

3.3 Characterization of Existing Water Quality

The characterization of existing surface water quality in Quesnel Lake has been updated as part of this WMP and is described below. The characterization of other receiving environments (Bootjack Lake, Hazeltine Creek, and Polley Lake) have not been updated in this WMP but have been previously characterized in Golder 2016g and Golder 2020e. Only the Quesnel Lake characterization has been updated as part of this WMP, as it is the sole discharge location permitted in the existing EMA permit, expected to continue through operations. This single discharge location may continue through closure or may share discharge with other distributed locations. Data from March 2015 to September 2023 collected in the West Basin, east of the sill near Cariboo Island, were summarized. These data represent the background water quality of Quesnel Lake, generally flowing into the West Basin.

The following summary statistics were calculated for Quesnel Lake to represent existing conditions:

- Number of samples.
- Number and percentage of samples with values below the method detection limit (MDL).
- Minimum, median, arithmetic mean, 95th percentile, and maximum concentrations.

Minimum, maximum, and median values were calculated using absolute values; that is, when the summary statistic corresponded to a non-detect value in the dataset, the MDL was reported. For values reported as less than the MDL, the MDL was substituted for calculation of the mean and 95th percentile. A mean was not calculated for parameters with greater than 50% non-detect values. A median was only reported where a mean was not calculated. A 95th percentile was not calculated for parameters with less than 10 measurements or with greater than 95% non-detect values.

Existing conditions were defined as arithmetic mean concentrations or median where a mean was not calculated. Data were compared to applicable BC drinking water guidelines and BC 30-day WQGs (BC ENV 2019b) protective of aquatic life; the maximum WQG was substituted where a 30-day WQG did not exist, as indicated in summary tables provided in Sections 3.3.1 through 3.3.4 in BC ENV 2019b. WQGs calculated based on toxicity modifying factors (e.g., hardness, pH, chloride, dissolved organic carbon) were calculated based on corresponding toxicity modifying factor values (i.e., minimum and maximum statistics) described in the summary statistics for each waterbody.

BC WQGs protective of the most sensitive receiving environment use (generally aquatic life) were used for screening water quality.

The average residence time of Quesnel Lake is approximately 10 years but is estimated to be 90 days within the West Basin (Laval et al. 2008). Quesnel Lake is oligotrophic, with low primary productivity and total dissolved solids (TDS). The West Basin has vertical mixing typical of temperate lakes, with thermal stratification for most of the year, interrupted by brief turnover periods in the spring and the fall when vertical density gradients are lowest. The physical limnology of the West Basin is described more fully in Laval et al. 2008 and Tetra Tech EBA Inc. (Tetra Tech 2015).

Levels of total suspended solids (TSS), turbidity, and total metals previously elevated in the West Basin as a result of the TSF foundation failure remained below WQGs from 2015 to 2023 east of Cariboo Island (Golder 2016a,c). All mean constituent concentrations were below applicable BC WQGs in Quesnel Lake baseline water quality measured east of Cariboo Island from 2015 to 2023 (Table 23). Figures comparing existing turbidity, TSS, total phosphorus and dissolved copper concentrations to corresponding water quality guidelines are presented in Figures 11 to 14, respectively.

Table 23: Summary of Water Quality Statistics for Quesnel Lake: Existing Conditions, East of Cariboo Island (2015 to 2023, from QUL-40A and QUL-120 Sampling Stations)

Parameter	Units	BC Drinking Water Quality Guidelines[a]		BC Water Quality Guidelines[b]		Quesnel Lake							
		Maximum	Notes	30-day Average	Notes	Number of Samples	Number of Samples <MDL	Percent of Samples <MDL	Minimum[s]	Median[s]	Mean[t]	95th[u], [v]	Maximum[s]
Physical Parameters													
pH (field)	pH units	-	-	6.5 – 9.0	A	123	0	0	6.4	7.7	7.4	8.4	8.9
Temperature (field)	°C	-	-	-	-	123	0	0	2.5	4.1	6.4	18	21
Conductivity (field)	µs/cm	-	-	-	-	123	0	0	21	112	115	143	202
Turbidity	NTU	+1 NTU from background	A	+2 NTU from background	A, (c)	124	0	0	0	0.29	0.7	1.8	48
Dissolved organic carbon	mg/L	-	-	-	-	156	0	0	1.2	1.8	2.1	2.5	13
Hardness (Dissolved)	mg/L	-	-	-	-	165	0	0	44	53	53	56	58
Total Dissolved Solids	mg/L	-	-	-	-	165	0	0	57	70	71	84	92
Total Suspended Solids	mg/L	-	-	+5 mg/L from background	A, (c)	226	186	82	<1	1.1	2.0	<3	12
Major Ions													
Alkalinity, Total (as CaCO3)	mg/L	-	-	-	-	226	0	0	39	50	49	52	54
Chloride	mg/L	250	A	150	A	226	201	89	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoride	mg/L	1.5	A	1.00 – 1.11	A, Max, (d)	226	0	0	0.025	0.034	0.034	0.038	0.045
Sulphate	mg/L	-	-	218	A, (e)	226	0	0	4.5	6.3	6.3	6.8	6.9
Nutrients													
Ammonia	mg/L (as N)	-	-	0.175	A, (f)	226	190	84	<0.005	<0.005	0.0052	0.0052	0.013
Nitrate	mg/L (as N)	10	A	3	A	226	0	0	0.014	0.14	0.13	0.15	0.15
Nitrite	mg/L (as N)	1	A	0.02	A, (g)	226	201	89	<0.001	<0.001	<0.001	<0.001	<0.001
Total Phosphorus	mg/L	0.01	A, lakes	0.005 – 0.015 in Lakes	A	218	92	42	<0.002	<0.002	0.0039	0.0063	0.098
Total Metals													
Aluminum	mg/L	-	-	5	A, WW, Max	226	0	0	0.0063	0.013	0.017	0.036	0.22
Antimony	mg/L	0.006	A	0.009	W	226	189	84	<0.0001	<0.0001	NC	<0.0001	0.00013
Arsenic	mg/L	0.01	A	0.005	A, Max	226	43	19	<0.0001	0.00011	0.00012	0.00015	0.00022
Barium	mg/L	-	-	1	W	226	0	0	0.0043	0.0052	0.0053	0.006	0.0081
Beryllium	mg/L	-	-	0.00013	W	226	201	89	<0.0001	<0.0001	NC	<0.0001	<0.0001
Boron	mg/L	5	A	1.2	A	226	200	88	<0.01	<0.01	NC	<0.01	<0.01
Cadmium	mg/L	0.005	A	-	-	226	192	85	<0.000005	<0.000005	NC	NC	0.00001
Calcium	mg/L	-	-	See note	W, (h)	226	0	0	13	18	18	19	20
Chromium	mg/L	0.05	A	0.001	W, (i)	226	201	89	<0.0005	<0.0005	<0.0005	<0.0005	0.0005
Cobalt	mg/L	0.001	A	0.004	A	226	200	88	<0.0001	<0.0001	NC	<0.0001	0.00017
Copper	mg/L	2	A	-	-	226	14	6	<0.0005	0.00067	0.0008	0.0013	0.0073
Iron	mg/L	-	-	1	A, Max	226	179	79	<0.03	<0.03	0.032	0.039	0.17
Lead	mg/L	0.005	A	0.0044 – 0.0049	A, (j)	225	117	52	<0.00005	<0.00005	0.00012	0.0004	0.0031
Lithium	mg/L	-	-	-	-	226	140	62	<0.0005	<0.001	0.001	0.0011	0.0016
Magnesium	mg/L	-	-	-	-	226	0	0	1.8	2.0	2.0	2.2	2.3
Manganese	mg/L	0.12	A	0.84 – 0.86	A, (k)	226	0	0	0.00012	0.001	0.0012	0.0023	0.0089
Mercury	mg/L	0.001	A	0.00001	A, (l)	25	20	80	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.088	A	7.6	A	226	0	0	0.00026	0.00034	0.00034	0.00041	0.00051

Table 23: Summary of Water Quality Statistics for Quesnel Lake: Existing Conditions, East of Cariboo Island (2015 to 2023, from QUL-40A and QUL-120 Sampling Stations)

Parameter	Units	BC Drinking Water Quality Guidelines[a]		BC Water Quality Guidelines[b]		Quesnel Lake							
		Maximum	Notes	30-day Average	Notes	Number of Samples	Number of Samples <MDL	Percent of Samples <MDL	Minimum[s]	Median[s]	Mean[t]	95th[u], [v]	Maximum[s]
Total Metals (cont'd)													
Nickel	mg/L	0.08	A	0.025	W, (m)	226	196	87	<0.0005	<0.0005	NC	<0.0005	0.00068
Selenium	mg/L	0.01	A	0.002	A	226	10	4	0.000057	0.000098	0.00012	0.00016	<0.0005
Silicon	mg/L	-	-	-	-	226	0	0	0.82	1.8	1.8	2.0	2.1
Silver	mg/L	-	-	0.00005	A, (n)	226	200	88	<0.00001	<0.00001	NC	<0.00001	0.000012
Sodium	mg/L	-	-	-	-	226	0	0	0.78	0.96	0.96	1.0	1.5
Strontium	mg/L	7	A	-	-	226	0	0	0.094	0.14	0.14	0.15	0.15
Thallium	mg/L	-	-	0.0008	W	226	201	89	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	226	199	88	<0.0001	<0.0001	NC	<0.0001	0.00023
Titanium	mg/L	-	-	-	-	226	200	88	<0.01	<0.01	NC	<0.01	0.011
Uranium	mg/L	0.02	A	0.0085	W	226	0	0	0.00012	0.00016	0.00016	0.00018	0.00018
Vanadium	mg/L	-	-	-	-	226	199	88	<0.0005	<0.0005	NC	NC	<0.001
Zinc	mg/L	3	A	-	-	226	198	88	<0.003	<0.003	NC	<0.003	0.0057
Dissolved Metals													
Aluminum	mg/L	-	-	0.05	A, (o)	226	0	0	0.004	0.0059	0.0066	0.011	0.02
Antimony	mg/L	0.006	A	-	-	226	201	89	<0.0001	<0.0001	NC	<0.0001	<0.0001
Arsenic	mg/L	0.01	A	-	-	226	139	62	<0.0001	<0.0001	0.0001	0.00013	0.00018
Barium	mg/L	-	-	-	-	226	0	0	0.0046	0.0051	0.0052	0.0056	0.0065
Beryllium	mg/L	-	-	-	-	226	201	89	<0.0001	<0.0001	NC	<0.001	<0.001
Boron	mg/L	5	A	-	-	226	201	89	<0.01	<0.01	NC	<0.01	<0.01
Cadmium	mg/L	0.005	A	0.00011 – 0.00014	A, (p)	226	198	88	<0.000005	<0.000005	NC	NC	<0.00001
Calcium	mg/L	-	-	-	-	226	0	0	15	18	18	19	20
Chromium	mg/L	0.05	A	-	-	226	201	89	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	mg/L	0.001	A	-	-	226	201	89	<0.0001	<0.0001	NC	<0.0001	<0.0001
Copper	mg/L	2	A	0.00020 – 0.0021	A, (q)	226	45	20	<0.0005	0.0006	0.00064	0.00094	0.002
Iron	mg/L	-	-	0.35	A, Max	226	201	89	<0.03	<0.03	NC	<0.03	<0.03
Lead	mg/L	0.005	A	-	-	221	105	48	<0.00005	<0.00005	0.0001	0.0003	0.00071
Lithium	mg/L	-	-	-	-	226	172	76	0.00069	<0.001	0.0010	<0.001	0.0013
Magnesium	mg/L	-	-	-	-	226	0	0	1.8	2.0	2.0	2.1	2.3
Manganese	mg/L	0.12	A	-	-	226	14	6	0.000086	0.00021	0.00031	0.001	0.0028
Mercury	mg/L	0.001	A	-	-	10	10	100	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005
Molybdenum	mg/L	0.088	A	-	-	226	0	0	0.00026	0.00033	0.00033	0.00038	0.00045
Nickel	mg/L	0.08	A	-	-	226	198	88	<0.0005	<0.0005	<0.0005	<0.0005	0.0012
Potassium	mg/L	-	-	-	-	226	0	0	0.43	0.49	0.49	0.53	0.62
Selenium	mg/L	0.01	A	-	-	226	10	4	0.00005	0.00009	0.00011	0.00016	<0.0005
Silicon	mg/L	-	-	-	-	226	0	0	0.76	1.7	1.7	1.9	2.0
Silver	mg/L	-	-	-	-	226	201	89	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium	mg/L	-	-	-	-	226	0	0	0.82	0.95	0.95	1.0	1.2

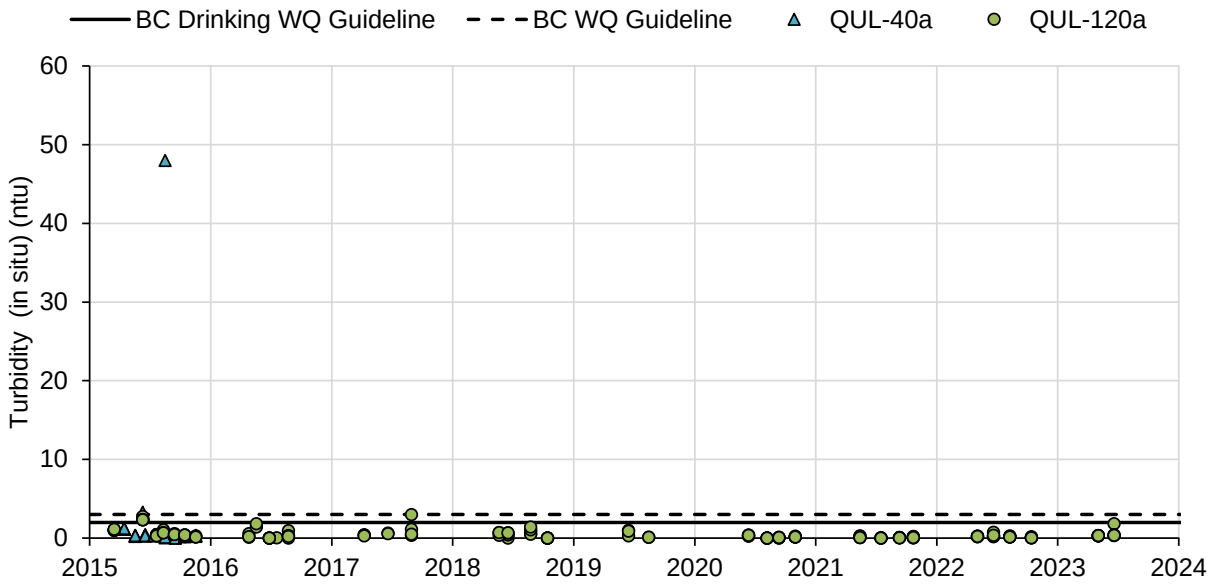
Table 23: Summary of Water Quality Statistics for Quesnel Lake: Existing Conditions, East of Cariboo Island (2015 to 2023, from QUL-40A and QUL-120 Sampling Stations)

Parameter	Units	BC Drinking Water Quality Guidelines[a]		BC Water Quality Guidelines[b]		Quesnel Lake							
		Maximum	Notes	30-day Average	Notes	Number of Samples	Number of Samples <MDL	Percent of Samples <MDL	Minimum[s]	Median[s]	Mean[t]	95th[u], [v]	Maximum[s]
Dissolved Metals (cont'd)													
Strontium	mg/L	7	A	-	-	226	0	0	0.1	0.14	0.13	0.15	0.15
Thallium	mg/L	-	-	-	-	226	201	89	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001
Tin	mg/L	-	-	-	-	226	200	88	<0.0001	<0.0001	NC	<0.0001	0.00013
Titanium	mg/L	-	-	-	-	226	201	89	<0.01	<0.01	NC	<0.01	<0.01
Uranium	mg/L	0.02	A	-	-	226	0	0	0.00012	0.00016	0.00015	0.00017	0.00018
Vanadium	mg/L	-	-	-	-	226	201	89	<0.0005	<0.0005	NC	<0.0005	<0.001
Zinc	mg/L	3	A	0.008	A, (r)	225	195	87	<0.003	<0.003	0.0031	<0.003	0.0081

(a) BC WQ guideline for the protection of drinking water, available at https://www2.gov.bc.ca/gov/content/environment/air-land-water/water/water-quality/water-quality-guidelines/approved-water-quality-guidelines, accessed October 31, 2023.
(b) BC Water Quality Guidelines (BC WQG). Fresh Water Aquatic Life 30-day Guidelines used, except where noted (e.g., molybdenum, total aluminum). Maximum (Max) guidelines substituted where 30-d guidelines do not exist.
(c) For guideline comparison, Quesnel Lake background turbidity is assumed equal to 1 NTU and background TSS is equal to the MDL of 3.0 mg/L.
(d) Hardness dependent fluoride guideline: BC Max WQG (mg/L) = (-51.73+(92.57log10(hardness))*0.01), 0.4 at hardness 10 mg/L.
(e) Hardness dependent sulphate guideline: BC 30-d WQG (mg/L) = 128 at hardness <30 mg/L, 218 at hardness 31-75 mg/L, 309 at hardness 76-180 mg/L, 429 at hardness 181-250 mg/L, determined based on site water at hardness >250 mg/L.
(f) pH and temperature dependent ammonia guideline: values selected from Table 4 in BC WQG based on maximum temperature and pH.
(g) Chloride (Cl) dependent nitrite guideline: BC 30-d WQG (mg/L) = 0.02 at Cl <2 mg/L, 0.04 at Cl 2-4 mg/L, 0.06 at Cl 4-6 mg/L, 0.08 at Cl 6-8 mg/L, 0.10 at Cl 8-10 mg/L, 0.20 at Cl >10 mg/L.
(h) up to 4 – highly sensitive to acid inputs; 4 to 8 – moderately sensitive; over 8 – low sensitivity. Refer to alkalinity, the more restrictive of calcium or alkalinity applies.
(i) Max guideline is for hexavalent chromium.
(j) Hardness dependent lead guideline: BC 30-d WQG (mg/L) = (3.31 + exp(1.273*ln(hardness) - 4.704)) / 1000 at hardness >8 mg/L.
(k) Hardness dependent manganese guideline: BC 30-d WQG (mg/L) = 0.0044*hardness+0.605.
(l) Mercury BC 30-d WQG (mg/L) = 0.0001/(MeHg/THg), where MeHg is mass (or concentration) of methyl mercury and THg is total mass (or concentration) of mercury in a given water volume; assumed = 0.00001 at 1% MeHg.
(m) Hardness dependent nickel guideline: BC 30-d WQG (mg/L) = 0.025 at hardness <60 mg/L, (exp(0.76*ln(hardness)+1.06))/1000 at hardness <180 mg/L, 0.15 at hardness >180 mg/L.
(n) Hardness dependent silver guideline: BC 30-d WQG (mg/L) = 0.00005 at hardness ≤100 mg/L, 0.0015 at hardness >100 mg/L.
(o) pH dependent dissolved aluminum guideline: BC 30-d WQG (mg/L) = 0.05 at pH ≥6.5, exp(1.6-3.327*(median pH)+0.402*(median pH2)) at pH <6.5.
(p) Hardness dependent dissolved cadmium guideline: BC 30-d WQG (mg/L) = (exp(0.736*ln(hardness)-4.943))/1000.
(q) pH, dissolved organic carbon, and hardness dependent copper guideline was calculated using the BC copper biotic ligand model. BC 30-d WQG range calculated using minimum and maximum pH (6.4 – 8.9), dissolved organic carbon (1.3 to 13 mg/L), and hardness (44 – 58 mg/L) values.
(r) Hardness dependent zinc guideline: BC 30-d WQG (mg/L) = (7.5+0.75(hardness-90))/1000.
(s) Minimum, maximum, and median were calculated using absolute values; that is, when the summary statistic corresponded to a non-detect (ND) value in the dataset, the MDL was reported.
(t) Mean was not calculated for parameters with greater than 50% non-detect values. A median was reported where a mean was not calculated.
(u) 95th percentile was not calculated for parameters with less than 10 samples.
(v) 95th percentile was not calculated for parameters with greater than 95% non-detect values.

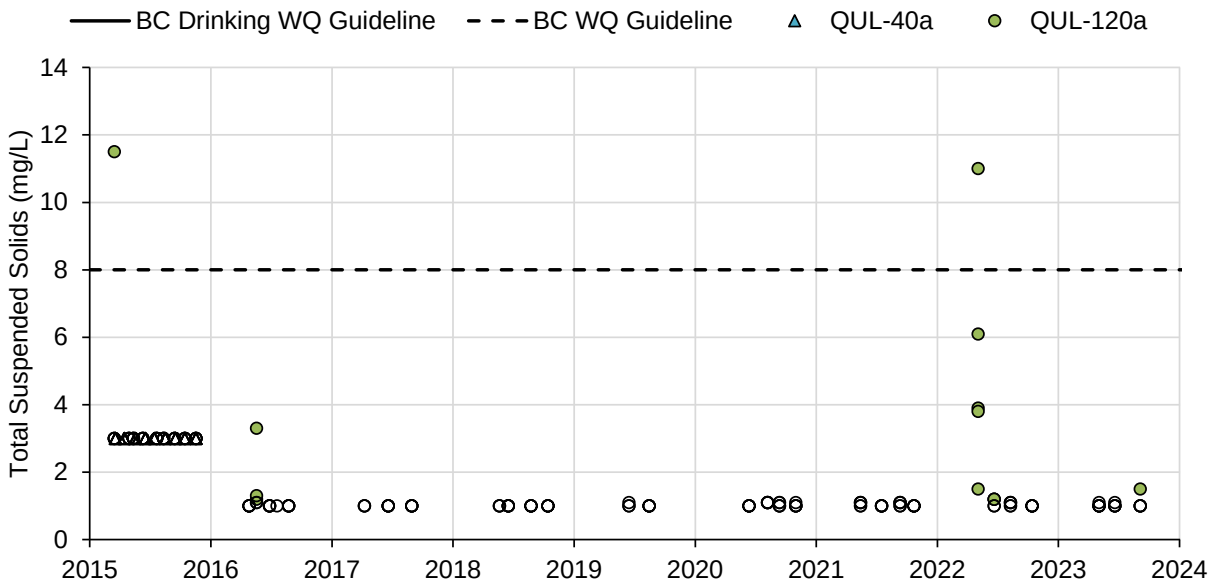
Underlined value = exceeds maximum BC Drinking Water Quality Guidelines.
Shaded value = exceeds 30-day average BC Water Quality Guidelines.

A = approved guideline; W = working guideline; Max = maximum guideline used; Min = Minimum concentration requirement based on life stage; WW = wildlife water supply guidelines; NC = not calculated; "<" = reported value is less than method detection limit (MDL).



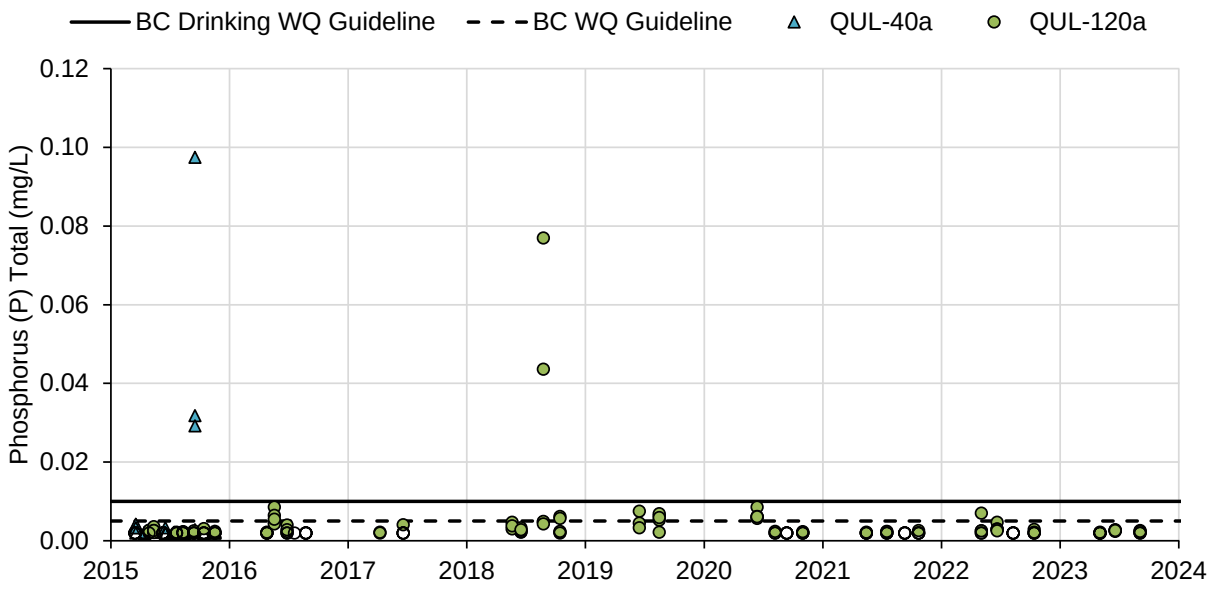
Note: Unfilled data points represent samples below detection limits.

Figure 11: Monitored Turbidity at QUL-40a and QUL-120a in Quesnel Lake, 2015 to 2023



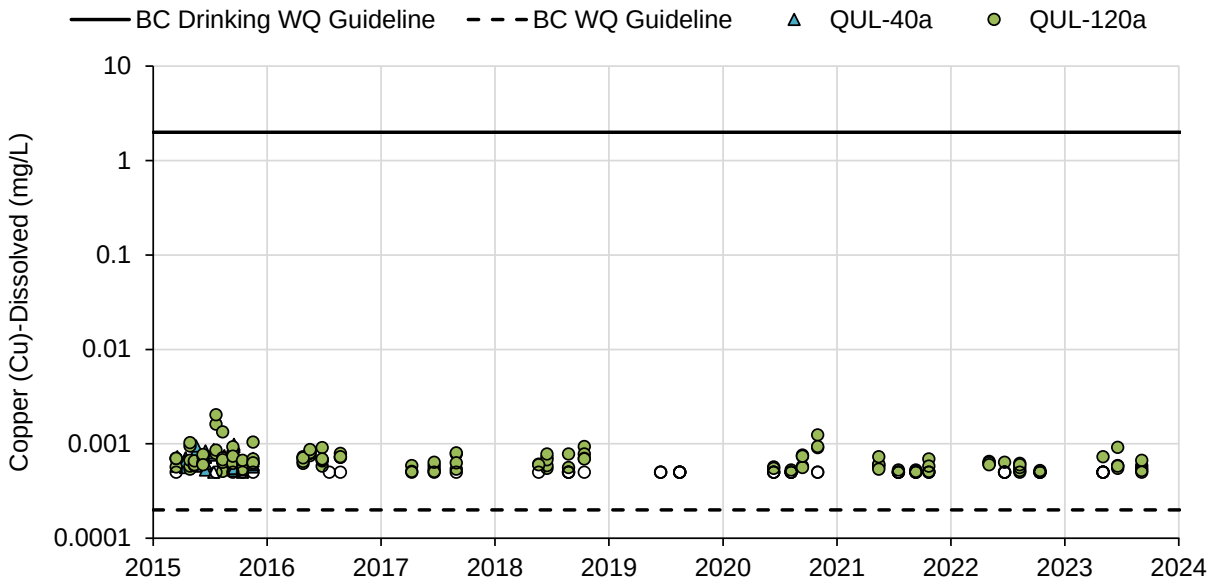
Note: Unfilled data points represent samples below detection limits.

Figure 12: Monitored Total Suspended Solids at QUL-40a and QUL-120a in Quesnel Lake, 2015 to 2023



Note: Unfilled data points represent samples below detection limits.

Figure 13: Monitored Total Phosphorus at QUL-40a and QUL-120a in Quesnel Lake, 2015 to 2023



Note: Unfilled data points represent samples below detection limits. The y-axis is presented using a logarithmic scale (base = 10).

Figure 14: Monitored Dissolved Copper at QUL-40a and QUL-120a in Quesnel Lake, 2015 to 2023

4.0 WATER MANAGEMENT AND TREATMENT

4.1 Water Management Summary

A network of channels, ponds, and pumping systems is operated by MPMC for managing surface water at the mine. Contact (mine-affected) and non-contact water (non-mine-affected) systems are managed with the objective of avoiding the mixing of these waters.

The non-contact water system includes channels to divert runoff from undisturbed catchments away from mine infrastructure. Contact water from within the mine site is actively managed using on-site water management infrastructure and conveyed to the TSF or to the PETBP for re-use as part of mine operations or for treatment through the Water Treatment Plant (WTP) and subsequent discharge through a pipeline to Quesnel Lake.

The mine has a positive water balance, with discharge required during mine operations to prevent year-on-year accumulation of water. The only currently permitted discharge of treated contact water from site occurs through the existing WTP and the Quesnel Lake pipe and diffusers. Water management during operations will continue per the current water management infrastructure. The existing WTP (Actiflo patented high-rate ballasted coagulation and flocculation process) is considered the Best Achievable Technology (BAT, BC ENV 2015) for treatment and discharge through assumed future operations (Golder 2015g).

The treatment flow rate of the existing WTP varies between approximately 0.21 m^3/s and 0.31 m^3/s, pending operator control of the plant. The allowable maximum annual discharge volume from site is currently 10.59 M-m^3/year (average of 0.33 m^3/s), as per EMA Permit 11678. The design capacity of the WTP effluent pipeline and diffusers is 0.6 m^3/s (equivalent to the permitted maximum daily instantaneous rate).

The mine's water management plan assumes minimal storage of contact water on site, although during freshet (April through June) and extreme storm events, the volume of mine water runoff will exceed the discharge and treatment capacity, and temporary retention will be necessary to store water prior to discharge. Temporary water accumulation will occur in the TSF or in available pit volume(s). Temporary stored water will be discharged to the environment through the WTP following the freshet period or the storm event.

As the mine moves into closure and post-closure, the objectives of water management are to return the impacted land to pre-mining land functions. As the mine is constructed across a watershed divide, it is desired that during the post-closure period, drainages will be distributed back to their natural watersheds (i.e., to Bootjack Lake, Polley Lake, and Hazeltine Creek), provided that this can be achieved in an environmentally appropriate and permittable manner. MPMC has been proceeding with a program of evaluating and developing passive, semi-passive, and active water treatment technologies for their possible use during mine closure to support the goal of distributing discharge back into the pre-mining configuration. Two treatment options are considered the BAT for treatment during closure and post-closure: Option A – distributed passive/semi-passive treatment systems (applied to select sources), and Option B – pit-lake treatment followed by the centralized Actiflo plant (Golder 2016h). Option B is the current assumption for water treatment during closure/post-closure, but MPMC has also been progressing technology evaluations to support Option A.

This water management plan provides an update on expected water quantity and quality required for treatment during both operations and closure/post-closure (treatment design basis) and provides an update on treatment technology development considered for closure/post-closure (Section 4.7).

4.1.1 Short-term Water Management Strategy

Current water management practices have the objective to minimize mixing of contact and non-contact surface water sources where practicable. The flows from these sources are driven by direct precipitation, runoff, and snowmelt from the associated catchments. The majority of the contact water at the Site is collected along two ditches that run north to south along the western and eastern edges of the Mine: West Ditch and Long Ditch respectively. During large runoff events, the water management infrastructure is subject to increased runoff volumes that require careful planning to mitigate potential risk for discharging contact water to the receiving environment.

To address BC ENV recommendations, WSP is developing a short-term water management strategy, scheduled for completion in 2024, through staged analysis and reporting of surface water infrastructure and flow assessment for runoff and pumps and pipeline conveyance. The aim of the short-term water management strategy is reducing uncertainty during operational scenarios, providing tools for identifying/characterizing real-time events, and providing a decision-making framework for Site personnel during large runoff events.

4.2 Description of Source Inventory

Flow and water quality parameter inputs to the site water management tools, specifically the SWWBM and the SWWQM, are derived from a combination of measured data sources and assumed values based on established modelling practices and site knowledge. The primary objective of these water management tools is to predict the chemistry of water; in particular, the concentrations of constituents that have been identified in PE-11678 and how the loading behaves as water flows through disturbed and undisturbed landforms and constructed conveyance structures (e.g., ditches, pipelines, channels). The amount of loading (constituent concentrations) in contact water is generally influenced by the geochemistry of the source material (i.e., waste rock, ore) and the quantity of water. Non-contact water is not influenced by mine operations.

For the purposes of advancing the development of these water management tools, contact water flows can be classified as follows:

- **Waste rock contact water**—sourced primarily from waste dumps and ore stockpiles distributed throughout the mine.
- **Pit wall runoff**—sourced from the containment walls of excavated voids (i.e., pit shells).
- **Tailings Storage Facility**—sourced from the seepage collection system of the TSF.
- **Other**—site-wide sources for disturbed and undisturbed runoff and groundwater inflows.

As part of this WMP and water management framework, a source inventory (Table 24) has been compiled that identifies areas of the mine that generate mine-contact water. The inventory is intended to be a living database and may need to be updated as the mine layout changes over time or as the mine transition into closure becomes more defined. The source inventory is composed of the following data:

- Modelled or measured water quality data (i.e., station names, station UTM co-ordinates, number of samples, date range of samples).
- Modelled or measured flow (i.e., availability of flow records and a qualitative measure of how well the source is modelled in the SWWBM).

The water quality data from the source inventory is further defined and expanded upon in Section 4.4, where the water quality data are used to calibrate the SWWQM and provide context to the key findings from the model simulation results.

Table 24: Source Inventory

	Description	Water Quality			Data Source Coordinates	Water Quantity			
		Data Source[a]	Number of WQ Samples[b]	Period of Record (inclusive)	UTM Zone 10 (X/Y)[c]	Measured Flow Data	Period of Record (inclusive)	Number of Flow Records	Modelled Flows Available (Y = YES, N = NO; P = PARTIAL)[d]
Waste Rock Contact Water	Boundary Pit Waste Rock Seepage and Runoff	Boundary Dump SEEPS[e]	70	2013–2022	591906/5825223	No Data	-	-	P
	Wight Pit Waste Rock Seepage and Runoff	JCP[f]	66	2014–2023	593634/5823889	Spot Flow Data	2013–2020	73	P
	NAG Waste Rock Seepage and Runoff (including ore stockpiles)	SERDS SEEPS[g]	523	2013–2022	594170/5822279	Spot Flow Data (SERDS Ditch)	2014–2019	28	P
	Temporary NW PAG Stockpile Seepage and Runoff	PAG Dump SEEPS	140	2013–2023	590736/5823923	No Data	-	-	P
	Ore Stockpile Runoff	SERDS SEEPS	523	2013–2022	594456/5821005	Spot Flow Data (SERDS Ditch)	2014–2019	28	P
Pit Wall Runoff	Boundary Pit Wall Runoff	BP[h]	16	2016–2023	591784/5825446	No Data	-	-	Y
	Wight Pit Wall Runoff	E10[h]	71	2016–2023	592872/5825309	No Data	-	-	Y
	Cariboo Pit Wall Runoff	E8[h]	40	2016–2023	592128/5823173	No Data	-	-	Y
	Springer Pit Wall Runoff	E11[h]	53	2016–2022	591703/5823328	No Data	-	-	Y
Tailings Storage Facility	TSF Pumped Draindown	E5[i]	144	2014–2023	NA	No Data	-	-	P
	TSF Process Water	E1/E1a[j]	157	2011–2023	594480/5819669	No Data	-	-	Y
	TSF Seepage – Saturated	E1/E1a[j]	157	2011–2023	594480/5819669	No Data	-	-	P
	TSF Seepage – Unsaturated	E1/E1a[j]	157	2011–2023	594480/5819669	No Data	-	-	P
	TSF Beach Runoff	E1/E1a[j]	157	2011–2023	594480/5819669	No Data	-	-	Y
Other	Disturbed Runoff	W5[k]	256	2014–2023	593125/5822868	No Data	-	-	Y
	Undisturbed Runoff	W8[l]	224	2006–2023	597020/5817600	No Data	-	-	Y
	Groundwater Inflow	GW12/GW15[m]	53	2013–2023	594170/5822279	No Data	-	-	P

(a) Boundary Dump SEEPS, SERDS SEEPS, and PAG Dump SEEPS contain multiple sampling points in the vicinity of the prescribed area.
(b) Samples collected before the period of record are excluded.
(c) UTM Zone 10 X and Y coordinates are approximate and represent the general location of the sampling point. Certain areas have multiple sampling points in the vicinity of the prescribed area.
(d) “Partial” designation indicates that the SWWBM only captures selected elements of the source category. Flows are not calibrated due to a lack of adequate flow records at preferred calibration points.
(e) Seepage stations beside the waste rock piles near Boundary Pit.
(f) Located east of the start of the Long Ditch in a clearing.
(g) Seepage stations located between the Northeast Zone Dump, the SERDS and the SERDS Ditch.
(h) Water quality inputs assigned to pit wall runoff were based on SRK source terms for wall rock lithologies and proportions instead of source terms calculated from pit water monitoring data.
(i) Located in the main embankment seepage collection pond.
(j) Water quality assigned from model predictions of the TSF instead of source terms calculated from pit water monitoring data.
(k) Located in Bootjack Creek above Hazeltine Creek.
(l) Located in the Northeast Edney Creek Tributary.
(m) GW12 sample stations located in the Springer Pit Well and NW of the Temporary PAG Dump. GW15 sample stations located the South and North Springer Pit Wells.

Source: Holmes 2020, pers. comms.; Ivens 2020, pers. comms.

WQ = Water Quality; SEEPS = Seepage; JCP = Joe’s Creek Pipe; NAG = Non-potentially Acid Generating; NW = Northwest; SERDS = Southeast Rock Disposal Site; PAG = Potentially Acid Generating; TSF = Tailings Storage Facility; NA = Not Available; MTD = Main Toe Drain; GW = Groundwater; SWWBM = site-wide water balance model.

4.3 Water Balance

This section describes the SWWBM, including discussion of calibration to observed data, implementation of updates to reflect the Springer Expansion LOM Plan, and simulation results. The SWWBM represents a key water management tool that is used to confirm whether existing and proposed site Water Management Plans are adequate for supporting the joint permit application associated with the proposed Springer Expansion LOM plan.

4.3.1 Water Balance Model

An update to the existing SWWBM was carried out using GoldSim™ (Version 14.0). The SWWBM was originally developed for the TAR to support the effects predictions in the LTWMP for the mine and has since been calibrated on an annual basis (refer to WSP 2023e for 2022 annual calibration). WSP incorporated the Springer Expansion LOM Plan (MPMC 2023b) for the implementation of future operations scenario in the SWWBM.

The updated SWWBM simulates the site water circuitry (the logic driving water transfers, discharges, and flows on site) under the assumed future operations scenario. The model is built to project inflows and outflows to major storage locations and conveyance structures on-site. The SWWBM water quantity projections are then fed into the WQM to generate predictions on water quality parameter concentrations at selected locations of interest.

4.3.1.1 Model Software

GoldSim allows dynamic and complex water quantity interactions to be represented through a visual and highly modular framework. All input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. GoldSim is widely used for mine water quantity studies and provides the following capabilities:

- Deterministic and probabilistic simulations can be run within the model, which allows statistics and probabilities to be assigned to the model outputs.
- Simulation periods can be varied within the same model.
- The model framework can be easily adjusted to account for evolving conditions on a mine site, which allows the model to be used as an operational planning tool.
- Water quantity and water quality modules can be directly linked within the model, which allows both modules to be updated simultaneously; this is particularly useful when evaluating a range of scenarios (e.g., alternative water management strategies).

4.3.1.2 Model Objectives

This SWWBM has the following objectives:

- Include a future operational phase that will extend from May 2, 2023, to March 31,2031.
- Include a closure phase extending from April 1, 2031, to March 31,2041.
- Include a post-closure phase commencing on April 1, 2041, and extending to March 31, 2131 (100 years including closure).
- Estimate the quantity of contact water collected on-site per the climate conditions.
- Estimate water retention requirements in major storage locations at site such as the TSF and pits.

- Estimate the quantity of contact water requiring treatment.
- Provide support for the assessment of future operations water quality and associated water treatment and/or discharge options.
- Provide a model that can be linked to a water quality module that assesses site water quality during forecasted future operations.

4.3.1.3 General Assumptions and Key Input Parameters

General assumptions applied to this model update are as follows:

- Continuation of mining of the Springer Pit and Cariboo Pit will not significantly increase the footprint of the pits.
- There is no seepage from the ponds or sumps other than the TSF (i.e., all ponds and sumps are assumed to be lined, or seepage is assumed to be negligible).
- Direct precipitation, evaporation, and seepage loss from ditches are assumed to be negligible.
- Precipitation occurs as snow from December to February and as rain or a mixture of rain and snow in all other months.
- Snowpack is represented by the cumulative precipitation depths over the months of December, January, and February, spanning a period of three months.
- Snowmelt occurs in the months of March, April, and May as a percentage of the maximum snowpack at the end of February (5% in March, 90% in April, and 5% in May).
- The closure and post-closure phases are included in the SWWBM, and the flow logic and model wiring for these phases are based on 2022 Reclamation and Closure Plan (RCP) (MPMC 2022a).

Key input parameter values and assumptions for the operational phase simulations are presented in Table 25.

Table 25: Key Input Parameter Values and Assumptions

Parameter	Value	Reference
TSF emergency spillway invert elevation at 987 m dam crest elevation during operations	985.8 m	WSP 2023g
Initial TSF water volume	2.84 M-m^3	TSF Weekly Report (MPMC 2023a)
Initial Springer Pit water level	970.66 m	TSF Weekly Report (MPMC 2023a)
Initial Cariboo Pit water level	954.72 m	TSF Weekly Report (MPMC 2023a)
Initial Wight Pit water level	912.87 m	TSF Weekly Report (MPMC 2023a)
Tailings stored in Springer Pit	2.00 M-m^3	TSF Weekly Report (MPMC 2023a)
Water Treatment Plant (WTP) treatment capacity	25,000 m^3/d (0.29 m^3/s)	Provided by MPMC (MPMC 2023c)

4.3.1.4 Model Scope and Flow Diagram

The scope and structure of the SWWBM is outlined in the conceptual flow diagram for forecasted future operations in Figure 15. The flow diagram illustrates the water circuitry at the Mine, including operational storage, conveyance, and discharge of water. The water management infrastructure modelled within the SWWBM is summarized in Table 26. The flow types that are programmed into the SWWBM are outlined in Table 27.

From closure and progressively to post-closure, certain Site areas will be reclaimed, and run-off will become non-contact water. Pumping rates for the Site will be reduced at the end of the closure period, as certain areas are assumed reclaimed. Closure and post-closure flow diagrams are shown in Figure 16 and Figure 17, respectively.

Table 26: Water Management Infrastructure

Major Ditches	Sumps and Minor Ponds	Major Ponds and Storage Facilities
▪ Long Ditch ▪ SERDS Ditch (lower portion of West Ditch)	▪ South Seepage Pond ▪ Main Embankment Seepage Pond ▪ Central Collection Pond ▪ Bootjack Creek Sump ▪ Mill Site Sump ▪ Mine Drainage Creek Sump ▪ NW Sump ▪ 9K Sump ▪ Boundary Pit	▪ TSF ▪ Cariboo Pit ▪ Springer Pit ▪ Wight Pit ▪ Perimeter Embankment Till Borrow Pond

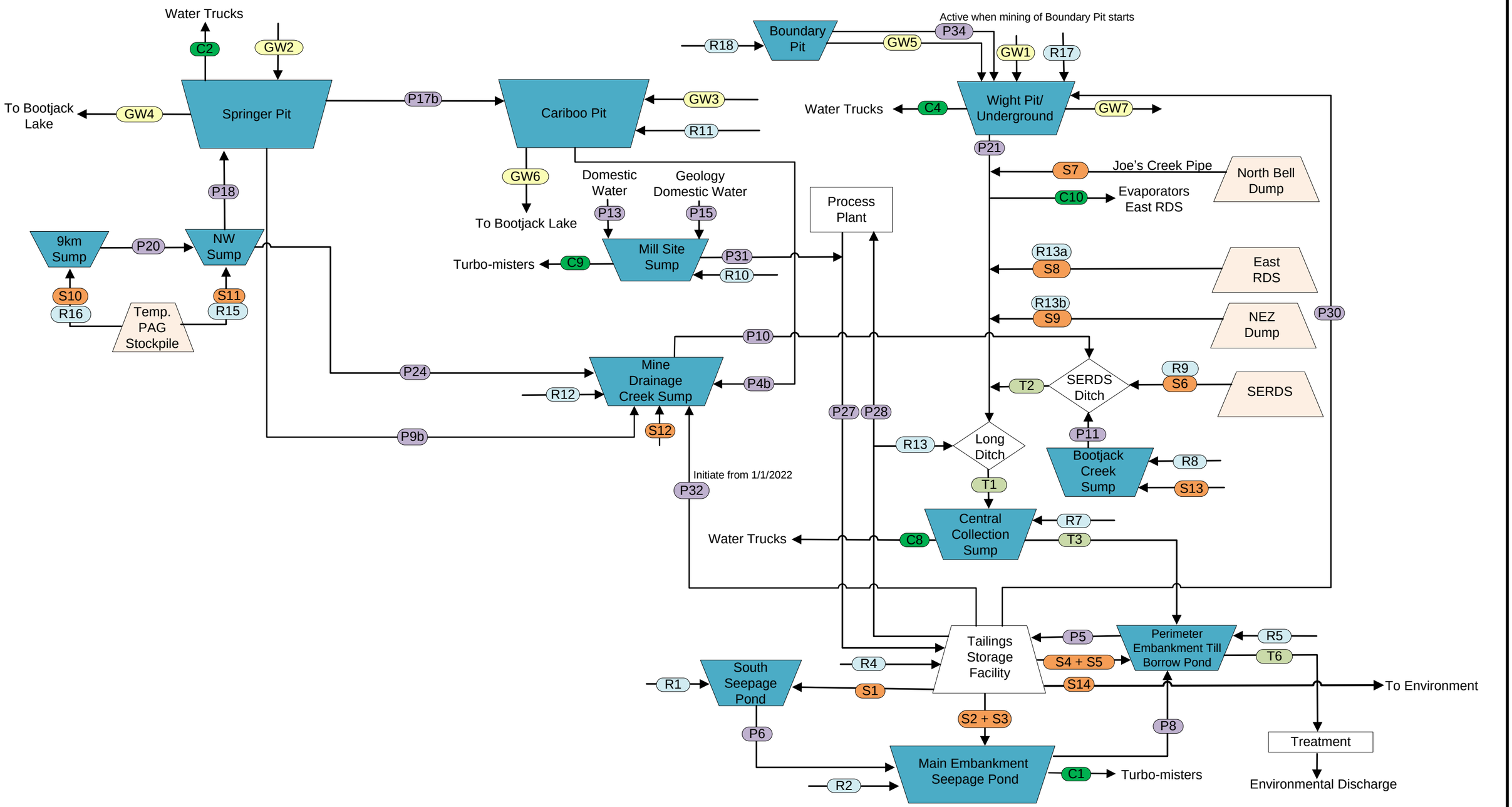
Source: WSP 2023e.

SERDS=Southeast Rock Disposal Site; T.SF = Tailings Storage Facility.

Table 27: Types of Flows Represented in the SWWBM

Site Inflows	Site Outflows or Transfers
▪ Direct precipitation ▪ Runoff ▪ Seepage (includes baseflows)	▪ Water consumption flows (turbo-misters, and water trucks) ▪ Water treatment discharge ▪ permanent, unrecoverable storage in tailings (interstitial water) ▪ Open water evaporation ▪ Pumped flows between facilities ▪ Transfer flows (gravity flows between facilities) ▪ Groundwater flows

Source: WSP 2023e.



Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

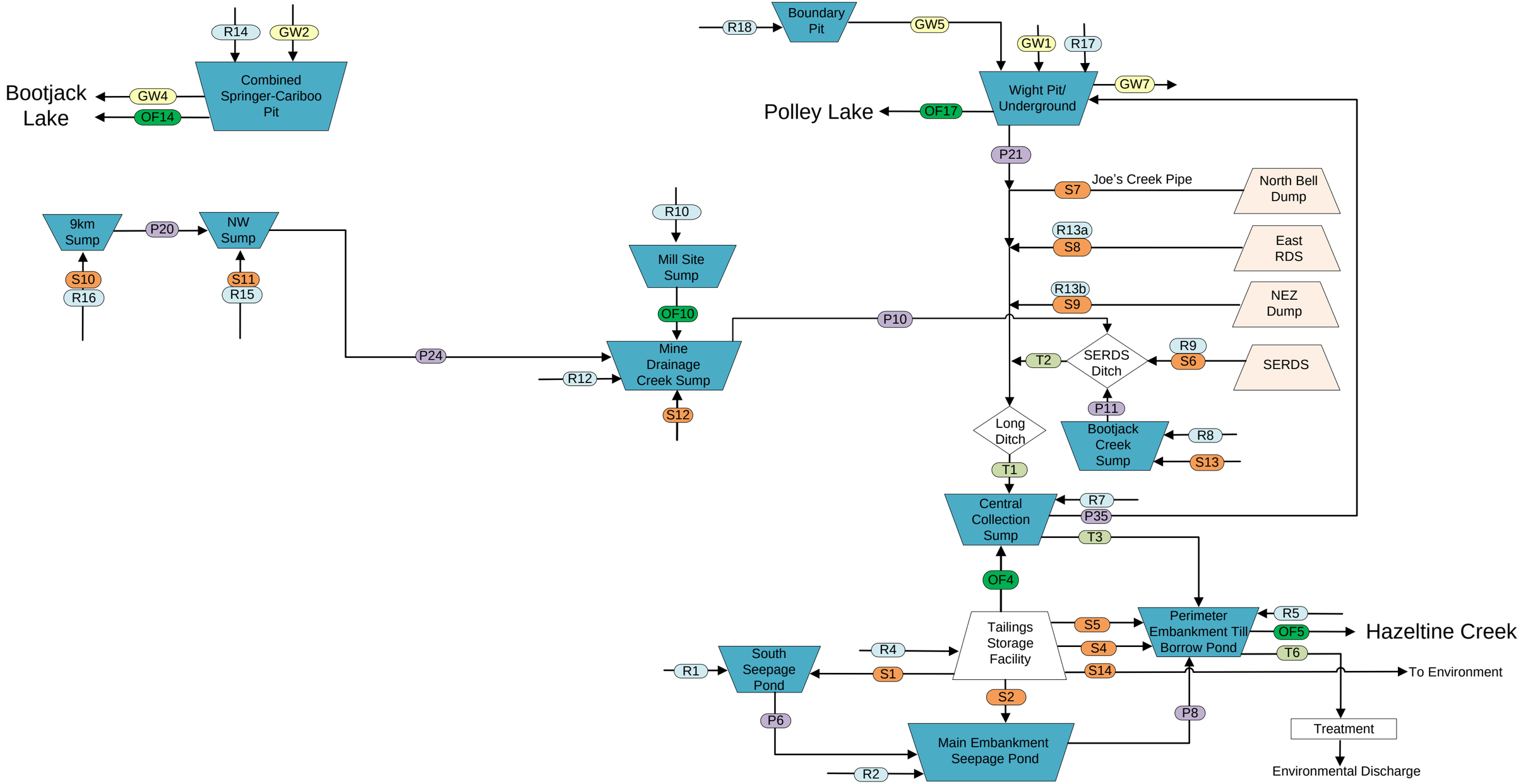
Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	4 December 2023
CHECKED	GD
DATE	4 December 2023
SCALE	Not to Scale
PROJECT No	23590671/31191
FIGURE No	15
REV No	0

TITLE

Springer Expansion LOM Site Wide Water Balance
Operational Phase Flow Diagram
2 May 2023 – 31 March 2031



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

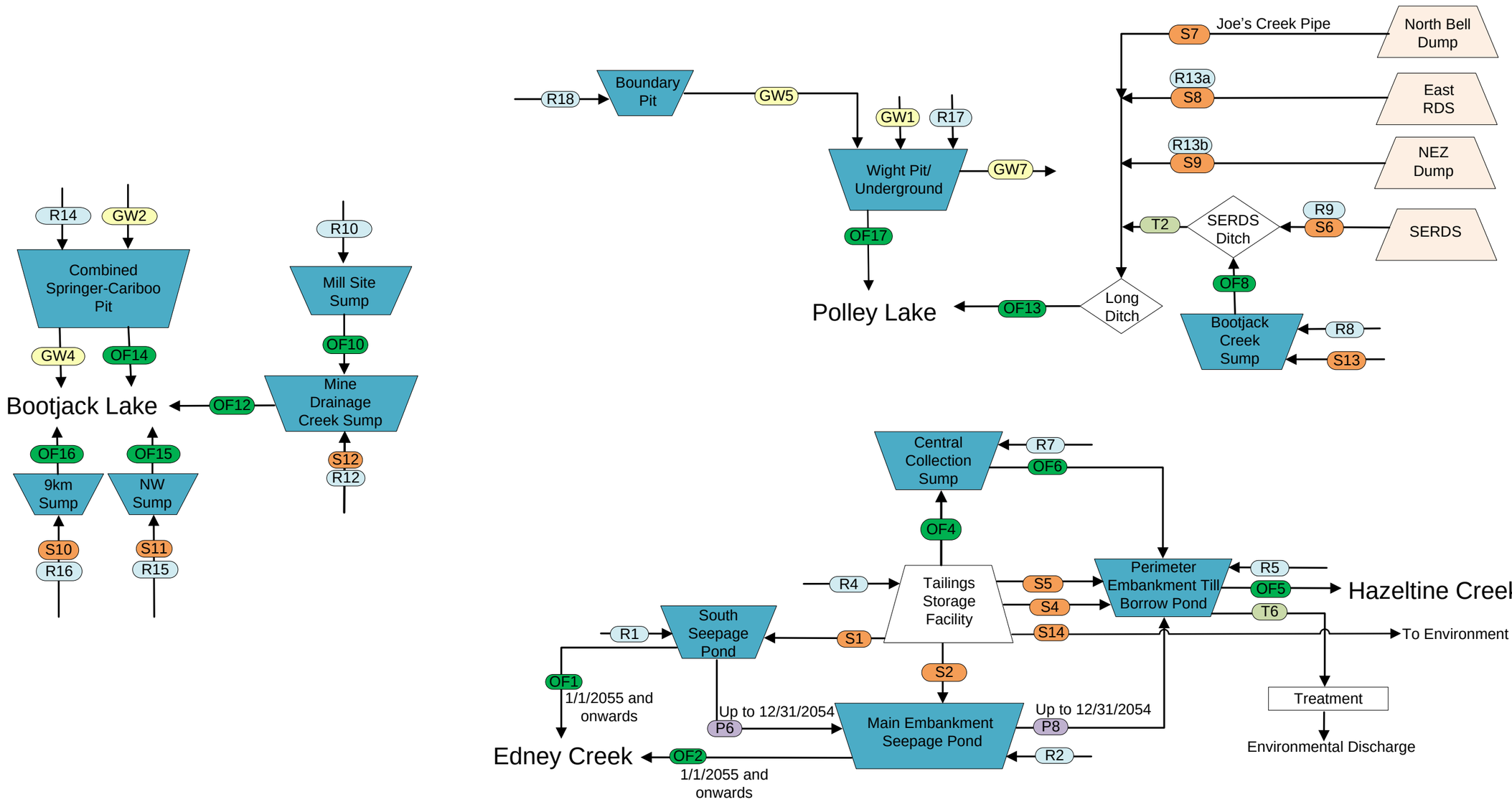
DRAWN: SC
DATE: 4 December 2023

CHECKED: GD
DATE: 4 December 2023

SCALE: Not to Scale
PROJECT No: 23590671/31191
FIGURE No: 16
REV No: 0

TITLE

Springer Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 April 2031 – 31 March 2041



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 4 December 2023

CHECKED: GD
DATE: 4 December 2023

SCALE: Not to Scale
PROJECT No: 23590671/31191

TITLE

Springer Expansion LOM Site Wide Water Balance
Post-closure Phase Flow Diagram
1 April 2041 Onwards

FIGURE No: 17
REV No: 0

4.3.1.5 Climate Inputs

The following sections describe the climate inputs used in the SWWBM. The climate datasets are derived from local and site-based climate stations as described in Section 3.2.1.

Deterministic Climate Inputs

The model features a deterministic simulation mode, which allows the user to select from three predefined climate scenarios based on long-term ECCC and local data (as described in Section 3.2.1):

- average annual precipitation data (Table 9)
- 1:10-year wet annual precipitation (Table 6)
- 1:200-year wet annual precipitation (Table 6)

For each selected scenario, the associated annual precipitation is repeated for each year of the simulation period. Annual median lake evaporation is used for the deterministic mode, and snowpack is accumulated within the model based on the assumption that snow accumulates from December to February, with a 5%, 90%, and 5% melting in March, April, and May, respectively.

Stochastic Climate Inputs

GoldSim has stochastic elements, allowing uncertainty to be represented in model input data. GoldSim uses the Monte Carlo method to sample stochastic elements for probabilistic simulations. A stochastic generator is included in the model to probabilistically simulate natural climatic variation at the mine. The stochastic generator operates on an annual basis and generates random sequences of annual precipitation over the simulation period (one such random sequence is called a “realization”). This method of climate input is used to model a wide range of precipitation inputs and acts as a sensitivity analysis that can be easily viewed as results in the form of percentile values.

To simulate stochastic conditions, monthly precipitation data were fitted to a normal distribution. A normal distribution is a type of probability distribution (a mathematical representation of the relative likelihood of an uncertain variable having specific values). All distribution types use a set of arguments to specify the relative likelihood for each possible value. The arguments for normal distribution are the dataset’s mean and standard deviation. The mean and standard deviation for the monthly precipitation values were determined. The standard deviations were adjusted using a standard z-table, so that the annual mean of the stochastically generated results agreed with the mean of the historical data. The monthly input arguments (mean and standard deviation) are shown in Table 28.

The derived monthly means and standard deviations of the precipitation values, defined in the model as stochastic elements, were used to generate random values based on the normal distribution of the dataset. The stochastic generator was set to perform 2000 realizations to create a sample size that was sufficiently large to account for a range of conceivable climatic scenarios for the study period.

Table 28: Stochastic Climate Generator Log-normal Distribution Input Arguments

Month	Mean of the Monthly Precipitation Depths (mm)	Standard Deviation of the Monthly Precipitation Depths (mm)
January	49.4	30.9
February	35.8	24.2
March	29.7	13.9
April	44.7	43.6
May	49.9	20.2
June	70.8	32.9
July	63.6	55.1
August	50.6	31.2
September	52.3	30.1
October	58.1	27.9
November	49.8	28.9
December	57.6	32.7

Table 29: Stochastic Generated Precipitation

Month	Monthly Average Precipitation (mm) [1]			
	Mean	50%	90%	99.50%
January	49.2	41.8	87.2	181.7
February	35.9	29.8	65.3	146.6
March	29.7	26.9	47.7	84.6
April	44.9	32.1	91.7	264.7
May	50.0	46.3	76.2	126.6
June	70.8	64.2	113.2	202.1
July	63.5	48.1	124.9	331.0
August	50.6	43.1	89.4	186.3
September	52.3	45.4	89.9	180.4
October	58.1	52.3	93.8	168.7
November	49.8	43.0	86.1	173.6
December	57.6	50.2	98.7	195.0
Annual Total	**612.3**	**523.2**	**1064.1**	**2241.3**

(1) Average during the modeling period (2024 to 2131).

Climate Change

An ensemble of monthly temperature and precipitation projections were obtained from ClimateBC consisting of 8 Global Climate Models (UBC 2022) and two emissions scenarios (SSP2-4.5 and SSP5-8.5) covering mid to high emissions from the Sixth Intergovernmental Panel on Climate Change Assessment Report (IPCC 2021). A stochastic approach (outside the GoldSim model) was used to extend these projections from year 2100 to 2200 by resampling monthly data from 2071-2100 and relating projected changes in temperature and precipitation

climate variables to a set of extended greenhouse gas concentration pathways beyond year 2100 (van Vuuren et al. 2011). The range of projected temperature and precipitation values for each month was summarized across the ensemble of climate models and emissions scenarios using a range of values. The mean, and the upper bound, have been included in the SWWBM to analyze the effects of climate change. Lake evaporation, snow accumulation and snowmelt were calculated in the same way as for the average scenario.

4.3.1.6 Hydrology Inputs

The following sections describe the processes and inputs that define the SWWBM's hydrology.

Runoff Parameters

Runoff in the SWWBM is estimated using seasonal runoff coefficients. Runoff coefficients represent the proportion of rainfall that reports as runoff or seepage, accounting for losses due to evaporation, storage, and infiltration. Adjustment during the calibration process resulted in a 30% increase of the general runoff coefficients in cases where the monthly precipitation exceeds 50 mm. The runoff coefficients account for the following two seasonal climate periods:

- **General (July to February)**—mid-range coefficients to reflect soil moisture contents for intermittent runoff events.
- **Freshet (March to June)**—highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.

The seasonal runoff coefficients defined for the catchment types considered in the SWWBM are presented in Table 29.

Table 30: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Catchment Areas

To model runoff, direct precipitation, and evaporation, the catchment areas for each storage element were defined in the model. The catchment/reporting area for each storage element remains consistent with the TAR (Golder 2016g). However, there's one exception: the TSF impoundment catchment at the projected 987 m crest. Any alterations would mainly affect the infrastructure downstream of the TSF, but these changes are expected to have minimal impact on the model results. The catchments are shown in Table 30 and illustrated in Figure 18.

Table 31: Current Catchment Areas for SWWBM Storage/Conveyance Elements

Storage or Conveyance Element	Total Reporting Area (m^2)
South Seepage Pond	385
Main Embankment Seepage Pond	376,900
TSF Upstream Catchment (External)	622,800
TSF Impoundment Catchment (Internal – current)	2,269,700
TSF Impoundment Catchment (Internal – projected at 987m raise)[(a)]	2,860,000
Perimeter Embankment Till Borrow Pond (PETBP)	524,300
Central Collection Sump (CCS)	438,600
Bootjack Creek Sump	175,200
SERDS Ditch[(b)]	1,537,600
Mill Site Sump	1,630
Mine Drainage Creek Sump	1,115,900
Long Ditch	2,494,000
Cariboo Pit	1,320,400
Springer Pit	651,900
NW Sump	330,200
9K Sump	698,700
Wight Pit	413,900
Boundary Pit	23,400
Total Reporting Area	**12,997,315**

(a) The raise of the TSF will affect the catchments producing runoff into the TSF. To consider the increase of the TSF impoundment catchment, the model interpolates the TSF impoundment catchments between the current state and the TSF raise to 987m. Changes in other catchments are minor.

(b) The current SERDS Tailings Co-disposal project does not affect the delineation of the catchment.

Source: Golder 2016g. Update on TSF impoundment based on TSF projections.

TSF = Tailings Storage Facility; PETBP = Perimeter Embankment Till Borrow Pond; CCS = Central Collection Sump; SERDS = Southeast Rock Disposal Site.



LEGEND

- WATER CATCHMENT AREA
- WATER COLLECTION DITCH
- CONTOUR (10m)

0 600 1,200

1:30,000 METRES

REFERENCES

1. CONTOURS AND PROJECT IMAGERY OBTAINED FROM MOUNT POLLEY MINING CORPORATION (2019)
2. WATER CATCHMENT AREAS INTERPOLATED BY GOLDER ASSOCIATES LTD. (2016)
3. BASE IMAGERY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY
4. DATUM: NAD 1983 UTM ZONE 10N

CLIENT
MOUNT POLLEY MINING CORPORATION

PROJECT
WATER MANAGEMENT PLAN

TITLE
WATER CATCHMENT AREAS

CONSULTANT

YYYY-MM-DD	2024-11-12
DESIGNED	SC
PREPARED	CDB
REVIEWED	GD
APPROVED	JM

PROJECT NO.	PHASE	REV.	FIGURE
23590671	31100/31191	0	**18**

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4.3.1.7 Storage Capacities

Free water volumes in storage ponds, sumps, and tailings facilities depend on a balance between their inflows and outflows. The stage (elevation) can be directly correlated to a specific storage volume using site bathymetric (sub-aqueous surface) and topographic (land surface) data. These relationships can be referred to as stage-storage curves.

Dynamic storage facilities such as the TSF, where tailings deposition changes the available storage, require regular survey updates to confirm whether existing stage storage curves are appropriate for projecting free water volumes. Stage-storage curves for the TSF up to a crest elevation of 987 m were developed from the 2020 TSF survey. These curves were obtained from preliminary tailings deposition modelling carried out in support of the design of the 987 m TSF.

The stage-storage curves projected up to a crest elevation of 987 m constitute a 2-D element that considers the tailings tonnage. These curves will interpolate according to the dry tailings volume across the Springer Expansion LOM schedule. Additionally, these curves are limited by the spillway invert stated in Table 25, serving as the upper boundary for the maximum TSF elevation.

- Springer Pit (November 7, 2019, bathymetry survey)
- Cariboo Pit (June 3, 2022, topographic survey)
- TSF (June 17, 2020, bathymetric survey tied-in with October 22, 2019, topographic survey)
- Wight Pit (January 13, 2022, bathymetric survey)

The estimated volume capacities for the facilities listed above and other storage locations are presented in Table 31.

Table 32: Maximum Capacities for Major Storage Facilities

Major Storage Facility	Estimated Capacity (M-m^3)
Springer Pit[(a)]	14.8
Cariboo Pit[(b)]	5.1
Combined Springer-Cariboo Pit final mine-out	30.3
TSF – 987 m crest elevation design	5.7[(b)]
Wight Pit	3.8
PETBP	0.17

(a) Represents current individual pit volumes (i.e., before pits are combined or further mined).

(b) Capacity at the final stage of the TSF, when tailings deposition ends.

Source: WSP 2023a.

4.3.1.8 Mine Plan

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage/volume of dry tailings during the project is provided in Table 32 (MPMC 2022b). It is assumed that 6.55 M-tons of dry tailings have been placed in the TSF between the mine plan start date of July 1, 2022, and the assumed SWWBM operations start date of May 2, 2023.

Table 33: Mine Plan (Annual Totals)

Year	Dry Tailings (tons)
2022[(a)]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[(b)]	860,381

(a) Mine plan starts on July 1, 2022.

(b) Mine plan ends on March 31, 2031.

4.3.1.9 TSF Water Volumes

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on-site year over year (including within the TSF) by treating and discharging water.

The minimum and maximum operational water volumes in the TSF under normal conditions are 1.5 M-m^3 and 1.7 M-m^3, respectively.

The water balance model activates and deactivates pumping flows. As a result, the TSF water volume is set at 1.5 M-m^3 prior to freshet and it returns to the specified normal operating range after freshet. TSF water volume conditions are presented in Table 33.

Table 34: TSF Water Volume Values

Condition	TSF Water Volume (M-m^3)
Minimum under normal conditions	1.5
Maximum prior to freshet (February-April)	1.5
Maximum after freshet and until freeze-up	1.7

4.3.1.10 Flow Derivation and Logic

This section describes the model logic for pumped flows, seepage (from the TSF), groundwater inflows and outflows, consumption, and transfer flows.

Pumped Flows

The most relevant transfer rates, including rates between TSF, Pits and PETBP; have been informed by MPMC (MPMC 2023c), while the remaining rates remain consistent with the TAR model and were based on engineering judgement (Golder 2016g). Maximum pumping rates for the operational, closure, and post-closure phases (2023 to 2131) are available in Appendix A.

It should be noted that the capacity set for transfer from TSF to Wight Pit (P30) was assumed at a capacity to avoid PETBP overflow during operations. Capacity set for transfer from CCS to Wight Pit (P35) during closure is a WSP assumption to allow suitable water transfer capacity between CCS and Wight Pit during the closure phase, and this future conveyance system will require design confirmation as the Site approaches closure.

PETBP Pumping Logic

The PETBP functions as attenuation pond for the WTP, with a storage capacity of 170,000 m^3. If this storage capacity is depleted, water is pumped to the TSF for temporary detention (P5).

Mill Process Flows

The mill process water requirements are based on 2.0 m^3/t of dry tailings. Interstitial water sequestered in the deposited tailings is based on 0.347 m^3/t of dry tailings deposited.

Tailings Storage Facility Seepage Flows

Seepage flows from the TSF (S1 to S5) were estimated using a two-dimensional numerical groundwater flow model to quantify anticipated seepage rates through the embankment and foundation. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. The TSF seepage rates are presented in Section 3.2.4.

Consumption Flows

Consumption flows are system losses attributed to the operation of dust suppression equipment. Consumption flows were estimated by MPMC staff for operations (MPMC 2023c) and are modelled according to the following logic:

- Turbo-misters operate from May to September.
- Water trucks withdraw water at variable rates from May to September.

Consumption flow rates are presented in Appendix A.

4.3.2 Water Balance Calibration

Models are representations of systems, and as a result, accuracy will vary. Models are used to provide an indication of a system and how the system behaves under certain conditions. Calibration and validation exercises are used as an indicator of how well the model replicates conditions during the calibration period and provide the basis for future projections assuming that past behavior is an indicator of future behavior. The level of accuracy in model calibrations is dependent on the availability and quality of historical data and whether the logic for transferring or storing water is representative of actual conditions. If there are significant changes to the system that is being modelled, then those assumptions should be validated through additional model calibration as more monitoring data become available. The following sections provide information on the calibration process and the associated results.

4.3.2.1 Calibration Period

The calibration period is from January 1, 2017, to December 31, 2022. A 6-year period was selected to capture variable climatic, operational, and hydrological conditions that have been experienced on site.

4.3.2.2 Tailings Storage Facility Water Volume

The TSF represents the largest designated water storage facility at the mine. The large volume capacity of the facility, coupled with the availability of water level and survey data, and the TSF's role in the production mill reclaim water system, means the structure is a key indicator of large water volume changes on site, and with that, a good location for conducting a calibration check that is representative of the entire mine. A calibration check was carried out for the TSF water volume. Measured TSF water levels and operational water transfer data formed the primary inputs (e.g., water transfers to the Springer or Cariboo pits, production mill process flows, and water transfer to and from the PETBP). In addition, a global water balance check was performed to check that the difference between total water inflows and total water outflows was equal to the change in site storage.

Initial model simulation runs during the calibration period, without any adjustments, revealed poor agreement for selected periods. To account for these differences, general seasonal runoff coefficients (July to February) were assigned a 30% increase (scalar factor applied to the runoff coefficients for the applicable period) to represent higher antecedent moisture conditions if the previous month accumulated more than 50 mm of precipitation depth. In addition, general runoff coefficients were applied to what was defined as dry period in the TAR. Climate records obtained from a nearby ECCC station (Spokin Lake 4E; 1097646) appeared to support the hypothesis that rain-on-snow events, occurring for short and discrete periods, would have contributed to higher runoff conditions. The model was run again, and the results are shown in Figure 19.

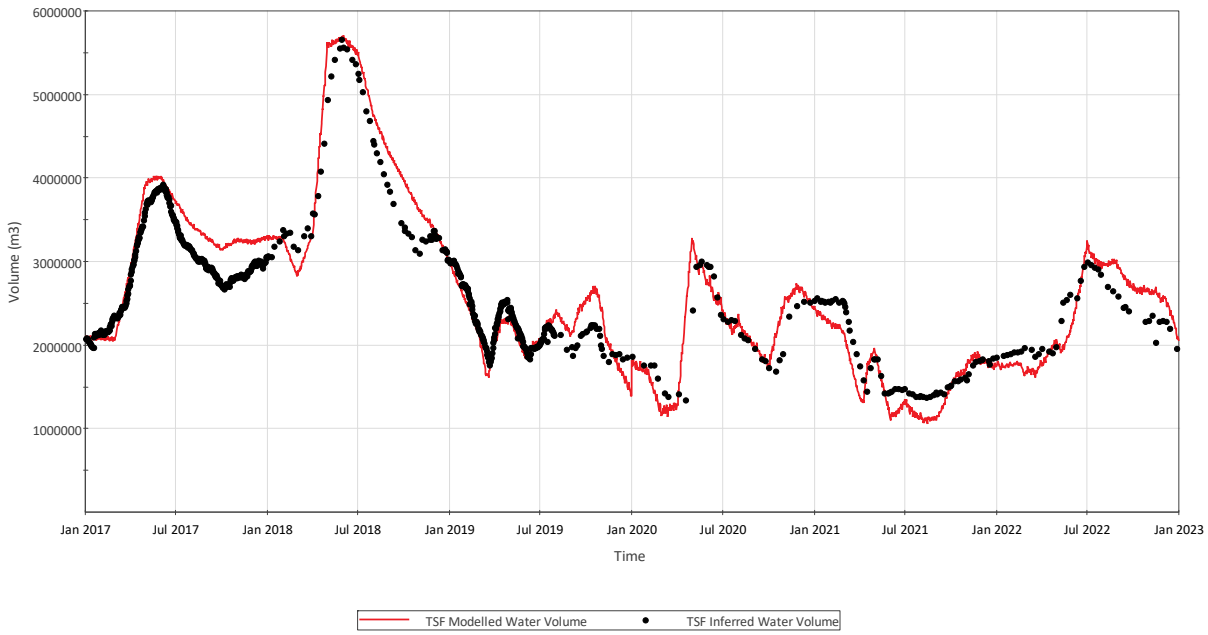


Figure 19: Tailings Storage Facility Water Volume Calibration from January 1, 2017, to December 31, 2022

As illustrated in Figure 19, the TSF modelled water volumes appear to demonstrate good agreement between modelled and inferred water volumes (water level measurements converted to a volume using interpolated stage-storage curves), with modelled volumes consistently tracking inflection points (change from accumulation to depletion or vice-versa). There are select periods where the calibrated model is slightly over-estimating or under-estimating the inferred volumes.

Remaining differences between modelled and inferred values may have several explanations:

- Variability in runoff coefficient throughout the year.
- Uncertainties in the climate data (e.g., snowpack surveys can miss intermittent snowmelt if conducted infrequently and the use of composite datasets may over or under-estimate actual conditions).
- Uncertainties in the TSF bathymetric survey (e.g., the transition between exposed tailings surface [i.e., beach] and free water can be complex).
- Uncertainties in the TSF storage curve after the start of tailings deposition.
- Potential inaccuracies in water level measurements.
- Gaps and/or inconsistent water level measurements.
- Potential inaccuracies and/or missing WTP discharge data.
- In general, the modelled results for the 2022 SWWBM calibration give a reasonable approximation of site conditions and are considered suitable for water management planning exercises.

4.3.3 Water Balance Results

The updated SWWBM results are intended to inform the water quality assessment for this WMP. The primary use of the water quantity and quality assessments are to predict whether the discharge water quality from the mine during operations will meet the parameter concentrations and discharge quantities and to anticipate water treatment requirements. This section provides an overview of the key results of the SWWBM. Full detailed SWWBM results can be found in Appendix A.

Quantity of Discharge

Throughout the entire planned future operations and closure periods to March 31, 2041, the maximum treatment capacity of the WTP in the model is assumed to be 25,000 m^3/day (0.29 m^3/s, 9.15 M-m^3/year). Excess water beyond this discharge rate is temporarily stored on-site until it can be treated and discharged.
Centralized collection and treatment of contact water is assumed during operations, closure, and post-closure. The Mine's current discharge permit authorizes an annual discharge volume of 10.59 M-m^3.

In year 2041, the assumed treatment capacity of the WTP in the model remains at 25,000 m^3/day (0.29 m^3/s). However, annual contact water requiring treatment is reduced over the post-closure phase as site areas are remediated and some runoff is considered non-contact water, as shown in Figure 17. The annual contact water treated discharge volume declines further in year 2051 when the South Seepage Pond and Main Embankment Seepage Pond catchments are considered remediated, commencing 10 years after the post-closure phase. At the end of the operations phase, contact water requiring treatment notably increases in 2031, as milling is assumed to terminate in 2031 and the demand for milling process water also terminates.

Estimated annual contact water volumes requiring treatment from operations to post-closure are presented in Table 34.

Table 35: WTP Annual Volume Requiring Treatment

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th Percentile	99.5th Percentile
2023[a]	3.90	4.57	5.72
2024	5.00	5.94	7.24
2025	3.50	4.97	6.79
2026	3.37	4.72	6.53
2027	3.35	4.79	6.60
2028	3.36	4.80	6.70
2029	3.39	4.78	6.46
2030	3.31	4.75	6.56
2031[b]	3.93	4.39	5.04
2032	5.56	6.68	7.82
2033	5.54	6.57	7.57
2034	5.50	6.54	7.49
2035	5.42	6.42	7.44
2036	5.43	6.44	7.36
2041[c]	2.36	2.88	4.04
2046	1.80	2.27	3.31
2051	0.46	0.83	1.39

Table 35: WTP Annual Volume Requiring Treatment

Year	Annual Volume Requiring Treatment at WTP (M-m³)		
	50th Percentile	90th Percentile	99.5th Percentile
2071	0.33	0.71	1.48
2091	0.32	0.69	1.60
2111	0.32	0.71	1.44
2131	0.02	0.03	0.05

(a) Model simulation start date: May 2, 2023.

(b) Closure starts on April 1, 2031.

(c) Post-closure starts on April 1, 2041.

Tailings Storage Facility

Temporary detention of water will be necessary to manage the large runoff volumes generated during freshet (typically April to June). The inflows during freshet will exceed treatment capacity, and detention volume is required to prevent uncontrolled release from the PETBP and to equalize the flow for treatment. The TSF is available to store excess freshet water until four months after the start of closure. At that time, the TSF water volume will decrease to a maximum of 0.25 M-m³, the maximum allowable water volume at closure. To create the reduced TSF water volume, a closure spillway will be constructed at the north abutment (Corner 5) of the TSF. Water will discharge from the TSF to the CCS, and then flow to the PETBP for treatment prior to discharge.

During closure and post-closure, the TSF is modelled to discharge annually via the spillway, and the TSF water volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m³. As from Figure 20, the water volume fluctuation follows a consistent pattern during both closure and post-closure periods, with minimum values occurring in winter and reaching maximum capacity during freshet (0.25 M-m³).

Figure 20 shows the water volume in the TSF throughout future operations and into closure until 10 years after post-closure. The TSF water volume pattern shown for the 2041-2051 post-closure period is continued for the remaining 80 years of post-closure (until 2131). Table 35 shows tabulated minimum, average, and maximum bounds for the three percentile trends shown in Figure 20.

Table 36: TSF Water Volume (m³)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1,330,244	1,390,394	1,429,751
	Average	1,493,500	1,576,822	1,809,717
	Maximum	2,840,000	2,840,000	3,493,139
Closure	Minimum	0	0	0
	Average	119,248	188,149	265,076
	Maximum	1,756,506	2,012,120	2,479,271
Post-closure	Minimum	0	0	0
	Average	50,710	116,082	182,881
	Maximum	252,571	252,571	252,571

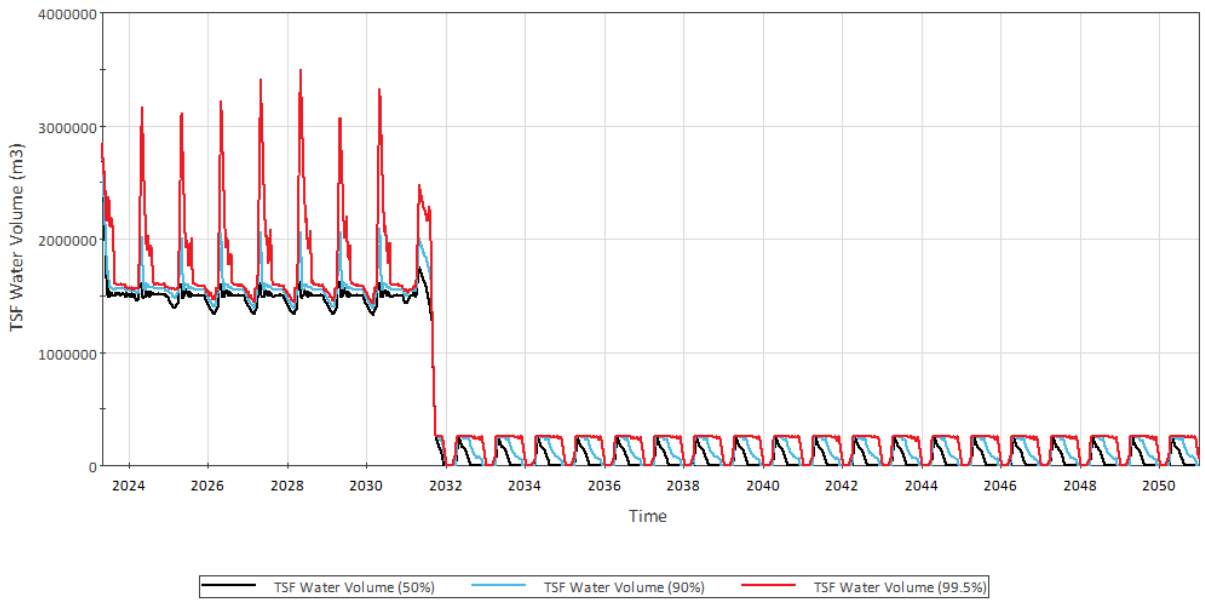


Figure 20: TSF Water Volume During Operations to 10 Years After Post-closure

Combined Springer-Cariboo Pit

Springer Pit and Cariboo Pit were modelled as a single pit for the closure and post-closure phases (starting April 1, 2031). A result comparison between different percentiles for Combined Springer-Cariboo Pit volume during closure and post-closure is provided in Figure 21 . Potentially Acid Generating (PAG) waste rock will be stacked uniformly to an elevation of 1,004 m in the base of the Combined Springer-Cariboo Pit at the end of the operations phase. Results of the simulations indicate that water levels within the pit will cover the PAG material placed in pit by approximately 2033 under the 99.5th percentile condition, while under the rest of the climate conditions it is estimated to cover the PAG material placed in pit by 2034. Under the 50th percentile results, the combined Springer-Cariboo Pit lake is estimated to start overflowing in 2058, while under the 90th percentile it is estimated to start overflowing in 2056, and in 2055 under the 99.5th percentile. The Water Quality Report (WSP 2023c) discusses modelled water quality of the Springer-Cariboo pit lake at the estimated time of overflow.

Table 37: Combined Springer-Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Closure	Minimum	109,345	145,263	211,031
	Average	4,827,785	5,199,295	5,652,177
	Maximum	9,030,590	9,598,661	10,300,000
Post-closure	Minimum	9,032,744	9,600,627	10,300,000
	Average	20,033,811	20,167,573	20,287,305
	Maximum	21,100,000	21,100,000	21,100,000

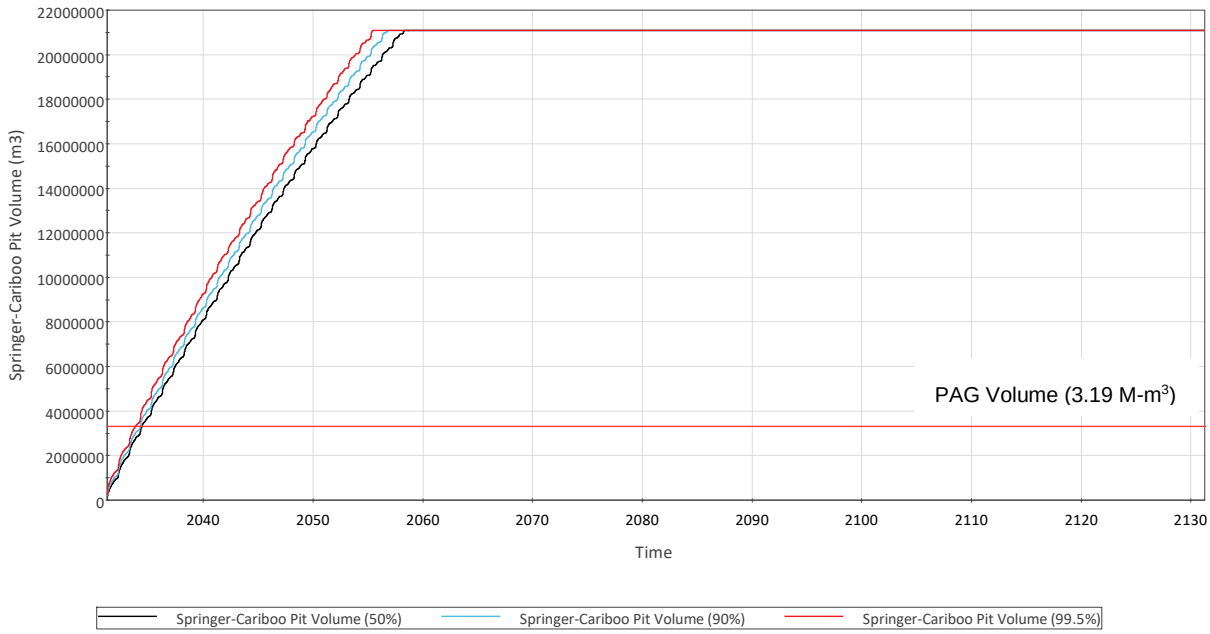


Figure 21: Combined Springer-Cariboo Pit Water Volume from Closure

The combined Springer-Cariboo Pit is modelled to fill to its maximum volume during post-closure. Following that time, additional volume collected in the combined pit will overflow from the pit's spillway and is assumed to direct discharge to the receiving environment in the SWWBM. Water quality and water treatment discussion is included under separate cover regarding this assumption of direct environmental discharge of pit lake overflow during post-closure.

Table 37 shows the modelled average annual overflow volume from the combined Springer-Cariboo Pit.

Table 38: Combined Springer-Cariboo Pit Annual Overflow (m^3)

Phase	Combined Springer-Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	469,711	1,051,048	2,249,910

Wight Pit

The water volume in Wight Pit is expected to increase during every freshet season. Four months into the closure phase, the TSF water volume will be reduced to a maximum of 0.25 M-m^3 within two months. Once the TSF can no longer provide freshet storage, Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for freshet storage and will be allowed to fill. Wight Pit is projected to start overflowing in 2049 under the 50th percentile results, and in 2047 under the 90th and 99.5th percentile results. Overflow from Wight Pit during post-closure is assumed as direct environmental discharge to Polley Lake and the water quality implications of this assumption are discussed in the water treatment section of this WMP. Estimated volumes stored in Wight Pit from operations to 10 years after post-closure are presented in Figure 22 and the average annual post-closure overflow volumes are shown in Table 39.

Table 39: Wight Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	459,747	650,947	1,128,389
	Maximum	3,427,576	3,483,974	3,495,141
Closure	Minimum	0	0	0
	Average	80,815	373,440	1,188,190
	Maximum	490,123	1,153,040	2,326,346
Post-Closure	Minimum	0	0	0
	Average	4,835,386	4,841,820	4,849,597
	Maximum	4,984,114	4,984,114	4,984,114

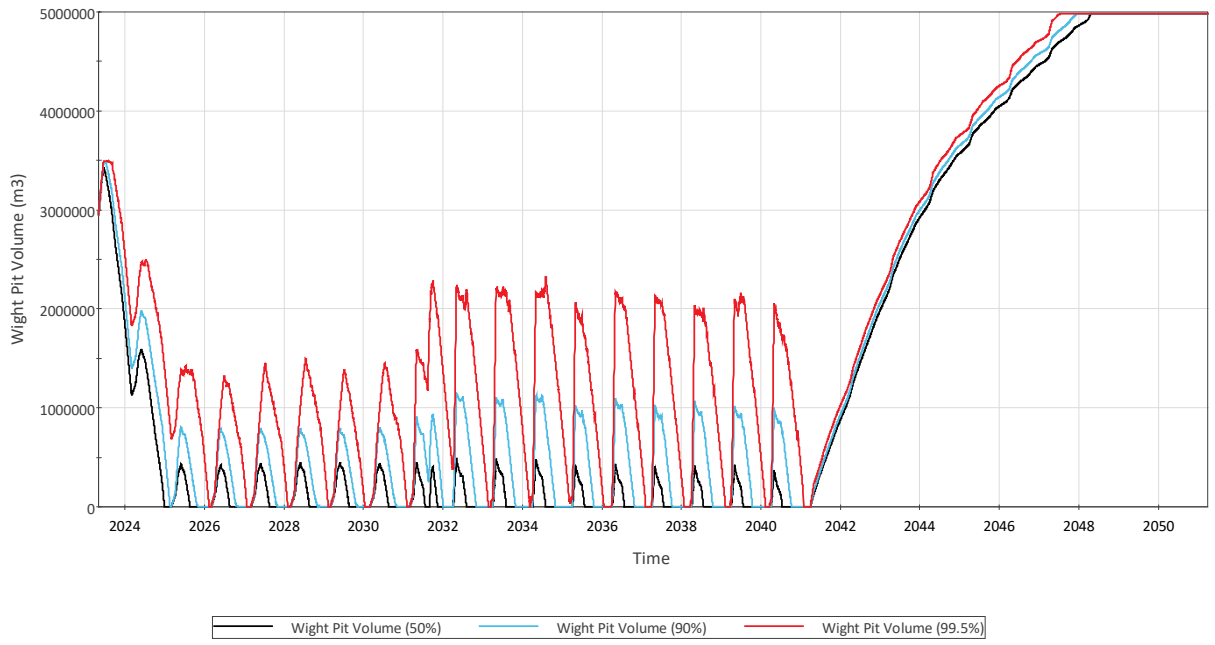


Figure 22: Wight Pit Water Volume During Operations to 10 Years After Post-closure

Table 40: Wight Pit Annual Average Overflow (m^3)

Phase	Wight Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-closure	466,741	617,692	993,214

4.3.4 Water Balance Model Summary

The SWWBM was updated to reflect the Springer Expansion LOM plan during the operational phase and incorporates closure and post-closure phases for the Mount Polley Mine. The SWWBM supports water management planning and the assessment of water quality and associated water treatment and discharge options.

The model was run from May 2, 2023, to March 31, 2131, and included the following LOM phases:

- Operational phase extending from May 2, 2023, to March 31, 2031.
- Closure phase extending from April 1, 2031, to March 31, 2041.
- Post-closure phase commencing on April 1, 2041, and extending, for the purposes of this analysis, to 2131.

The model was run stochastically for 2000 realizations to present 50th, 90th, and 99.5th percentile model results. The results for the modelling during the operational phase are presented as follows:

- The average annual treated discharge for the 50th percentile is approximately 3.65 M-m^3 between 2023 and 2031, while the milling process water demand exists.
- The maximum annual treated discharge for the 99.5th percentile is 7.21 M-m^3 in 2031.
- The maximum TSF water volume during the operational phase is approximately 3.49 M-m^3 for 99.5th percentile, and 1.62 M-m^3 for the 50th percentile results (excluding 2023 when the TSF is initially set to 2.84 M-m^3 in the model).
- During the operational phase, the volume in Springer Pit and Cariboo Pit are both decreased to empty before each freshet, and temporary storage will occur during the freshet.
- There are no overflows from the PETBP under the simulated conditions during the operational phase.

The conclusions for the modelling during closure and post-closure phases are as follows:

- The average annual treated discharge for the 50th percentile result is approximately 0.95 M-m^3.
- The TSF water volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3.
- The combined Springer-Cariboo Pit Lake is estimated to start overflowing between 2055 and 2058, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.
- PAG material placed in the combined Springer-Cariboo Pit is estimated to be inundated and covered by the pit lake between 2033 and 2034.
- During closure, the volumes in PETBP are reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet under each of the climate conditions simulated. During closure and post-closure phases, the PETBP does not have sufficient storage capacity to prevent overflow during freshet for the 99.5th percentile condition; however, these overflow volumes are included with the annual treatment requirement volumes. System modifications will occur during closure to prevent overflow of contact water requiring treatment.
- The Wight Pit is expected to initiate spilling between 2047 and 2049, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.

4.4 Water Quality

The Site Wide Water Quality Model Report (SWWQM), developed in GoldSim for the TAR (Appendix D; Golder 2016g) and linked to the SWWBM, was updated as part of this WMP. The complete description of the model setup, inputs, assumptions, calibration and model results are presented in the Springer Expansion water quality model report (Appendix B, WSP 2023c). The objectives of the SWWQM are as follows:

- Hindcast concentrations of constituents in the influent to the WTP (i.e., water quality in the PETBP) and at other Mine facilities (i.e., CCS, Springer Pit, Cariboo Pit, 9K Sump, NW Sump, Mine Drainage Creek Sump, Bootjack Creek Sump, South Embankment Seepage Collection Pond, Main Embankment Seepage Collection Pond, TSF supernatant pond, and seepage from all ore stockpiles) for the calibration period.
- Forecast concentrations of constituents during operations, closure and post-closure as part of the permit application for the Springer Expansion LOM.

The model simulation included four time periods:

- **Calibration** (1 January 2017 to 31 December 2022) – the calibration period includes operations (1 January 2017 to 1 May 2019), care and maintenance of the Mine site (2 May 2019 to 31 October 2021) and the beginning of resumed operations (starting 1 November 2021). During the calibration period, water in the Perimeter Embankment Till Borrow Pond (PETBP) is treated at the water treatment plant (WTP) and discharged to Quesnel Lake.
- **Resumed Operations** (1 May 2023 to 31 March 2031) – the resumed operations period when, similar to the calibration period, water in the PETBP is treated at the WTP and discharged to Quesnel Lake.
- **Closure** (April 1,2031, to March 31, 2041) – a ten-year active closure period is assumed, during which potentially acid generating (PAG) stockpile material from the Temporary Northwest (NW) PAG stockpile is deposited into the Springer-Cariboo Pit and other facilities are reclaimed. The closure phase will include reclamation activities as identified in the RCP (MPMC 2022a). The WTP is assumed to be in operation through all of the closure period. Details on the closure and post-closure management of mine facilities are provided in the MPMC 2022a.
- **Post-closure** (April 1, 2041, to April 1, 2131) – this period includes filling of pits, discharge, and establishment of steady-state conditions for the drainage from mine facilities. Results are presented for two periods within post-closure:
  - Early post-closure (April 1, 2041, to March 31, 2051) – Represents the first ten years of post-closure during which drainage from Mine facilities is assumed to progressively return to undisturbed water quality. The WTP is assumed to be in operation during this period.
  - Long-term post-closure (April 1, 2051, to April 1, 2131) – this time period has been selected to represent steady-state conditions after all closure and post-closure changes have taken place. The need for treatment during long-term post-closure will be confirmed as MPMC approaches this phase and may be achieved through distributed passive or semi-passive treatment systems if required.

Uncertainty exists regarding the exact timing of these transitions. The time periods are intended to show, at a conceptual level, the difference in site drainage quality as the site progresses through the post-closure period; it is not intended to imply that the transitions will occur on precisely those dates.

4.4.1 Constituents in the Model

The constituents in the SWWQM include physical parameters, major ions, nutrients, and dissolved metals and metalloids (Table 40). The dissolved fractions of metals and metalloids are used in all mixing calculations in the model. The total concentrations of metals and metalloids are calculated by adding particulate fractions to the dissolved concentrations as described in the Particulate Addition and Total Metals section that follows the table.

Table 41: Constituents in the Site-wide Water Quality Model

Category	Constituent
Physical parameters	Total dissolved solids (calculated), hardness (calculated).
Major ions	Calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate.
Nutrients	Nitrate, nitrite, total ammonia, total phosphorus.
Dissolved metals and metalloids	Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc.

Particulate Addition and Total Metals

The process of calculating particulate fractions of constituents and total metals and metalloids concentrations was described in Appendix D of the TAR (Golder 2016g). Predictions of total metals and metalloids were calculated by adding empirical particulate fractions to the predicted dissolved metals and metalloids concentrations. Particulate fractions were calculated for two periods:

1) **Operations and Closure:** Monitoring data in the SERDS Ditch and Long Ditch between 2008 and 2023 were used to establish the empirical particulate metal concentrations during operations and closure because these facilities are expected to contribute the majority of particulate load to site flows. The model assumes that total suspended solids (TSS) will be settled to 15 mg/L during operations and closure (i.e., the maximum permitted discharge concentration) before being discharged.

2) **Post-closure:** Monitoring data from Edney Creek was used to establish the empirical particulate metal concentrations because data from this location is considered representative of undisturbed (i.e. reclaimed) surface runoff. The model assumes that TSS will be settled to 3 mg/L (i.e., the 95th percentile of TSS from monitoring data at Edney Creek from 2016 to 2022).

4.4.2 Model Set-up

The model simulated concentrations on a daily time step from January 2017 to December 2022 (calibration period), May 2023 to March 2031 (operations) and from April 2031 to March 2131 (closure and post-closure). Probabilistic climate and water quality inputs were used to run the model stochastically for 2000 simulations:

- **Climate Inputs:** The SWWQM was run with probabilistic monthly climate inputs during operations, closure and post-closure as described in Section 4.3.1.5. Monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022a) were fitted to a log-normal probability distribution. The calibration period used historical climate data for the climate inputs.

- **Water Quality Inputs:** For each realization, a unique concentration for each parameter was selected based on randomly sampled values from within a statistical probability distribution function that was derived from each input.

To interpret the results, median and 95th percentile concentrations were calculated for each Mine facility. To put the results in context, a 95th percentile prediction indicates the maximum concentration that is likely to be reached over the duration of the simulation, with a 95% likelihood that concentrations will be at or below that concentration (it does not suggest that concentrations will exceed this value 5% of the time).

4.4.3 Model Inputs

Water quality inputs in the SWWQM were derived from site monitoring data. A summary of the water quality inputs assigned to each flow in the SWWQM is presented in Table 42 and described below.

Site Water Quality Monitoring Data

Site water quality monitoring data from 2006 to 2023 (depending on the input) were used to develop water quality inputs in the SWWQM. For each constituent, water quality inputs were represented in the model by probability distribution functions. The same standardized process described in the TAR (Appendix D, Golder 2016g) was used to fit probability distribution functions to the monitoring data. A summary of the distributions selected, maximum, 95th percentile, and mean values used for each constituent, and number of samples for each water quality input are presented in in the Springer Expansion SWWQM Report (WSP 2023c).

Geochemical Source Terms

Water quality inputs derived from geochemical source terms developed by SRK Consulting Canada were applied to the SWWQM as an additional scenario in the 2016 Long Term Water Management Plan (Golder 2016). Updates to these geochemical source terms were completed by SRK consulting (SRK 2023). An alternative model scenario was completed using the geochemical source terms as water quality inputs in place of inputs calculated from monitoring data. The results of the two scenarios (using monitoring data or geochemical inputs) were compared. Consistent with the previous geochemical source terms provided by SRK for the 2016 TAR (Golder 2016g) and the 2020 WMP (Golder 2020e), the SRK inputs were considered more conservative than the monitoring data inputs and produced generally higher concentrations in the SWWQM. The results presented in this report are from the scenario that utilized the water quality inputs that were calculated from monitoring data (Section 2.6.3). The results from the geochemical source term scenario are not presented because the model predictions were considered overly conservative for most parameters and because the model was calibrated using the inputs calculated from monitoring data.

Table 42: Summary of Water Quality Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Rock Disposal Site Contact Water	RDS Runoff to Boundary Pit	Boundary Dump Seep station water quality data (n = 70, June 2013 – July 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Boundary Pit	Boundary Dump Seep station water quality data (n = 70, June 2013 – July 2022)		
	RDS Runoff to Wight Pit	Joe's Creek Pipe station (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Wight Pit	Joe's Creek Pipe station (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)		
	NAG Waste Rock Runoff	East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	NAG Waste Rock Seepage	East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)		
	Temporary NW PAG Stockpile Runoff	PAG Dump Seep station water quality (n = 140, May 2013 – January 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Temporary NW PAG Stockpile Seepage	PAG Dump Seep station water quality (n = 140, May 2013 – January 2023)	NAG Waste Rock: East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)	
Pit Wall Runoff	Boundary Pit Wall Runoff	Boundary Pit station water quality (n = 16, February 2016 – July 2023)		
	Wight Pit Wall Runoff	Wight Pit (Station E10) water quality (n = 71, January 2016 – February 2023)		
	Springer Pit Wall Runoff	Springer Pit (Station E11) water quality (n = 53, January 2016 – August 2022)		
	Cariboo Pit Wall Runoff	Cariboo Pit (Station E8) water quality (n = 40, January 2016 – February 2023)		
Tailings Storage Facility	TSF Beach, Impoundment, and Embankment Runoff	TSF supernatant (Station E1a) water quality (n = 157, May 2011 to February 2023)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Unsaturated TSF Seepage	TSF Main Embankment Seepage Collection Pond (Station E4) water quality (n = 144, January 2006 – February 2023)		
	Saturated TSF Seepage	Predicted concentration in the TSF		
Other	Haul Road Runoff	NAG Waste Rock: East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Disturbed Runoff	W4 and W5 site monitored data (n = 256, January 2014 to February 2023)		
	Undisturbed Runoff	W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)		
	Groundwater Inflow to Springer-Cariboo Pit	GW12-1/2, GW15-1/2 site monitored data		
		(n = 253, June 2013 to January 2023)		

NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site.

4.4.4 Model Assumptions

The key assumptions that have been made in the SWWQM are:

- The input water qualities used in the SWWQM are representative of their respective input sources and will continue to be representative over the modelled timeframe. Water quality data for model inputs were selected from available lab testing and field monitoring, augmented by professional judgement where necessary.
- Concentrations of parameters from monitoring data that were lower than the analytical detection limit were set equal to half the detection limit.
- Concentrations of parameters in direct precipitation onto the water surface of water management facilities were assumed to be zero. No mass was removed or added to modelled systems through evaporation or direct precipitation. These processes affected water quantity only and did not affect mass of modelled parameters in the system.
- All open pits, ponds, and sumps are fully mixed systems. No stratification is considered over the modelled timeframe. All inputs are mixed with existing water volumes to calculate concentrations of parameters.
- All parameters are assumed to behave conservatively. That is, they are assumed to not settle, precipitate, sorb, degrade, or undergo any other process that would reduce concentrations. This assumption is likely to have negligible effects on major ion predictions but may lead to over-estimation of some nutrients and metals.
- All PAG waste rock will be disposed sub-aqueously in the Springer-Cariboo Pit at closure to mitigate onset of acid generation. Acid generation is not expected to occur prior to subaqueous disposal, and disposal in the Springer-Cariboo Pit Lake will prevent acid onset in the future by limiting oxidation in the waste rock. Geochemical characterization studies estimate the time to the onset of acid generation varies between decades and 100 years (MPMC 2022a).
- The combined Springer-Cariboo Pit is assumed to be empty at the start of closure.
- Rock disposal sites (RDS) are assumed to be reclaimed in post-closure. Following revegetation, the runoff from these facilities is assumed to return to undisturbed runoff quality over the course of ten years.
- Diffusive flux from the submerged PAG waste rock into the Springer-Cariboo Pit Lake water cap was not modelled.
- Accumulation and flushing of oxidation products from weathered PAG material prior to subaqueous disposal was not modelled.
- Ice formation and melting were not considered in pits, ponds, and ditches that retain water.

4.4.5 Model Calibration

The SWWQM was set up to hindcast concentrations from January 1, 2017, to December 31, 2022, at seven locations:

- Springer Pit
- Cariboo Pit
- Wight Pit
- CCS
- PETBP
- TSF
- NW Sump

Where discrepancies between model results and monitoring data existed, the model was adjusted to better reflect monitoring data. The same adjustments, made during calibration of the SWWQM in the 2020 Water Management Plan (Golder 2020e) and during the calibration of the SWWQM in the 2022 Reclamation and Closure Plan (MPMC 2022a), were maintained in this update to achieve calibration with monitoring data:

- Adjusting the proportion of Wight Pit runoff and groundwater inflows that are assigned a waste rock contact water input based on storage of waste rock in the pit.
- Adjusting the proportion of runoff from waste rock that is assigned an undisturbed water quality input.
- In the TSF, applying calibration factors greater than 1.0 to improve the model calibration for chloride, fluoride, potassium, sodium, nitrite, dissolved antimony, dissolved arsenic, dissolved barium, dissolved lithium, dissolved molybdenum, and dissolved vanadium. These calibration factors are applied during periods when tailings are deposited to the TSF.

Calibration Results

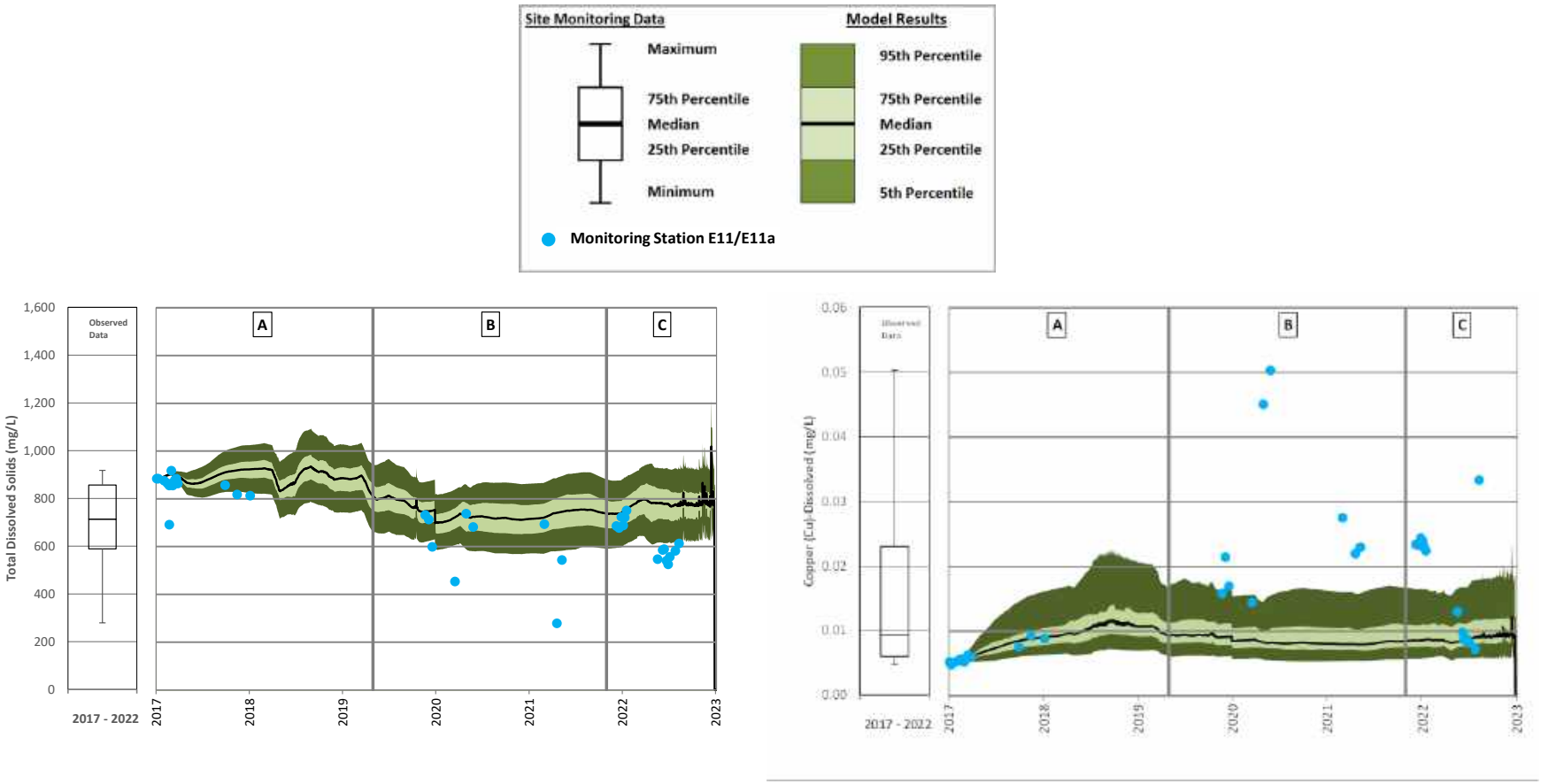
Model calibration results are shown compared to monitoring data for total dissolved solids and dissolved copper in Figure 23 through Figure 29. Model calibration results for all parameters and locations are provided in the Springer Pit Expansion SWWQM Report (Appendix B, WSP 2023c). Monitoring data were generally between the projected 5th and 95th percentile model calibration results for all parameters. However, several parameters (e.g., dissolved copper) were underpredicted during periods in 2018, 2020, and 2021. The source of the increased concentrations in the monitoring data for these parameters is thought to be due to the discharge of leachate to the TSF from the onsite test heap leach facility (Golder 2022f). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process.

Where monitoring data fell within the 5th and 95th percentile model calibration results, the model was considered to be in good agreement with monitoring data. The good agreement indicates that model inputs were well characterized and that these parameters had low sensitivity to assumptions or model conditions not matching site conditions.

Where monitoring data were consistently below the 5th percentile predictions, the model was considered to be over predicting concentrations. Possible reasons why the model may be over-predicting concentrations are:

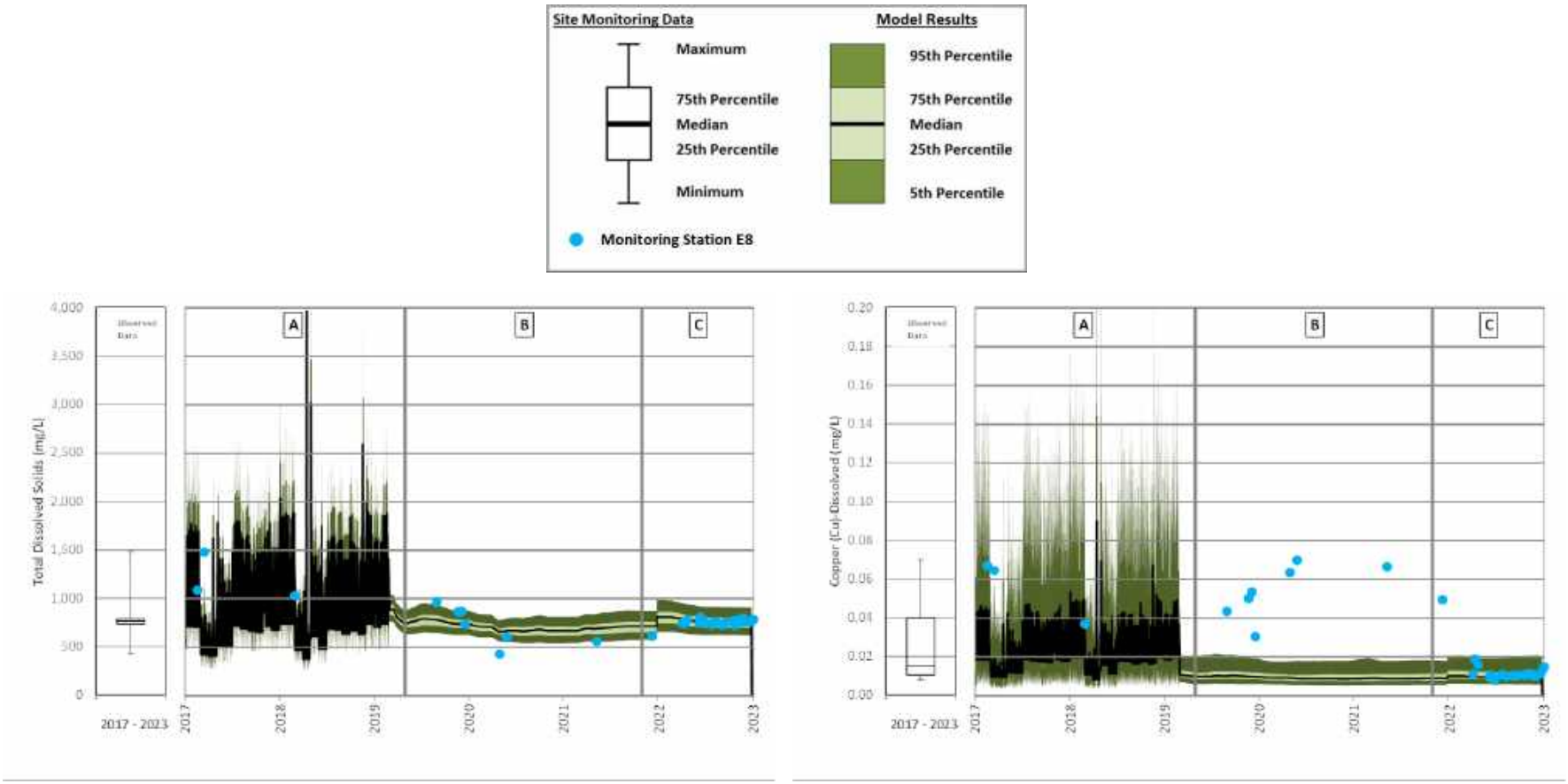
- The model was developed to predict water quality conservatively; where uncertainty exists in model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected. For example, seepage from RDSs was assigned a NAG water quality for the entire model simulation period, which is a conservative assumption.
- Metal concentrations that are far below detection limits may be skewed upward by model inputs where half-detection limits were applied.
- Settling of particulate material is not accounted for in the model.
- Geochemical processes, such as precipitation and adsorption, are not accounted for in the model.

Although these factors may lead to over-prediction of concentrations, the model is considered valid for the purpose of predicting concentrations of parameters on the Mine and in the influent to the WTP because deviations in model predictions from monitoring data in this category tend toward additional environmental protection.



A = Operations; B = Care and Maintenance; C = Resumed Operations.

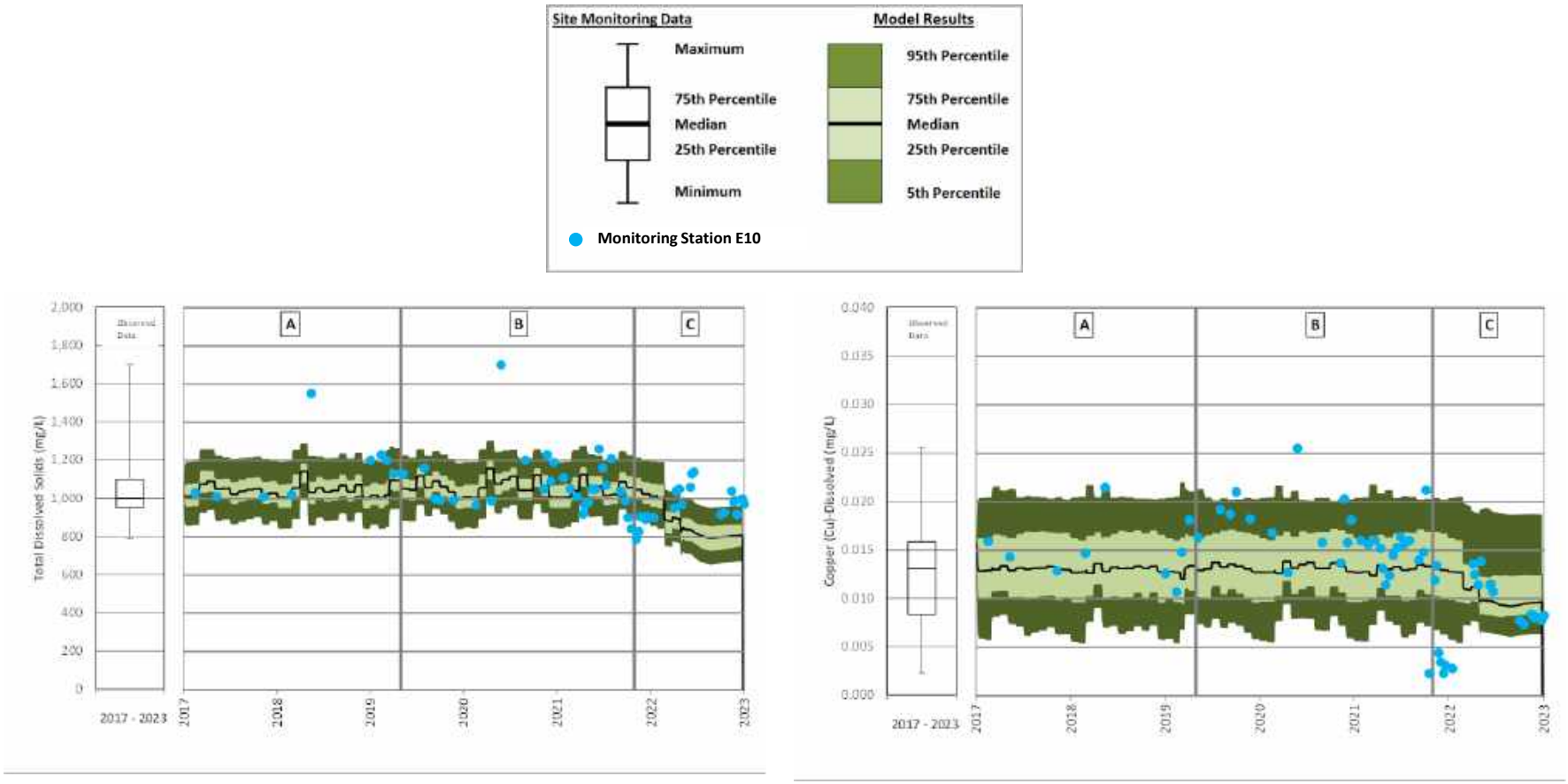
Figure 23: Springer Pit Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintenance; C = Resumed Operations.

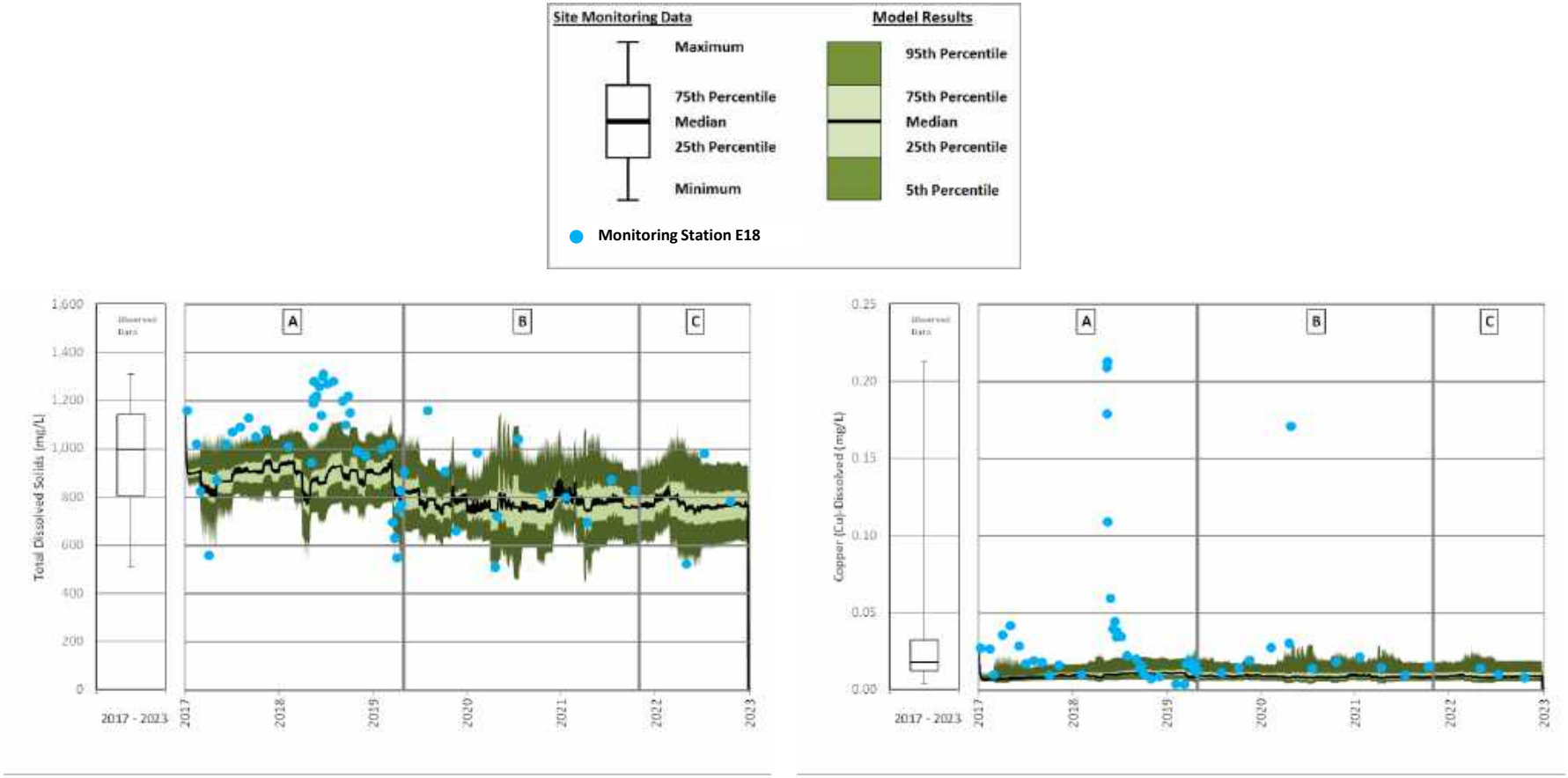
Note(s): Cariboo Pit is a flow-through system from the beginning of the model simulation to March 2019, which results in a wide range in predicted concentrations. After March 2019, Cariboo Pit stores water, which reduces the range in predicted concentrations. The source of increased copper concentrations in 2019, 2020 and 2021 monitoring data is due to the discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to Cariboo Pit). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

Figure 24: Cariboo Pit Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintenance; C = Resumed Operations.

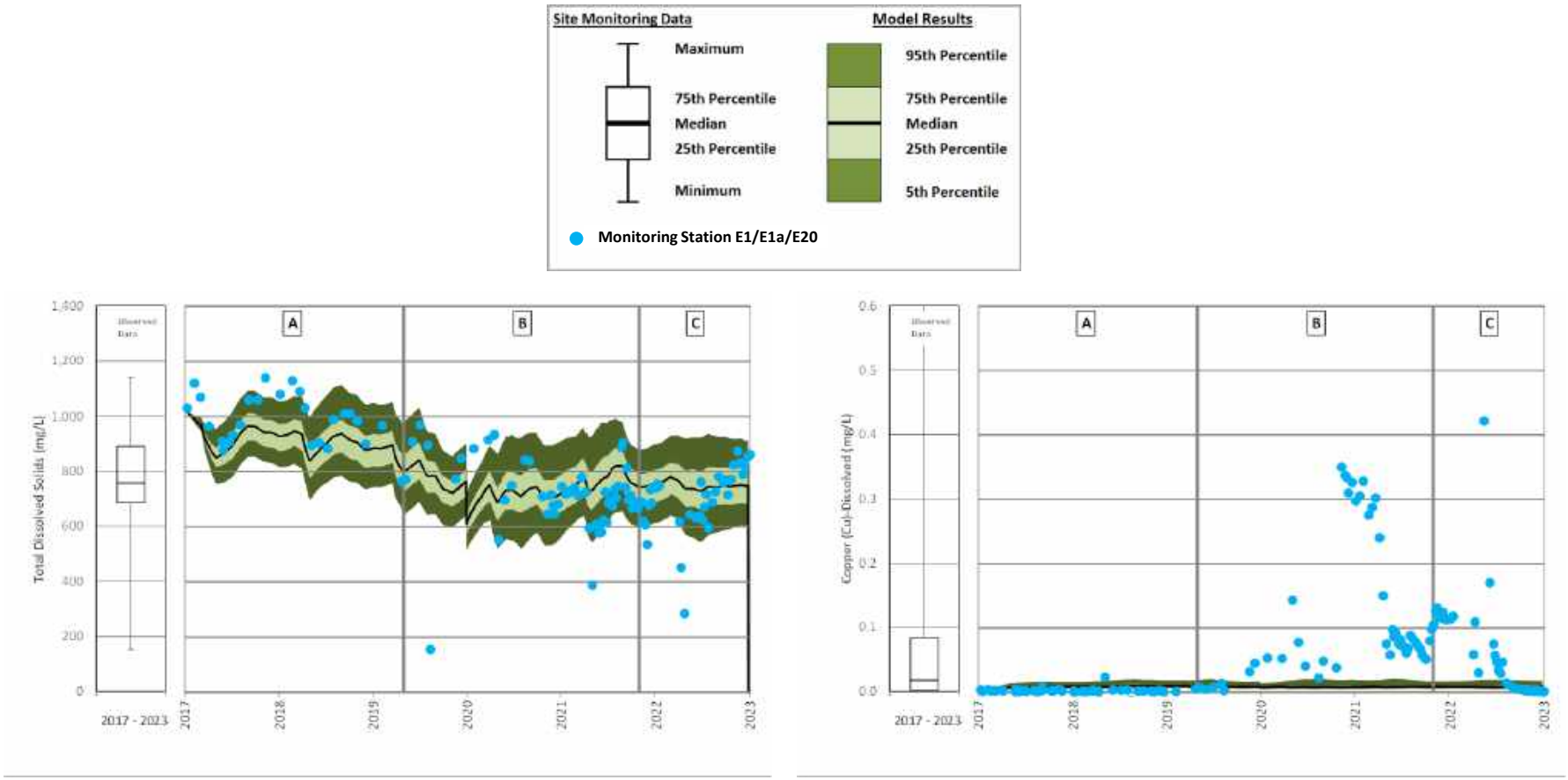
Figure 25: Wight Pit Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintenance; C = Resumed Operations.

Note(s): The source of increased dissolved copper concentrations in the Central Collection Sump 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the CCS. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

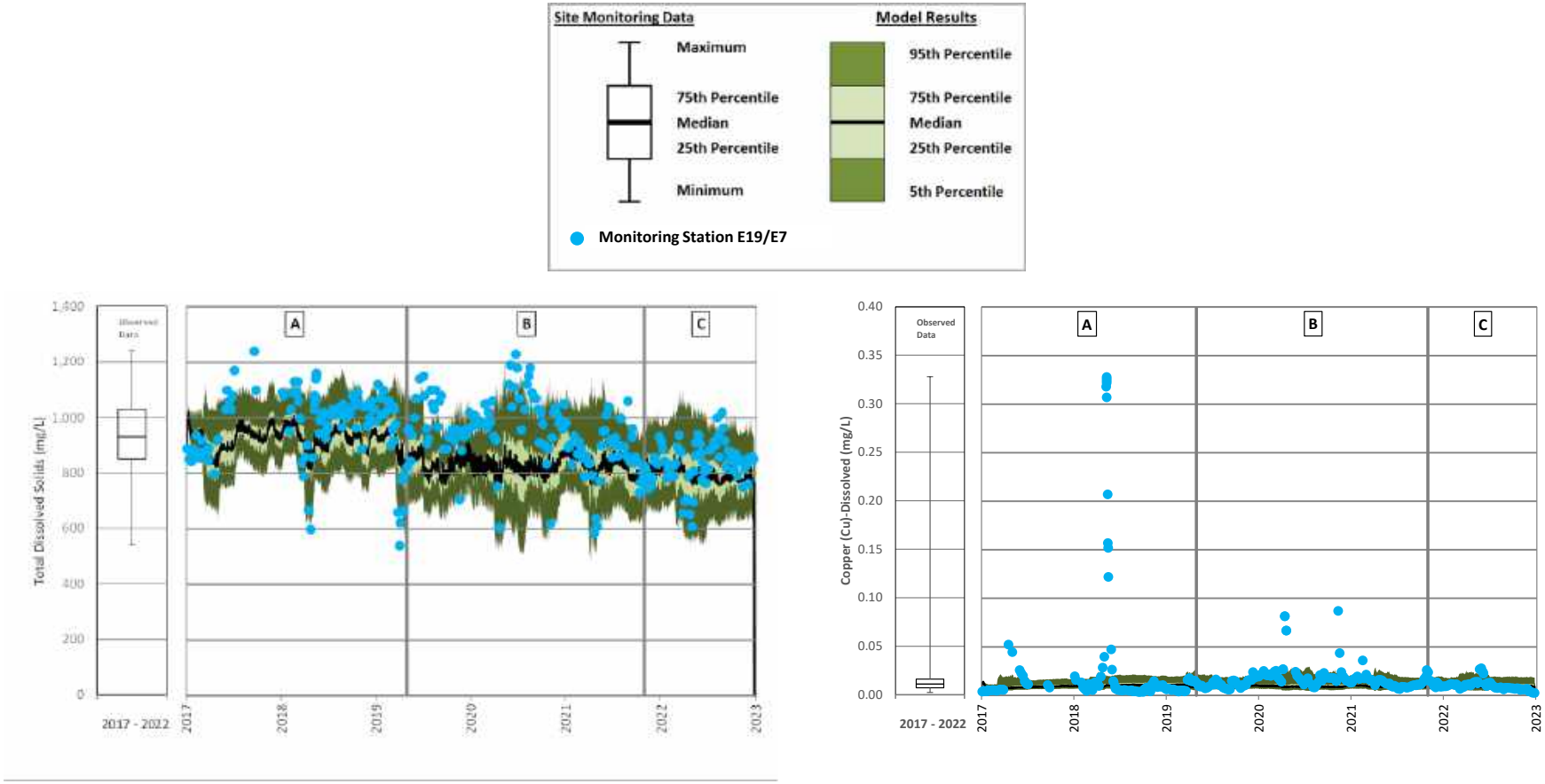
Figure 26: Central Collection Sump Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintenance; C = Resumed Operations.

Note(s): The source of increased copper concentrations in 2018 and from 2020 to 2022 in the monitoring data of the Tailings Storage Facility (TSF) is due to the discharge of leachate to the TSF from the onsite test heap leach facility. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

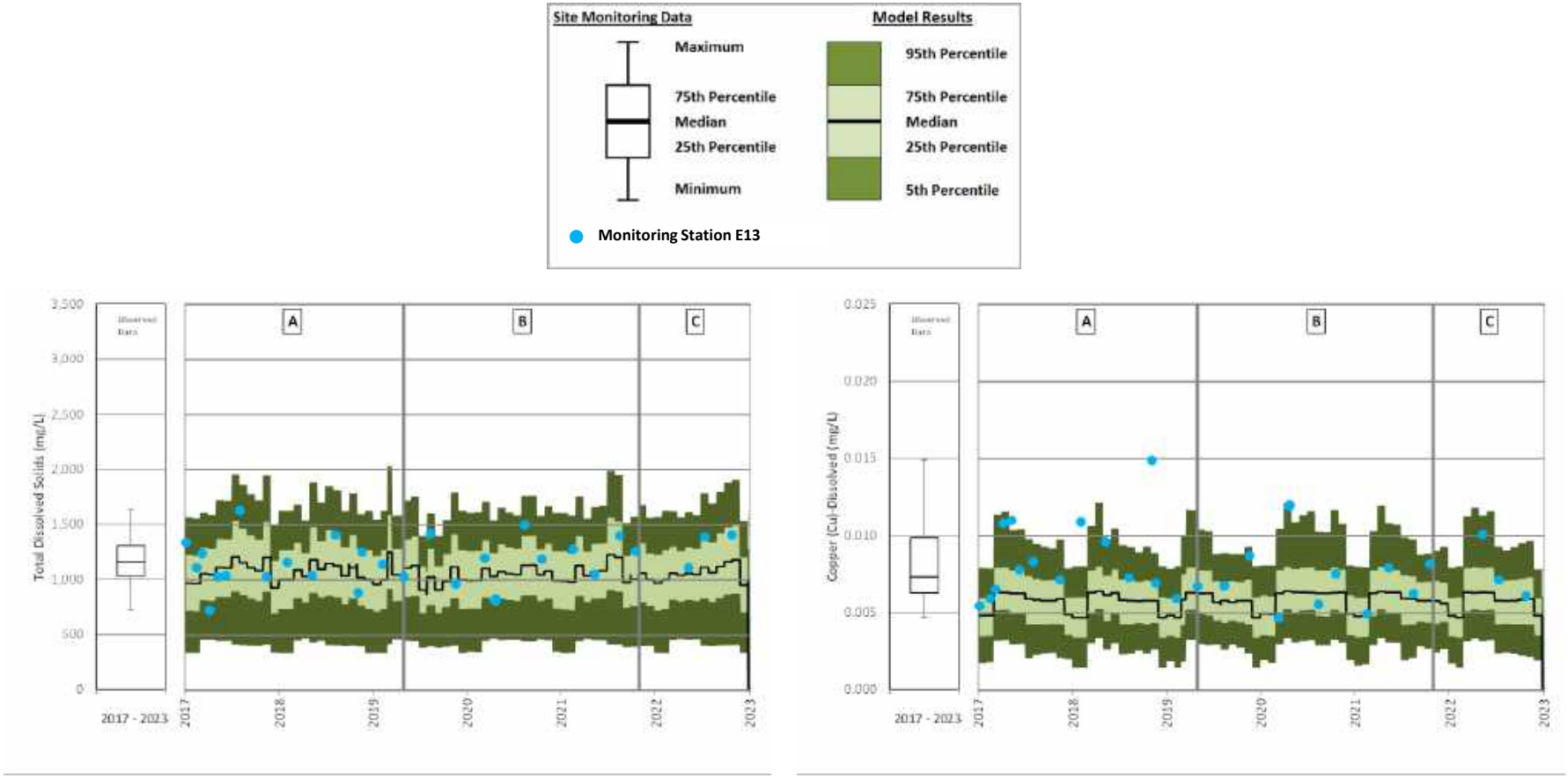
Figure 27: Tailings Storage Facility Supernatant Pond – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintenance; C = Resumed Operations.

Note(s): The source of increased dissolved copper concentrations in the Perimeter Embankment Till Borrow Pond 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the PETBP. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022a).

Figure 28: Perimeter Embankment Till Borrow Pond – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintenance; C = Resumed Operations.

Figure 29: Northwest Sump – Total Dissolved Solids and Dissolved Copper

4.4.6 Model Simulation

After the model calibration was completed, model simulations were performed for the following periods:

- Operations (January 1, 2024, to March 31, 2031)
- Closure (April 1, 2031, to March 31, 2041)
- Post-closure (April 1, 2041, to April 1, 2131)

For most parameters, peak concentrations of parameters occur in operations or closure. Concentrations decrease during closure and post closure as Site areas are reclaimed. Runoff inflows from reclaimed areas are assigned the undisturbed runoff water quality input. Some parameters (for example, dissolved aluminum and dissolved chromium) increase in concentration from operations to closure and post-closure because the statistical distributions assigned to undisturbed runoff water quality have higher concentrations than the statistical distributions assigned to the contact areas of the Site (disturbed runoff areas, TSF beach runoff areas, NAG waste rock areas and PAG waste rock areas).

The following sections present time series of predicted concentrations of several key parameters (copper and selenium) for the PETBP, the Springer-Cariboo Pit Sump, Wight Pit and Long Ditch (which receives contact water from the SERDS). Maximum of median and 95th percentile predicted concentrations are presented for all modelled parameters in these locations. Time series and maximum concentrations for all modelled parameters and locations are presented in the SWWQM report (Appendix B).

4.4.6.1 Perimeter Embankment Till Borrow Pond

During operations, closure and the first ten years of post-closure, the PETBP is the assumed influent water to the WTP, which discharges to Quesnel Lake. Maximum of the daily median and maximum of the daily 95th percentile concentrations in the PETBP are presented in Table 42. Time series for predicted copper and selenium concentrations in the PETBP are presented in Figure 30.

In general, concentrations in the PETBP are predicted to remain relatively consistent during operations until the end of pumping from the mill processing plant in 2031. This consistency is due to the assumption that the entire surface areas of the RDS are accounted for at the beginning of the model simulation. Therefore, the runoff and seepage volumes from the RDS do not change. Changes in predicted concentrations in the PETBP are due to:

- Variable pumping from the TSF to the Mine Drainage Creek Sump (MDCS) during operations. During periods when the TSF is pumped to the MDCS, concentrations of most parameters increase in the MDCS. Concentrations decrease in the MDCS when there is no pumping from the TSF. Changes in MDSC water quality reach the PETBP through the pathway connecting the MDCS to the PETBP:
  - TSF → MDCS → SERDS Ditch → Long Ditch → CCS → PETBP.
- Surface runoff at the mine site causes fluctuations in concentrations depending on the proportions of the catchment areas flowing into the facilities (e.g., RDS areas, disturbed areas, undisturbed areas). Parameter concentrations reach steady-state during the winter months because surface runoff is low.

Discharge from the PETBP may be directed to Hazeltine Creek in closure if distributed discharge can be achieved. This discharge may also include overflow and seepage from the TSF, as well as runoff from surrounding catchment areas of the PETBP, TSF, and CCS.

Predicted concentrations in the PETBP change from operations to closure and into early post-closure because of the staggered reclamation of the TSF beach and impoundment areas which are then assigned an undisturbed water quality once the areas are reclaimed. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the PETBP. In closure and post-closure, concentrations in the PETBP follow two patterns:

1) Decrease from operations because the statistical distributions assigned to undisturbed runoff water quality have lower concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., sulphate, nitrate and dissolved copper).

2) Increase from operations because the statistical distributions assigned to undisturbed runoff water quality have higher concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., total phosphorus, dissolved chromium and dissolved iron).

Predicted concentrations in the PETBP reach a steady state approximately 10 years after the start of post-closure when all mine site areas have been reclaimed.

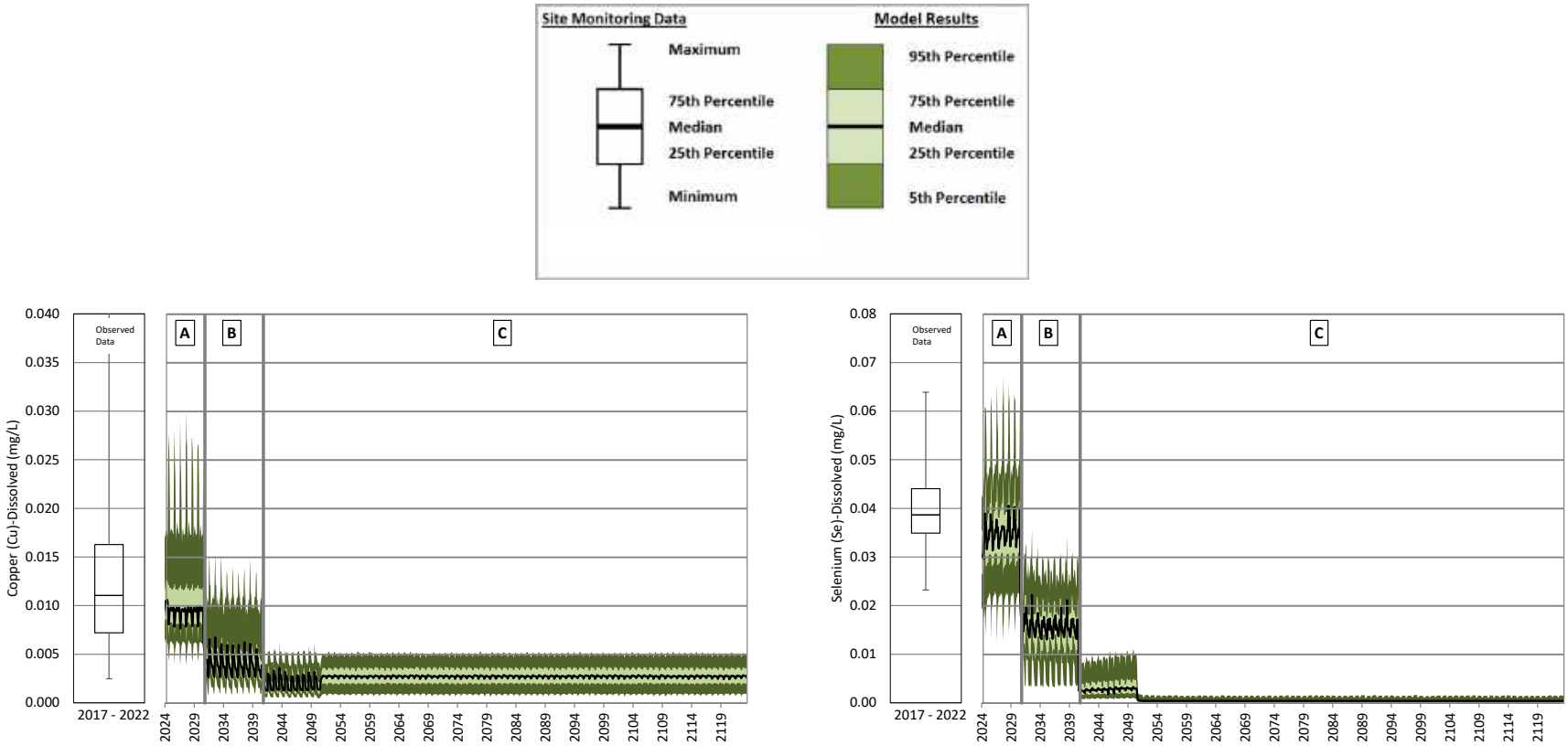
Table 43: Summary of Predicted Water Quality in Perimeter Embankment Till Borrow Pond

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 - March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	649	809	340	483	220	314	153	233
Total Dissolved Solids	mg/L	948	1,117	500	710	359	496	239	313
Major Ions									
Calcium	mg/L	208	250	102	144	61	84	41	55
Chloride	mg/L	17	20	4.6	11	6.6	10	5.1	8.0
Fluoride	mg/L	0.74	1.0	0.28	0.39	0.24	0.35	0.17	0.24
Magnesium	mg/L	31	45	21	30	16	26	12	23
Potassium	mg/L	16	19	3.7	6.8	3.8	5.0	2.7	3.5
Sodium	mg/L	63	75	23	32	24	32	18	22
Sulphate	mg/L	576	681	268	401	138	189	104	144
Nutrients									
Ammonia	mg/L (as N)	0.021	0.058	0.032	0.074	0.012	0.051	0.0081	0.038
Nitrate	mg/L (as N)	3.4	23	2.1	6.4	0.61	2.5	0.45	1.9
Nitrite	mg/L (as N)	0.055	0.069	0.017	0.032	0.0054	0.06	0.0041	0.045
Total Phosphorus	mg/L	0.014	0.029	0.015	0.025	0.017	0.026	0.022	0.033
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.048	0.2	0.07	0.3
Antimony	mg/L	0.0012	0.0016	0.00048	0.00095	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0028	0.0033	0.002	0.0032	0.00085	0.0012	0.00086	0.0016
Barium	mg/L	0.054	0.073	0.028	0.056	0.022	0.031	0.015	0.022
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.37	0.19	0.36	0.046	0.061	0.031	0.042
Cadmium	mg/L	0.00022	0.00041	0.000029	0.00014	0.000019	0.000079	0.000013	0.00006
Chromium	mg/L	0.00065	0.0007	0.00072	0.00082	0.00055	0.0013	0.00084	0.0017
Cobalt	mg/L	0.00064	0.0014	0.00036	0.00062	0.000083	0.00029	0.000058	0.00023
Copper	mg/L	0.02	0.19	0.016	0.17	0.004	0.0079	0.0032	0.007
Iron	mg/L	0.48	0.58	0.48	0.54	0.087	0.33	0.13	0.44
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.000019	0.000072	0.000016	0.0001
Lithium	mg/L	0.0095	0.012	0.0052	0.011	0.0027	0.0041	0.0017	0.0027
Manganese	mg/L	0.14	0.26	0.058	0.14	0.075	0.16	0.057	0.13
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Molybdenum	mg/L	0.24	0.28	0.089	0.16	0.045	0.071	0.034	0.054
Nickel	mg/L	0.0011	0.0021	0.001	0.0016	0.00058	0.0013	0.00087	0.0019
Selenium	mg/L	0.041	0.074	0.022	0.044	0.0034	0.011	0.0025	0.0083
Silver	mg/L	0.0000053	0.000013	0.0000053	0.000013	0.0000052	0.000015	0.0000062	0.000019
Strontium	mg/L	5.3	8.4	1.1	2.1	0.59	1.2	0.41	0.85
Thallium	mg/L	0.0000089	0.000014	0.0000049	0.0000058	0.0000051	0.0000052	0.000005	0.0000052

Table 43: Summary of Predicted Water Quality in Perimeter Embankment Till Borrow Pond

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 - March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Tin	mg/L	0.000049	0.00013	0.000051	0.00015	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.025	0.026	0.024	0.027	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0035	0.00087	0.0019	0.00084	0.0015	0.00055	0.0011
Vanadium	mg/L	0.0035	0.0039	0.0018	0.0027	0.00058	0.001	0.0007	0.0012
Zinc	mg/L	0.012	0.019	0.0069	0.011	0.002	0.0032	0.0017	0.0027
Dissolved Metals									
Aluminum	mg/L	0.017	0.047	0.019	0.067	0.02	0.084	0.042	0.18
Antimony	mg/L	0.0012	0.0014	0.00046	0.00081	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0025	0.003	0.0017	0.0029	0.00082	0.0011	0.00083	0.0015
Barium	mg/L	0.052	0.064	0.026	0.047	0.021	0.03	0.014	0.02
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.34	0.19	0.33	0.046	0.059	0.031	0.04
Cadmium	mg/L	0.00021	0.00036	0.000026	0.000091	0.000018	0.000071	0.000012	0.000053
Chromium	mg/L	0.00027	0.00031	0.00034	0.00044	0.00044	0.00077	0.00073	0.0011
Cobalt	mg/L	0.00036	0.0011	0.000078	0.00034	0.000083	0.00022	0.000058	0.00016
Copper	mg/L	0.012	0.03	0.0068	0.018	0.0036	0.0063	0.0029	0.0054
Iron	mg/L	0.036	0.14	0.04	0.097	0.043	0.14	0.089	0.26
Lead	mg/L	0.000025	0.00003	0.000024	0.000037	0.000019	0.000052	0.000016	0.000083
Lithium	mg/L	0.0093	0.011	0.005	0.0096	0.0027	0.004	0.0017	0.0026
Manganese	mg/L	0.12	0.24	0.037	0.12	0.071	0.14	0.054	0.11
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Molybdenum	mg/L	0.24	0.27	0.089	0.15	0.045	0.07	0.034	0.054
Nickel	mg/L	0.00056	0.0016	0.00046	0.001	0.00051	0.001	0.0008	0.0016
Selenium	mg/L	0.041	0.068	0.022	0.038	0.0033	0.011	0.0025	0.0082
Silicon	mg/L	6.5	8.1	6.9	8.0	5.2	6.7	5.9	8.1
Silver	mg/L	0.0000053	0.0000076	0.0000053	0.0000069	0.0000052	0.0000084	0.0000062	0.000012
Strontium	mg/L	5.3	8.1	1.1	1.8	0.59	1.2	0.4	0.83
Thallium	mg/L	0.0000089	0.000013	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Tin	mg/L	0.000049	0.000054	0.000051	0.000071	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.0066	0.0075	0.0056	0.0085	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0032	0.00085	0.0016	0.00084	0.0014	0.00055	0.0011
Vanadium	mg/L	0.0023	0.0028	0.00065	0.0015	0.00043	0.00062	0.00055	0.00085
Zinc	mg/L	0.0092	0.016	0.0043	0.0079	0.002	0.0032	0.0017	0.0027

(a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure.

Note(s): The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 30: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

4.4.6.2 Springer-Cariboo Pit

At closure, the PAG material from the Temporary NW PAG Stockpile will be placed in the Springer-Cariboo Pit, and a pit lake will form. The pit will fill passively with groundwater and surface runoff from the pit catchment area. The groundwater inflow to the pit is assumed to flow into the stored PAG material in closure and post-closure. The surface runoff includes runoff and seepage from North Bell RDS, East RDS, and the haul roads. These facilities will be reclaimed during closure. The pit lake is predicted to completely fill between 2059 (99.5th percentile of the 2000 water balance model simulations) and 2063 (mean of the 2000 water balance model simulations), at which point, overflow from the pit will discharge to Bootjack Lake.

Maximum of the daily median and maximum of the daily 95th percentile concentrations in the Springer-Cariboo Pit are presented in Table 43. Time series for predicted copper and selenium concentrations in the Springer-Cariboo Pit are presented in Figure 31. Peak concentrations for most parameters are predicted to occur during the closure period because:

- The PAG material in the Springer-Cariboo Pit contains pore water with a NAG Seep water quality.
- The groundwater inflow to the pit, which has a groundwater water quality (Table 24), is assumed to flow into the PAG material and displace the pore water upwards into the forming pit lake.
- The displacement of pore water from the PAG material into the pit lake causes pit lake concentrations to peak in closure.

The only parameters with predicted maximum concentrations greater in post-closure than closure are aluminum, chromium, iron, and lead. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to a greater proportion of the total inflows to the Springer-Cariboo pit.

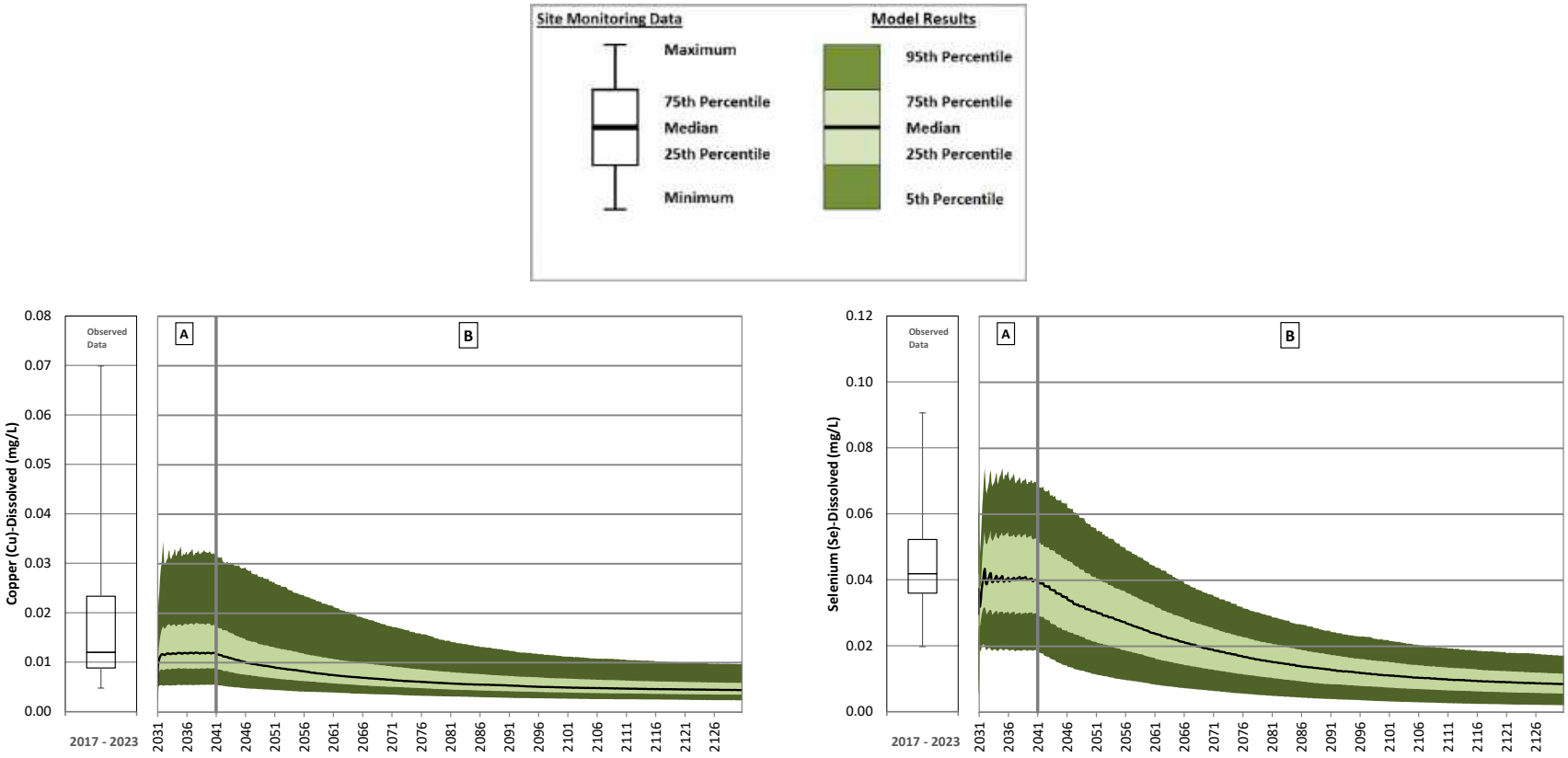
Table 44: Summary of Predicted Water Quality in Springer-Cariboo Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	539	781	580	822	533	739	448	629
Total Dissolved Solids	mg/L	798	1,177	858	1,238	796	1,139	659	954
Major Ions									
Calcium	mg/L	167	245	178	251	163	223	135	189
Chloride	mg/L	3.6	9.2	3.8	5.2	3.8	5.1	3.0	4.4
Fluoride	mg/L	0.21	0.29	0.29	0.41	0.28	0.39	0.21	0.31
Magnesium	mg/L	30	41	33	48	31	44	27	38
Potassium	mg/L	3.0	4.9	2.7	3.9	2.7	3.8	1.9	2.7
Sodium	mg/L	21	31	19	24	18	23	14	18
Sulphate	mg/L	417	686	475	687	432	628	343	510
Nutrients									
Ammonia	mg/L (as N)	0.023	0.053	0.024	0.04	0.024	0.039	0.015	0.023
Nitrate	mg/L (as N)	8.9	19	4.5	9.1	2.0	5.1	1.1	2.8
Nitrite	mg/L (as N)	0.011	0.022	0.011	0.022	0.010	0.02	0.0056	0.011
Total Phosphorus	mg/L	0.021	0.033	0.017	0.032	0.016	0.031	0.016	0.029
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.049	0.17	0.049	0.19
Antimony	mg/L	0.00035	0.00065	0.0005	0.00083	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0015	0.0025	0.0011	0.0014	0.00068	0.001	0.00062	0.00093
Barium	mg/L	0.044	0.078	0.038	0.057	0.034	0.046	0.027	0.038
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.3	0.097	0.17	0.069	0.093	0.051	0.072
Cadmium	mg/L	0.000029	0.00018	0.000046	0.00022	0.000041	0.00017	0.000034	0.00015
Chromium	mg/L	0.00065	0.00071	0.00063	0.00073	0.00042	0.00092	0.0005	0.0011
Cobalt	mg/L	0.00039	0.00073	0.00041	0.00092	0.00012	0.00067	0.000092	0.00059
Copper	mg/L	0.015	0.17	0.021	0.19	0.012	0.033	0.0095	0.028
Iron	mg/L	0.47	0.55	0.48	0.54	0.087	0.27	0.088	0.3
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000057	0.000023	0.000065
Lithium	mg/L	0.0038	0.0068	0.0042	0.0067	0.0039	0.0057	0.0028	0.0044
Manganese	mg/L	0.072	0.87	0.061	0.27	0.031	0.22	0.024	0.19
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Molybdenum	mg/L	0.081	0.15	0.1	0.16	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00098	0.0012	0.001	0.0022	0.00059	0.0019	0.00061	0.0018
Selenium	mg/L	0.038	0.077	0.044	0.081	0.04	0.069	0.031	0.056
Silver	mg/L	0.000005	0.000012	0.0000061	0.000014	0.0000061	0.000015	0.000006	0.000015
Strontium	mg/L	0.98	1.7	1.9	3.4	1.8	2.9	1.4	2.4
Thallium	mg/L	0.0000048	0.0000056	0.0000051	0.0000059	0.0000051	0.0000052	0.000005	0.0000051
Tin	mg/L	0.000049	0.00014	0.000051	0.00013	0.000051	0.000052	0.00005	0.000051

Table 44: Summary of Predicted Water Quality in Springer-Cariboo Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Titanium	mg/L	0.024	0.026	0.026	0.027	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00093	0.0017	0.0012	0.0035	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.0018	0.0024	0.002	0.0024	0.00097	0.0015	0.00082	0.0013
Zinc	mg/L	0.0059	0.0079	0.0072	0.013	0.0039	0.0092	0.003	0.0075
Dissolved Metals									
Aluminum	mg/L	0.013	0.042	0.017	0.07	0.021	0.057	0.021	0.077
Antimony	mg/L	0.00033	0.00051	0.00048	0.00069	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0012	0.0022	0.00084	0.0012	0.00065	0.00091	0.00059	0.00083
Barium	mg/L	0.042	0.069	0.036	0.048	0.034	0.045	0.027	0.036
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.27	0.093	0.14	0.069	0.091	0.051	0.07
Cadmium	mg/L	0.000027	0.00013	0.000044	0.00018	0.00004	0.00016	0.000032	0.00014
Chromium	mg/L	0.00027	0.00032	0.00024	0.00034	0.00031	0.0004	0.00039	0.00056
Cobalt	mg/L	0.00011	0.00045	0.00013	0.00064	0.00012	0.0006	0.000092	0.00051
Copper	mg/L	0.0063	0.011	0.012	0.035	0.012	0.032	0.0091	0.026
Iron	mg/L	0.027	0.11	0.033	0.095	0.043	0.087	0.044	0.11
Lead	mg/L	0.000024	0.000028	0.000026	0.000031	0.000025	0.000037	0.000023	0.000045
Lithium	mg/L	0.0036	0.0058	0.004	0.0057	0.0039	0.0056	0.0028	0.0043
Manganese	mg/L	0.051	0.85	0.04	0.25	0.027	0.2	0.02	0.18
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Molybdenum	mg/L	0.081	0.14	0.1	0.15	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00043	0.0007	0.00049	0.0016	0.00052	0.0015	0.00054	0.0015
Selenium	mg/L	0.038	0.071	0.044	0.075	0.04	0.069	0.031	0.056
Silicon	mg/L	6.7	7.7	5.9	6.7	5.7	6.7	5.5	6.4
Silver	mg/L	0.000005	0.0000059	0.0000061	0.0000084	0.0000061	0.0000081	0.000006	0.0000079
Strontium	mg/L	0.96	1.3	1.9	3.1	1.8	2.8	1.4	2.3
Thallium	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Tin	mg/L	0.000049	0.00006	0.000051	0.000053	0.000051	0.000052	0.00005	0.000051
Titanium	mg/L	0.0055	0.0072	0.0074	0.0085	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00091	0.0014	0.0011	0.0032	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.00059	0.0012	0.00083	0.0012	0.00082	0.0011	0.00067	0.00091
Zinc	mg/L	0.0032	0.0053	0.0045	0.01	0.0039	0.0092	0.003	0.0075

(a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure.

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 31: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Springer-Cariboo Pit – Operations, Closure and Post-closure

4.4.6.3 Wight Pit

Towards the last year of operation, the TSF water volume will be progressively reduced to a maximum of 0.25 M-m^3. During that time and continuing into closure, the Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for storage and will be allowed to fill. A pit lake will form in Wight Pit as the mined-out pit refills passively with groundwater, seepage from Boundary Pit, surface runoff from pit walls, disturbed areas, and haul roads in the Wight Pit catchment. Wight Pit is projected to start overflowing in 2048 under the mean results and in 2046 under 99.5th percentile, at which point overflow will be directed to Polley Lake. Reclamation of the disturbed areas and haul roads is assumed to occur during closure. Runoff water quality from these facilities is predicted to return to undisturbed water quality.

Maximum of the daily median and maximum of the daily 95th percentile concentrations in Wight Pit are presented in Table 44. Time series for predicted copper and selenium concentrations in the Wight Pit are presented in Figure 32.

Predicted concentrations of parameters in Wight Pit are generally stable 10 years after the start of post-closure. Concentrations of most parameters decrease slightly through early post-closure after the pit has filled and is flushed with runoff from reclaimed disturbed areas and haul roads in the Wight Pit catchment area.

Some parameters are predicted to have higher concentrations in post-closure than closure (for example, dissolved copper). The increase in concentration for these parameters is caused by either:

a) Higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Wight Pit.

b) Increased proportions of the total inflows to Wight Pit from pit wall runoff that is assigned the Wight Pit wall runoff during post-closure.

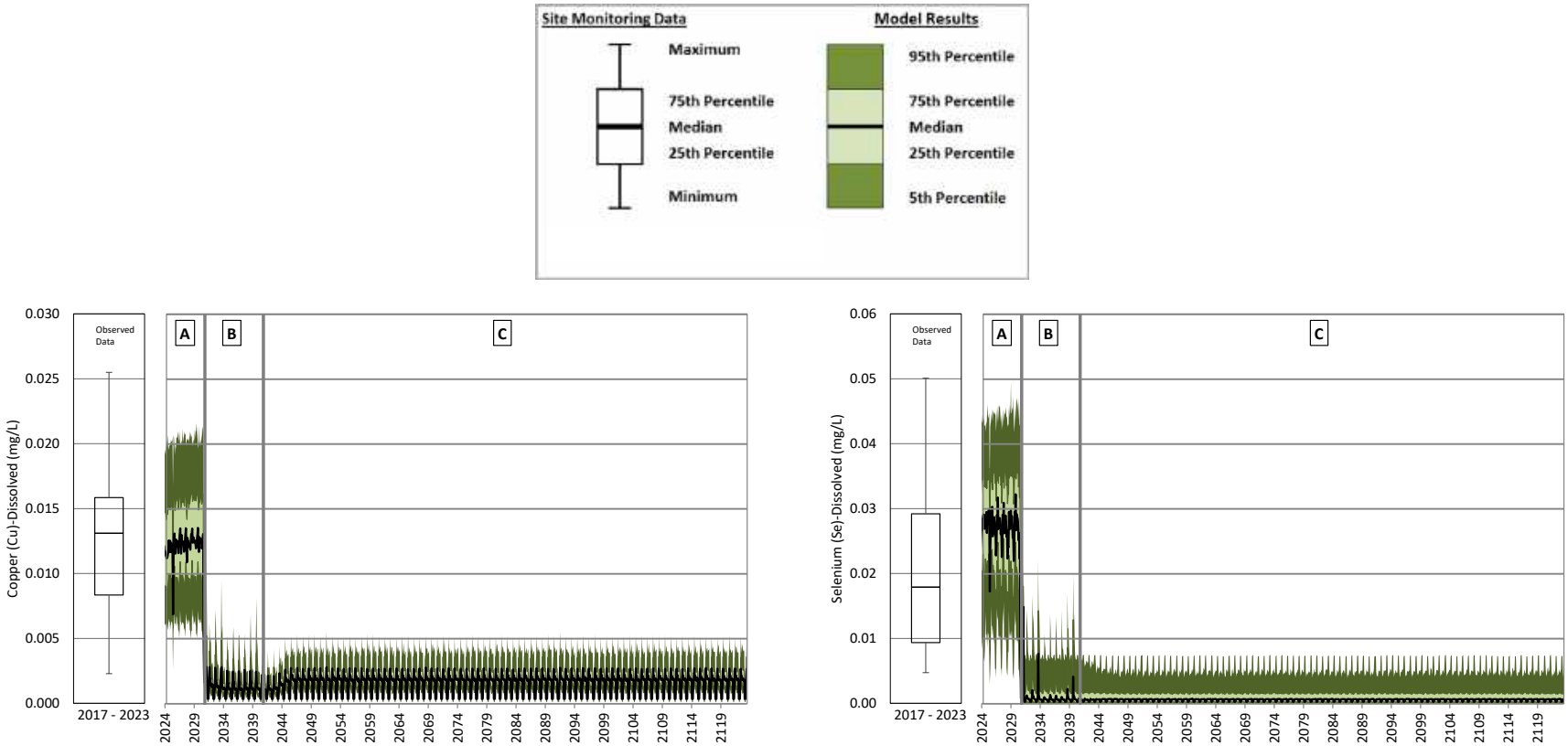
Table 45: Summary of Predicted Water Quality in Wight Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	730	896	182	379	159	323	159	323
Total Dissolved Solids	mg/L	1,080	1,242	251	570	216	439	215	440
Major Ions									
Calcium	mg/L	238	294	54	114	47	94	47	94
Chloride	mg/L	9.6	22	2.9	16	2.4	16	2.4	16
Fluoride	mg/L	0.76	1.1	0.28	0.49	0.28	0.49	0.28	0.49
Magnesium	mg/L	33	40	11	23	9.8	22	9.8	22
Potassium	mg/L	9.0	21	0.59	6.0	0.55	0.83	0.46	0.83
Sodium	mg/L	47	84	20	31	20	31	20	31
Sulphate	mg/L	646	743	101	302	93	187	93	188
Nutrients									
Ammonia	mg/L (as N)	0.016	0.07	0.0031	0.056	0.0024	0.014	0.0022	0.014
Nitrate	mg/L (as N)	1.6	5.4	0.23	3.8	0.08	1.6	0.072	1.6
Nitrite	mg/L (as N)	0.031	0.071	0.0011	0.029	0.0004	0.019	0.00038	0.019
Total Phosphorus	mg/L	0.013	0.018	0.014	0.027	0.014	0.027	0.013	0.027
Total Metals									
Aluminum	mg/L	0.46	0.47	0.46	0.5	0.036	0.15	0.036	0.15
Antimony	mg/L	0.0011	0.0018	0.000071	0.00084	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.002	0.0035	0.0027	0.0047	0.0024	0.0045	0.0024	0.0045
Barium	mg/L	0.05	0.074	0.021	0.07	0.017	0.063	0.017	0.063
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.45	0.28	0.53	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00052	0.000011	0.000089	0.0000079	0.000028	0.0000075	0.000028
Chromium	mg/L	0.00063	0.00065	0.00066	0.00076	0.00041	0.00089	0.00037	0.00085
Cobalt	mg/L	0.00072	0.0018	0.00034	0.00044	0.000055	0.00016	0.000052	0.00015
Copper	mg/L	0.022	0.18	0.012	0.17	0.0031	0.007	0.0031	0.0071
Iron	mg/L	0.46	0.62	0.46	0.53	0.065	0.24	0.065	0.24
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000052	0.000025	0.000048
Lithium	mg/L	0.009	0.013	0.0035	0.009	0.0033	0.0046	0.0033	0.0046
Manganese	mg/L	0.16	0.31	0.048	0.078	0.03	0.074	0.03	0.073
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.19	0.3	0.031	0.11	0.031	0.047	0.031	0.047
Nickel	mg/L	0.0012	0.0016	0.00085	0.0014	0.0004	0.0011	0.0004	0.0011
Selenium	mg/L	0.03	0.052	0.0019	0.03	0.00081	0.0077	0.00076	0.0077
Silver	mg/L	0.000005	0.000011	0.0000051	0.000012	0.000005	0.000012	0.000005	0.000012
Strontium	mg/L	6.6	11	0.25	1.6	0.18	0.61	0.15	0.61
Thallium	mg/L	0.00001	0.000017	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.000053	0.00017	0.000053	0.000085	0.000053	0.000086

Table 45: Summary of Predicted Water Quality in Wight Pit

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Titanium	mg/L	0.024	0.026	0.024	0.027	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0041	0.00036	0.0014	0.00027	0.001	0.00023	0.001
Vanadium	mg/L	0.0028	0.0041	0.0016	0.0034	0.00048	0.0026	0.00048	0.0026
Zinc	mg/L	0.014	0.024	0.0065	0.013	0.003	0.0099	0.0031	0.0099
Dissolved Metals									
Aluminum	mg/L	0.0048	0.017	0.0083	0.045	0.0079	0.033	0.0079	0.033
Antimony	mg/L	0.0011	0.0016	0.000051	0.0007	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.0017	0.0032	0.0024	0.0044	0.0024	0.0044	0.0024	0.0044
Barium	mg/L	0.048	0.065	0.019	0.061	0.017	0.061	0.017	0.061
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.42	0.28	0.5	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00048	0.0000086	0.000044	0.0000067	0.00002	0.0000063	0.00002
Chromium	mg/L	0.00025	0.00026	0.00028	0.00037	0.0003	0.00037	0.00026	0.00033
Cobalt	mg/L	0.00044	0.0015	0.000056	0.00016	0.000055	0.00008	0.000052	0.000078
Copper	mg/L	0.013	0.021	0.0032	0.011	0.0028	0.0054	0.0028	0.0055
Iron	mg/L	0.014	0.18	0.02	0.084	0.021	0.061	0.021	0.059
Lead	mg/L	0.000025	0.000025	0.000025	0.00003	0.000025	0.000032	0.000025	0.000028
Lithium	mg/L	0.0088	0.012	0.0033	0.008	0.0033	0.0044	0.0033	0.0044
Manganese	mg/L	0.14	0.29	0.027	0.057	0.027	0.057	0.027	0.057
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.19	0.28	0.031	0.098	0.031	0.046	0.03	0.047
Nickel	mg/L	0.00064	0.0011	0.0003	0.00081	0.00033	0.00081	0.00033	0.00081
Selenium	mg/L	0.03	0.046	0.0019	0.024	0.00079	0.0076	0.00074	0.0076
Silicon	mg/L	6.8	9.0	7.8	9.4	7.8	9.4	7.8	9.4
Silver	mg/L	0.000005	0.0000054	0.0000051	0.0000064	0.000005	0.0000059	0.000005	0.000005
Strontium	mg/L	6.6	10	0.24	1.3	0.17	0.59	0.15	0.59
Thallium	mg/L	0.00001	0.000016	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.000053	0.000086	0.000053	0.000085	0.000053	0.000086
Titanium	mg/L	0.0054	0.007	0.005	0.0078	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0038	0.00033	0.0012	0.00027	0.00096	0.00023	0.00096
Vanadium	mg/L	0.0016	0.003	0.00042	0.0022	0.00033	0.0022	0.00033	0.0022
Zinc	mg/L	0.012	0.021	0.0038	0.0099	0.003	0.0099	0.0031	0.0099

(a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure.

Note(s): The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 32: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Wight Pit – Operations, Closure and Post-closure

4.4.6.4 Long Ditch

In closure, the Long Ditch continues to receive flow from the SERDS Ditch and overflow from Bootjack Creek Sump (via SERDS Ditch). Discharge from the Long Ditch is assumed to be directed to Polley Lake during post-closure. The combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek includes the SERDS RDS, NEZ RDS, and East RDS along with haul roads, disturbed areas, and undisturbed catchment area. Tailings co-disposal to the SERDS location will include a soil cover during closure that will remediate runoff from the tailings deposition area to that runs off to SERDS Ditch. However, seepage water quality from the SERDS tailings are assumed to remain unchanged through closure and post-closure. The proportion of seepage assigned tailings water quality is calculated based on the total proportions of tailings relative to waste rock deposited (3.5% tailings and 96.5% waste rock; (MPMC 2022b).

Maximum of the daily median and maximum of the daily 95th percentile concentrations in Long Ditch are presented in Table 45. Time series for predicted copper and selenium concentrations in the Long Ditch are presented in Figure 33.

Peak concentrations in Long Ditch are predicted to occur during operations, representing runoff and seepage from un-reclaimed RDS areas within the combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek. These facilities are reclaimed throughout closure, at which point runoff is assigned undisturbed water quality. Most parameter concentrations in Long Ditch are predicted to decrease through closure, reaching steady state conditions 10 years after the start of post-closure.

Seasonal peak concentrations in winter are driven by seepage from the RDS area within the watershed which is assigned the NAG water quality in perpetuity. During winter months, when precipitation occurs as snowfall, RDS seepage represents a higher proportion of the total flow to the Long Ditch and causes concentrations to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Bootjack Creek Sump, SERDS Ditch, and Long Ditch which causes concentrations of some parameters, such as aluminum, to increase.

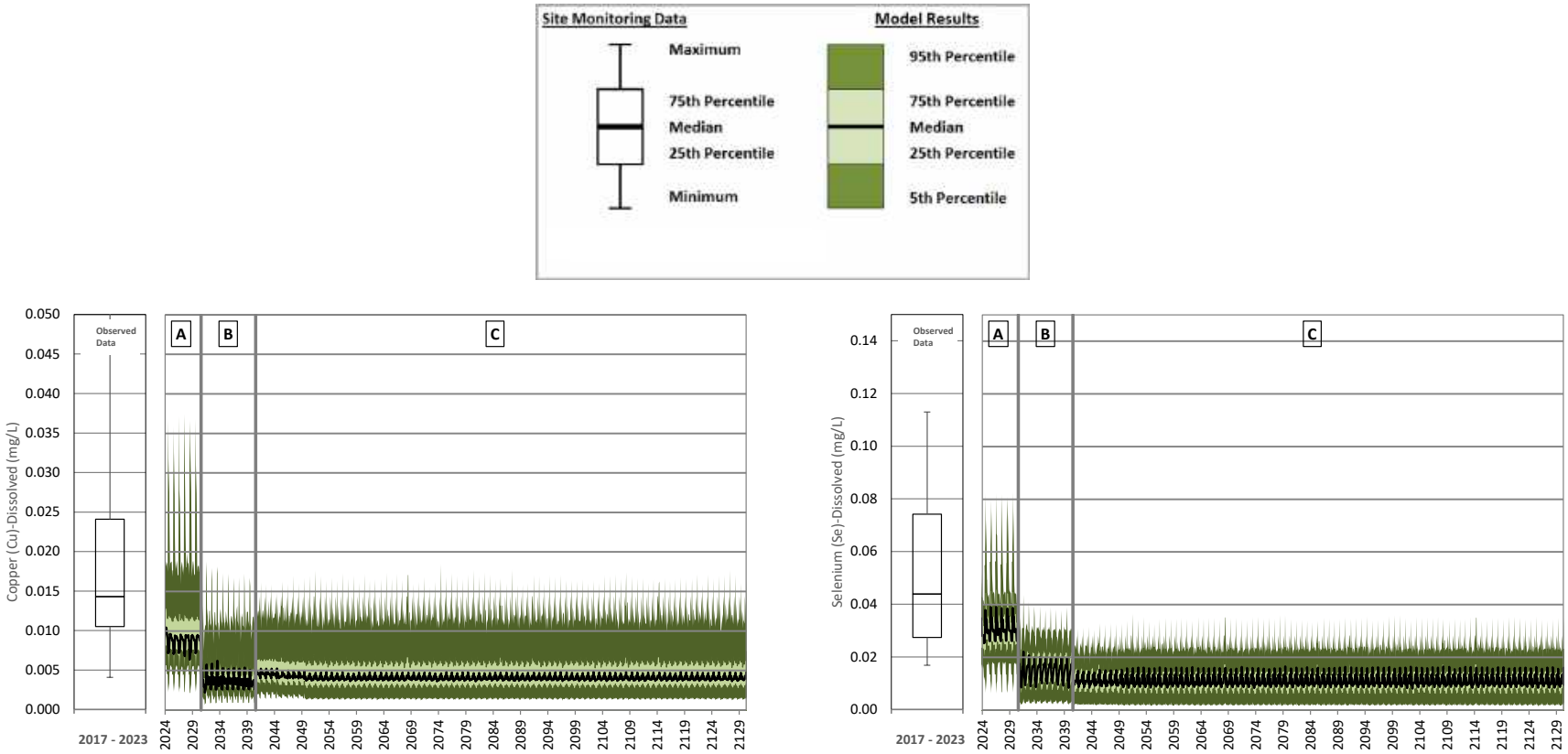
Table 46: Summary of Predicted Water Quality in Long Ditch

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	676	873	385	570	330	503	339	510
Total Dissolved Solids	mg/L	963	1,327	554	826	465	709	479	730
Major Ions									
Calcium	mg/L	216	263	116	173	92	137	95	139
Chloride	mg/L	17	25	2.7	12	3.0	8.9	3.1	9.0
Fluoride	mg/L	0.67	0.97	0.25	0.4	0.14	0.25	0.14	0.26
Magnesium	mg/L	33	52	23	34	24	39	25	39
Potassium	mg/L	16	23	1.0	4.8	1.4	1.9	1.4	1.9
Sodium	mg/L	65	88	18	27	10	15	10	15
Sulphate	mg/L	569	728	281	437	191	317	195	321
Nutrients									
Ammonia	mg/L (as N)	0.02	0.059	0.0044	0.044	0.0063	0.012	0.0063	0.012
Nitrate	mg/L (as N)	3.5	33	0.53	7.1	0.36	3.7	0.37	3.9
Nitrite	mg/L (as N)	0.056	0.081	0.0014	0.023	0.00084	0.0019	0.00085	0.0019
Total Phosphorus	mg/L	0.014	0.034	0.016	0.026	0.025	0.037	0.025	0.037
Total Metals									
Aluminum	mg/L	0.47	0.5	0.48	0.54	0.07	0.31	0.069	0.31
Antimony	mg/L	0.0012	0.0018	0.00012	0.00071	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0027	0.0037	0.002	0.0034	0.00095	0.0017	0.00096	0.0017
Barium	mg/L	0.052	0.076	0.023	0.056	0.017	0.025	0.017	0.026
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.4	0.2	0.41	0.03	0.047	0.03	0.048
Cadmium	mg/L	0.00024	0.00045	0.000028	0.00016	0.000024	0.0001	0.000025	0.00011
Chromium	mg/L	0.00064	0.00069	0.00075	0.00091	0.00088	0.0017	0.00088	0.0017
Cobalt	mg/L	0.00067	0.0015	0.00034	0.00072	0.000071	0.00044	0.000072	0.00046
Copper	mg/L	0.02	0.19	0.015	0.18	0.0056	0.019	0.0052	0.02
Iron	mg/L	0.48	0.6	0.5	0.56	0.14	0.45	0.14	0.46
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.00002	0.00011	0.000019	0.00011
Lithium	mg/L	0.0083	0.013	0.003	0.0074	0.0022	0.0037	0.0022	0.0037
Manganese	mg/L	0.15	0.3	0.049	0.18	0.02	0.14	0.02	0.15
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Molybdenum	mg/L	0.22	0.3	0.05	0.1	0.032	0.061	0.032	0.062
Nickel	mg/L	0.0011	0.0025	0.0011	0.0019	0.00098	0.0021	0.00098	0.0021
Selenium	mg/L	0.039	0.089	0.023	0.053	0.016	0.034	0.017	0.037
Silver	mg/L	0.0000054	0.000014	0.0000056	0.000014	0.0000071	0.00002	0.0000072	0.00002
Strontium	mg/L	5.7	9.2	1.1	2.3	0.97	1.7	0.97	1.7
Thallium	mg/L	0.0000094	0.000015	0.0000049	0.0000058	0.0000057	0.0000057	0.0000057	0.0000058
Tin	mg/L	0.000049	0.00014	0.000051	0.00015	0.000057	0.000057	0.000057	0.000058

Table 46: Summary of Predicted Water Quality in Long Ditch

Parameter	Units	Operations Period (January 2024 – March 2031)		Closure (April 2031 – March 2041)		Early Post-closure (April 2041 – March 2051)		Long Term Post-closure (April 2051 – April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Total Metals (cont'd)									
Titanium	mg/L	0.026	0.026	0.025	0.026	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0037	0.00064	0.0022	0.00088	0.002	0.00089	0.0022
Vanadium	mg/L	0.0035	0.0044	0.0017	0.0028	0.00075	0.0013	0.00075	0.0013
Zinc	mg/L	0.013	0.021	0.0073	0.012	0.0029	0.0056	0.0012	0.0049
Dissolved Metals									
Aluminum	mg/L	0.016	0.046	0.025	0.08	0.042	0.19	0.041	0.19
Antimony	mg/L	0.0012	0.0017	0.0001	0.00057	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0025	0.0034	0.0017	0.0032	0.00092	0.0016	0.00093	0.0016
Barium	mg/L	0.05	0.067	0.021	0.048	0.016	0.024	0.017	0.025
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.37	0.19	0.38	0.03	0.045	0.03	0.046
Cadmium	mg/L	0.00024	0.0004	0.000025	0.00012	0.000023	0.000096	0.000024	0.00011
Chromium	mg/L	0.00026	0.00031	0.00037	0.00053	0.00077	0.0012	0.00077	0.0012
Cobalt	mg/L	0.00039	0.0013	0.000061	0.00044	0.000071	0.00036	0.000072	0.00038
Copper	mg/L	0.012	0.038	0.0065	0.021	0.0053	0.017	0.0049	0.019
Iron	mg/L	0.037	0.15	0.051	0.12	0.095	0.27	0.095	0.27
Lead	mg/L	0.000024	0.000029	0.000024	0.000043	0.00002	0.00009	0.000019	0.00009
Lithium	mg/L	0.0081	0.012	0.0028	0.0064	0.0022	0.0035	0.0022	0.0036
Manganese	mg/L	0.13	0.27	0.028	0.16	0.016	0.12	0.016	0.13
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Molybdenum	mg/L	0.22	0.29	0.049	0.091	0.032	0.061	0.032	0.061
Nickel	mg/L	0.00058	0.0019	0.00051	0.0013	0.00091	0.0018	0.00091	0.0018
Selenium	mg/L	0.039	0.083	0.023	0.047	0.016	0.034	0.017	0.037
Silicon	mg/L	6.7	8.5	7.0	8.2	6.7	9.1	6.7	9.1
Silver	mg/L	0.0000054	0.0000084	0.0000056	0.0000078	0.0000071	0.000014	0.0000072	0.000014
Strontium	mg/L	5.6	8.8	1.1	2.0	0.97	1.6	0.97	1.7
Thallium	mg/L	0.0000094	0.000014	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Tin	mg/L	0.000049	0.000055	0.000051	0.000073	0.000057	0.000057	0.000057	0.000058
Titanium	mg/L	0.0068	0.0076	0.0059	0.0074	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0034	0.00061	0.0019	0.00088	0.0019	0.00089	0.0021
Vanadium	mg/L	0.0023	0.0032	0.00047	0.0016	0.0006	0.00092	0.0006	0.00092
Zinc	mg/L	0.01	0.018	0.0046	0.009	0.0029	0.0056	0.0012	0.0049

(a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure.

Note(s): The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 33: Predicted Dissolved Copper and Dissolved Selenium Concentrations in the Long Ditch – Operations, Closure and Post-closure

4.5 Description of Discharge Options Inventory

4.5.1 Restoration of Watercourses

There are few ecologically productive watercourses that have been changed as a result of mining activity. Hazeltine Creek and a lower portion of Edney Creek were changed extensively as a result of the August 2014 foundational failure and resulting TSF breach. The restoration of those watercourses began to take place as soon as safe access was possible following that breach. Historical changes to the natural drainage patterns occurred well before the Mount Polley Mine was developed. Bootjack Creek drainage and Hazeltine Creek drainages were modified to support hydraulic placer mining.

The primary driver behind watercourse restoration at Mount Polley is aquatic productivity / productive capacity of aquatic habitats, rather than the use of a watercourse as a discharge conveyance system [1]. However, some amount of flows within Hazeltine Creek could potentially augment the amount of habitat available, particularly during seasonally dry periods (e.g., August). Currently, the weir at the confluence of Hazeltine Creek and Polley Lake is being used to mute the peak flows and to provide flow nourishment to Hazeltine Creek.

Other streams affected by mine development include Bootjack Creek and Mine Drainage Creek. MPMC has determined that Bootjack Creek cannot maintain its current alignment while still functioning as fish habitat. Impacts to Bootjack Creek will be addressed through the development of offset habitat in accordance with Fisheries and Oceans Canada's fish habitat policy. Mine Drainage Creek is currently captured as contact water in Mine Drainage Creek sump and pumped to the west ditch for management and treatment. However, rainbow trout spawning was recorded previously in the lower reach of the creek (~25 m upstream of Bootjack Lake), and restoration of this watercourse could be considered as part of future planning.

Should additional drainages need to be constructed at closure, they will be constructed with the objective of developing those watercourses as aquatic habitats where feasible. Feasibility evaluations will include the stream gradient, access and connectivity to other habitats, habitat enhancement objectives, stream bed characteristics (i.e., the stream bed must be capable of maintaining surface water) and the cost to construct as a habitat. Where it is not feasible to construct a drainage feature as an aquatic habitat, hydraulic engineering design principles (Chow 1959) will be used to provide drainage features that are built to sustain themselves without maintenance following closure. The details of such drainages will be identified as closure designs are developed in advance of the mine going into closure.

4.5.2 Watercourses Available to Receive Discharge

Over 2015 and 2016, Golder assessed the capacity of the following receiving environments around the Mine to receive treated effluent discharge (Golder 2015a, Golder 2016b, Appendix G of the TAR – Golder 2016g):

- Polly Lake outlet
- Hazeltine Creek at the mouth
- Bootjack Lake outlet
- Edney Creek at the mouth
- Quesnel River at Likely

[1] Note: Prior to Hazeltine Creek being made accessible to fish, it was temporarily used to convey treated water flows to Quesnel Lake while the current pipeline and diffuser were being constructed.

Based on the far-field volumetric dilution values for the mean seven-day low flow condition, concentrations of constituents in the treated effluent discharge were calculated such that concentrations at the potential effluent discharge locations would meet WQGs. The concentrations of constituents in the treated effluent discharge to meet WQGs were compared to monitoring data at station HAD-3 to determine if additional water treatment would be required.

Based on median concentrations from monitoring data, additional water treatment would be required to meet WQGs for several constituents (sulphate, nitrate, nitrite, dissolved aluminum, dissolved copper, and total selenium) if considering discharge to the receiving environments listed above.

In Golder (2016g), two potential discharge locations were presented for long-term discharge at the mine in operations:

- Pipeline to Quesnel River
- Pipeline to Quesnel Lake

Based on the hydrologic and chemical assimilative capacities of potential receiving environments, a pipeline to Quesnel Lake was ranked to provide the best assimilative capacity for discharge from the Mount Polley Mine during operations. A pipeline from the WTP to Quesnel Lake was constructed, including submerged diffuser at the pipeline terminus, to convey treated mine contact water to this selected receiving environment. This discharge location remains as the single permitted discharge location for the mine, which is anticipated to continue through operations and potentially into closure/post-closure.

A detailed description of this receiving environment assessment and results are provided in the 2020 Water Management Plan (Golder 2020e) and not duplicated in full here.

4.6 Water Treatment

This section provides details regarding water treatment for the Mine to identify the design basis for current (operations) and potential future (closure/post-closure) water treatment options. This section also provides updates on the progression of water treatment technology development.

4.6.1 Design Basis

The flows and associated water quality that require treatment during the operational and closure periods are described in this section and form the design basis for the current treatment system and the design basis for identification of water treatment technologies for closure.

Flow Rate

Operations

The treatment flow rate of the existing WTP varies between approximately 0.21 m^3/s and 0.31 m^3/s, pending operator control of the plant. The allowable maximum annual discharge volume from site is currently 10.59 M-m^3/year (average of 0.33 m^3/s), as per EMA Permit 11678. The design capacity of the WTP effluent pipeline and diffusers is 0.6 m^3/s (equivalent to the permitted maximum daily instantaneous rate).

The SWWBM has assumed a maximum WTP treatment capacity of 0.29 m^3/s for modelling purposes and this flow rate results in sufficient treatment of all contact water required for discharge from Site for the predicted operations period (WSP 2023a). The SWWBM has predicted that the 50th percentile average annual treated water discharge from Site is 3.72 M-m^3 during operations (average of 0.12 m^3/s). Stochastic results from the SWWBM were also used to predict 90th percentile annual volume requirements for treated water discharge during operation, resulting in an annual average volume of 4.64 M-m^3 (average of 0.15 m^3/s) Given these volume predictions and the modelled WTP capacity, the treatment capacity of the existing WTP has been assumed sufficient for the remainder of the LOM operations period.

Closure and Post-closure

For closure and post-closure, the SWWBM was again used to predict annual treatment volumes for the period of 2031 to 2131. For the closure period of 2031 to 2041, results showed an annual average treatment volume of approximately 5.50 M-m^3 for 50th percentile climate conditions and 6.53 M-m^3 for the 90th percentile climate conditions, which results in an average treatment flow rate of 0.17 m^3/s and 0.21 m^3/s, respectively (WSP 2023a). For the post-closure period of 2041 to 2131, results showed an annual average treatment volume of approximately 0.80 M-m^3 for 50th percentile climate conditions and 1.16 M-m^3 for the 90th percentile climate conditions, which results in an average treatment flow rates of 0.03 m^3/s and 0.04 m^3/s, respectively.
The treatment flow rate design basis is selected as the 90th percentile average requirement of 0.21 m^3/s during closure and 0.04 m^3/s during post-closure.

The combined Springer-Cariboo Pit and Wight Pit are both modelled to become pit lakes during post-closure and are assumed to fill and overflow directly to the environment without treatment. Overflow is predicted to occur between 2047 and 2049 for Wight Pit and between 2055 and 2058 for Springer-Cariboo pit. Annual overflow volume from these pits is predicted to be 0.62 M-m^3 for Wight Pit and 1.05 M-m^3 for Springer-Cariboo Pit for the 90th percentile climate scenario. Water quality and treatment requirements for pit overflow water is discussed in the closure/post-closure water quality section. If overflow from both pits is included in the annual treatment volume, then the design basis for water treatment during post-closure would increase to 0.09 m^3/s.

Water Quality and Targets

Operations

The SWWBM was used to predict water quality at the PETBP during operations (the current influent source to the WTP). Table 46 provides a list of constituents of interest determined following review of modelled water quality predictions during operations (WSP 2023c). Table 46 compares the current EMA Permit 11678 WTP discharge limits with the predicted 95th percentile parameter concentrations in the PETBP.

Table 47: Predicted Water Quality Concentrations and Permit Limits for Treatment During Operations

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations
Major Ions			
Total Sulphate	mg/L	1,100	681
Nutrients			
Total Ammonia	mg/L (as N)	1.30	0.06
Total Nitrate	mg/L (as N)	34	23
Total Phosphorus	mg/L	0.09	0.03

Table 47: Predicted Water Quality Concentrations and Permit Limits for Treatment During Operations

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations
Total Metals			
Arsenic	mg/L	0.028	0.003
Chromium	mg/L	0.004	0.001
Copper	mg/L	0.033	**0.190**
Iron	mg/L	1.00	0.58
Manganese	mg/L	3.4	0.26
Molybdenum	mg/L	0.36	0.28
Selenium	mg/L	0.075	0.074
Zinc	mg/L	0.059	0.019
Dissolved Metals			
Cadmium	mg/L	0.00034	**0.00036**
Copper	mg/L	No EMA Permit Limit	0.030

Note(s): **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to the PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter. The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Table 46 shows that total copper and dissolved cadmium are predicted to require treatment during operations. Total Suspended Solids (TSS), not listed in Table 46, is also required for treatment during operations. The existing WTP has been shown to effectively treat TSS for historical operating conditions (discussed in more detail in Golder 2022b). WTP influent and effluent quality were assessed over six years between 2016 and 2021, showing effluent TSS consistently below permit limit (Golder 2022b).

The existing WTP has been able to effectively treat total copper for the majority of historic operating conditions, as demonstrated in Figure 34, which shows total copper concentration in the WTP influent and effluent over the period of 2016 through 2023. Also shown in the figure is the total copper EMA permit limit for the WTP effluent (0.033 mg/L). The SWWQM predicted maximum of the 95th percentile concentration for total copper of 0.190 mg/L in the WTP influent shown in Table 46 is a conservative prediction and the average WTP influent total copper illustrated in Figure 34 is significantly lower at a value of 0.025 mg/L (between 2016 and 2023). Figure 34 shows that the existing WTP is able to maintain WTP effluent total copper below the permit limit with only occasional occurrences of total copper above the permit limit. These occurrences are managed by halting WTP discharge and temporary WTP recirculation until copper concentration is below permit limit. This process is managed through MPMC's Trigger Response Plan, further discussed in Golder 2022b.

There is one instance of high historic total copper that is not seen on Figure 34 due to the axis limits in the figure. In May 2018, specific conditions occurred on-site to produce a WTP influent total copper concentration of 0.933 mg/L. The Trigger Response Plan was initiated for this occurrence to manage the high copper instance. This particular event is an outlier occurrence and is further discussed in Appendix B (Section 3.1) when discussing total copper model predictions.

A full record of the tabulated Figure 34 monitoring data is not provided due to the number of records; however, statistics of the monitoring data are provided in Table 48.

The EMA Permit also includes a Numeric Performance Metric (NPM) for total copper at a value of 0.012 mg/L (annual average). The existing WTP is able to meet this NPM, and the annual average of total copper in the WTP effluent during 2022 and 2023 was 0.012 mg/L and 0.010 mg/L, respectively.

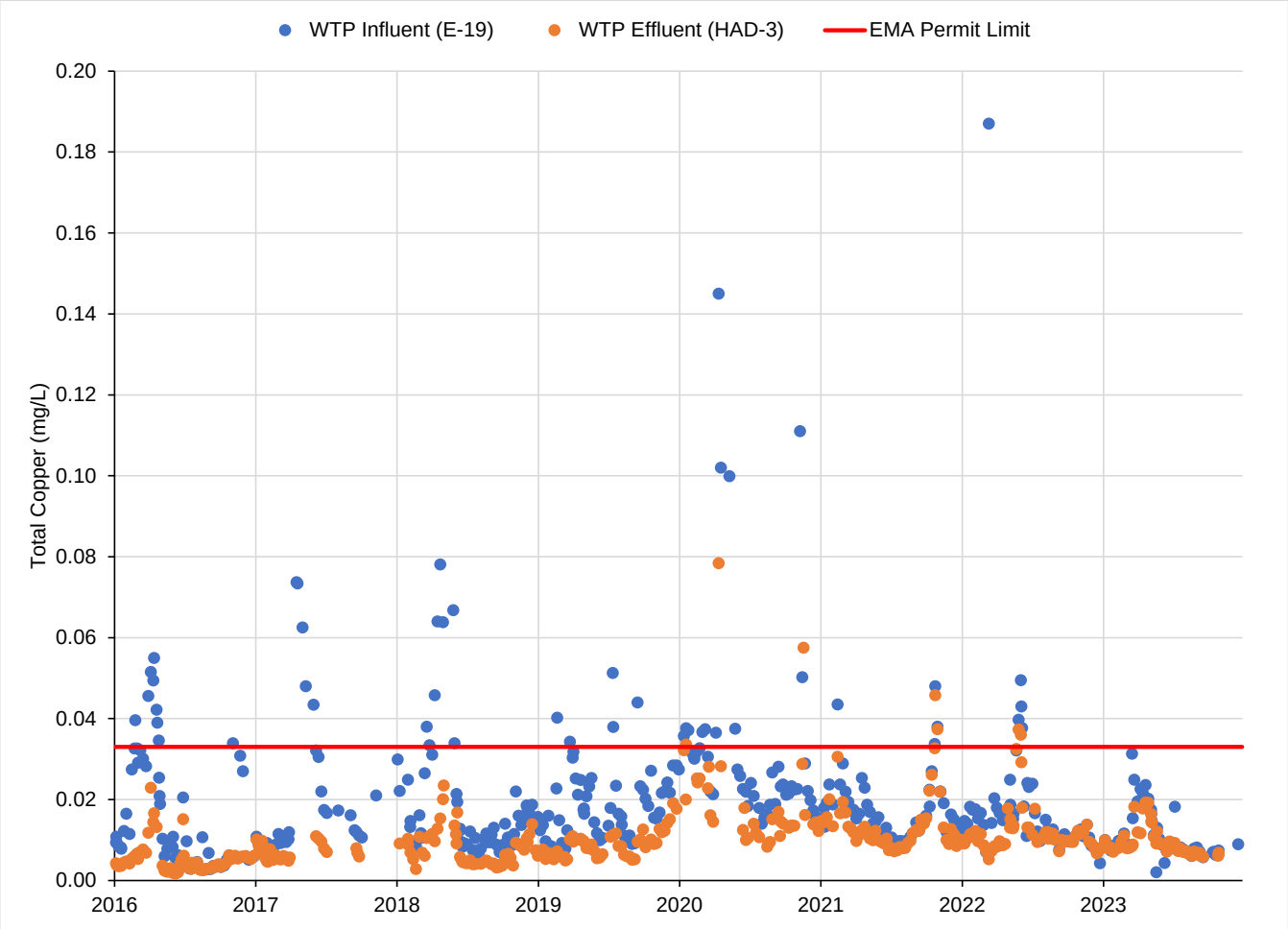


Figure 34: Historical Total Copper in WTP Influent and WTP Effluent from 2016 through 2023

Table 48: Historical Total Copper Trend Statistics (WTP Influent and WTP Effluent from 2016 through 2023)

	E-19 (WTP Influent) Total Copper (mg/L)	HAD-3 (WTP Effluent) Total Copper (mg/L)
Minimum	0.002	0.002
Maximum	0.933	0.282
Average	0.025	0.012
Median	0.015	0.009
Standard Deviation	0.065	0.019

Total selenium is not predicted to require treatment during operations, as shown by the 95th percentile PETBP concentration shown in Table 46. Even though predictions show that PETBP total selenium concentration is near the permit limit, monitoring data has shown actual total selenium in the PETBP consistently below the permit limit (Golder 2022b). The water treatment system during operations has not required selenium treatment and it is not anticipated to require selenium treatment for the remainder of operations. The Selenium Management Plan (SeMP, Golder 2016i) lists in-pit treatment along with biological treatment as two of the measures that may be employed to mitigate selenium if required.

Table 46 shows that dissolved cadmium is predicted to require treatment during operations. This modelled 0.36 µg/L concentration is a conservative estimate from the model, and monitoring data from existing operation does not show dissolved cadmium in concentrations requiring treatment. The existing WTP does not target dissolved cadmium as a constituent of concern (COC), but similar to copper and selenium, total cadmium is partially removed through TSS removal at the WTP.

Closure and Post-closure

The SWWBM was used to predict water quality at the PETBP during closure/post-closure. Central collection to the PETBP may not be the final post-closure water treatment configuration (particularly if distributed treatment and discharge can be permitted), but collection to this location has been assumed as the closure base case as it represents the currently permitted system configuration and is one of the two BAT options identified for closure. Table 47 provides a list of constituents of interest and the maximum of the 95th percentile predicted concentrations in the PETBP during closure and post-closure (WSP 2023c). Table 47 also compares predicted PETBP water quality to MPMC's current EMA Permit 11678 WTP discharge limits. These WTP discharge limits have been assumed for closure/post-closure as they represent the currently permitted treatment requirements. Distributed treatment during closure/post-closure may discharge to different receiving environments with different discharge limits than the existing EMA Permit, but the current limits have been assumed for closure/post-closure for the purposes of this Water Management Plan.

Table 49: Predicted Water Quality Concentrations at Perimeter Embankment Till Borrow Pond During Closure/Post-closure

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations – Closure	PETBP – Maximum of 95th Percentile Predicted Concentrations – Post-closure
Major Ions				
Total Sulphate	mg/L	1,100	401	144
Nutrients				
Total Ammonia	mg/L (as N)	1.30	0.07	0.04
Total Nitrate	mg/L (as N)	34	6	2
Total Phosphorus	mg/L	0.09	0.03	0.03
Total Metals				
Arsenic	mg/L	0.028	0.003	0.002
Chromium	mg/L	0.004	0.001	0.002
Copper	mg/L	0.033	**0.17**	**0.01**
Iron	mg/L	1.00	0.54	0.44
Manganese	mg/L	3.40	0.14	0.13
Molybdenum	mg/L	0.36	0.16	0.05
Selenium	mg/L	0.075	0.044	0.008
Zinc	mg/L	0.059	0.011	0.003

Table 49: Predicted Water Quality Concentrations at Perimeter Embankment Till Borrow Pond During Closure/Post-closure

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations – Closure	PETBP – Maximum of 95th Percentile Predicted Concentrations – Post-closure
Dissolved Metals				
Cadmium	mg/L	0.00034	0.00009	0.00005

Note(s): **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to the PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter. The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Table 47 shows that total copper is predicted to require treatment during closure and post-closure. TSS, not listed in Table 47, is also required for treatment during closure/post-closure. Total selenium is not predicted to require treatment in closure/post-closure but is still considered as a potential COC for these phases.

The assumed BAT treatment system during closure/post-closure is pit-lake treatment (for selenium treatment if required) followed by the centralized Actiflo plant (existing WTP), with the possibility of distributed passive/semi-passive treatment if systems are environmentally appropriate and permittable. TSS treatment is assumed to be required through closure and post-closure and will be achieved with the Actiflo plant. Total copper treatment is predicted to be required through closure and post-closure and will be achieved with a combination of the Actiflo plant (total copper removal through TSS removal), and future trimercapto-striazine trisodium salt (TMT) pre-treatment, if required (for dissolved copper precipitation).

Total selenium is considered a potential COC during closure and post-closure, though not predicted to require treatment. Existing monitoring data has consistently shown total selenium in Site contact water to be below discharge limits. If required, the assumed method of selenium treatment is semi-passive pit-lake pre-treatment for dissolved selenium (active dosing of carbon source to pit-lake), followed by treatment by the Actiflo plant for TSS and particulate selenium removal. MPMC has also been progressing the development of multiple passive and semi-passive closure treatment technologies that target selenium in order to potentially reduce the complexity and operating footprint of long-term treatment system during post-closure.

At mine closure, three major zones are in long-term contact with waste rock: the combined Springer-Cariboo Pit, Wight Pit, and the SERDS which drains into Long Ditch. Table 48 provides a list of constituents of interest and the maximum of the 95th percentile predicted concentrations in the Springer-Cariboo Pit, Wight Pit, and Long Ditch during closure and post-closure (WSP 2023c). Predicted parameters are shown post-2041 for Wight Pit and Long Ditch, the period in closure they have been assumed to discharge directly to environment in the SWWBM. Predicted parameters are shown post-2055 for Springer-Cariboo, the period in closure that the pit is assumed to overflow directly to the environment in the SWWBM.

Table 50: Predicted Water Quality Concentrations at Springer-Cariboo Pit, Wight Pit, and Long Ditch During Closure/Post-closure

Parameter	Unit	Springer-Cariboo Pit – Maximum of 95th Percentile Predicted Concentrations – Post-closure (post-2055)	Wight Pit – Maximum of 95th Percentile Predicted Concentrations – Post-closure (post-2041)	Long Ditch – Maximum of 95th Percentile Predicted Concentrations – Post-closure (post-2041)
Major Ions				
Total Sulphate	mg/L	510	187	317
Nutrients				
Total Ammonia	mg/L (as N)	0.02	0.01	0.01
Total Nitrate	mg/L (as N)	3	2	4
Total Phosphorus	mg/L	0.03	0.03	0.04
Total Metals				
Arsenic	mg/L	0.001	0.005	0.002
Chromium	mg/L	0.001	0.001	0.002
Copper	mg/L	0.028	0.007	0.019
Iron	mg/L	0.30	0.24	0.45
Manganese	mg/L	0.19	0.07	0.14
Molybdenum	mg/L	0.11	0.05	0.06
Selenium	mg/L	0.056	0.008	0.034
Zinc	mg/L	0.008	0.010	0.006
Dissolved Metals				
Cadmium	mg/L	0.00014	0.00002	0.00010

Note: The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.

Direct discharge of the Table 48 catchments to the environment during post-closure is assumed in the SWWBM, but this will not occur until appropriate permit limits are established and when actual water quality near post-closure is confirmed. Copper and selenium concentrations in these drainages will be monitored through operations and closure. If copper treatment is required during post-closure for these drainage sources, then centralized or distributed TMT pre-treatment and/or TSS settling could be employed to reduce total copper to below established limits. Other technologies being considered for closure may also address copper reduction. If selenium treatment is required during post-closure, then centralized pit-lake or distributed passive/semi-passive treatment could be employed to reduce total selenium to below established limits.

Details on modelled water quality concentrations for all parameters and mine phases at various site locations (in addition to the locations discussed here) can be found in Appendix B.

4.6.2 Water Treatment Technology Development

Good engineering practice typically requires a project to follow a standardized engineering design process for the selection and progressive refinement of the final project concept. A project progresses from a pre-concept phase for the identification of multiple treatment options, through concept, pre-feasibility, and feasibility phases to project execution. Generally, the engineering studies performed for each of these project phases are supported by test work that progresses from proof-of-concept and detailed bench-scale testing to pilot-scale and demonstration-scale test work. Some of the treatment technologies tested may not progress to the next stage of development. For example, a treatment technology may be eliminated if its treatment capacity is insufficient to treat the forecast volumes. This framework takes a staged approach, such that input assumptions, design,

and cost for the total system can be refined as each stage is completed and the information that the plan relies on becomes more certain. This allows input assumptions to be less conservative as they become more accurate with accumulated knowledge. Additional details regarding this project development framework and how it aligns with the BC Ministry of Environment and Climate Change Strategy's BAT policy is provided in Golder 2020e.

A generic model for such a project development framework is provided in Figure 35. This framework also approximates the sequence of steps outlined in BC ENV's BAT policy (BC ENV 2015).

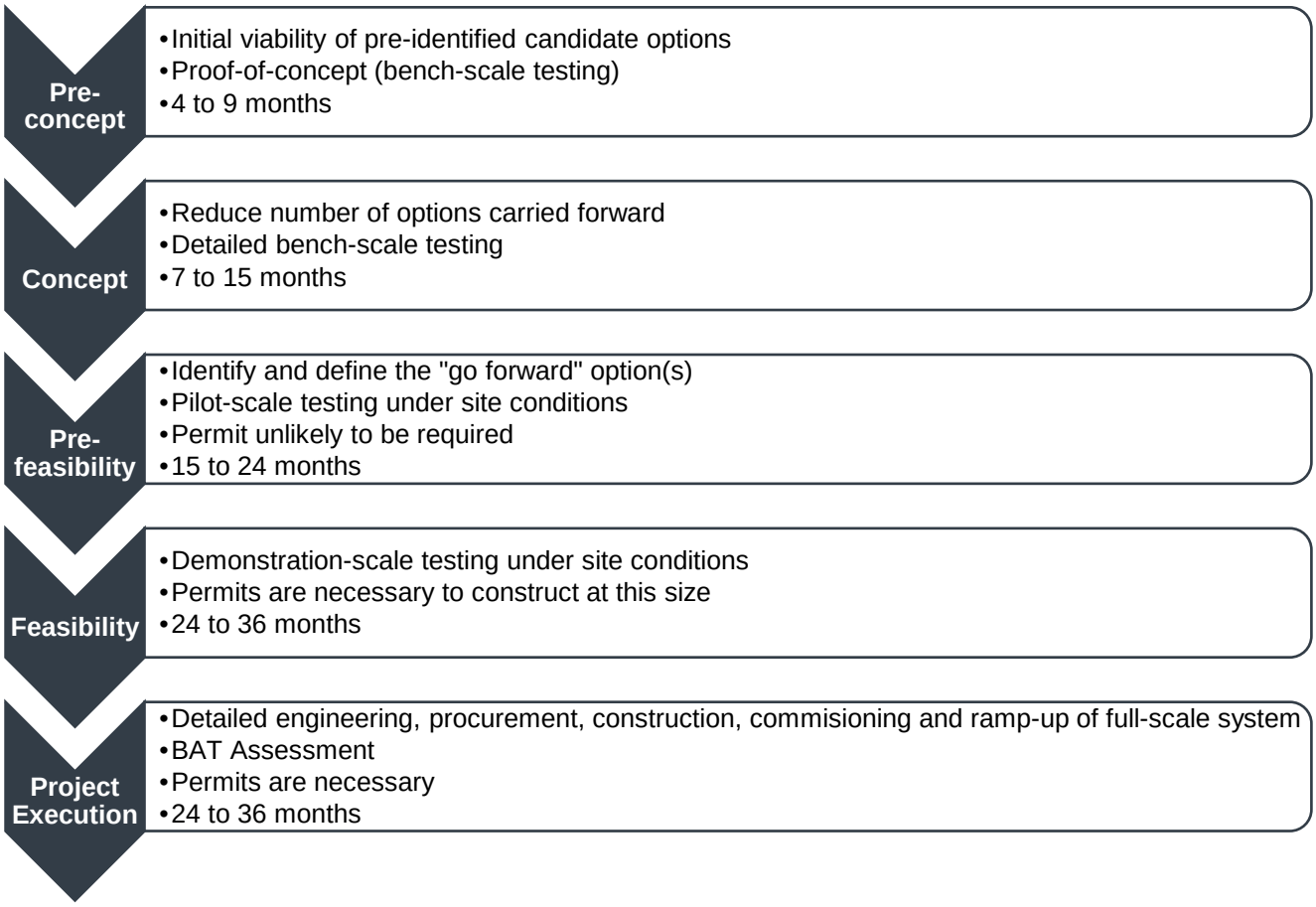


Figure 35: Project Development Framework

MPMC has been progressing and evaluating multiple technologies under this project development framework to support the treatment of identified COCs and to support potential decentralized treatment and discharge during closure/post-closure. Various studies and trials have been completed to support these efforts as an important component of water management planning and closure refinement. An inventory of treatment technologies and a summary of their development is presented in Table 49.

This Water Management Plan assumes that the reader is familiar with the technologies presented in Table 49; this document only provides updates on work completed by MPMC since circa 2017 to support the development of these technologies. Detailed descriptions of these technologies and associated process flow schematics can be found in Golder 2020e.

Table 51: Treatment Technology Inventory and Stage of Development

Technology/ Stage of Development	Targeted COCs	Proof-of-Concept Bench-Scale Testing	Detailed Bench-Scale Testing	Pilot-Scale Testing	Demo-Scale Testing	Full-Scale Execution	Work Completed
Actiflo	TSS, total copper					→	Bench and full-scale testing. Flocculant Management Plan.
Lime Treatment	Dissolved copper					→	N/A
TMT Treatment	Dissolved copper	→	→	→	→		Bench and full-scale testing. Toxicity evaluation.
Pit-Lake Treatment	Selenium, nitrate	→	→	→			Preliminary concept design and proof-of-concept bench-scale testing. Pilot-scale testing workplan.
Saturated Rock Fill (SRF)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, detailed bench-scale testing workplan, and long-term substrate leach testing. Wight Pit SRF assessments.
Packed Bed Reactor (PBR)	Selenium, nitrate	→	→				Concept design, proof-of-concept bench-scale testing, and detailed bench scale testing workplan.
Biochemical Reactor (BCR)	Selenium, nitrate	▬	▬				Concept design and proof-of-concept bench-scale testing.
Submerged Sand Reactor (SSR)	Selenium, nitrate	▬					Screening analysis.
Constructed Wetland Treatment (CWT)	Selenium, nitrate	→	→	→			Concept design, bench-scale testing, and on-site pilot scale testing (by others).

Implemented → Under Consideration → Eliminated/Paused ▬

Actiflo

Actiflo, the tradename of a technology supplied by Veolia, is the technology currently in use as the Site's WTP and is considered the BAT for TSS removal during operations and closure/post-closure. The main targeted COC of this technology is TSS, with total copper removal also occurring via TSS removal. Polyaluminum chloride (PAC) is dosed into the influent water in the Actiflo process, which produces aluminum hydroxide precipitates that adsorb to copper complexes, thus removing copper during the solids-liquids separation step of the process. The Actiflo technology is currently implemented at full-scale on-site, as indicated in Table 49.

Concept design, bench-scale, and full-scale testing have been completed for the Actiflo technology, including assessment and optimization of PAC and various chelating agent dosages (including TMT) to assist copper removal (Golder 2016k, Golder 2017a, Golder 2018a, Golder 2019a, Golder 2019b, Golder 2020f). A Flocculant Management Plan for the Actiflo WTP was also recently completed (WSP 2023d) to address recent EMA Permit requirements, which describes the Actiflo process and associated flocculant use in detail, including PAC, polymer, and microsand. Golder 2022b also provides a detailed summary of recent WTP performance regarding TSS, total copper, and total selenium removal.

Actiflo treatment is currently operating as the core component of the treatment system during operations and is currently assumed as the base case core component of treatment during closure/post-closure.

Lime Treatment

Active treatment with lime is currently in use at the site, where existing mill process plant infrastructure is used to dose lime, raise contact water pH, resulting in the precipitation of metal hydroxides, particularly dissolved copper. Precipitated copper is then removed via TSS removal in the Actiflo system. The main targeted COC of this technology is dissolved copper. Lime treatment is currently implemented on-site, as indicated in Table 49, and used as a pre-treatment step of the Actiflo water treatment system to target dissolved copper removal. Use of this technology is well known to industry and technology development to support this has not been required.

Lime treatment, when required, is currently a component of the water treatment system during operations.

TMT Treatment

TMT is a chelating agent that aids with dissolved copper precipitation that allows copper treatment through TSS removal. The main targeted COC of this technology is dissolved copper.

Bench-scale test work completed showed that TMT is able to effectively precipitate dissolved copper (Golder 2016k, Golder 2017a, Golder 2018a) and the full-scale trials completed showed that the existing Actiflo treatment system was able to remove the copper bound with TMT to below the permit limit (Golder 2019a, Golder 2019b, Golder 2020f). Full-scale trials also showed that copper removal to lower concentrations (total copper <0.012 mg/L) was challenging for Actiflo with TMT treatment, not due to limitations in dissolved copper precipitation but due to limitations in Actiflo TSS removal to low concentrations. TMT was effective in precipitating dissolved copper, but the Actiflo system was not effective in subsequently removing the precipitate to result in low effluent copper concentrations. The toxicity of TMT has also been evaluated and showed that its use would not result in an acutely lethal effluent (Golder 2018b).

TMT treatment is still being considered for full-scale implementation during closure/post-closure if required.

Pit-Lake Treatment

Pit-lake treatment targeting COCs of selenium and nitrate is an in-situ technology that requires nutrient and carbon source dosing to create conditions for biological treatment within the pit-lake.

A conceptual assessment of full-scale pit-lake selenium treatment was completed (Golder 2017b) and the technology was deemed a cost-effective approach to managing selenium and was recommended for further bench and pilot-scale testing. Proof-of-concept bench-scale testing for pit-lake selenium treatment was also completed and showed effective removal of selenium and nitrate, with further pilot-scale testing recommended (Golder 2019c). A pilot-scale study for pit-lake treatment was designed for Cariboo Pit (Golder 2020d), but the pit is being dewatered to support future mining activities and this work has not yet been completed. A pit-lake trial is also not currently available in Wight Pit, as the pit is providing required water storage during storm and freshet operations and will not remain at a steady volume required for the trial.

Pit-lake treatment targeting selenium and nitrate is still being considered for full-scale implementation and is currently assumed as part of the treatment system during closure/post-closure if required.

Saturated Rock Fill (SRF)

SRF treatment is a fixed-film anaerobic system targeting the treatment of selenium and nitrate and ideally utilizes a mined open pit as a bioreactor operated in a horizontal flow configuration.

A concept study for SRF treatment was completed (Golder 2020g) and SRF was recommended for further bench-scale and pilot-scale testing. Proof-of-concept bench-scale testing for SRF was also completed (Golder 2021), which showed effective removal of selenium and nitrate, but also indicated metal leaching. Detailed bench-scale testing and waste rock SRF substrate metal leach testing was recommended following completion of the proof-of-concept work. Bench-scale leach testing using anticipated SRF substrate waste rock from site was completed (Golder 2022c), which monitored leached metals over a long-term test period of 52 weeks. Results showed that metal leaching varies over time and differs between metals and must be considered during the start-up phase of SRF implementation (and may lead to additional required polishing treatment steps downstream of the SRF). Detailed bench-scale testing for SRF has been proposed and a test plan has been submitted to MPMC (Golder 2022d). Geotechnical and geochemical substrate characterization for SRF media waste rock is currently ongoing and anticipated for completion in 2023. It is anticipated that geochemical substrate characterization will be conducted by MPMC's geochemical consultant SRK.

SRF treatment is still being evaluated for full-scale implementation and is currently considered a technology option for semi-passive treatment of selenium and nitrate during closure/post-closure if required.

Packed Bed Reactor (PBR)

PBR treatment is another fixed-film anaerobic system targeting the treatment of selenium and nitrate. PBR treatment differs from SRF treatment through the use of a vertical flow (top to bottom) reactor.

Proof-of-concept bench-scale testing was completed (Golder 2019d) and PBR treatment was shown to be effective in reducing selenium and nitrate. Further detailed bench-scale and pilot-scale testing was recommended following completion of the initial testing. Detailed bench-scale testing for PBR has been proposed and a test plan has been submitted to MPMC (Golder 2022e).

PBR treatment is still being evaluated for full-scale implementation and is currently considered a technology option for semi-passive distributed treatment of selenium and nitrate during closure/post-closure if required.

Biochemical Reactor (BCR)

BCR treatment is another fixed-film anaerobic treatment technology that consists of a lined pond filled with a submerged organic substrate media mix. The main targeted COCs of this technology are selenium and nitrate. BCR treatment is passive and does not involve continuous dosing of a carbon source to the media bed.

Proof-of-concept bench-scale testing was completed (Golder 2019d) and BCR treatment was shown to be effective in reducing selenium and nitrate, but redox sensitive metals were present in the BCR effluent.

Upon review of the BCR technology in comparison to other passive and semi-passive technologies, MPMC decided to not proceed with further development of this technology (MPMC 2021) for the following reasons:

- Limited lifespan of BCR passive treatment systems based on the availability of a carbon source that is encapsulated in the system during construction – this needs to be replaced periodically at significant cost.
- Emission of elevated levels of biochemical oxygen demand (BOD) from the system during commissioning and start-up of operation that exceed standards for discharge to the environment.
- Persistent emission of phosphorus from the BCR during operation that will likely exceed plausible standards for discharge to the environment.

BCR treatment is no longer being developed as a passive treatment technology option during closure/post-closure.

Submerged Sand Reactor (SSR)

SSR is similar to other anaerobic reactor technologies, with the use of the existing tailings as media for the bioreactor. The main targeted COCs of this technology are selenium and nitrate.

A concept study was completed for SSR (Golder 2020g), as well as proof-of-concept bench-scale testing (Golder 2019d). Use of MPMC tailings as SSR bioreactor media or use of the site's TSF as an in-situ SSR was not recommended for further investigation. Bench-scale testing resulting in metal release in the reactor effluent when using site tailings as the reactor media. The concept study also concluded that further investigation of SSR was not warranted, based on a review of literature, an evaluation of historical water quality monitoring data, and an evaluation of the feasibility of utilizing the TSF from a hydrogeological and permitting perspective.

SSR treatment is no longer being developed as a treatment technology option during closure/post-closure.

Constructed Wetland Treatment (CWT)

MPMC retained Ensero Solutions Inc. (Ensero), formerly known as Contango Strategies Ltd., to conduct a detailed assessment and evaluation of the feasibility of a CWT system for passive/semi-passive treatment during closure/post-closure. The main targeted COCs of this technology are selenium and nitrate.

Pilot-scale design, sizing, and testing for CWT was completed by Ensero (Ensero 2020), and the technology demonstrated successful results for treatment of targeted COCs; however other passive/semi-passive technologies have indicated improved treatment capability in comparison. MPMC may choose to proceed with demonstration-scale on-site testing of CWT once the pilot-scale results have been fully understood and if the performance of competing technologies (SRF and others) indicates an advantage for CWT.

CWT is still being evaluated for full-scale implementation and is currently considered a technology option for passive/semi-passive and distributed treatment of selenium and nitrate during closure/post-closure if required.

5.0 WATER MANAGEMENT PLAN REVISION TRIGGERS

Operational events (i.e., triggers) that may result in updates to the WMP being required are listed in Table 50 as part of the revision process. These triggers cover changes to the mine plan or changes to site catchments or the TSF that would likely have a material impact on how water is conveyed, stored, and treated at the mine.
When one of the operational events occur, it is expected that an update will be required to the WMP to address changes to the water management approach. Triggers and proposed timelines for a WMP update are included in Table 50.

The need for changes to water treatment will be evaluated for each operational trigger. If it is determined that an operational trigger requires a change to the water treatment approach, the required engineering design process will be followed for the selection and progressive refinement of options as described in Figure 35.

Table 52: Water Management Plan: Revision Process for Potential Future Updates to Water Management Plan

Revision Trigger	Applicable Regulatory Body and Permit	WMP Update	Anticipated WMP Update Submission (revision trigger + X months)	Additional Notes
Mine plan update: a change to the permitted mine plan or implementation schedule that results in modifications to the water management systems.	MEMPR; M-200 EMA; PE-11678	Full update	10 months	Update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.
Tailings Storage Facility: a change to the permitted configuration (i.e., dam crest elevation, water storage volume, or tailings volumes) of the TSF that impacts water storage and discharge requirements.	MEMPR; M-200 EMA; PE-11678	Full update	6 months	Update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.
Catchment areas: change in the site footprint of more than 10% increase or decrease in runoff volume attributed to changes in the permitted and modified mine areas.	MEMPR; M-200 EMA; PE-11678	Partial update	3 months	Update will be composed of a calibration and sensitivity exercise on the existing water balance (including water quality model). Updates to groundwater/hydrogeological models may be required.
Requirement to update WMP by the Engineer of Record or the Independent Engineering Review Panel.	MEMPR; HSRC	Level of update depends on requirement of Engineer of Record or Independent Engineering Review Panel	6 months	To be determined; however, it may include an update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.
Requirement to update the WMP by the Statutory Decision Maker of MEMPR or BC ENV.	MEMPR; M-200 EMA; PE-11678	Level of update depends on requirement of statutory decision maker	6-10 months	To be determined; however, it may include an update to water balance (including water quality model) and implementation schedule. Updates to groundwater/hydrogeological models may be required.

WMP = Water Management Plan; TSF = Tailings Storage Facility; EMA = *Environmental Management Act*; MEMPR = Ministry of Energy, Mines, and Petroleum Resources; HSRC = Health, Safety and Reclamation Code for Mines in British Columbia; BC ENV = British Columbia Ministry of Environment and Climate Change Strategy.

6.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust the above meets your present requirements. If you have any questions or comments, please contact the undersigned.

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APPENDIX A

Site-wide Water Balance Model (SWWBM)

REPORT

Mount Polley Mine Water Balance Model

Springer Expansion Life-of-Mine

Submitted to:

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May 21, 2024



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APPENDICES

APPENDIX A
Springer Expansion LOM SWWBM Inputs

APPENDIX B
Flow Diagrams and 2022 Water Management Infrastructure

APPENDIX C
SWWBM Results

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) is currently submitting a permit application for the new Springer Expansion phase, extending assumed operations until March 31, 2031. The Site Wide Water Balance Model (SWWBM) presented in this report is a critical component, essential to support the Water Management Plan required for the Springer Expansion permit application. It should be noted that the specific operation, closure, and post-closure dates in this report have been assumed for the purpose of modelling. There are many factors that exist that can alter these dates, such as delays on the mine production as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan. Thus, these time frames should not be considered static.

The SWWBM was originally developed for the Technical Assessment Report (TAR) to support the effects predictions in the Mount Polley Mine Long Term Water Management Plan (Golder 2016a) for the Mount Polley Mine (the Mine) and has since been calibrated on an annual basis (refer to WSP 2023a for the latest 2022 annual calibration). This report presents the SWWBM based on the Springer Expansion Life-of-Mine (LOM) Plan informed by MPMC (MPMC 2022), to a crest elevation of 987 m of the TSF.

The work presented in this report is as follows:

- A summary of the physical setting at the Site (Section 2.0)
- An overview of the climate and hydrology at the Site (Section 3.0)
- A description of the SWWBM, including inputs and assumptions (Section 4.0)
- A presentation of SWWBM results, including operational, closure, post-closure phases (Section 5.0)
- Tabular inputs of the SWWBM (APPENDIX A)
- Flow Diagrams and 2022 Water Management Infrastructure Drawing (APPENDIX B)

This report has been prepared in accordance with the “Study Limitations,” which are presented at the beginning of the report. The reader’s attention is specifically drawn to this information for reference during use of this report.

2.0 BACKGROUND

2.1 General Information

Mount Polley Mine is a copper and gold mine operated by MPMC, a subsidiary of Imperial Metals Corporation. The Mine is located approximately 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake. Within the area of the Mine, the plateau has somewhat higher relief, with the Mine rising approximately 300 metres (m) above the surrounding terrain. Topographically, the Site area consists of north–south trending ridges of moderate elevation and relief. Local elevations range from 922 metres above sea level (masl) at Polley Lake to 1,266 masl at the top of Polley Mountain with an average elevation of 1,038 masl. The total surface area of the Site is 17.8 square kilometers (km^2).

MPMC is applying for a permit for the new Springer Expansion phase, which extends operations until 2031. Updating the SWWBM to reflect the Springer Expansion LOM plan is required to support the Water Management Plan for this permit application. The updated SWWBM will generate results throughout the operational phase to a crest level of 987 m of the TSF (to be completed before the end of operations), extending into the closure and post-closure phases.

3.0 CLIMATE AND HYDROLOGY

3.1 Climate

In 2022, WSP Canada Inc. (WSP) updated the climate baseline data for the Mine. The climate of the Mine was characterized in the Baseline Climate Update Report (Golder 2022b) using historical measurements from local climate stations, supported by data obtained from five nearby regional Environment and Climate Change Canada (ECCC) climate stations. During the winter, snowpack is measured at four snow course sites at a minimum frequency of once per month, with more frequent measurements typically being taken during the melt phase. Detailed climate information can be viewed in Golder 2022b. The climate inputs for the SWWBM are presented in Section 4.5.1.

3.2 Site Drainage and Surface Hydrology

A network of ditches, sumps, and pumping systems are operated by MPMC to manage surface water at the Mine. The current water management infrastructure of Mount Polley is presented in the MPMC 2022 Water Management Infrastructure Drawing provided in APPENDIX B. Surface water is separated between contact (mine affected) and non-contact (non mine affected) sources of runoff. The two water sources can be characterized as follows:

- Contact water: water that may have come into direct contact with mining and milling activities. This water generally requires treatment before release to the environment.
- Non-contact water: runoff originating from areas unaltered by mining activity that does not contact mining areas. It is typically diverted to the maximum extent practicable and allowed to discharge directly to the receiving environment.

The objective of current water management practices is to minimize the mingling of contact and non-contact surface water sources whenever possible. These flows originate from direct precipitation, runoff, and snowmelt from catchments. Contact water is mainly collected along two ditches running north to south along the Site: West Ditch and Long Ditch. A block flow diagram provides a conceptual overview of the sumps and their respective connections across the Mine area presented in Figure 1.

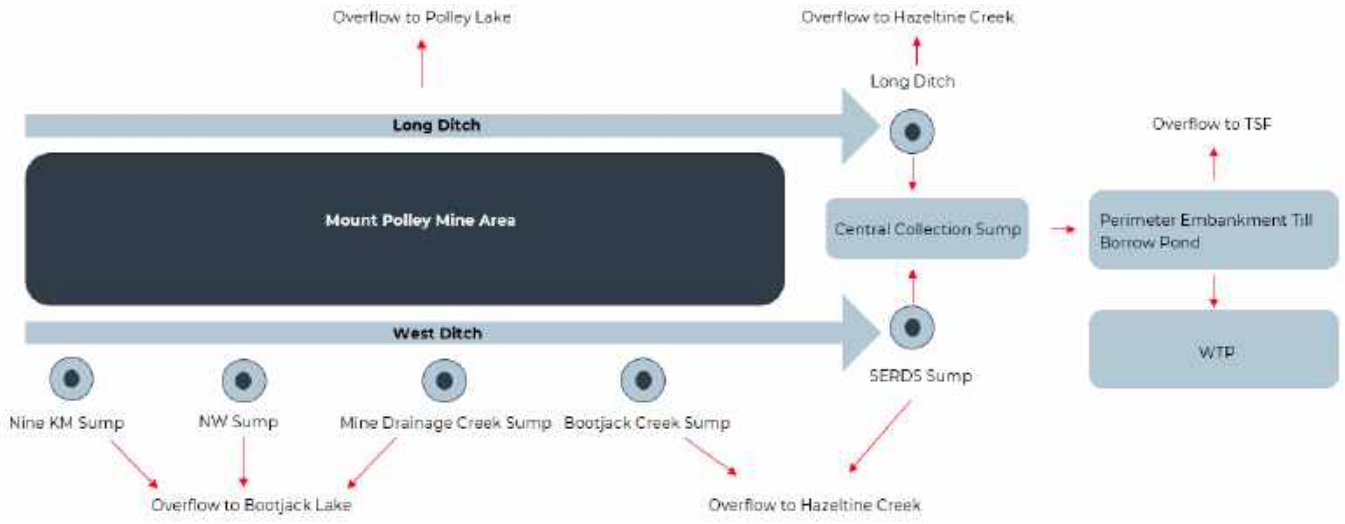


Figure 1: Conceptual Block Flow Diagram of Mount Polley Mine Contact Water Management Infrastructure

The West Ditch system collects contact water starting from the west side of the Site, progressing from the Nine KM Sump to the SERDS Sump. Components of the West Ditch system include various sumps, ditches, and pumping systems.

Similarly, the Long Ditch system manages contact water from the east side of the Site, extending from below the site access road to the Central Collection Sump. This system also comprises various sumps, ditches, and pumping systems.

3.3 Pit Groundwater Hydrogeology

Groundwater flow has been assessed for the following open pits at the mine: Springer Pit, Cariboo Pit, Wight Pit, and Boundary Pit. The analysis for each pit is described in a series of technical memoranda in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a).

Hydrogeological assessments for the pits were conducted as part of the TAR to estimate groundwater seepage into and out of the pits. Seepage estimates have not been updated for the WBM results presented in this document, which relies on the estimates completed in the 2016 TAR. WSP is currently updating these seepage estimates for the Mine pits, the seepage estimates will be updated in the SWWBM when available. Results will be assessed to identify any notable changes to the seepage estimate. Updated seepage parameters are not expected to alter the water balance results for the site or alter the water treatment quantity design basis; however, this will be confirmed once updated parameters are available. Groundwater inputs for the SWWBM are presented in Section 4.5.3.

3.4 Tailings Storage Facility

Flows from the TSF have been discussed in the TAR (Golder 2016a). WSP is currently designing a new upstream drainage system within the TSF to accommodate the increase in the TSF pond elevation (WSP 2023e). Updated estimations of seepage flow rates have been developed for each embankment as part of the TSF embankment crest at elevation 987 m design and are provided in Section 4.5.7.5.

4.0 SITE WIDE WATER BALANCE MODEL

An update to the existing SWWBM was carried out using GoldSim™ (Version 14.0). This section presents SWWBM software, model objectives, general assumptions, processes, and inputs.

4.1 Model Software

GoldSim allows dynamic and complex water quantity interactions to be represented through a visual and highly modular framework. All input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. GoldSim is widely used for mine water quantity studies and provides the following capabilities:

- Deterministic and probabilistic simulations can be run within the model, which allows statistics and probabilities to be assigned to the model outputs.
- Simulation periods can be varied within the same model.
- The model framework can be easily adjusted to account for evolving conditions on a mine site, which allows the model to be used as an operational planning tool.
- Water quantity and water quality modules can be directly linked within the model, which allows both modules to be updated simultaneously; this is particularly useful when evaluating a range of scenarios (e.g., alternative water management strategies).

4.2 Model Objectives

This SWWBM was updated to include the future operational phase, in line with the assumed Springer Expansion LOM plan. Additionally, it has been updated to reflect changes in the closure and post-closure phases since the Reclamation and Closure Model update completed in 2022 (Golder 2022a).

This SWWBM has the following objectives:

- Include a future operational phase that will extend from May 2, 2023, to March 31, 2031.
- Include a closure phase extending from April 1, 2031, to March 31, 2041.
- Include a post-closure phase commencing on April 1, 2041, and extending to March 31, 2131 (100 years including closure).
- Estimate the quantity of contact water collected on-site per the climate conditions.
- Estimate water retention requirements in major storage locations at site such as the TSF and pits.
- Estimate the quantity of contact water requiring treatment.
- Enable assessment of future operations water quality and associated water treatment and/or discharge options.
- Provide a model that can be linked to a water quality module that assesses site water quality during forecasted future operations.

4.3 Assumptions and Key Input Parameter Values

General assumptions applied to this model are as follows:

- Continuation of mining of the Springer Pit and Cariboo Pit will not significantly increase the footprint of the pits.
- There is no seepage from the ponds or sumps other than the TSF (i.e., all ponds and sumps are assumed to be lined, or seepage is assumed to be negligible).
- Direct precipitation, evaporation, and seepage loss from ditches are assumed to be negligible.
- Precipitation occurs as snow from December to February and as rain or a mixture of rain and snow in all other months.
- Snowpack is represented by the cumulative precipitation depths over the months of December, January, and February, spanning a period of three months.
- Snowmelt occurs in the months of March, April, and May as a percentage of the maximum snowpack at the end of February (5% in March, 90% in April, and 5% in May).
- The closure and post-closure phases are included in the SWWBM, and the flow logic and model wiring for these phases are based on the 2022 Reclamation and Closure Plan (RCP) (Golder 2022a). Flow diagrams for closure and post-closure phases are also presented in Appendix B.

Key input parameter values and assumptions for the operational phase simulations are presented in Table 1.

Table 1: Key Input Parameter Values and Assumptions

Parameter	Value	Reference
TSF emergency spillway invert elevation at 987 m dam crest elevation during operations	985.8 m	WSP 2023c
Initial TSF water volume	2.84 M-m^3	TSF Weekly Report (MPMC 2023a)
Initial Springer Pit water level	970.66 m	TSF Weekly Report (MPMC 2023a)
Initial Cariboo Pit water level	954.72 m	TSF Weekly Report (MPMC 2023a)
Initial Wight Pit water level	912.87 m	TSF Weekly Report (MPMC 2023a)
Tailings stored in Springer Pit	2.00 M-m^3	TSF Weekly Report (MPMC 2023a)
Water Treatment Plant (WTP) treatment capacity	25,000 m^3/d	Provided by MPMC (MPMC 2023b)

4.4 Model Domain

A description of the model flows is provided in APPENDIX A. The domain and structure of the SWWBM is outlined in the conceptual flow diagrams for the forecasted operational, closure and post-closure phases in Appendix B. The flow diagrams illustrate the assumed water circuit system at the Site during operations, closure, and post-closure, including the storage and conveyance of water. The water management infrastructure within the SWWBM for the operational phase is summarized in Table 2 and flow types are outlined in Table 3.

From closure and progressively to post-closure, certain Site areas will be reclaimed, and run-off will become non-contact water and the volume of annual contact water will reduce. Pumping rates for the Site will be reduced at the end of the closure period, as certain areas are assumed reclaimed. The progression of flow routes and discharges to the environment are shown on the flow diagrams presented in Appendix B.

Table 2: Water Management Infrastructure during Operations

Major Ditches	Sumps and Minor Ponds	Major Ponds and Storage Facilities
▪ Long Ditch ▪ SERDS Ditch (lower portion of West Ditch)	▪ South Seepage Pond ▪ Main Embankment Seepage Pond ▪ Central Collection Pond ▪ Bootjack Creek Sump ▪ Mill Site Sump ▪ Mine Drainage Creek Sump ▪ NW Sump ▪ 9K Sump ▪ Boundary Pit	▪ TSF ▪ Cariboo Pit ▪ Springer Pit ▪ Wight Pit ▪ Perimeter Embankment Till Borrow Pond

SERDS=Southeast Rock Disposal Site; TSF = Tailings Storage Facility

Table 3: Types of Flows Represented in the SWWBM

Site Inflows	Site Outflows or Transfers
▪ Direct precipitation ▪ Runoff ▪ Seepage (includes baseflows)	▪ Water consumption flows (turbo-misters, and water trucks) ▪ Water treatment discharge ▪ permanent, unrecoverable storage in tailings (interstitial water) ▪ Open water evaporation ▪ Pumped flows between facilities ▪ Transfer flows (gravity flows between facilities) ▪ Groundwater flows

4.5 Model Inputs

4.5.1 Climate Inputs

The following sections describe the climate inputs used in the SWWBM.

4.5.1.1 Precipitation

The SWWBM was run with probabilistic monthly climate inputs for this assessment. To develop probabilistic inputs, monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022b) were fitted to a log-normal probability distribution. The mean and standard deviation for the monthly precipitation values are shown in Table 4.The model is run using a daily time step, which represents better variation between months such as the water volume in the TSF or the pits.

The derived monthly means and standard deviations of the precipitation values, defined in the model as stochastic elements, were used to generate random values based on the distribution of the dataset. The stochastic generator was set to perform 2000 realizations to create a sample size that was sufficiently large to account for a range of conceivable monthly climatic precipitation scenarios for the study period. The results of these 2000 realizations were compiled to generate probability distributions that yield percentile values. To represent average and extreme climate scenarios, results for the 50th, 90th and 99.5th percentiles are presented in Section 5.0.

Table 4: Stochastic Climate Generator Log-Normal Distribution Input Arguments

Month	Mean of the Monthly Precipitation Depths (mm)	Standard Deviation of the Monthly Precipitation Depths (mm)
January	49.4	30.9
February	35.8	24.2
March	29.7	13.9
April	44.7	43.6
May	49.9	20.2
June	70.8	32.9
July	63.6	55.1
August	50.6	31.2
September	52.3	30.1
October	58.1	27.9
November	49.8	28.9
December	57.6	32.7

4.5.1.2 Evaporation

The median annual shallow lake evaporation rate is estimated to be 670 mm. Monthly evaporation rates vary between 0 mm in December to 136 mm in July. Estimated median monthly and annual shallow lake evaporation from 1974 to 2001 are presented in Table 5.

Table 5: Median Monthly and Annual Shallow Lake Evaporation Statistics for the Site (1974-2001)

Month	Median Shallow Lake Evaporation (mm)
January	0
February	7
March	32
April	67
May	102
June	121
July	136
August	113
September	60
October	21
November	4
December	0
Annual	**663**

4.5.1.3 Climate Change

An ensemble of monthly temperature and precipitation projections were obtained from ClimateBC consisting of 8 Global Climate Models (UBC 2022) and two emissions scenarios (SSP2-4.5 and SSP5-8.5) covering mid to high emissions from the Sixth Intergovernmental Panel on Climate Change Assessment Report (IPCC 2021). A stochastic approach (outside the GoldSim model) was used to extend these projections from year 2100 to 2200 by resampling monthly data from 2071-2100 and relating projected changes in temperature and precipitation climate variables to a set of extended greenhouse gas concentration pathways beyond year 2100 (van Vuuren et al. 2011). The range of projected temperature and precipitation values for each month was summarized across the ensemble of climate models and emissions scenarios using a range of values. The mean, and the upper bound, have been included in the SWWBM to analyze the effects of climate change. Lake evaporation, snow accumulation and snowmelt were calculated in the same way as for the average scenario.

4.5.2 Hydrology Inputs

The following sections describe the hydrologic processes and inputs used in the SWWBM.

4.5.2.1 Runoff Parameters

Runoff in the SWWBM is estimated using seasonal runoff coefficients. Runoff coefficients represent the proportion of rainfall that reports as runoff or seepage, accounting for losses due to evaporation, storage, and infiltration. Adjustment during the calibration process resulted in a 30% increase of the general runoff coefficients in cases where the monthly precipitation exceeds 50 mm. The runoff coefficients account for the following two seasonal climate periods:

- **General (July to February)** – mid-range coefficients to reflect soil moisture contents for intermittent runoff events.
- **Freshet (March to June)** – highest runoff coefficients to represent expected higher soil moisture content, and therefore greater runoff.

The seasonal runoff coefficients defined for the catchment types considered in the SWWBM are presented in Table 6.Runoff coefficients are adjusted during the annual SWWBM calibration to align estimated runoff volumes with Site monitoring data.

Table 6: Seasonal Runoff Coefficients

Catchment Type	General	Freshet
Exposed tailings	0.6	0.9
Disturbed areas	0.3	0.9
Rock disposal site areas	0.1	0.6
Open pits	0.75	0.9
Undisturbed catchments	0.4	0.42
Haul roads and access roads	0.15	0.9
Mill site area	0.1	0.1

Source: Golder 2020

4.5.2.2 Catchment Areas

To model runoff, direct precipitation, and evaporation, the catchment areas for each storage element were defined in the model. The catchment/reporting area for each storage element remains consistent with the TAR (Golder 2016a). However, there's one exception: the TSF impoundment catchment at the projected 987 m crest. Any alterations would mainly affect the infrastructure downstream of the TSF, but these changes are expected to have minimal impact on the model results. The catchments are shown in Table 7. Subdivision of catchments areas by land type are presented in Table A-1 in APPENDIX A.

Table 7: Current Catchment Areas for SWWBM Storage/Conveyance Elements

Storage or Conveyance Element	Total Reporting Area (m^2)
South Seepage Pond	385
Main Embankment Seepage Pond	376,900
TSF Upstream Catchment (External)	622,800
TSF Impoundment Catchment (Internal – current)	2,269,700
TSF Impoundment Catchment (Internal – projected at 987m raise) [(a)]	2,860,000
Perimeter Embankment Till Borrow Pond (PETBP)	524,300
Central Collection Sump (CCS)	438,600
Bootjack Creek Sump	175,200
SERDS Ditch[(b)]	1,537,600
Mill Site Sump	1,630
Mine Drainage Creek Sump	1,115,900
Long Ditch	2,494,000
Cariboo Pit	1,320,400
Springer Pit	651,900
NW Sump	330,200
9K Sump	698,700
Wight Pit	413,900
Boundary Pit	23,400
Total Reporting Area	**12,997,315**

Source: Golder 2016a. Update on TSF impoundment based on TSF projections.

(a) The raise of the TSF will affect the catchments producing runoff into the TSF pond. To consider the increase of the TSF impoundment catchment, the model interpolates the TSF impoundment catchments between the current state and the TSF raise to 987m. Changes in other catchments are minor.

(b) The current SERDS Tailings Co-Disposal project does not affect the delineation of the catchment.

After finishing operations, some mining features become remediated during closure and become non-contact water during post-closure. This is modelled by changing the land types, from disturbed to not disturbed areas. The land types define the runoff coefficients (Table 6) and the water quality, which is analyzed in the Water Quality Report (WSP 2023d). The model logic to convert the land types it is as follows (all timeframes are from start of closure on April 1, 2031 – assumed for the purpose of modelling):

- Roads:
  - 14% of total road area switch to disturbed at year 3.
  - 21% of total road area (additional 7%) switch to disturbed at year 4.
  - Negligible amount of road surface is fully reclaimed (no undisturbed road area ever).
- Dump areas transition to disturbed at the following rate:
  - Closure + year 1 = 22%.
  - Closure + year 2 = 37%.
  - Closure + year 3 = 61%.
  - Closure + year 4 = 100%.
- Mill site
  - Areas switch to disturbed at year 2.
- All Disturbed areas, not including unreclaimed roads, will transition to undisturbed at the following schedule:
  - year 5 = 25%.
  - year 10 = 50%.
  - year 15 = 75%.
  - year 20 = 100%.

After this time all areas will be undisturbed except Pit areas and unreclaimed roads.

4.5.3 Groundwater Inputs

Groundwater flow has been assessed for the following open pits at the mine: Springer Pit, Cariboo Pit, Wight Pit, and Boundary Pit. Groundwater flows with dependency on the water level of the pits are presented in Appendix B of the TAR (Attachments C, D, E, and F; Golder 2016a) and repeated in Appendix A of this report.

4.5.4 Storage Capacities

Free water volumes in storage ponds, sumps, and the TSF depend on a balance between their inflows and outflows. The stage (elevation) can be directly correlated to a specific storage volume using bathymetric and topographic data. These relationships are referred to as stage-storage curves.

Dynamic storage facilities such as the TSF, where tailings deposition changes the available storage, require regular survey updates to confirm whether existing stage storage curves are appropriate for projecting free water volumes. Stage-storage curves for the TSF up to a crest elevation of 987 m were developed from the 2020 TSF survey. These curves were obtained from preliminary tailings deposition modelling carried out in support of the design of the 987 m TSF.

The stage-storage curves projected up to a crest elevation of 987 m constitute a 2-D element that considers the tailings tonnage. These curves will interpolate according to the dry tailings volume across the Springer Expansion LOM schedule. Additionally, these curves are limited by the spillway invert stated in Table 1, serving as the upper boundary for the maximum TSF elevation. The stage-storage curves up to a crest elevation of 987 m crest in this report are provided in APPENDIX A.

Stage-storage curves were available for the following major storage elements and are provided in APPENDIX A:

- Springer Pit (November 7, 2019, bathymetry survey)
- Cariboo Pit (June 3, 2022, topographic survey)
- TSF (June 17, 2020, bathymetric survey tied-in with October 22, 2019, topographic survey)
- Wight Pit (January 13, 2022, bathymetric survey)

The estimated volume capacities for the facilities listed above and other storage locations are presented in Table 8.

Table 8: Maximum Capacities for Major Storage Facilities

Major Storage Facility	Estimated Capacity (M-m^3)
Springer Pit[(a)]	14.8
Cariboo Pit[(a)]	5.1
Combined Springer-Cariboo Pit final mine-out	30.3
TSF – 987 m crest elevation design	5.7[(b)]
Wight Pit	3.8
PETBP	0.17

(a) Represents current individual pit volumes (i.e., before pits are combined or further mined.)

(b) Capacity at the final stage of the TSF, when tailings deposition ends.

When the embankment reaches an elevation of 987 m, the TSF pond will be pushed towards the north abutment. The TSF will be available to store freshet water until four months after the start of the closure phase (July 31, 2031) in order to capture the last freshet period during the operations phase. Commencing August 1, 2031, TSF volume will be progressively reduced to 0.25 M-m^3 over the course of two months due to construction of the closure spillway.

4.5.5 Mine Plan

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage/volume of dry tailings during the project is provided in Table 9 (MPMC 2022). It is assumed that 6.55 M-tons of dry tailings have been placed in the TSF between the mine plan start date of July 1, 2022, and the assumed SWWBM operations start date of May 2, 2023.

Table 9: Mine Plan (Annual Totals)

Year	Dry Tailings (tons)
2022[(a)]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[(b)]	860,381

(a) Mine plan starts on July 1, 2022.

(b) Mine plan ends on March 31, 2031.

4.5.6 TSF Pond Volumes

Temporary detention of water in the TSF is necessary to manage large site runoff volumes that can be generated during freshet; however, a fundamental basis of the water management plan is to not accumulate water on-site year over year (including within the TSF) by treating and discharging water.

The minimum and maximum operational water volumes in the TSF under normal conditions are 1.5 M-m^3 and 1.7 M-m^3, respectively.

The water balance model activates and deactivates pumping flows. As a result, the TSF pond volume is set at 1.5 M-m^3 prior to freshet and it returns to the specified normal operating range after freshet. TSF volume conditions are presented in Table 10.

Table 10: TSF Pond Volume Values

Condition	TSF Pond Volume (M-m^3)
Minimum under normal conditions	1.5
Maximum prior to freshet (February-April)	1.5
Maximum after freshet and until freeze-up	1.7

Note: M-m^3 = 1 × 10^6 m^3

4.5.7 Flow Derivation and Logic

This section describes the model logic for pumped flows, seepage (from the TSF), groundwater inflows and outflows, consumption, and transfer flows.

In general, the model localizes the outflows of the TSF and pits and ponds; based on demand priorities using modeling elements known as "allocators." When water is present in storage, the allocator calculates evaporation as the first priority, followed by all pumping flows depending on the configured priorities. The maximum pumping capacity is utilized when water is available. If the total outflow is restricted, a lower or zero pumping rate is applied.

4.5.7.1 Pumped Flows

The most relevant transfer rates, including rates between TSF, Pits and PETBP; have been informed by MPMC (MPMC 2023b), while the remaining rates remain consistent with the TAR model and were based on engineering judgement (Golder 2016a). Maximum pumping rates for the operational, closure, and post-closure phases (2023 to 2131) are shown in APPENDIX A.

It should be noted that the capacity set for transfer from TSF to Wight Pit (P30) was assumed at a capacity to avoid PETBP overflow during operations. Capacity set for transfer from CCS to Wight Pit (P35) during closure is a WSP assumption to allow suitable water transfer capacity between CCS and Wight Pit during the closure phase, and this future conveyance system will require design confirmation as the Site approaches closure.

4.5.7.2 PETBP Pumping Logic

PETBP will begin pumping water to the TSF when the water elevation at the PETBP surpasses 923.25 m or when the TSF water volume drops below the minimum threshold by 50,000 m^3 or more.

4.5.7.3 Mill Process Flows

The mill process water requirements are based on 2.0 m^3/t of tailings. Interstitial water sequestered in the deposited tailings is based on 0.347 m^3/t of tailings deposited.

4.5.7.4 Consumption Flows

Consumption flows are system losses attributed to the operation of dust suppression equipment. Consumption flows were estimated by MPMC staff for operations (MPMC 2023b) and are modelled according to the following logic:

- Turbo-misters operate from May to September.
- Water trucks withdraw water at variable rates from May to September.

Consumption flow rates are presented in APPENDIX A.

4.5.7.5 Tailings Storage Facility Flows

WSP is currently designing a new upstream drain system to accommodate the increase in the TSF pond elevation (WSP 2023e). The new upstream drain system will capture water within the tailings above 970 m and convey it to the seepage collection system, downstream of the TSF embankment. WSP has estimated the water flows through the upstream drains based on the distance between the pond and the embankment (beach width).

Estimation of flows have been made for each embankment:

- S1: South Embankment
- S2: Main Embankment
- S4: Corner 1 Embankment
- S5: Perimeter Embankment

Seepage flows from the TSF (S1 to S5) during operations were estimated using a two-dimensional numerical groundwater flow model to quantify anticipate seepage rates through the embankment and foundation. Seepage analyses for typical sections of the elevation of 987 m configuration of the South Embankment, Main Embankment, Perimeter Embankment, and Corner 1 Embankment under steady-state conditions. The analyses were conducted using GeoStudio 2021, developed by GEOSLOPE International Ltd. Seepage from the TSF has been defined to occur continuously without interruption in the SWWBM. Table 11 presents the estimated seepage flow rates through each embankment with dependency on the beach width.

Table 11: Seepage Flow Rates

Beach (m)	Flow Rate (L/s)			
	S1	S2	S4	S5
0	79	96	81	89
50	39	50	53	46
100	25	32	38	31
200	14	18	23	18
300	9	12	15	13

Note: includes flows through upstream drains and embankment. All flows estimated for the 987 m raise.

The progressive location of the TSF pond will depend on operational decisions during the deposition of tailings; thus, the change in beach widths have been assumed consistent for each embankment. Based on estimates of the TSF pond volume and satellite imagery of the pond location since restart of operation in 2016, an estimation of embankment beach width has been made for different pond sizes. The estimates are provided in Table 12, which outline a conservative scenario, in terms of seepage flow quantities.

Table 12: Tailings Beach Width

TSF Pond Volume (m^3)	Beach Width (m)			
	S1	S2	S4	S5
0	300	300	300	300
1,500,000	300	300	300	300
2,500,000	200	200	200	200
3,000,000	100	100	100	100
5,500,000	0	0	0	0

The model uses both Table 11 and Table 12 presented above to calculate the beach width and consequently the seepage flow rates through the embankments during operations. For every time step the model calculates the TSF volume and consequently the beach width, and finally the seepage flow rate.

Starting from four months into closure (August 1, 2031), the TSF pond reduces its volume to 0.25 M-m^3 within two months due to the construction of the closure TSF spillway. This is estimated to increase in the seepage flow rate on the perimeter embankment close to corner 1, as the TSF pond will be pushed to that corner. For modelling purposes, it is considered that the seepage flow rate in Table 13 will be in effect 6 months after the end of the operation phase and throughout the post-closure phase.

Table 13: Tailings Beach Width at Last Year of Operation and Closure

Flow Rate (L/s)			
S1	**S2**	**S4**	**S5**
70	0	0	0

Note: Values start 6 months after end of operation. Maximum capacity of TSF pond is limited to 250,000 m³.

5.0 WATER BALANCE RESULTS

The following sections present major model results for the operational and closure phases, and partial results for post-closure phase. Full extension of post-closure results are presented in Appendix C.

5.1 WTP Treatment Capacity

Throughout the entire planned future operations and closure periods to March 31, 2041, the maximum treatment capacity of the WTP in the model is assumed to be 25,000 m^3/day (0.29 m^3/s, 9.15 M-m^3/year). Excess water beyond this discharge rate is temporarily stored within the TSF until it can be treated and discharged. Centralized collection and treatment of contact water is assumed during operations, closure, and post-closure. The Mine's current discharge permit authorizes an annual discharge volume of 10.59 M-m^3.

In year 2041, the assumed treatment capacity of the WTP in the model remains at 25,000 m^3/day (0.29 m^3/s). However, annual contact water requiring treatment is reduced over the post-closure phase as site areas are remediated and some runoff is considered non-contact water, as shown in the flow diagram Figure B-3 provided in Appendix B. The annual contact water treated discharge volume declines further in year 2051 when the South Seepage Pond and Main Embankment Seepage Pond catchments are considered remediated, commencing 10 years after the post-closure phase. At the end of the operations phase, contact water requiring treatment notably increases in 2031, as milling is assumed to terminate in 2031 and the demand for milling process water also terminates.

Estimated annual contact water volumes requiring treatment from operations to post-closure are presented in Table 14, and Figure 2 illustrates daily WTP discharge rates from operations to 10 years after post-closure.

Table 14: WTP Annual Volume Requiring Treatment (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[a]	3.90	4.57	5.72
2024	5.00	5.94	7.24
2025	3.50	4.97	6.79
2026	3.37	4.72	6.53
2027	3.35	4.79	6.60
2028	3.36	4.80	6.70
2029	3.39	4.78	6.46
2030	3.31	4.75	6.56
2031[b]	3.93	4.39	5.04
2032	5.56	6.68	7.82
2033	5.54	6.57	7.57
2034	5.50	6.54	7.49
2035	5.42	6.42	7.44
2036	5.43	6.44	7.36

Table 14: WTP Annual Volume Requiring Treatment (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2041[(c)]	2.36	2.88	4.04
2046	1.80	2.27	3.31
2051	0.46	0.83	1.39
2071	0.33	0.71	1.48
2091	0.32	0.69	1.60
2111	0.32	0.71	1.44
2131	0.02	0.03	0.05

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

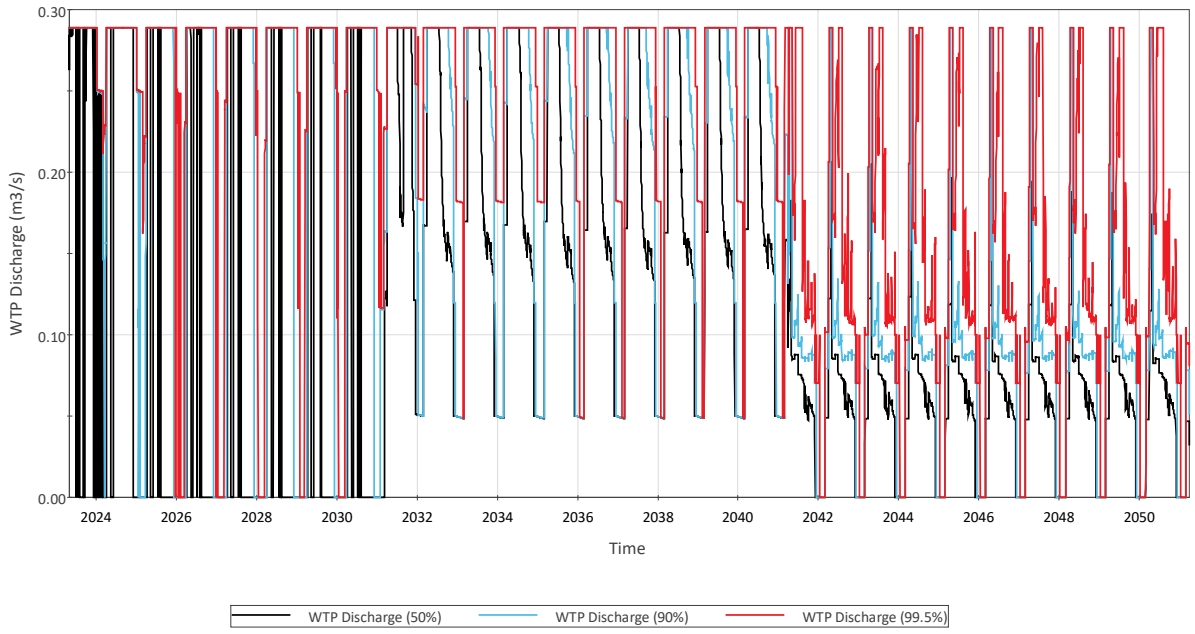


Figure 2: WTP Discharge Rate from Operations to 10 years after Post-Closure

5.2 Tailings Storage Facility

Temporary detention of water will be necessary to manage the large runoff volumes generated during freshet (typically April to June). The inflows during freshet will exceed treatment capacity, and detention volume is required to prevent uncontrolled release from the PETBP and to equalize the flow for treatment. The TSF is available to store excess freshet water until four months after the start of closure. At that time, the TSF pond will decrease its volume to 0.25 M-m³, the maximum allowable volume at closure.

To create the reduced TSF pond, a closure spillway will be constructed at the north abutment (Corner 5) of the TSF. Water will discharge from the TSF to the CCS, and then flow to the PETBP for treatment prior to discharge.

During closure and post-closure, the TSF pond is modelled to discharge annually via the spillway, and the TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3. As from Figure 3, the volume fluctuation follows a consistent pattern during both closure and post-closure periods, with minimum values occurring in winter and reaching maximum capacity during freshet (0.25 M-m^3).

Figure 3 shows the water volume in the TSF throughout future operations and into closure until 10 years after post-closure. The TSF volume pattern shown for the 2041-2051 post-closure period is continued for the remaining 80 years of post-closure (until 2131). Table 15 shows tabulated minimum, average, and maximum bounds for the three percentile trends shown in Figure 3.

Table 15: TSF Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1,330,244	1,390,394	1,429,751
	Average	1,493,500	1,576,822	1,809,717
	Maximum	2,840,000	2,840,000	3,493,139
Closure	Minimum	0	0	0
	Average	119,248	188,149	265,076
	Maximum	1,756,506	2,012,120	2,479,271
Post-Closure	Minimum	0	0	0
	Average	50,710	116,082	182,881
	Maximum	252,571	252,571	252,571

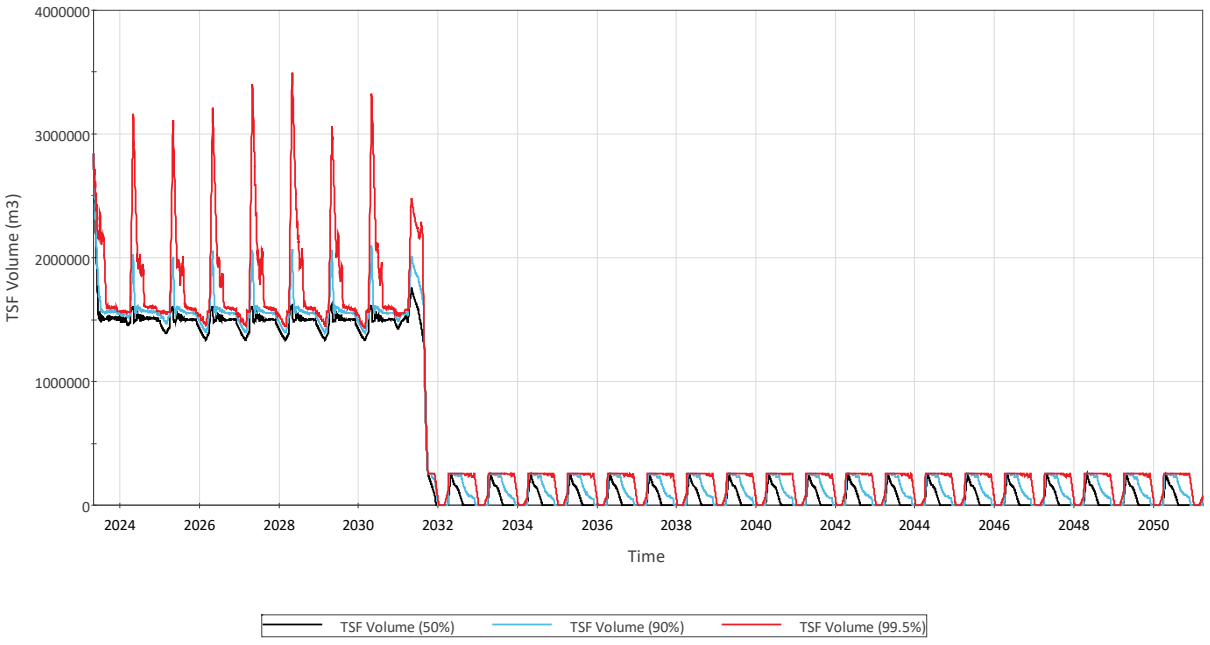


Figure 3: TSF Water Volume from Operations to 10 Years after Post-Closure

5.3 Springer Pit

The simulated Springer Pit water volume during the operational phase is shown in Figure 4 for the 50th, the 90th, and the 99.5th percentiles. The simulations were run from an initial Springer Pit storage volume of 0 m^3 on May 2, 2023. During the operational phase, the volume in Springer Pit is reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet, as freshet inflow exceeds pit dewatering pumping capacity.

Springer Pit and Cariboo Pit are modelled as a single pit in the closure phase, using the stage-storage curve based on the ultimate projected topography, as detailed in Section 5.5.

Table 16: Springer Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	8,620	35,720	117,745
	Maximum	74,124	169,623	361,074

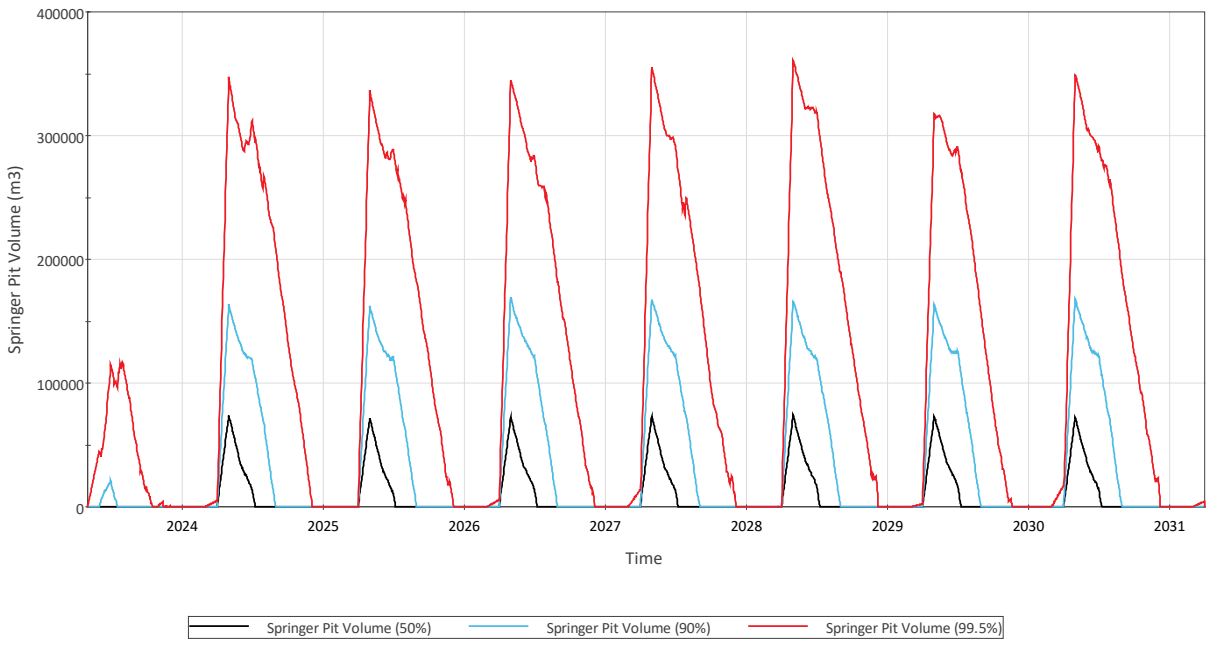


Figure 4: Springer Pit Water Volume during Operations

5.4 Cariboo Pit

Simulated Cariboo Pit water volumes during the operational phase are shown in Figure 5 for the 50th, the 90th, and the 99.5th percentiles. The simulations were run from an initial Cariboo Pit storage volume of 0.24 M-m^3 on May 2, 2023. During the operational phase, the volume in Cariboo Pit is reduced to the minimum volume before each freshet, and temporary storage will increase to its maximum volume of 0.26 M-m^3 during the freshet. Springer Pit and Cariboo Pit have been modelled as one combined pit in the closure phase as explained in Section 5.3.

Table 17: Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	81,256	112,813	169,463
	Maximum	259,249	259,249	259,249

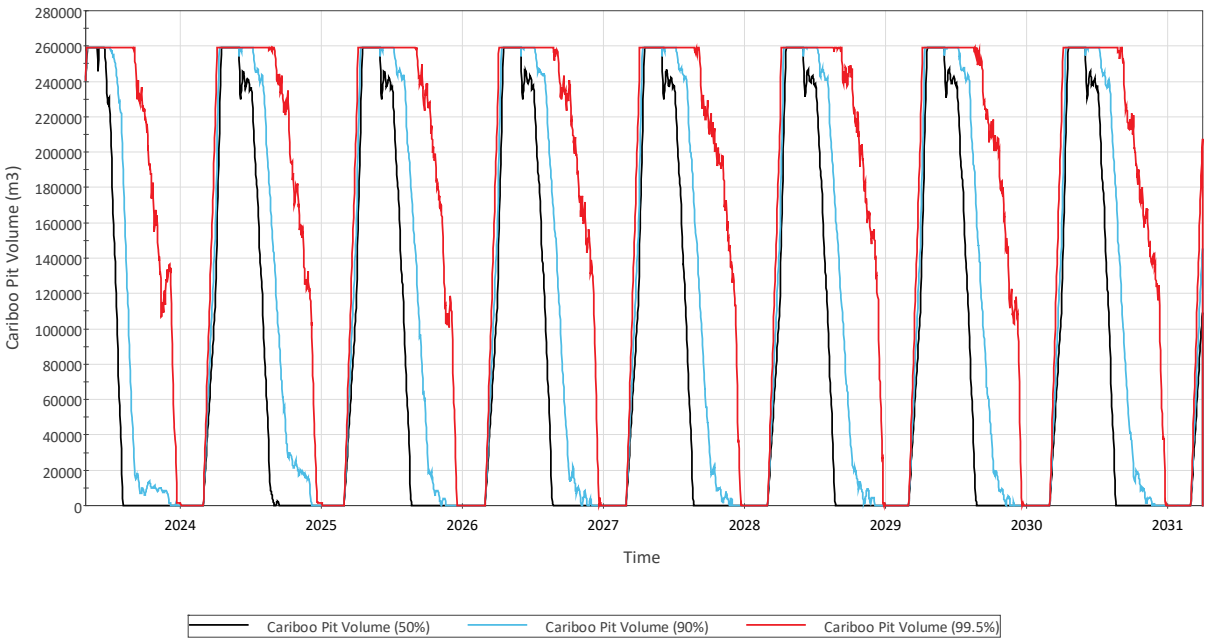


Figure 5: Cariboo Pit Water Volume during Operations

Table 18 shows the modelled average annual overflow volume from the Cariboo Pit during operations, and these overflow volumes are included in the total annual volumes required for treatment shown in Table 14.

Table 18: Cariboo Pit Annual Overflow (m^3)

Phase	Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Operations	283,897	574,260	1,221,920

5.5 Combined Springer-Cariboo Pit

Springer Pit and Cariboo Pit were modelled as a single pit for the closure phase (starting April 1, 2031). A result comparison between different percentiles for Combined Springer-Cariboo Pit volume during closure and post-closure is provided in Figure 6 . Potentially Acid Generating (PAG) waste rock will be stacked uniformly to an elevation of 1,004 m in the base of the Combined Springer-Cariboo Pit at the end of the operations phase. Results of the simulations indicate that water levels within the pit will cover the PAG material placed in pit by approximately 2033 under the 99.5th percentile condition, while under the rest of the climate conditions it is estimated to cover the PAG material placed in pit by 2034. Under the 50th percentile results, the combined Springer-Cariboo Pit lake is estimated to start overflowing in 2058, while under the 90th percentile it is estimated to start overflowing in 2056, and in 2055 under the 99.5th percentile. The Water Quality Report (WSP 2023d) discusses modelled water quality of the Springer-Cariboo pit lake at the estimated time of overflow.

Table 19: Combined Springer-Cariboo Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Closure	Minimum	109,345	145,263	211,031
	Average	4,827,785	5,199,295	5,652,177
	Maximum	9,030,590	9,598,661	10,300,000
Post-Closure	Minimum	9,032,744	9,600,627	10,300,000
	Average	20,033,811	20,167,573	20,287,305
	Maximum	21,100,000	21,100,000	21,100,000

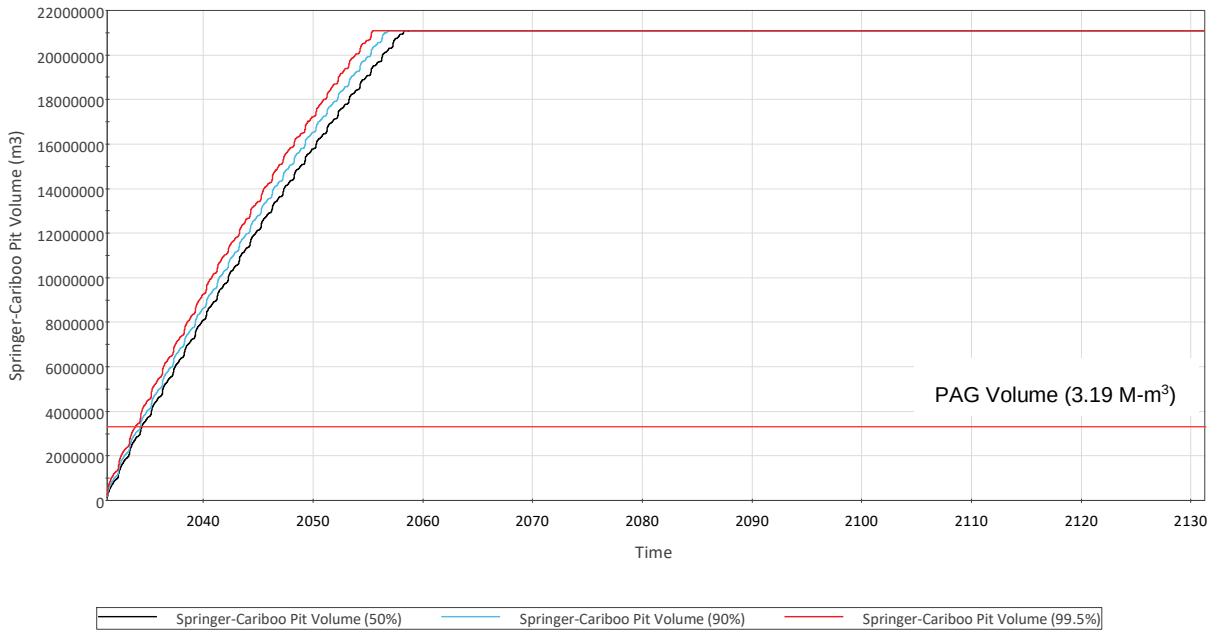


Figure 6: Combined Springer-Cariboo Pit Water Volume from Closure

The combined Springer-Cariboo Pit is modelled to fill to its maximum volume during post-closure. Following that time, additional volume collected in the combined pit will overflow from the pit's spillway and is assumed to direct discharge to the receiving environment in the SWWBM. Water quality and water treatment discussion is included under separate cover regarding this assumption of direct environmental discharge of pit lake overflow during post-closure.

Table 20 shows the modelled average annual overflow volume from the combined Springer-Cariboo Pit.

Table 20: Combined Springer-Cariboo Pit Annual Overflow (m^3)

Phase	Combined Springer-Cariboo Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	469,711	1,051,048	2,249,910

5.6 Perimeter Embankment Till Borrow Pond (PETBP)

The PETBP serves as the final component of the centralized water management infrastructure, collecting water from the entire site. From this point, the water is pumped back to the mine for reuse, storage, or treated and discharged through the adjacent WTP. The current maximum capacity of the PETBP is 170,000 m^3. When the water volume in the PETBP exceeds 121,700 m^3 during the operations phase, modelled pumps to the TSF are activated to prevent overflow.

The 50th percentile results show that the maximum volume in the pond approaches 125,000 m^3 during the freshet. There are no occurrences of overflow from the PETBP under the simulated conditions during the future operational phase. During closure and post-closure, less storage is available in the overall water management system, and the PETBP reaches higher maximum volumes during freshet periods and does not have the capacity to prevent overflow for the 99.5th percentile results (as shown in PETBP overflow volumes listed in Table 22). The SWWBM predicts that the PETBP will have sufficient capacity to prevent overflow for the 50th and 90th percentile climate conditions. It is assumed that sufficient storage will be implemented during closure to prevent any unwanted overflow of contact water requiring treatment during the closure phase. The volumes listed in Table 22 are included in the total annual volumes required for treatment shown in Table 14.

Estimated storage volumes in the Perimeter Embankment Till Borrow Pond (PETBP) from operations to 10 years after post-closure are presented in Figure 7, with minimum, average, and maximum bounds of those trends shown in Table 21.

Table 21: PETBP Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	57,800	57,800	57,800
	Average	70,564	86,981	108,041
	Maximum	122,966	148,674	170,000
Closure	Minimum	57,800	57,800	57,800
	Average	65,872	73,383	93,979
	Maximum	120,397	149,882	170,000
Post-Closure	Minimum	57,800	57,800	57,800
	Average	58,029	57,924	65,613
	Maximum	72,012	137,714	170,000

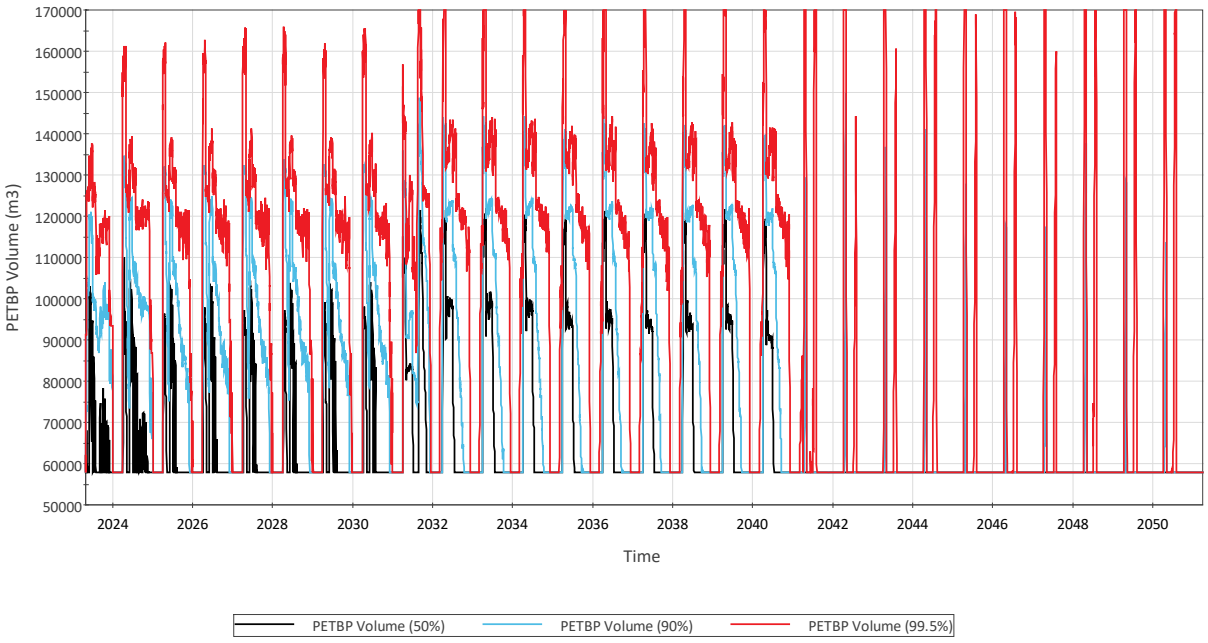


Figure 7: PETBP Water Volume in Pond during Operations to 10 years after Post-Closure

Table 22: Annual PETBP Overflow Volume for Treatment (m^3)

Year	Annual Overflow Volume at PETBP (m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[(a)]	0	0	0
2024	0	0	0
2025	0	0	0
2026	0	0	0
2027	0	0	0
2028	0	0	0
2029	0	0	0
2030	0	0	0
2031	0	0	0
2032	0	0	227,098
2033	0	0	39,339
2034	0	0	9,640
2035	0	0	0
2041	0	0	498,988
2046	0	0	456,228

Table 22: Annual PETBP Overflow Volume for Treatment (m^3)

Year	Annual Overflow Volume at PETBP (m^3)		
	50th Percentile	90th percentile	99.5th percentile
2051	0	0	126,721
2056	0	0	334,984
2076	0	0	259,000
2096	0	0	269,515
2116	0	0	240,229
2131	0	0	0

(a) Model simulation start date: May 2, 2023.
(b) Closure starts on April 1, 2031.
(c) Post-closure starts on April 1, 2041.

5.7 Wight Pit

The water volume in Wight Pit is expected to increase during every freshet season. Four months into the closure phase, the TSF pond will be reduced to 0.25 M-m^3 within two months. Once the TSF can no longer provide freshet storage, Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for freshet storage and will be allowed to fill. Wight Pit is projected to start overflowing in 2049 under the 50th percentile results, and in 2047 under the 90th and 99.5th percentile results. Overflow from Wight Pit during post-closure is assumed as direct environmental discharge to Polley Lake and the water quality implications of this assumption are discussed under separate cover. Estimated volumes stored in Wight Pit from operations to 10 years after post-closure are presented in Figure 8 and the average annual post-closure overflow volumes are shown in Table 24.

Table 23: Wight Pit Water Volume (m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	459,747	650,947	1,128,389
	Maximum	3,427,576	3,483,974	3,495,141
Closure	Minimum	0	0	0
	Average	80,815	373,440	1,188,190
	Maximum	490,123	1,153,040	2,326,346
Post-Closure	Minimum	0	0	0
	Average	4,835,386	4,841,820	4,849,597
	Maximum	4,984,114	4,984,114	4,984,114

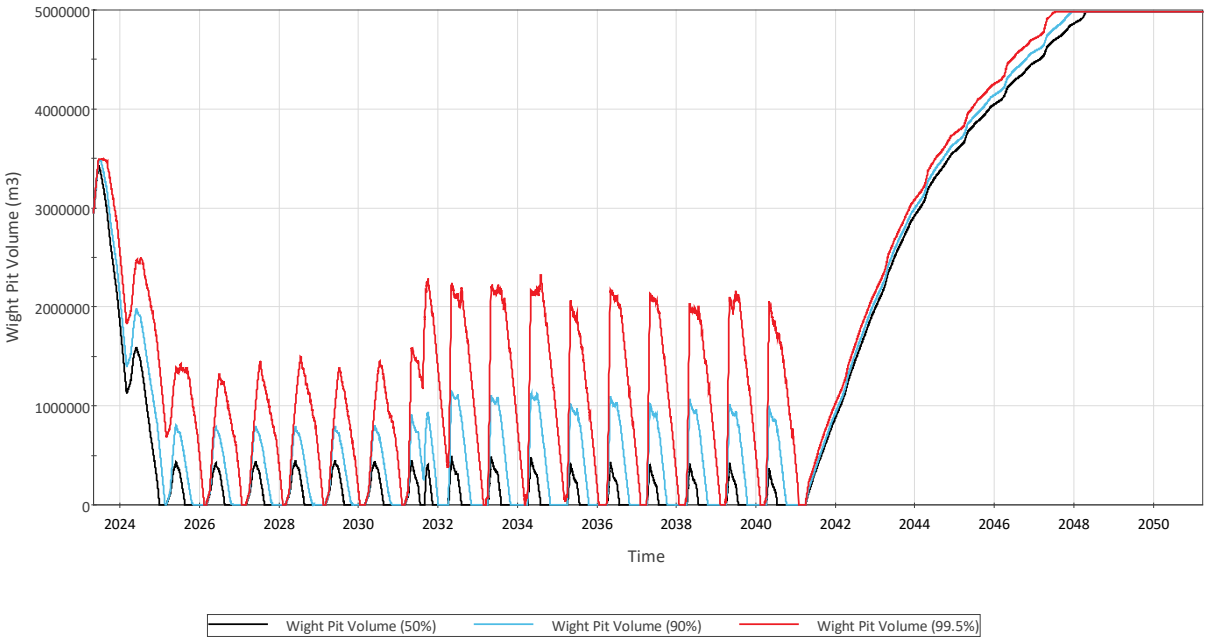


Figure 8: Wight Pit Water Volume from Operations to 10 years after Post-Closure

Table 24: Wight Pit Annual Average Overflow (m^3)

Phase	Wight Pit Annual Average Overflow (m^3)		
	50th Percentile	90th percentile	99.5th percentile
Post-Closure	466,741	617,692	993,214

6.0 SUMMARY

The SWWBM was updated to reflect the Springer Expansion LOM plan during the operational phase and incorporates closure and post-closure phases for the Mount Polley Mine. The SWWBM supports water management planning and the assessment of water quality and associated water treatment and discharge options.

The model was run from May 2, 2023, to March 31, 2131, and included the following LOM phases:

- operational phase extending from May 2, 2023, to March 31, 2031.
- closure phase extending from April 1, 2031, to March 31, 2041.
- post-closure phase commencing on April 1, 2041, and extending, for the purposes of this analysis, to 2131.

The model was run stochastically for 2000 realizations to present 50th, 90th, and 99.5th percentile model results. The results for the modelling during the operational phase are presented as follows:

- The average annual treated discharge for the 50th percentile is approximately 3.65 M-m^3 between 2023 and 2031, while the milling process water demand exists.
- The maximum annual treated discharge for the 99.5th percentile 7.21 M-m^3 in 2031.
- The maximum TSF pond volume during the operational phase is approximately 3.49 M-m^3 for 99.5th percentile, and 1.62 M-m^3 for the 50th percentile results (excluding 2023 when the TSF is initially set to 2.84 M-m^3 in the model).
- During the operational phase, the volume in Springer Pit and Cariboo Pit are both decreased to empty before each freshet, and temporary storage will occur during the freshet.
- There are no overflows from the PETBP under the simulated conditions during the operational phase.

The conclusions for the modelling during closure and post-closure phases are as follows:

- The average annual treated discharge for the 50th percentile result is approximately 0.95 M-m^3.
- The TSF pond volume will vary seasonally, limited by the spillway invert, to a maximum of approximately 0.25 M-m^3.
- The combined Springer-Cariboo Pit Lake is estimated to start overflowing between 2055 and 2058, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.
- PAG material placed in the combined Springer-Cariboo Pit is estimated to be inundated and covered by the pit lake between 2033 and 2034.
- During closure, the volumes in PETBP are reduced to the minimum volume before each freshet, and temporary storage will occur during the freshet under each of the climate conditions simulated. During closure and post-closure phases, the PETBP does not have sufficient storage capacity to prevent overflow during freshet for the 99.5th percentile condition; however, these overflow volumes are included with the annual treatment requirement volumes.
- The Wight Pit is expected to initiate spilling between 2047 and 2049, with an average annual 50th percentile overflow volume of approximately 0.47 M-m^3.

7.0 CLOSING

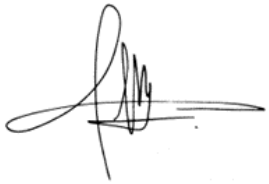
This report summarizes the SWWBM to support the water management information requirements for the Springer Expansion LOM plan.

We trust that this report satisfies your current requirements. Please contact the undersigned should you have any questions.

WSP Canada Inc.



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https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/084-r-31182- mount polley mine water balance model - springer expansion life-of-mine/rev1/23590671-084-r-rev1-31182-wbm_springer_expansion 21may_24.docx

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APPENDIX A

Springer Expansion LOM SWWBM Inputs

A1.0 CATCHMENT AREAS BY LAND TYPE

Table A-1: Catchment Areas by Land Type

Catchment	Land Types (m^2)						
	Waste Rock	Haul Roads	Mill Site Area	Disturbed Area	Undisturbed Area	Maximum Pond Area	Total Catchment
South Seepage Pond	0	0	0	0	0	385	385
Main Embankment Seepage Pond	214,904	0	0	124,485	0	37,546	376,935
TSF Upstream (External)	0	238,423	0	63,800	320,559	0	622,782
PETBP	100,535	96,348	0	193,072	65,060	69,307	524,322
CCS	0	67,918	0	122,204	248,419	21,823	438,541
Bootjack Creek Sump	0	103,986	0	70,041	0	1,130	175,157
SERDS Ditch	401,235	165,456	273,919	313,059	383,918	0	1,537,587
Mill Site Sump	0	0	0	0	0	1,628	1,628
Cariboo Pit	922,698	0	129,436	0	0	268,208	1,320,342
Mine Drainage Creek Sump	437,190	137,335	314,166	114,972	111,134	1,125	1,115,922
Nez Dump	199,116	261,421	0	237,889	202,646	0	1,299,306
North Bell Dump	0	0	0	0	0	0	597,350
East RDS	693,392	0	0	899,543	0	0	597,350
Springer Pit	0	0	0	156,100	0	280,478	436,578
NW Sump	205,919	63,800	0	60,210	0	231	330,160
9K Sump	497,228	0	0	60,735	140,272	400	698,635
Wight Pit	162,022	0	0	0	0	251,888	413,910
Boundary Pit	3,511	0	0	0	10,286	9,616	23,413

Note: TSF-Tailing Storage Facility; PETBP-Perimeter Till Borrow Pond; CCS-Central Collection Sump.

A2.0 FLOW INVENTORY

A description of the model flows is provided in Table A-2. Direct precipitation, runoff and environmental discharge flows are numbered according to their associated elements and are therefore not described herein.

Table A-2: Description of Flows for Operational Phase

Flow Process	Component	Flow Label
Hydrology	Precipitation	N/A[(a)]
	Evaporation	N/A[(a)]
	Runoff	All flows labelled R[(b)]
Consumption	Turbo-misters	C1, C10
	Water Truck Usage	C4, C8
Seepage (from Tailings Storage Facility)	South Seepage Pond Inflow	S1
	Perimeter Embankment Till Borrow Pond (PETBP)	S4, S5
	Main Embankment Seepage Pond	S2, S3
	Seepage to Environment	S14
Seepage (from Other Facilities)	SERDS Dump to SERDS Ditch	S6
	North Bell Dump to Wight Pit	S7
	East RDS to Long Ditch	S8
	NEZ Dump to Long Ditch	S9
	To 9KM Sump	S10
	To NW Sump	S11
	To Mine Drainage Creek Sump	S12
	To Bootjack Creek Sump	S13
Groundwater Flows	Wight Pit Groundwater Inflow	GW1
	Springer Pit Groundwater Inflow	GW2
	Cariboo Pit Groundwater Inflow	GW3
	Springer Pit Groundwater Outflow	GW4
	Boundary Pit to Wight Pit	GW5
	Cariboo Pit Groundwater Outflow	GW6
	Wight Pit Groundwater Outflow	GW7
Transfers	Long Ditch to Central Collection Sump (CCS)	T1
	SERDS Ditch to Long Ditch	T2
	CCS to PETBP	T3
	PETBP to Water Treatment Plant (WTP)	T6
Pumped Flows – Wight Pit	TSF to Wight Pit	P30
	Boundary Pit to Wight Pit	P34
	Wight Pit to Long Ditch	P21
Pumped Flows – Springer Pit	NW Sump to Springer Pit	P18
	Springer Pit to Cariboo Pit	P17b
	Springer Pit to SERDS Ditch	P9b

Table A-2: Description of Flows for Operational Phase

Flow Process	Component	Flow Label
Pumped Flows – Process Plant	Process flow from TSF	P28
	Process return to TSF	P27
Pumped Flows – Sumps	Cariboo Pit to SERDS Ditch	P4b
	PETBP to TSF	P5
	South Seepage Pond to Main Embankment Seepage Pond	P6
	Main Embankment Seepage Pond to PETBP	P8
	Mine Drainage Creek Sump to SERDS Ditch	P10
	Bootjack Creek Sump to SERDS Ditch	P11
	Mill Domestic Water to Mill Site Sump	P13
	Geology Domestic Water Effluent to Mill Site Sump	P15
	9K Sump to NW Sump	P20
	NW Sump to Mine Drainage Creek Sump	P24
	Mill Site Sump to TSF	P31
	TSF to Mine Drainage Creek Sump	P32

(a) Evaporation and direct precipitation flows not shown on flow diagram.

(b) No flows were assigned specifically for snowmelt. Instead, snowpack was accumulated in the model and snowmelt was included in the runoff flows.

Source: Springer Pit Expansion LOM SWWBM Flow Diagram (Appendix B).

A3.0 FLOW RATES

A3.1 Pumped Flows

Except for P13 and P15, which were measured at 545 m^3/d and 2.5 m^3/d, respectively (Golder 2016a), all maximum pumping rates have been assumed. Among these rates, P4b, P5, T6, P9b, P17b, P21, P30, and P32 were provided by MPMC (MPMC 2023b), while the remaining rates remain consistent with the TAR model and were based on Golder's engineering judgement (Golder 2016a).

Maximum pumping rates for operational flows are shown in Table A-3, and maximum pumping rates for closure flows are shown in Table A-4. It should be noted that any pumped flows shown in Table A-3, but not shown in Table A-4, are assumed to be decommissioned with zero transfer capacity.

Table A-3: Maximum Pumping Rates for Operational Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P4b	Cariboo Pit	PETBP	13,000	MPMC 2023b
P5	PETBP	TSF	100,000	Golder 2016a
P6	South Seepage Pond	Main Embankment Seepage Pond	8,640	Golder 2016a

Table A-3: Maximum Pumping Rates for Operational Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P8	Main Embankment Seepage Pond	PETBP	8,640	MPMC 2023b
P9b	Springer Pit	PETBP	0	MPMC 2023b
P10	Mine Drainage Creek Sump	SERDS Ditch	N/A[a]	Golder 2016a
P11	Bootjack Creek Sump	SERDS Ditch	8,640	Golder 2016a
P13[b]	Mill Domestic Water	Mill Site Sump	545	Golder 2016a
P15[b]	Geology Domestic Water	Mill Site Sump	2.5	Golder 2016a
P17b	Springer Pit	Cariboo Pit	4,000	MPMC 2023b
P18	NW Sump	Springer Pit	9,594	Golder 2016a
P20	9KM Sump	NW Sump	13,633	Golder 2016a
P21	Wight Pit	PETBP	8,712/14,088[c]	MPMC 2023b
P24	NW Sump	Mine Drainage Creek Sump	8,640	Golder 2016a
P27	Mill	TSF	N/A[e]	Golder 2016a
P28	TSF	Mill	N/A[e]	Golder 2016a
P30[d]	TSF	Wight Pit	10,000	Determined in this SWWBM
P31	Mill Site Sump	TSF	8,640	Golder 2016a
P32	TSF	PETBP	13,000	MPMC 2023b

(a) No maximum pumping rate applied. This pumping demand is dynamic and depend on the required pumping rate to dewater the Mine Drainage Creek Sump.

(b) Based on measured flow rates (Golder 2016a).

(c) 14,088 m3/day effective starting September 2023.

(d) Capacity assumed to avoid PETBP overflow during operation. See Section 4.5.7.1 in the main report.

(e) No maximum pumping rate applied. These are defined based on the process flow requirements from the Mill, where P27 is defined as process water (including interstitial water) in addition to tailings solids, and P28 is defined as process water demand.

Table A-4: Maximum Pumping Rates for Closure Flows

Flow ID	From	To	Flow Rate (m^3/day)	Reference
P6	South Seepage Pond	Main Embankment Seepage Pond	8,640	Golder 2016a
P8	Main Embankment Seepage Pond	PETBP	8,640	MPMC 2023b
P10	Mine Drainage Creek Sump	SERDS Ditch	8,640	Golder 2016a
P11	Bootjack Creek Sump	SERDS Ditch	8,640	Golder 2016a
P20	9KM Sump	NW Sump	8,640	Golder 2016a
P21	Wight Pit	PETBP	8,712	MPMC 2023b
P24	NW Sump	Mine Drainage Creek Sump	8,640	Golder 2016a
P35[(a)]	CCS	Wight Pit	85,000	Determined in this SWWBM

(a) Active to use Wight Pit to store water when TSF is not available for storage during closure. See Section 4.5.7.1 in the main report.

A3.2 Consumption Flows

The flow parameters for the turbomisters are shown in Table A-5 and Table A-6.

Table A-5: Operational Hours per Day for Turbomisters

Flow ID	From	Hours per Day				
		May	June	July	August	September
C1	Main Embankment Seepage Collection Pond	10	10	10	10	10
C10	Wight Pit	10	10	10	10	10

Table A-6: Operational Flow Rates for Turbomisters

Flow ID	From	Evaporation Rates (m^3/hr)	
		May and June	July to September
C1	Main Embankment Seepage Collection Pond	5.5	12.7
C10	Wight Pit	5.5	12.7

The flow parameters for water trucks are shown in Table A-7 and Table A-8 below.

Table A-7: Operational Days per Month for Water Trucks

Flow ID	From	Days per Month				
		May	June	July	August	September
C4	Wight Pit	0	0	20	20	15
C8	CCS	4.5	19	12.6	21.5	10.6

Table A-8: Operational Flow Rates for Water Trucks

Flow ID	From	Flow Rates (m^3/day)
C4	Wight Pit	818
C8	CCS	818

A3.3 Transfer Flows

The flow rates for the transfer flows were defined in the model as described in Table A-9.

Table A-9: Transfer Flows

Flow ID	From	To	Flow Definition/Rates
T1	Long Ditch	Central Collection Sump	Flow rates determined by runoff and baseflow from the Long Ditch catchment.
T2	SERDS Ditch	Central Collection Sump	Flow rates determined by runoff and baseflow from the SERDS ditch catchment.
T3	Central Collection Sump	PETBP	Modelled as the overflow rate from the CCS.
T6[(a)]	PETBP	Water Treatment Plant	Maximum capacity 25,000 m^3/day during operations until post-closure.

(a) Provided by Maximum pumping rates provided by MPMC (MPMC 2023b).

A3.4 Groundwater inputs

Springer Pit

A hydrogeological assessment was conducted to predict the quantity of long-term groundwater seepage from both the Springer and the Cariboo pits towards Bootjack Lake (Golder 2016b). The analysis considered placing waste rock in the ultimate pit prior to the pit lake formation. As the pit lake level increases between 1,020 masl and 1,030 masl, seepage in the range of 10 to 100 m^3/d from the Springer Pit Lake into the subsurface was predicted to occur (Table A-10). Seepage was found to gradually increase to approximately 400 m^3/d when the pit lake reaches the spillway at 1,050 masl.

Table A-10: Springer Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
880	520	0
940	510	0
960	490	0
980	460	0
1000	420	0
1020	320	10
1030	300	100
1040	280	250
1050	270	400

Cariboo Pit

Predicted groundwater flows of Cariboo Pit remain consistent from Golder 2016b. In the Cariboo Pit, seepage towards the Bootjack Lake of approximately 20 m^3/d was predicted to occur only when the pit lake level approaches 1,050 masl.

Table A-11: Cariboo Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
880	600	0
940	610	0
960	610	0
980	590	0
1000	540	0
1020	460	0
1030	420	0
1040	380	0
1050	320	20

Wight Pit

Groundwater inflow to the Wight Pit is projected to gradually decrease from 2,600 m^3/d at of 804 masl, to 600 m^3/d at 935 masl (Golder 2015). Table A-12 shows the predicted groundwater flows for Wight Pit.

Table A-12: Wight Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Flow (m^3/d)	
	Into the Pit	Out of the Pit
804	2600	0
880	2600	0
900	2500	0
910	2100	0
920	800	0
926	600	500
930	600	500
935	600	500

Boundary Pit

MPMC reported that seepage was not observed along the pit walls during mining. However, seepage out of the pit could still occur due to water entering via surface water runoff and direct precipitation. Potential seepage rates out of the pit were estimated to incorporate them into the pit water balance and to characterize a possible seepage pathway originating from this pit (Golder 2016c).

Seepage rates out of the Boundary Pit were estimated from a Darcy's Law calculation that considers changes in the dimensions of the seepage area as the pit is being flooded. The estimated seepage rate from the Boundary Pit when the pit lake surface level is 5m above its base (1,072 masl) is approximately 59 m^3/d, with a potential range between 35 m^3/d and 177 m^3/d due to uncertainty in bedrock permeability. Seepage outflow is estimated to decrease as the height of water column above the pit bottom decreases as shown in Table A-13.

Table A-13: Boundary Pit Predicted Groundwater Flows

Pit Lake Elevation (masl)	Groundwater Outflow (m^3/d)
1067	3
1068	10
1069	20
1070	26
1071	53
1072	59
1073	59

A4.0 STORAGE CHARACTERIZATION

Table A-14 to Table A-18 show the stage-storage curves for the following facilities:

- Springer Pit
- Cariboo Pit

- Combined Springer-Cariboo Pit
- Tailings Storage Facility
- Wight Pit

Table A-14: Springer Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
970.66	0
975	34,449
980	281,473
985	689,185
990	1,150,873
995	1,693,101
1000	2,297,269
1005	3,045,813
1010	3,869,395
1015	4,768,531
1020	5,738,839
1025	6,755,500
1030	7,834,556
1035	8,957,496
1040	10,176,962
1045	11,466,163
1050	12,809,134
1053	13,659,688

Table A-15: Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
920	0
925	3,372
930	12,800
935	29,815
940	54,426
945	91,091

Table A-15: Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
950	138,417
955	203,118
958.3	259,149

Table A-16: Combined Springer-Cariboo Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
878	0
880	5,448
890	35,320
900	80,294
910	146,856
920	238,531
930	356,228
940	511,132
950	722,060
960	997,061
970	1,333,646
980	1,732,505
990	2,217,857
1,000	2,813,866
1,010	4,854,554
1,020	8,247,385
1,030	12,008,865
1,040	16,312,811
1,050	21,104,196

Table A-17: TSF Stage-storage Curves

Elevation (masl)	Storage (m^3)			
	2020 Survey	Projected 972.5 m TSF Crest	Projected 975m TSF Crest	Projected 987m TSF Crest
956.2	0	0	0	0
957	30,784	0	0	0
958	162,897	0	0	0
959	374,780	0	0	0
960	711,559	0	0	0
961	1,173,550	0	0	0
962	1,790,644	0	0	0
963	2,875,098	0	0	0
964	4,542,339	0	0	0
965	6,448,707	179,178	0	0
966	8,512,995	486,916	0	0
967	10,624,891	881,413	39,874	0
968	12,568,198	1,366,370	307,114	0
969	12,568,198	2,006,216	656,772	0
970	12,568,198	2,973,695	1,096,052	0
971	12,568,198	4,343,412	1,634,717	0
972	12,568,198	6,174,788	2,418,560	0
973	12,568,198	7,184,001	3,568,309	0
974	12,568,198	7,184,001	5,176,980	0
975	12,568,198	7,184,001	7,180,246	0
976	12,568,198	7,184,001	7,180,246	0
977	12,568,198	7,184,001	7,180,246	0
978	12,568,198	7,184,001	7,180,246	0
979	12,568,198	7,184,001	7,180,246	0
980	12,568,198	7,184,001	7,180,246	0
981	12,568,198	7,184,001	7,180,246	273
982	12,568,198	7,184,001	7,180,246	67,347
983	12,568,198	7,184,001	7,180,246	323,880
984	12,568,198	7,184,001	7,180,246	890,494
985	12,568,198	7,184,001	7,180,246	1,912,234

Table A-17: TSF Stage-storage Curves

Elevation (masl)	Storage (m^3)			
	2020 Survey	Projected 972.5 m TSF Crest	Projected 975m TSF Crest	Projected 987m TSF Crest
986	12,568,198	7,184,001	7,180,246	3,505,768
987	12,568,198	7,184,001	7,180,246	5,704,281

Table A-18: Wight Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
803.99	5
804.99	52
809.99	3,282
814.99	8,195
819.99	14,407
824.99	22,909
829.99	34,808
834.99	57,021
839.99	84,080
844.99	122,282
849.99	167,552
854.99	223,215
859.99	289,126
864.99	363,462
869.99	449,185
874.99	544,867
879.99	696,584
884.99	883,743
889.99	1,100,537
894.99	1,349,504
899.99	1,630,787
904.99	1,970,250
909.99	2,341,775
914.99	2,881,655

Table A-18: Wight Pit Stage-storage Curve

Elevation (masl)	Storage (m^3)
919.99[(a)]	3,546,163
924.99	4,266,921
927.99	4,752,523

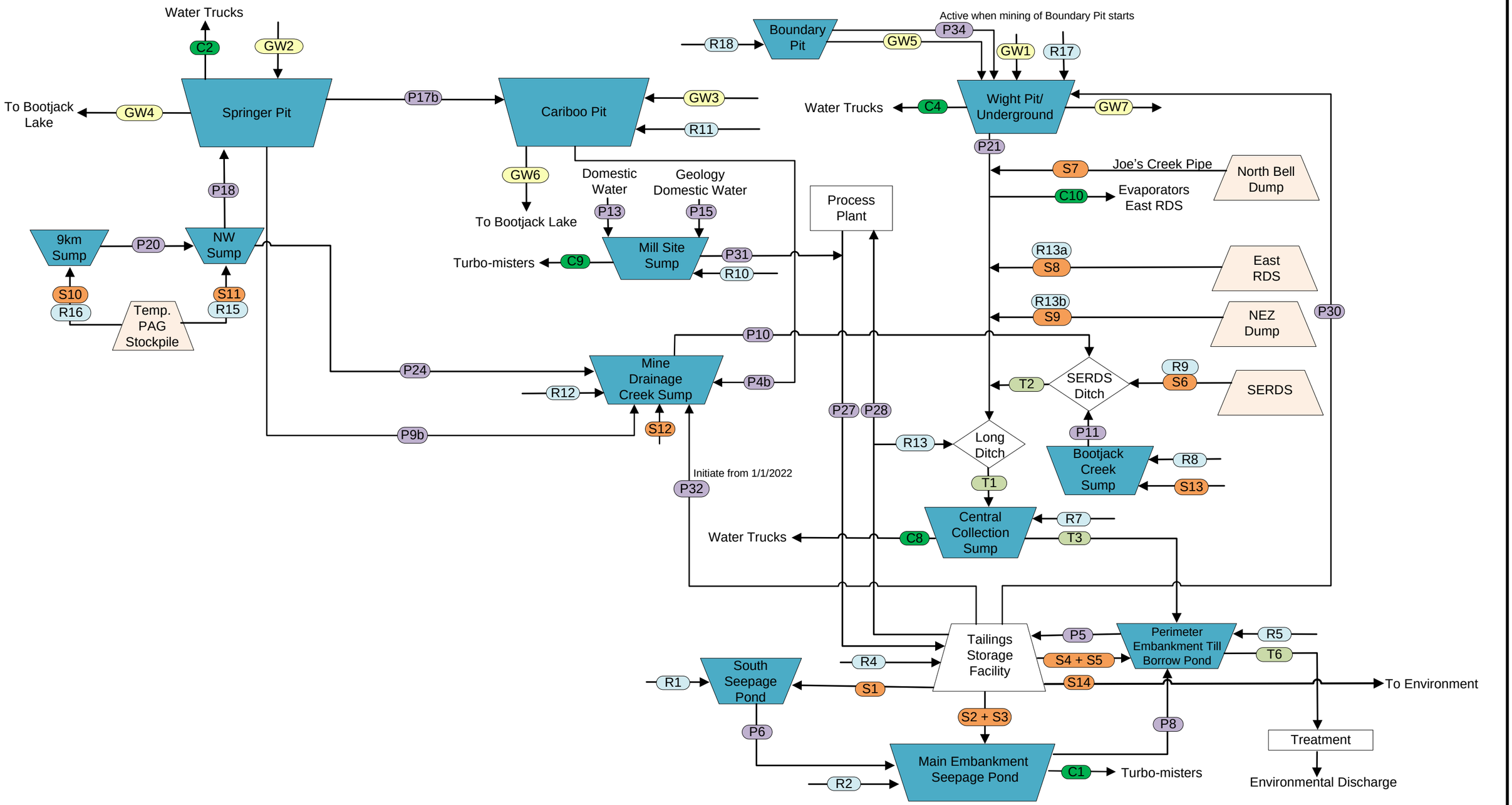
(a) Upper bound during operations is 919.99 m

Table A-19: Maximum Capacities for All Storage Facilities

Storage Facility	Estimated Capacity (m^3)
South Seepage Pond	315
Main Embankment Seepage Pond	86,146
TSF Upstream (External)	2,300,000
PETBP	170,000
CCS	50,990
Bootjack Creek Sump	1,420
Mill Site Sump	2,106
Cariboo Pit	1,234,641
Mine Drainage Creek Sump	1,420
Springer Pit	14,806,107
NW Sump	200
9K Sump	330
Wight Pit	3,779,404
Boundary Pit	14,468

APPENDIX B

Flow Diagrams and 2022 Water Management Infrastructure



Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023

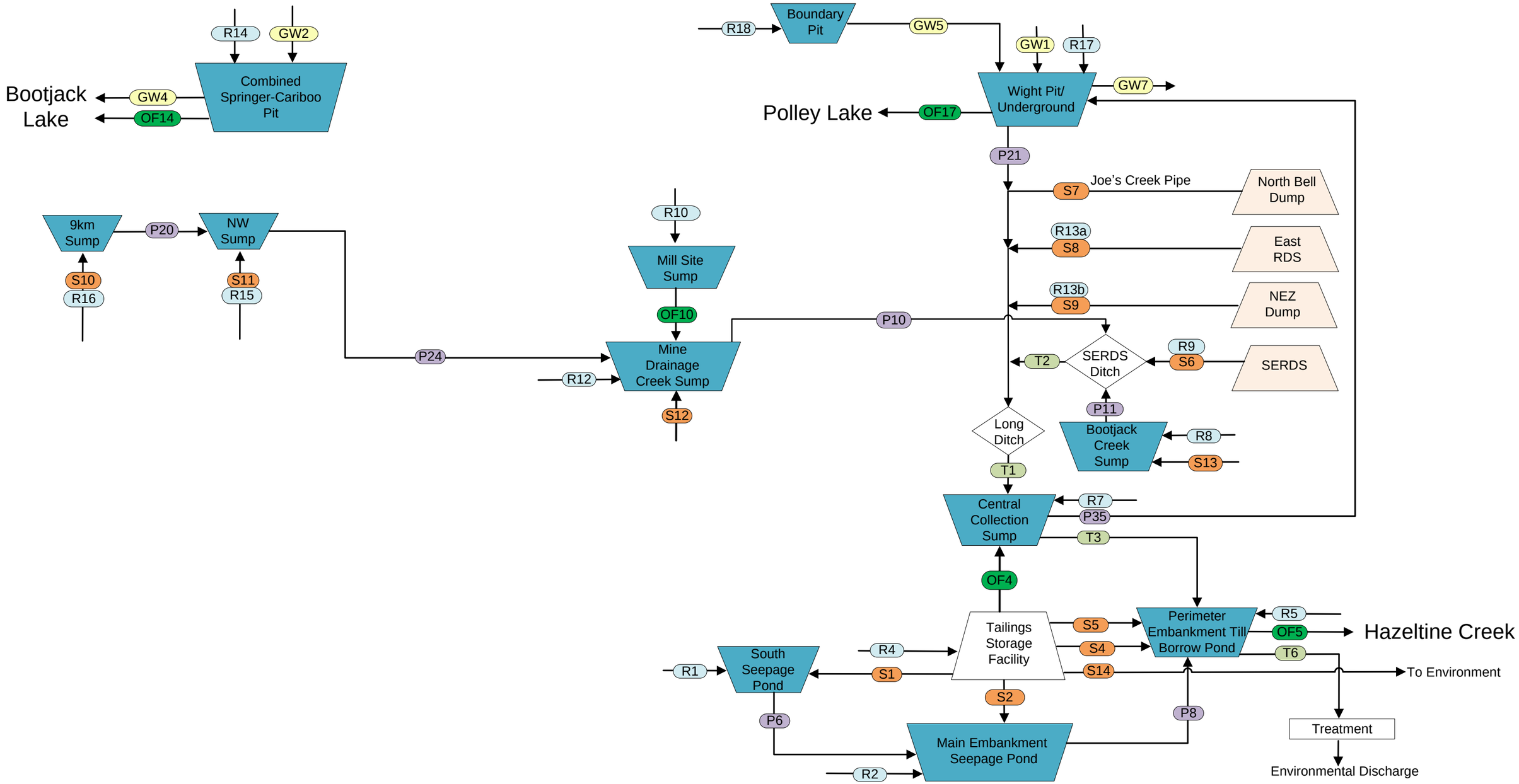
CHECKED: GD
DATE: 31 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance Operational Phase Flow Diagram 2 May 2023 – 31 April 2031

FIGURE No: B-1
REV No: 0



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023

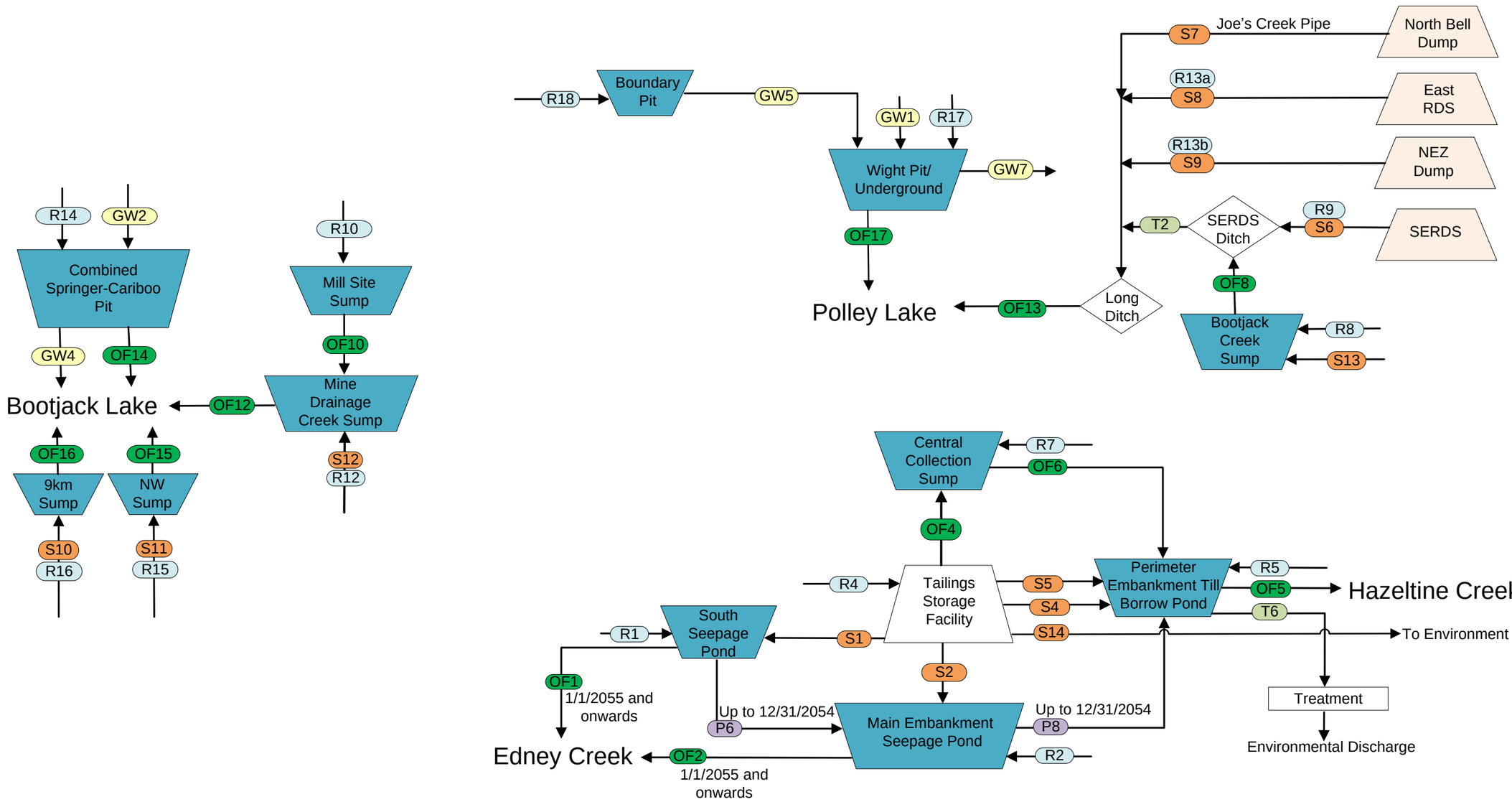
CHECKED: GD
DATE: 31 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 April 2031 – 31 March 2041

FIGURE No: B-2
REV No: 0



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 31 October 2023
CHECKED: GD
DATE: 31 October 2023
SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Post-closure Phase Flow Diagram
1 April 2041 Onwards

FIGURE No: B-3
REV No: 0

Mount Polley Mining Corporation

2022 Water Management Infrastructure

1:25,000

Gabriel Holmes
Date: 3/20/2023
Photo Dates: 2013, 2021

0 200 400 800 1,200 1,600
Meters

- Sprinklers
- Booster Tanks
- Barges
- Sumps/Ponds
- Pipelines
- Diversion Ditches
- Collection Ditches
- 20m Contours

Polley Lake

Bootjack Lake

TSF

Wight Pit Sump
Wight Pit Booster Blue
Wight Pit Dewatering Line
NEZ Booster to Mill
NEZ to Wight Pit Gravity Feed
Wight Pit Booster To Mill
Wight Pit North Diversion
Wight Pit Central Diversion
Boundary Pit
Joes Creek Coffer Dam
Gavins Ditch
East RD Ditch
NEZ Sump
Long Ditch
Bootjack Creek Diversion
SERD Sump
Long Ditch Pipe
SERD Pipe
Central Collection Sump
Breach Sump
Perimeter Embankment Till Borrow Pit
WMP Sludge Pond
PERP to TSF
Corner 2 Ditch
WTP Discharge Line
Main Seepage Pond Ditch
Sprinkler Line
MESCP
MESCP Dewatering Line
Tailings Storage Facility Supernatant
Tailings Corner 1 Line
CCS to TSF
Settling Pond
TSF Reclaim Barge
TSF Diversion
Tailings Corner 4 Line
SESCP
SESCP Dewatering Line
South Seepage Pond Ditch
Upper and Lower Long Ditch Sumps
Bootjack Creek Sump
BJ Creek Upstream Sump
Tailings/Reclaim Lines
Reclaim Booster
Tailings Pipe Containment Ditch
SERD Ditch
Canboo Pit
Canboo Pit to West Ditch
Leach Pad to Mill
Mill Site Ditch
Mill Site Sump
Springer Pit
Springer Pit to SERD Ditch
West Ditch West Portion
Mine Drainage Creek Sump
Junction Zone Seepage Collection Sump
9 Km Sump
Northwest Sump
NW Sump to Springer Pit
9K Sump to NW Sump

APPENDIX C

SWWBM Results

C1.0 SWWBM RESULTS FOR THE ENTIRE MODELLED DURATION

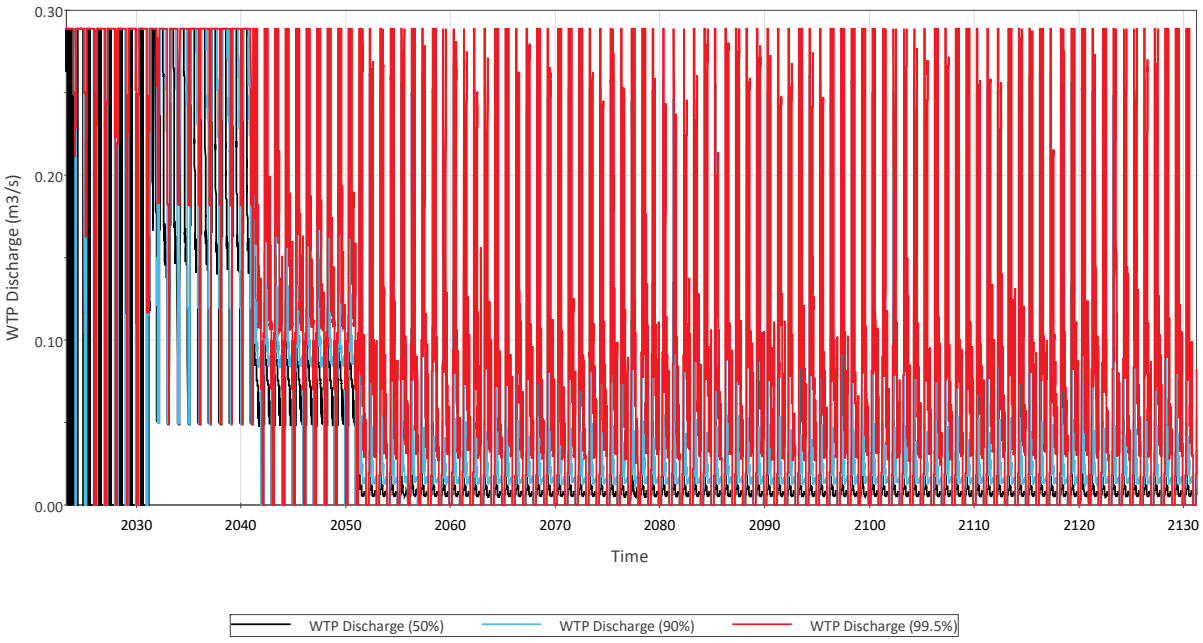


Figure C-1: WTP Discharge Rate

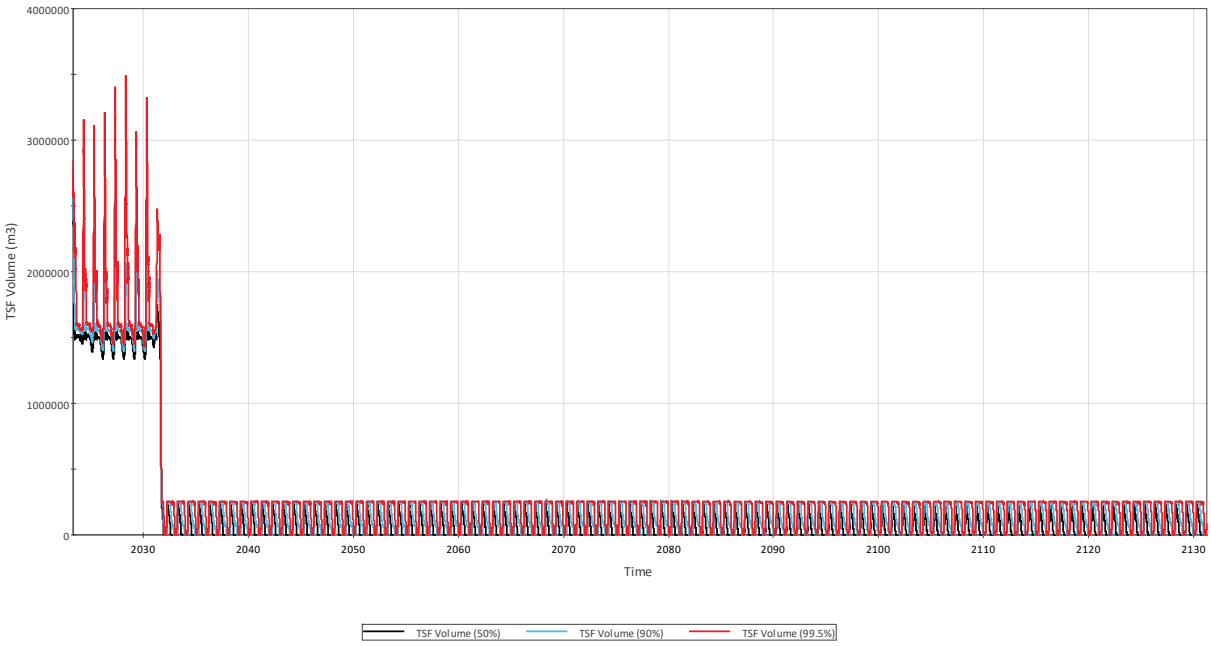


Figure C-2: TSF Water Volume

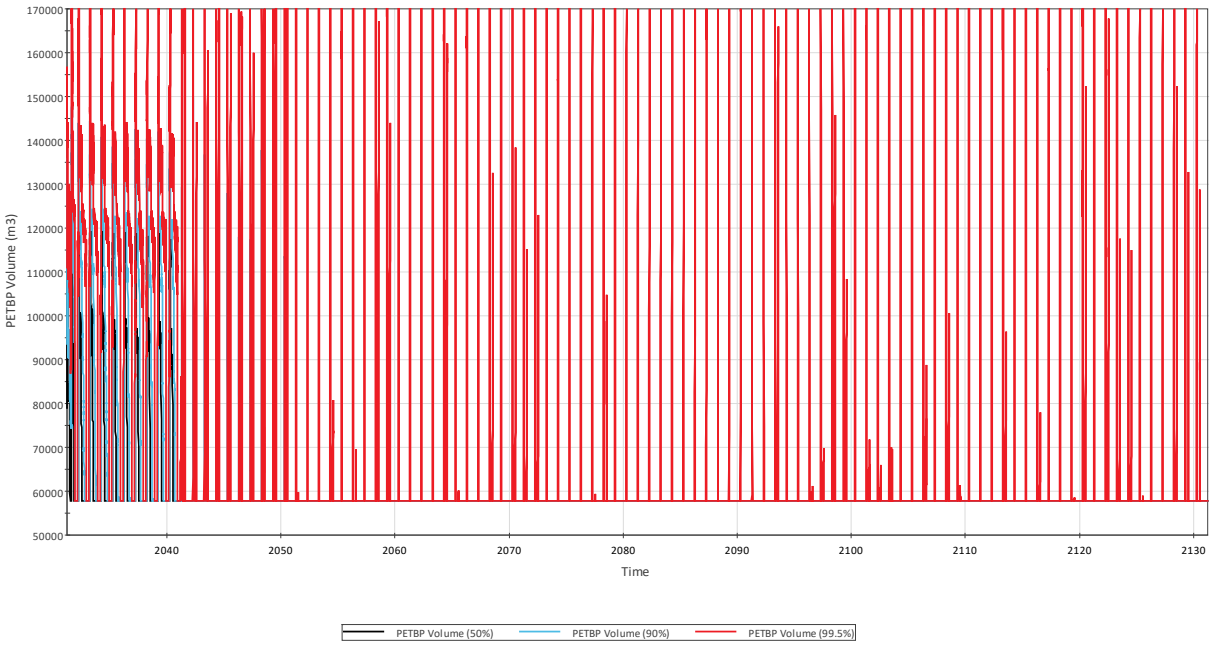


Figure C-3: PETBP Volume

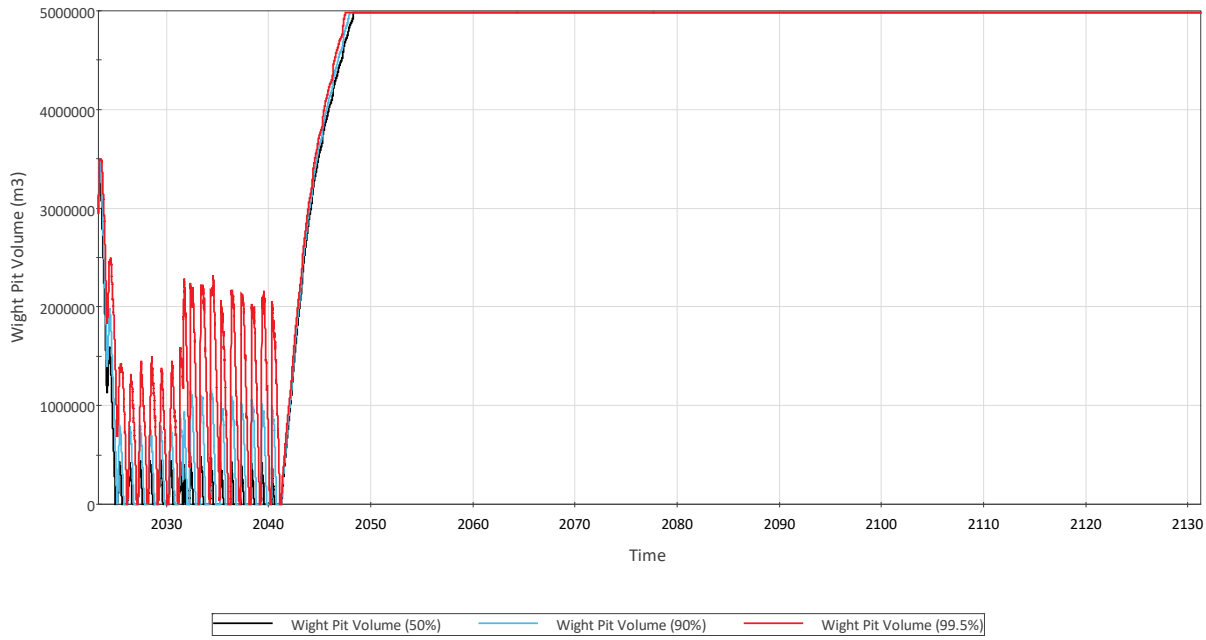


Figure C-4: Wight Pit Volume

C2.0 WTP MONTHLY VOLUME REQUIRING TREATMENT

This section is the monthly WTP volume requiring treatment corresponding to Table 14 in the main report. Results for the 50th, 90th, and 99.5th percentiles are shown in Table C-1,Table C-2, and Table C-3, respectively.

Table C-1: Monthly WTP Volume Requiring Treatment for the 50th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	816,200	714,510	466,465	298,682	393,832	463,508	445,012	301,332	3,899,541
2024	301,982	322,462	76,026	726,922	523,873	539,217	517,617	447,473	414,717	452,531	431,880	246,110	5,000,810
2025	0	0	53,142	720,473	591,207	534,104	514,400	382,392	201,214	243,282	229,247	27,300	3,496,761
2026	0	0	0	688,329	521,182	542,808	524,114	386,785	176,998	244,214	243,589	40,074	3,368,093
2027	0	0	0	688,776	534,057	536,783	519,699	387,212	196,149	226,169	214,556	42,347	3,345,748
2028	0	0	0	688,891	531,950	539,151	521,670	396,985	195,580	234,616	211,572	40,014	3,360,429
2029	0	0	0	688,784	544,074	541,812	528,879	381,832	204,143	238,037	220,087	42,961	3,390,609
2030	0	0	0	688,176	538,822	531,757	509,464	354,337	172,519	251,827	215,659	46,981	3,309,542
2031	0	0	237,630	731,590	765,112	731,759	662,575	497,020	747,088	751,567	580,182	269,013	5,973,536
2032	131,342	125,704	448,444	738,838	769,600	740,196	716,634	556,391	384,194	421,400	381,192	148,665	5,562,600
2033	127,587	117,879	445,027	738,690	768,837	739,082	713,725	575,883	385,994	414,549	366,935	147,325	5,541,513
2034	127,597	117,891	437,865	738,650	768,819	742,270	713,301	541,642	385,473	408,260	370,575	150,231	5,502,574
2035	127,586	117,878	444,939	738,787	766,046	735,339	695,924	494,783	377,100	398,504	366,789	158,514	5,422,189
2036	127,576	122,067	429,120	737,706	767,650	736,600	701,205	515,991	380,646	401,859	364,644	148,376	5,433,440
2041	127,587	117,877	413,048	362,220	249,322	241,876	208,531	165,735	151,247	157,910	143,254	22,615	2,361,222
2046	0	0	123,083	323,226	243,391	241,126	220,680	179,310	153,569	162,800	135,467	13,109	1,795,761
2051	0	0	119,167	121,927	44,866	45,020	32,832	21,846	20,830	24,124	24,756	648	456,016
2071	0	0	17,031	87,326	47,547	45,644	34,582	21,884	21,211	24,356	25,574	604	325,759
2091	0	0	16,622	86,552	42,145	52,098	36,589	17,207	19,486	30,153	21,007	501	322,360
2111	0	0	16,769	87,191	47,016	44,779	37,451	20,173	21,125	26,512	23,155	531	324,702
2131	0	0	16,786	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	16,786

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

Table C-2: Monthly WTP Volume Requiring Treatment for the 90th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	885,614	958,697	578,613	446,170	447,714	481,672	462,761	309,174	4,570,415
2024	377,183	322,277	113,359	894,904	779,430	707,385	562,135	490,842	459,376	483,603	469,228	278,584	5,938,306
2025	323,561	171,779	98,804	780,798	646,909	707,544	569,266	473,066	423,510	388,419	316,149	65,368	4,965,173
2026	0	0	13,559	921,364	860,396	697,753	558,474	498,251	448,535	417,750	261,713	45,218	4,723,013
2027	0	0	0	909,318	883,083	690,653	567,414	494,660	461,943	440,356	286,990	54,549	4,788,966
2028	0	0	0	905,149	887,772	719,201	557,734	472,854	449,297	463,258	297,832	51,563	4,804,660
2029	0	0	31,781	908,298	851,264	743,112	563,432	469,271	458,404	424,635	285,248	48,768	4,784,213
2030	0	0	0	921,523	871,912	711,883	548,263	482,499	432,592	421,499	312,624	51,493	4,754,288
2031	0	139,919	257,819	737,112	766,533	738,071	713,096	711,970	749,089	768,000	724,613	524,247	6,830,469
2032	187,843	126,063	625,665	745,943	767,394	745,350	723,700	692,818	669,208	655,228	519,533	221,585	6,680,330
2033	127,805	118,150	644,497	745,302	770,615	740,246	731,736	697,401	661,853	636,522	498,198	198,112	6,570,437
2034	127,800	118,135	637,439	745,437	768,720	741,344	723,879	696,275	672,179	649,275	476,996	183,273	6,540,752
2035	127,802	118,141	645,117	745,232	763,488	736,645	727,405	695,144	649,488	628,630	419,917	163,355	6,420,364
2036	127,797	122,341	613,083	744,624	767,206	737,447	719,757	703,975	656,267	626,538	438,312	183,768	6,441,115
2041	127,799	118,132	580,468	469,180	331,660	250,918	239,674	194,673	184,385	183,246	175,373	25,134	2,880,642
2046	0	0	197,894	487,380	328,197	255,875	244,583	189,140	163,557	181,219	165,921	55,582	2,269,348
2051	0	0	197,677	329,334	74,348	62,290	63,306	27,312	25,911	26,119	20,689	578	827,564
2071	0	0	28,327	359,639	84,532	60,635	73,332	29,193	23,735	25,201	21,288	629	706,511
2091	0	0	27,250	340,424	87,555	69,665	69,251	29,607	16,467	27,933	23,053	439	691,644
2111	0	0	27,975	361,283	80,159	60,050	73,821	30,598	25,085	24,980	24,788	646	709,385
2131	0	0	27,475	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	27,475

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

Table C-3: Monthly WTP Volume Requiring Treatment for the 99.5th Percentile (m^3)

Year	Month												Total
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2023	N/A	N/A	N/A	N/A	940,831	1,017,066	1,014,689	840,704	540,347	540,241	486,389	343,028	5,723,295
2024	385,574	322,644	375,957	1,052,693	876,096	941,834	805,020	635,879	467,136	543,423	512,886	324,468	7,243,610
2025	380,429	308,546	172,950	1,041,321	857,806	918,684	799,156	649,819	510,215	471,458	466,990	210,118	6,787,492
2026	268,122	205,663	137,139	1,006,448	664,073	928,893	776,396	656,365	484,345	507,440	543,055	353,048	6,530,987
2027	248,025	987	174,709	1,079,656	779,401	899,129	839,908	631,130	532,026	571,311	506,640	339,650	6,602,572
2028	301,944	154,165	17,859	1,070,472	856,776	913,431	833,476	624,229	500,595	561,590	537,481	331,434	6,703,452
2029	323,617	171,421	36,359	1,004,402	813,070	885,392	783,514	584,930	486,866	548,893	479,899	342,520	6,460,883
2030	235,921	0	169,714	1,092,716	879,138	846,907	878,625	572,737	469,739	557,987	494,851	356,974	6,555,309
2031	366,468	232,600	99,485	735,675	764,489	744,587	754,595	713,896	749,088	774,058	691,134	580,977	7,207,052
2032	525,067	415,819	756,422	976,186	774,058	748,499	765,138	727,786	604,316	631,416	502,789	391,970	7,819,466
2033	471,811	382,127	429,403	777,737	774,058	749,088	593,182	679,723	736,429	727,938	679,985	572,660	7,574,141
2034	471,811	439,306	616,955	746,919	774,058	749,088	667,234	535,682	667,972	674,220	661,799	487,664	7,492,708
2035	471,811	439,306	571,375	741,446	774,058	749,088	669,320	543,308	604,006	754,476	637,604	481,521	7,437,319
2036	354,383	122,484	525,917	749,088	773,390	748,129	772,095	769,990	695,682	685,335	650,794	512,808	7,360,095
2041	471,811	174,423	458,123	1,005,000	408,139	247,481	375,939	247,970	235,638	162,452	169,983	82,562	4,039,521
2046	54,814	0	193,956	1,025,727	466,256	307,922	362,470	246,942	211,775	170,928	144,565	128,795	3,314,150
2051	54,672	0	191,316	611,260	216,955	112,875	61,647	51,906	31,348	38,903	11,959	11,056	1,393,897
2071	0	0	49,327	704,072	231,146	68,286	221,257	108,687	41,189	25,820	26,475	499	1,476,758
2091	0	0	48,392	869,063	209,395	89,442	113,091	149,427	51,126	17,419	53,586	989	1,601,930
2111	0	0	48,511	786,421	233,424	73,247	94,044	65,403	77,612	29,724	34,557	1,166	1,444,109
2131	0	0	48,429	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	48,429

Note: “N/A” – Not applicable when the dates are out of the range of modeling dates.

C3.0 TOTAL ANNUAL RUNOFF VOLUME FROM STOCKPILES/DUMPS

C3.1 Temp PAG Stockpile

The total annual runoff volume during operations for Temp PAG Stockpile is shown in Table C-5. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, and haul road). This catchment area breakdown was inserted as input into SWWBM. Table C-4 presents the distribution of these land types.

Table C-4: Temp PAG Stockpile Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	703,147
Disturbed Area	120,945
Undisturbed Area	140,272
Haul Road Area	63,800

Table C-5: Temp PAG Stockpile Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	122,711	226,570	445,588
2024	248,347	421,842	768,449
2025	247,456	422,850	766,070
2026	247,757	428,520	753,043
2027	247,936	425,785	793,090
2028	248,912	426,147	794,141
2029	249,343	422,660	755,345
2030	248,572	425,593	777,709
2031	26,050	41,089	68,748

C3.2 SERDS

The total annual runoff volume during operations for SERDS is shown in Table C-7. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, haul road, and mill site). This catchment area breakdown was inserted as input into SWWBM. Table C-6 presents the distribution of these land types.

Table C-6: SERDS Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	401,235
Disturbed Area	313,059
Undisturbed Area	383,918
Mill Site Area	273,919
Haul Road Area	165,456

Table C-7: SERDS Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	192,874	365,010	738,562
2024	360,384	625,704	1,163,887
2025	359,170	627,159	1,167,189
2026	359,541	635,520	1,138,079
2027	359,635	632,119	1,195,850
2028	360,975	631,021	1,198,955
2029	361,394	625,581	1,140,716
2030	360,604	629,622	1,172,763
2031	34,619	54,596	91,336

C3.3 NEZ Dump

The total annual runoff volume during operations for NEZ Dump is shown in Table C-9. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock, disturbed, undisturbed, and haul road). This catchment area breakdown was inserted as input into SWWBM. Table C-8 presents the distribution of these land types.

Table C-8: NEZ Dump Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	199,116
Disturbed Area	237,889
Undisturbed Area	202,646
Haul Road Area	261,421

Table C-9: NEZ Dump Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	134,053	250,501	499,643
2024	261,170	448,211	824,647
2025	260,297	449,304	824,468
2026	260,554	455,313	807,290
2027	260,710	452,591	849,291
2028	261,692	452,458	850,911
2029	262,082	448,643	809,462
2030	261,399	451,677	832,800
2031	26,321	41,516	69,459

C3.4 East RDS

The total annual runoff volume during operations for East RDS is shown in Table C-11. The runoff was generated over the catchment area, which was broken down by different land types (i.e., waste rock and disturbed). This catchment area breakdown was inserted as input into SWWBM. Table C-10 presents the distribution of these land types.

Table C-10: East RDS Catchment Area Breakdown by Land Type

Land Type	Catchment Area (m^2)
Waste Rock Area	693,392
Disturbed Area	899,543

Table C-11: East RDS Annual Runoff Volume during Operations (m^3)

Year	50th Percentile	90th percentile	99.5th percentile
2023	235,819	436,431	860,762
2024	473,874	806,323	1,471,681
2025	472,115	808,296	1,467,921
2026	472,643	819,122	1,441,909
2027	472,982	813,946	1,518,218
2028	474,853	814,415	1,520,466
2029	475,642	807,784	1,446,191
2030	474,205	813,412	1,488,869
2031	49,338	77,807	130,151



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APPENDIX B

Site-wide Water Quality Model (SWWQM)

REPORT

Mount Polley Mine Water Quality Model

Springer Expansion – LOM Water Quality Model

Submitted

Mount Polley Mining Corporation

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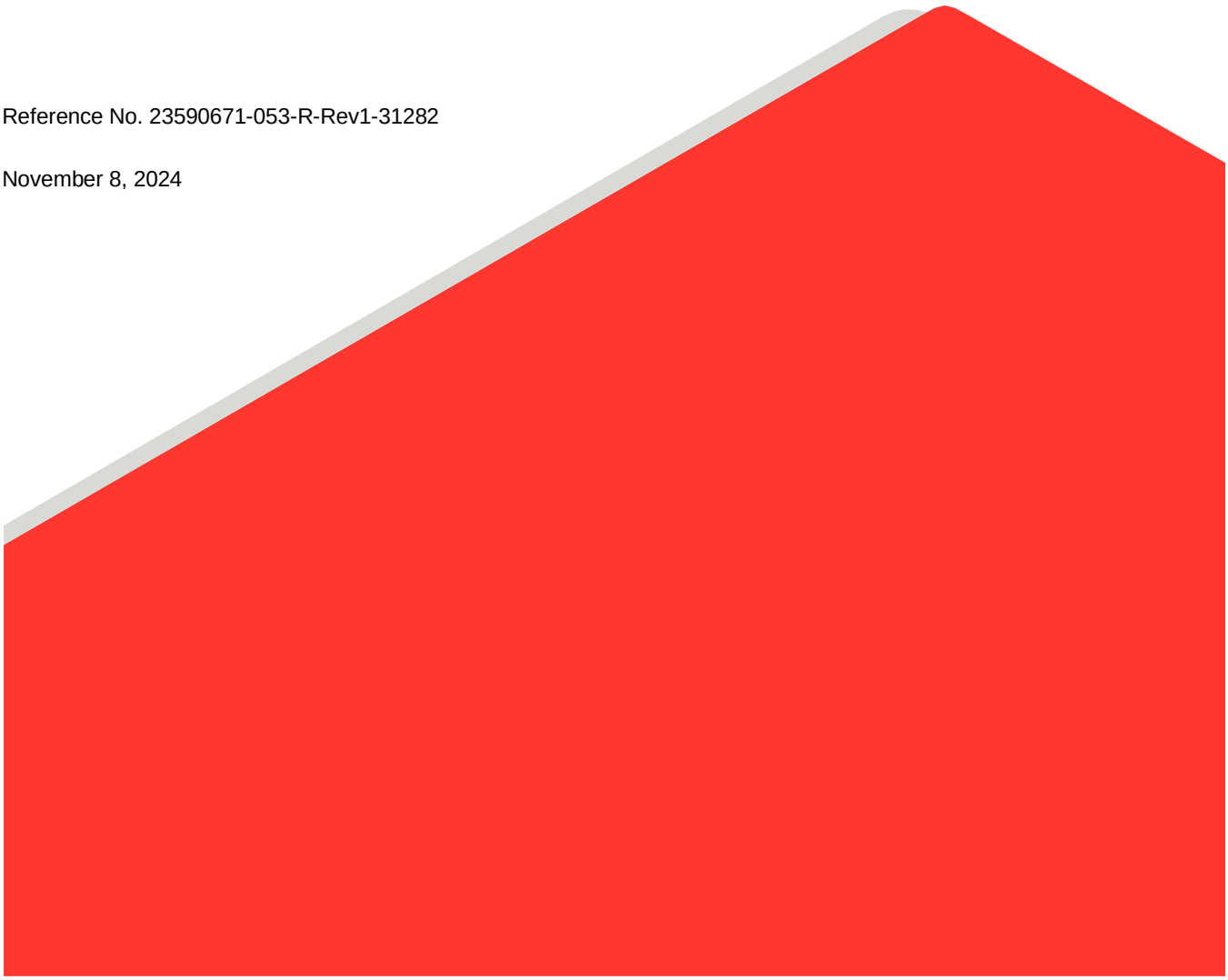
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Reference No. 23590671-053-R-Rev1-31282

November 8, 2024



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EXECUTIVE SUMMARY

Background

The Mount Polley Mine (the Mine, or Site) is a copper and gold mine operated by Mount Polley Mining Corporation (MPMC), a subsidiary of Imperial Metals Corporation. The Mine is located 56 km northeast of Williams Lake, British Columbia (BC), and is located between Polley Lake and Bootjack Lake.

MPMC began production at the mine in 1997 and operated until October 2001 when operations were suspended temporarily for economic reasons. In March 2005, the Mine restarted production and it was in continuous operation until 4 August 2014 when a subsurface failure of the Tailings Storage Facility (TSF) foundation resulted in mining and milling operations being suspended. MPMC was subsequently issued with a Pollution Abatement Order (Order #107461) by the BC Ministry of Environment and Climate Change Strategy (BC ENV). Containment infrastructure for collection of drainage from the breached section of the TSF was constructed by 4 September 2014, and all contact water was subsequently directed to and contained within the Springer Pit. This measure was implemented as part of the emergency response and was considered a temporary Water Management Plan to deal with changed conditions arising from the breach.

On 9 July 2015, MPMC was provided approval by the Ministry of Energy, Mines and Petroleum Resources (MEMPR) to return to restricted operations for a one-year period using the Springer Pit for tailings deposition and subject to the conditions stated in the M-200 Permit (Mine No. 1101163). On 23 June 2015, MPMC was provided approval by MEMPR to return to normal operations using the TSF for tailings deposition under an approved four-year mine plan as stated in the M-200 Permit.

MPMC has been in care and maintenance since May 31, 2019, which has resulted in an extension to the operational period needed to develop the permitted Phase 4 Cariboo-Springer Pit. In addition to this, the results of exploration and strong resource prices have provided the basis for an extended life of mine plan that will result in mining activity beyond Phase 4 Cariboo-Springer Pit, to include additional phases that will expand Springer Pit to consolidate Springer and Cariboo pits adding approximately 8 years to the life of the mine.

For the purposes of this report, WSP Canada Inc. (WSP) has assumed that the mine will be in operation until 31 March 2031, followed by a closure phase from 1 April 2031 to 31 March 2041, and a post-closure phase from 1 April 2041 to 31 March 2131. It should be recognized that this mine life may change as a result of metal prices, new exploration, care and maintenance periods, revisions to the mine plan, and other factors that are common to mining operations. These are only assumed mine phase dates to allow completion of modelling and should not be considered by regulators as static dates.

MPMC has a permit to discharge treated effluent from the Mine under the *Environmental Management Act* (EMA; SBC 2003) as Permit 11678. The permit was issued on 30 May 1997 and most recently amended through a Consent Order on 18 September 2020. An interim extension to Section 1.2.3 of PE-11678 was granted by BC ENV in 2022, allowing the existing discharge to Quesnel Lake to continue until 30 June 2025. The (2022) TAR provided an update on, among other things, receiving environment data and, in aggregate, provided scientific rationale to support the view that the discharge is not causing pollution. Under section 1.2.3 of Permit 11678, the “authorized discharge period” for discharge of effluent to Quesnel Lake expires on June 30, 2025. This discharge period is anticipated to support the permitted Phase 4 Cariboo-Springer Pit. However, MPMC is pursuing an extension to the life of the Mount Polley mine with the development of the Springer Expansion Project, which will add approximately 8 years of operational mining life.

Approval of this project will be sought through a Joint Application through the Ministry of Energy, Mines, and Low Carbon Innovation and the Ministry of Environment and Climate Change Strategy, with the request to BC ENV being an extension of the discharge period beyond 2025.

Section 2.10 of EMA Permit 11678 requires the development of a water management plan (WMP) that addresses future Water Management Plans beyond the end of 2022 and during mining operations. The WMP seeks to provide a practical plan for managing mine water for the proposed life of mine and to do so in a manner that reflects the requirements of Section 2.10 of the permit, based on information available at the time of writing. It also proposes an implementation schedule and revision process for the WMP.

In support of the WMP, the site wide water quality model was updated to reflect predicted mine site conditions during operations, closure, and post-closure (this report). This included updates to the water balance inputs and water quality inputs based on monitoring data. Updated geochemical source terms were also modelled in an alternative scenario (in place of inputs calculated from monitoring data) and were compared to model results that used monitoring data to calculate the water quality inputs. The model results from the scenario that used the geochemical source terms were considered overly conservative and are not presented in this report.

The updated predicted concentrations during operations, closure and post-closure in the mine site are similar to those presented in previous iterations of the water quality model including the 2016 Long Term Water Management Plan (Golder 2016) and the 2020 Water Management Plan (Golder 2020). For some parameters, the maximum predicted concentrations of total metals are lower during post-closure in this update of the water quality model. This change in predicted total metal concentrations is due to an adjustment to the particulate addition calculation during post-closure that now assumes a total suspended solids concentration that is representative of a reclaimed water quality input. Changes in concentrations from operations to closure and post-closure are caused by reclamation of mine site areas that are complete during post-closure. Predicted concentrations reach a steady state during post-closure after reclamation of the mine site areas is complete and the Springer Expansion pit is filled. Treatment and mitigation strategies during operations, closure and post- closure are addressed in the treatment section of the WMP (WSP 2023a).

STUDY LIMITATIONS

WSP Canada Inc. (WSP) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

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The factual data, interpretations, suggestions, recommendations and opinions expressed in this document pertain to the specific project, site conditions, design objective, development and purpose described to WSP by MPMC, and are not applicable to any other project or site location. In order to properly understand the factual data, interpretations, suggestions, recommendations and opinions expressed in this document, reference must be made to the entire document.

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APPENDICES

APPENDIX A
Water Quality Model Calibration Results

APPENDIX B
Water Quality Model Results - Operations, Closure and Post-closure

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to update the Site Wide Water Quality Model (SWWQM) to support the joint permit amendment application for the new Springer Expansion life-of-mine (LOM) plan that will extend operations until 31 March 2031 (current estimates).

The SWWQM was developed as part of the Mount Polley Mine (Mine) Resumed Operations and Closure Water Management Plan Permit Amendment Application and Technical Assessment Report (Golder 2016a) to model water quality across the site. The SWWQM was updated in 2020 as part of the Water Management Plan that addressed water management through future operations (Golder 2020). The SWWQM was also updated as part of the Five Year Mine and Reclamation Plan (RCP) to include the closure and post-closure phases for the period of 1 September 2024 to 1 September 2124 (Golder 2022a).

This report presents the updates made to the SWWQM to predict parameter concentrations within the mine site during operations, closure and post-closure as part of the permit application for the Springer Expansion LOM plan. Included here is a summary of the model, assumptions, model inputs and results.

2.0 MODEL APPROACH

A site wide surface water balance model (SWWBM; WSP 2023a) was developed to predict flow quality at the Mine and potential discharges to the receiving environment during operations, closure and post-closure, and comprises the underlying framework for evaluating mass transfers in the SWWQM. The SWWQM is directly linked to the reclamation and closure SWWBM and includes mass transfers for each flow.

The SWWQM model does not include water treatment or mixing in the receiving environment. Rather, water quality was simulated in Mine facilities so that treatment technologies can be selected and applied, as described in the Water Management Plan that was prepared along with this report (WSP 2023b).

2.1 Model Platform

The model was developed using GoldSim Version 14.0 (GoldSim 2021). GoldSim is a graphical, object-oriented mathematical modelling program where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the program is designed to facilitate an understanding of the various factors that control an engineered or natural system and to predict potential changes in the system.

GoldSim was selected for the current assessment for the following reasons:

- It facilitates probabilistic simulations, allowing descriptive statistics and probabilities to be assigned to the model outputs.
- The model framework can be easily adjusted to account for changing/future conditions on a mine site, allowing the model to be used as a planning tool.
- Water quantity and water quality models can be directly linked, allowing both models to be updated simultaneously when conducting sensitivity scenarios for alternate water management strategies.

2.2 Model Simulation Period

The model simulations included four time periods:

- **Calibration** (1 January 2017 to 31 December 2022) – the calibration period includes operations (1 January 2017 to 1 May 2019), care and maintenance of the Mine site (2 May 2019 to 31 October 2021) and the beginning of resumed operations (1 November 2021). During the calibration period, water in the Perimeter Embankment Till Borrow Pond (PETBP) is treated at the water treatment plant (WTP) and discharged to Quesnel Lake.
- **Resumed Operations** (1 May 2023 to 31 March 2031) – the resumed operations period when, similar to the calibration period, water in the PETBP is treated at the WTP and discharged to Quesnel Lake.
- **Closure** (1 April 2031 to 31 March 2041) – a ten-year active closure period is assumed, during which potentially acid generating (PAG) stockpile material from the Temporary Northwest (NW) PAG stockpile is deposited into the Springer-Cariboo Pit and other facilities are reclaimed. The closure phase will include reclamation activities as identified in the WMP. The WTP is assumed to be in operation through all of the closure period. Details on the closure and post-closure management of mine facilities are provided in the SWWBM Report (WSP 2023a).
- **Post-closure** (1 April 2041 to 1 April 2131) – this period includes filling of pits, discharge, and establishment of steady-state conditions for the drainage from mine facilities. Results are presented for two periods within post-closure:
  - Early post-closure (1 April 2041 to 31 March 2051) – Represents the first ten years of post-closure during which drainage from Mine facilities is assumed to progressively return to undisturbed water quality. The WTP is assumed to be in operation during this period.
  - Long-term post-closure (1 April 2051 to 1 April 2131) – this time period has been selected to represent steady-state conditions after all closure and post-closure changes have taken place. The need for treatment during long-term post-closure will be confirmed as MPMC approaches this phase and may be achieved through distributed passive or semi-passive treatment systems if required.

Uncertainty exists regarding the exact timing of these transitions. The time periods are intended to show, at a conceptual level, the difference in site drainage quality as the site progresses through the post-closure period; it is not intended to imply that the transitions will occur on precisely those dates.

2.3 Facilities

The SWWQM includes the following facilities (grouped into five categories):

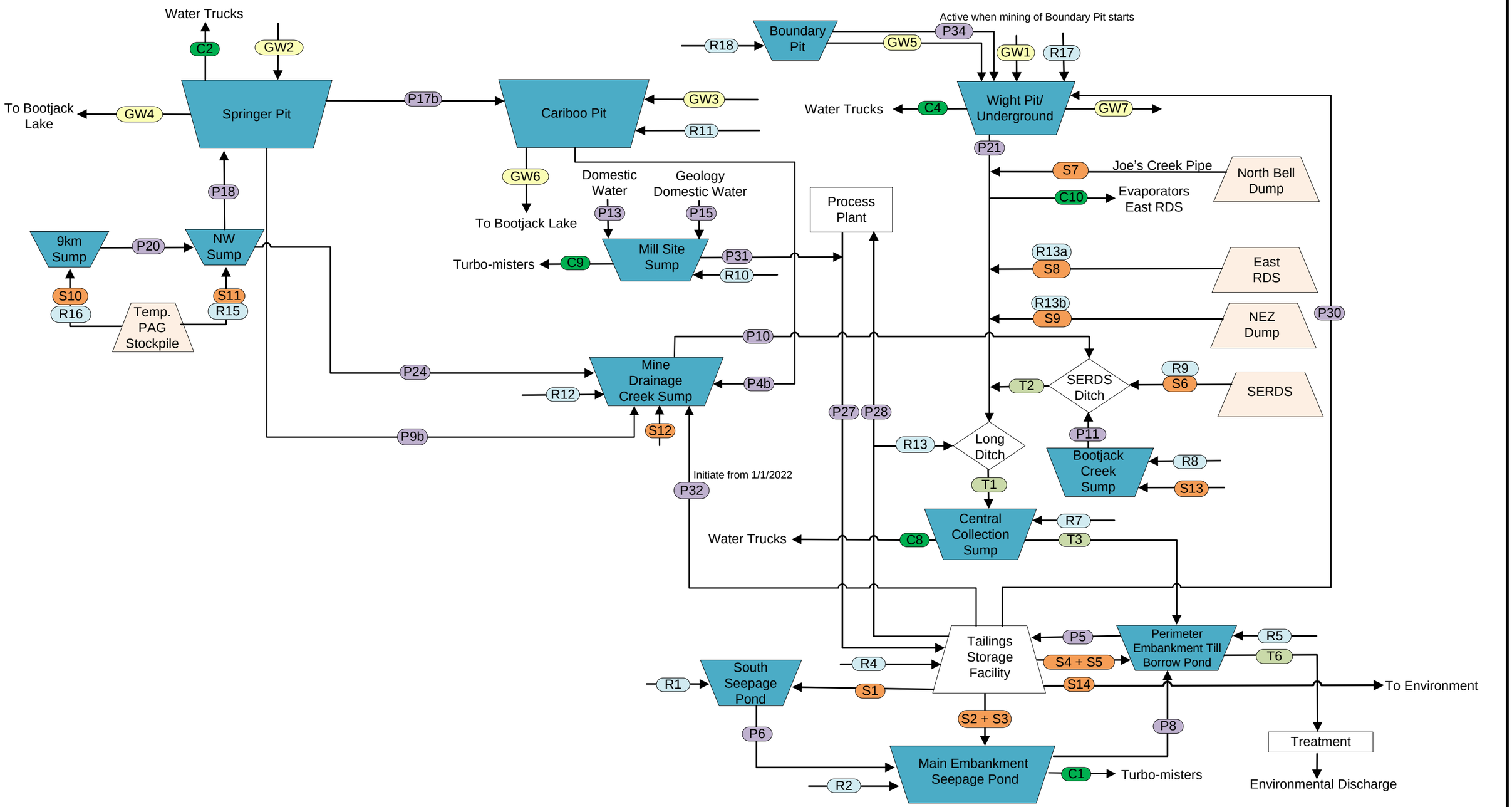
- **Open Pits**: Springer-Cariboo Pit, Wight Pit, and Boundary Pit.
- **Sumps**: NW Sump, 9K Sump, Mine Drainage Creek Sump (MDCS), Bootjack Creek Sump (BCS), Central Collection Sump (CCS), Perimeter Embankment Till Borrow Pond (PETBP), South Embankment Seepage Collection Pond (SESCP), and Main Embankment Seepage Collection Pond (MESCP).
- **Ditches/Drains**: Long Ditch and Southeast Rock Disposal Site (SERDS) Ditch.

- **Rock Disposal Sites (RDSs)**: East RDS, SERDS, Northeast Zone (NEZ) RDS, North Bell RDS, and Boundary RDS.
- **Other Facilities**: Tailings Storage Facility (TSF), TSF Quarry, Temporary NW PAG Stockpile, and haul roads.

2.4 Mine Site Flows

The SWWBM accounts for mine waste and water management plans, which are described in detail in the Springer Expansion Model SWWBM Report (WSP 2023b). During the calibration and operations periods, the Mine facilities are used to manage water within the Mine site and the only Mine discharge to the receiving environment is from the WTP (Table 1 and Figure 1). During closure, water will continue to be managed within the Mine facilities and the combined Springer-Cariboo Pit will be allowed to fill before discharging to Bootjack Lake (Table 2 and Figures 2 and 3). To the extent possible, flows from the Mine site will be returned to pre-disturbance watershed flows as the facilities are reclaimed during closure (Table 3).

During post-closure, most site catchment areas are expected to drain directly to their pre-disturbance watersheds; this applies to 9K Sump, NW Sump, Springer-Cariboo Pit, Mine Drainage Creek, Wight Pit, Joe's Creek, SESCP, and the MESCP. Some sumps, ponds, and ditches are expected to flow together and to be discharged as a combined flow to their pre-disturbance watersheds; Long Ditch discharge will include flow from SERDS Ditch and Bootjack Creek Sump, and PETBP discharge will include overflows from the TSF and CCS (Table 3).



Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

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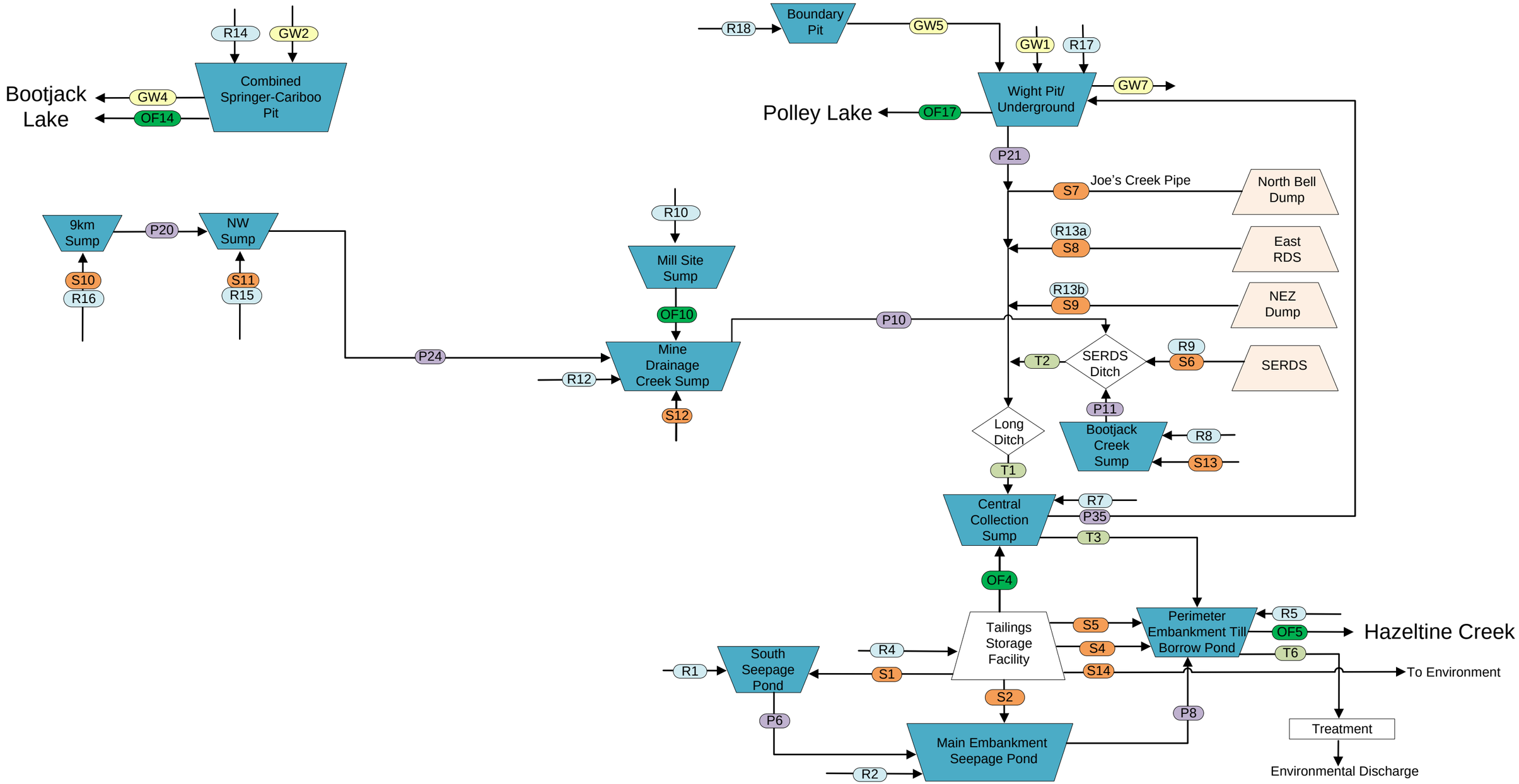
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TITLE

Springer Pit Expansion LOM Site Wide Water Balance Operational Phase Flow Diagram
2 May 2023 – 1 January 2035

FIGURE No: 1
REV No: 1



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

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CLIENT: Mount Polley Mining Corporation

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DATE: 2 October 2023

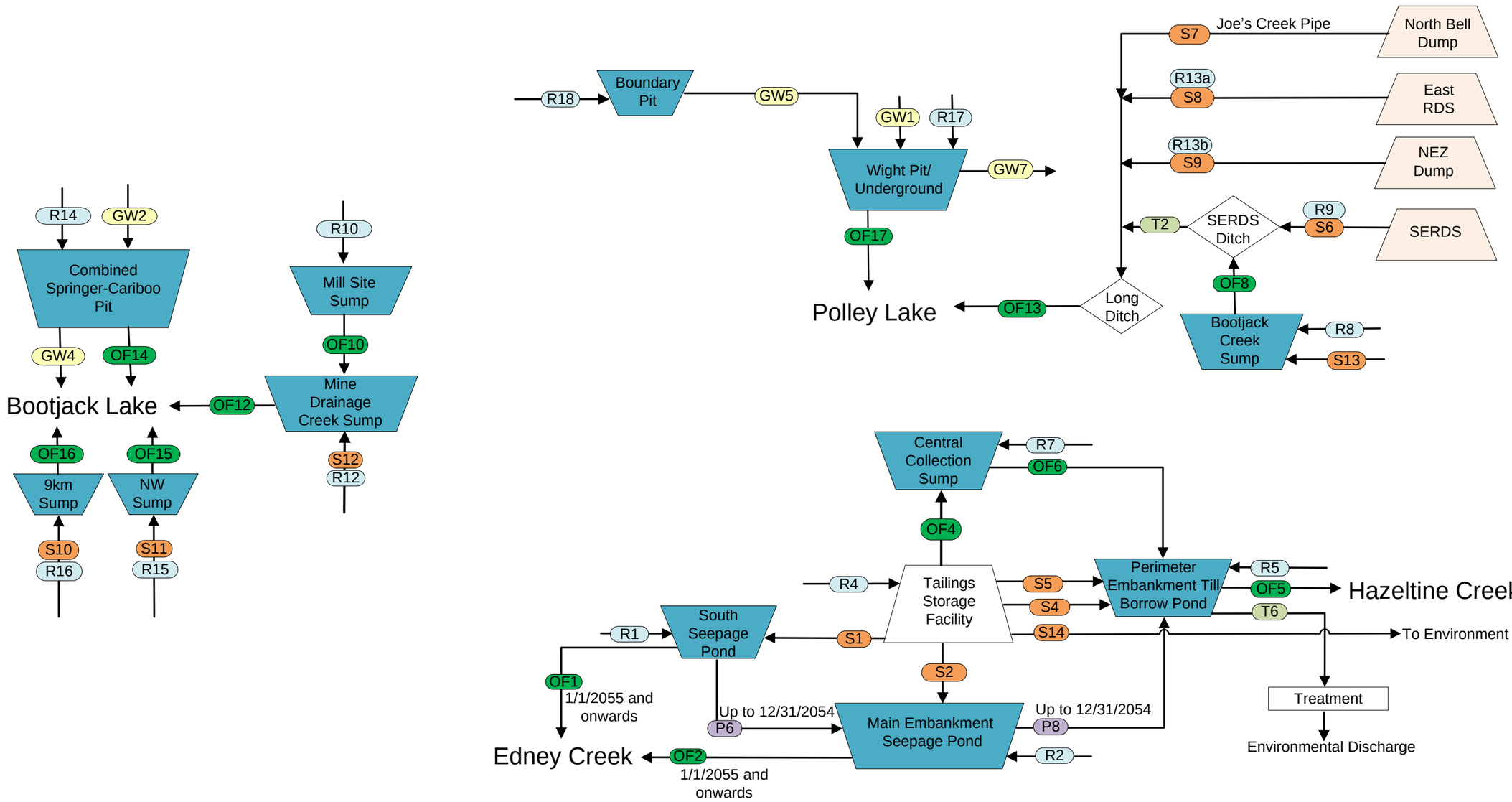
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DATE: 2 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Closure Phase Flow Diagram
1 January 2035 – 1 January 2045

FIGURE No: 2
REV No: 1



Runoff (R)
Seepage Flow (S)
Overflow (OF)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

wsp

CLIENT: Mount Polley Mining Corporation

DRAWN: SC
DATE: 2 October 2023

CHECKED: GD
DATE: 2 October 2023

SCALE: Not to Scale
PROJECT No: 23590671/31182

TITLE

Springer Pit Expansion LOM Site Wide Water Balance
Post-closure Phase Flow Diagram
1 January 2045 Onwards

FIGURE No: 3
REV No: 1

Table 1: Facility Flows during Calibration and Operations

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas.	NW Sump
NW Sump	Pumping from 9K Sump; Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas.	MDCS
Springer Pit	Pumping from TSF, NW Sump and Cariboo Pit; pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	Cariboo Pit and TSF
Cariboo Pit	Pumping from TSF and Springer Pit; pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	Wight Pit and TSF
MDCS	Pumping from TSF, Springer Pit, and Cariboo Pit; runoff and seepage from haul roads, disturbed, undisturbed and RDS areas.	SERDS Ditch
Wight Pit Lake	Pumping from TSF and Cariboo Pit; Seepage from Boundary Pit; pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed, and RDS areas.	Long Ditch
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas.	CCS
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas.	MESCP
MESCP	Pumping from SESCP; TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas.	PETBP
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area.	Influent to the water treatment plant

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

Table 2: Facility Flows during Closure

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas.	NW Sump
NW Sump	Pumping from 9K Sump; Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas.	Springer Pit
Springer-Cariboo Pit	Pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	Bootjack Lake
MDCS	Pumping from TSF, Springer Pit, and Cariboo Pit; runoff and seepage from haul roads, disturbed, undisturbed and RDS areas.	SERDS Ditch
Wight Pit Lake	Seepage from Boundary Pit; pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas.	SERDS Ditch
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas.	CCS
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas.	MESCP
MESCP	Pumping from SESCP; TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas.	PETBP
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area.	Influent to the water treatment plant and Hazeltine Creek

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

Table 3: Facility Flows during Post-Closure.

Facility	Inflows to the Facility	Discharge Destinations
9K Sump	Runoff and seepage from the Temporary NW PAG Stockpile, North Bell RDS, disturbed, and undisturbed watershed areas.	Bootjack Lake
NW Sump	Runoff and seepage from the Temporary NW PAG Stockpile, disturbed, and undisturbed watershed areas.	
Springer-Cariboo Pit Lake	Pit wall runoff, groundwater inflow, disturbed, and undisturbed watershed areas.	
MDCS	Runoff and seepage from haul roads, disturbed, undisturbed and RDS areas.	
Wight Pit Lake	Pit wall runoff, groundwater inflow, and runoff and seepage from haul roads, undisturbed, disturbed area, and RDS areas.	Polley Lake
Long Ditch	SERDS Ditch overflow and runoff and seepage from the East RDS, NEZ RDS, SERDS RDS, haul roads, disturbed and undisturbed watershed areas.	
SESCP	TSF seepage and minimal runoff from undisturbed watershed areas.	Edney Creek
MESCP	TSF seepage, runoff from the TSF embankment, and runoff and seepage from undisturbed watershed areas.	
PETBP	TSF pond overflow (via CCS), TSF seepage, runoff from TSF impoundment, and runoff and seepage from haul roads, disturbed, and undisturbed watershed area.	Influent to the water treatment plant and Hazeltine Creek

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; Central Collection Sump = CCS; SERDS = Southeast Rock Disposal Site.

2.5 Mine Plan

The SWWQM predicts concentrations based on water quality concentrations assigned to runoff from surface areas (Section 2.5.1), scheduled water management pumping and waste rock/tailings production from mine operations according to the mine plan presented in Section 2.5.2 (WSP 2023a).

2.5.1 Mine Site Surface Areas

The SWWQM and SWWBM assumes the entire surface area of the RDS, disturbed runoff areas and undisturbed runoff areas are accounted for at the beginning of operations. Therefore, the runoff and seepage volumes do not change until closure and post-closure when remediation of mine surface areas begin. The total surface areas are presented in the Springer Expansion Model Water Balance Report (WSP 2023a).

2.5.2 Waste Rock and Tailings Deposition

The mine plan for the Springer Expansion was updated in the SWWBM and assumed a milling operational end date of March 2031. Tonnage of dry tailings during the project is provided in Table 4 (MPMC 2023). Tailings are deposited into either the TSF or the SERDS Tailings Co-disposal site. The tailings beach area increases during operations until deposition is complete in 2031. The tailings and waste rock excavated from Springer Pit are to be deposited in the SERDS Tailings Co-disposal site according to the 3-year schedule presented in Table 5 (WSP 2022a).

Table 4: Annual Tonnes of Dry Tailings Deposited

Year	Dry Tailings (tonnes)
2022[(a)]	3,530,469
2023	7,300,000
2024	7,300,000
2025	7,300,000
2026	7,300,000
2027	7,300,000
2028	7,300,000
2029	7,300,000
2030	7,300,000
2031[(b)]	860,381

(a) Mine plan starts on 1 July 2022.

(b) Mine plan ends on 31 March 2031.

Table 5: Annual Tonnes of NAG Waste Rock and Tailings Deposited in the SERDS (MPMC 2022)

Year	Non-acid Generating Waste Rock (dry tonnes)	Tailings (dry tonnes)
May 2022	1,849,434	0
June 2022	1,533,187	0
July 2022	1,646,190	0
August 2022	1,876,485	0
September 2022	1,810,659	75,000
October 2022	1,503,095	75,000
November 2022	1,826,860	75,000
December 2022	1,472,950	350,000
January 2023	1,938,754	600,000
February 2023	1,472,298	600,000
March 2023	1,976,869	600,000
April 2023	1,714,812	600,000
May 2023	1,831,868	600,000
June 2023	1,804,423	60,000

Table 5: Annual Tonnes of NAG Waste Rock and Tailings Deposited in the SERDS (MPMC 2022)

Year	Non-acid Generating Waste Rock (dry tonnes)	Tailings (dry tonnes)
July 2023	1,930,151	0
August 2023	1,897,087	0
September 2023	1,902,815	0
October 2023	1,892,896	0
November 2023	1,841,006	0
December 2023	1,909,111	0
January 2024	1,966,900	0
February 2024	1,813,317	0
March 2024	1,975,000	0
April 2024	1,848,880	0
May 2024	1,758,513	0
June 2024	1,834,097	0
July 2024	1,875,487	0
August 2024	1,852,433	0
September 2024	2,151,911	0
October 2024	1,712,150	0
November 2024	1,911,993	0
December 2024	1,921,593	0
Total	58,253,223	3,635,000

2.6 Model Setup

The model simulated concentrations on a daily time step from January 2017 to December 2022 (calibration period), May 2023 to December 2034 (operations) and from January 2035 to January 2135 (closure and post-closure). Probabilistic climate and water quality inputs were used to run the model stochastically for 2000 simulations:

- **Climate Inputs:** The SWWQM was run with probabilistic monthly climate inputs during operations, closure and post-closure as described in Appendix H of the WMP. Monthly precipitation data in the Mount Polley Mine Climate Baseline Update (Golder 2022b) were fitted to a log-normal probability distribution. The calibration period used historical climate data for the climate inputs.
- **Water Quality Inputs:** For each realization, a unique concentration for each parameter was selected based on randomly sampled values from within a statistical probability distribution function that was derived from each input.

To interpret the results, median and 95th percentile concentrations were calculated for each Mine facility. To put the results in context, a 95th percentile prediction indicates the maximum concentration that is likely to be reached over the duration of the simulation, with a 95% likelihood that concentrations will be at or below that concentration (it does not suggest that concentrations will exceed this value 5% of the time).

2.6.1 Modelled Parameters and Particulate Addition

The parameters in the SWWQM include physical parameters, major ions, nutrients, and dissolved metals and metalloids (Table 6). The dissolved fractions of metals and metalloids are used in all mixing calculations in the model. The total concentrations of metals and metalloids are calculated by adding particulate fractions to the dissolved concentrations as described below.

Table 6: Parameters in the Site Wide Water Quality Model

Category	Parameters
Physical parameters	Total dissolved solids (calculated), hardness (calculated)
Major ions	Calcium, chloride, fluoride, magnesium, potassium, sodium, sulphate
Nutrients	Nitrate, nitrite, total ammonia, total phosphorus
Dissolved metals and metalloids	Aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc

Total metal predictions were calculated using dissolved metal predictions and empirical particulate metal concentrations for Operations and Closure (Section 2.6.1.1) and Post-closure (Section 2.6.1.2).

2.6.1.1 Particulate Addition – Operations and Closure

Monitoring data from the SERDS Ditch and Long Ditch were used to establish the empirical particulate metal concentrations because these facilities are expected to contribute the majority of particulate load to site discharges during operations and closure. The model assumes that TSS will be settled/removed to 15 mg/L (i.e., the current average authorized discharge concentrations) prior to discharge.

Monitored data for total and dissolved metals were used to calculate observed particulate metal concentrations in the SERDS Ditch and Long Ditch. The strength of correlation of measured particulate metal concentrations to TSS concentrations was calculated using linear regressions. An empirical particulate metal concentration for each parameter was established by grouping each parameter into the following categories:

- Correlated parameters ($R^2 \geq 0.75$)—a particulate concentration using 15 mg/L during operations/closure was calculated using the regression equation, and this concentration was added to both the maximum median and 95th percentile dissolved metal predictions to calculate a total metal concentration.
- Poorly-correlated parameters ($0.25 < R^2 < 0.75$)—median and 95th percentile particulate concentrations were calculated based on observed data for samples with a TSS below 15 mg/L, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively.
- Non-correlated parameters ($R^2 \leq 0.25$)—median and 95th percentile particulate concentrations were calculated based on all observed data, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively.

A summary of the correlated and non-correlated parameters and the particulate concentrations used for operations and closure in the model are presented in Table 7.

Table 7: Particulate Metal Concentrations – Operations and Closure

Parameter	Coefficient of Determination (R^2)	Category	Median Particulate Concentration (mg/L)	95th Percentile Particulate Concentration (mg/L)
Aluminum	0.82	Correlated	0.46	0.46
Antimony	0.021	Non-correlated	0.000020	0.00014
Arsenic	0.87	Correlated	0.00019	0.00019
Barium	0.74	Poorly-correlated	0.0015	0.0083
Beryllium	0.39	Poorly-correlated	-	-
Boron	0.001	Non-correlated	0.0040	0.031
Cadmium	0.37	Poorly-correlated	0.0000017	0.000073
Chromium	0.76	Correlated	0.00049	0.00049
Cobalt	0.84	Correlated	0.00032	0.00032
Copper	0.024	Non-correlated	0.0090	0.16
Iron	0.85	Correlated	0.49	0.49
Lead	0.86	Correlated	0.00013	0.00013
Lithium	0.51	Poorly-correlated	0.00020	0.0010
Manganese	0.79	Correlated	0.014	0.014
Mercury	0.016	Non-correlated	-	-
Molybdenum	0.0071	Non-correlated	-	0.011
Nickel	0.84	Correlated	0.00047	0.00047
Selenium	0.0087	Non-correlated	-	0.0056
Silver	0.63	Poorly-correlated	-	0.000005
Strontium	0.0029	Non-correlated	0.017	0.34
Thallium	0.41	Poorly-correlated	-	-
Tin	0.22	Non-correlated	-	0.000080
Titanium	0.81	Correlated	0.022	0.022
Uranium	0.008	Non-correlated	0.000023	0.00031
Vanadium	0.84	Correlated	0.0012	0.0012
Zinc	0.77	Correlated	0.0014	0.0014

2.6.1.2 Particulate Addition – Post-closure

Monitoring data from Edney Creek was used to establish the empirical particulate metal concentrations because data from this location is considered representative of undisturbed (i.e., reclaimed) surface runoff. The model assumes that TSS will be settled to 3 mg/L (i.e., the 95th percentile of TSS from monitoring data at Edney Creek from 2016 to 2022).

Monitored data for total and dissolved metals were used to calculate observed particulate metal concentrations in Edney Creek. The strength of correlation of measured particulate metal concentrations to TSS concentrations was calculated using linear regressions. Measured particulate metal concentrations were not correlated to TSS ($R^2 \leq 0.25$) for all parameters. Median and 95th percentile particulate concentrations were calculated based on all observed data, and these concentrations were added to the maximum median and 95th percentile dissolved metal concentrations, respectively (Table 8).

Table 8: Particulate Metal Concentrations – Post-closure

Parameter	Coefficient of Determination (R^2)	Category	Median Particulate Concentration (mg/L)	95th Percentile Particulate Concentration (mg/L)
Aluminum	0.012	Non-correlated	0.028	0.12
Antimony	0.0048	Non-correlated	0	0
Arsenic	0.0083	Non-correlated	0.00003	0.00011
Barium	0.00008	Non-correlated	0.00038	0.0015
Beryllium	-[a]	Non-correlated	0	0
Boron	0.028	Non-correlated	0	0.002
Cadmium	0.02	Non-correlated	0.0000012	0.0000078
Chromium	0.0000024	Non-correlated	0.00011	0.00052
Cobalt	0.000022	Non-correlated	0	0.000076
Copper	0.0046	Non-correlated	0.00034	0.0016
Iron	0.0051	Non-correlated	0.044	0.18
Lead	0.0012	Non-correlated	0	0.00002
Lithium	0.0078	Non-correlated	0	0.00016
Manganese	0.0039	Non-correlated	0.0038	0.016
Mercury	-[a]	Non-correlated	0	0
Molybdenum	0.046	Non-correlated	0.00003	0.00045
Nickel	0.0055	Non-correlated	0.00007	0.00031
Selenium	0.006	Non-correlated	0.000022	0.00012
Silver	0.038	Non-correlated	0	0.0000066
Strontium	0.0015	Non-correlated	0.0029	0.023
Thallium	-[a]	Non-correlated	0	0
Tin	0.0077	Non-correlated	0	0
Titanium	-[a]	Non-correlated	0	0
Uranium	0.00018	Non-correlated	0.000001	0.00004
Vanadium	0.00047	Non-correlated	0.00015	0.00039
Zinc	0.0057	Non-correlated	0	0

a) Coefficients of determination could not be calculated for beryllium, mercury, thallium and titanium because concentrations in the Edney Creek monitoring data were all below detection limits.

2.6.2 Water Quality Calculations

In the SWWQM, Mine facilities were grouped into four categories: open pits, water management ponds sumps and ditches, RDSs, and TSF. The concentrations of parameters at each Mine facility were estimated as described below.

2.6.2.1 Pits, Ponds and Ditches

Conveyance facilities on site (Long Ditch and SERDS Ditch) that are flow-through systems (i.e., they do not retain water for more than a single timestep) were modelled by assigning a water quality to each inflow and calculating a mixed water quality based on the proportions of each inflow (Equation 1). For pits, sumps, and ponds where water can be stored (9K Sump, NW Sump, Springer-Cariboo Pit, MDCS, Wight Pit, SESCP, MESCP and the PETBP), the concentration and volume retained from the previous time step is included in the calculation (Equation 2).

$$C_{pond} = \frac{\sum C_i Q_i}{\sum Q_i}$$ Equation 1

Where:

C_{pond} = concentration in facility
C_i = concentration in inflow *i*
Q_i = flow rate of inflow *i*

$$C_{pond} = \frac{C_x V_x + \sum C_i Q_i - \sum C_x Q_o}{V_x + \sum Q_i - \sum Q_o}$$ Equation 2

Where:

C_{pond} = concentration in facility
C_i = concentration in inflow *i*
Q_i = flow rate of inflow *i*
C_x = concentration in facility in previous timestep *x*
V_x = volume of water in facility in previous timestep *x*
Q_o = flow rate of outflow *o*

Evaporation from water surfaces was included as a decrease in total volume (V_i); in other words, evaporation was a water quantity reduction only and did not remove mass of modelled parameters from the system.

2.6.2.2 Rock Disposal Sites and Tailings Storage Facility

Runoff and seepage volumes from RDSs and the TSF were predicted by the SWWBM and input water quality was assigned to these flows based on site monitoring data. Concentrations at these Mine facilities were calculated using Equation 1.

2.6.2.3 SERDS Tailings Co-Disposal

Water quality modelling of seepage from the SERDS Tailings Co-disposal Facility was consistent with the modelling presented in the 2022 Permit Amendment Application (MPMC 2022). Seepage from the SERDS Tailings Co-disposal Facility into SERDS Ditch is assigned a combination of unsaturated TSF seepage water quality and NAG waste rock seepage water quality (Equation 3; Table 8). Source terms for waste rock were not modified upwards to reflect co-disposal with tailings because concentrations in the waste rock are a function of solubility rather than oxygen penetration (MPMC 2022).

$$C_{SERDS} = \left(C_{Tailings} \times \frac{\sum M_{Tailings}}{\sum M_{Tailings} + \sum M_{NAG}}\right) + \left(C_{NAG} \times \frac{\sum M_{NAG}}{\sum M_{Tailings} + \sum M_{NAG}}\right)$$ Equation 3

Where:

C_{SERDS} = concentration of SERDS runoff or seepage during mine operations

$C_{Tailings}$ = unsaturated tailings water quality input (Table 8)

$\Sigma M_{\text{Tailings}}$ = cumulative mass of tailings deposited in the SERDS Tailings Co-disposal Facility

ΣM_{NAG} = cumulative mass of waste rock deposited in the SERDS Tailings Co-disposal Facility

$C_{Tailings}$ = NAG waste rock seepage water quality input (Table 8)

2.6.3 Model Inputs

Water quality inputs in the SWWQM were derived from site water quality monitoring data. A summary of the water quality inputs assigned to each flow in the SWWQM is presented in Table 9 and described below. Site water quality monitoring data from 2006 to 2023 (depending on the input) were used to develop water quality inputs in the SWWQM. For each parameter, water quality inputs were represented in the model by probability distribution functions. The development of the distribution inputs is described in Section 2.6.3.1. A summary of the distributions selected, the maximum and mean values used for each parameter, and the number of samples for each water quality input are presented in Table 10.

As areas in the mine site are reclaimed, the assigned water quality inputs are adjusted in the SWWQM (Table 6):

- Before reclamation of the RDS facilities, the water quality of runoff is assigned either PAG, non-potentially acid-generating (NAG), Boundary Dump (in the Boundary Pit RDS runoff), or Joe' s Creek Pipe (in the Wight Pit RDS runoff) water quality depending on the RDS location. The water quality of runoff is assumed to be equal to disturbed runoff while the facilities are being reclaimed, and then gradually return to undisturbed watershed runoff.
- Seepage from the RDS facilities is conservatively assumed to remain as contact water in perpetuity.
- For Wight Pit and Boundary Pit, the pit wall runoff is assigned the same water quality input during the calibration, operations, closure and post-closure periods. The water quality input assigned to runoff from each of the pit walls is calculated using monitoring data from the corresponding pit (e.g., the water quality distribution assigned to pit wall runoff into Wight Pit is calculated using monitoring data from Wight Pit).
- Pit wall runoff into the Springer-Cariboo Pit during calibration, operations, closure and post-closure is assigned water quality from two source terms:
  - For pit walls of the former Springer Pit, the source term is calculated based on observed data from Springer Pit. This assumes no acid generation or change in pit wall runoff water quality over time.
  - For pit walls of the former Cariboo Pit, the source term is calculated based on observed data from Cariboo Pit. This assumes no acid generation or change in pit wall runoff water quality over time.
- During the calibration, operations, closure and post-closure periods, disturbed areas are assigned a water quality input calculated using monitoring data from the North Dump Creek and Bootjack Creek (Stations W4 and W5).

- During the calibration, operations, closure and post-closure periods, undisturbed areas are assigned a water quality input calculated using monitoring data from undisturbed runoff (Stations W8 and W8z).
- During the calibration, operations and closure periods, runoff from the TSF beach, impoundment and embankment is assigned a water quality input calculated using monitoring data from the TSF supernatant (Stations E1 and E1a). The water quality of TSF beach, impoundment and embankment runoff is assumed to be equal to undisturbed runoff once the area has been reclaimed in post-closure.
- The proportion of seepage from saturated and unsaturated tailings in the TSF during closure and post-closure are based on hydrogeologic modelling of seepage from the facility (Appendix F). Seepage from unsaturated tailings is assigned the water quality input calculated using monitoring data from the MESCP (Stations E4 and E5). Seepage from the saturated tailings is assigned predicted water quality from the TSF.
- Runoff from the Haul Road is assigned NAG water quality until it is reclaimed in post-closure. Once the Haul Road is reclaimed, runoff from this area is assigned the undisturbed water quality input.
- During the calibration, operations, closure and post-closure periods, groundwater inflow into the combined Springer-Cariboo Pit is assigned a water quality input calculated using monitoring data from Springer Pit Wells (Stations GW12-1/2 and GW15-1/2).

Table 9: Site-Wide Water Quality Model Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Rock Disposal Site Contact Water	RDS Runoff to Boundary Pit	Boundary Dump Seep station water quality data (n = 70, June 2013 – July 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Boundary Pit	Boundary Dump Seep station water quality data (n = 70, June 2013 – July 2022)		
	RDS Runoff to Wight Pit	Joe's Creek Pipe station (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	RDS Seepage to Wight Pit	Joe's Creek Pipe station (from North Bell Dump) water quality (n = 66, August 2014 to February 2023)		
	NAG Waste Rock Runoff	East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep water quality (n = 523, May 2013 to October 2022)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	NAG Waste Rock Seepage	East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)		
	Temporary NW PAG Stockpile Runoff	PAG Dump Seep station water quality (n = 140, May 2013 - January 2023)	Disturbed Runoff: W4 and W5 site monitored data (n = 256, January 2014 to February 2023)	Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Temporary NW PAG Stockpile Seepage	PAG Dump Seep station water quality (n = 140, May 2013 - January 2023)	NAG Waste Rock: East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)	

Table 9: Site-Wide Water Quality Model Inputs

Category	Description	Model Input		
		Calibration Period and Operations	Closure	Post-closure
Pit Wall Runoff	Boundary Pit Wall Runoff	Boundary Pit station water quality (n = 16, February 2016 - July 2023)		
	Wight Pit Wall Runoff	Wight Pit (Station E10) water quality (n = 71, January 2016 - February 2023)		
	Springer Pit Wall Runoff	Springer Pit (Station E11) water quality (n = 53, January 2016 - August 2022)		
	Cariboo Pit Wall Runoff	Cariboo Pit (Station E8) water quality (n = 40, January 2016 - February 2023)		
Tailings Storage Facility	TSF Beach, Impoundment, and Embankment Runoff	TSF supernatant (Station E1a) water quality (n = 157, May 2011 to February 2023)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Unsaturated TSF Seepage	TSF Main Embankment Seepage Collection Pond (Station E4) water quality (n = 144, January 2006 - February 2023)		
	Saturated TSF Seepage	Predicted concentration in the TSF		
Other	Haul Road Runoff	NAG Waste Rock: East Rock Disposal Site station, Northeast Zone Dump station, SERDS Seep station water quality (n = 523, May 2013 to October 2022)		Undisturbed Runoff: W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)
	Disturbed Runoff	W4 and W5 site monitored data (n = 256, January 2014 to February 2023)		
	Undisturbed Runoff	W8 and W8z site monitored water quality (n = 224, January 2006 to January 2023)		
	Groundwater Inflow to Springer-Cariboo Pit	GW12-1/2, GW15-1/2 site monitored data (n = 253, June 2013 to January 2023)		

Note: NW Sump = Northwest Sump; MDCS = Mine Drainage Creek Sump; SESCP = South Embankment Seepage Collection Pond; MESCP = Main Embankment Seepage Collection Pond; PETBP = Perimeter Embankment Till Borrow Pond; PAG = potentially acid-generating; NAG = Non-potentially acid-generating; RDS = Rock Disposal Site; TSF = Tailings Storage Facility; SERDS = Southeast Rock Disposal Site.

Table 10: Summary of Stochastic Water Quality Inputs

Table 10. Summary of Stochastic Water Quality Inputs

Parameter	Units	RDS Runoff and Seepage Water to Boundary Pit					RDS Runoff and Seepage Water to Wight Pit				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	760	267	1,560	70	Lognormal	1,546	1.1	2,200	66
Major Ions											
Calcium	mg/L	Lognormal	167	1.7	1,500	70	Normal	322	34	423	66
Chloride	mg/L	Delta-lognormal	1.2	1.6	8.9	70	Lognormal	4.7	1.8	20	66
Fluoride	mg/L	Lognormal	0.19	2.0	1.5	70	Normal	0.17	0.069	0.38	66
Magnesium	mg/L	Normal	23	10	55	70	Lognormal	64	1.1	90	66
Potassium	mg/L	Normal	1.4	0.29	2.3	70	Normal	2.2	0.3	3.1	66
Sodium	mg/L	Normal	6.3	1.5	11	70	Lognormal	17	1.1	23	66
Sulphate	mg/L	Normal	402	173	920	70	Lognormal	911	1.1	1,240	58
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.026	3.9	2.0	68	Lognormal	0.0033	1.7	0.018	66
Nitrate	mg/L (as N)	Lognormal	0.25	5.1	12	70	Normal	25	11	59	66
Nitrite	mg/L (as N)	Lognormal	0.004	3.0	1.0	69	Constant	-	-	0.0025	12
Total Phosphorus	mg/L	Lognormal	0.032	3.3	0.8	62	Lognormal	0.044	1.2	0.071	66
Dissolved Metals											
Aluminum	mg/L	Normal	0.0033	0.002	0.031	70	Lognormal	0.0035	1.6	0.015	66
Antimony	mg/L	Normal	0.00013	0.000054	0.0017	70	Lognormal	0.00051	1.1	0.00066	66
Arsenic	mg/L	Lognormal	0.00075	1.6	0.0034	70	Lognormal	0.0014	1.1	0.0018	66
Barium	mg/L	Normal	0.038	0.0095	0.083	70	Normal	0.057	0.012	0.091	66
Beryllium	mg/L	Delta-lognormal	0.00016	1.7	0.0005	70	Constant	-	-	0.00005	35
Boron	mg/L	Normal	0.05	0.014	0.092	70	Normal	0.076	0.0098	0.1	66
Cadmium	mg/L	Lognormal	0.000029	2.3	0.0003	70	Lognormal	0.000043	1.3	0.000096	66
Chromium	mg/L	Constant	-	-	0	70	Constant	-	-	0.00025	64
Cobalt	mg/L	Lognormal	0.00015	2.6	0.0024	70	Lognormal	0.000078	1.5	0.00026	66
Copper	mg/L	Delta-lognormal	0.005	2.3	0.064	70	Lognormal	0.018	1.1	0.025	66
Iron	mg/L	Lognormal	0.035	2.7	0.69	70	Constant	-	-	0.015	64
Lead	mg/L	Delta-lognormal	0.000095	1.5	0.0003	70	Constant	-	-	0.000025	37
Lithium	mg/L	Lognormal	0.0023	2.2	0.023	70	Normal	0.0041	0.0005	0.0056	66
Manganese	mg/L	Lognormal	0.041	5.1	2.0	70	Lognormal	0.012	2.0	0.1	66
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0.0000025	1.0
Molybdenum	mg/L	Lognormal	0.03	2.4	0.6	70	Lognormal	0.075	1.2	0.13	66
Nickel	mg/L	Delta-lognormal	0.00051	1.7	0.05	70	Constant	-	-	0.00025	35

Table 10. Summary of Stochastic Water Quality Inputs

Parameter	Units	RDS Runoff and Seepage Water to Boundary Pit					RDS Runoff and Seepage Water to Wight Pit				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Selenium	mg/L	Lognormal	0.0038	2.8	0.2	70	Lognormal	0.067	1.3	0.13	66
Silicon	mg/L	Lognormal	5.4	1.5	60	70	Normal	6.0	0.33	7.0	66
Silver	mg/L	Lognormal	0.0000054	1.4	0.000032	70	Constant	-	-	0.000005	37
Strontium	mg/L	Normal	2.2	0.86	4.8	70	Lognormal	3.2	1.1	4.6	66
Thallium	mg/L	Lognormal	0.0000051	1.2	0.00002	70	Constant	-	-	0.000005	37
Tin	mg/L	Lognormal	0.000052	1.3	0.00034	70	Constant	-	-	0.00005	37
Titanium	mg/L	Normal	0.0082	0.0052	0.024	70	Lognormal	0.0064	1.6	0.028	66
Uranium	mg/L	Lognormal	0.001	2.4	0.05	70	Lognormal	0.0013	1.2	0.002	66
Vanadium	mg/L	Lognormal	0.00041	1.6	0.0018	70	Lognormal	0.00059	1.3	0.0012	66
Zinc	mg/L	Lognormal	0.0016	1.3	0.0058	70	Lognormal	0.0058	1.3	0.012	66

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	NAG Waste Rock Runoff and Seepage					PAG Waste Rock Runoff and Seepage				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	1,441	546	3,410	523	Normal	1,280	525	2,280	136
Major Ions											
Calcium	mg/L	Normal	300	100	626	523	Normal	271	112	485	136
Chloride	mg/L	Normal	3.1	1.8	9.9	508	Lognormal	2.3	2.2	15	136
Fluoride	mg/L	Normal	0.32	0.2	0.97	521	Lognormal	0.11	1.7	0.38	136
Magnesium	mg/L	Normal	57	21	124	523	Normal	47	17	79	136
Potassium	mg/L	Lognormal	2.0	1.4	5.0	501	Lognormal	2.7	1.6	10	136
Sodium	mg/L	Normal	19	6.3	44	523	Lognormal	20	1.7	72	136
Sulphate	mg/L	Normal	840	315	1,590	490	Normal	685	352	1,480	102
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0039	2.1	0.058	497	Lognormal	0.0092	3.6	0.2	125
Nitrate	mg/L (as N)	Delta-lognormal	3.6	5.5	160	523	Normal	14	12	60	140
Nitrite	mg/L (as N)	Lognormal	0.0045	2.3	0.11	499	Lognormal	0.0042	2.4	0.058	112
Total Phosphorus	mg/L	Lognormal	0.013	2.4	0.14	507	Normal	0.027	0.015	0.074	123

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	NAG Waste Rock Runoff and Seepage					PAG Waste Rock Runoff and Seepage				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0053	2.7	0.072	520	Lognormal	0.004	2.1	0.031	135
Antimony	mg/L	Lognormal	0.00024	2.1	0.0017	523	Normal	0.00023	0.00013	0.00062	140
Arsenic	mg/L	Lognormal	0.00032	2.0	0.0017	519	Normal	0.00039	0.00015	0.00084	125
Barium	mg/L	Lognormal	0.035	1.5	0.095	489	Normal	0.059	0.034	0.19	140
Beryllium	mg/L	Constant	-	-	0.00005	319	Constant	-	-	0.00005	94
Boron	mg/L	Lognormal	0.059	1.5	0.18	507	Lognormal	0.063	2.3	0.5	140
Cadmium	mg/L	Delta-lognormal	0.00008	3.4	0.00062	502	Lognormal	0.000034	3.6	0.00072	139
Chromium	mg/L	Constant	-	-	0.0001	2.0	Constant	-	-	0.00025	129
Cobalt	mg/L	Delta-lognormal	0.00064	2.6	0.0027	449	Lognormal	0.00014	3.2	0.0021	120
Copper	mg/L	Lognormal	0.011	3.1	0.2	468	Normal	0.0059	0.0026	0.014	133
Iron	mg/L	Constant	-	-	0	2.0	Delta-lognormal	0.083	2.3	0.45	135
Lead	mg/L	Constant	-	-	0	328	Constant	-	-	0	97
Lithium	mg/L	Delta-lognormal	0.0033	1.8	0.012	491	Lognormal	0.0016	2.3	0.012	140
Manganese	mg/L	Delta-lognormal	0.024	9.9	1.2	484	Delta-lognormal	0.088	10	4.0	129
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0	0
Molybdenum	mg/L	Normal	0.13	0.073	0.35	506	Normal	0.097	0.082	0.37	123
Nickel	mg/L	Delta-lognormal	0.0017	2.2	0.0059	476	Lognormal	0.00038	1.7	0.0021	139
Selenium	mg/L	Normal	0.065	0.053	0.23	490	Normal	0.061	0.044	0.19	136
Silicon	mg/L	Lognormal	5.7	1.2	9.5	523	Lognormal	7.1	1.1	10	136
Silver	mg/L	Lognormal	0.0000066	1.5	0.000044	523	Constant	-	-	0	95
Strontium	mg/L	Normal	3.4	1.8	9.3	523	Normal	1.1	0.37	1.8	139
Thallium	mg/L	Constant	-	-	0.000005	334	Constant	-	-	0.000005	102
Tin	mg/L	Constant	-	-	0.00005	331	Constant	-	-	0.00005	99
Titanium	mg/L	Constant	-	-	0	406	Constant	-	-	0	112
Uranium	mg/L	Lognormal	0.0013	2.7	0.016	523	Normal	0.0011	0.0007	0.0027	140
Vanadium	mg/L	Lognormal	0.00039	1.6	0.0014	517	Lognormal	0.00044	1.6	0.0013	128
Zinc	mg/L	Delta-lognormal	0.0086	2.0	0.028	467	Lognormal	0.0021	1.7	0.02	137

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Boundary Pit Wall Runoff					Wight Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	371	118	726	16	Lognormal	1,020	1.1	1,340	69
Major Ions											
Calcium	mg/L	Normal	92	30	182	16	Lognormal	231	1.2	367	70
Chloride	mg/L	Delta-lognormal	1.1	1.5	3.9	16	Delta-lognormal	4.1	1.5	10	71
Fluoride	mg/L	Normal	0.63	0.19	1.2	16	Lognormal	0.76	1.3	1.5	71
Magnesium	mg/L	Normal	8.6	3.0	18	16	Lognormal	28	1.1	41	70
Potassium	mg/L	Normal	1.4	0.32	2.4	16	Lognormal	1.7	1.3	3.3	71
Sodium	mg/L	Normal	5.2	1.6	10	16	Lognormal	27	1.2	44	71
Sulphate	mg/L	Normal	166	70	375	16	Lognormal	611	1.1	810	69
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0076	1.8	0.042	15	Delta-lognormal	0.022	3.2	0.2	71
Nitrate	mg/L (as N)	Delta-lognormal	0.51	6.2	10	16	Delta-lognormal	0.5	4.2	4.0	71
Nitrite	mg/L (as N)	Lognormal	0.0028	4.0	0.19	16	Lognormal	0.0044	2.2	0.031	71
Total Phosphorus	mg/L	Lognormal	0.0068	2.8	0.15	16	Lognormal	0.0051	1.6	0.018	69
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0034	2.5	0.051	16	Lognormal	0.0022	1.7	0.0098	71
Antimony	mg/L	Normal	0.00099	0.00048	0.0024	16	Lognormal	0.00065	1.4	0.0014	71
Arsenic	mg/L	Normal	0.00058	0.00019	0.0011	16	Lognormal	0.0007	1.3	0.0015	68
Barium	mg/L	Normal	0.035	0.016	0.084	16	Lognormal	0.029	1.5	0.08	71
Beryllium	mg/L	Constant	-	-	0	16	Constant	-	-	0.00005	47
Boron	mg/L	Delta-lognormal	0.028	1.3	0.064	16	Normal	0.27	0.097	0.48	71
Cadmium	mg/L	Normal	0.000073	0.000035	0.00018	16	Normal	0.00027	0.00013	0.00057	70
Chromium	mg/L	Constant	-	-	0	16	Constant	-	-	0.00025	54
Cobalt	mg/L	Delta-lognormal	0.0002	1.7	0.00084	16	Delta-lognormal	0.00058	2.0	0.0025	71
Copper	mg/L	Normal	0.023	0.01	0.054	16	Normal	0.013	0.005	0.028	71
Iron	mg/L	Constant	-	-	0	16	Delta-lognormal	0.17	1.7	0.42	71
Lead	mg/L	Constant	-	-	0	16	Constant	-	-	0	44
Lithium	mg/L	Delta-lognormal	0.0079	1.6	0.02	16	Delta-lognormal	0.0085	1.1	0.013	71
Manganese	mg/L	Lognormal	0.016	3.5	0.67	16	Normal	0.13	0.095	0.41	71
Mercury	mg/L	Constant	-	-	0	14	Constant	-	-	0	0
Molybdenum	mg/L	Normal	0.12	0.059	0.3	16	Lognormal	0.14	1.1	0.21	67
Nickel	mg/L	Constant	-	-	0	16	Normal	0.00064	0.00025	0.0014	66
Selenium	mg/L	Normal	0.02	0.011	0.053	16	Normal	0.021	0.014	0.05	71

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Boundary Pit Wall Runoff					Wight Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Silicon	mg/L	Normal	3.6	1.3	7.6	16	Normal	6.8	1.3	11	71
Silver	mg/L	Delta-lognormal	0.000021	1.7	0.000093	16	Constant	-	-	0.000005	41
Strontium	mg/L	Normal	2.7	1.0	5.7	16	Lognormal	6.6	1.3	14	71
Thallium	mg/L	Constant	-	-	0	16	Normal	0.00001	0.0000033	0.00002	67
Tin	mg/L	Constant	-	-	0	15	Constant	-	-	0.00005	42
Titanium	mg/L	Constant	-	-	0	15	Constant	-	-	0.005	54
Uranium	mg/L	Normal	0.0043	0.002	0.01	16	Lognormal	0.0029	1.2	0.0048	70
Vanadium	mg/L	Constant	-	-	0	16	Normal	0.00058	0.00036	0.0013	70
Zinc	mg/L	Constant	-	-	0	15	Delta-lognormal	0.012	1.5	0.027	65

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Springer Pit Wall Runoff					Cariboo Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Normal	758	148	1,000	53	Lognormal	747	1.3	1,536	39
Major Ions											
Calcium	mg/L	Normal	136	27	180	53	Lognormal	137	1.3	289	39
Chloride	mg/L	Normal	8.8	3.3	14	53	Normal	7.0	2.6	15	40
Fluoride	mg/L	Normal	0.48	0.11	0.67	53	Lognormal	0.44	1.2	0.82	40
Magnesium	mg/L	Normal	26	4.7	33	52	Lognormal	27	1.3	61	39
Potassium	mg/L	Normal	9.4	5.2	20	53	Lognormal	2.8	1.5	9.2	40
Sodium	mg/L	Normal	44	13	64	53	Normal	30	8.6	58	40
Sulphate	mg/L	Normal	453	101	600	53	Normal	437	146	1,050	40
Nutrients											
Ammonia	mg/L (as N)	Normal	0.084	0.066	0.24	53	Normal	0.041	0.036	0.15	33
Nitrate	mg/L (as N)	Normal	6.1	2.8	10	53	Lognormal	6.6	2.3	65	40
Nitrite	mg/L (as N)	Normal	0.045	0.026	0.12	53	Lognormal	0.02	2.3	0.15	33
Total Phosphorus	mg/L	Lognormal	0.011	2.1	0.066	51	Lognormal	0.012	2.2	0.08	38

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Springer Pit Wall Runoff					Cariboo Pit Wall Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Dissolved Metals											
Aluminum	mg/L	Normal	0.013	0.0069	0.034	53	Lognormal	0.0045	2.3	0.057	40
Antimony	mg/L	Normal	0.0013	0.00037	0.002	53	Lognormal	0.0012	1.3	0.0026	35
Arsenic	mg/L	Lognormal	0.0013	1.4	0.003	53	Lognormal	0.0012	1.3	0.0028	38
Barium	mg/L	Normal	0.048	0.014	0.091	53	Lognormal	0.058	1.2	0.11	40
Beryllium	mg/L	Constant	-	-	0.00005	50	Constant	-	-	0.00005	37
Boron	mg/L	Normal	0.14	0.023	0.21	52	Normal	0.13	0.029	0.22	34
Cadmium	mg/L	Normal	0.000026	0.000019	0.000065	51	Lognormal	0.000045	1.6	0.00019	39
Chromium	mg/L	Constant	-	-	0.00025	53	Constant	-	-	0.00025	40
Cobalt	mg/L	Normal	0.00012	0.000058	0.0003	50	Lognormal	0.00025	2.2	0.002	39
Copper	mg/L	Lognormal	0.0068	2.6	0.068	53	Lognormal	0.02	2.1	0.12	39
Iron	mg/L	Constant	-	-	0.015	53	Constant	-	-	0.015	39
Lead	mg/L	Constant	-	-	0.000025	53	Constant	-	-	0.000025	38
Lithium	mg/L	Normal	0.012	0.0048	0.02	53	Normal	0.0063	0.0012	0.011	36
Manganese	mg/L	Normal	0.032	0.018	0.086	53	Normal	0.06	0.017	0.11	35
Mercury	mg/L	Constant	-	-	0.0000025	26	Constant	-	-	0.0000025	16
Molybdenum	mg/L	Normal	0.17	0.028	0.25	52	Normal	0.15	0.042	0.28	39
Nickel	mg/L	Normal	0.00051	0.00024	0.0014	53	Normal	0.0007	0.00032	0.0017	39
Selenium	mg/L	Normal	0.036	0.0038	0.047	51	Lognormal	0.055	1.3	0.12	39
Silicon	mg/L	Lognormal	4.4	1.2	7.8	53	Lognormal	6.1	1.3	12	40
Silver	mg/L	Constant	-	-	0.000005	52	Constant	-	-	0.000005	38
Strontium	mg/L	Normal	1.9	0.76	3.3	53	Normal	1.3	0.33	2.3	40
Thallium	mg/L	Constant	-	-	0.000005	52	Constant	-	-	0.000005	39
Tin	mg/L	Constant	-	-	0.00005	53	Constant	-	-	0.00005	39
Titanium	mg/L	Normal	0.0083	0.0053	0.024	53	Constant	-	-	0.005	40
Uranium	mg/L	Normal	0.0017	0.00042	0.0029	53	Normal	0.0022	0.0004	0.0034	35
Vanadium	mg/L	Lognormal	0.0012	1.6	0.0038	53	Lognormal	0.0017	1.5	0.0061	40
Zinc	mg/L	Lognormal	0.0017	1.4	0.007	47	Lognormal	0.0018	1.5	0.0055	40

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Unsaturated TSF Seepage					TSF Beach, Impoundment and Embankment Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	899	1.2	1,428	99	Normal	814	143	1,140	152
Major Ions											
Calcium	mg/L	Lognormal	149	1.2	245	88	Normal	135	22	200	151
Chloride	mg/L	Normal	21	4.1	33	105	Normal	14	8.2	34	157
Fluoride	mg/L	Lognormal	0.71	1.2	1.3	73	Normal	0.59	0.21	1.2	149
Magnesium	mg/L	Lognormal	24	1.3	48	88	Normal	22	4.9	36	151
Potassium	mg/L	Lognormal	12	1.2	20	131	Normal	13	8.4	36	151
Sodium	mg/L	Normal	77	11	111	88	Normal	59	28	123	151
Sulphate	mg/L	Lognormal	504	1.2	875	99	Normal	491	85	684	153
Nutrients											
Ammonia	mg/L (as N)	Normal	0.043	0.032	0.14	97	Delta-lognormal	0.049	4.3	0.7	150
Nitrate	mg/L (as N)	Normal	1.9	0.98	4.8	77	Normal	3.7	3.5	14	155
Nitrite	mg/L (as N)	Delta-lognormal	0.011	3.1	0.06	92	Normal	0.073	0.076	0.3	155
Total Phosphorus	mg/L	Normal	0.025	0.011	0.061	100	Lognormal	0.016	1.9	0.07	153
Dissolved Metals											
Aluminum	mg/L	Lognormal	0.0022	1.6	0.0083	130	Lognormal	0.027	1.6	0.09	150
Antimony	mg/L	Lognormal	0.00035	1.5	0.0011	133	Normal	0.001	0.00068	0.0026	149
Arsenic	mg/L	Lognormal	0.0017	1.2	0.0027	133	Normal	0.0014	0.00059	0.003	151
Barium	mg/L	Normal	0.055	0.017	0.11	88	Normal	0.052	0.018	0.094	150
Beryllium	mg/L	Constant	-	-	0.000025	4.0	Constant	-	-	0.00005	138
Boron	mg/L	Lognormal	0.13	1.2	0.19	133	Normal	0.1	0.037	0.2	151
Cadmium	mg/L	Lognormal	0.000039	2.3	0.0003	118	Lognormal	0.00003	2.1	0.00017	149
Chromium	mg/L	Lognormal	0.00029	1.4	0.002	132	Constant	-	-	0.00025	150
Cobalt	mg/L	Delta-lognormal	0.00029	1.4	0.00046	132	Lognormal	0.00021	3.8	0.0047	151
Copper	mg/L	Lognormal	0.0018	2.2	0.012	120	Lognormal	0.012	7.2	1.3	149
Iron	mg/L	Constant	-	-	0.0025	1.0	Constant	-	-	0.005	1.0
Lead	mg/L	Lognormal	0.000028	1.4	0.0001	131	Constant	-	-	0.000025	150
Lithium	mg/L	Normal	0.0059	0.0017	0.011	131	Lognormal	0.0084	1.6	0.03	149
Manganese	mg/L	Normal	0.11	0.089	0.38	49	Normal	0.05	0.041	0.16	146
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0.000025	8.0
Molybdenum	mg/L	Lognormal	0.17	1.3	0.4	133	Normal	0.17	0.044	0.27	151
Nickel	mg/L	Lognormal	0.00031	1.5	0.0011	132	Lognormal	0.00065	2.3	0.0045	151
Selenium	mg/L	Lognormal	0.011	2.1	0.06	84	Lognormal	0.026	1.3	0.05	149

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Unsaturated TSF Seepage					TSF Beach, Impoundment and Embankment Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Silicon	mg/L	Lognormal	6.2	1.1	8.5	86	Lognormal	3.9	1.3	8.0	151
Silver	mg/L	Constant	-	-	0.0001	132	Constant	-	-	0.000005	146
Strontium	mg/L	Lognormal	1.6	1.6	6.0	133	Normal	1.6	0.28	2.4	146
Thallium	mg/L	Constant	-	-	0.000005	64	Constant	-	-	0.000005	146
Tin	mg/L	Constant	-	-	0.000025	4.0	Constant	-	-	0.00005	147
Titanium	mg/L	Constant	-	-	0	76	Constant	-	-	0.0003	1.0
Uranium	mg/L	Lognormal	0.0015	1.3	0.0031	87	Normal	0.001	0.00042	0.0023	151
Vanadium	mg/L	Lognormal	0.0006	1.6	0.002	88	Lognormal	0.0013	2.3	0.01	151
Zinc	mg/L	Lognormal	0.0012	1.9	0.01	133	Lognormal	0.0023	2.1	0.016	149

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Disturbed Runoff					Undisturbed Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters											
Total Dissolved Solids	mg/L	Lognormal	171	1.7	1,340	255	Normal	169	67	396	220
Major Ions											
Calcium	mg/L	Lognormal	35	2.0	281	245	Normal	29	14	60	206
Chloride	mg/L	Lognormal	0.51	2.2	6.9	255	Delta-lognormal	3.4	2.1	12	153
Fluoride	mg/L	Lognormal	0.067	1.3	0.15	246	Lognormal	0.071	1.7	0.25	99
Magnesium	mg/L	Lognormal	5.5	1.8	52	245	Normal	13	7.5	30	208
Potassium	mg/L	Lognormal	0.55	1.4	1.8	226	Normal	0.97	0.3	1.9	204
Sodium	mg/L	Lognormal	3.5	1.7	29	245	Normal	6.6	3.1	13	206
Sulphate	mg/L	Lognormal	21	3.4	463	253	Delta-lognormal	6.3	2.3	30	219
Nutrients											
Ammonia	mg/L (as N)	Lognormal	0.0039	1.8	0.016	247	Normal	0.0055	0.0035	0.016	219
Nitrate	mg/L (as N)	Lognormal	0.033	5.4	2.6	244	Delta-lognormal	0.061	3.2	0.7	206
Nitrite	mg/L (as N)	Delta-lognormal	0.0026	2.3	0.0093	246	Lognormal	0.00075	2.1	0.01	211
Total Phosphorus	mg/L	Normal	0.017	0.0048	0.031	230	Normal	0.023	0.0069	0.043	217

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Disturbed Runoff					Undisturbed Runoff				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples	Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Dissolved Metals											
Aluminum	mg/L	Delta-lognormal	0.026	4.0	0.31	243	Delta-lognormal	0.043	3.4	0.28	203
Antimony	mg/L	Lognormal	0.000053	1.3	0.00027	241	Lognormal	0.00005	1.2	0.00016	208
Arsenic	mg/L	Lognormal	0.0003	1.3	0.00056	241	Normal	0.00087	0.00044	0.0019	208
Barium	mg/L	Normal	0.016	0.0053	0.032	230	Normal	0.0093	0.0022	0.016	206
Beryllium	mg/L	Constant	-	-	0	213	Constant	-	-	0	14
Boron	mg/L	Normal	0.025	0.011	0.059	241	Normal	0.017	0.0073	0.041	208
Cadmium	mg/L	Lognormal	0.0000058	1.8	0.000028	240	Lognormal	0.0000078	1.9	0.000035	204
Chromium	mg/L	Lognormal	0.0003	1.5	0.00094	242	Normal	0.00077	0.00027	0.0015	206
Cobalt	mg/L	Lognormal	0.000059	1.6	0.00053	245	Lognormal	0.000056	1.4	0.00028	207
Copper	mg/L	Lognormal	0.0063	1.7	0.035	244	Normal	0.0022	0.0016	0.0071	208
Iron	mg/L	Delta-lognormal	0.10	1.9	0.33	243	Delta-lognormal	0.11	1.9	0.39	207
Lead	mg/L	Lognormal	0.000026	1.3	0.00011	243	Delta-lognormal	0.000071	1.4	0.00017	206
Lithium	mg/L	Lognormal	0.00051	1.6	0.0076	246	Normal	0.0016	0.0009	0.003	208
Manganese	mg/L	Lognormal	0.0046	3.3	0.08	241	Normal	0.0088	0.0064	0.037	205
Mercury	mg/L	Constant	-	-	0	0	Constant	-	-	0	0
Molybdenum	mg/L	Lognormal	0.0035	3.2	0.18	246	Normal	0.0017	0.0012	0.0056	205
Nickel	mg/L	Normal	0.00046	0.00028	0.0013	244	Normal	0.00077	0.00053	0.0026	208
Selenium	mg/L	Lognormal	0.00091	4.7	0.082	245	Normal	0.00037	0.00015	0.0006	202
Silicon	mg/L	Normal	5.7	0.79	7.4	245	Normal	6.0	1.6	9.0	208
Silver	mg/L	Lognormal	0.0000056	1.4	0.000019	243	Lognormal	0.0000061	1.6	0.000039	208
Strontium	mg/L	Lognormal	0.19	1.6	0.74	236	Normal	0.24	0.11	0.45	206
Thallium	mg/L	Constant	-	-	0	244	Constant	-	-	0	93
Tin	mg/L	Constant	-	-	0	244	Constant	-	-	0	11
Titanium	mg/L	Constant	-	-	0	238	Lognormal	0.0047	1.4	0.015	208
Uranium	mg/L	Lognormal	0.00016	2.1	0.002	245	Normal	0.00054	0.00038	0.0017	208
Vanadium	mg/L	Normal	0.00056	0.00026	0.0014	244	Lognormal	0.00054	1.3	0.0018	208
Zinc	mg/L	Normal	0.0073	0.0048	0.022	235	Lognormal	0.0012	1.9	0.0066	207

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Groundwater Inflow to Springer-Cariboo Pit				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Physical Parameters						
Total Dissolved Solids	mg/L	Lognormal	217	1.6	639	222
Major Ions						
Calcium	mg/L	Normal	45	29	145	253
Chloride	mg/L	Delta-lognormal	2.6	3.1	15	239
Fluoride	mg/L	Normal	0.28	0.13	0.67	242
Magnesium	mg/L	Normal	8.5	8.0	28	252
Potassium	mg/L	Normal	0.43	0.24	1.2	247
Sodium	mg/L	Normal	20	6.4	39	243
Sulphate	mg/L	Normal	88	59	341	225
Nutrients						
Ammonia	mg/L (as N)	Delta-lognormal	0.010	1.7	0.037	249
Nitrate	mg/L (as N)	Delta-lognormal	0.38	4.1	3.1	248
Nitrite	mg/L (as N)	Delta-lognormal	0.011	3.0	0.036	253
Total Phosphorus	mg/L	Lognormal	0.014	1.5	0.038	225
Dissolved Metals						
Aluminum	mg/L	Lognormal	0.0022	1.7	0.0089	248
Antimony	mg/L	Delta-lognormal	0.00017	1.7	0.00052	251
Arsenic	mg/L	Normal	0.0024	0.0013	0.0052	251
Barium	mg/L	Lognormal	0.017	2.3	0.12	252
Beryllium	mg/L	Constant	-	-	0.00005	233
Boron	mg/L	Normal	0.27	0.16	0.57	243
Cadmium	mg/L	Lognormal	0.0000064	2.0	0.000054	249
Chromium	mg/L	Constant	-	-	0	240
Cobalt	mg/L	Lognormal	0.000053	1.3	0.0002	246
Copper	mg/L	Lognormal	0.00037	1.9	0.0027	247
Iron	mg/L	Delta-lognormal	0.093	1.8	0.2	249
Lead	mg/L	Constant	-	-	0.000025	246
Lithium	mg/L	Normal	0.0033	0.00067	0.0054	238
Manganese	mg/L	Normal	0.024	0.02	0.077	238
Mercury	mg/L	Constant	-	-	0.0000025	2.0
Molybdenum	mg/L	Normal	0.032	0.013	0.05	252
Nickel	mg/L	Delta-lognormal	0.00086	1.4	0.0015	247
Selenium	mg/L	Delta-lognormal	0.0009	5.7	0.018	251
Silicon	mg/L	Normal	7.9	1.0	10	252
Silver	mg/L	Constant	-	-	0.000005	245
Strontium	mg/L	Lognormal	0.14	2.5	1.3	252
Thallium	mg/L	Constant	-	-	0.000005	248
Tin	mg/L	Lognormal	0.000053	1.3	0.00034	251
Titanium	mg/L	Constant	-	-	0	244

Table 10. Summary of Stochastic Water Quality Inputs (Continued)

Parameter	Units	Groundwater Inflow to Springer-Cariboo Pit				
		Distribution Selected	Mean	Standard Deviation	Maximum	Number of Samples
Uranium	mg/L	Delta-lognormal	0.00023	2.8	0.0015	251
Vanadium	mg/L	Delta-lognormal	0.0015	1.9	0.0029	251
Zinc	mg/L	Delta-lognormal	0.0076	1.8	0.027	251

Note: Standard deviation calculated as $\sigma = \sqrt{\frac{\sum(x_i - \mu)^2}{n}}$ where σ = standard deviation; x_i = individual sample from distribution dataset; μ = mean of dataset distribution; n = number of samples from distribution dataset.

2.6.3.1 Development of Water Quality Inputs

The following standardized process was used to develop a statistical distribution for each parameter (Table 7):

- Step 1: Determine if data are available and if values are less than the method detection limit (MDL). Except for special cases listed below under Step 5, values below the MDL were set equal to half of the MDL.
- Step 2: Examine time-series of available data to select the most representative range of data to use for input:
  - The following general rules were used to select the data used for input to the model:
    - Where no trend was apparent in the monitoring data over time, the whole data set was used as input to the model.
    - Where a decreasing trend was observed in the monitoring data, the whole data set was used, including the earlier, higher values, thereby adding conservatism and representing a potential return to conditions that led to higher concentrations (without specifying what those conditions were).
    - Where an increasing trend was observed in the monitoring data, input data were limited to the range of data most representative of current or recent conditions.
- Step 3: Remove outliers from selected data:
  - Three statistical tests were used to identify outliers. These included the three times standard deviation (3σ) rule, the Hampel identifier, and combined Rosner-Dixon test. A data point was considered an outlier only if it was flagged by all three tests. By using multiple tests, the possibility of misdiagnoses was reduced (Beckman and Cook 1983; Jain 1981; Kottegoda 1984; Pearson 2001).
- Step 4: Fit suitable statistical distributions to the resulting data:
  - The probability distributions considered for the water quality data were normal, lognormal, or delta-lognormal, as these are typical distributions for water quality data (AEP 1995; US EPA 1991). To identify which distribution best described a constituent, all three distributions were initially fitted to the available data. Statistical goodness of fit tests, consisting of the Chi-squared test, the Kolmogorov-Smirnov test and the squared correlation coefficient (Sokal and Rohlf 1981) were used to determine which distribution was most appropriate.
- Step 5: Process data with a single value:
  - Where all data were at a single value a constant input was used equal to this value.
  - Where all data were below the MDL, a constant input was used at half the MDL.

    - Where dissolved mercury data were not available for a location, a constant input was used equal to half the lowest detection limit measured on site, consistent with other locations.

- Step 6: Determine the minimum and maximum bounds to define a reasonable range for the selected distribution:
    - When possible, the maximum observed value was used as the maximum bound of all distributions. In cases where the maximum observed value was too low to result in a fitted distribution, the lowest maximum value acceptable for a fitted distribution was used as the maximum bound. The maximum is considered reasonable because there is a large dataset of mine water chemistry and parameter concentrations in drainage water are not expected to increase significantly from the period of observed data to closure.

The minimum value of a distribution was set to zero for the normal distribution, a value very close to zero (e.g., 0.00000001) for the lognormal distribution, or half the detection limit for the delta-lognormal distribution.

2.6.4 Geochemical Source Terms

Water quality inputs derived from geochemical source terms developed by SRK Consulting Canada were applied to the SWWQM as an additional scenario in the 2016 Long Term Water Management Plan (Golder 2016). Updates to these geochemical source terms were completed by SRK consulting (SRK 2023). An alternative model scenario was completed using the SRK geochemical source terms as water quality inputs in place of inputs calculated from monitoring data. The results of the two scenarios (using monitoring data or SRK geochemical inputs) were compared. Consistent with the previous geochemical source terms provided by SRK for the 2016 TAR (Golder 2016) and the 2020 WMP (Golder 2020), the SRK inputs were considered more conservative than the monitoring data inputs and produced generally higher concentrations in the SWWQM. The results presented in this report are from the scenario that utilized the water quality inputs that were calculated from monitoring data (Section 2.6.3). The results from the geochemical source term scenario are not presented because the model predictions were considered overly conservative for most parameters and because the model was calibrated using the inputs calculated from monitoring data.

2.6.5 Initial Water Quality

Concentrations in ponds, sumps, and pits at the beginning of the calibration period are based on monitoring data in January 2017. Concentrations in ponds, sumps, and pits at the beginning of the operations period are based on monitoring data in May 2023.

2.7 Model Assumptions

Assumptions that have been made in the SWWQM are:

- The input water qualities used in the SWWQM are representative of their respective input sources and will continue to be representative over the modelled timeframe. Water quality data for model inputs were selected from available lab testing and field monitoring, augmented by professional judgement where necessary.
- Concentrations of parameters from monitoring data that were lower than the analytical detection limit were set equal to half the detection limit.

- Concentrations of parameters in direct precipitation onto the water surface of water management facilities were assumed to be zero. No mass was removed or added to modelled systems through evaporation or direct precipitation. These processes affected water quantity only and did not affect mass of modelled parameters in the system.
- All open pits, ponds, and sumps are fully mixed systems. No stratification is considered over the modelled timeframe. All inputs are mixed with existing water volumes to calculate concentrations of parameters.
- All parameters are assumed to behave conservatively. That is, they are assumed to not settle, precipitate, sorb, degrade, or undergo any other process that would reduce concentrations. This assumption is likely to have negligible effects on major ion predictions but may lead to over-estimation of some nutrients and metals.
- All PAG waste rock will be disposed sub-aqueously in the Springer-Cariboo Pit at closure to mitigate onset of acid generation. Acid generation is not expected to occur prior to subaqueous disposal, and disposal in the Springer-Cariboo Pit Lake will prevent acid onset in the future by limiting oxidation in the waste rock. Geochemical characterization studies estimate the time to the onset of acid generation varies between decades and 100 years (MPMC 2022).
- The combined Springer-Cariboo Pit is assumed to be empty at the start of closure.
- Rock disposal sites are assumed to be reclaimed in post-closure. Following revegetation, the runoff from these facilities is assumed to return to undisturbed runoff quality over the course of ten years.
- Diffusive flux from the submerged PAG waste rock into the Springer-Cariboo Pit Lake water cap was not modelled.
- Accumulation and flushing of oxidation products from weathered PAG material prior to subaqueous disposal was not modelled.
- Ice formation and melting were not considered in pits, ponds, and ditches that retain water.

3.0 MODEL CALIBRATION

The SWWQM was set up to hindcast concentrations from 1 January 2017 to 31 December 2022 at seven locations:

- Springer Pit
- Cariboo Pit
- Wight Pit
- CCS
- PETBP
- TSF
- NW Sump

Where discrepancies between model results and monitoring data existed, the model was adjusted to better reflect monitoring data. The same adjustments, made during calibration of the SWWQM in the 2020 Water Management Plan (Golder 2020) and during the calibration of the SWWQM in the 2022 Reclamation and Closure Plan (WSP 2022), were maintained in this update to achieve calibration with monitoring data:

- Adjusting the proportion of Wight Pit runoff and groundwater inflows that are assigned a waste rock contact water input based on storage of waste rock in the pit.
- Adjusting the proportion of runoff from waste rock that is assigned an undisturbed water quality input.
- In the TSF, applying calibration factors greater than 1.0 to improve the model calibration for chloride, fluoride, potassium, sodium, nitrite, dissolved antimony, dissolved arsenic, dissolved barium, dissolved lithium, dissolved molybdenum, and dissolved vanadium. These calibration factors are applied during periods when tailings are deposited to the TSF.

3.1 Calibration Results

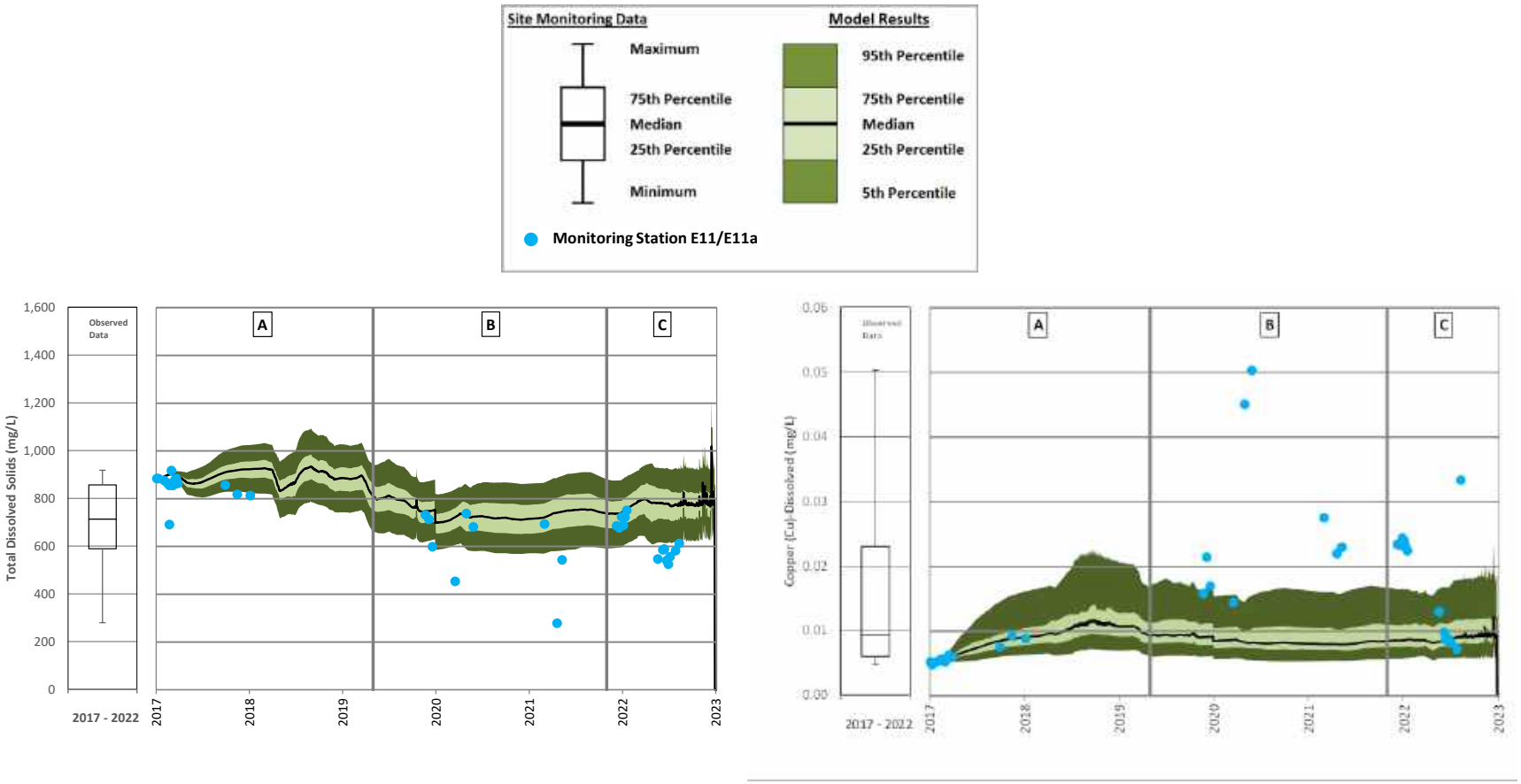
Model calibration results are shown compared to monitoring data in Figures 4 to 9 (model calibration results for all parameters and locations are provided in Appendix A). Monitoring data were generally between the projected 5th and 95th percentile model calibration results for all parameters. However, several parameters (e.g., dissolved copper) were underpredicted during periods in 2018, 2020, and 2021 (Figure 5, Figure 7, Figure 8 and Figure 9). The source of the increased concentrations in the monitoring data for these parameters is thought to be due to the discharge of leachate to the TSF from the onsite test heap leach facility (Golder 2022c). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process.

Where monitoring data fell within the 5th and 95th percentile model calibration results, the model was considered to be in good agreement with monitoring data. The good agreement indicates that model inputs were well characterized and that these parameters had low sensitivity to assumptions or model conditions not matching site conditions.

Where monitoring data were consistently below the 5th percentile predictions, the model was considered to be over predicting concentrations. Possible reasons why the model may be over-predicting concentrations are:

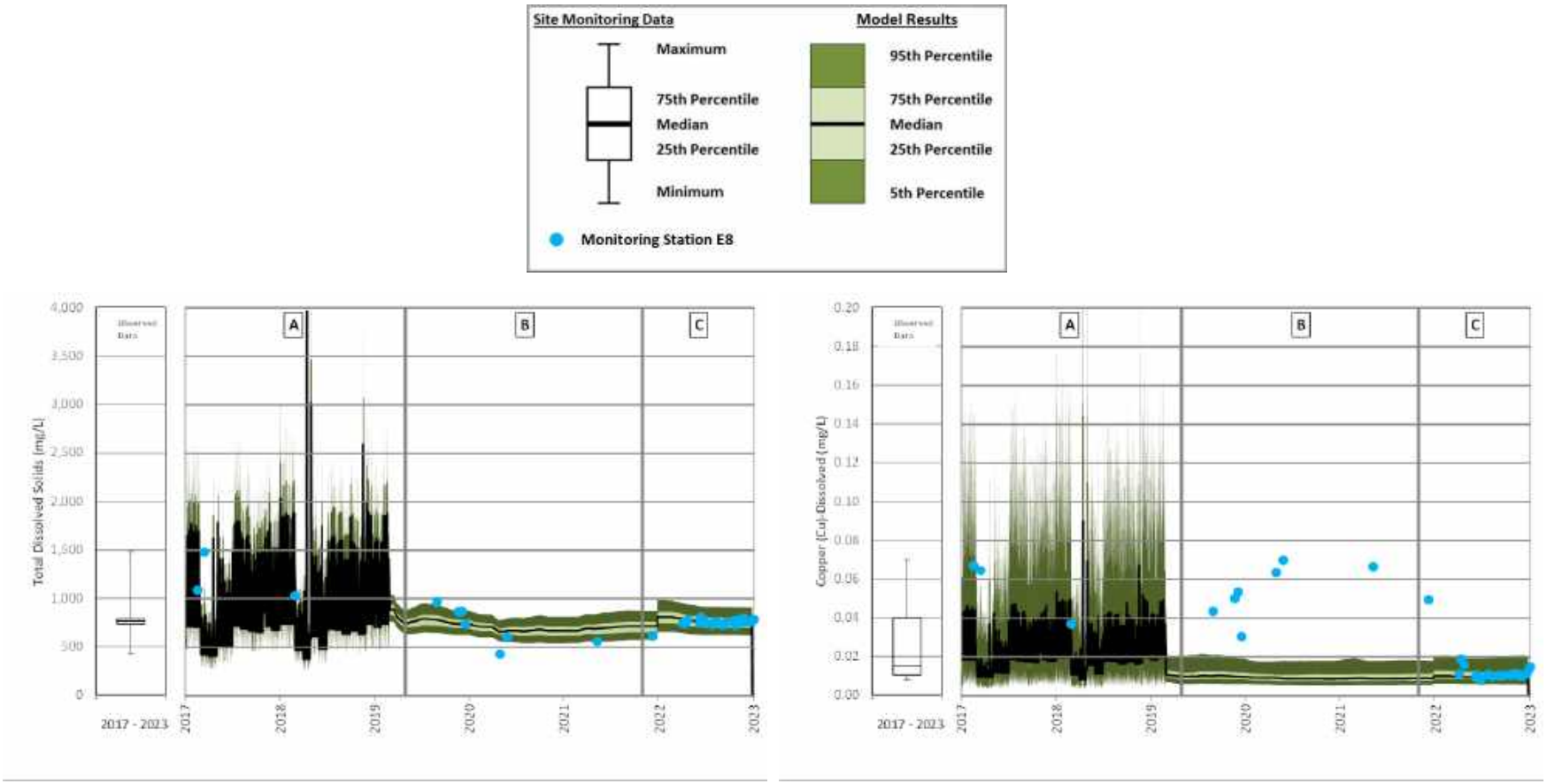
- The model was developed to predict water quality conservatively; where uncertainty exists in model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected. For example, seepage from RDSs was assigned a NAG water quality for the entire model simulation period, which is a conservative assumption.
- Metal concentrations that are far below detection limits may be skewed upward by model inputs where half-detection limits were applied.
- Settling of particulate material is not accounted for in the model.
- Geochemical processes, such as precipitation and adsorption, are not accounted for in the model.

Although these factors may lead to over-prediction of concentrations, the model is considered valid for the purpose of predicting concentrations of parameters on the mine site and in the influent to the WTP because deviations in model predictions from monitoring data in this category tend toward additional environmental protection.



A = Operations; B = Care and Maintanence; C = Resumed Operations

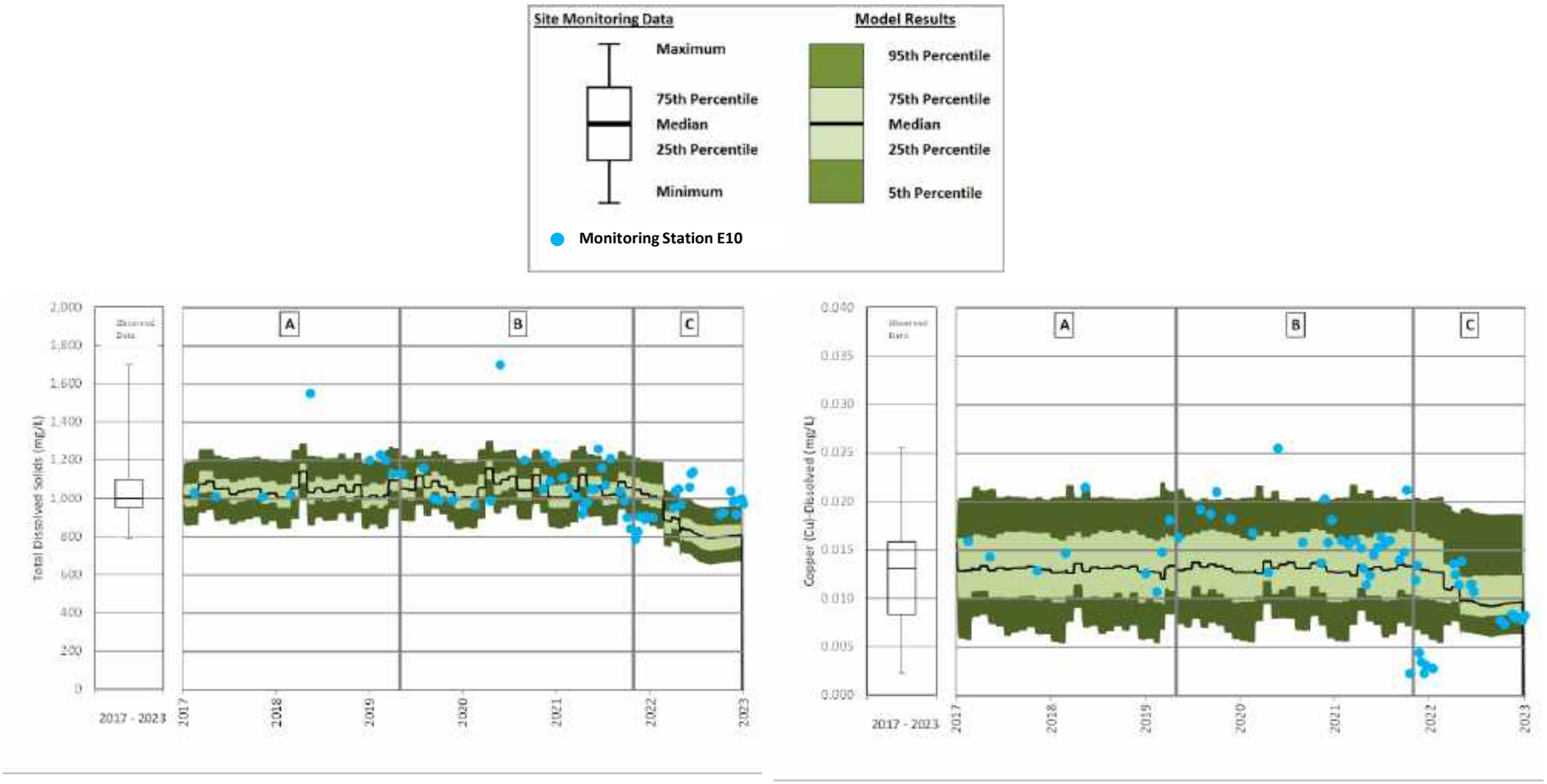
Figure 4: Springer Pit Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintanence; C = Resumed Operations

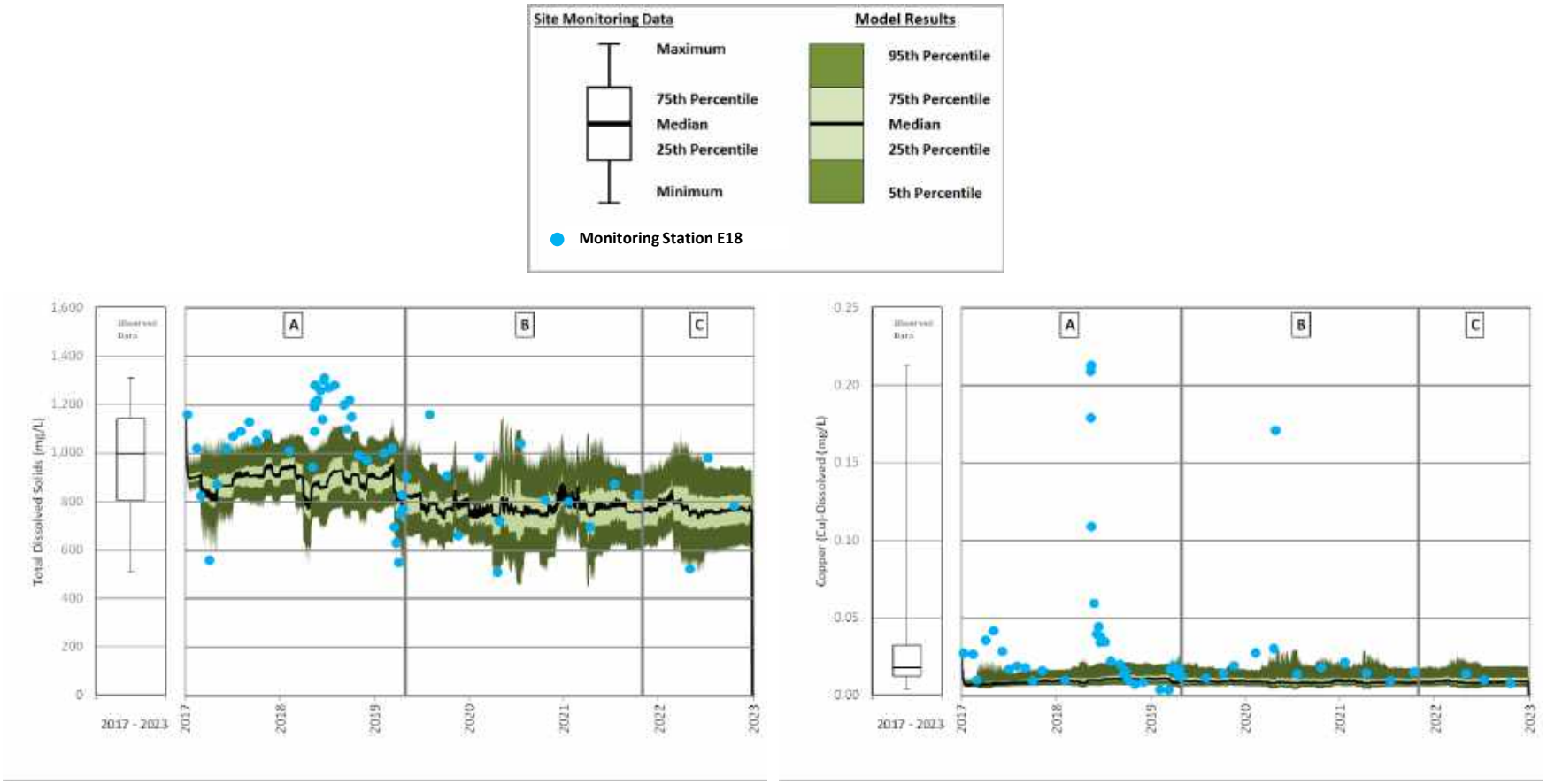
Note: Cariboo Pit is a flow-through system from the beginning of the model simulation to March 2019, which results in a wide range in predicted concentrations. After March 2019, Cariboo Pit stores water, which reduces the range in predicted concentrations. The source of increased copper concentrations in 2019, 2020 and 2021 monitoring data is due to the discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to Cariboo Pit). These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

Figure 5: Cariboo Pit Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintanence; C = Resumed Operations

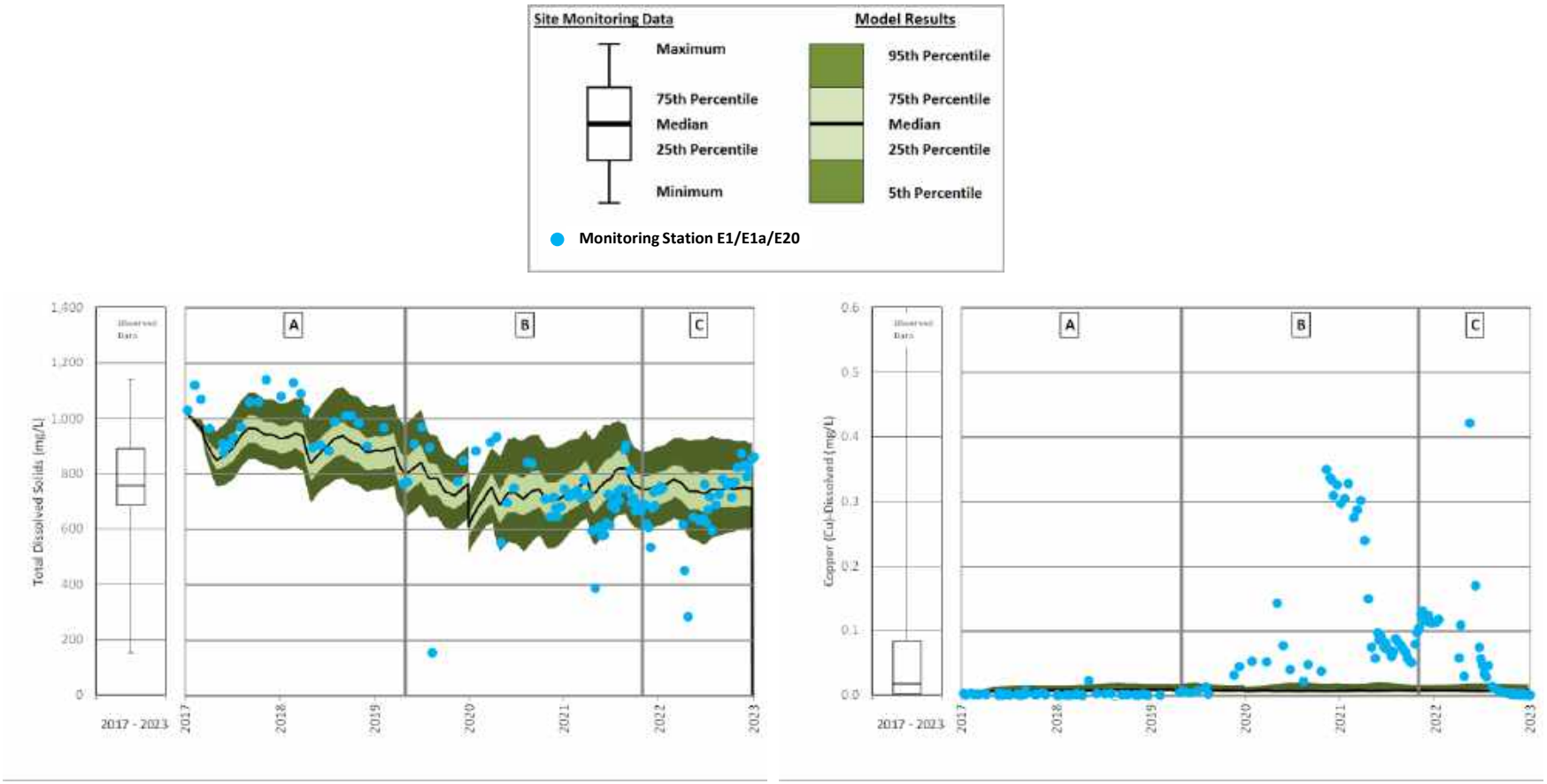
Figure 6: Wight Pit Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The source of increased dissolved copper concentrations in the Central Collection Sump 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the CCS. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

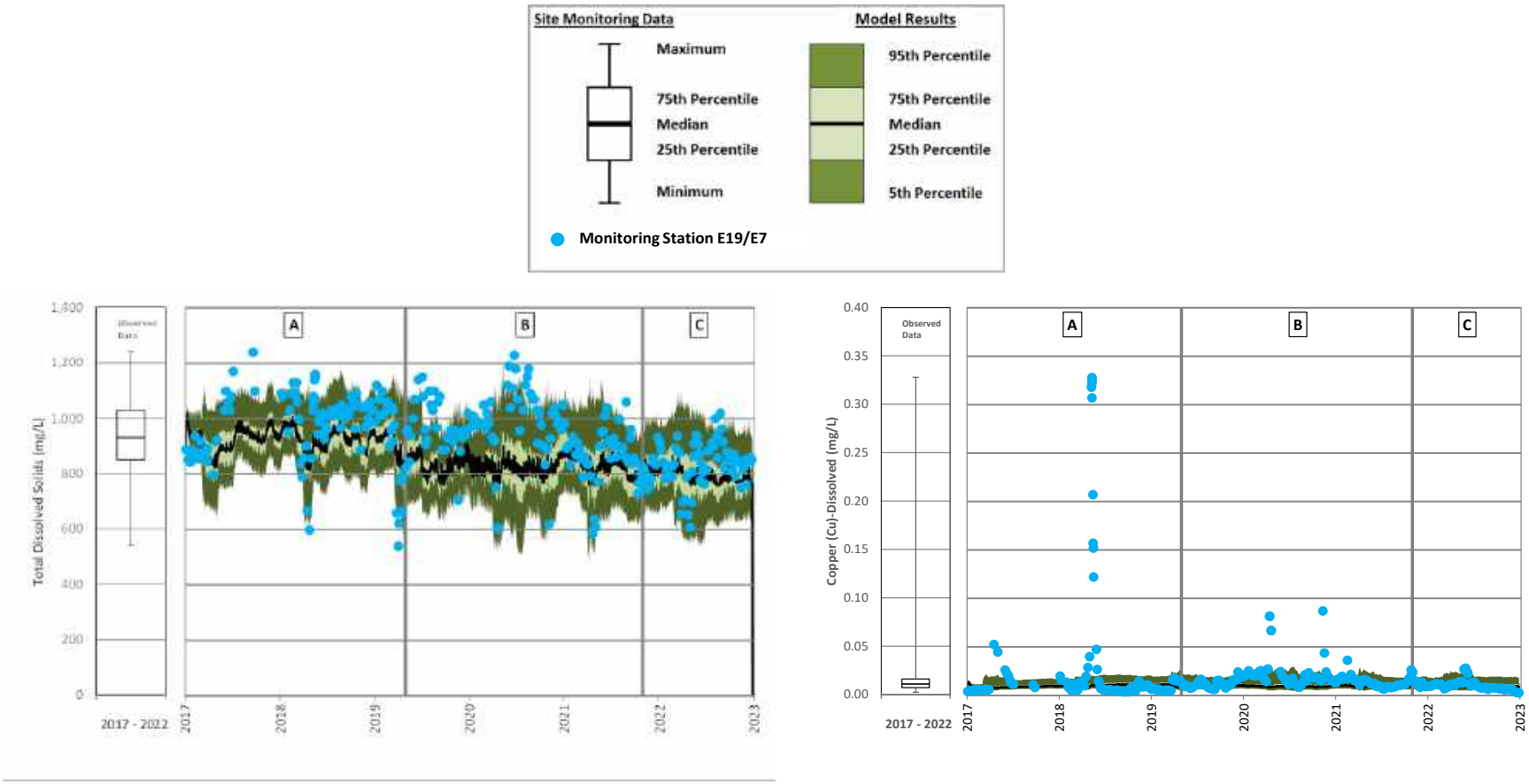
Figure 7: Central Collection Sump Calibration – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The source of increased copper concentrations in 2018 and from 2020 to 2022 in the monitoring data of the Tailings Storage Facility (TSF) is due to the discharge of leachate to the TSF from the onsite test heap leach facility. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

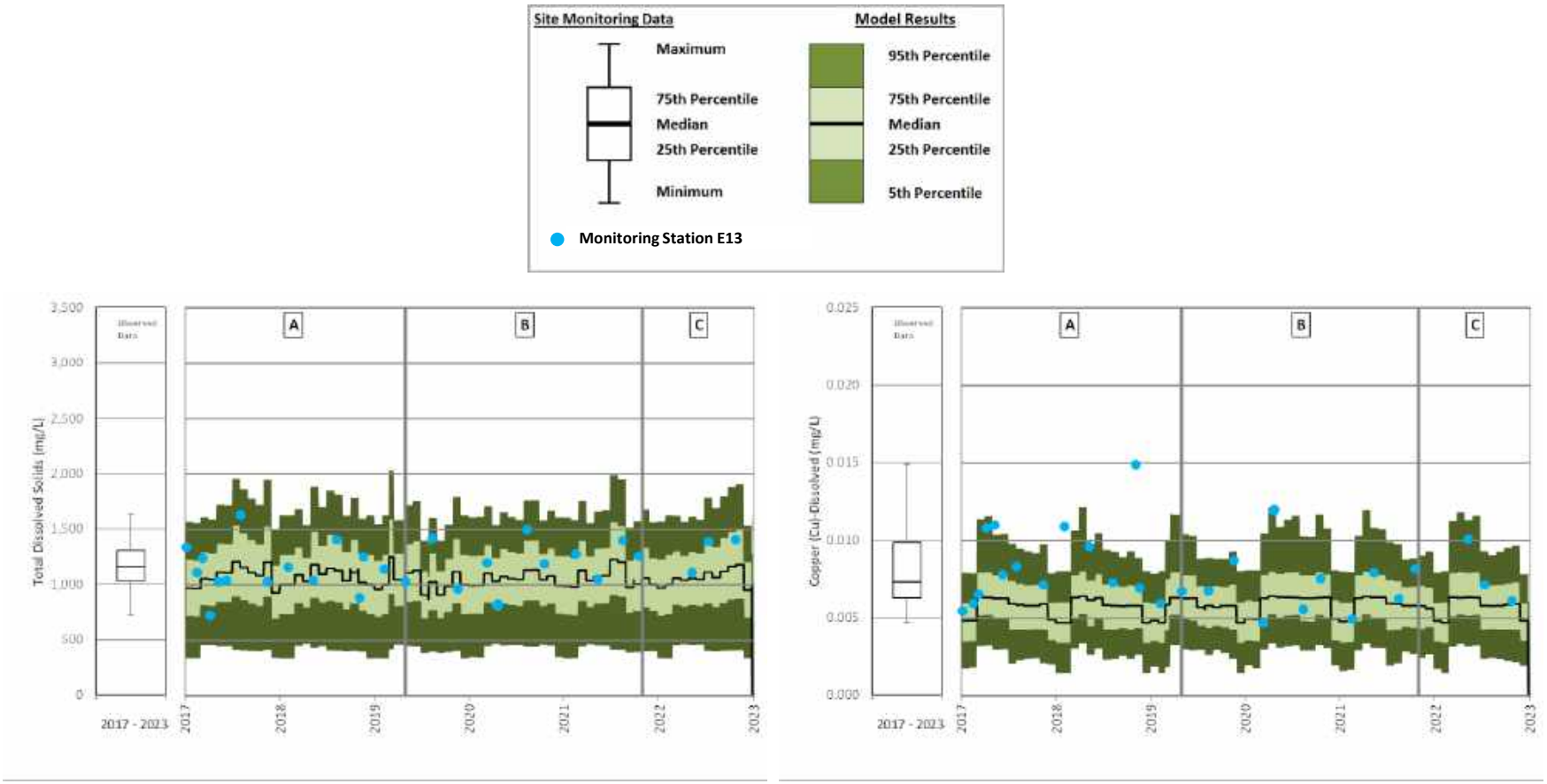
Figure 8: Tailings Storage Facility Supernatant Pond – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The source of increased dissolved copper concentrations in the Perimeter Embankment Till Borrow Pond 2018 monitoring data is due to discharge of leachate from the onsite test heap leach facility to the TSF, which is then pumped to the PETBP. These concentrations were not observed throughout the operational phases of the mine and are considered atypical. These conditions are not expected to persist during future operational phases as the leachate will be managed exclusively through the milling process (Golder 2022c).

Figure 9: Perimeter Embankment Till Borrow Pond – Total Dissolved Solids and Dissolved Copper



A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure 10: Northwest Sump – Total Dissolved Solids and Dissolved Copper

4.0 MODEL RESULTS

After the model calibration was completed, model simulations were performed for the following periods:

- Operations (1 January 2024 to 31 March 2031)
- Closure (1 April 2031 to 31 March 2041)
- Post-closure (1 April 2041 to 31 March 2131)

The following sections present predicted discharge concentrations for the PETBP in operations, which represents predicted WTP influent concentrations, and each of the nine discharge locations in closure and post-closure that discharge to receiving environments (Section 2.4):

- PETBP
- 9 km Sump
- NW Sump
- Springer-Cariboo Pit Sump
- MDCS
- Wight Pit
- Long Ditch
- SESCP
- MESCP

Maximum of median and 95th percentile predicted concentrations are presented for all modelled parameters. Time series of predicted dissolved concentrations are presented for parameters with permit limits. Time series predictions are also compared to historical observed data for each facility in the model as a quality control check.

4.1 Perimeter Embankment Till Borrow Pond

During operations, closure and the first ten years of post-closure, the PETBP is the influent water to the WTP, which discharges to Quesnel Lake. Maximum of the daily median and maximum of the daily 95th percentile concentrations in the PETBP are presented in Table 11. Predicted total concentrations in the PEBTP are based on a TSS concentration of 15 mg/L. Time series for predicted concentrations in the PETBP are presented for parameters with permit limits in Figures 10 to 15.

In general, concentrations in the PETBP are predicted to remain relatively consistent during operations until the end of pumping from the mill processing plant in 2031. This consistency is due to the assumption that the entire surface areas of the RDS are accounted for at the beginning of the model simulation. Therefore, the runoff and seepage volumes from the RDS do not change. Changes in predicted concentrations in the PETBP are due to:

- Variable pumping from the TSF to the MDCS during operations. During periods when the TSF is pumped to the MDCS (P100 booster pumping in Figure 1), concentrations of most parameters increase in the MDCS. Concentrations decrease in the MDCS when there is no pumping from the TSF. Changes in MDSC water quality reach the PETBP through the pathway connecting the MDCS to the PETBP:
  - TSF → MDCS → SERDS Ditch → Long Ditch → CCS → PETBP
- Surface runoff at the mine site causes fluctuations in concentrations depending on the proportions of the catchment areas flowing into the facilities (e.g., RDS areas, disturbed areas, undisturbed areas). Parameter concentrations reach steady-state during the winter months because surface runoff is low.

Discharge from the PETBP will be directed to Hazeltine Creek in closure. This discharge includes overflow and seepage from the TSF, as well as runoff from catchment areas of the PETBP, TSF, and CCS.

Predicted concentrations in the PETBP change from operations to closure and into early post-closure because of the staggered reclamation of the TSF beach and impoundment areas which are then assigned an undisturbed water quality once the areas are reclaimed. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the PETBP. In closure and post-closure, concentrations in the PETBP follow two patterns:

1) Decrease from operations because the statistical distributions assigned to undisturbed runoff water quality have lower concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., sulphate, nitrate and dissolved copper).
2) Increase from operations because the statistical distributions assigned to undisturbed runoff water quality have higher concentrations than the statistical distributions assigned to the TSF beach runoff and the NAG waste rock runoff quality (e.g., total phosphorus, dissolved chromium and dissolved iron).

Predicted concentrations in the PETBP reach a steady state approximately 10 years after the start of post-closure when all mine site areas have been reclaimed.

Table 11: Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	649	809	340	483	220	314	153	233
Total Dissolved Solids	mg/L	948	1,117	500	710	359	496	239	313
Major Ions									
Calcium	mg/L	208	250	102	144	61	84	41	55
Chloride	mg/L	17	20	4.6	11	6.6	10	5.1	8.0
Fluoride	mg/L	0.74	1.0	0.28	0.39	0.24	0.35	0.17	0.24
Magnesium	mg/L	31	45	21	30	16	26	12	23
Potassium	mg/L	16	19	3.7	6.8	3.8	5.0	2.7	3.5
Sodium	mg/L	63	75	23	32	24	32	18	22
Sulphate	mg/L	576	681	268	401	138	189	104	144
Nutrients									
Ammonia	mg/L (as N)	0.021	0.058	0.032	0.074	0.012	0.051	0.0081	0.038
Nitrate	mg/L (as N)	3.4	23	2.1	6.4	0.61	2.5	0.45	1.9
Nitrite	mg/L (as N)	0.055	0.069	0.017	0.032	0.0054	0.06	0.0041	0.045
Total Phosphorus	mg/L	0.014	0.029	0.015	0.025	0.017	0.026	0.022	0.033
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.048	0.2	0.07	0.3
Antimony	mg/L	0.0012	0.0016	0.00048	0.00095	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0028	0.0033	0.002	0.0032	0.00085	0.0012	0.00086	0.0016
Barium	mg/L	0.054	0.073	0.028	0.056	0.022	0.031	0.015	0.022
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.37	0.19	0.36	0.046	0.061	0.031	0.042
Cadmium	mg/L	0.00022	0.00041	0.000029	0.00014	0.000019	0.000079	0.000013	0.00006
Chromium	mg/L	0.00065	0.0007	0.00072	0.00082	0.00055	0.0013	0.00084	0.0017
Cobalt	mg/L	0.00064	0.0014	0.00036	0.00062	0.000083	0.00029	0.000058	0.00023
Copper	mg/L	0.02	0.19	0.016	0.17	0.004	0.0079	0.0032	0.007
Iron	mg/L	0.48	0.58	0.48	0.54	0.087	0.33	0.13	0.44
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.000019	0.000072	0.000016	0.0001
Lithium	mg/L	0.0095	0.012	0.0052	0.011	0.0027	0.0041	0.0017	0.0027
Manganese	mg/L	0.14	0.26	0.058	0.14	0.075	0.16	0.057	0.13
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052

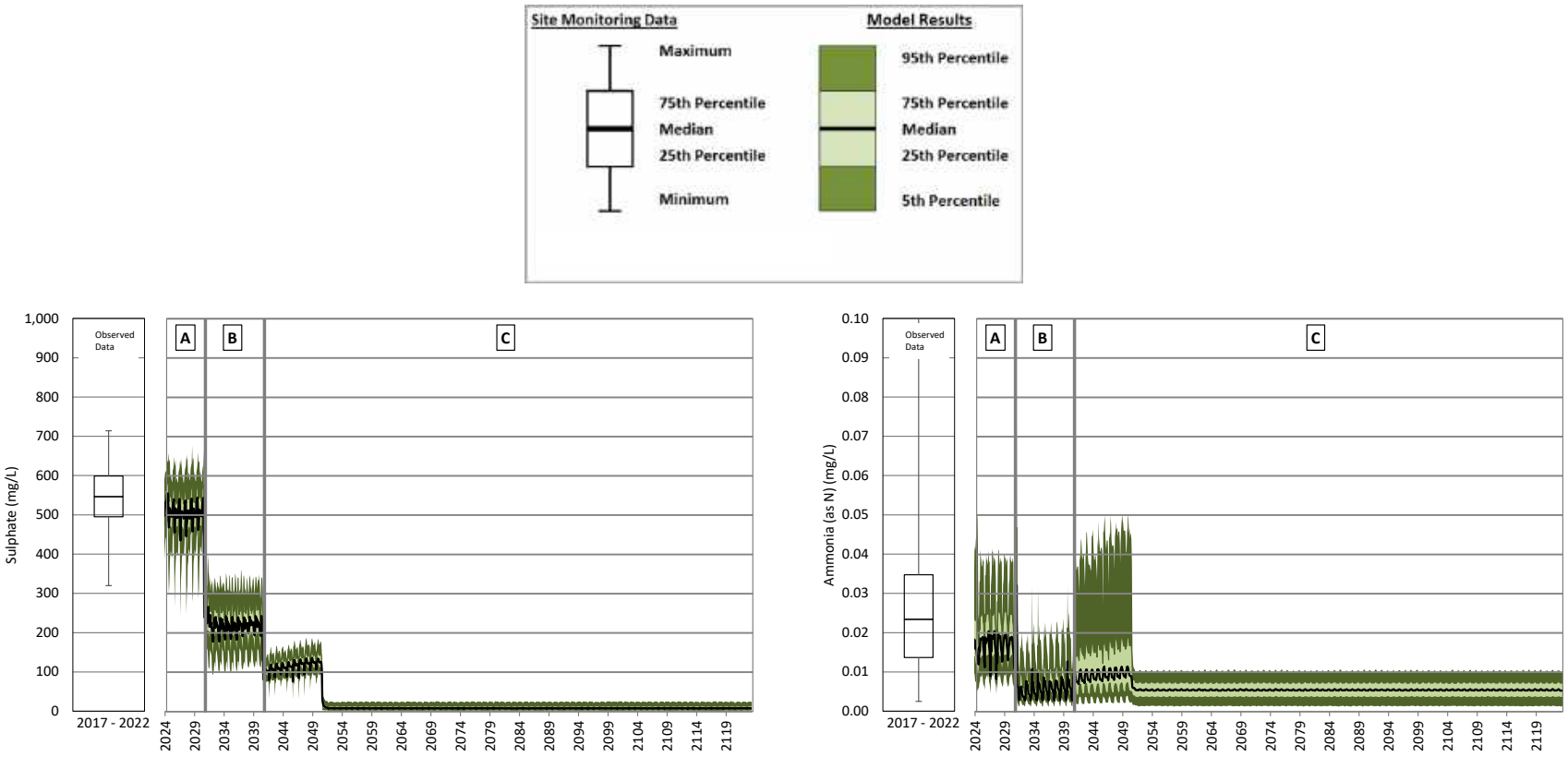
Table 11: Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.24	0.28	0.089	0.16	0.045	0.071	0.034	0.054
Nickel	mg/L	0.0011	0.0021	0.001	0.0016	0.00058	0.0013	0.00087	0.0019
Selenium	mg/L	0.041	0.074	0.022	0.044	0.0034	0.011	0.0025	0.0083
Silver	mg/L	0.0000053	0.000013	0.0000053	0.000013	0.0000052	0.000015	0.0000062	0.000019
Strontium	mg/L	5.3	8.4	1.1	2.1	0.59	1.2	0.41	0.85
Thallium	mg/L	0.0000089	0.000014	0.0000049	0.0000058	0.0000051	0.0000052	0.000005	0.0000052
Tin	mg/L	0.000049	0.00013	0.000051	0.00015	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.025	0.026	0.024	0.027	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0035	0.00087	0.0019	0.00084	0.0015	0.00055	0.0011
Vanadium	mg/L	0.0035	0.0039	0.0018	0.0027	0.00058	0.001	0.0007	0.0012
Zinc	mg/L	0.012	0.019	0.0069	0.011	0.002	0.0032	0.0017	0.0027
Dissolved Metals									
Aluminum	mg/L	0.017	0.047	0.019	0.067	0.02	0.084	0.042	0.18
Antimony	mg/L	0.0012	0.0014	0.00046	0.00081	0.00013	0.00021	0.000089	0.00015
Arsenic	mg/L	0.0025	0.003	0.0017	0.0029	0.00082	0.0011	0.00083	0.0015
Barium	mg/L	0.052	0.064	0.026	0.047	0.021	0.03	0.014	0.02
Beryllium	mg/L	0.000049	0.000051	0.000049	0.000051	0.000051	0.000052	0.00005	0.000052
Boron	mg/L	0.23	0.34	0.19	0.33	0.046	0.059	0.031	0.04
Cadmium	mg/L	0.00021	0.00036	0.000026	0.000091	0.000018	0.000071	0.000012	0.000053
Chromium	mg/L	0.00027	0.00031	0.00034	0.00044	0.00044	0.00077	0.00073	0.0011
Cobalt	mg/L	0.00036	0.0011	0.000078	0.00034	0.000083	0.00022	0.000058	0.00016
Copper	mg/L	0.012	0.03	0.0068	0.018	0.0036	0.0063	0.0029	0.0054
Iron	mg/L	0.036	0.14	0.04	0.097	0.043	0.14	0.089	0.26
Lead	mg/L	0.000025	0.00003	0.000024	0.000037	0.000019	0.000052	0.000016	0.000083
Lithium	mg/L	0.0093	0.011	0.005	0.0096	0.0027	0.004	0.0017	0.0026
Manganese	mg/L	0.12	0.24	0.037	0.12	0.071	0.14	0.054	0.11
Mercury	mg/L	0.0000049	0.0000051	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Molybdenum	mg/L	0.24	0.27	0.089	0.15	0.045	0.07	0.034	0.054
Nickel	mg/L	0.00056	0.0016	0.00046	0.001	0.00051	0.001	0.0008	0.0016
Selenium	mg/L	0.041	0.068	0.022	0.038	0.0033	0.011	0.0025	0.0082
Silicon	mg/L	6.5	8.1	6.9	8.0	5.2	6.7	5.9	8.1
Silver	mg/L	0.0000053	0.0000076	0.0000053	0.0000069	0.0000052	0.0000084	0.0000062	0.000012
Strontium	mg/L	5.3	8.1	1.1	1.8	0.59	1.2	0.4	0.83

Table 11: Predicted Maximum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Thallium	mg/L	0.0000089	0.000013	0.0000049	0.0000051	0.0000051	0.0000052	0.000005	0.0000052
Tin	mg/L	0.000049	0.000054	0.000051	0.000071	0.000051	0.000052	0.00005	0.000052
Titanium	mg/L	0.0066	0.0075	0.0056	0.0085	0.005	0.0064	0.0048	0.0076
Uranium	mg/L	0.0025	0.0032	0.00085	0.0016	0.00084	0.0014	0.00055	0.0011
Vanadium	mg/L	0.0023	0.0028	0.00065	0.0015	0.00043	0.00062	0.00055	0.00085
Zinc	mg/L	0.0092	0.016	0.0043	0.0079	0.002	0.0032	0.0017	0.0027

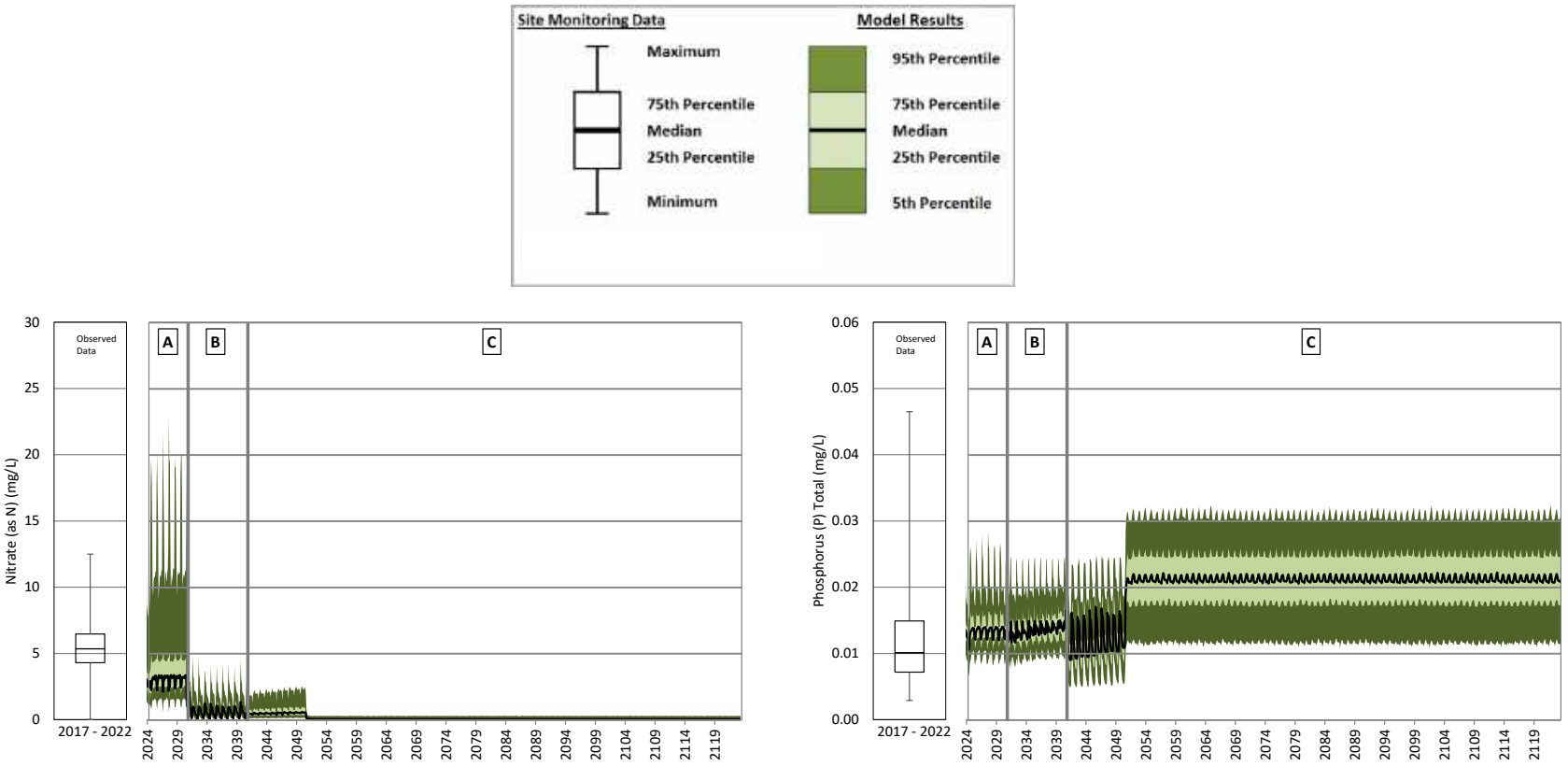
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. The increase in total ammonia concentrations during the first ten years of post-closure is caused by the pumping from the MESCP which ends in 2051. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

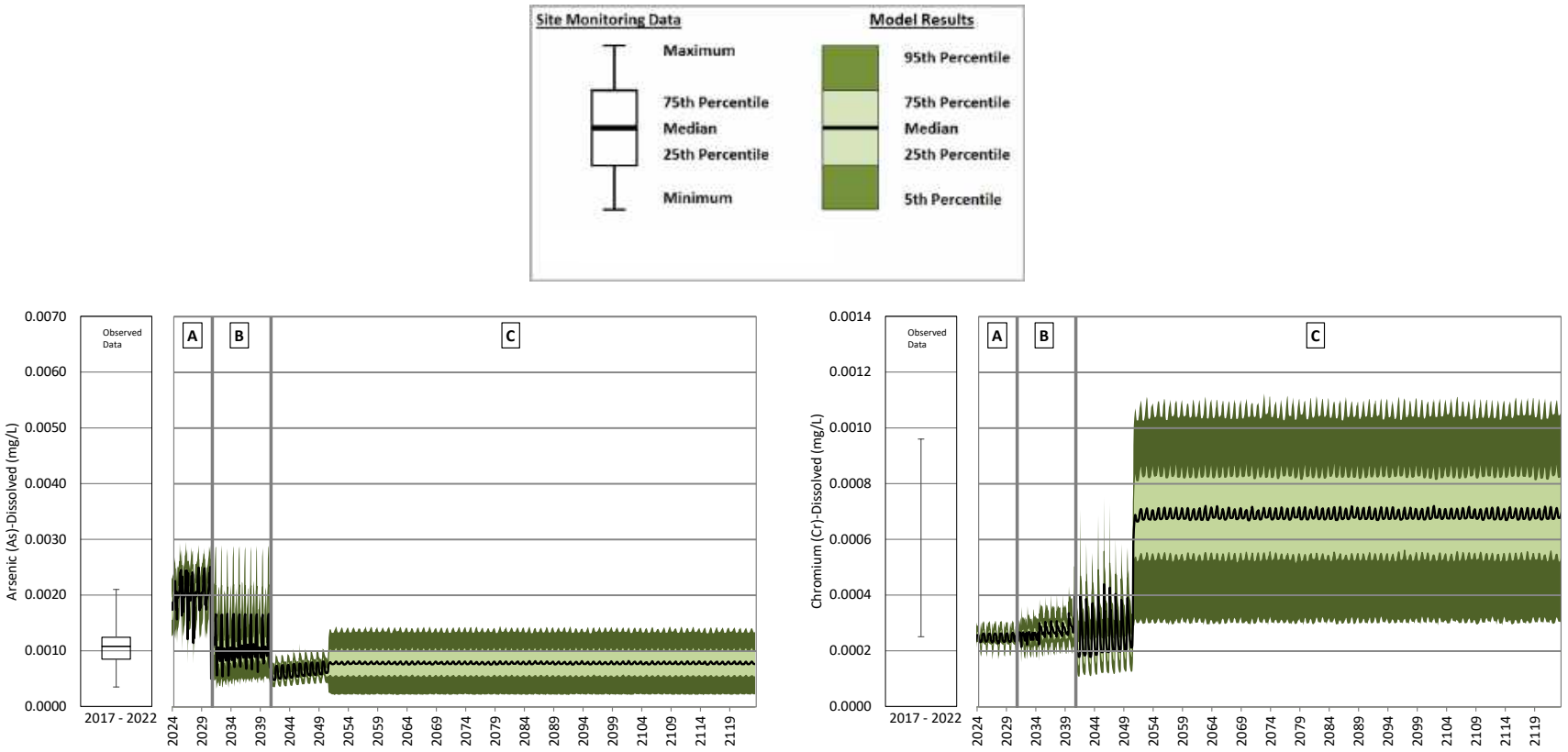
Figure 11: Predicted Sulphate and Total Ammonia Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

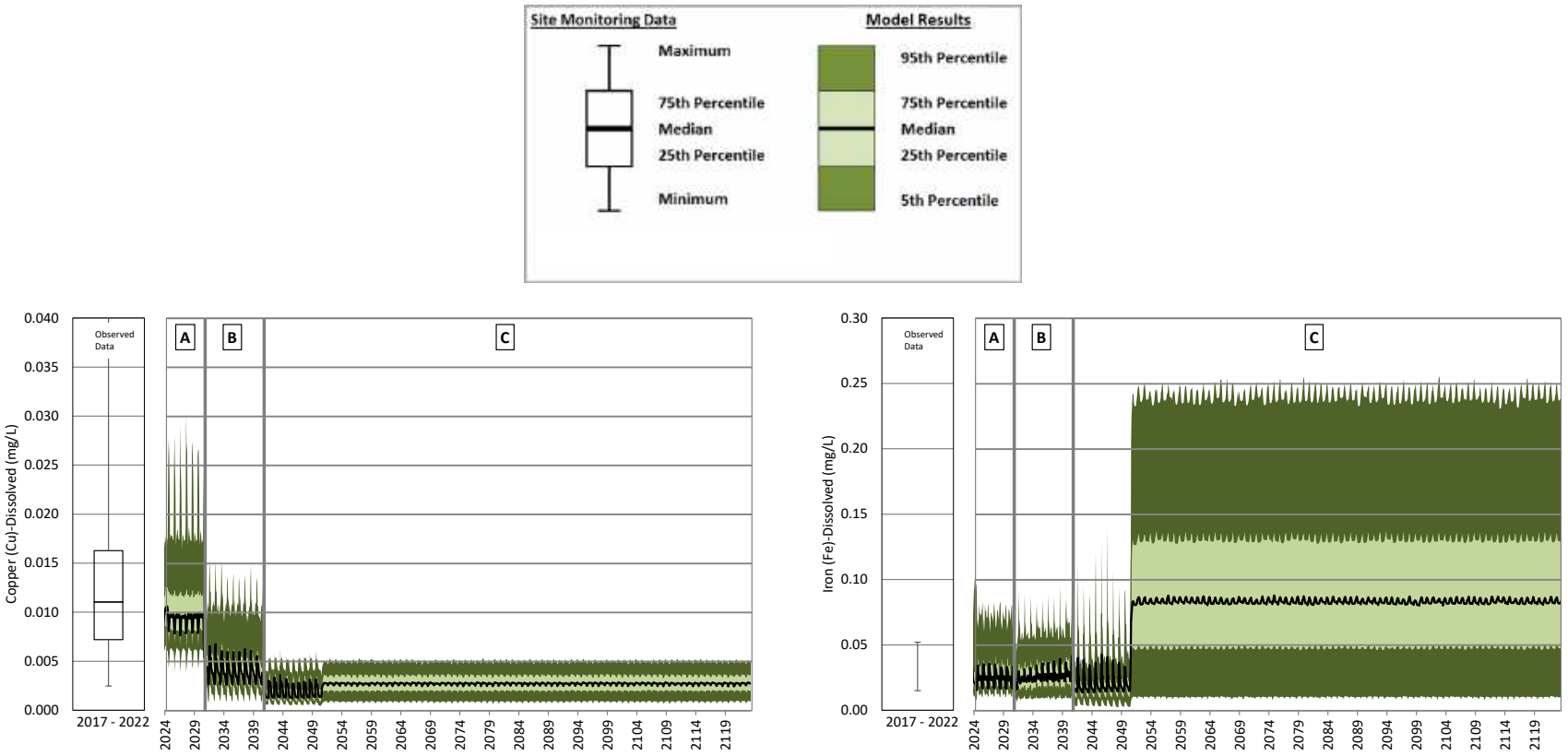
Figure 12: Predicted Nitrate and Total Phosphorus Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

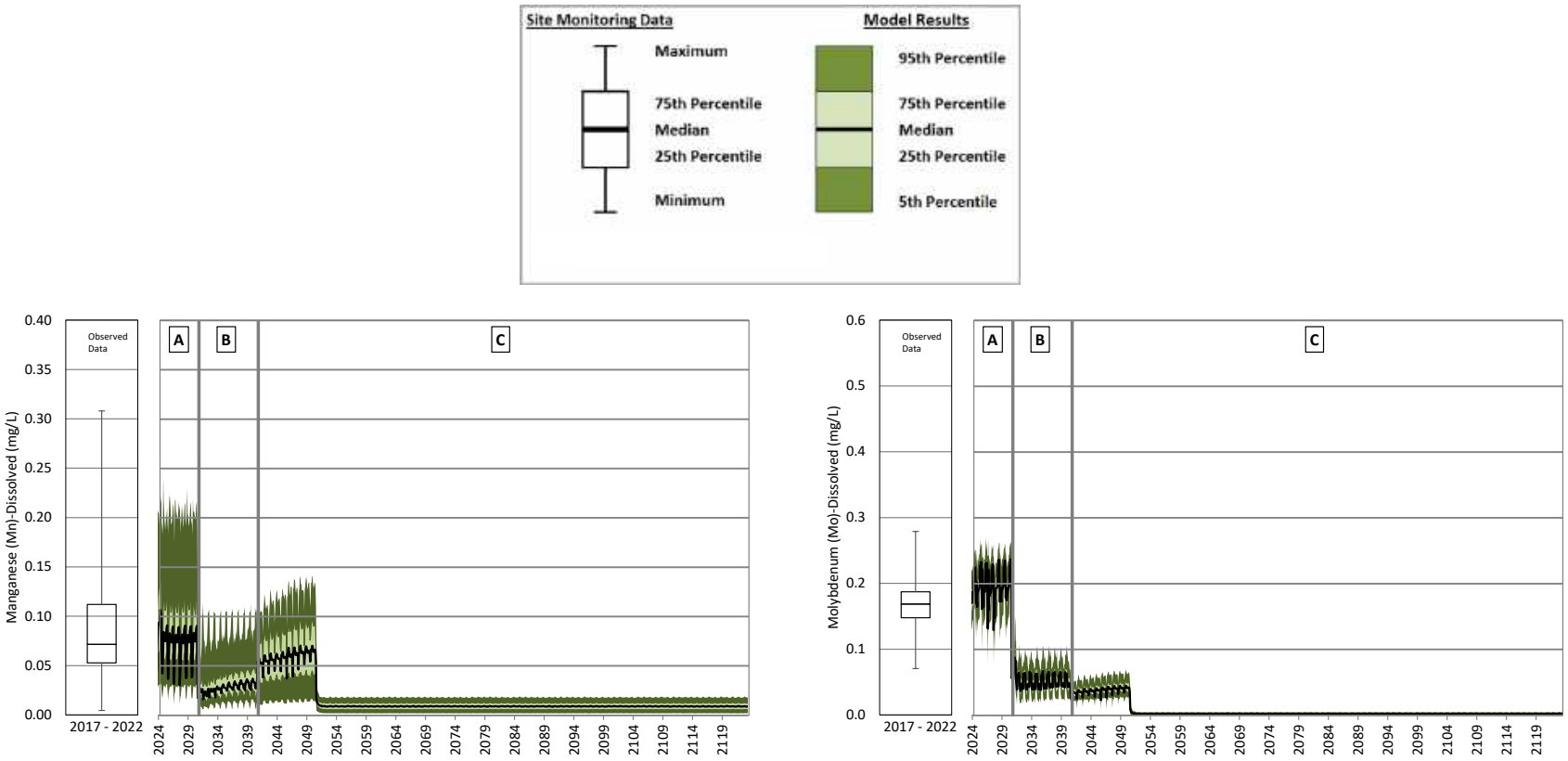
Figure 13: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

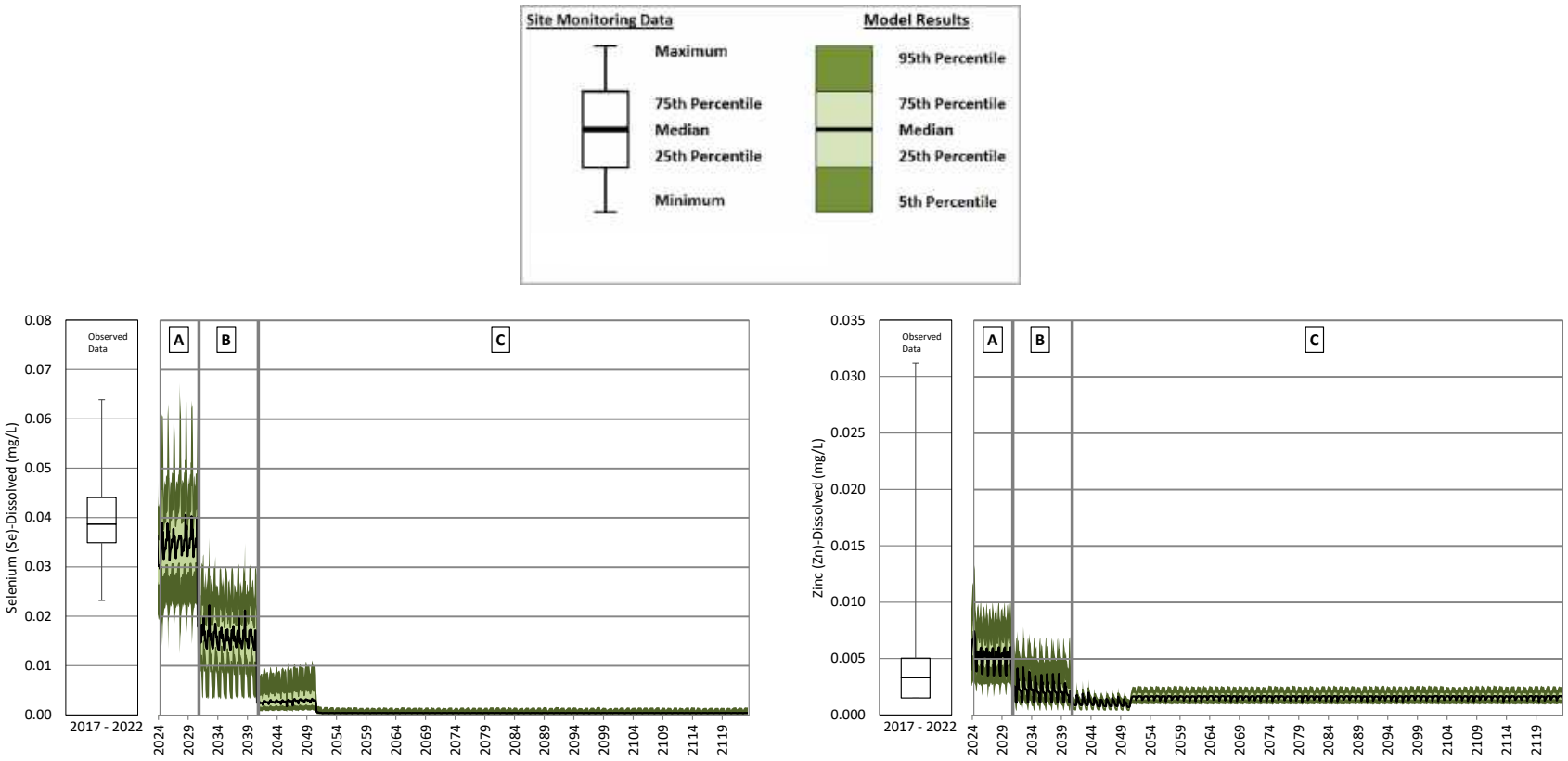
Figure 14: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. The increase in manganese concentrations during the first ten years of post-closure is caused by the pumping from the MESCP which ends in 2051. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 15: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 16: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Perimeter Embankment Till Borrow Pond – Operations, Closure and Post-closure

4.2 9 km Sump and Northwest Sump

The 9 km (9K) Sump and the NW Sump receive drainage from undisturbed and disturbed areas in their catchment areas, as well as runoff and seepage from the Temporary NW PAG Stockpile and East RDS. Discharge from the 9K Sump and NW Sump is assumed to be directed to Bootjack Lake during post-closure.

Time series plots for key parameters in the 9K Sump for operations, closure and post-closure are shown in Figures 17 to 22. Time series plots for key parameters in the Northwest Sump for closure and post-closure are shown in Figures 23 to 28. Maximum of median and 95th percentile predictions are presented in Tables 12 and 13 for the 9K Sump and NW Sump, respectively.

Changes in concentrations in the 9K and Northwest Sumps from operations to closure and post-closure are due to remediation of the catchment areas. Trends for all key parameters reach steady state conditions in the 9K Sump and NW Sump 10 years after the start of post-closure when the runoff areas are assumed to be reclaimed (Figures 16 to 21 for the 9K Sump; Figures 22 to 27 for the NW Sump). Concentrations of most parameters gradually decrease as runoff water qualities from all facilities reporting to the 9K Sump are predicted to return to undisturbed water quality (Table 9). After the PAG material has been removed from the 9K Sump catchment area, runoff from the Temporary NW PAG Stockpile is assigned the disturbed runoff water quality and returns to undisturbed after ten years, which causes concentrations of most parameters to decrease.

Seasonal concentration peaks during winter are associated with continued seepage through the reclaimed Temporary NW PAG Stockpile. During winter months, the relative flow contribution of seepage from the Temporary NW PAG Stockpile is high compared to runoff because snowfall is assumed to accumulate on the stockpile and not melt until spring. Seepage from the Temporary NW PAG Stockpile is assigned a PAG water quality input during reclamation and then a NAG water quality input in perpetuity once reclamation is complete. The NAG and PAG water quality in the seepage flows during the winter results in the seasonal winter peaks in concentrations.

The only parameters with predicted maximum concentrations greater in post-closure than closure are total phosphorus, aluminum, arsenic, chromium, iron, lead, silver and silicon. These parameters have higher concentrations in the statistical distributions assigned for undisturbed runoff water quality than the statistical distributions assigned for PAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more flows on the Mine site, which results in predicted concentrations of aluminum, arsenic, chromium, iron, lead, silver and silicon to be higher in post-closure than closure.

Table 12: Predicted Maximum Concentrations in the 9K Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	759	1,206	592	958	518	887	515	904
Total Dissolved Solids	mg/L	1,124	1,770	852	1,425	741	1,317	738	1,337
Major Ions									
Calcium	mg/L	236	378	183	298	156	272	155	278
Chloride	mg/L	2.5	7.2	2.0	4.6	2.4	7.5	2.5	7.8
Fluoride	mg/L	0.1	0.23	0.093	0.19	0.094	0.19	0.094	0.19
Magnesium	mg/L	41	63	33	52	31	50	31	51
Potassium	mg/L	2.4	5.4	1.5	2.4	1.5	2.4	1.5	2.4
Sodium	mg/L	18	41	12	20	12	20	12	20
Sulphate	mg/L	596	1,068	464	796	376	737	375	735
Nutrients									
Ammonia	mg/L (as N)	0.0091	0.07	0.0052	0.0097	0.0058	0.011	0.0058	0.011
Nitrate	mg/L (as N)	16	35	0.055	0.5	0.046	0.32	0.043	0.32
Nitrite	mg/L (as N)	0.0042	0.018	0.0004	0.0032	0.0005	0.00066	0.0005	0.0005
Total Phosphorus	mg/L	0.027	0.048	0.019	0.03	0.021	0.031	0.022	0.031
Total Metals									
Aluminum	mg/L	0.47	0.5	0.49	0.59	0.063	0.27	0.063	0.28
Antimony	mg/L	0.00023	0.00053	0.00015	0.00043	0.00012	0.00027	0.00012	0.00027
Arsenic	mg/L	0.00075	0.0010	0.00084	0.0012	0.0008	0.0015	0.00082	0.0015
Barium	mg/L	0.056	0.11	0.027	0.053	0.024	0.045	0.024	0.045
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.06	0.24	0.042	0.1	0.036	0.07	0.036	0.072
Cadmium	mg/L	0.000032	0.00027	0.000021	0.00014	0.000019	0.000093	0.000019	0.000096
Chromium	mg/L	0.00072	0.00086	0.00088	0.0011	0.00077	0.0015	0.00078	0.0016
Cobalt	mg/L	0.0004	0.001	0.00034	0.00052	0.000058	0.00032	0.000058	0.00032
Copper	mg/L	0.014	0.16	0.014	0.17	0.0045	0.0088	0.0044	0.0089
Iron	mg/L	0.48	0.62	0.51	0.62	0.12	0.41	0.12	0.42
Lead	mg/L	0.00014	0.00015	0.00014	0.00017	0.000022	0.000097	0.000022	0.00010
Lithium	mg/L	0.0017	0.0062	0.0015	0.0041	0.0016	0.0034	0.0016	0.0034
Manganese	mg/L	0.087	1.5	0.032	0.19	0.016	0.17	0.016	0.17
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.095	0.22	0.067	0.16	0.053	0.13	0.053	0.13
Nickel	mg/L	0.001	0.0015	0.0012	0.0016	0.0008	0.0017	0.00081	0.0018

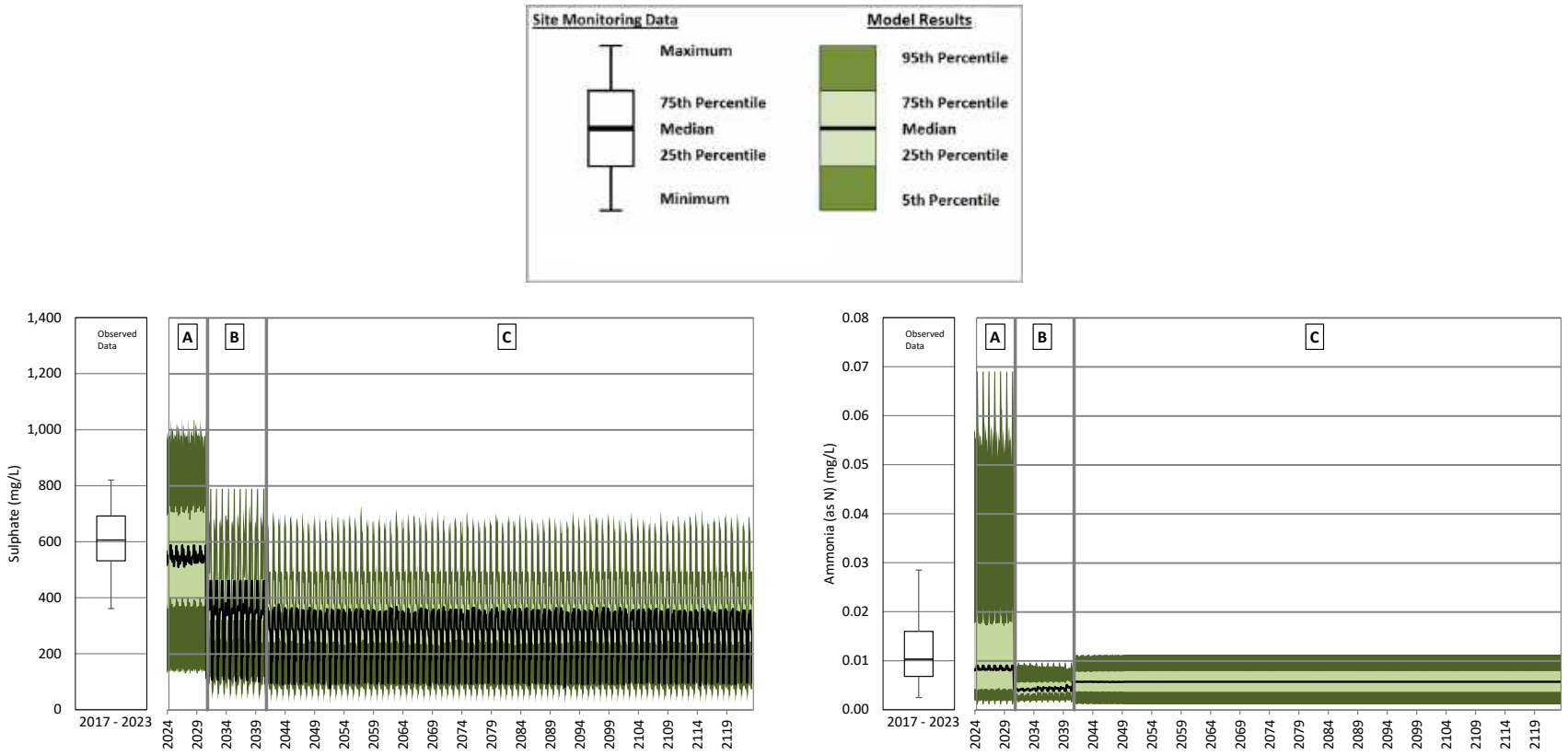
Table 12: Predicted Maximum Concentrations in the 9K Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Selenium	mg/L	0.057	0.12	0.036	0.085	0.03	0.071	0.03	0.072
Silver	mg/L	0.0000052	0.000012	0.0000058	0.000015	0.0000059	0.000018	0.0000059	0.000018
Strontium	mg/L	0.96	1.8	0.84	1.6	0.75	1.2	0.76	1.3
Thallium	mg/L	0.000005	0.0000057	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.024	0.024	0.024	0.025	0.0049	0.0074	0.0049	0.0074
Uranium	mg/L	0.0011	0.0023	0.0007	0.0018	0.00073	0.0015	0.00074	0.0015
Vanadium	mg/L	0.0017	0.002	0.0017	0.002	0.00066	0.0012	0.00066	0.0012
Zinc	mg/L	0.0054	0.0079	0.0085	0.014	0.0014	0.003	0.0011	0.003
Dissolved Metals									
Aluminum	mg/L	0.014	0.047	0.036	0.13	0.035	0.16	0.035	0.17
Antimony	mg/L	0.00021	0.00039	0.00013	0.00029	0.00012	0.00027	0.00012	0.00027
Arsenic	mg/L	0.00047	0.00073	0.00057	0.00092	0.00077	0.0013	0.00079	0.0014
Barium	mg/L	0.053	0.1	0.025	0.044	0.024	0.044	0.024	0.044
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.056	0.21	0.038	0.072	0.036	0.068	0.036	0.07
Cadmium	mg/L	0.00003	0.00023	0.000018	0.000091	0.000017	0.000085	0.000018	0.000088
Chromium	mg/L	0.00034	0.00048	0.0005	0.00072	0.00066	0.001	0.00067	0.0011
Cobalt	mg/L	0.00012	0.00073	0.000061	0.00024	0.000058	0.00024	0.000058	0.00024
Copper	mg/L	0.0057	0.0094	0.0058	0.012	0.0041	0.0073	0.004	0.0073
Iron	mg/L	0.033	0.17	0.07	0.17	0.079	0.23	0.081	0.24
Lead	mg/L	0.000024	0.000037	0.000025	0.000057	0.000022	0.000077	0.000022	0.00008
Lithium	mg/L	0.0015	0.0052	0.0013	0.0031	0.0016	0.0032	0.0016	0.0033
Manganese	mg/L	0.065	1.5	0.01	0.17	0.012	0.16	0.012	0.15
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.095	0.21	0.066	0.15	0.053	0.13	0.053	0.13
Nickel	mg/L	0.00048	0.00098	0.00061	0.001	0.00073	0.0014	0.00074	0.0015
Selenium	mg/L	0.057	0.12	0.036	0.079	0.03	0.071	0.03	0.072
Silicon	mg/L	6.9	8.5	5.8	7.0	5.9	7.9	5.9	8.0
Silver	mg/L	0.0000052	0.0000066	0.0000058	0.000009	0.0000059	0.000011	0.0000059	0.000012
Strontium	mg/L	0.95	1.4	0.83	1.3	0.74	1.2	0.75	1.2
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.005	0.0056	0.005	0.0063	0.0049	0.0074	0.0049	0.0074
Uranium	mg/L	0.001	0.002	0.00068	0.0015	0.00073	0.0015	0.00074	0.0015

Table 12: Predicted Maximum Concentrations in the 9K Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Vanadium	mg/L	0.00048	0.00085	0.00054	0.00086	0.00051	0.00079	0.00051	0.00081
Zinc	mg/L	0.0027	0.0052	0.0059	0.011	0.0014	0.003	0.0011	0.003

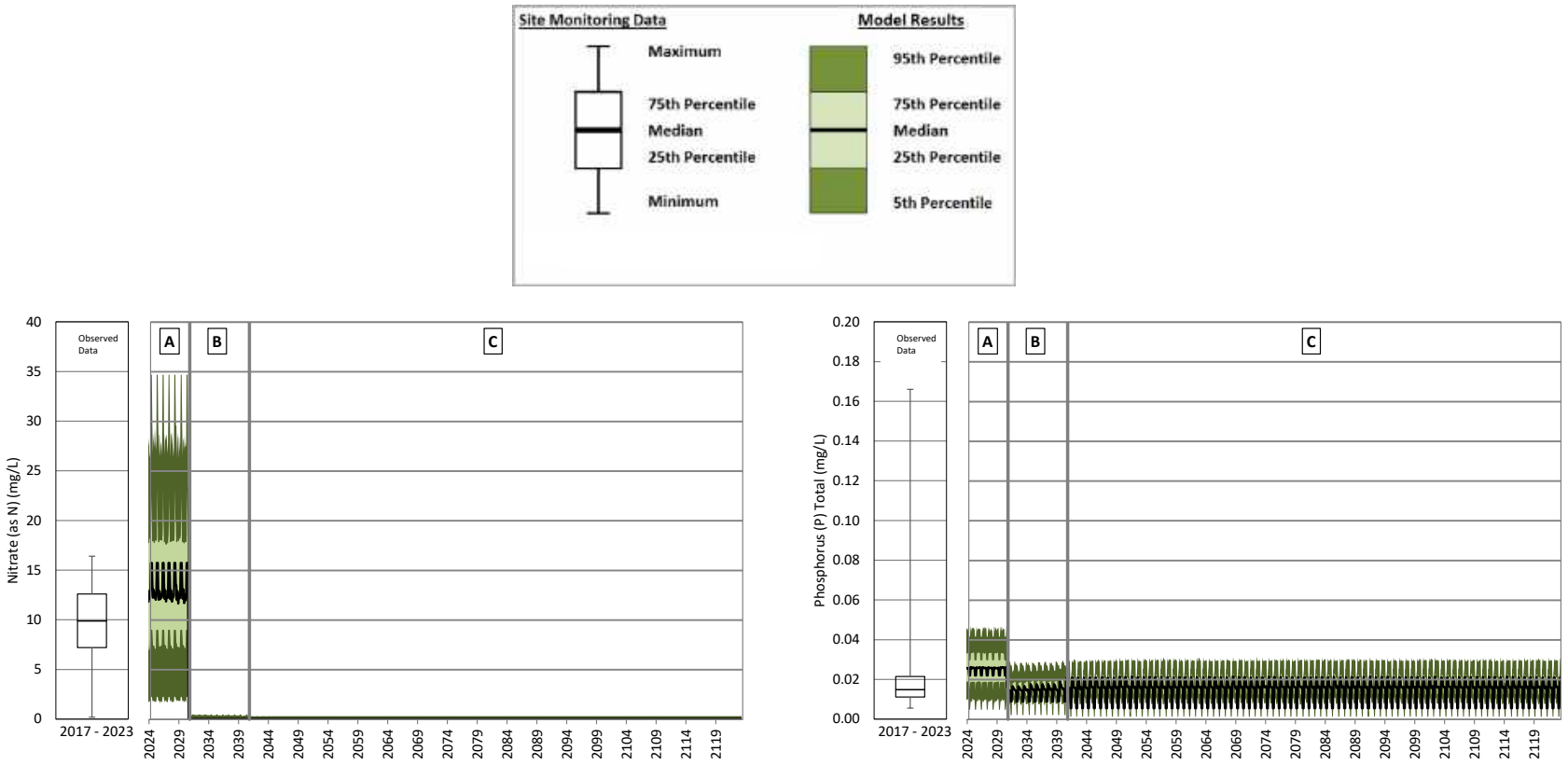
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

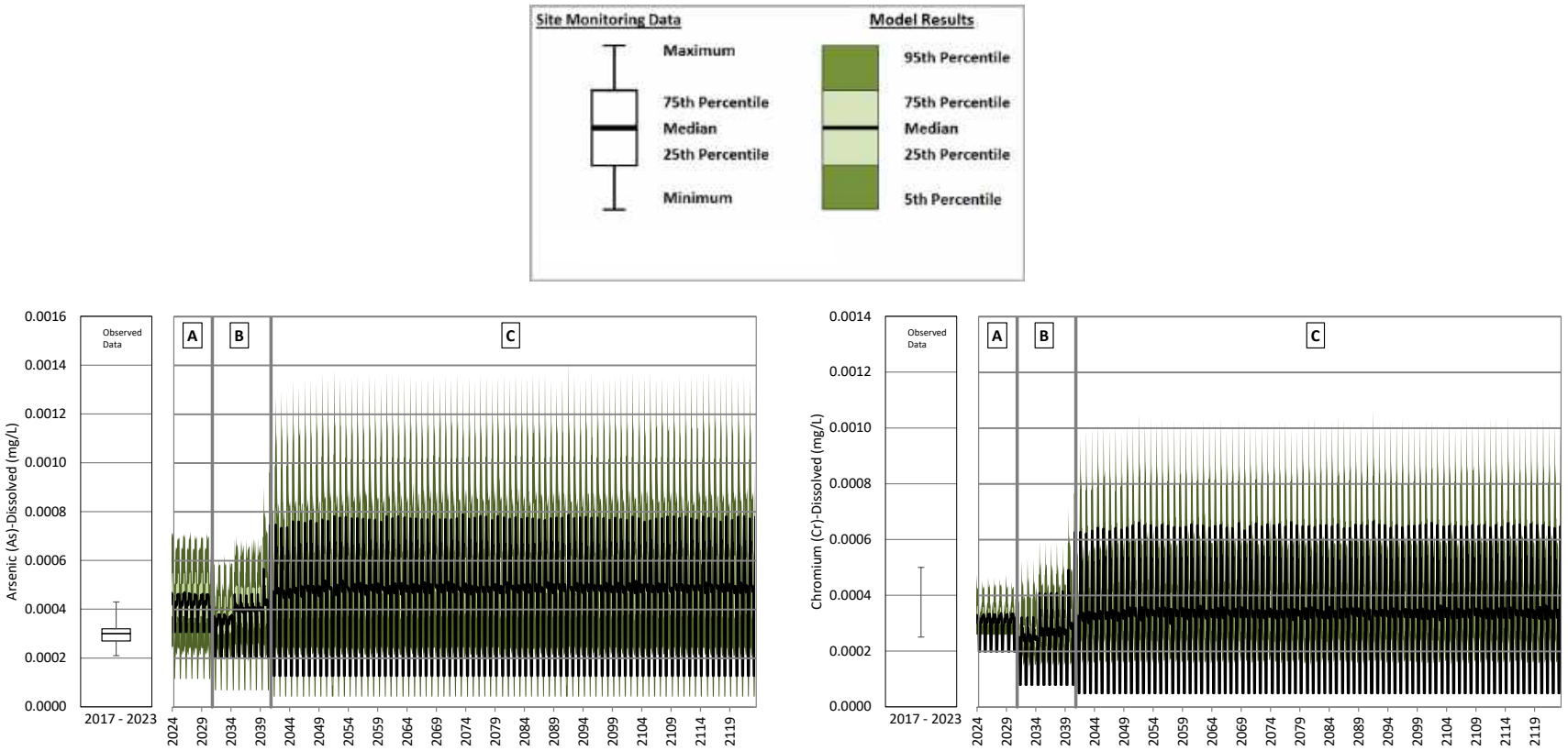
Figure 17: Predicted Sulphate and Total Ammonia Concentrations in the 9K Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

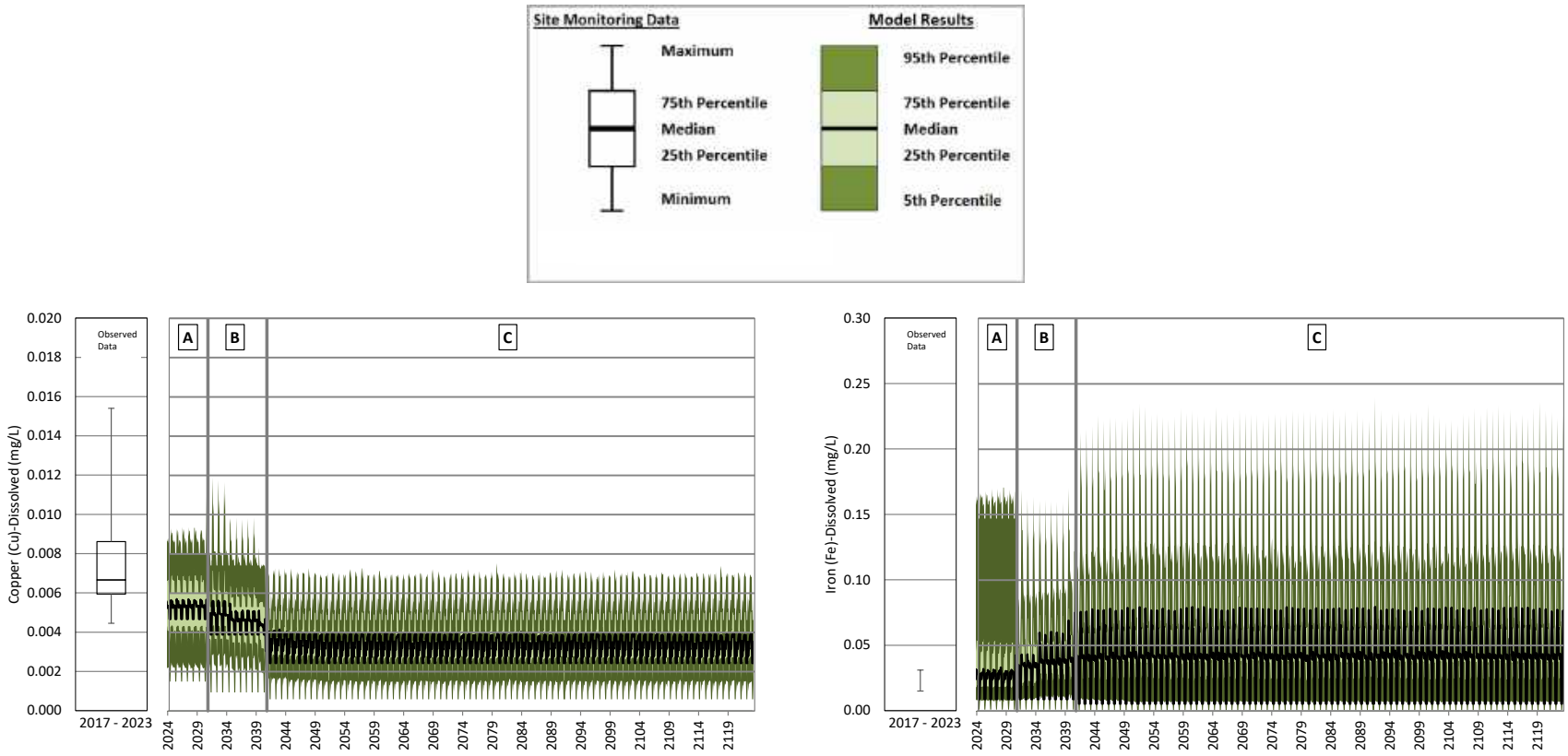
Figure 18: Predicted Nitrate and Total Phosphorus Concentrations in the 9K Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

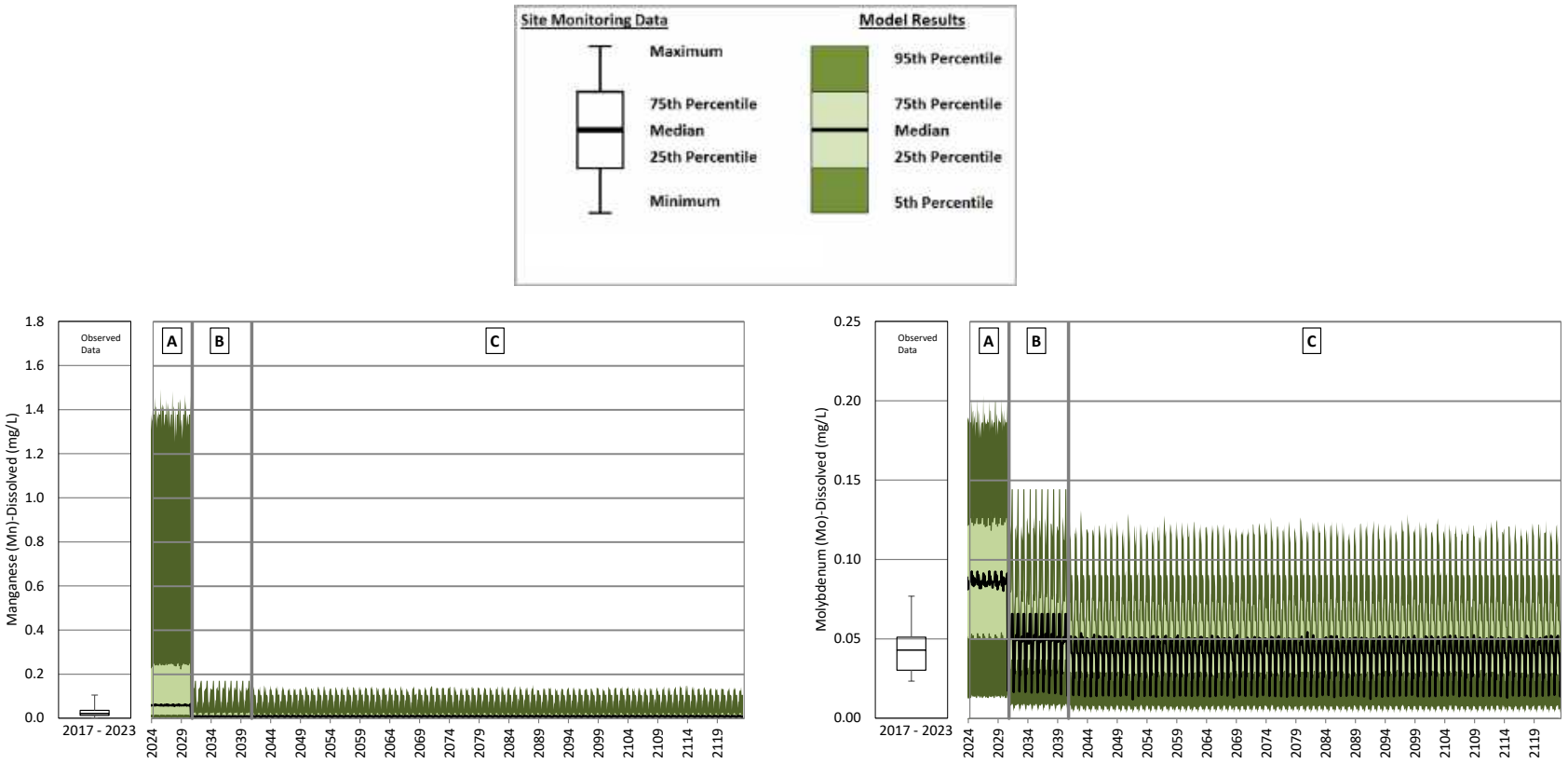
Figure 19: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the 9K Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

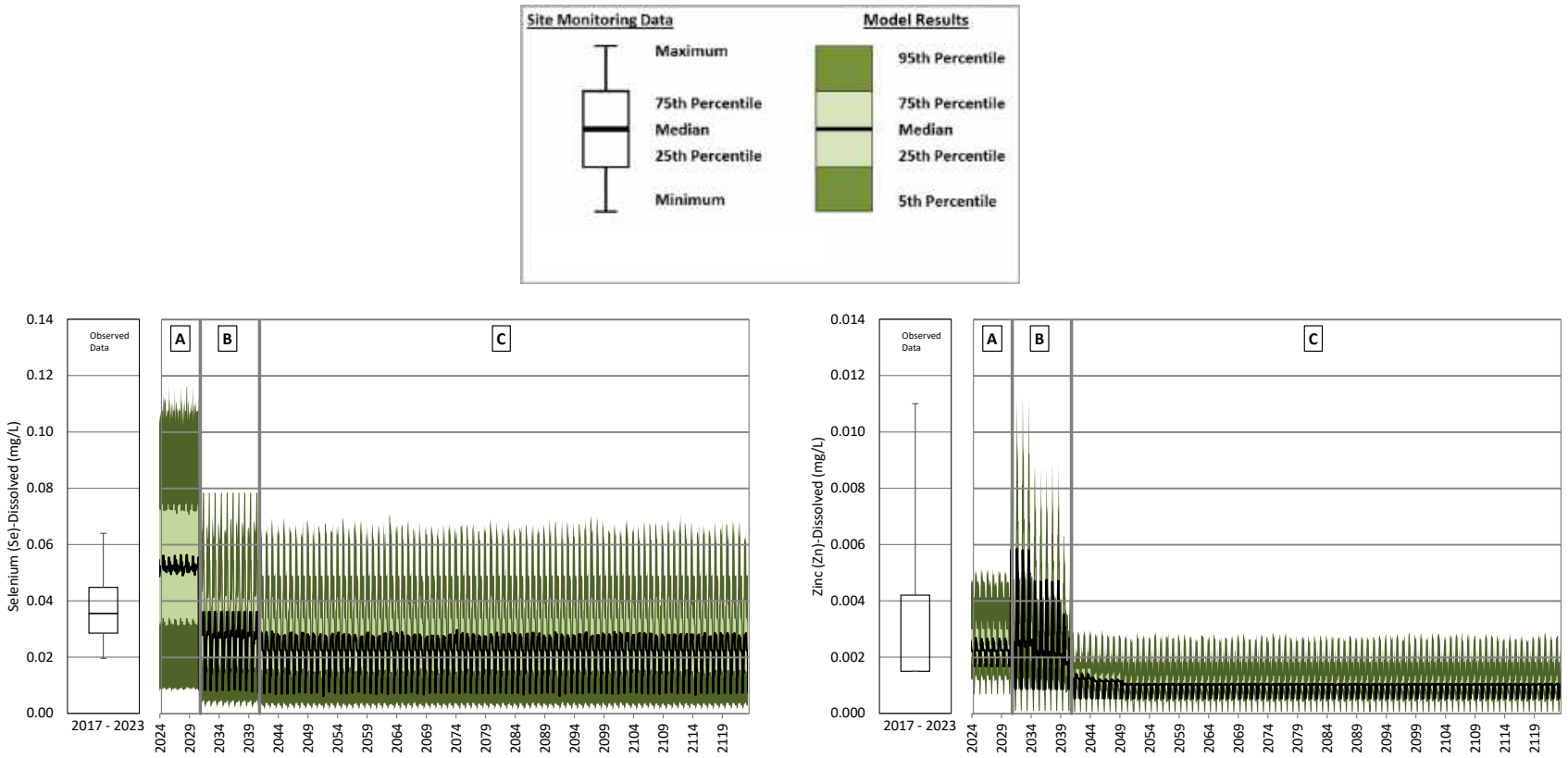
Figure 20: Predicted Dissolved Copper and Dissolved Iron Concentrations in the 9K Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 21: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the 9K Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 22: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the 9K Sump – Operations, Closure and Post-closure

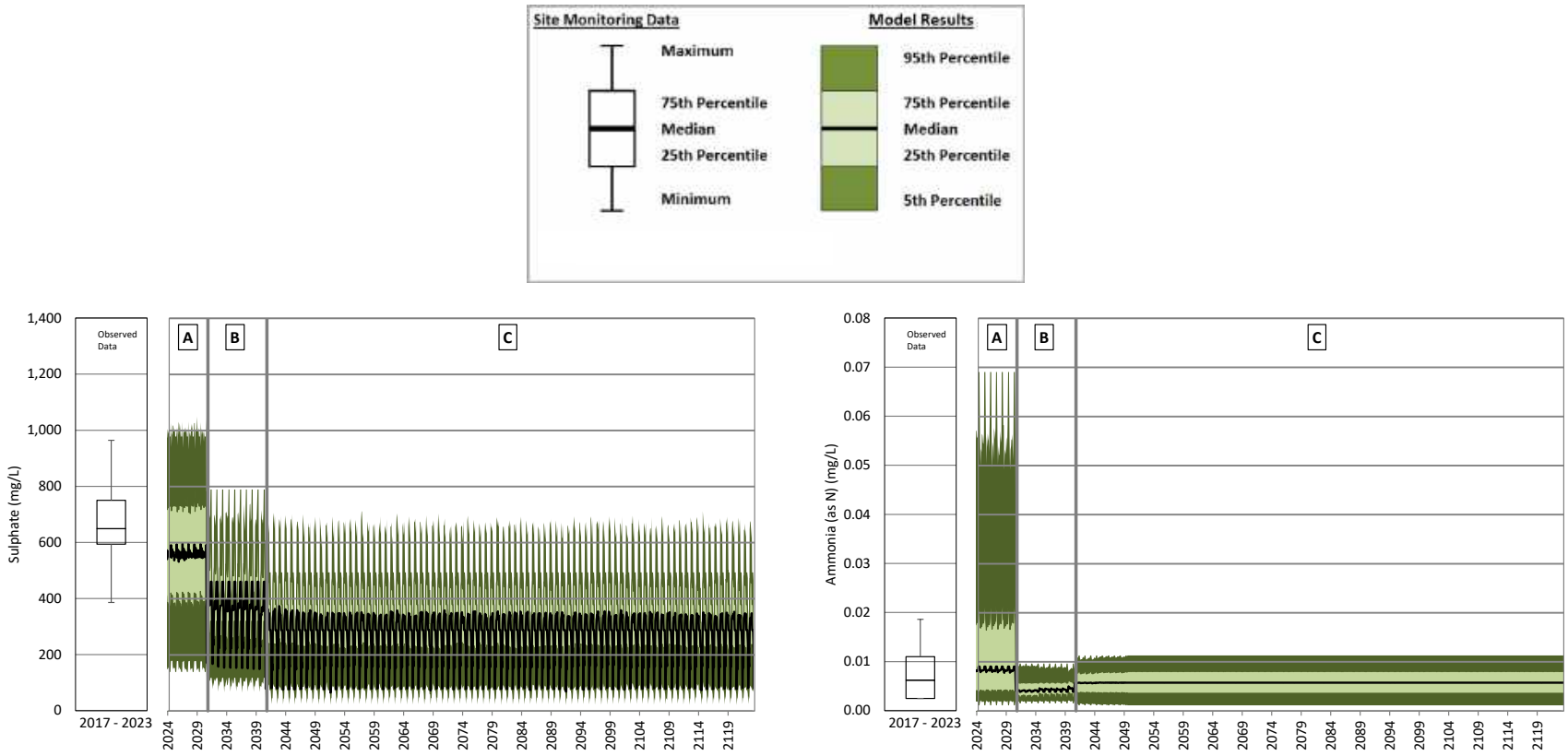
Table 13: Predicted Maximum Concentrations in the Northwest Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	769	1,190	592	958	512	878	505	890
Total Dissolved Solids	mg/L	1,126	1,757	852	1,425	730	1,304	724	1,311
Major Ions									
Calcium	mg/L	240	374	183	298	155	270	152	273
Chloride	mg/L	2.4	7.1	2.0	4.4	2.4	7.7	2.5	8.0
Fluoride	mg/L	0.12	0.23	0.099	0.19	0.094	0.19	0.094	0.19
Magnesium	mg/L	42	62	33	52	30	50	30	51
Potassium	mg/L	2.4	5.2	1.5	2.4	1.5	2.4	1.5	2.4
Sodium	mg/L	18	40	12	20	12	20	12	20
Sulphate	mg/L	602	1,053	464	796	373	734	366	726
Nutrients									
Ammonia	mg/L (as N)	0.0091	0.07	0.005	0.0097	0.0058	0.011	0.0058	0.011
Nitrate	mg/L (as N)	16	35	0.37	3.8	0.051	0.32	0.043	0.32
Nitrite	mg/L (as N)	0.0042	0.018	0.00069	0.0033	0.0005	0.00086	0.0005	0.0005
Total Phosphorus	mg/L	0.026	0.047	0.019	0.03	0.022	0.032	0.022	0.032
Total Metals									
Aluminum	mg/L	0.47	0.49	0.49	0.58	0.066	0.27	0.064	0.29
Antimony	mg/L	0.00023	0.00053	0.00015	0.00043	0.00012	0.00027	0.00012	0.00026
Arsenic	mg/L	0.00072	0.00095	0.00082	0.0011	0.00082	0.0015	0.00084	0.0015
Barium	mg/L	0.055	0.11	0.028	0.053	0.024	0.045	0.024	0.045
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.061	0.23	0.043	0.1	0.036	0.07	0.036	0.071
Cadmium	mg/L	0.000038	0.00026	0.000022	0.00014	0.000018	0.000091	0.000019	0.000094
Chromium	mg/L	0.0007	0.00079	0.00084	0.001	0.0008	0.0016	0.00079	0.0016
Cobalt	mg/L	0.00042	0.0010	0.00035	0.00053	0.000059	0.00031	0.000058	0.00032
Copper	mg/L	0.015	0.17	0.015	0.17	0.0047	0.0091	0.0043	0.0088
Iron	mg/L	0.47	0.61	0.51	0.61	0.12	0.42	0.13	0.43
Lead	mg/L	0.00014	0.00014	0.00014	0.00016	0.000023	0.000098	0.000022	0.0001
Lithium	mg/L	0.0018	0.0061	0.0015	0.0041	0.0016	0.0033	0.0016	0.0034
Manganese	mg/L	0.089	1.5	0.034	0.19	0.015	0.17	0.016	0.17
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.096	0.21	0.067	0.16	0.053	0.13	0.052	0.13
Nickel	mg/L	0.001	0.0015	0.0012	0.0016	0.0008	0.0018	0.00082	0.0018
Selenium	mg/L	0.058	0.12	0.036	0.085	0.03	0.071	0.029	0.071
Silver	mg/L	0.0000054	0.000012	0.0000059	0.000014	0.000006	0.000018	0.000006	0.000019

Table 13: Predicted Maximum Concentrations in the Northwest Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Strontium	mg/L	1.1	1.9	0.84	1.6	0.74	1.2	0.74	1.2
Thallium	mg/L	0.000005	0.0000057	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.024	0.024	0.024	0.025	0.0049	0.0074	0.0049	0.0075
Uranium	mg/L	0.0011	0.0022	0.00071	0.0018	0.00073	0.0015	0.00074	0.0015
Vanadium	mg/L	0.0017	0.002	0.0017	0.002	0.00067	0.0012	0.00067	0.0012
Zinc	mg/L	0.0058	0.0081	0.0088	0.014	0.002	0.0033	0.0011	0.0029
Dissolved Metals									
Aluminum	mg/L	0.013	0.038	0.034	0.13	0.038	0.16	0.036	0.17
Antimony	mg/L	0.00021	0.00039	0.00013	0.00029	0.00012	0.00027	0.00012	0.00026
Arsenic	mg/L	0.00044	0.00067	0.00055	0.00086	0.00079	0.0014	0.00081	0.0014
Barium	mg/L	0.053	0.099	0.026	0.044	0.024	0.043	0.024	0.043
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.057	0.2	0.039	0.073	0.036	0.068	0.036	0.069
Cadmium	mg/L	0.000036	0.00022	0.00002	0.000091	0.000017	0.000083	0.000018	0.000086
Chromium	mg/L	0.00031	0.00041	0.00046	0.00066	0.00069	0.001	0.00068	0.0011
Cobalt	mg/L	0.00014	0.00072	0.000068	0.00025	0.000059	0.00024	0.000058	0.00024
Copper	mg/L	0.0065	0.011	0.0067	0.015	0.0044	0.0075	0.004	0.0072
Iron	mg/L	0.028	0.17	0.068	0.16	0.081	0.23	0.083	0.24
Lead	mg/L	0.000025	0.000034	0.000026	0.000053	0.000023	0.000078	0.000022	0.000081
Lithium	mg/L	0.0016	0.0051	0.0013	0.0031	0.0016	0.0031	0.0016	0.0033
Manganese	mg/L	0.068	1.4	0.012	0.17	0.012	0.15	0.012	0.15
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.096	0.2	0.066	0.15	0.053	0.13	0.052	0.13
Nickel	mg/L	0.00047	0.00096	0.0006	0.001	0.00073	0.0015	0.00075	0.0015
Selenium	mg/L	0.058	0.12	0.036	0.079	0.029	0.071	0.029	0.07
Silicon	mg/L	6.9	8.4	5.8	7.0	5.9	8.0	5.9	8.0
Silver	mg/L	0.0000054	0.0000065	0.0000059	0.0000088	0.000006	0.000012	0.000006	0.000012
Strontium	mg/L	1.1	1.5	0.83	1.3	0.73	1.2	0.74	1.2
Thallium	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.0054	0.0056	0.0054	0.0065	0.0049	0.0074	0.0049	0.0075
Uranium	mg/L	0.0011	0.002	0.00069	0.0015	0.00073	0.0014	0.00074	0.0015
Vanadium	mg/L	0.00047	0.00084	0.00053	0.00085	0.00052	0.00081	0.00052	0.00082
Zinc	mg/L	0.0031	0.0055	0.0061	0.011	0.002	0.0033	0.0011	0.0029

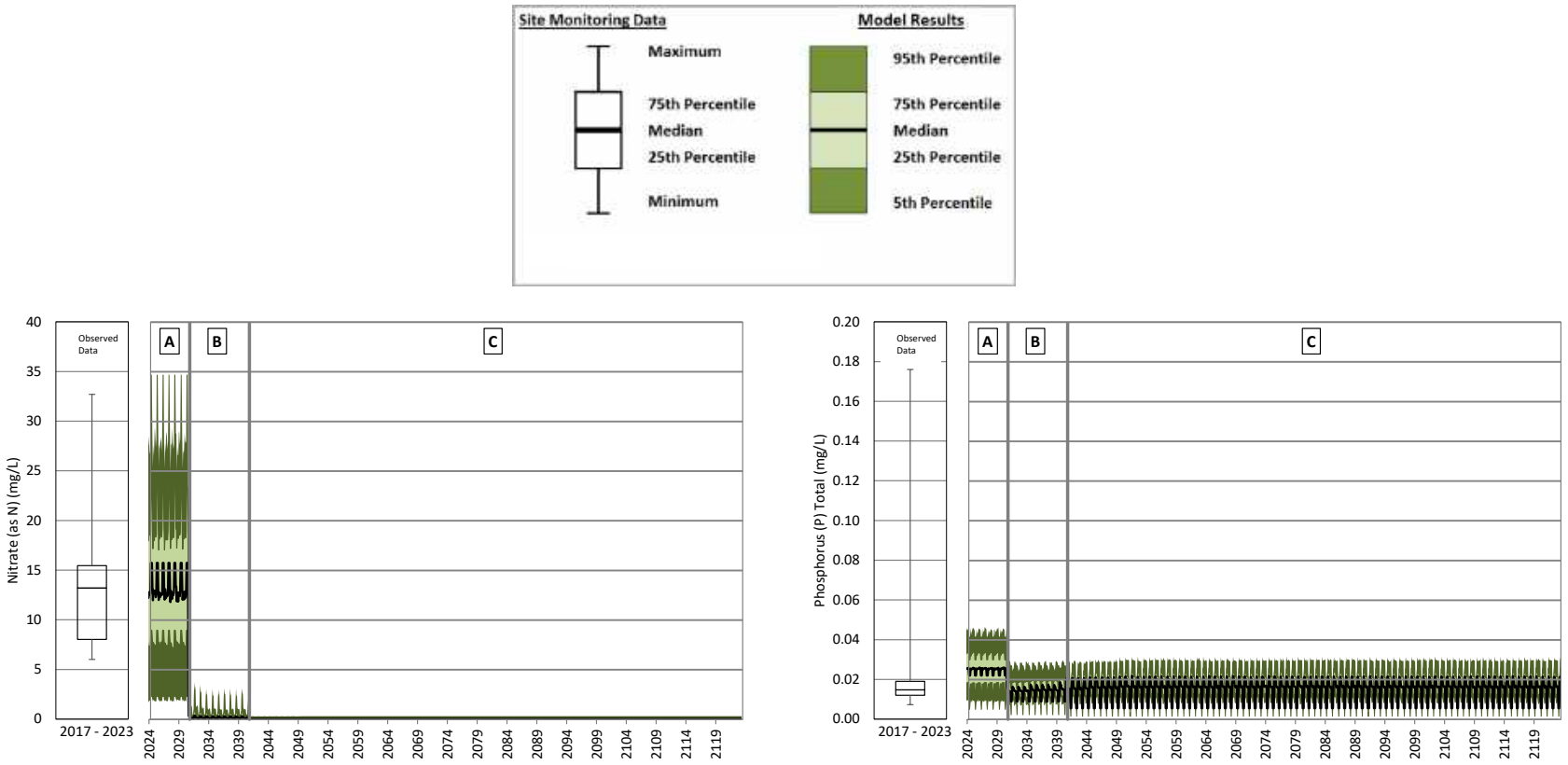
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

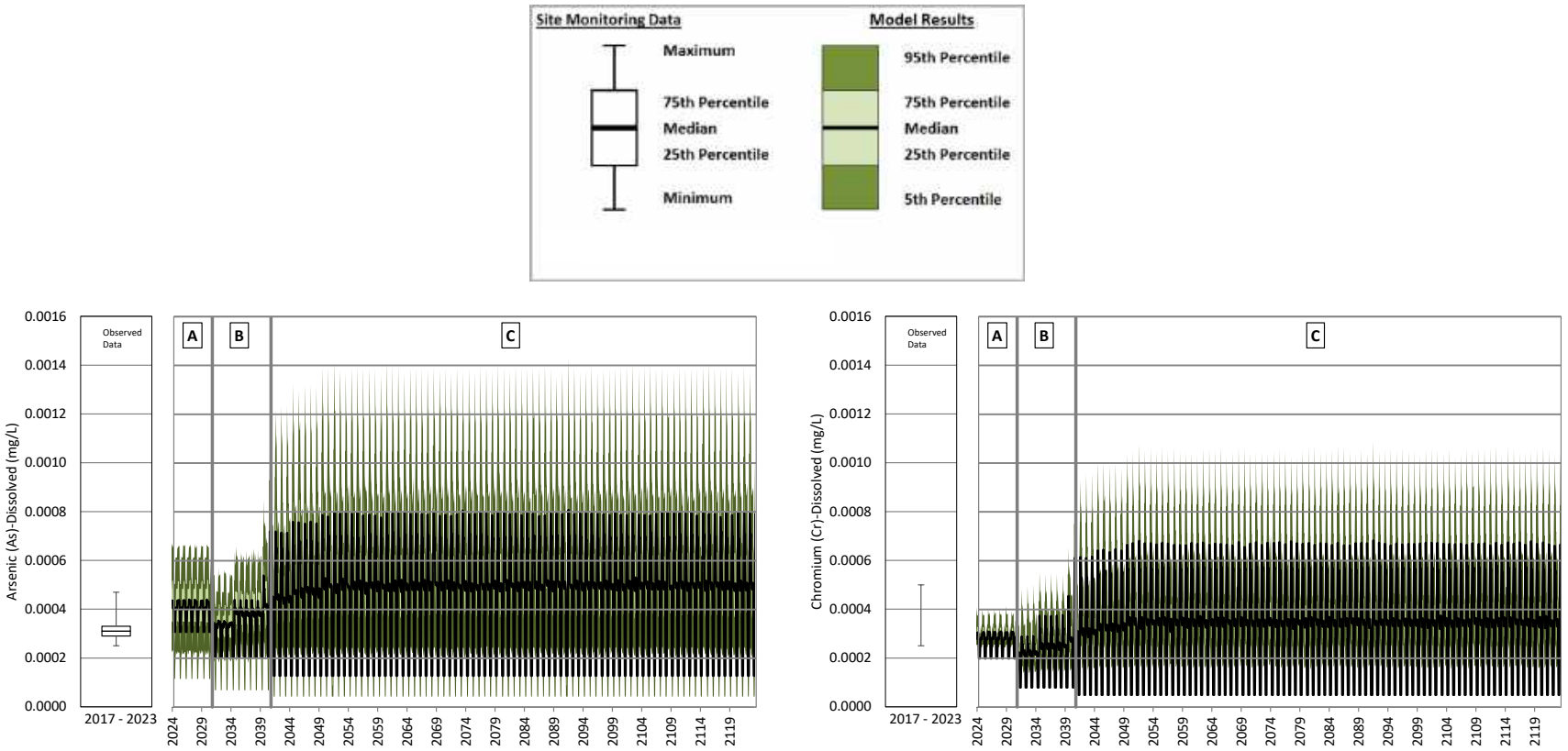
Figure 23: Predicted Sulphate and Total Ammonia Concentrations in the Northwest Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

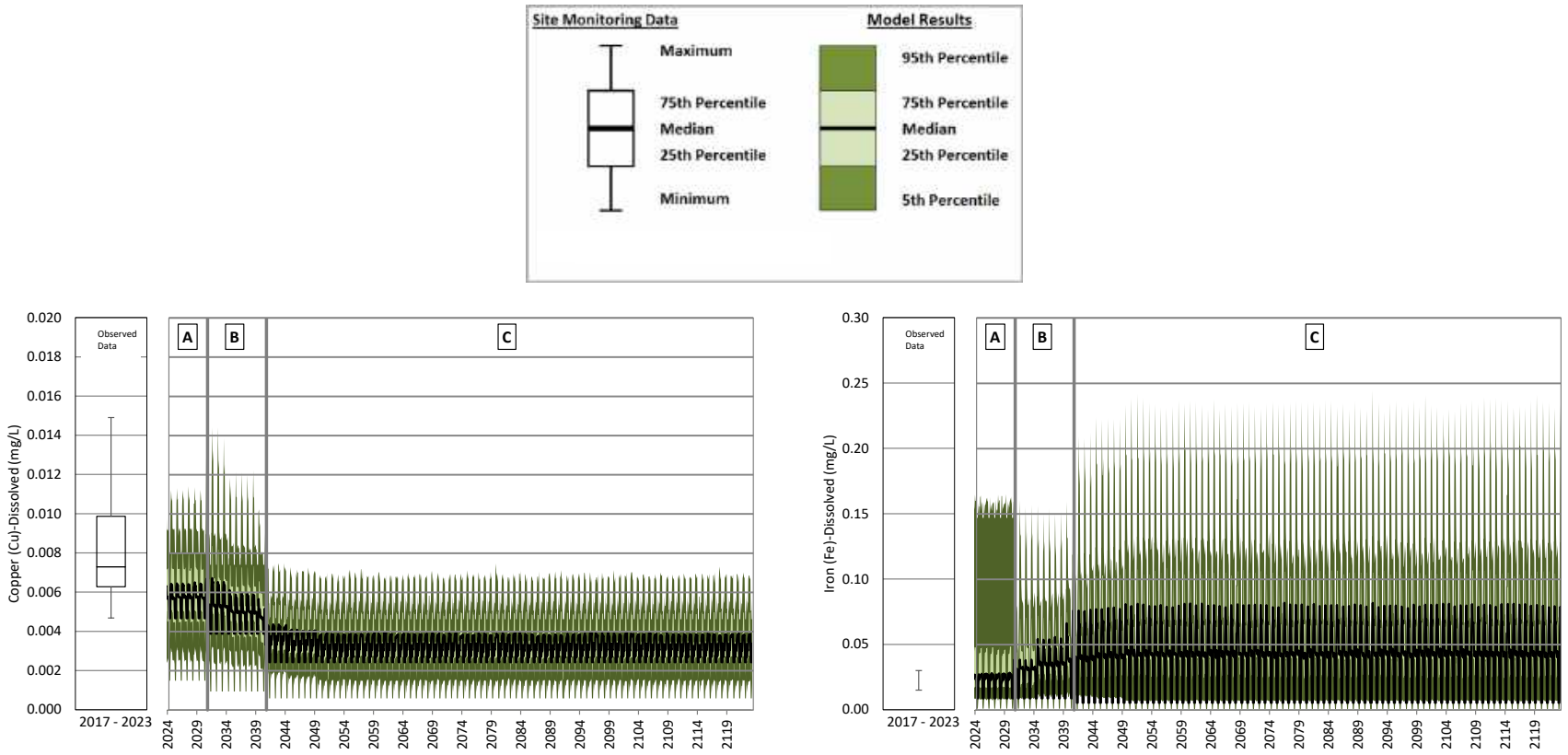
Figure 24: Predicted Nitrate and Total Phosphorus Concentrations in the Northwest Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

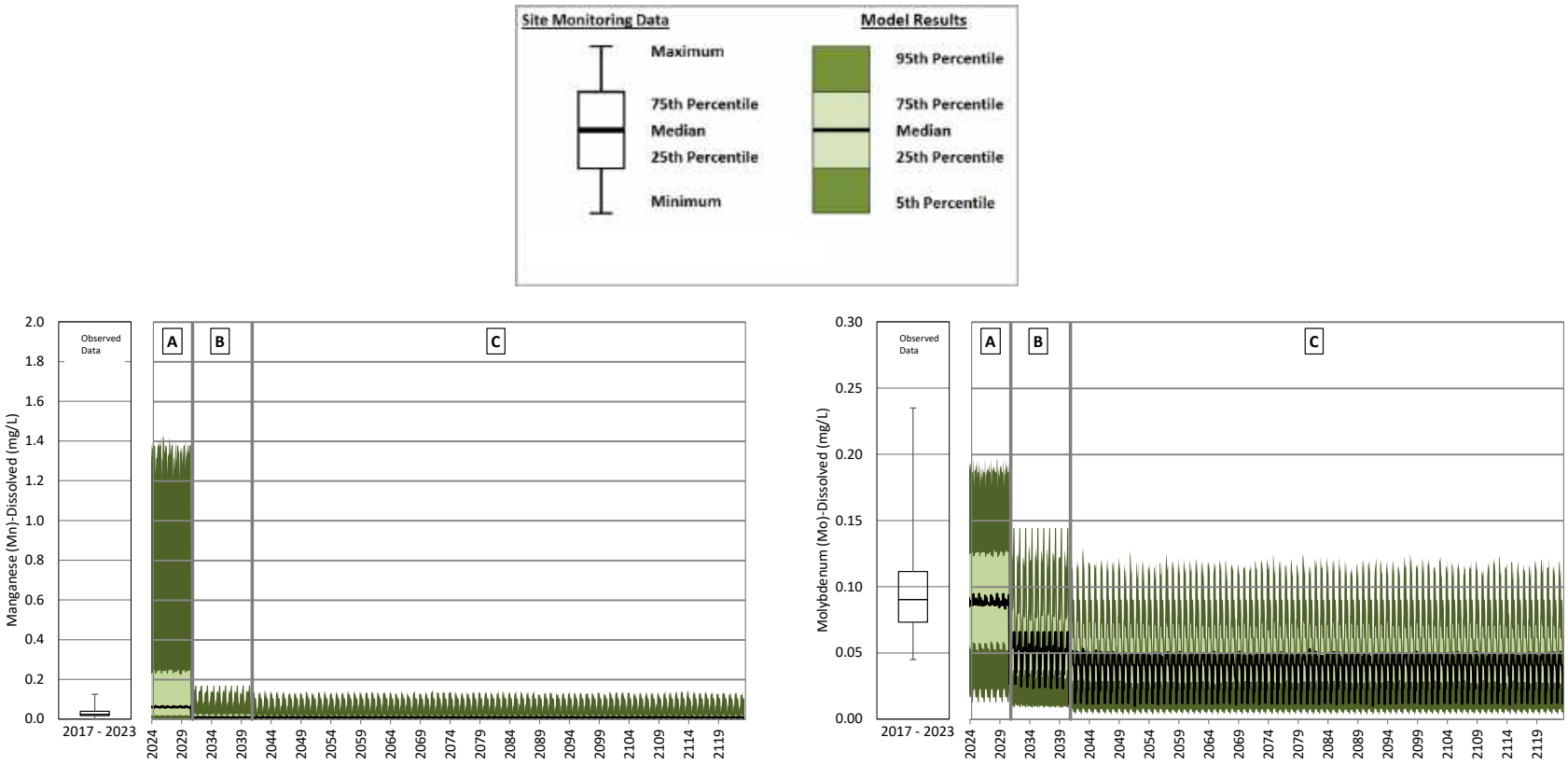
Figure 25: Predicted Total Arsenic and Total Chromium Concentrations in the Northwest Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

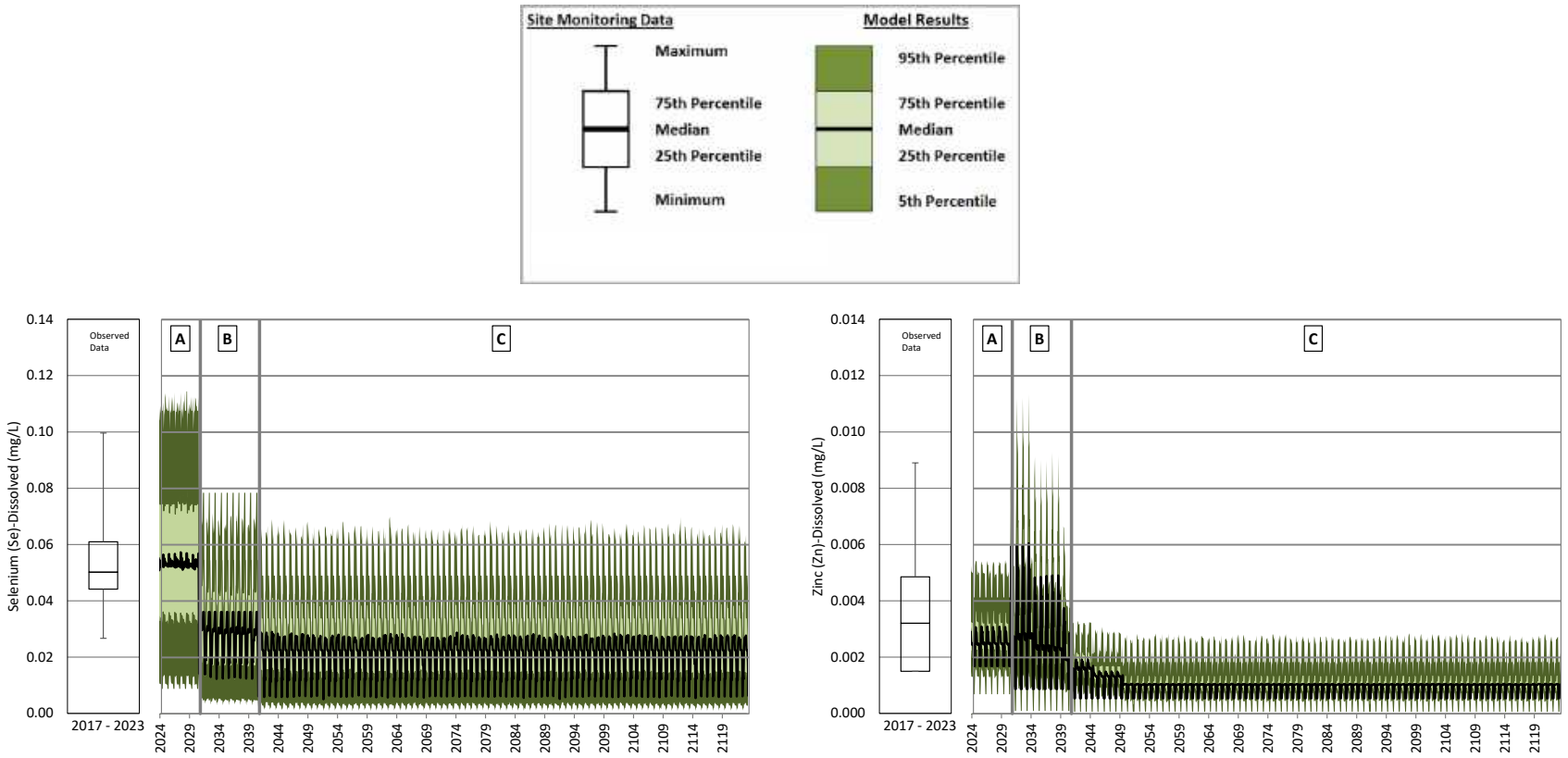
Figure 26: Predicted Total Copper and Total Iron Concentrations in the Northwest Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 27: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Northwest Sump – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 28: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Northwest Sump – Operations, Closure and Post-closure

4.3 Springer-Cariboo Pit

At closure, the PAG material from the Temporary NW PAG Stockpile will be placed in the Springer-Cariboo Pit, and a pit lake will form. The pit will fill passively with groundwater and surface runoff from the pit catchment area. The groundwater inflow to the pit is assumed to flow into the stored PAG material in closure and post-closure. The surface runoff includes runoff and seepage from North Bell RDS, East RDS, and the haul roads. These facilities will be reclaimed during closure. The pit lake is predicted to completely fill between 2059 (99.5th percentile of the 2000 water balance model simulations) and 2063 (mean of the 2000 water balance model simulations), at which point, overflow from the pit will discharge to Bootjack Lake.

Time series plots for key parameters in the Springer-Cariboo Pit for closure and post-closure are shown in Figures 29 to 34. Maximum of median and 95th percentile predictions are presented in Table 14. It is anticipated that particulate metals such as aluminum and copper will be lower in pit lake waters compared to model predictions, as has been observed in operational monitoring (Golder 2016b).

Peak concentrations for most parameters are predicted to occur during the closure period because:

- The PAG material in the Springer-Cariboo Pit contains pore water with a NAG Seep water quality (Table 9).
- The groundwater inflow to the pit, which has a groundwater water quality (Table 9), is assumed to flow into the PAG material and displace the pore water upwards into the forming pit lake.
- The displacement of pore water from the PAG material into the pit lake causes pit lake concentrations to peak in closure.

The only parameters with predicted maximum concentrations greater in post-closure than closure are aluminum, chromium, iron, and lead. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to a greater proportion of the total inflows to the Springer-Cariboo pit.

Table 14: Predicted Maximum Concentrations in the Springer-Cariboo Pit during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[(a)]	mg $CaCO_3$/L	539	781	580	822	533	739	448	629
Total Dissolved Solids	mg/L	798	1,177	858	1,238	796	1,139	659	954
Major Ions									
Calcium	mg/L	167	245	178	251	163	223	135	189
Chloride	mg/L	3.6	9.2	3.8	5.2	3.8	5.1	3.0	4.4
Fluoride	mg/L	0.21	0.29	0.29	0.41	0.28	0.39	0.21	0.31
Magnesium	mg/L	30	41	33	48	31	44	27	38
Potassium	mg/L	3.0	4.9	2.7	3.9	2.7	3.8	1.9	2.7
Sodium	mg/L	21	31	19	24	18	23	14	18
Sulphate	mg/L	417	686	475	687	432	628	343	510
Nutrients									
Ammonia	mg/L (as N)	0.023	0.053	0.024	0.04	0.024	0.039	0.015	0.023
Nitrate	mg/L (as N)	8.9	19	4.5	9.1	2.0	5.1	1.1	2.8
Nitrite	mg/L (as N)	0.011	0.022	0.011	0.022	0.010	0.02	0.0056	0.011
Total Phosphorus	mg/L	0.021	0.033	0.017	0.032	0.016	0.031	0.016	0.029
Total Metals									
Aluminum	mg/L	0.47	0.5	0.47	0.52	0.049	0.17	0.049	0.19
Antimony	mg/L	0.00035	0.00065	0.0005	0.00083	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0015	0.0025	0.0011	0.0014	0.00068	0.001	0.00062	0.00093
Barium	mg/L	0.044	0.078	0.038	0.057	0.034	0.046	0.027	0.038
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.3	0.097	0.17	0.069	0.093	0.051	0.072
Cadmium	mg/L	0.000029	0.00018	0.000046	0.00022	0.000041	0.00017	0.000034	0.00015
Chromium	mg/L	0.00065	0.00071	0.00063	0.00073	0.00042	0.00092	0.0005	0.0011
Cobalt	mg/L	0.00039	0.00073	0.00041	0.00092	0.00012	0.00067	0.000092	0.00059
Copper	mg/L	0.015	0.17	0.021	0.19	0.012	0.033	0.0095	0.028
Iron	mg/L	0.47	0.55	0.48	0.54	0.087	0.27	0.088	0.3
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000057	0.000023	0.000065
Lithium	mg/L	0.0038	0.0068	0.0042	0.0067	0.0039	0.0057	0.0028	0.0044
Manganese	mg/L	0.072	0.87	0.061	0.27	0.031	0.22	0.024	0.19
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051

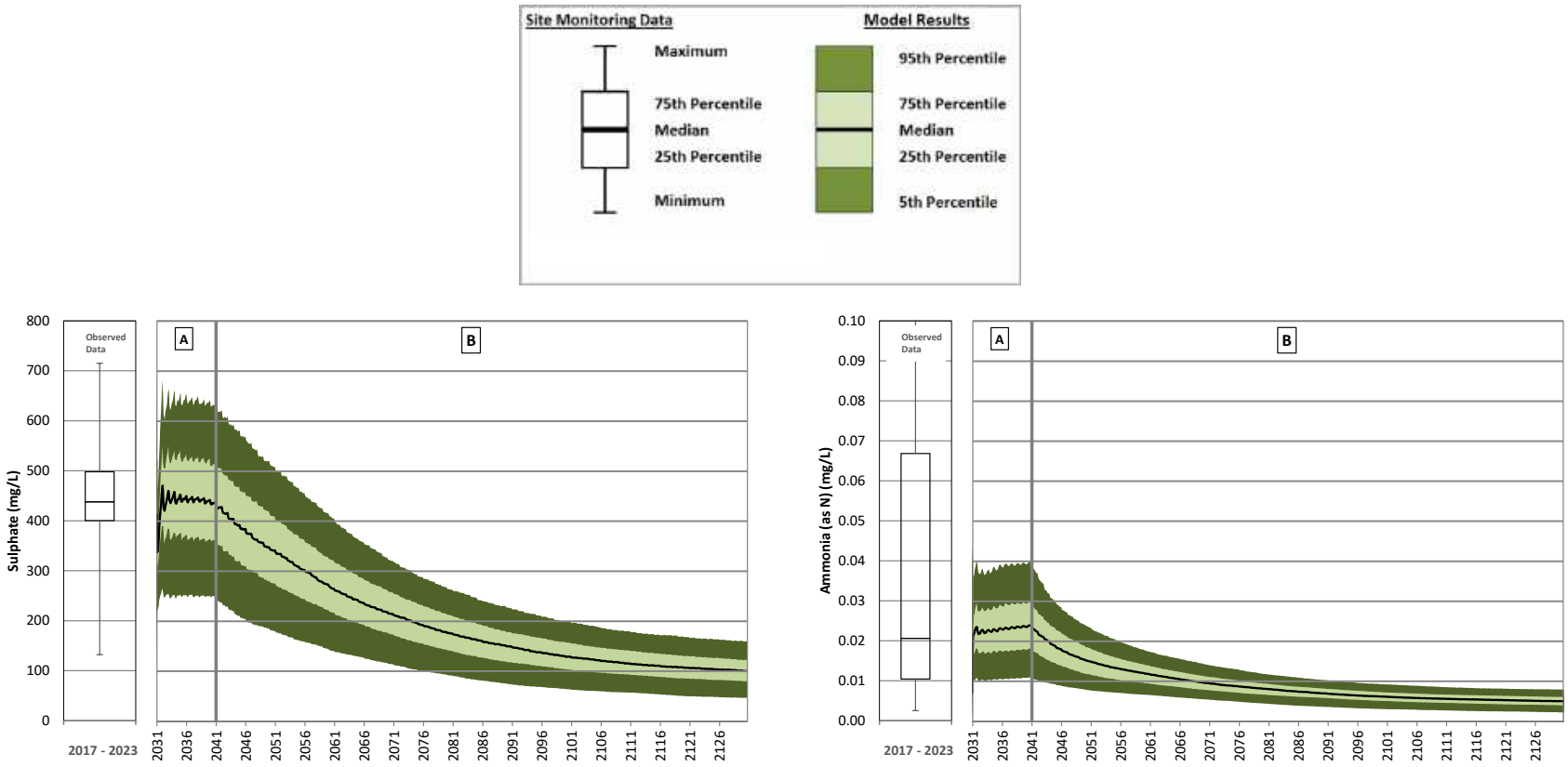
Table 14: Predicted Maximum Concentrations in the Springer-Cariboo Pit during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.081	0.15	0.1	0.16	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00098	0.0012	0.001	0.0022	0.00059	0.0019	0.00061	0.0018
Selenium	mg/L	0.038	0.077	0.044	0.081	0.04	0.069	0.031	0.056
Silver	mg/L	0.000005	0.000012	0.0000061	0.000014	0.0000061	0.000015	0.000006	0.000015
Strontium	mg/L	0.98	1.7	1.9	3.4	1.8	2.9	1.4	2.4
Thallium	mg/L	0.0000048	0.0000056	0.0000051	0.0000059	0.0000051	0.0000052	0.000005	0.0000051
Tin	mg/L	0.000049	0.00014	0.000051	0.00013	0.000051	0.000052	0.00005	0.000051
Titanium	mg/L	0.024	0.026	0.026	0.027	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00093	0.0017	0.0012	0.0035	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.0018	0.0024	0.002	0.0024	0.00097	0.0015	0.00082	0.0013
Zinc	mg/L	0.0059	0.0079	0.0072	0.013	0.0039	0.0092	0.003	0.0075
Dissolved Metals									
Aluminum	mg/L	0.013	0.042	0.017	0.07	0.021	0.057	0.021	0.077
Antimony	mg/L	0.00033	0.00051	0.00048	0.00069	0.00047	0.00067	0.00029	0.00047
Arsenic	mg/L	0.0012	0.0022	0.00084	0.0012	0.00065	0.00091	0.00059	0.00083
Barium	mg/L	0.042	0.069	0.036	0.048	0.034	0.045	0.027	0.036
Beryllium	mg/L	0.000048	0.000049	0.000051	0.000052	0.000051	0.000052	0.00005	0.000051
Boron	mg/L	0.16	0.27	0.093	0.14	0.069	0.091	0.051	0.07
Cadmium	mg/L	0.000027	0.00013	0.000044	0.00018	0.00004	0.00016	0.000032	0.00014
Chromium	mg/L	0.00027	0.00032	0.00024	0.00034	0.00031	0.0004	0.00039	0.00056
Cobalt	mg/L	0.00011	0.00045	0.00013	0.00064	0.00012	0.0006	0.000092	0.00051
Copper	mg/L	0.0063	0.011	0.012	0.035	0.012	0.032	0.0091	0.026
Iron	mg/L	0.027	0.11	0.033	0.095	0.043	0.087	0.044	0.11
Lead	mg/L	0.000024	0.000028	0.000026	0.000031	0.000025	0.000037	0.000023	0.000045
Lithium	mg/L	0.0036	0.0058	0.004	0.0057	0.0039	0.0056	0.0028	0.0043
Manganese	mg/L	0.051	0.85	0.04	0.25	0.027	0.2	0.02	0.18
Mercury	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051
Molybdenum	mg/L	0.081	0.14	0.1	0.15	0.096	0.14	0.069	0.11
Nickel	mg/L	0.00043	0.0007	0.00049	0.0016	0.00052	0.0015	0.00054	0.0015
Selenium	mg/L	0.038	0.071	0.044	0.075	0.04	0.069	0.031	0.056
Silicon	mg/L	6.7	7.7	5.9	6.7	5.7	6.7	5.5	6.4
Silver	mg/L	0.000005	0.0000059	0.0000061	0.0000084	0.0000061	0.0000081	0.000006	0.0000079
Strontium	mg/L	0.96	1.3	1.9	3.1	1.8	2.8	1.4	2.3
Thallium	mg/L	0.0000048	0.0000049	0.0000051	0.0000052	0.0000051	0.0000052	0.000005	0.0000051

Table 14: Predicted Maximum Concentrations in the Springer-Cariboo Pit during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Tin	mg/L	0.000049	0.00006	0.000051	0.000053	0.000051	0.000052	0.00005	0.000051
Titanium	mg/L	0.0055	0.0072	0.0074	0.0085	0.0073	0.0084	0.0067	0.0076
Uranium	mg/L	0.00091	0.0014	0.0011	0.0032	0.0011	0.0029	0.00089	0.0024
Vanadium	mg/L	0.00059	0.0012	0.00083	0.0012	0.00082	0.0011	0.00067	0.00091
Zinc	mg/L	0.0032	0.0053	0.0045	0.01	0.0039	0.0092	0.003	0.0075

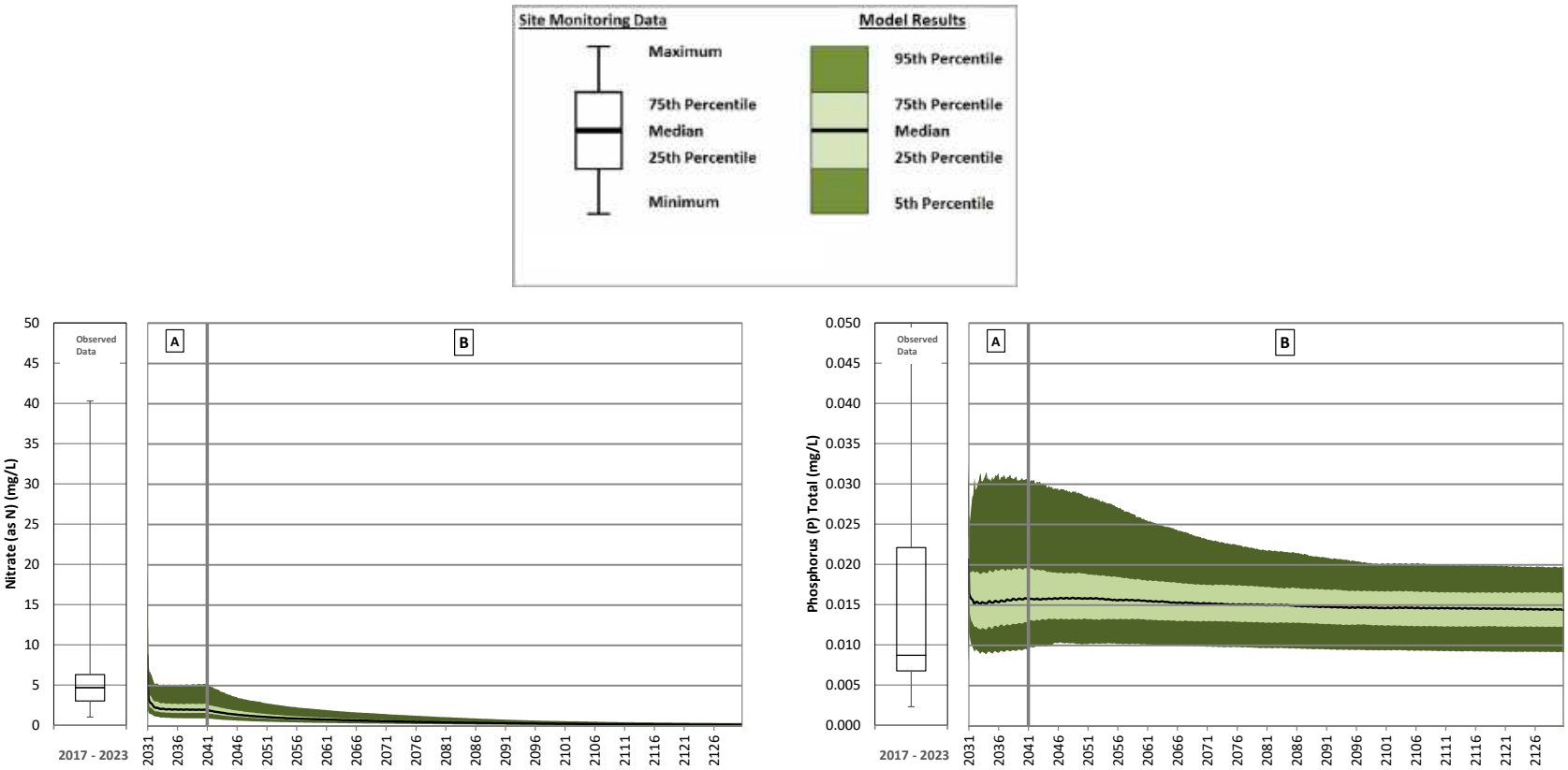
a) Calculated based on predicted calcium and magnesium concentrations



A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

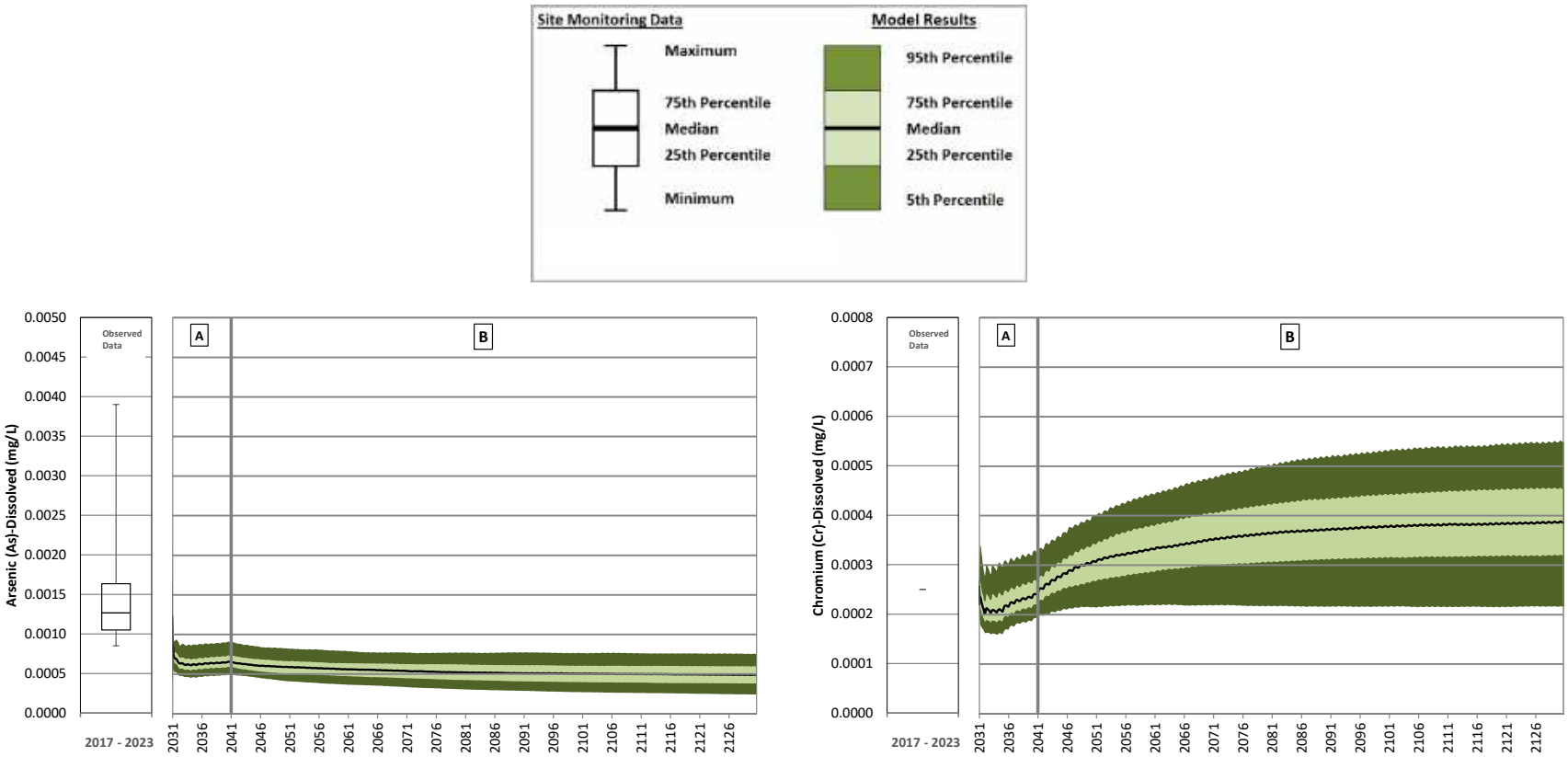
Figure 29: Predicted Sulphate and Total Ammonia Concentrations in the Springer-Cariboo Pit – Closure and Post-closure



A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

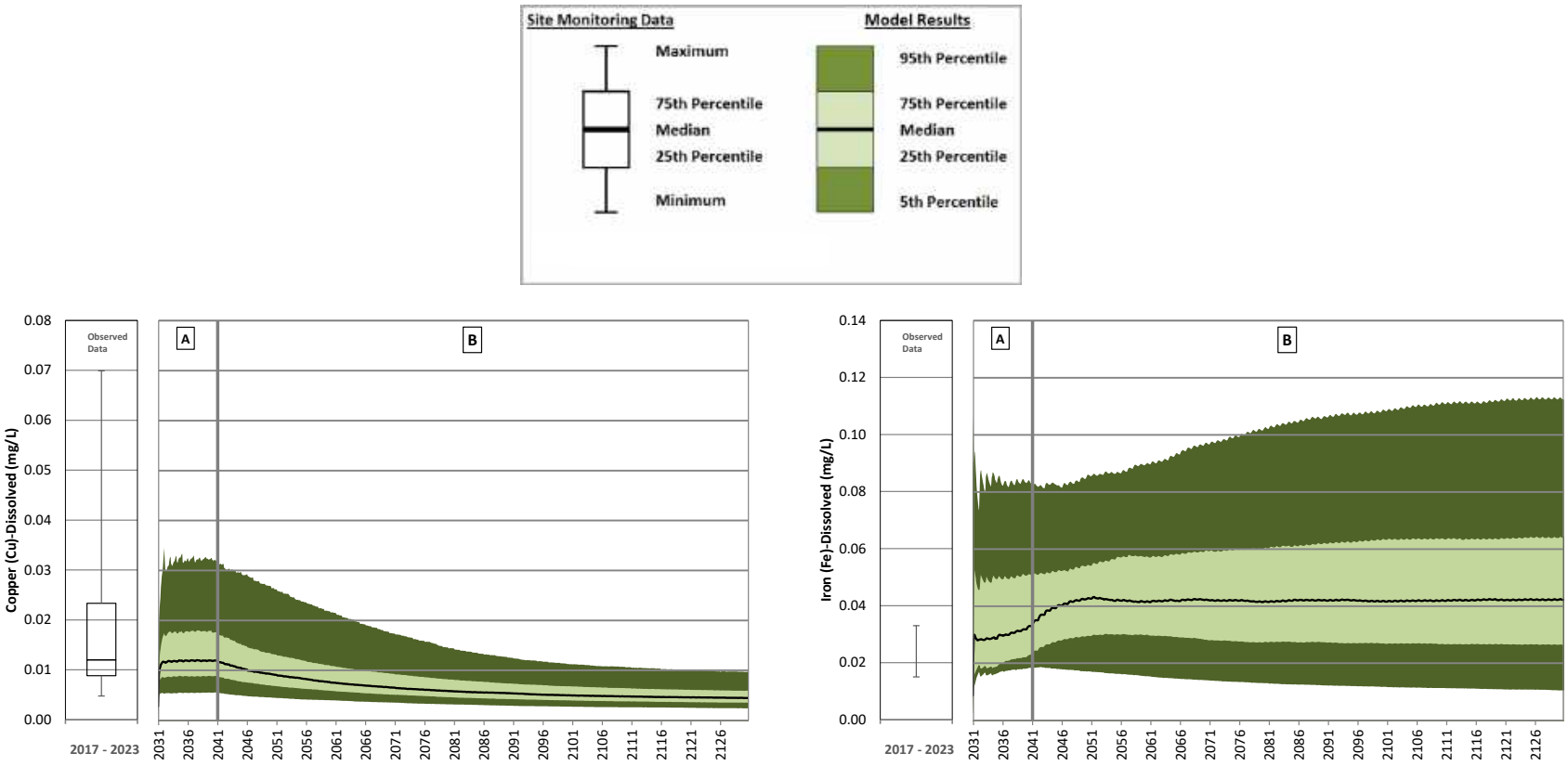
Figure 30: Predicted Nitrate and Total Phosphorus Concentrations in the Springer-Cariboo Pit – Closure and Post-closure



A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

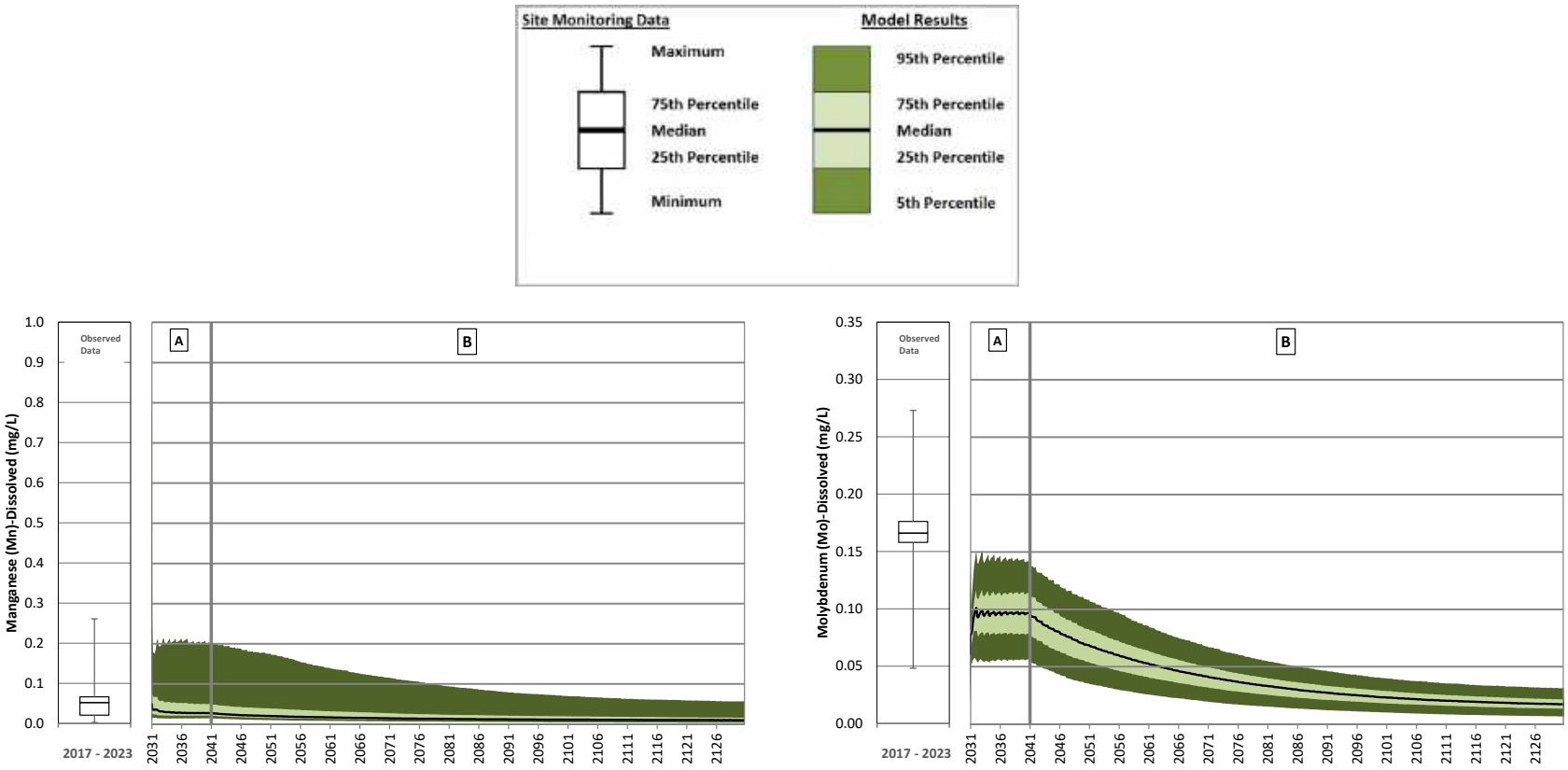
Figure 31: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Springer-Cariboo Pit – Closure and Post-closure



A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

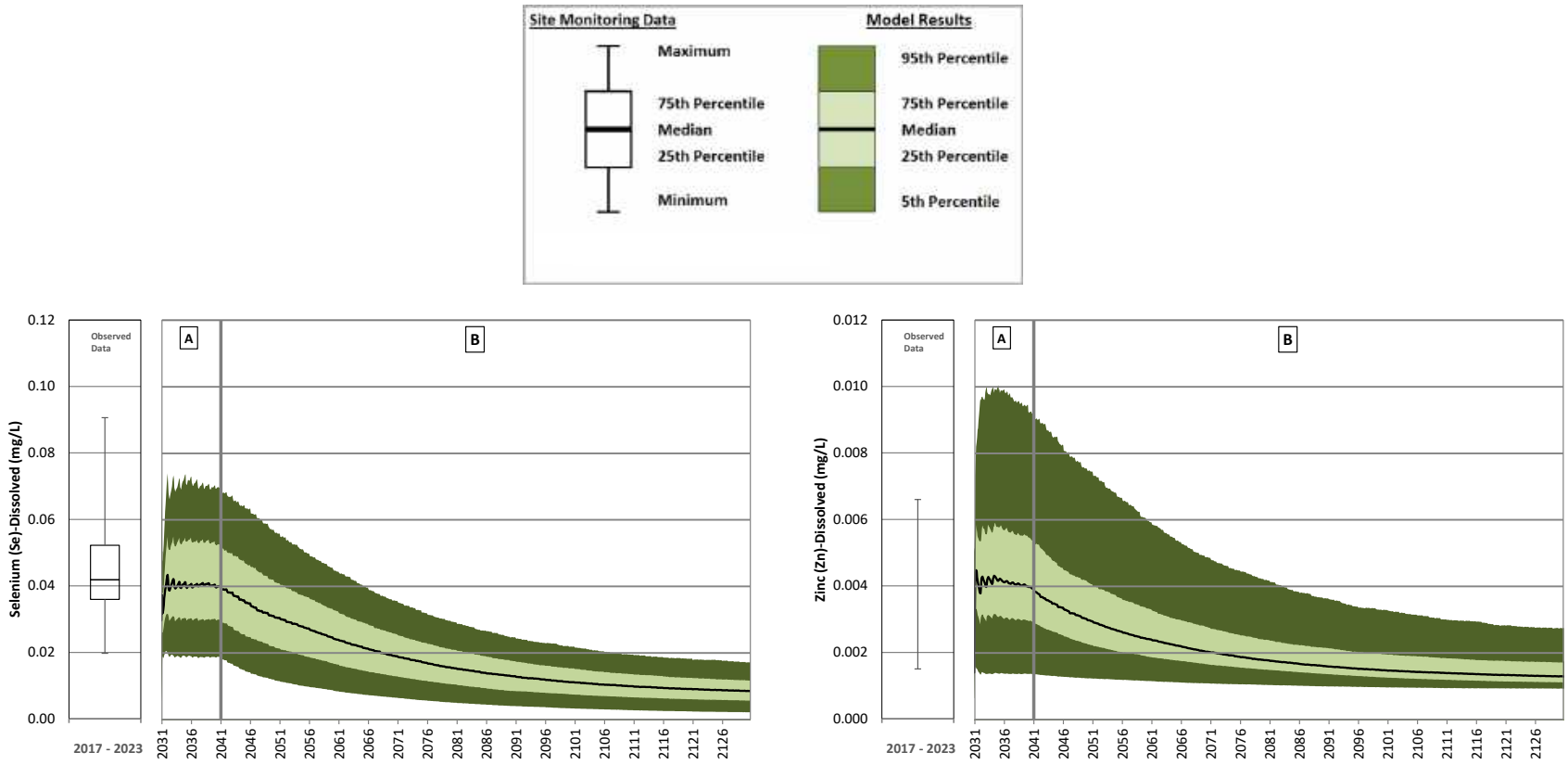
Figure 32: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Springer-Cariboo Pit – Closure and Post-closure



A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 33: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Springer-Cariboo Pit – Closure and Post-closure



A = Closure; B = Post-closure

Note: The change in concentrations during closure and post-closure is caused by reclamation of mine site areas and the filling of the combined Springer-Cariboo Pit.

Figure 34: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Springer-Cariboo Pit – Closure and Post-closure

4.4 Mine Drainage Creek Sump

The Mine Drainage Creek Sump receives drainage from undisturbed and disturbed areas, haul roads, and RDSs in its catchment area. Discharge from the Mine Drainage Creek Sump is planned to be directed to Bootjack Lake.

Time series plots for key parameters in the Mine Drainage Creek Sump for closure and post-closure are shown in Figures 35 to 40. Maximum of median and 95th percentile predictions are presented in Table 15.

For most parameters, predicted peak concentrations in the Mine Drainage Creek Sump occur during closure, and then decrease as disturbed areas, haul roads, and RDS areas are reclaimed (Figures 35 to 40). Concentrations are highest during operations for most parameters because RDS and haul road runoff is assigned the NAG water quality input until reclamation, which will occur throughout closure. Water qualities from these facilities are predicted to return to the undisturbed water quality (Table 9). Predicted water quality reaches steady state 10 years after the start of post-closure, after all watershed areas have been reclaimed.

Seasonal peak concentrations during winter are driven by seepage from the East RDS. During winter months, when precipitation occurs as snowfall, East RDS seepage represents a high proportion of the total flow to the Mine Drainage Creek Sump and causes concentrations of parameters to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows to the Mine Drainage Creek Sump, which causes concentrations of parameters, such as aluminum, to increase from closure to post-closure.

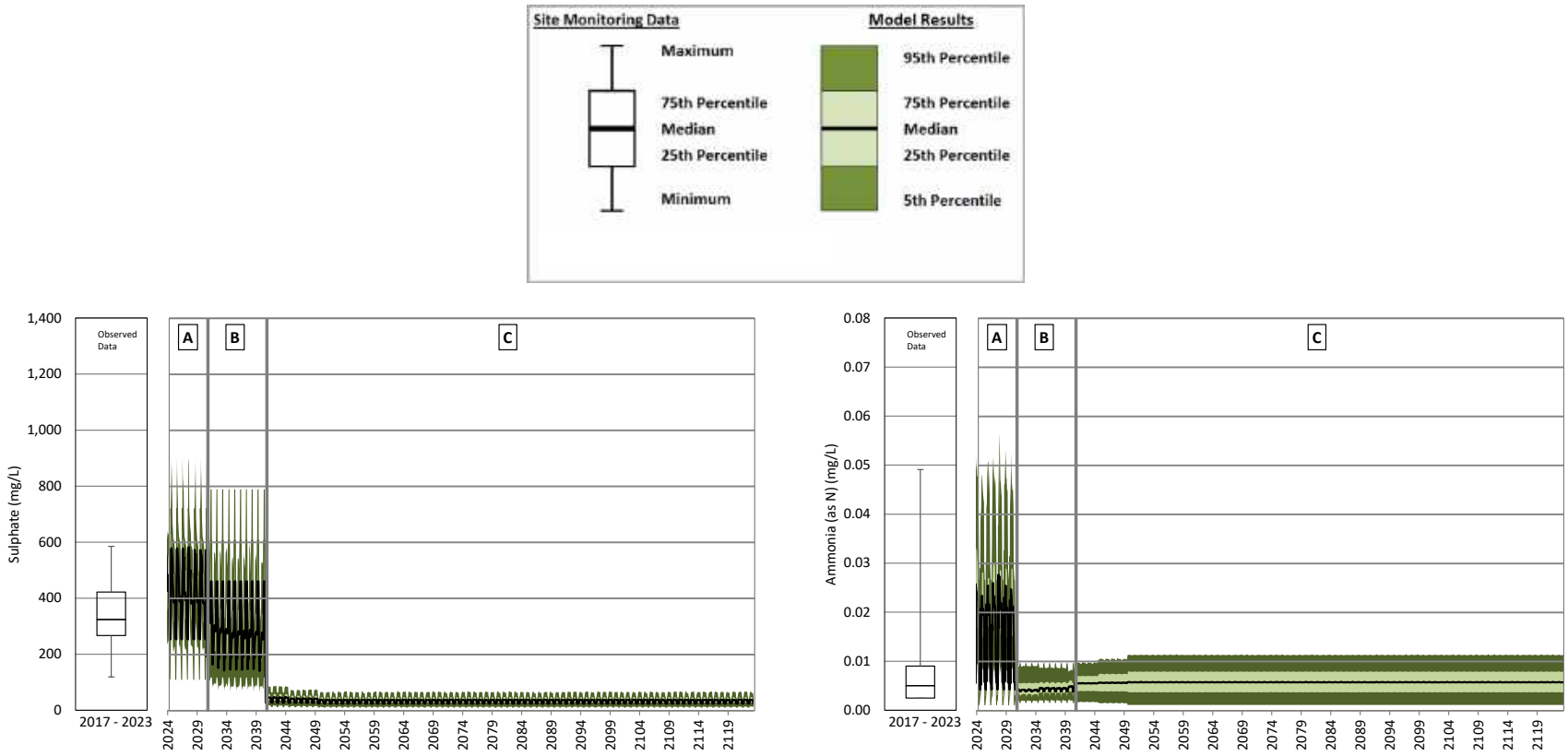
Table 15: Predicted Maximum Concentrations in the Mine Drainage Creek Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	718	1,086	592	958	172	277	164	261
Total Dissolved Solids	mg/L	1,053	1,647	852	1,425	232	337	222	337
Major Ions									
Calcium	mg/L	220	329	183	298	45	69	41	62
Chloride	mg/L	26	31	2.0	4.5	2.5	8.5	2.5	8.5
Fluoride	mg/L	0.84	1.0	0.11	0.18	0.075	0.16	0.074	0.16
Magnesium	mg/L	41	64	33	52	15	26	15	26
Potassium	mg/L	25	30	1.4	2.3	1.0	1.5	1.0	1.5
Sodium	mg/L	94	113	12	20	7.1	12	7.2	12
Sulphate	mg/L	587	910	464	796	49	89	40	70
Nutrients									
Ammonia	mg/L (as N)	0.028	0.057	0.005	0.0097	0.0058	0.011	0.0059	0.012
Nitrate	mg/L (as N)	6.4	35	0.57	6.8	0.056	0.32	0.045	0.32
Nitrite	mg/L (as N)	0.085	0.11	0.00095	0.004	0.0005	0.0013	0.0005	0.00052
Total Phosphorus	mg/L	0.017	0.041	0.018	0.029	0.023	0.033	0.023	0.033
Total Metals									
Aluminum	mg/L	0.47	0.5	0.49	0.59	0.069	0.3	0.067	0.3
Antimony	mg/L	0.0017	0.0023	0.00015	0.00043	0.000059	0.000079	0.000058	0.00008
Arsenic	mg/L	0.0039	0.0046	0.00079	0.0011	0.00089	0.0016	0.0009	0.0016
Barium	mg/L	0.069	0.09	0.027	0.053	0.013	0.017	0.011	0.016
Beryllium	mg/L	0.00005	0.000051	0.00005	0.00005	0.00005	0.000051	0.00005	0.000052
Boron	mg/L	0.21	0.38	0.04	0.1	0.021	0.033	0.019	0.033
Cadmium	mg/L	0.0001	0.00033	0.000024	0.00014	0.0000093	0.000028	0.0000094	0.000028
Chromium	mg/L	0.00065	0.00069	0.00081	0.001	0.00086	0.0017	0.00086	0.0017
Cobalt	mg/L	0.00046	0.0012	0.00035	0.00056	0.00006	0.00017	0.000057	0.00017
Copper	mg/L	0.018	0.2	0.016	0.17	0.0041	0.0079	0.0029	0.0065
Iron	mg/L	0.48	0.52	0.51	0.61	0.13	0.45	0.13	0.45
Lead	mg/L	0.00014	0.00014	0.00014	0.00016	0.000019	0.00011	0.000016	0.00011
Lithium	mg/L	0.011	0.015	0.0016	0.0041	0.0016	0.0029	0.0016	0.0029
Manganese	mg/L	0.096	0.52	0.034	0.19	0.015	0.041	0.015	0.04
Mercury	mg/L	0.000005	0.0000051	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000052
Molybdenum	mg/L	0.3	0.38	0.067	0.16	0.008	0.016	0.0066	0.013
Nickel	mg/L	0.001	0.003	0.0011	0.0016	0.00087	0.0019	0.00087	0.0019
Selenium	mg/L	0.05	0.11	0.036	0.085	0.0037	0.0078	0.003	0.0066
Silver	mg/L	0.0000064	0.000016	0.000006	0.000014	0.0000061	0.000019	0.0000061	0.000019

Table 15: Predicted Maximum Concentrations in the Mine Drainage Creek Sump during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Strontium	mg/L	2.9	4.6	0.84	1.6	0.28	0.47	0.29	0.47
Thallium	mg/L	0.0000058	0.0000083	0.000005	0.0000057	0.000005	0.0000051	0.000005	0.0000052
Tin	mg/L	0.00005	0.00015	0.00005	0.00013	0.00005	0.000051	0.00005	0.000052
Titanium	mg/L	0.027	0.027	0.024	0.025	0.0049	0.0077	0.0048	0.0078
Uranium	mg/L	0.0015	0.0045	0.00067	0.0018	0.00061	0.0012	0.00061	0.0012
Vanadium	mg/L	0.0046	0.0053	0.0017	0.0021	0.0007	0.0012	0.00069	0.0013
Zinc	mg/L	0.0074	0.016	0.0091	0.015	0.0029	0.005	0.001	0.0012
Dissolved Metals									
Aluminum	mg/L	0.017	0.05	0.033	0.13	0.041	0.18	0.039	0.19
Antimony	mg/L	0.0017	0.0021	0.00013	0.00029	0.000059	0.000079	0.000058	0.00008
Arsenic	mg/L	0.0036	0.0043	0.00051	0.00081	0.00086	0.0015	0.00087	0.0015
Barium	mg/L	0.067	0.081	0.025	0.044	0.012	0.016	0.011	0.014
Beryllium	mg/L	0.00005	0.000051	0.00005	0.00005	0.00005	0.000051	0.00005	0.000052
Boron	mg/L	0.2	0.35	0.036	0.072	0.021	0.031	0.019	0.031
Cadmium	mg/L	0.000099	0.00028	0.000021	0.000091	0.0000081	0.00002	0.0000082	0.00002
Chromium	mg/L	0.00026	0.0003	0.00043	0.00064	0.00075	0.0012	0.00075	0.0012
Cobalt	mg/L	0.00018	0.00096	0.000068	0.00027	0.00006	0.000095	0.000057	0.000096
Copper	mg/L	0.0092	0.047	0.0074	0.017	0.0038	0.0063	0.0026	0.0049
Iron	mg/L	0.039	0.08	0.063	0.17	0.09	0.26	0.09	0.26
Lead	mg/L	0.000025	0.000031	0.000026	0.000049	0.000019	0.000086	0.000016	0.000086
Lithium	mg/L	0.011	0.014	0.0014	0.0031	0.0016	0.0027	0.0016	0.0027
Manganese	mg/L	0.074	0.5	0.013	0.17	0.011	0.025	0.011	0.024
Mercury	mg/L	0.000005	0.0000051	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000052
Molybdenum	mg/L	0.3	0.37	0.066	0.15	0.0079	0.016	0.0066	0.013
Nickel	mg/L	0.00046	0.0024	0.00058	0.001	0.0008	0.0016	0.0008	0.0016
Selenium	mg/L	0.05	0.1	0.036	0.079	0.0037	0.0077	0.003	0.0065
Silicon	mg/L	7.1	8.2	5.8	7.0	6.0	8.2	6.0	8.3
Silver	mg/L	0.0000064	0.00001	0.000006	0.0000087	0.0000061	0.000013	0.0000061	0.000013
Strontium	mg/L	2.8	4.3	0.83	1.3	0.28	0.44	0.29	0.45
Thallium	mg/L	0.0000058	0.0000076	0.000005	0.000005	0.000005	0.0000051	0.000005	0.0000052
Tin	mg/L	0.00005	0.00007	0.00005	0.00005	0.00005	0.000051	0.00005	0.000052
Titanium	mg/L	0.0083	0.0086	0.0056	0.0065	0.0049	0.0077	0.0048	0.0078
Uranium	mg/L	0.0015	0.0042	0.00064	0.0015	0.00061	0.0012	0.00061	0.0012
Vanadium	mg/L	0.0034	0.0042	0.00054	0.00088	0.00055	0.00085	0.00054	0.00086
Zinc	mg/L	0.0048	0.013	0.0065	0.012	0.0029	0.005	0.001	0.0012

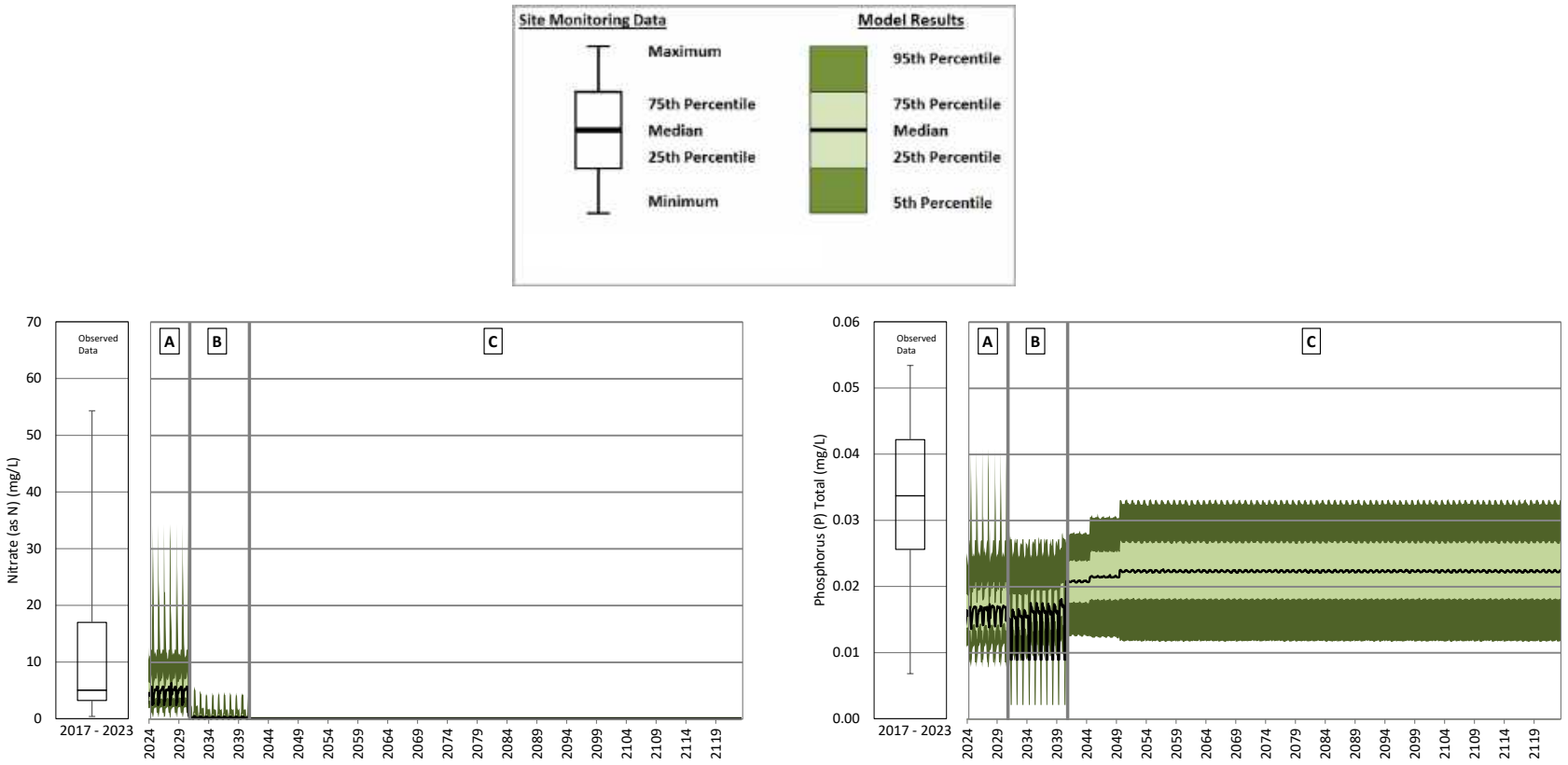
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

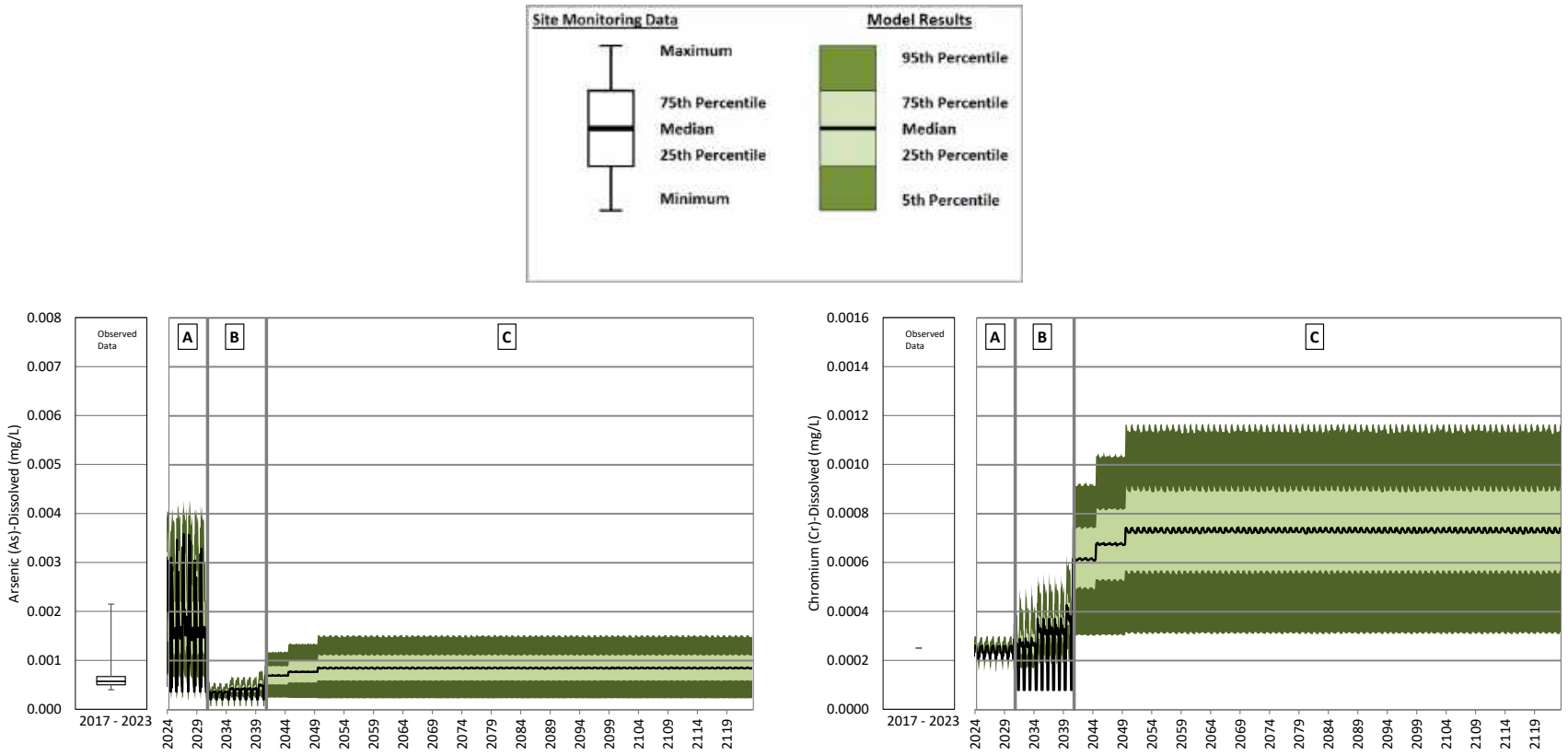
Figure 35: Predicted Sulphate and Total Ammonia Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

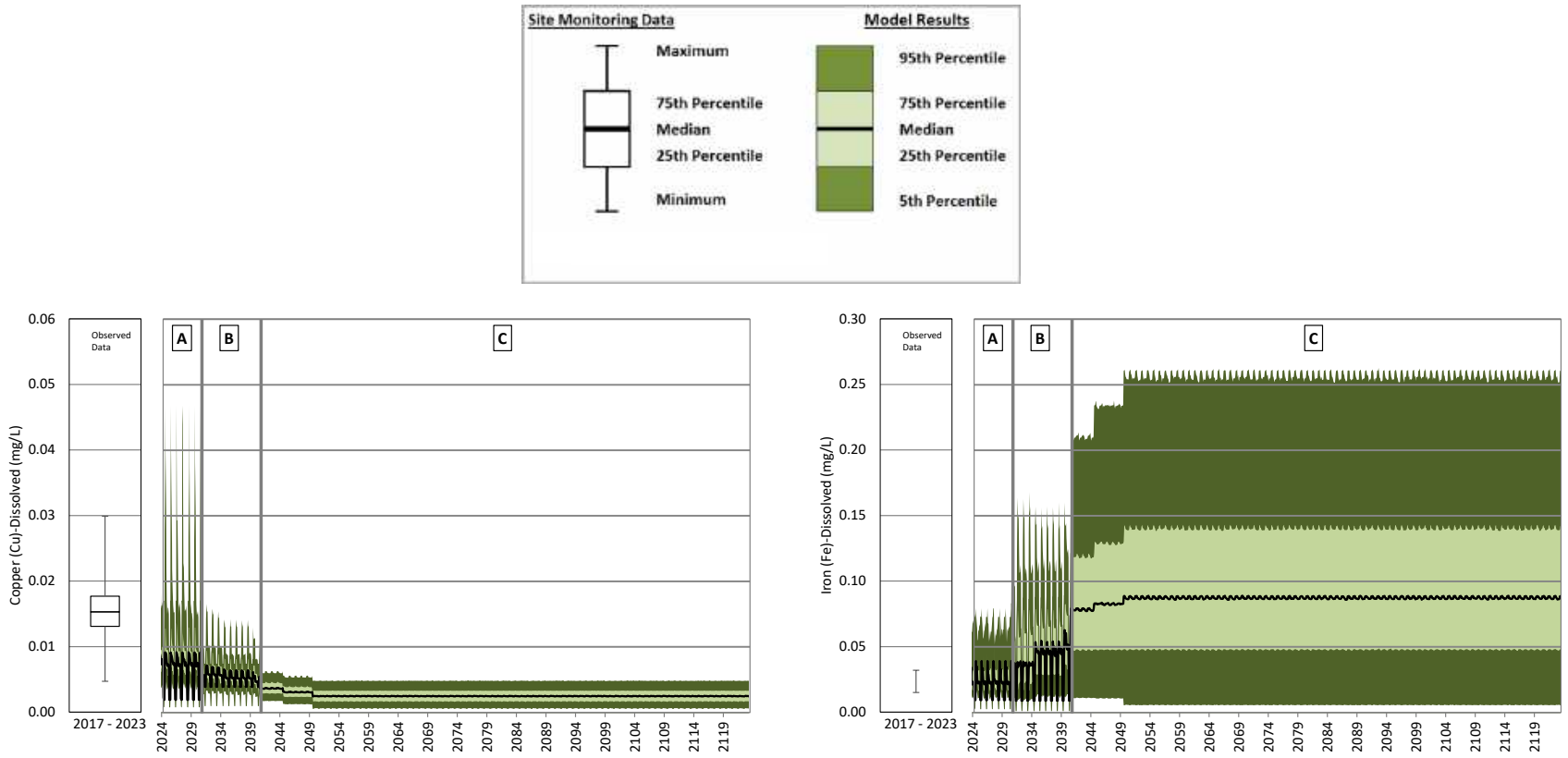
Figure 36: Predicted Nitrate and Total Phosphorus Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

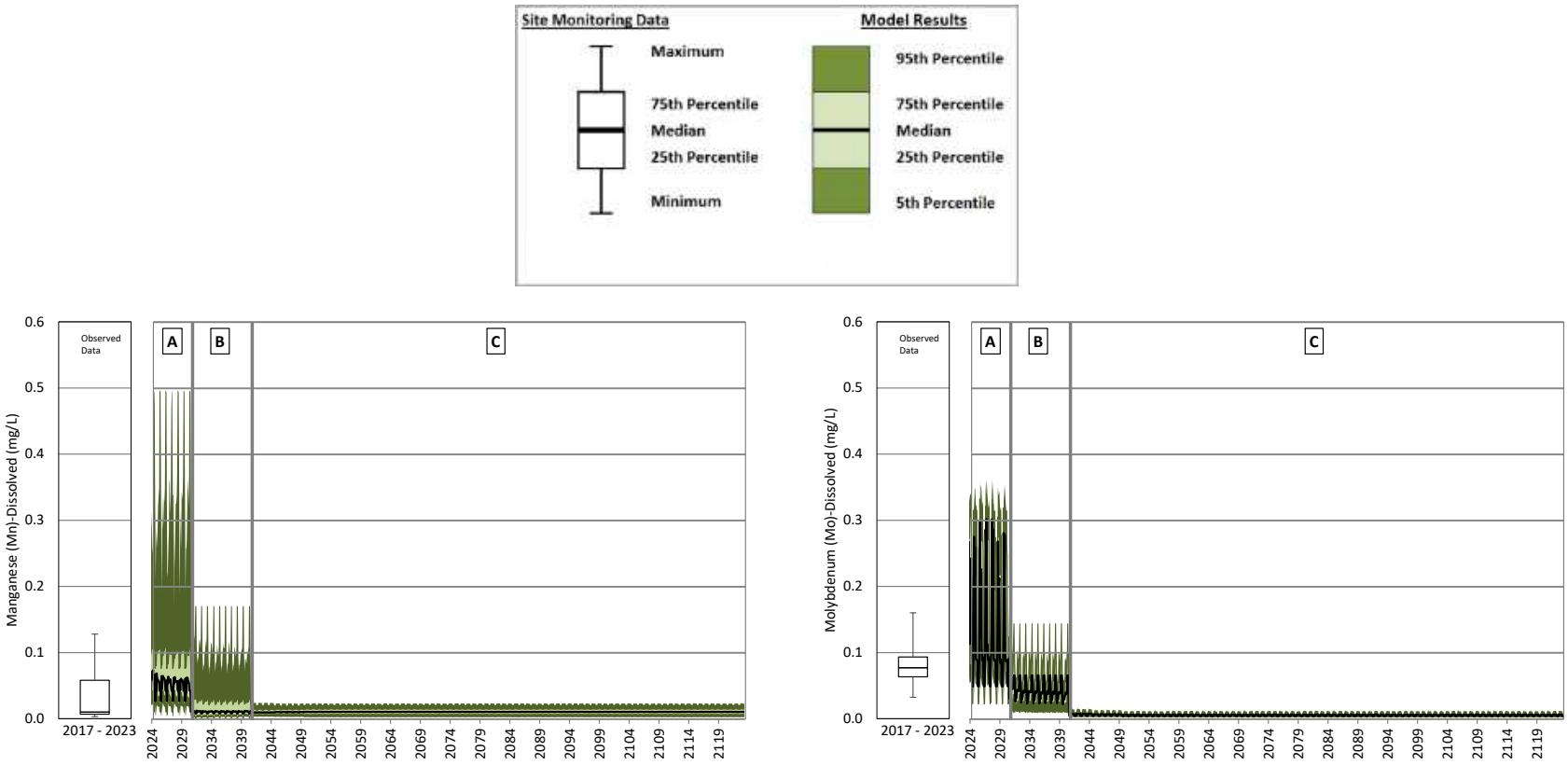
Figure 37: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

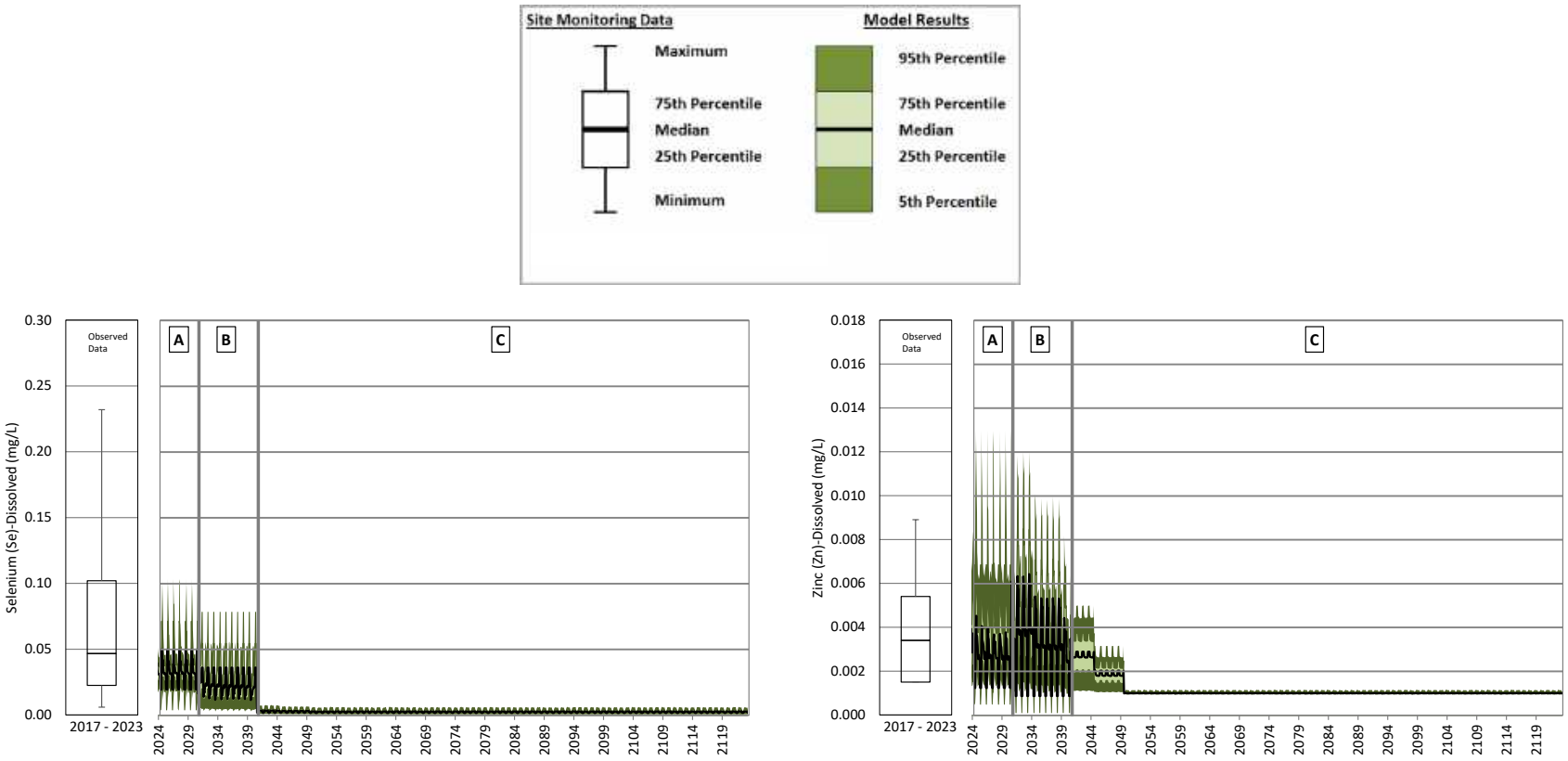
Figure 38: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 39: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 40: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Mine Drainage Creek Sump – Closure and Post-closure

4.4.1 Wight Pit

Towards the last year of operation, the TSF pond will be progressively reduced to 0.25 M-m^3 of water. During that time and continuing into closure, the Wight Pit will be used to store excess water. During post-closure, Wight Pit will no longer be used for storage and will be allowed to fill. A pit lake will form in Wight Pit as the mined-out pit refills passively with groundwater, seepage from Boundary Pit, surface runoff from pit walls, disturbed areas, and haul roads in the Wight Pit catchment. Wight Pit is projected to start overflowing in 2048 under the mean results and in 2046 under 99.5th percentile, at which point overflow will be directed to Polley Lake. Reclamation of the disturbed areas and haul roads is assumed to occur during closure (see Section 2.2). Runoff water quality from these facilities is predicted to return to undisturbed water quality as presented in Table 9.

Time series plots for key parameters in Wight Pit for operations, closure and post-closure are shown in Figures 41 to 46. Maximum of median and 95th percentile predictions are presented in Table 16.

Predicted concentrations of key parameters in Wight Pit are generally stable 10 years after the start of post-closure (Figures 41 to 46). Concentrations of key parameters decrease slightly through early post-closure after the pit has filled and is flushed with runoff from reclaimed disturbed areas and haul roads in the Wight Pit catchment area.

Some parameters are predicted to have higher concentrations in post-closure than closure (for example, dissolved copper). The increase in concentration for these parameters is caused by either:

a) Higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Wight Pit.

b) Increased proportions of the total inflows to Wight Pit from pit wall runoff that is assigned the Wight Pit wall runoff during post-closure.

Wight Pit has been the subject of some experimental work that looked at Wight Pit as a possible saturated rock fill reactor. Those trials are incomplete, and Wight Pit is currently being used for water storage. This use remains the intended use within the Reclamation and Closure Plan. Should MPMC advance the use of Wight Pit as a saturated rockfill reactor, there will need to be permitting (following a decision) and updates to the Reclamation and Closure Plan.

Table 16: Predicted Maximum Concentrations Wight Pit during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	730	896	182	379	159	323	159	323
Total Dissolved Solids	mg/L	1,080	1,242	251	570	216	439	215	440
Major Ions									
Calcium	mg/L	238	294	54	114	47	94	47	94
Chloride	mg/L	9.6	22	2.9	16	2.4	16	2.4	16
Fluoride	mg/L	0.76	1.1	0.28	0.49	0.28	0.49	0.28	0.49
Magnesium	mg/L	33	40	11	23	9.8	22	9.8	22
Potassium	mg/L	9.0	21	0.59	6.0	0.55	0.83	0.46	0.83
Sodium	mg/L	47	84	20	31	20	31	20	31
Sulphate	mg/L	646	743	101	302	93	187	93	188
Nutrients									
Ammonia	mg/L (as N)	0.016	0.07	0.0031	0.056	0.0024	0.014	0.0022	0.014
Nitrate	mg/L (as N)	1.6	5.4	0.23	3.8	0.08	1.6	0.072	1.6
Nitrite	mg/L (as N)	0.031	0.071	0.0011	0.029	0.0004	0.019	0.00038	0.019
Total Phosphorus	mg/L	0.013	0.018	0.014	0.027	0.014	0.027	0.013	0.027
Total Metals									
Aluminum	mg/L	0.46	0.47	0.46	0.5	0.036	0.15	0.036	0.15
Antimony	mg/L	0.0011	0.0018	0.000071	0.00084	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.002	0.0035	0.0027	0.0047	0.0024	0.0045	0.0024	0.0045
Barium	mg/L	0.05	0.074	0.021	0.07	0.017	0.063	0.017	0.063
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.45	0.28	0.53	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00052	0.000011	0.000089	0.0000079	0.000028	0.0000075	0.000028
Chromium	mg/L	0.00063	0.00065	0.00066	0.00076	0.00041	0.00089	0.00037	0.00085
Cobalt	mg/L	0.00072	0.0018	0.00034	0.00044	0.000055	0.00016	0.000052	0.00015
Copper	mg/L	0.022	0.18	0.012	0.17	0.0031	0.007	0.0031	0.0071
Iron	mg/L	0.46	0.62	0.46	0.53	0.065	0.24	0.065	0.24
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000025	0.000052	0.000025	0.000048
Lithium	mg/L	0.009	0.013	0.0035	0.009	0.0033	0.0046	0.0033	0.0046
Manganese	mg/L	0.16	0.31	0.048	0.078	0.03	0.074	0.03	0.073
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005

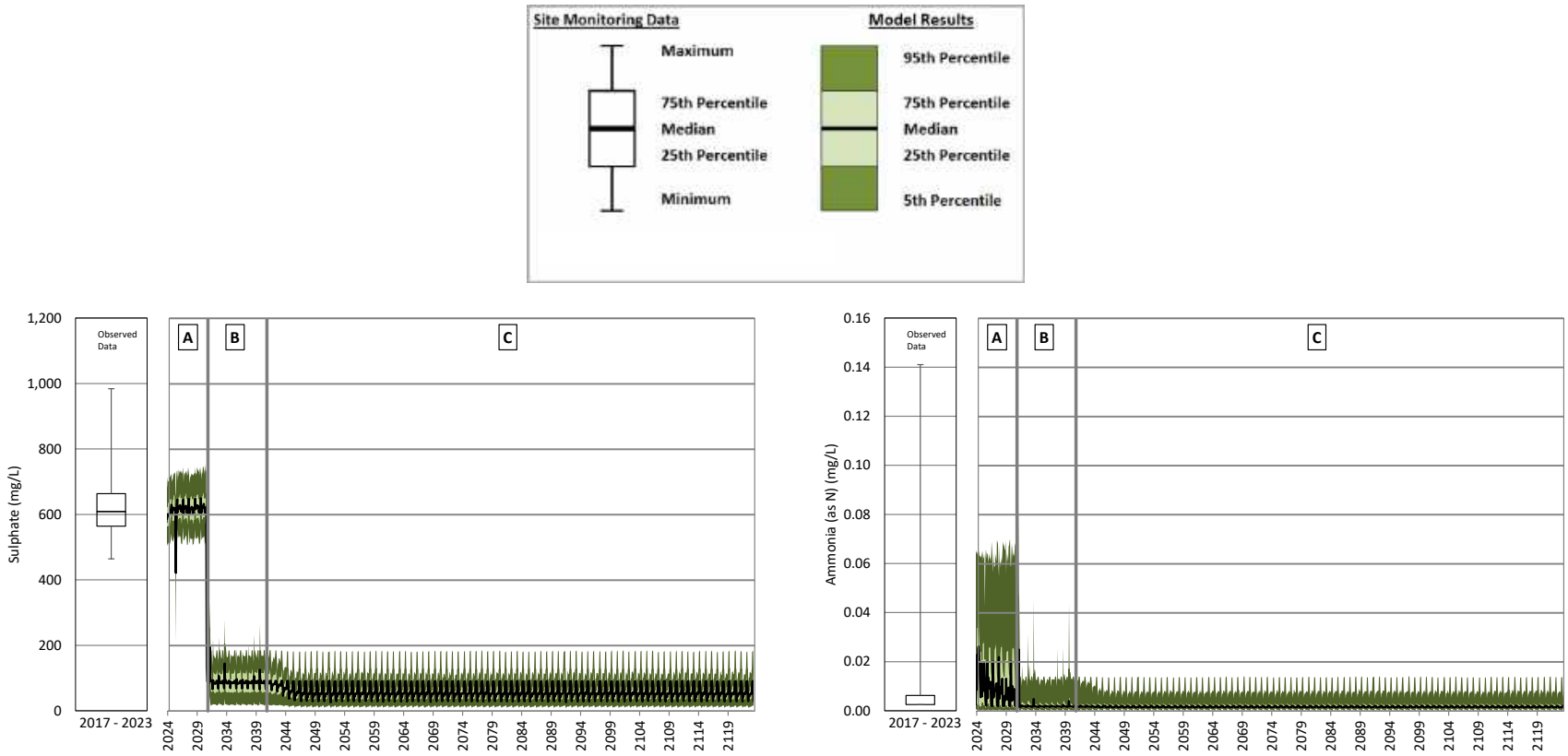
Table 16: Predicted Maximum Concentrations Wight Pit during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.19	0.3	0.031	0.11	0.031	0.047	0.031	0.047
Nickel	mg/L	0.0012	0.0016	0.00085	0.0014	0.0004	0.0011	0.0004	0.0011
Selenium	mg/L	0.03	0.052	0.0019	0.03	0.00081	0.0077	0.00076	0.0077
Silver	mg/L	0.000005	0.000011	0.0000051	0.000012	0.000005	0.000012	0.000005	0.000012
Strontium	mg/L	6.6	11	0.25	1.6	0.18	0.61	0.15	0.61
Thallium	mg/L	0.00001	0.000017	0.000005	0.0000057	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.000053	0.00017	0.000053	0.000085	0.000053	0.000086
Titanium	mg/L	0.024	0.026	0.024	0.027	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0041	0.00036	0.0014	0.00027	0.001	0.00023	0.001
Vanadium	mg/L	0.0028	0.0041	0.0016	0.0034	0.00048	0.0026	0.00048	0.0026
Zinc	mg/L	0.014	0.024	0.0065	0.013	0.003	0.0099	0.0031	0.0099
Dissolved Metals									
Aluminum	mg/L	0.0048	0.017	0.0083	0.045	0.0079	0.033	0.0079	0.033
Antimony	mg/L	0.0011	0.0016	0.000051	0.0007	0.000041	0.00023	0.000035	0.00023
Arsenic	mg/L	0.0017	0.0032	0.0024	0.0044	0.0024	0.0044	0.0024	0.0044
Barium	mg/L	0.048	0.065	0.019	0.061	0.017	0.061	0.017	0.061
Beryllium	mg/L	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.27	0.42	0.28	0.5	0.28	0.5	0.28	0.5
Cadmium	mg/L	0.00028	0.00048	0.0000086	0.000044	0.0000067	0.00002	0.0000063	0.00002
Chromium	mg/L	0.00025	0.00026	0.00028	0.00037	0.0003	0.00037	0.00026	0.00033
Cobalt	mg/L	0.00044	0.0015	0.000056	0.00016	0.000055	0.00008	0.000052	0.000078
Copper	mg/L	0.013	0.021	0.0032	0.011	0.0028	0.0054	0.0028	0.0055
Iron	mg/L	0.014	0.18	0.02	0.084	0.021	0.061	0.021	0.059
Lead	mg/L	0.000025	0.000025	0.000025	0.00003	0.000025	0.000032	0.000025	0.000028
Lithium	mg/L	0.0088	0.012	0.0033	0.008	0.0033	0.0044	0.0033	0.0044
Manganese	mg/L	0.14	0.29	0.027	0.057	0.027	0.057	0.027	0.057
Mercury	mg/L	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.19	0.28	0.031	0.098	0.031	0.046	0.03	0.047
Nickel	mg/L	0.00064	0.0011	0.0003	0.00081	0.00033	0.00081	0.00033	0.00081
Selenium	mg/L	0.03	0.046	0.0019	0.024	0.00079	0.0076	0.00074	0.0076
Silicon	mg/L	6.8	9.0	7.8	9.4	7.8	9.4	7.8	9.4
Silver	mg/L	0.000005	0.0000054	0.0000051	0.0000064	0.000005	0.0000059	0.000005	0.000005
Strontium	mg/L	6.6	10	0.24	1.3	0.17	0.59	0.15	0.59
Thallium	mg/L	0.00001	0.000016	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005

Table 16: Predicted Maximum Concentrations Wight Pit during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Tin	mg/L	0.00005	0.00005	0.000053	0.000086	0.000053	0.000085	0.000053	0.000086
Titanium	mg/L	0.0054	0.007	0.005	0.0078	0.005	0.0053	0.005	0.005
Uranium	mg/L	0.0029	0.0038	0.00033	0.0012	0.00027	0.00096	0.00023	0.00096
Vanadium	mg/L	0.0016	0.003	0.00042	0.0022	0.00033	0.0022	0.00033	0.0022
Zinc	mg/L	0.012	0.021	0.0038	0.0099	0.003	0.0099	0.0031	0.0099

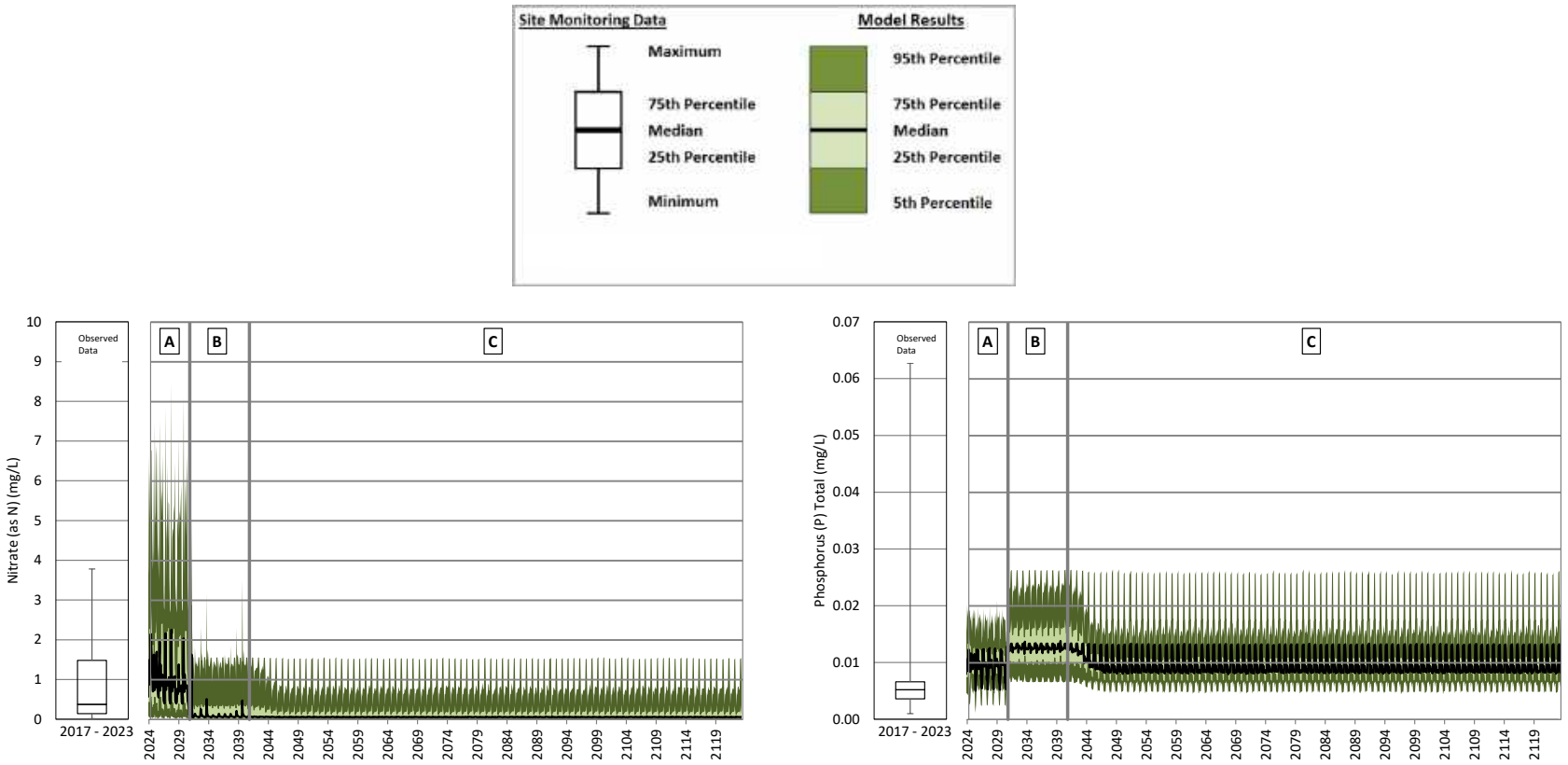
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

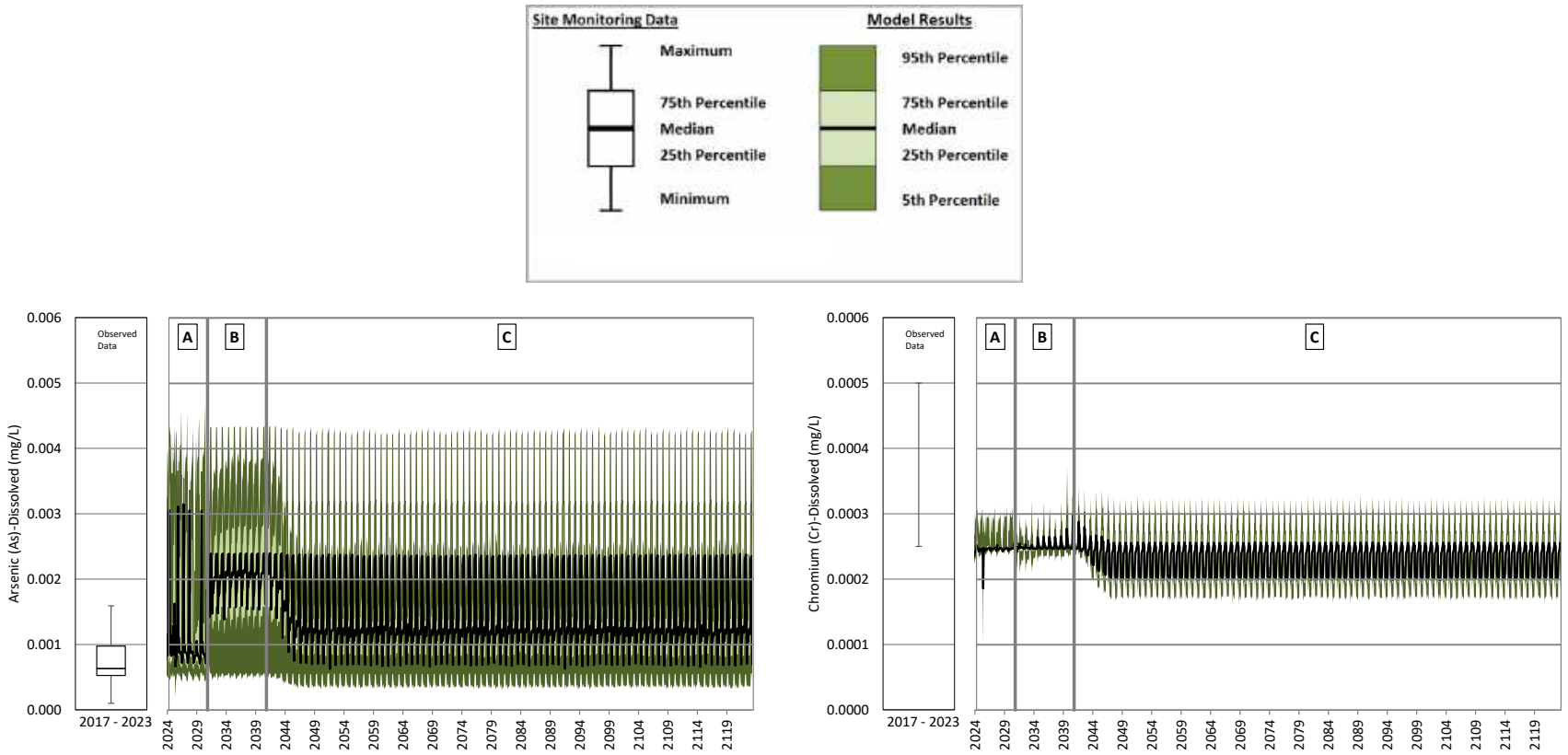
Figure 41: Predicted Sulphate and Total Ammonia Concentrations in Wight Pit – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

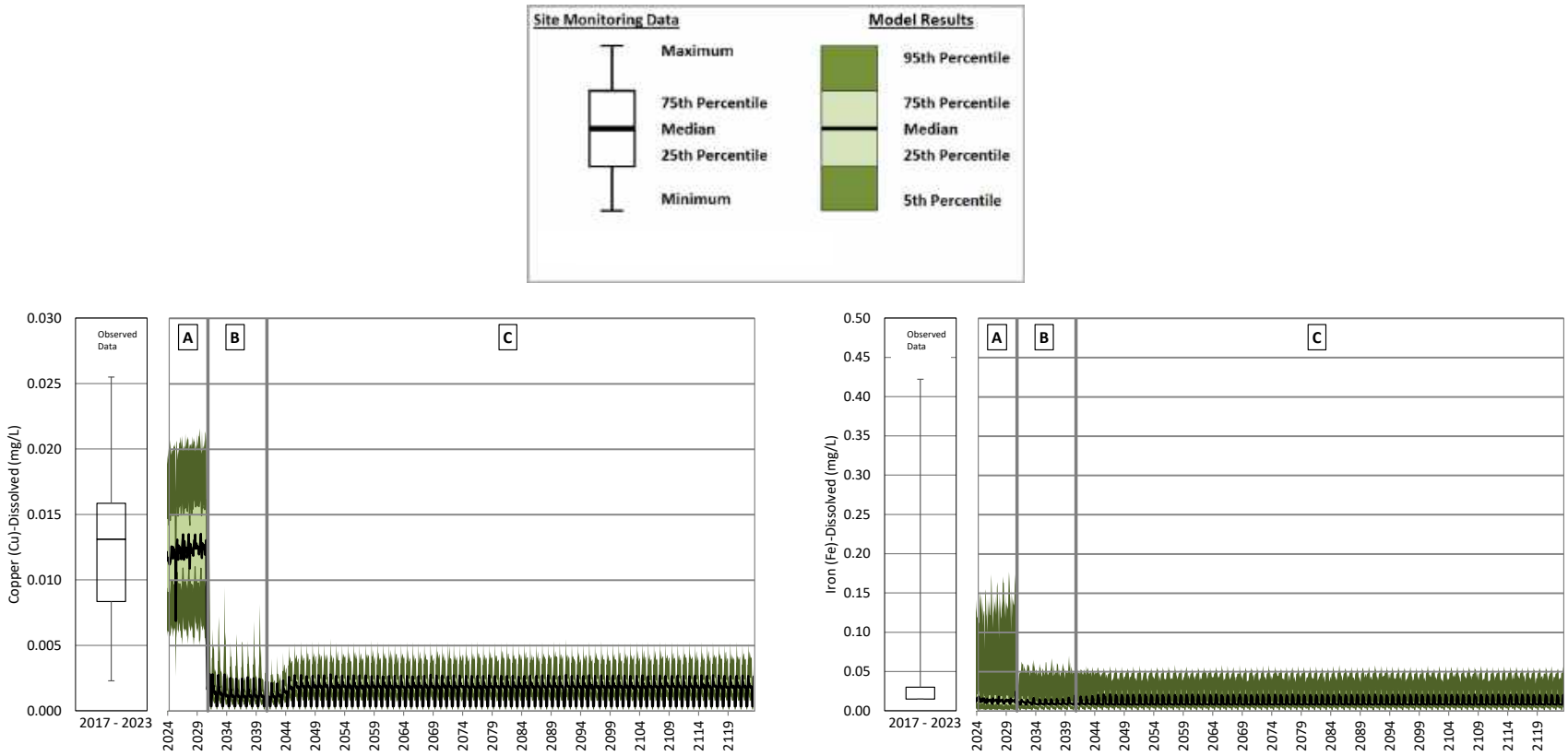
Figure 42: Predicted Nitrate and Total Phosphorus Concentrations in Wight Pit – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

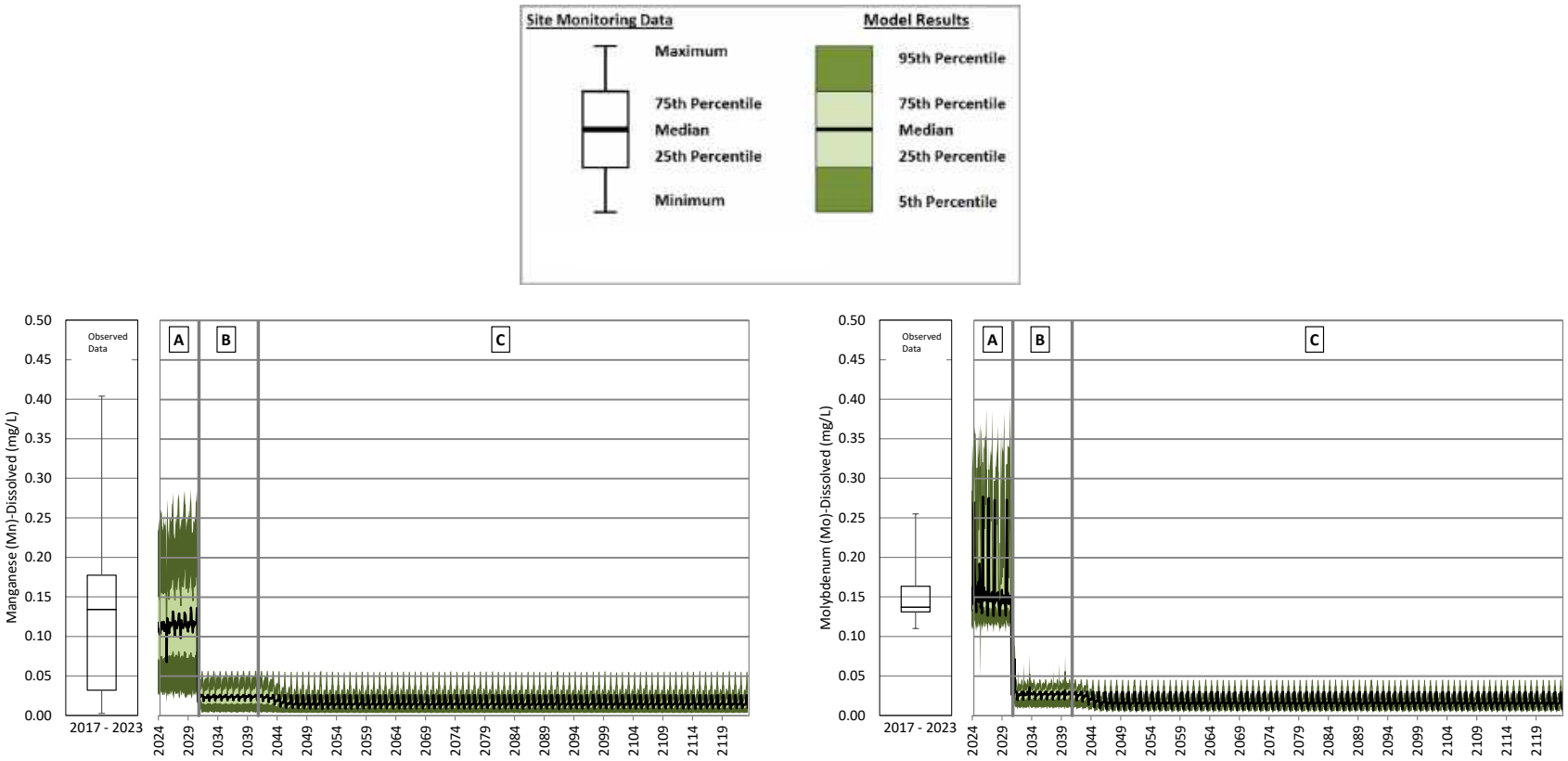
Figure 43: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in Wight Pit – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

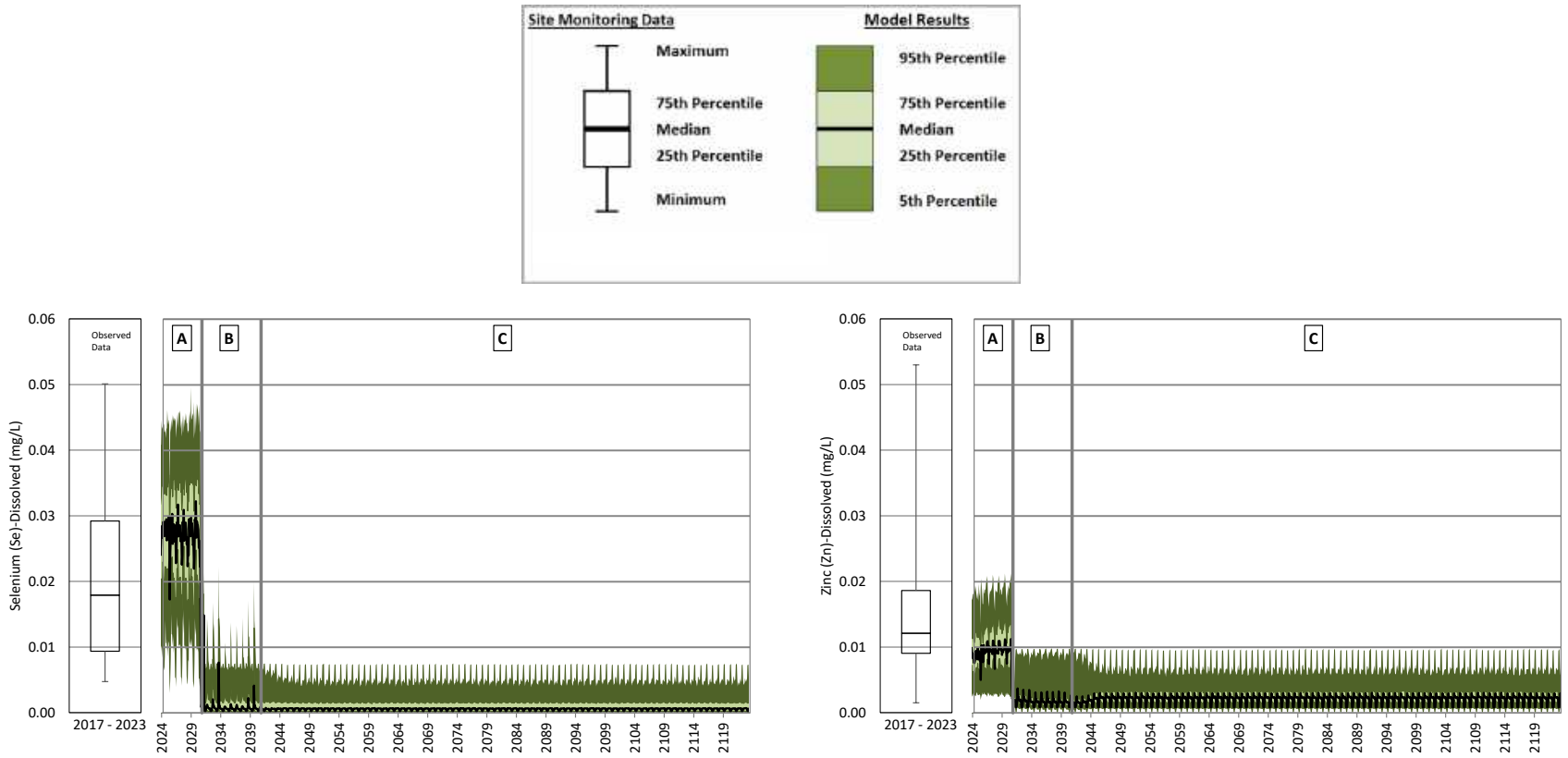
Figure 44: Predicted Dissolved Copper and Dissolved Iron Concentrations in Wight Pit – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 45: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in Wight Pit – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 46: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in Wight Pit – Operations, Closure and Post-closure

4.5 Long Ditch

In closure, the Long Ditch continues to receive flow from the SERDS Ditch and overflow from Bootjack Creek Sump (via SERDS Ditch). Discharge from the Long Ditch will be directed to Polley Lake, subject to water quality meeting requirements. The combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek includes the SERDS RDS, NEZ RDS, and East RDS along with haul roads, disturbed areas, and undisturbed catchment area. Tailings co-disposal to the SERDS location will include a soil cover during closure that will remediate runoff from the tailings deposition area which runs off into SERDS Ditch. However, seepage water quality from the SERDS tailings is assumed to remain unchanged through closure and post-closure. The proportion of seepage assigned tailings water quality is calculated based on the total proportions of tailings relative to waste rock deposited (3.5% tailings and 96.5% waste rock; MPMC 2022).

Time series plots for key parameters in Long Ditch for closure and post-closure are shown in Figures 46 to 48 for the climate change module results and in Figures 47 to 52. Maximum of median and 95th percentile predictions are presented in Table 17.

Peak concentrations in the Long Ditch are predicted to occur during operations, representing runoff and seepage from un-reclaimed RDS areas within the combined catchment area for the Long Ditch, the SERDS Ditch, and Bootjack Creek (Figures 47 to 52). These facilities are reclaimed throughout closure, at which point runoff is assigned undisturbed water quality (Table 9). Parameter concentrations in the Long Ditch are predicted to decrease through closure, reaching steady state conditions 10 years after the start of post-closure.

Seasonal peak concentrations in winter are driven by seepage from the RDS area within the watershed which is assigned the NAG water quality in perpetuity. During winter months, when precipitation occurs as snowfall, RDS seepage represents a higher proportion of the total flow to the Long Ditch and causes concentrations to peak.

Some parameters are predicted to have higher concentrations in post-closure than closure. These parameters have higher concentrations in the statistical distributions assigned to undisturbed runoff water quality than the statistical distributions assigned to NAG waste rock water quality. As more areas are reclaimed on the Mine site, undisturbed runoff water quality is assigned to more inflows into Bootjack Creek Sump, SERDS Ditch, and Long Ditch which causes concentrations of some parameters, such as aluminum, to increase.

Table 17: Predicted Maximum Concentrations in the Long Ditch during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	676	873	385	570	330	503	339	510
Total Dissolved Solids	mg/L	963	1,327	554	826	465	709	479	730
Major Ions									
Calcium	mg/L	216	263	116	173	92	137	95	139
Chloride	mg/L	17	25	2.7	12	3.0	8.9	3.1	9.0
Fluoride	mg/L	0.67	0.97	0.25	0.4	0.14	0.25	0.14	0.26
Magnesium	mg/L	33	52	23	34	24	39	25	39
Potassium	mg/L	16	23	1.0	4.8	1.4	1.9	1.4	1.9
Sodium	mg/L	65	88	18	27	10	15	10	15
Sulphate	mg/L	569	728	281	437	191	317	195	321
Nutrients									
Ammonia	mg/L (as N)	0.02	0.059	0.0044	0.044	0.0063	0.012	0.0063	0.012
Nitrate	mg/L (as N)	3.5	33	0.53	7.1	0.36	3.7	0.37	3.9
Nitrite	mg/L (as N)	0.056	0.081	0.0014	0.023	0.00084	0.0019	0.00085	0.0019
Total Phosphorus	mg/L	0.014	0.034	0.016	0.026	0.025	0.037	0.025	0.037
Total Metals									
Aluminum	mg/L	0.47	0.5	0.48	0.54	0.07	0.31	0.069	0.31
Antimony	mg/L	0.0012	0.0018	0.00012	0.00071	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0027	0.0037	0.002	0.0034	0.00095	0.0017	0.00096	0.0017
Barium	mg/L	0.052	0.076	0.023	0.056	0.017	0.025	0.017	0.026
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.4	0.2	0.41	0.03	0.047	0.03	0.048
Cadmium	mg/L	0.00024	0.00045	0.000028	0.00016	0.000024	0.0001	0.000025	0.00011
Chromium	mg/L	0.00064	0.00069	0.00075	0.00091	0.00088	0.0017	0.00088	0.0017
Cobalt	mg/L	0.00067	0.0015	0.00034	0.00072	0.000071	0.00044	0.000072	0.00046
Copper	mg/L	0.02	0.19	0.015	0.18	0.0056	0.019	0.0052	0.02
Iron	mg/L	0.48	0.6	0.5	0.56	0.14	0.45	0.14	0.46
Lead	mg/L	0.00014	0.00014	0.00013	0.00015	0.00002	0.00011	0.000019	0.00011
Lithium	mg/L	0.0083	0.013	0.003	0.0074	0.0022	0.0037	0.0022	0.0037
Manganese	mg/L	0.15	0.3	0.049	0.18	0.02	0.14	0.02	0.15
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058

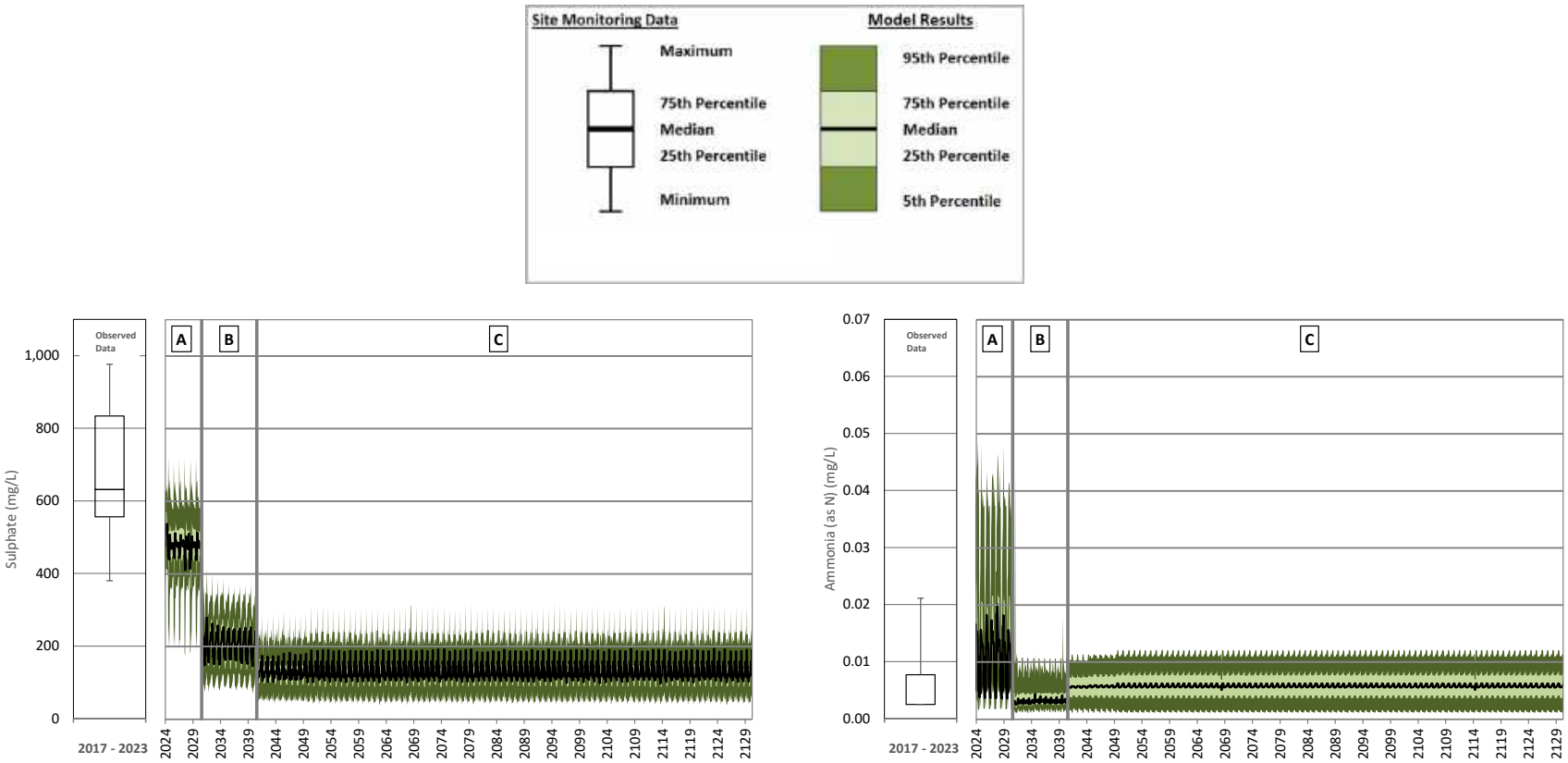
Table 17: Predicted Maximum Concentrations in the Long Ditch during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Molybdenum	mg/L	0.22	0.3	0.05	0.1	0.032	0.061	0.032	0.062
Nickel	mg/L	0.0011	0.0025	0.0011	0.0019	0.00098	0.0021	0.00098	0.0021
Selenium	mg/L	0.039	0.089	0.023	0.053	0.016	0.034	0.017	0.037
Silver	mg/L	0.0000054	0.000014	0.0000056	0.000014	0.0000071	0.00002	0.0000072	0.00002
Strontium	mg/L	5.7	9.2	1.1	2.3	0.97	1.7	0.97	1.7
Thallium	mg/L	0.0000094	0.000015	0.0000049	0.0000058	0.0000057	0.0000057	0.0000057	0.0000058
Tin	mg/L	0.000049	0.00014	0.000051	0.00015	0.000057	0.000057	0.000057	0.000058
Titanium	mg/L	0.026	0.026	0.025	0.026	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0037	0.00064	0.0022	0.00088	0.002	0.00089	0.0022
Vanadium	mg/L	0.0035	0.0044	0.0017	0.0028	0.00075	0.0013	0.00075	0.0013
Zinc	mg/L	0.013	0.021	0.0073	0.012	0.0029	0.0056	0.0012	0.0049
Dissolved Metals									
Aluminum	mg/L	0.016	0.046	0.025	0.08	0.042	0.19	0.041	0.19
Antimony	mg/L	0.0012	0.0017	0.0001	0.00057	0.000098	0.00023	0.0001	0.00023
Arsenic	mg/L	0.0025	0.0034	0.0017	0.0032	0.00092	0.0016	0.00093	0.0016
Barium	mg/L	0.05	0.067	0.021	0.048	0.016	0.024	0.017	0.025
Beryllium	mg/L	0.000049	0.000049	0.000049	0.000051	0.000057	0.000057	0.000057	0.000058
Boron	mg/L	0.25	0.37	0.19	0.38	0.03	0.045	0.03	0.046
Cadmium	mg/L	0.00024	0.0004	0.000025	0.00012	0.000023	0.000096	0.000024	0.00011
Chromium	mg/L	0.00026	0.00031	0.00037	0.00053	0.00077	0.0012	0.00077	0.0012
Cobalt	mg/L	0.00039	0.0013	0.000061	0.00044	0.000071	0.00036	0.000072	0.00038
Copper	mg/L	0.012	0.038	0.0065	0.021	0.0053	0.017	0.0049	0.019
Iron	mg/L	0.037	0.15	0.051	0.12	0.095	0.27	0.095	0.27
Lead	mg/L	0.000024	0.000029	0.000024	0.000043	0.00002	0.00009	0.000019	0.00009
Lithium	mg/L	0.0081	0.012	0.0028	0.0064	0.0022	0.0035	0.0022	0.0036
Manganese	mg/L	0.13	0.27	0.028	0.16	0.016	0.12	0.016	0.13
Mercury	mg/L	0.0000049	0.0000049	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058
Molybdenum	mg/L	0.22	0.29	0.049	0.091	0.032	0.061	0.032	0.061
Nickel	mg/L	0.00058	0.0019	0.00051	0.0013	0.00091	0.0018	0.00091	0.0018
Selenium	mg/L	0.039	0.083	0.023	0.047	0.016	0.034	0.017	0.037
Silicon	mg/L	6.7	8.5	7.0	8.2	6.7	9.1	6.7	9.1
Silver	mg/L	0.0000054	0.0000084	0.0000056	0.0000078	0.0000071	0.000014	0.0000072	0.000014
Strontium	mg/L	5.6	8.8	1.1	2.0	0.97	1.6	0.97	1.7
Thallium	mg/L	0.0000094	0.000014	0.0000049	0.0000051	0.0000057	0.0000057	0.0000057	0.0000058

Table 17: Predicted Maximum Concentrations in the Long Ditch during Operations, Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Tin	mg/L	0.000049	0.000055	0.000051	0.000073	0.000057	0.000057	0.000057	0.000058
Titanium	mg/L	0.0068	0.0076	0.0059	0.0074	0.0065	0.0093	0.0065	0.0094
Uranium	mg/L	0.0026	0.0034	0.00061	0.0019	0.00088	0.0019	0.00089	0.0021
Vanadium	mg/L	0.0023	0.0032	0.00047	0.0016	0.0006	0.00092	0.0006	0.00092
Zinc	mg/L	0.01	0.018	0.0046	0.009	0.0029	0.0056	0.0012	0.0049

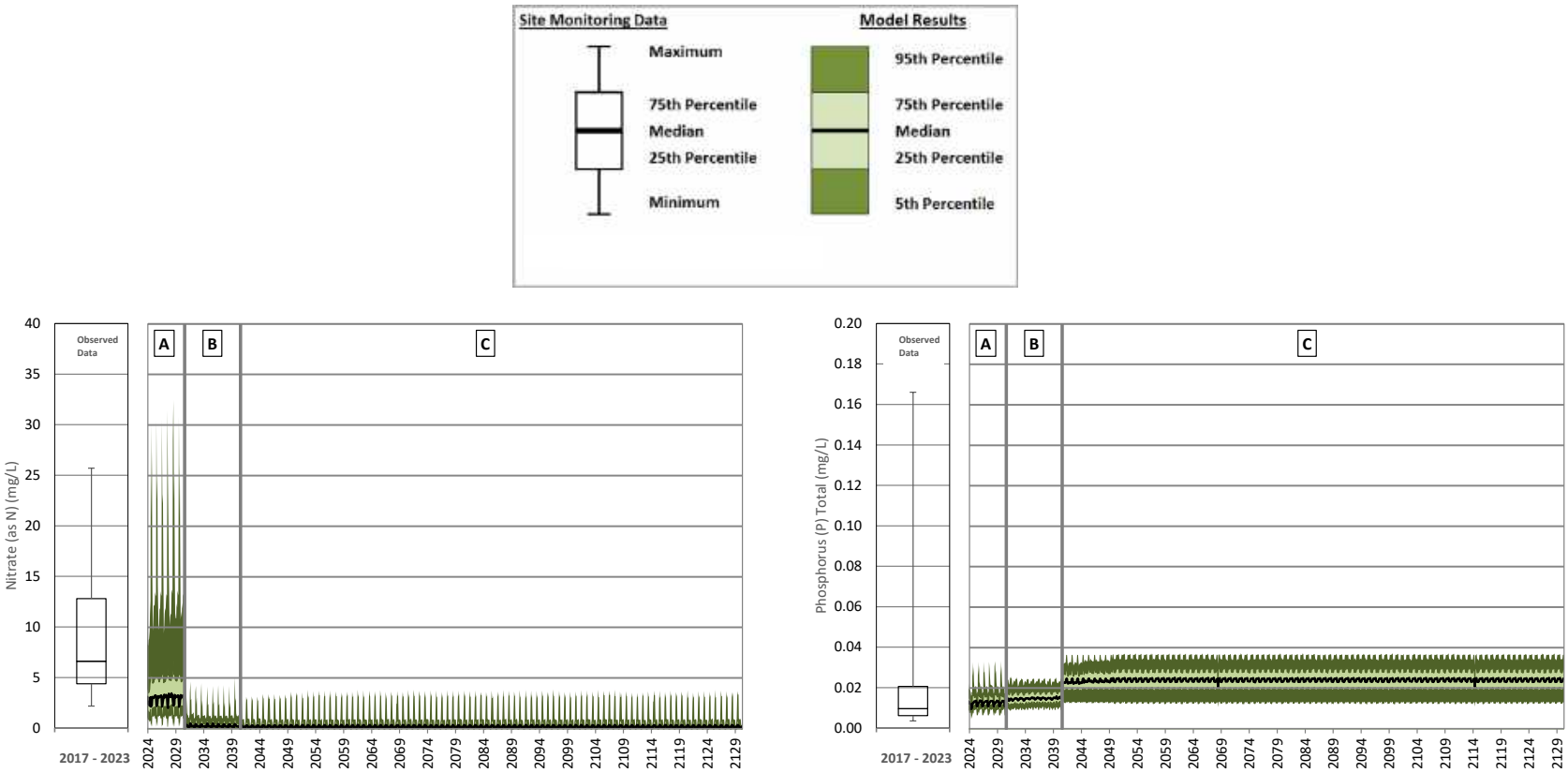
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

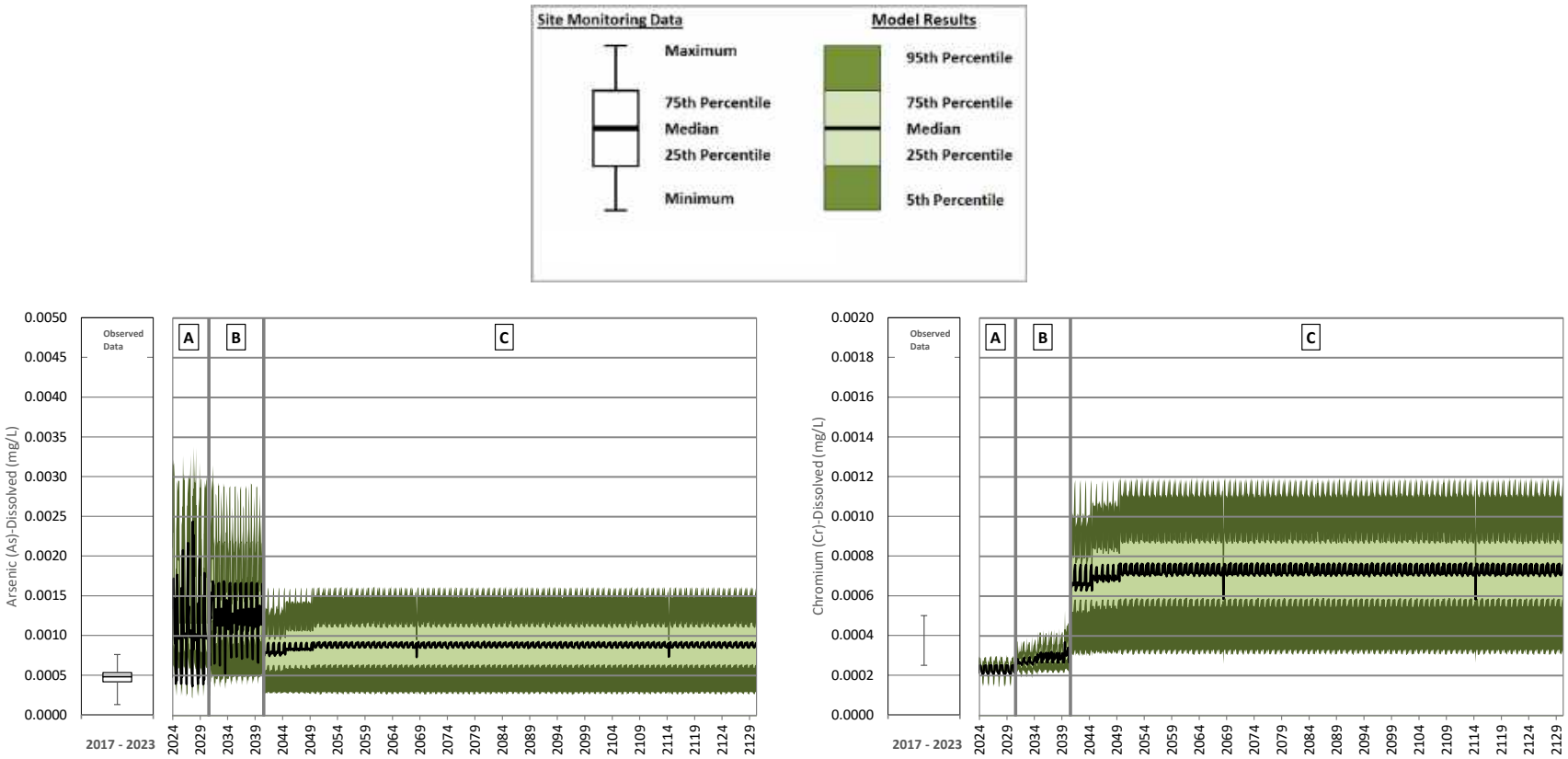
Figure 47: Predicted Sulphate and Total Ammonia Concentrations in Long Ditch – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

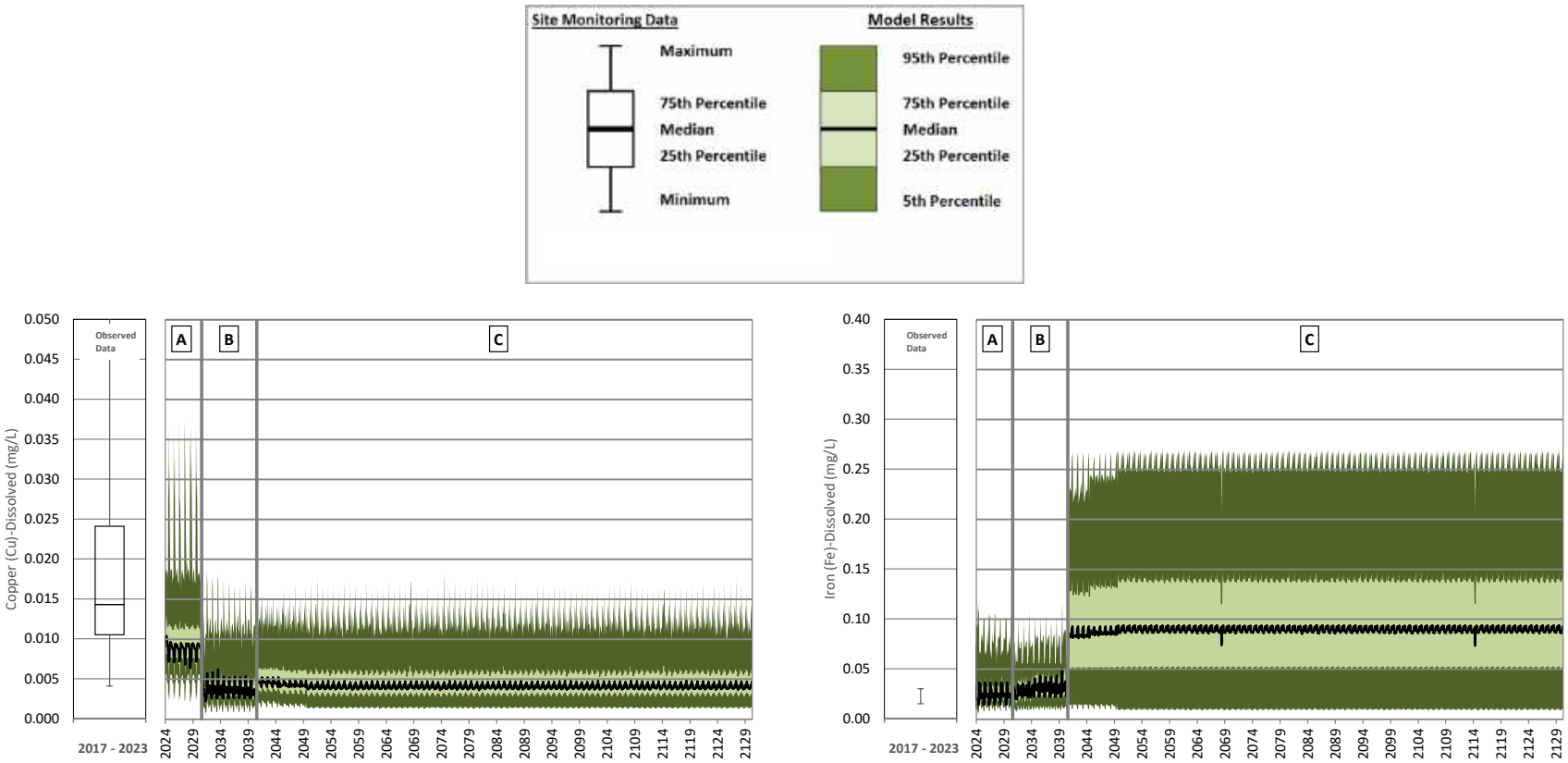
Figure 48: Predicted Nitrate and Total Phosphorus Concentrations in Long Ditch – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

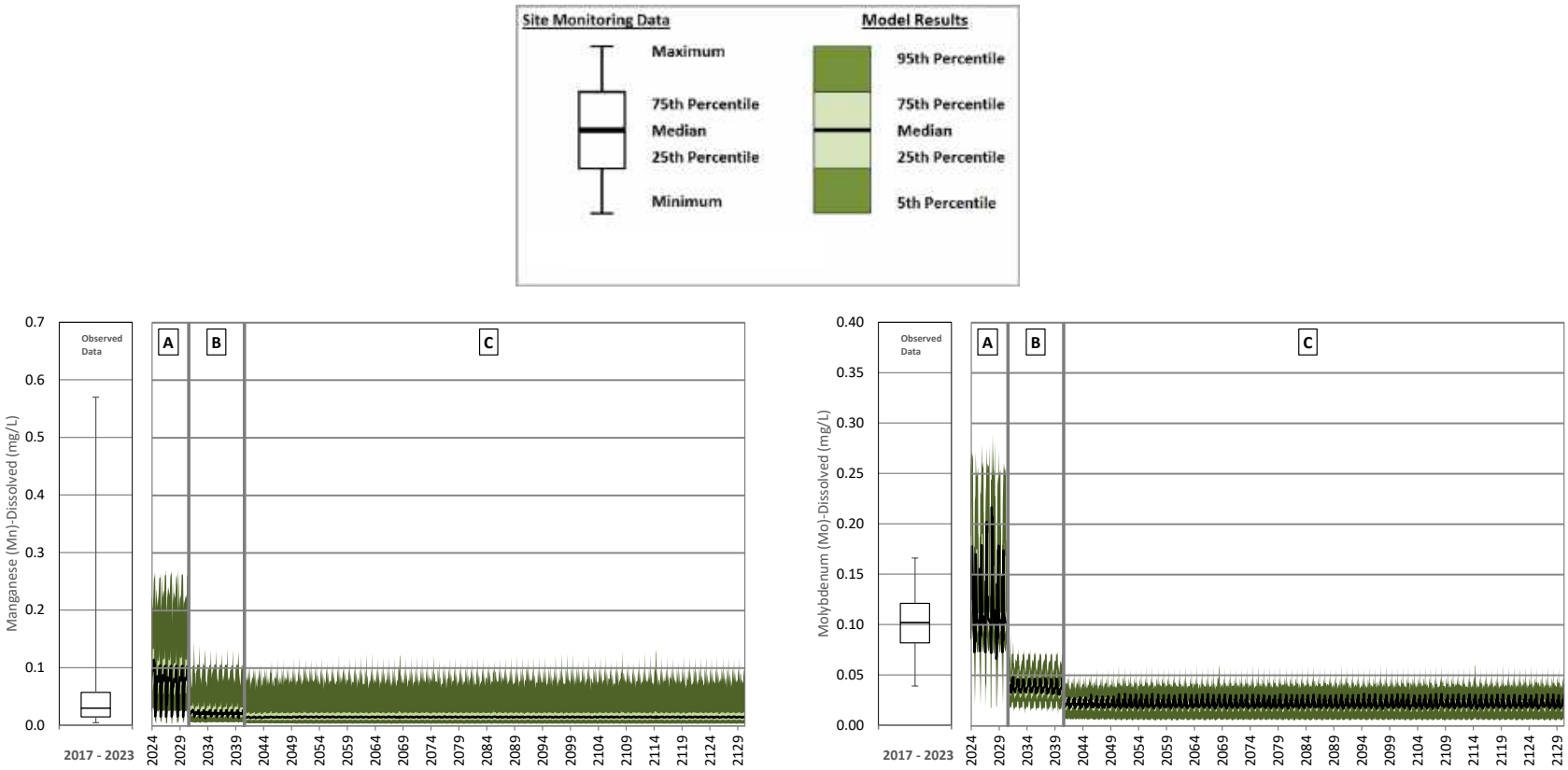
Figure 49: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in Long Ditch – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

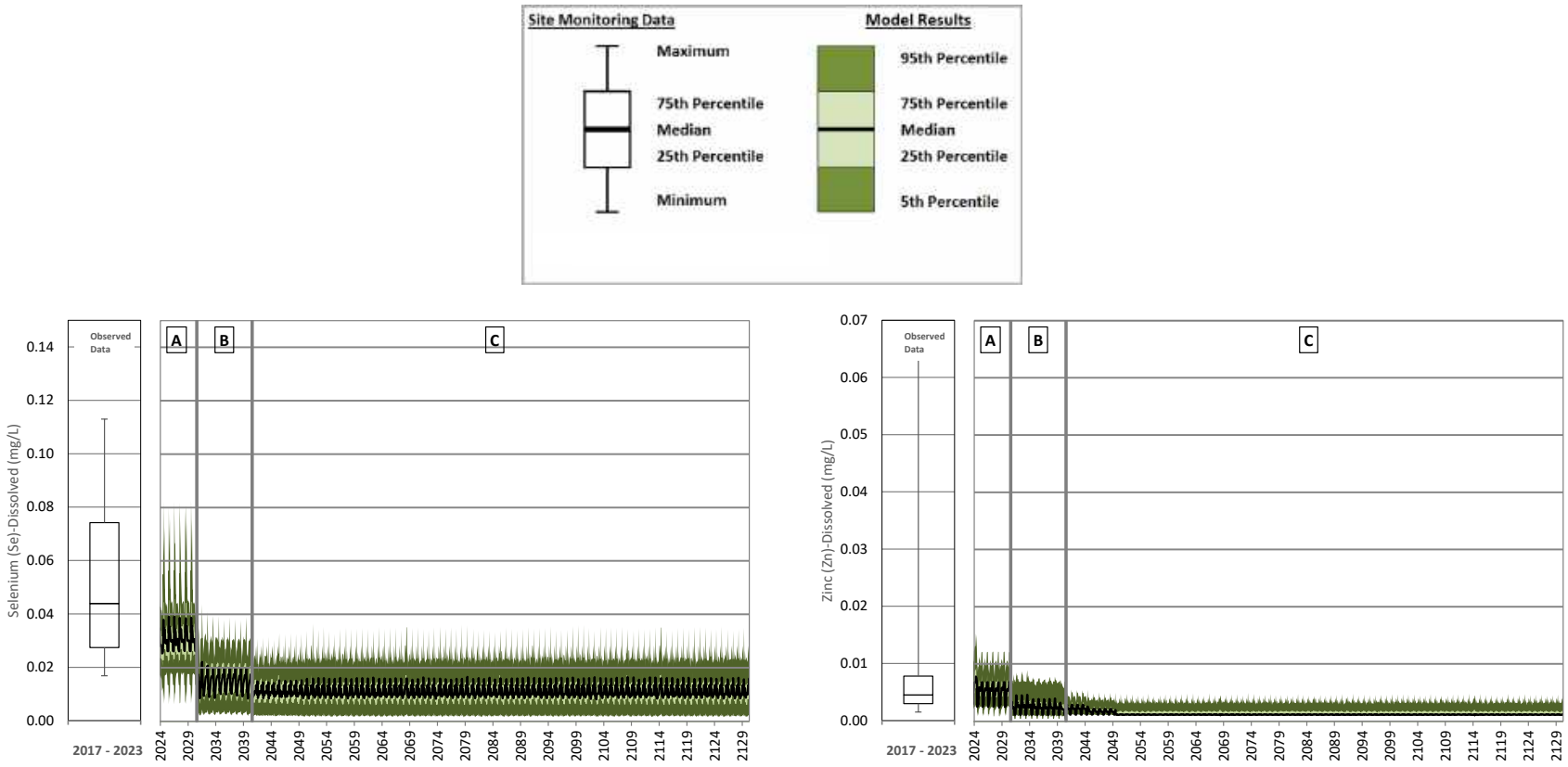
Figure 50: Predicted Dissolved Copper and Dissolved Iron Concentrations in Long Ditch – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 51: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in Long Ditch – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure 52: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in Long Ditch – Operations, Closure and Post-closure

4.5.1 South Embankment Seepage Collection Pond

The SWWBM assumes that the SESCP has a small catchment area and receives mostly TSF seepage in closure. Time series plots for key parameters in SESCP for operations, closure and post-closure are shown in Figures 53 to 58. Maximum of median and 95th percentile predictions are presented in Table 18.

For most parameters, the predicted peak concentrations in the SESCP occur during operations, and then decrease as TSF beach and impoundment areas are reclaimed during closure and post-closure. Water quality is predicted to reach steady-state conditions by 2074, after the TSF surface has been reclaimed. Because the saturated TSF seepage is assumed to be the same water quality as the TSF beach, impoundment, and embankment areas, the decrease in SESCP concentrations is coincident with the decrease in parameter concentrations in the TSF beach and impoundment.

The assigned TSF beach, impoundment and embankment water quality changes from the TSF supernatant input to undisturbed water quality during the closure period causing the decrease in concentration in the TSF. As TSF concentrations decrease, concentrations in the SESCP decrease due to saturated seepage from the TSF. The increase in concentrations until 2074 is due to a proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility. While the range in predicted concentrations is considered reasonable, the timing of this transition is uncertain because the amount of time it may take to flush process water from the tailings is unknown.

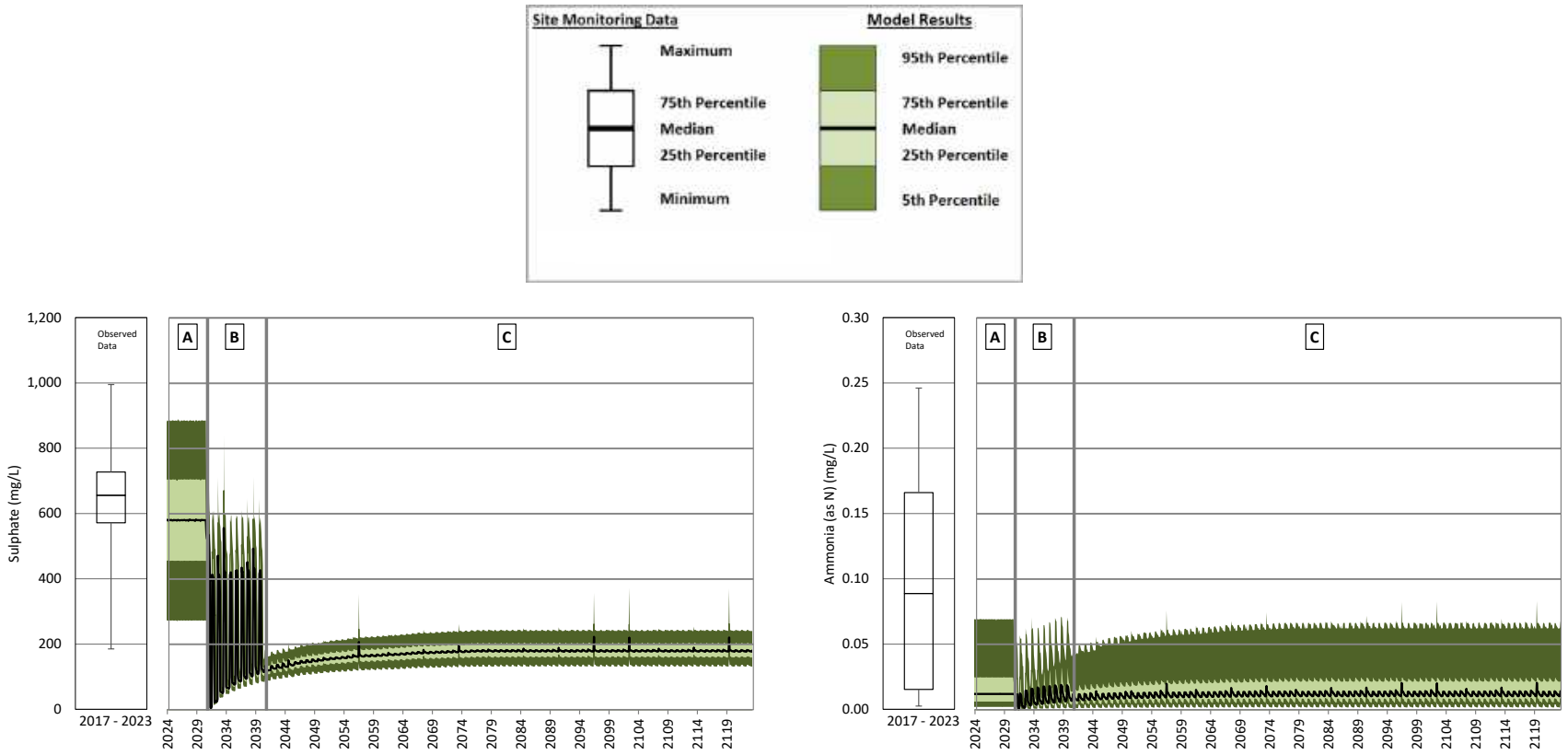
Table 18: Predicted Maximum Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	744	1,103	683	1,019	298	529	580	864
Total Dissolved Solids	mg/L	1,079	1,618	1,018	1,509	490	785	915	1,307
Major Ions									
Calcium	mg/L	221	321	206	300	81	139	172	254
Chloride	mg/L	2.3	13	6.5	13	7.3	12	9.1	15
Fluoride	mg/L	0.32	0.44	0.4	0.51	0.3	0.45	0.45	0.58
Magnesium	mg/L	46	73	41	65	23	44	36	56
Potassium	mg/L	1.7	2.6	4.0	4.9	4.4	5.6	5.3	6.7
Sodium	mg/L	16	25	29	38	29	37	37	46
Sulphate	mg/L	586	897	560	845	156	208	224	375
Nutrients									
Ammonia	mg/L (as N)	0.012	0.07	0.019	0.072	0.014	0.057	0.021	0.084
Nitrate	mg/L (as N)	2.2	10	2.4	8.4	0.71	2.9	1.2	4.1
Nitrite	mg/L (as N)	0.0051	0.026	0.011	0.059	0.0063	0.07	0.0097	0.084
Total Phosphorus	mg/L	0.0092	0.028	0.012	0.026	0.014	0.027	0.016	0.029
Total Metals									
Aluminum	mg/L	0.46	0.46	0.46	0.46	0.03	0.12	0.03	0.12
Antimony	mg/L	0.00026	0.00044	0.00029	0.00049	0.00018	0.00029	0.00028	0.0004
Arsenic	mg/L	0.0007	0.00084	0.00099	0.0012	0.00084	0.0011	0.00092	0.0012
Barium	mg/L	0.034	0.048	0.039	0.053	0.029	0.042	0.04	0.052
Beryllium	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.042	0.088	0.062	0.1	0.054	0.073	0.069	0.089
Cadmium	mg/L	0.00011	0.00027	0.00008	0.00019	0.000026	0.000093	0.000057	0.00016
Chromium	mg/L	0.00063	0.00063	0.00064	0.0007	0.00037	0.00085	0.00037	0.00087
Cobalt	mg/L	0.00033	0.00033	0.00036	0.00047	0.000088	0.00031	0.000097	0.00035
Copper	mg/L	0.027	0.18	0.023	0.18	0.0046	0.011	0.011	0.02
Iron	mg/L	0.46	0.46	0.46	0.46	0.056	0.2	0.055	0.2
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000024	0.00005	0.000026	0.000052
Lithium	mg/L	0.0099	0.016	0.0098	0.015	0.0038	0.007	0.0073	0.012
Manganese	mg/L	0.037	0.11	0.092	0.16	0.086	0.18	0.11	0.22
Mercury	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.31	0.46	0.31	0.42	0.051	0.079	0.074	0.11
Nickel	mg/L	0.00088	0.0011	0.00088	0.0011	0.0004	0.00081	0.0004	0.00081
Selenium	mg/L	0.11	0.19	0.076	0.15	0.0038	0.012	0.007	0.018
Silver	mg/L	0.000005	0.000011	0.000005	0.000011	0.000005	0.000012	0.000005	0.000012

Table 18: Predicted Maximum Concentrations in the South Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Strontium	mg/L	4.6	7.2	3.8	6.2	0.82	1.5	2.1	4.1
Thallium	mg/L	0.000005	0.0000057	0.000005	0.0000058	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00013	0.00005	0.00013	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.024	0.024	0.024	0.025	0.0051	0.0065	0.0053	0.0069
Uranium	mg/L	0.004	0.0068	0.0032	0.0059	0.0012	0.0027	0.0025	0.0043
Vanadium	mg/L	0.0014	0.0014	0.0015	0.0016	0.0005	0.00094	0.00052	0.00099
Zinc	mg/L	0.0066	0.015	0.0059	0.0096	0.0017	0.0029	0.0029	0.0071
Dissolved Metals									
Aluminum	mg/L	0.0023	0.0068	0.0024	0.0067	0.0023	0.0059	0.0023	0.0056
Antimony	mg/L	0.00024	0.0003	0.00027	0.00035	0.00018	0.00029	0.00028	0.0004
Arsenic	mg/L	0.00042	0.00057	0.00071	0.00089	0.00081	0.0010	0.00089	0.0011
Barium	mg/L	0.032	0.039	0.037	0.044	0.028	0.041	0.04	0.051
Beryllium	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.00005	0.00005	0.00005
Boron	mg/L	0.038	0.057	0.058	0.074	0.054	0.071	0.069	0.087
Cadmium	mg/L	0.0001	0.00022	0.000077	0.00015	0.000025	0.000085	0.000055	0.00015
Chromium	mg/L	0.00025	0.00025	0.00026	0.00031	0.00026	0.00033	0.00026	0.00035
Cobalt	mg/L	0.00005	0.00005	0.000078	0.00019	0.000088	0.00024	0.000097	0.00027
Copper	mg/L	0.018	0.027	0.014	0.023	0.0043	0.0098	0.011	0.019
Iron	mg/L	0.015	0.015	0.015	0.015	0.012	0.012	0.011	0.011
Lead	mg/L	0.000025	0.000025	0.000026	0.00003	0.000024	0.00003	0.000026	0.000032
Lithium	mg/L	0.0097	0.015	0.0096	0.014	0.0038	0.0068	0.0073	0.012
Manganese	mg/L	0.016	0.088	0.07	0.14	0.082	0.16	0.1	0.21
Mercury	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Molybdenum	mg/L	0.31	0.45	0.3	0.41	0.051	0.078	0.074	0.11
Nickel	mg/L	0.00034	0.00056	0.00034	0.00053	0.00033	0.00049	0.00033	0.0005
Selenium	mg/L	0.11	0.19	0.076	0.14	0.0038	0.012	0.007	0.018
Silicon	mg/L	4.7	7.0	4.9	6.9	5.1	6.8	5.2	6.8
Silver	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Strontium	mg/L	4.6	6.8	3.8	5.9	0.82	1.5	2.1	4.0
Thallium	mg/L	0.000005	0.000005	0.000005	0.0000051	0.000005	0.000005	0.000005	0.000005
Tin	mg/L	0.00005	0.00005	0.00005	0.000051	0.00005	0.00005	0.00005	0.00005
Titanium	mg/L	0.005	0.005	0.0051	0.0062	0.0051	0.0065	0.0053	0.0069
Uranium	mg/L	0.004	0.0066	0.0032	0.0056	0.0012	0.0026	0.0025	0.0043
Vanadium	mg/L	0.00025	0.00025	0.00033	0.00047	0.00035	0.00054	0.00037	0.0006
Zinc	mg/L	0.0039	0.012	0.0033	0.007	0.0017	0.0029	0.0029	0.0071

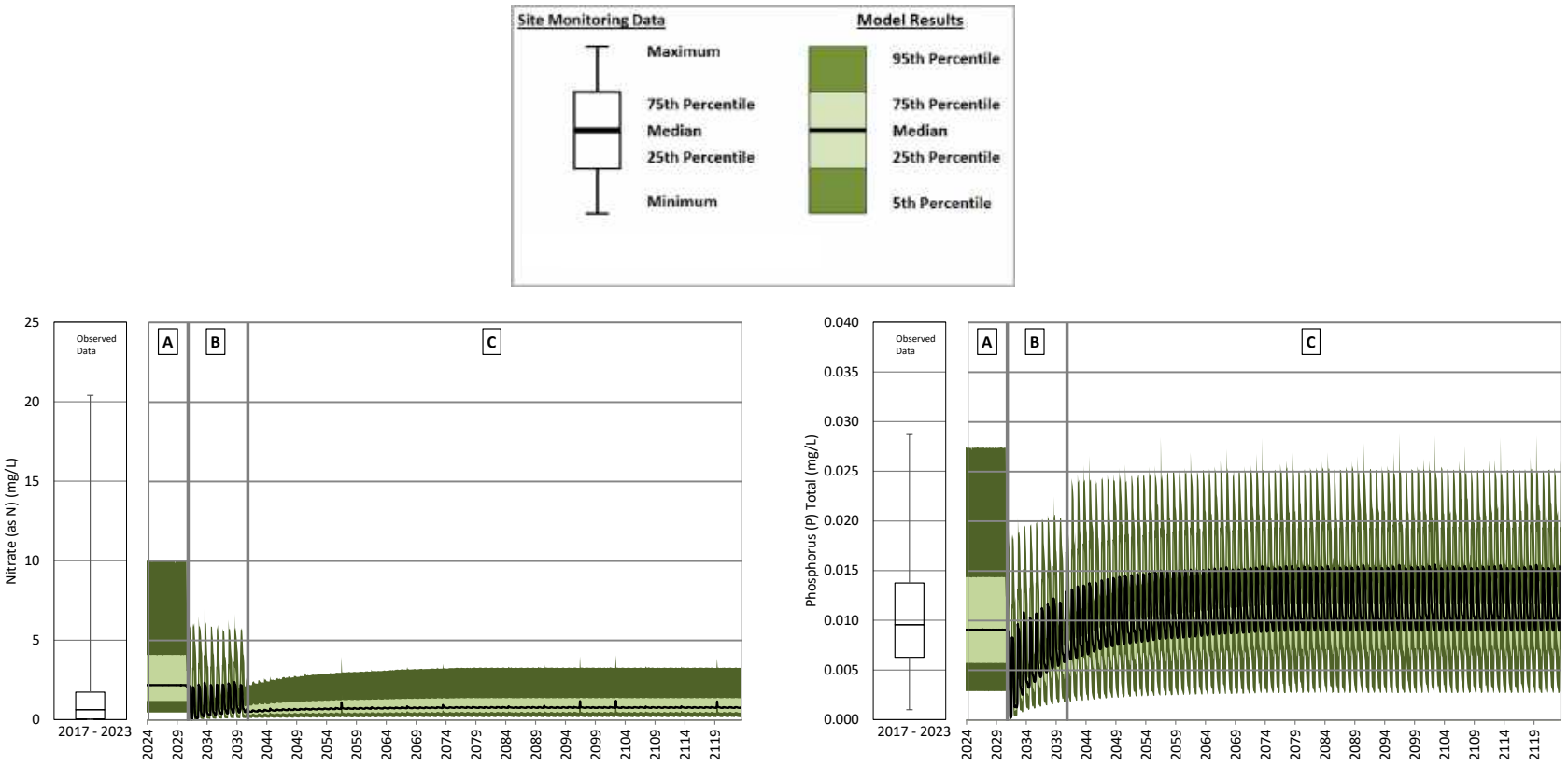
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

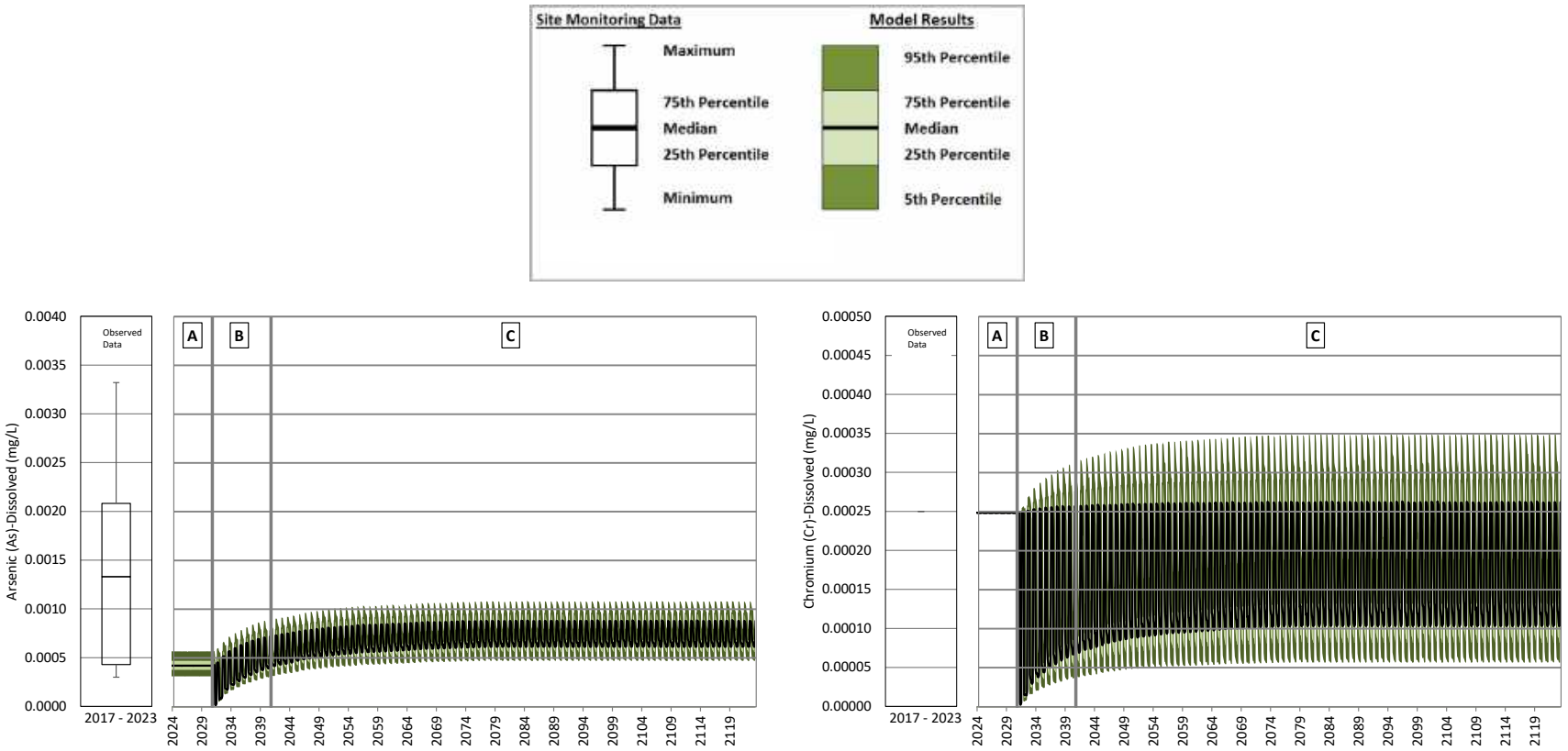
Figure 53: Predicted Sulphate and Total Ammonia Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

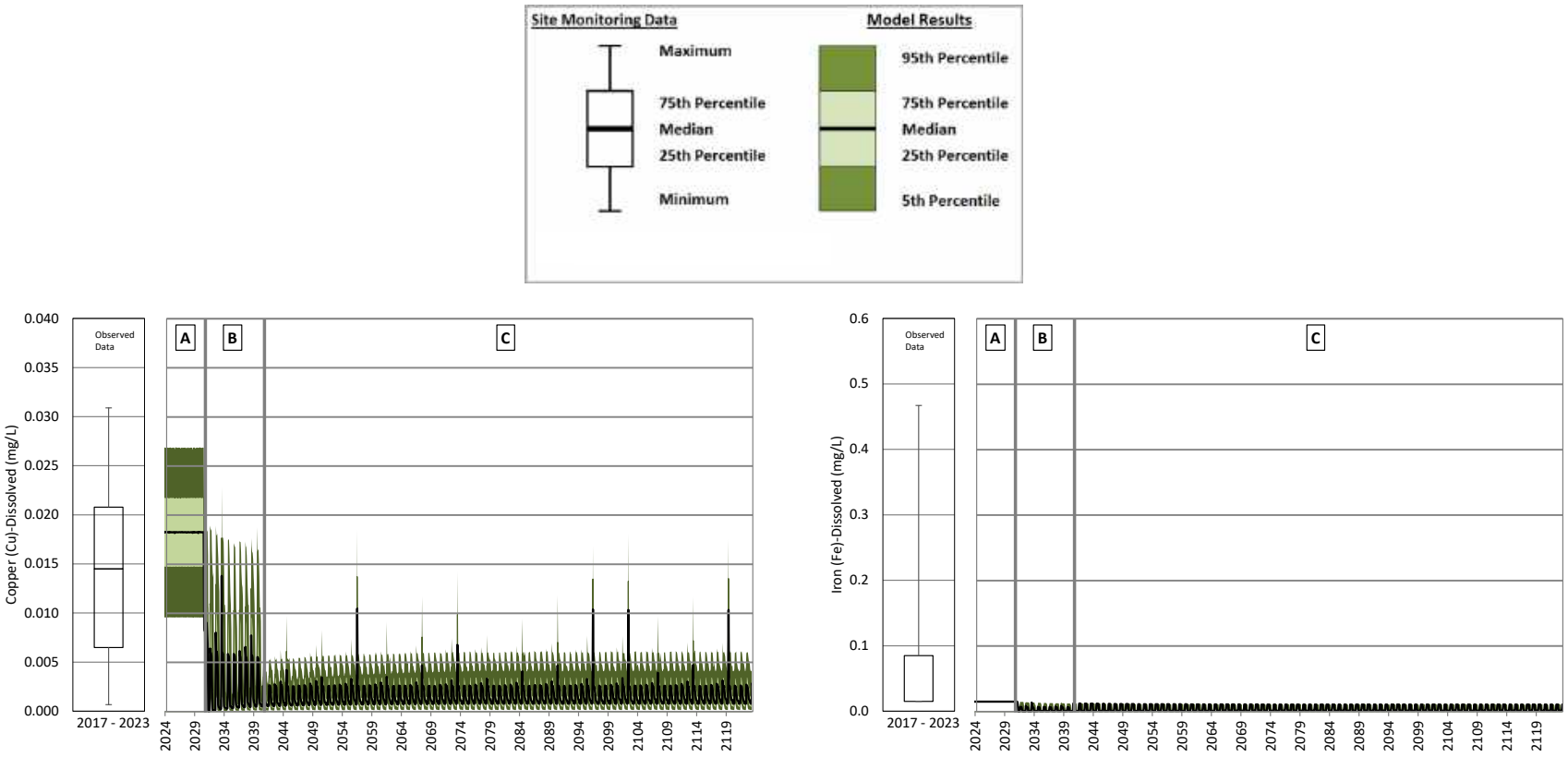
Figure 54: Predicted Nitrate and Total Phosphorus Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

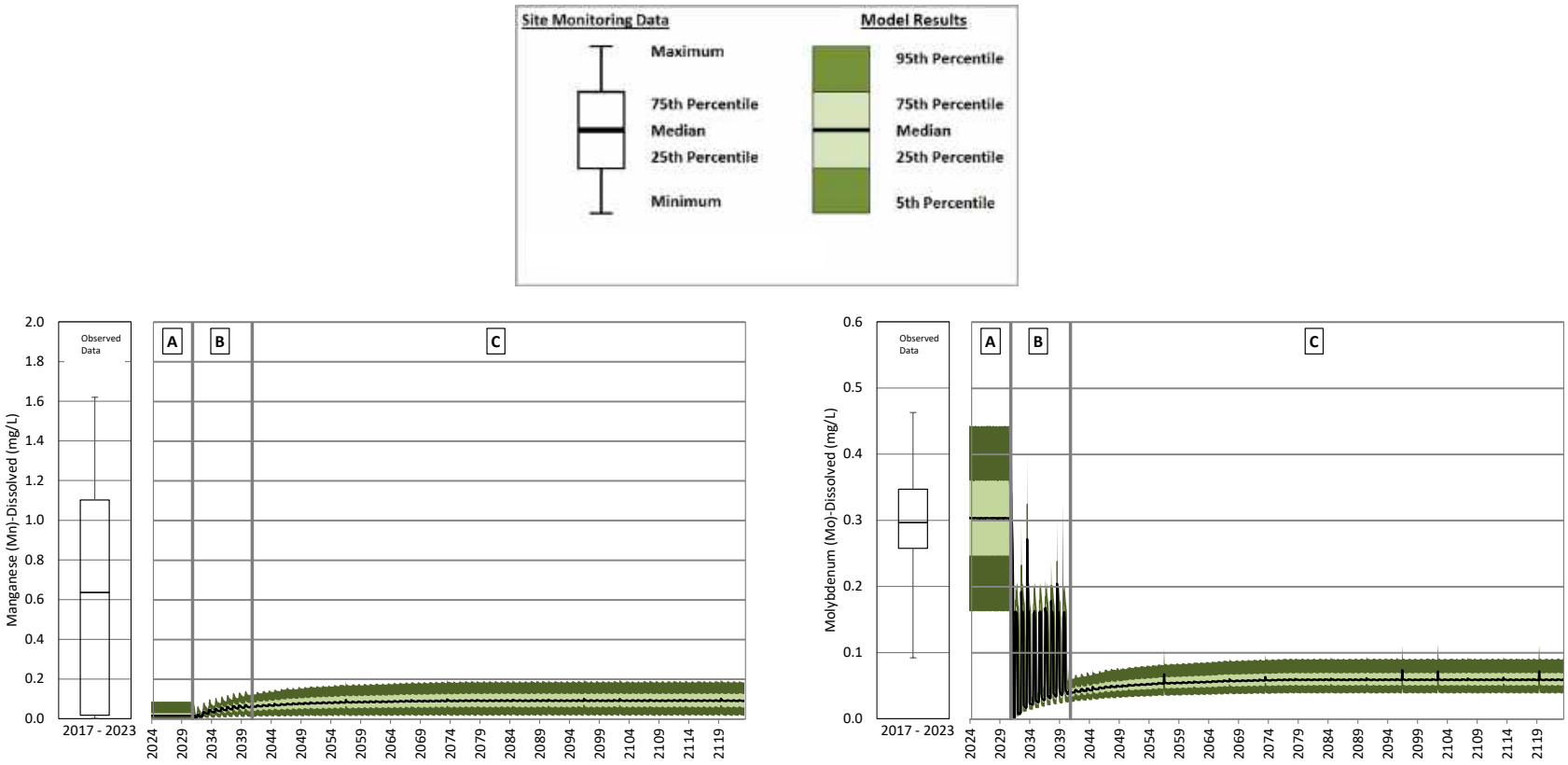
Figure 55: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

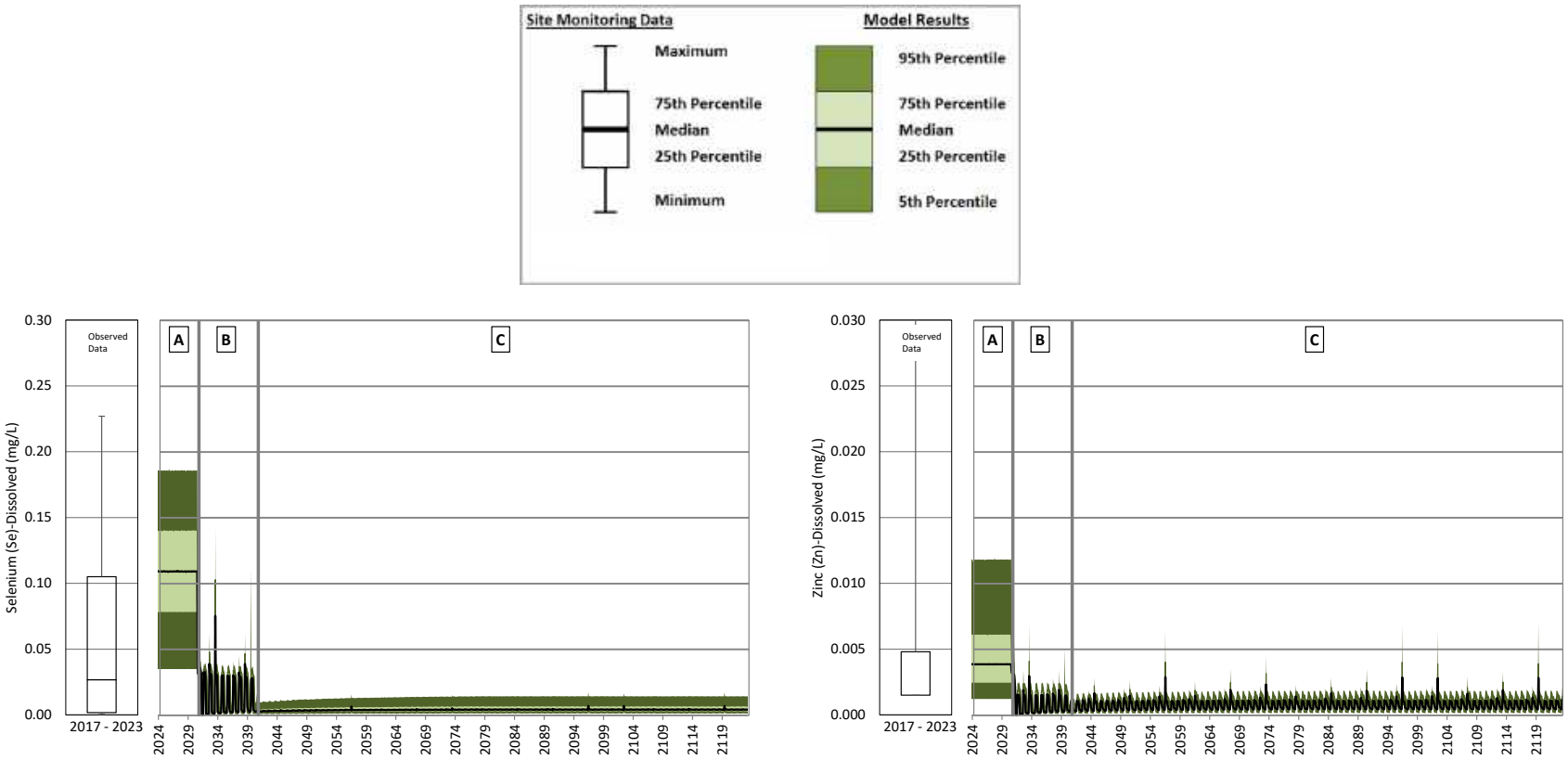
Figure 56: Predicted Dissolved Copper and Dissolved Iron Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 57: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2074 when the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility reaches a steady state.

Figure 58: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the South Embankment Seepage Collection Pond – Operations, Closure and Post-closure

4.5.2 Main Embankment Seepage Collection Pond

The SWWBM assumes that the MESCP has minimal surface catchment area from TSF area and undisturbed catchment area and receives mostly TSF seepage in closure. Discharge from the MESCP will be directed to upper Edney Creek. Time series plots for key parameters in MESCP for operations, closure and post-closure are shown in Figures 59 to 64. Maximum of median and 95th percentile predictions are presented in Table 19.

For most parameters, peak concentrations in the MESCP occur during operations, and then are predicted to decrease once mine site areas are reclaimed (Figures 59 to 64). Reclaimed areas of the TSF beach and impoundment are assigned an undisturbed water quality. The increase in concentration until 2051 for most parameters in the MESCP is caused by pumping from the SESCP. Pumping from the SESCP to the MESCP ends in 2051. Similar to the SESCP, the range in predicted concentrations is considered reasonable. However, the timing is uncertain because the amount of time it might take to flush process water from the tailings is unknown.

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Physical Parameters									
Hardness[a]	mg $CaCO_3$/L	641	800	469	681	331	562	153	254
Total Dissolved Solids	mg/L	950	1,216	753	1,046	516	819	215	314
Major Ions									
Calcium	mg/L	196	240	143	203	91	155	37	57
Chloride	mg/L	24	28	6.2	13	7.1	11	4.5	9.9
Fluoride	mg/L	0.86	0.97	0.39	0.51	0.3	0.41	0.15	0.21
Magnesium	mg/L	36	49	27	42	25	43	15	27
Potassium	mg/L	23	25	4.2	7.3	4.2	5.4	2.3	3.1
Sodium	mg/L	90	97	28	36	27	34	15	19
Sulphate	mg/L	614	757	469	626	153	205	82	119
Nutrients									
Ammonia	mg/L (as N)	0.031	0.057	0.04	0.08	0.013	0.057	0.0073	0.032
Nitrate	mg/L (as N)	3.6	15	2.9	6.3	0.68	2.8	0.37	1.5
Nitrite	mg/L (as N)	0.079	0.092	0.02	0.057	0.0061	0.067	0.0032	0.035
Total Phosphorus	mg/L	0.014	0.025	0.014	0.022	0.015	0.025	0.025	0.038
Total Metals									
Aluminum	mg/L	0.47	0.49	0.47	0.52	0.037	0.15	0.072	0.33
Antimony	mg/L	0.0016	0.0019	0.00056	0.001	0.00018	0.00026	0.000076	0.00013
Arsenic	mg/L	0.0037	0.004	0.00098	0.0013	0.00085	0.0011	0.001	0.0019
Barium	mg/L	0.069	0.083	0.038	0.053	0.029	0.038	0.013	0.02
Beryllium	mg/L	0.000052	0.000054	0.000051	0.000053	0.000051	0.000051	0.000055	0.000059

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Boron	mg/L	0.13	0.2	0.071	0.11	0.05	0.065	0.028	0.037
Cadmium	mg/L	0.00014	0.00025	0.000058	0.00015	0.000029	0.000091	0.000012	0.000052
Chromium	mg/L	0.00066	0.00069	0.00067	0.00073	0.00044	0.00094	0.00096	0.0019
Cobalt	mg/L	0.00047	0.00075	0.00036	0.00046	0.000086	0.00031	0.000063	0.00021
Copper	mg/L	0.022	0.18	0.02	0.17	0.0057	0.013	0.003	0.0071
Iron	mg/L	0.47	0.51	0.46	0.53	0.067	0.24	0.15	0.5
Lead	mg/L	0.00014	0.00014	0.00014	0.00014	0.000023	0.000054	0.000017	0.00012
Lithium	mg/L	0.013	0.016	0.0091	0.014	0.0041	0.0076	0.0018	0.0032
Manganese	mg/L	0.093	0.18	0.088	0.16	0.084	0.17	0.047	0.1
Mercury	mg/L	0.0000052	0.0000054	0.0000051	0.0000053	0.0000051	0.0000051	0.0000055	0.0000059
Molybdenum	mg/L	0.38	0.45	0.26	0.35	0.05	0.077	0.027	0.043
Nickel	mg/L	0.001	0.0017	0.00092	0.0011	0.00047	0.00091	0.00099	0.0022
Selenium	mg/L	0.064	0.1	0.057	0.1	0.0038	0.012	0.002	0.0069
Silver	mg/L	0.0000056	0.000013	0.0000051	0.000012	0.0000051	0.000013	0.0000067	0.000021
Strontium	mg/L	4.1	5.8	2.6	4.1	0.89	1.6	0.35	0.73
Thallium	mg/L	0.0000064	0.0000086	0.0000051	0.000006	0.0000051	0.0000051	0.0000055	0.0000059
Tin	mg/L	0.000052	0.00013	0.000051	0.00013	0.000051	0.000051	0.000055	0.000059
Titanium	mg/L	0.025	0.026	0.024	0.027	0.005	0.0064	0.0052	0.0087
Uranium	mg/L	0.0027	0.0041	0.0022	0.0038	0.0014	0.0028	0.00065	0.0014
Vanadium	mg/L	0.0044	0.0046	0.0018	0.0023	0.00053	0.00095	0.00075	0.0014
Zinc	mg/L	0.0084	0.013	0.0068	0.01	0.0021	0.0036	0.0011	0.0014

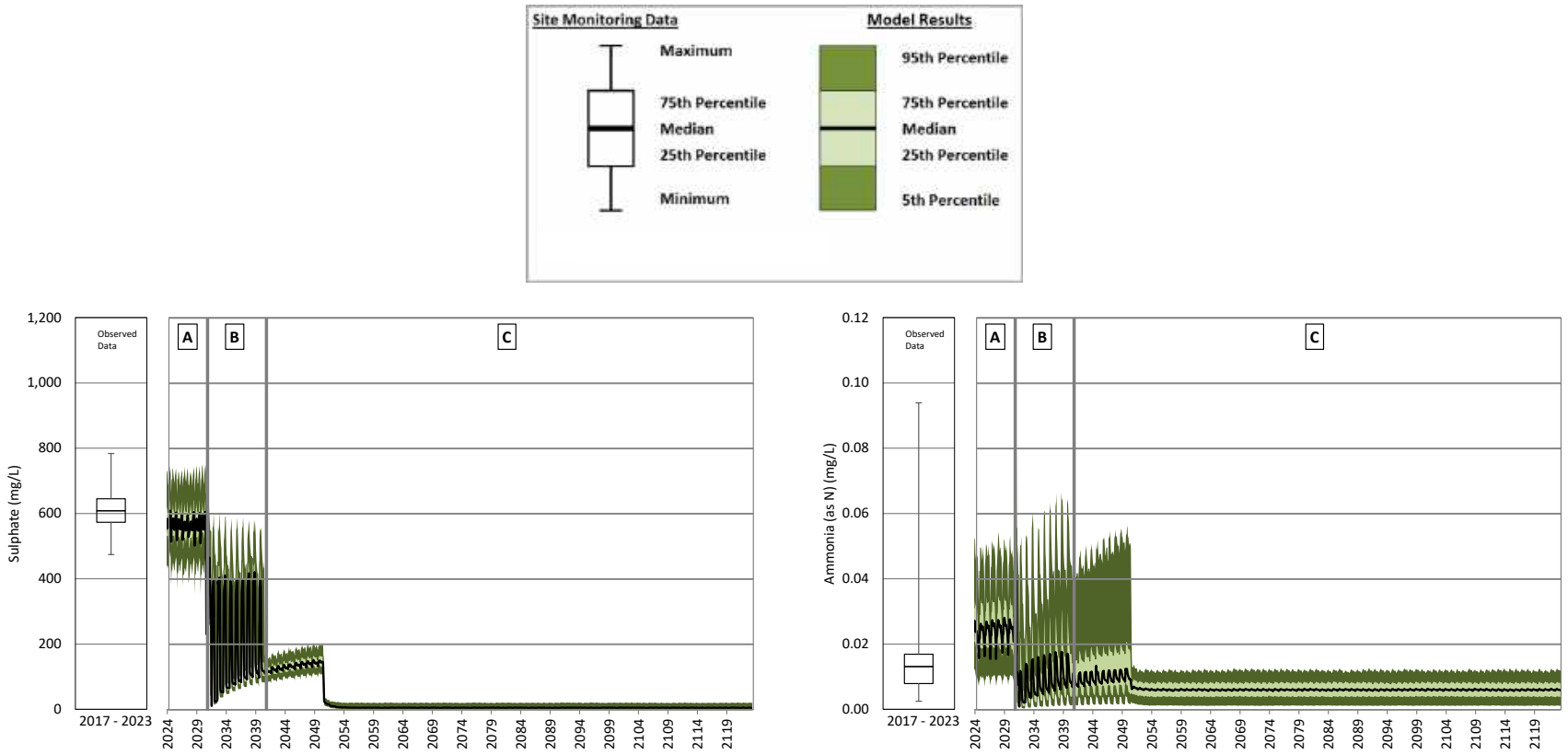
Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Dissolved Metals									
Aluminum	mg/L	0.012	0.039	0.013	0.069	0.009	0.031	0.044	0.21
Antimony	mg/L	0.0016	0.0018	0.00054	0.00089	0.00018	0.00026	0.000076	0.00013
Arsenic	mg/L	0.0035	0.0037	0.00071	0.0011	0.00082	0.0010	0.00098	0.0018
Barium	mg/L	0.067	0.074	0.036	0.044	0.028	0.037	0.013	0.018
Beryllium	mg/L	0.000052	0.000054	0.000051	0.000053	0.000051	0.000051	0.000055	0.000059
Boron	mg/L	0.13	0.17	0.067	0.083	0.05	0.063	0.028	0.035
Cadmium	mg/L	0.00013	0.0002	0.000056	0.00011	0.000028	0.000083	0.000011	0.000044
Chromium	mg/L	0.00027	0.0003	0.00029	0.00035	0.00033	0.00042	0.00085	0.0013
Cobalt	mg/L	0.00018	0.00047	0.000077	0.00018	0.000086	0.00023	0.000063	0.00013
Copper	mg/L	0.013	0.026	0.011	0.019	0.0054	0.011	0.0026	0.0055
Iron	mg/L	0.025	0.065	0.02	0.083	0.023	0.052	0.1	0.31
Lead	mg/L	0.000026	0.000029	0.000026	0.00003	0.000023	0.000034	0.000017	0.000099
Lithium	mg/L	0.013	0.015	0.0089	0.013	0.0041	0.0075	0.0018	0.003
Manganese	mg/L	0.071	0.16	0.067	0.13	0.08	0.16	0.043	0.088
Mercury	mg/L	0.0000052	0.0000054	0.0000051	0.0000053	0.0000051	0.0000051	0.0000055	0.0000059
Molybdenum	mg/L	0.38	0.44	0.25	0.33	0.05	0.077	0.027	0.043
Nickel	mg/L	0.00045	0.0011	0.00038	0.00057	0.0004	0.00059	0.00092	0.0019
Selenium	mg/L	0.064	0.096	0.057	0.096	0.0038	0.012	0.002	0.0068
Silicon	mg/L	5.6	6.8	5.0	6.4	5.2	6.6	6.5	9.3
Silver	mg/L	0.0000056	0.0000069	0.0000051	0.000006	0.0000051	0.000006	0.0000067	0.000015
Strontium	mg/L	4.1	5.5	2.5	3.7	0.89	1.6	0.35	0.71

Table 19: Predicted Maximum Concentrations in the Main Embankment Seepage Collection Pond during Closure and Post-closure

Parameter	Units	Operations Period (January 2024 - March 2031)		Closure (April 2031 - March 2041)		Early Post-Closure (April 2041 - March 2051)		Long Term Post-Closure (April 2051 - April 2131)	
		Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations	Maximum of Median Predicted Concentrations	Maximum of 95th Percentile Predicted Concentrations
Thallium	mg/L	0.0000064	0.0000079	0.0000051	0.0000053	0.0000051	0.0000051	0.0000055	0.0000059
Tin	mg/L	0.000052	0.000055	0.000051	0.000053	0.000051	0.000051	0.000055	0.000059
Titanium	mg/L	0.0065	0.0077	0.0056	0.0087	0.005	0.0064	0.0052	0.0087
Uranium	mg/L	0.0027	0.0039	0.0022	0.0035	0.0014	0.0028	0.00064	0.0013
Vanadium	mg/L	0.0032	0.0034	0.0006	0.0011	0.00038	0.00056	0.0006	0.00099
Zinc	mg/L	0.0057	0.01	0.0041	0.0075	0.0021	0.0036	0.0011	0.0014

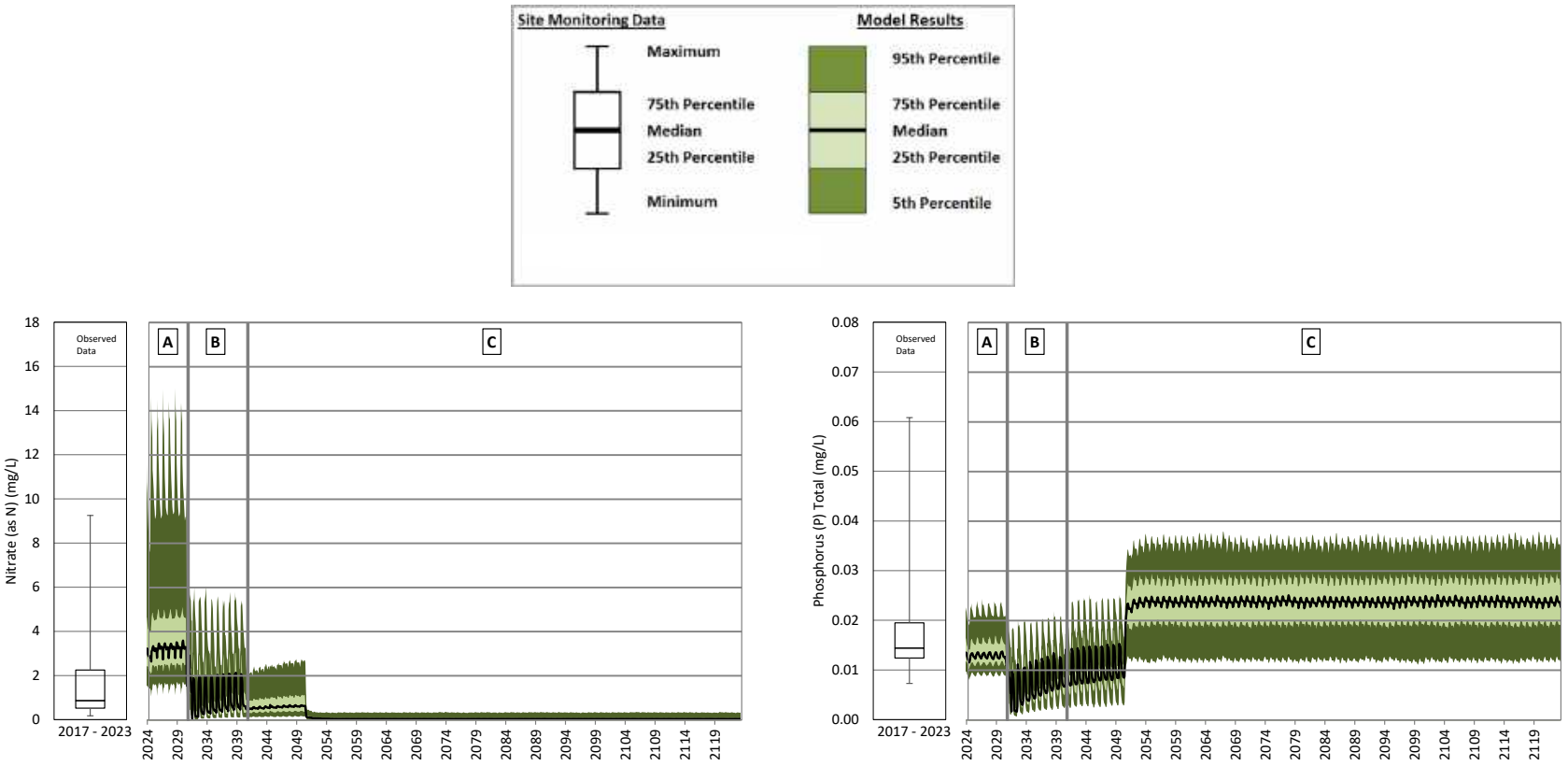
a) Calculated based on predicted calcium and magnesium concentrations.



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

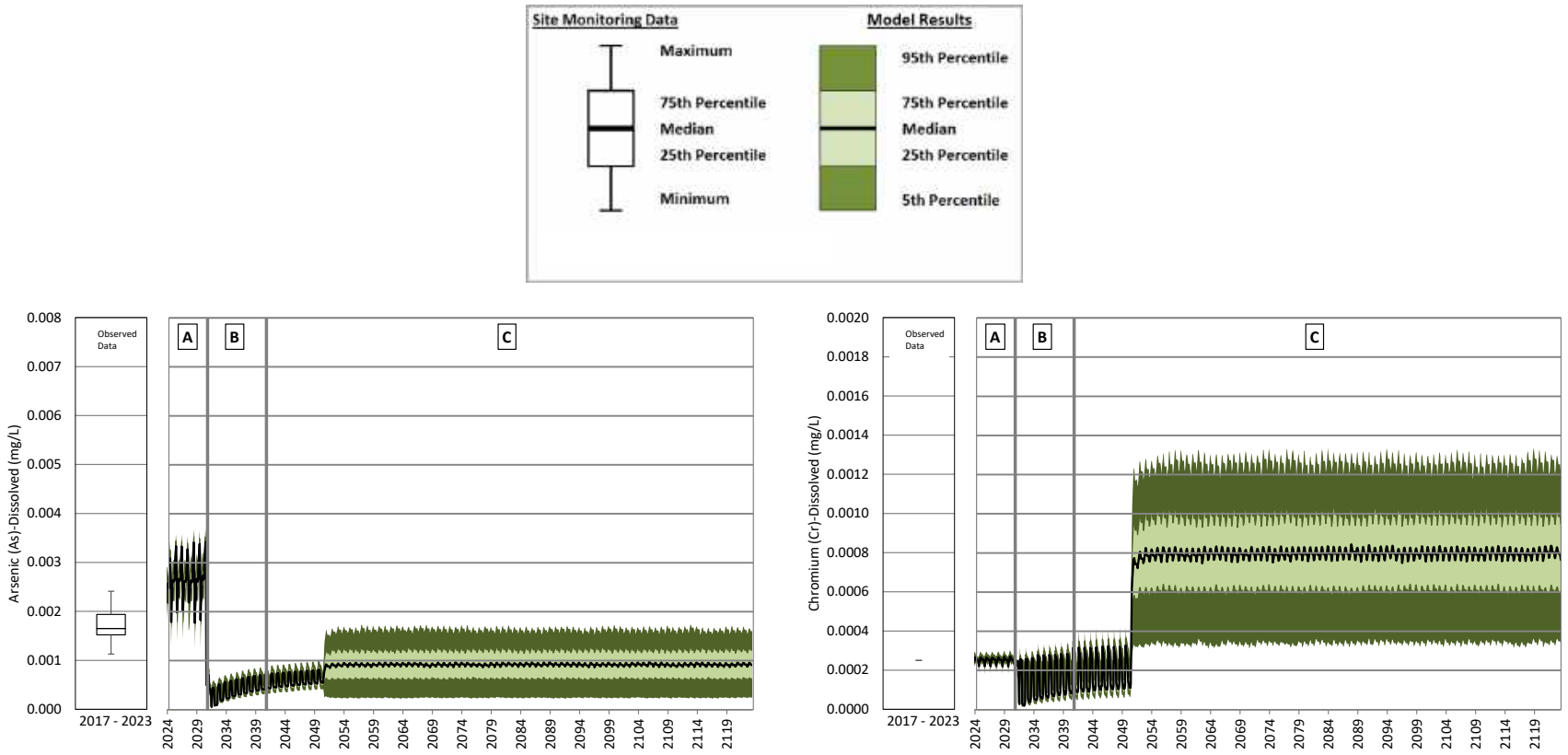
Figure 59: Predicted Sulphate and Total Ammonia Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

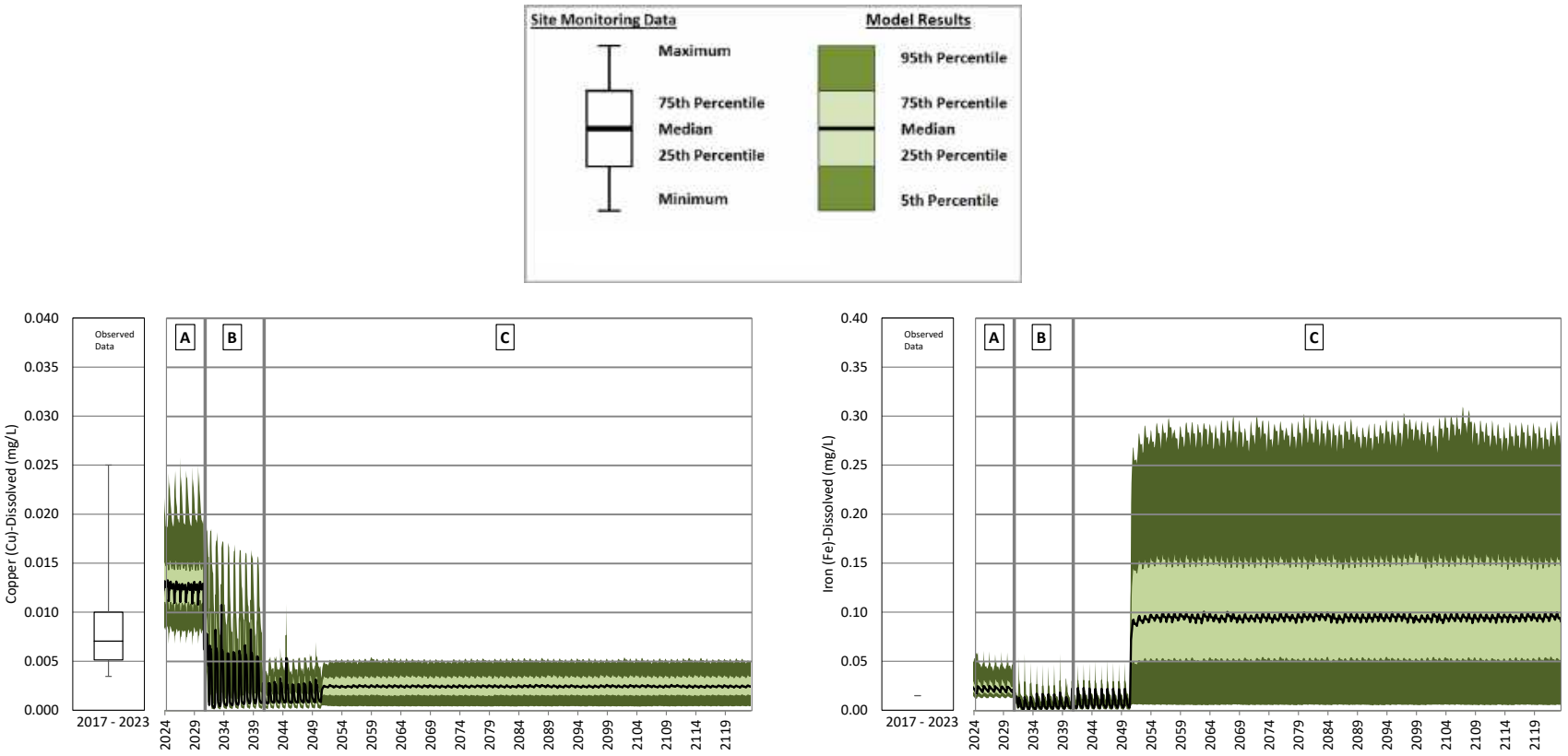
Figure 60: Predicted Nitrate and Total Phosphorus Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

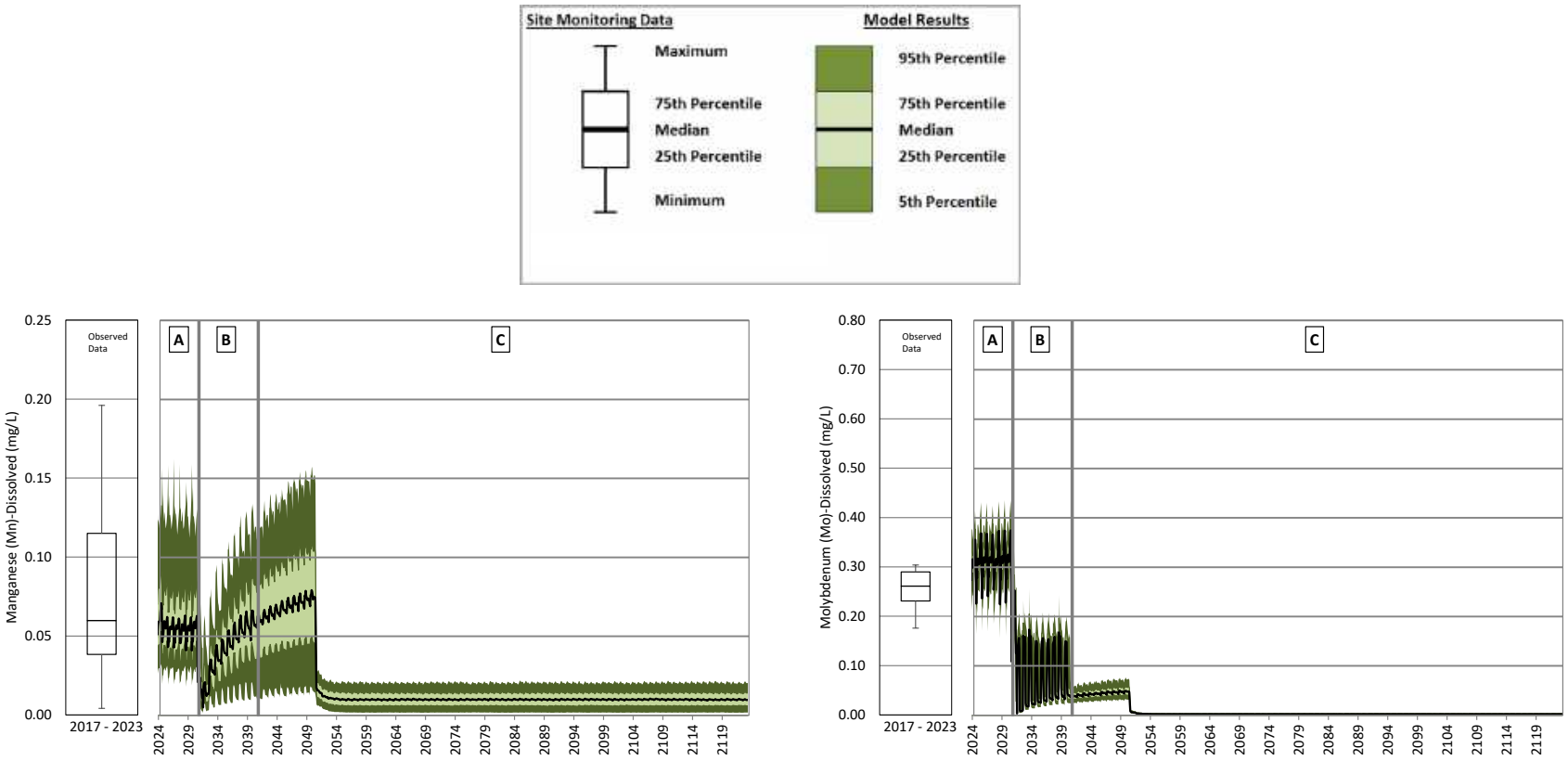
Figure 61: Predicted Dissolved Arsenic and Dissolved Chromium Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

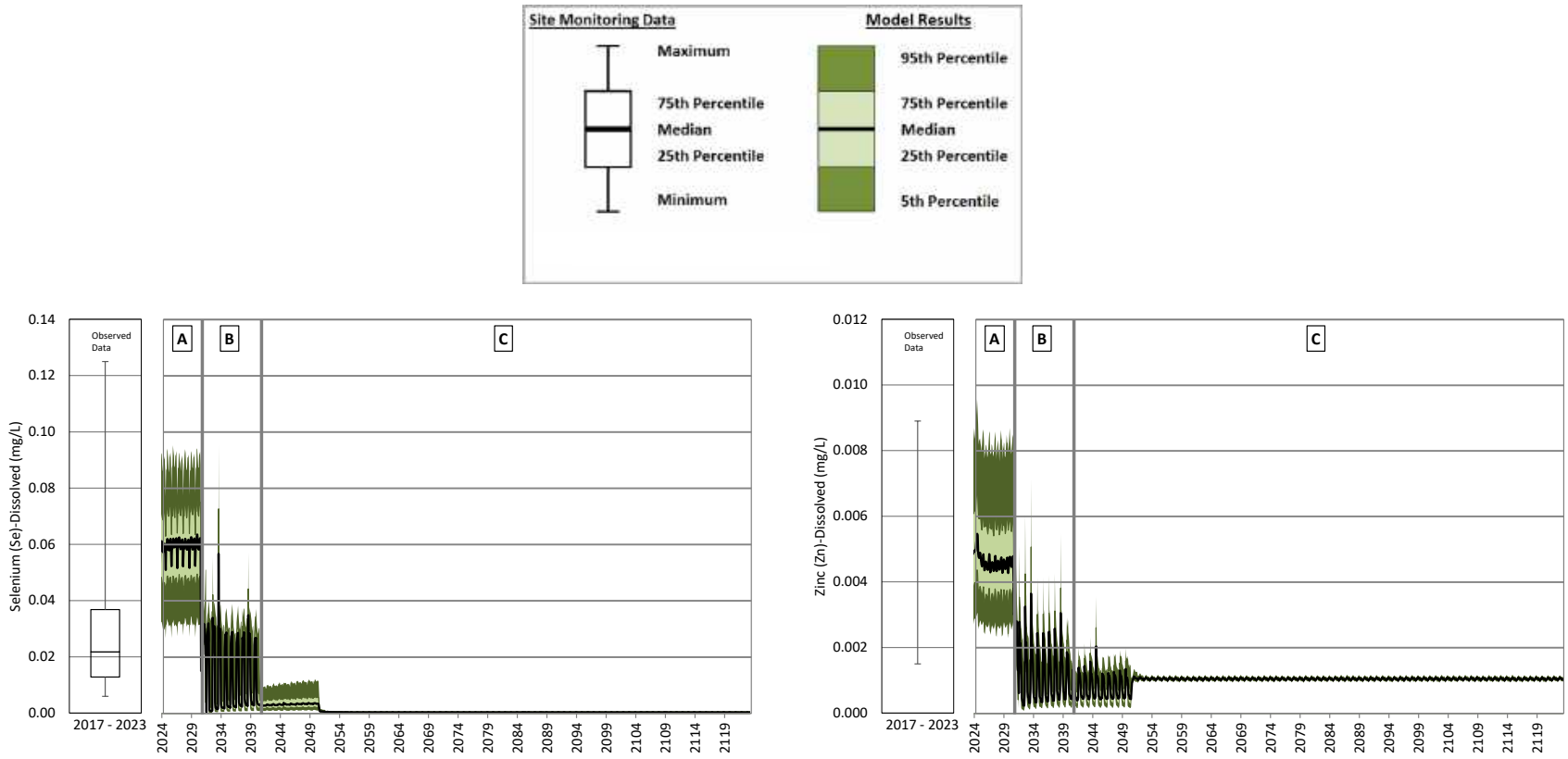
Figure 62: Predicted Dissolved Copper and Dissolved Iron Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 63: Predicted Dissolved Manganese and Dissolved Molybdenum Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into post-closure is caused by reclamation of mine site areas that are complete 10 years after the start of post-closure. Predicted concentrations reach a steady state by 2051 when pumping from the SESCP ends.

Figure 64: Predicted Dissolved Selenium and Dissolved Zinc Concentrations in the Main Embankment Seepage Collection Pond – Operations, Closure and Post-closure

5.0 SUMMARY

The GoldSim model that was developed for the 2020 WMP to predict discharge water quality at the mine during operations was updated to predict concentrations during operations, closure and post-closure on the mine site under the Springer Expansion mine plan. The model was also updated with additional monitoring data for assigned water quality inputs to refine the distribution inputs into the model. Updated geochemical source terms were also modelled in an alternative scenario (in place of inputs calculated from monitoring data) and were compared to model results that used monitoring data to calculate the water quality inputs. The model results from the scenario that used the geochemical source terms were considered overly conservative and not presented in this report.

The updated model was calibrated against monitoring data from the mine site. During closure and post-closure, discharges from the mine will preferably be returned to their undisturbed watersheds, to the extent possible. Specifically, nine potential mine discharge locations are expected to drain to Polley Lake, Bootjack Lake, Edney Creek, and Hazeltine Creek.

The updated predicted concentrations during operations, closure and post-closure in the mine site are similar to those presented in previous iterations of the water quality model including the 2016 Long Term Water Management Plan (Golder 2016), the 2020 Water Management Plane (Golder 2020) and the 2022 Reclamation and Closure Plan (Golder 2022a). For some parameters, the maximum predicted concentrations of total metals are lower during post-closure in this update of the water quality model. This change in predicted total metal concentrations is due to an adjustment to the particulate addition calculation during post-closure that now assumes a total suspended solids concentration that is representative of a reclaimed water quality input. Changes in concentrations from operations to closure and post-closure are caused by reclamation of mine site areas that are complete during post-closure. Predicted concentrations reach a steady state during post-closure after reclamation of the mine site areas is complete and the Springer Expansion pit is filled. In general, the model predicted higher concentrations in the closure period, relative to the post- closure period for most parameters with the exception of parameters that are predicted to be higher in the assigned undisturbed runoff water quality than in the assigned disturbed, NAG or PAG waste rock water quality. Treatment and mitigation strategies during operations, closure and post-closure are addressed in the treatment section of the WMP (WSP 2023a).

6.0 CLOSURE

This report summarizes the reclamation and closure update of the SWWQM.

We trust this report satisfies your current requirements. Please contact the undersigned should you have any questions.

Signature Page

WSP Canada Inc.



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SM/LN/ar/ap

https://wsponline.sharepoint.com/sites/gld-10023g/23590671 deliverables/002_issued/053-r-31282-springer expansion water quality model report/rev1/23590671-053-r-rev1-31282-springer pit expansion wq model report 08nov_24.docx

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APPENDIX A

Water Quality Model Calibration Results

APPENDIX

Appendix A

Water Quality Model Calibration Results

Reference No. 23590671-053-R-Rev0-31282

November 2024

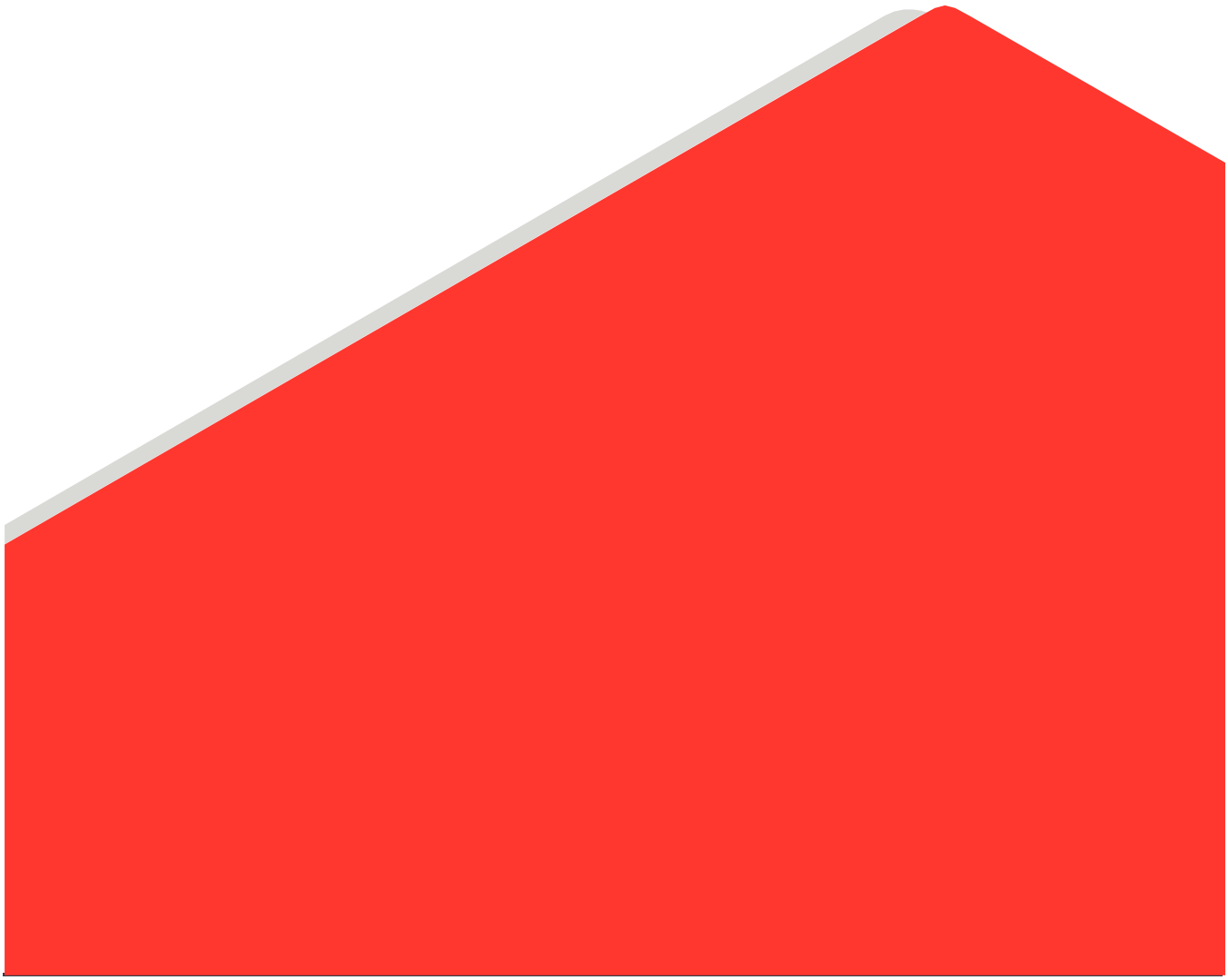


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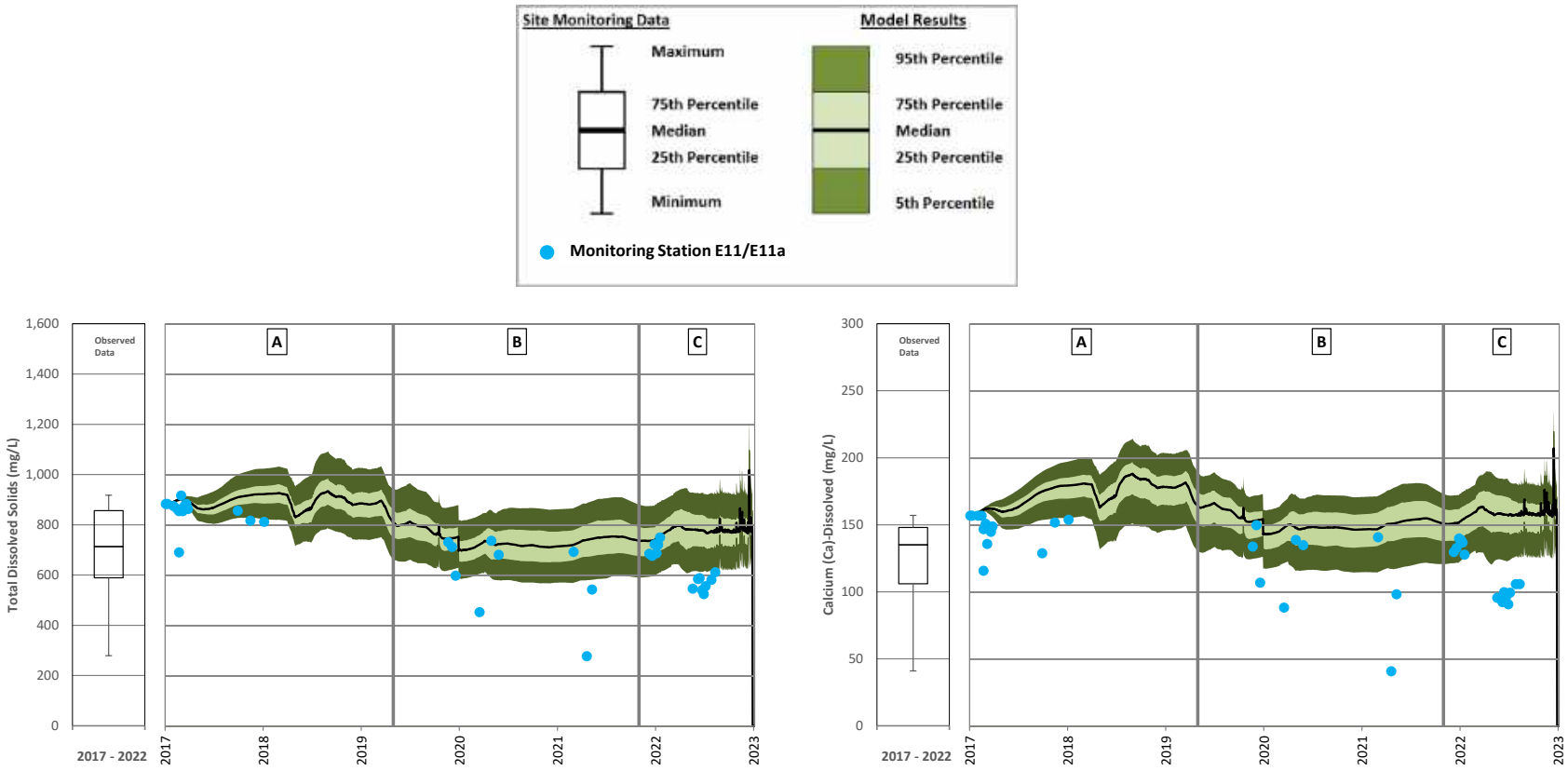
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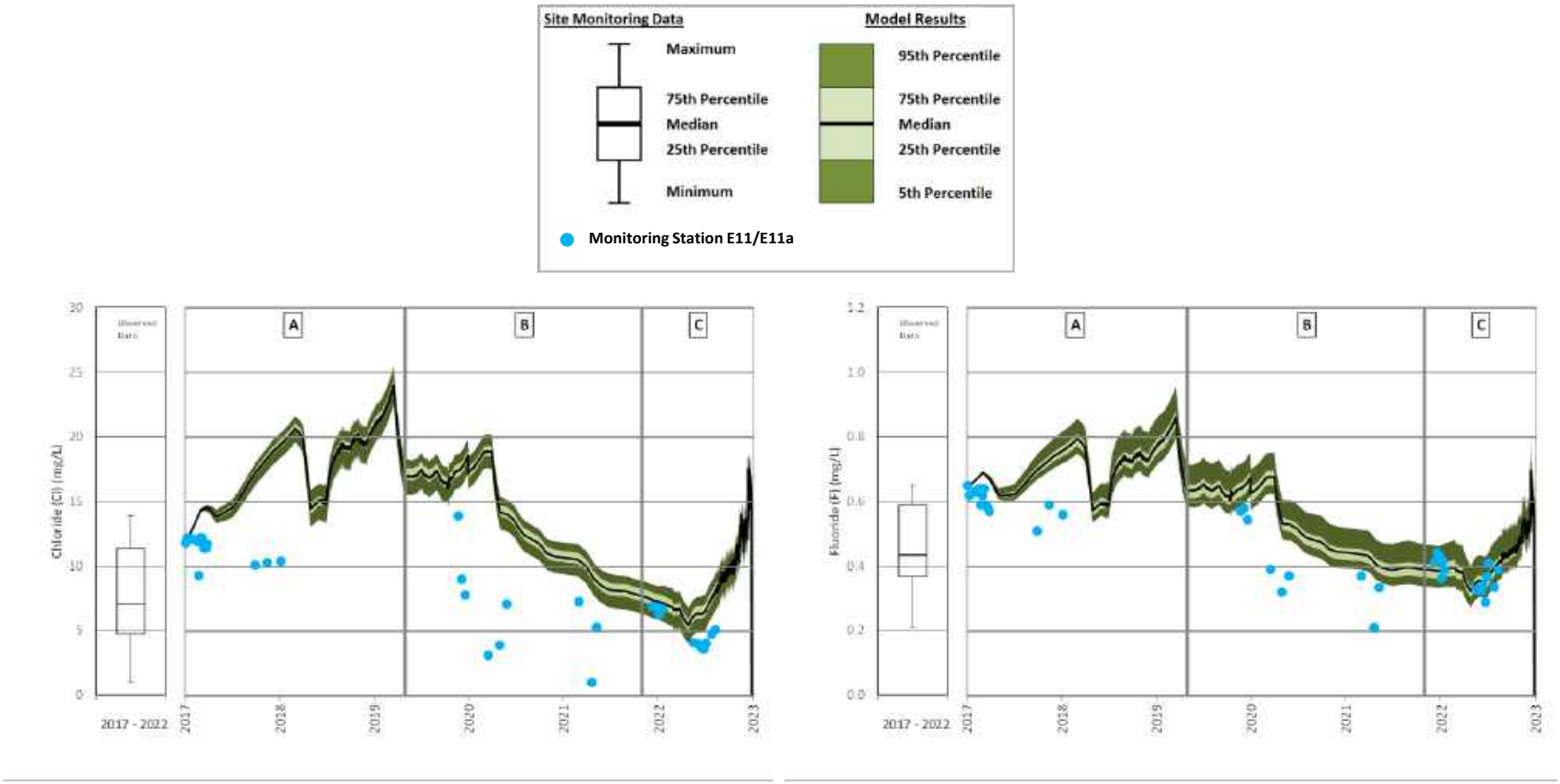
This attachment presents the water quality calibration Figures for Springer Pit, Cariboo Pit, Wight Pit, the Central Collection Sump, the Tailings Storage Facility, the Perimeter Embankment Till Borrow Pond and the Northwest Sump. The calibration period was from January 2017 to January 2023.

Springer Pit Calibration



A = Operations; B = Care and Maintanence; C = Resumed Operations

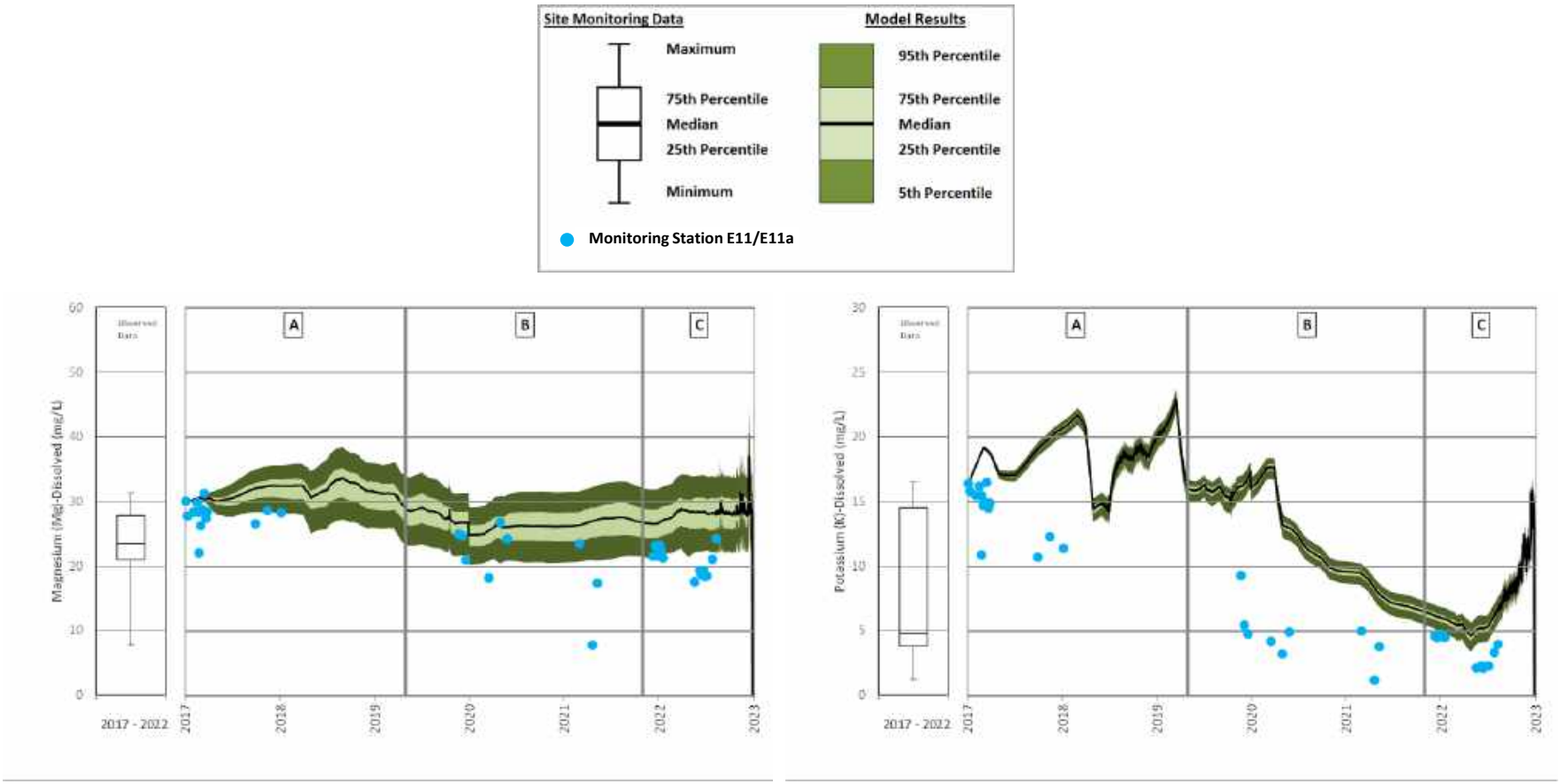
Figure A 1: Springer Pit Calibration – Total Dissolved Solids and Calcium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Chloride and fluoride concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

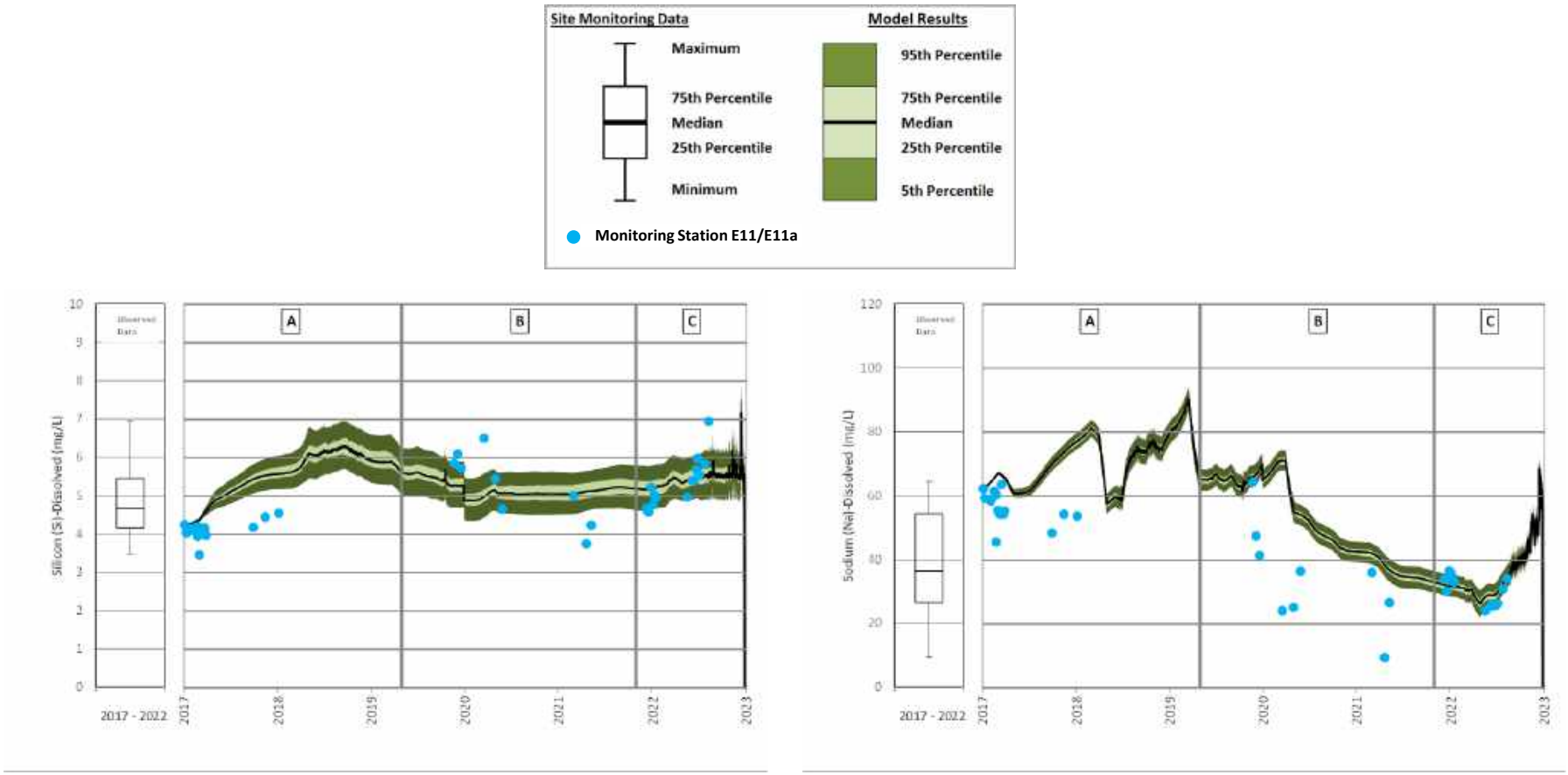
Figure A 2: Springer Pit Calibration – Chloride and Fluoride



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Potassium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

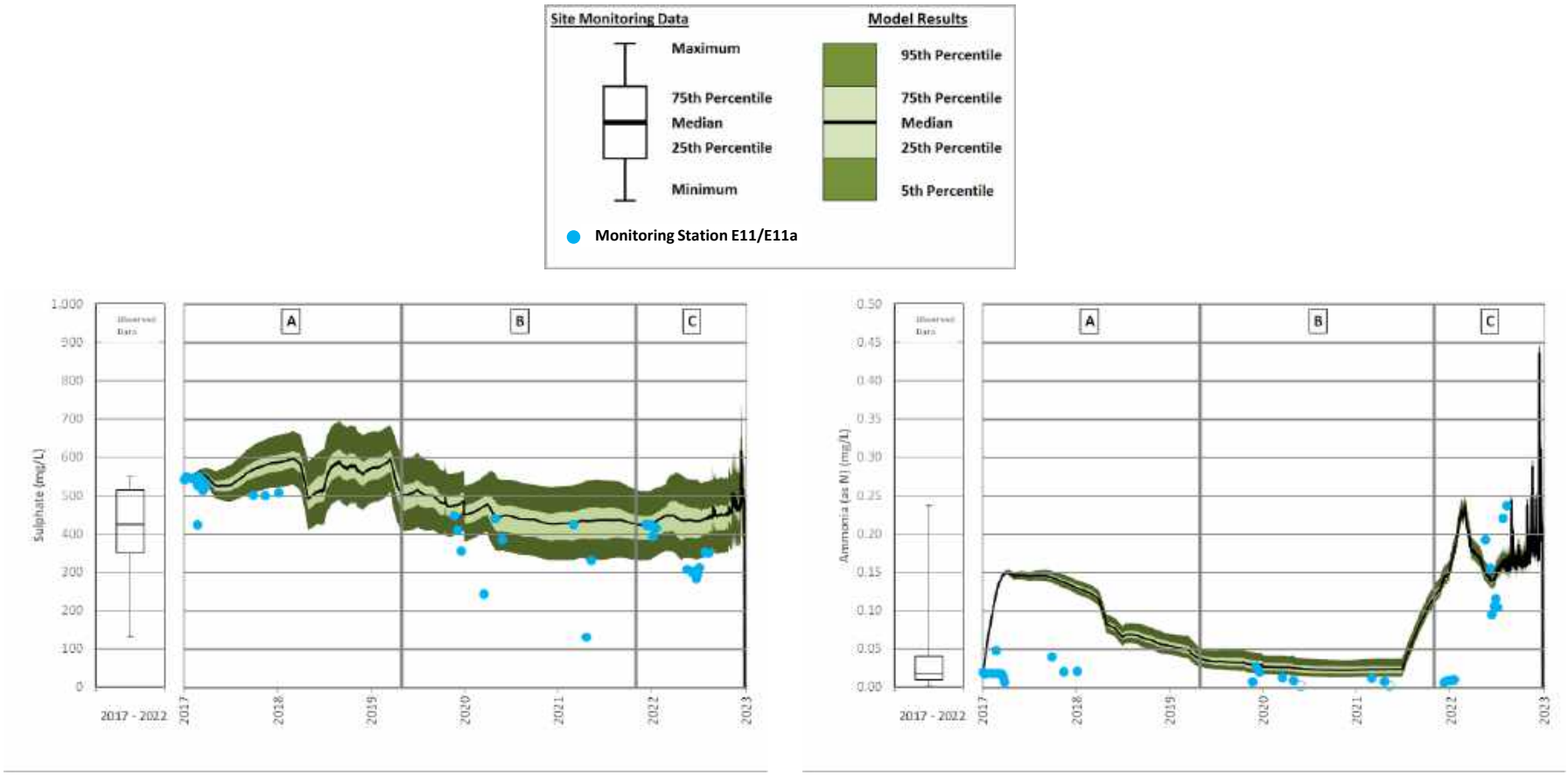
Figure A 3: Springer Pit Calibration – Magnesium and Potassium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Sodium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in Tailings Storage Facility (TSF) that is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

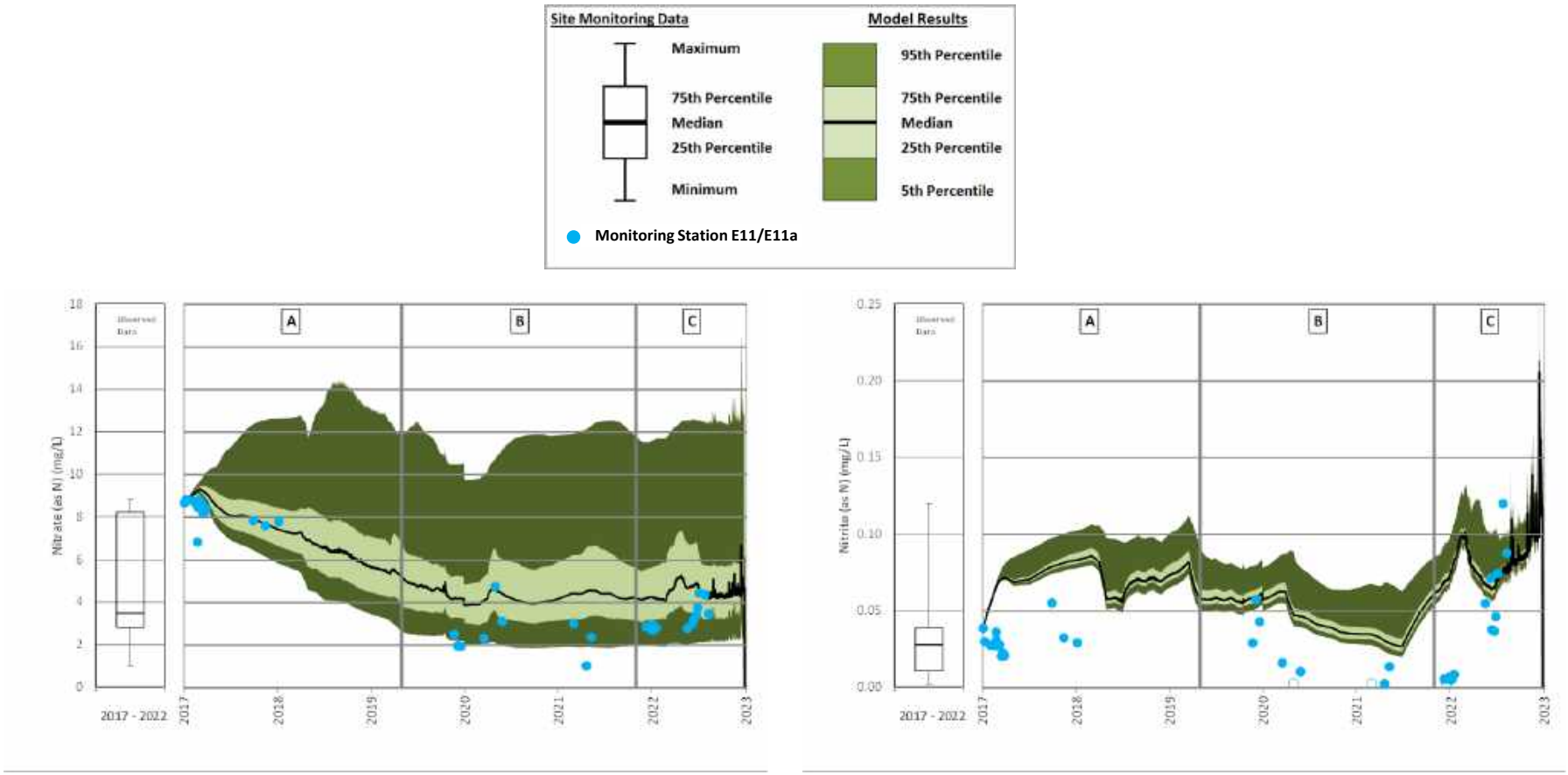
Figure A 4: Springer Pit Calibration – Silicon and Sodium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Total ammonia concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

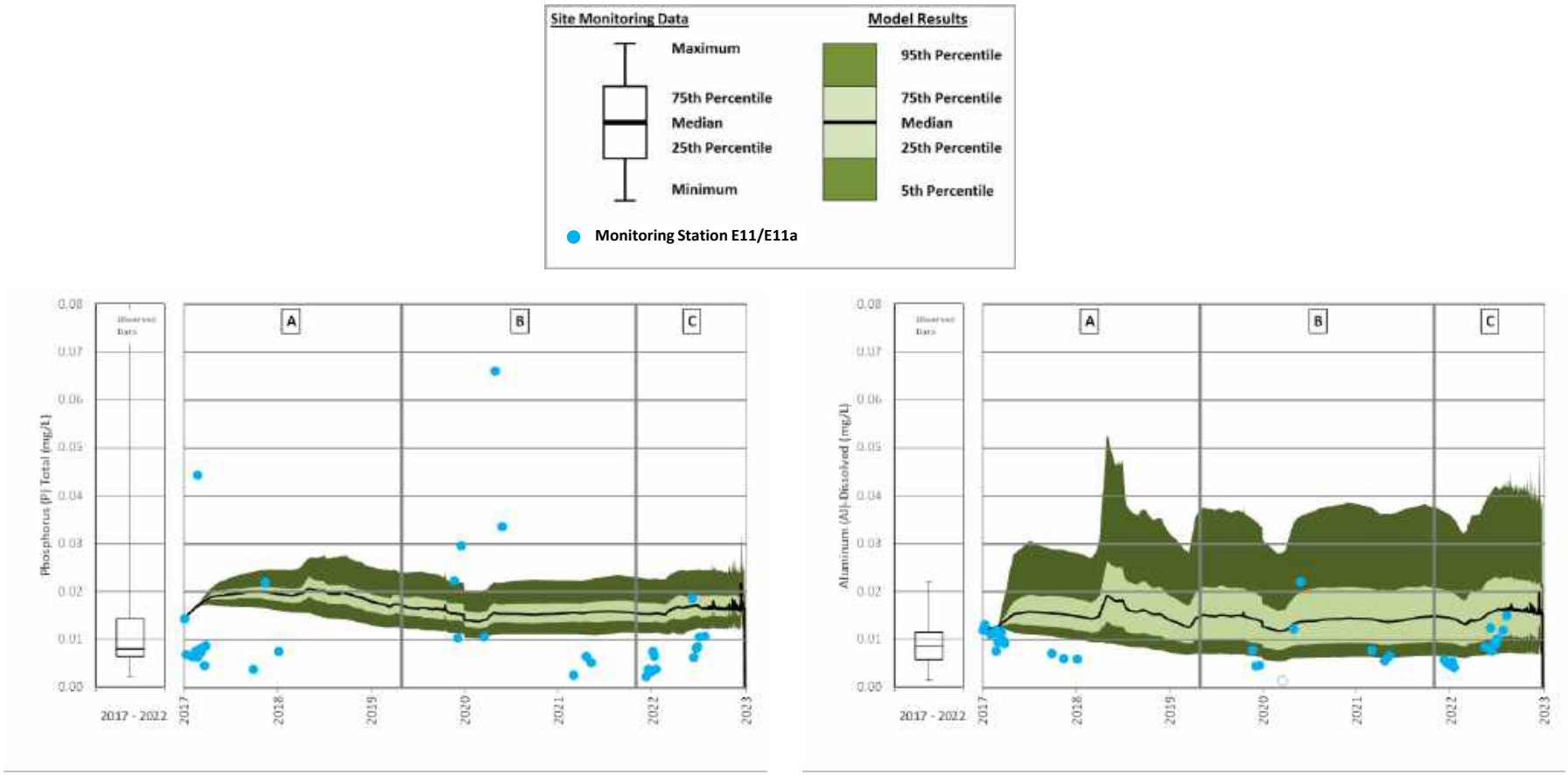
Figure A 5: Springer Pit Calibration – Sulphate and Total Ammonia



A = Operations; B = Care and Maintanence; C = Resumed Operations

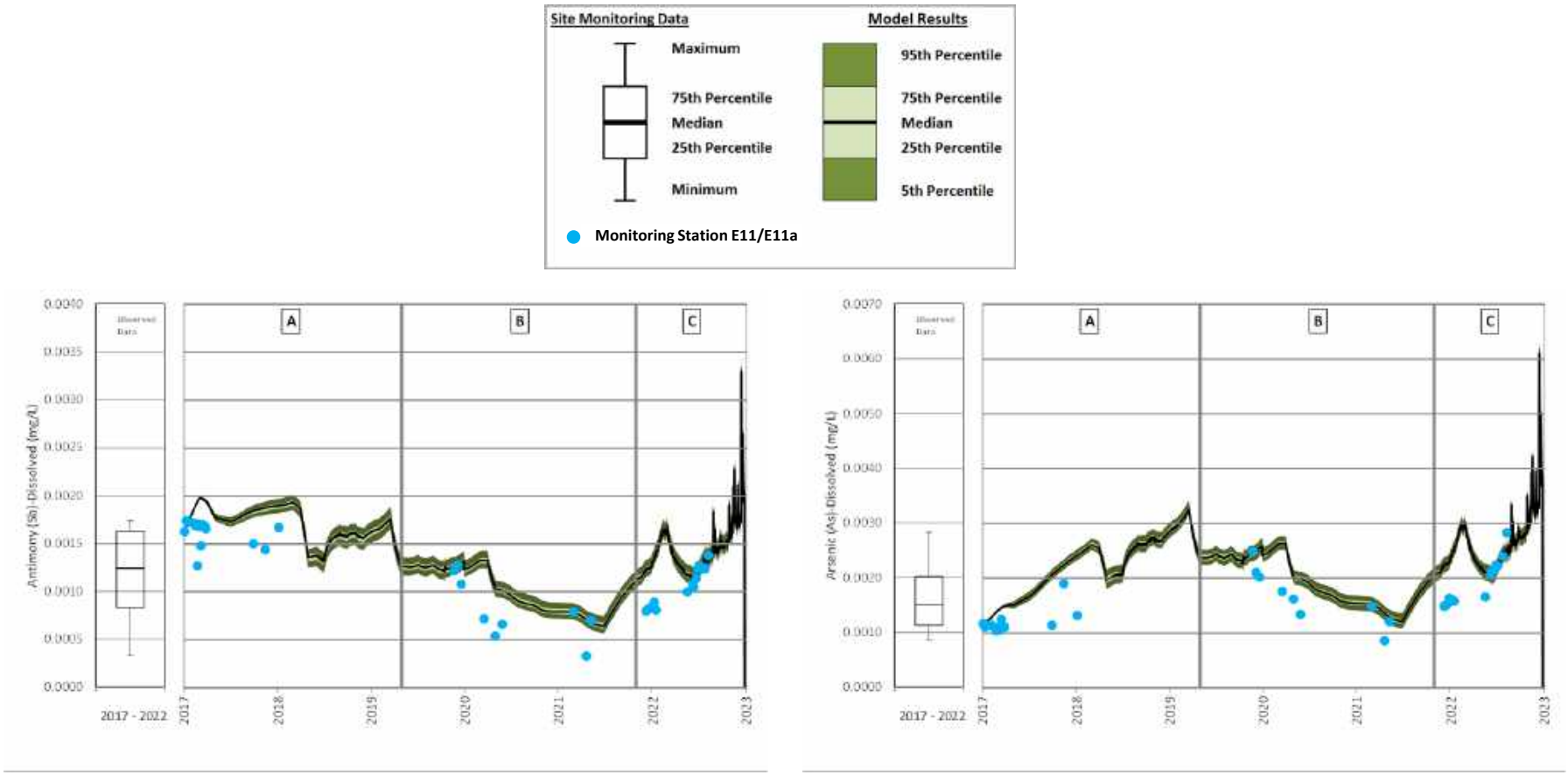
Note: Nitrite concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 6: Springer Pit Calibration – Nitrate and Nitrite



A = Operations; B = Care and Maintanence; C = Resumed Operations

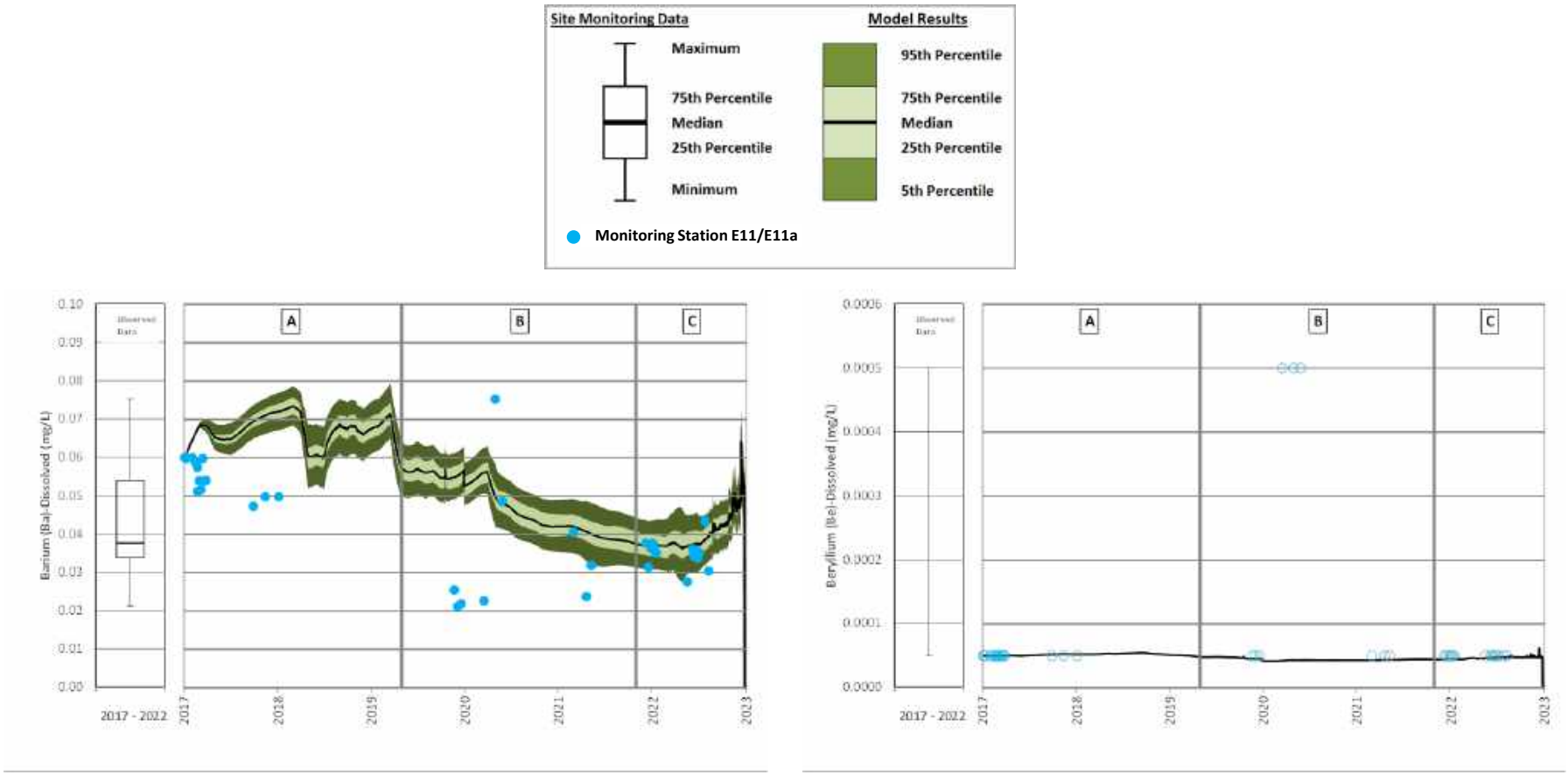
Figure A 7: Springer Pit Calibration – Total Phosphorus and Dissolved Aluminum



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

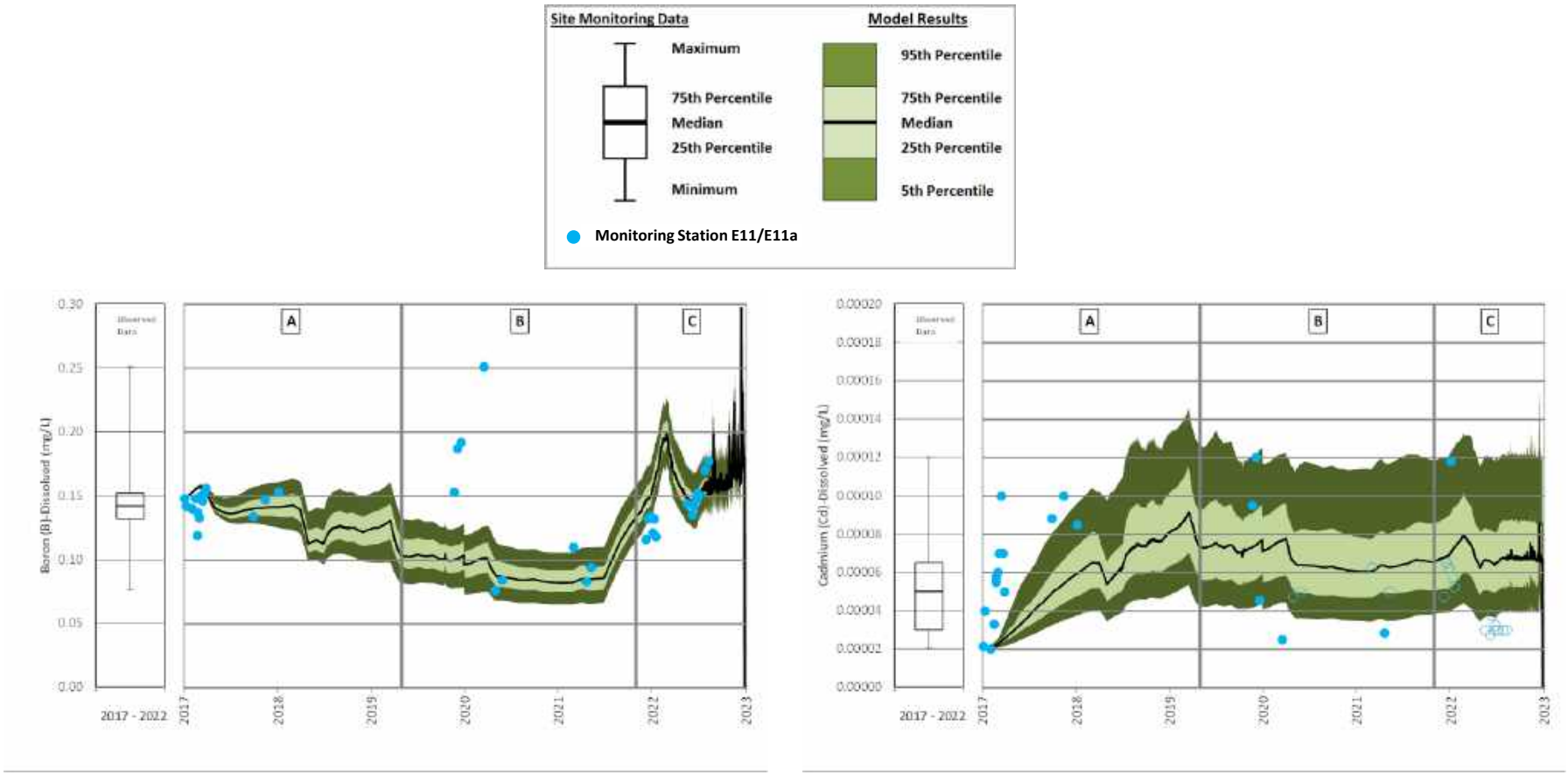
Figure A 8: Springer Pit Calibration – Dissolved Antimony and Dissolved Arsenic



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved barium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

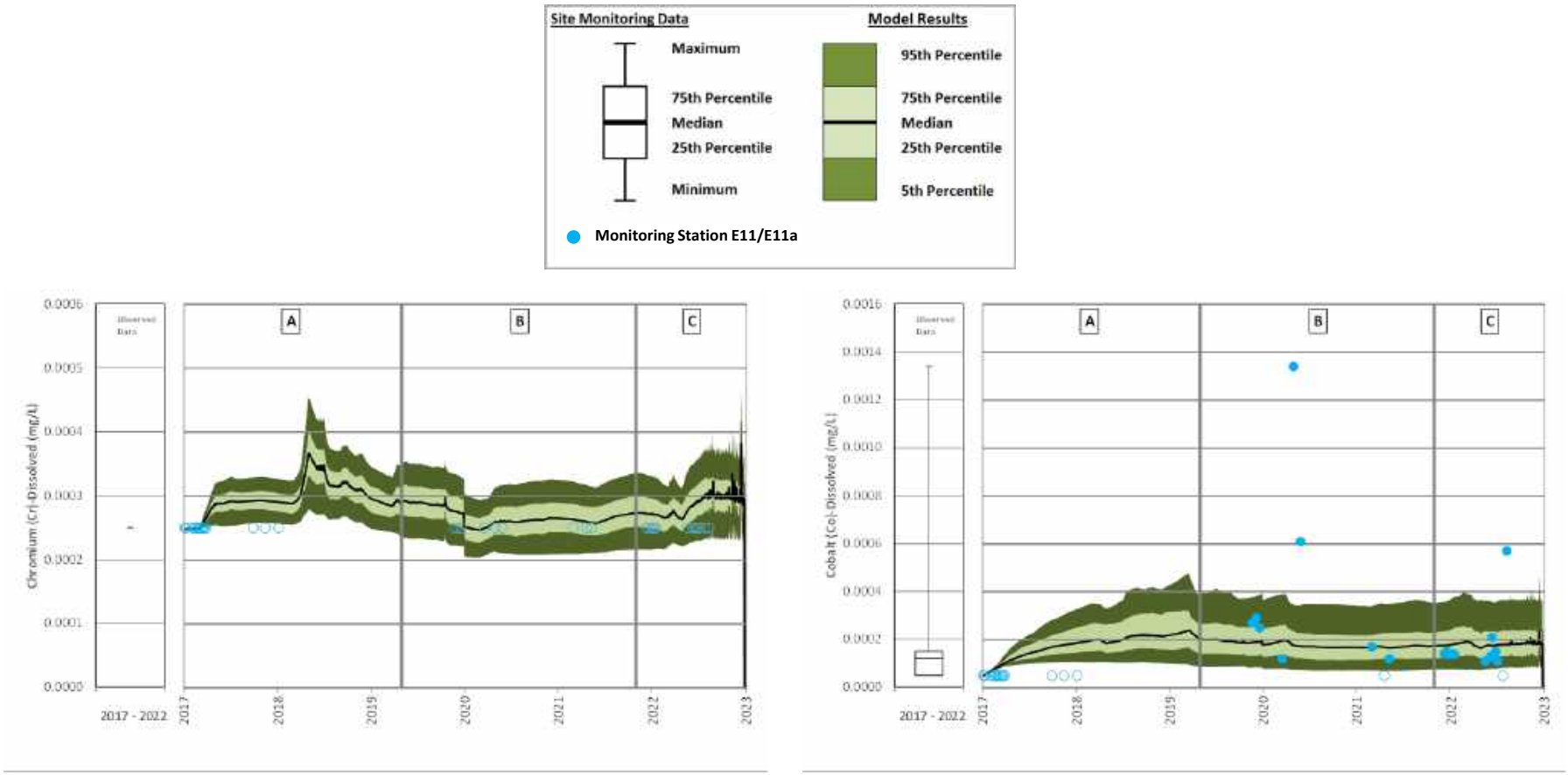
Figure A 9: Springer Pit Calibration – Dissolved Barium and Dissolved Beryllium



A = Operations; B = Care and Maintanence; C = Resumed Operations

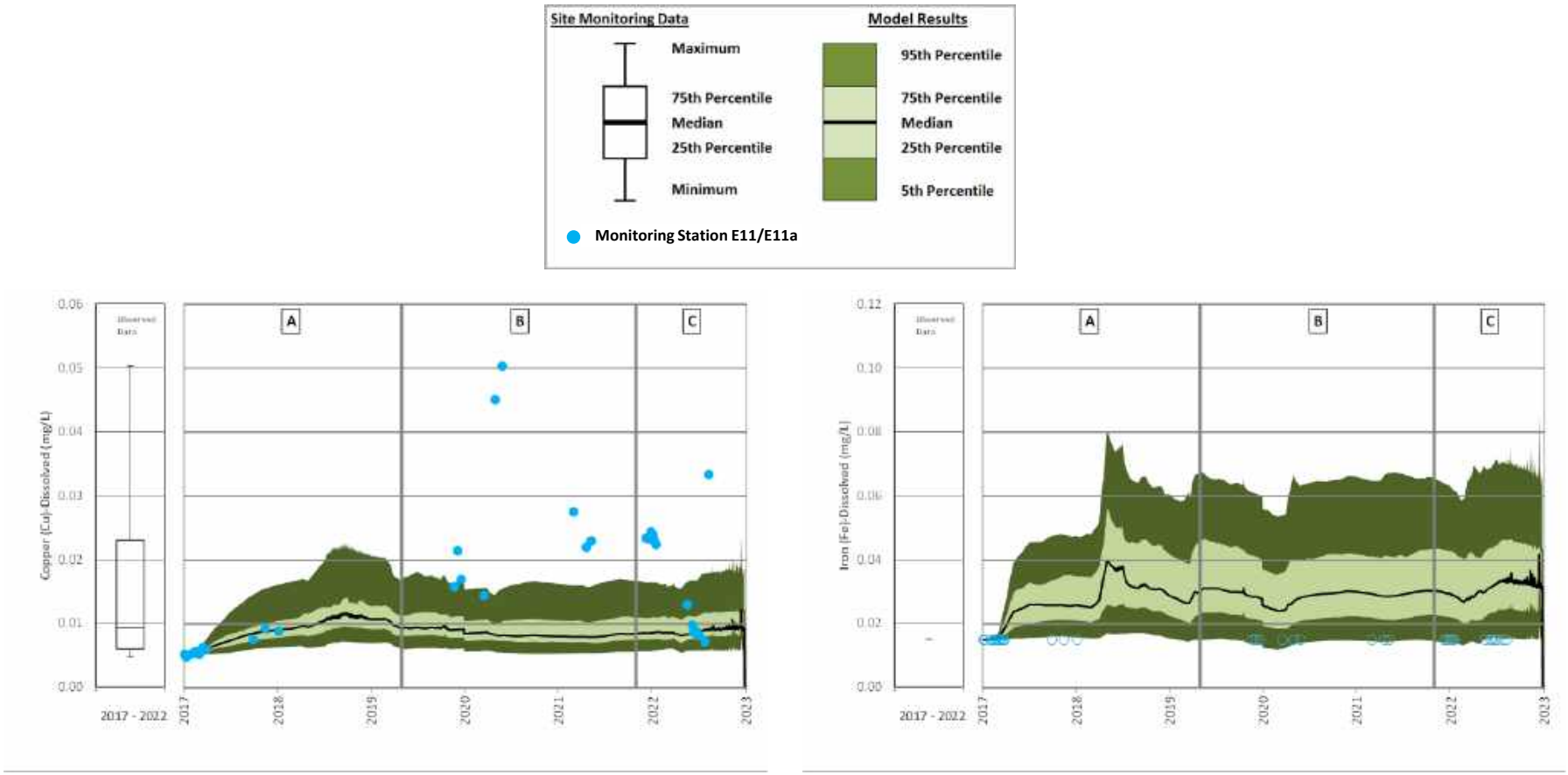
Note: Dissolved boron concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 10: Springer Pit Calibration – Dissolved Boron and Dissolved Cadmium



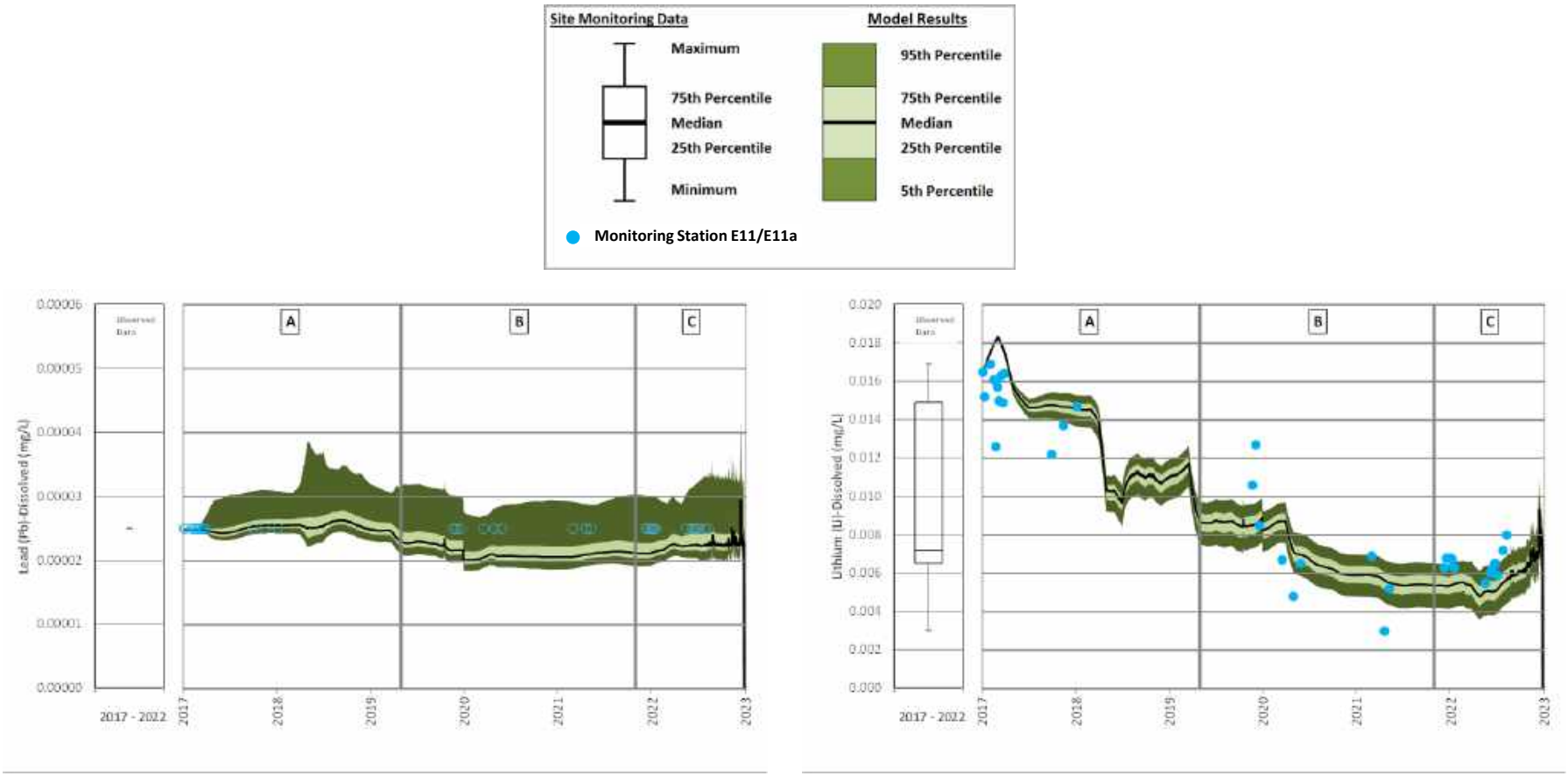
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 11: Springer Pit Calibration – Dissolved Chromium and Dissolved Cobalt



A = Operations; B = Care and Maintanence; C = Resumed Operations

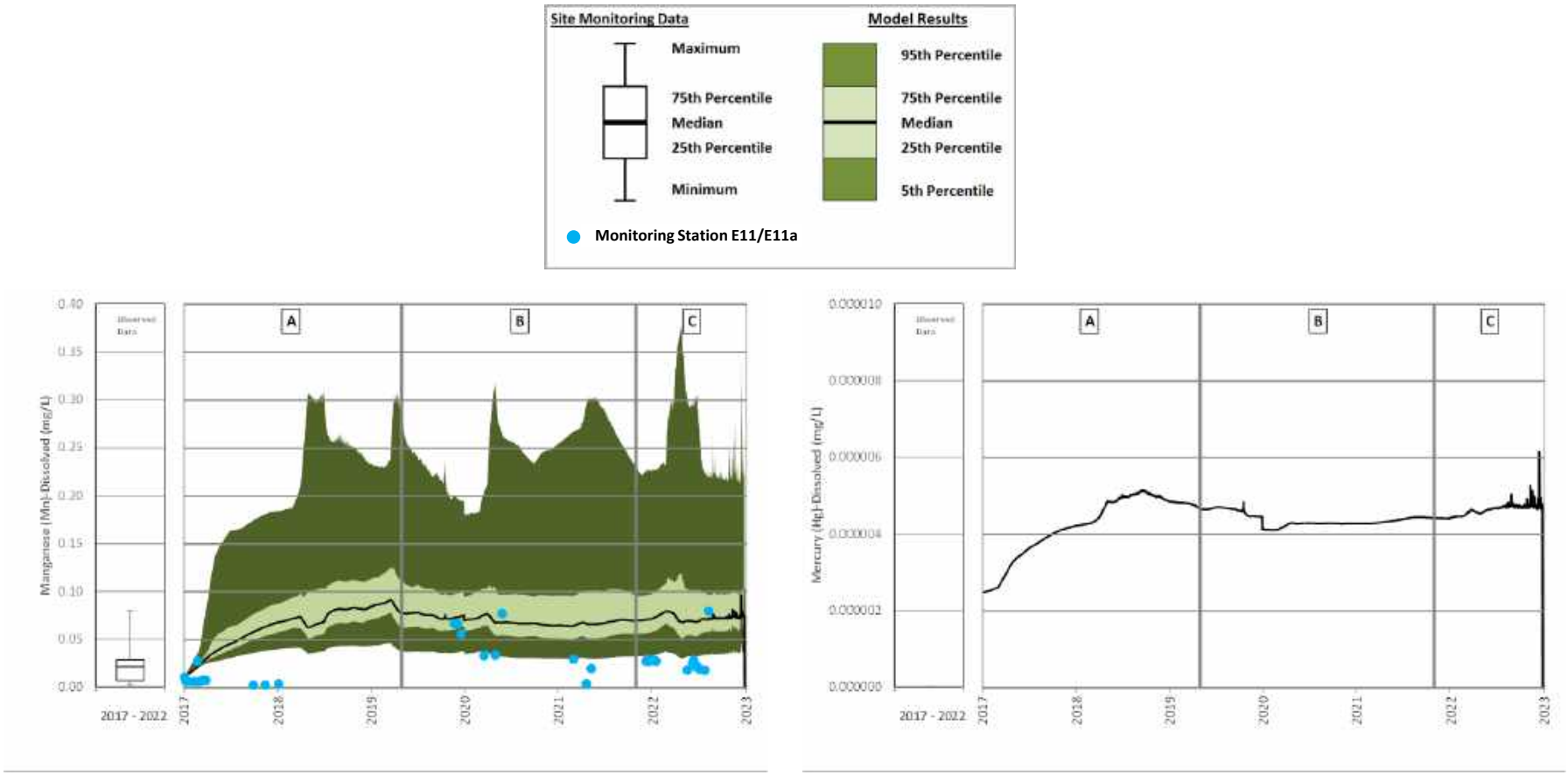
Figure A 12: Springer Pit Calibration – Dissolved Copper and Dissolved Iron



A = Operations; B = Care and Maintanence; C = Resumed Operations

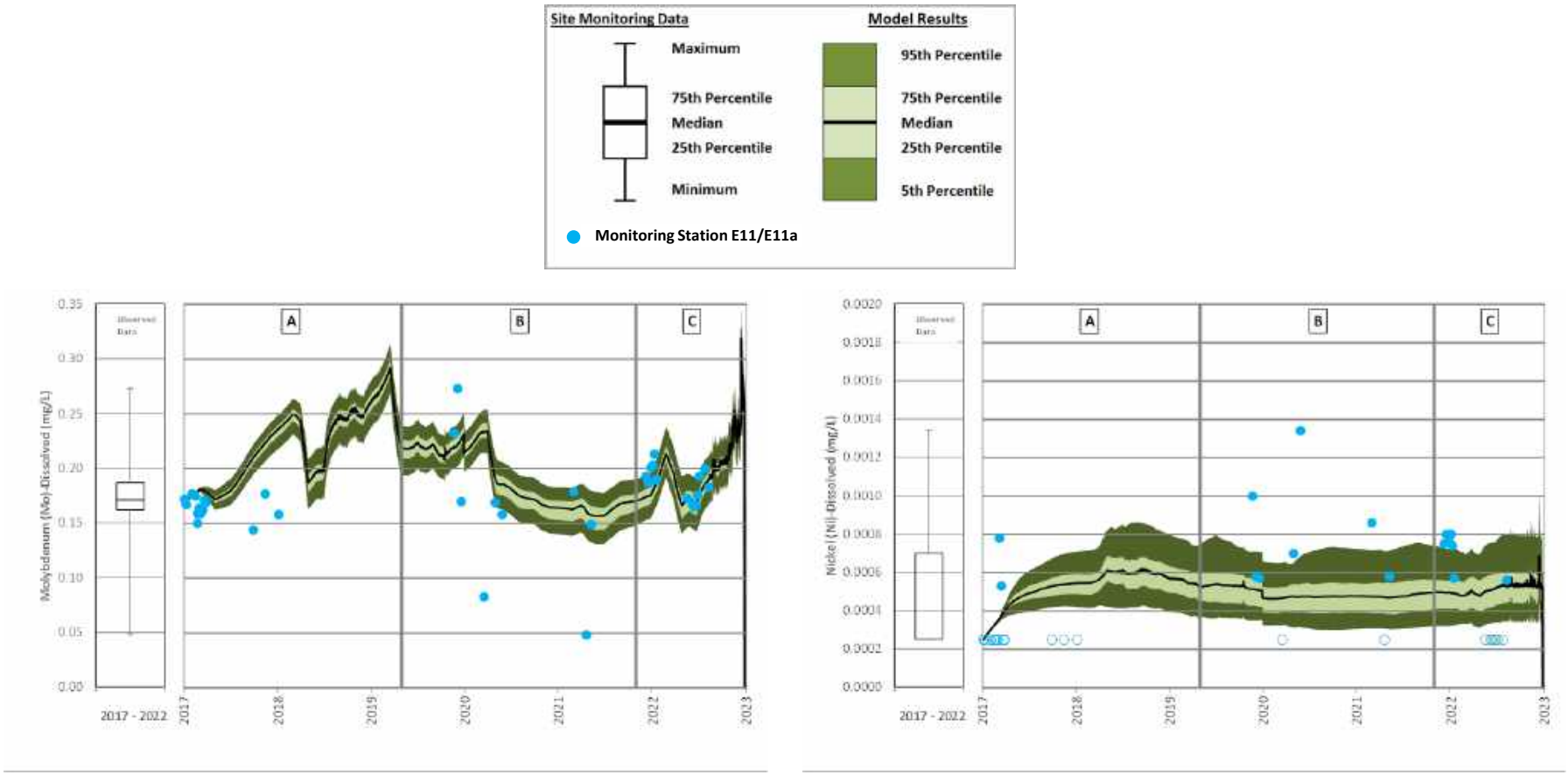
Note: Dissolved lithium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 13: Springer Pit Calibration – Dissolved Lead and Dissolved Lithium



A = Operations; B = Care and Maintanence; C = Resumed Operations

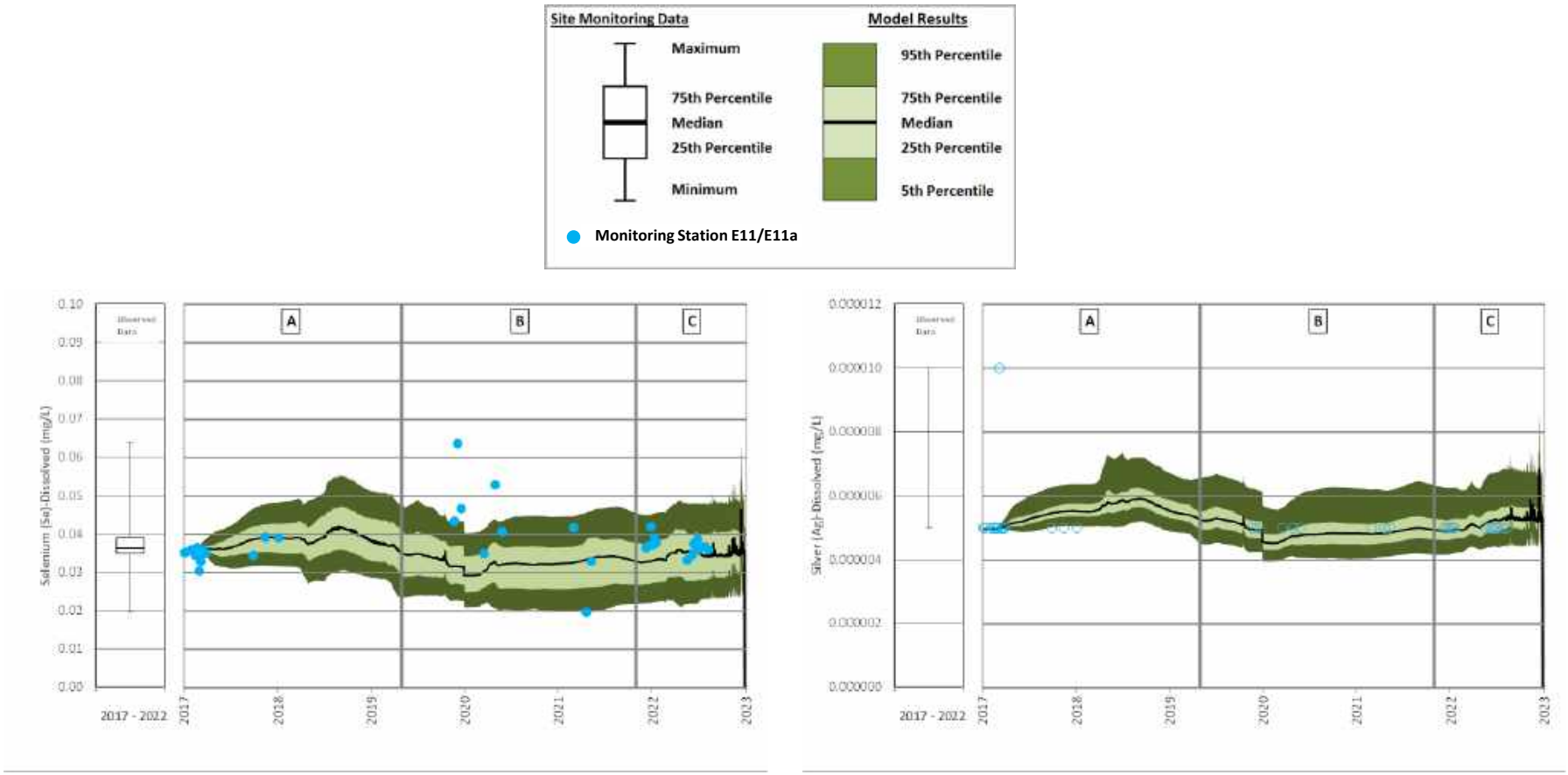
Figure A 14: Springer Pit Calibration – Dissolved Manganese and Dissolved Mercury



A = Operations; B = Care and Maintanence; C = Resumed Operations

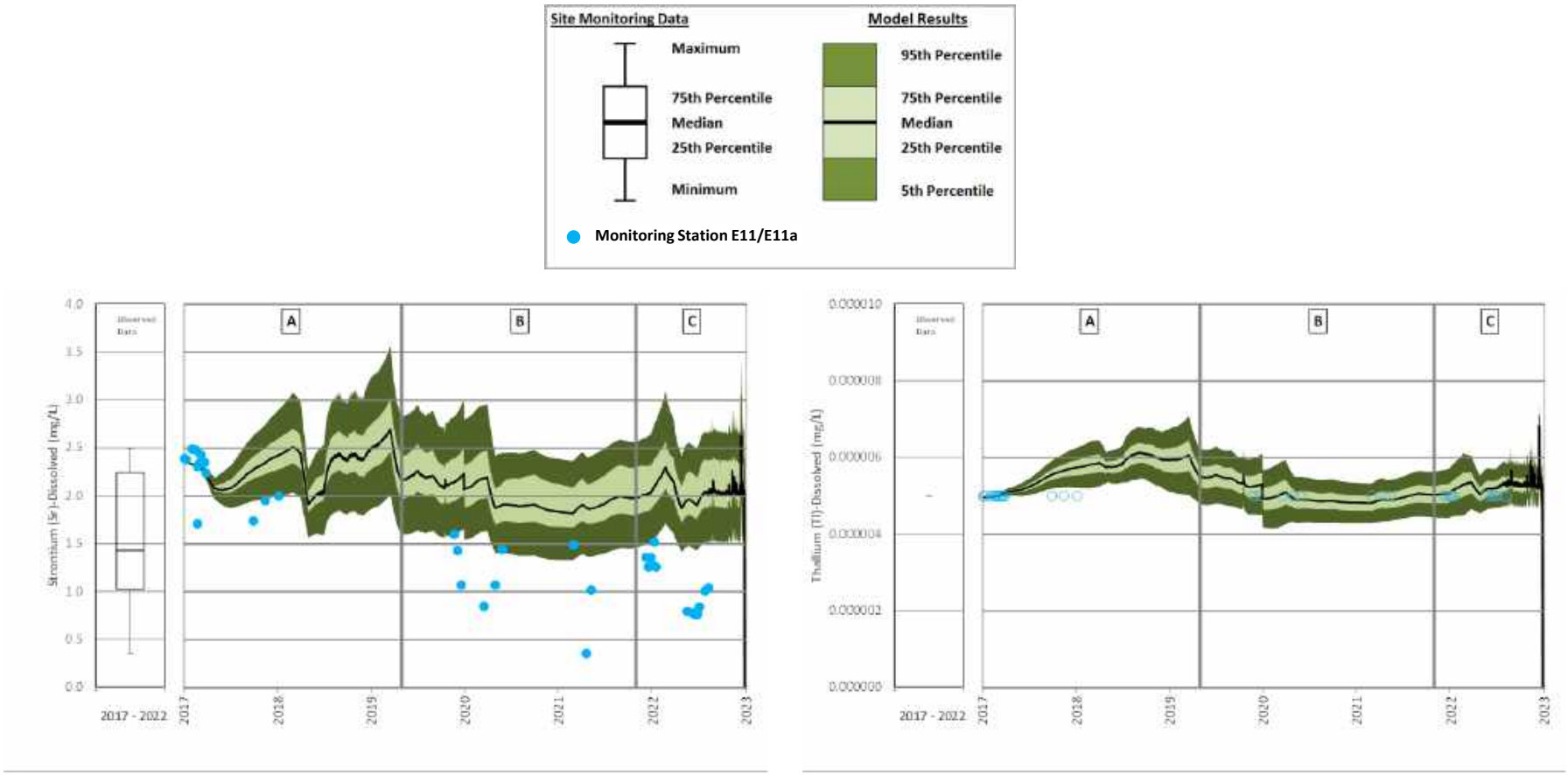
Note: Dissolved molybdenum concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 15: Springer Pit Calibration – Dissolved Molybdenum and Dissolved Nickel



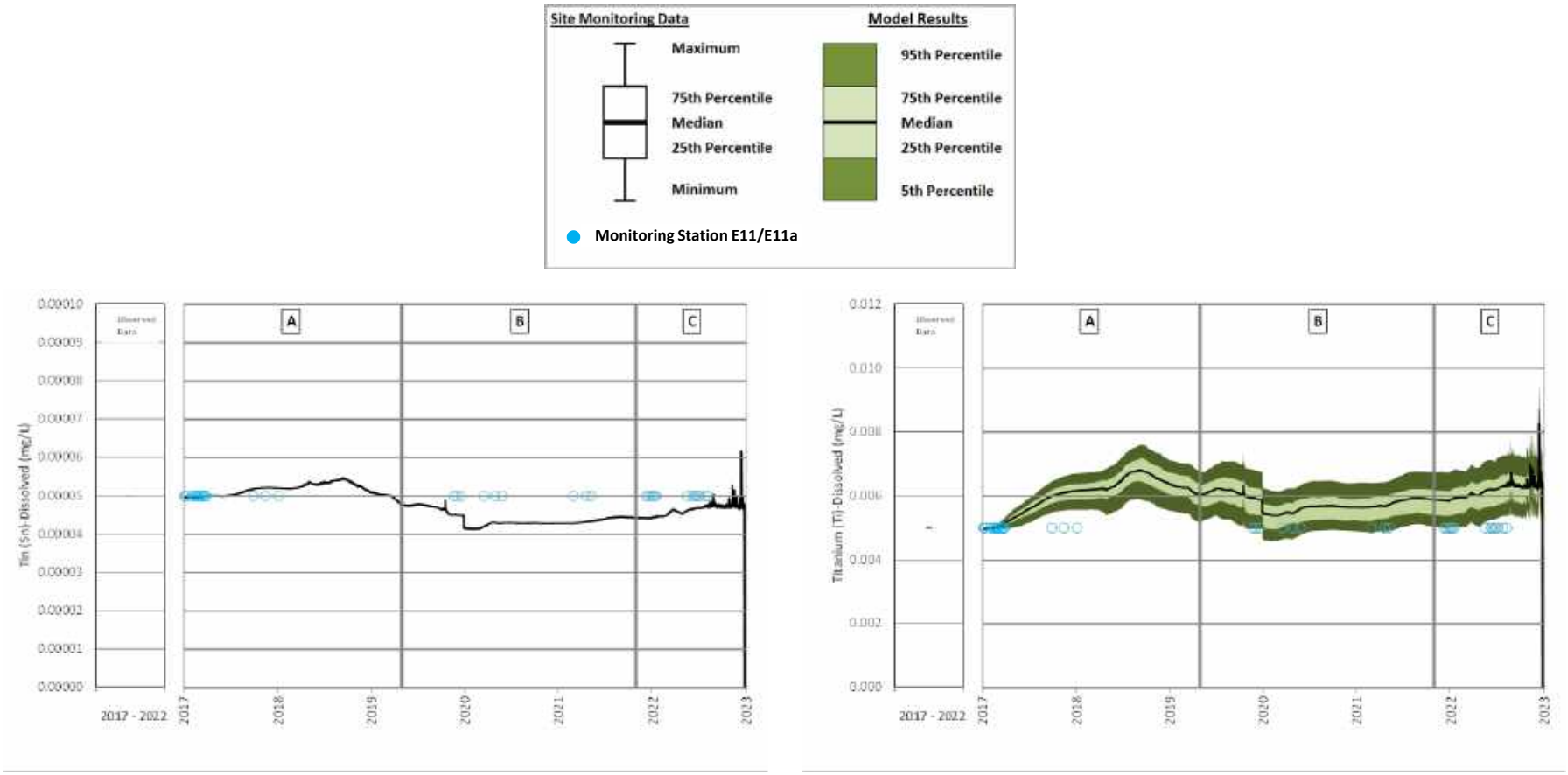
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 16: Springer Pit Calibration – Dissolved Selenium and Dissolved Silver



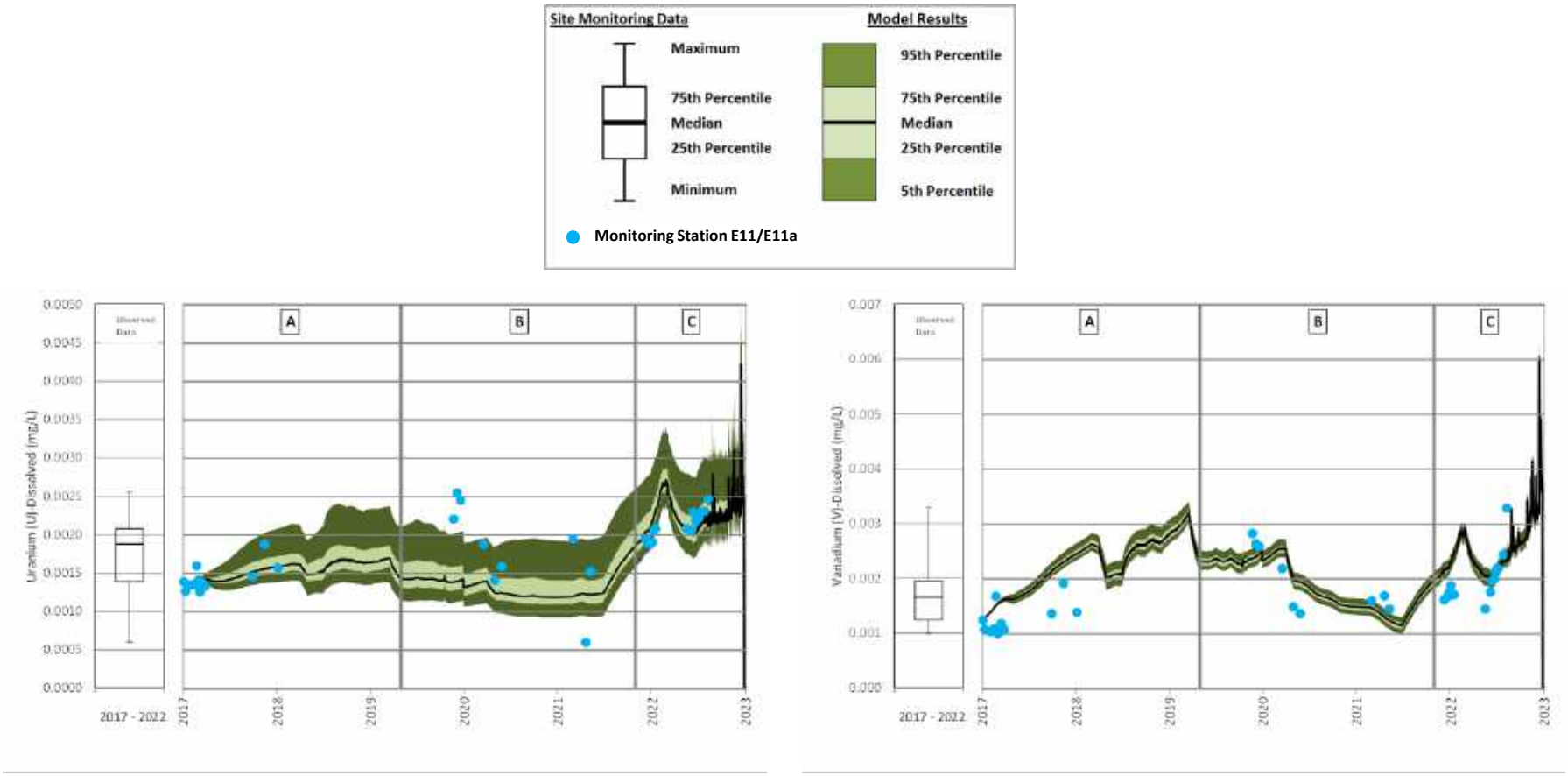
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 17: Springer Pit Calibration – Dissolved Strontium and Dissolved Thallium



A = Operations; B = Care and Maintanence; C = Resumed Operations

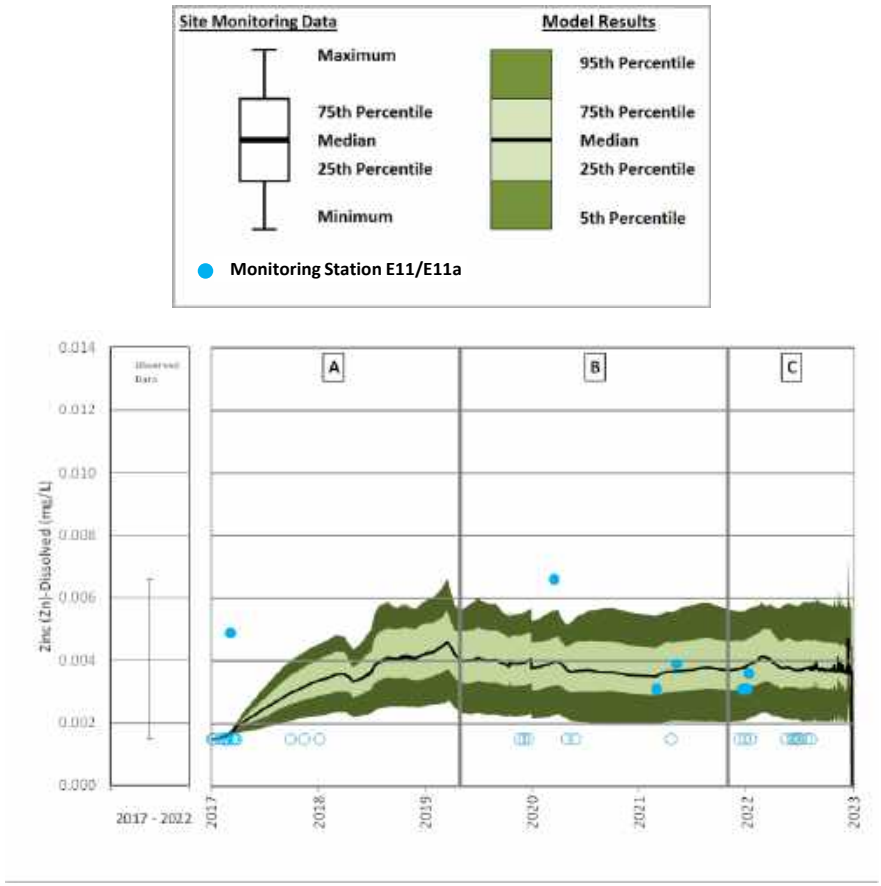
Figure A 18: Springer Pit Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved uranium and vanadium concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

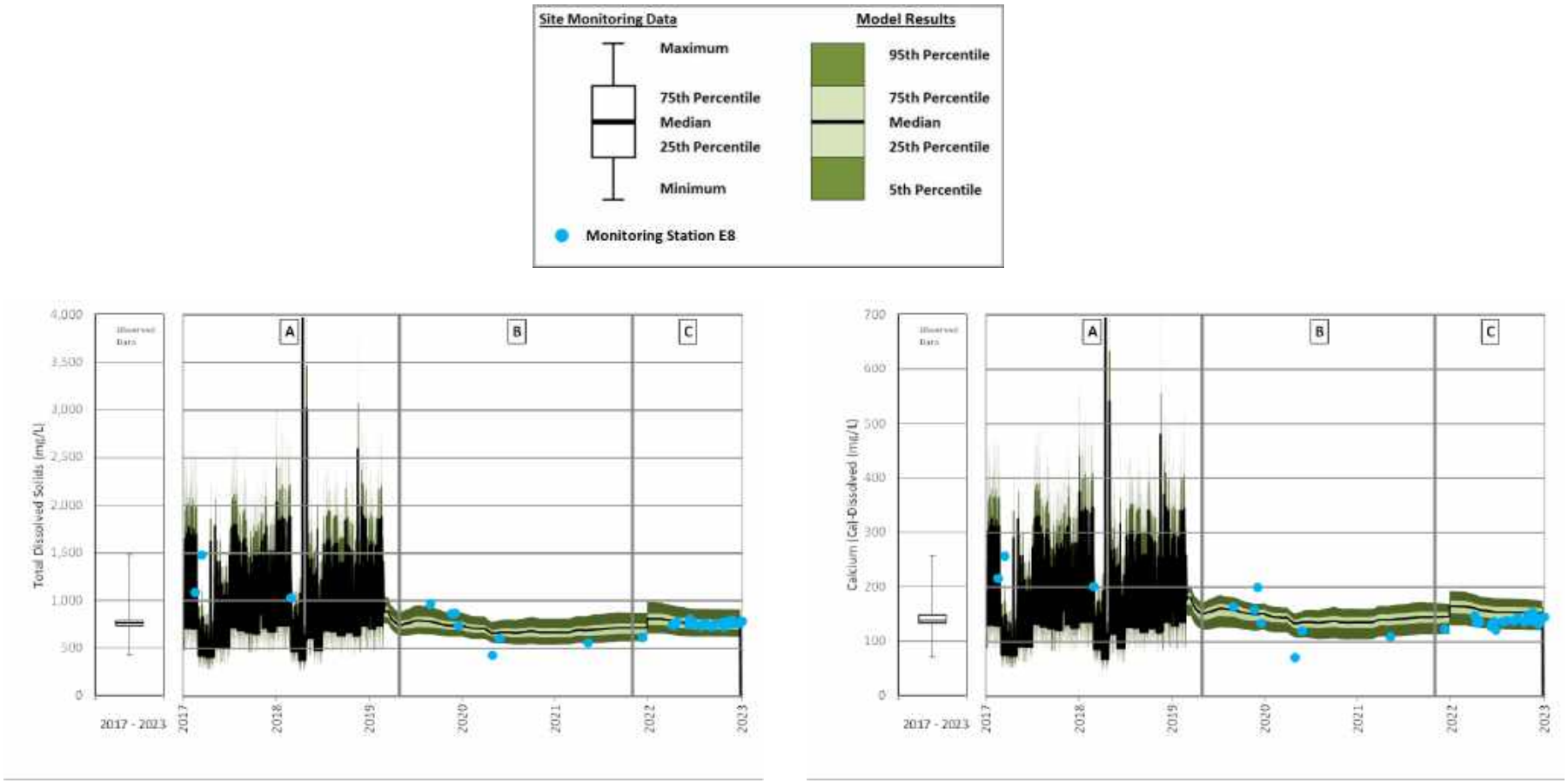
Figure A 19: Springer Pit Calibration – Dissolved Uranium and Dissolved Vanadium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 20: Springer Pit Calibration – Dissolved Zinc

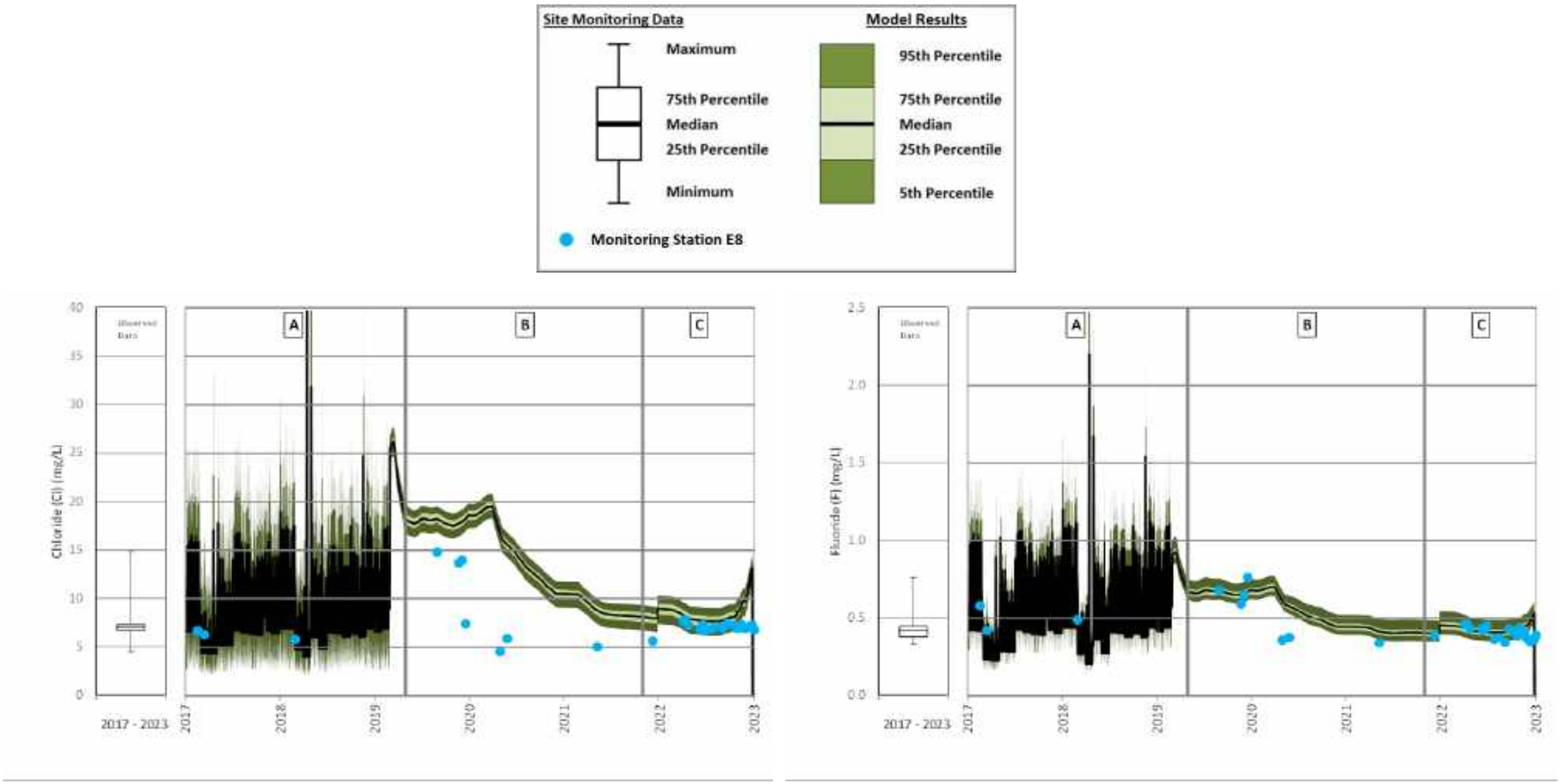
Cariboo Pit Calibration



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Total dissolved solids and calcium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

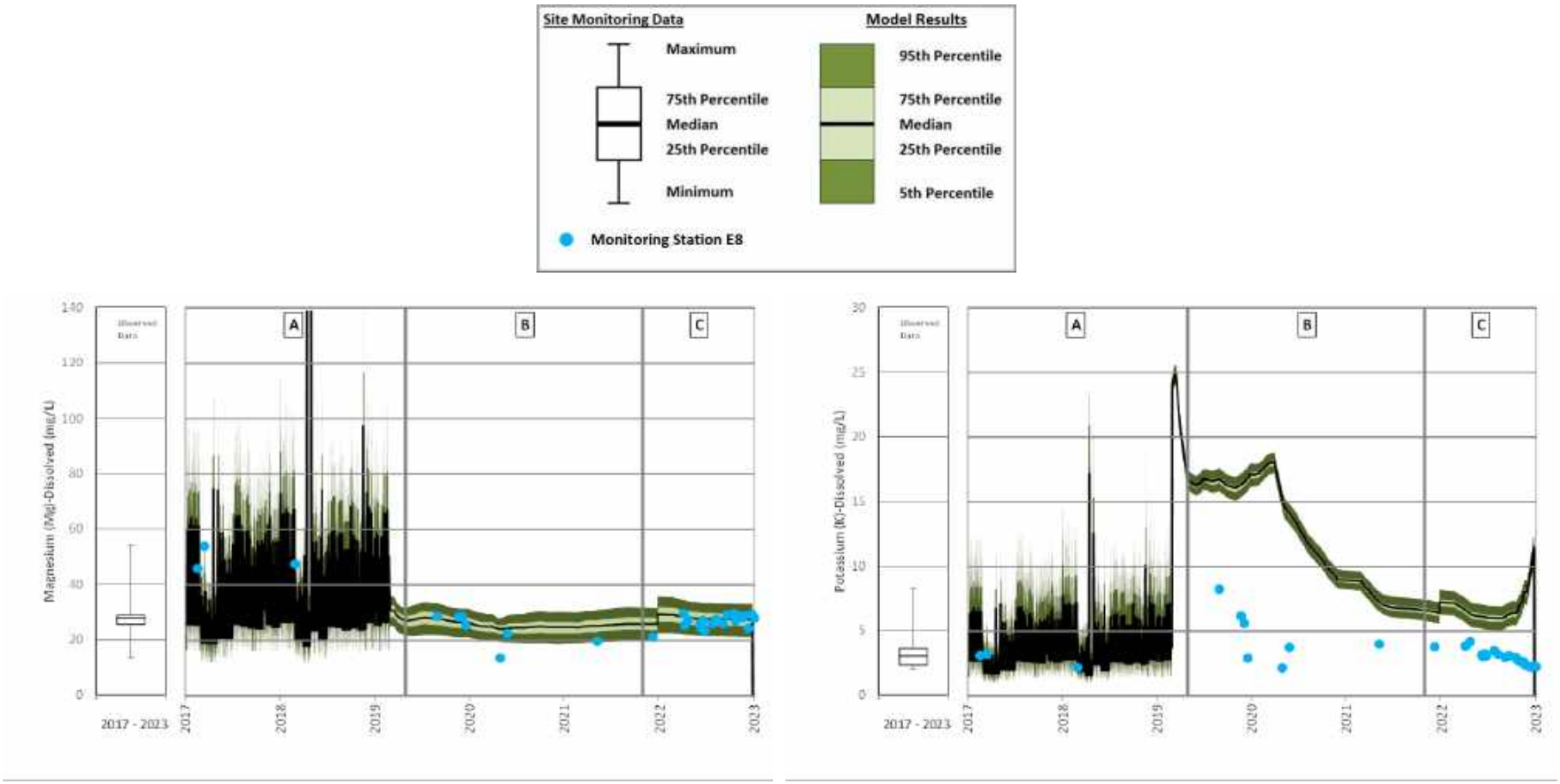
Figure A 21: Cariboo Pit Calibration – Total Dissolved Solids and Calcium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Chloride and fluoride concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

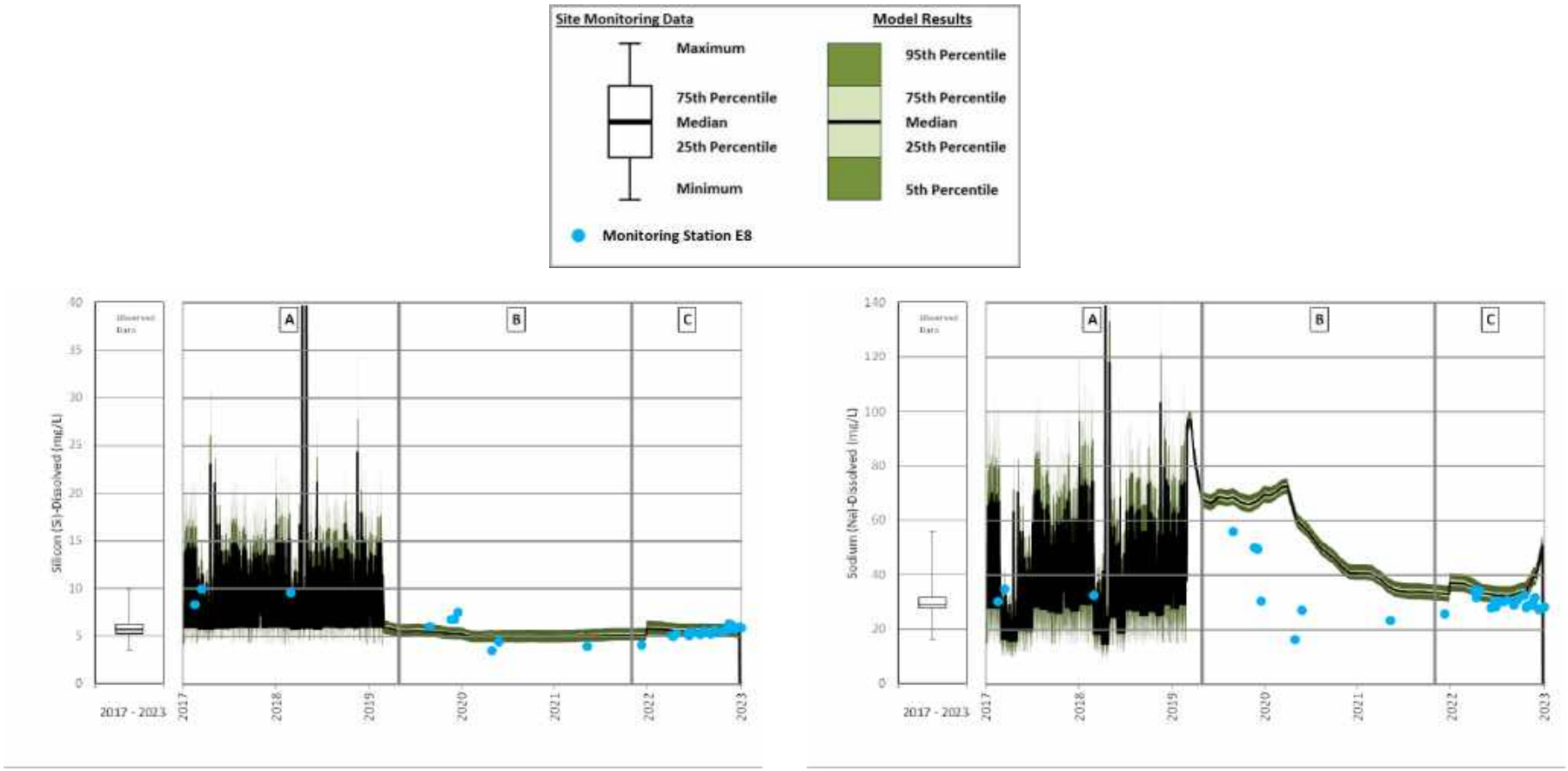
Figure A 22: Cariboo Pit Calibration – Chloride and Fluoride



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Magnesium and potassium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit..

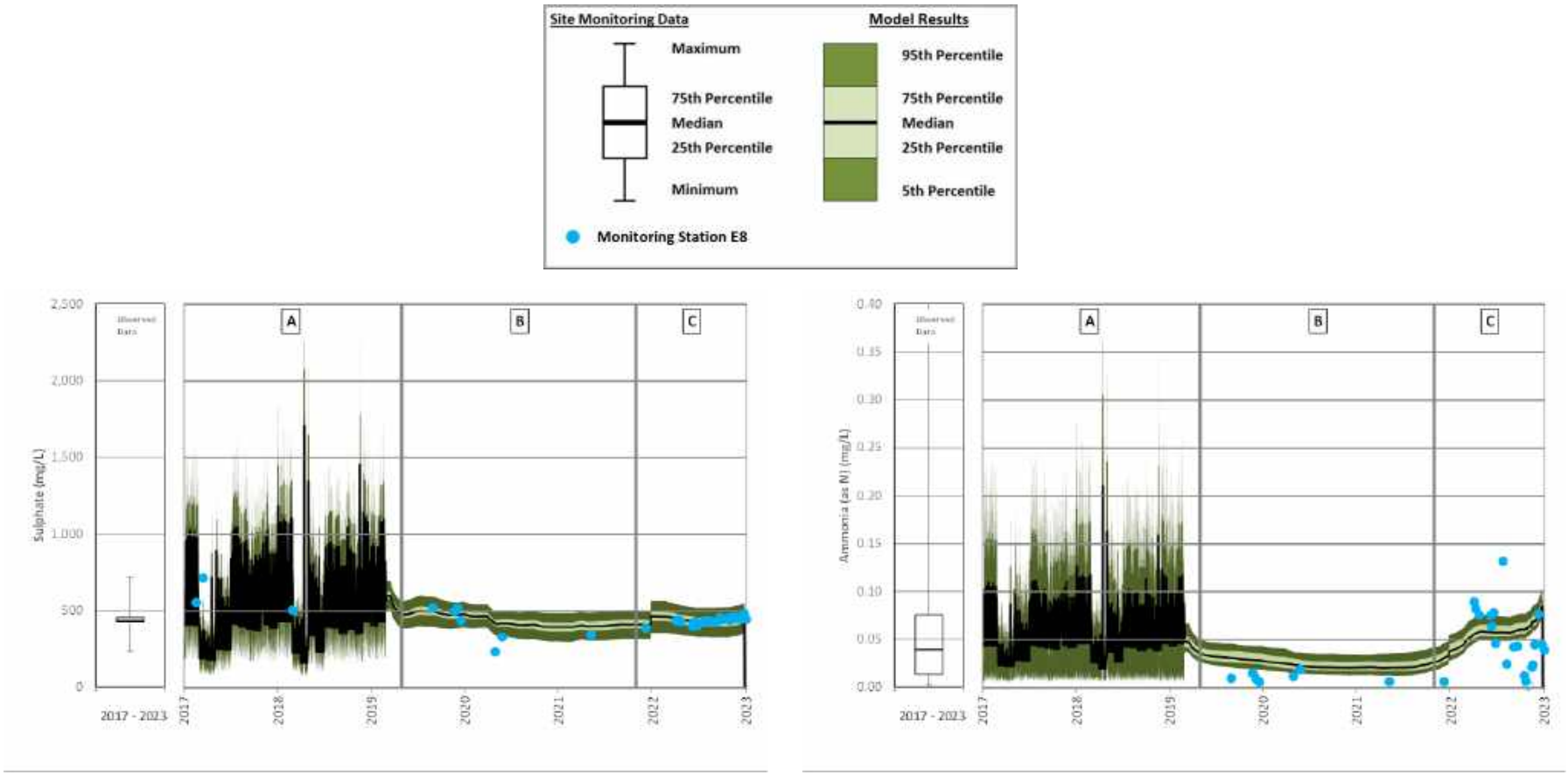
Figure A 23: Cariboo Pit Calibration – Magnesium and Potassium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Silicon and sodium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

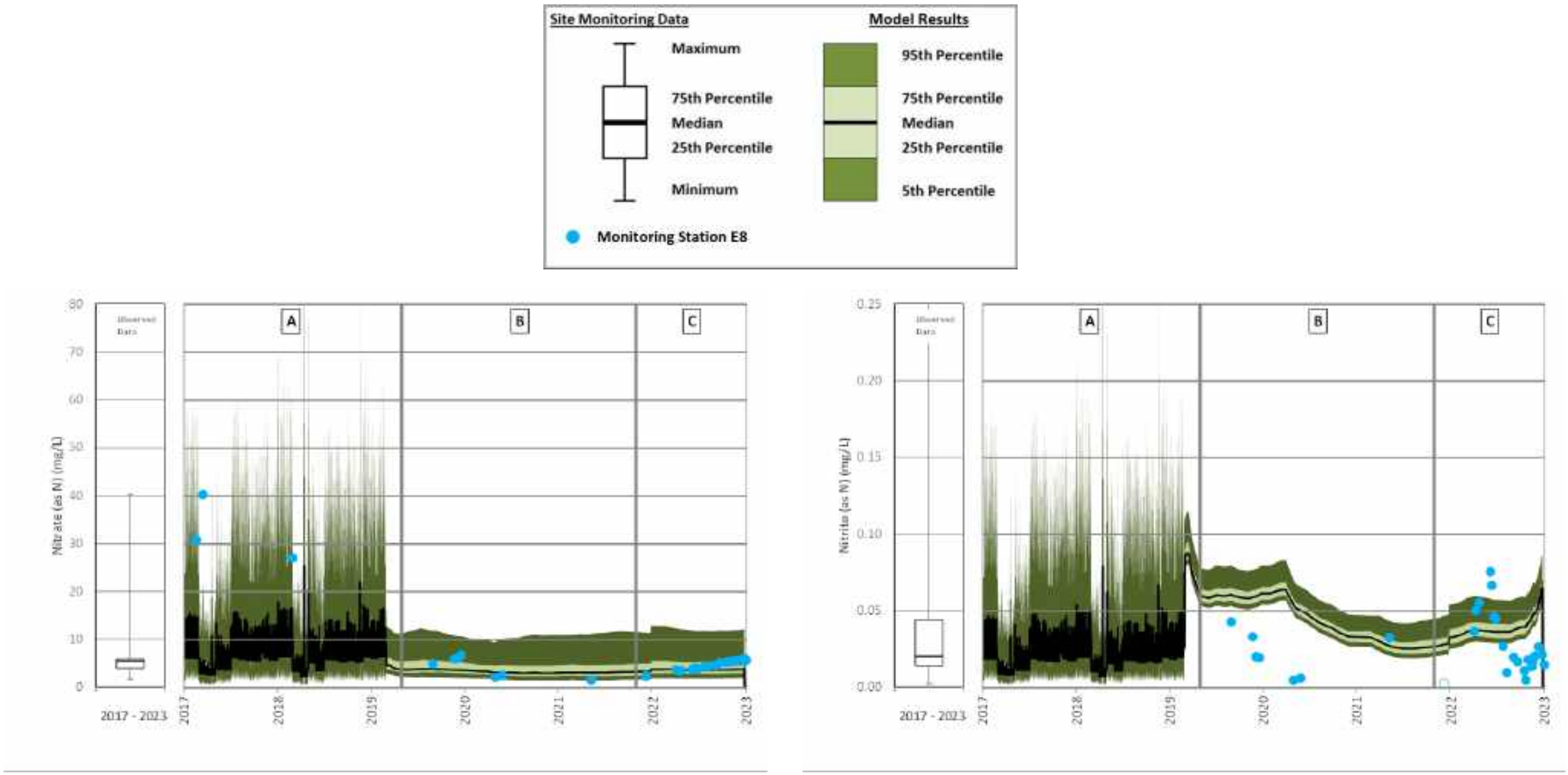
Figure A 24: Cariboo Pit Calibration – Silicon and Sodium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Sulphate and total ammonia concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

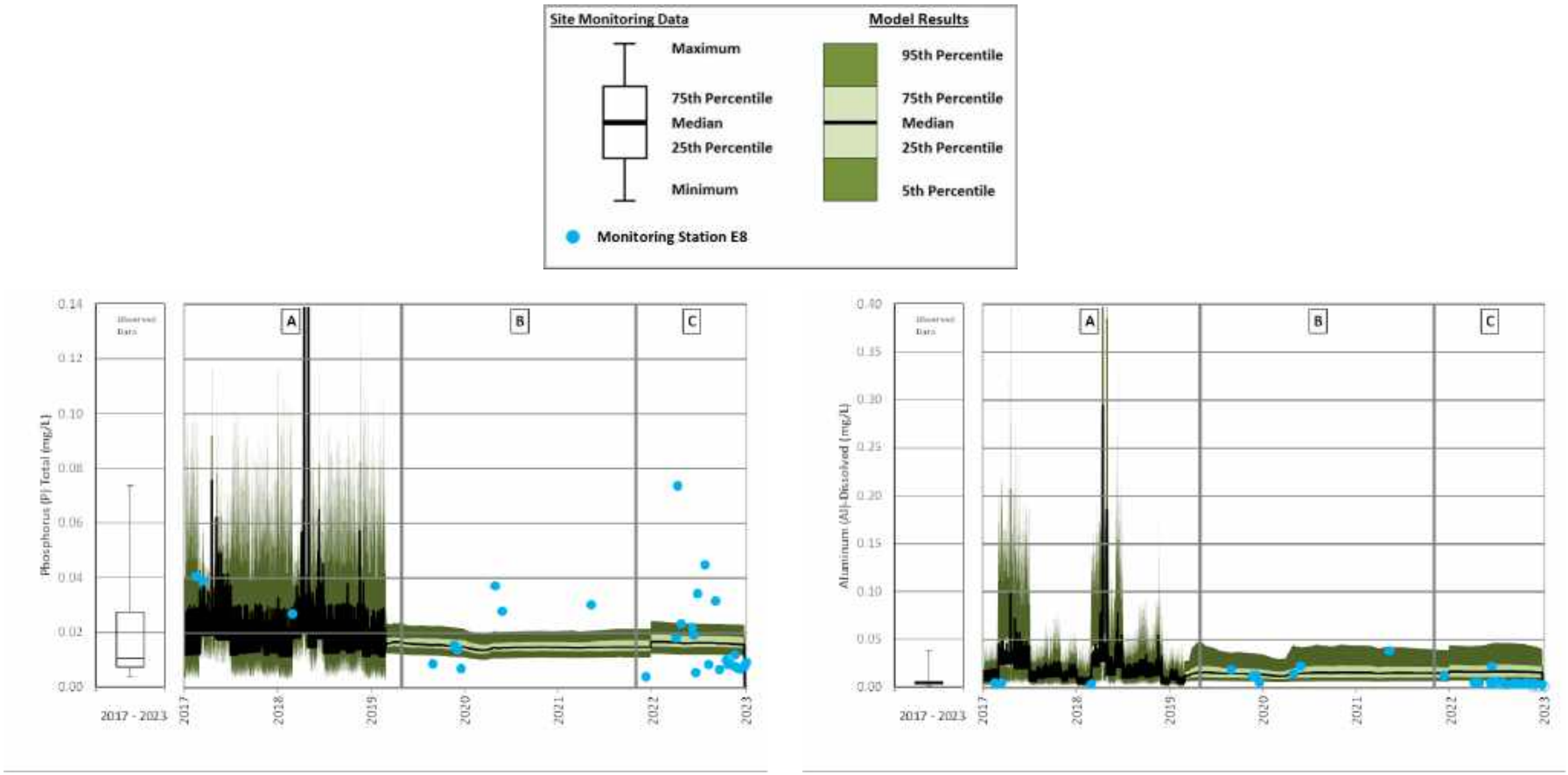
Figure A 25: Cariboo Pit Calibration – Sulphate and Total Ammonia



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Nitrate and nitrite concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

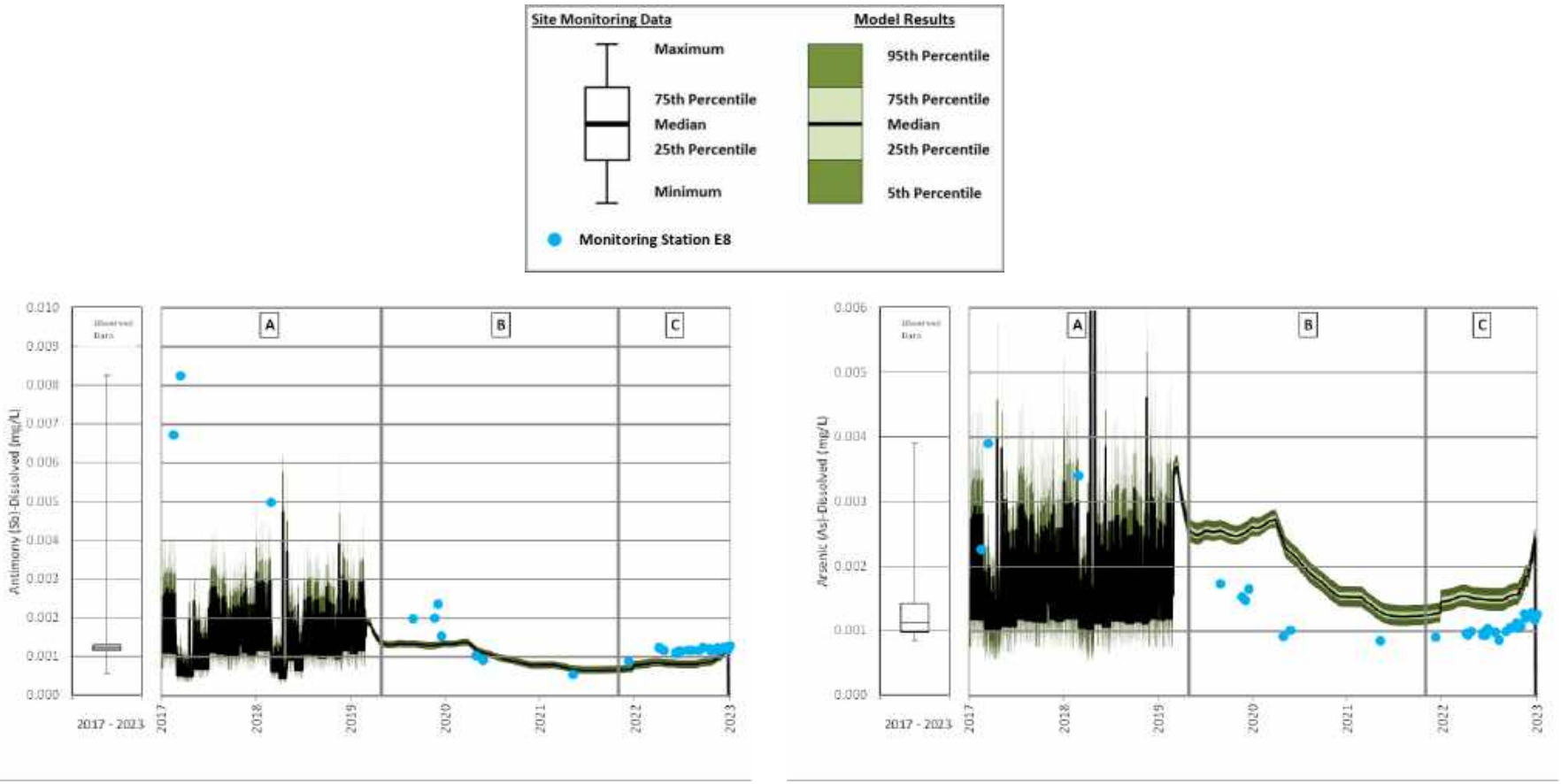
Figure A 26: Cariboo Pit Calibration – Nitrate and Nitrite



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Total phosphorus and dissolved aluminum concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

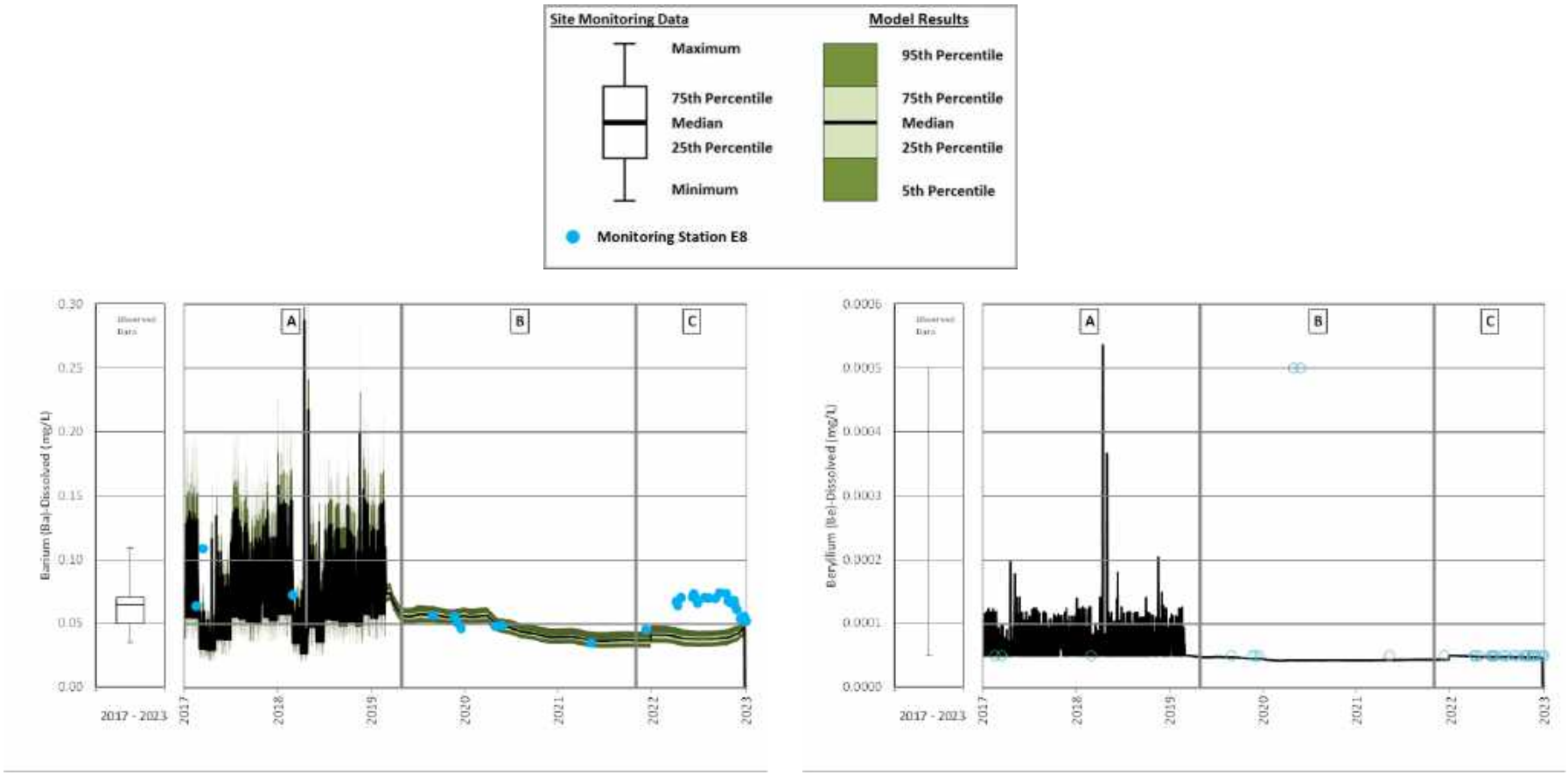
Figure A 27: Cariboo Pit Calibration – Total Phosphorus and Dissolved Aluminum



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in Springer Pit at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to Springer Pit. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

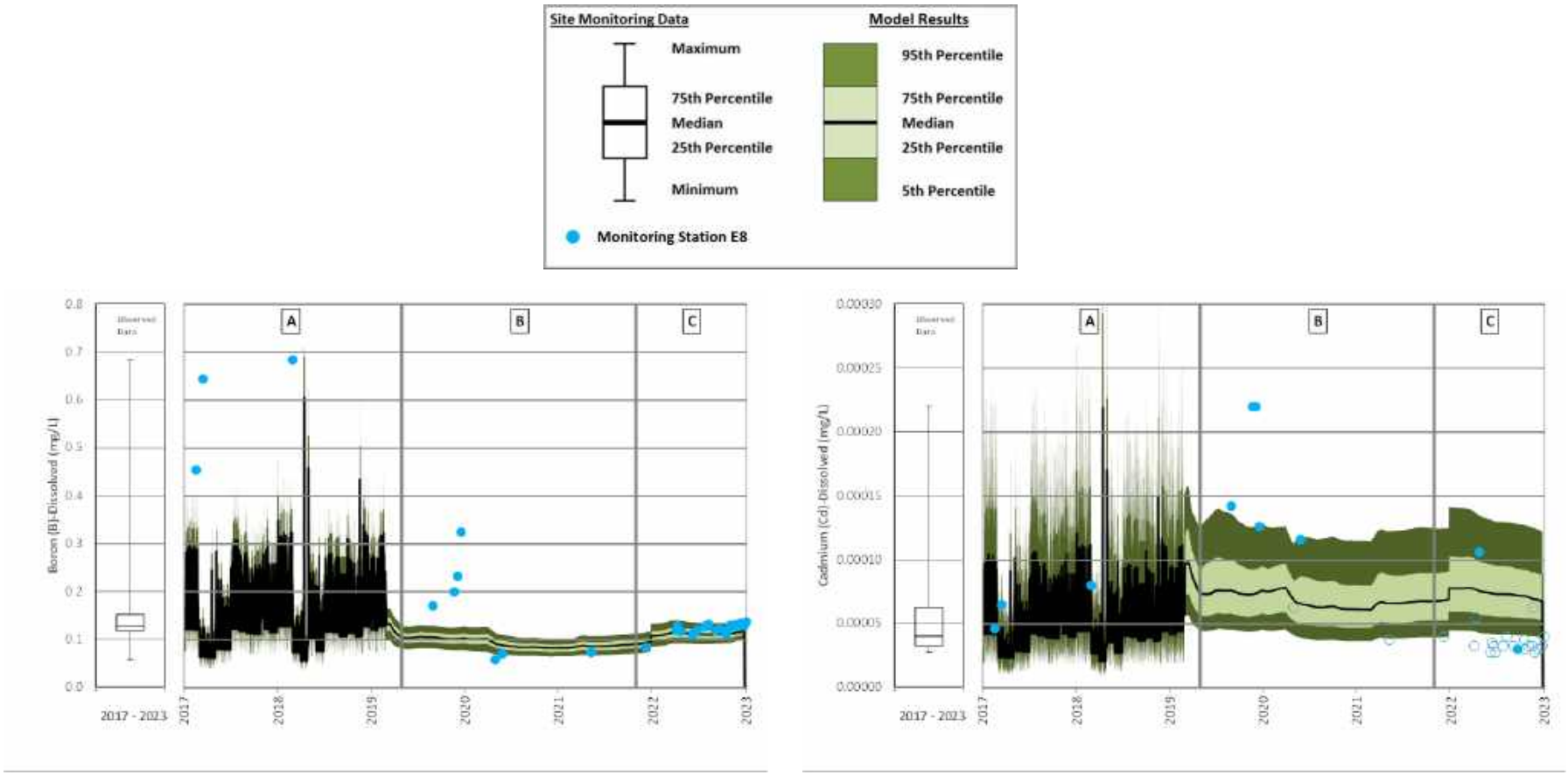
Figure A 28: Cariboo Pit Calibration – Dissolved Antimony and Dissolved Arsenic



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved barium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

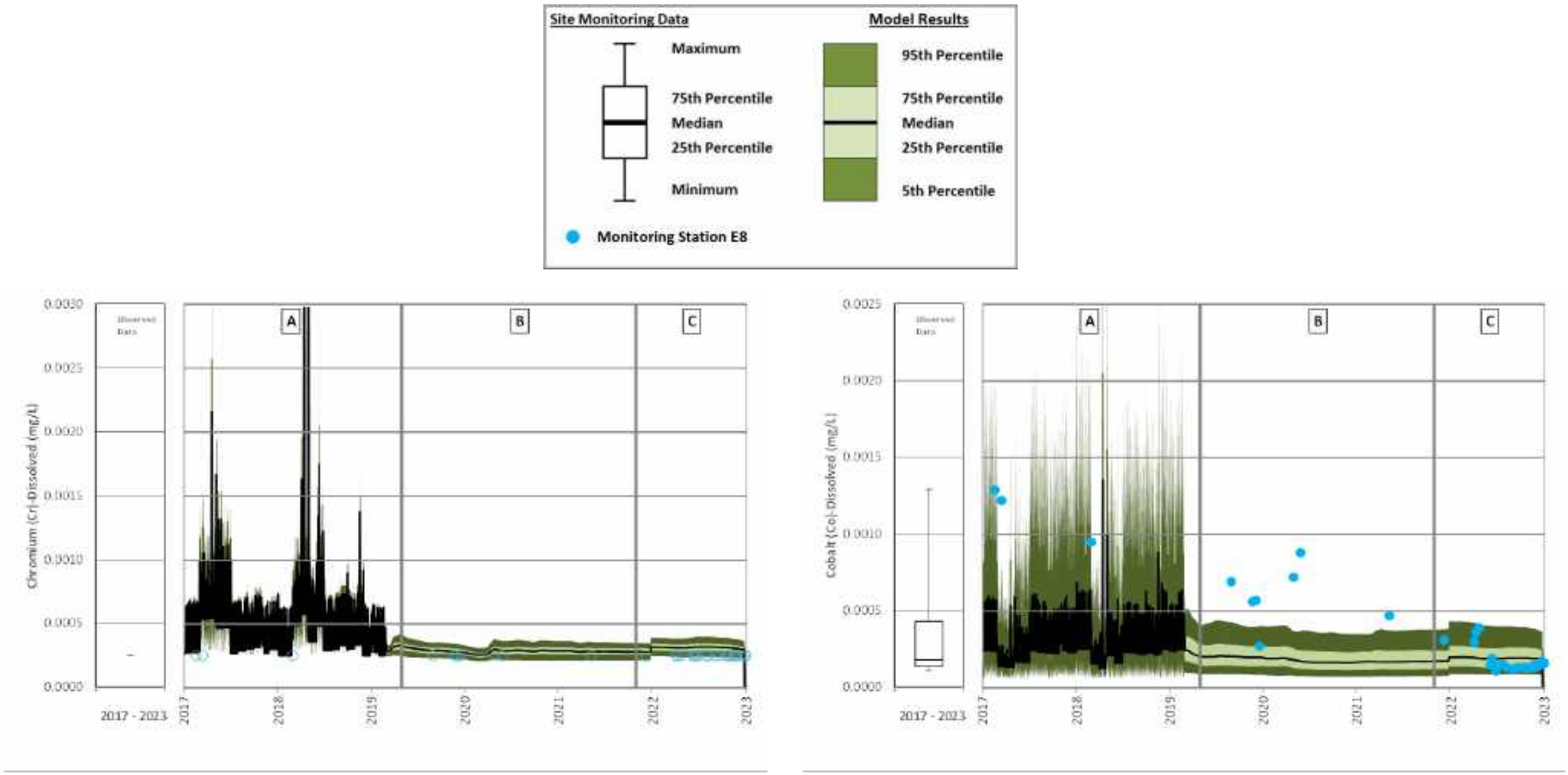
Figure A 29: Cariboo Pit Calibration – Dissolved Barium and Dissolved Beryllium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved boron and dissolved cadmium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

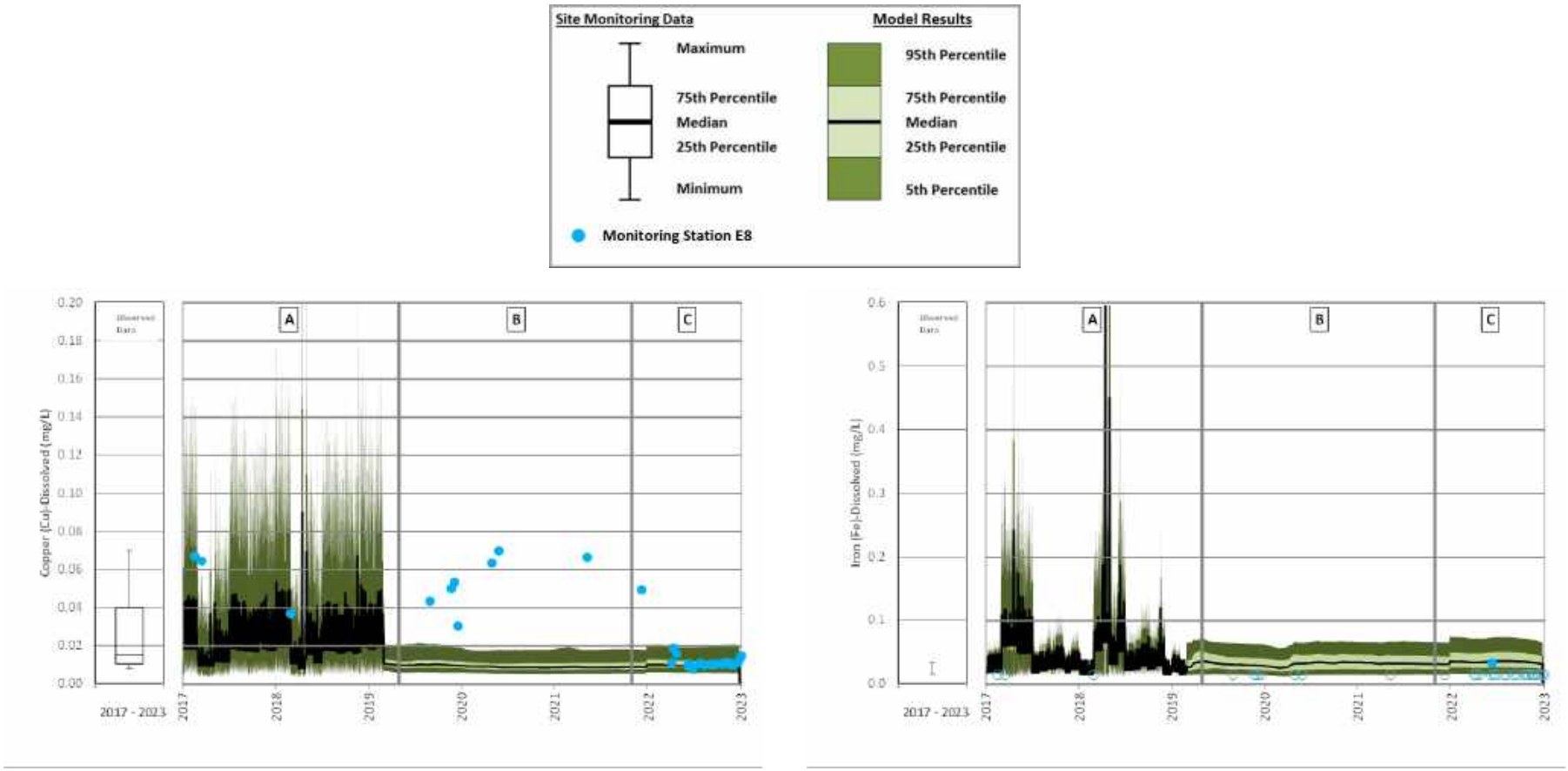
Figure A 30: Cariboo Pit Calibration – Dissolved Boron and Dissolved Cadmium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved chromium and dissolved cobalt concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

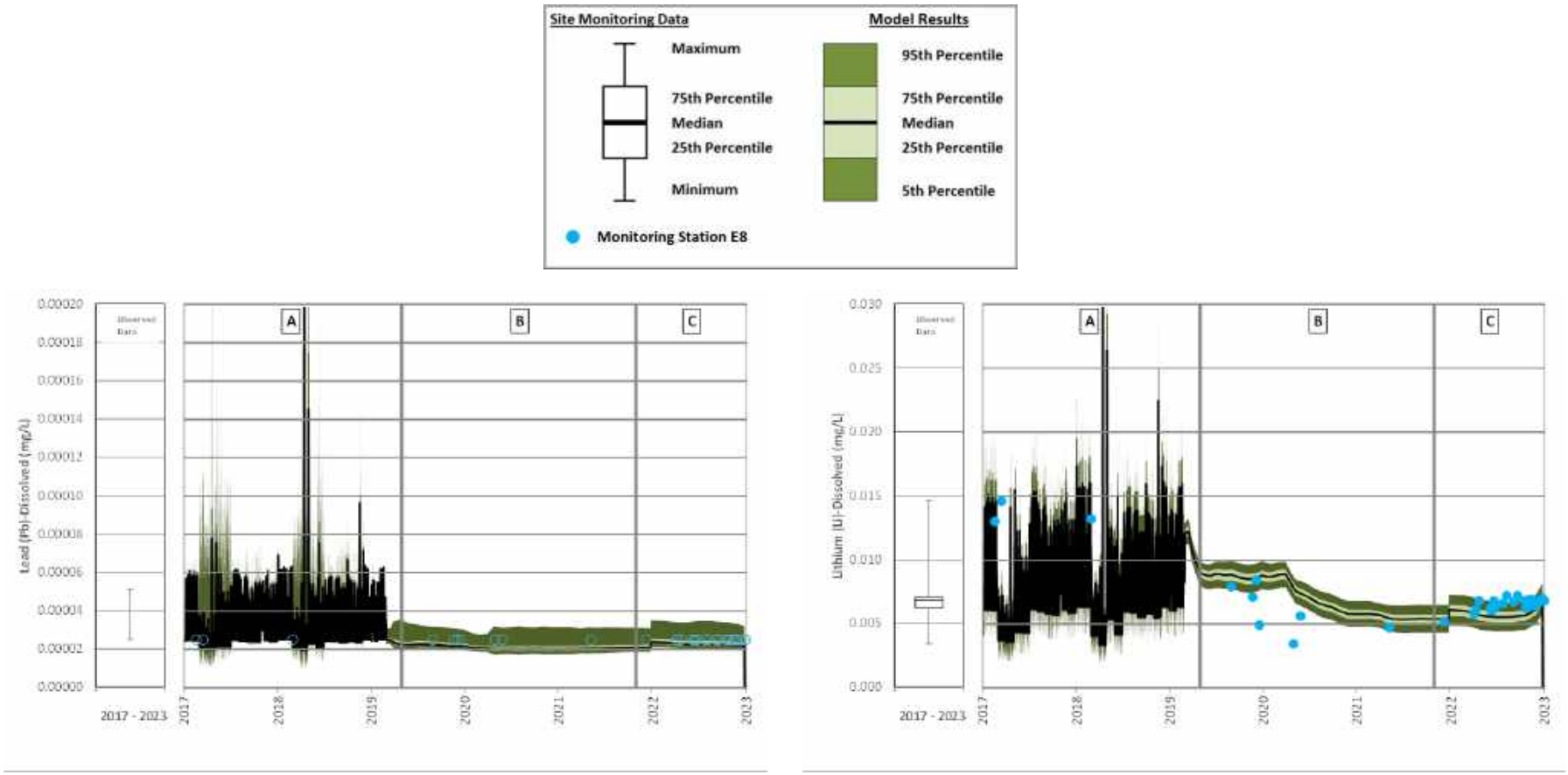
Figure A 31: Cariboo Pit Calibration – Dissolved Chromium and Dissolved Cobalt



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved copper and dissolved iron concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

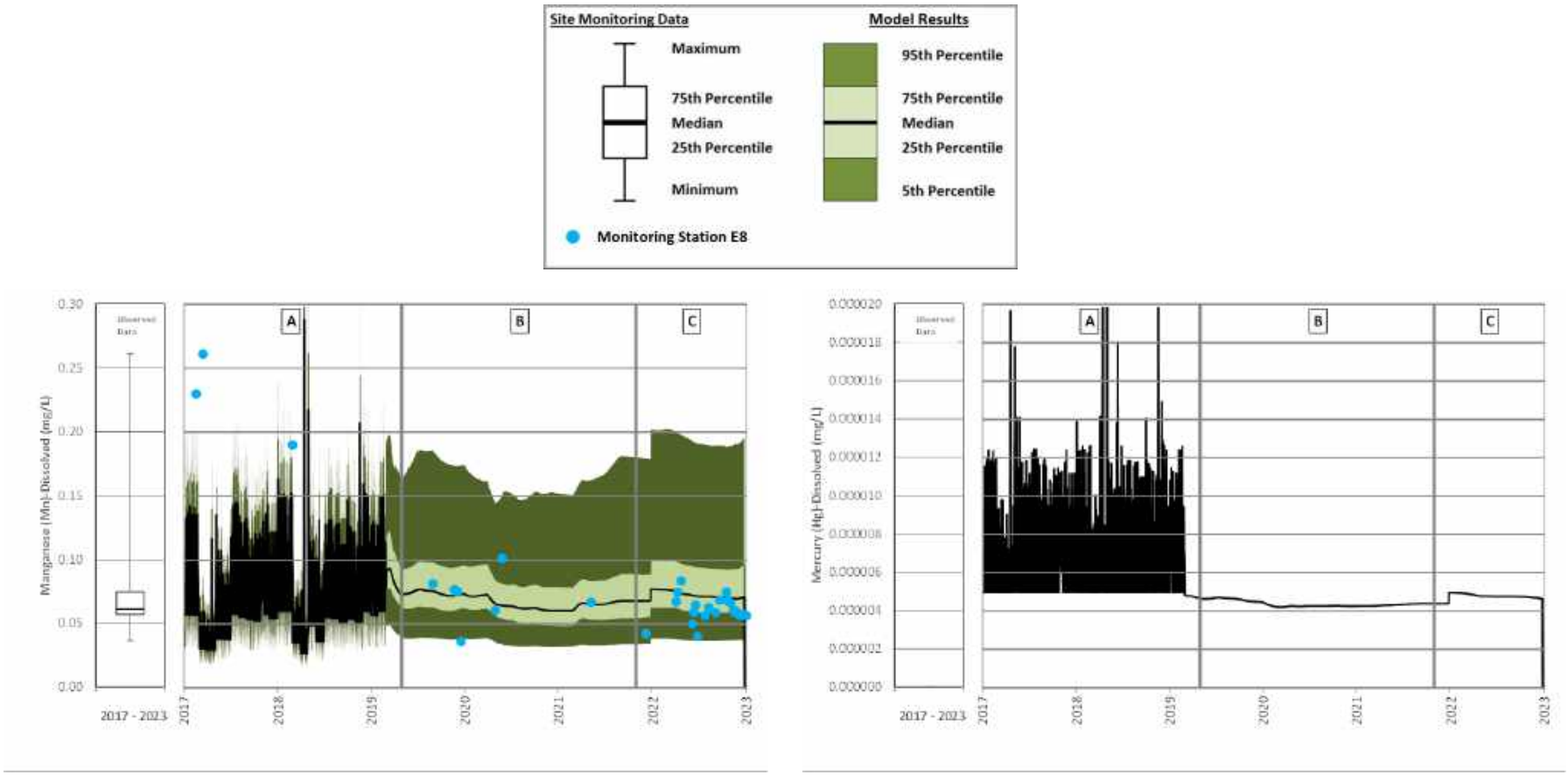
Figure A 32: Cariboo Pit Calibration – Dissolved Copper and Dissolved Iron



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved lead and dissolved lithium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

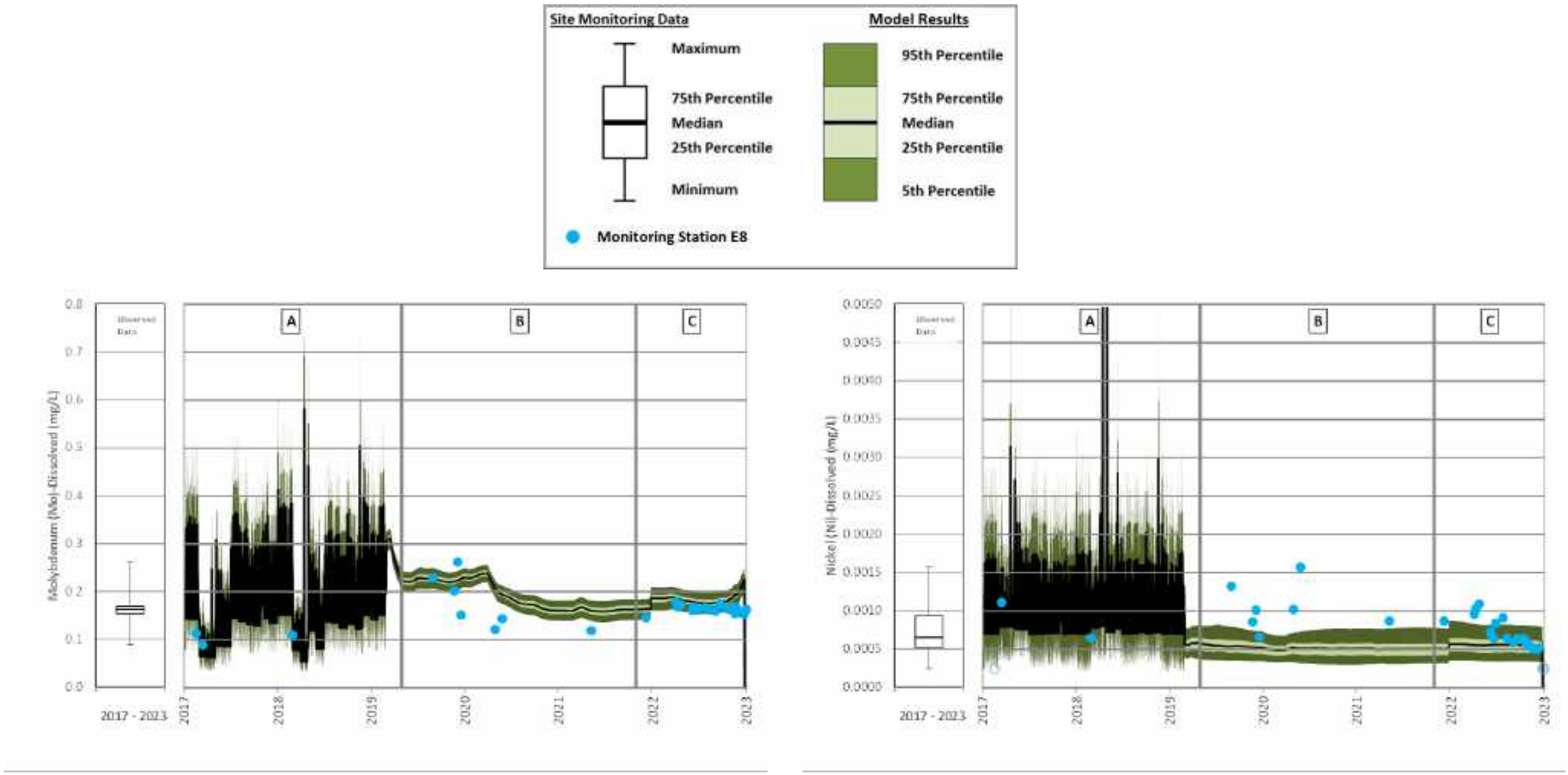
Figure A 33: Cariboo Pit Calibration – Dissolved Lead and Dissolved Lithium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved manganese concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

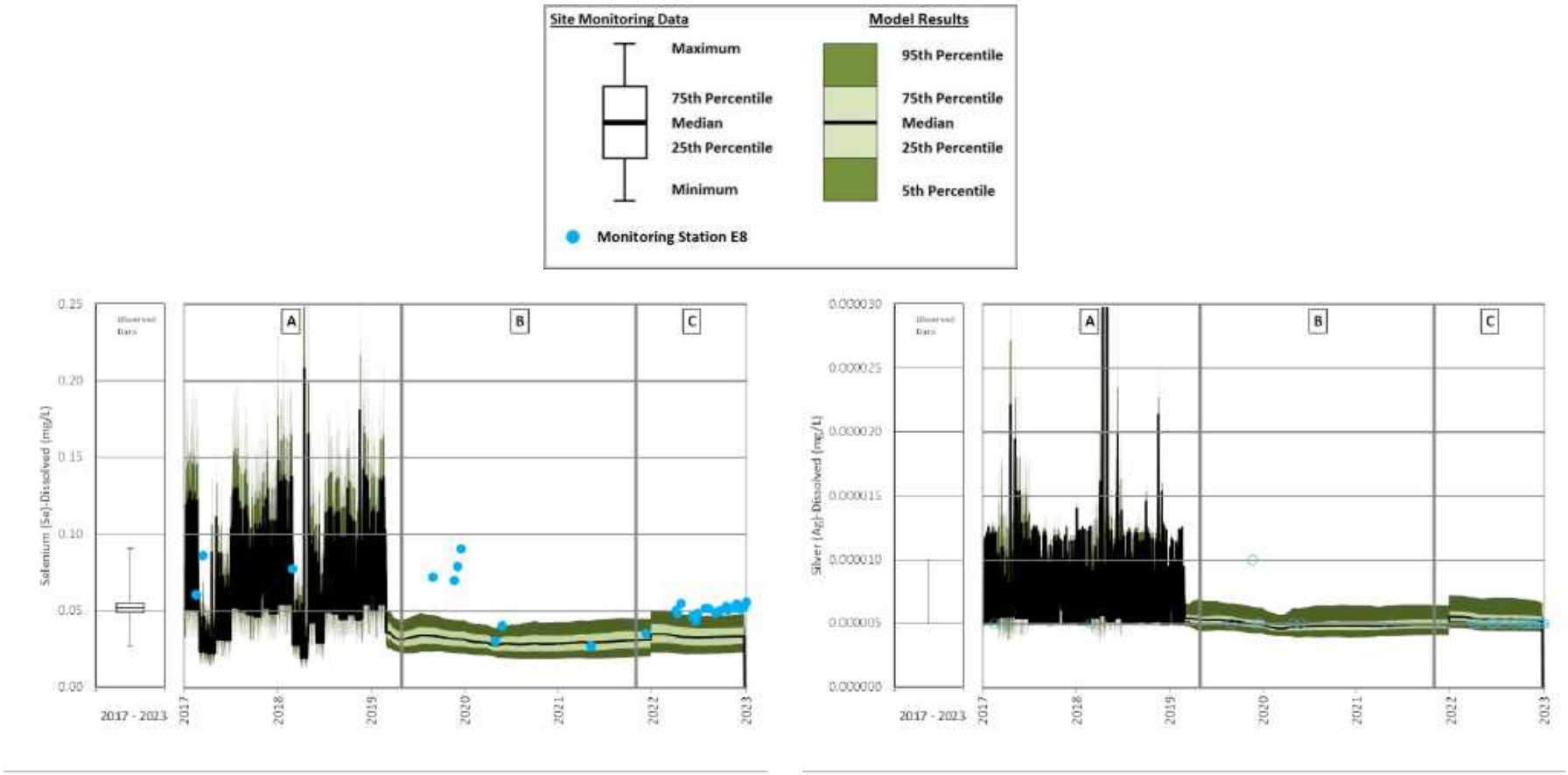
Figure A 34: Cariboo Pit Calibration – Dissolved Manganese and Dissolved Mercury



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved molybdenum and dissolved nickel concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

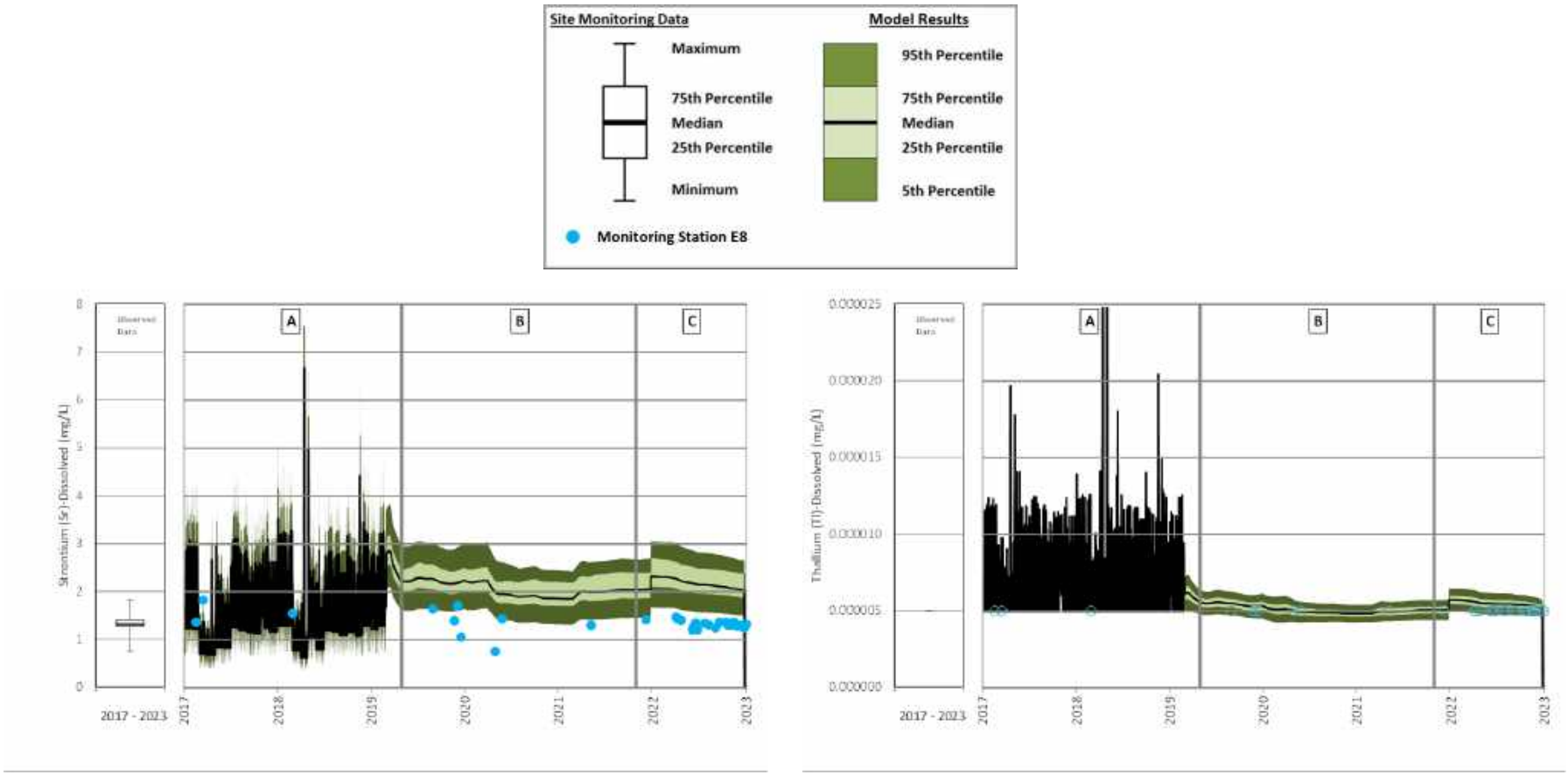
Figure A 35: Cariboo Pit Calibration – Dissolved Molybdenum and Dissolved Nickel



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved selenium and dissolved silver concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

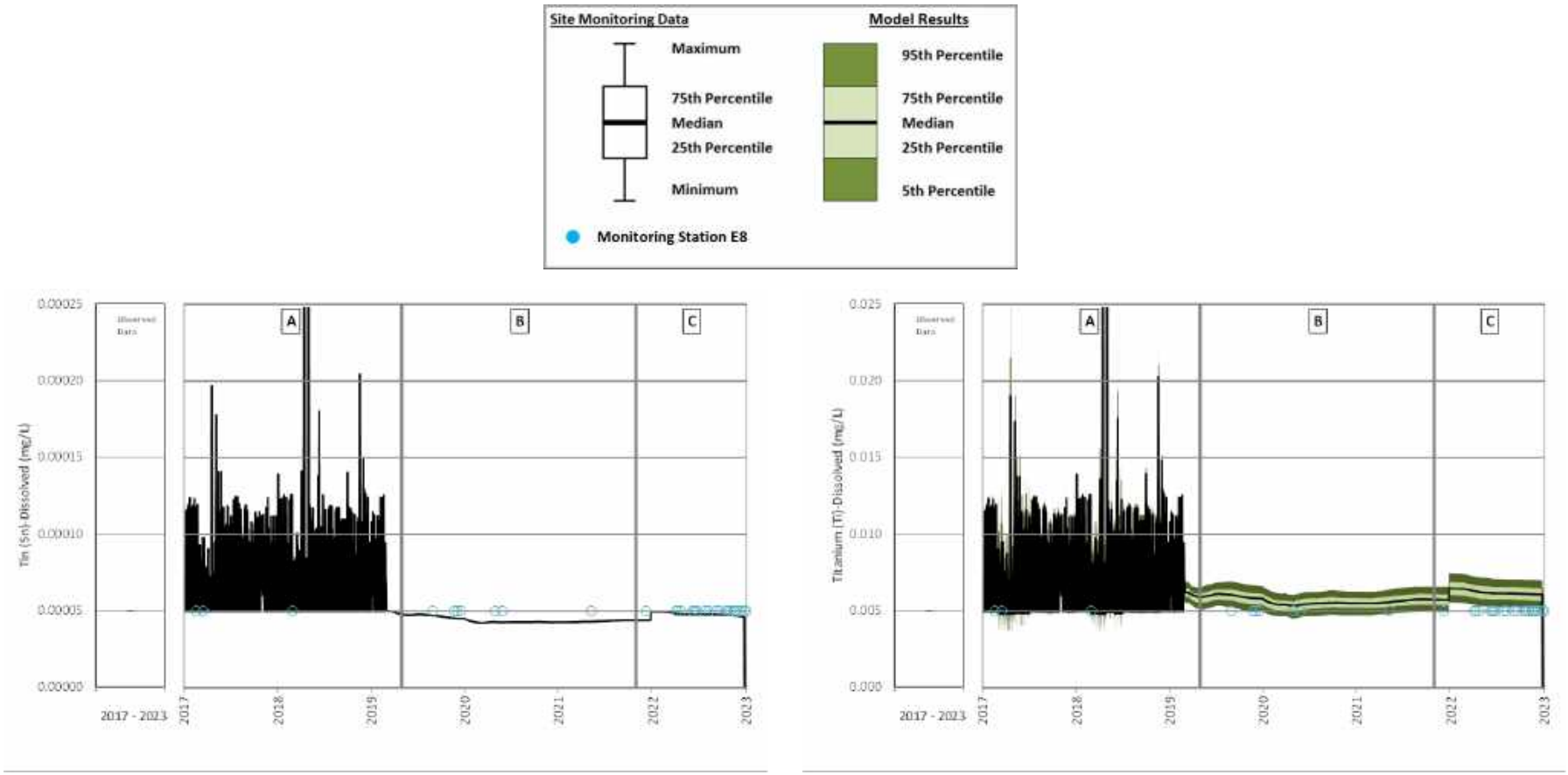
Figure A 36: Cariboo Pit Calibration – Dissolved Selenium and Dissolved Silver



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved strontium and dissolved thallium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

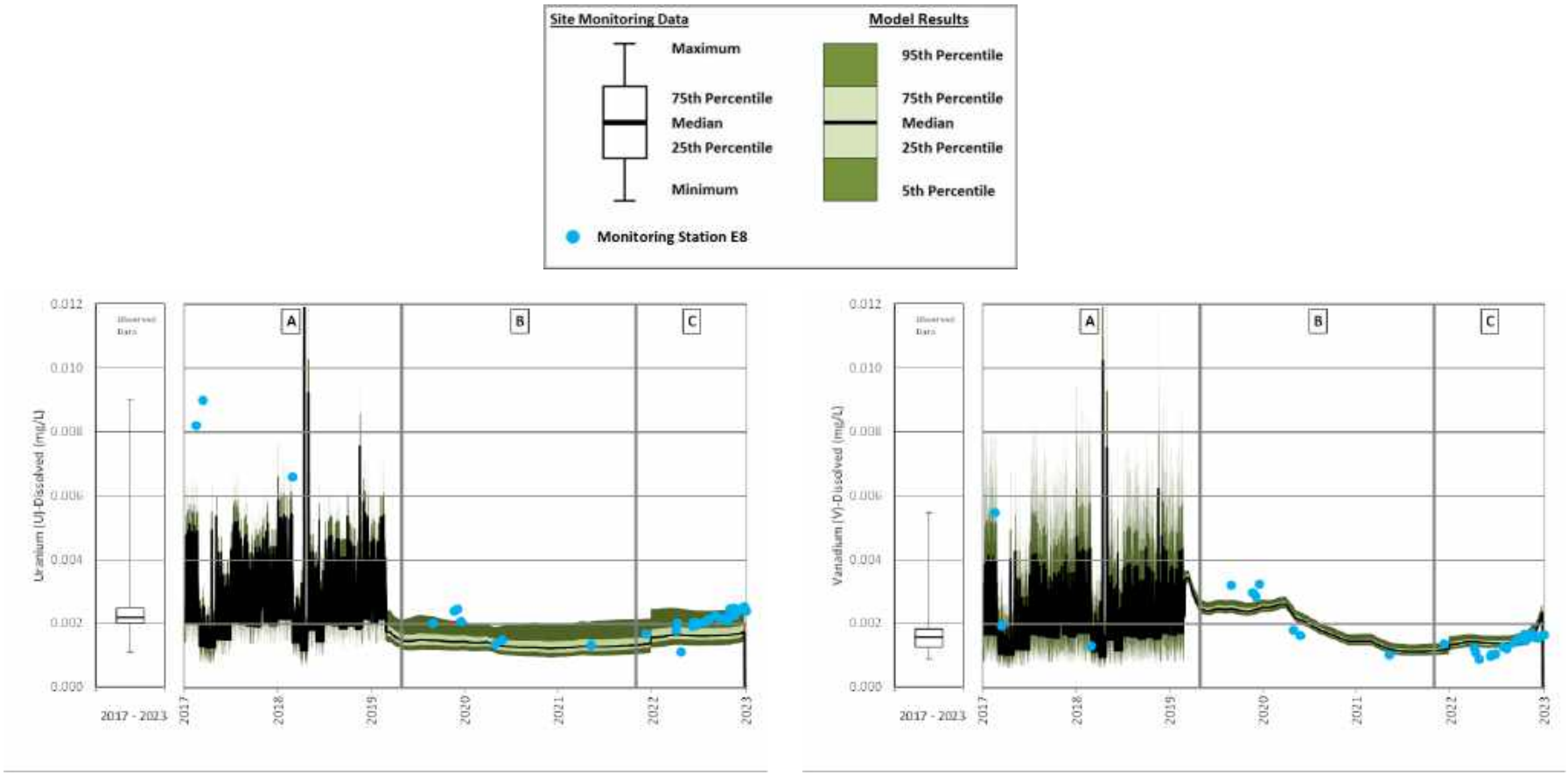
Figure A 37: Cariboo Pit Calibration – Dissolved Strontium and Dissolved Thallium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved titanium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

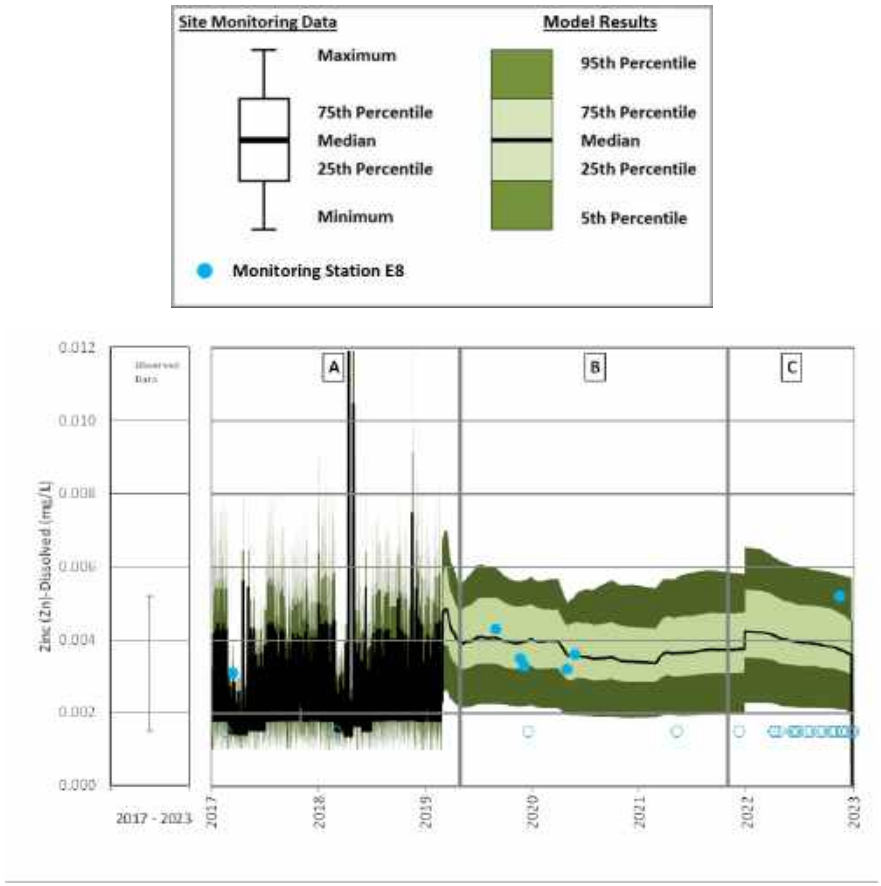
Figure A 38: Cariboo Pit Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved uranium and dissolved vanadium concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 39: Cariboo Pit Calibration – Dissolved Uranium and Dissolved Vanadium

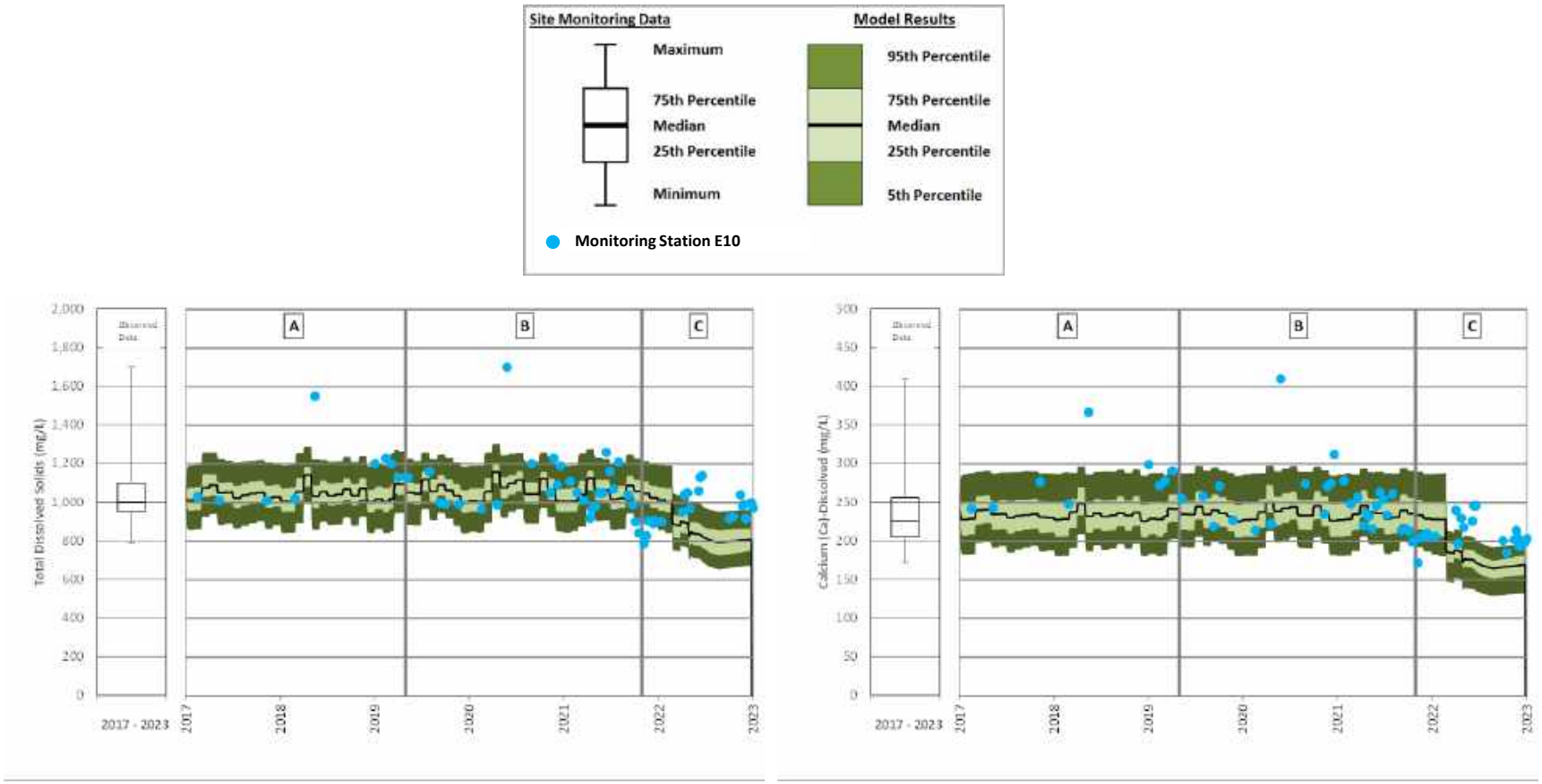


A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Cariboo Pit is a flow-through system until March 2019 when the Tailings Storage Facility (TSF) is pumped to Cariboo Pit. Dissolved zinc concentrations increase in 2022 because of pumping from Springer Pit to Cariboo Pit.

Figure A 40: Cariboo Pit Calibration – Dissolved Zinc

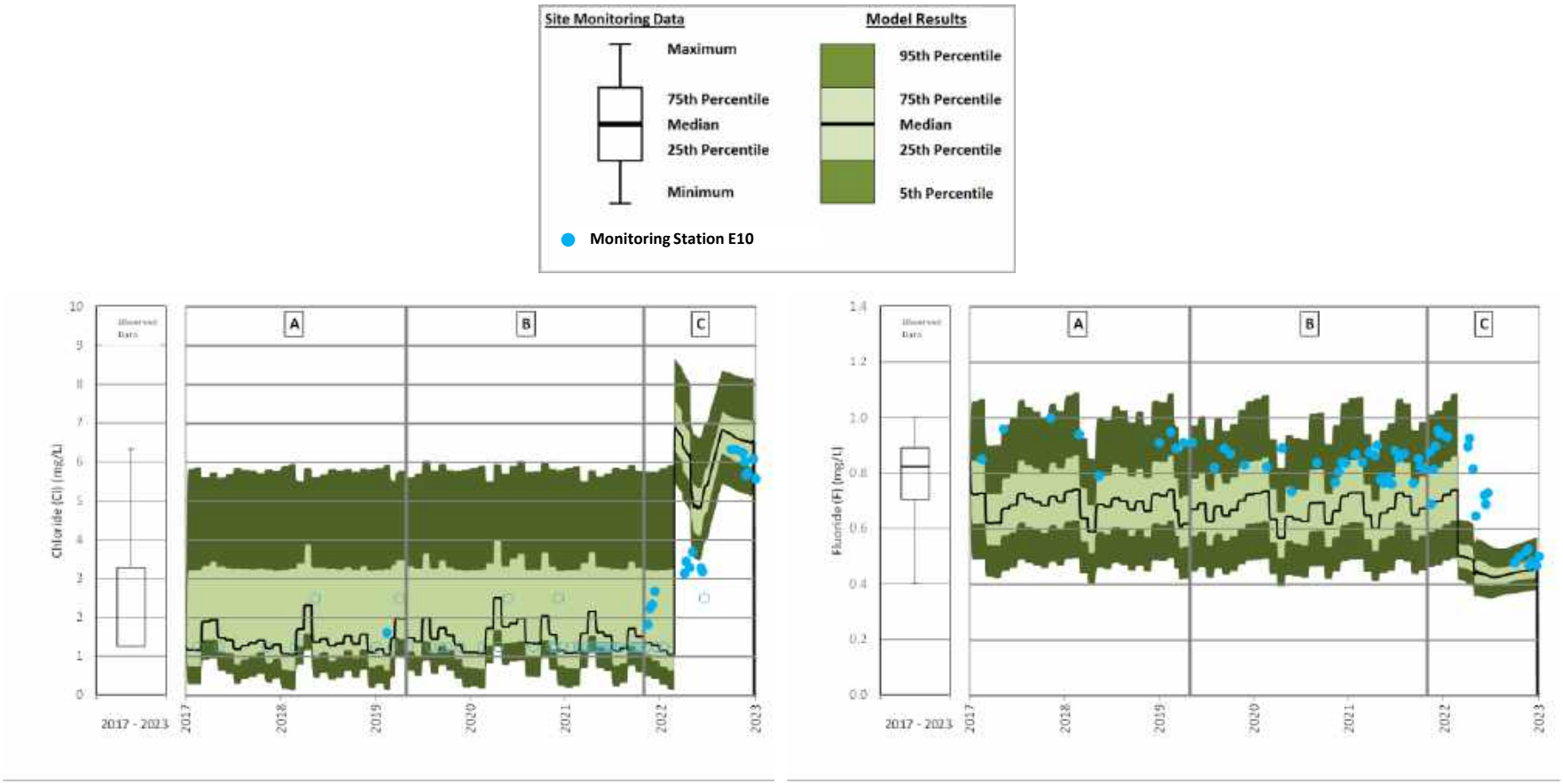
Wight Pit Calibration



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Total dissolved solids and calcium decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

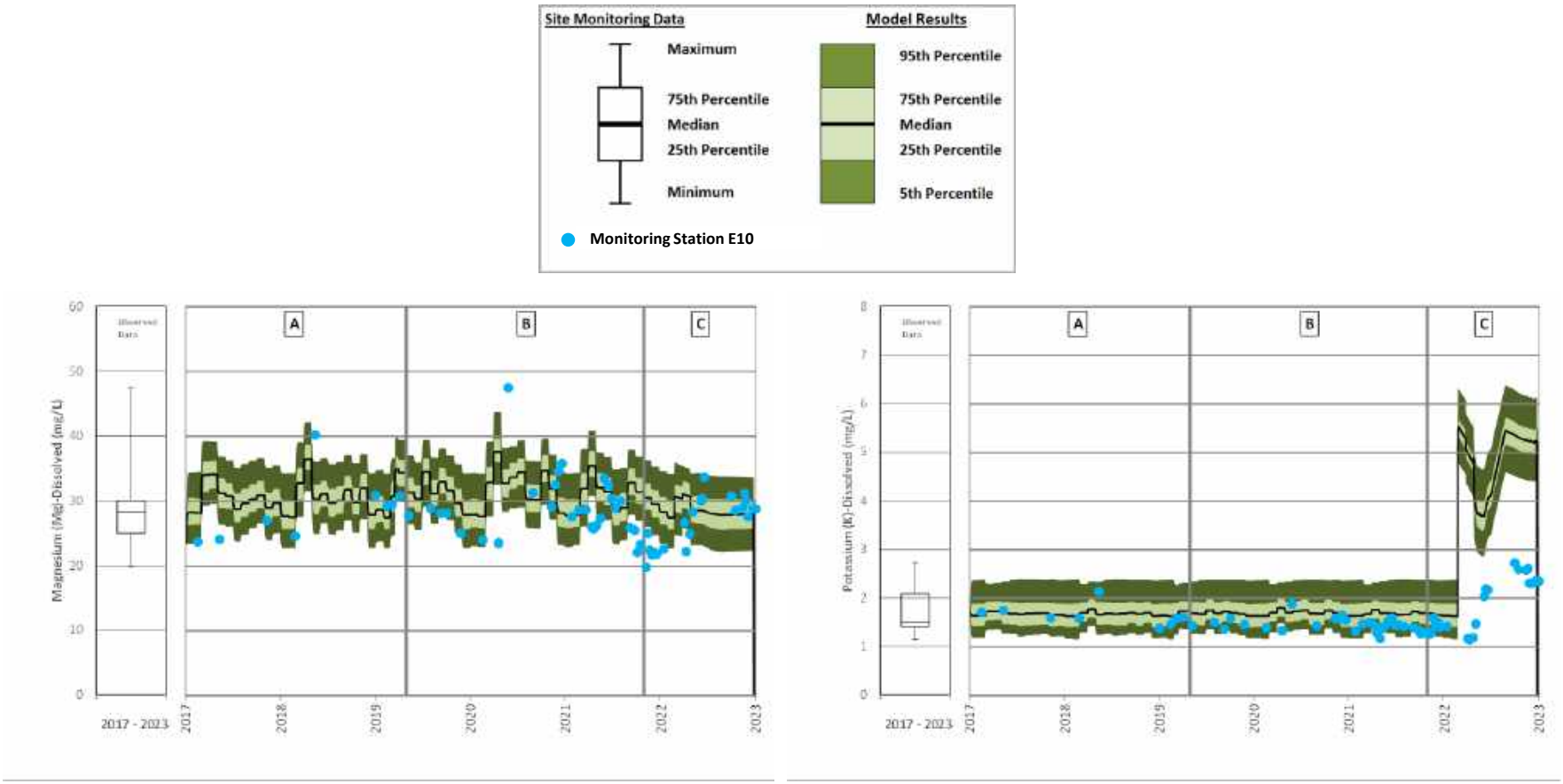
Figure A 41: Wight Pit Calibration – Total Dissolved Solids and Calcium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Chloride concentrations increase in Wight Pit and fluoride concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

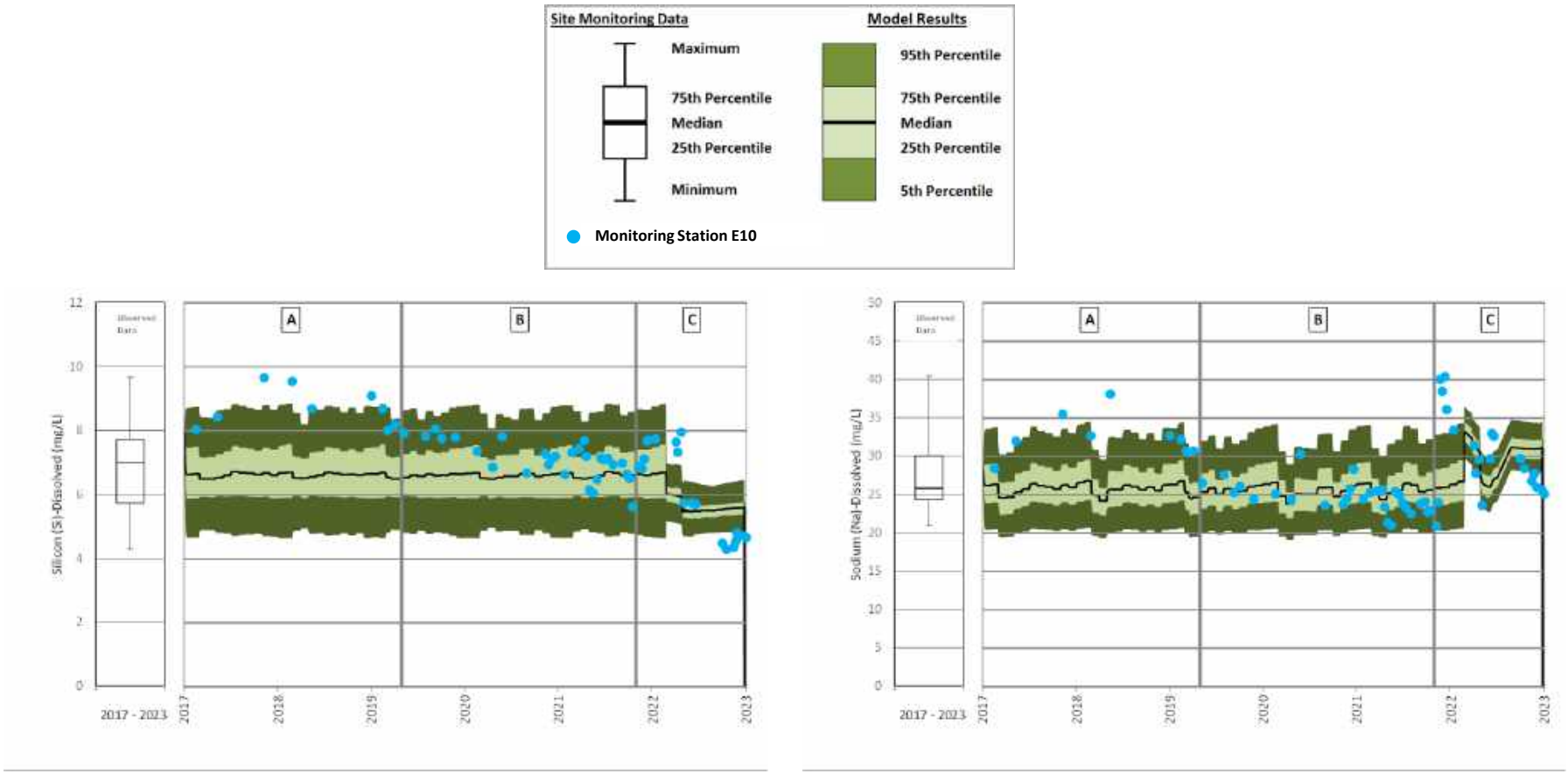
Figure A 42: Wight Pit Calibration – Chloride and Fluoride



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Potassium concentrations increase in Wight Pit decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

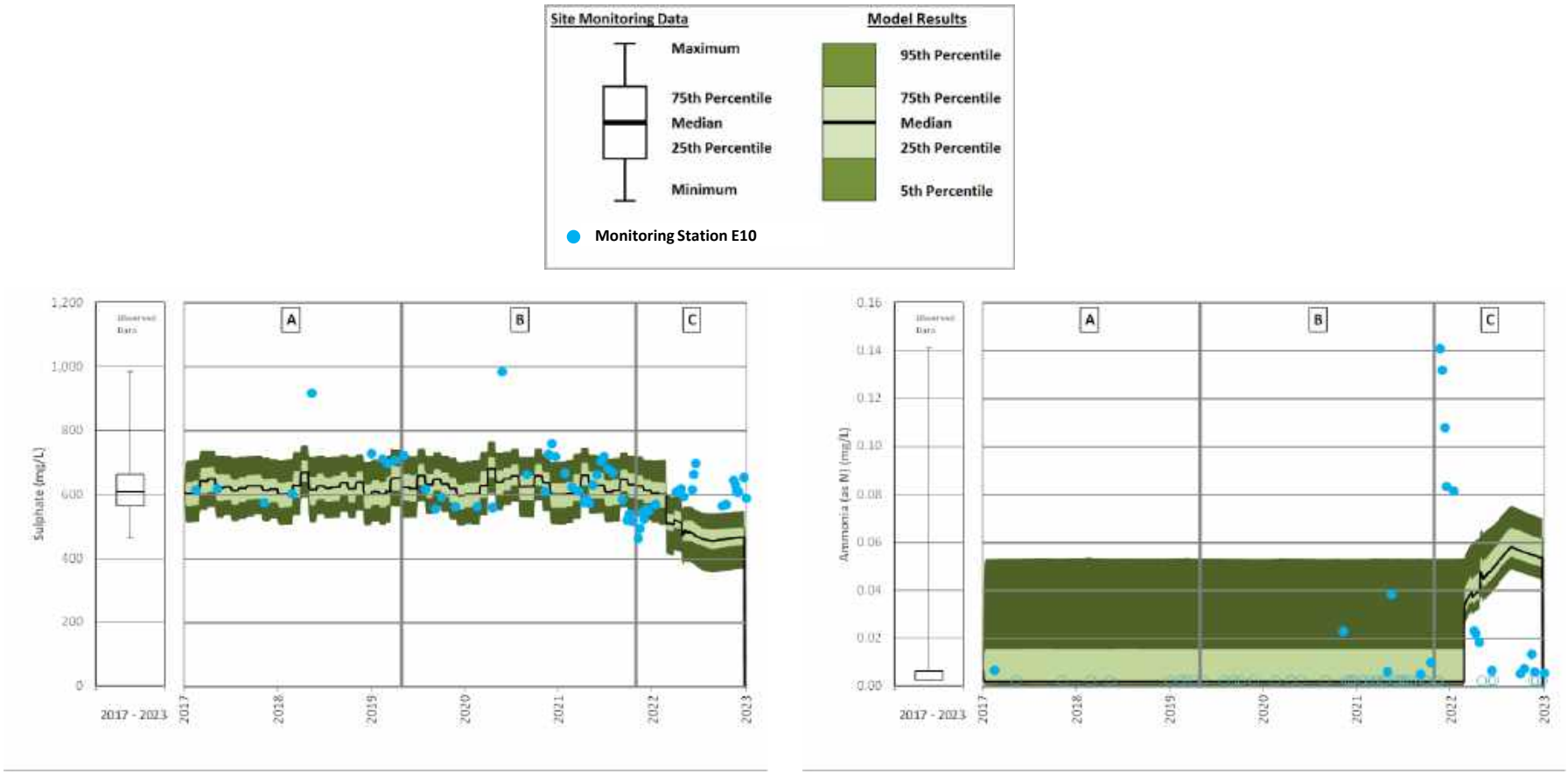
Figure A 43: Wight Pit Calibration – Magnesium and Potassium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Silicon concentrations decrease in Wight Pit and sodium concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

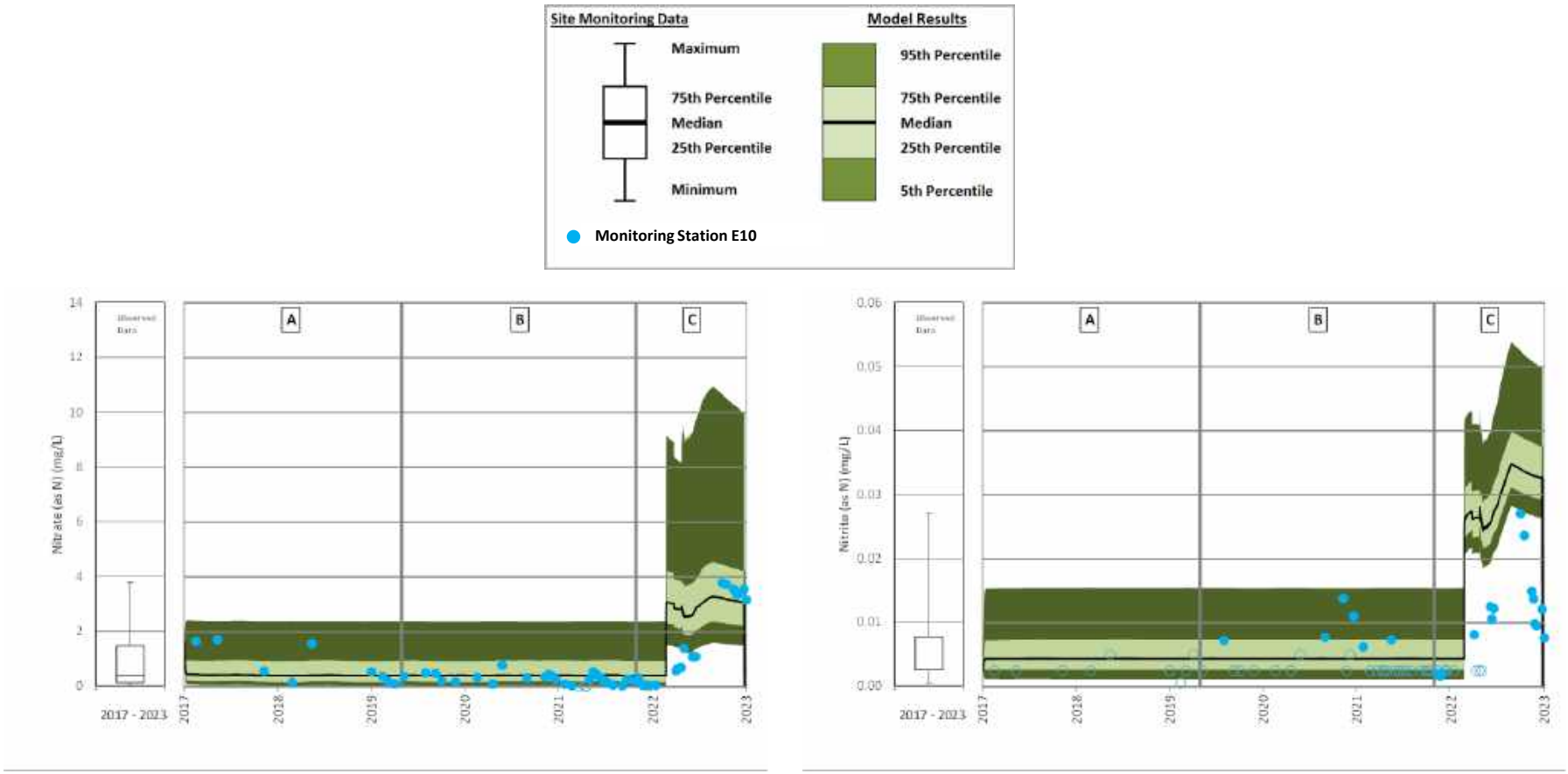
Figure A 44: Wight Pit Calibration – Silicon and Sodium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Sulphate concentrations decrease in Wight Pit and total ammonia concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

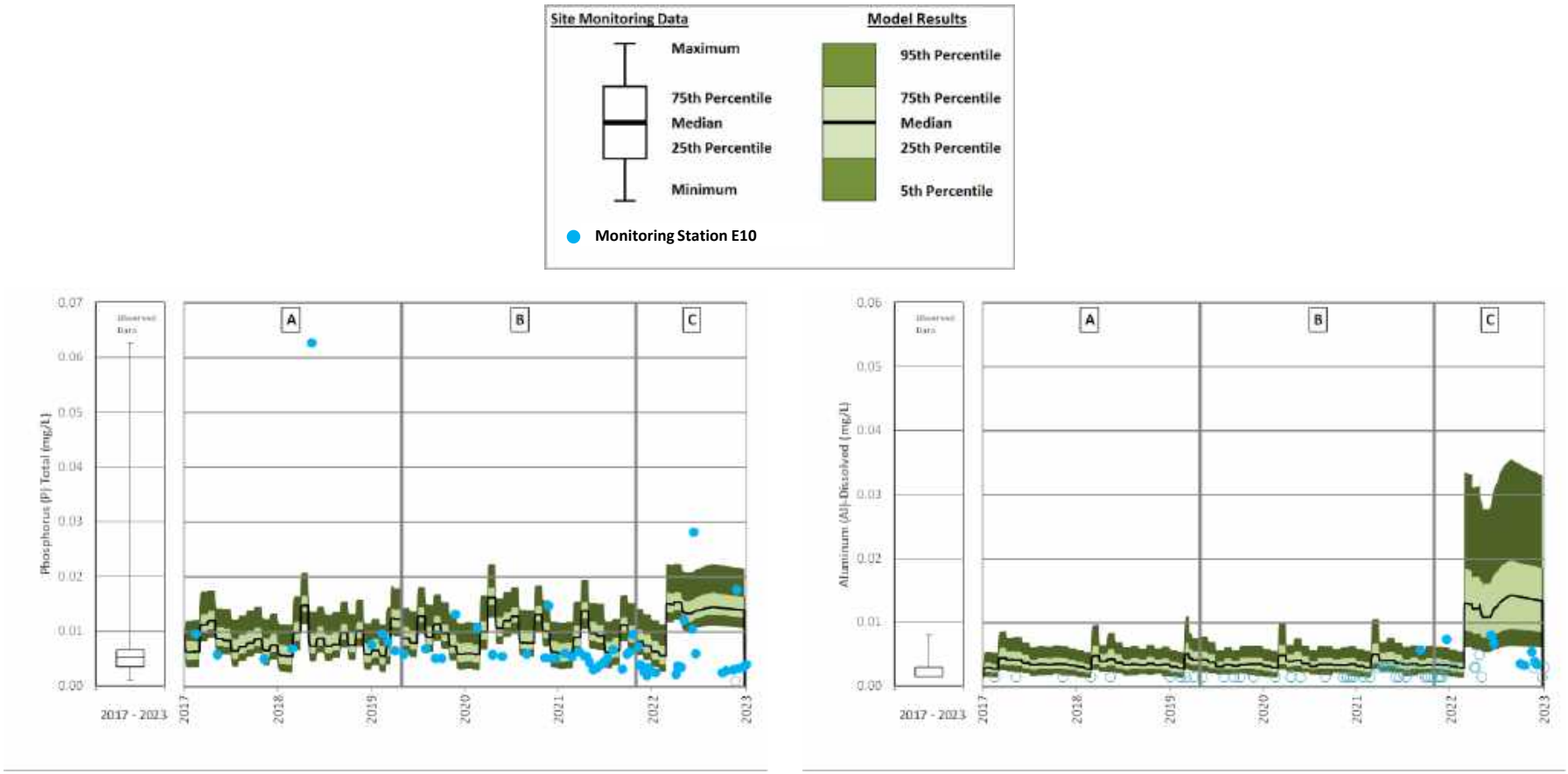
Figure A 45: Wight Pit Calibration – Sulphate and Total Ammonia



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Nitrate and nitrite concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

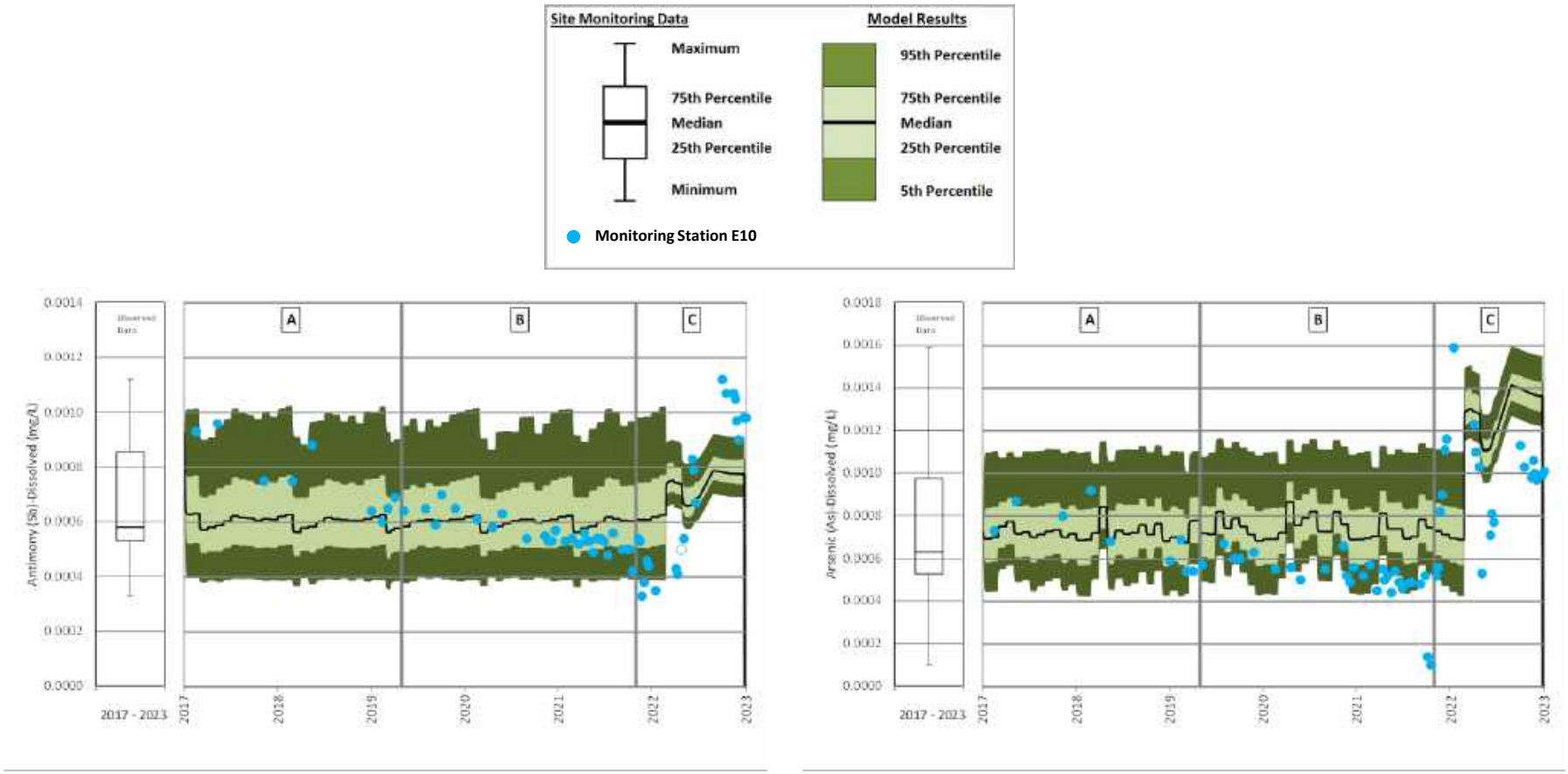
Figure A 46: Wight Pit Calibration – Nitrate and Nitrite



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Total phosphorus and dissolved aluminum concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

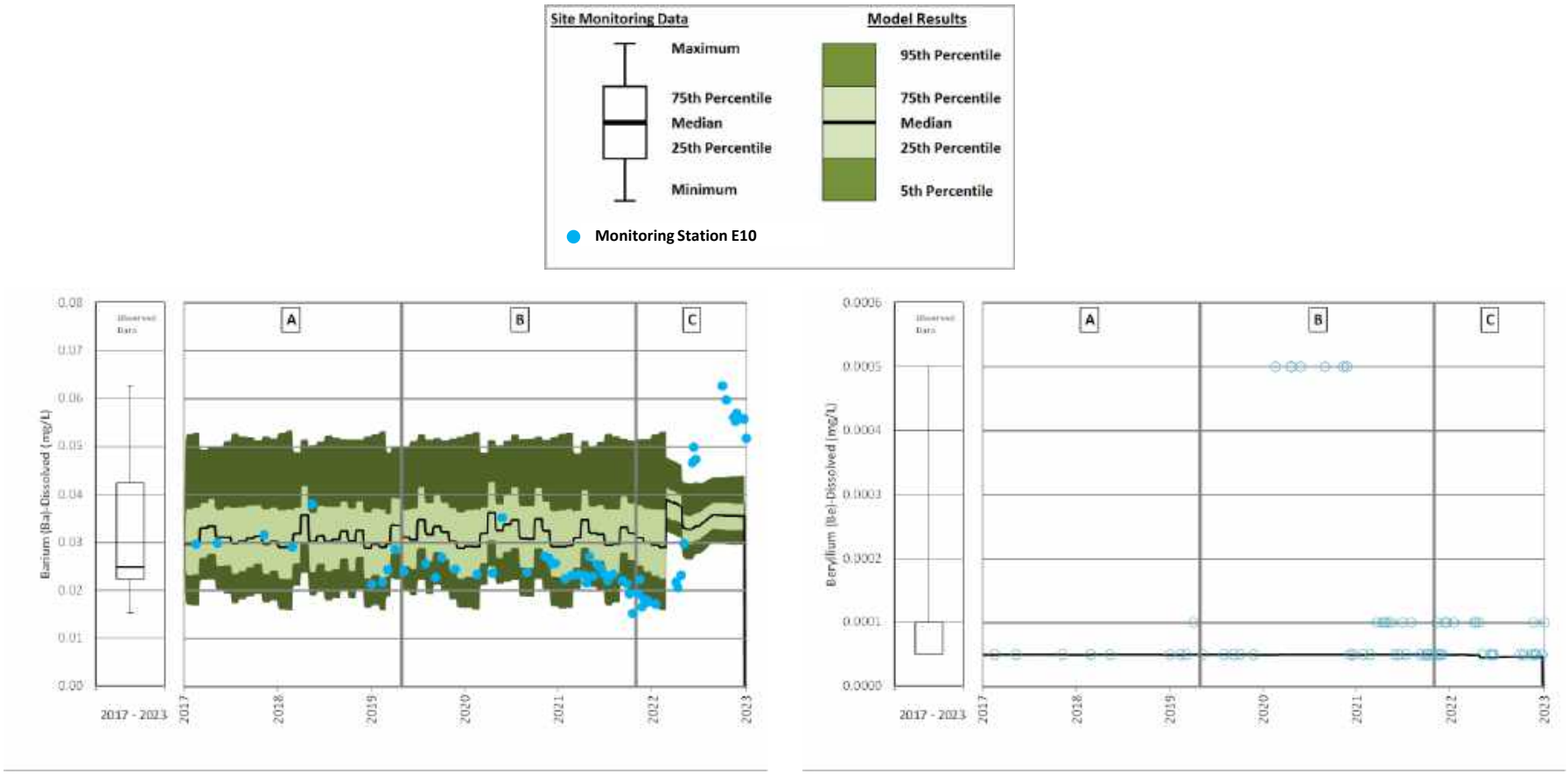
Figure A 47: Wight Pit Calibration – Total Phosphorus and Dissolved Aluminum



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

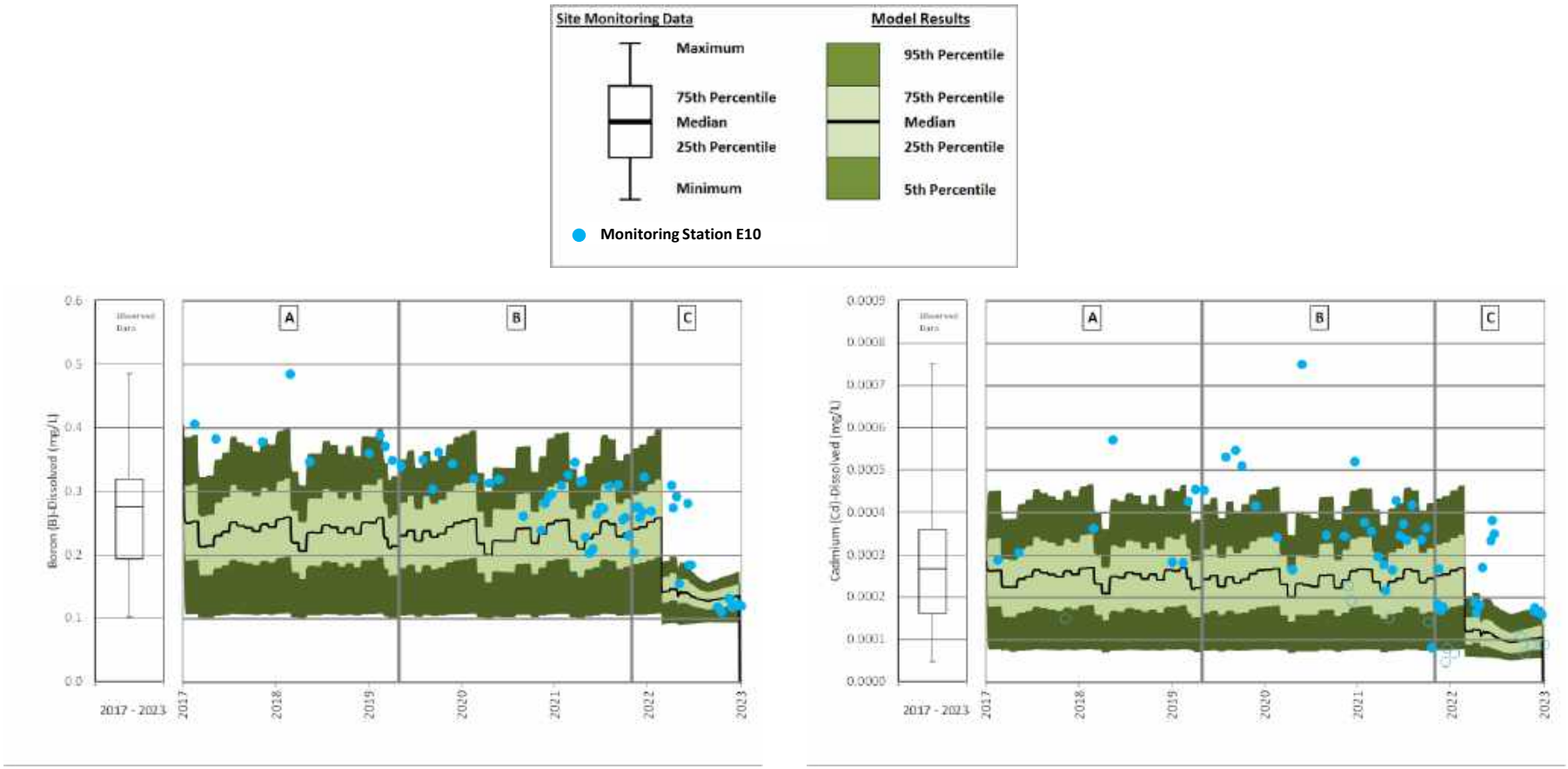
Figure A 48: Wight Pit Calibration – Dissolved Antimony and Dissolved Arsenic



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved barium concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

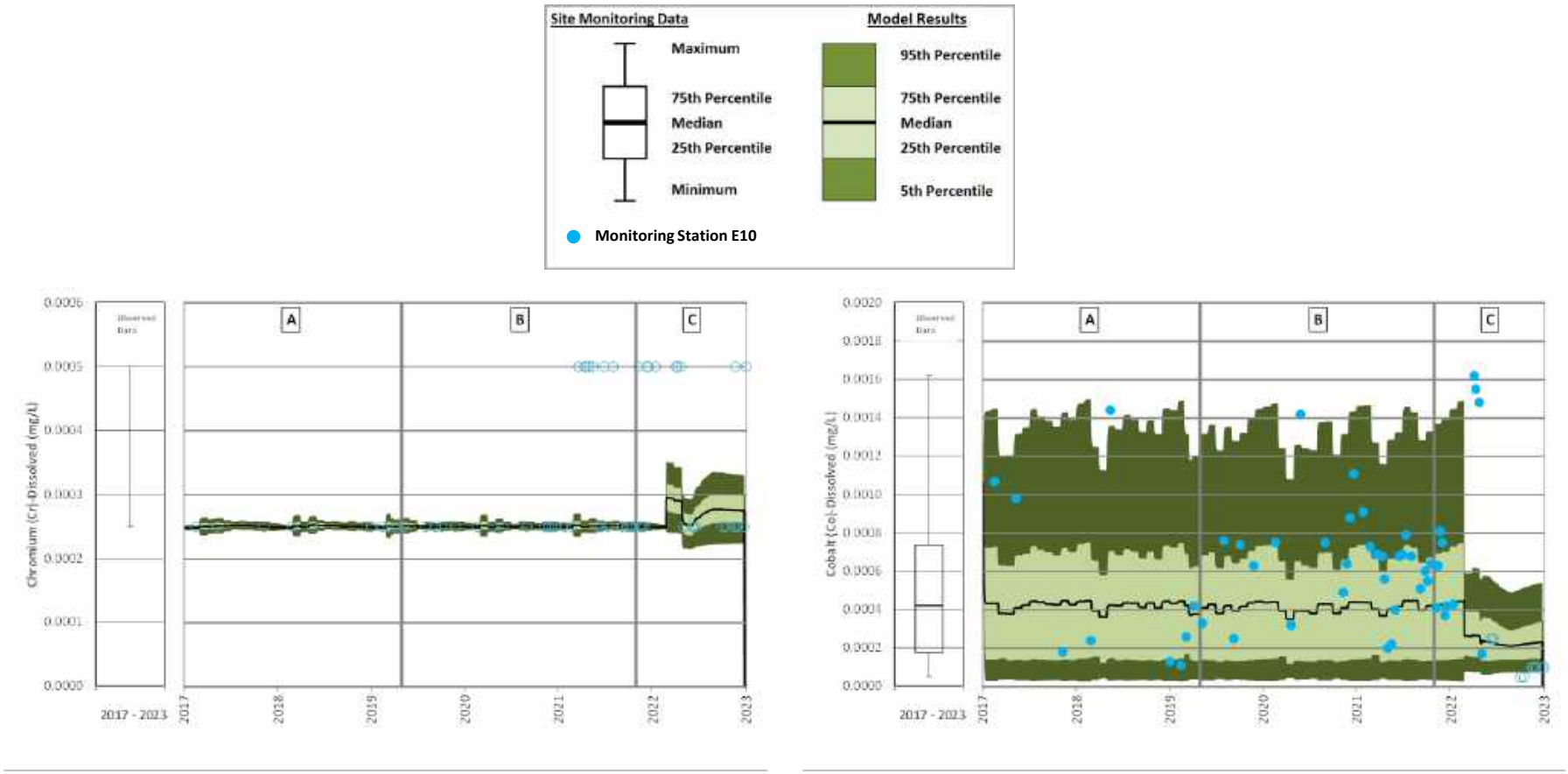
Figure A 49: Wight Pit Calibration – Dissolved Barium and Dissolved Beryllium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved boron and dissolved cadmium concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

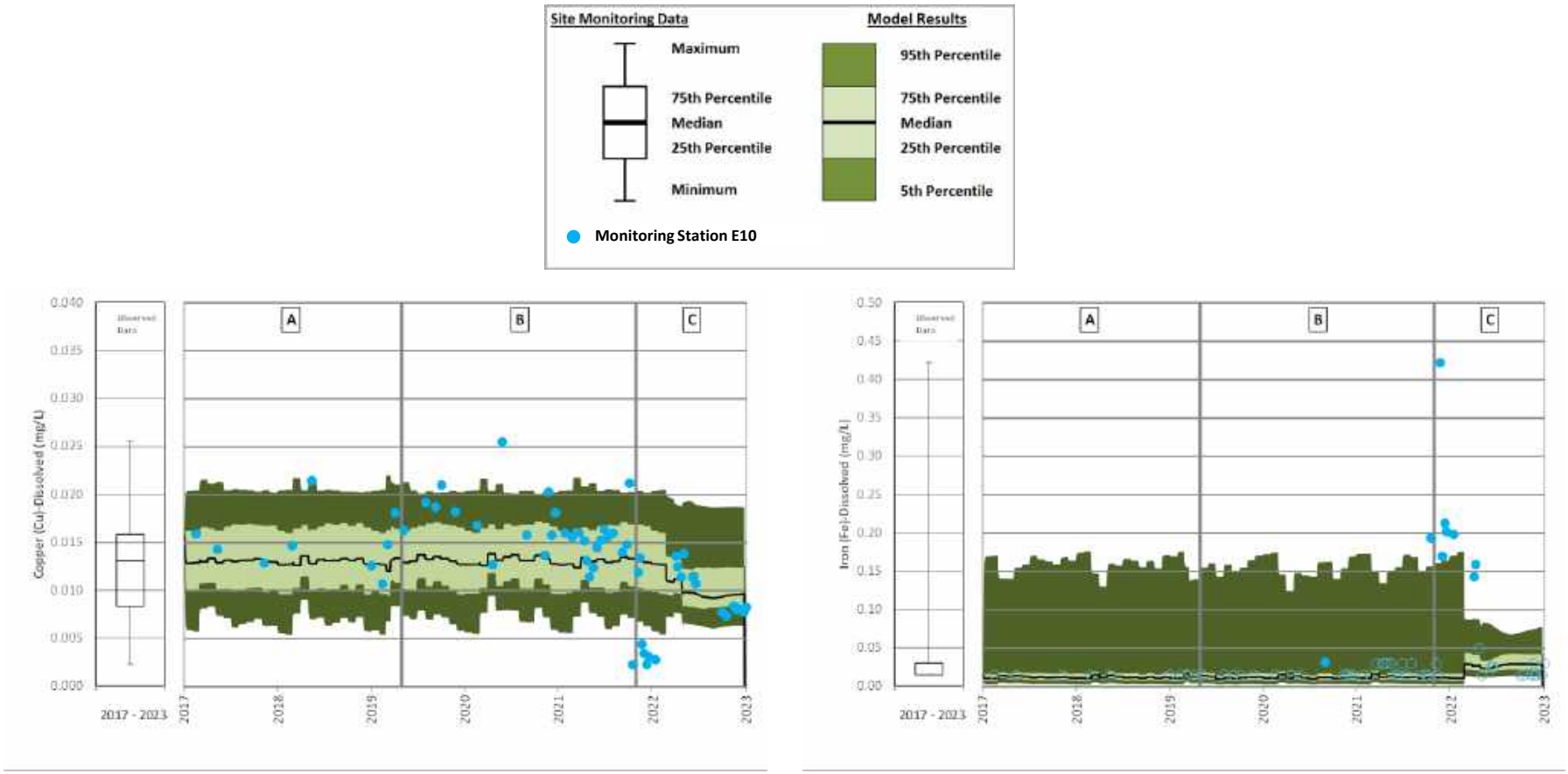
Figure A 50: Wight Pit Calibration – Dissolved Boron and Dissolved Cadmium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved chromium concentrations increase in Wight Pit and dissolved cobalt concentrations decrease at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

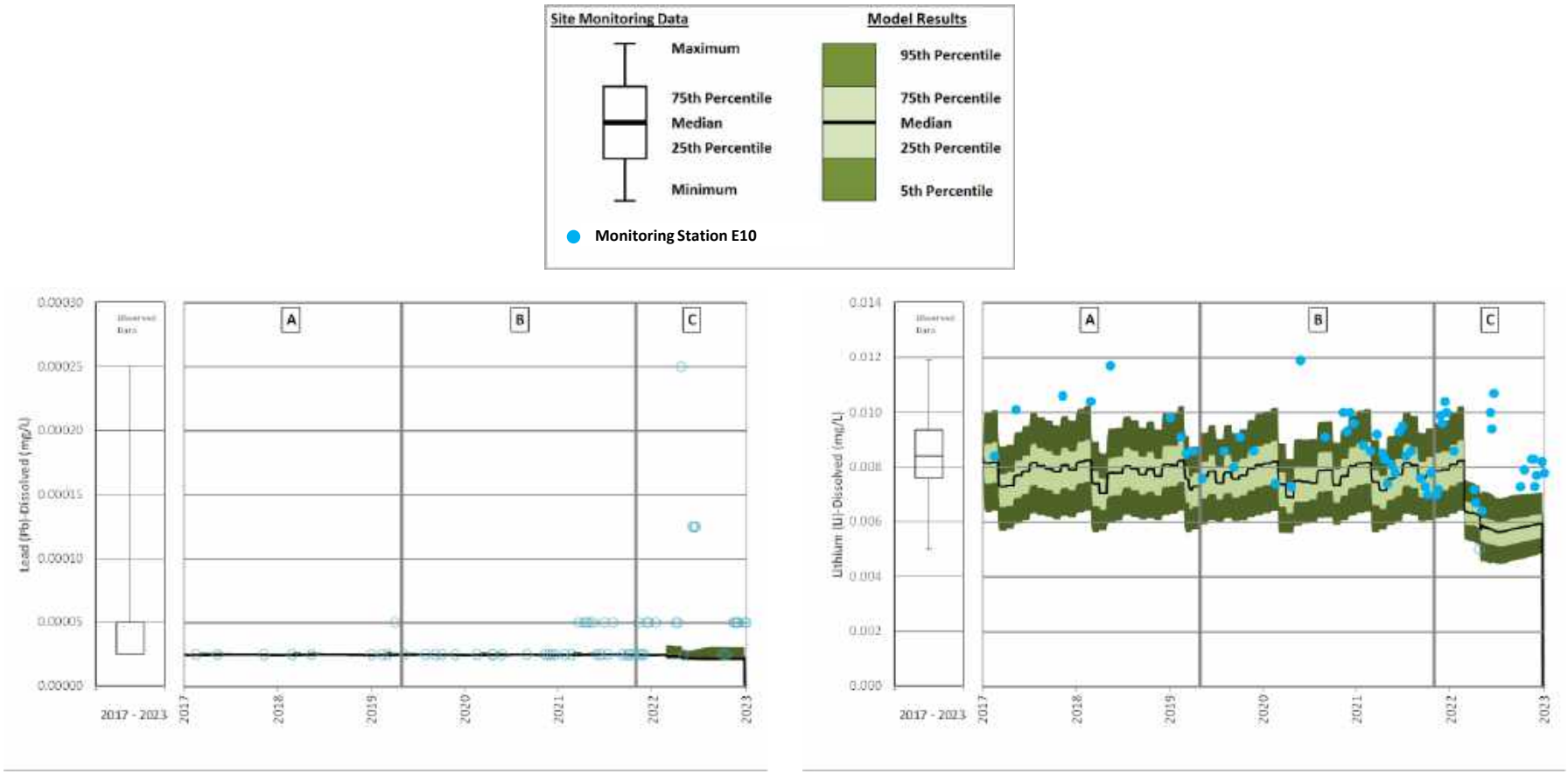
Figure A 51: Wight Pit Calibration – Dissolved Chromium and Dissolved Cobalt



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved copper concentrations increase in Wight Pit and dissolved iron concentrations decrease at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

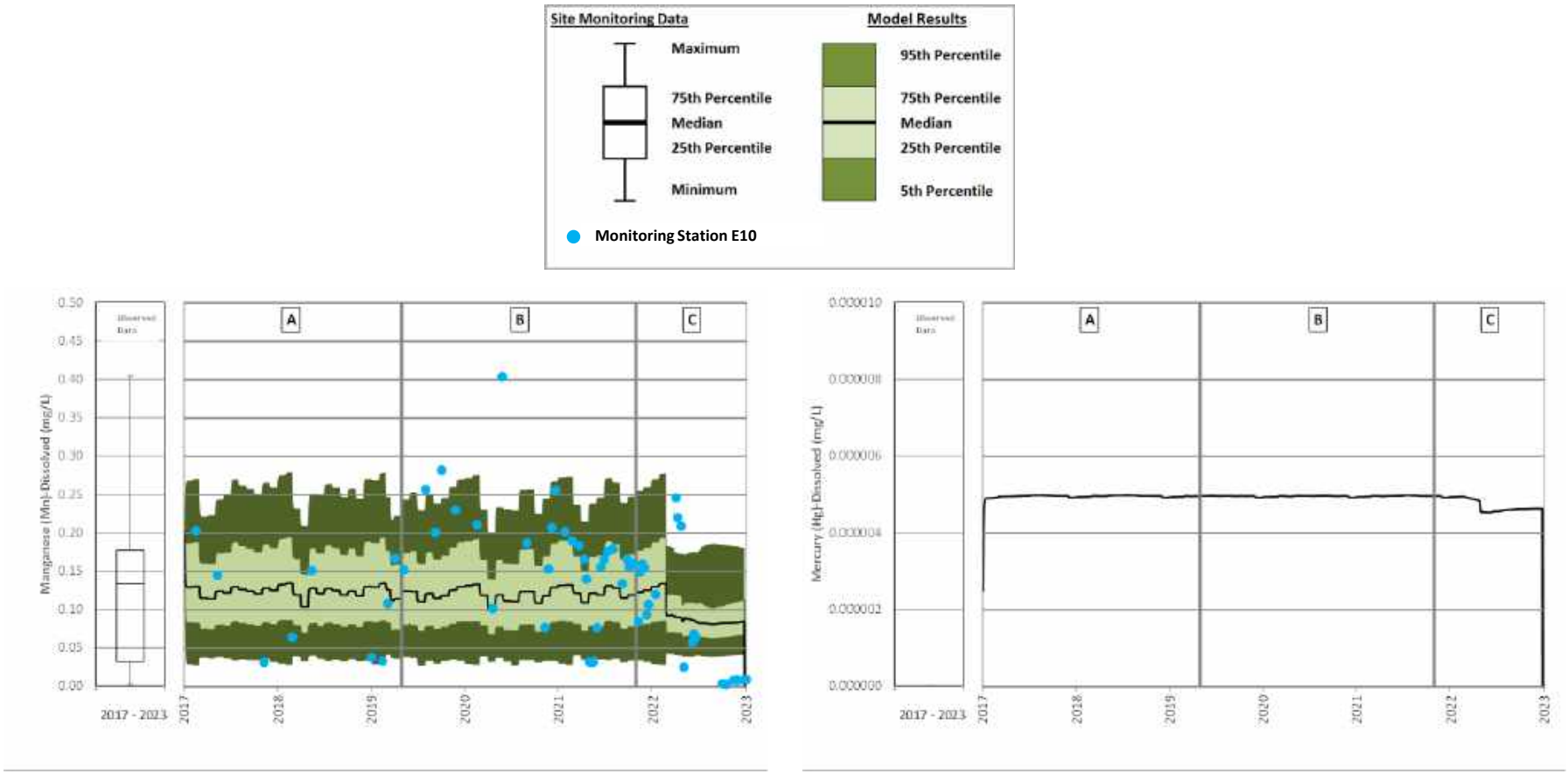
Figure A 52: Wight Pit Calibration – Dissolved Copper and Dissolved Iron



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved lithium concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

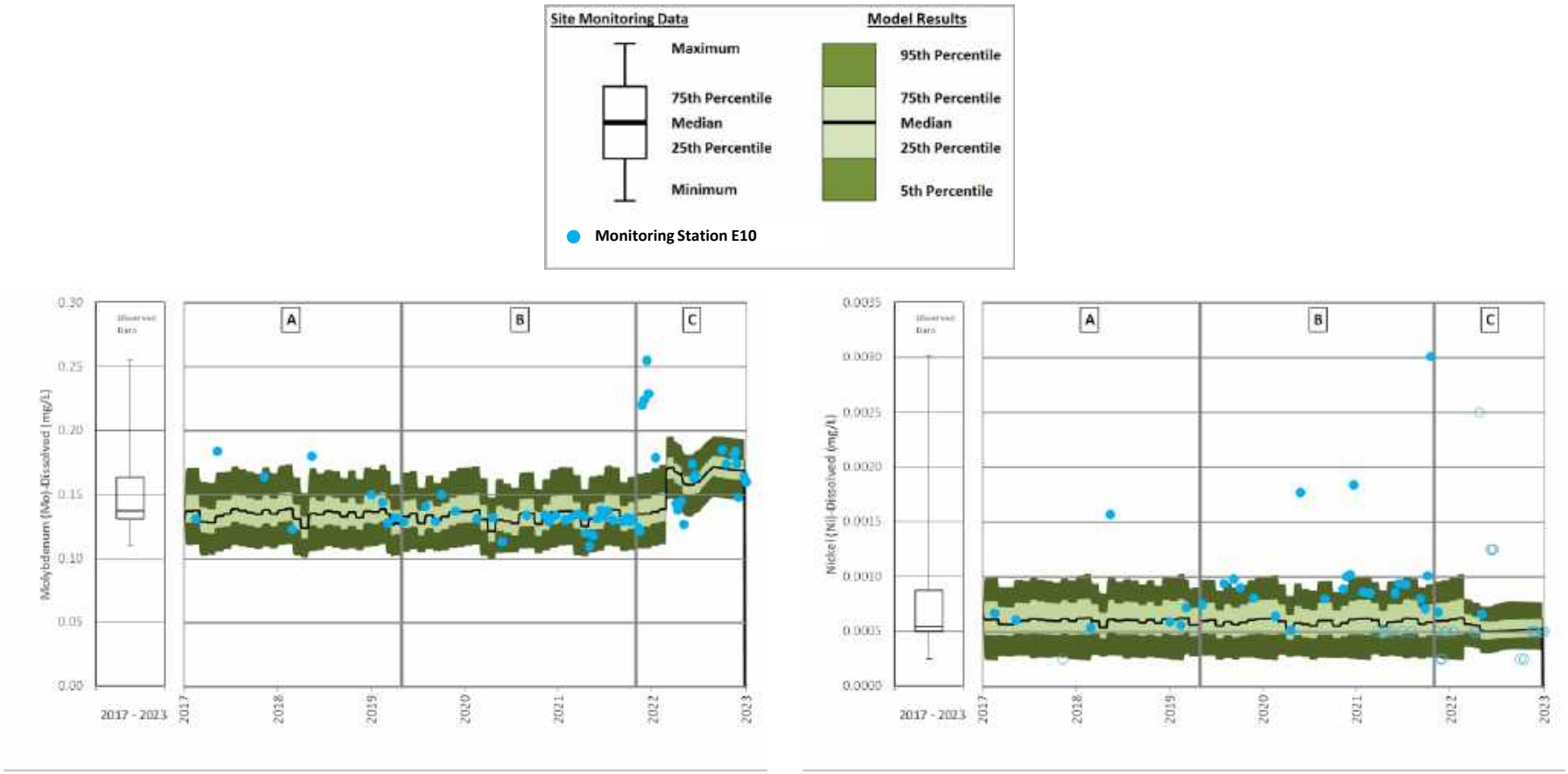
Figure A 53: Wight Pit Calibration – Dissolved Lead and Dissolved Lithium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved manganese concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

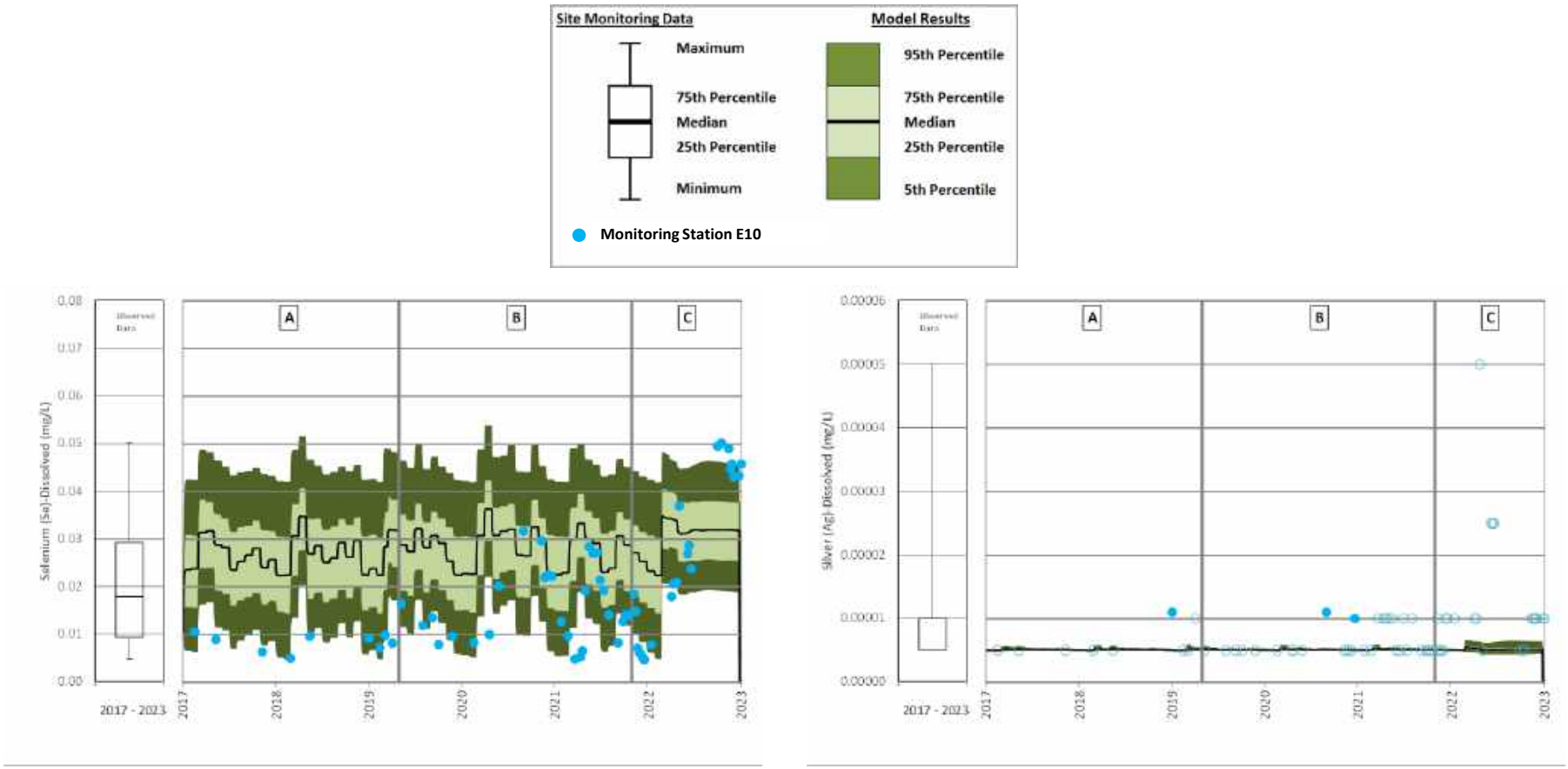
Figure A 54: Wight Pit Calibration – Dissolved Manganese and Dissolved Mercury



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved molybdenum concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

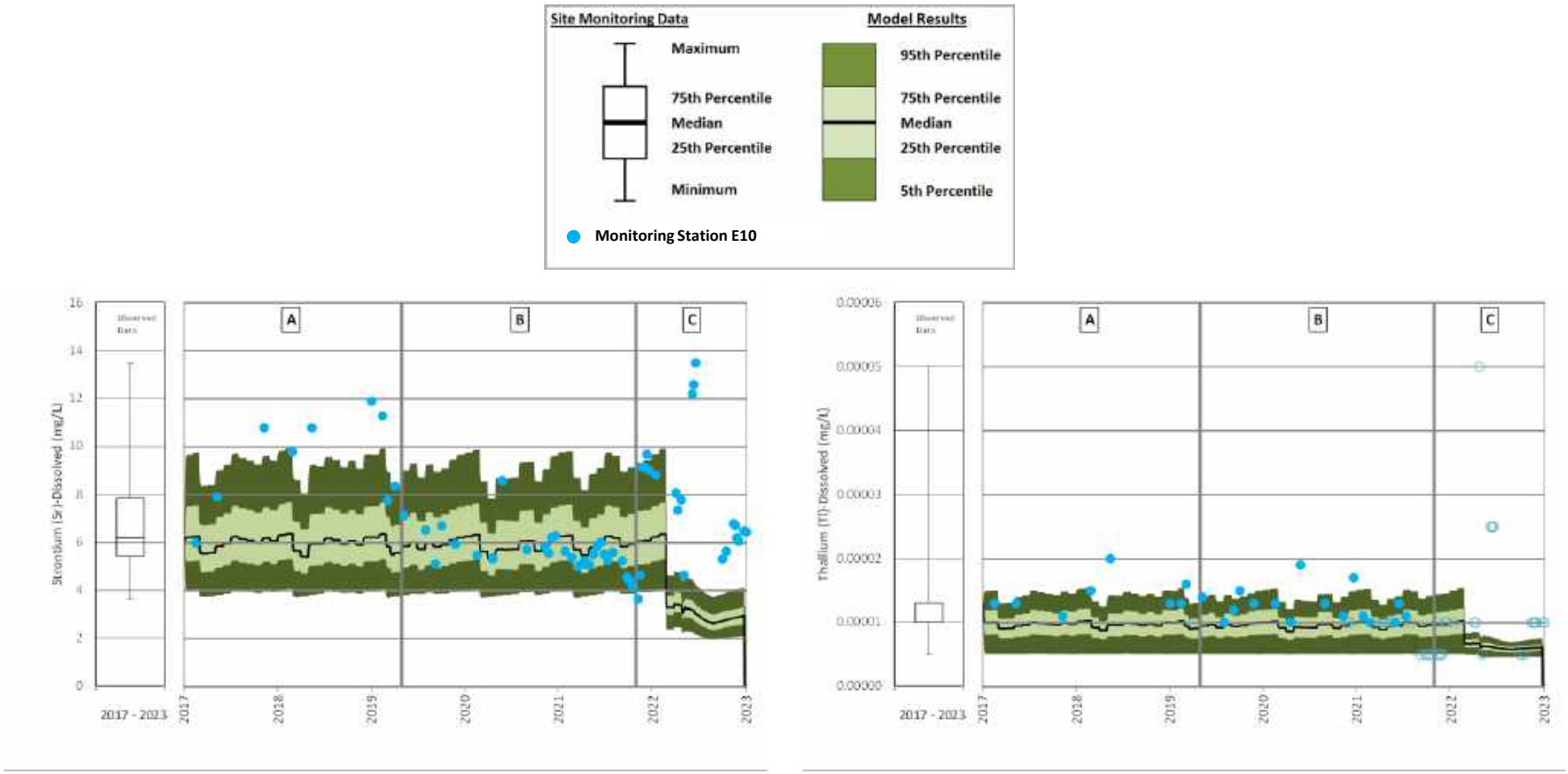
Figure A 55: Wight Pit Calibration – Dissolved Molybdenum and Dissolved Nickel



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved selenium concentrations increase in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

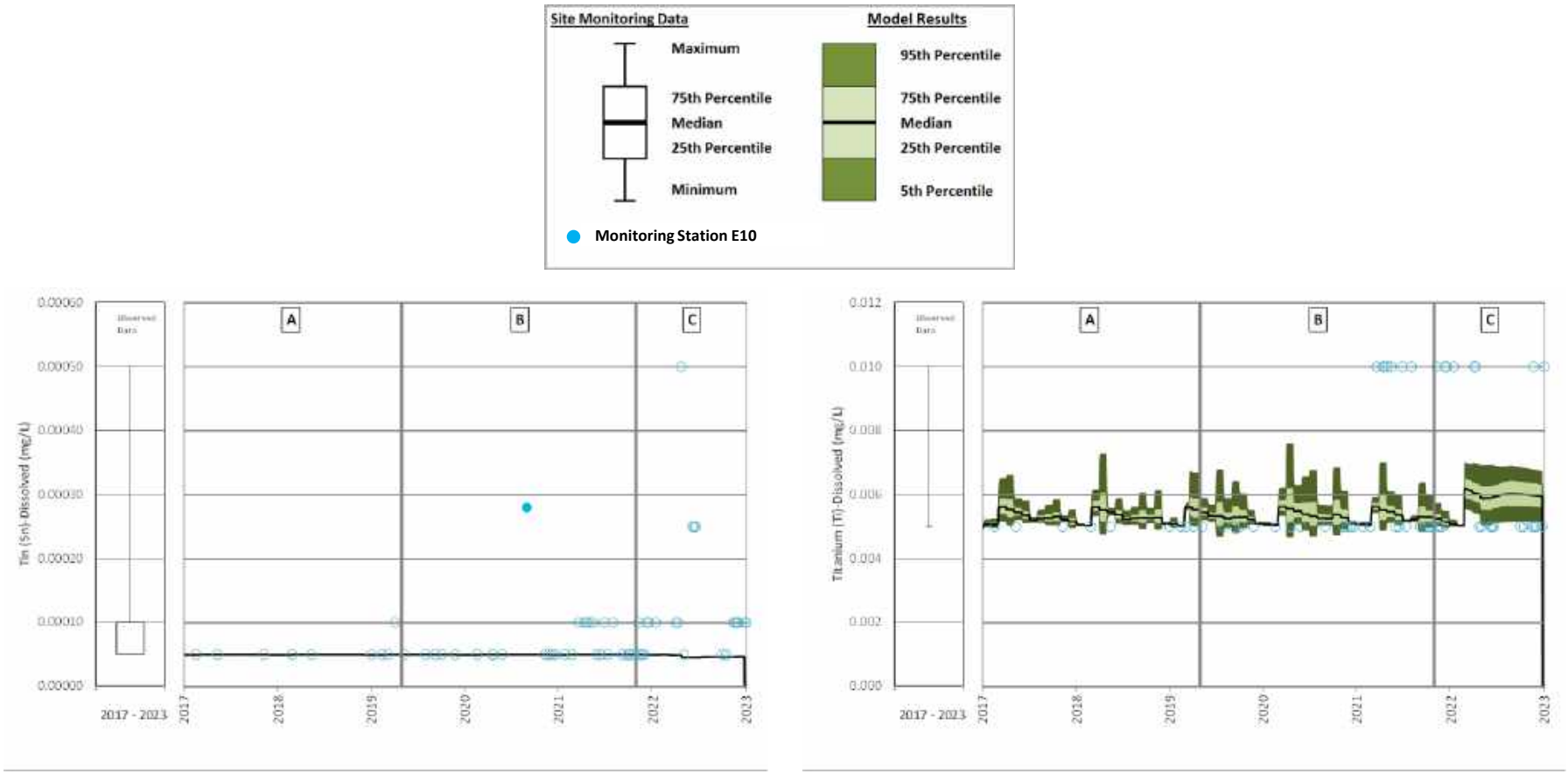
Figure A 56: Wight Pit Calibration – Dissolved Selenium and Dissolved Silver



A = Operations; B = Care and Maintanence; C = Resumed Operations

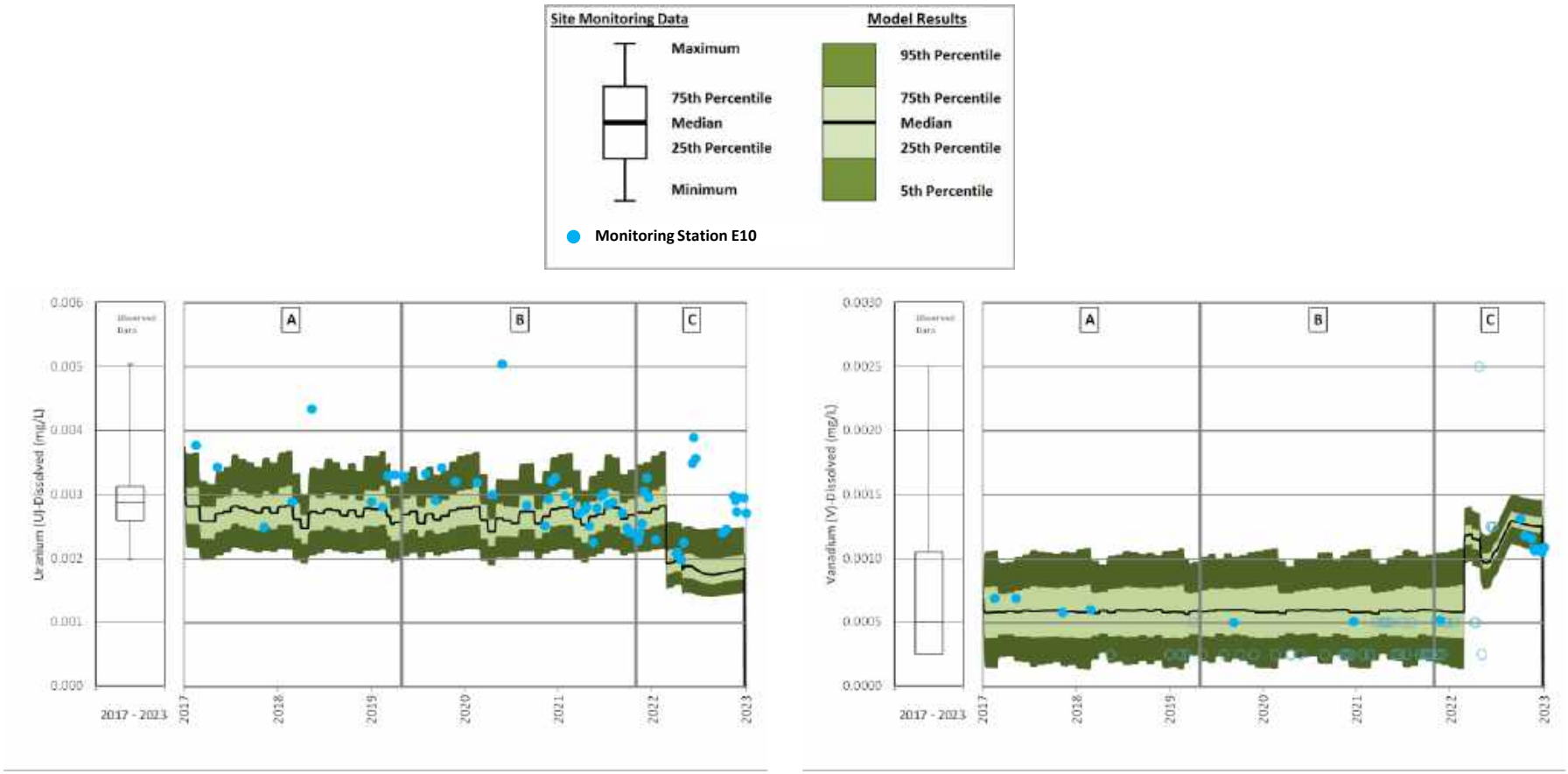
Note: Dissolved strontium and dissolved thallium concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 57: Wight Pit Calibration – Dissolved Strontium and Dissolved Thallium



A = Operations; B = Care and Maintanence; C = Resumed Operations

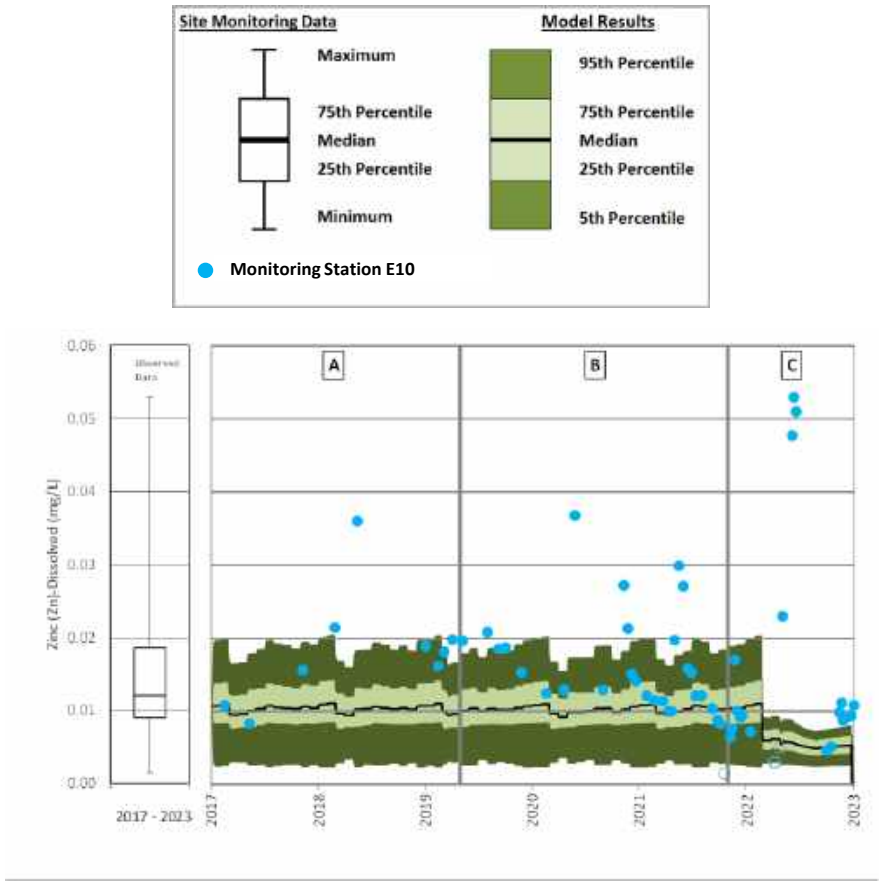
Figure A 58: Wight Pit Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved uranium concentrations decrease in Wight Pit and dissolved vanadium concentrations increase at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

Figure A 59: Wight Pit Calibration – Dissolved Uranium and Dissolved Vanadium

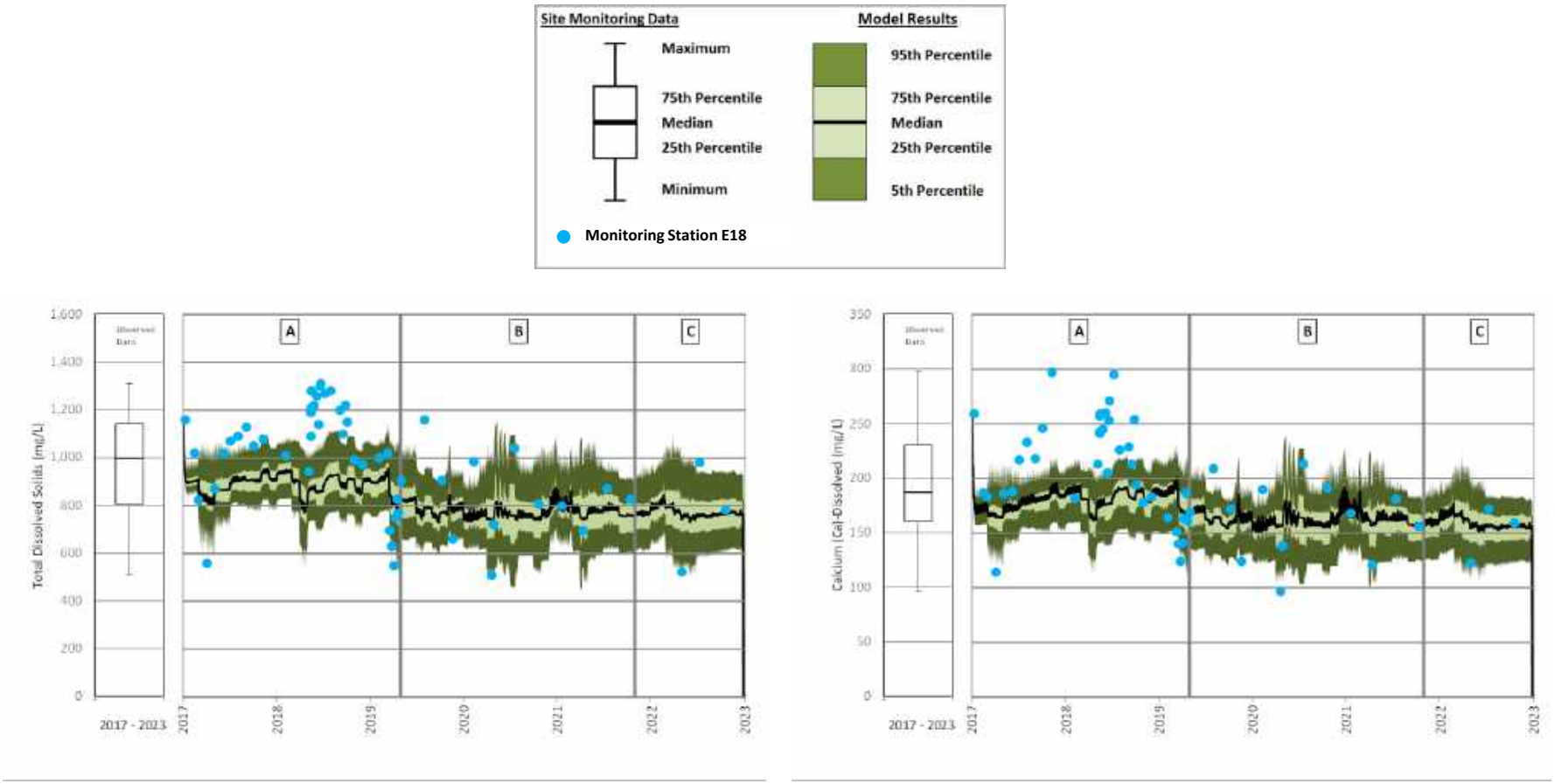


A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved zinc concentrations decrease in Wight Pit at the start of resumed operations because of pumping from the Tailings Storage Facility and from Cariboo Pit.

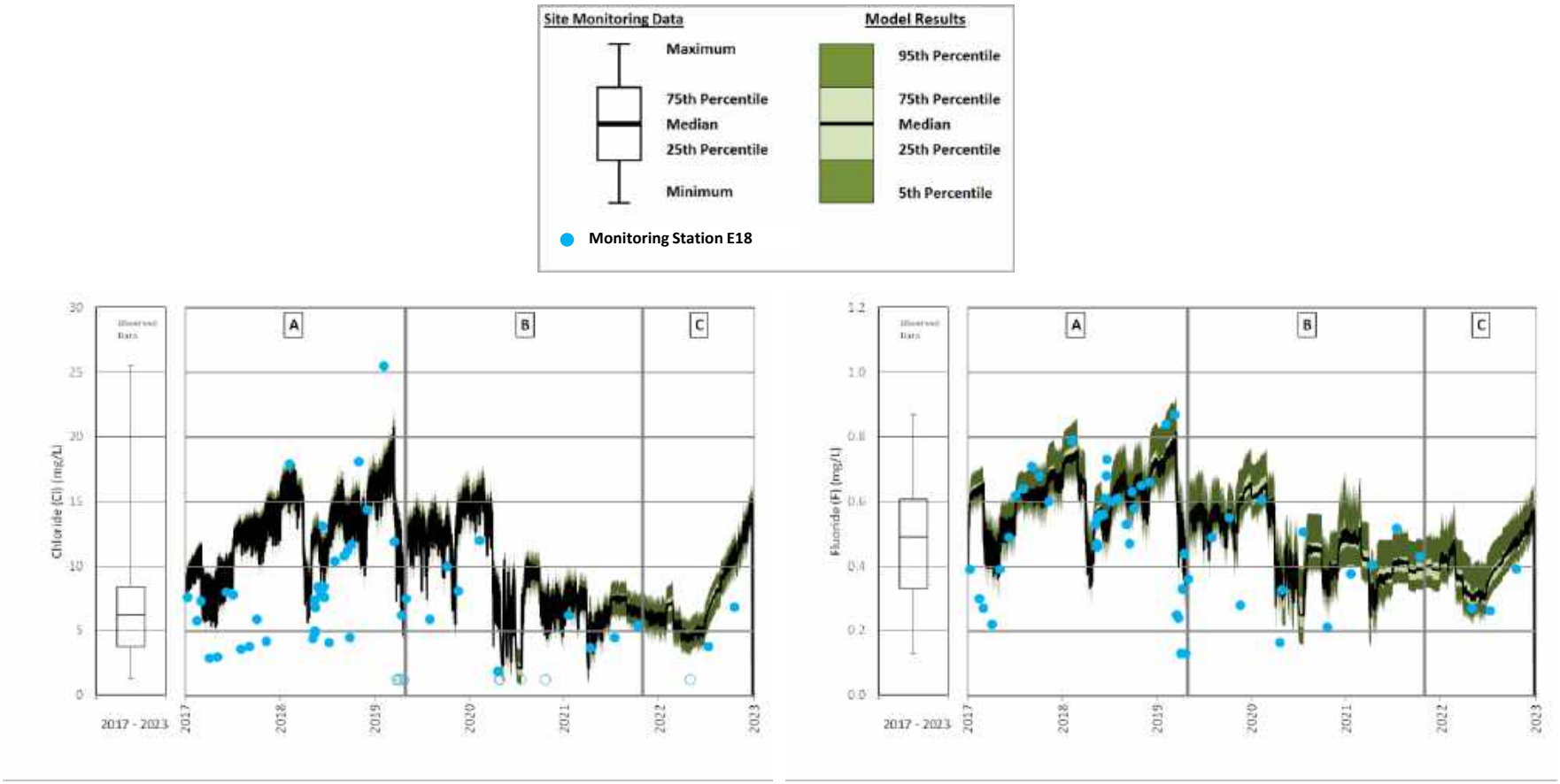
Figure A 60: Wight Pit Calibration – Dissolved Zinc

Central Collection Sump Calibration



A = Operations; B = Care and Maintanence; C = Resumed Operations

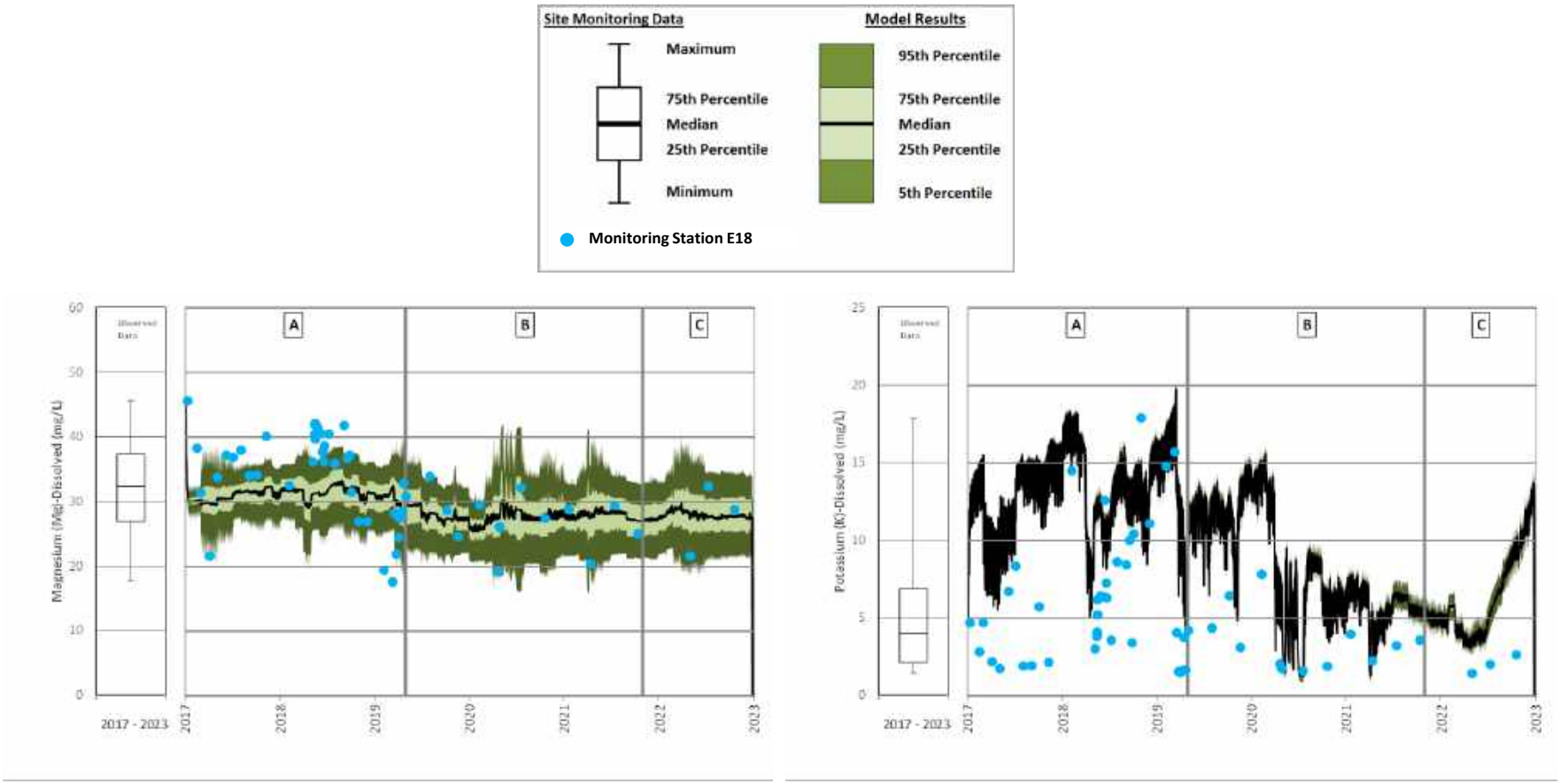
Figure A 61: Central Collection Sump Calibration – Total Dissolved Solids and Calcium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Chloride and fluoride concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

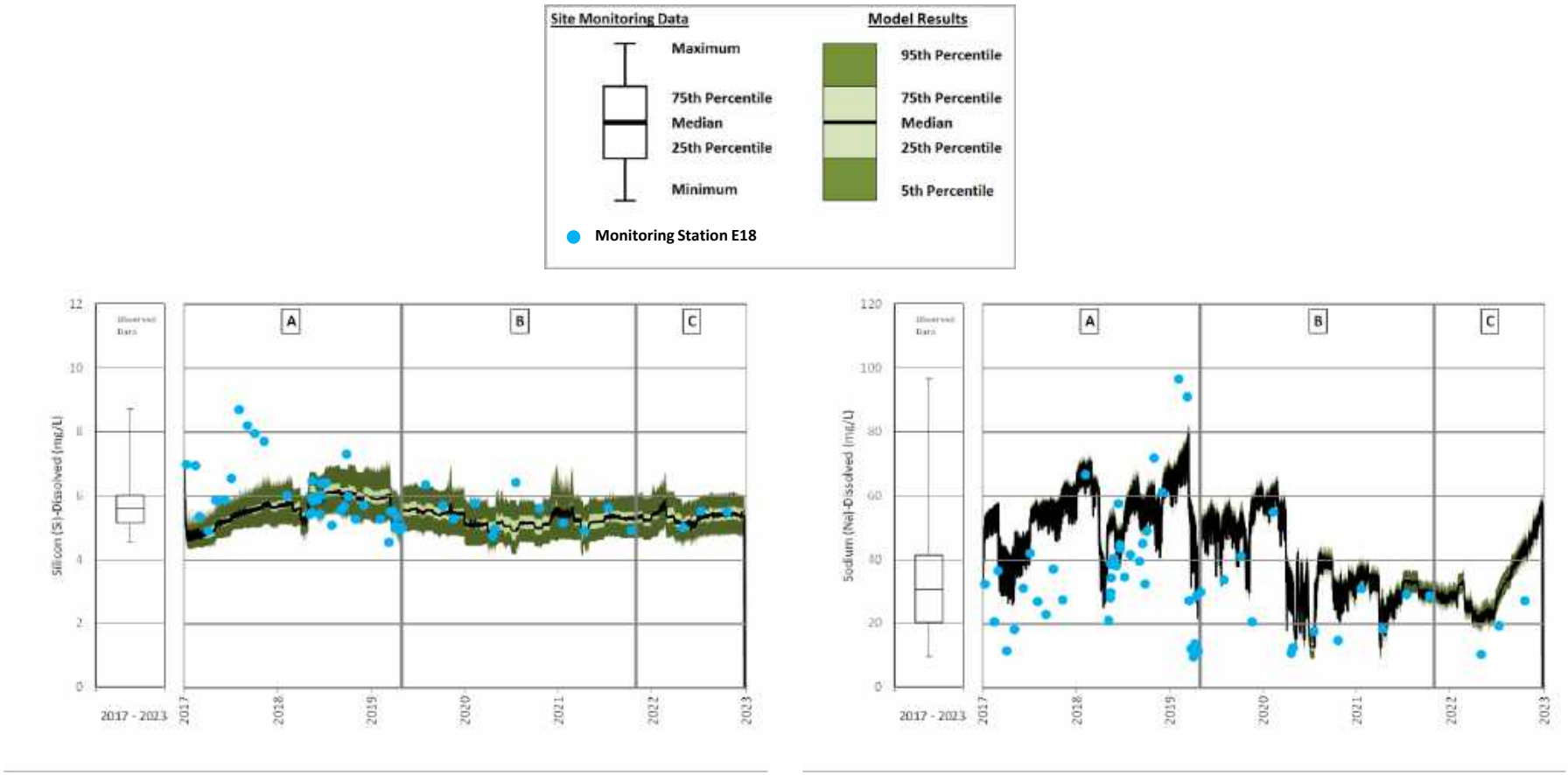
Figure A 62: Central Collection Sump Calibration – Chloride and Fluoride



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Potassium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

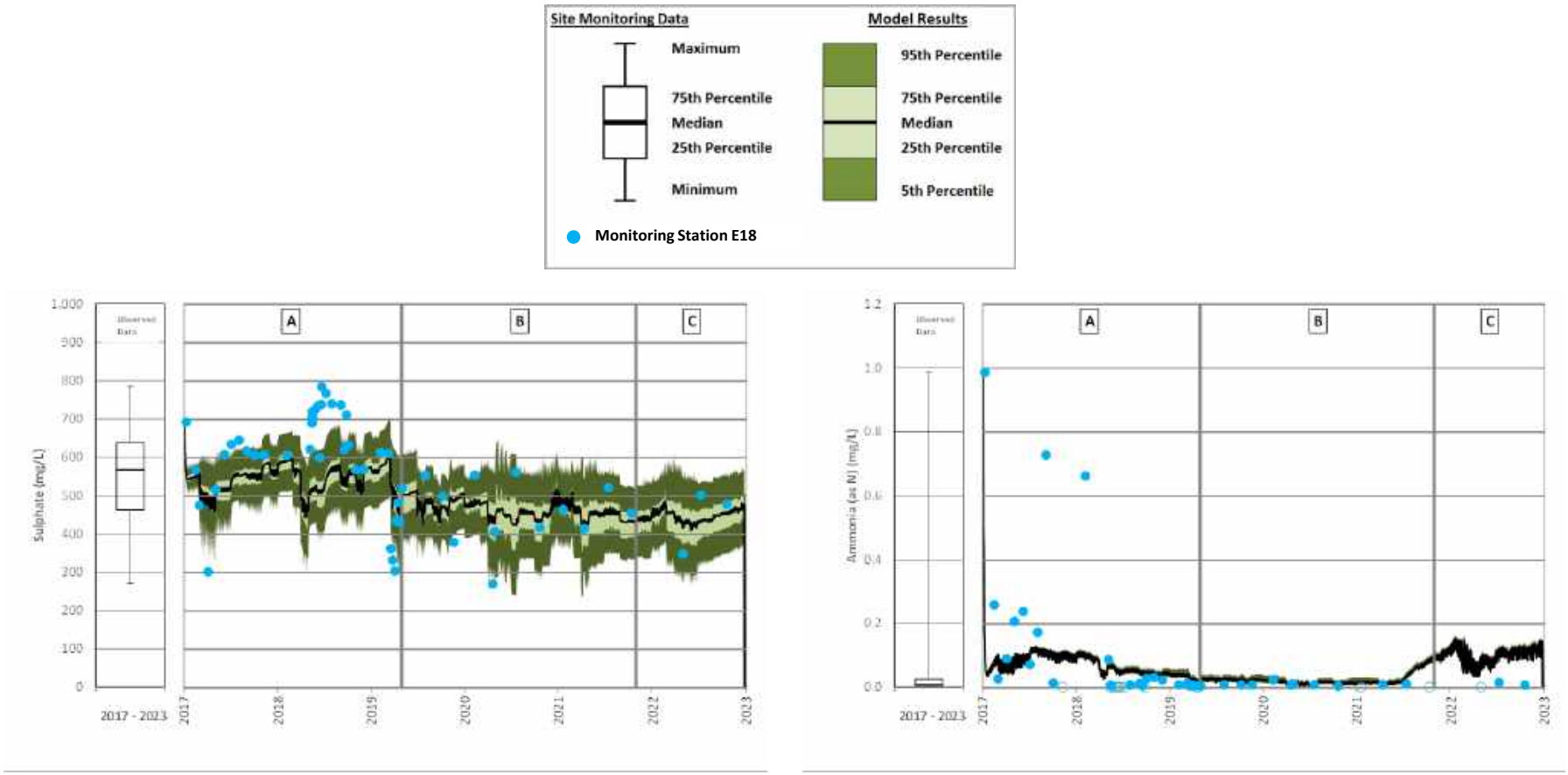
Figure A 63: Central Collection Sump Calibration – Magnesium and Potassium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Sodium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

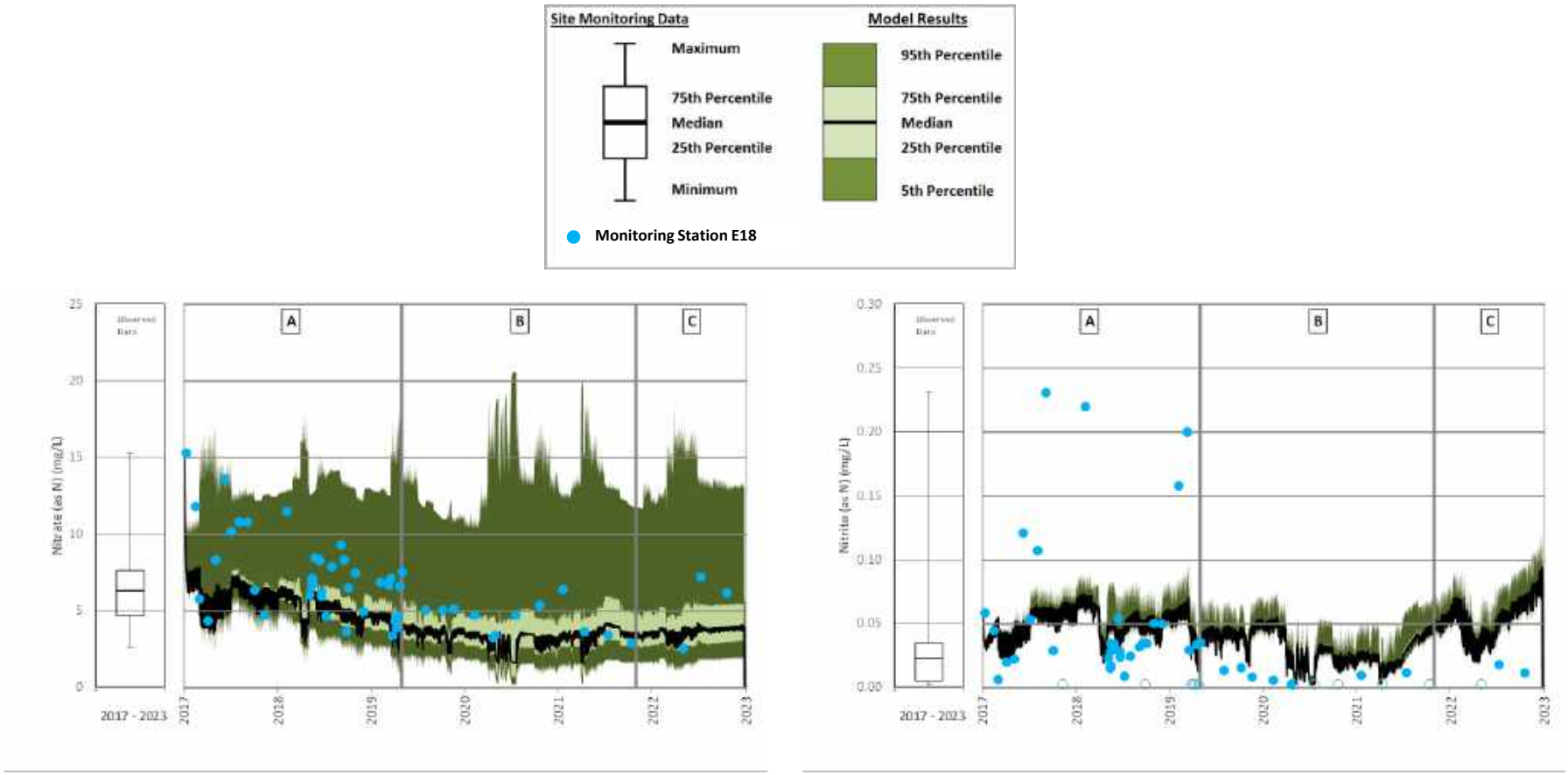
Figure A 64: Central Collection Sump Calibration – Silicon and Sodium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Sulphate and total ammonia concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

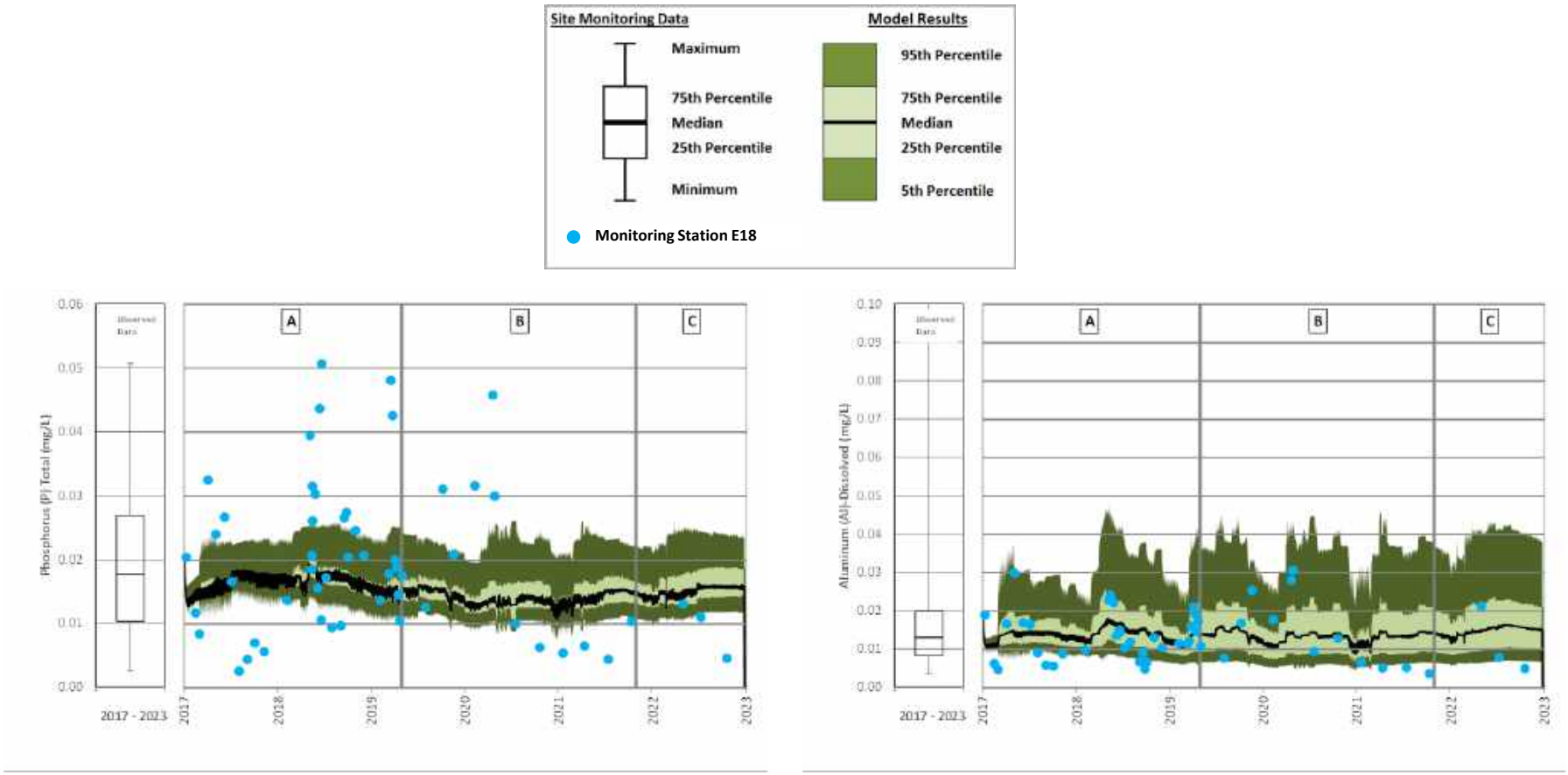
Figure A 65: Central Collection Sump Calibration – Sulphate and Total Ammonia



A = Operations; B = Care and Maintanence; C = Resumed Operations

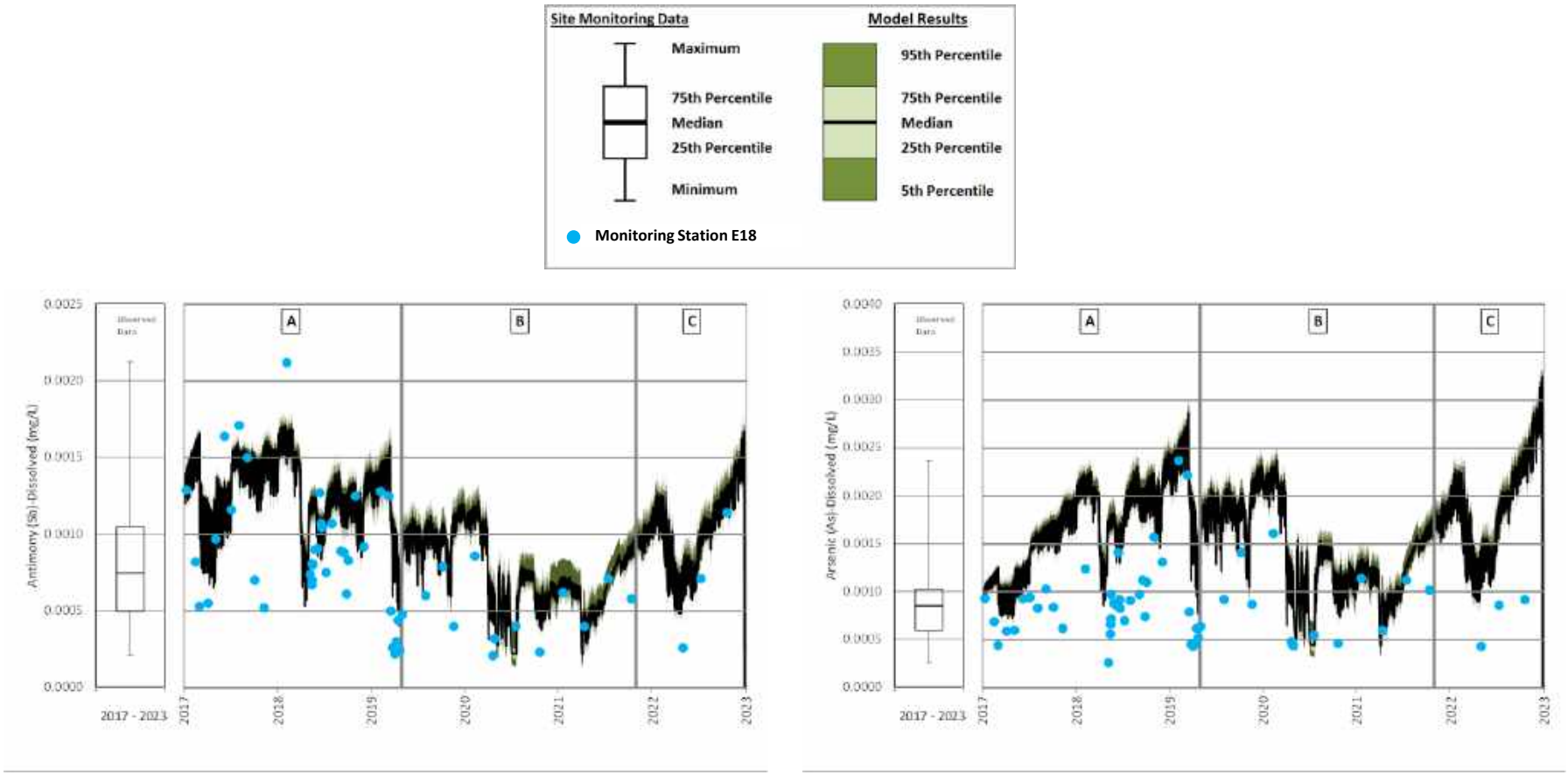
Note: Nitrite concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 66: Central Collection Sump Calibration – Nitrate and Nitrite



A = Operations; B = Care and Maintanence; C = Resumed Operations

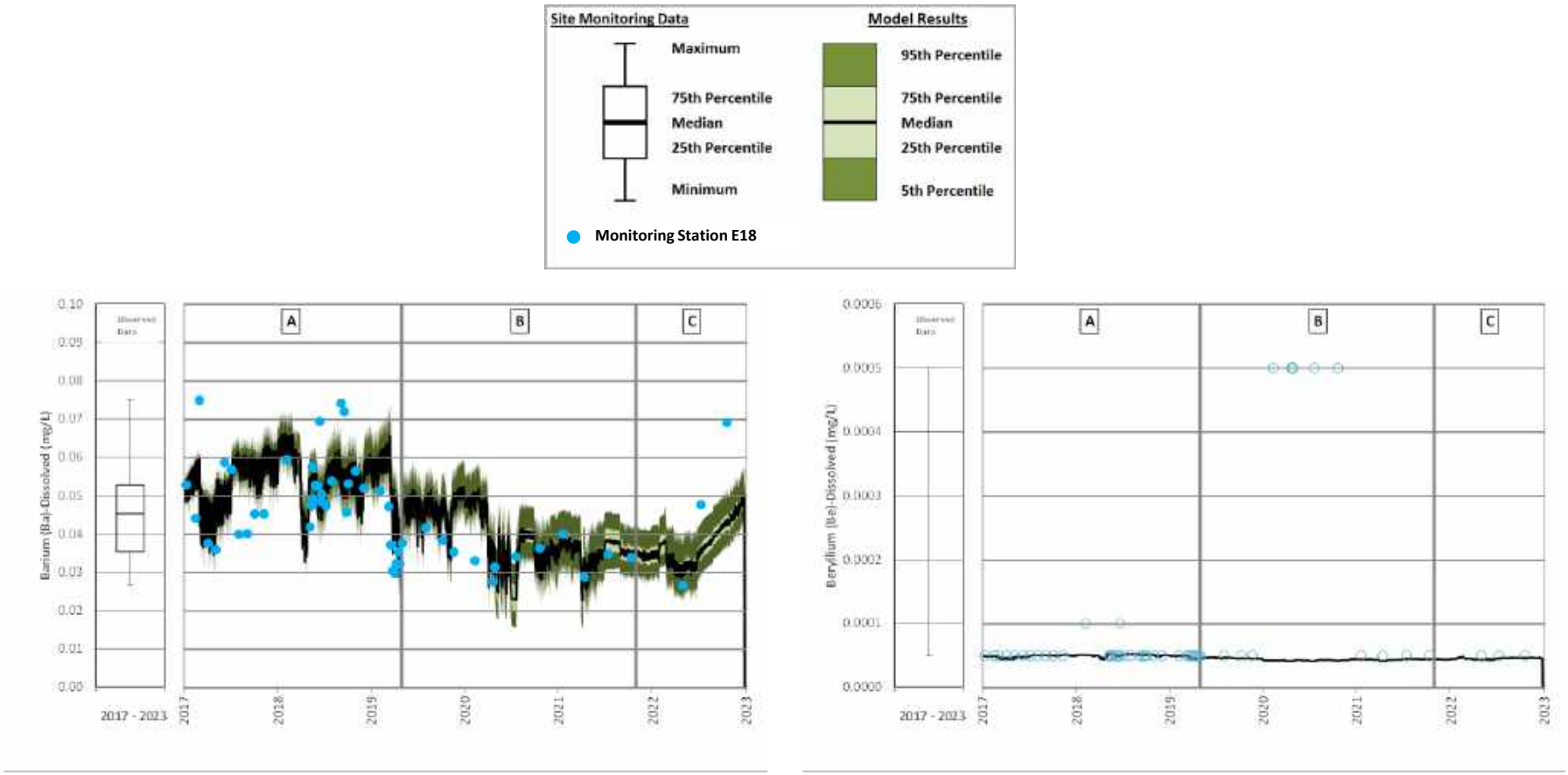
Figure A 67: Central Collection Sump Calibration – Total Phosphorus and Dissolved Aluminum



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

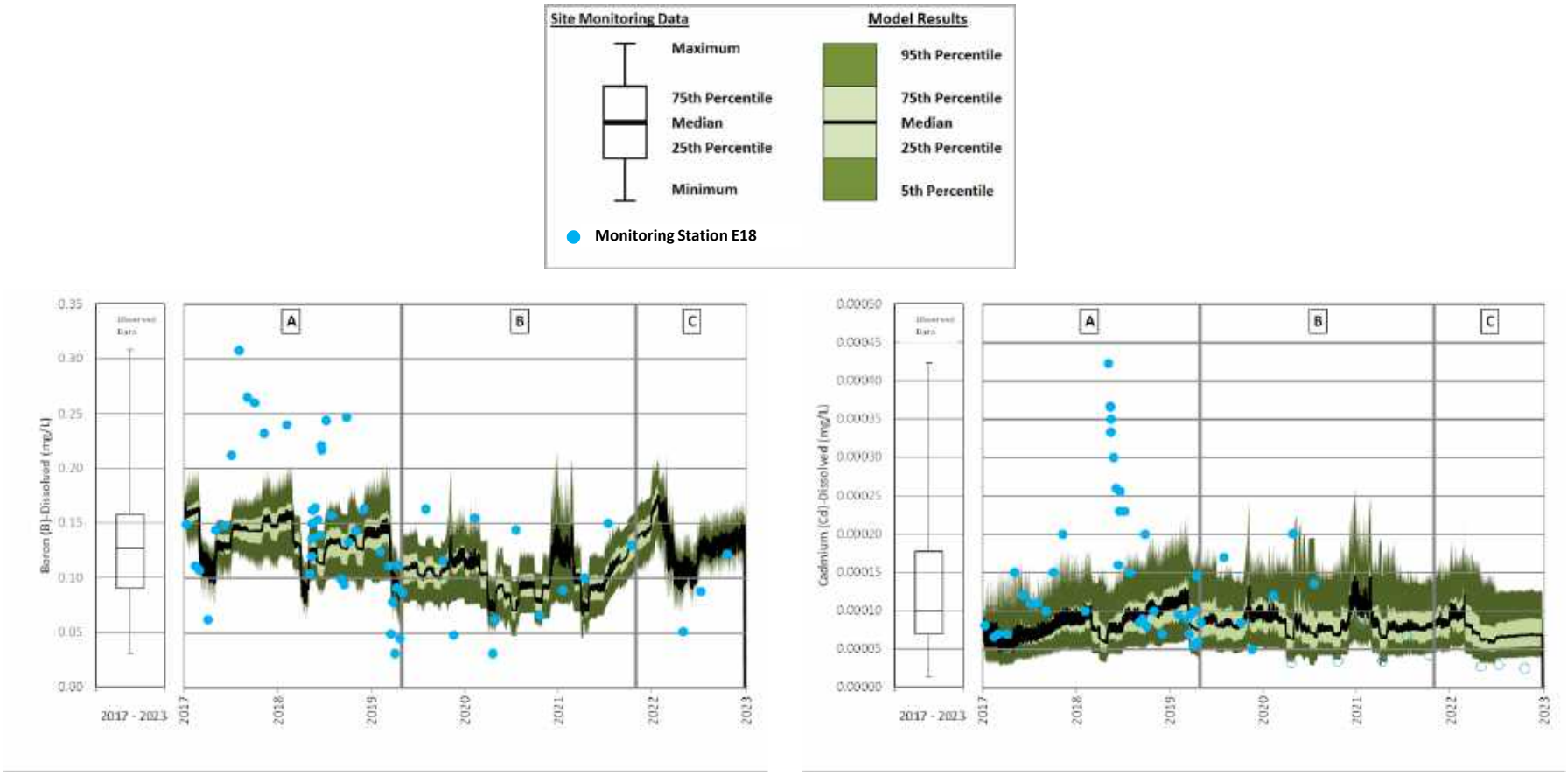
Figure A 68: Central Collection Sump Calibration – Dissolved Antimony and Dissolved Arsenic



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved barium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

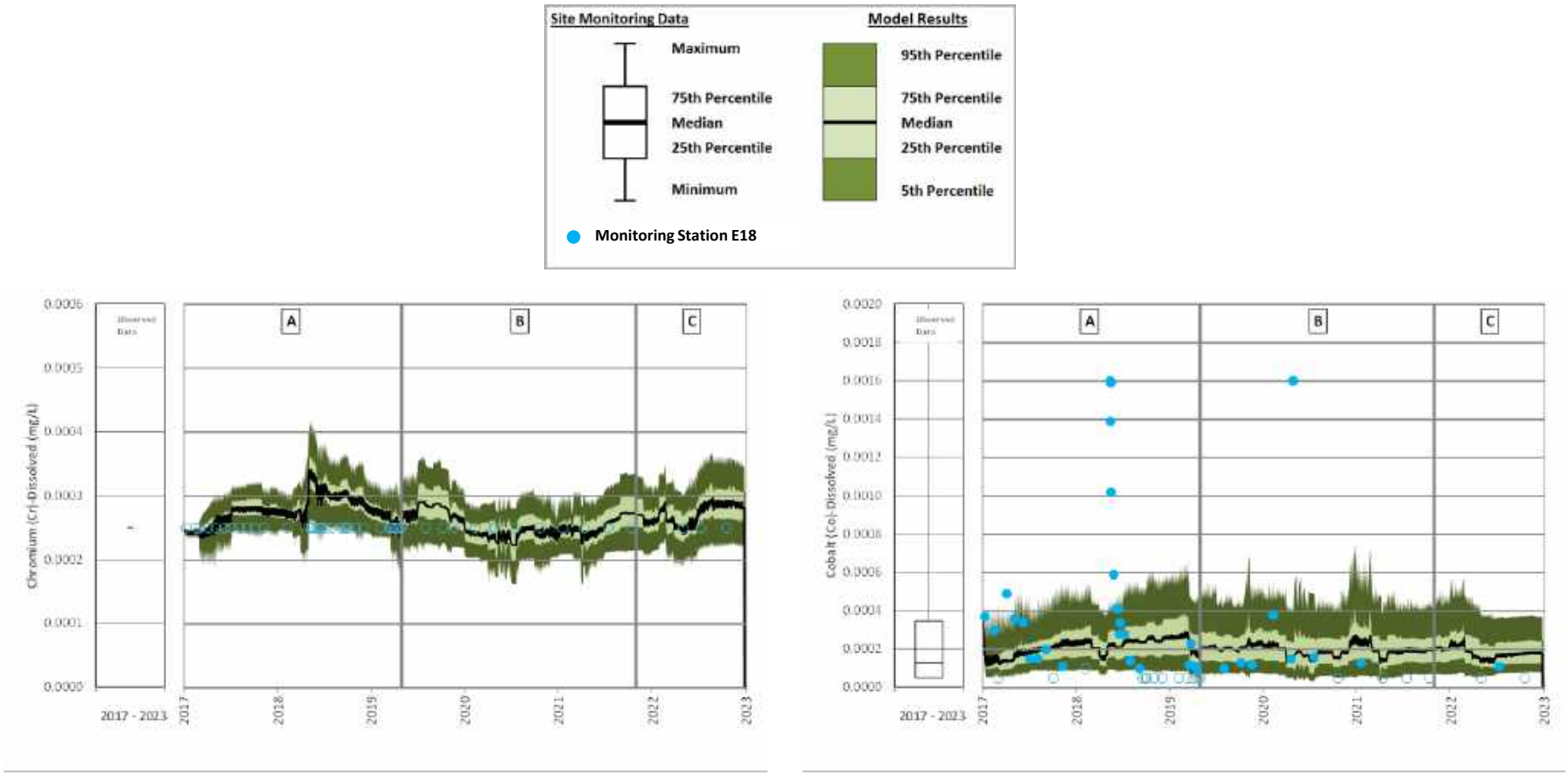
Figure A 69: Central Collection Sump Calibration – Dissolved Barium and Dissolved Beryllium



A = Operations; B = Care and Maintanence; C = Resumed Operations

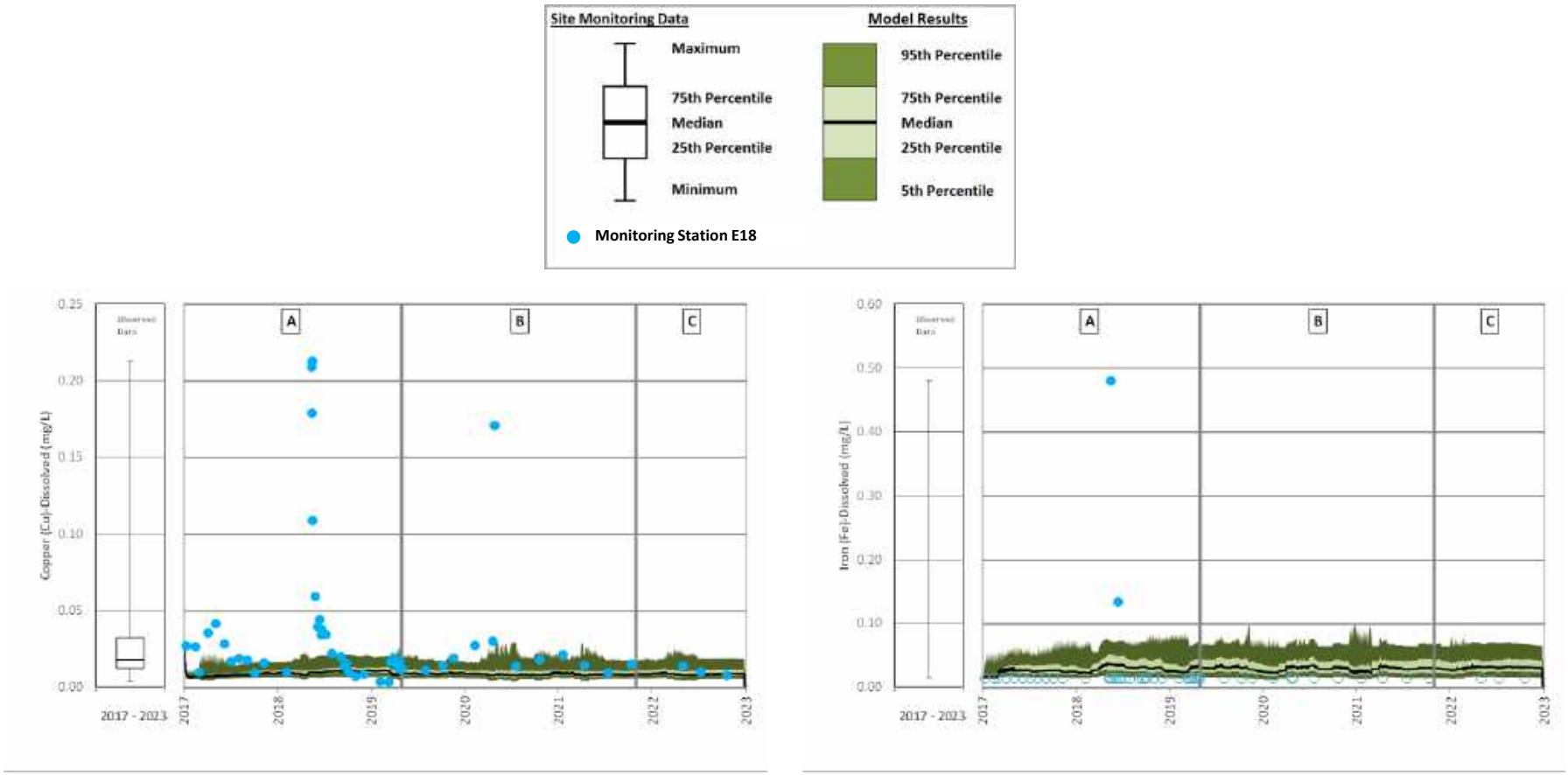
Note: Dissolved boron concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 70: Central Collection Sump Calibration – Dissolved Boron and Dissolved Cadmium



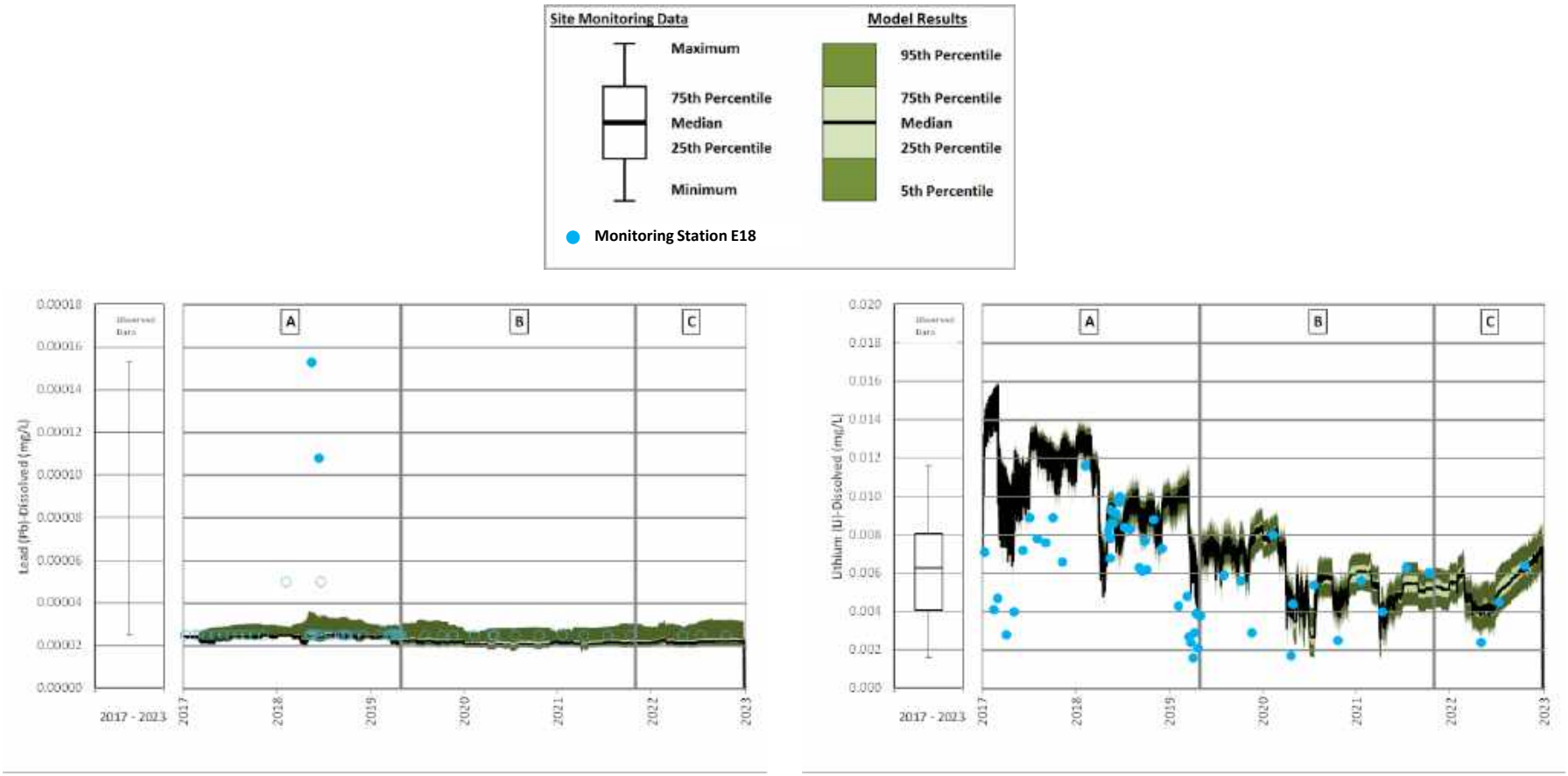
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 71: Central Collection Sump Calibration – Dissolved Chromium and Dissolved Cobalt



A = Operations; B = Care and Maintanence; C = Resumed Operations

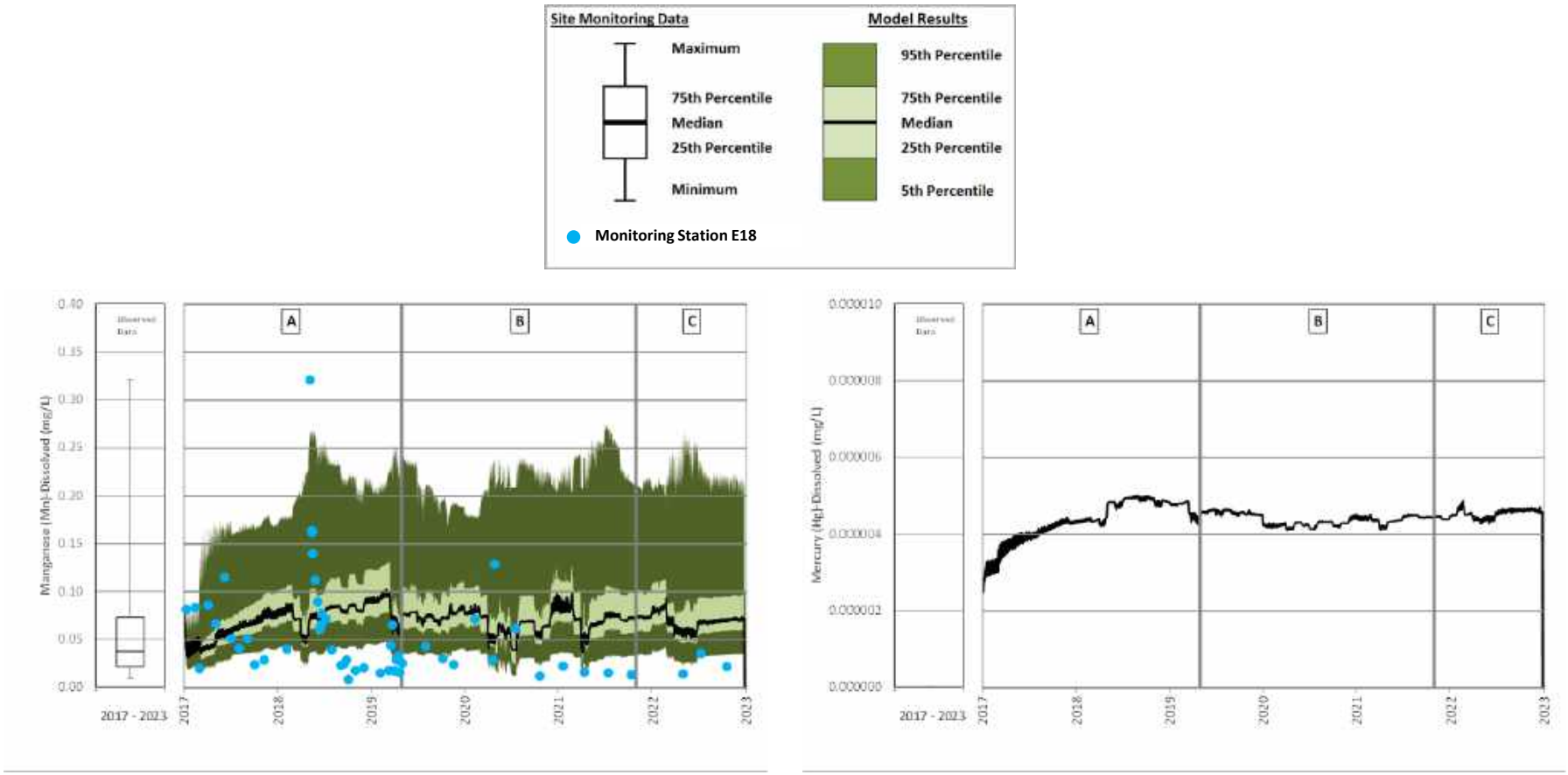
Figure A 72: Central Collection Sump Calibration – Dissolved Copper and Dissolved Iron



A = Operations; B = Care and Maintanence; C = Resumed Operations

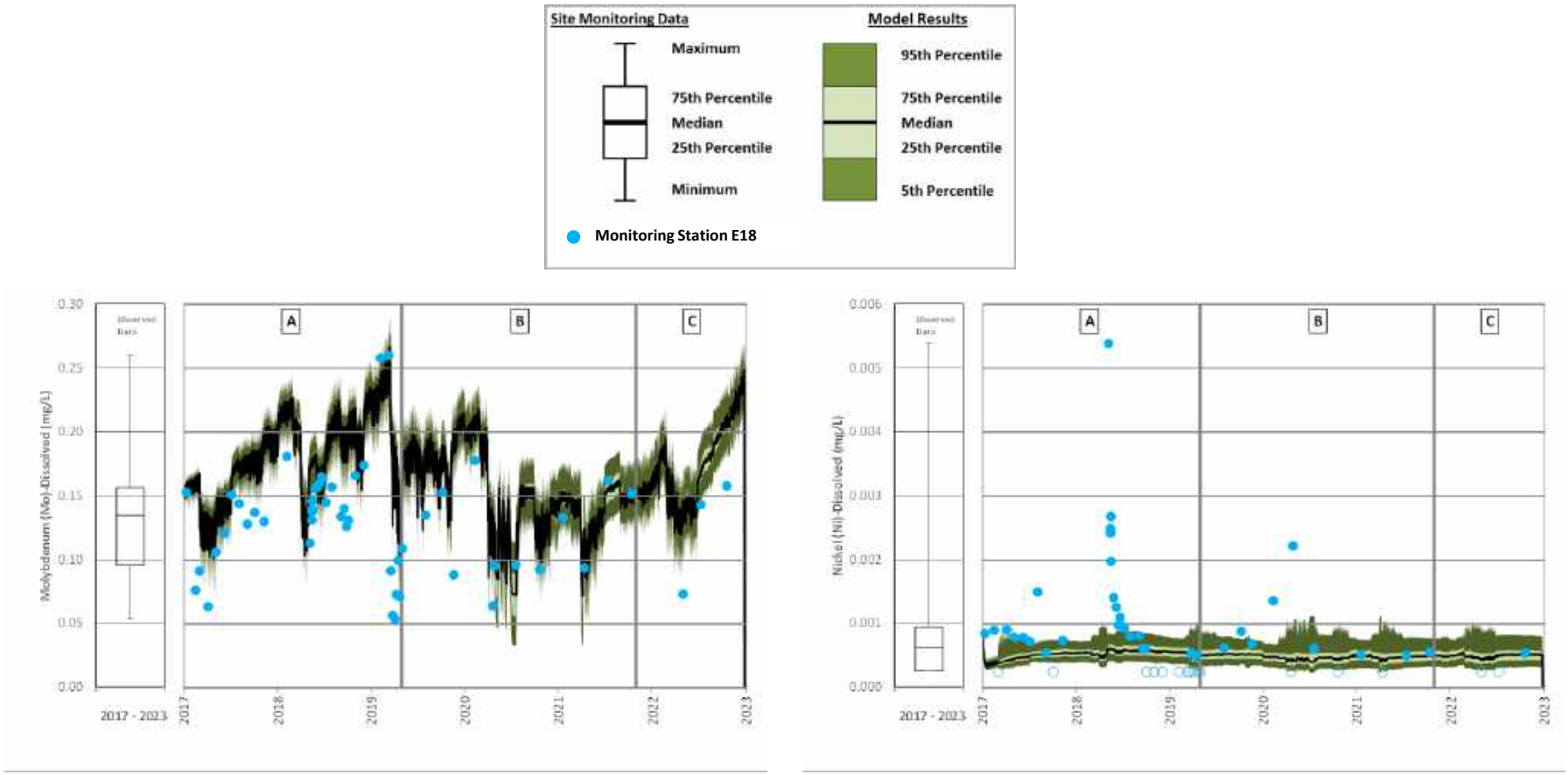
Note: Dissolved lithium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 73: Central Collection Sump Calibration – Dissolved Lead and Dissolved Lithium



A = Operations; B = Care and Maintanence; C = Resumed Operations

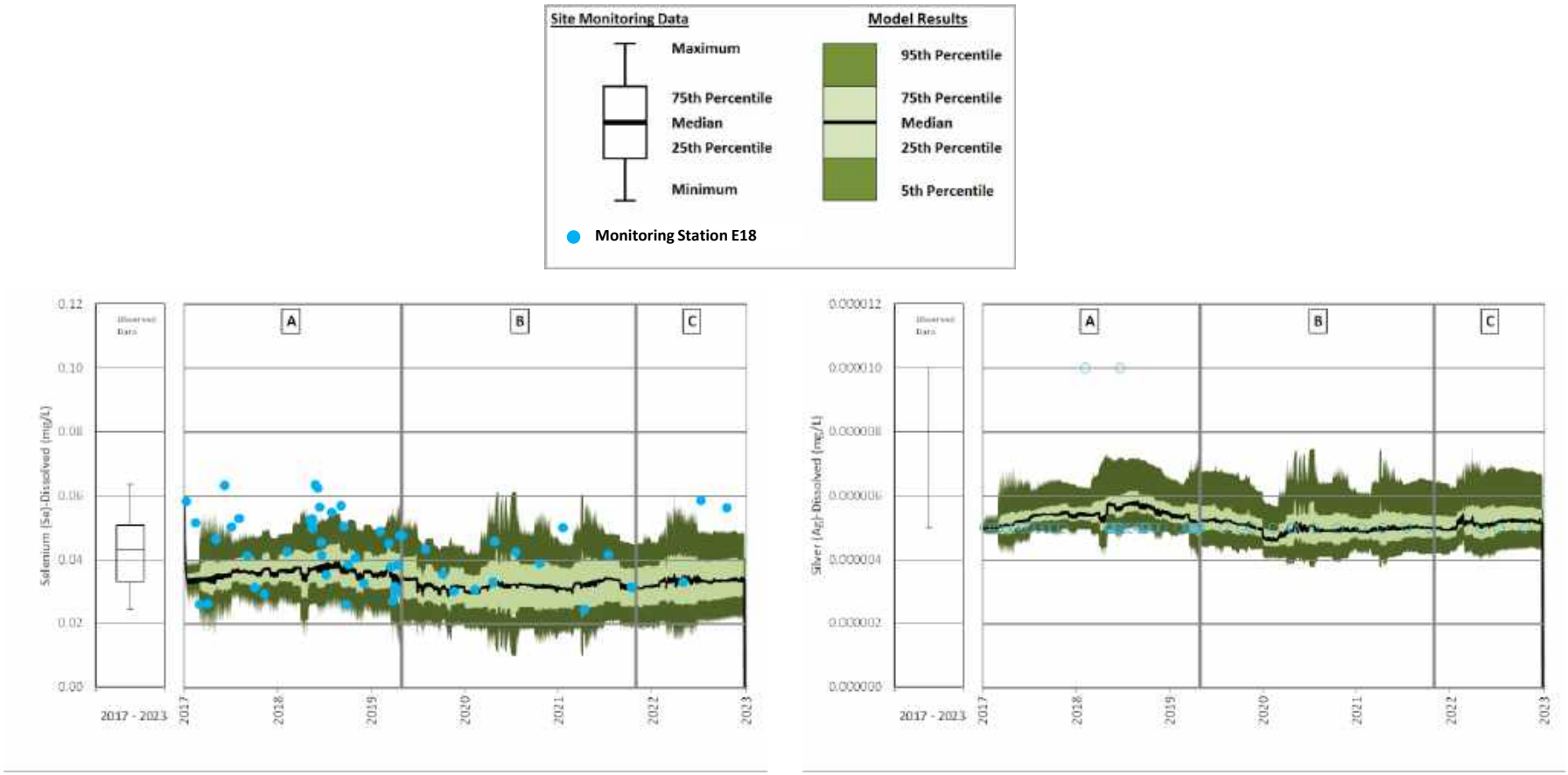
Figure A 74: Central Collection Sump Calibration – Dissolved Manganese and Dissolved Mercury



A = Operations; B = Care and Maintanence; C = Resumed Operations

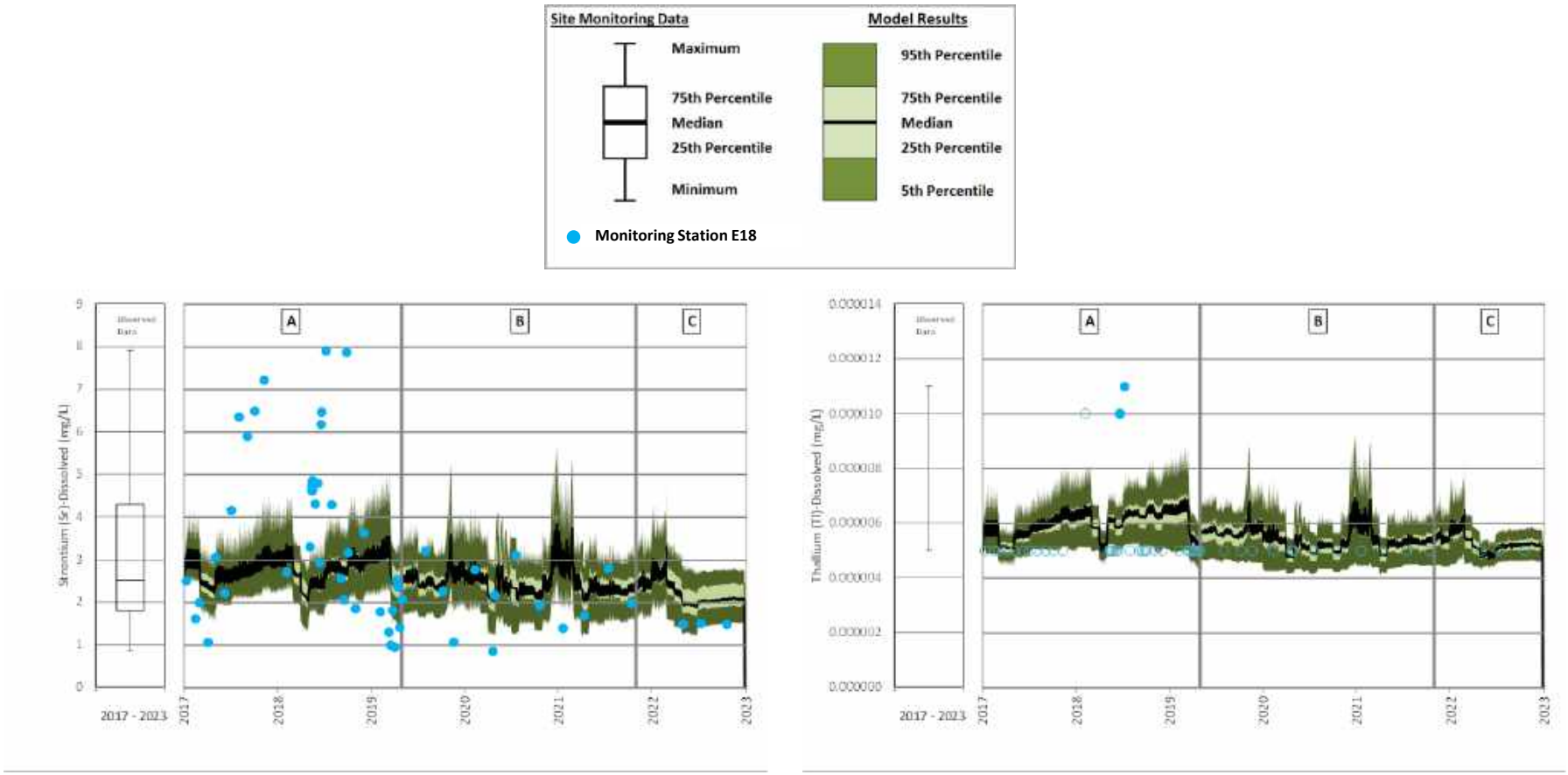
Note: Dissolved molybdenum concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

Figure A 75: Central Collection Sump Calibration – Dissolved Molybdenum and Dissolved Nickel



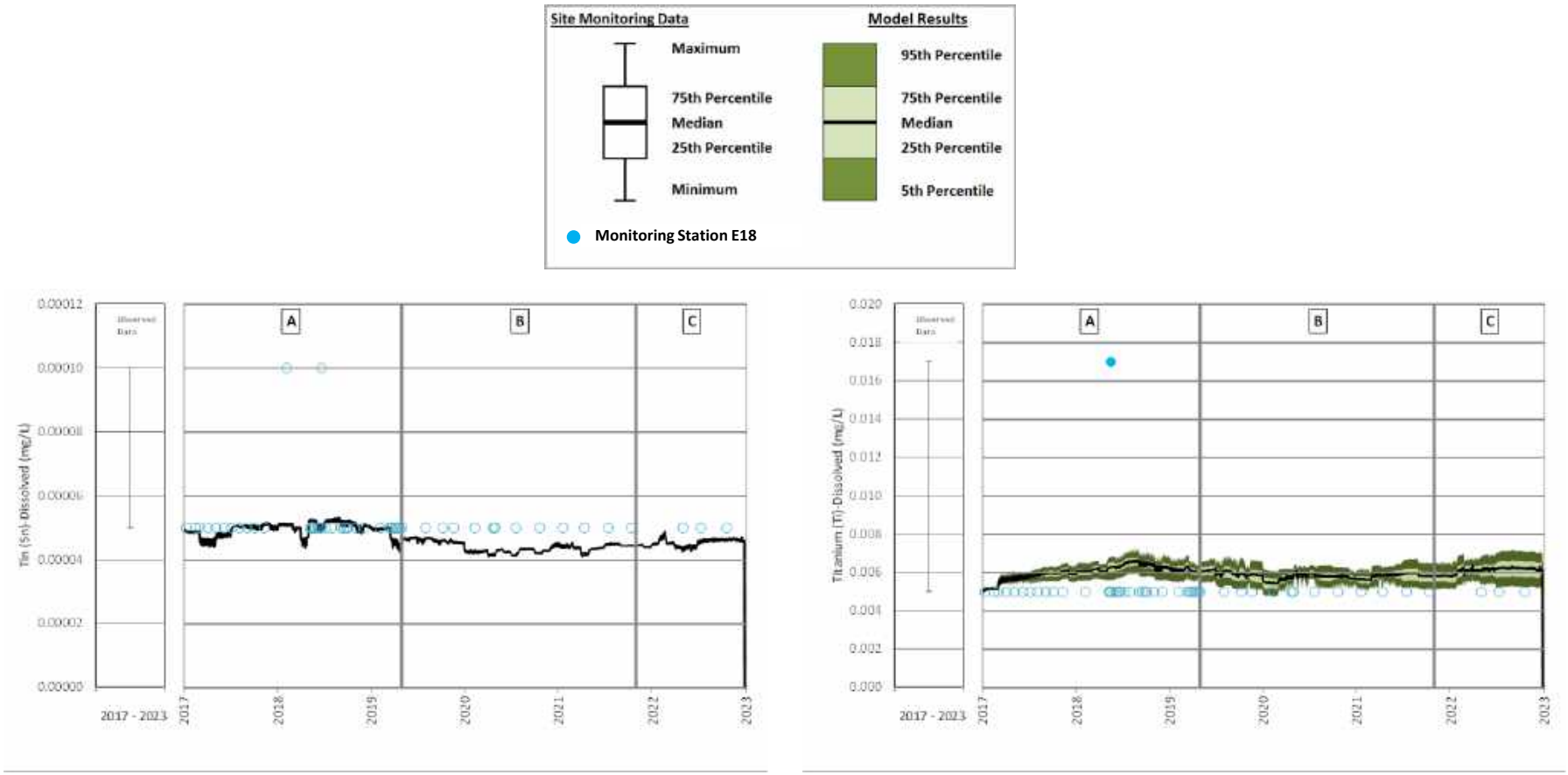
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 76: Central Collection Sump Calibration – Dissolved Selenium and Dissolved Silver



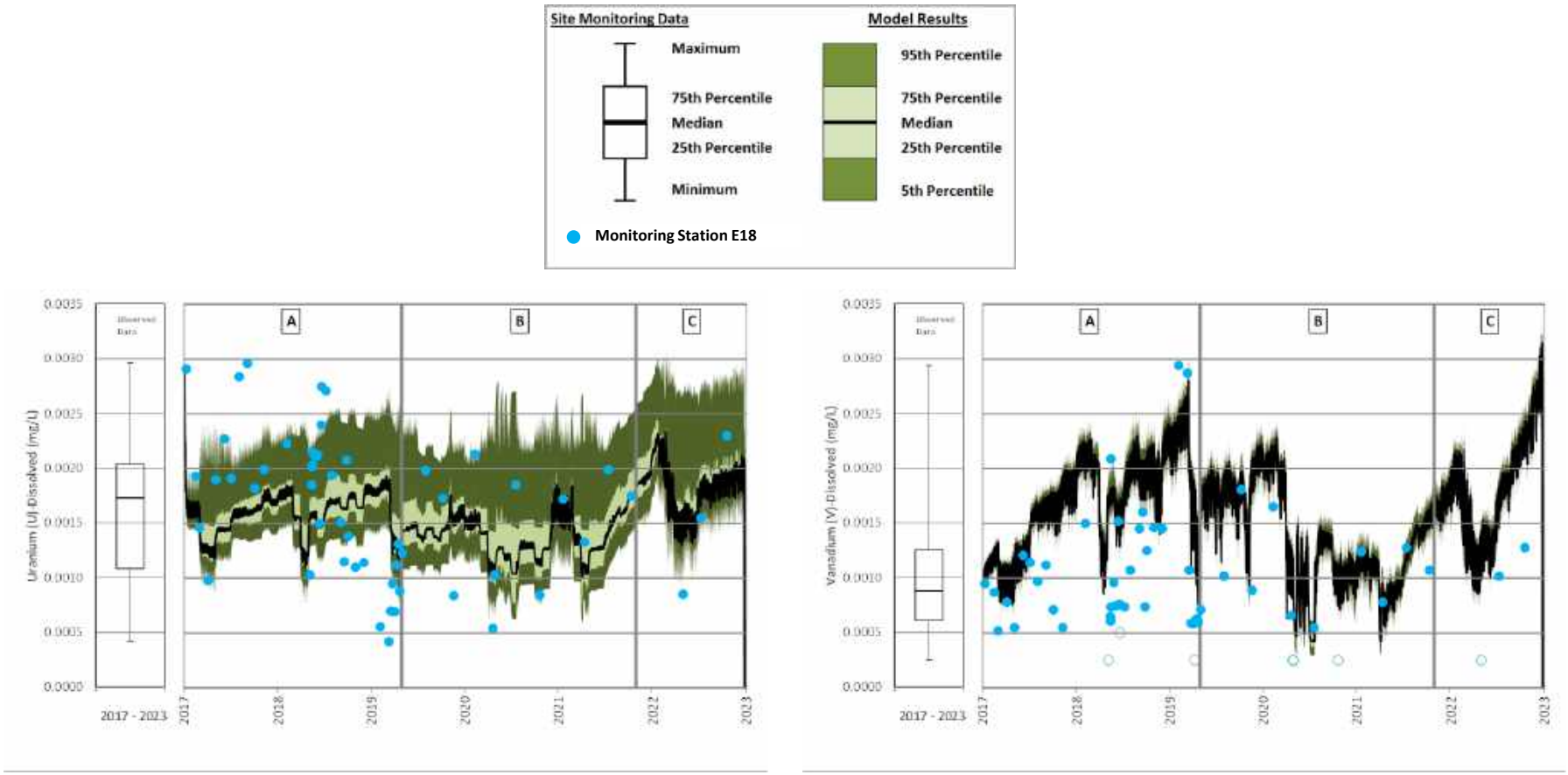
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 77: Central Collection Sump Calibration – Dissolved Strontium and Dissolved Thallium



A = Operations; B = Care and Maintanence; C = Resumed Operations

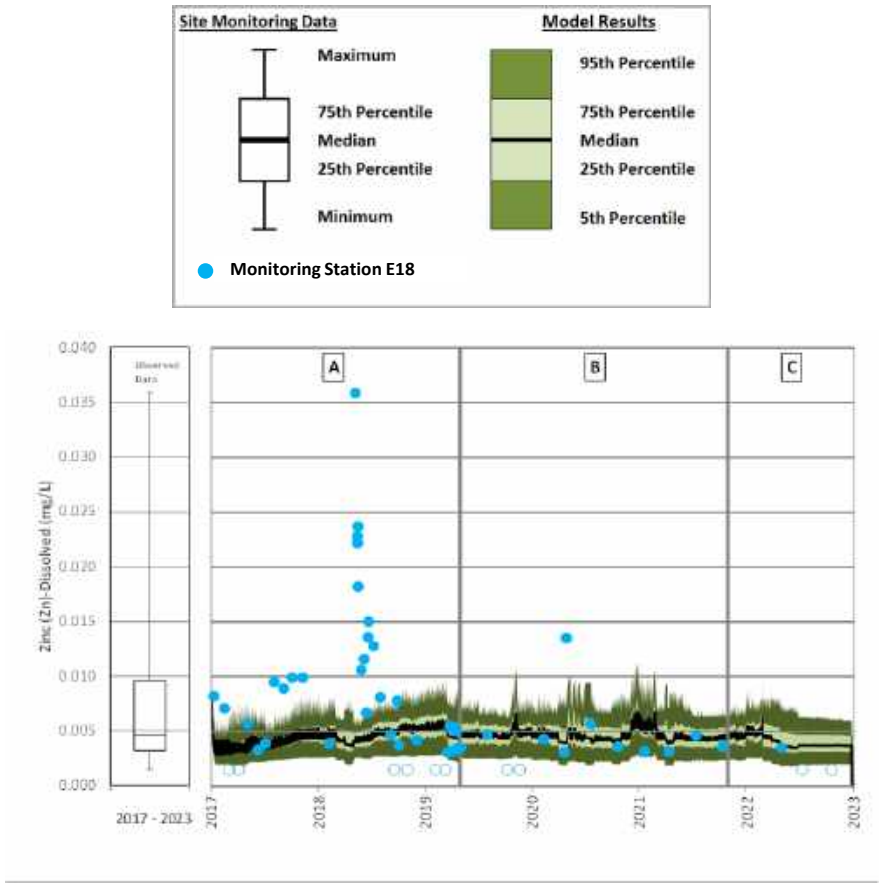
Figure A 78: Central Collection Sump Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved uranium and dissolved vanadium concentrations increase in the Central Collection Sump (CCS) at the start of resumed operations because of water transferred through the mine site from the Tailings Storage Facility and from Cariboo Pit through the following connection: TSF and Cariboo Pit → Mine Drainage Creek Sump → SERDS Ditch → Long Ditch → CCS.

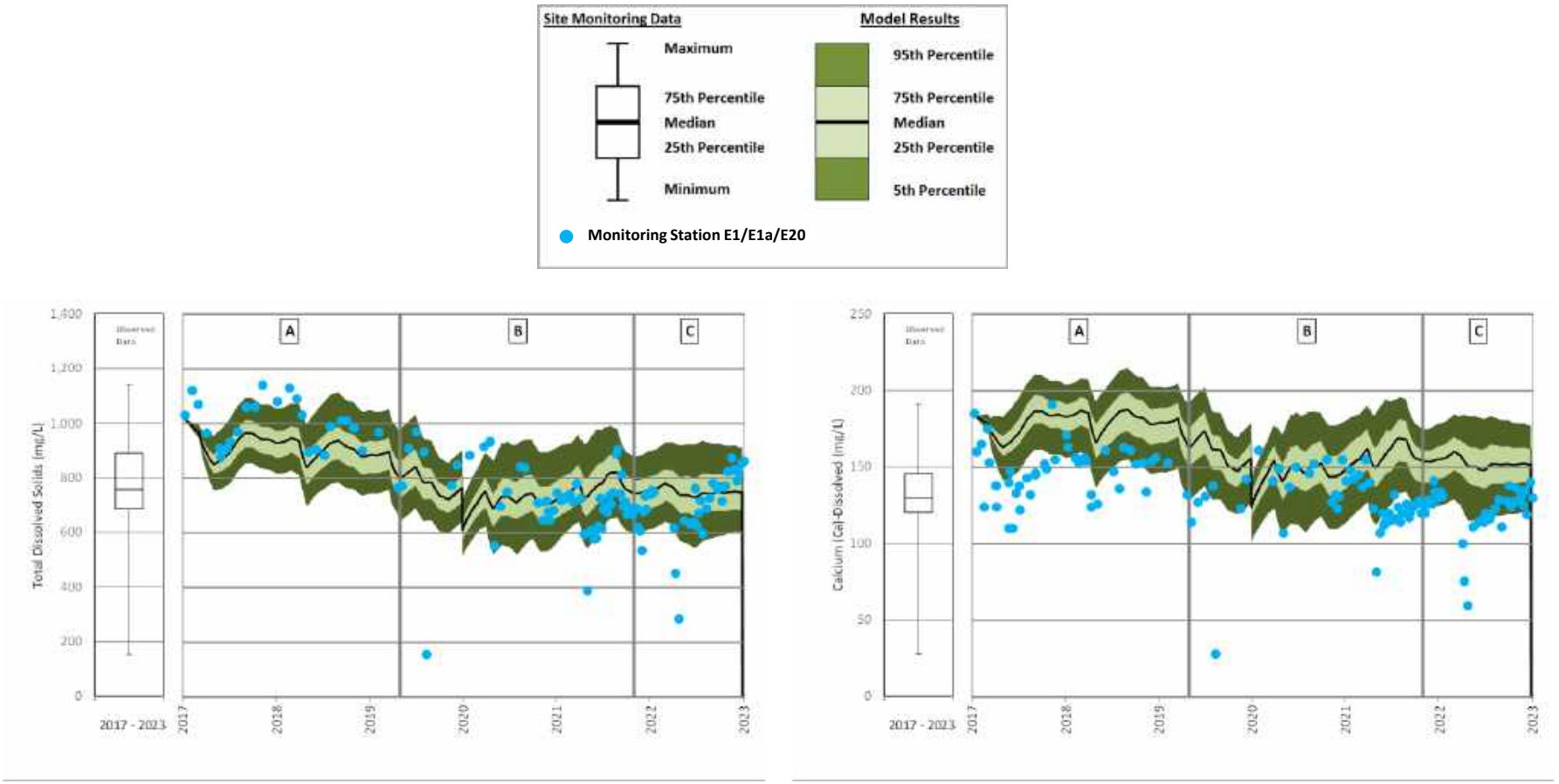
Figure A 79: Central Collection Sump Calibration – Dissolved Uranium and Dissolved Vanadium



A = Operations; B = Care and Maintanence; C = Resumed Operations

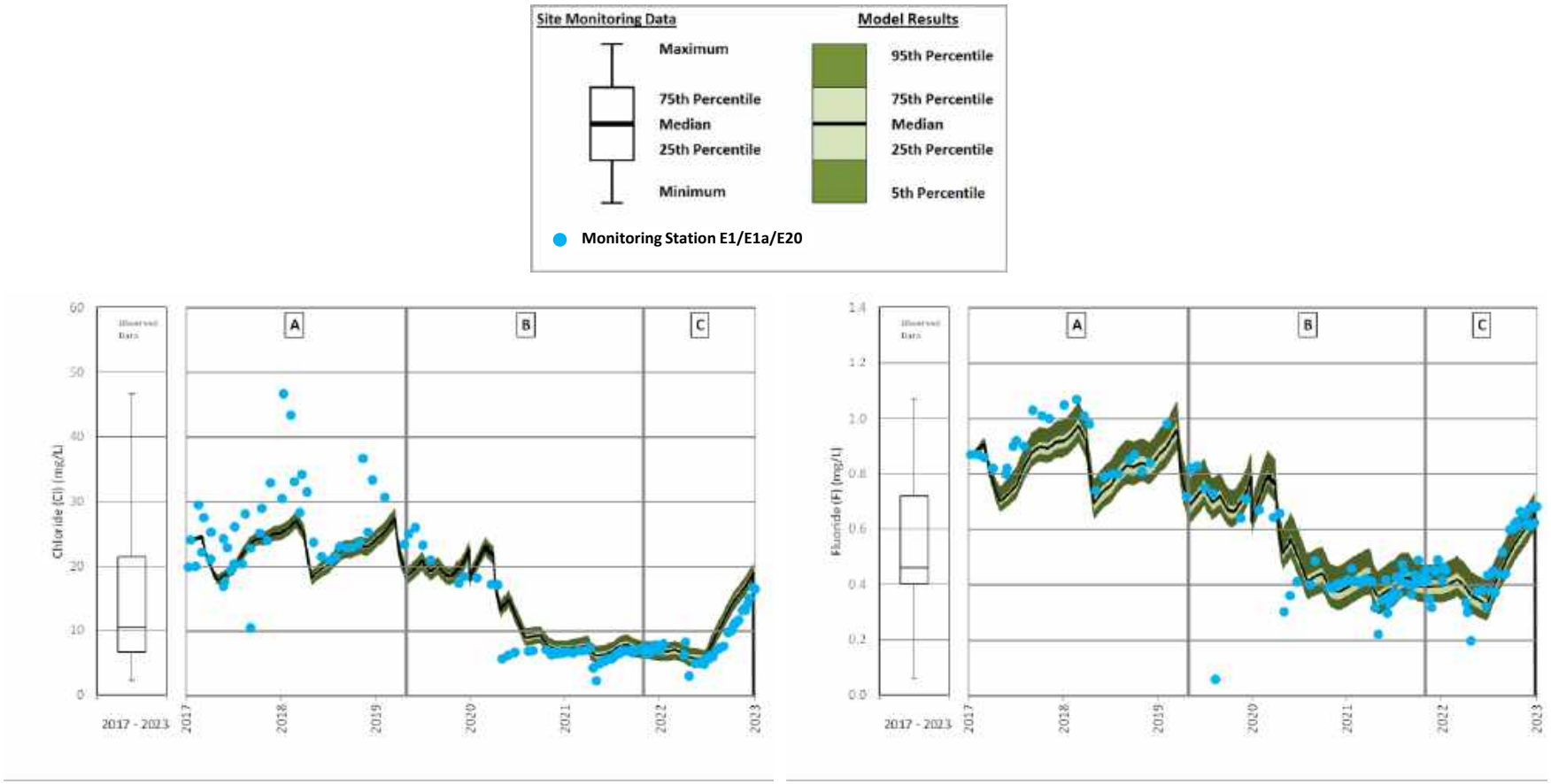
Figure A 80: Central Collection Sump Calibration – Dissolved Zinc

Tailings Storage Facility Calibration



A = Operations; B = Care and Maintanence; C = Resumed Operations

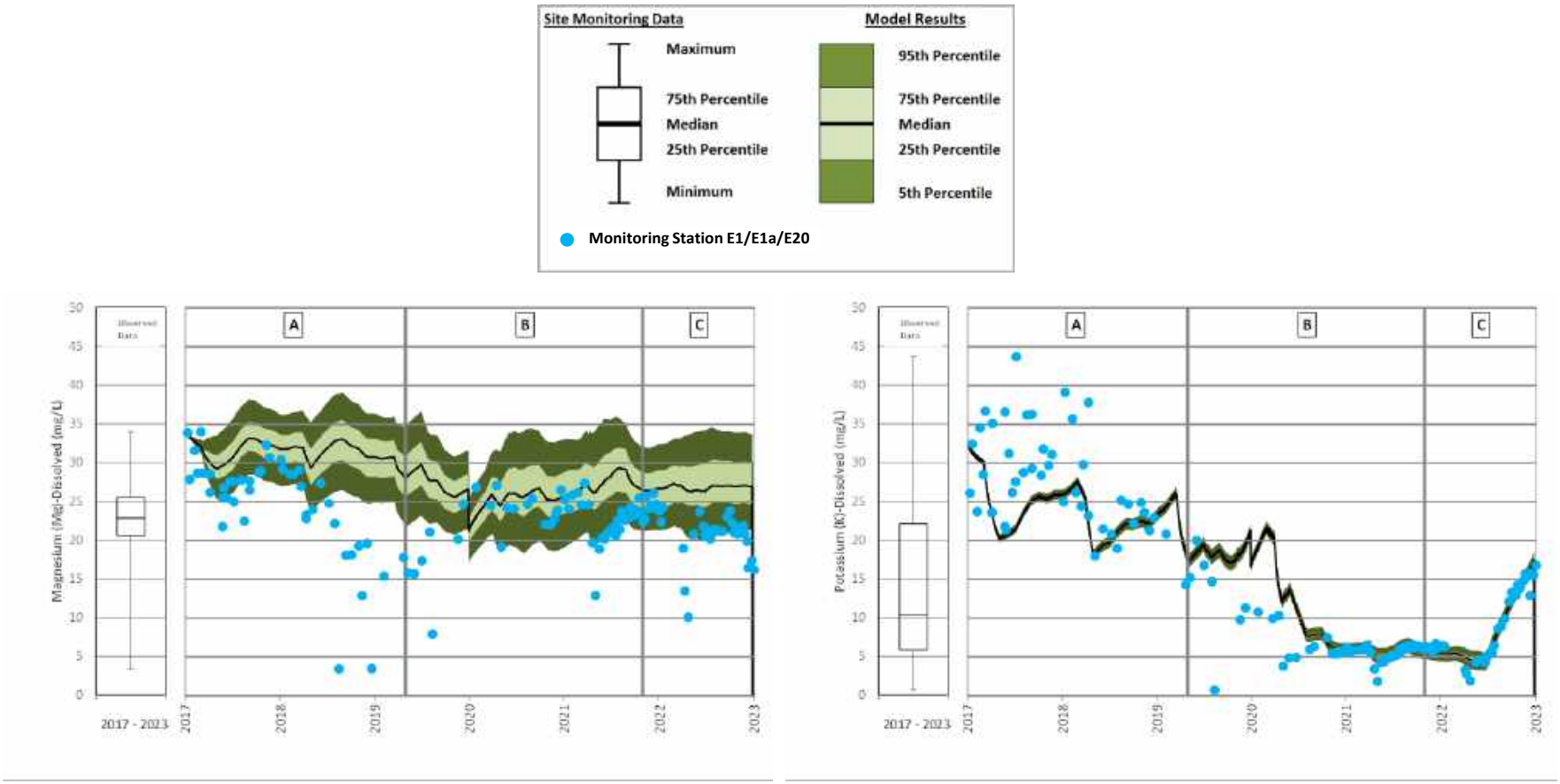
Figure A 81: Tailings Storage Facility Calibration – Total Dissolved Solids and Calcium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased chloride and fluoride concentrations in the TSF are caused by tailings deposition when operations resumed.

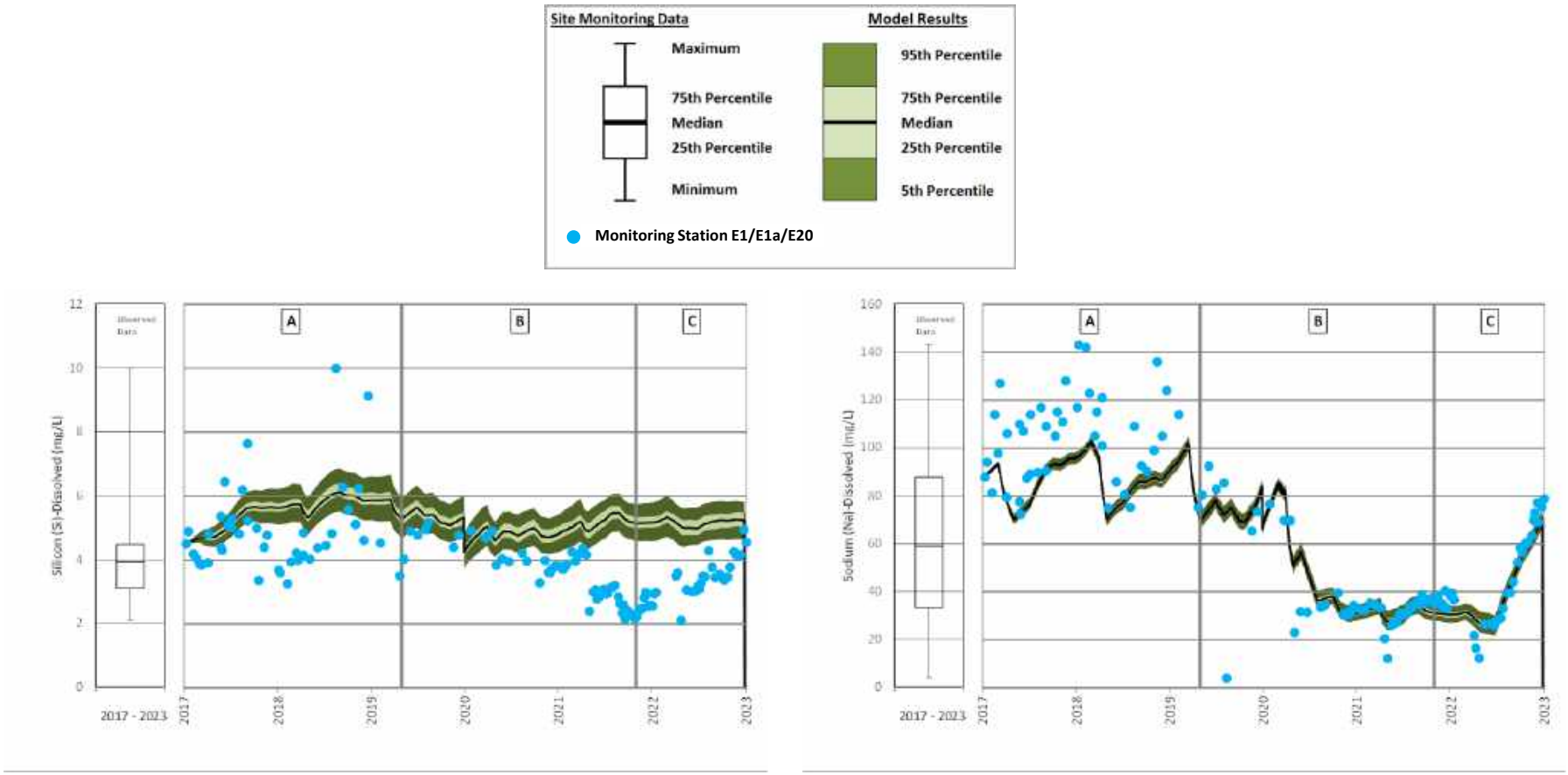
Figure A 82: Tailings Storage Facility Calibration – Chloride and Fluoride



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased potassium concentrations in the TSF are caused by tailings deposition when operations resumed.

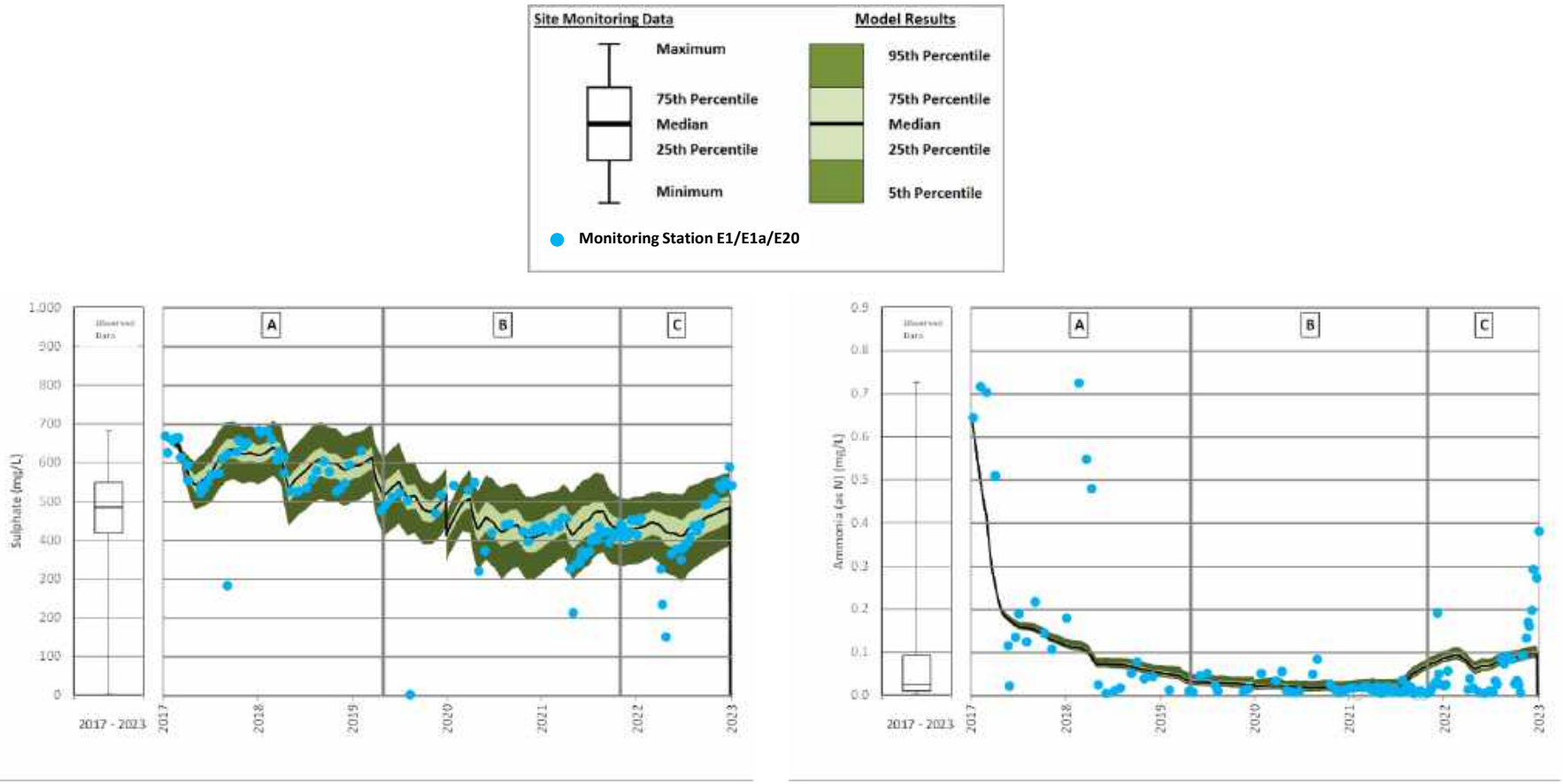
Figure A 83: Tailings Storage Facility Calibration – Magnesium and Potassium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased sodium concentrations in the TSF are caused by tailings deposition when operations resumed.

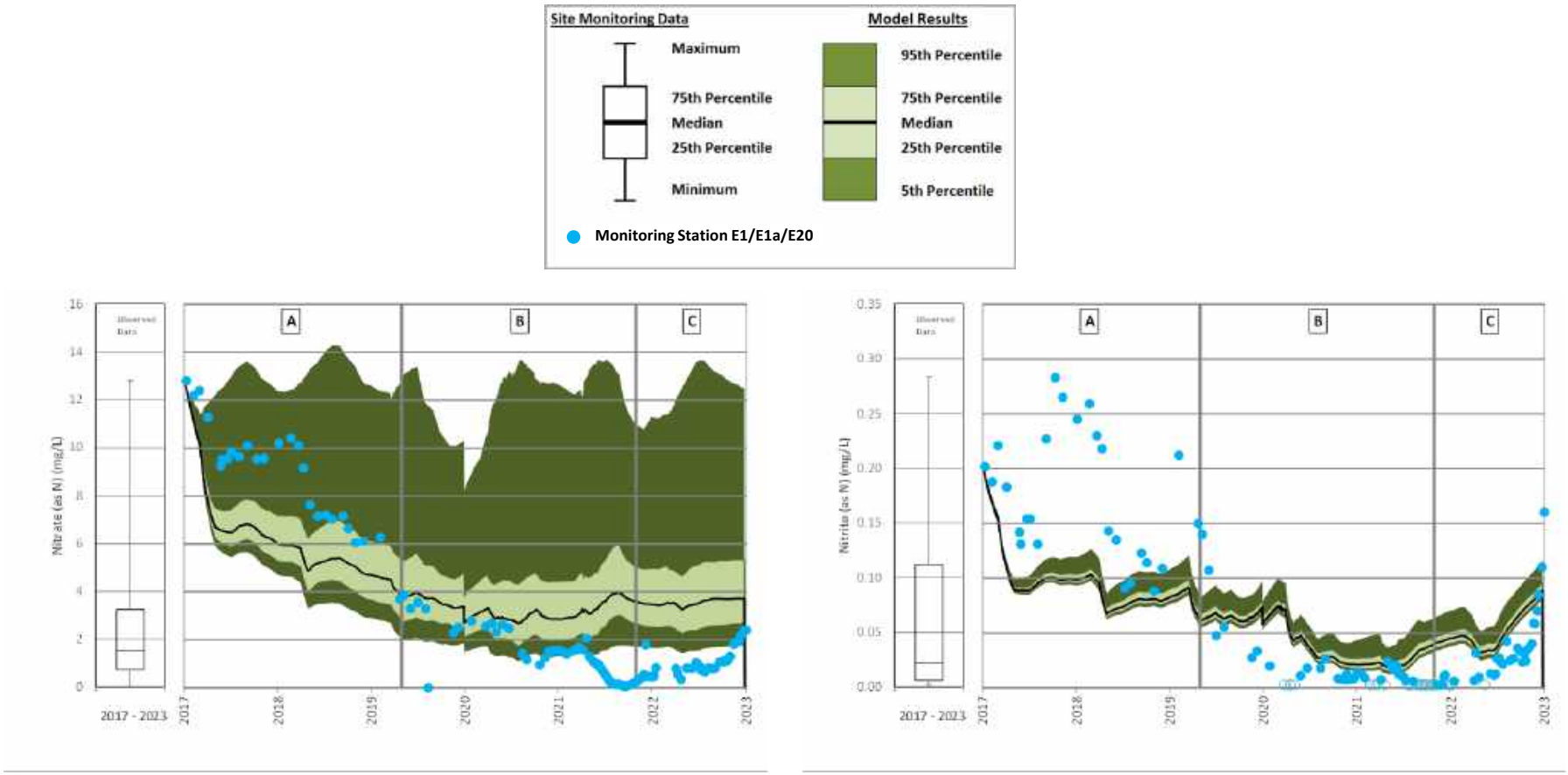
Figure A 84: Tailings Storage Facility Calibration – Silicon and Sodium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased sulphate and total ammonia concentrations in the TSF are caused by tailings deposition when operations resumed.

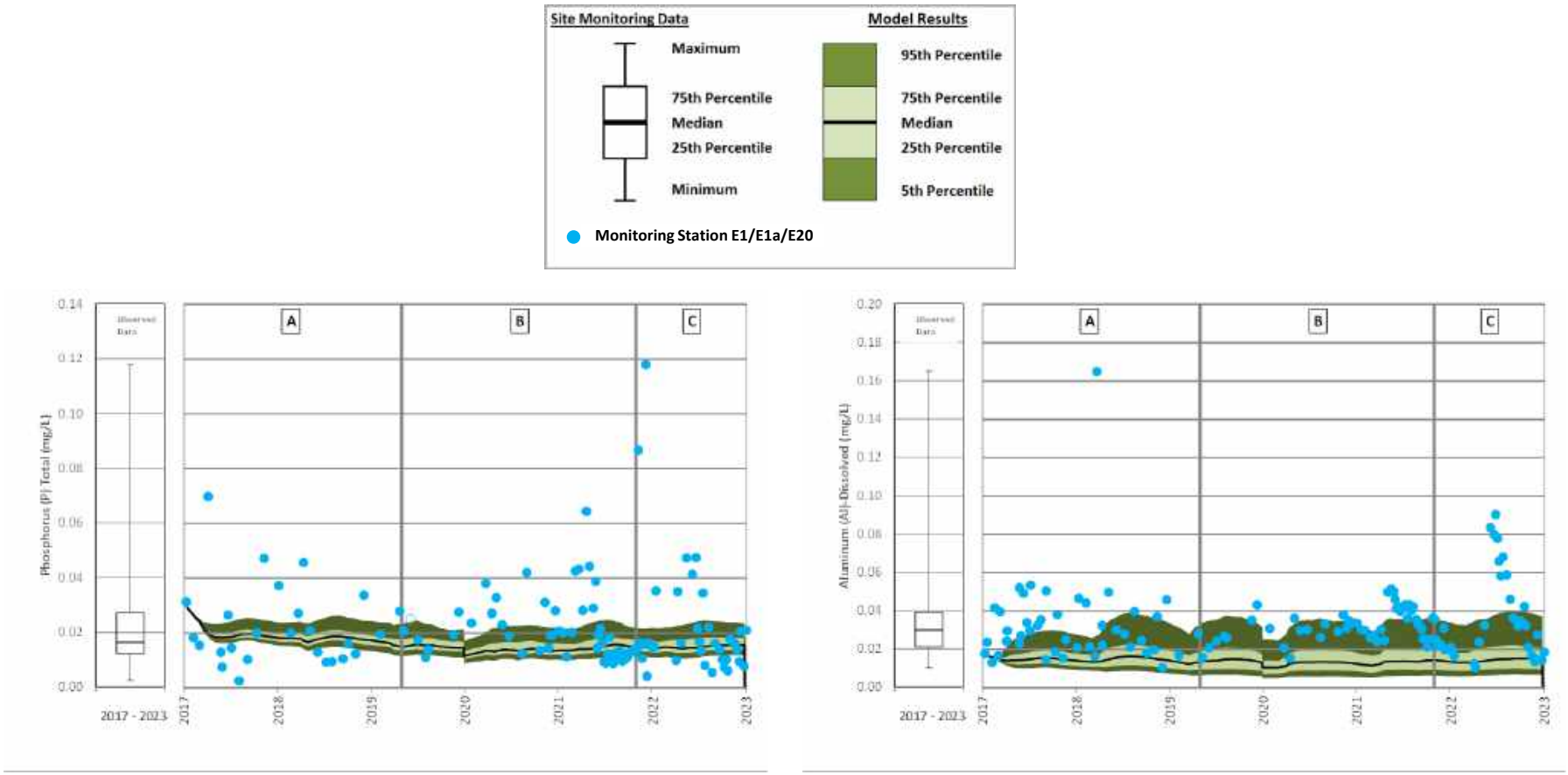
Figure A 85: Tailings Storage Facility Calibration – Sulphate and Total Ammonia



A = Operations; B = Care and Maintanence; C = Resumed Operations

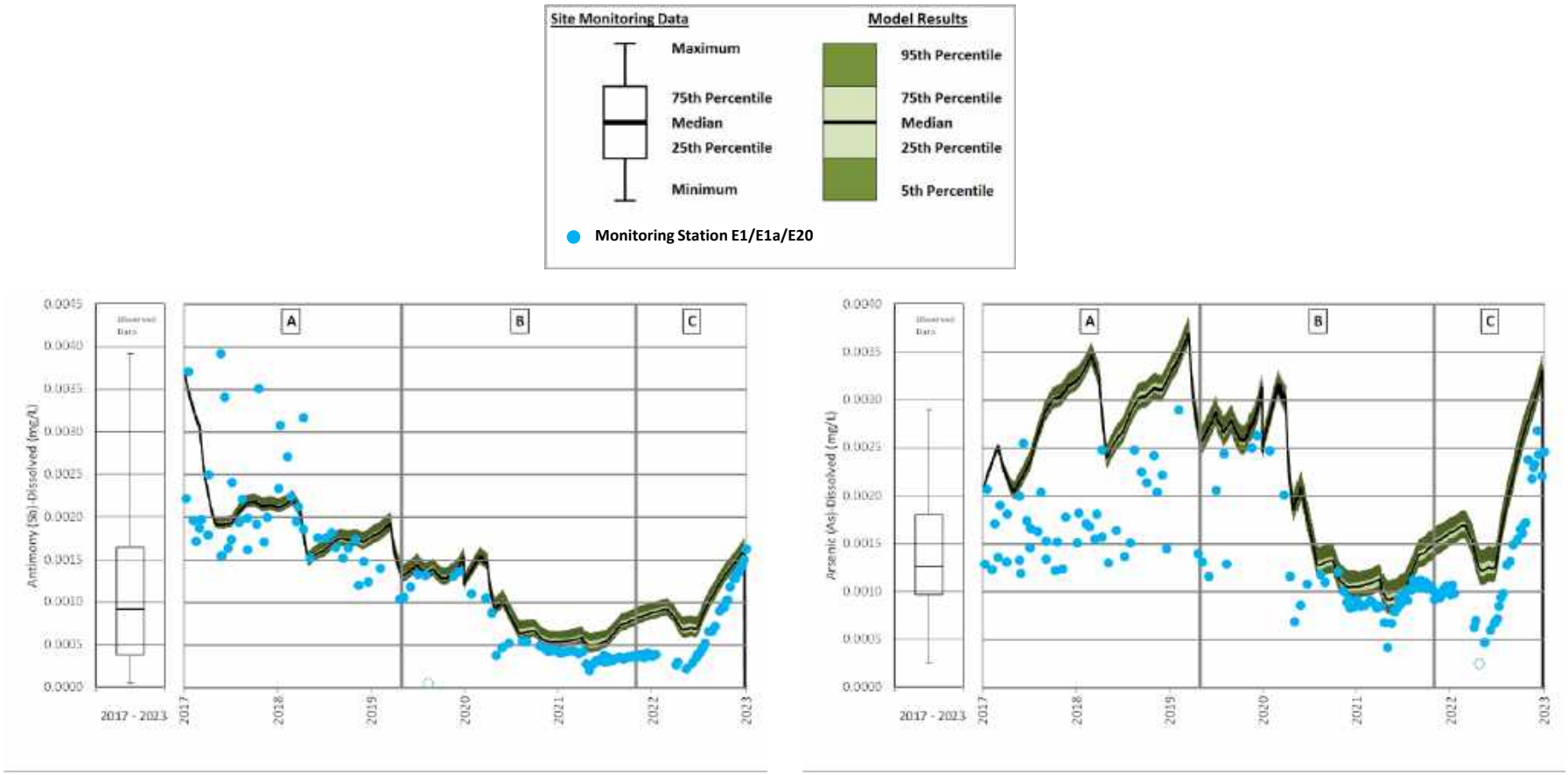
Note: The increased nitrite concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 86: Tailings Storage Facility Calibration – Nitrate and Nitrite



A = Operations; B = Care and Maintanence; C = Resumed Operations

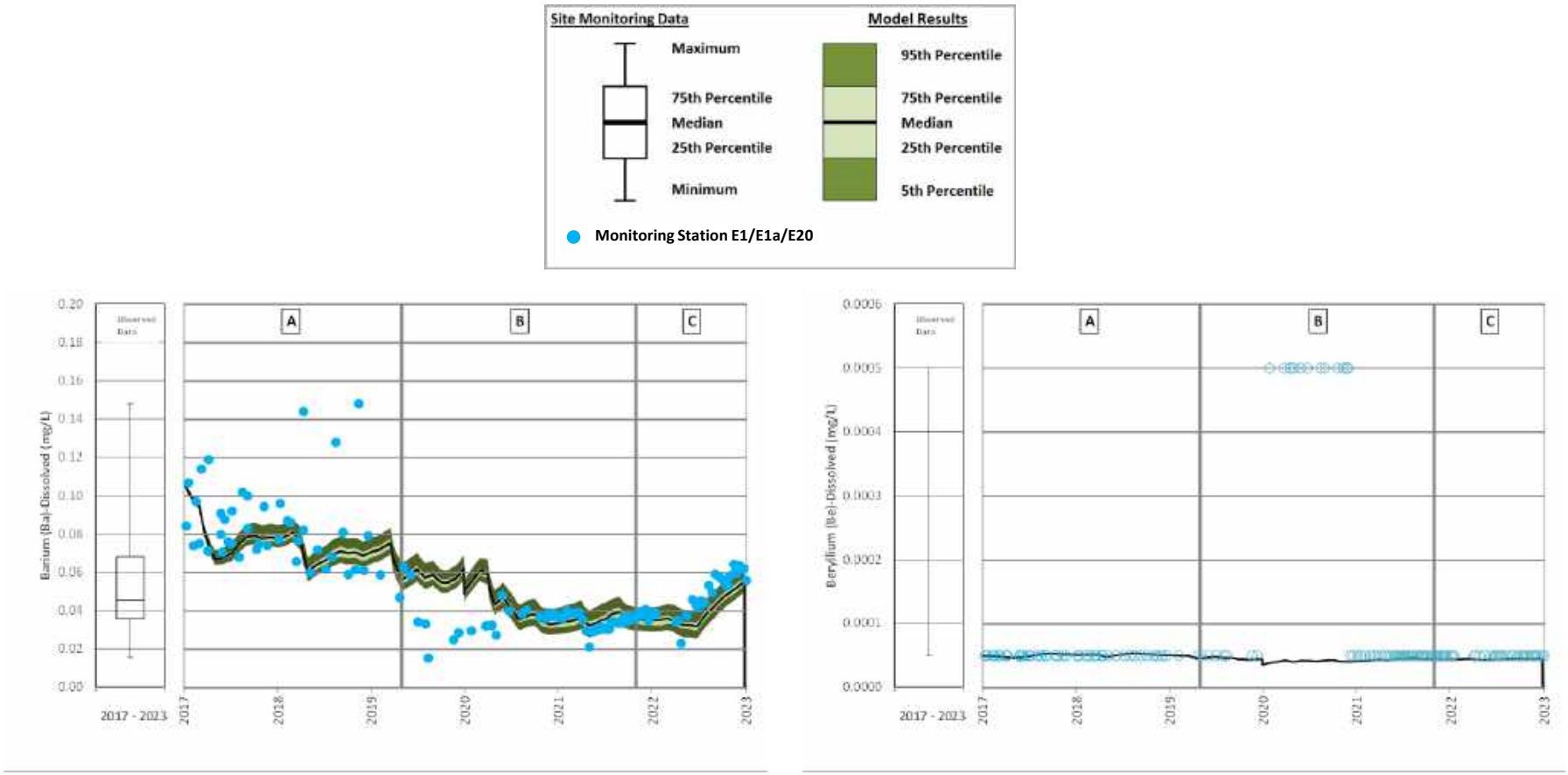
Figure A 87: Tailings Storage Facility Calibration – Total Phosphorus and Dissolved Aluminum



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased dissolved antimony and dissolved arsenic concentrations in the TSF are caused by tailings deposition when operations resumed.

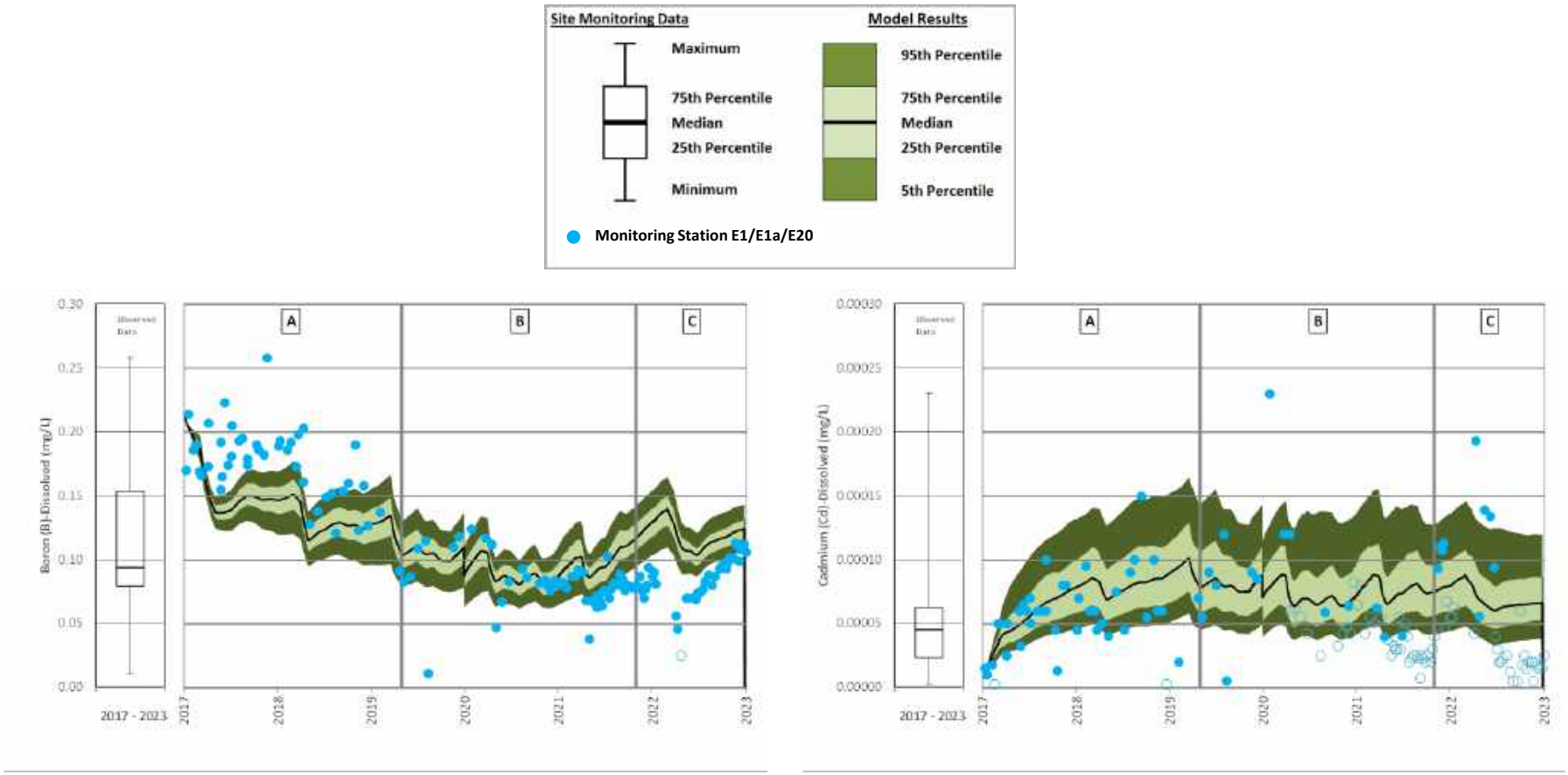
Figure A 88: Tailings Storage Facility Calibration – Dissolved Antimony and Dissolved Arsenic



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased dissolved barium concentrations in the TSF are caused by tailings deposition when operations resumed.

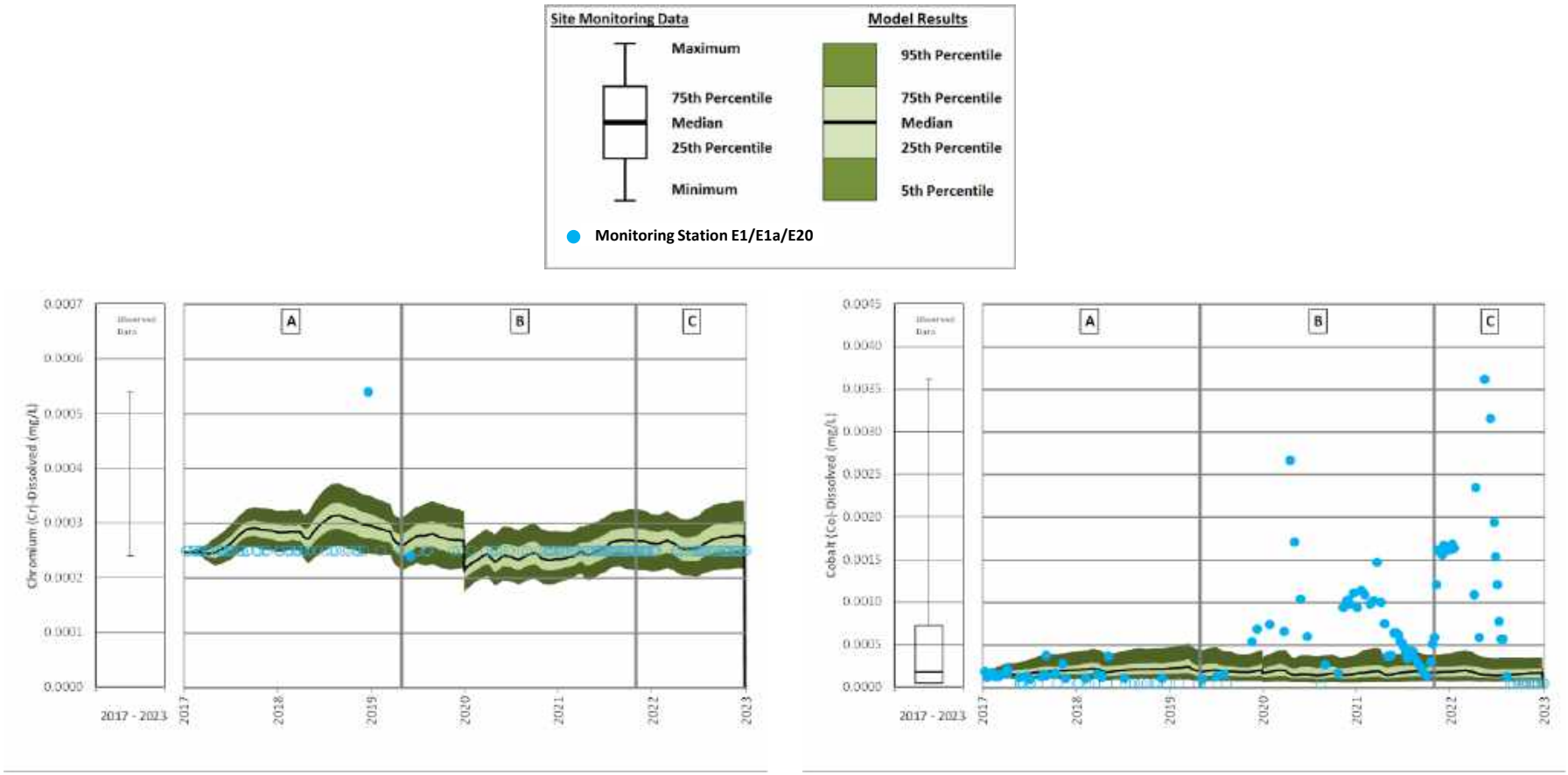
Figure A 89: Tailings Storage Facility Calibration – Dissolved Barium and Dissolved Beryllium



A = Operations; B = Care and Maintanence; C = Resumed Operations

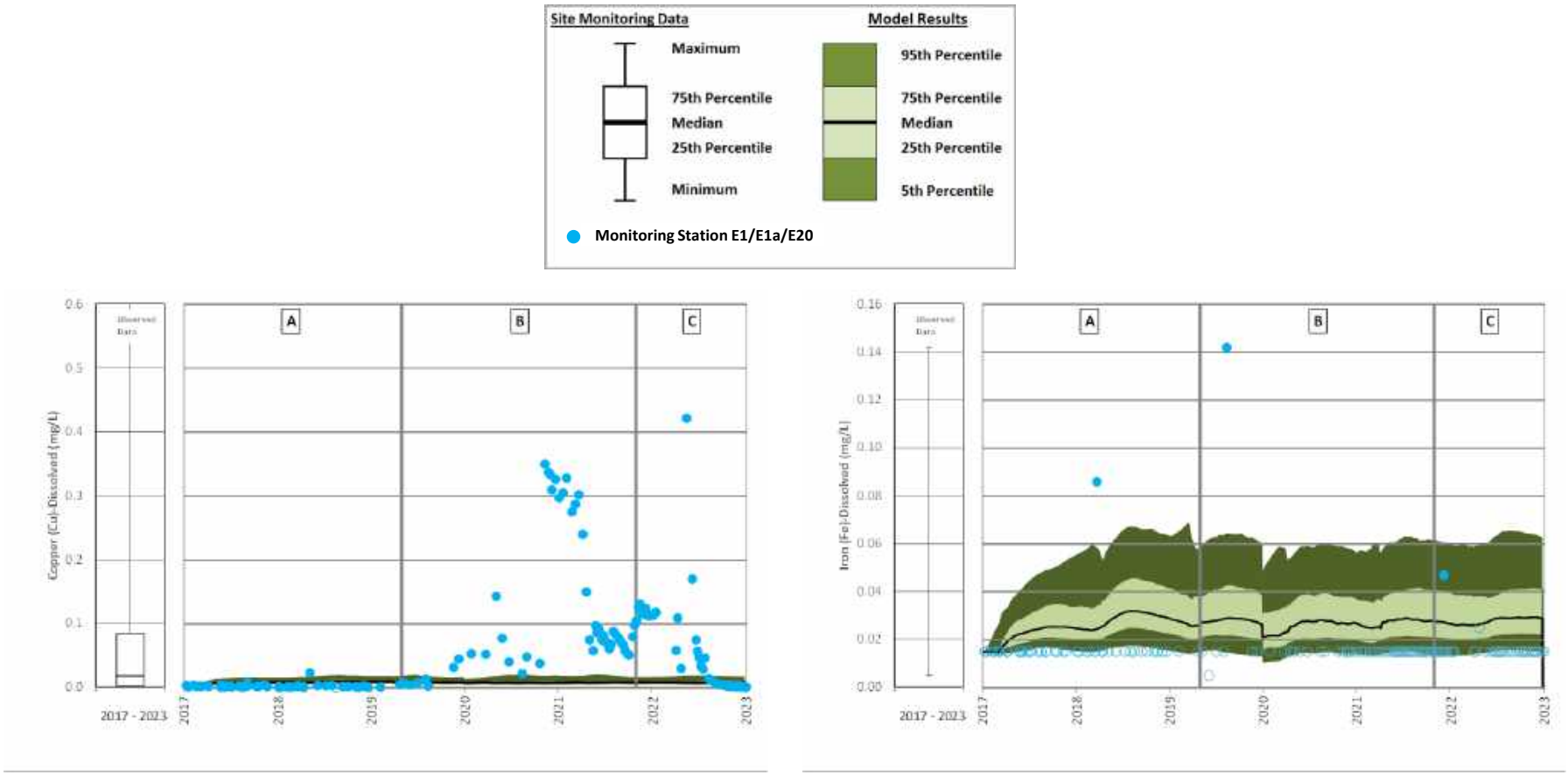
Note: The increased dissolved boron concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 90: Tailings Storage Facility Calibration – Dissolved Boron and Dissolved Cadmium



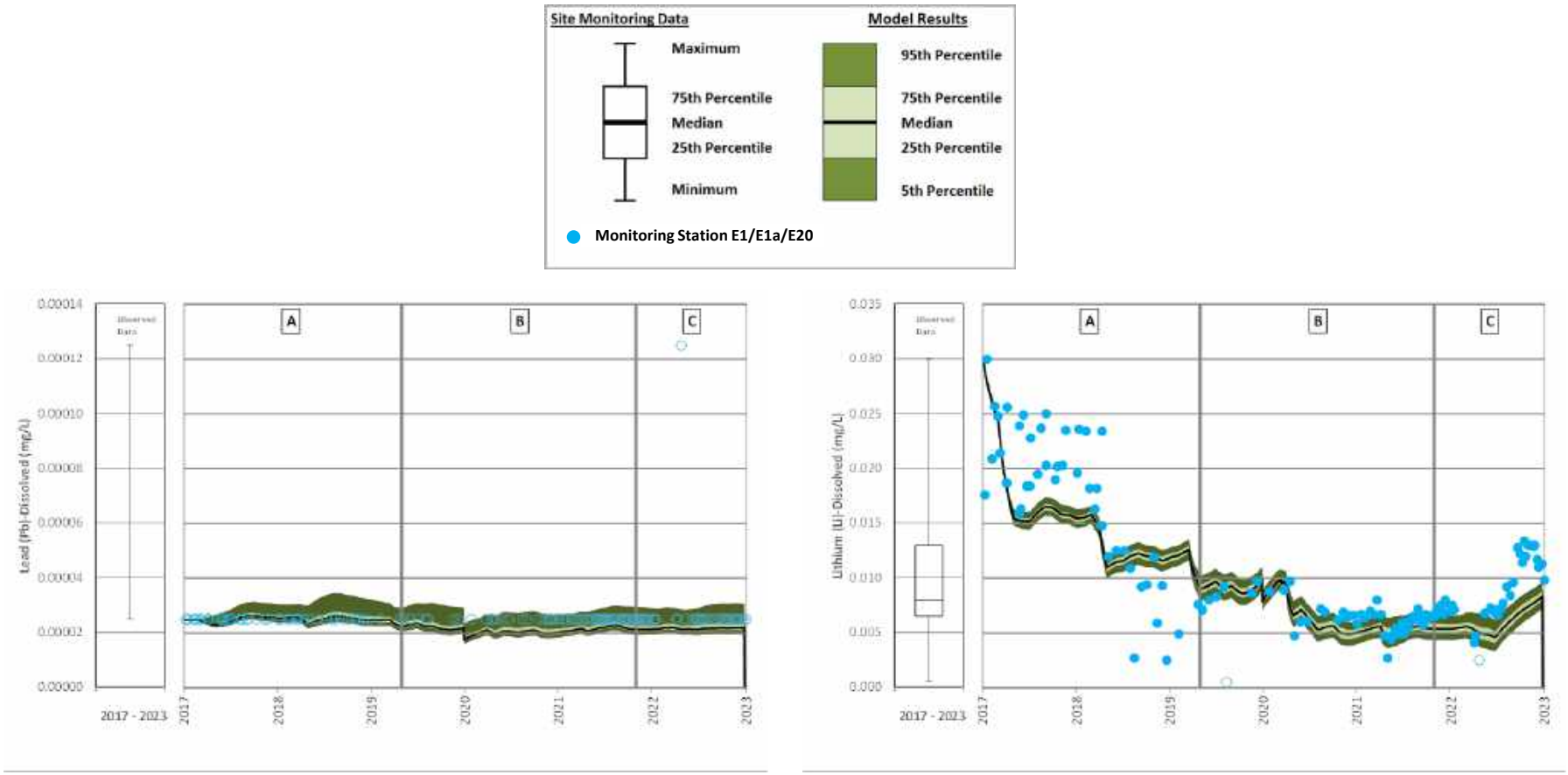
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 91: Tailings Storage Facility Calibration – Dissolved Chromium and Dissolved Cobalt



A = Operations; B = Care and Maintanence; C = Resumed Operations

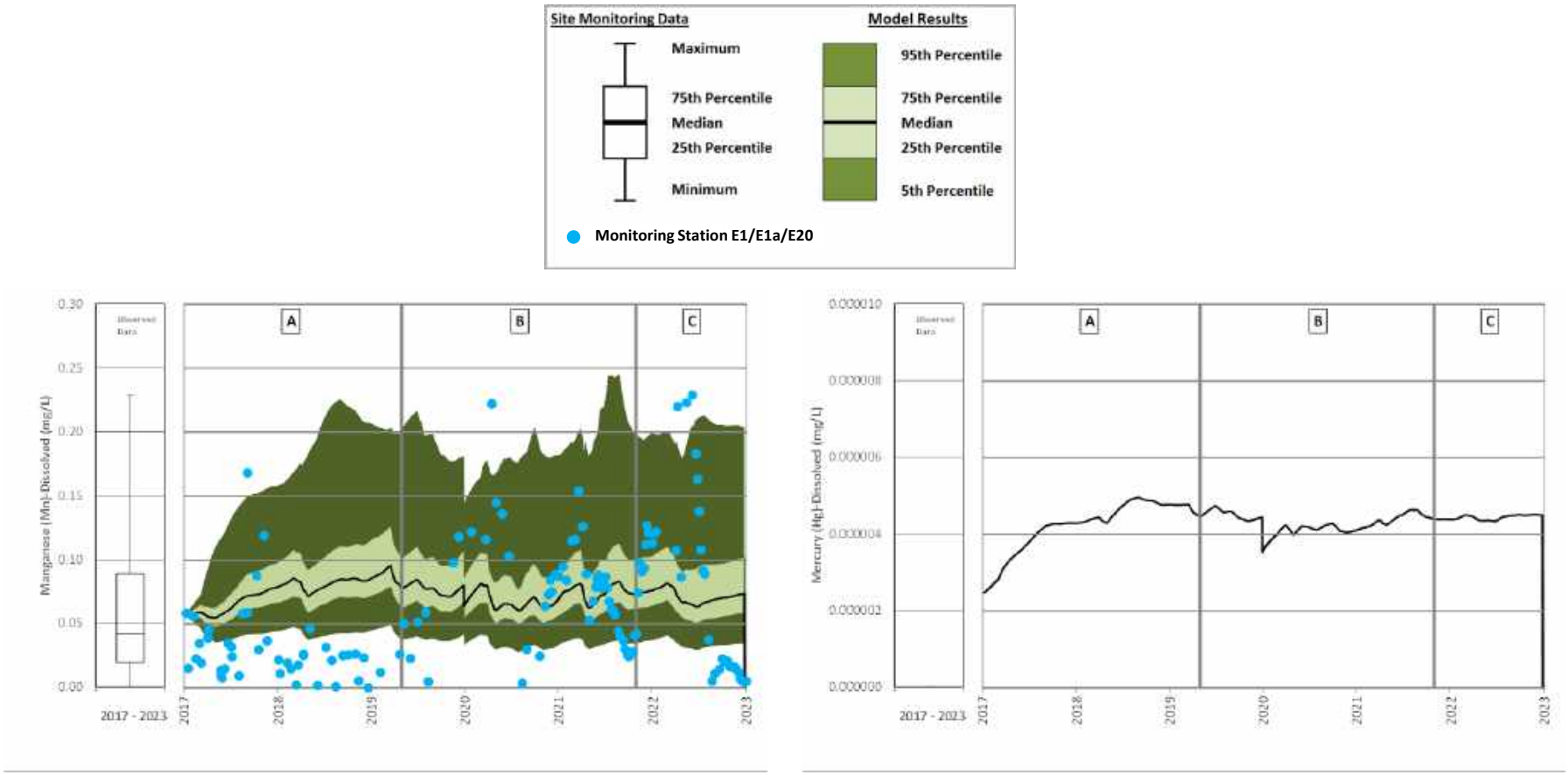
Figure A 92: Tailings Storage Facility Calibration – Dissolved Copper and Dissolved Iron



A = Operations; B = Care and Maintanence; C = Resumed Operations

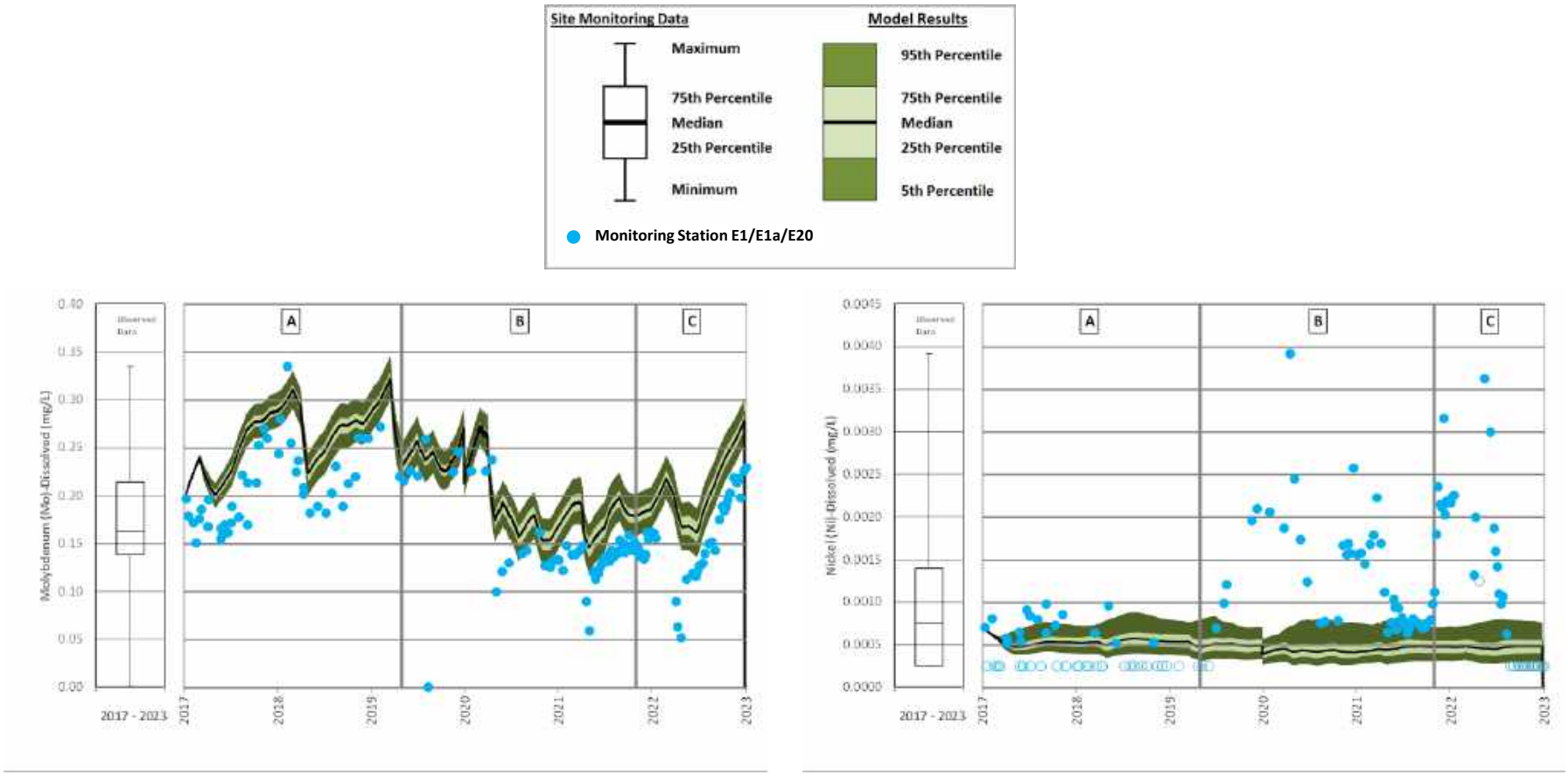
Note: The increased dissolved lithium concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 93: Tailings Storage Facility Calibration – Dissolved Lead and Dissolved Lithium



A = Operations; B = Care and Maintanence; C = Resumed Operations

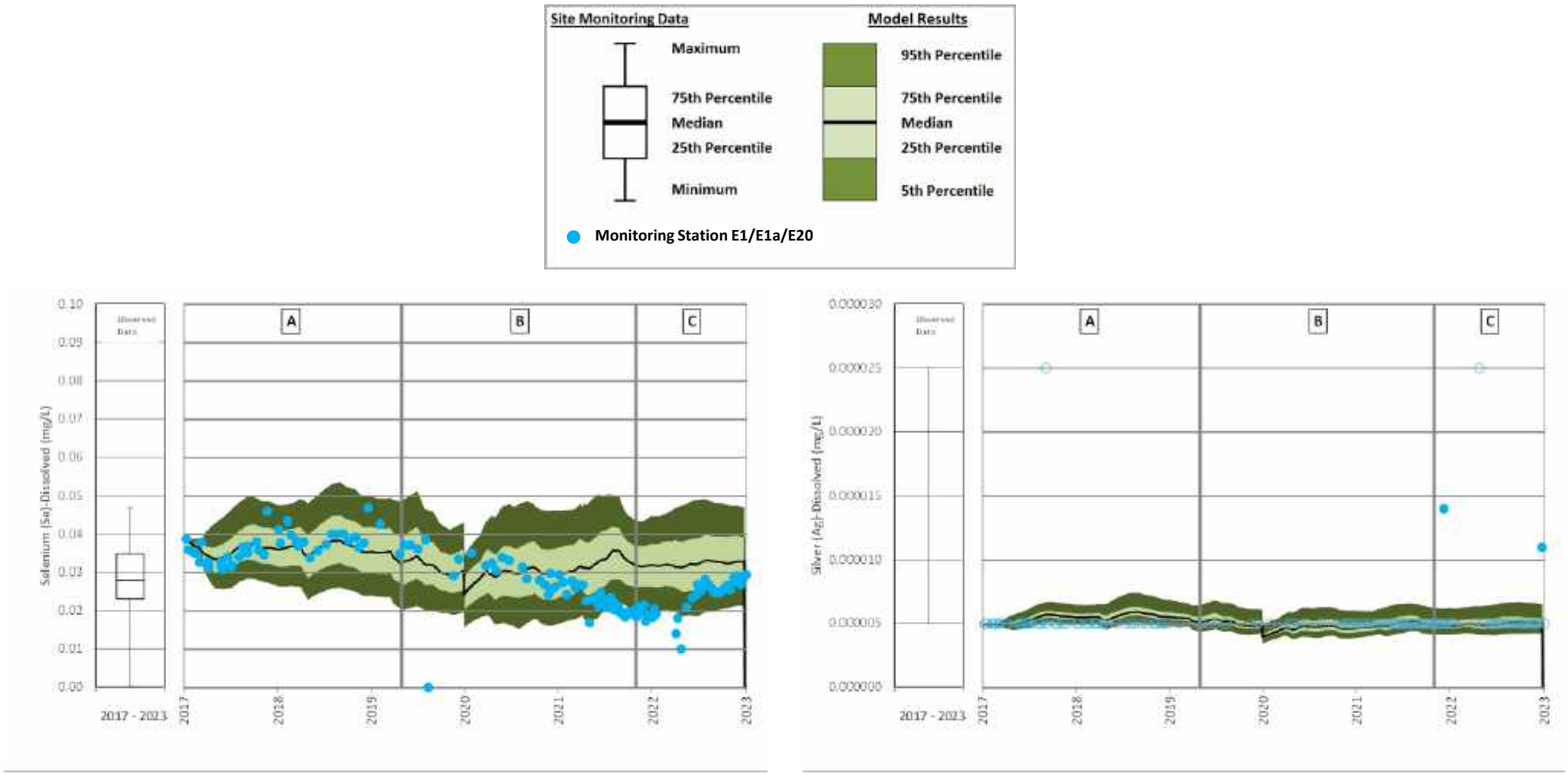
Figure A 94: Tailings Storage Facility Calibration – Dissolved Manganese and Dissolved Mercury



A = Operations; B = Care and Maintanence; C = Resumed Operations

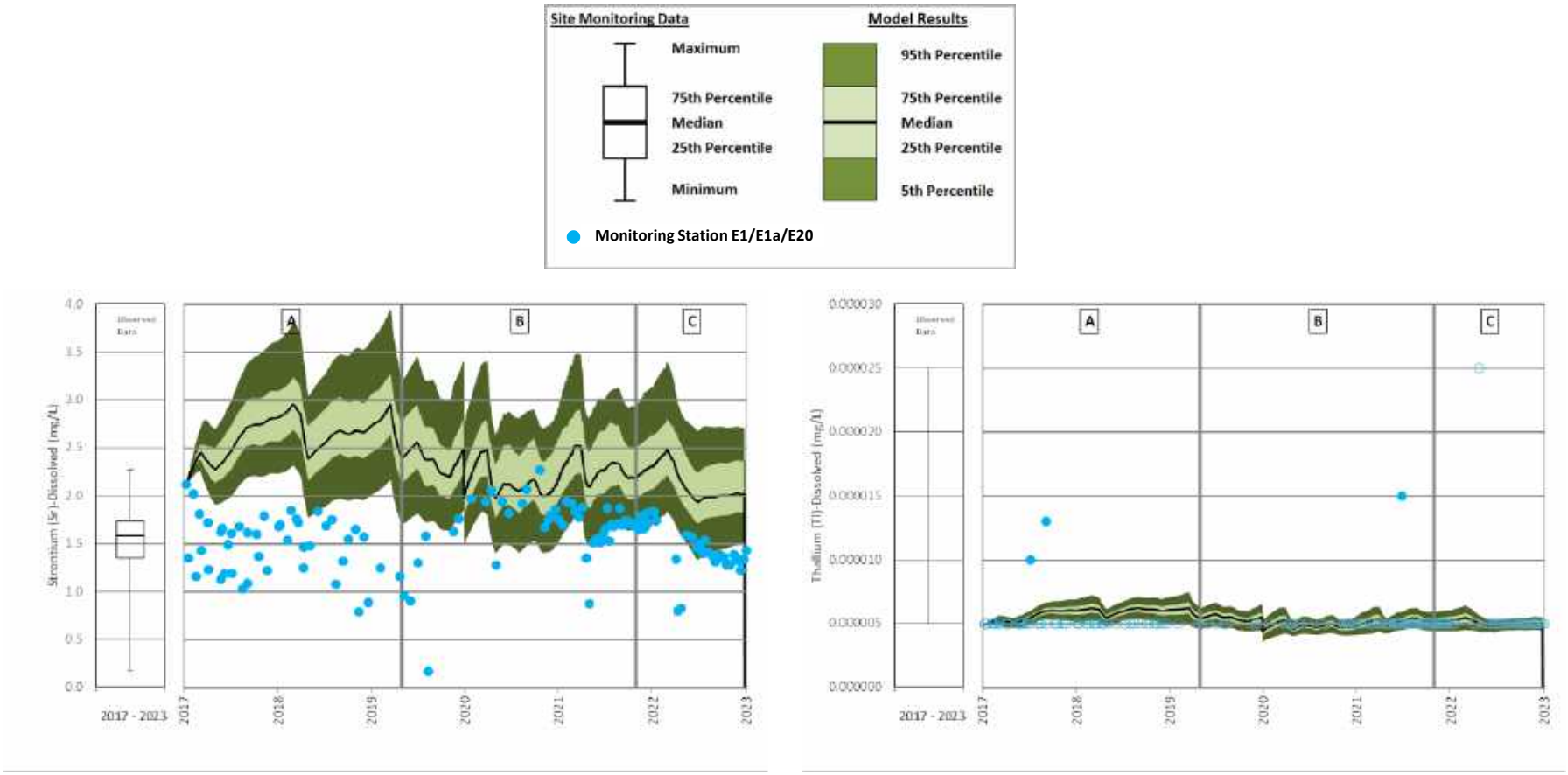
Note: The increased dissolved molybdenum concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 95: Tailings Storage Facility Calibration – Dissolved Molybdenum and Dissolved Nickel



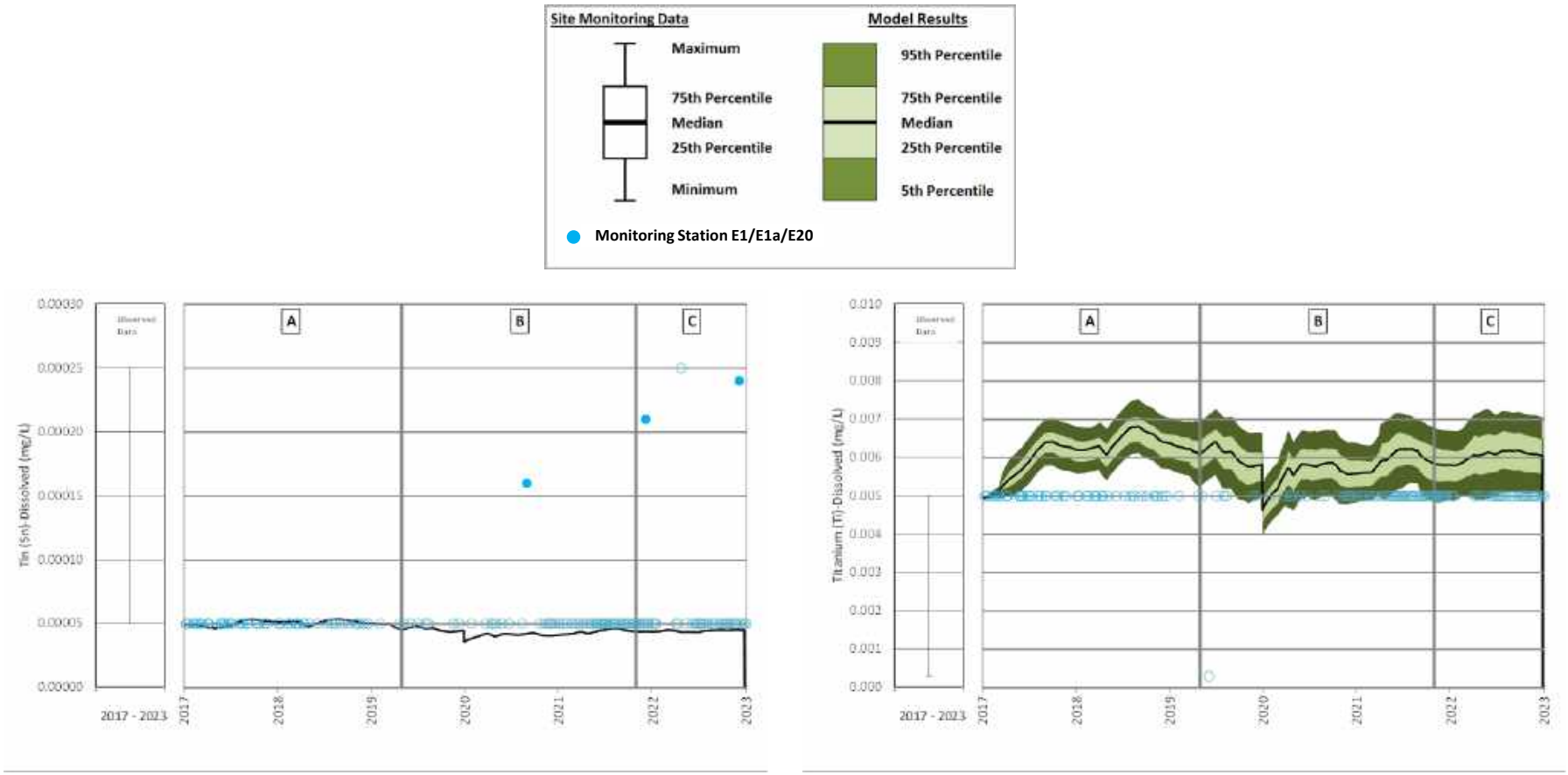
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 96: Tailings Storage Facility Calibration – Dissolved Selenium and Dissolved Silver



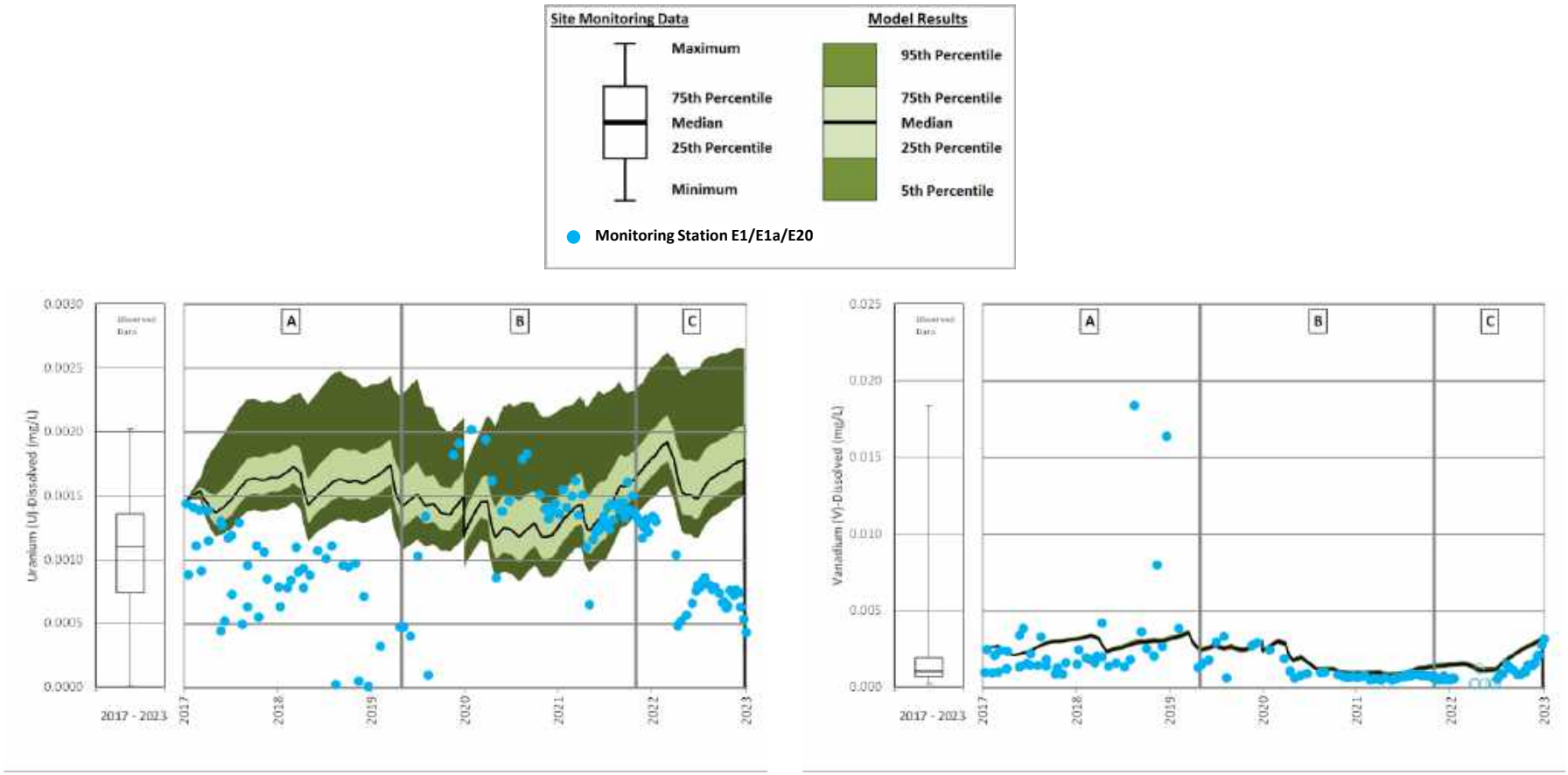
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 97: Tailings Storage Facility Calibration – Dissolved Strontium and Dissolved Thallium



A = Operations; B = Care and Maintanence; C = Resumed Operations

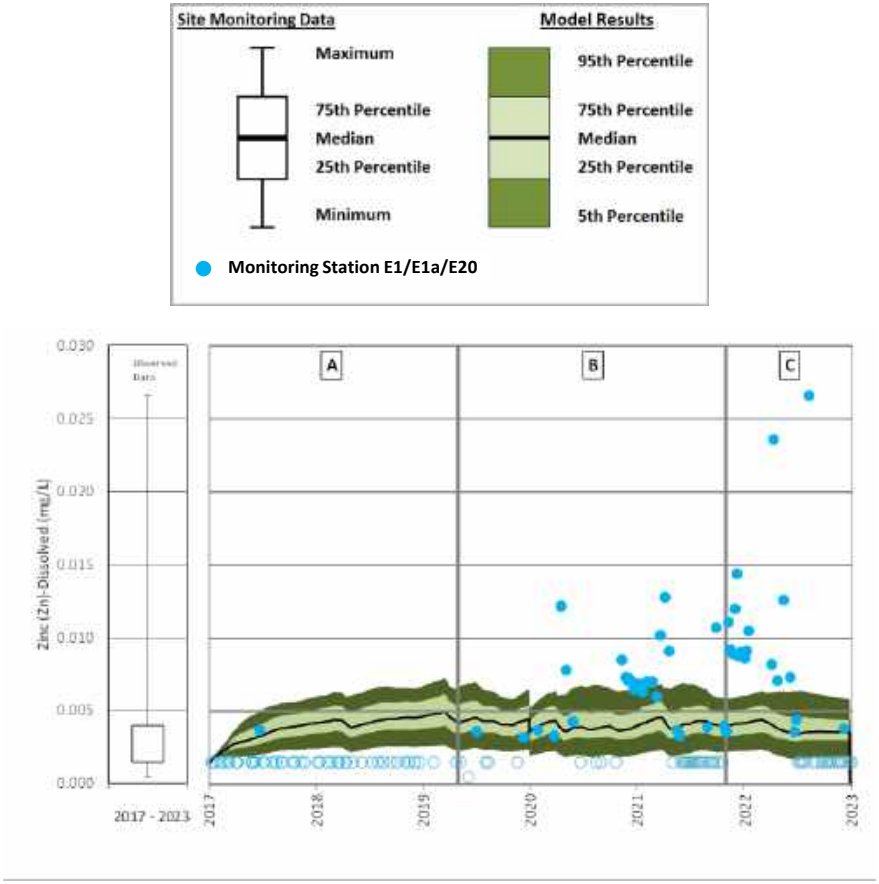
Figure A 98: Tailings Storage Facility Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: The increased dissolved uranium and dissolved vanadium concentrations in the TSF are caused by tailings deposition when operations resumed.

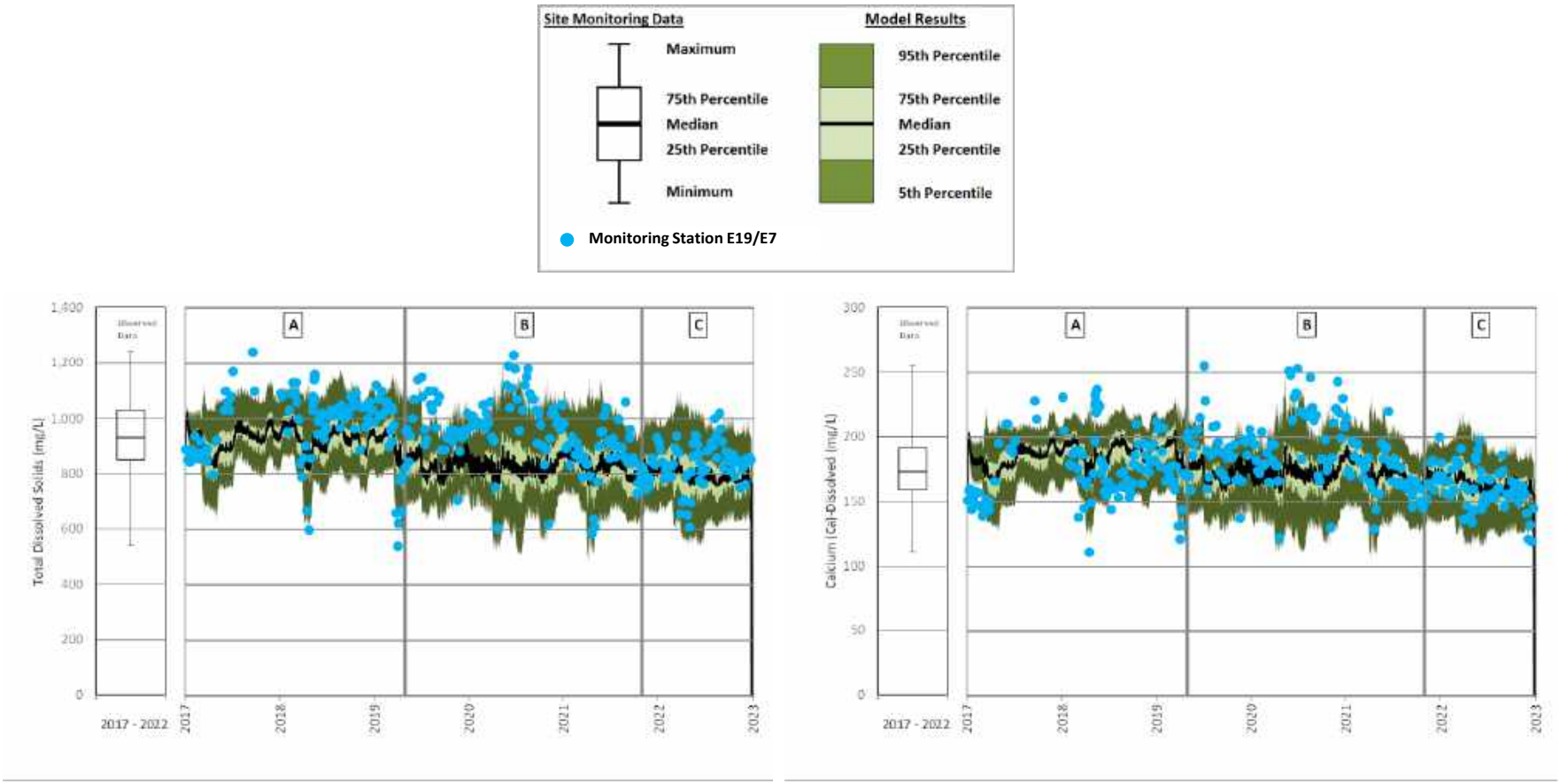
Figure A 99: Tailings Storage Facility Calibration – Dissolved Uranium and Dissolved Vanadium



A = Operations; B = Care and Maintanence; C = Resumed Operations

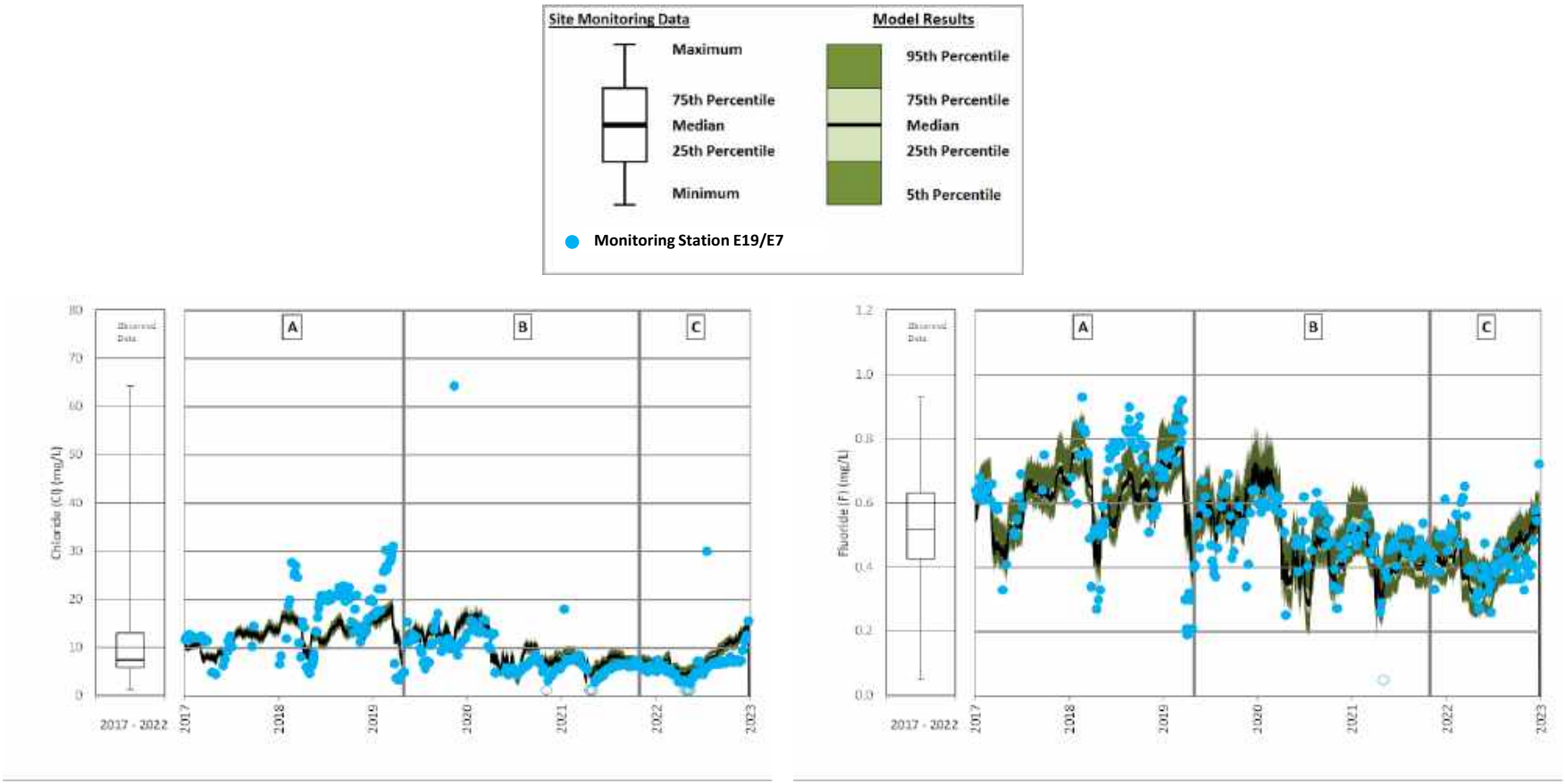
Figure A 100: Tailings Storage Facility Calibration – Dissolved Zinc

Perimeter Embankment Till Borrow Pond Calibration



A = Operations; B = Care and Maintanence; C = Resumed Operations

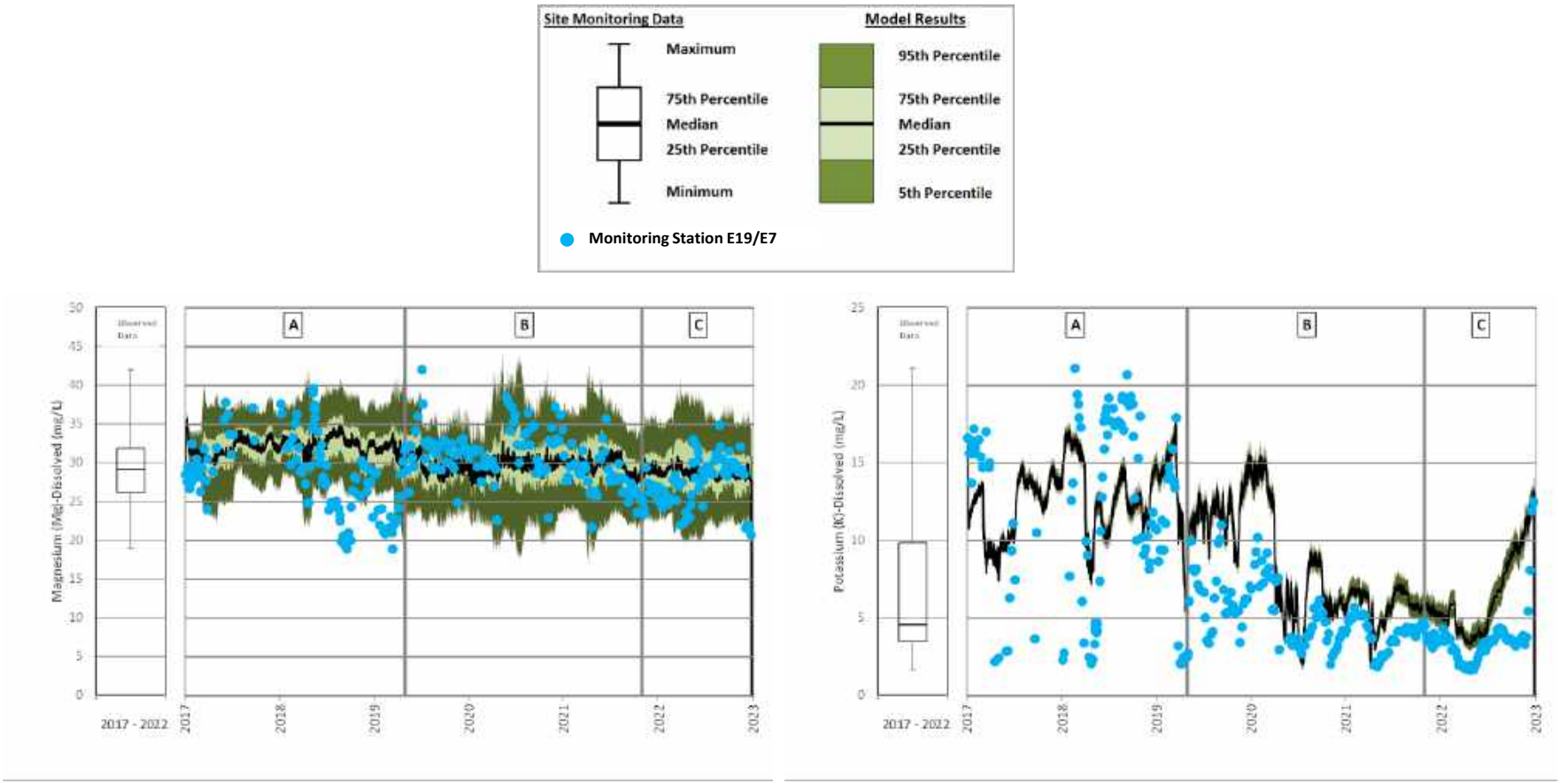
Figure A 101: Perimeter Embankment Till Borrow Pond Calibration – Total Dissolved Solids and Calcium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Chloride and fluoride concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

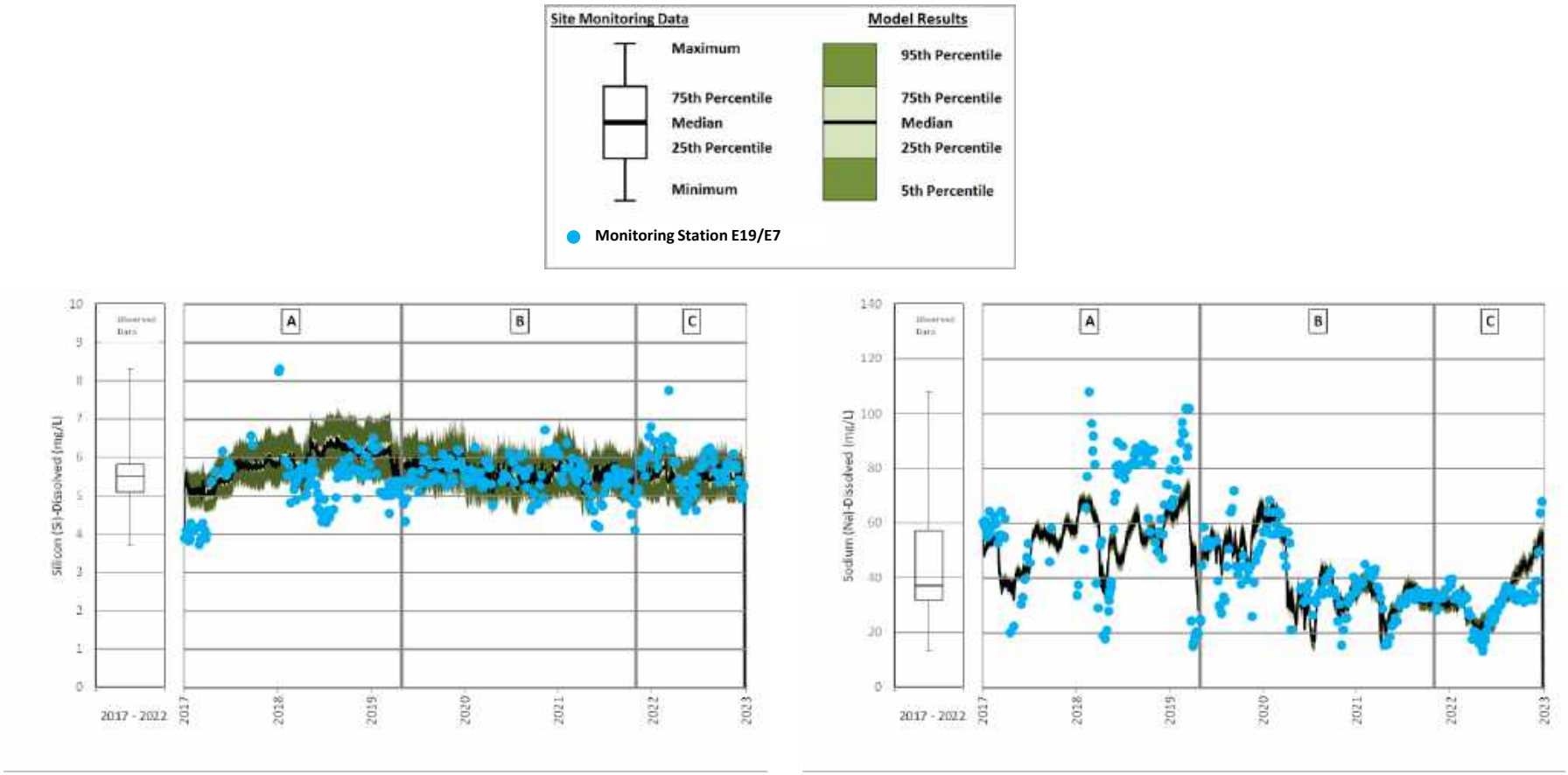
Figure A 102: Perimeter Embankment Till Borrow Pond Calibration – Chloride and Fluoride



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Potassium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

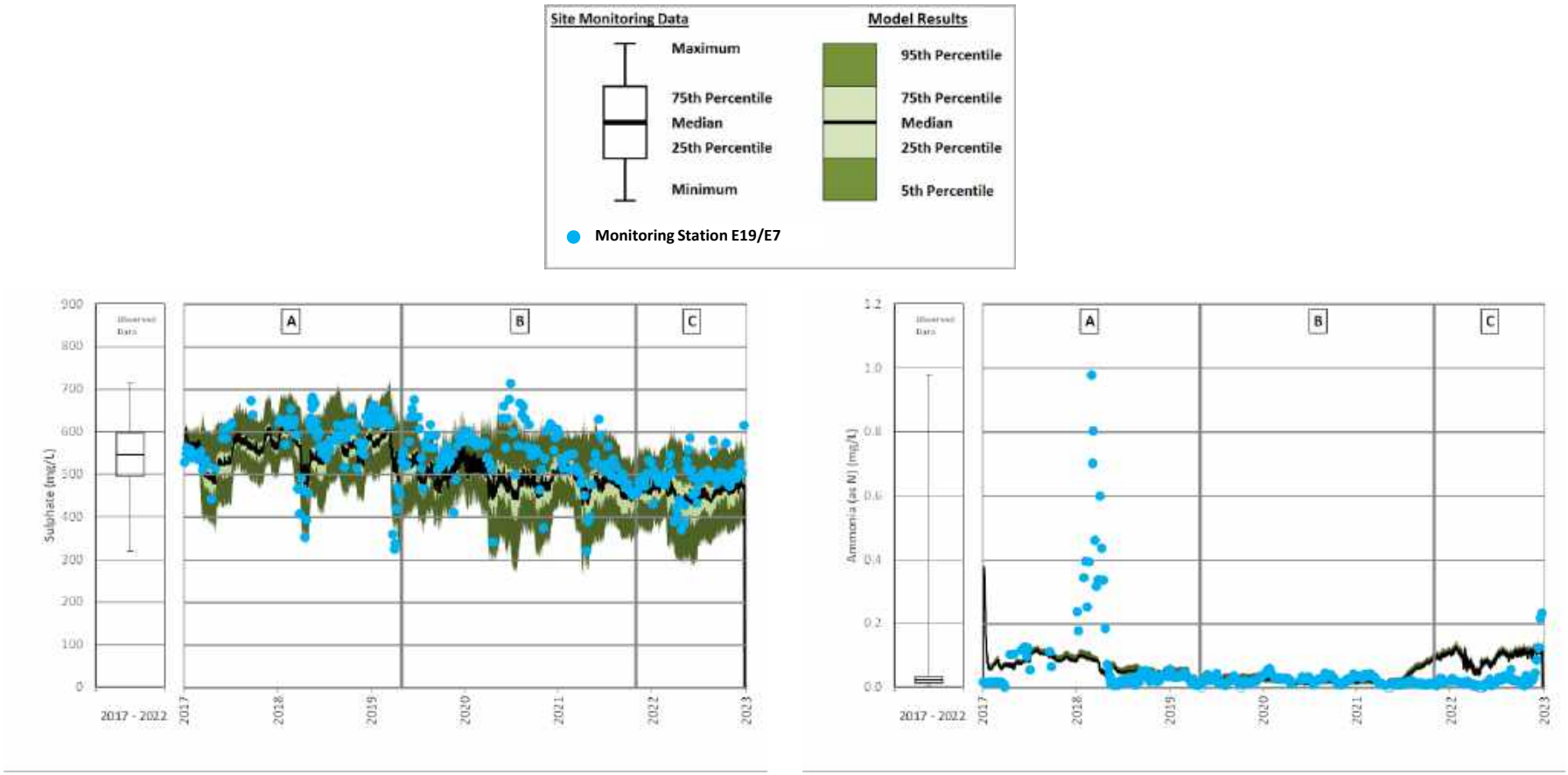
Figure A 103: Perimeter Embankment Till Borrow Pond Calibration – Magnesium and Potassium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Sodium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

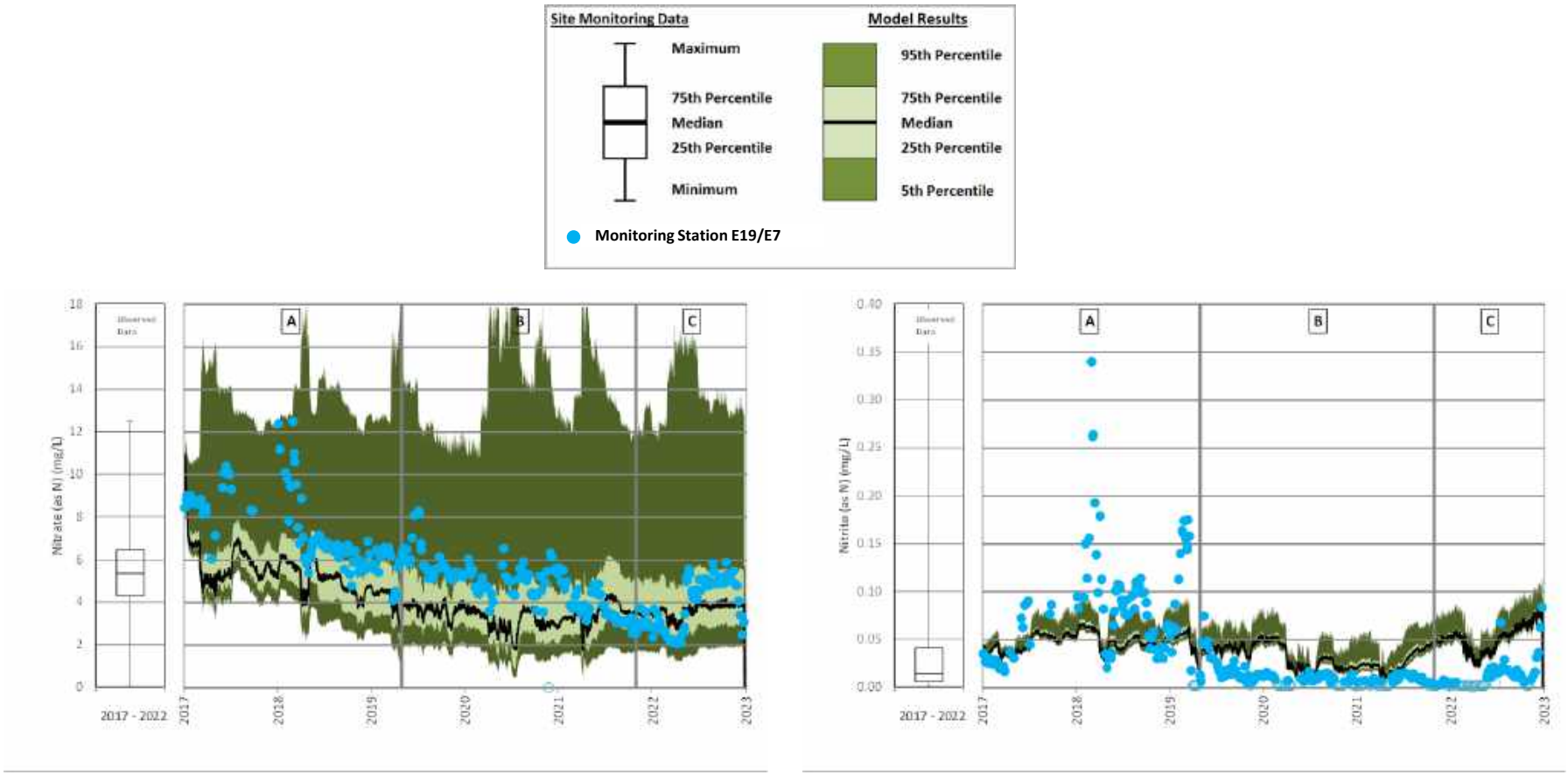
Figure A 104: Perimeter Embankment Till Borrow Pond Calibration – Silicon and Sodium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Total ammonia concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

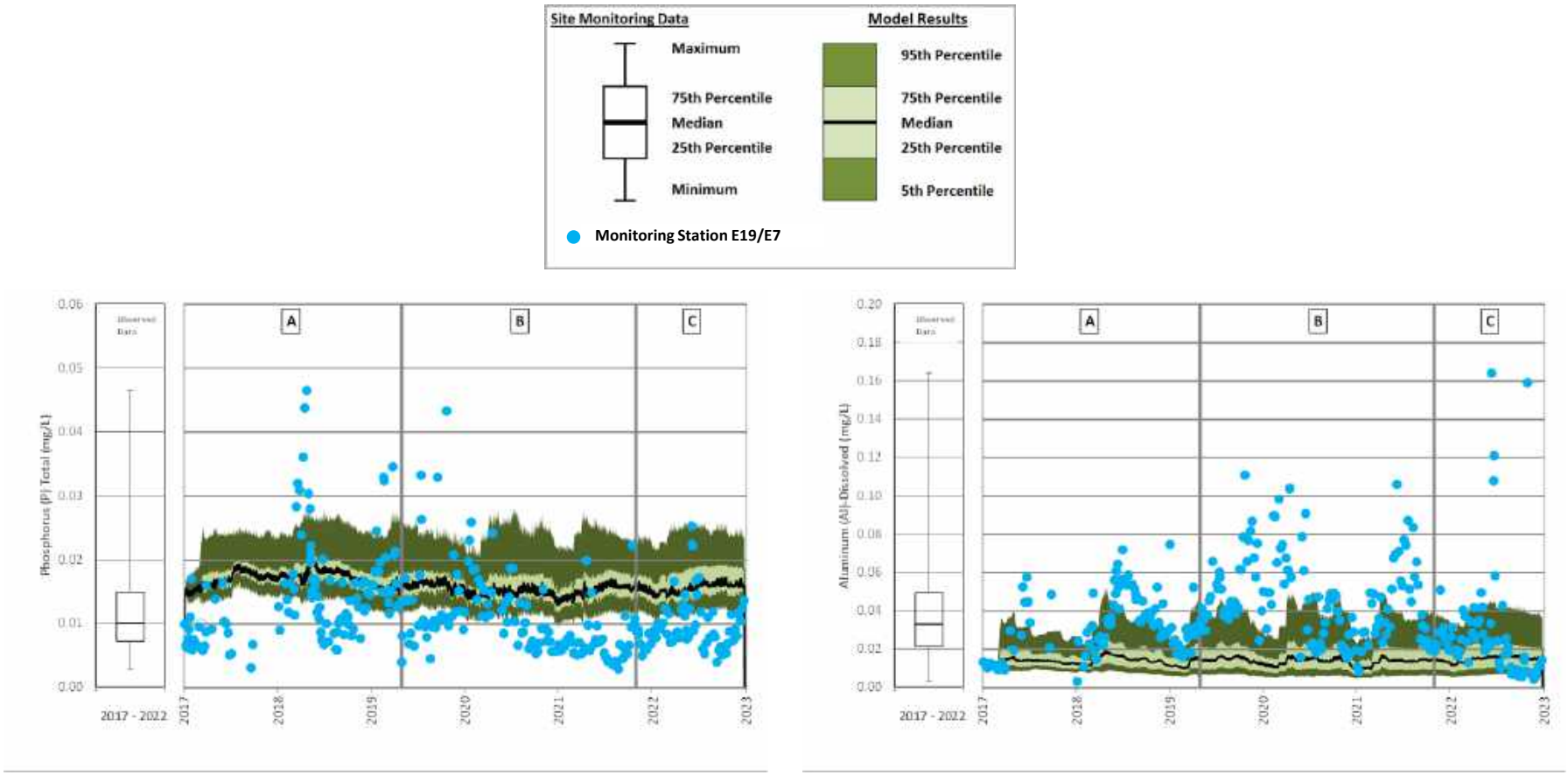
Figure A 105: Perimeter Embankment Till Borrow Pond Calibration – Sulphate and Total Ammonia



A = Operations; B = Care and Maintanence; C = Resumed Operations

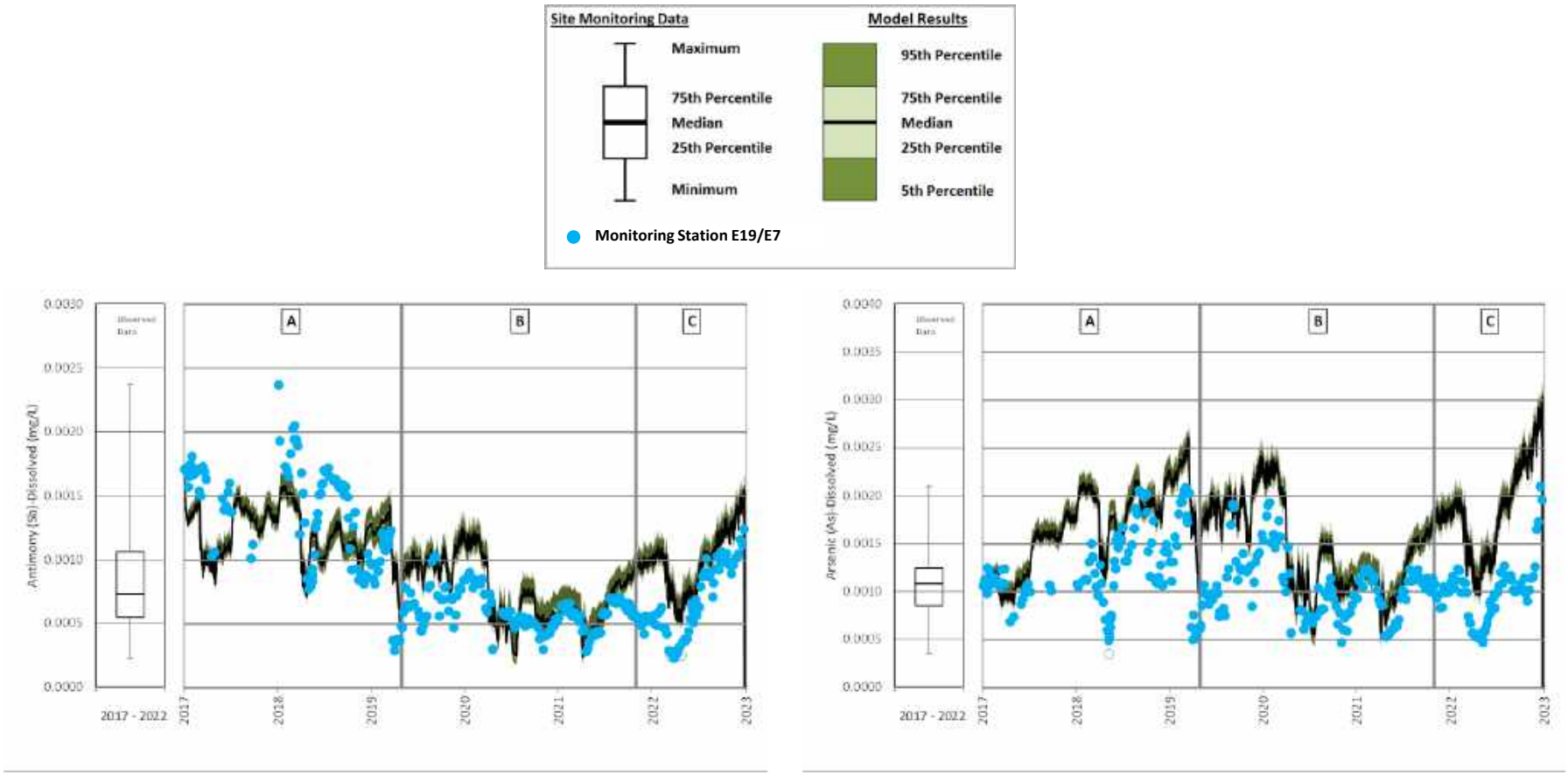
Note: Nitrite concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 106: Perimeter Embankment Till Borrow Pond Calibration – Nitrate and Nitrite



A = Operations; B = Care and Maintanence; C = Resumed Operations

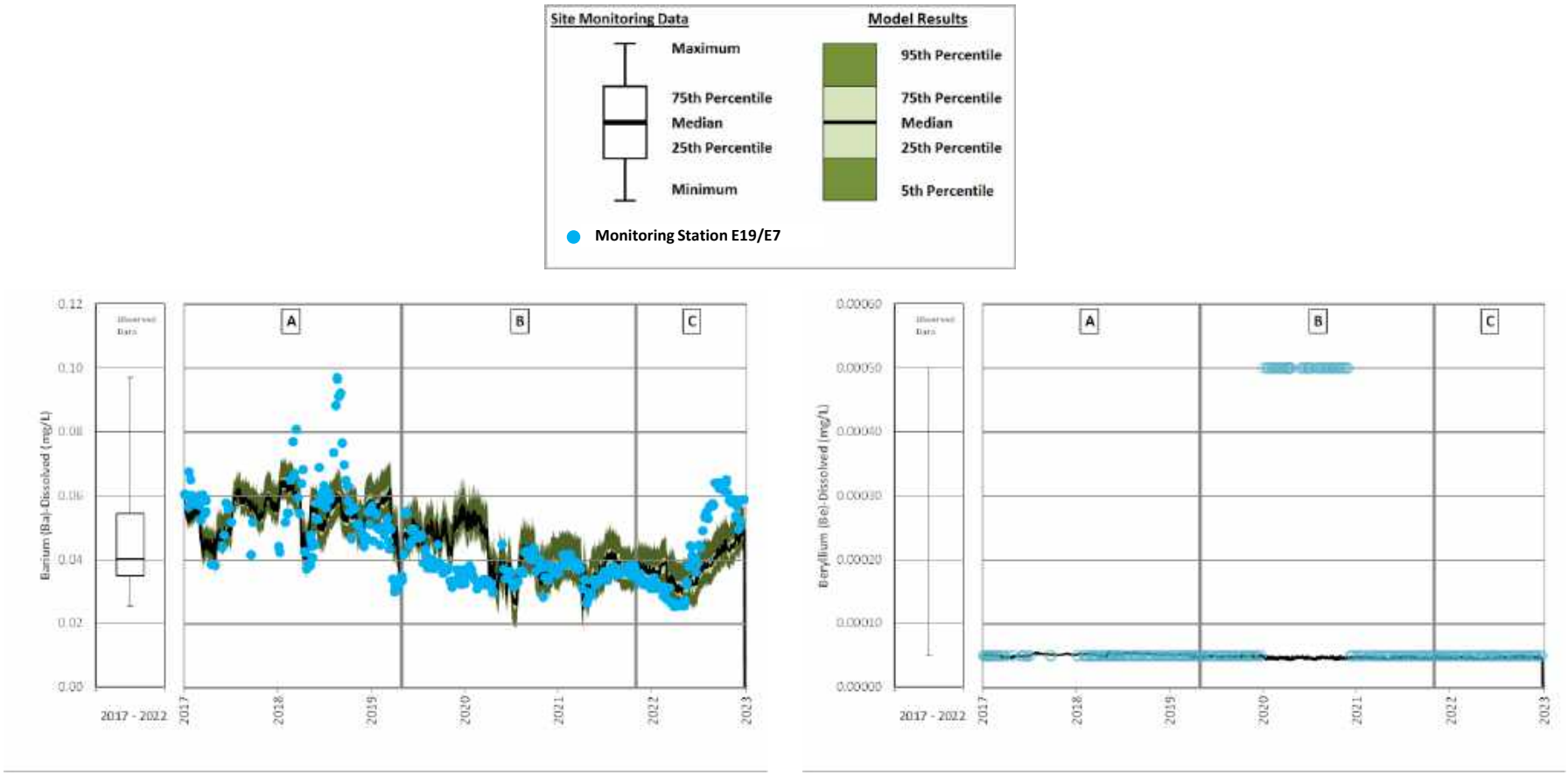
Figure A 107: Perimeter Embankment Till Borrow Pond Calibration – Total Phosphorus and Dissolved Aluminum



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved antimony and dissolved arsenic concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

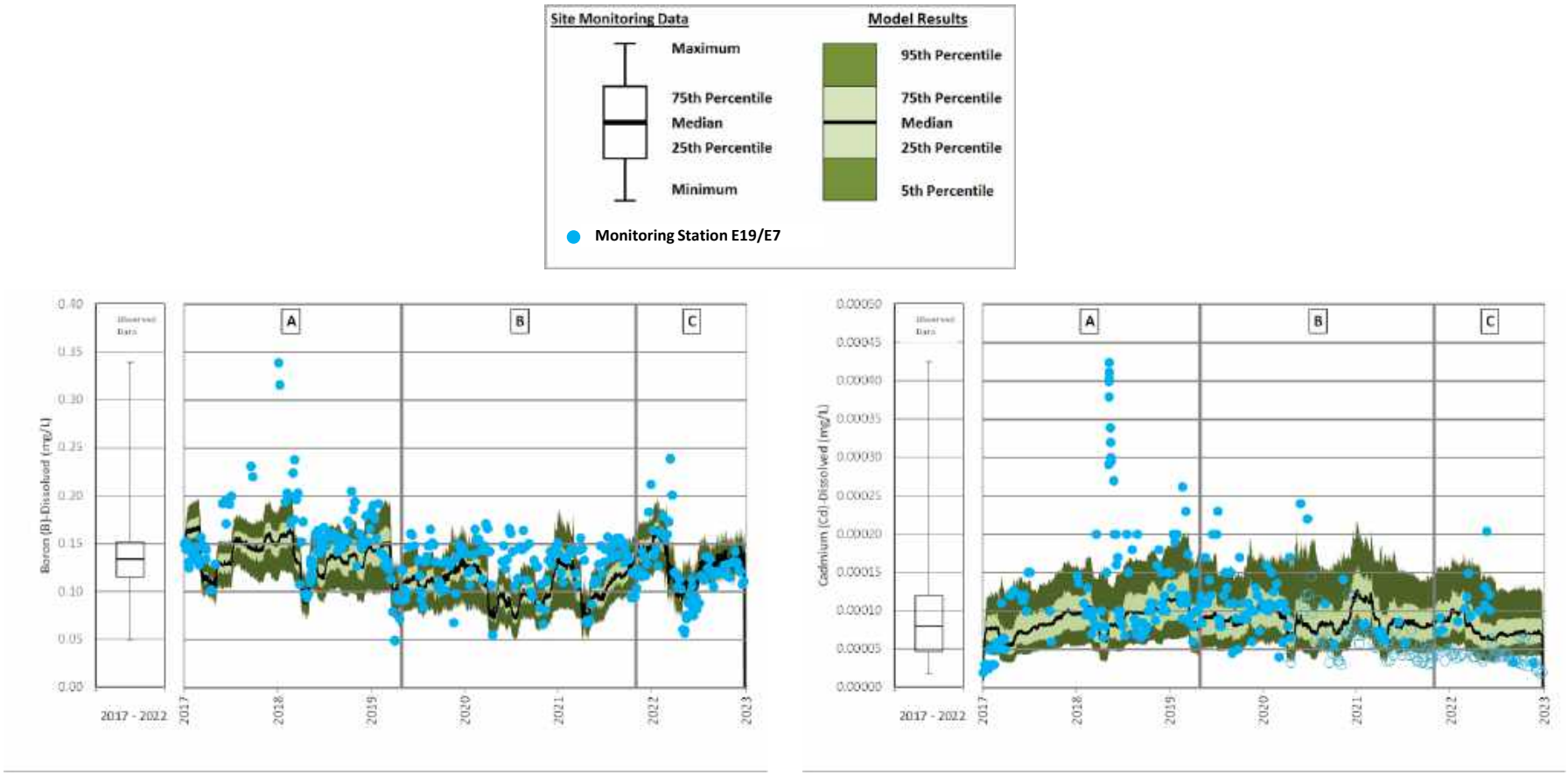
Figure A 108: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Antimony and Dissolved Arsenic



A = Operations; B = Care and Maintanence; C = Resumed Operations

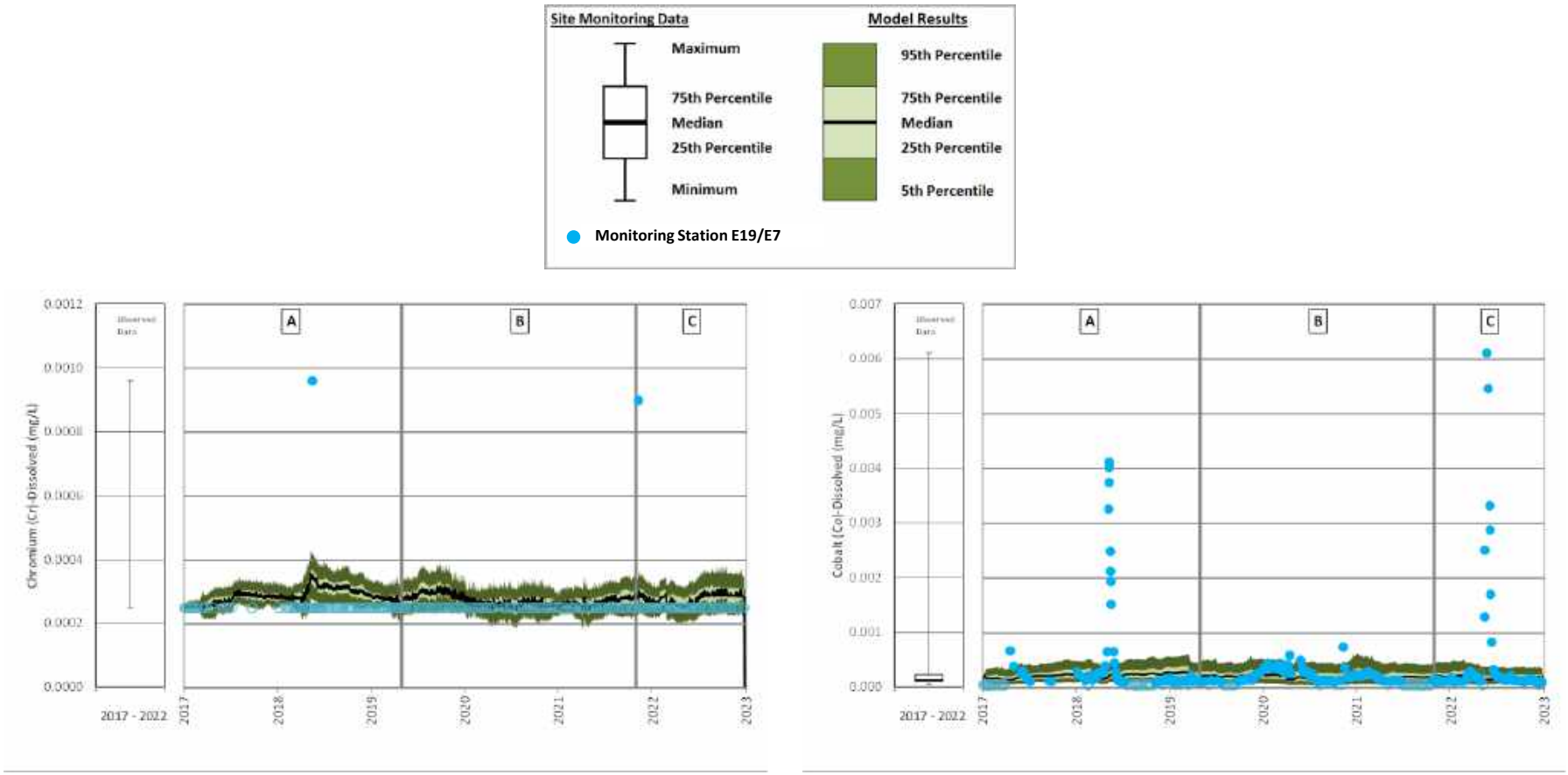
Note: Dissolved barium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 109: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Barium and Dissolved Beryllium



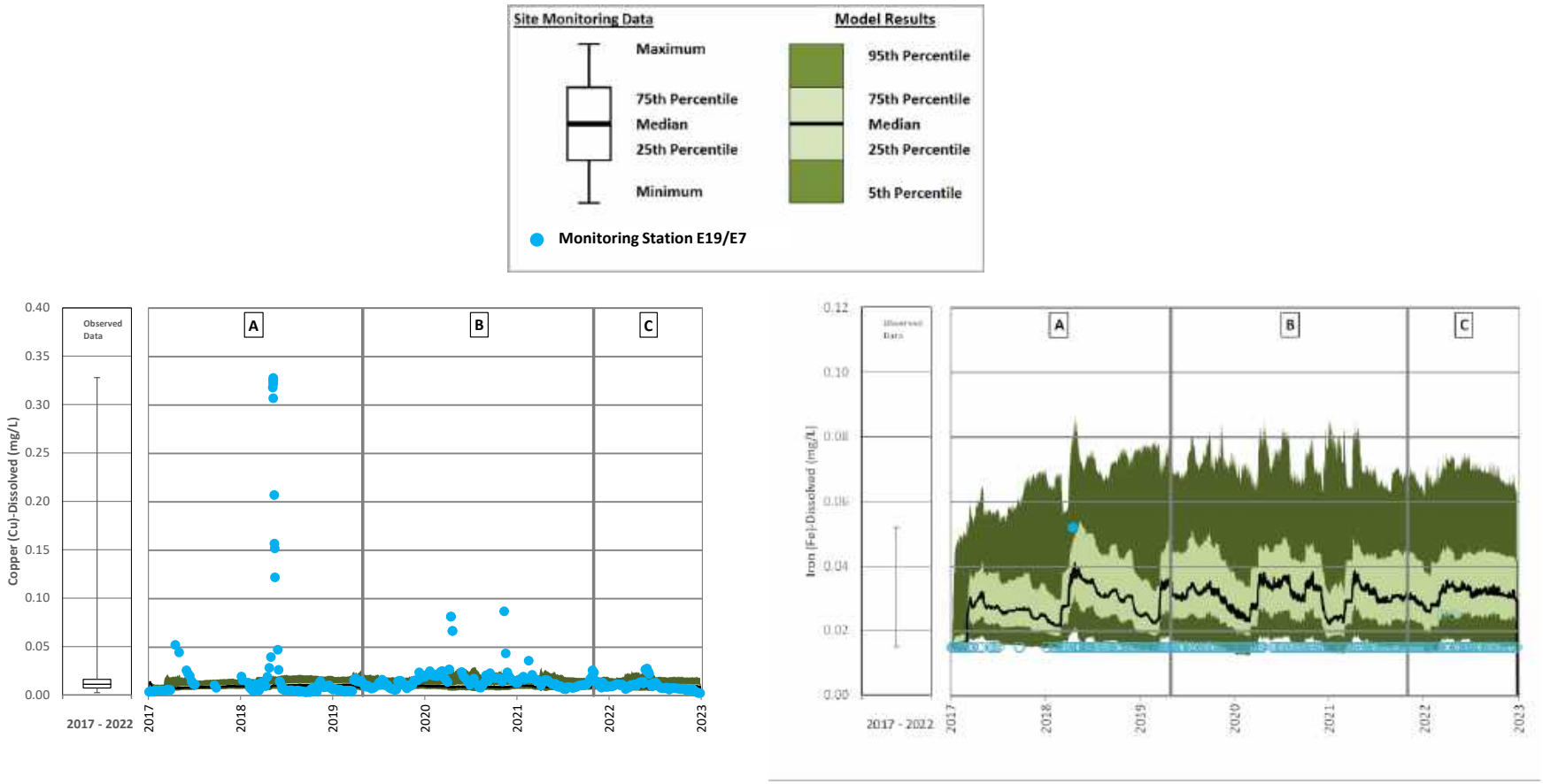
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 110: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Boron and Dissolved Cadmium



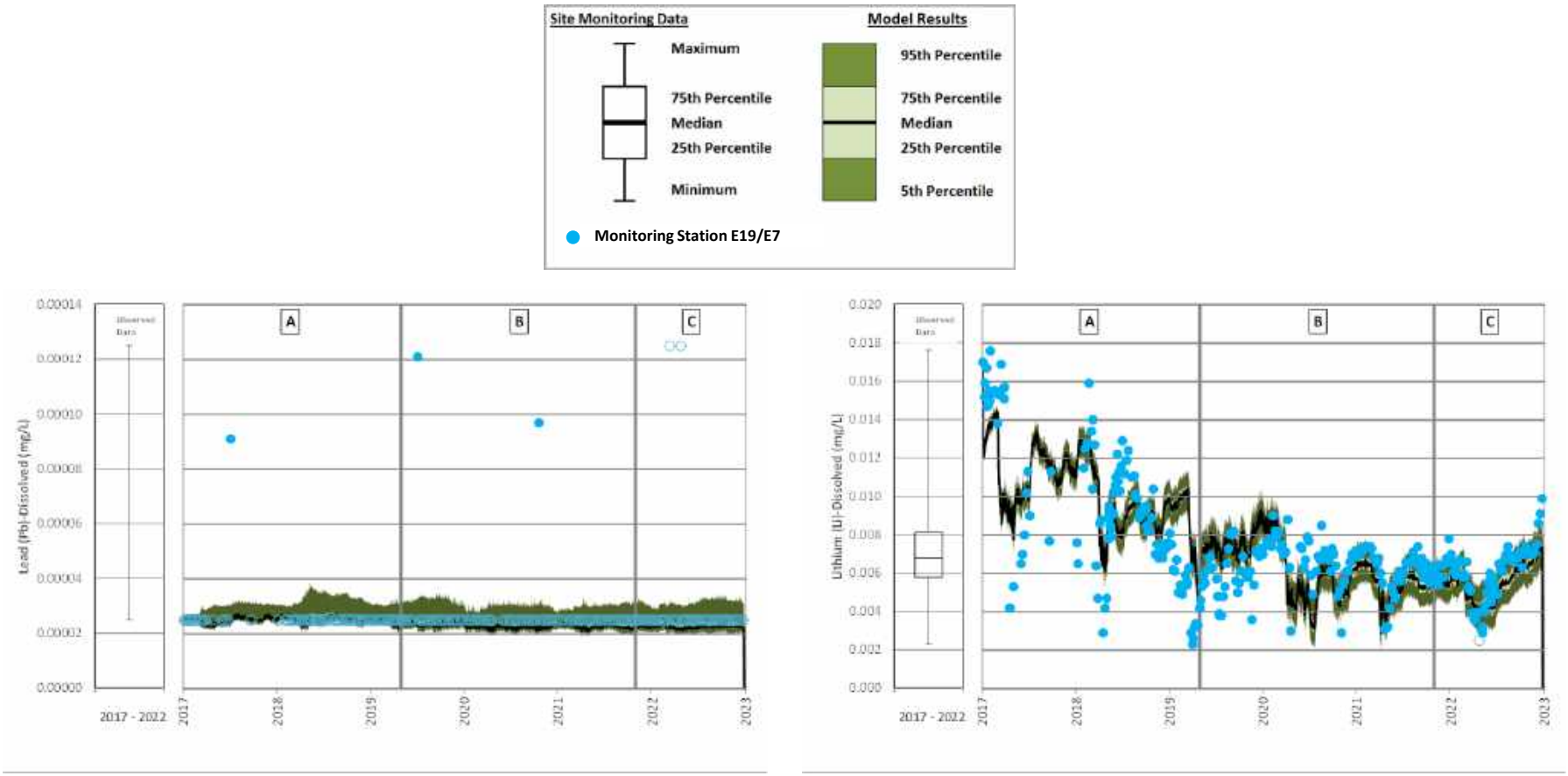
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 111: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Chromium and Dissolved Cobalt



A = Operations; B = Care and Maintanence; C = Resumed Operations

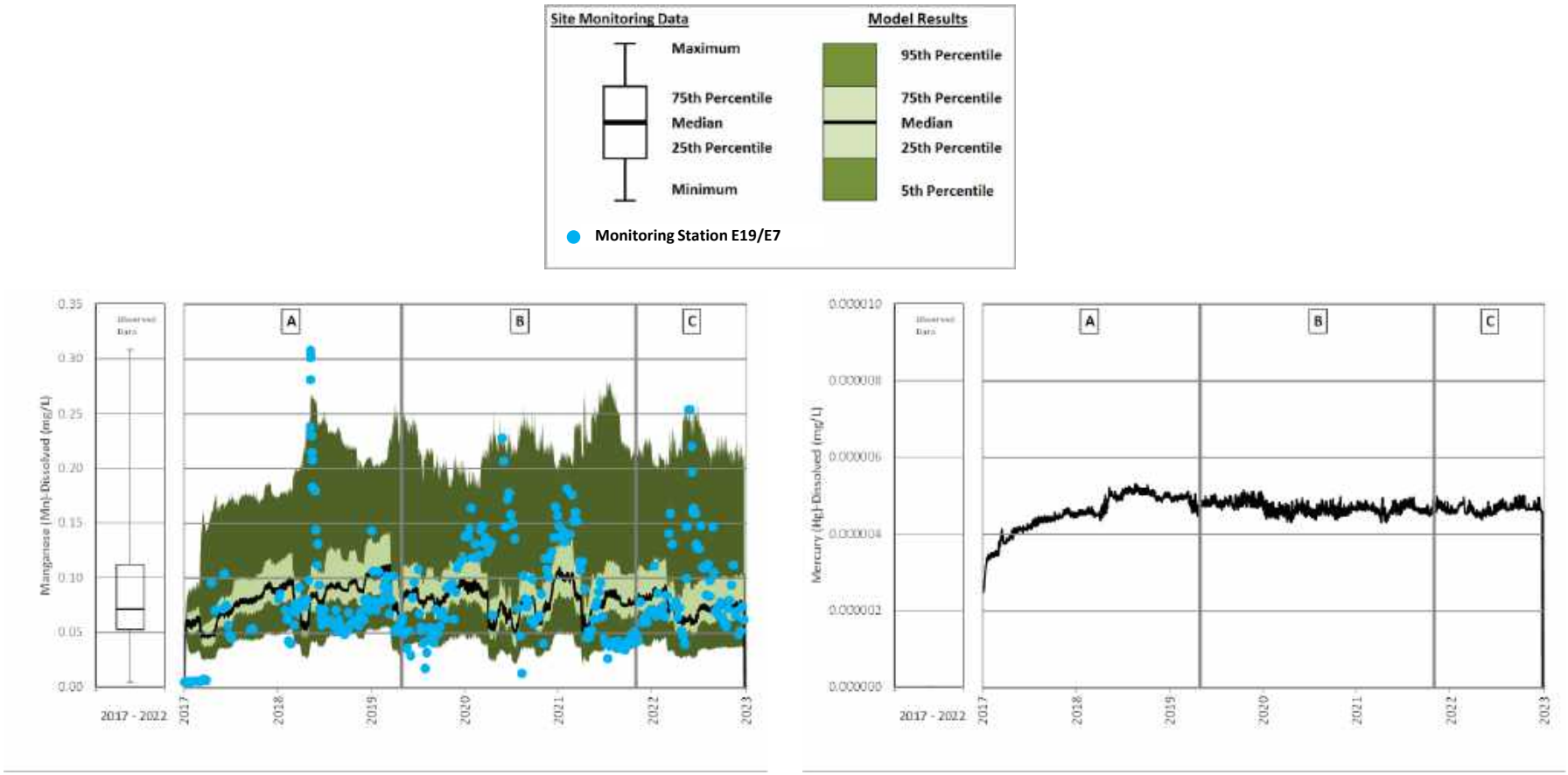
Figure A 112: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Copper and Dissolved Iron



A = Operations; B = Care and Maintanence; C = Resumed Operations

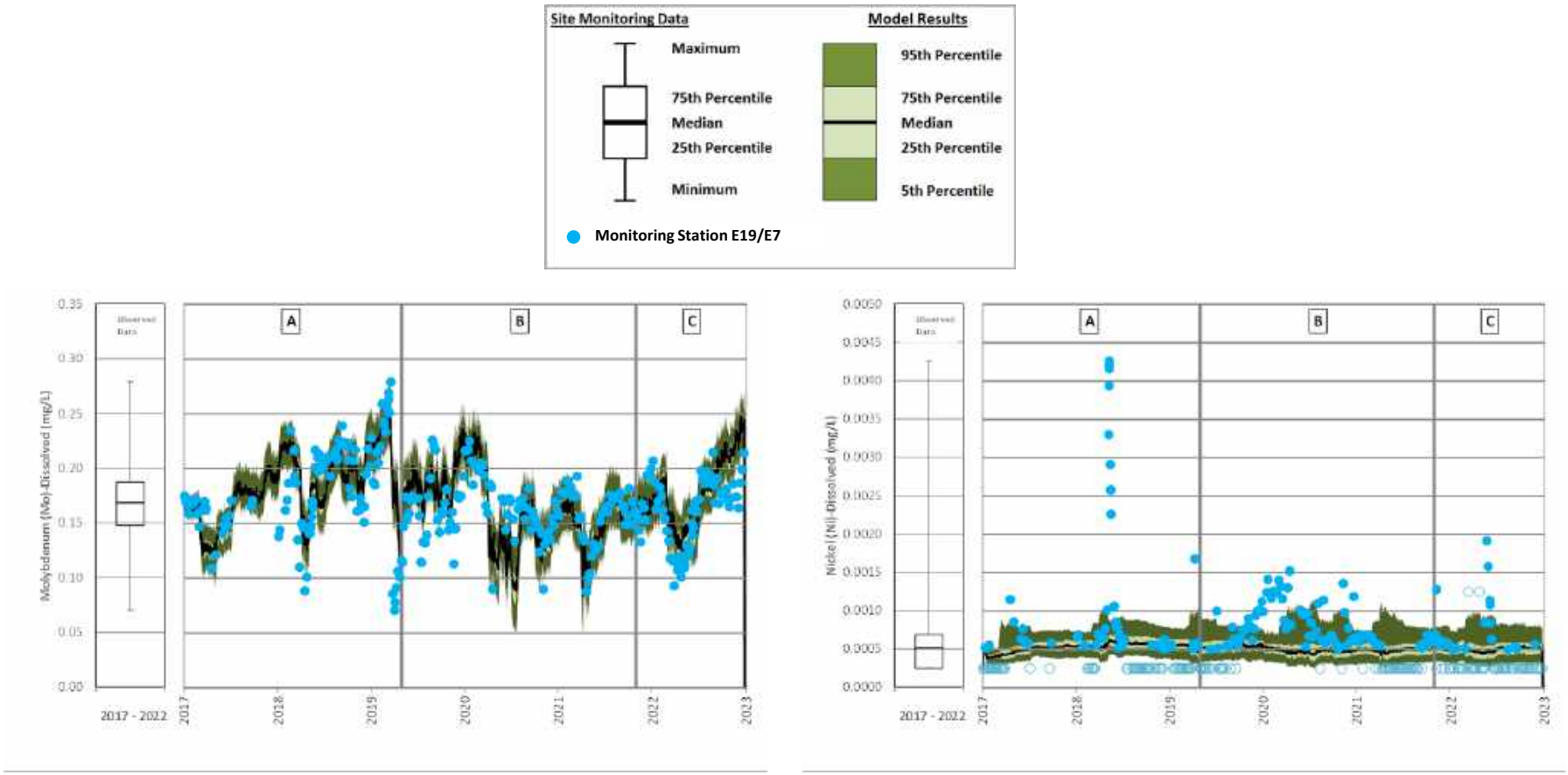
Note: Dissolved lithium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 113: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Lead and Dissolved Lithium



A = Operations; B = Care and Maintanence; C = Resumed Operations

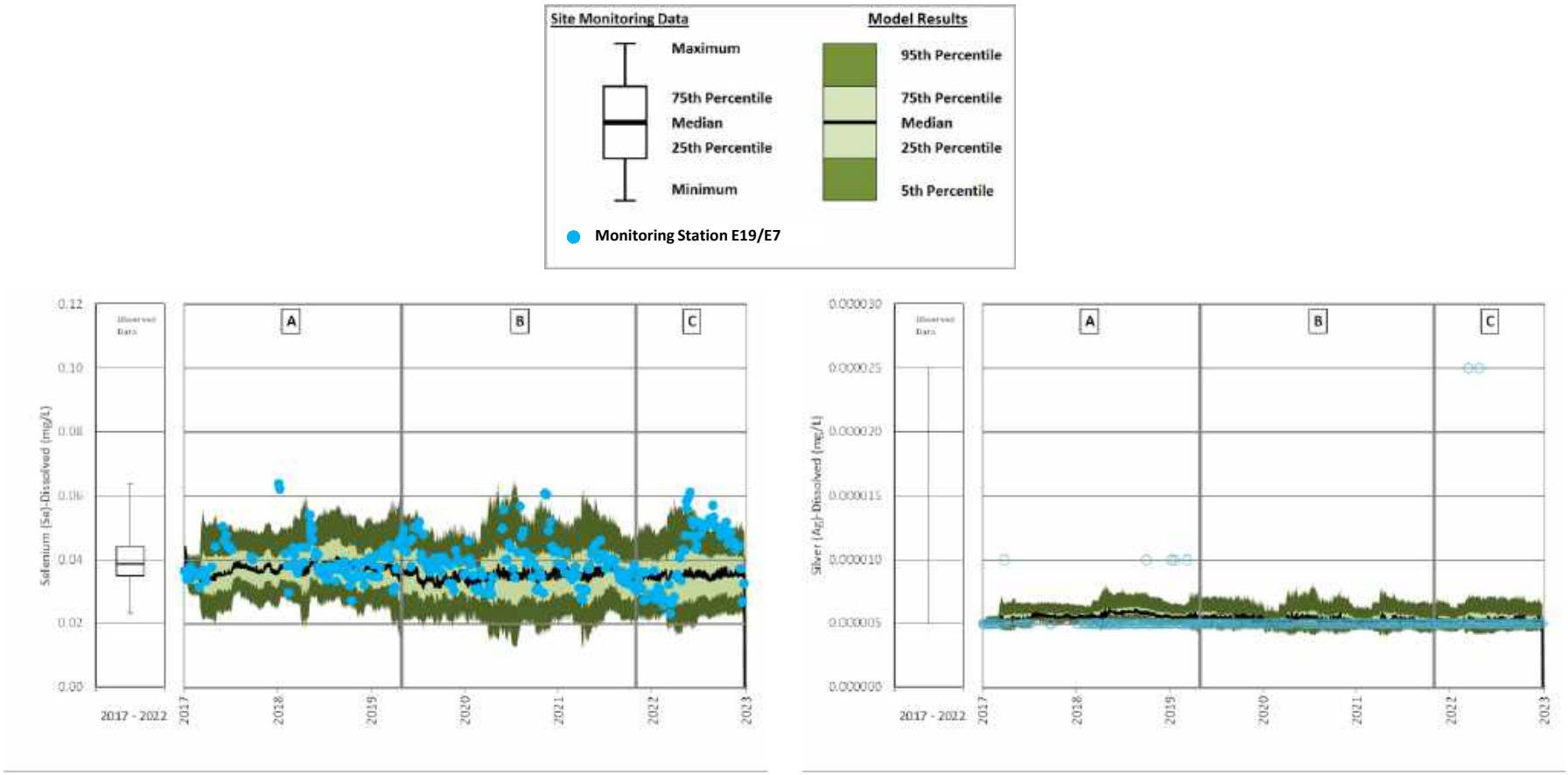
Figure A 114: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Manganese and Dissolved Mercury



A = Operations; B = Care and Maintanence; C = Resumed Operations

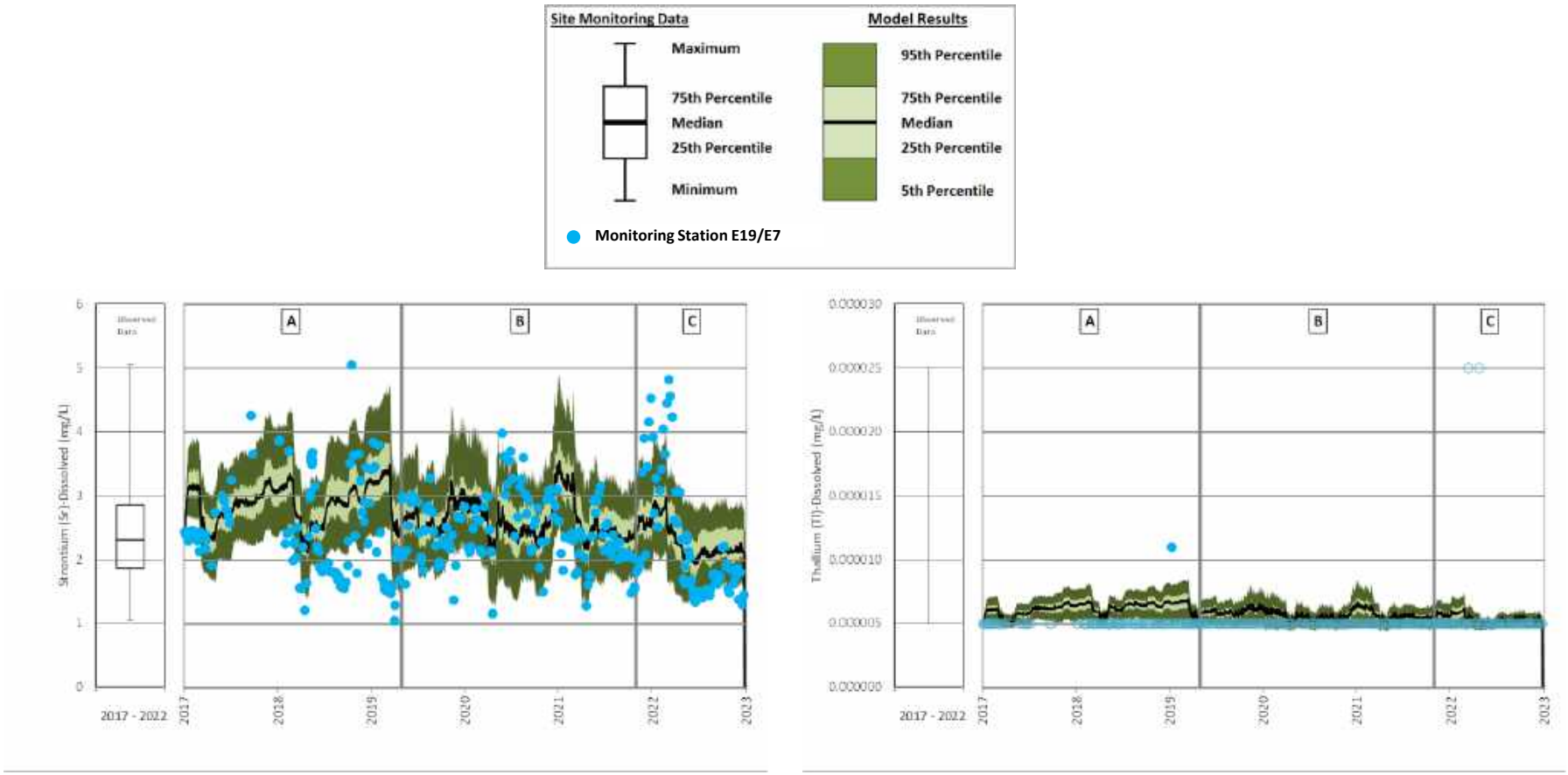
Note: Dissolved molybdenum concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

Figure A 115: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Molybdenum and Dissolved Nickel



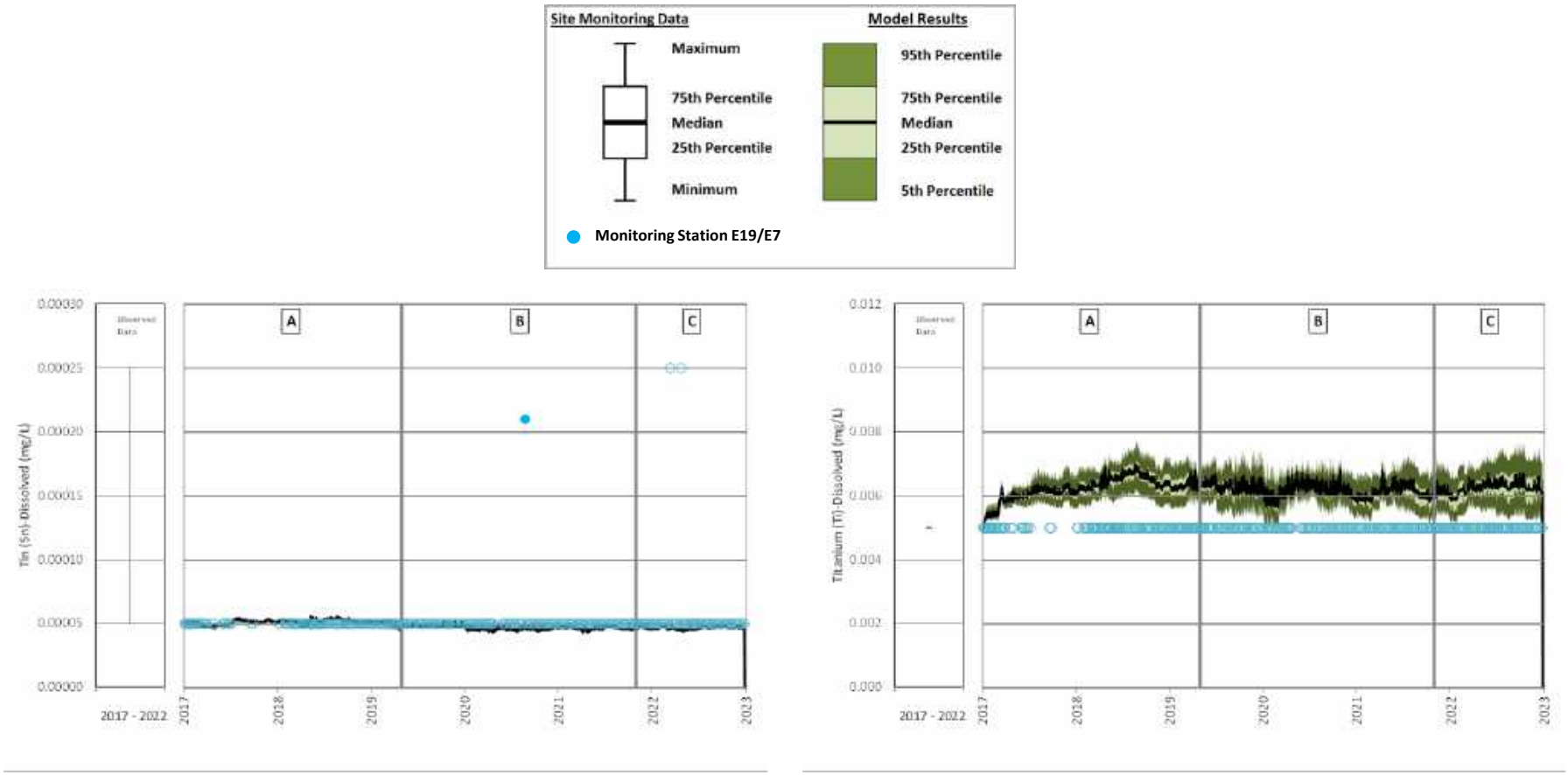
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 116: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Selenium and Dissolved Silver



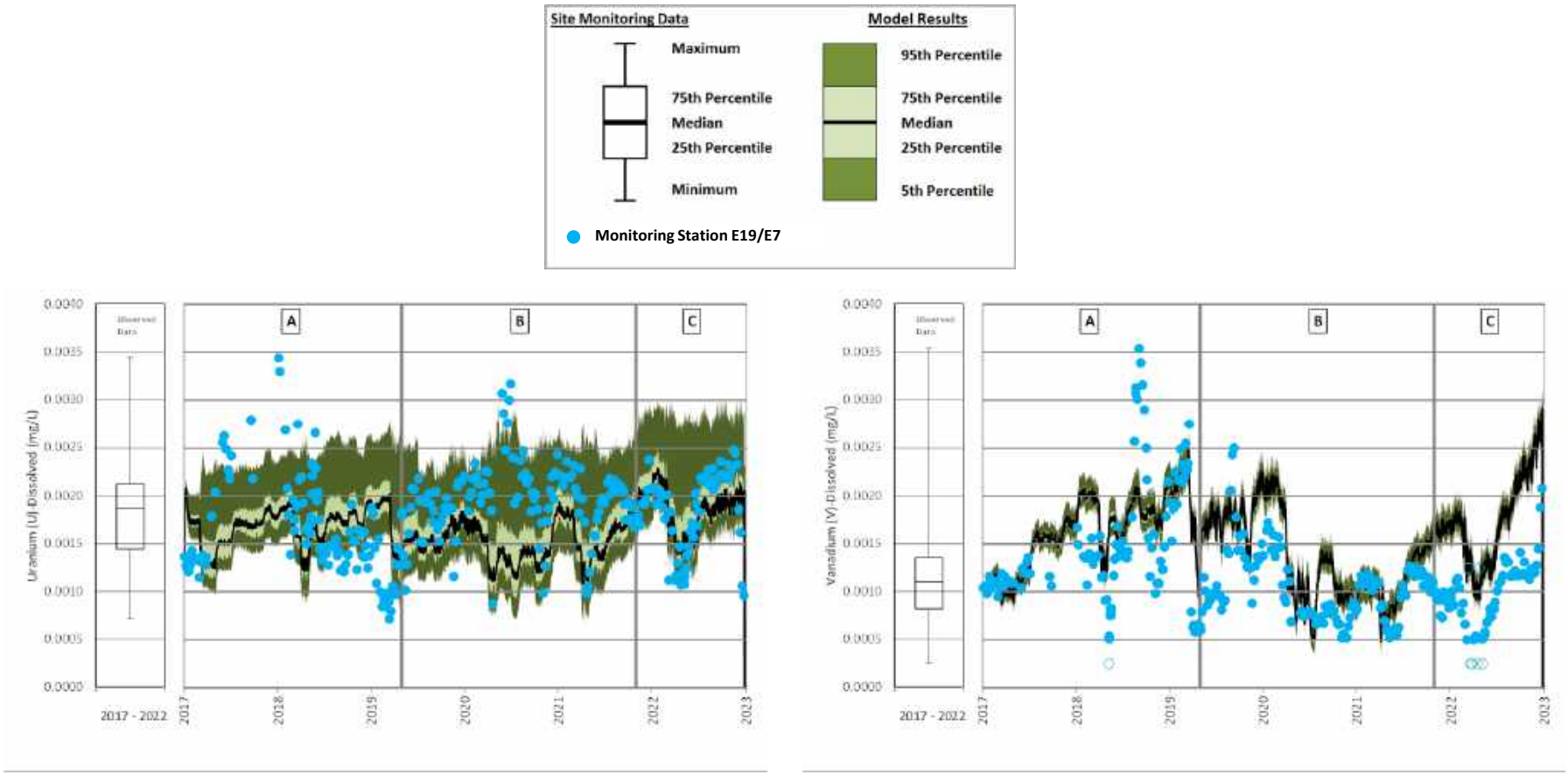
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 117: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Strontium and Dissolved Thallium



A = Operations; B = Care and Maintanence; C = Resumed Operations

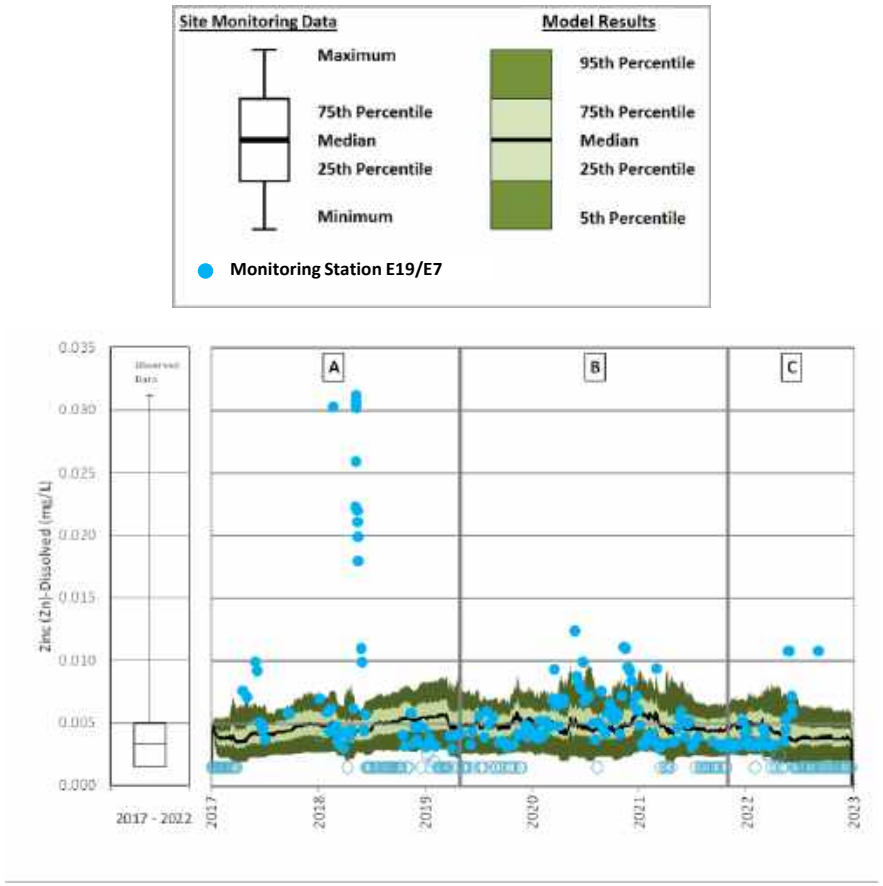
Figure A 118: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Note: Dissolved Vanadium concentrations increase in the Perimeter Embankment Till Borrow Pond (PETBP) at the start of resumed operations because of higher concentrations in the Tailings Storage Facility (TSF) which is pumped to the PETBP. The increased concentrations in the TSF are caused by tailings deposition when operations resumed.

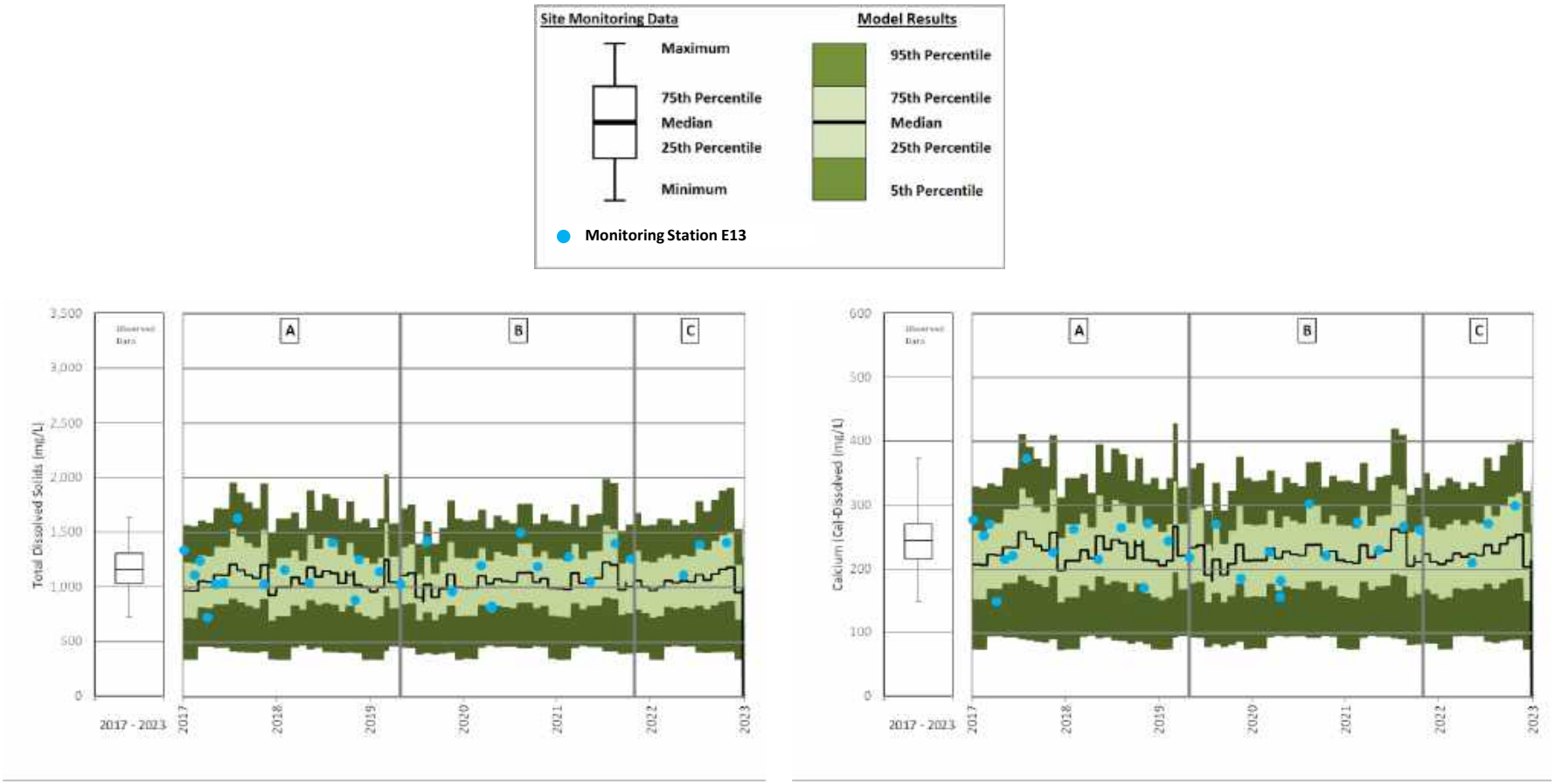
Figure A 119: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Uranium and Dissolved Vanadium



A = Operations; B = Care and Maintanence; C = Resumed Operations

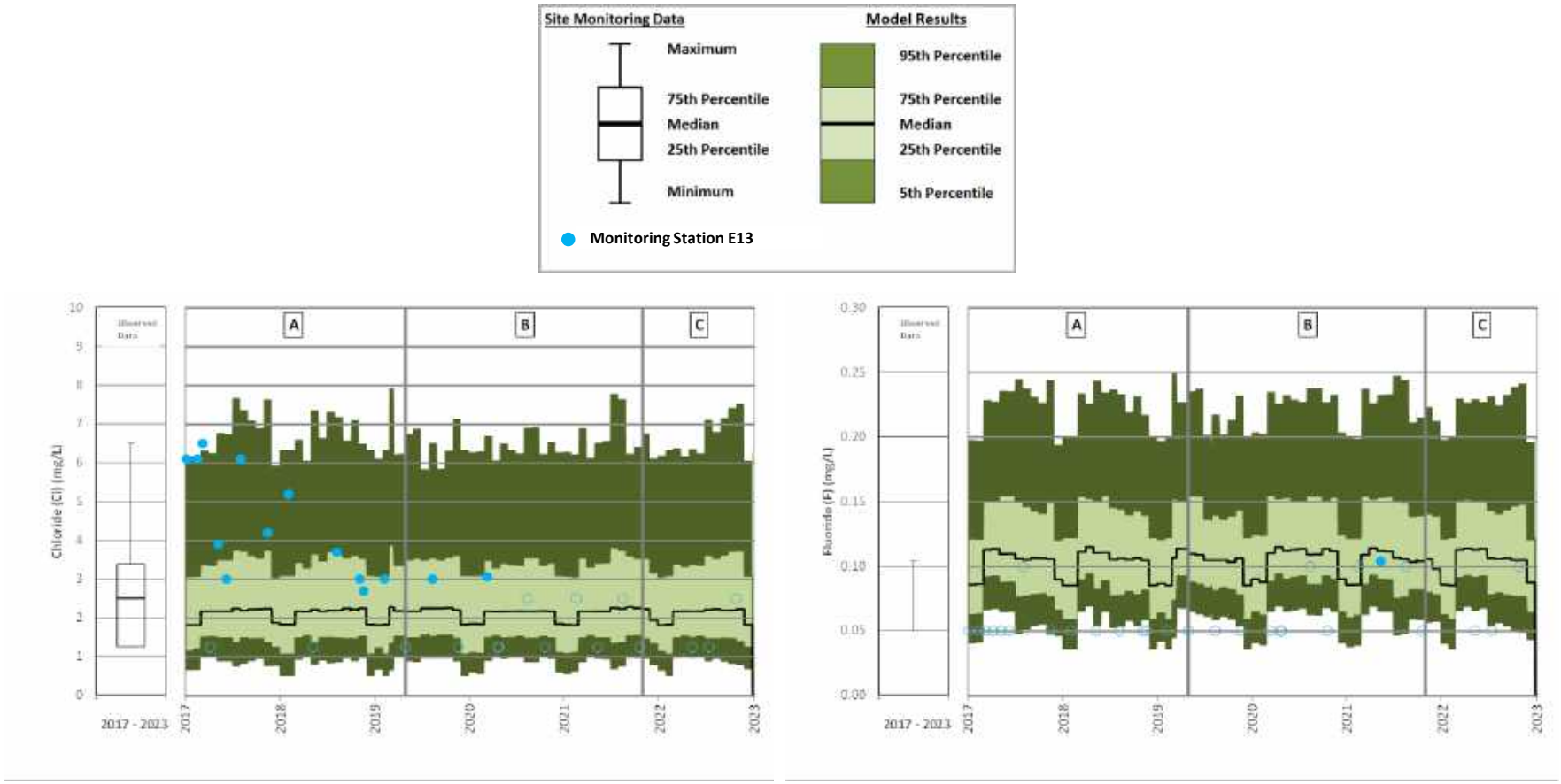
Figure A 120: Perimeter Embankment Till Borrow Pond Calibration – Dissolved Zinc

Northwest Sump Calibration



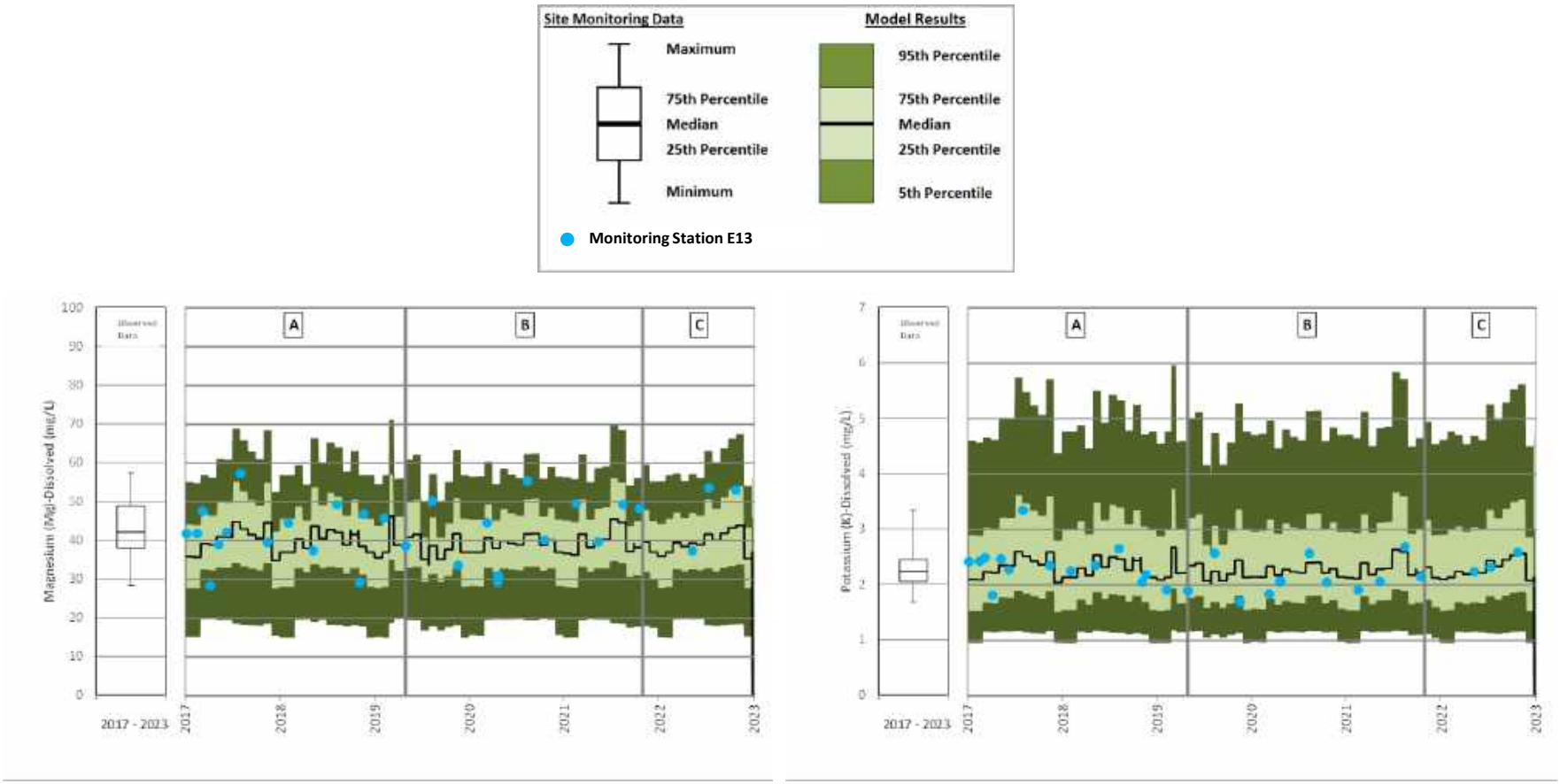
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 121: Northwest Sump Calibration – Total Dissolved Solids and Calcium



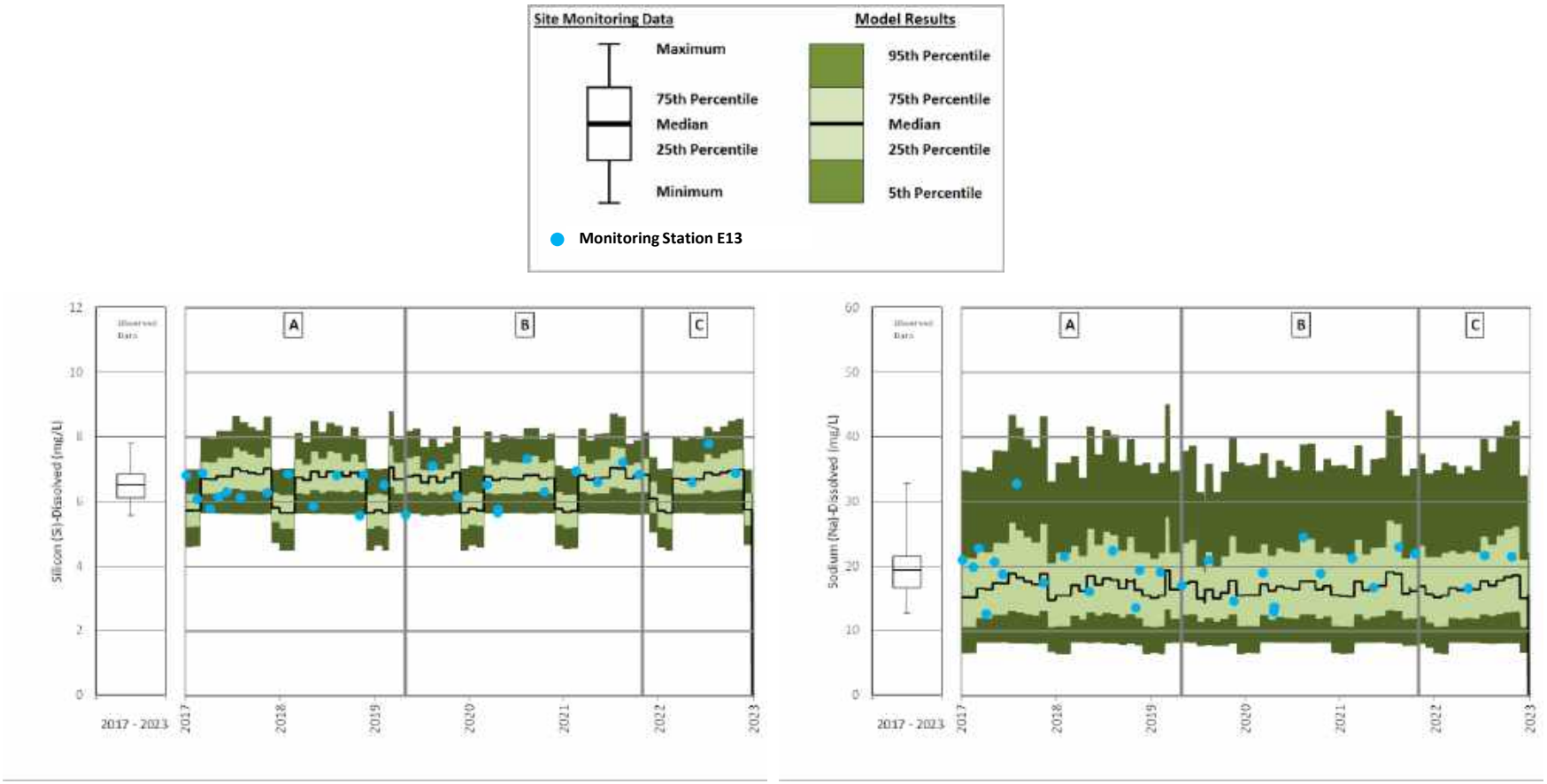
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 122: Northwest Sump Calibration – Chloride and Fluoride



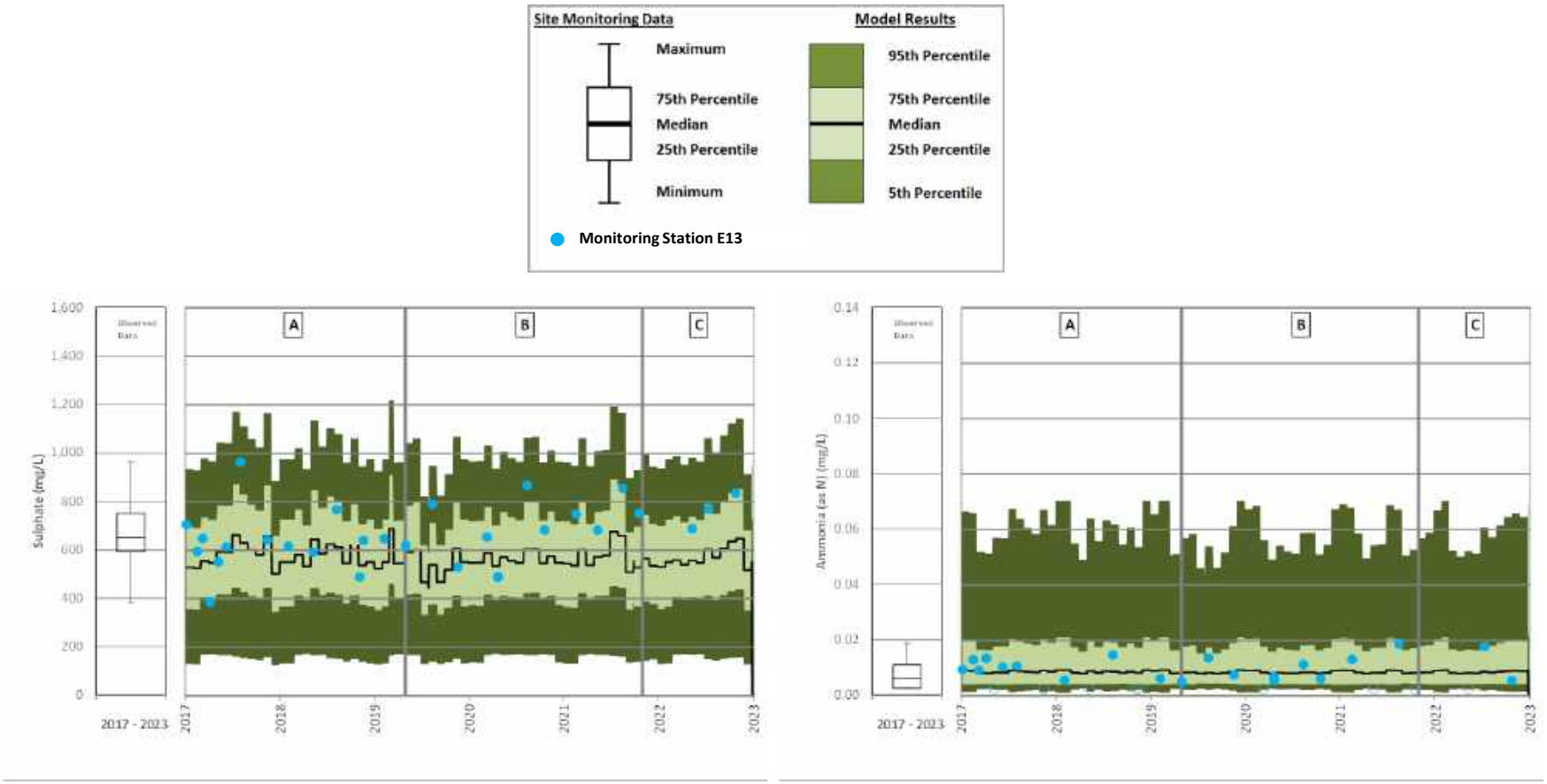
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 123: Northwest Sump Calibration – Magnesium and Potassium



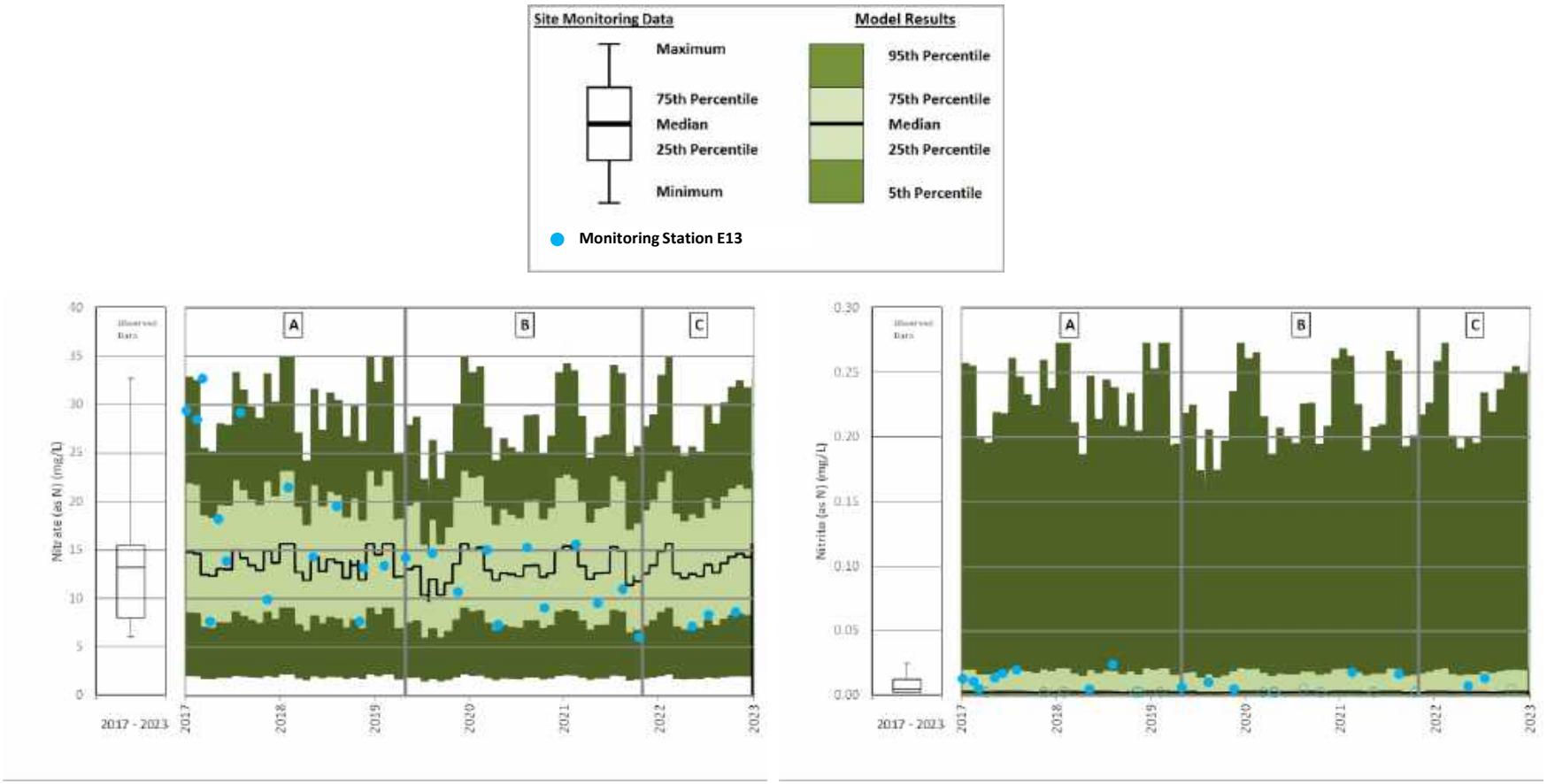
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 124: Northwest Sump Calibration – Silicon and Sodium



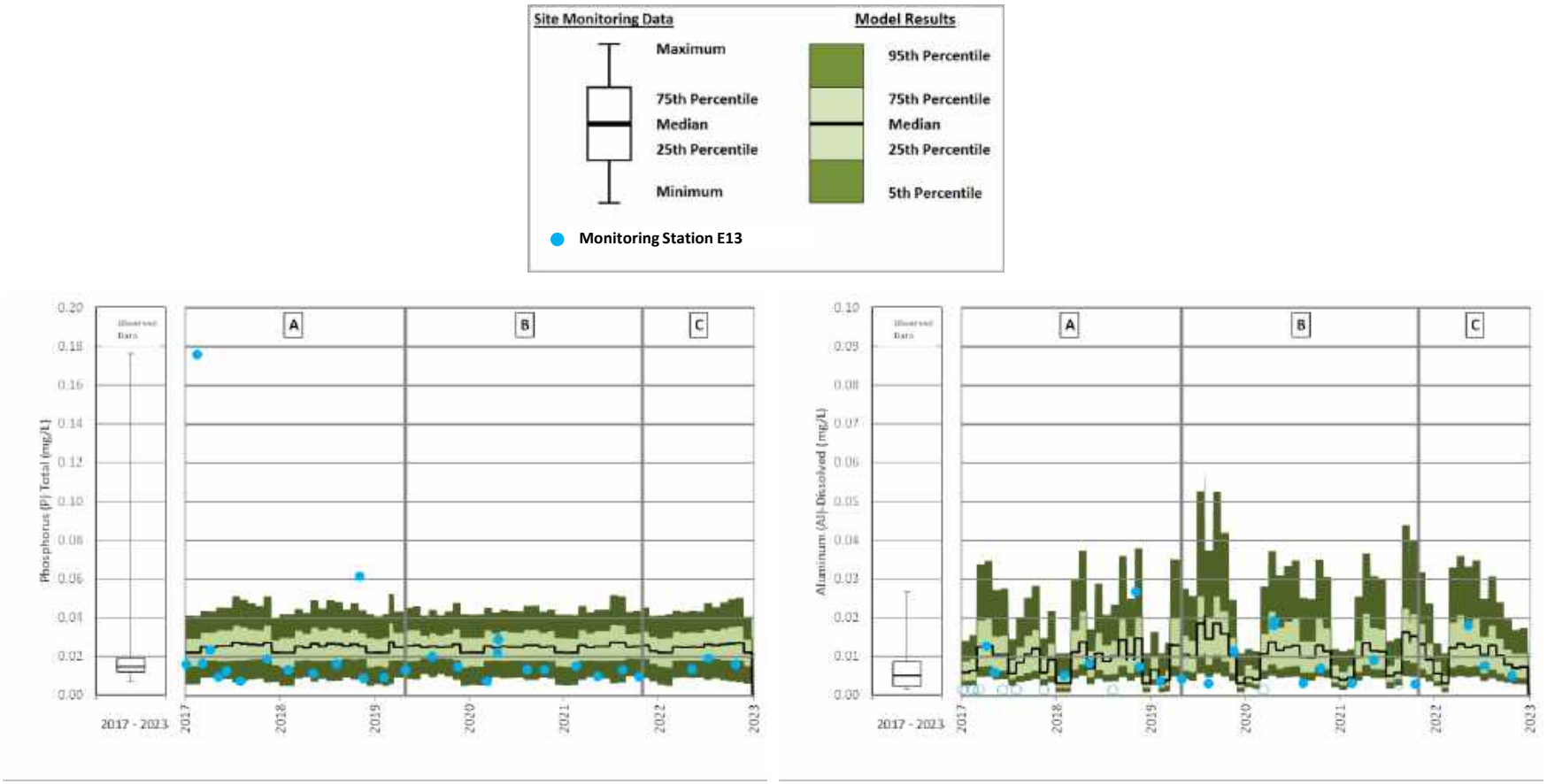
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 125: Northwest Sump Calibration – Sulphate and Total Ammonia



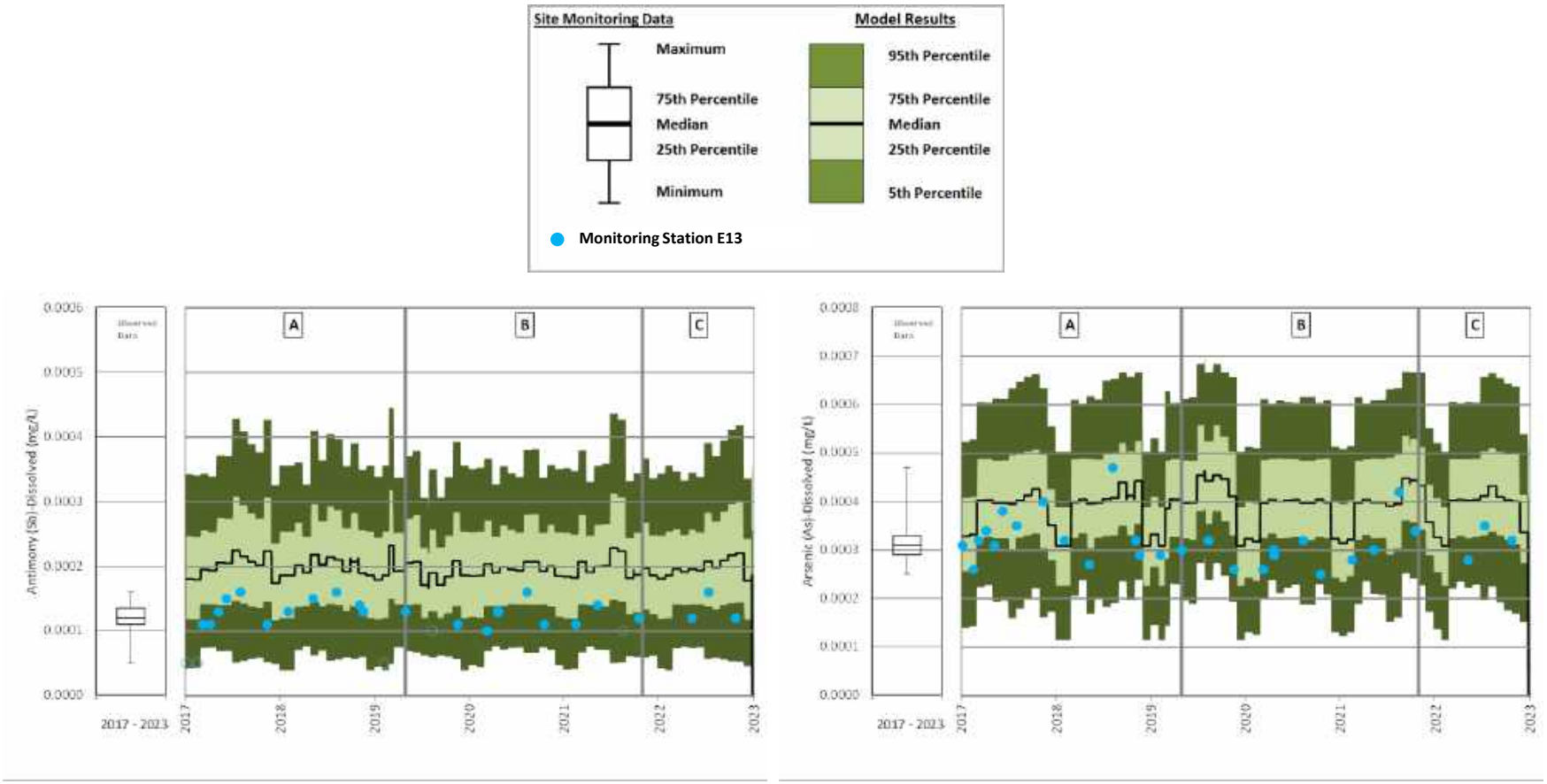
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 126: Northwest Sump Calibration – Nitrate and Nitrite



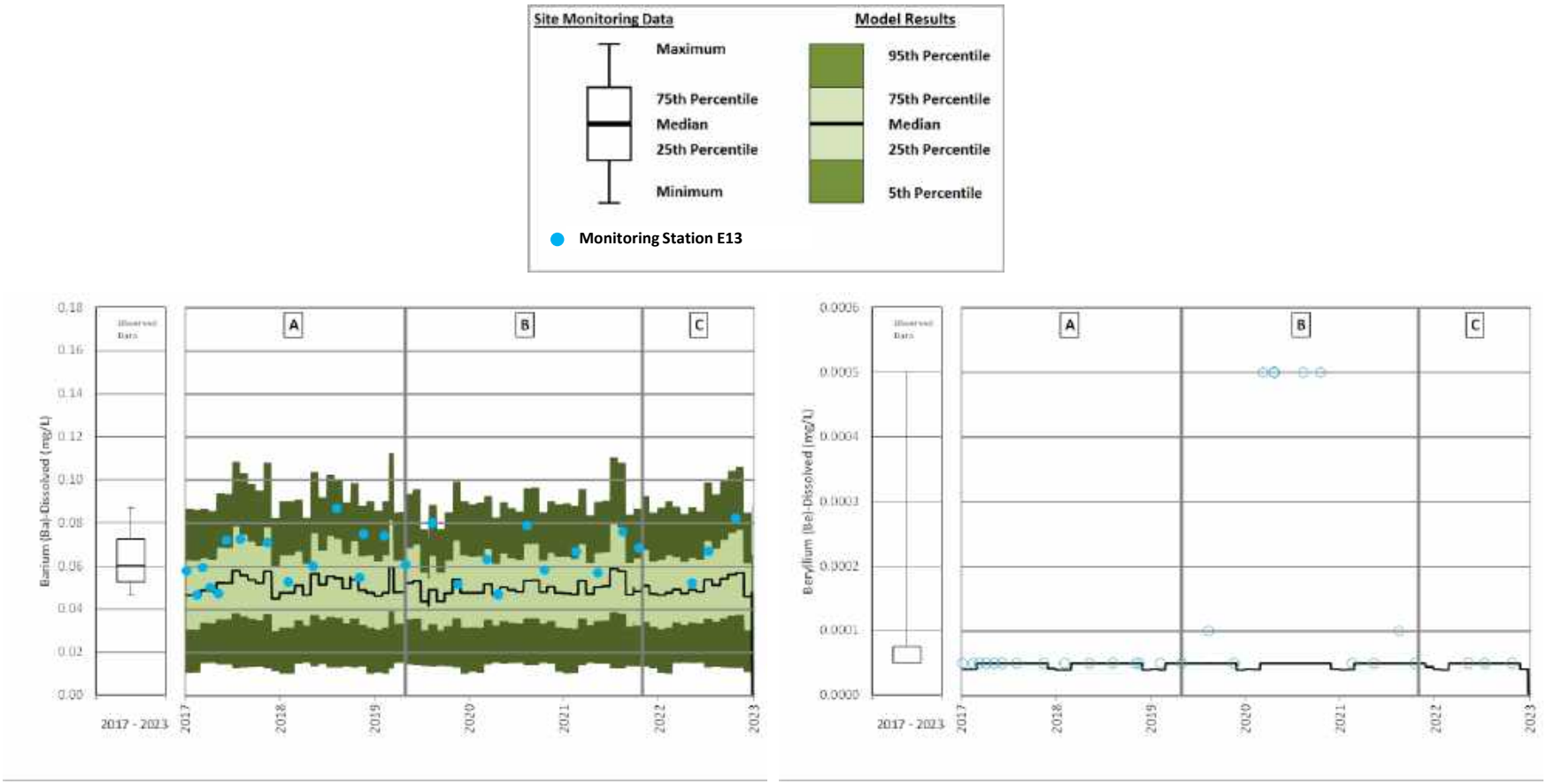
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 127: Northwest Sump Calibration – Total Phosphorus and Dissolved Aluminum



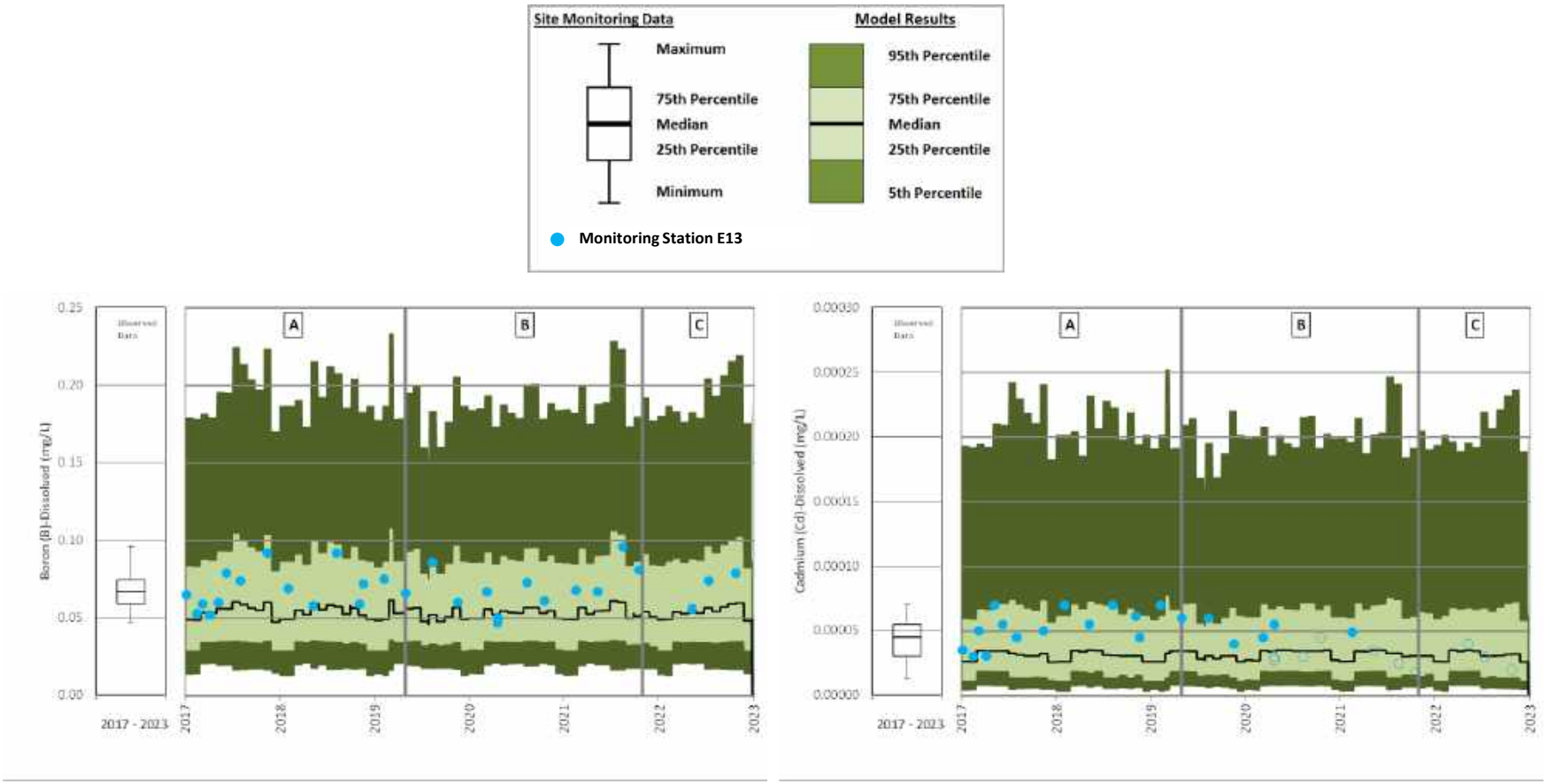
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 128: Northwest Sump Calibration – Dissolved Antimony and Dissolved Arsenic



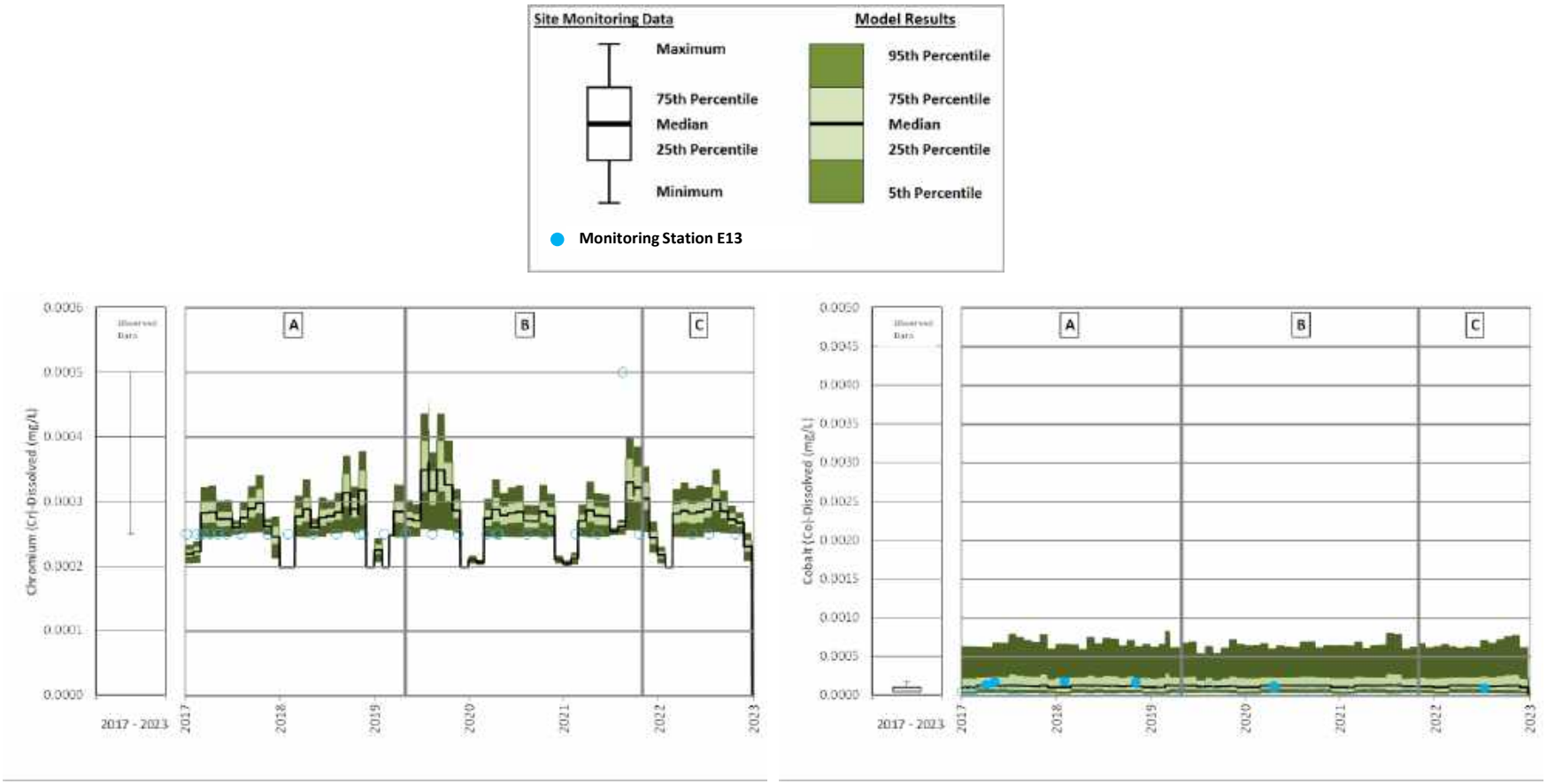
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 129: Northwest Sump Calibration – Dissolved Barium and Dissolved Beryllium



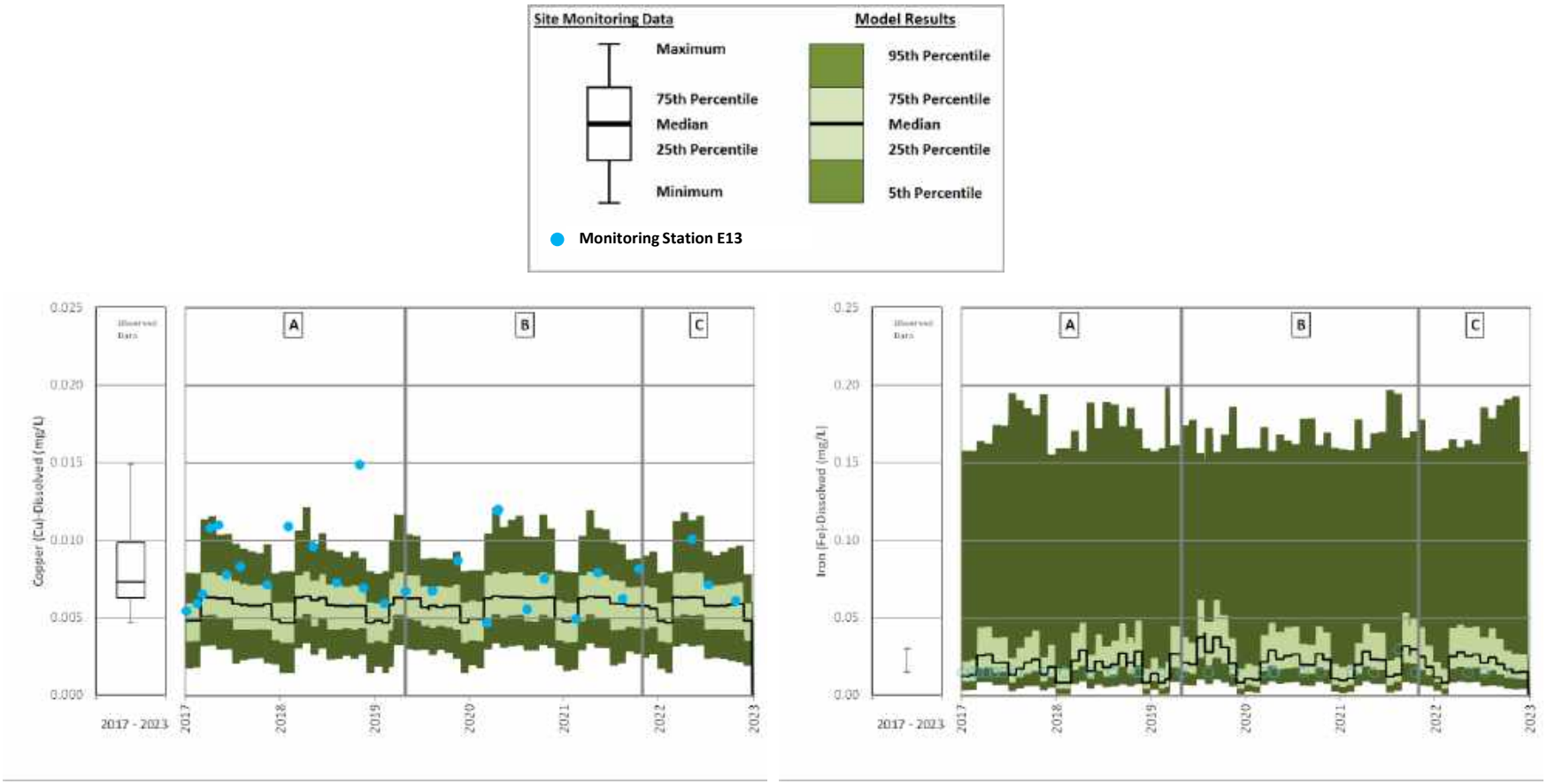
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 130: Northwest Sump Calibration – Dissolved Boron and Dissolved Cadmium



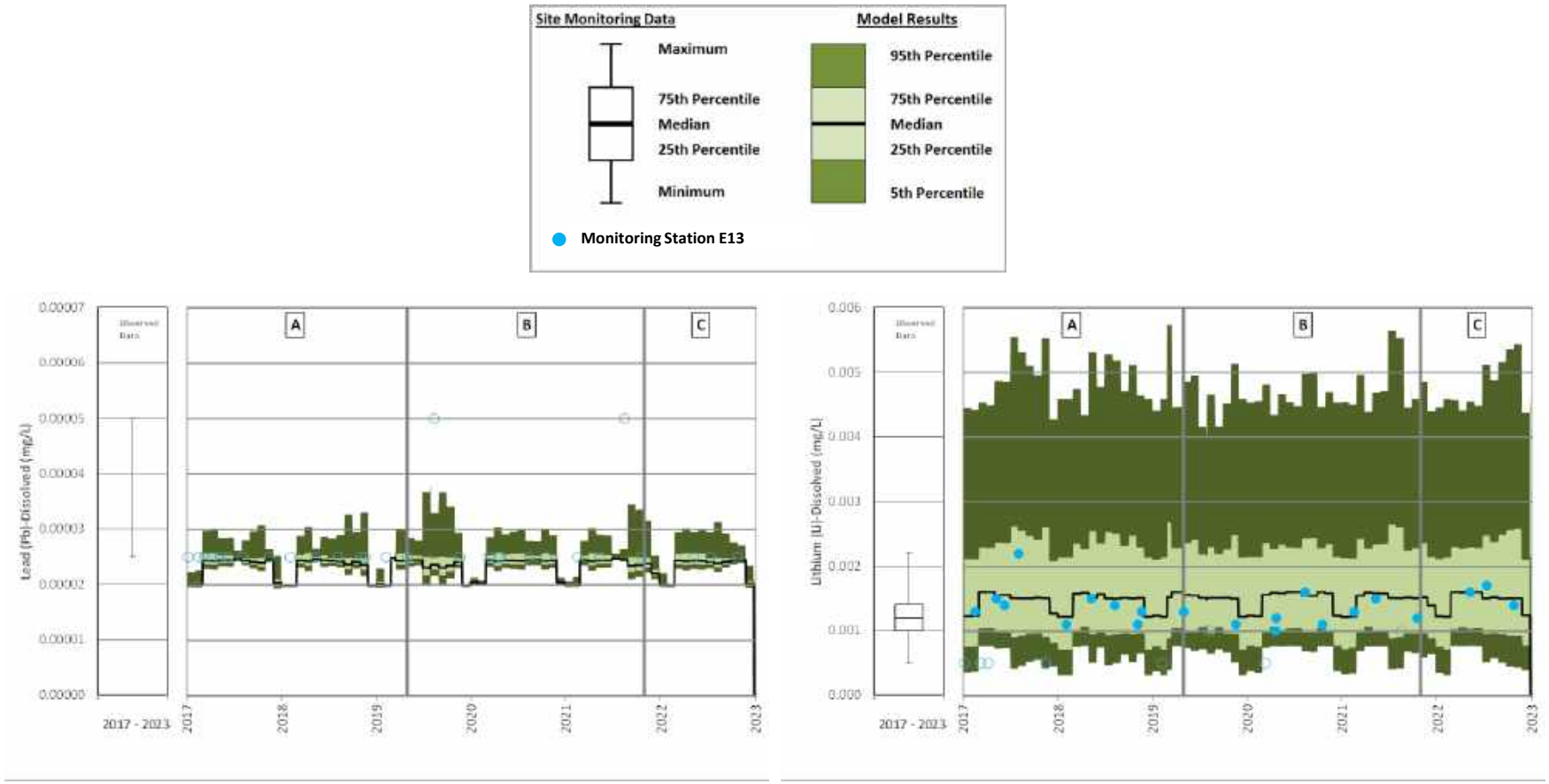
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 131: Northwest Sump Calibration – Dissolved Chromium and Dissolved Cobalt



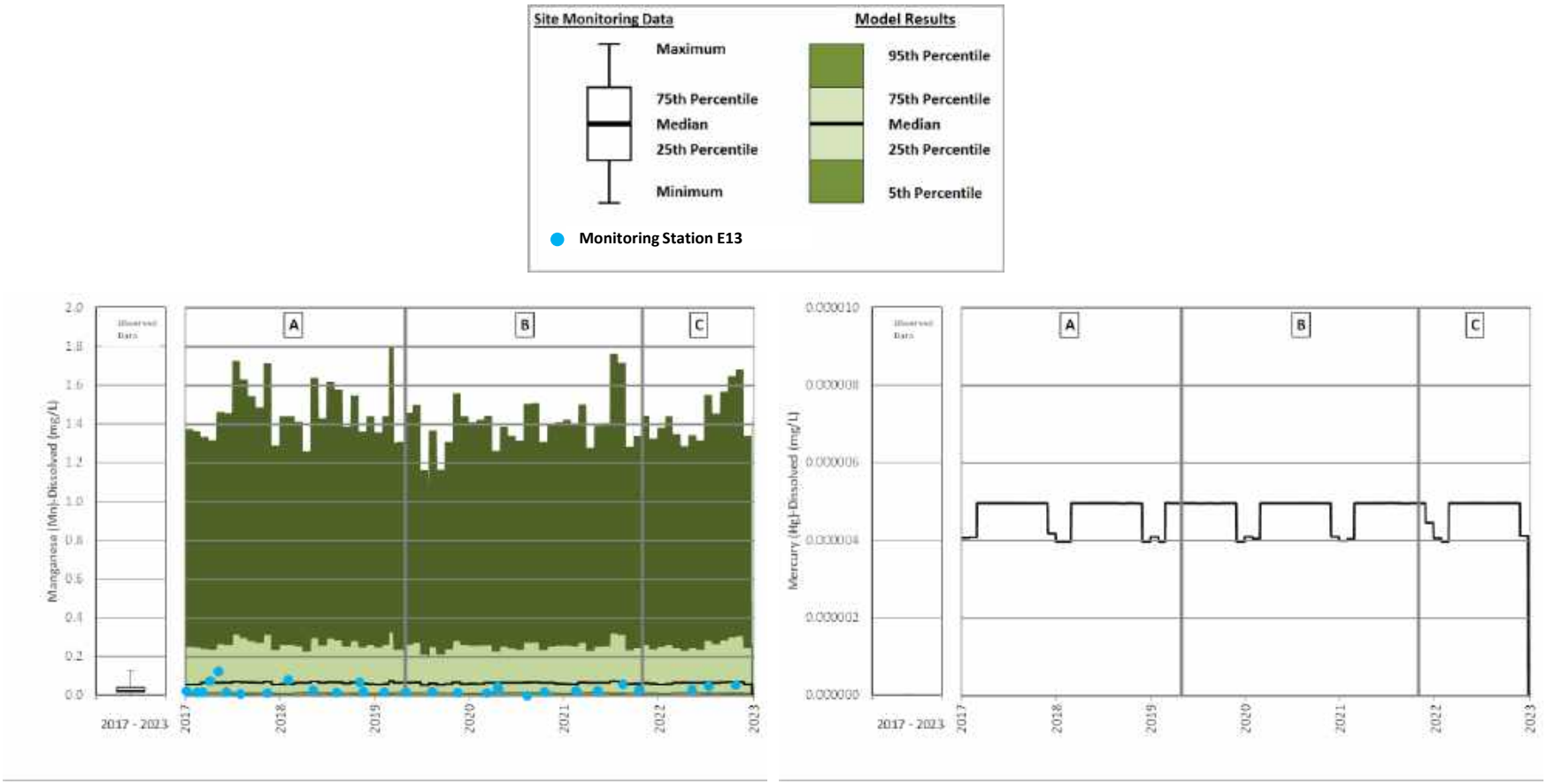
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 132: Northwest Sump Calibration – Dissolved Copper and Dissolved Iron



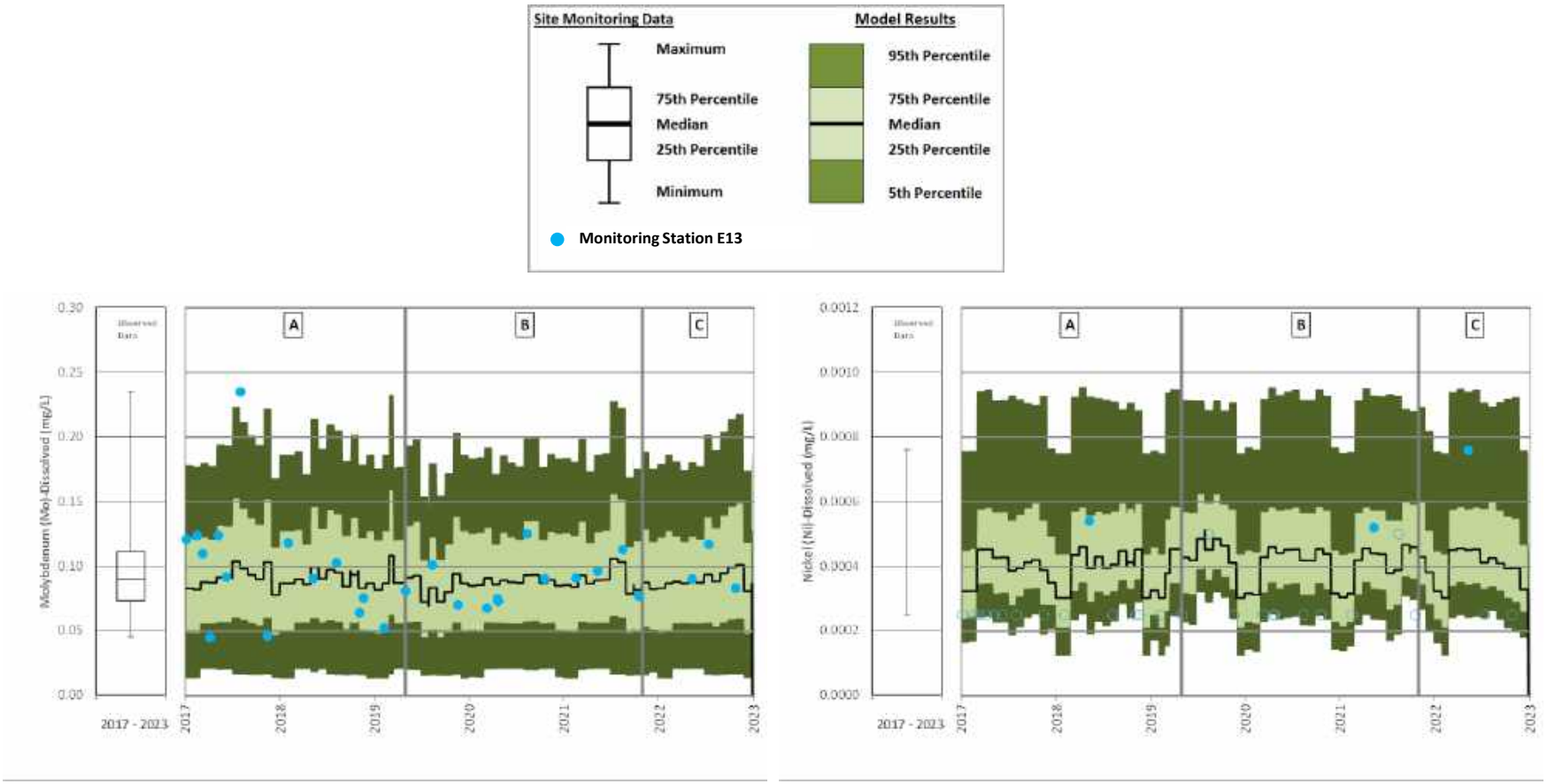
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 133: Northwest Sump Calibration – Dissolved Lead and Dissolved Lithium



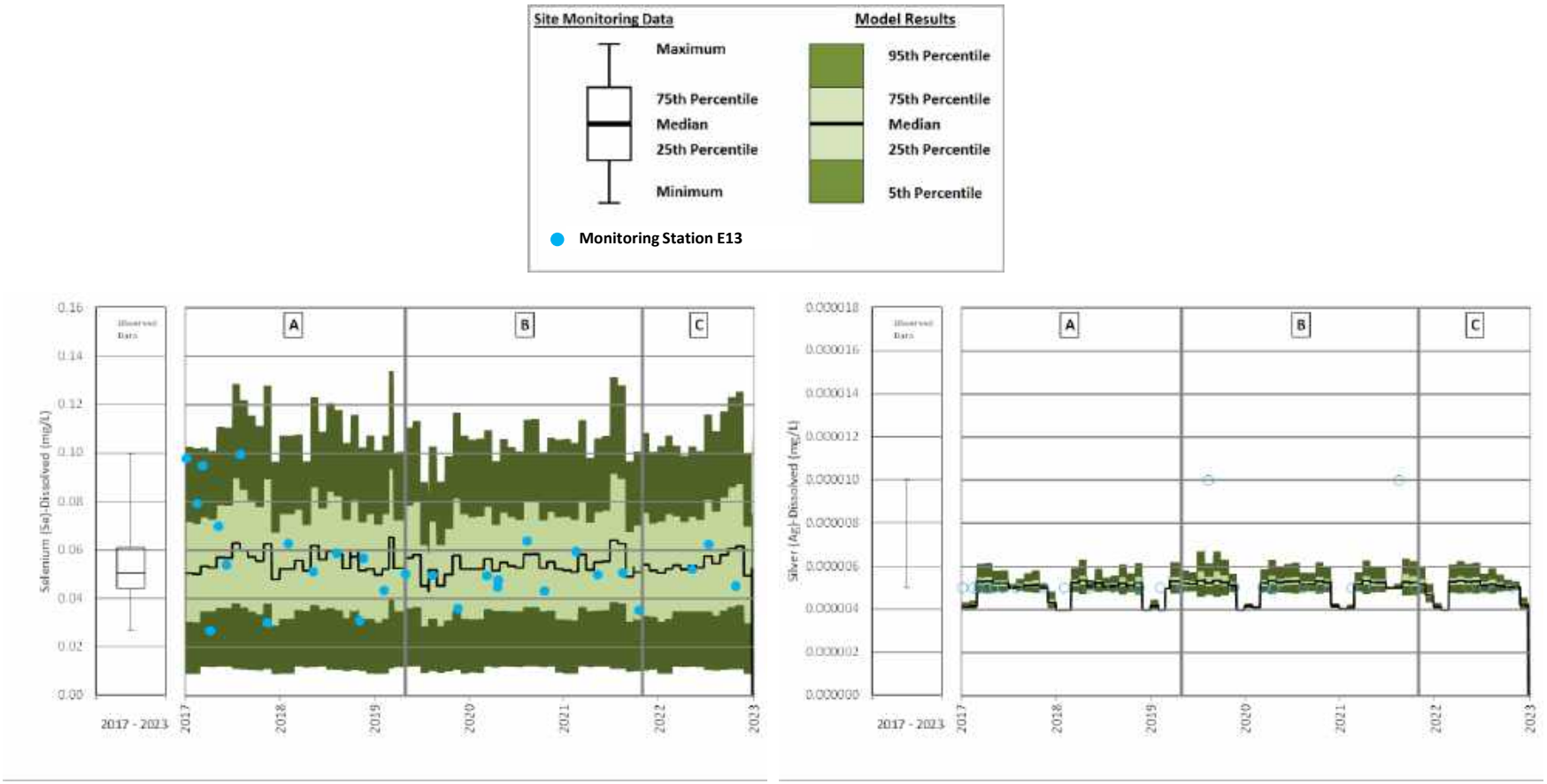
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 134: Northwest Sump Calibration – Dissolved Manganese and Dissolved Mercury



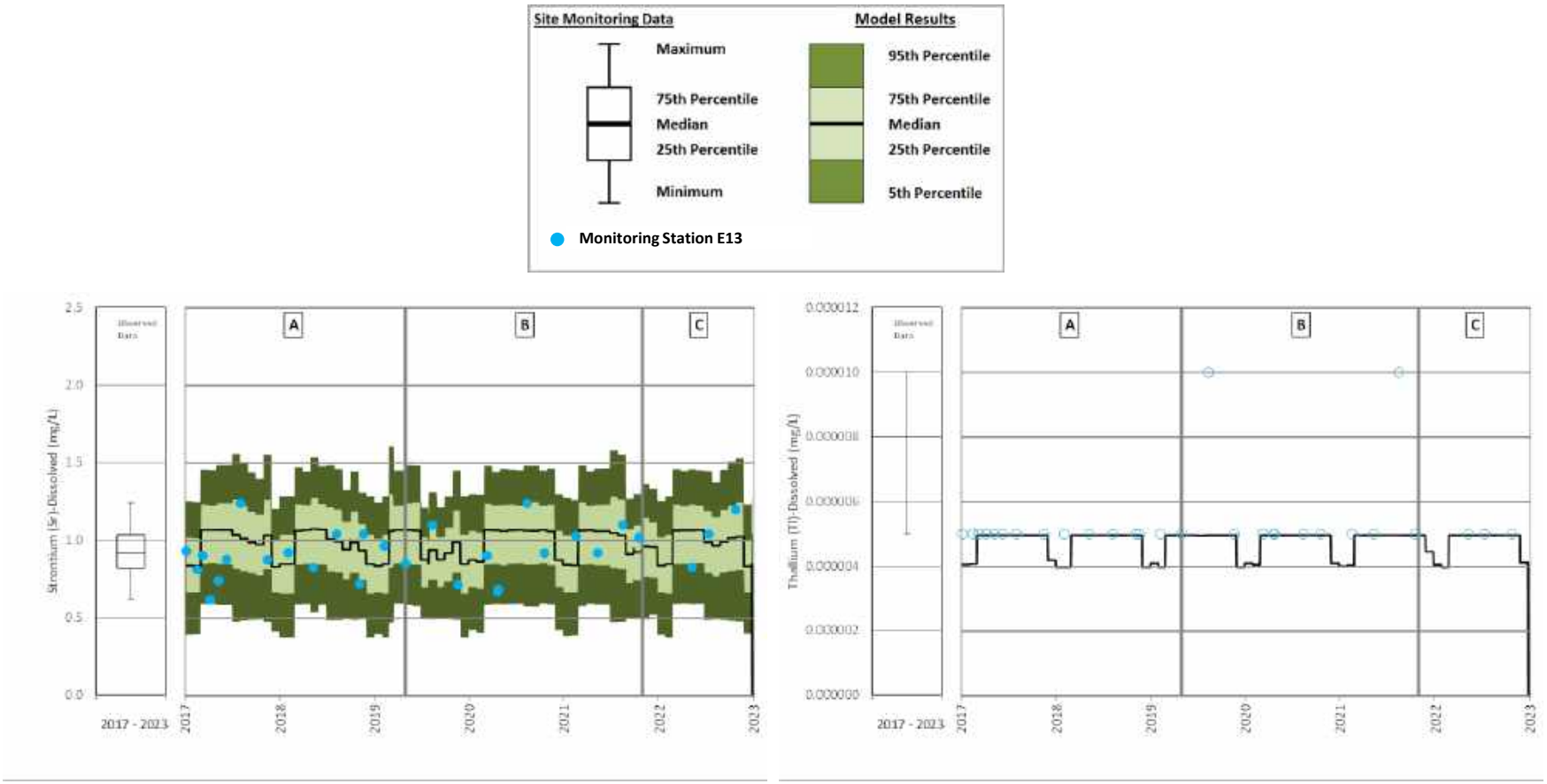
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 135: Northwest Sump Calibration – Dissolved Molybdenum and Dissolved Nickel



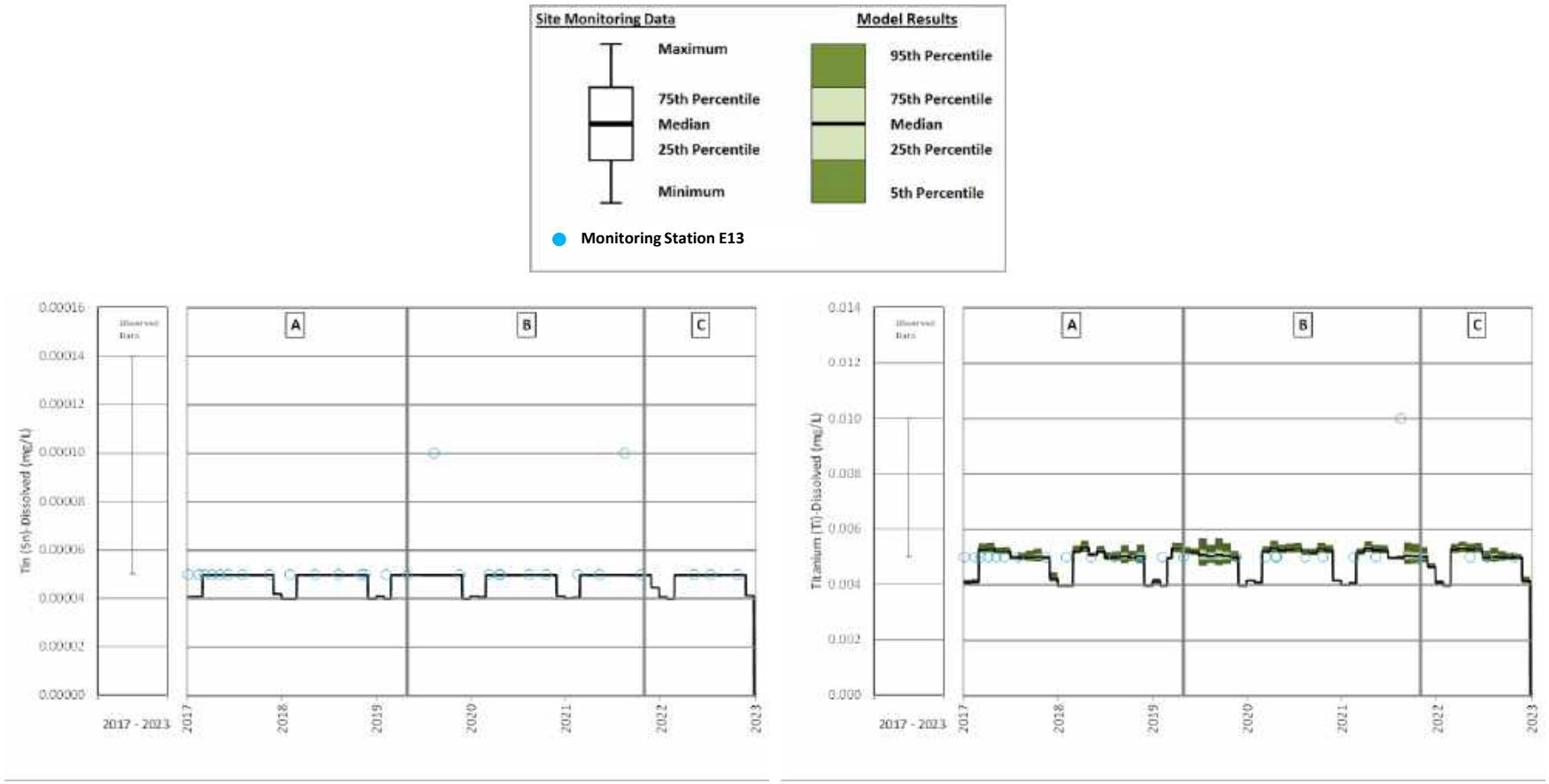
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 136: Northwest Sump Calibration – Dissolved Selenium and Dissolved Silver



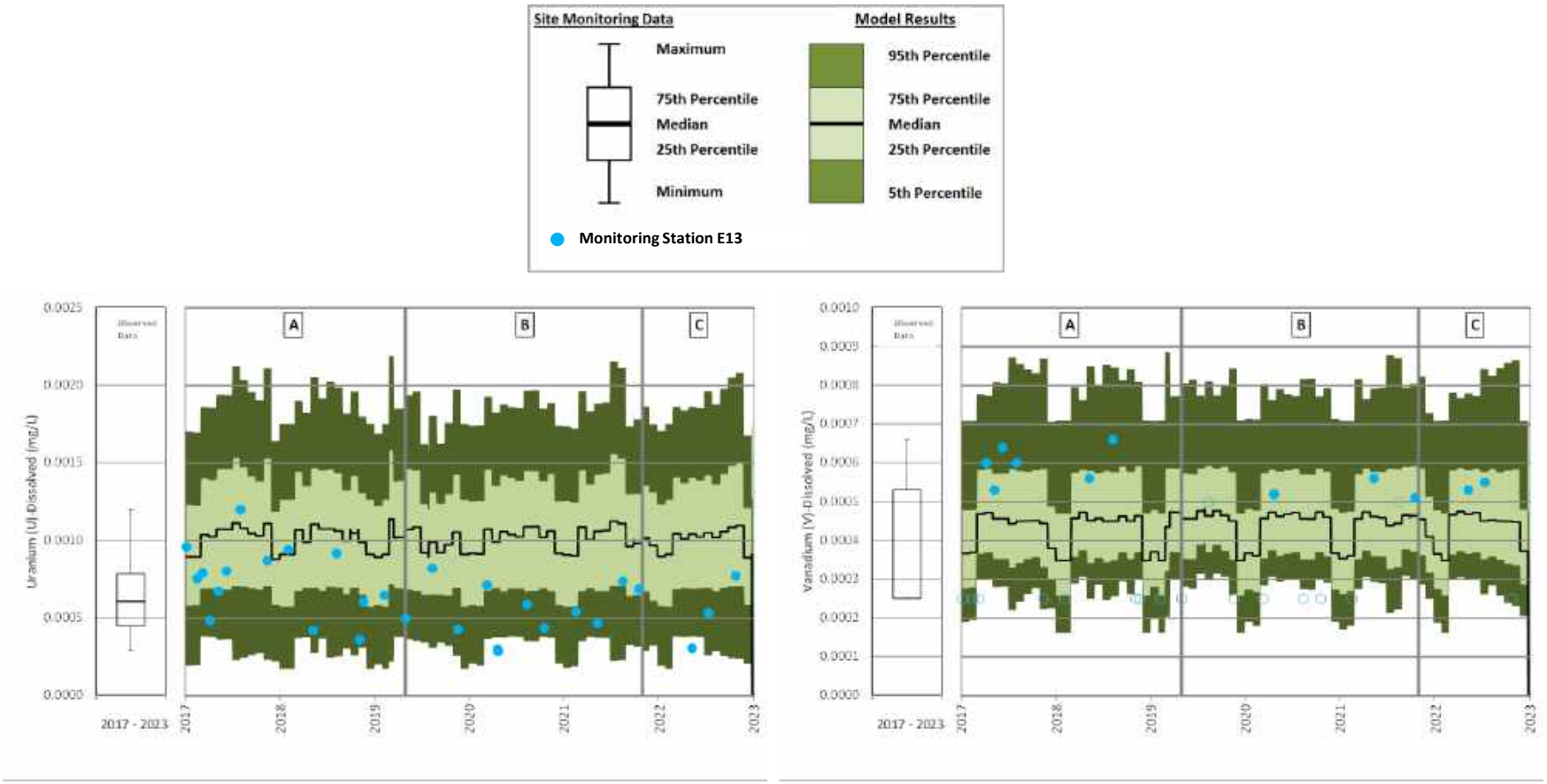
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 137: Northwest Sump Calibration – Dissolved Strontium and Dissolved Thallium



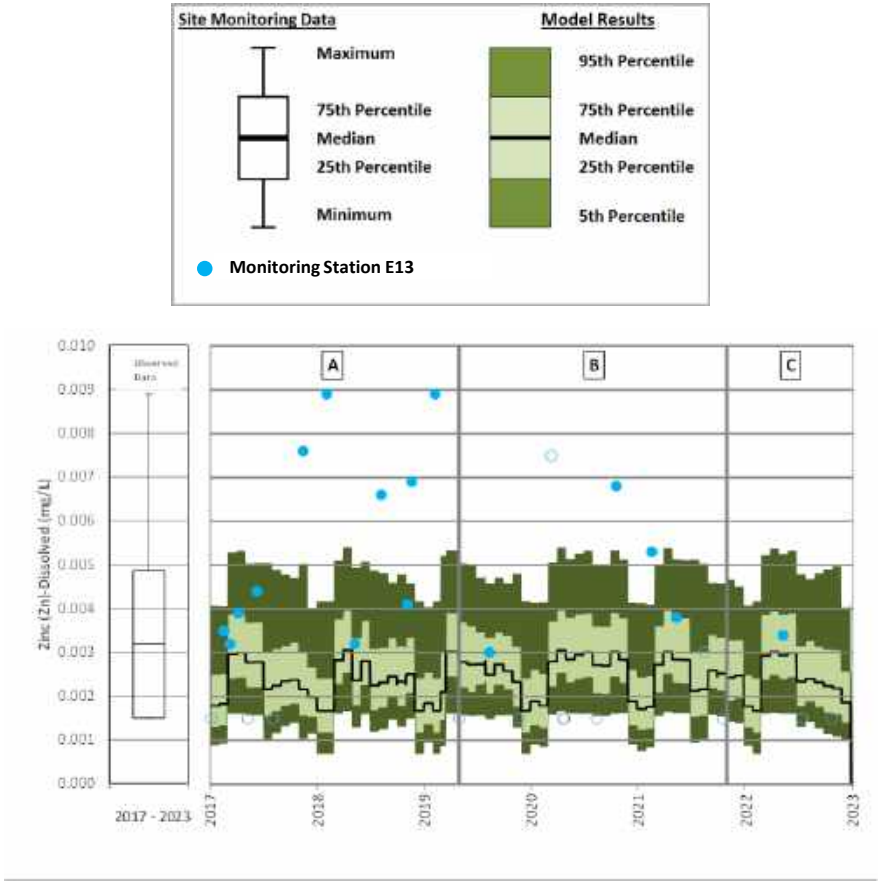
A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 138: Northwest Sump Calibration – Dissolved Tin and Dissolved Titanium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 139: Northwest Sump Calibration – Dissolved Uranium and Dissolved Vanadium



A = Operations; B = Care and Maintanence; C = Resumed Operations

Figure A 140: Northwest Sump Calibration – Dissolved Zinc

APPENDIX B

Water Quality Model Results - Operations, Closure and Post-closure

APPENDIX

Appendix B

Water Quality Model Results - Operations, Closure and Post-closure

Reference No. 23590671-053-R-Rev1-31282

November 2024

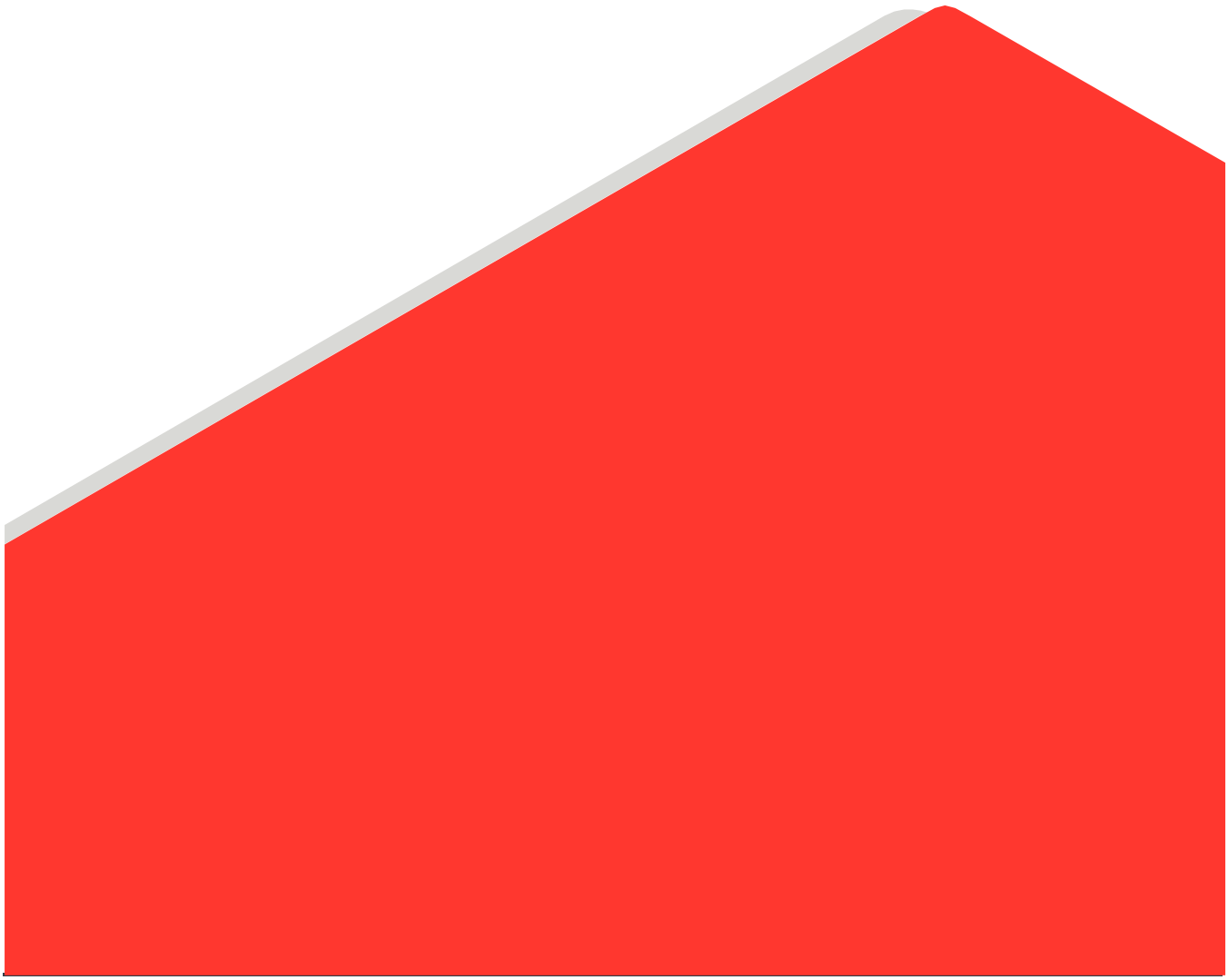


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Appendix B – Water Quality Figures B 1–B 260

This attachment presents the water quality results Figures for Springer Pit, Cariboo Pit, Springer-Cariboo Pit, Wight Pit, the Central Collection Sump, the Tailings Storage Facility, the Perimeter Embankment Till Borrow Pond the 9K Sump, the Northwest Sump and Long Ditch. The operations period is from January 2024 to December 2024. The closure period is from January 2035 to December 2045. The post-closure period is from January 2045 to January 2135.

Model Results for Springer Pit and Cariboo Pit are only presented for the operations period. The model results for the combined Springer-Cariboo Pit are presented for closure and post-closure.

Springer Pit Operations

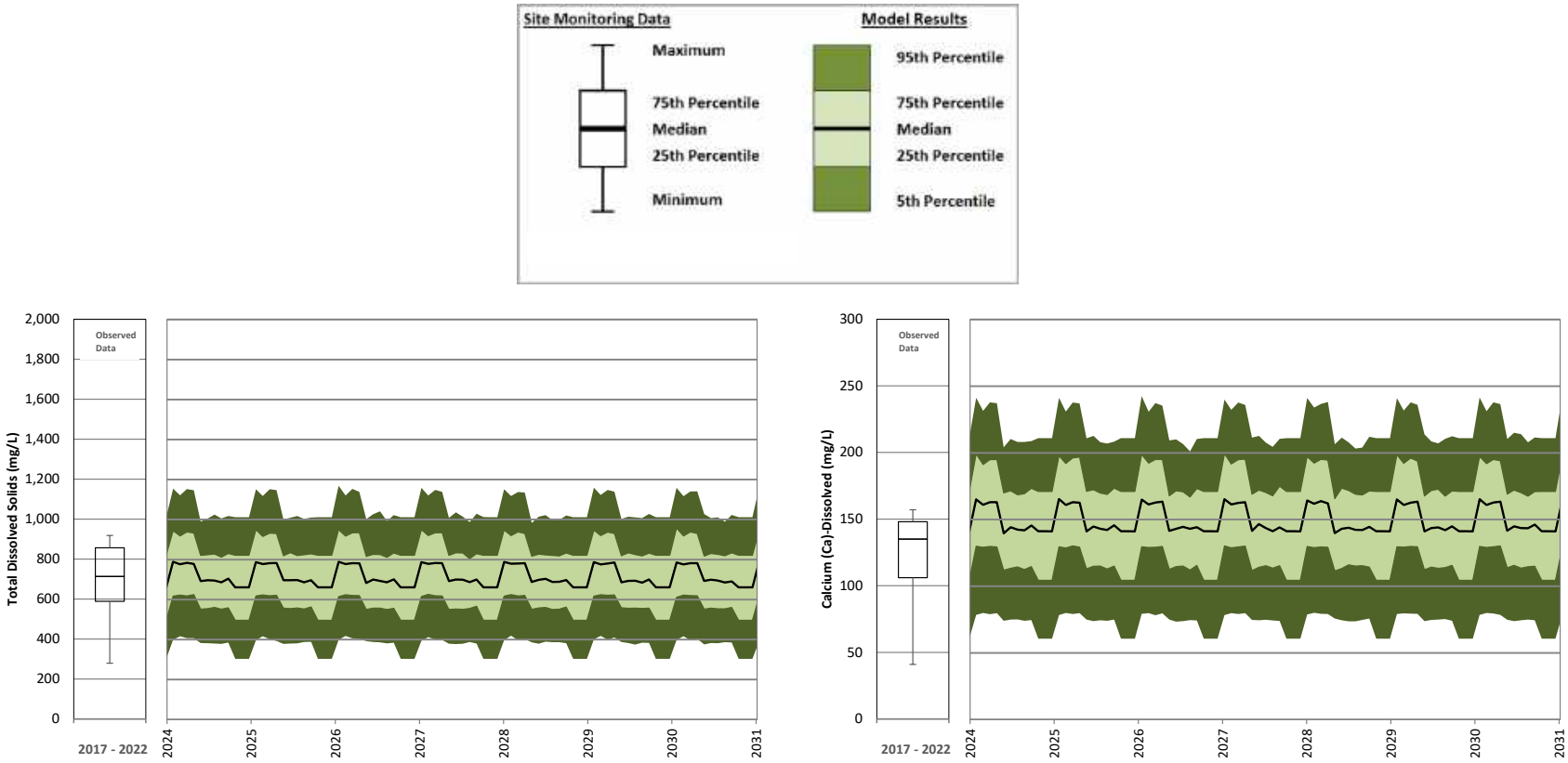


Figure B **1: Springer Pit Operations – Total Dissolved Solids and Calcium**

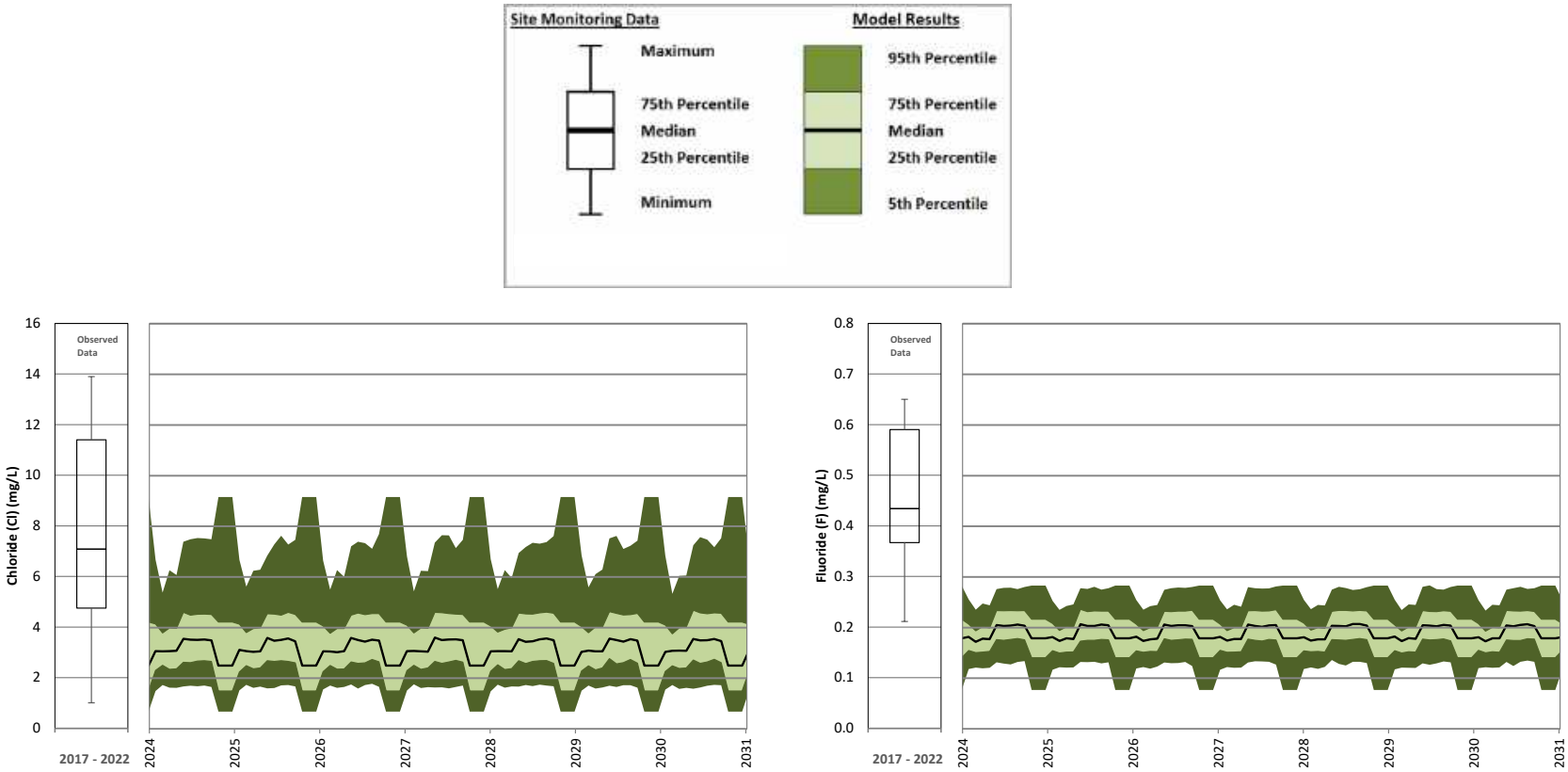


Figure B **2: Springer Pit Operations – Chloride and Fluoride**

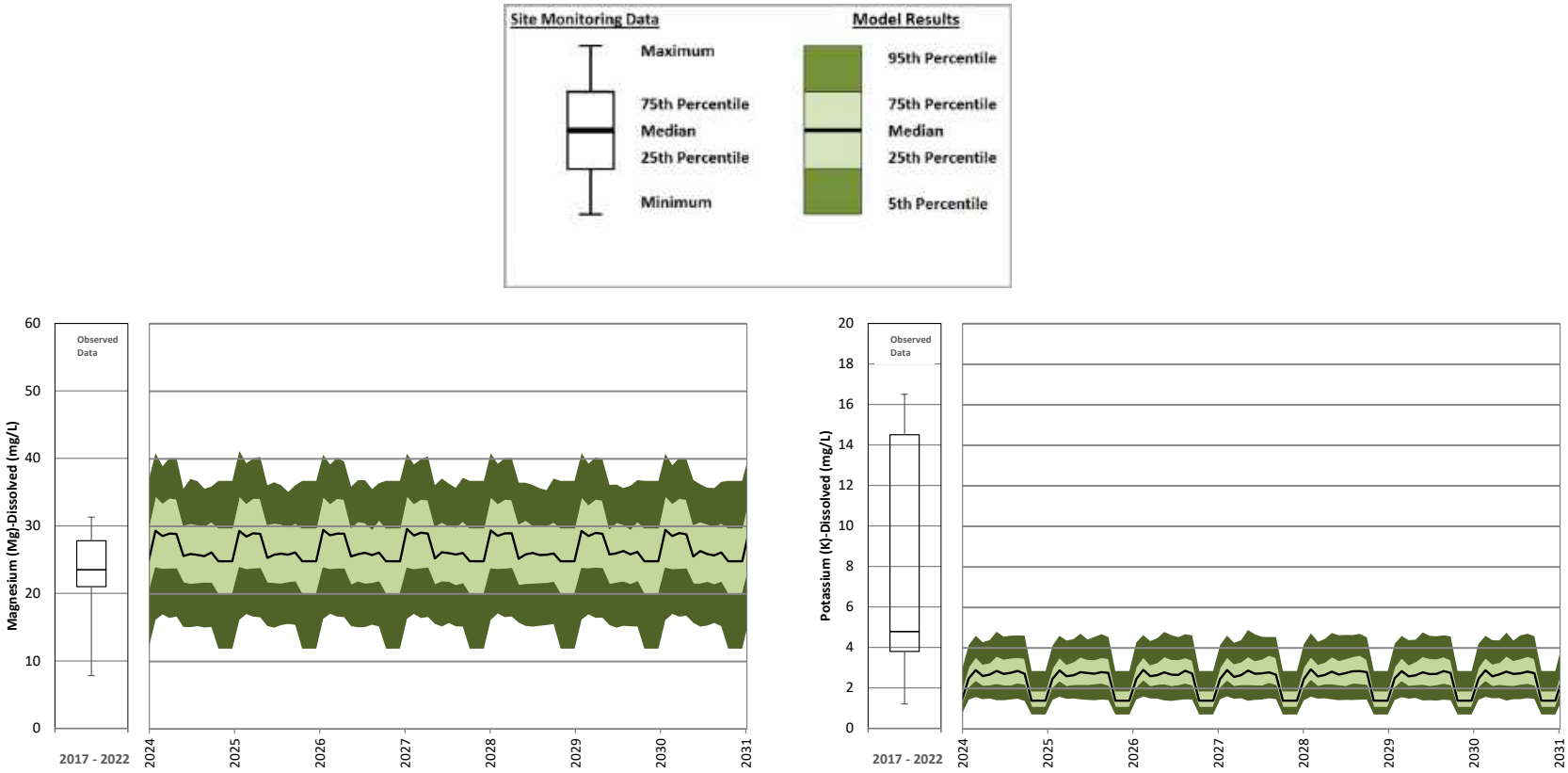


Figure B **3: Springer Pit Operations – Magnesium and Potassium**

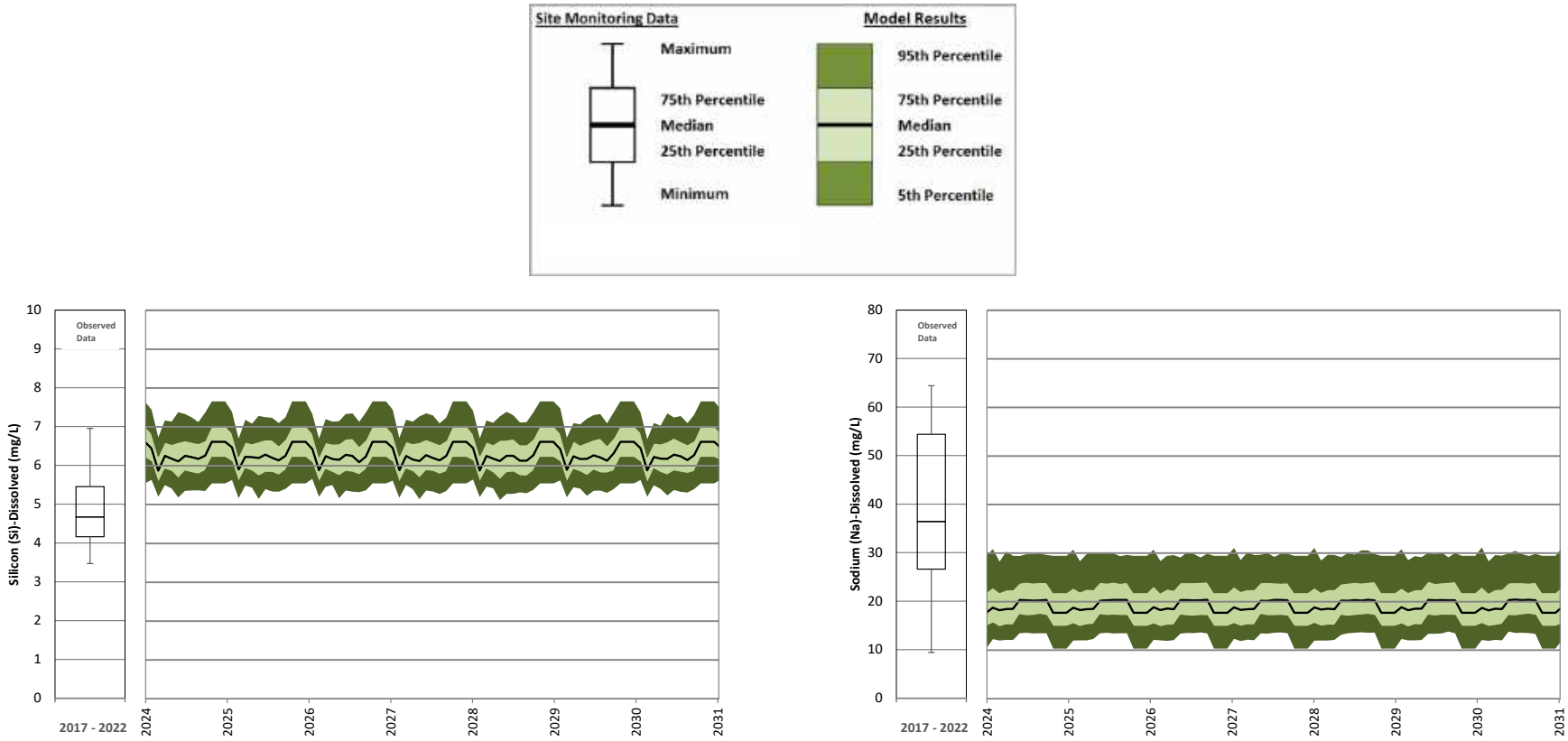


Figure B **4: Springer Pit Operations – Silicon and Sodium**

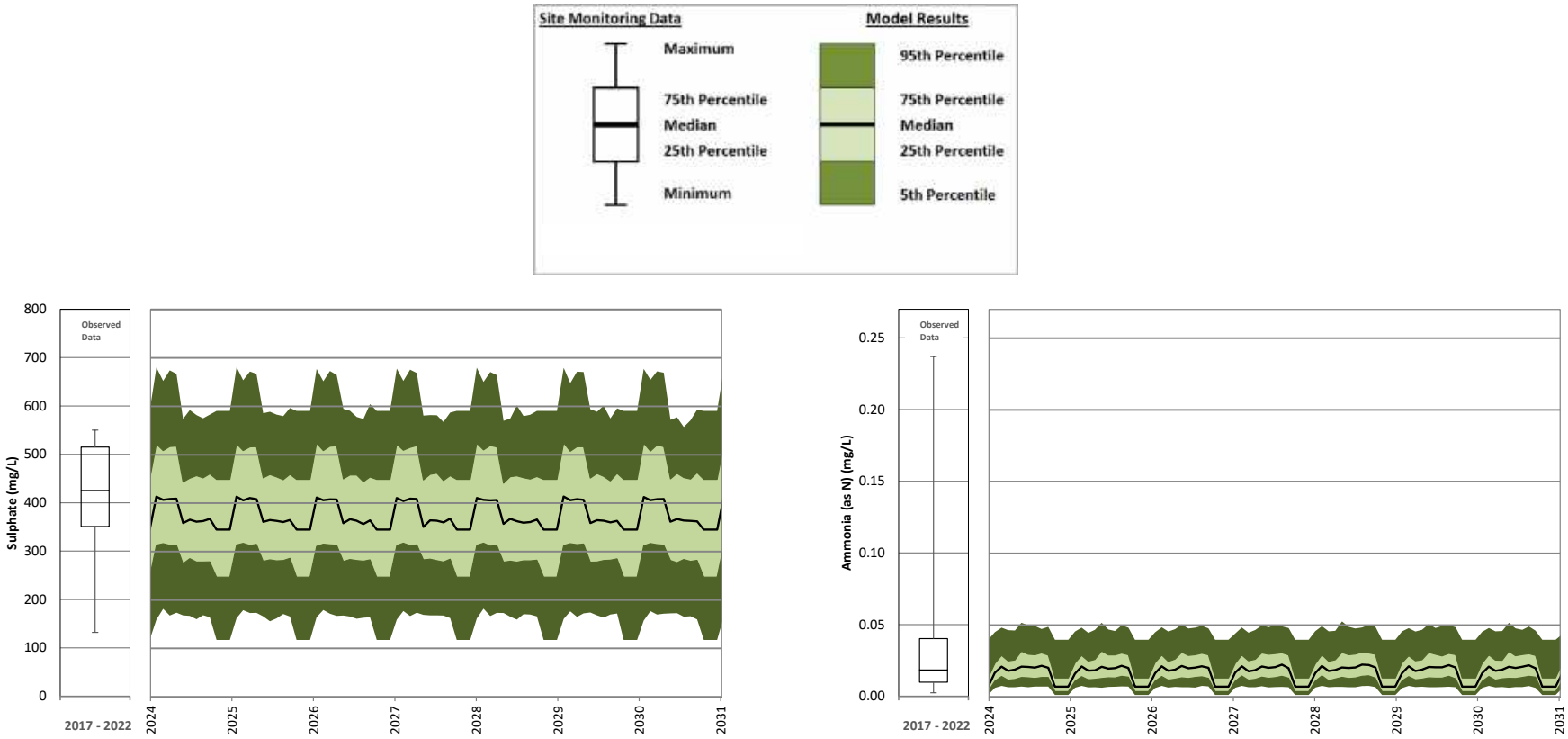


Figure B **5: Springer Pit Operations – Sulphate and Total Ammonia**

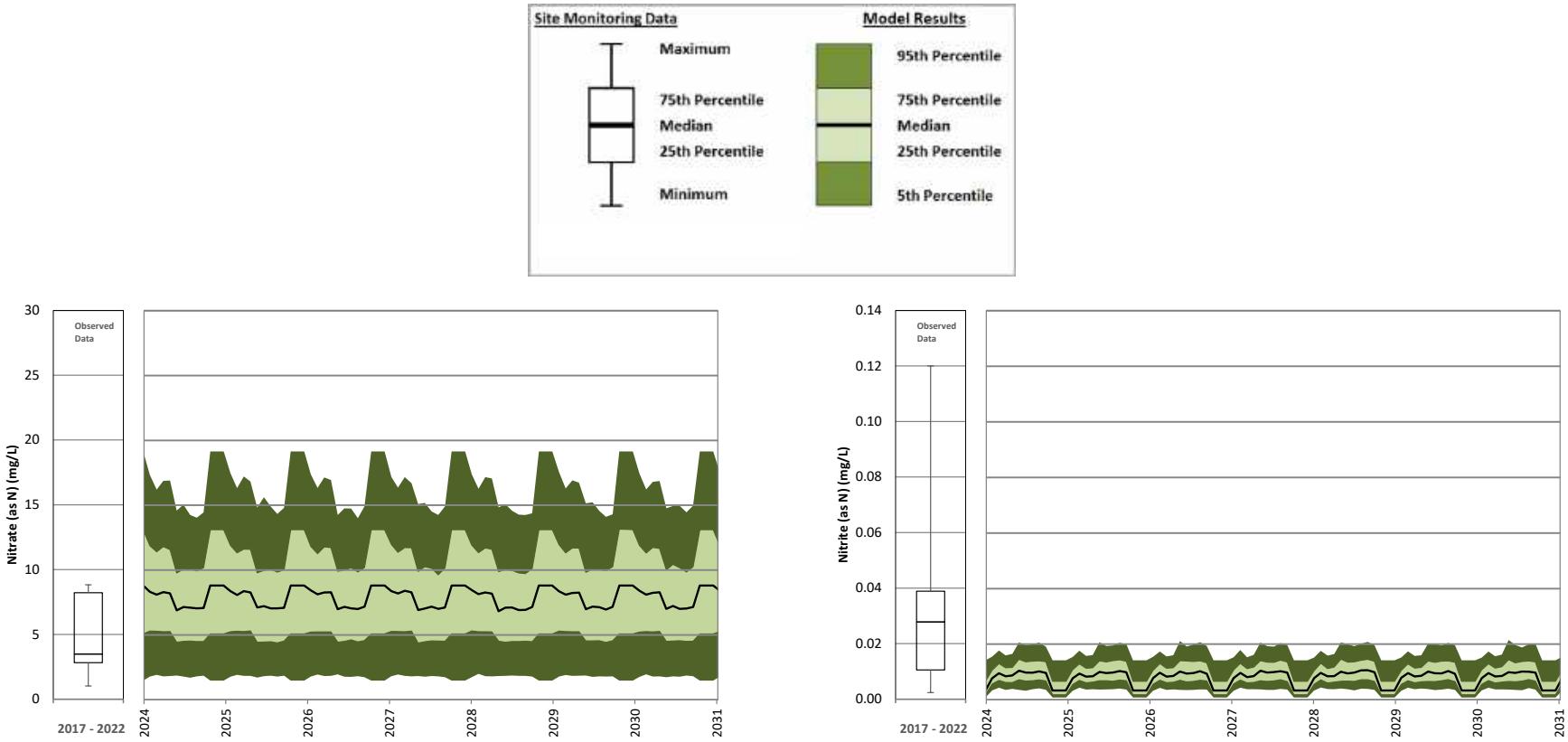


Figure B **6: Springer Pit Operations – Nitrate and Nitrite**

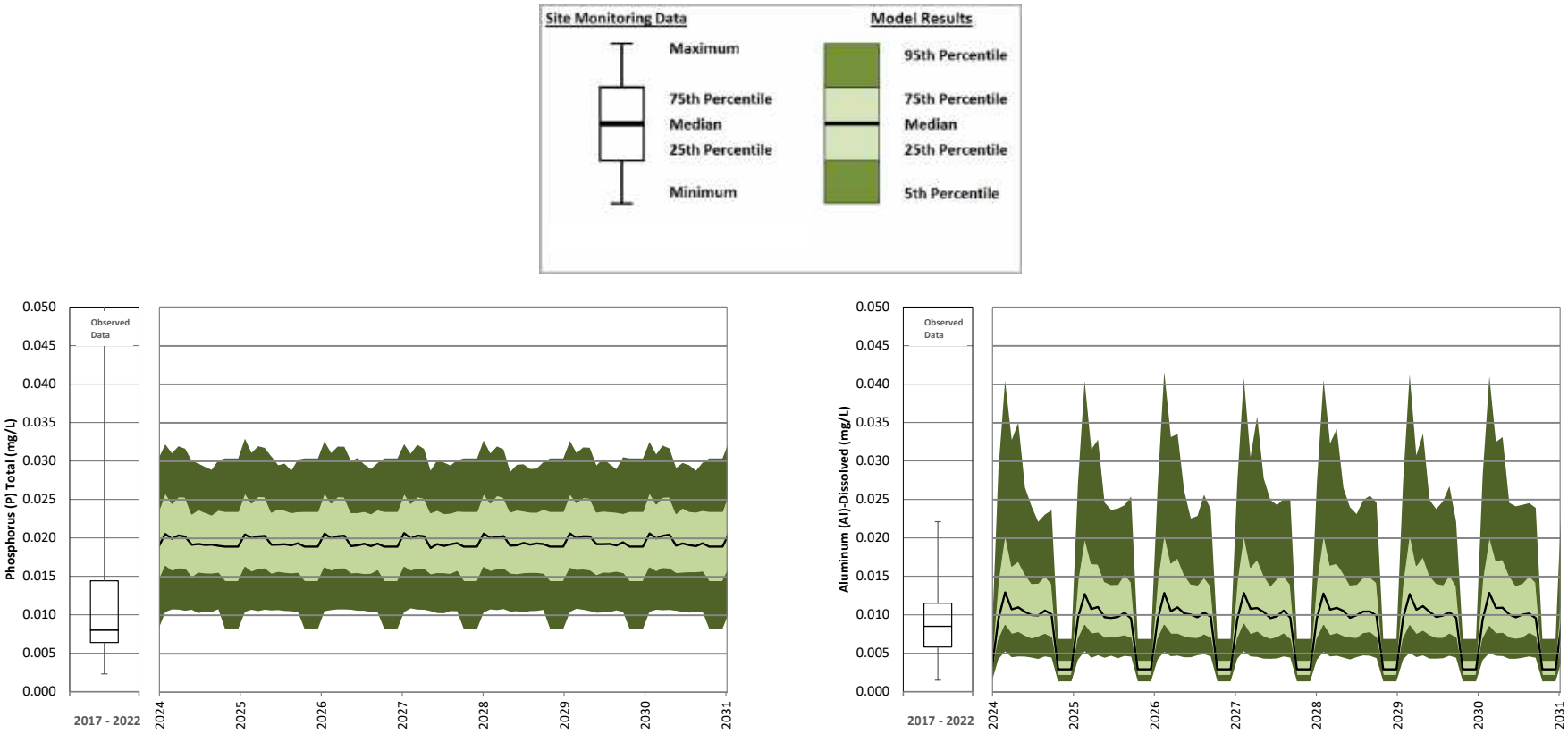


Figure B **7: Springer Pit Operations – Total Phosphorus and Dissolved Aluminum**

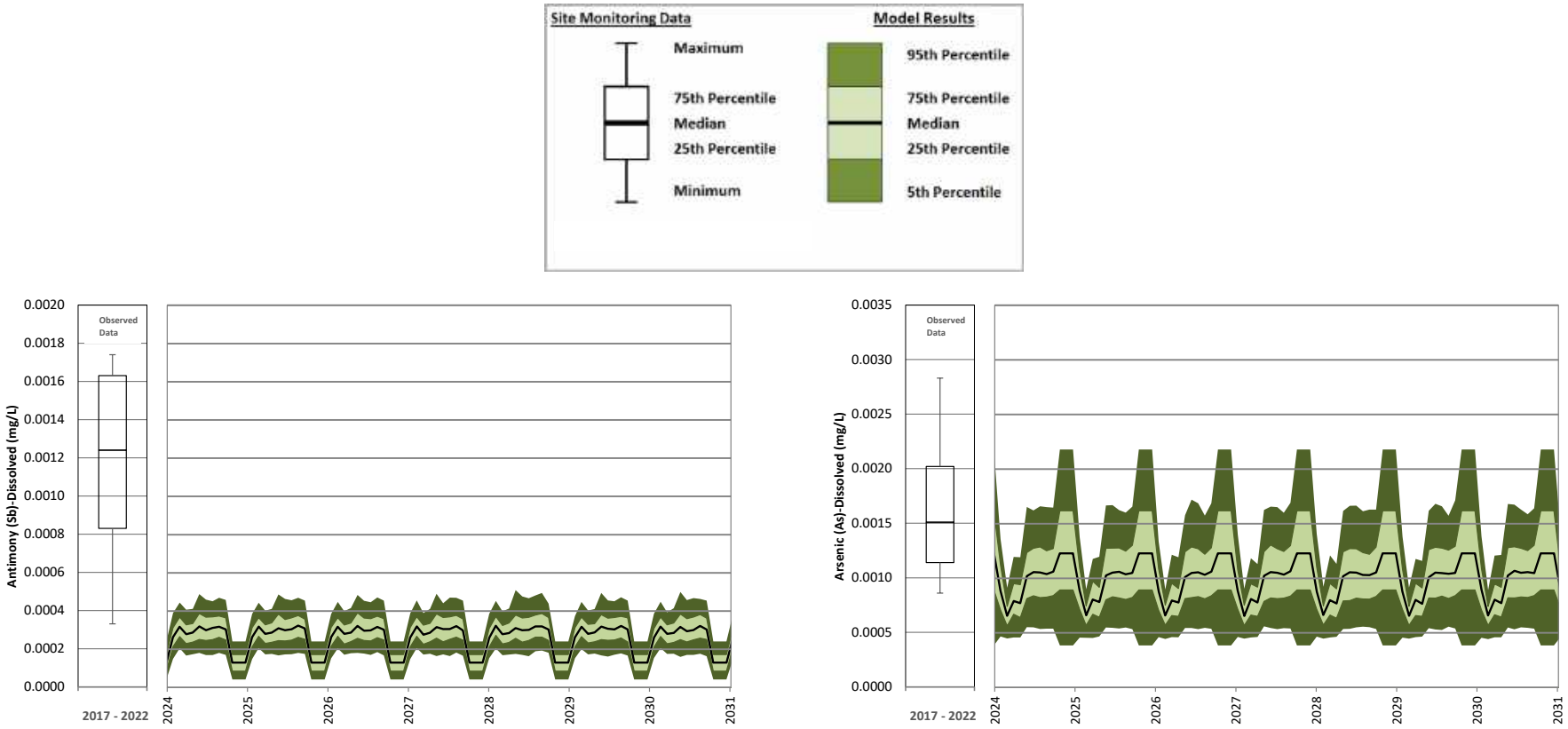


Figure B **8: Springer Pit Operations – Dissolved Antimony and Dissolved Arsenic**

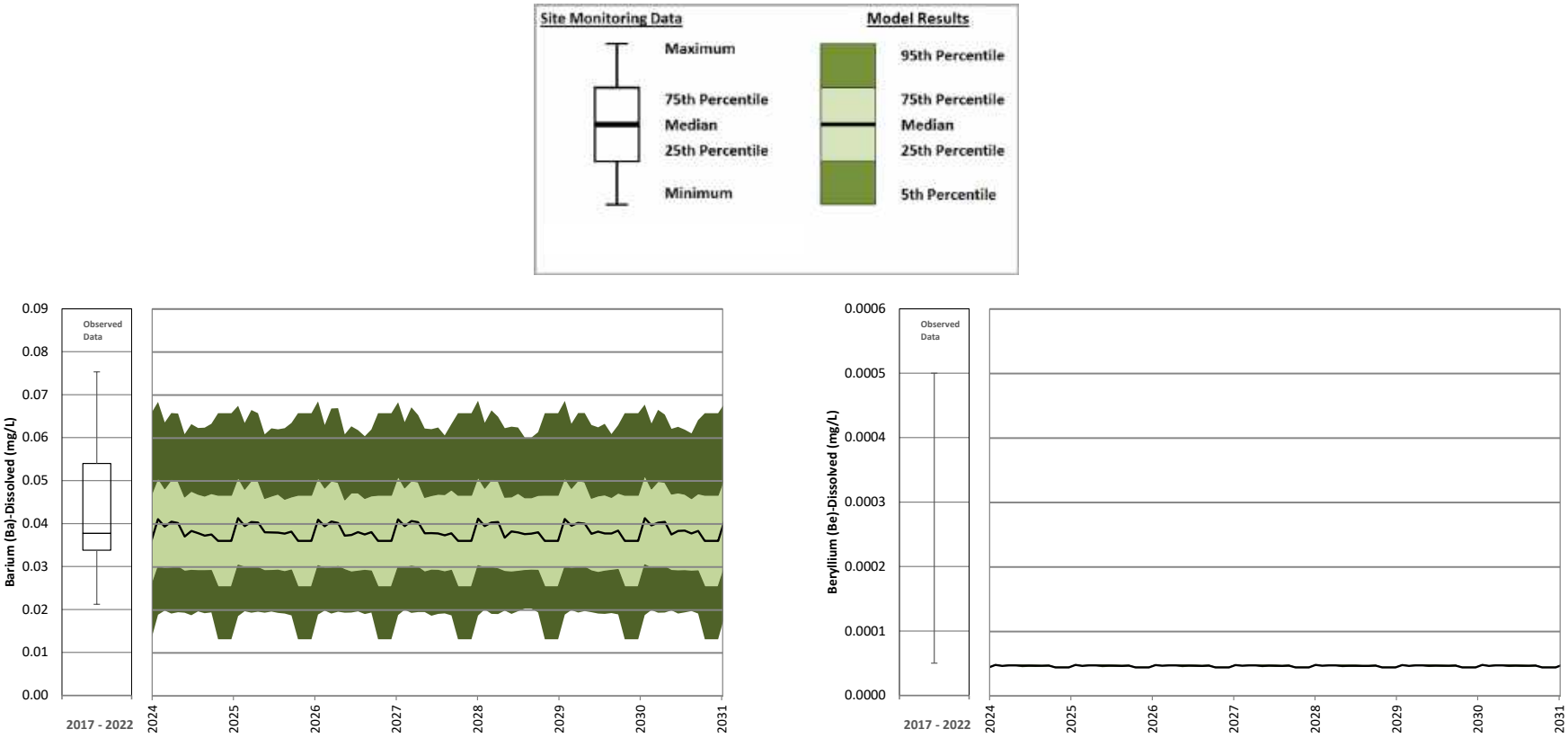


Figure B **9: Springer Pit Operations – Dissolved Barium and Dissolved Beryllium**

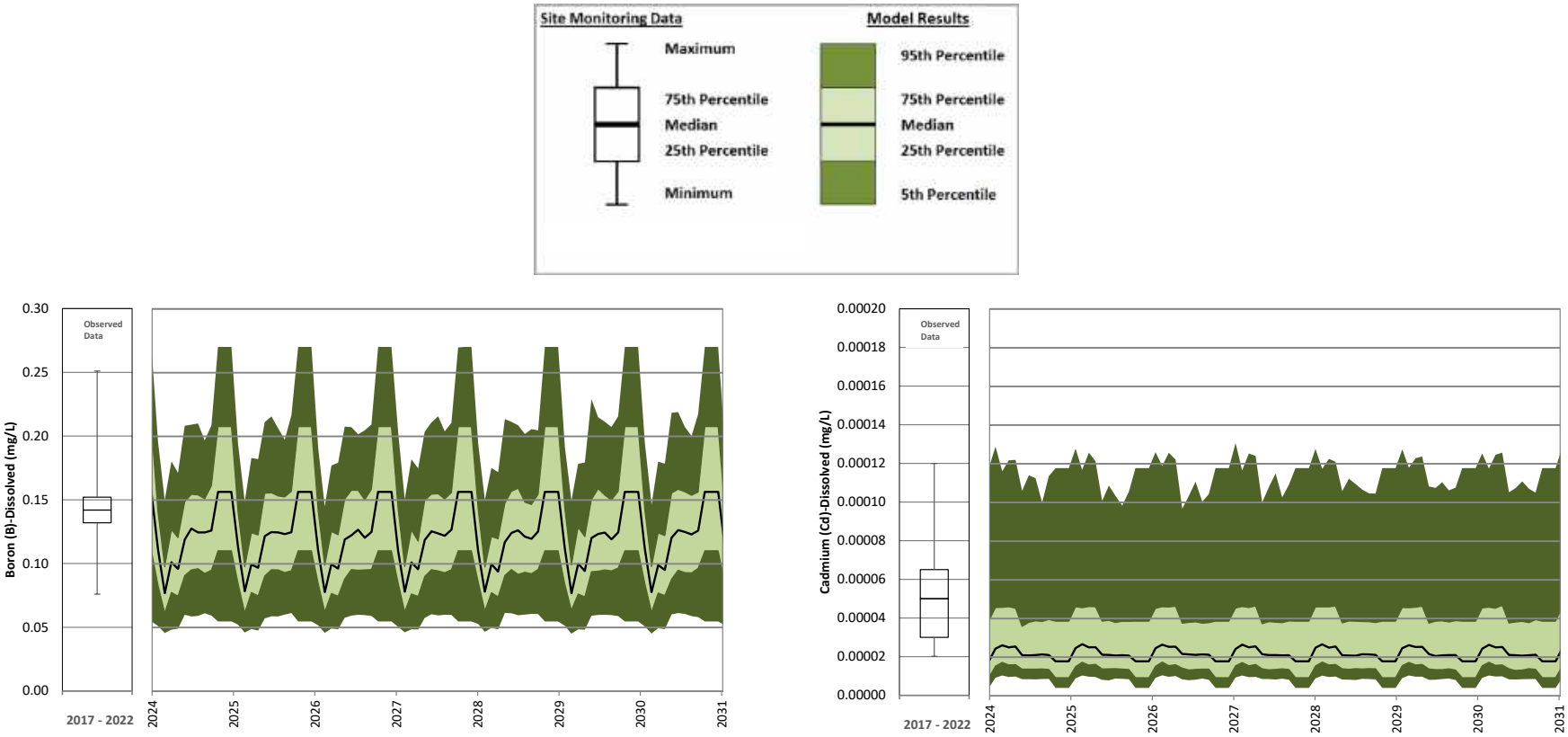


Figure B **10: Springer Pit Operations – Dissolved Boron and Dissolved Cadmium**

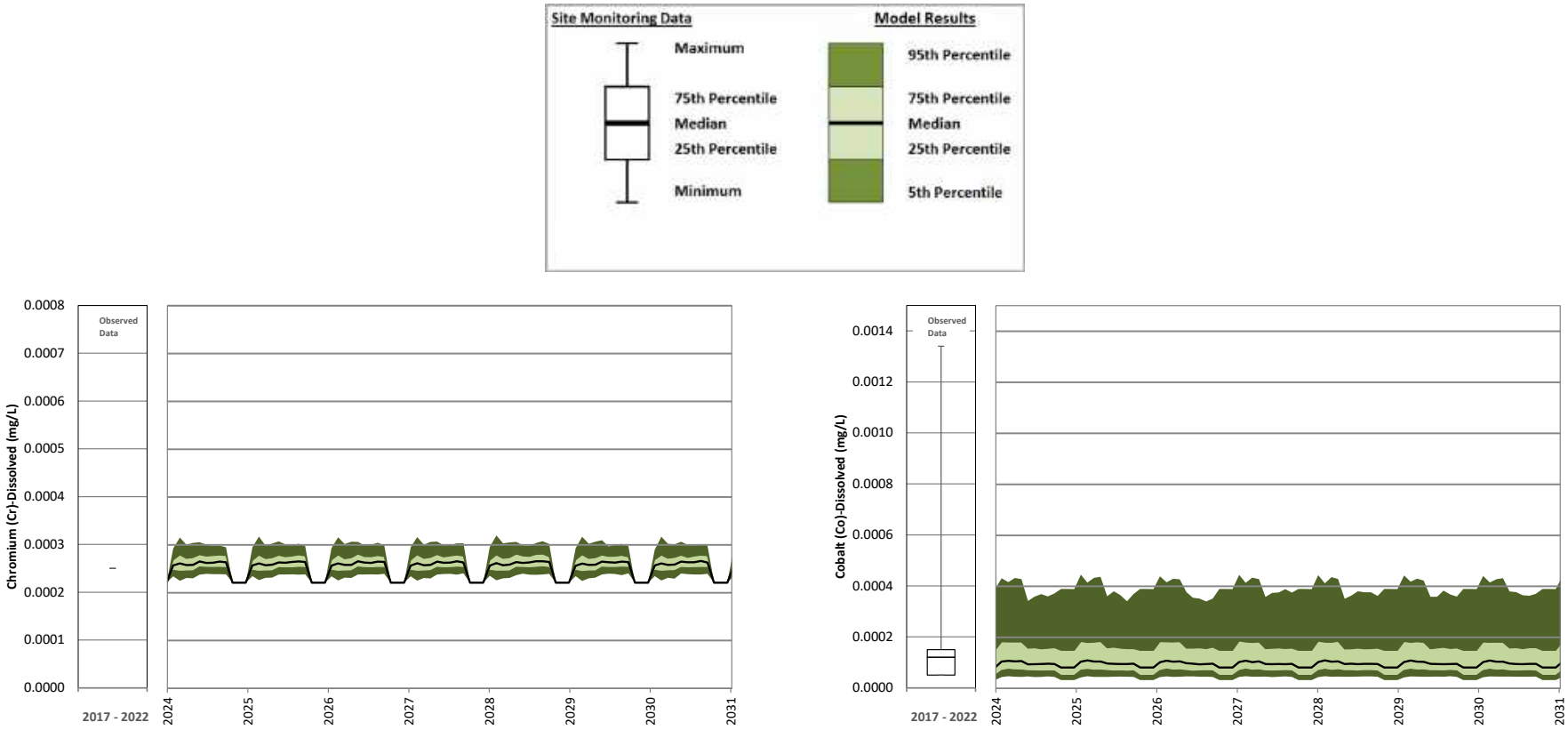


Figure B **11: Springer Pit Operations – Dissolved Chromium and Dissolved Cobalt**

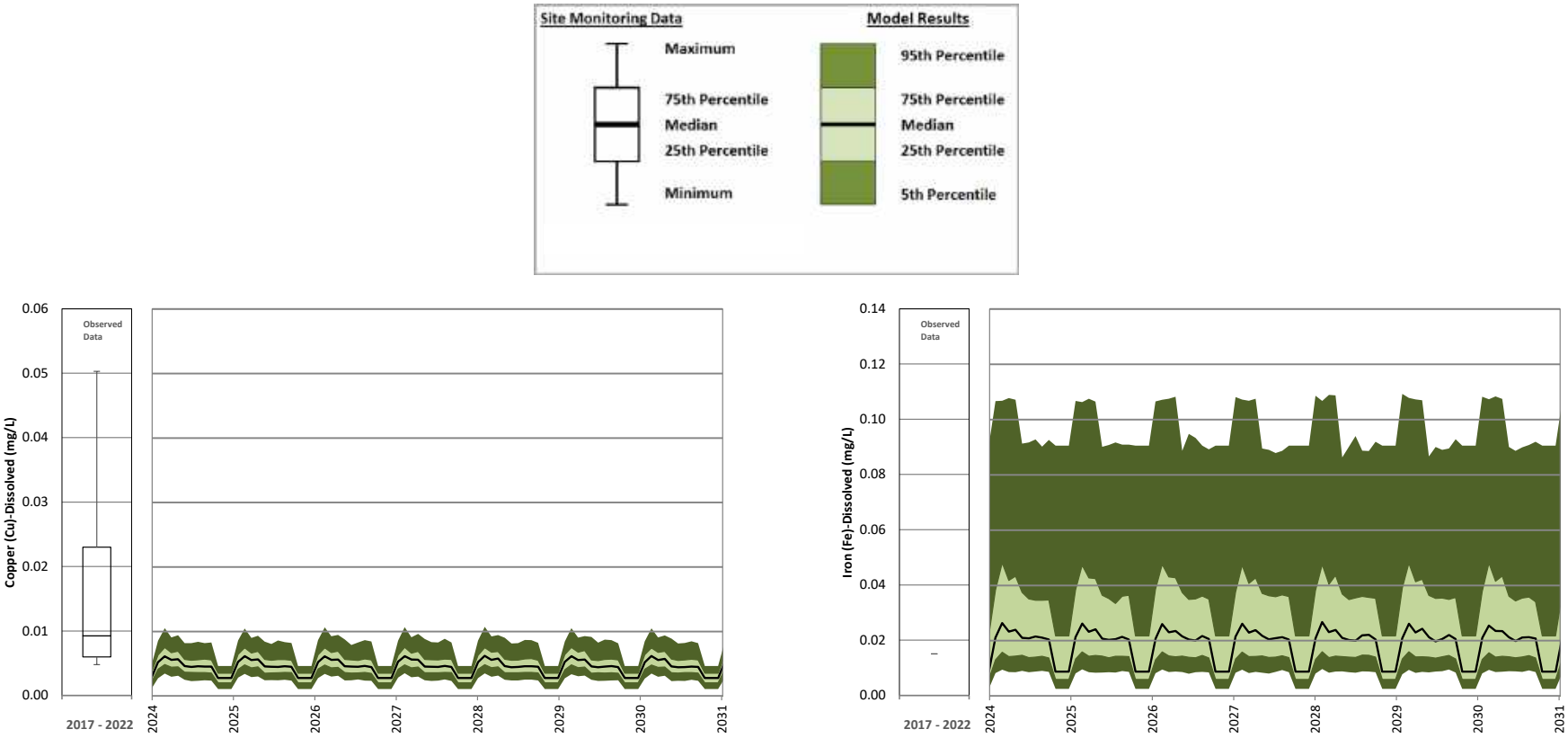


Figure B **12: Springer Pit Operations – Dissolved Copper and Dissolved Iron**

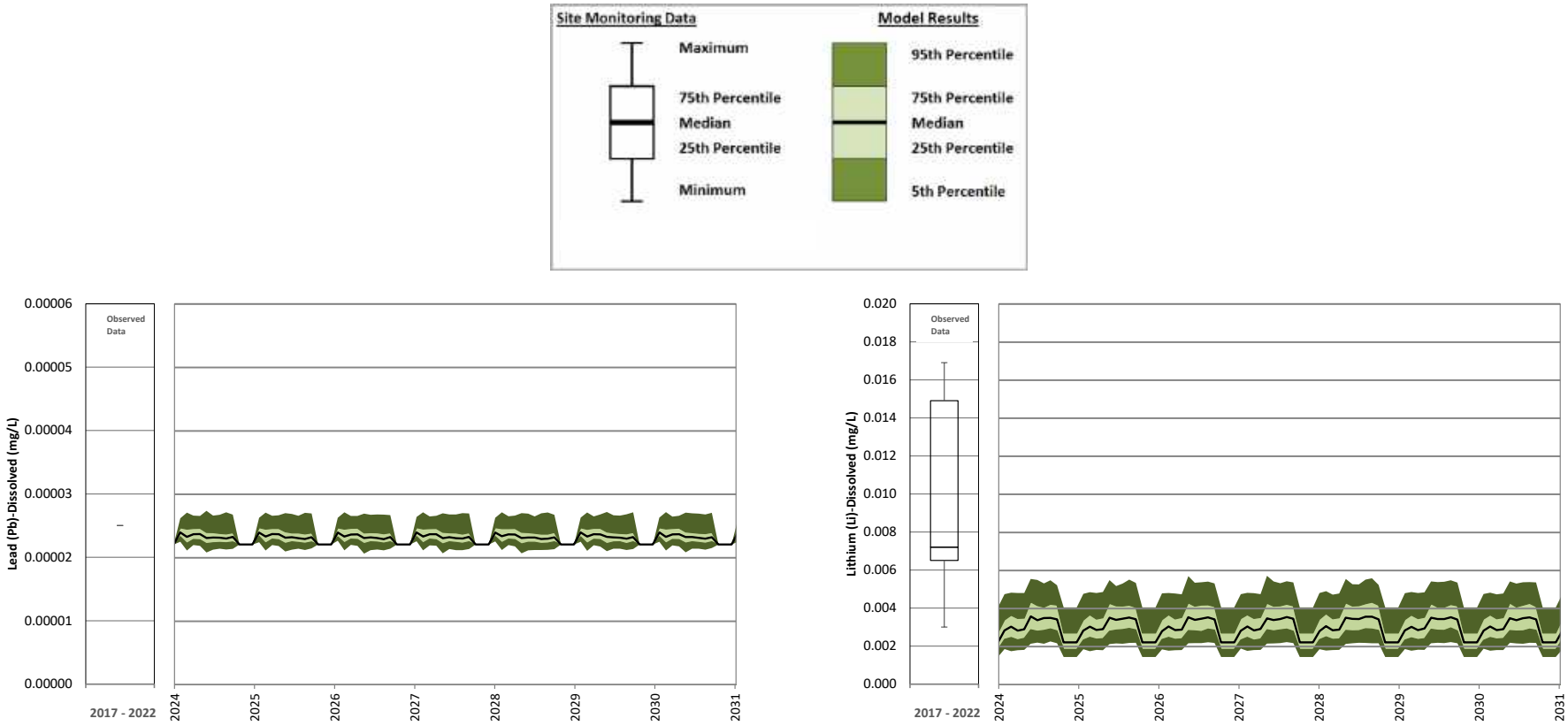


Figure B **13: Springer Pit Operations – Dissolved Lead and Dissolved Lithium**

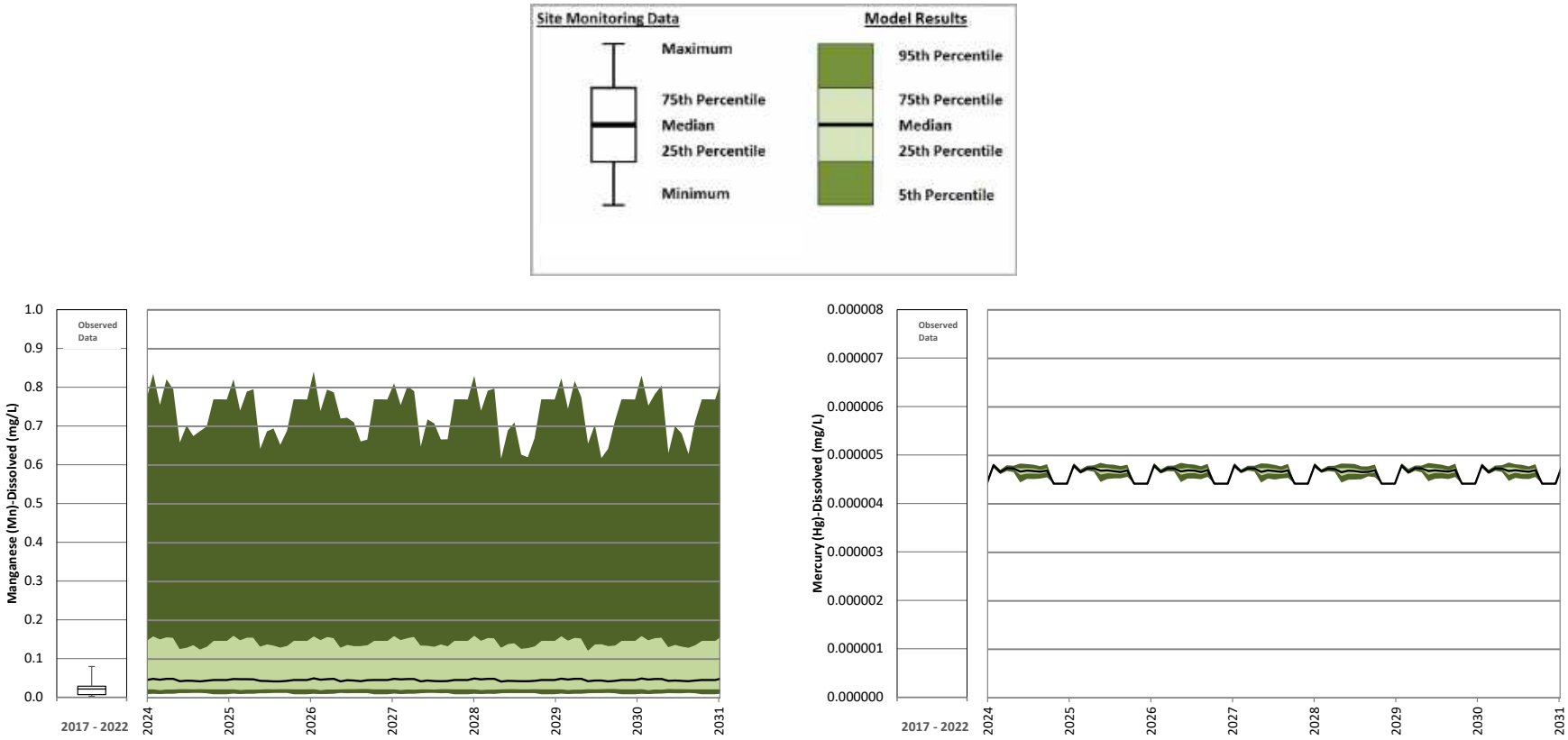


Figure B **14: Springer Pit Operations – Dissolved Manganese and Dissolved Mercury**

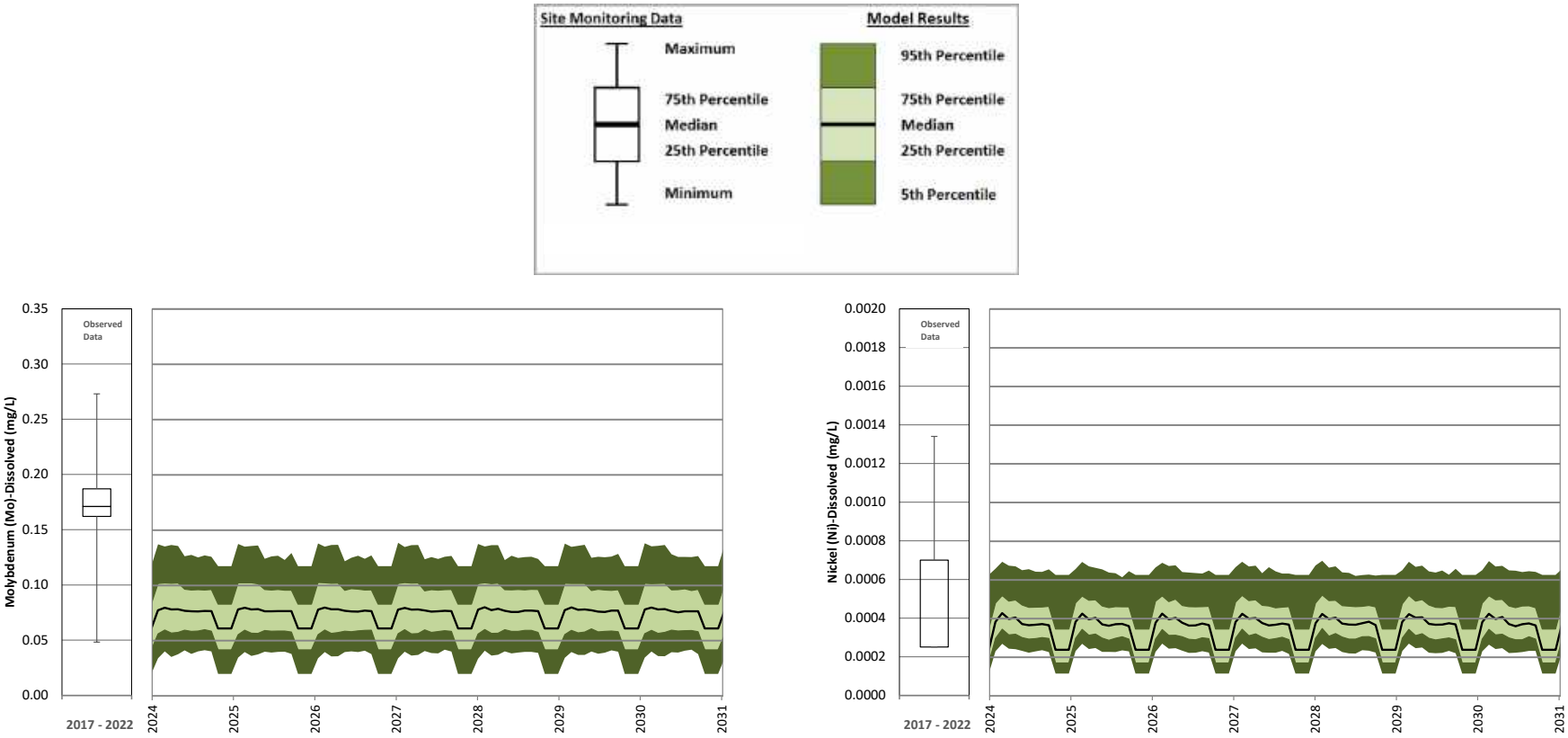


Figure B **15: Springer Pit Operations – Dissolved Molybdenum and Dissolved Nickel**

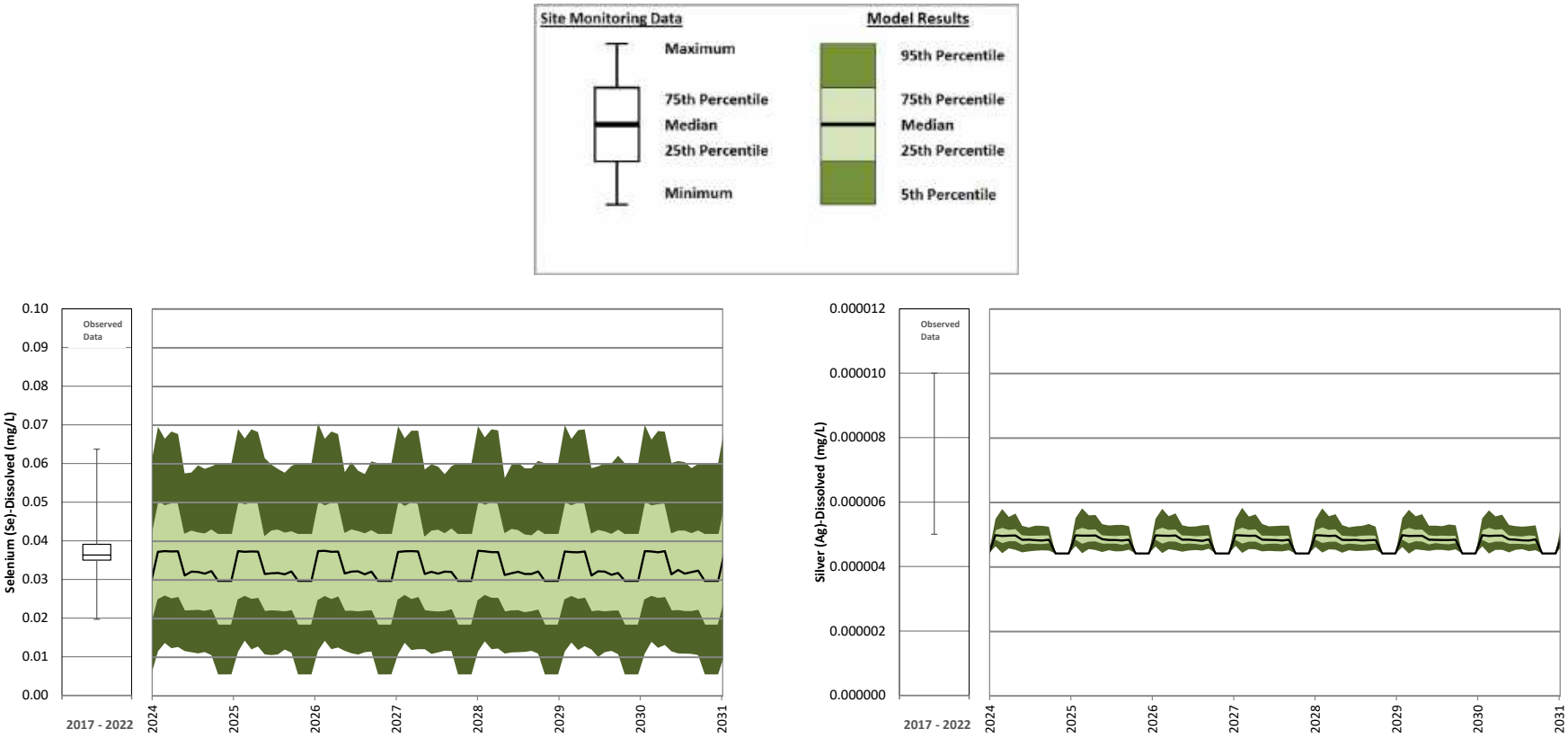


Figure B **16: Springer Pit Operations – Dissolved Selenium and Dissolved Silver**

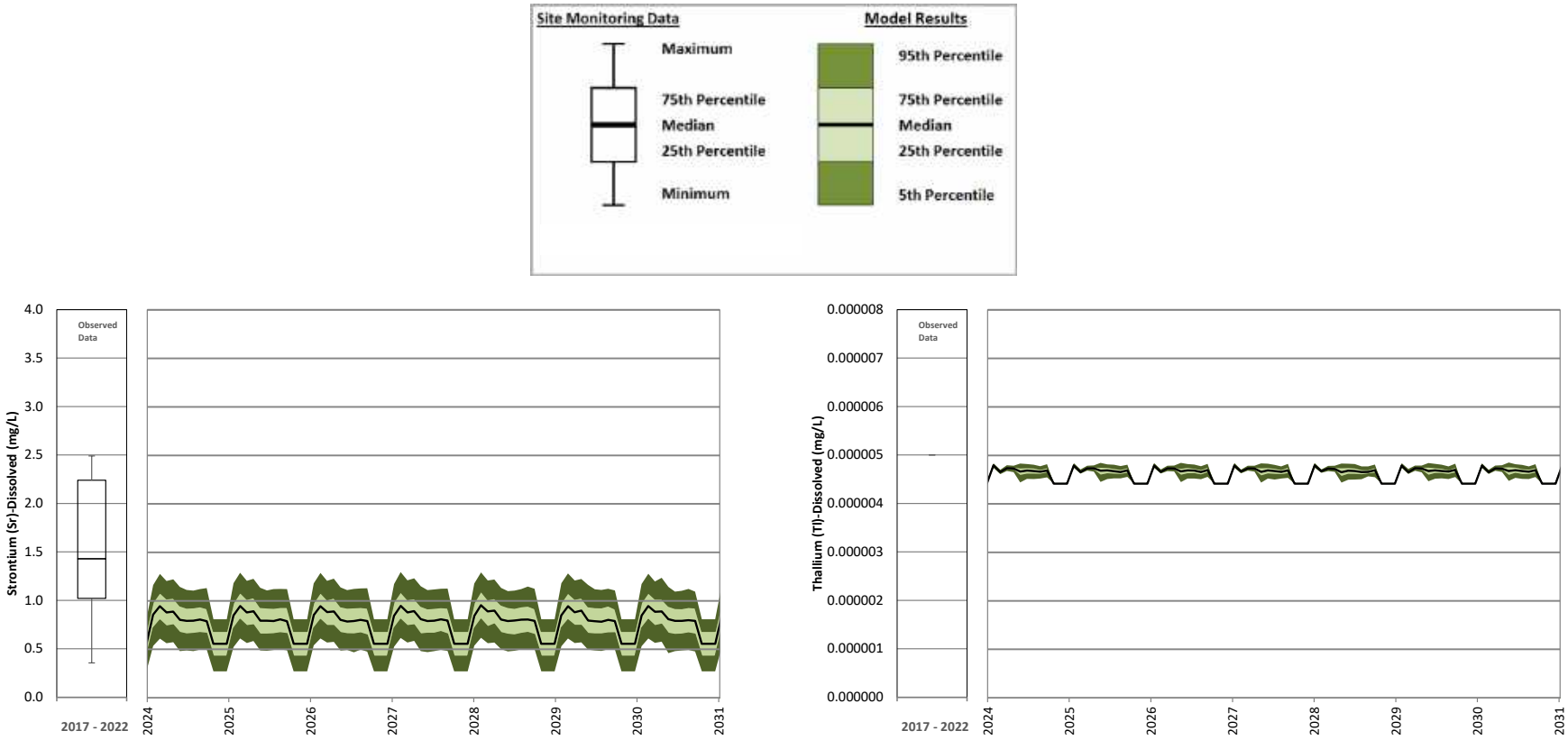


Figure B **17: Springer Pit Operations – Dissolved Strontium and Dissolved Thallium**

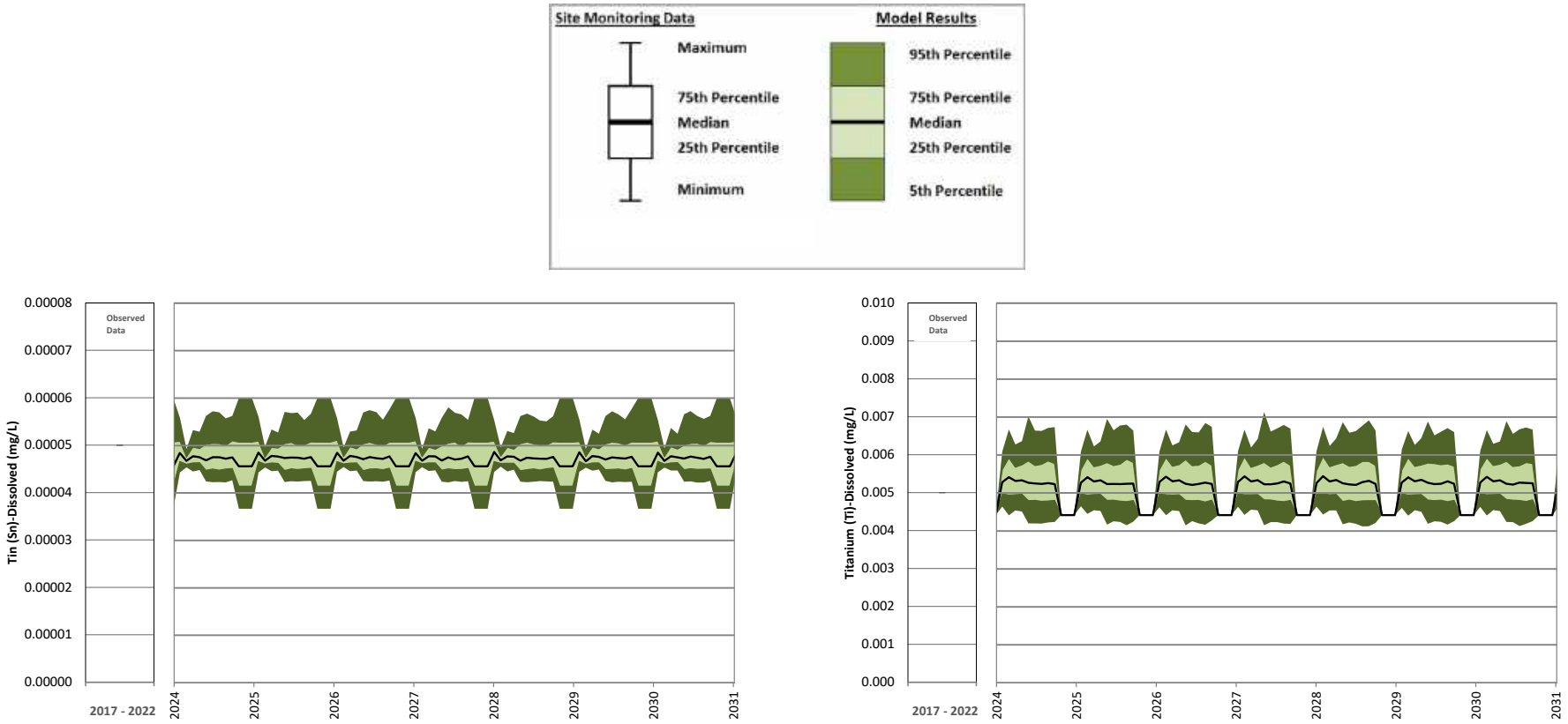


Figure B **18: Springer Pit Operations – Dissolved Tin and Dissolved Titanium**

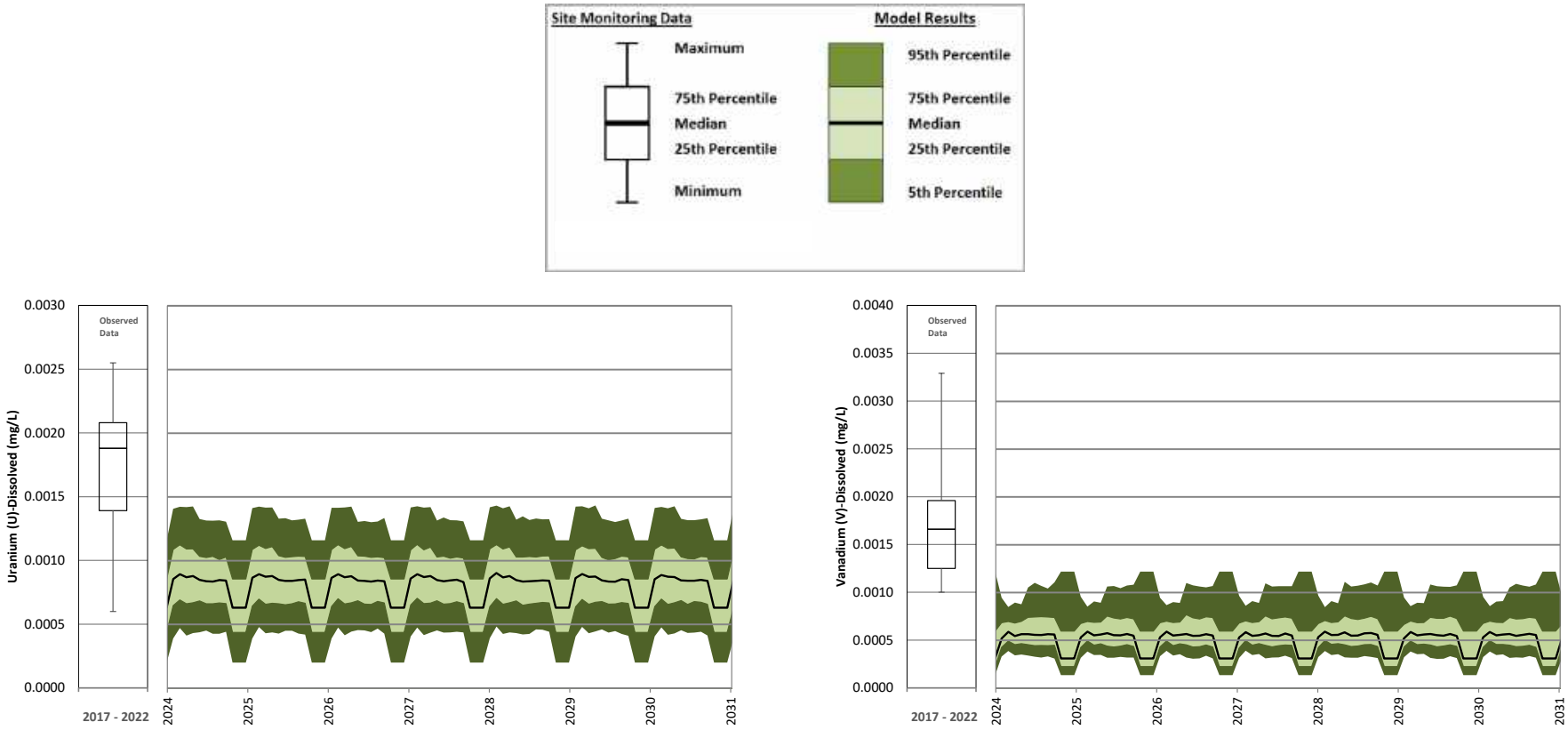


Figure B **19: Springer Pit Operations – Dissolved Uranium and Dissolved Vanadium**

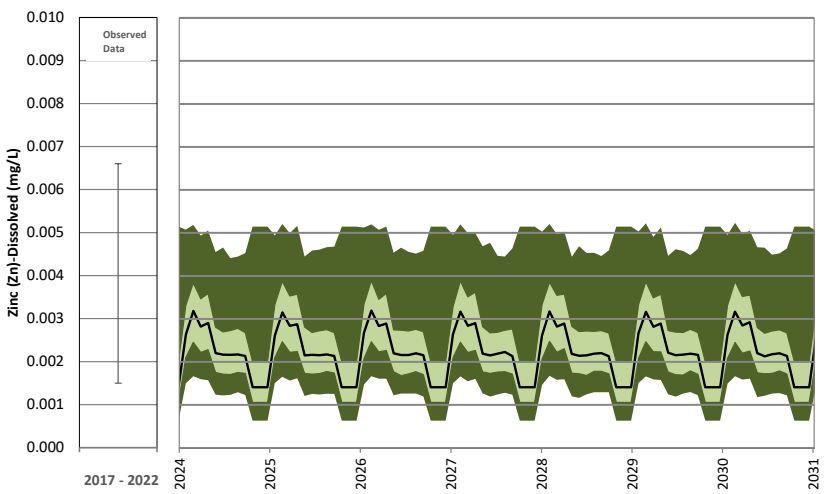


Figure B **20: Springer Pit Operations – Dissolved Zinc**

Cariboo Pit Operations

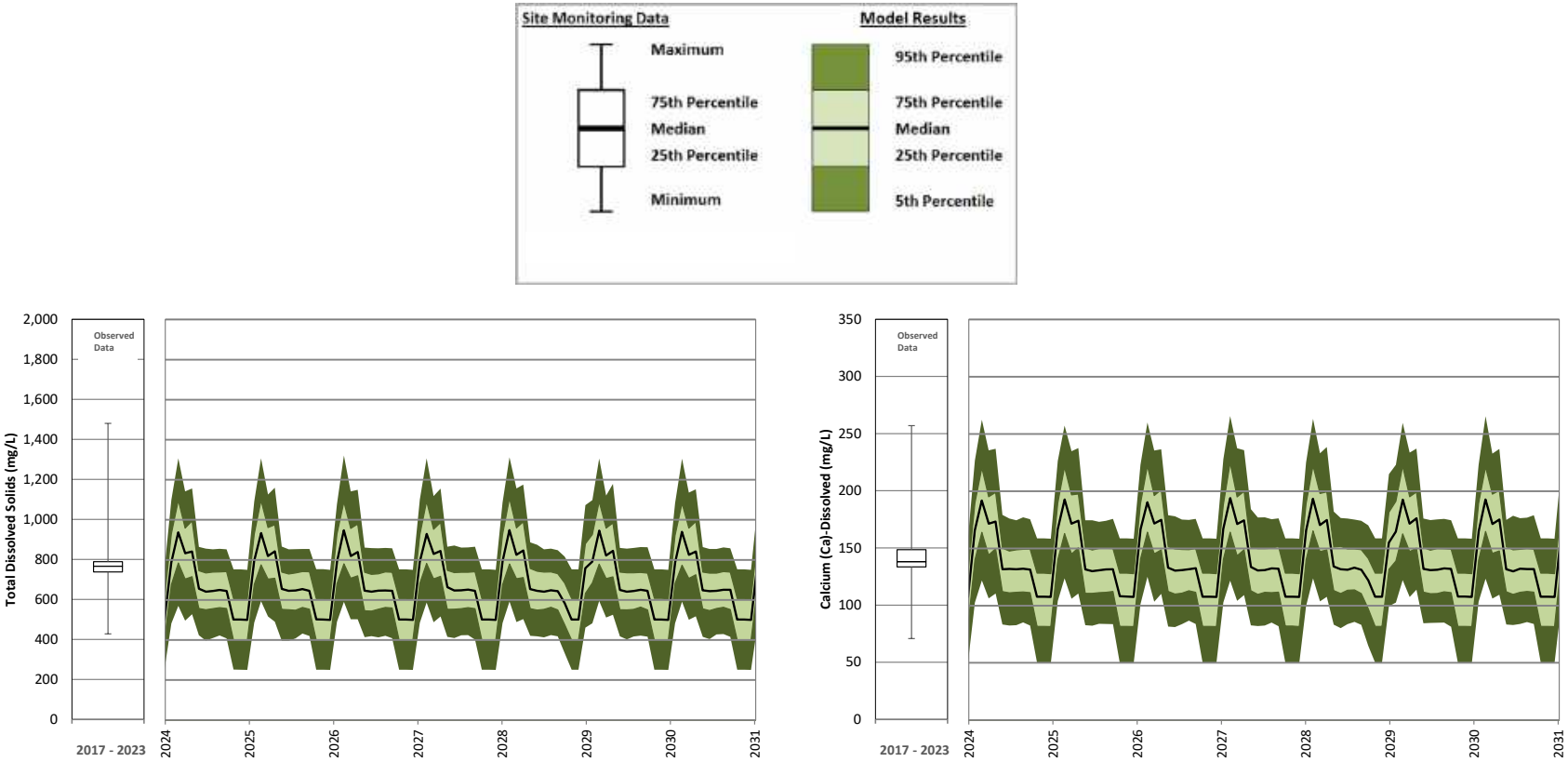


Figure B **21: Cariboo Pit Operations – Total Dissolved Solids and Calcium**

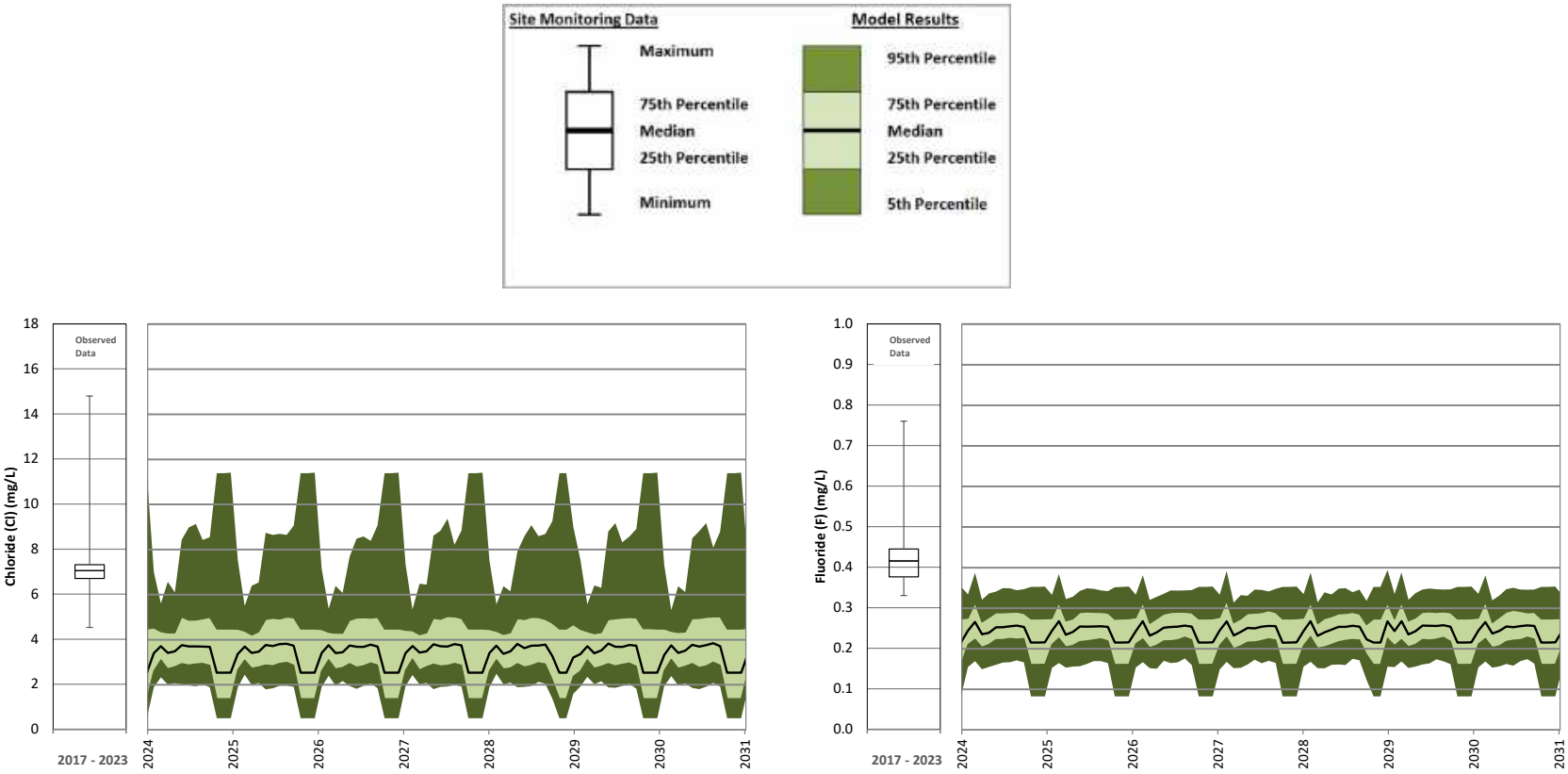


Figure B **22: Cariboo Pit Operations – Chloride and Fluoride**

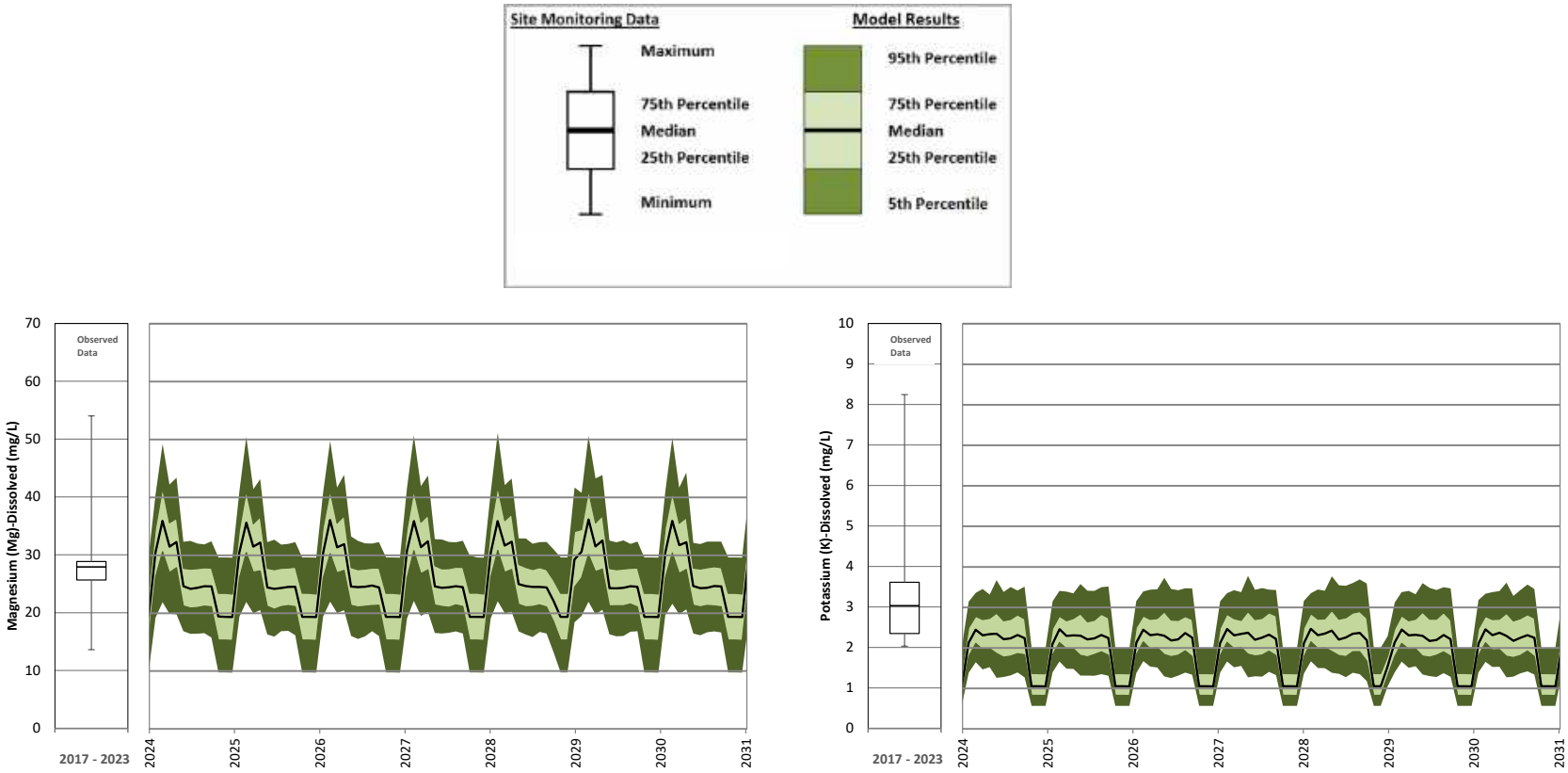


Figure B **23: Cariboo Pit Operations – Magnesium and Potassium**

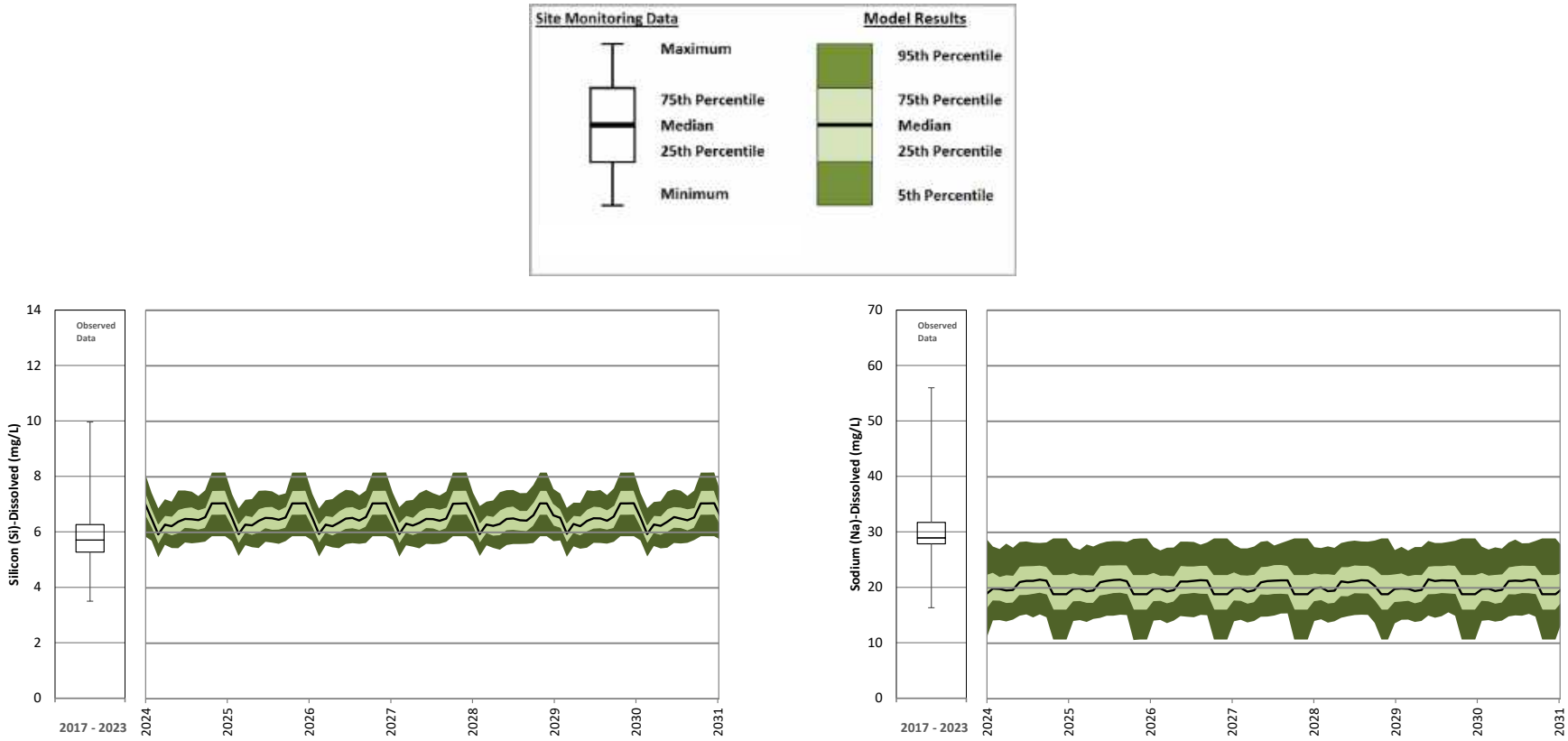


Figure B **24: Cariboo Pit Operations – Silicon and Sodium**

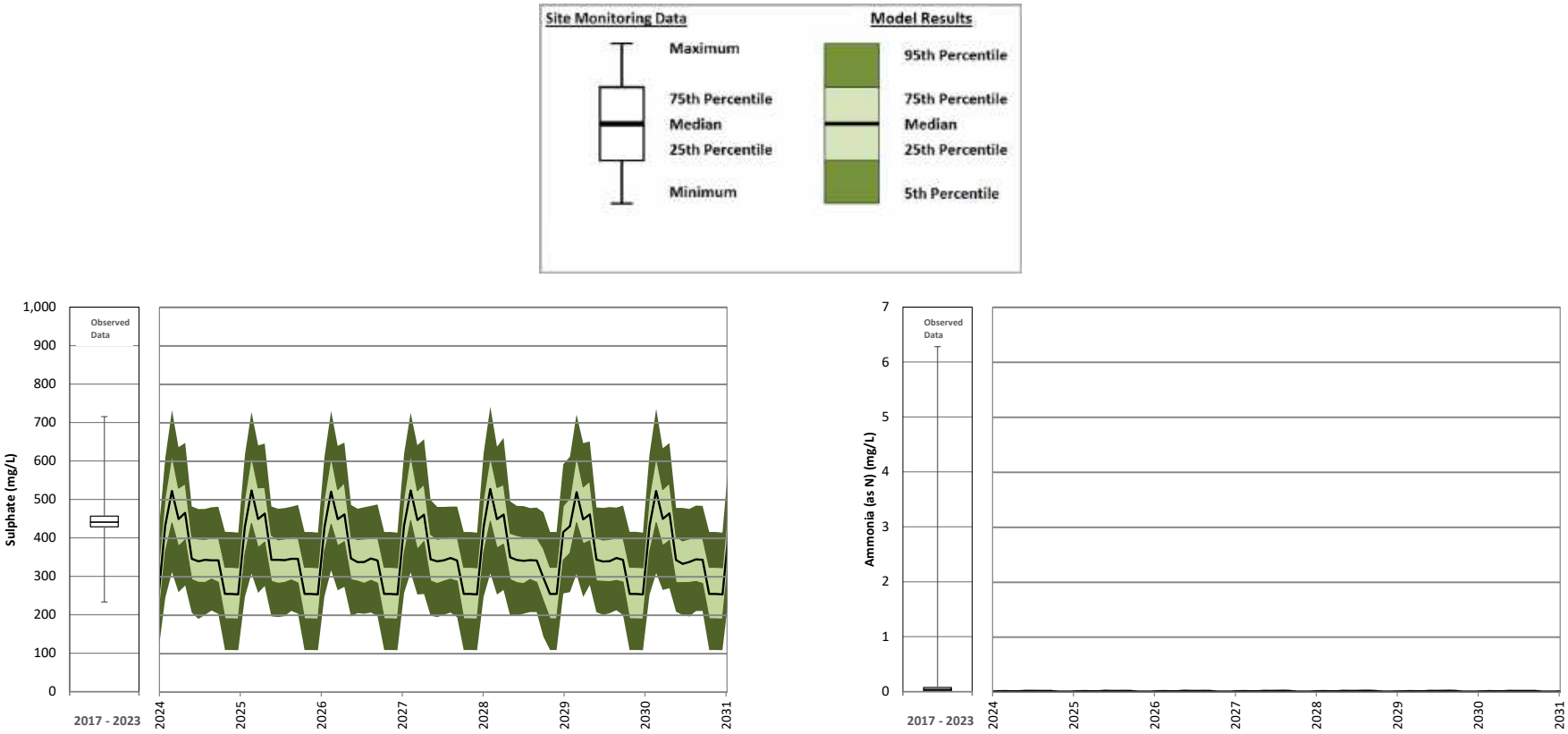


Figure B **25: Cariboo Pit Operations – Sulphate and Total Ammonia**

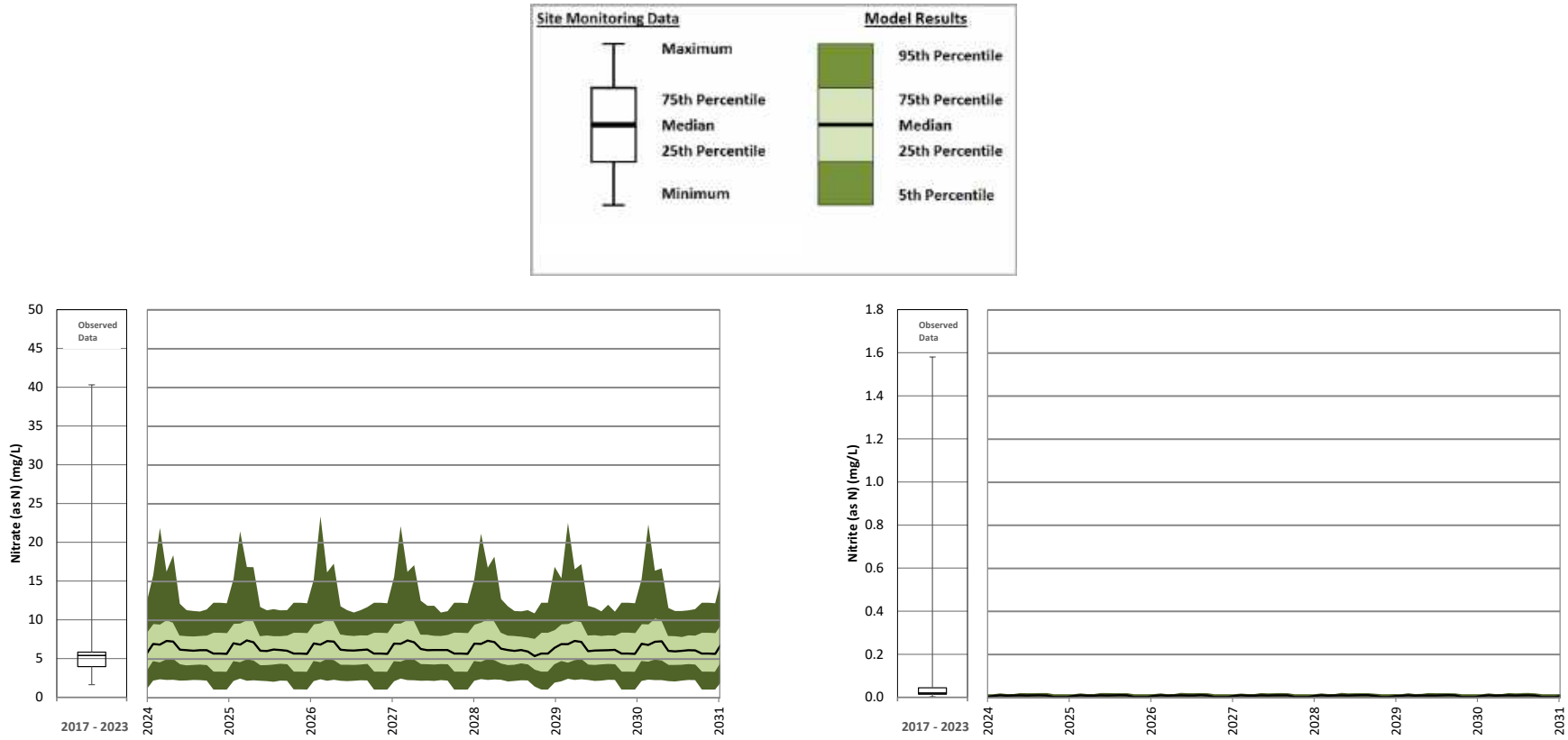


Figure B **26: Cariboo Pit Operations – Nitrate and Nitrite**

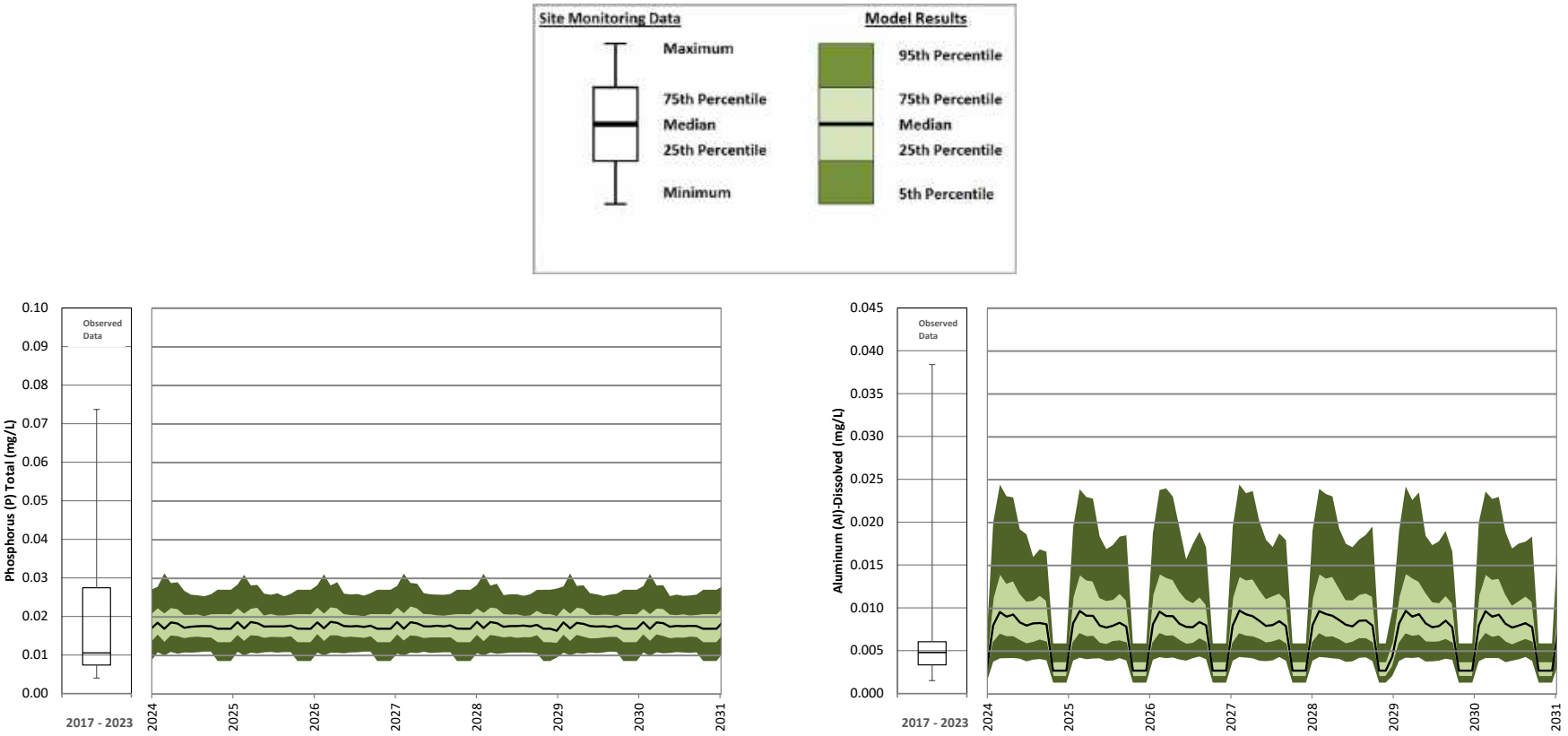


Figure B **27: Cariboo Pit Operations – Total Phosphorus and Dissolved Aluminum**

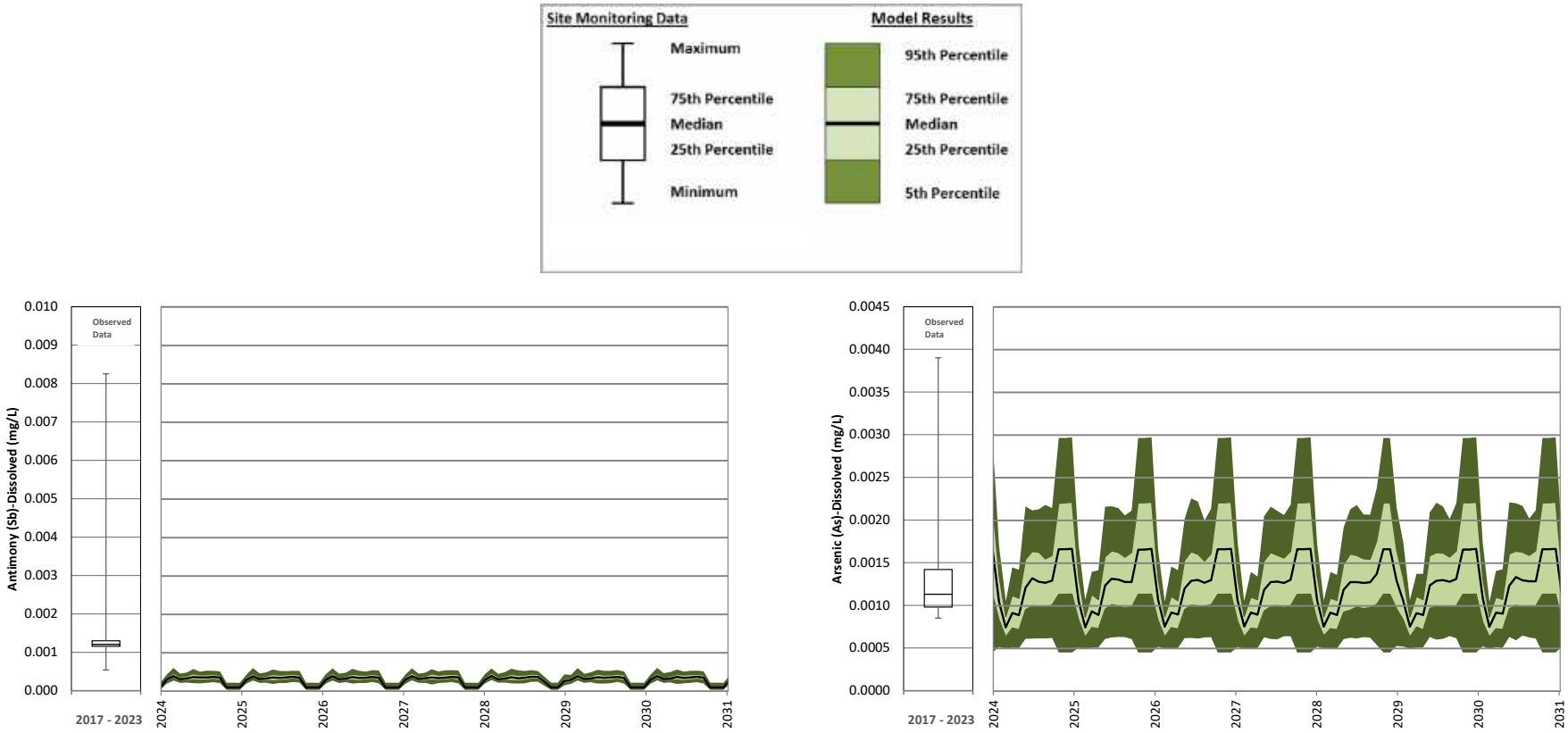


Figure B **28: Cariboo Pit Operations – Dissolved Antimony and Dissolved Arsenic**

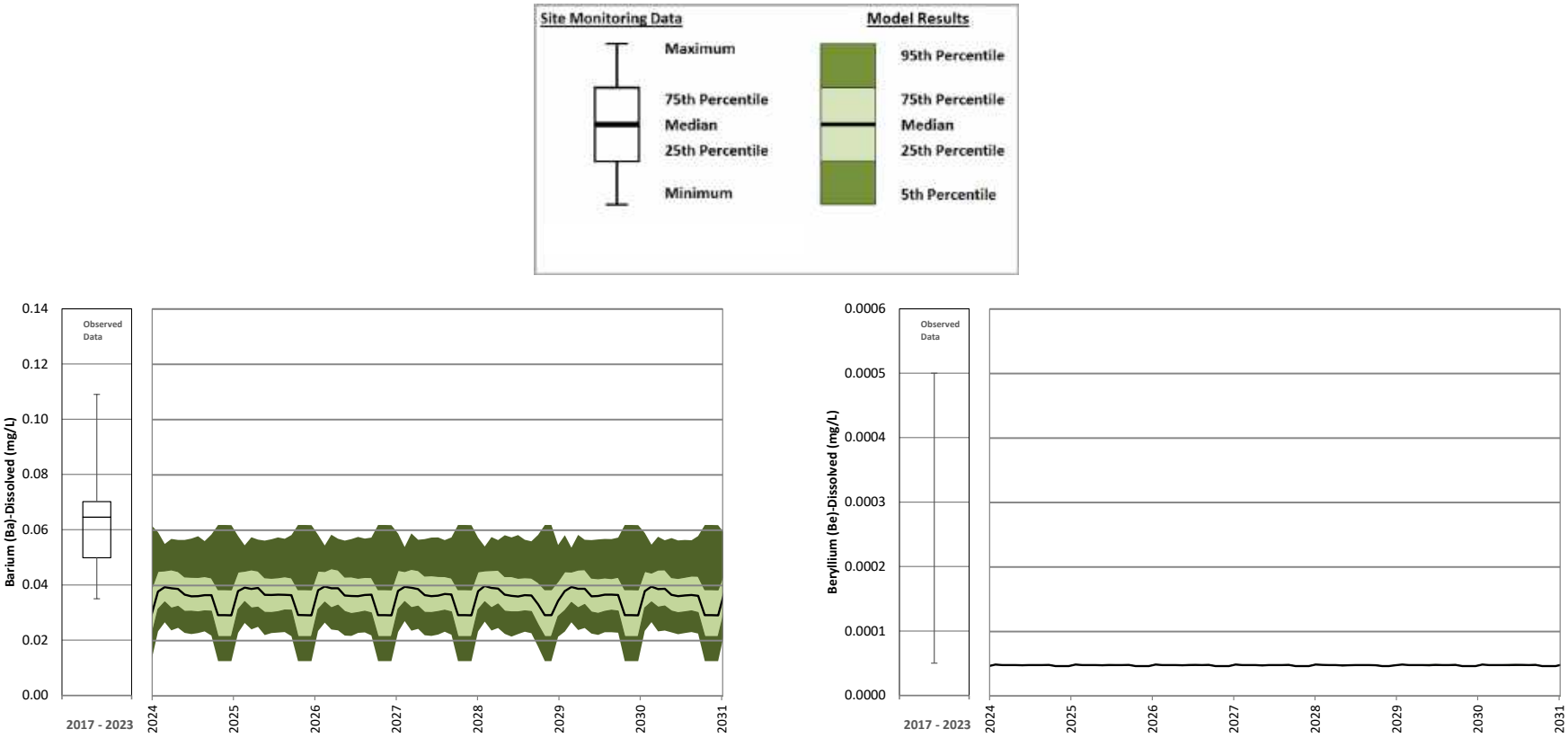


Figure B **29: Cariboo Pit Operations – Dissolved Barium and Dissolved Beryllium**

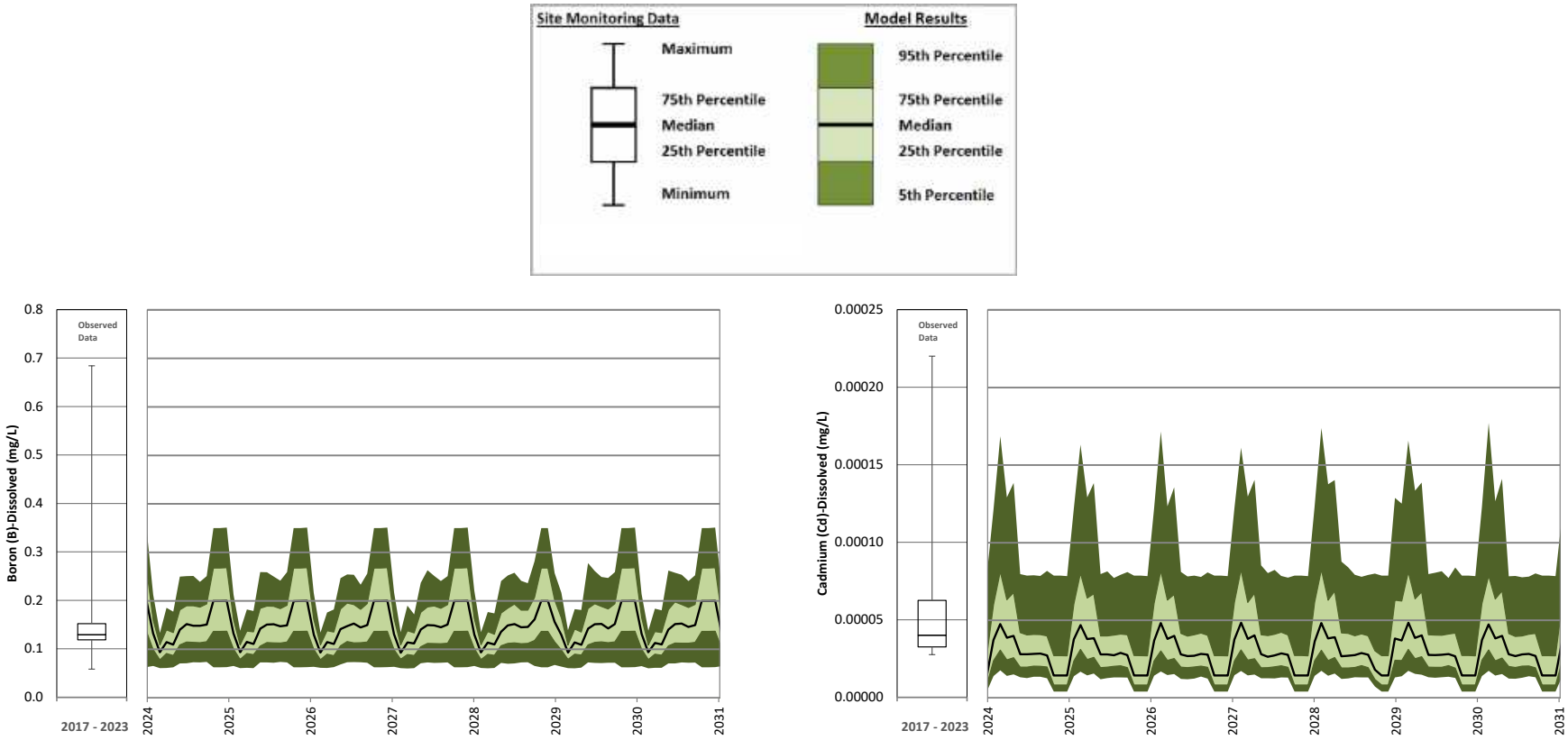


Figure B **30: Cariboo Pit Operations – Dissolved Boron and Dissolved Cadmium**

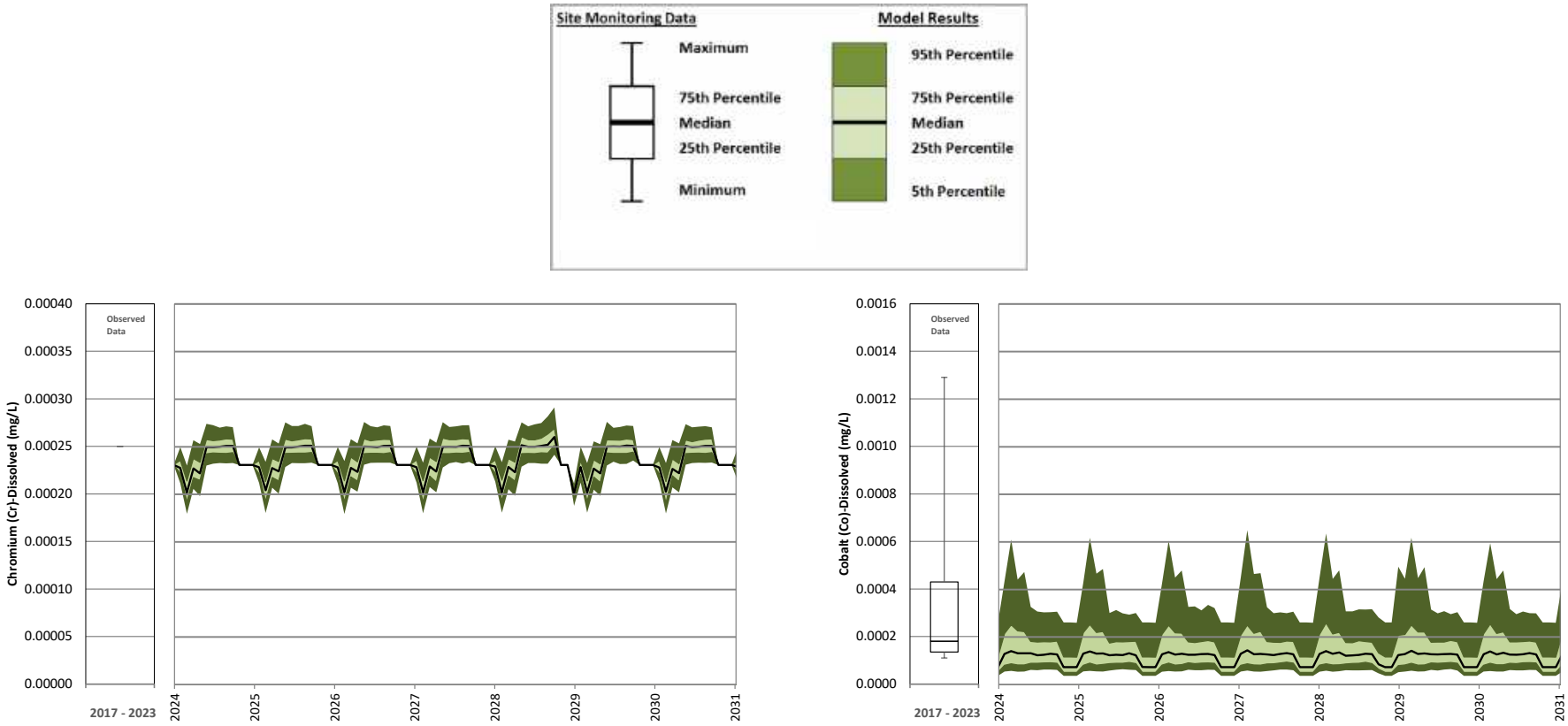


Figure B **31: Cariboo Pit Operations – Dissolved Chromium and Dissolved Cobalt**

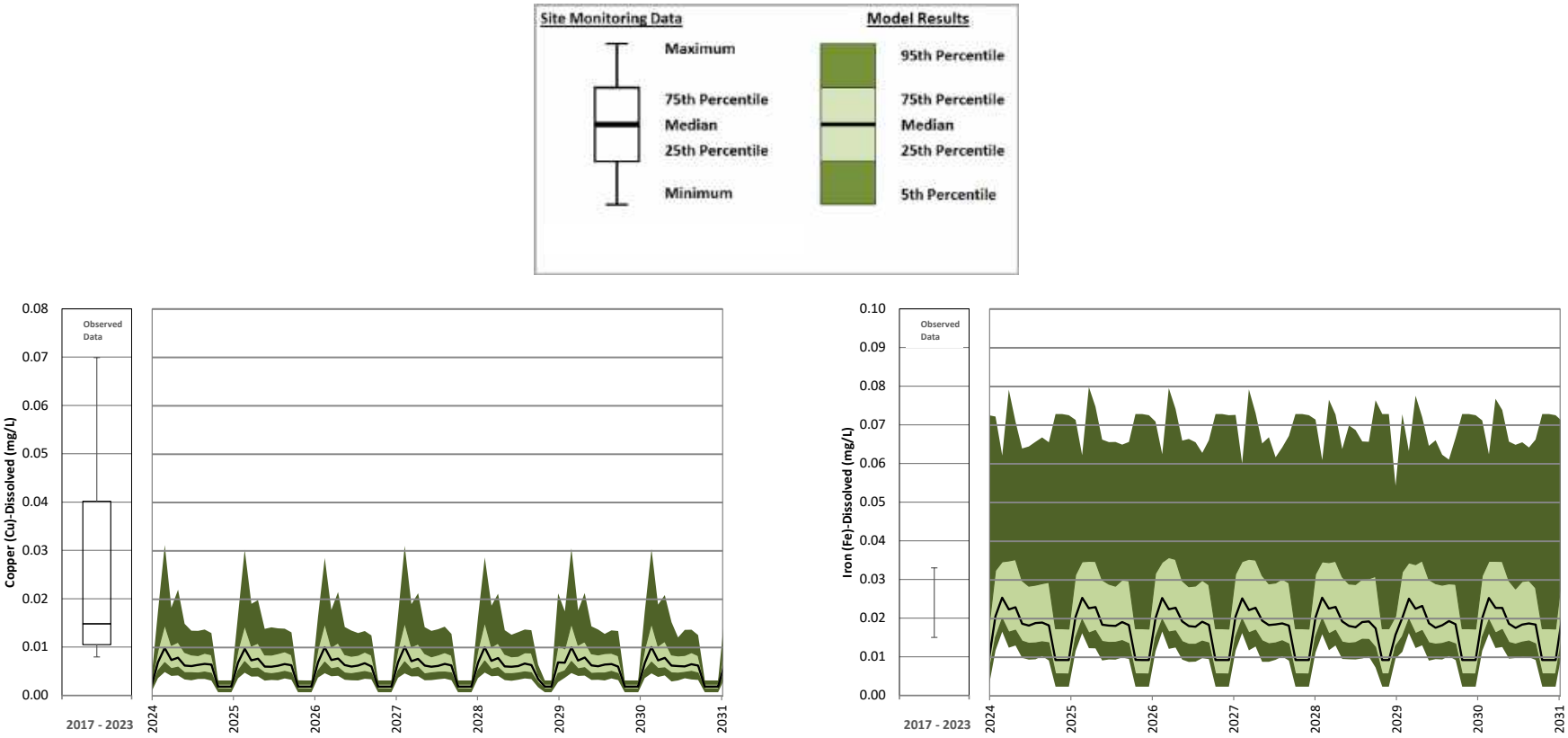


Figure B **32: Cariboo Pit Operations – Dissolved Copper and Dissolved Iron**

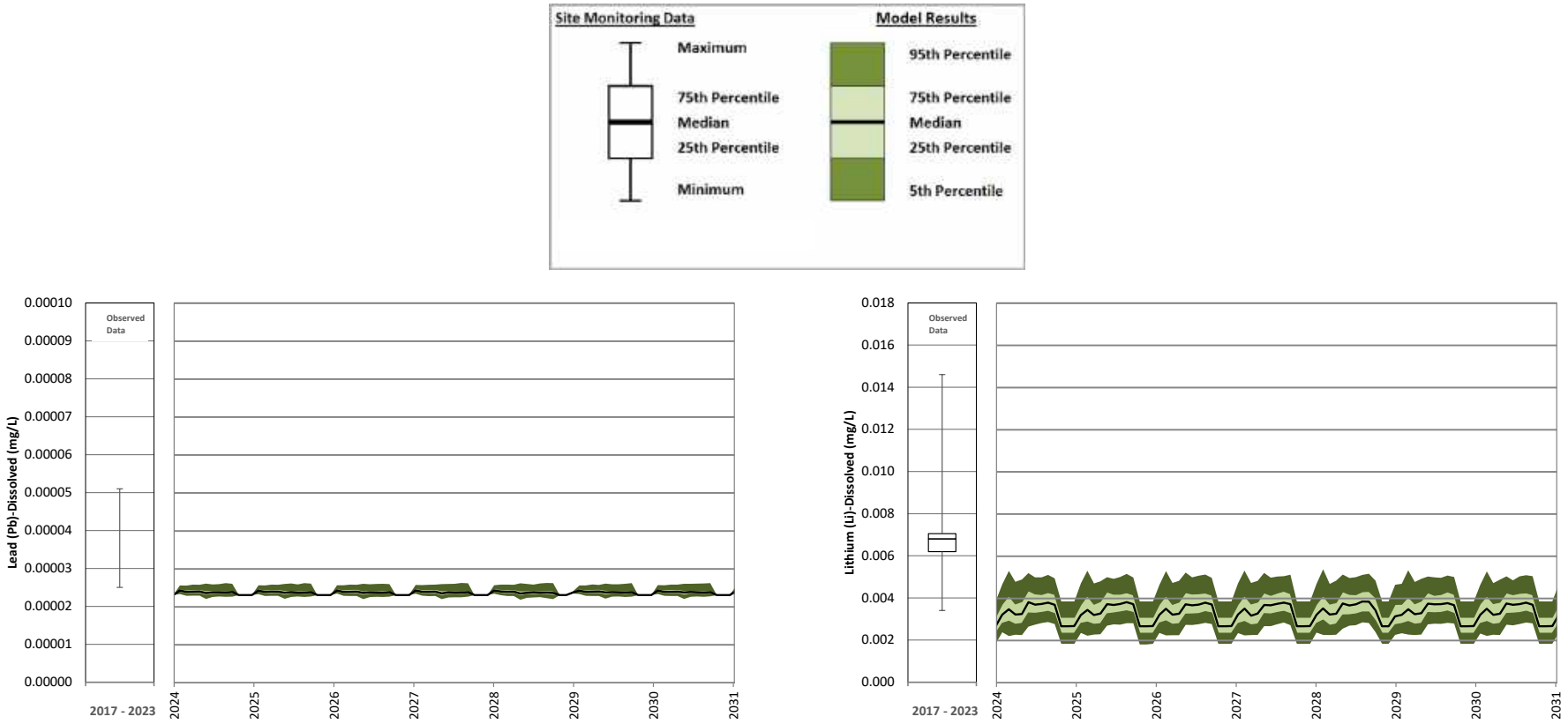


Figure B **33: Cariboo Pit Operations – Dissolved Lead and Dissolved Lithium**

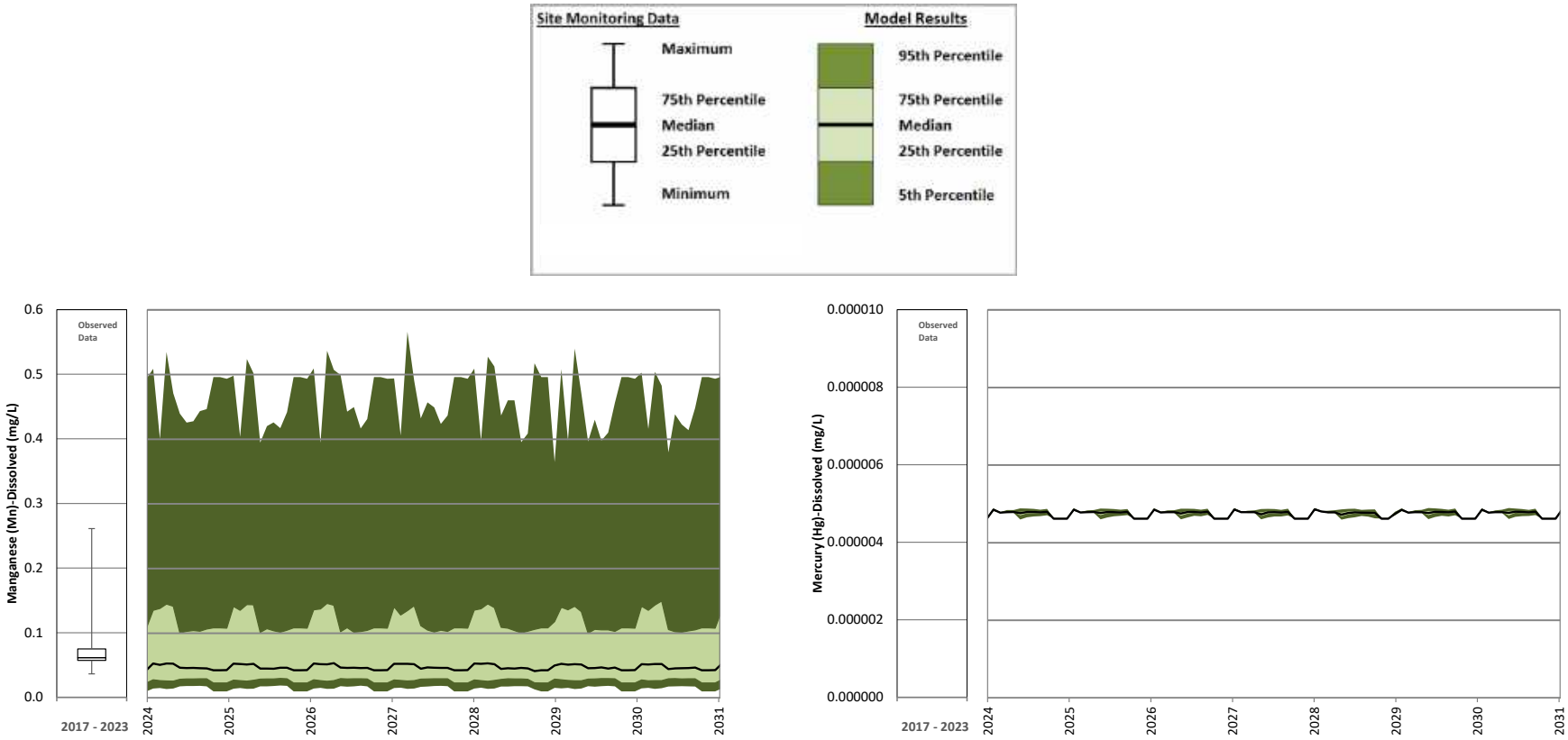


Figure B **34: Cariboo Pit Operations – Dissolved Manganese and Dissolved Mercury**

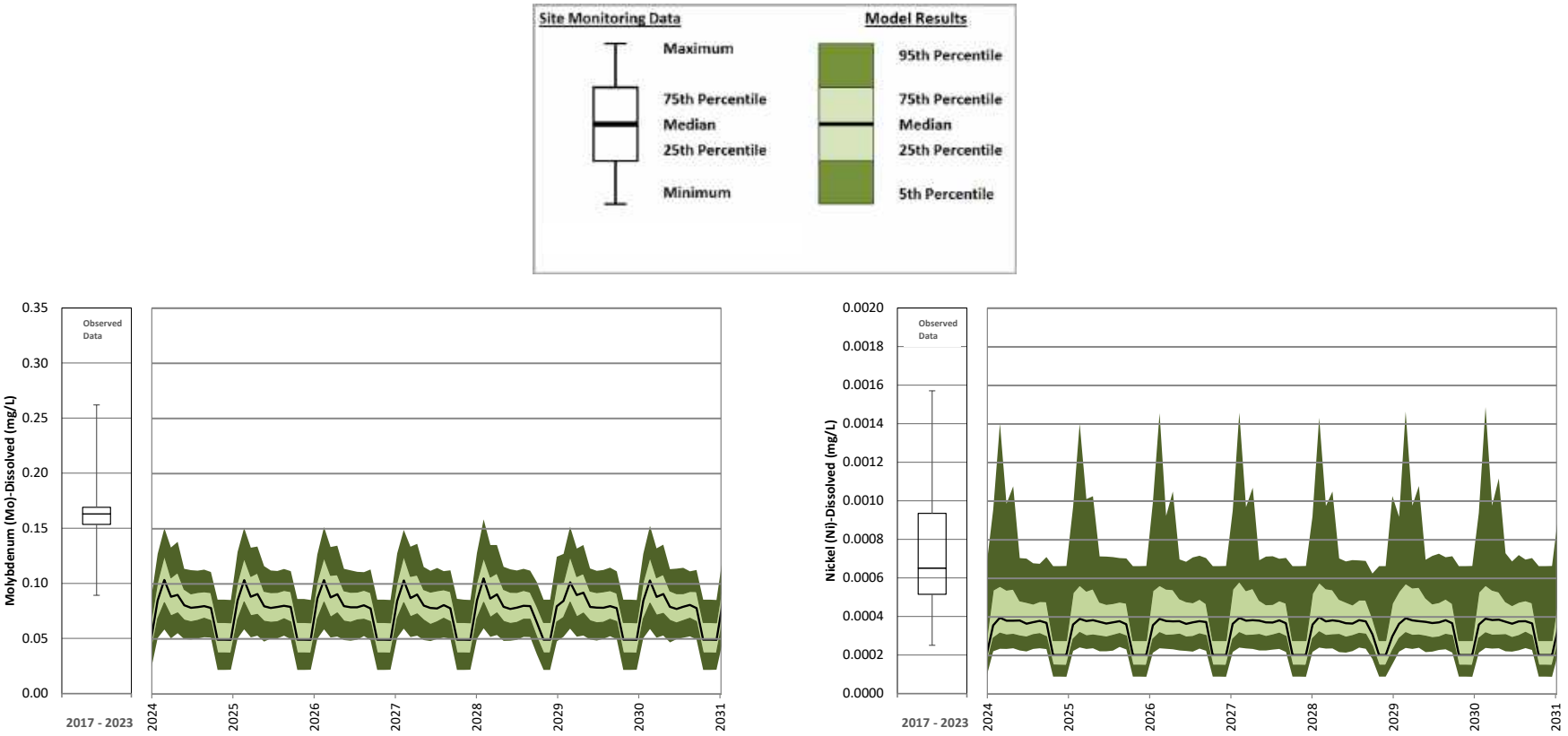


Figure B **35: Cariboo Pit Operations – Dissolved Molybdenum and Dissolved Nickel**

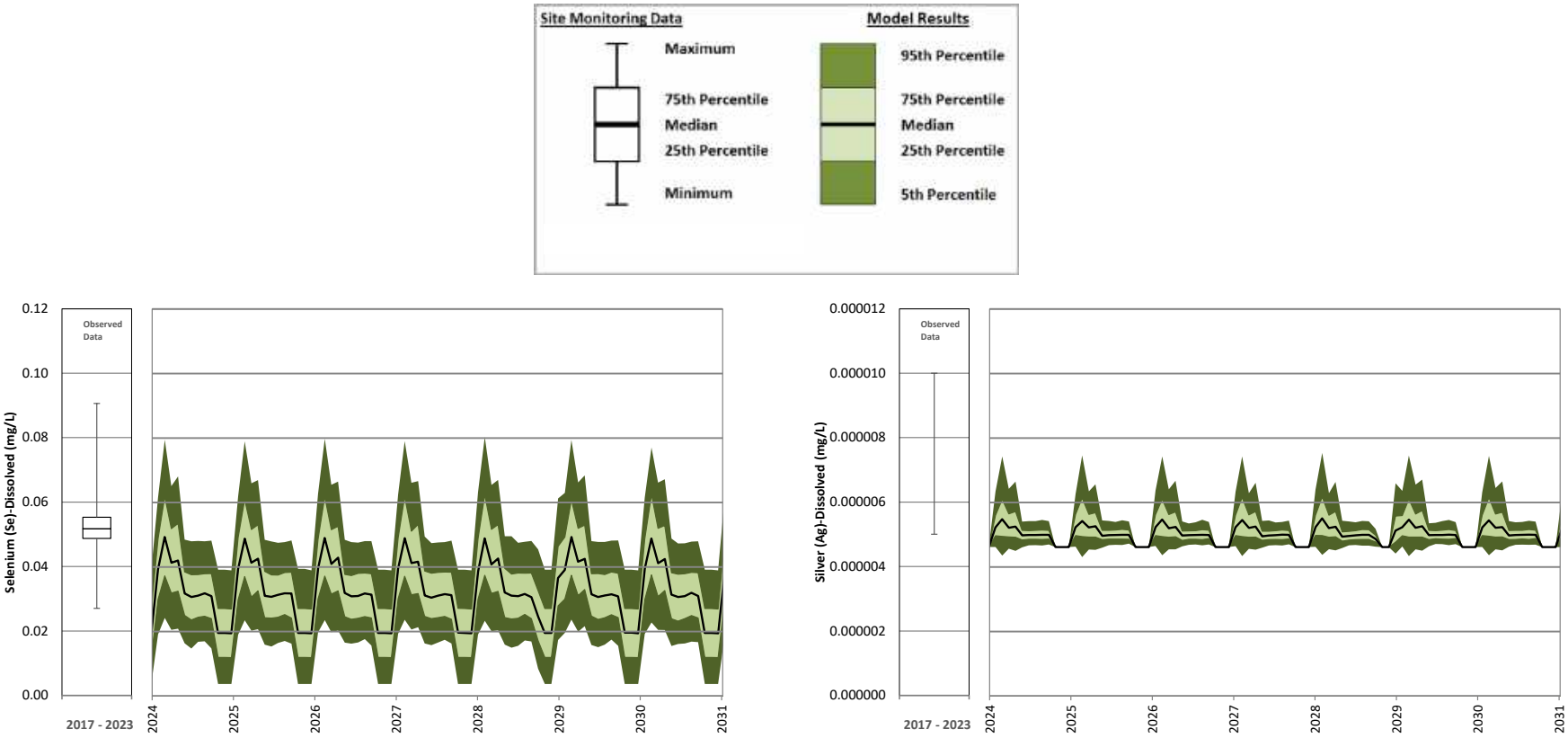


Figure B **36: Cariboo Pit Operations – Dissolved Selenium and Dissolved Silver**

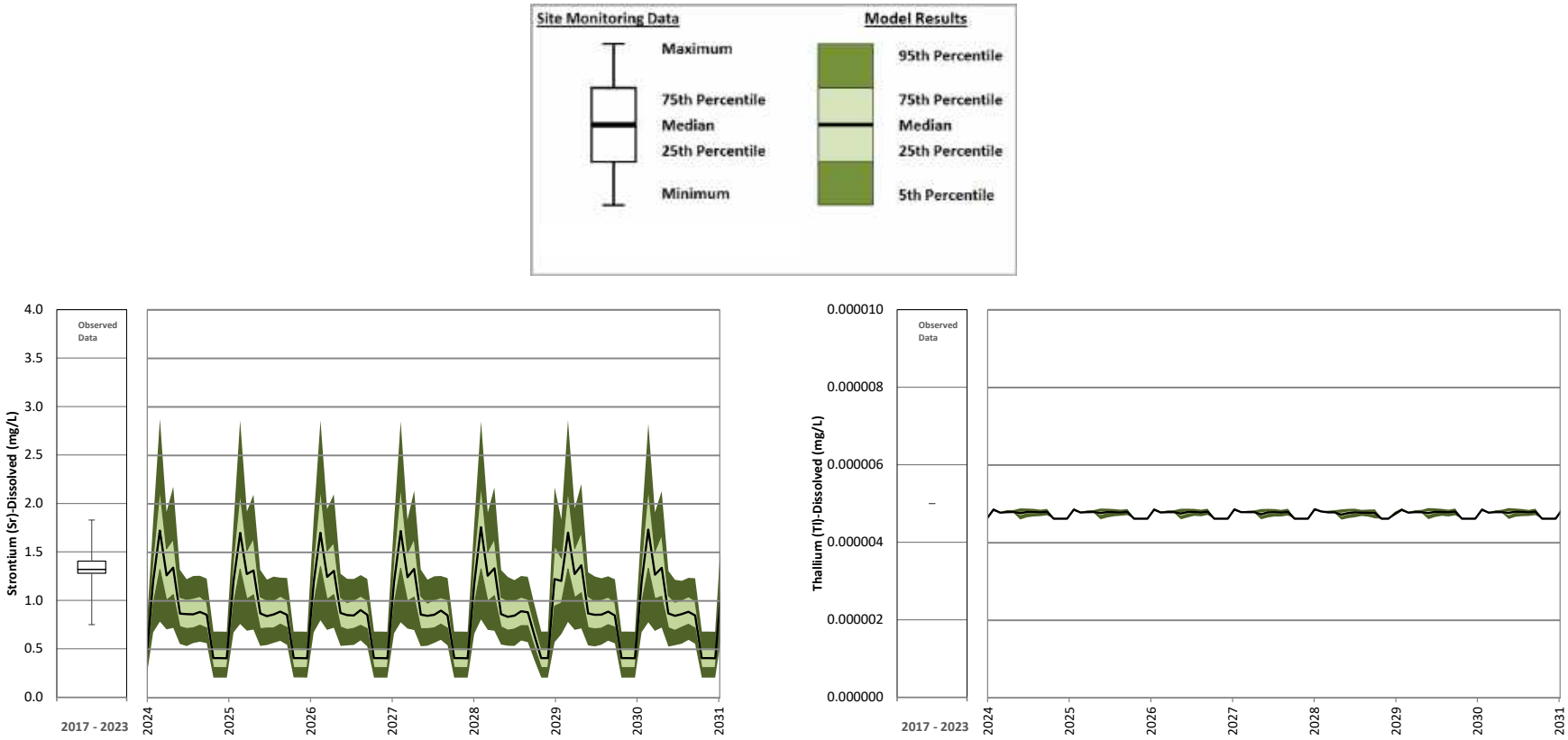


Figure B **37: Cariboo Pit Operations – Dissolved Strontium and Dissolved Thallium**

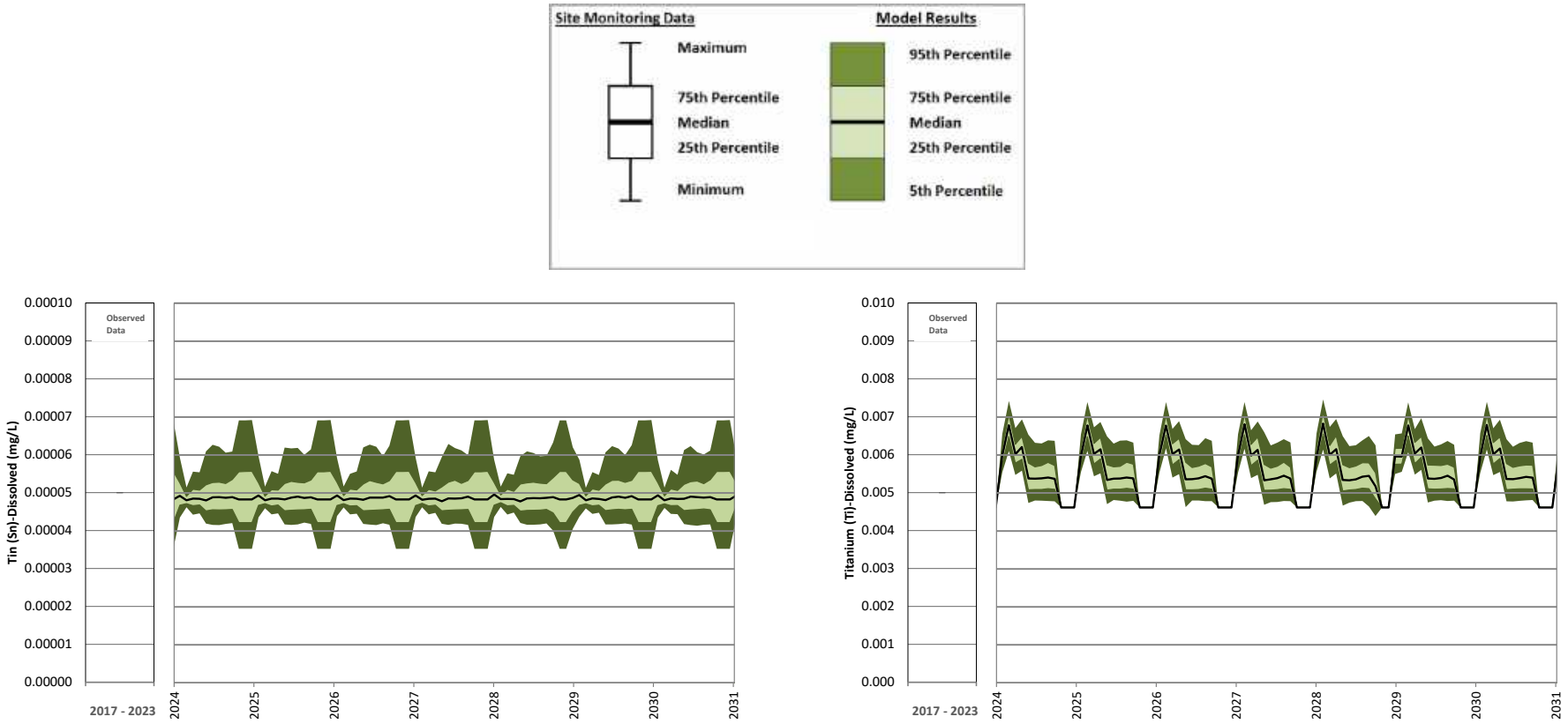


Figure B **38: Cariboo Pit Operations – Dissolved Tin and Dissolved Titanium**

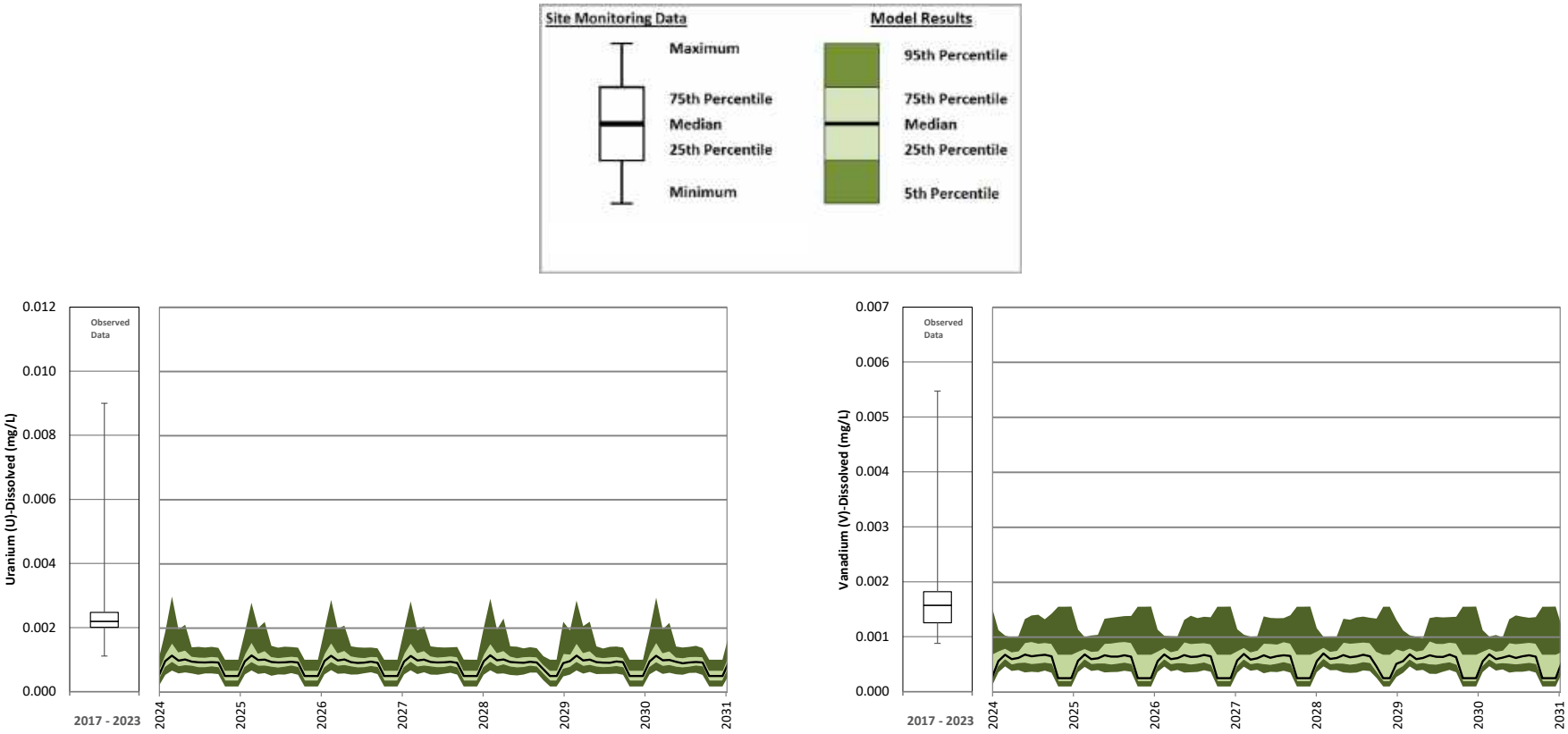


Figure B **39: Cariboo Pit Operations – Dissolved Uranium and Dissolved Vanadium**

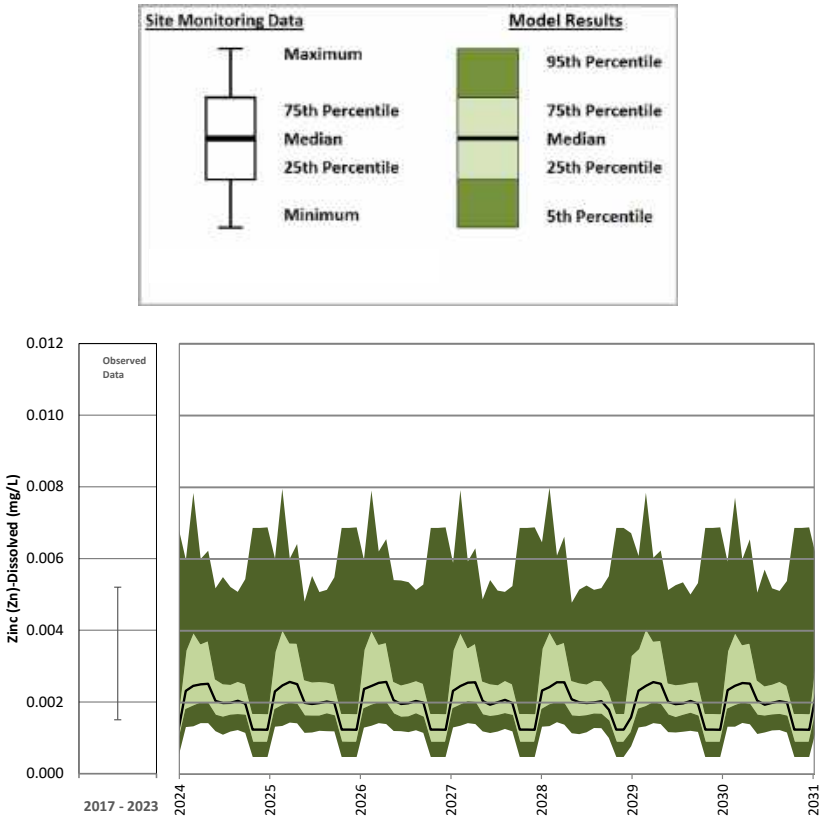
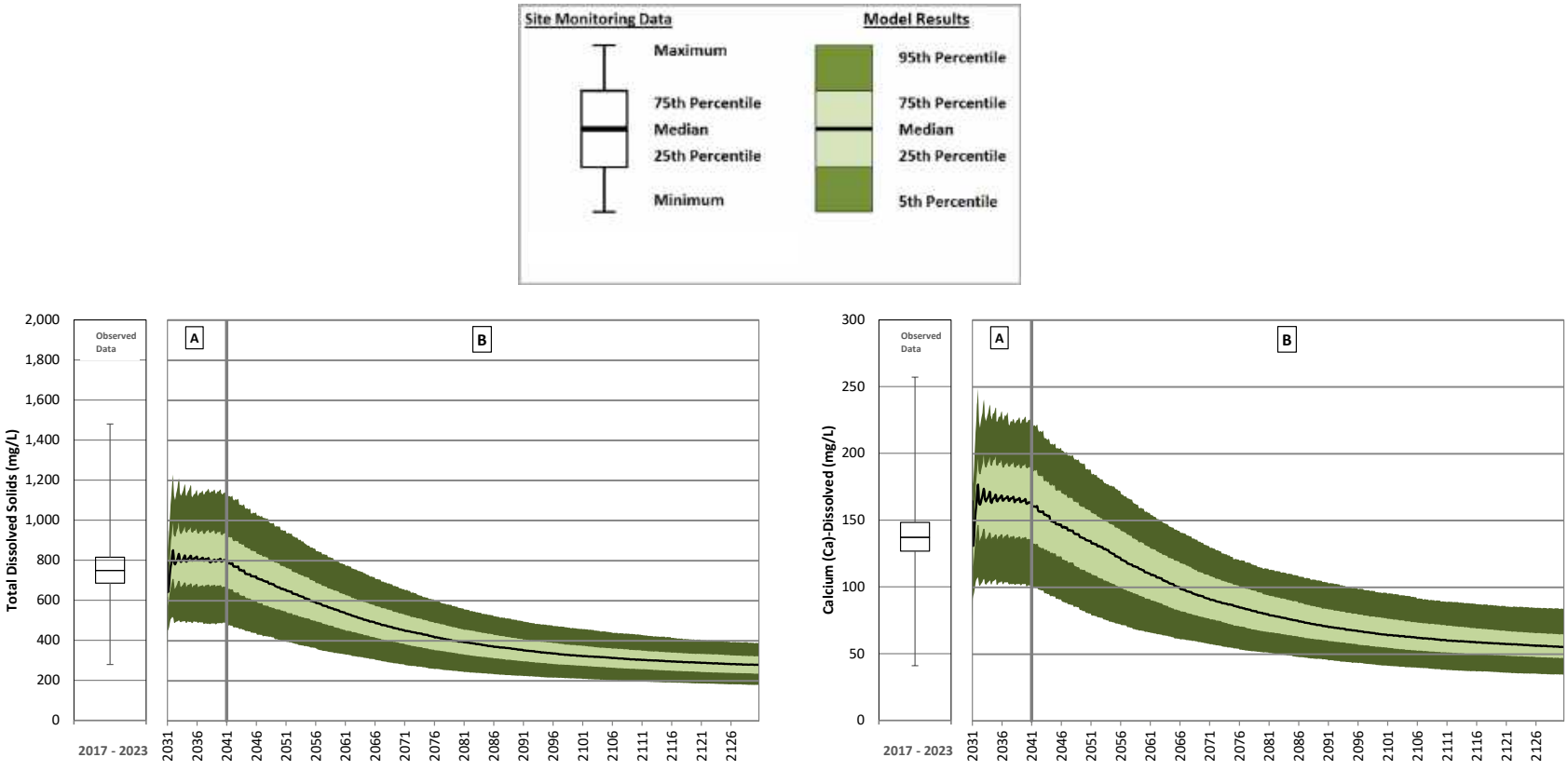


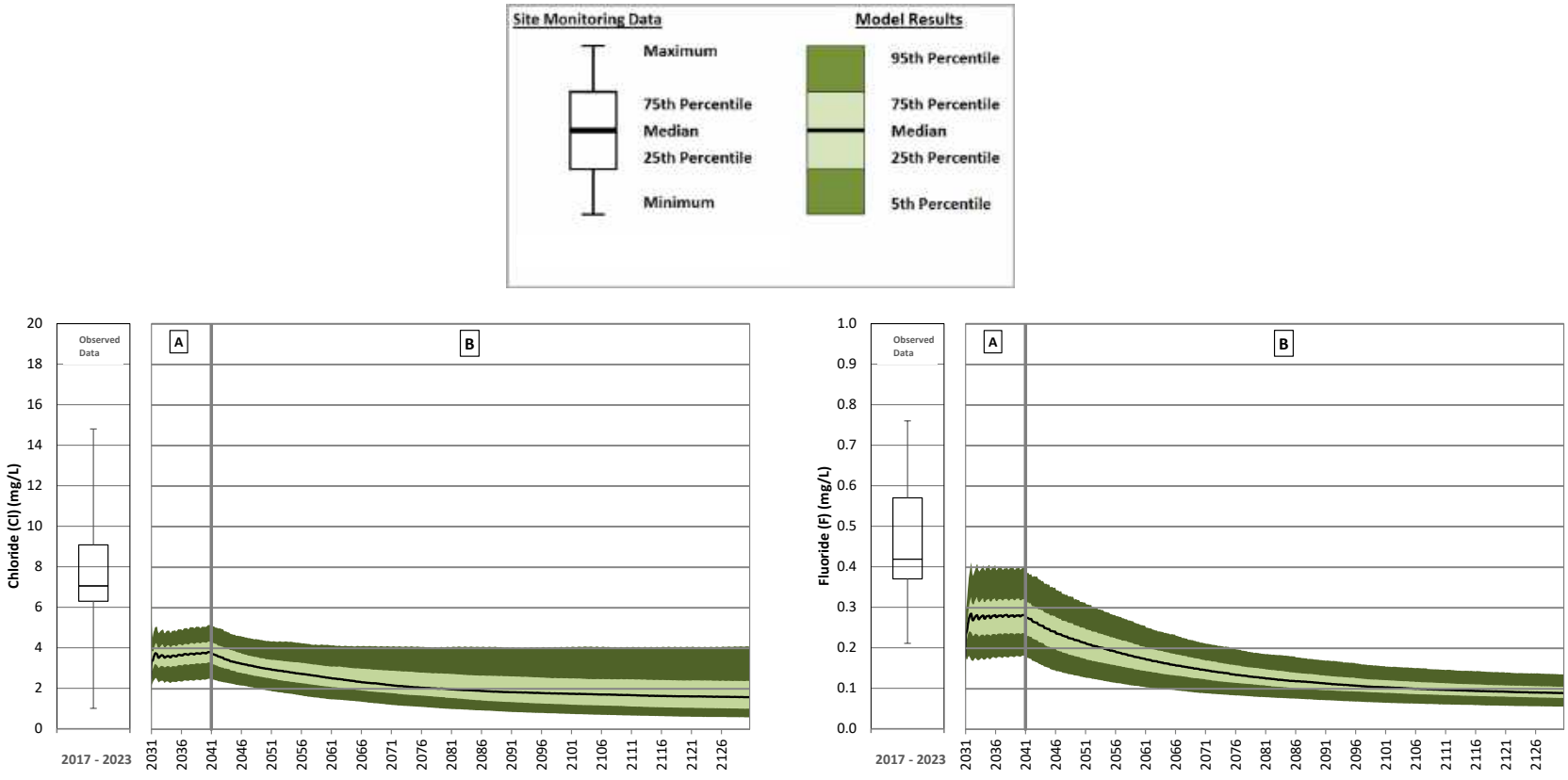
Figure B **40: Cariboo Pit Operations – Dissolved Zinc**

Springer-Cariboo Pit Operations, Closure and Post-closure



A = Closure; B = Post-closure

Figure B **41: Springer-Cariboo Pit Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Closure; B = Post-closure

Figure B **42: Springer-Cariboo Pit Operations, Closure and Post-closure – Chloride and Fluoride**

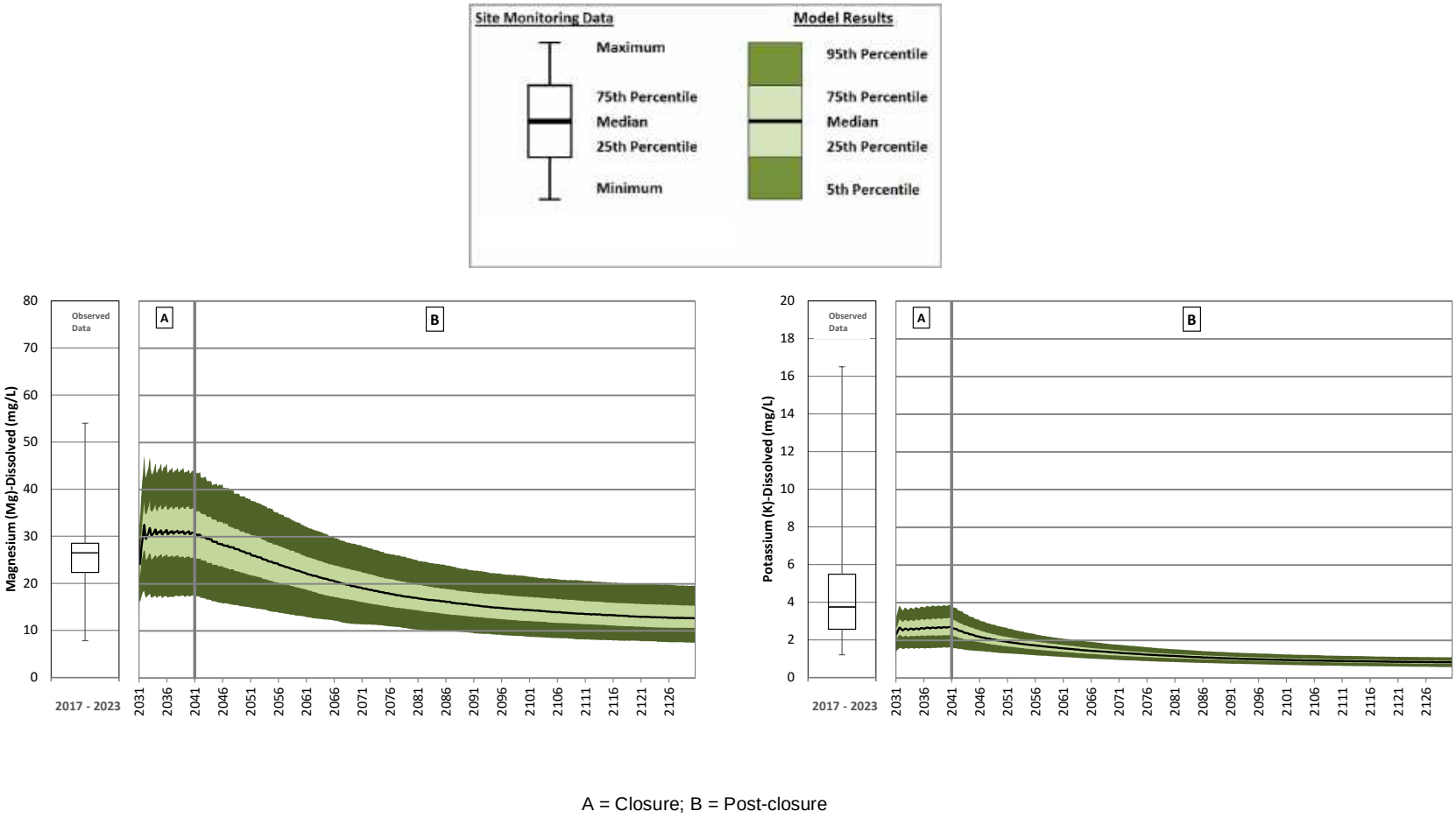
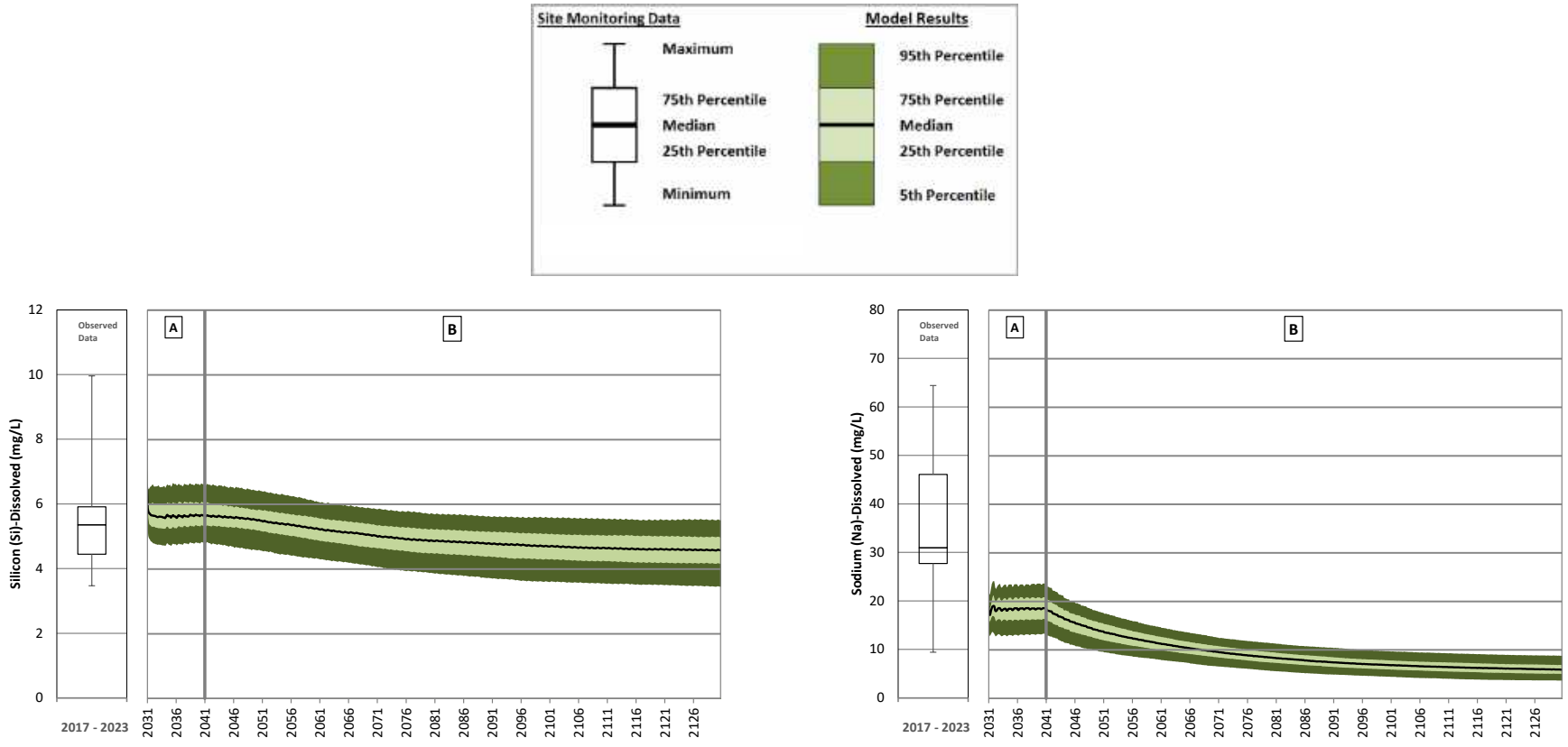
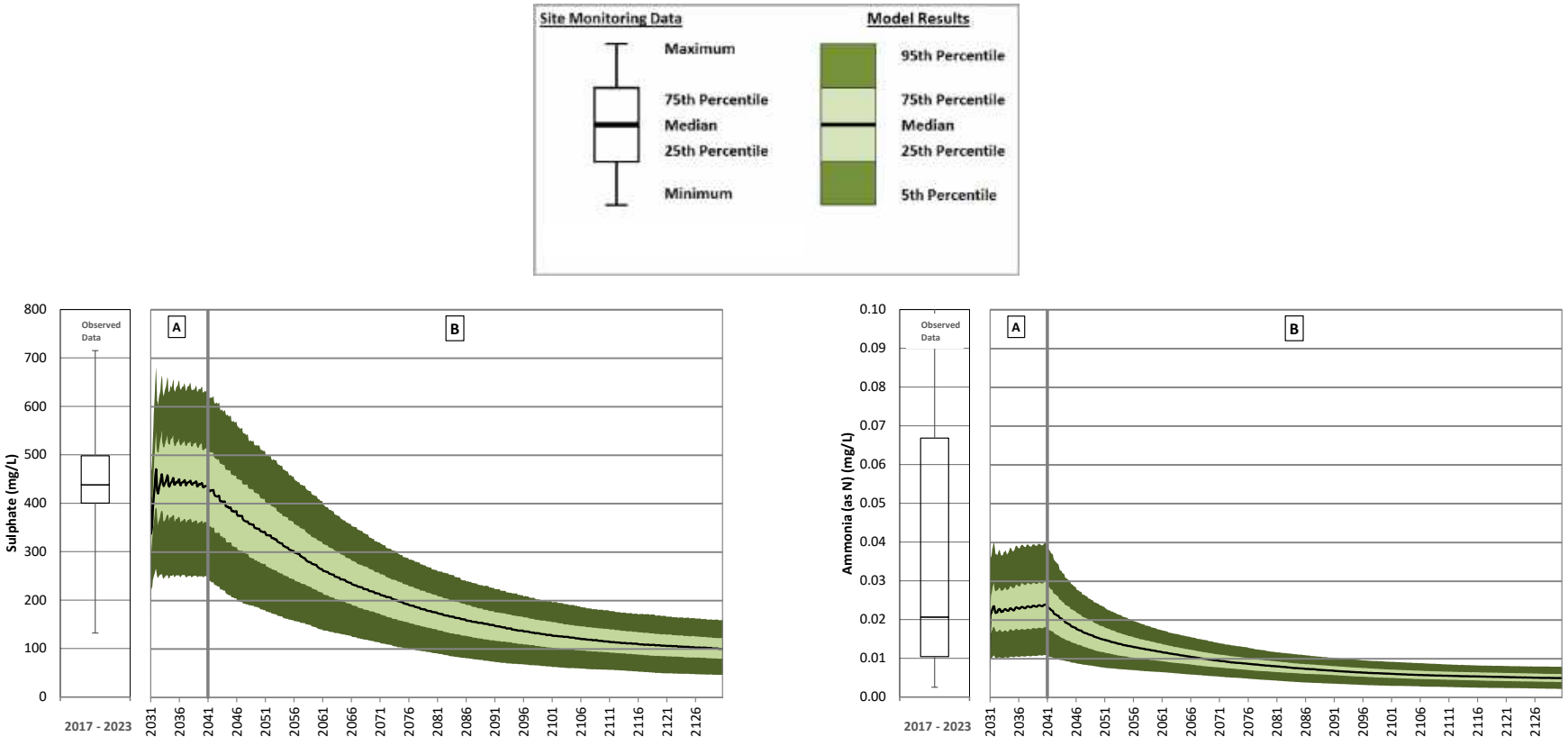


Figure B **43: Springer-Cariboo Pit Operations, Closure and Post-closure – Magnesium and Potassium**



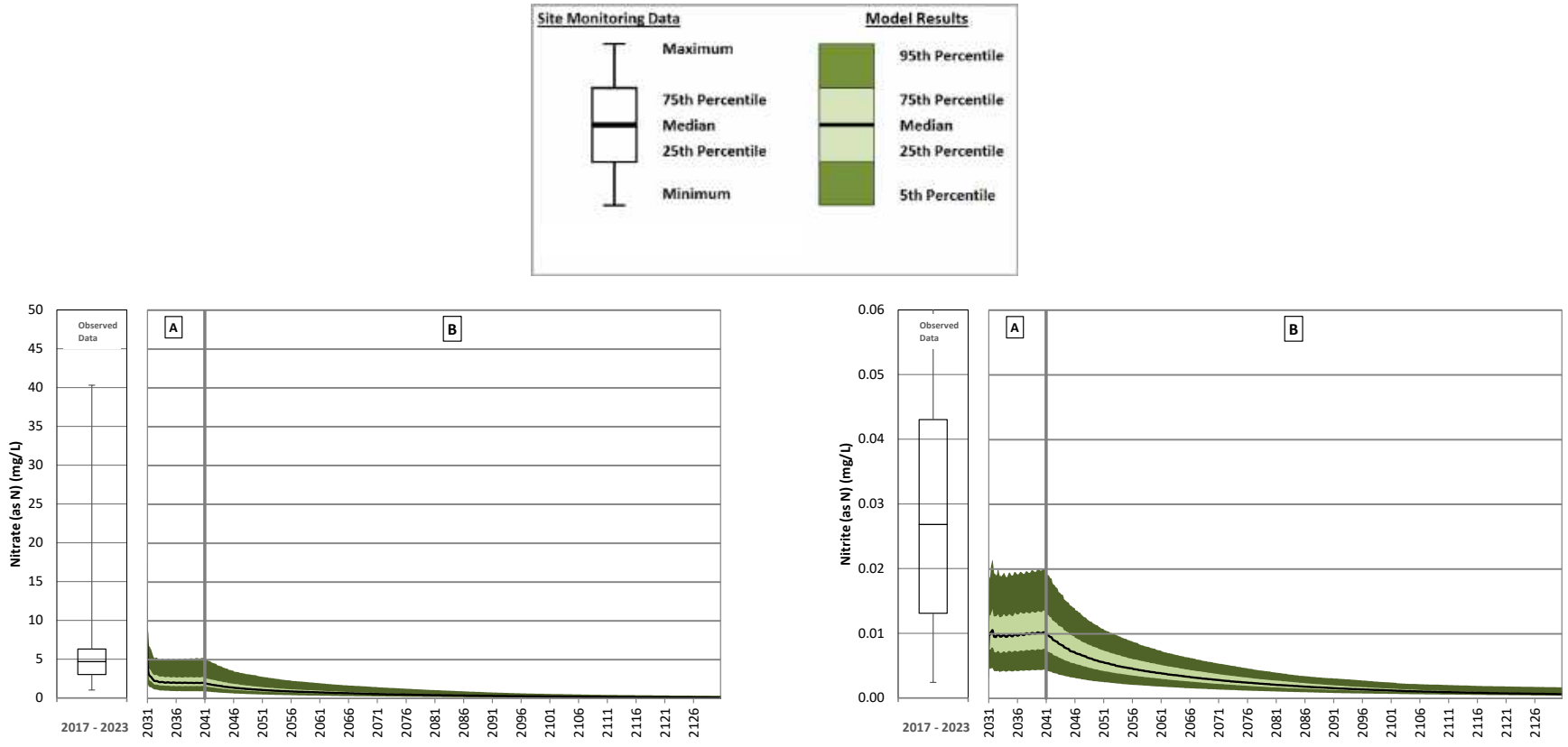
A = Closure; B = Post-closure

Figure B **44: Springer-Cariboo Pit Operations, Closure and Post-closure – Silicon and Sodium**



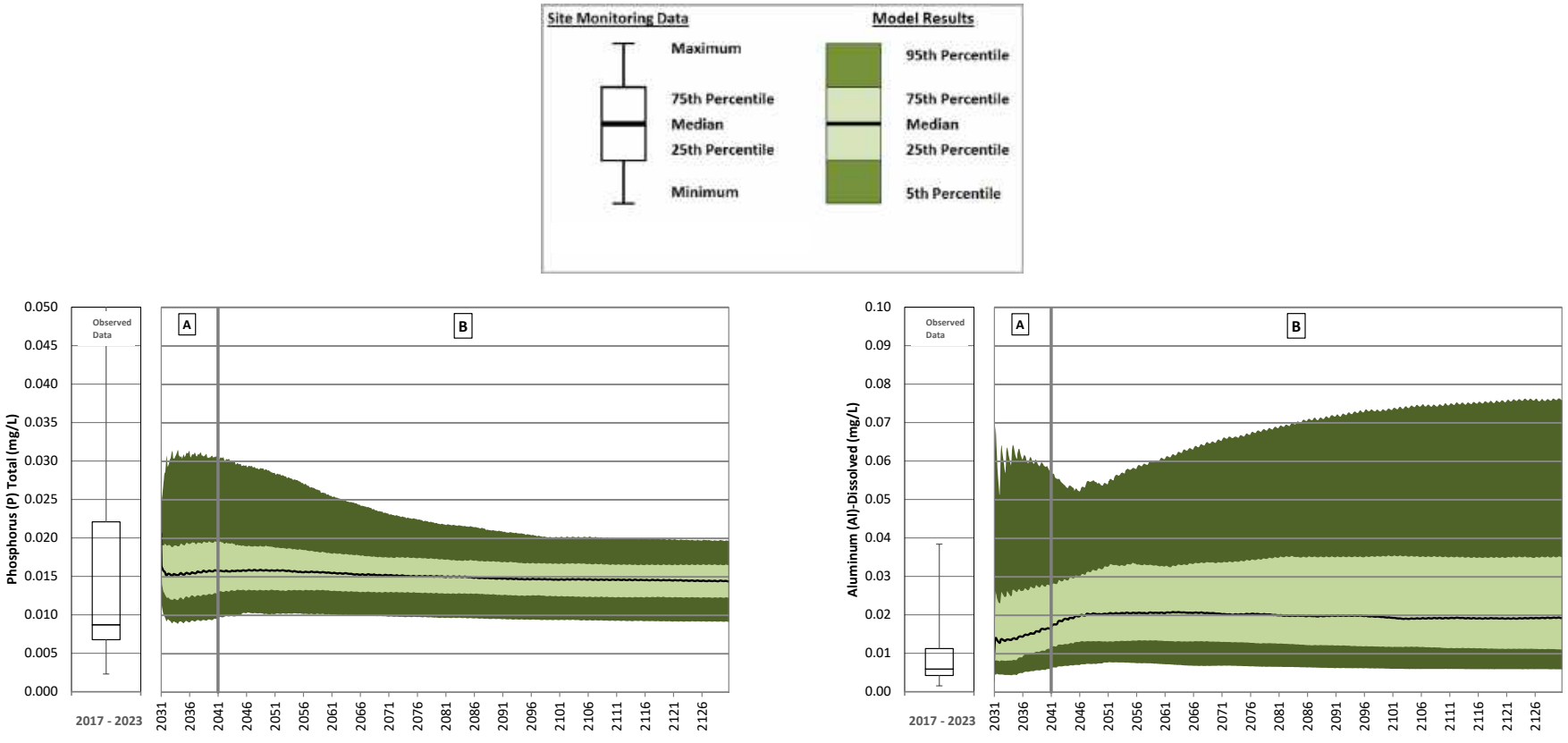
A = Closure; B = Post-closure

Figure B **45: Springer-Cariboo Pit Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Closure; B = Post-closure

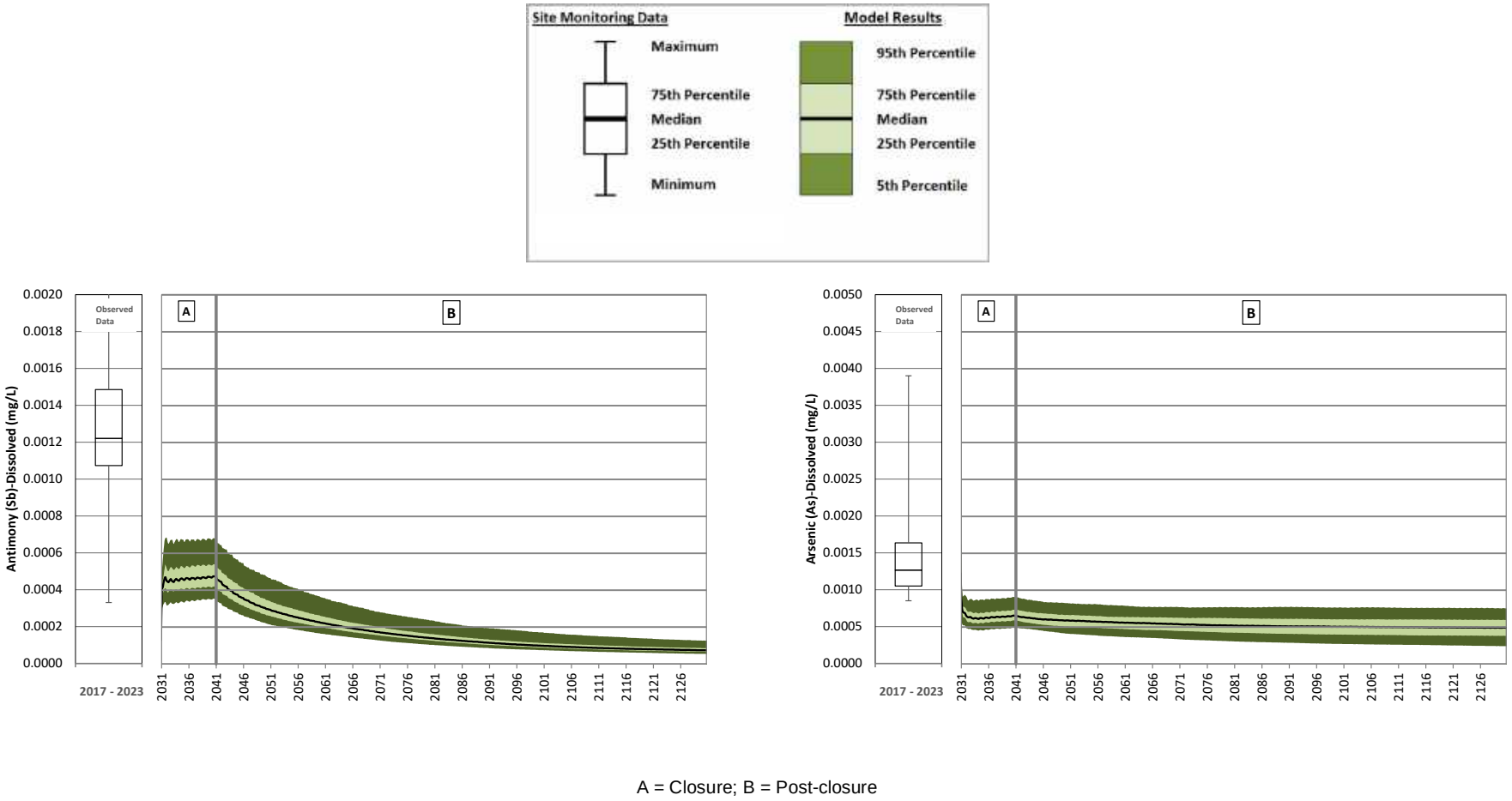
Figure B **46: Springer-Cariboo Pit Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Closure; B = Post-closure

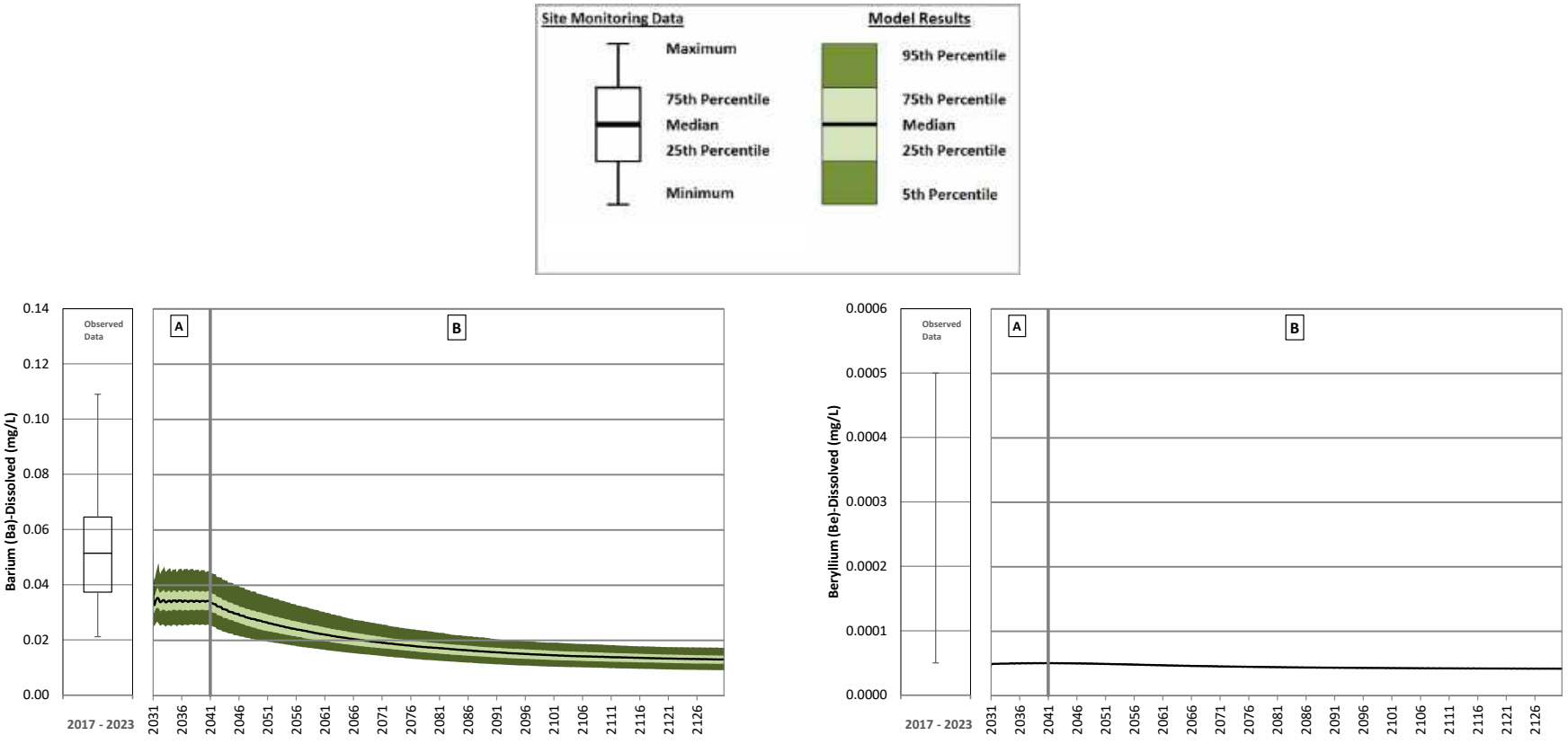
Note: The increases in dissolved aluminum concentrations are caused by higher concentrations in the undisturbed water quality inputs compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

Figure B **47: Springer-Cariboo Pit Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



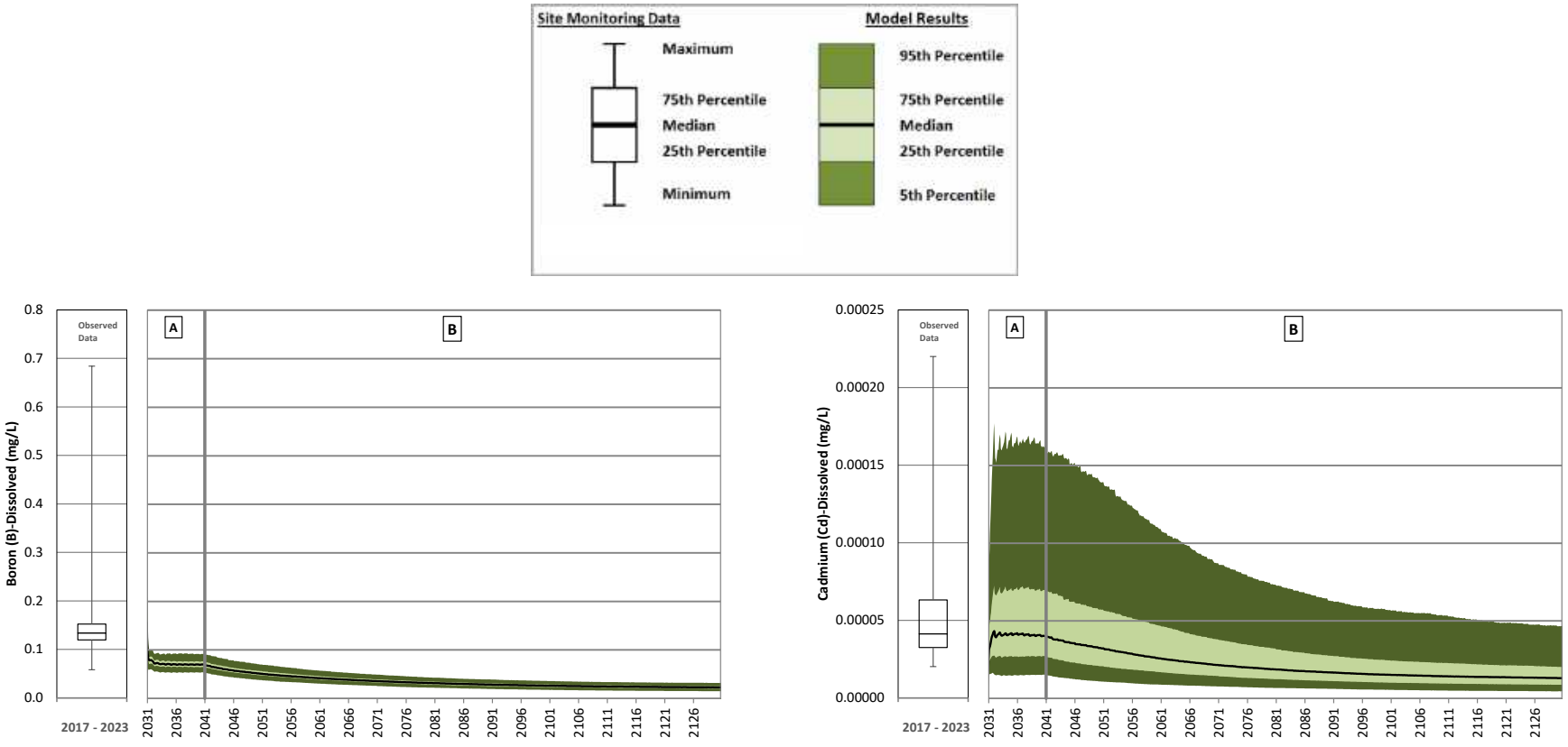
A = Closure; B = Post-closure

Figure B **48: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



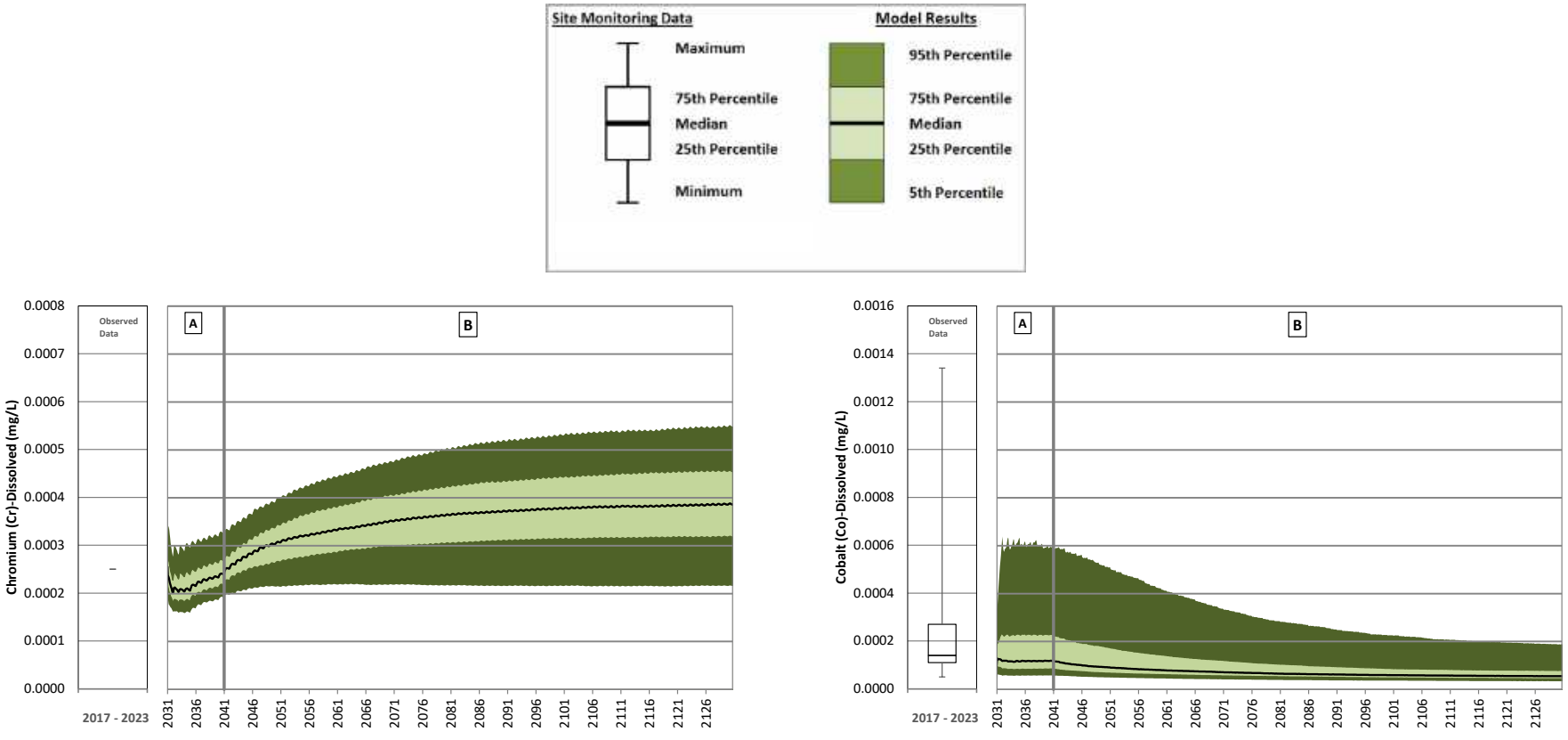
A = Closure; B = Post-closure

Figure B **49: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Closure; B = Post-closure

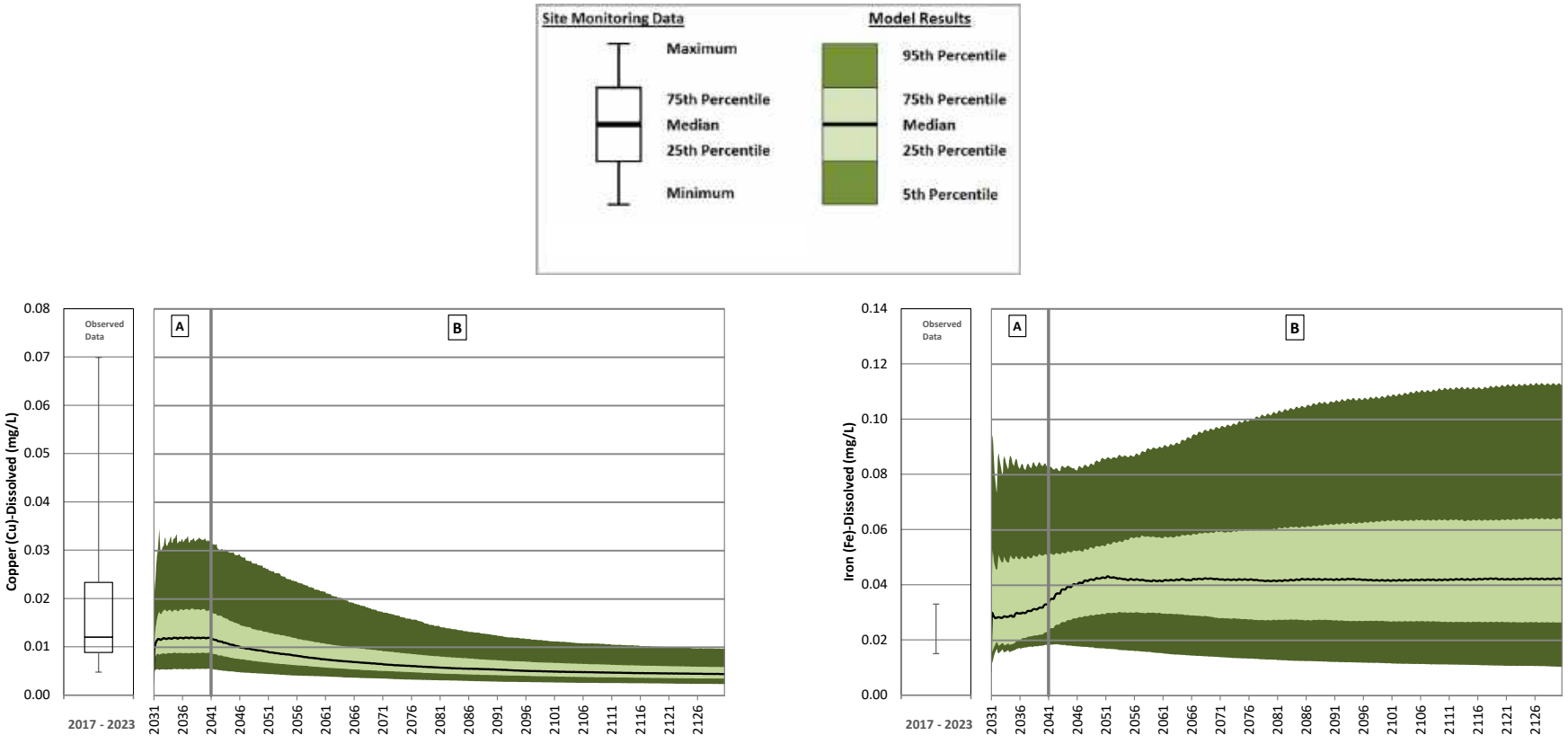
Figure B **50: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Closure; B = Post-closure

Note: The increase in dissolved chromium concentrations is caused by higher concentrations in the undisturbed water quality input compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

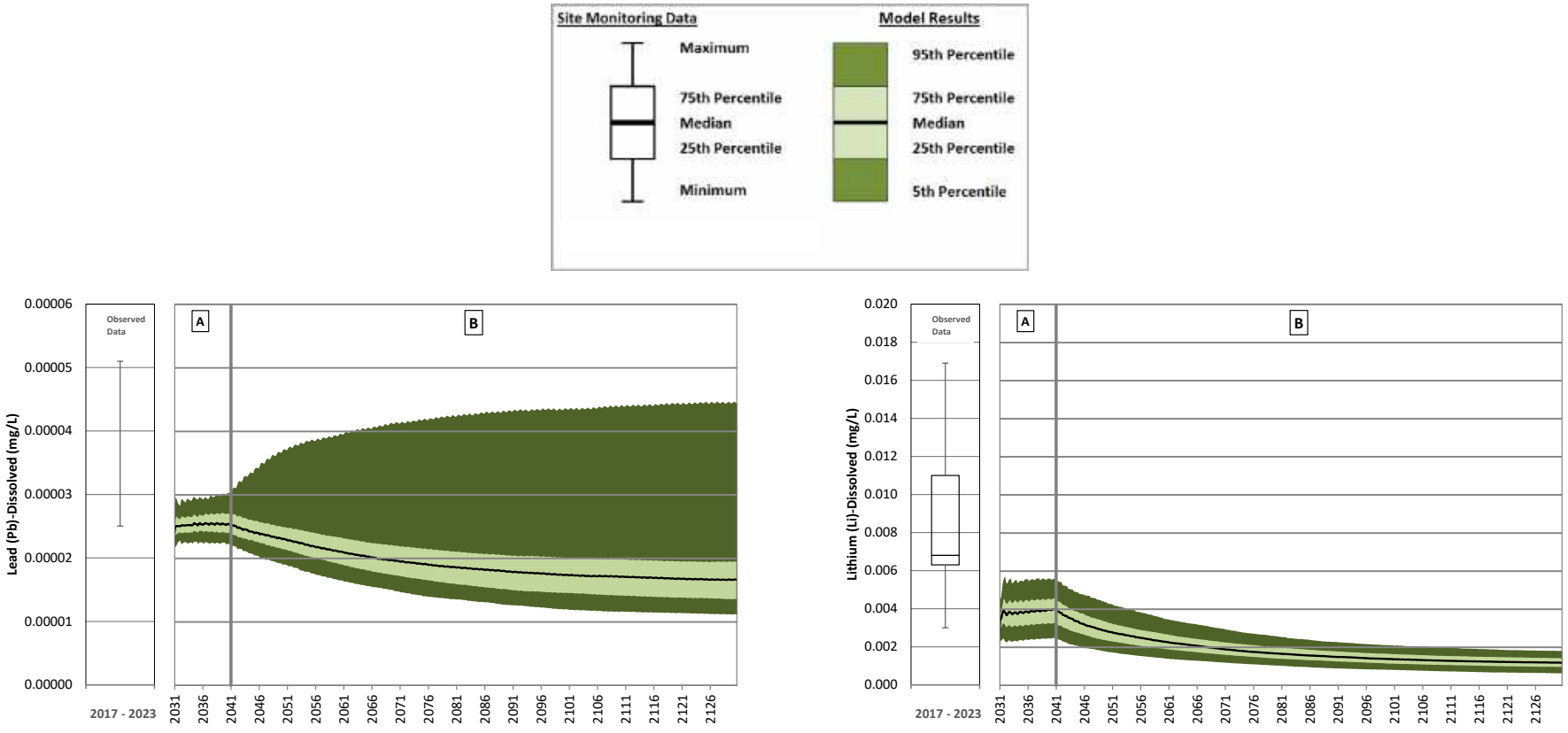
Figure B **51: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Closure; B = Post-closure

Note: The increase in dissolved iron concentrations is caused by higher concentrations in the undisturbed water quality input compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

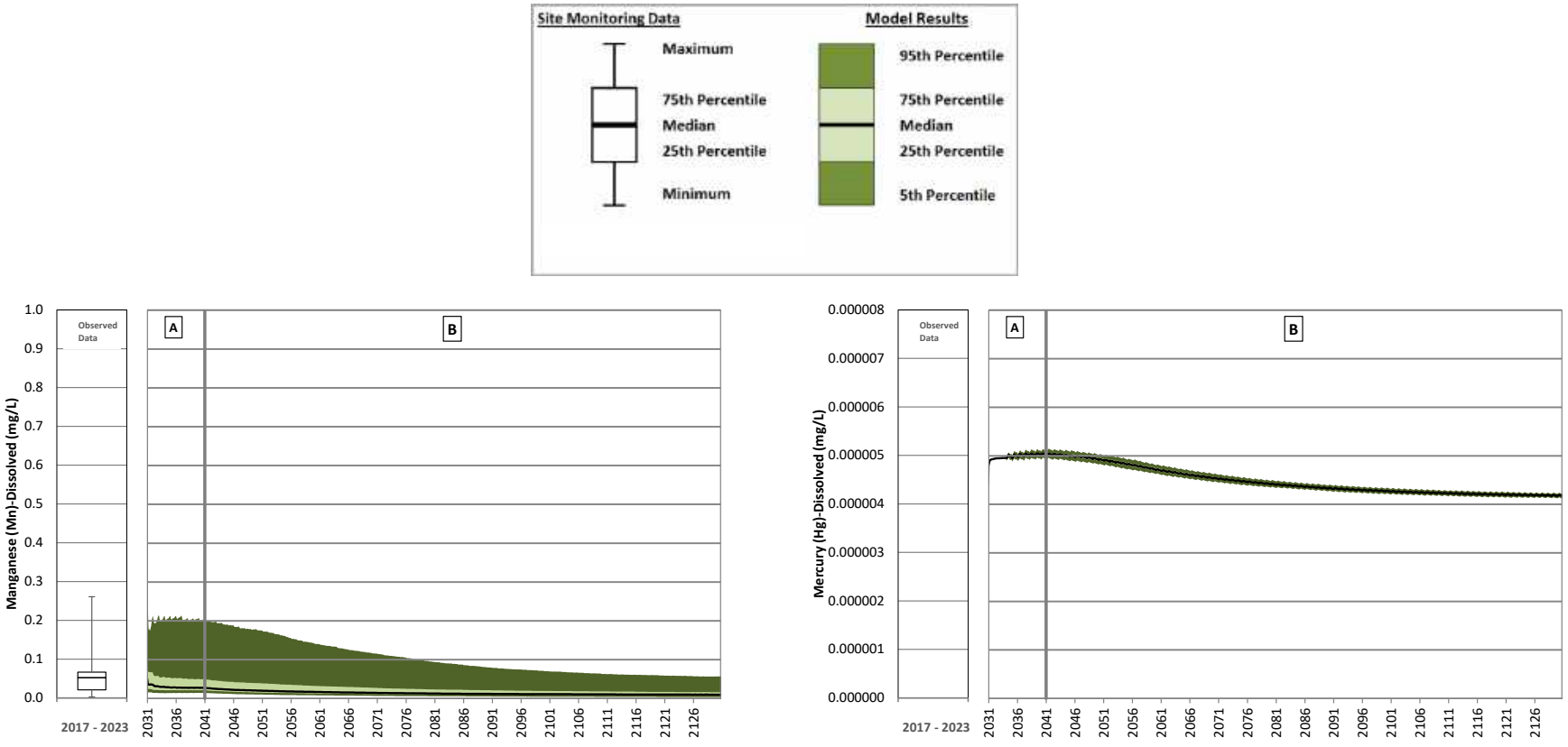
Figure B **52: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Closure; B = Post-closure

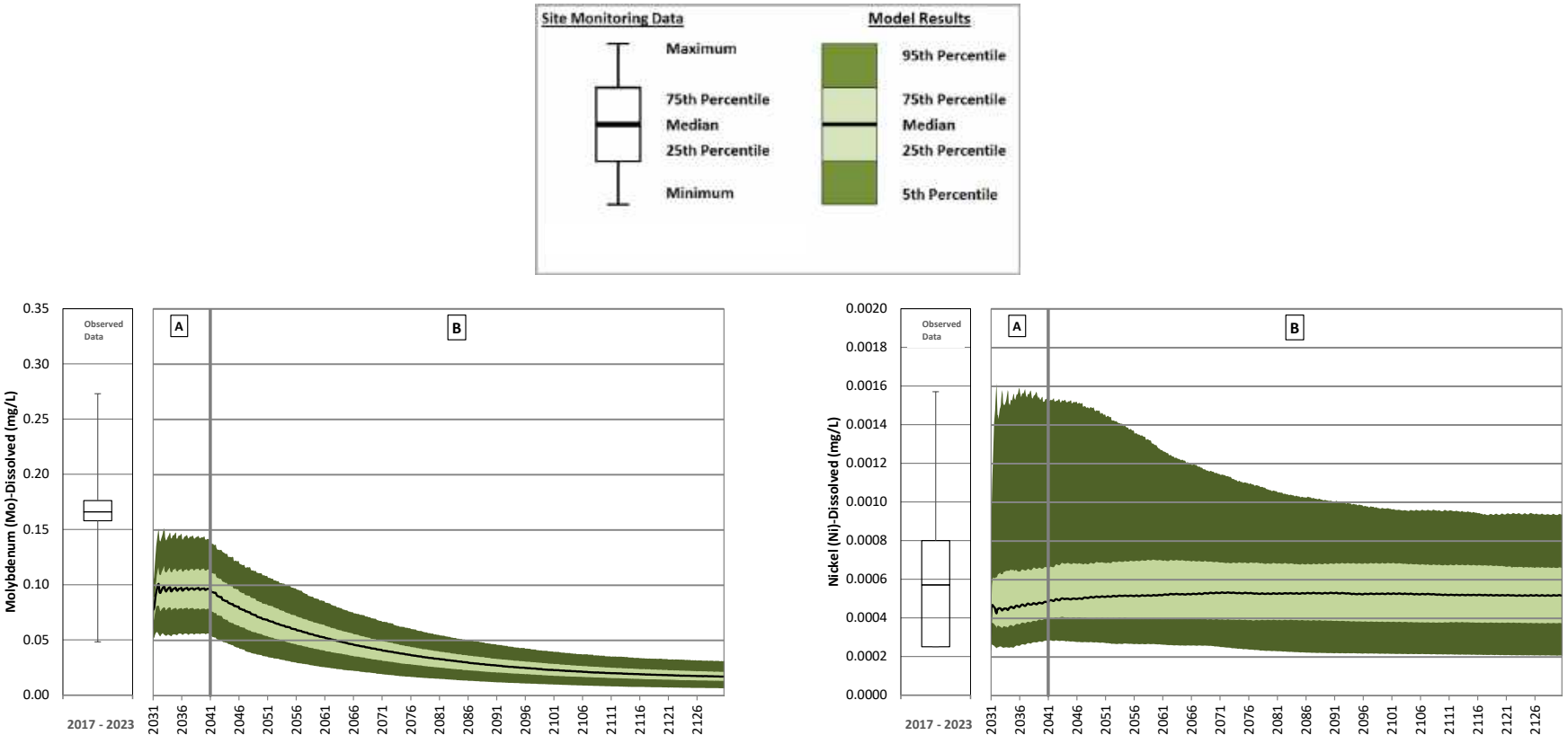
Note: The increase in the 95th percentile of dissolved lead concentrations is caused by higher maximum concentrations in the undisturbed water quality input compared to contact and disturbed runoff water quality inputs. Reclaimed areas are assigned the undisturbed water quality input.

Figure B **53: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



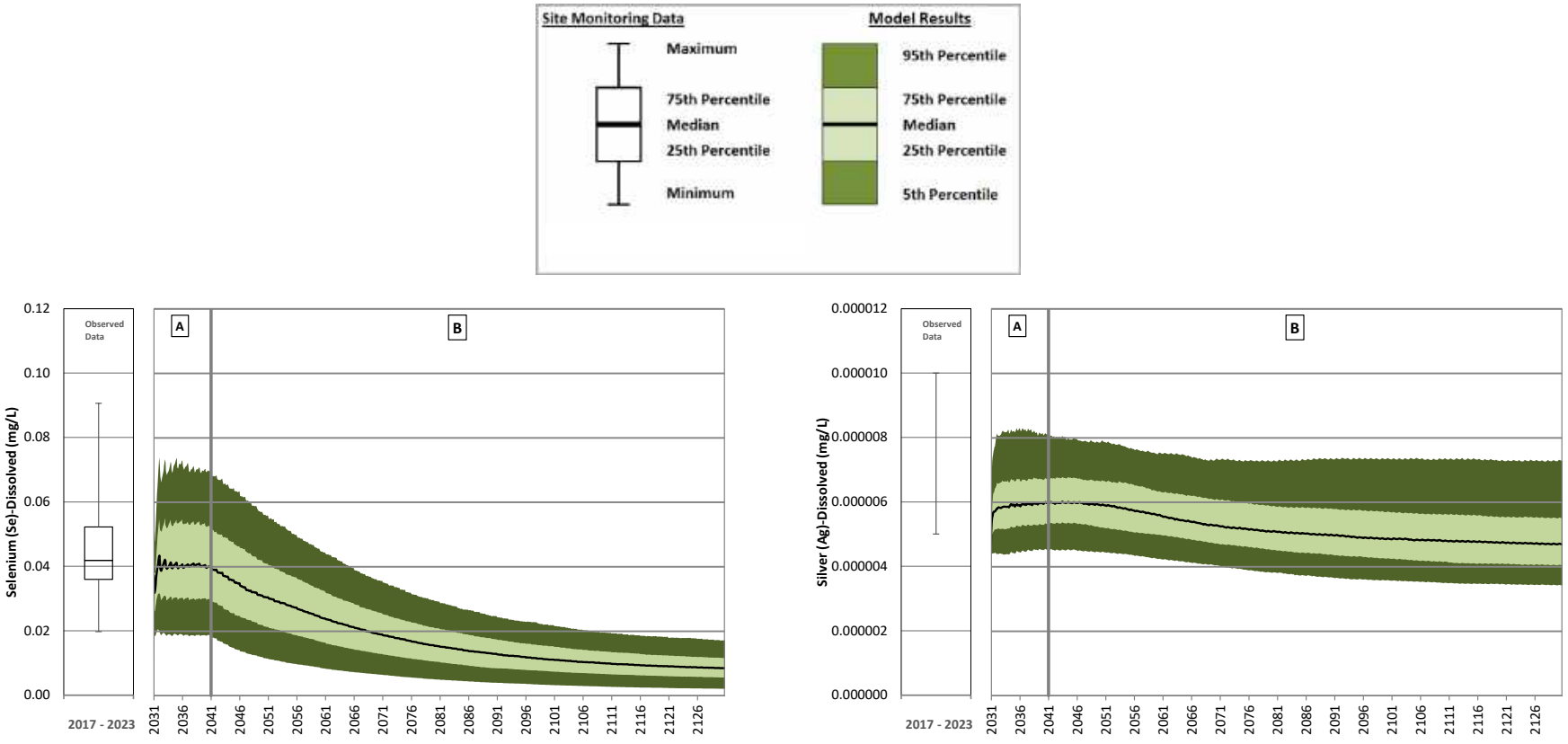
A = Closure; B = Post-closure

Figure B **54: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



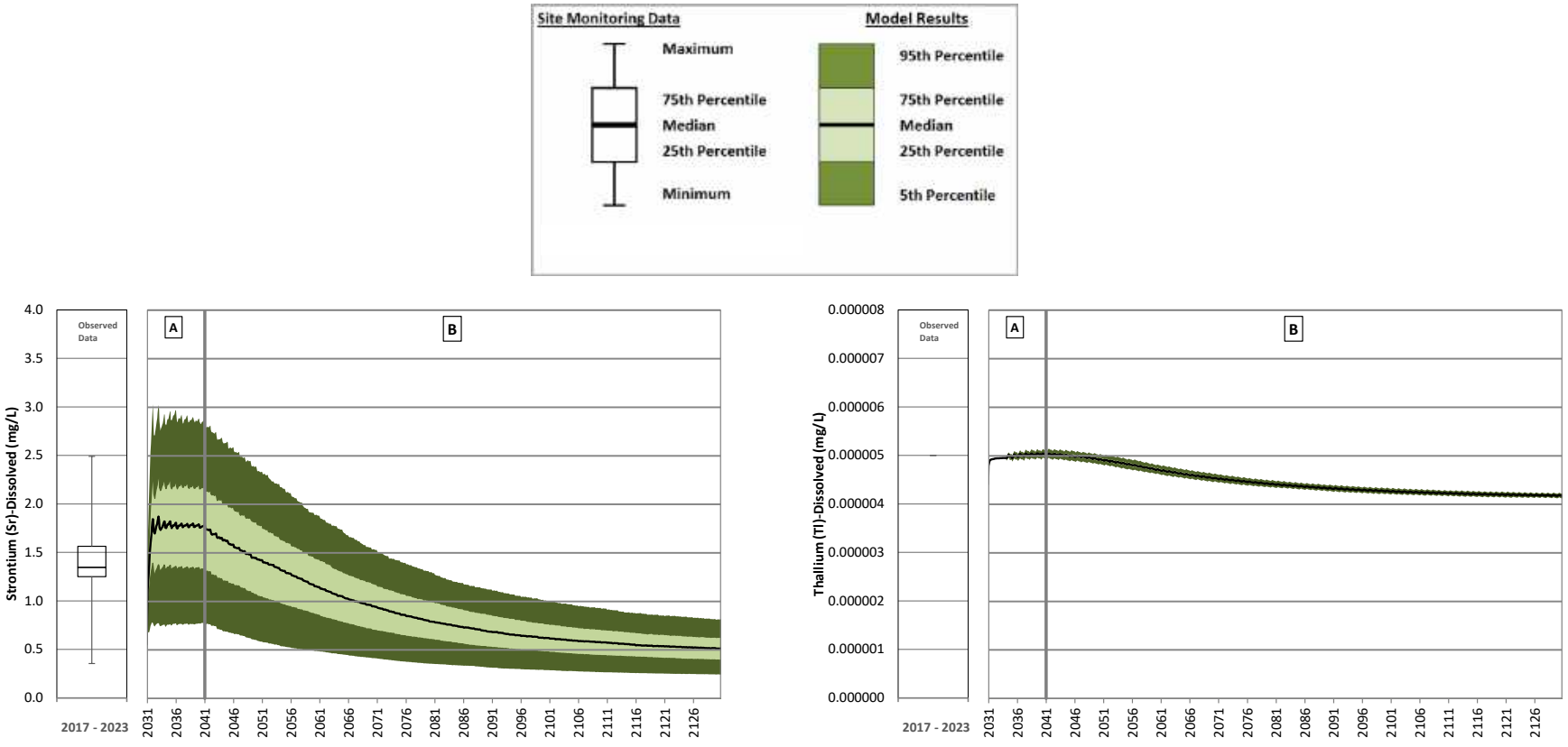
A = Closure; B = Post-closure

Figure B **55: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



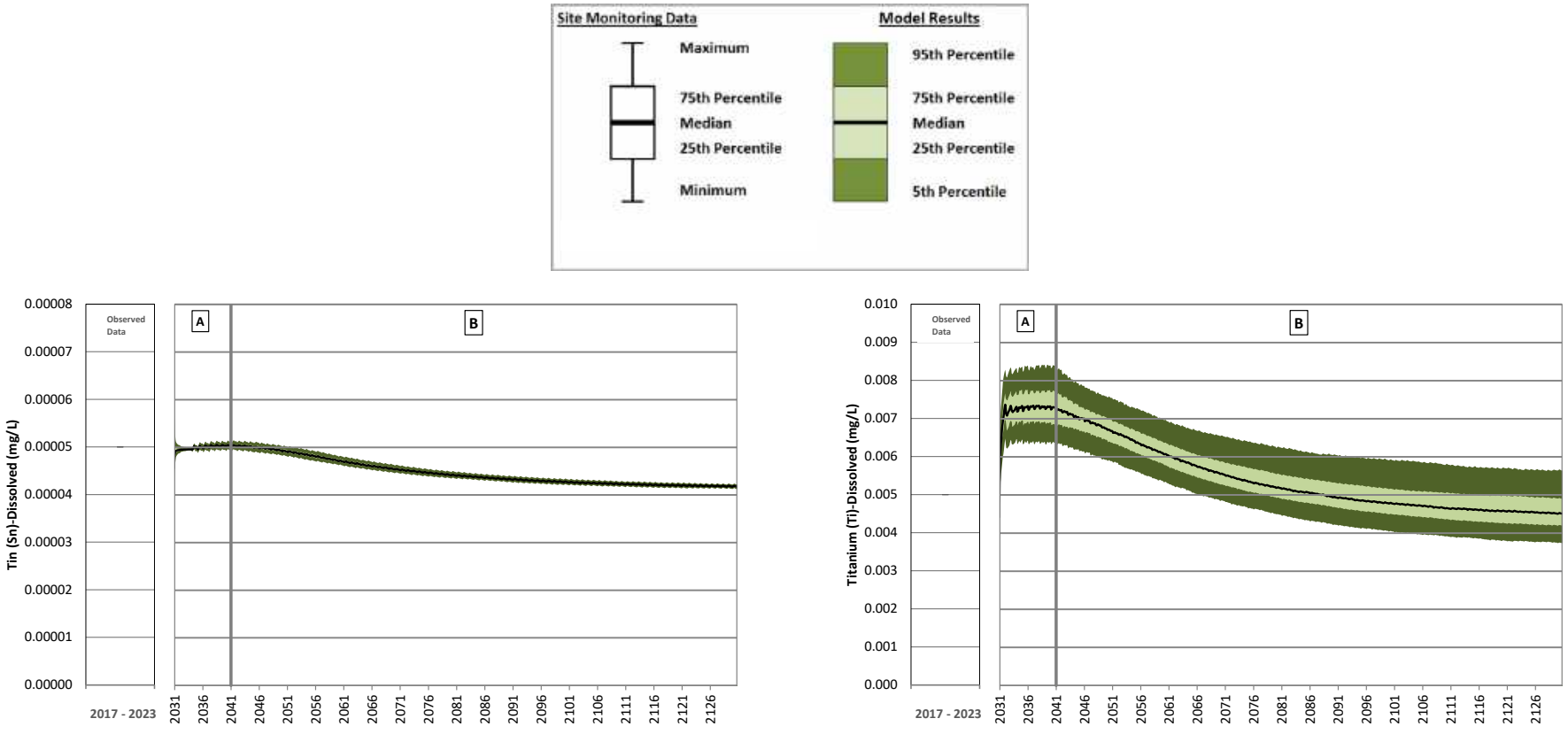
A = Closure; B = Post-closure

Figure B **56: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



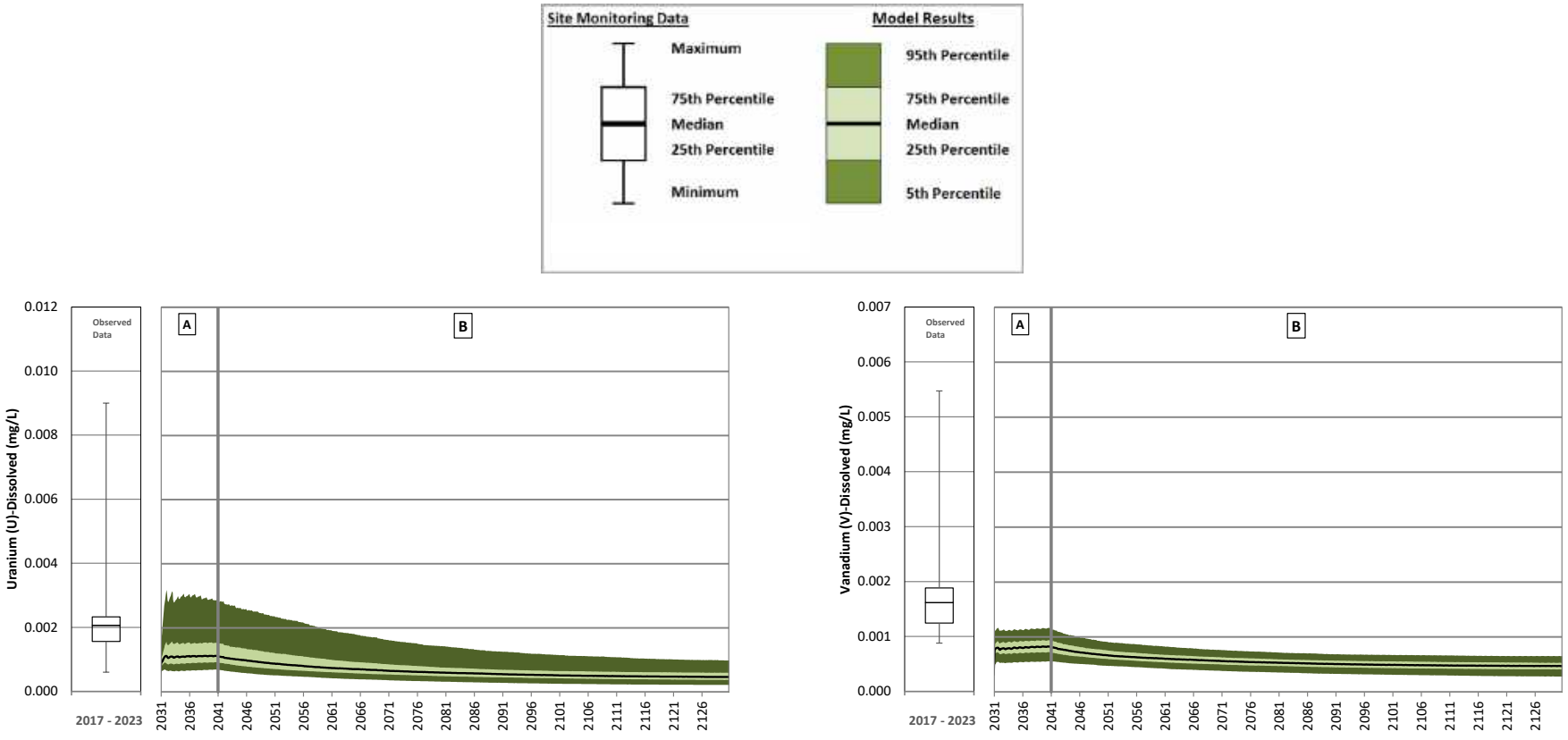
A = Closure; B = Post-closure

Figure B **57: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



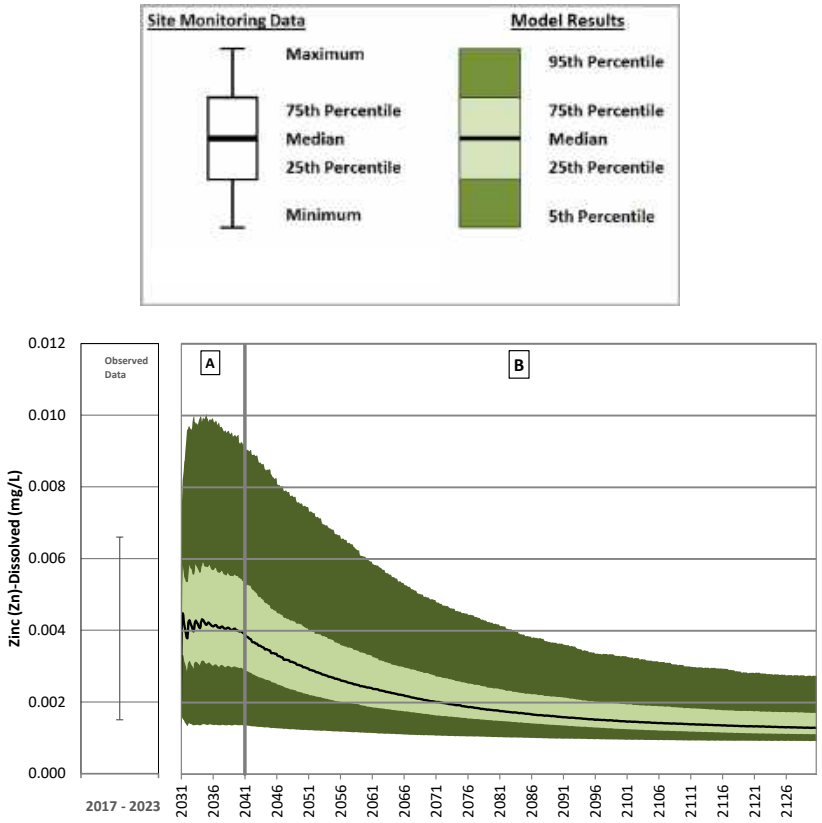
A = Closure; B = Post-closure

Figure B **58: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Closure; B = Post-closure

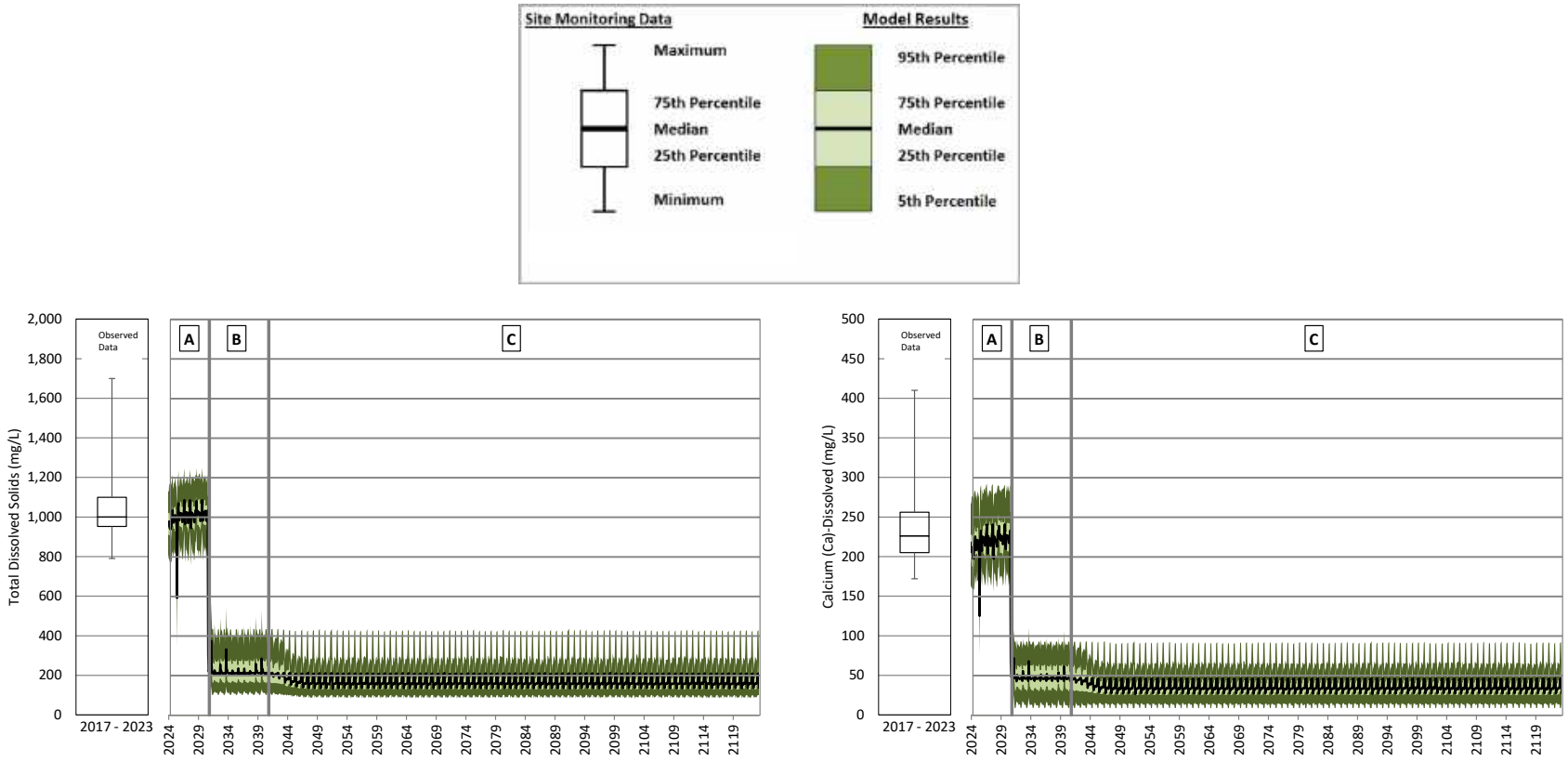
Figure B **59: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**



A = Closure; B = Post-closure

Figure B **60: Springer-Cariboo Pit Operations, Closure and Post-closure – Dissolved Zinc**

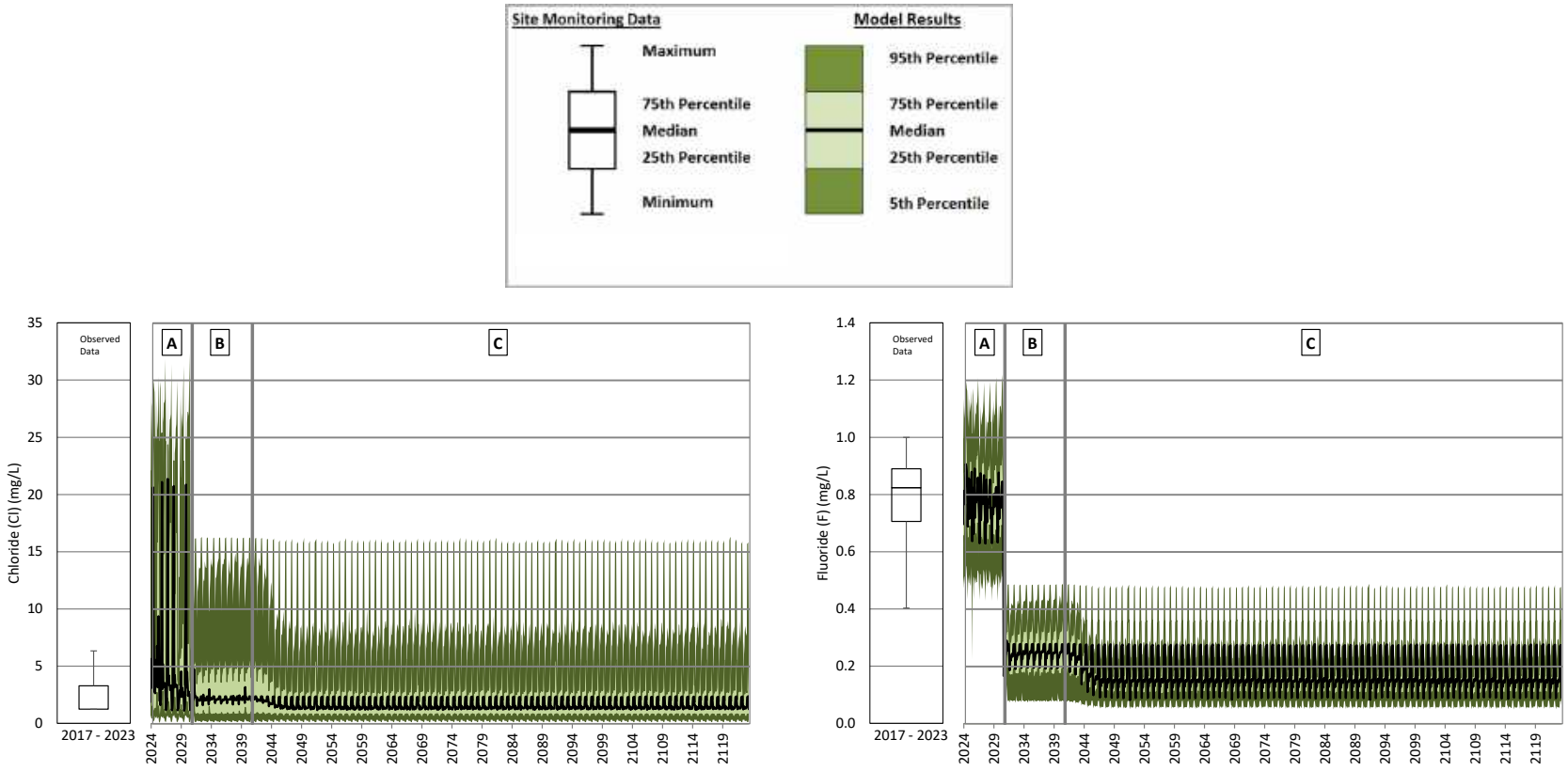
Wight Pit Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

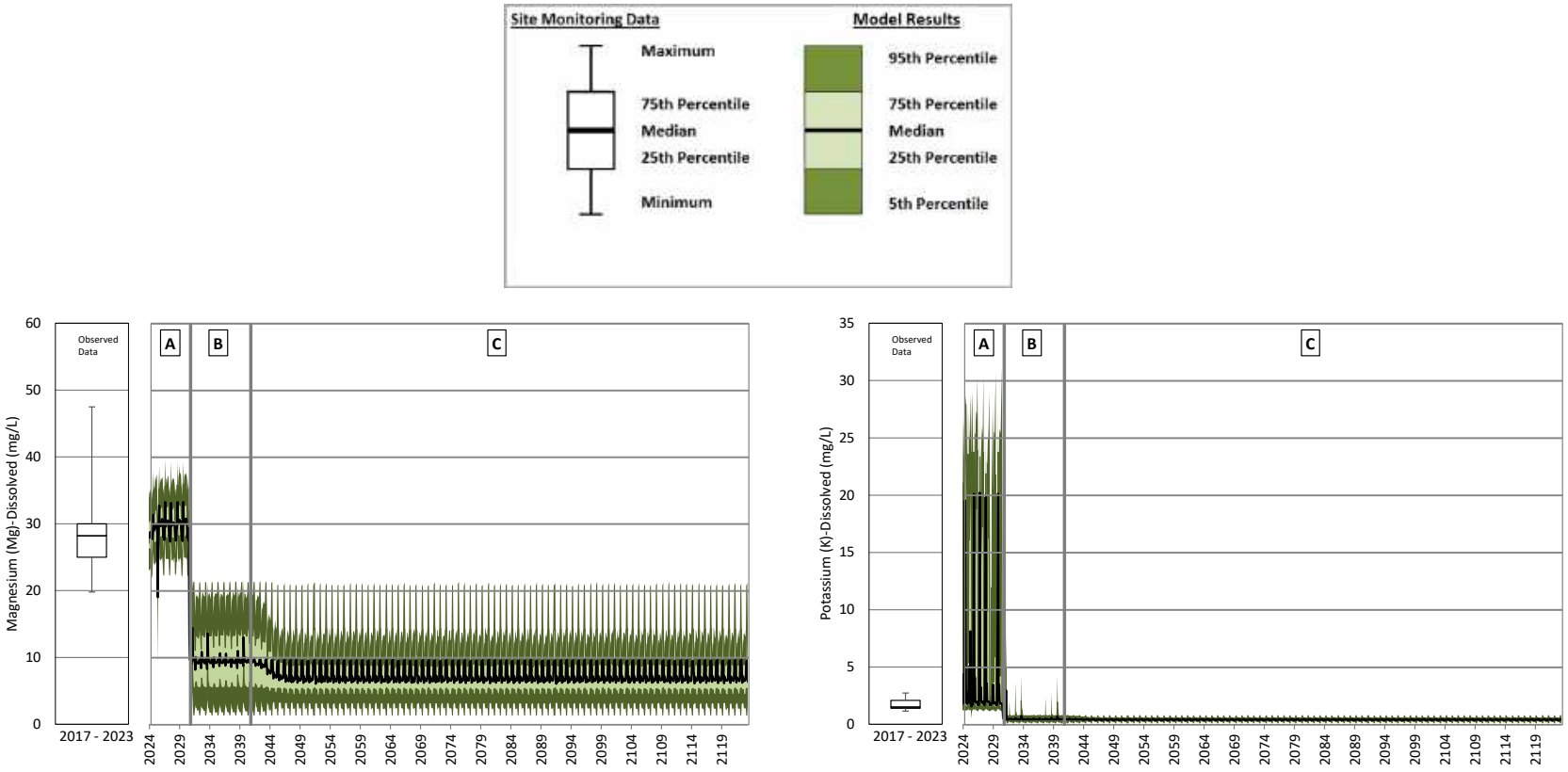
Figure B **61: Wight Pit Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-clsoure when reclamation of the mine site areas in complete.

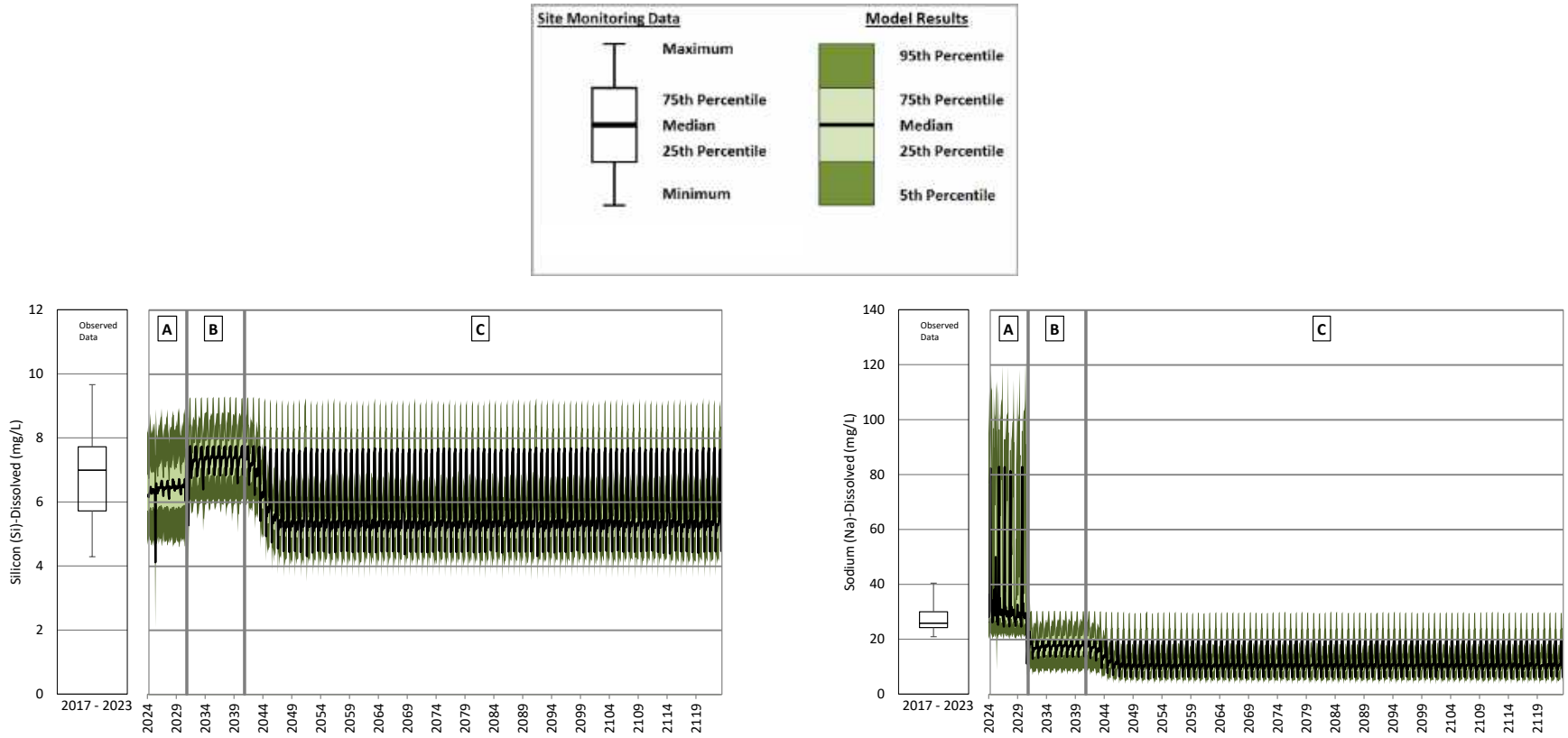
Figure B **62: Wight Pit Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

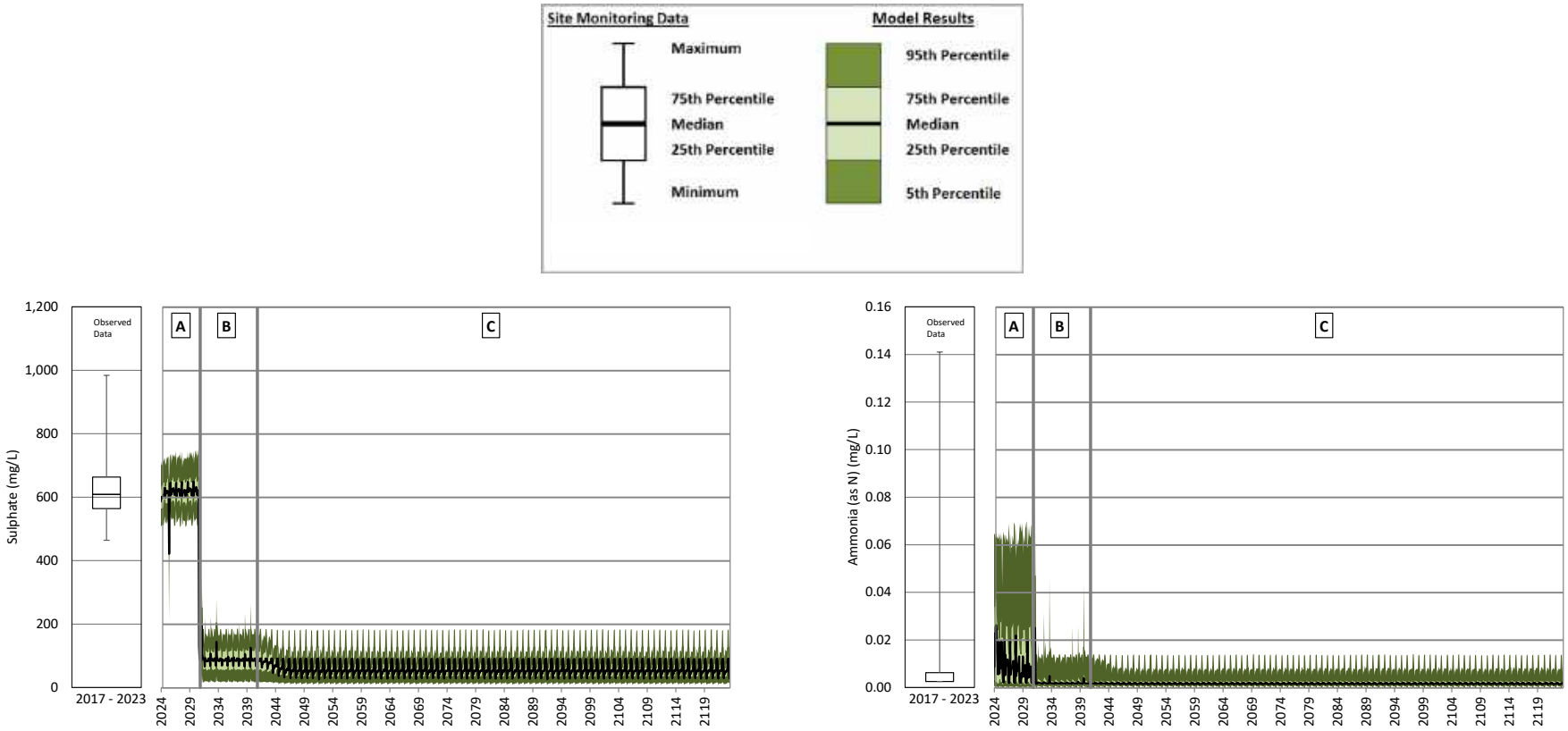
Figure B **63: Wight Pit Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

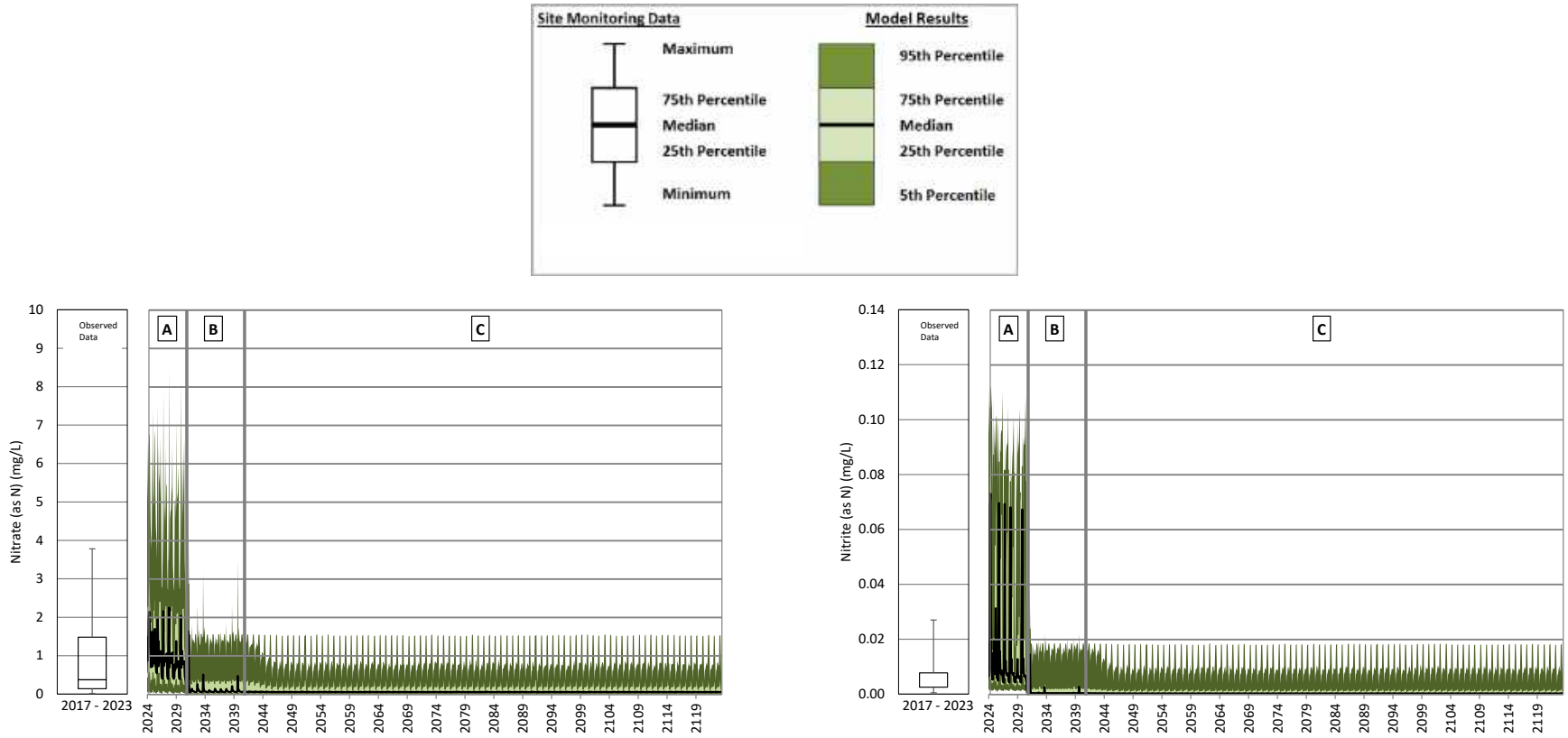
Figure B **64: Wight Pit Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

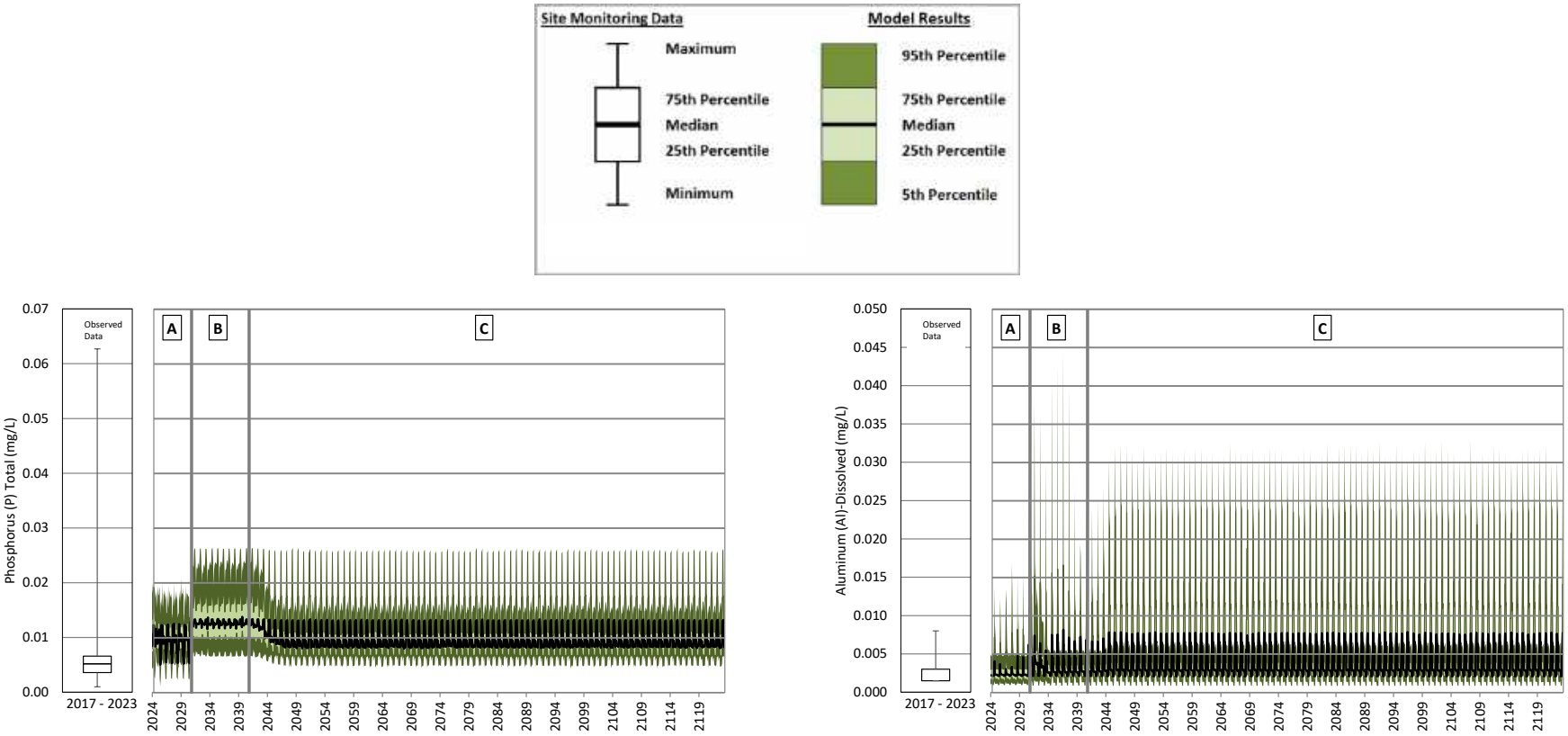
Figure B **65: Wight Pit Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

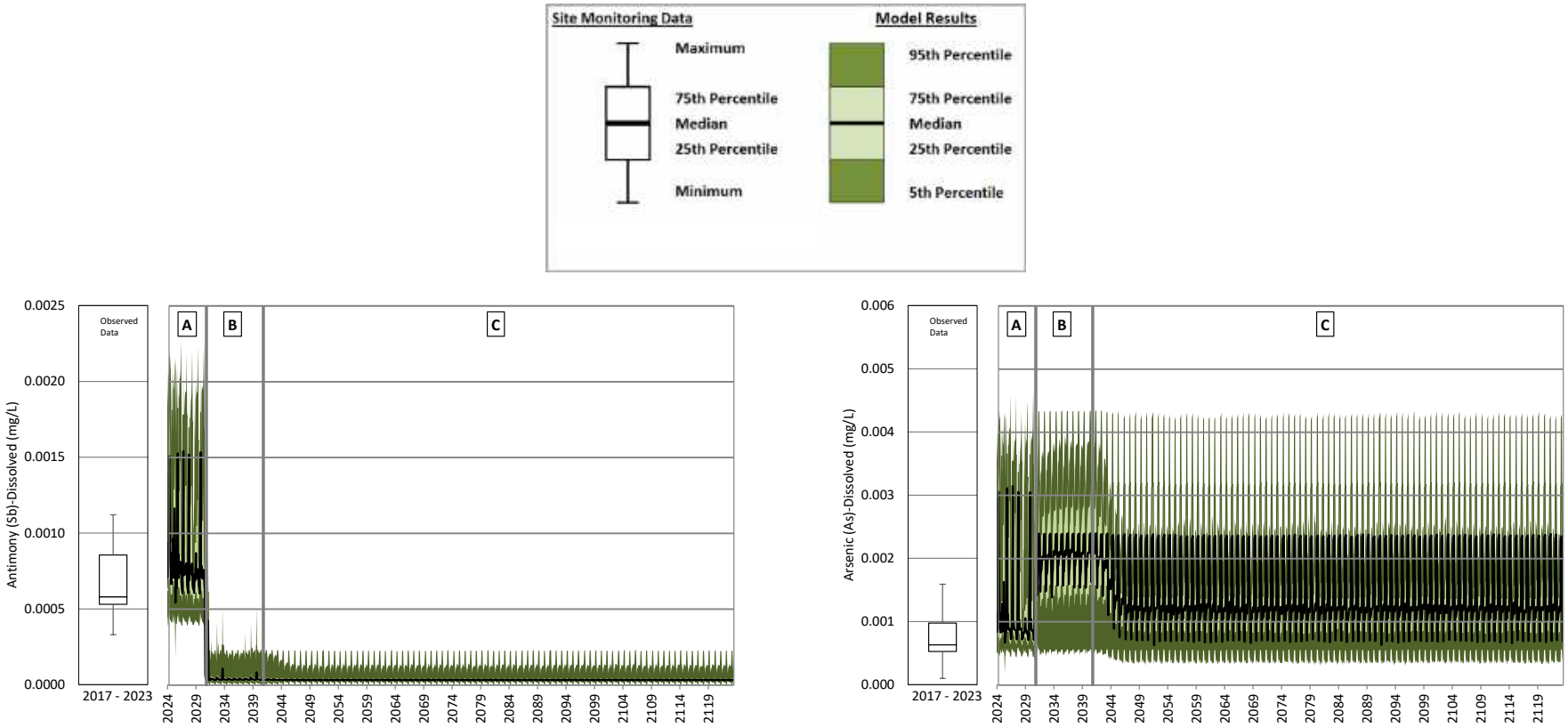
Figure B **66: Wight Pit Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus concentrations increase from operations to closure due to pumping from the Tailings Storage Facility. Total phosphorus concentrations then decrease during post-closure as runoff areas are remediated. The increase in dissolved aluminum concentrations from operations to closure and post-closure is caused by higher dissolved aluminum concentrations in the disturbed and undisturbed water quality inputs as well as pumping from the Central Collection Sump.

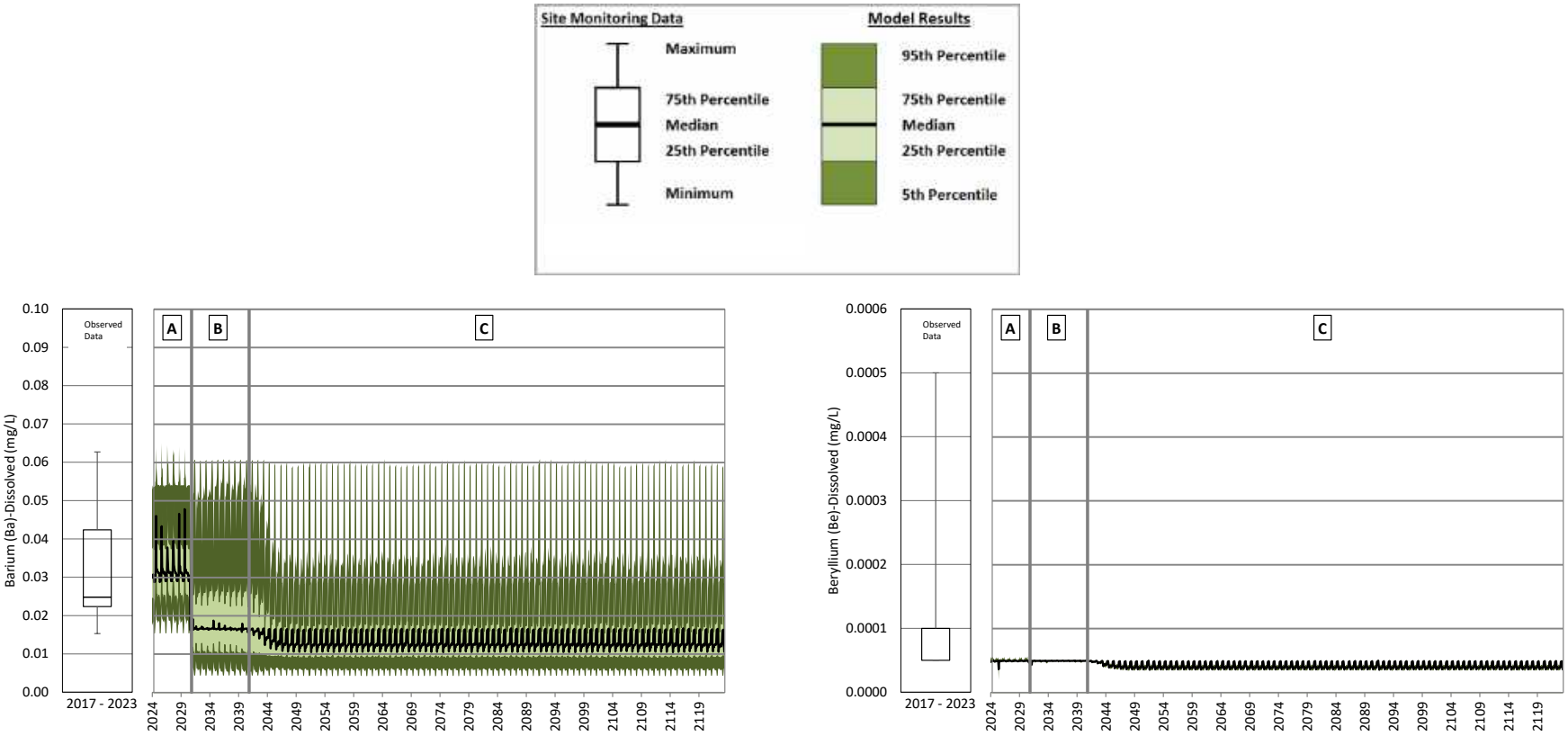
Figure B **67: Wight Pit Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

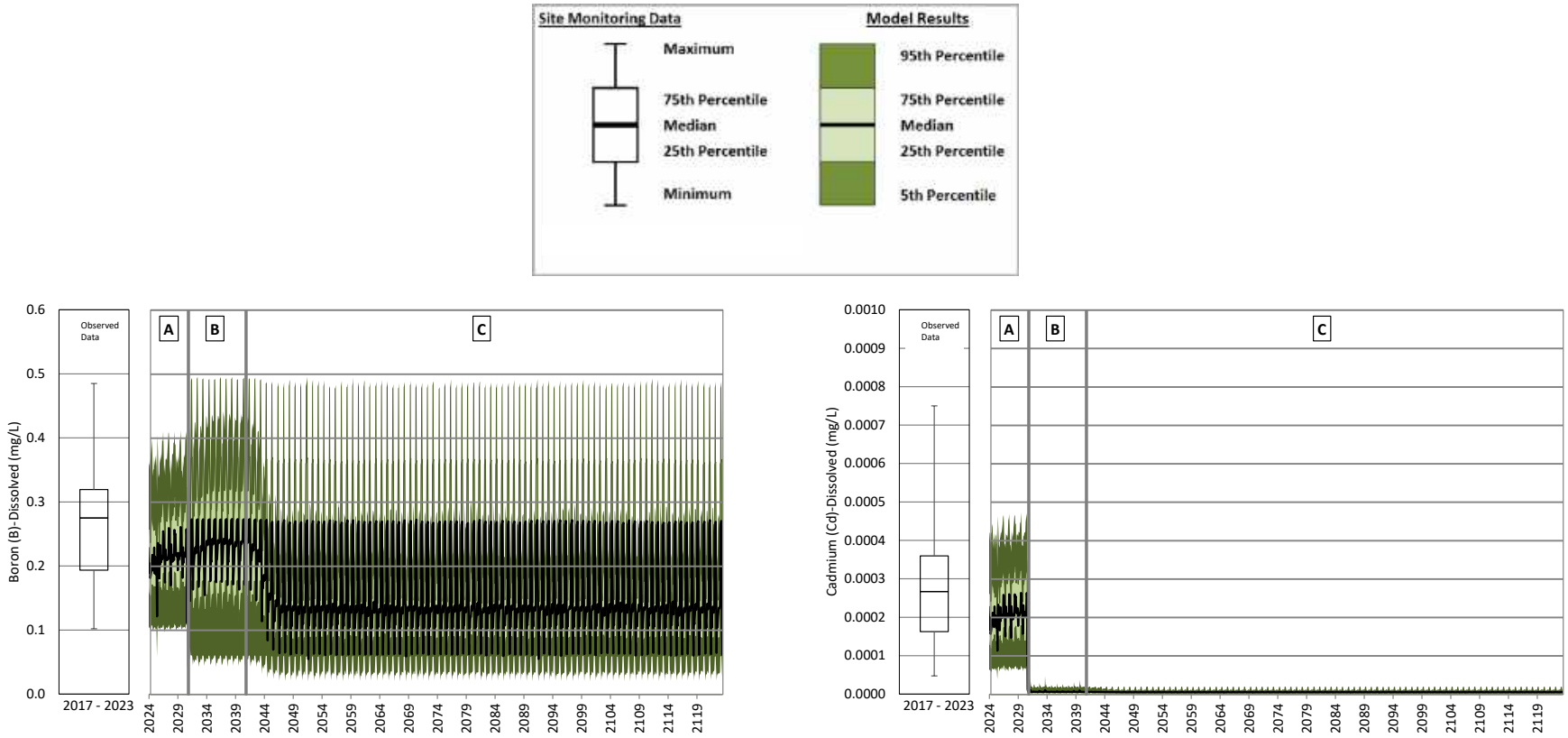
Figure B **68: Wight Pit Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

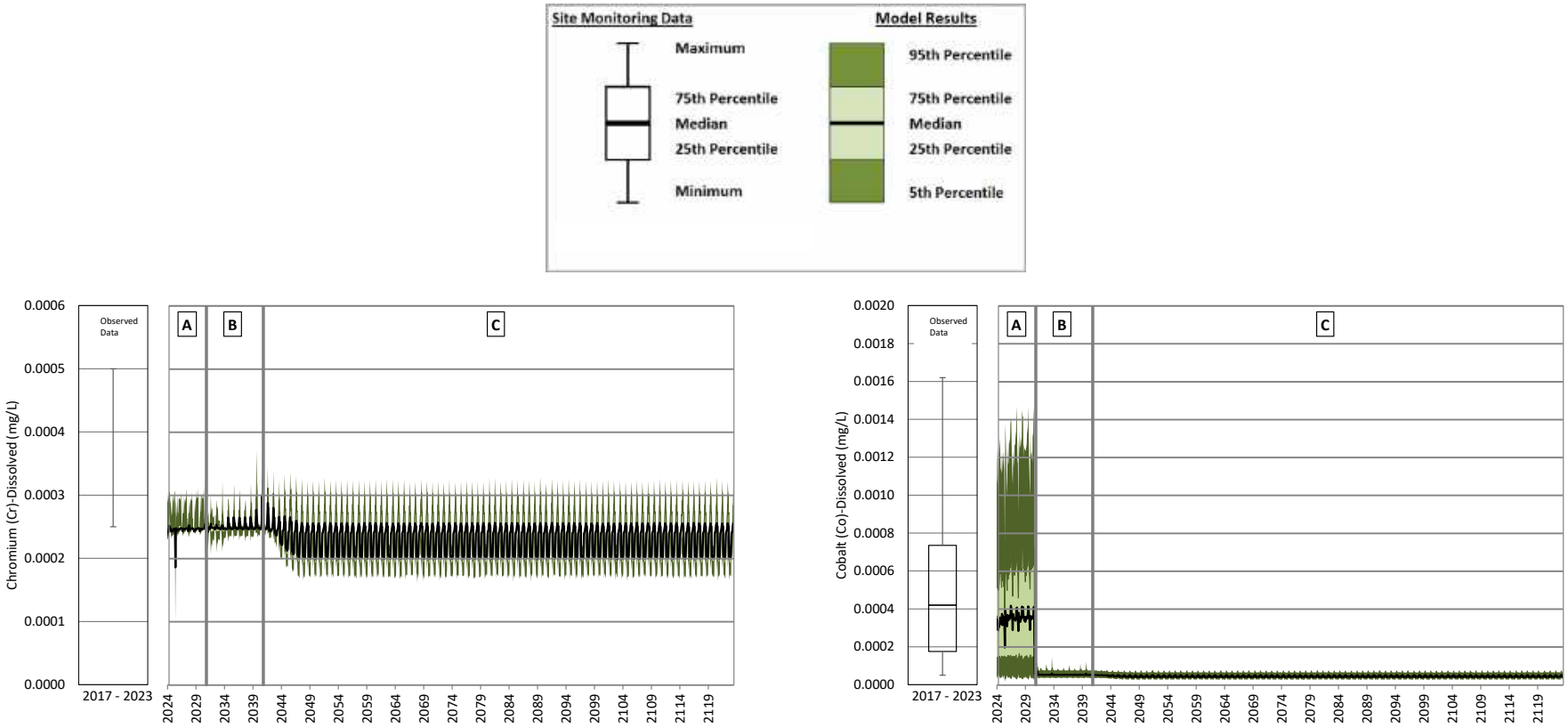
Figure B **69: Wight Pit Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

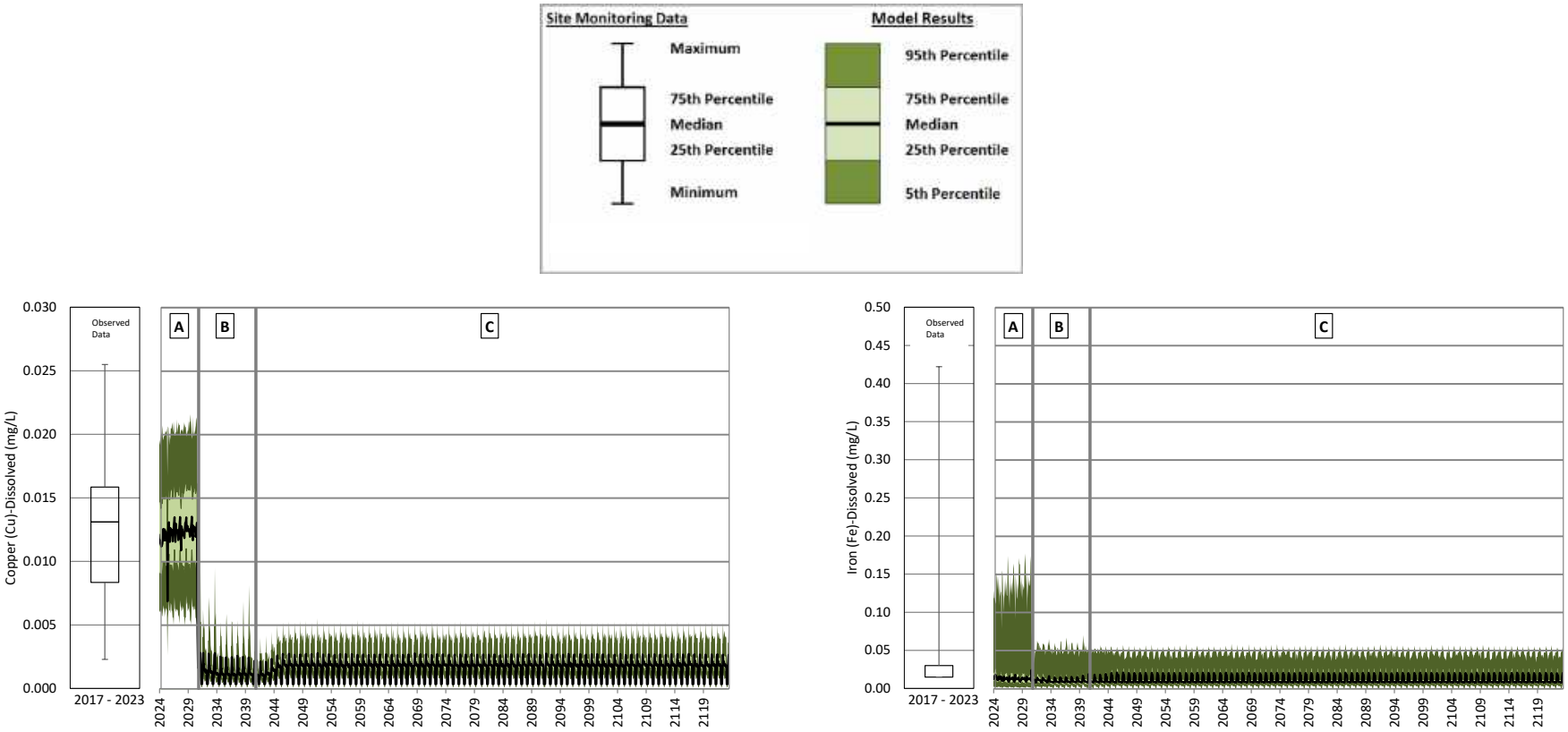
Figure B **70: Wight Pit Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

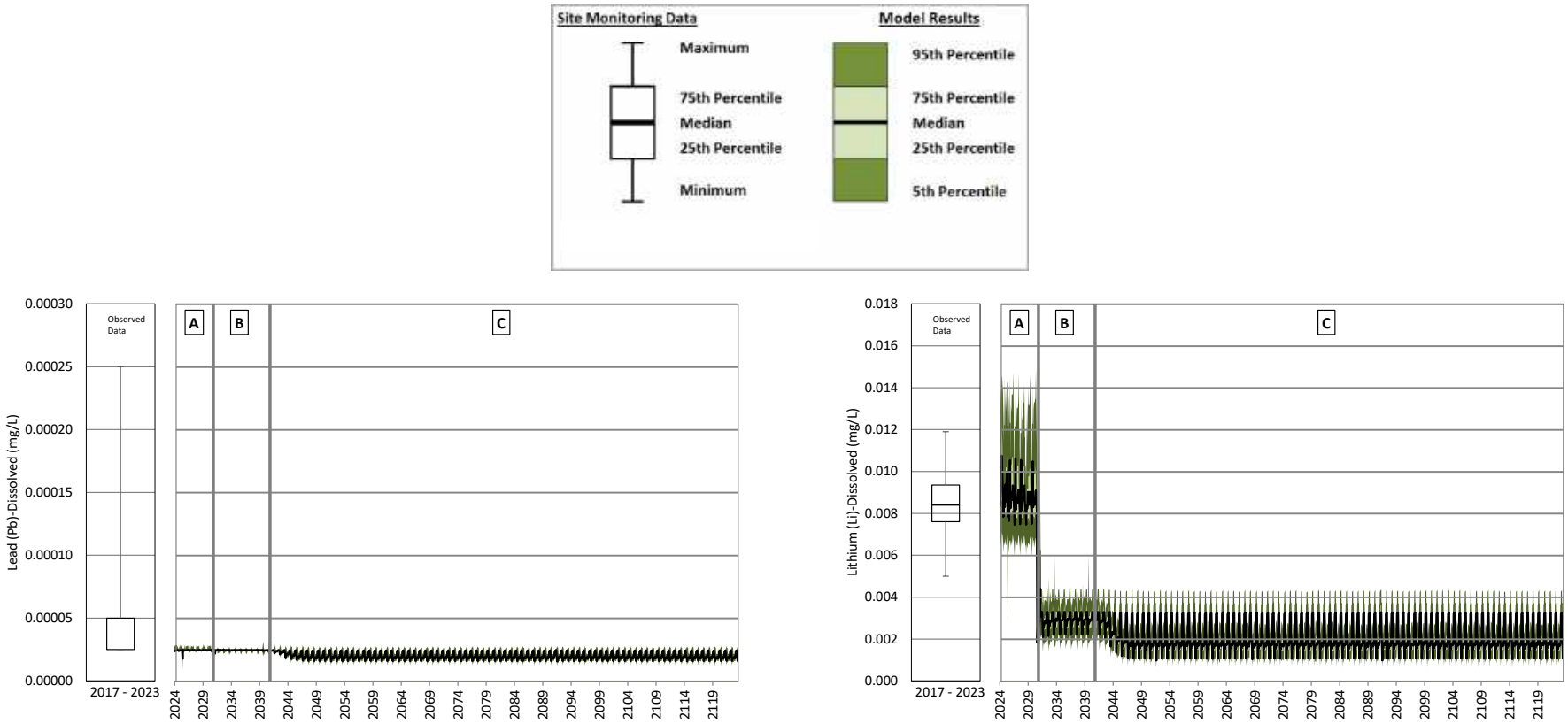
Figure B **71: Wight Pit Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

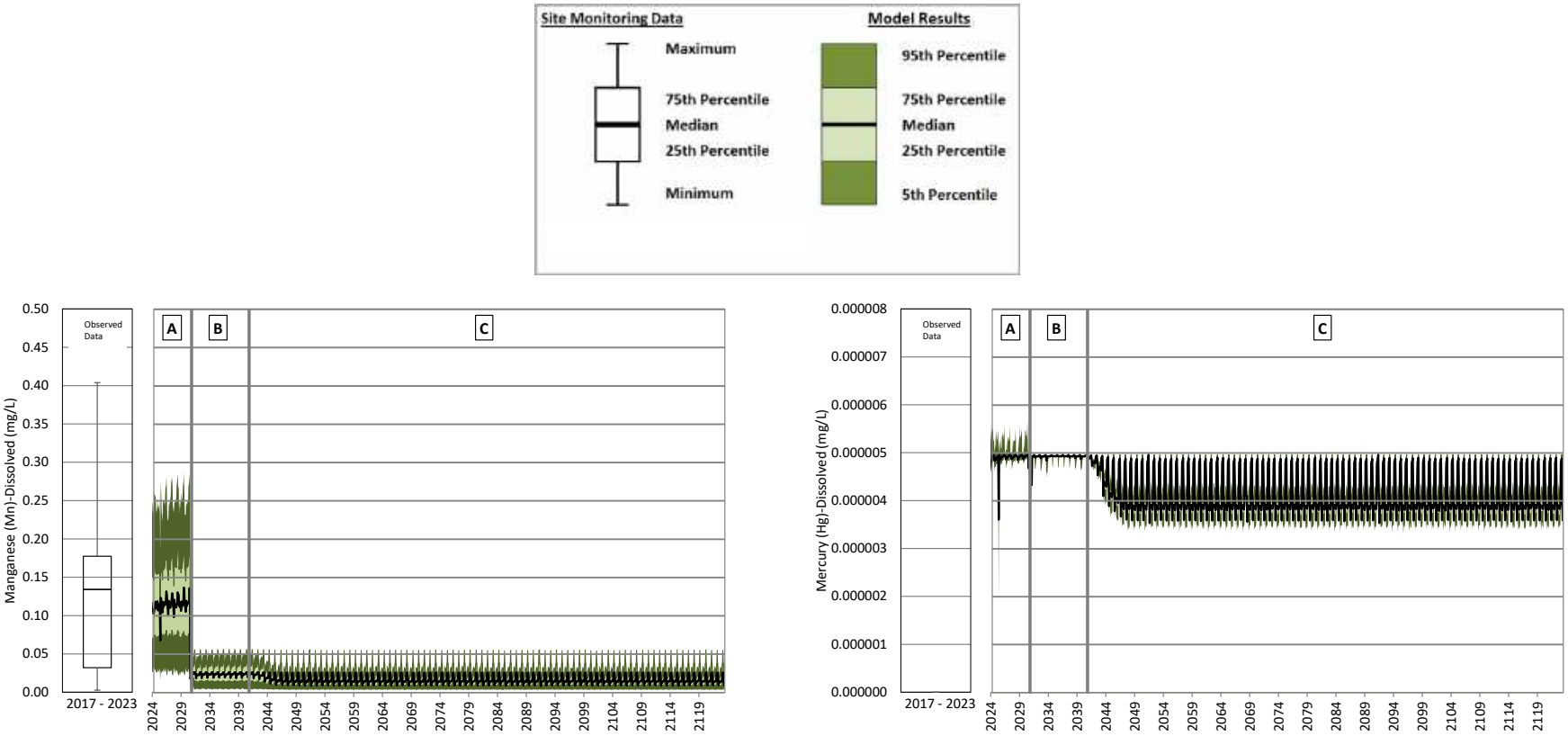
Figure B **72: Wight Pit Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

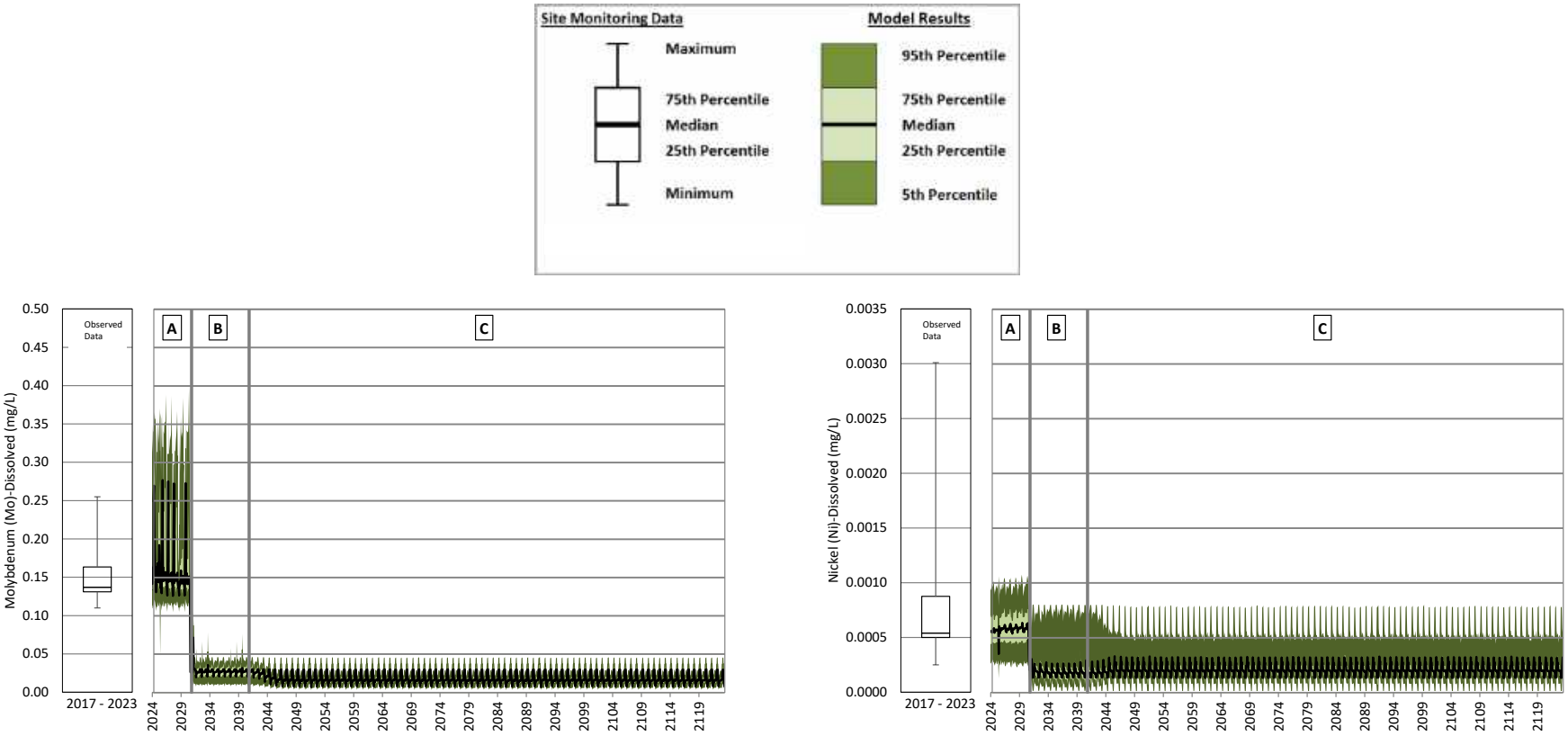
Figure B **73: Wight Pit Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

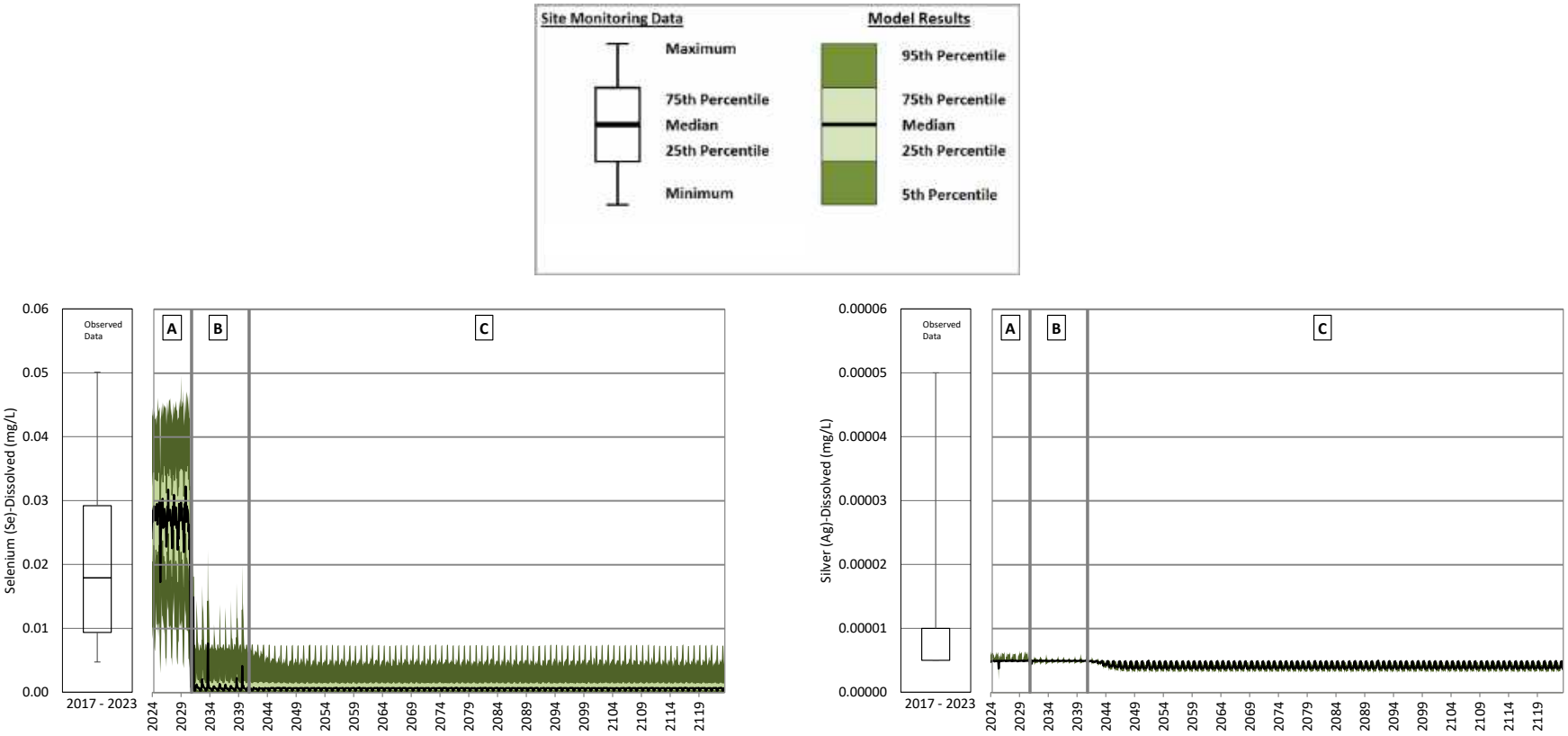
Figure B **74: Wight Pit Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

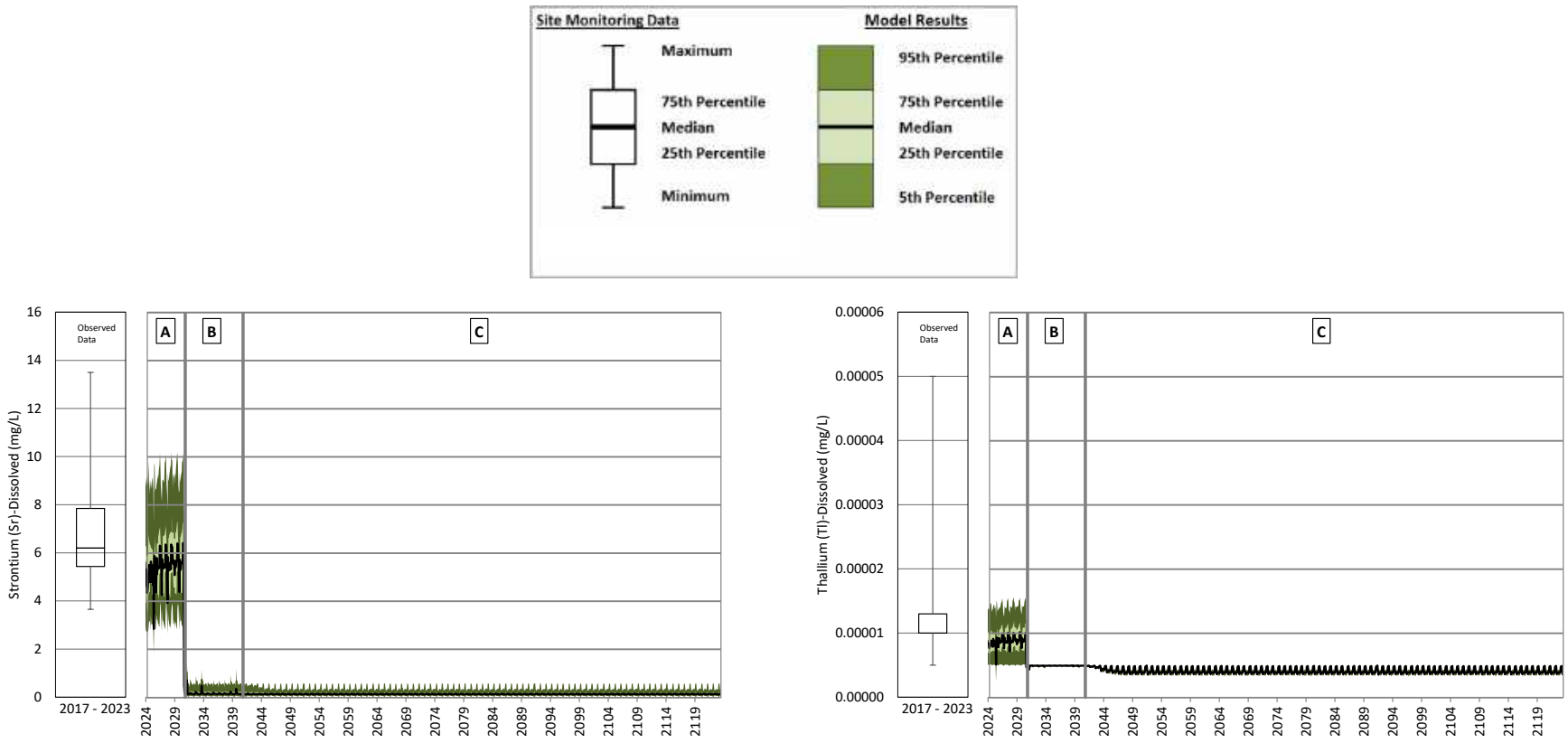
Figure B **75: Wight Pit Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

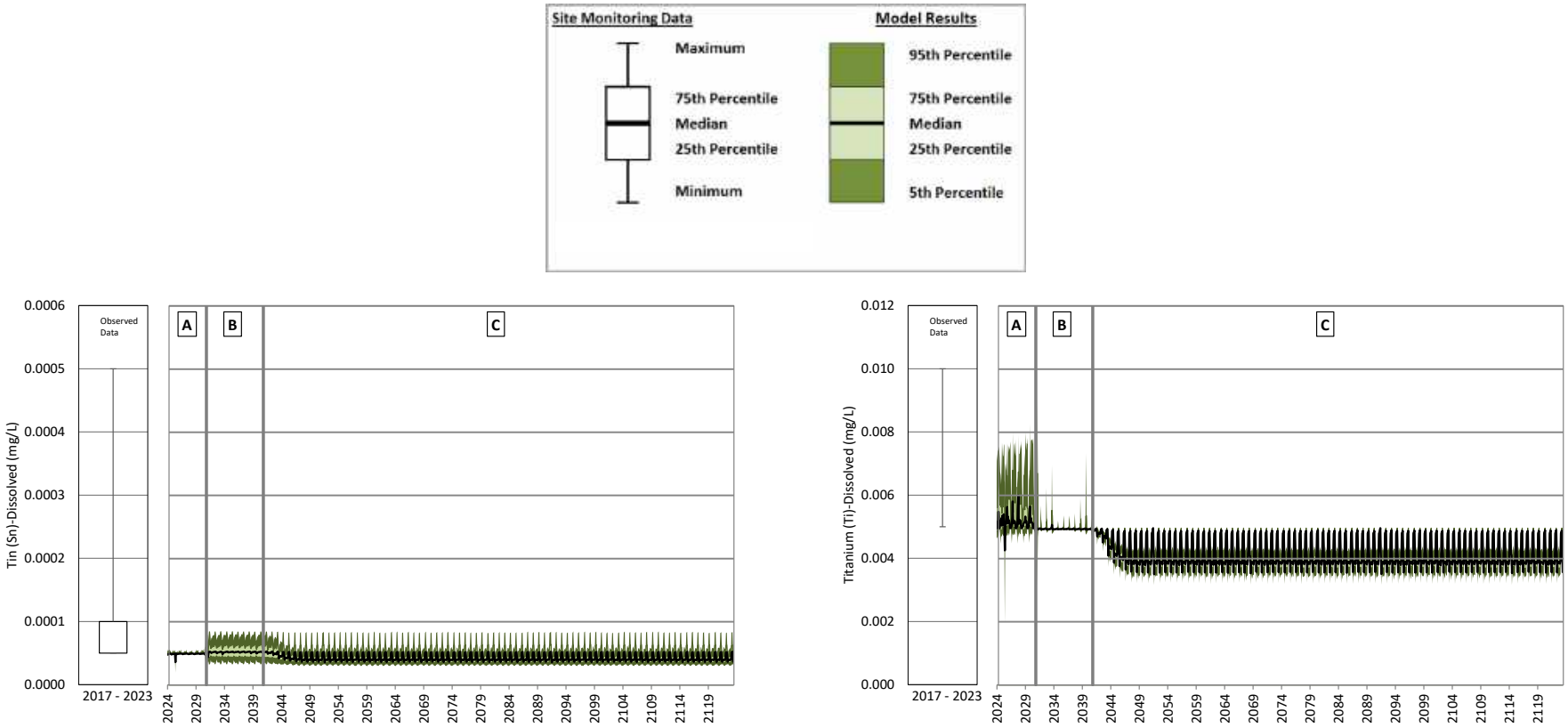
Figure B **76: Wight Pit Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

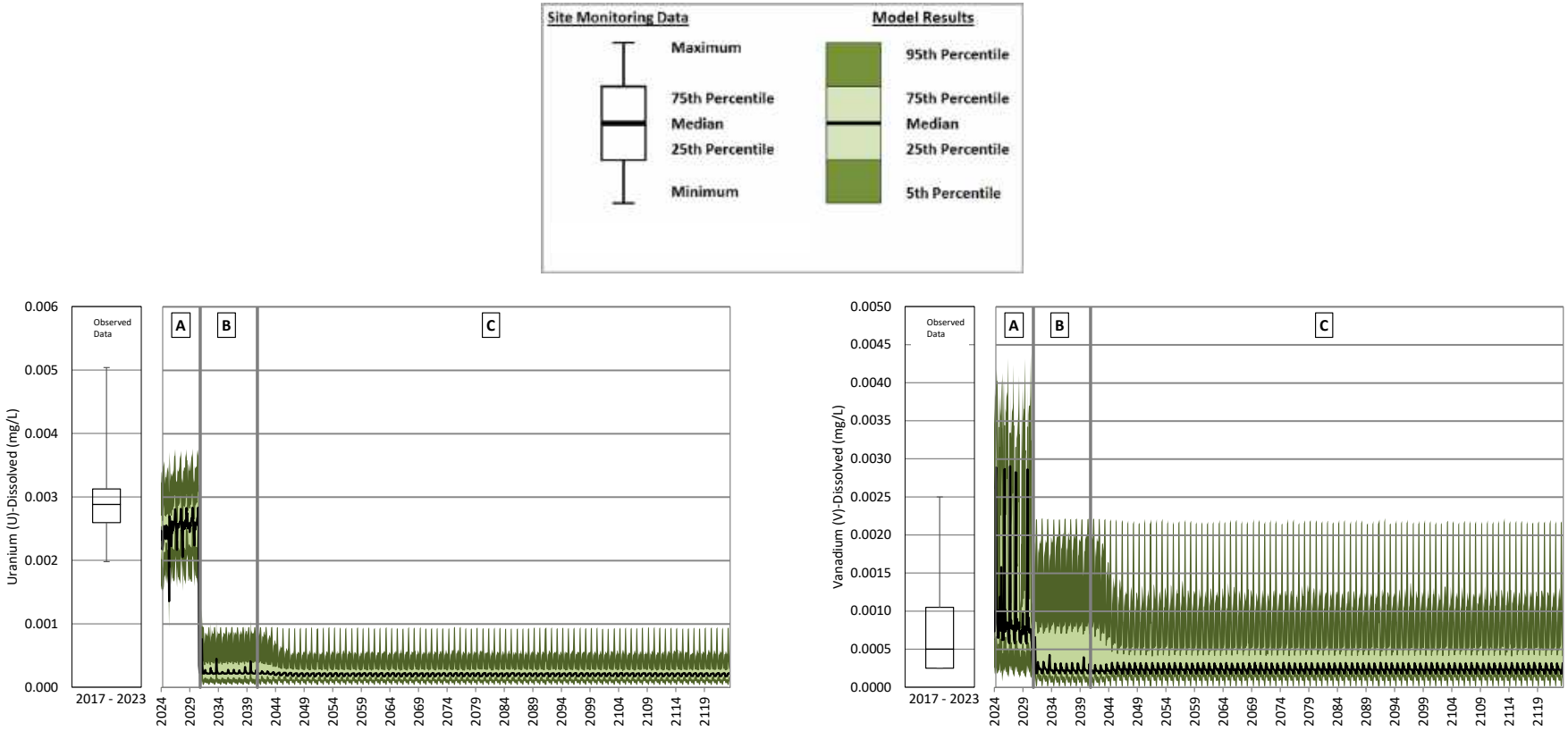
Figure B **77: Wight Pit Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved tin concentrations increase from operations to closure and post-closure due to a greater proportion of total inflows from groundwater. The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

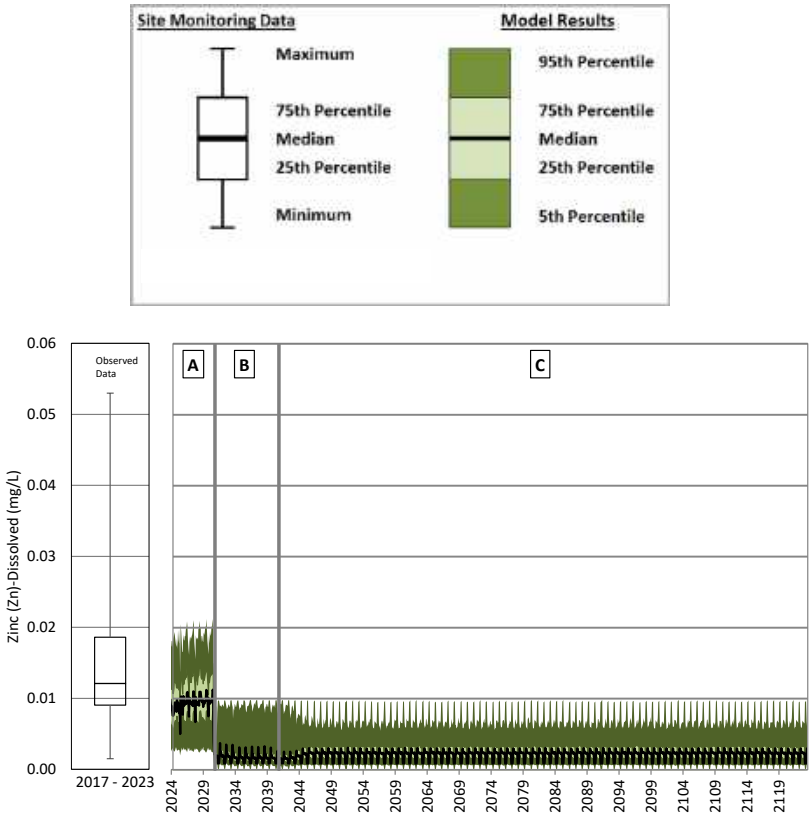
Figure B **78: Wight Pit Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **79: Wight Pit Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

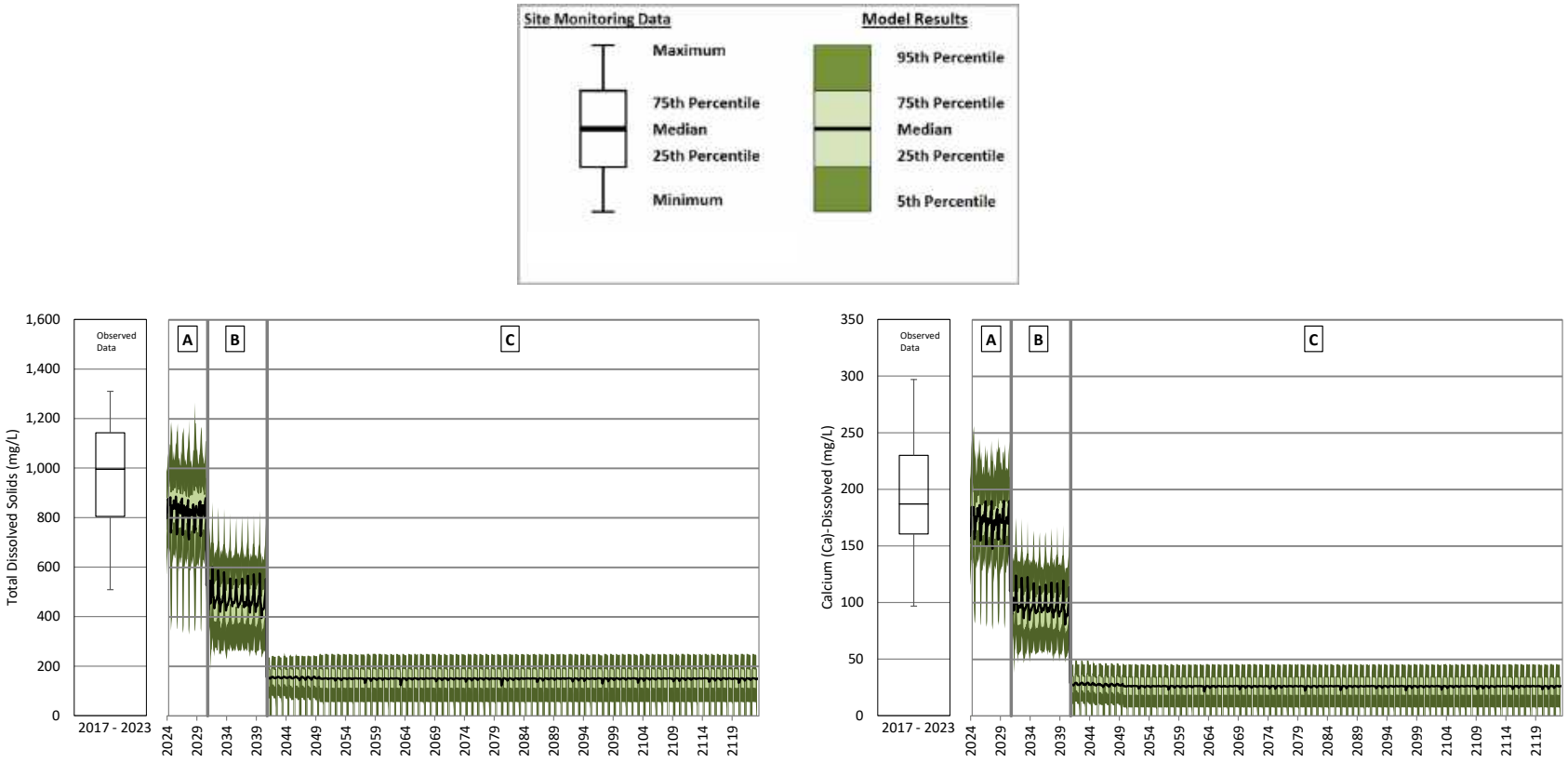


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **80: Wight Pit Operations, Closure and Post-closure – Dissolved Zinc**

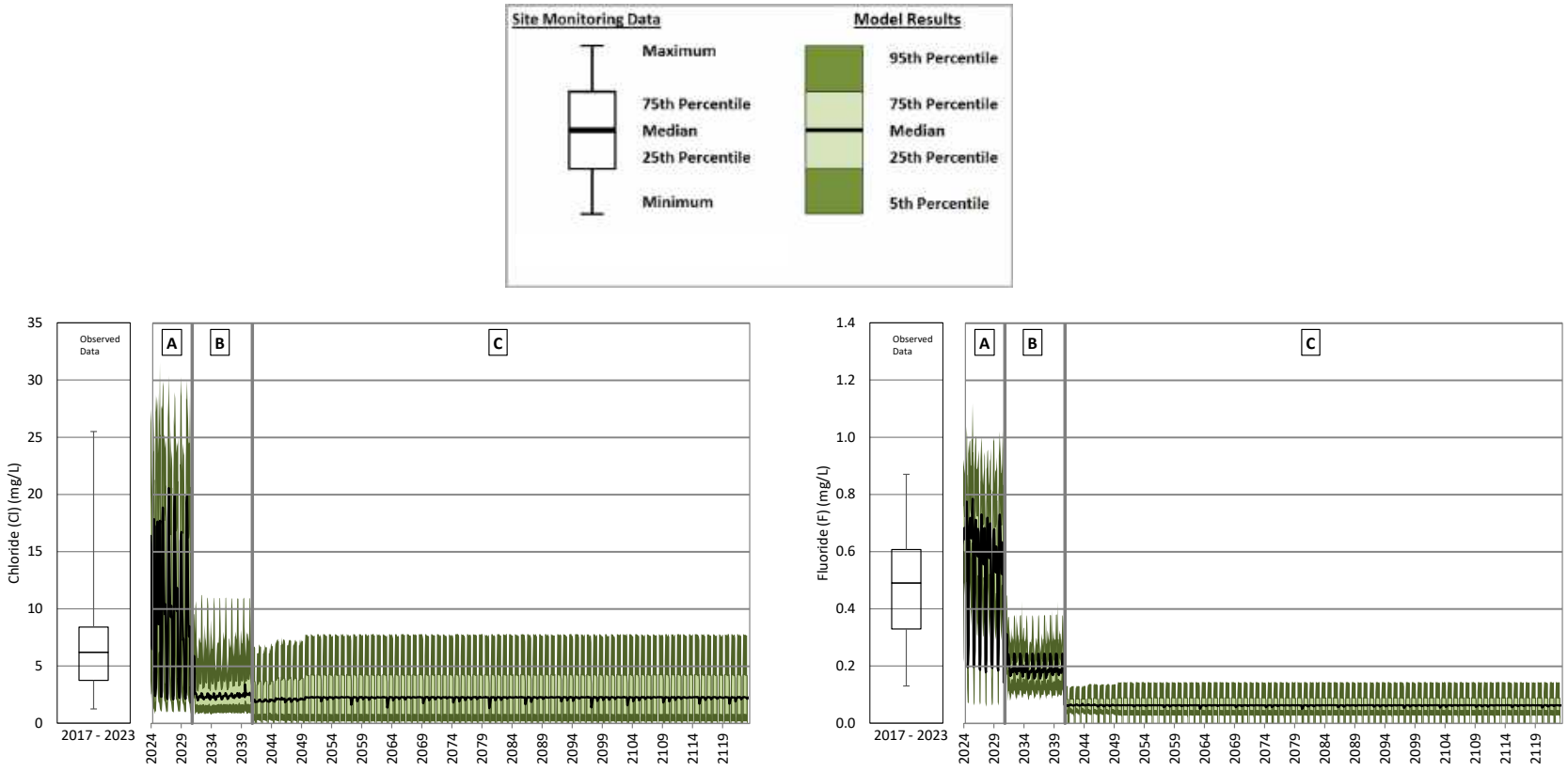
Central Collection Sump Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

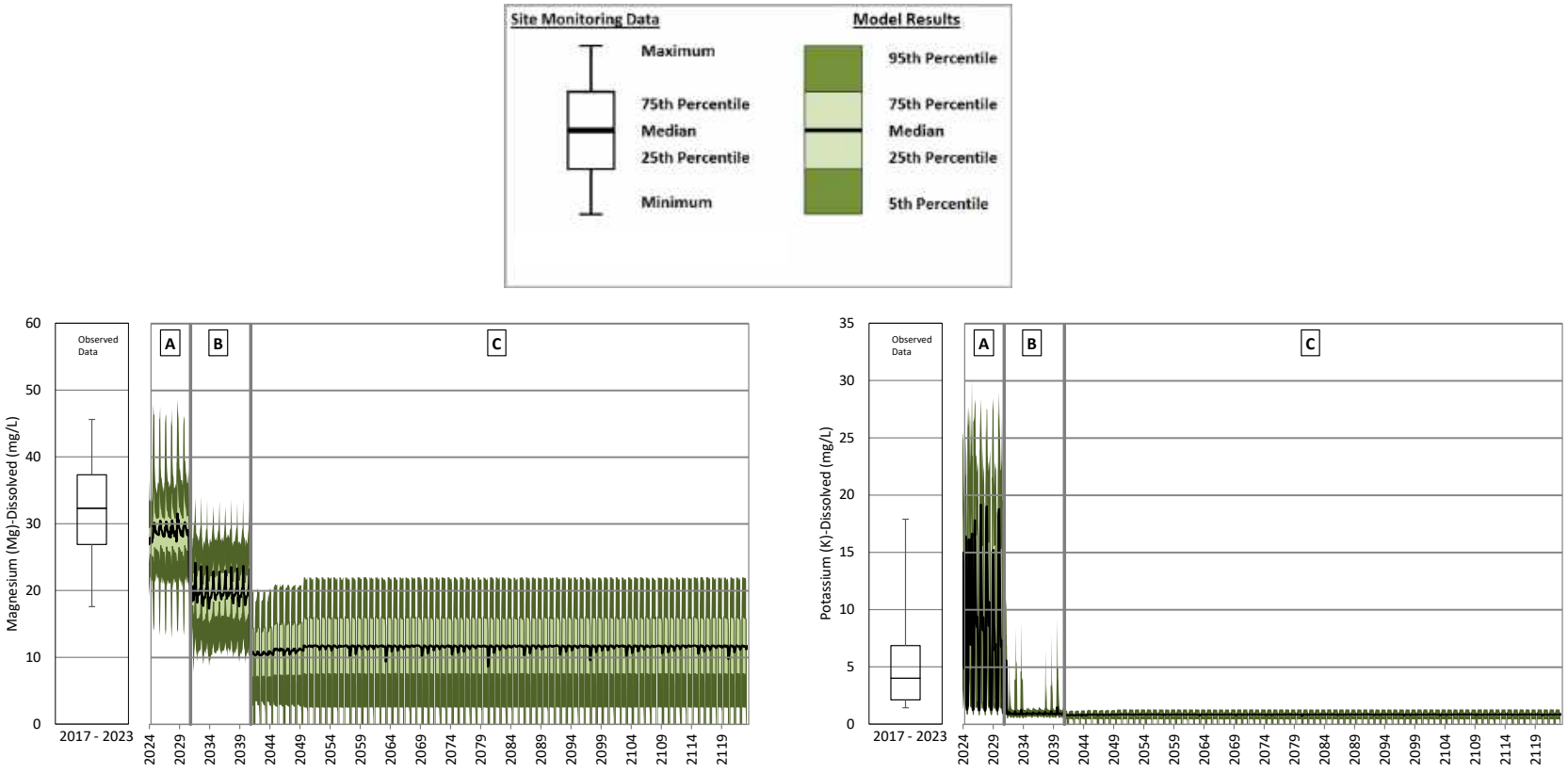
Figure B **81: Central Collection Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

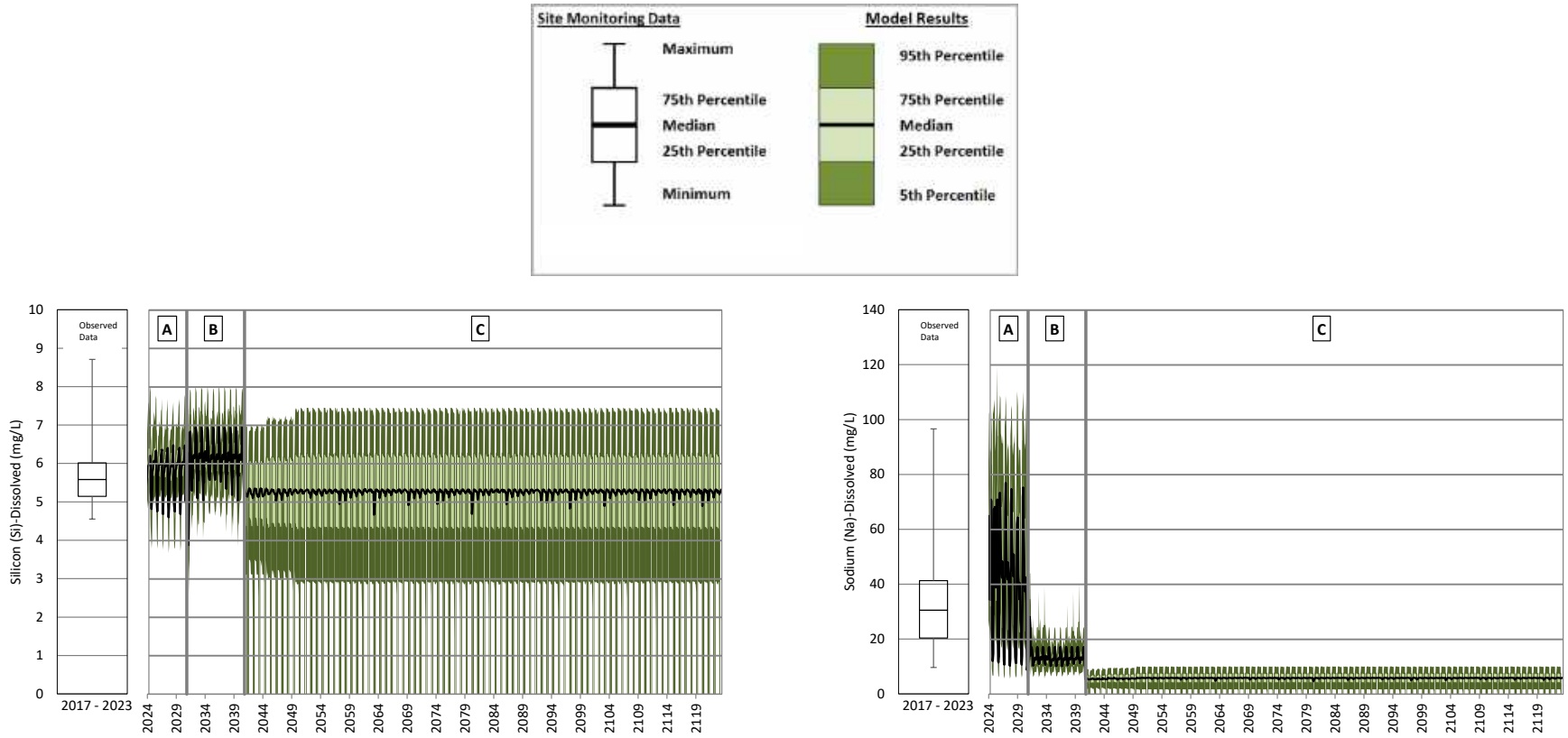
Figure B **82: Central Collection Sump Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

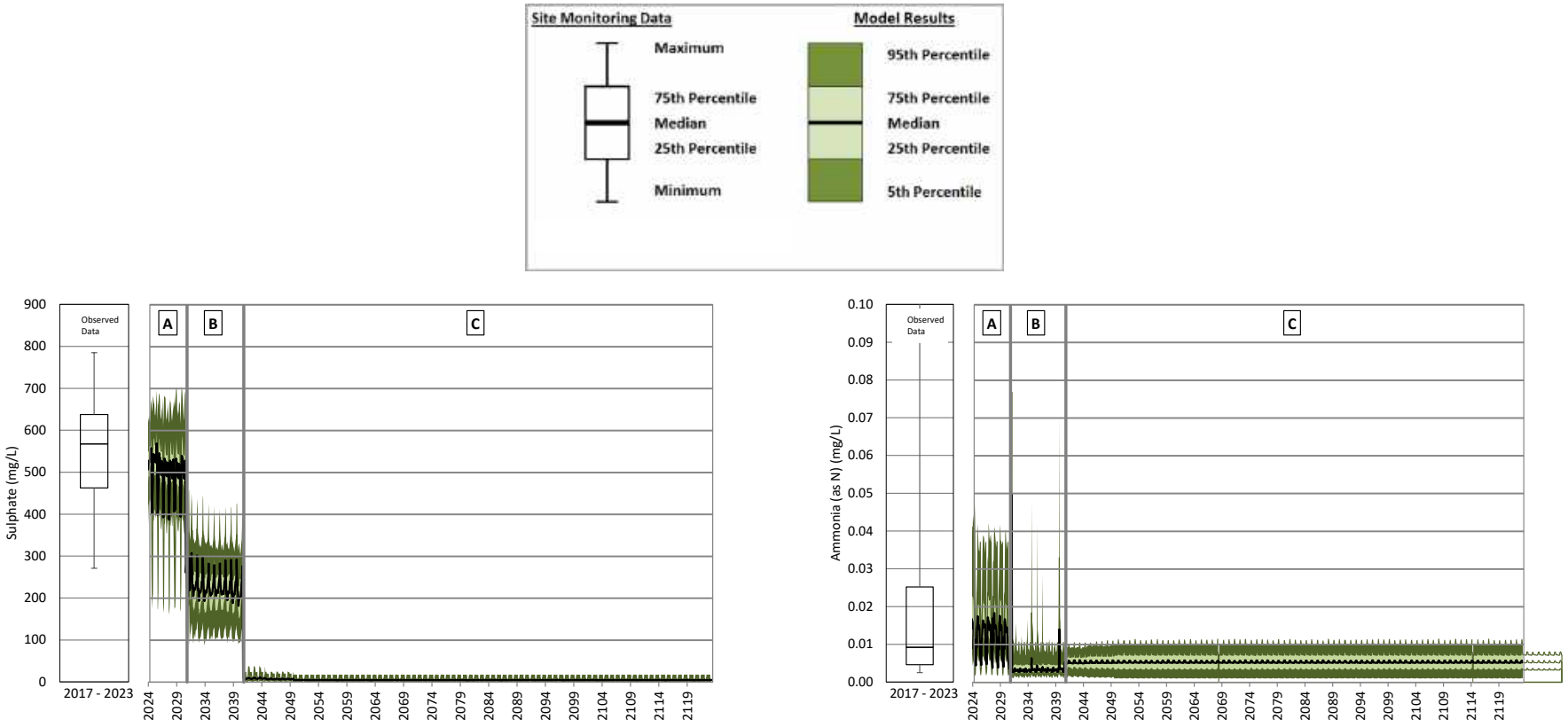
Figure B **83: Central Collection Sump Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The increase in silicon concentrations from operations to closure and post-closure is caused by runoff from areas that were assigned the disturbed water quality input being reclaimed and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum silicon concentrations than the disturbed water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

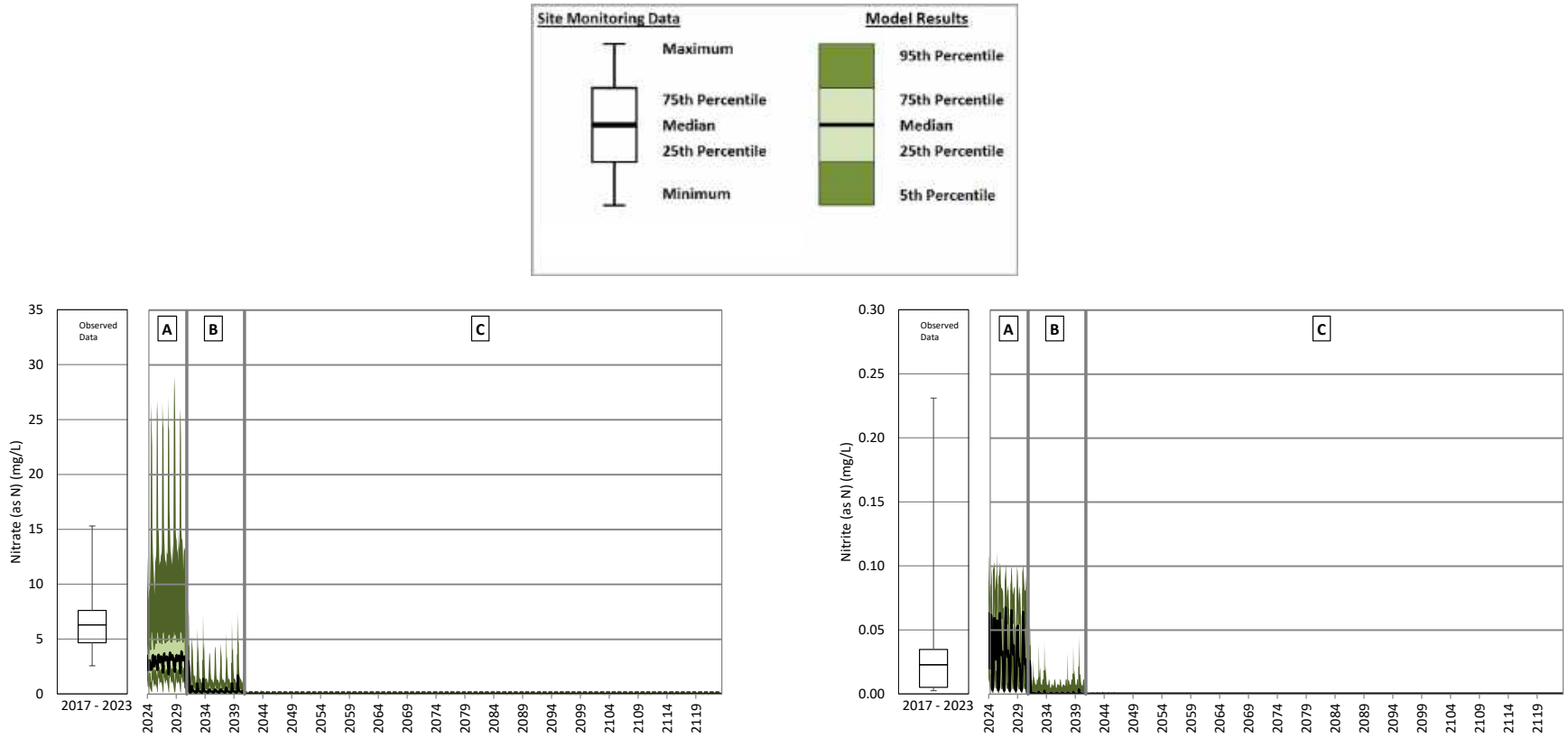
Figure B **84: Central Collection Sump Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

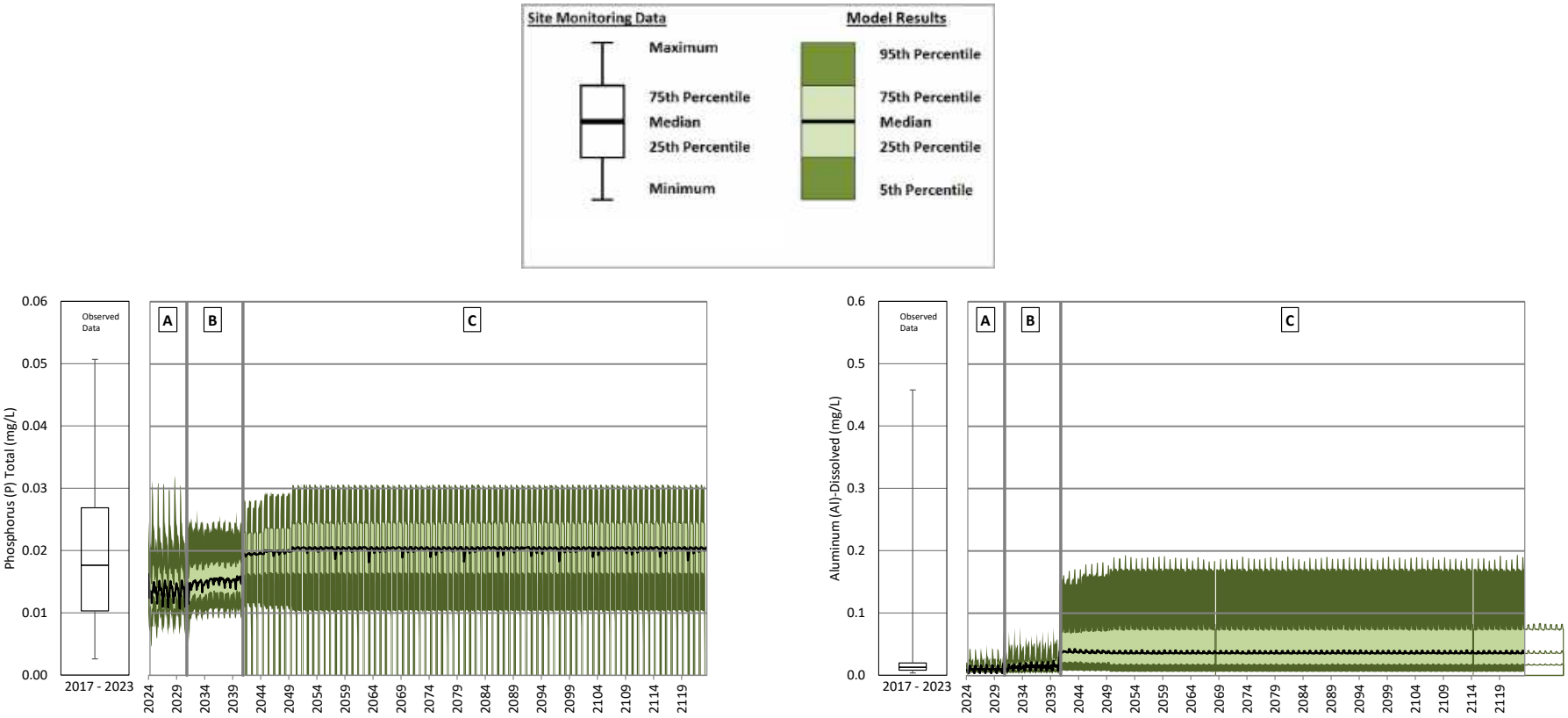
Figure B **85: Central Collection Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

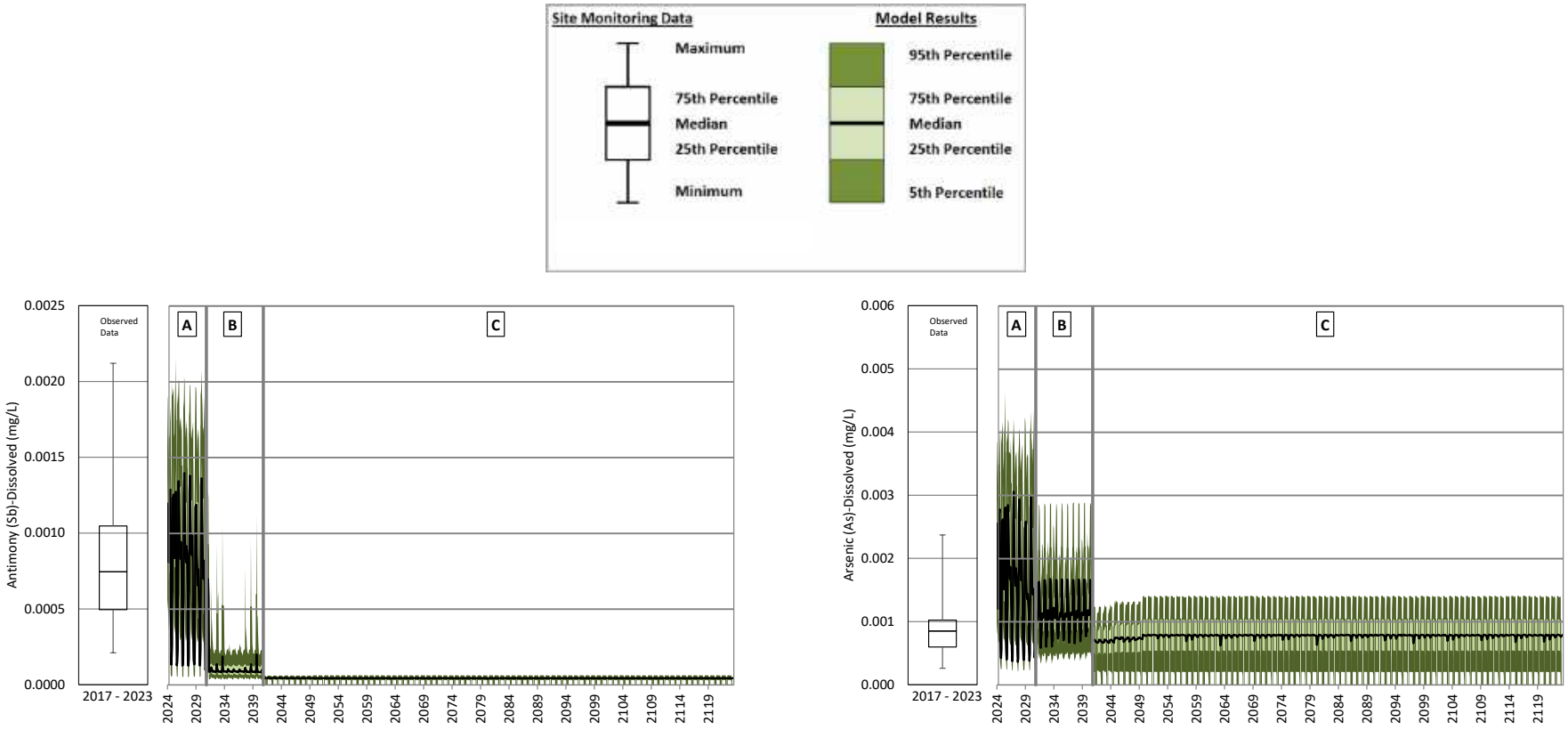
Figure B **86: Central Collection Sump Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

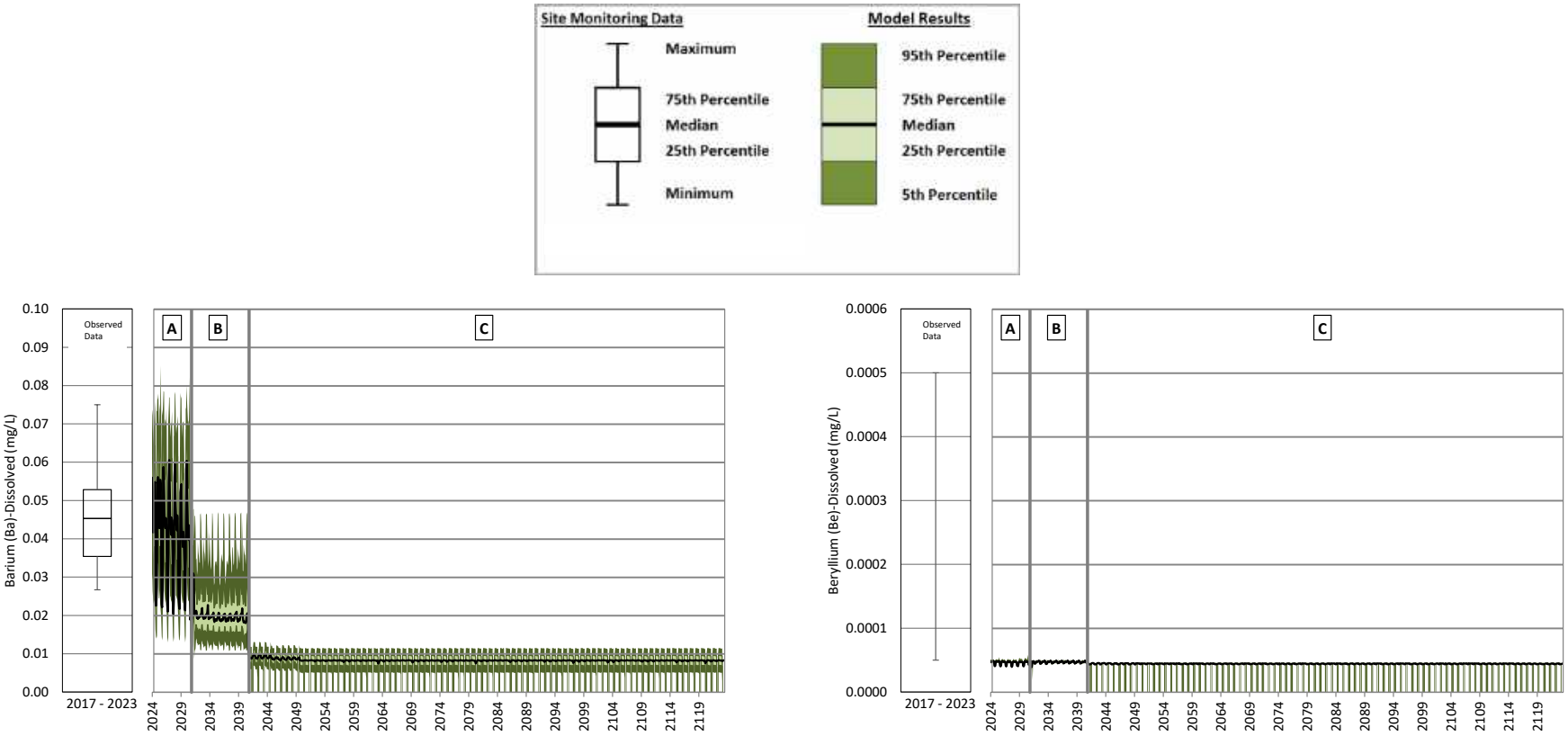
Figure B **87: Central Collection Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

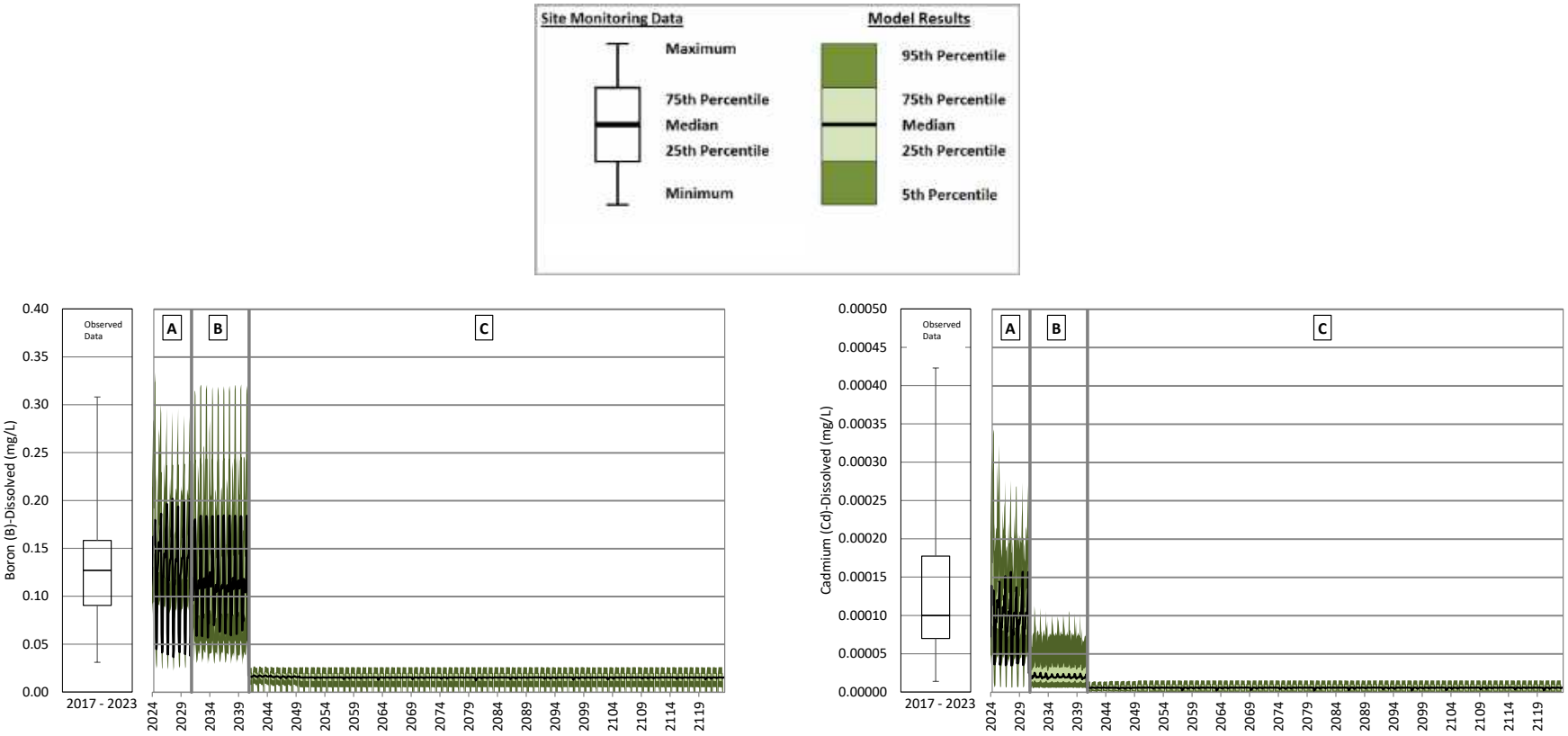
Figure B **88: Central Collection Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

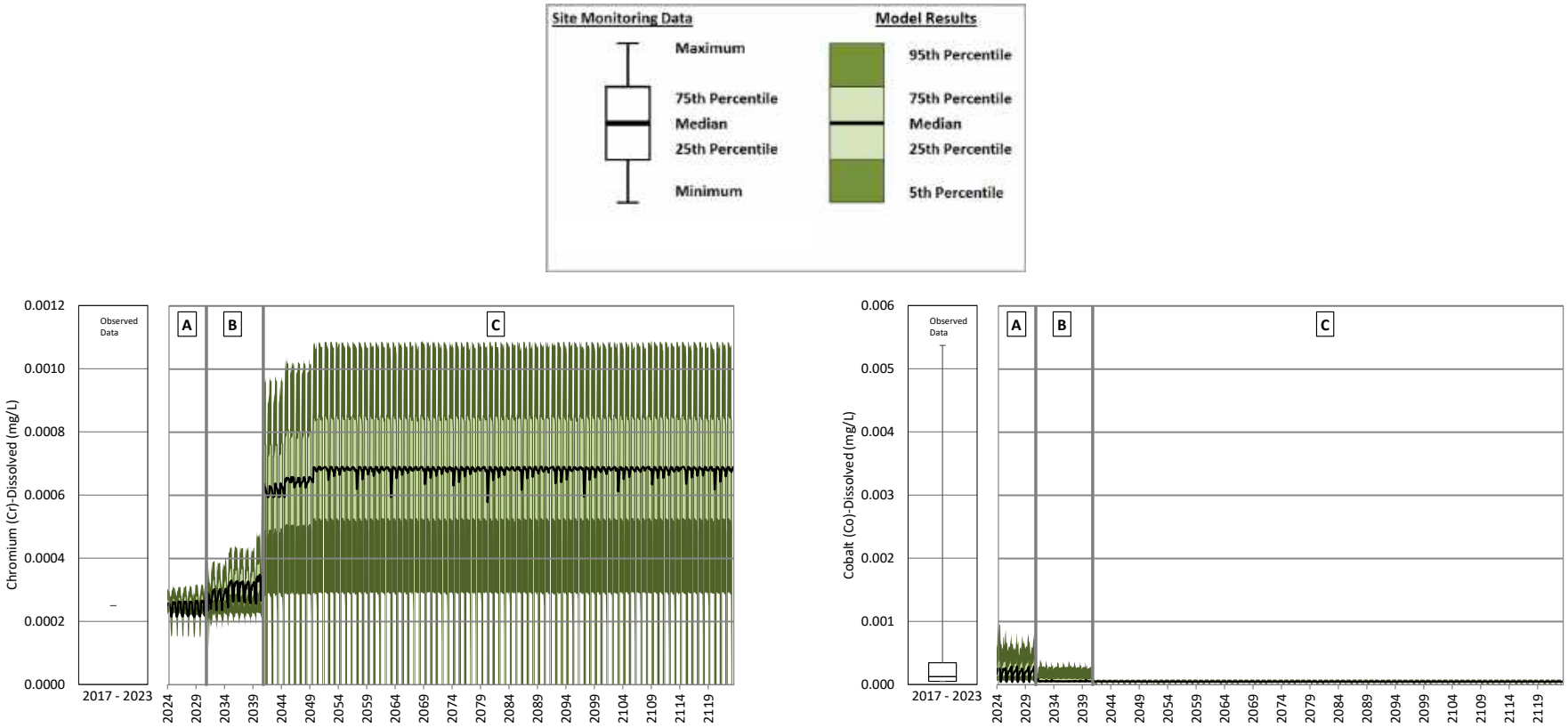
Figure B **89: Central Collection Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

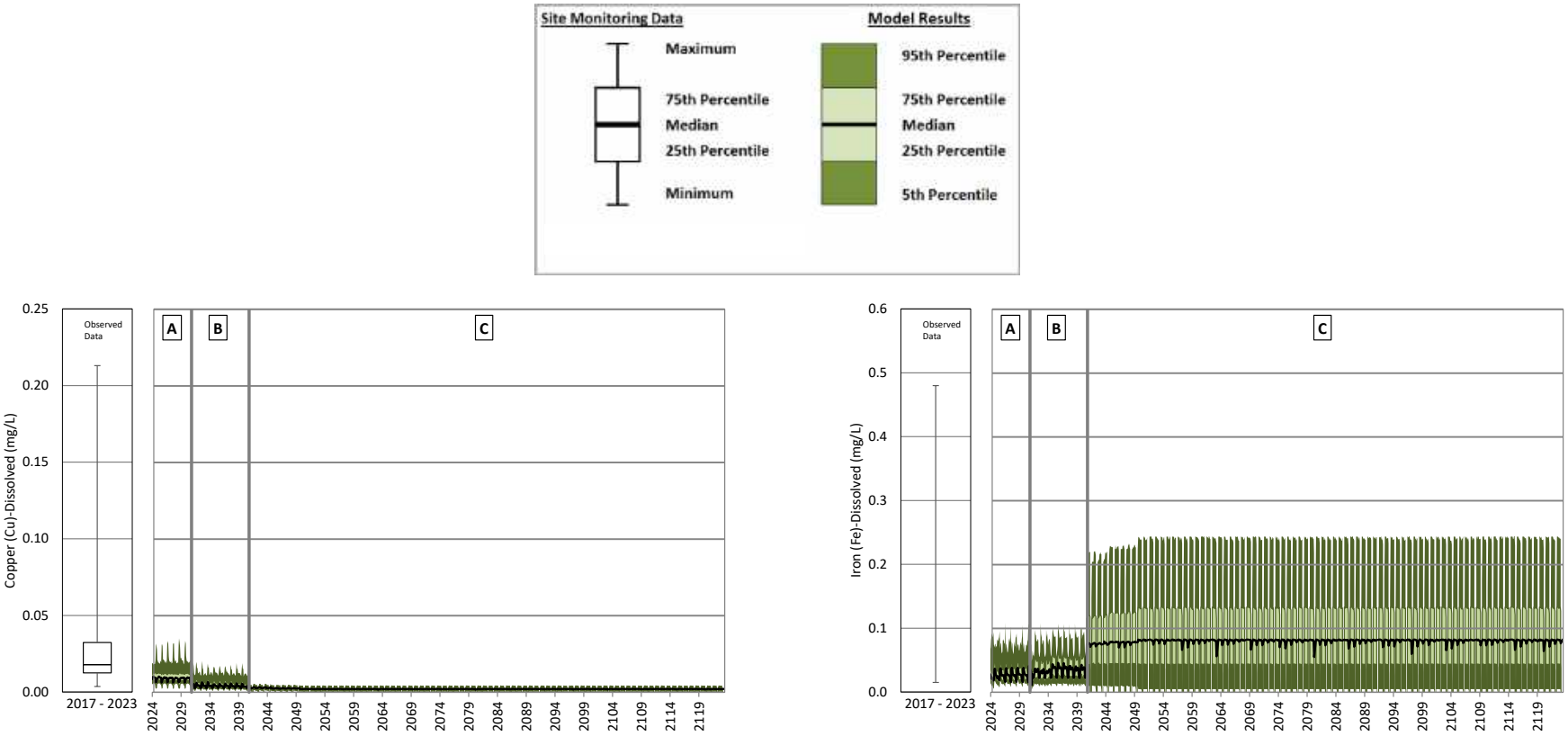
Figure B **90: Central Collection Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

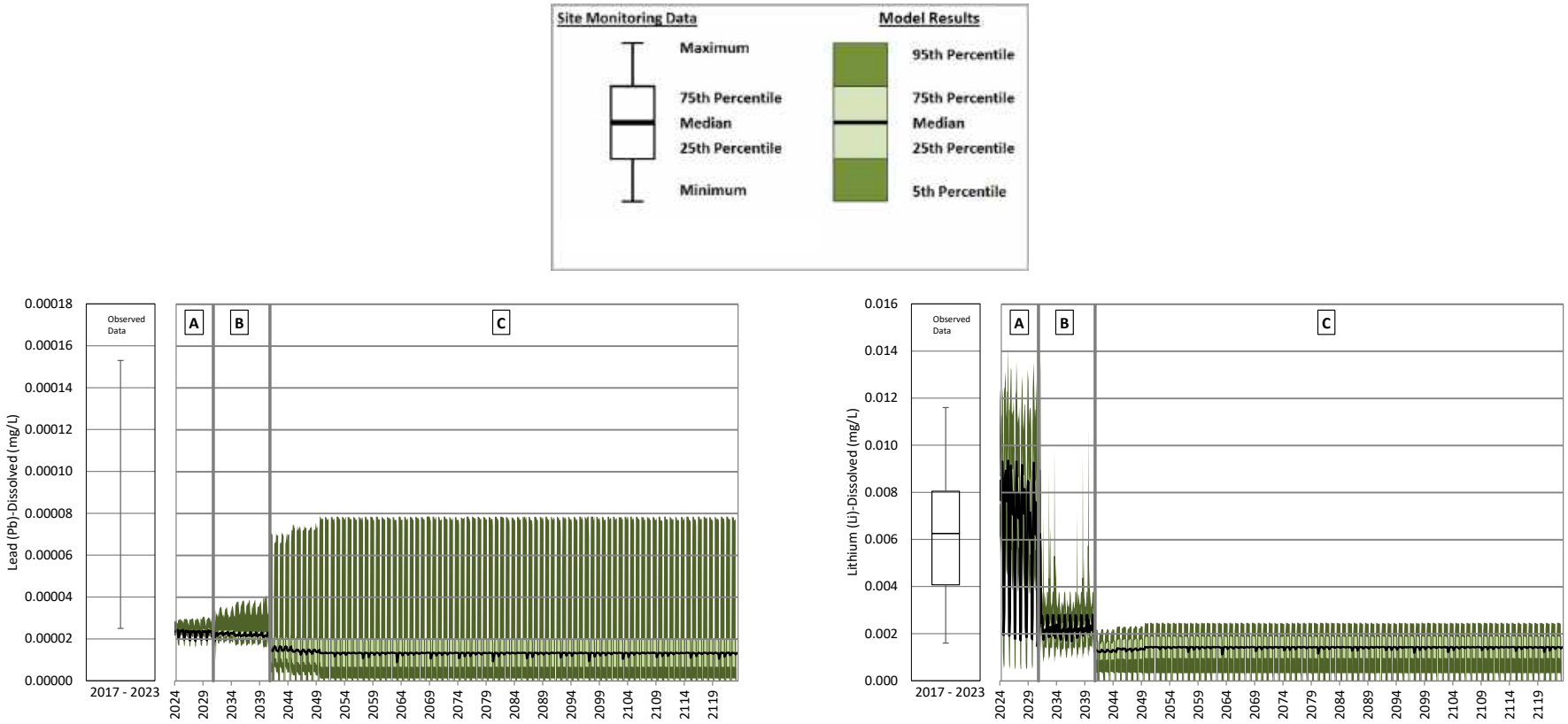
Figure B **91: Central Collection Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

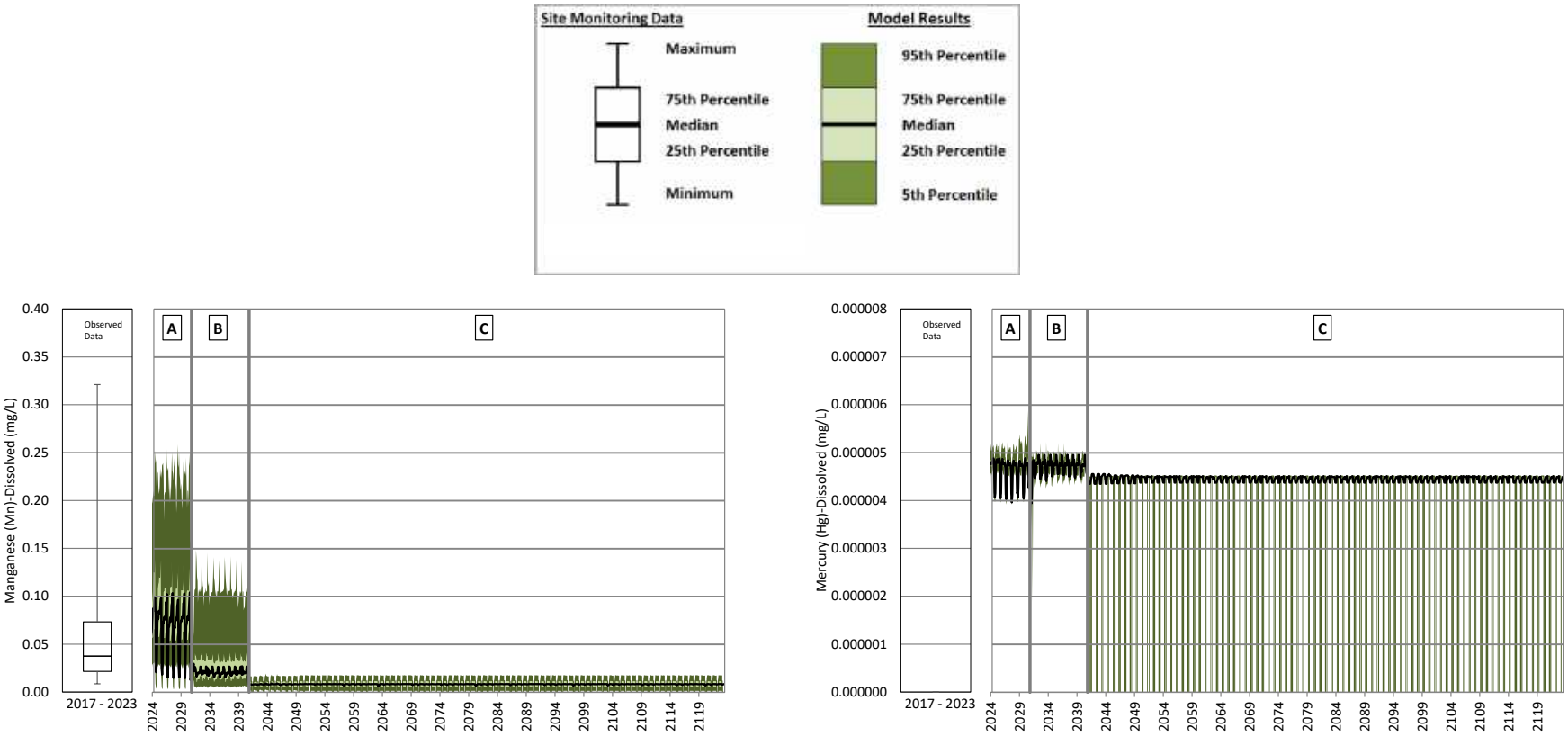
Figure B **92: Central Collection Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

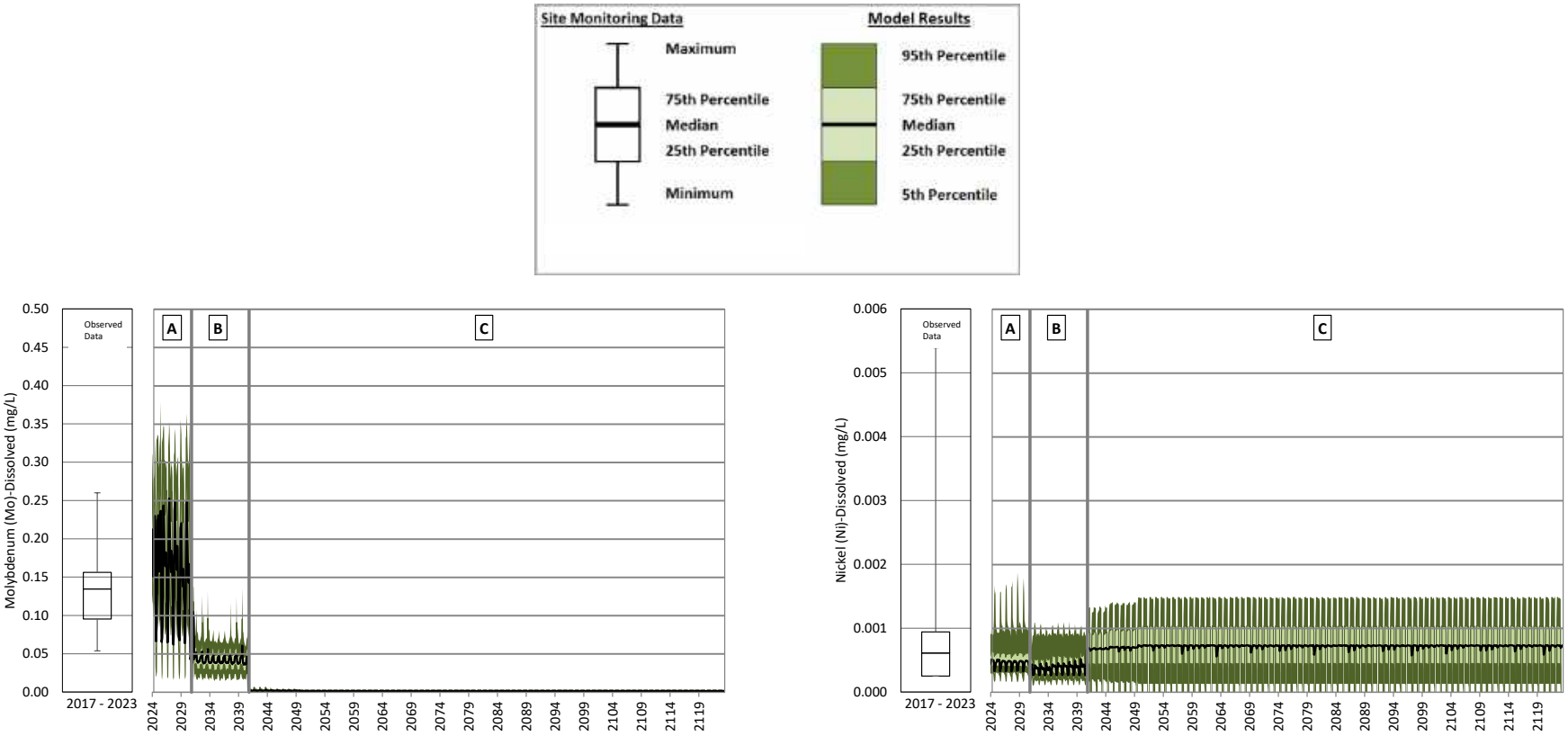
Figure B **93: Central Collection Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

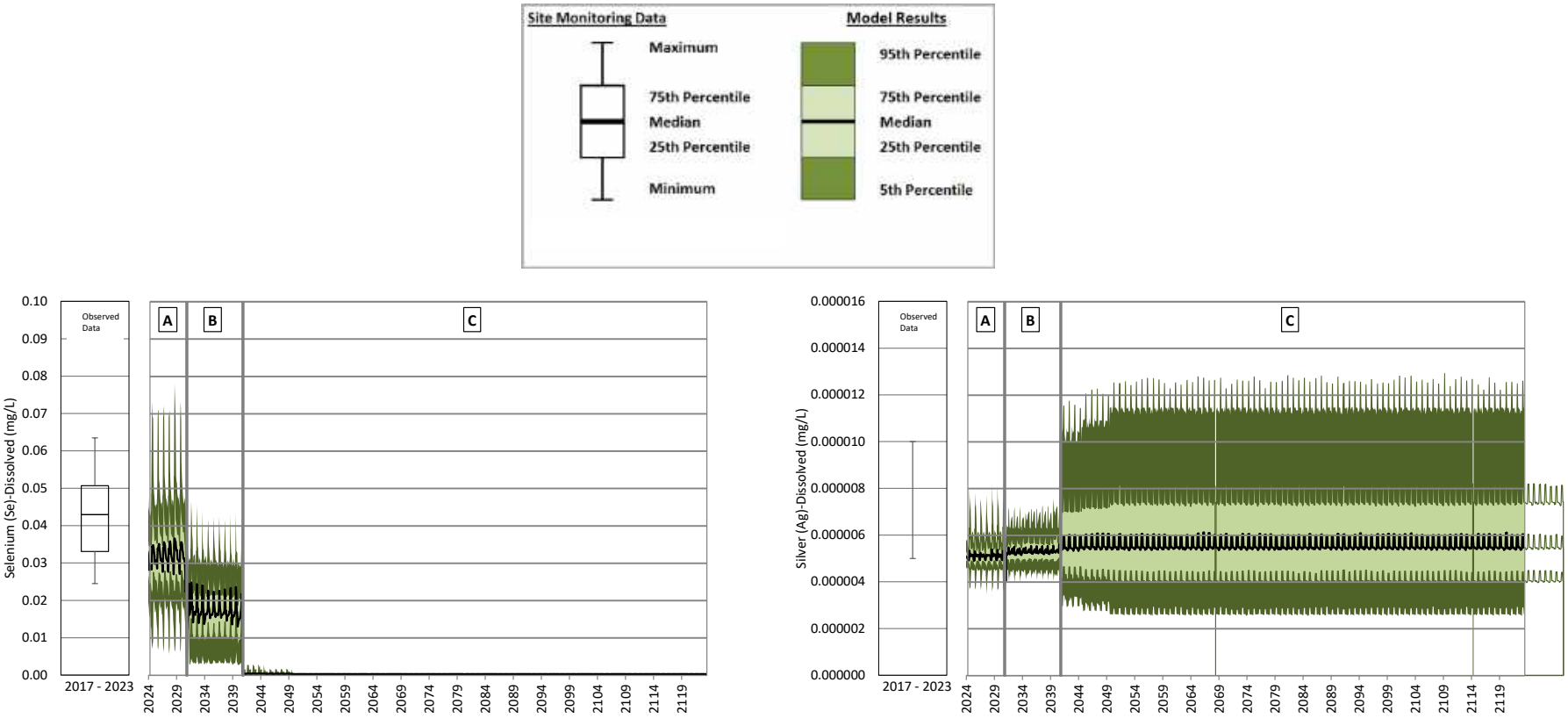
Figure B **94: Central Collection Sump Operations, Closure and Post-closure – Dissolved Manganese and Dbootissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

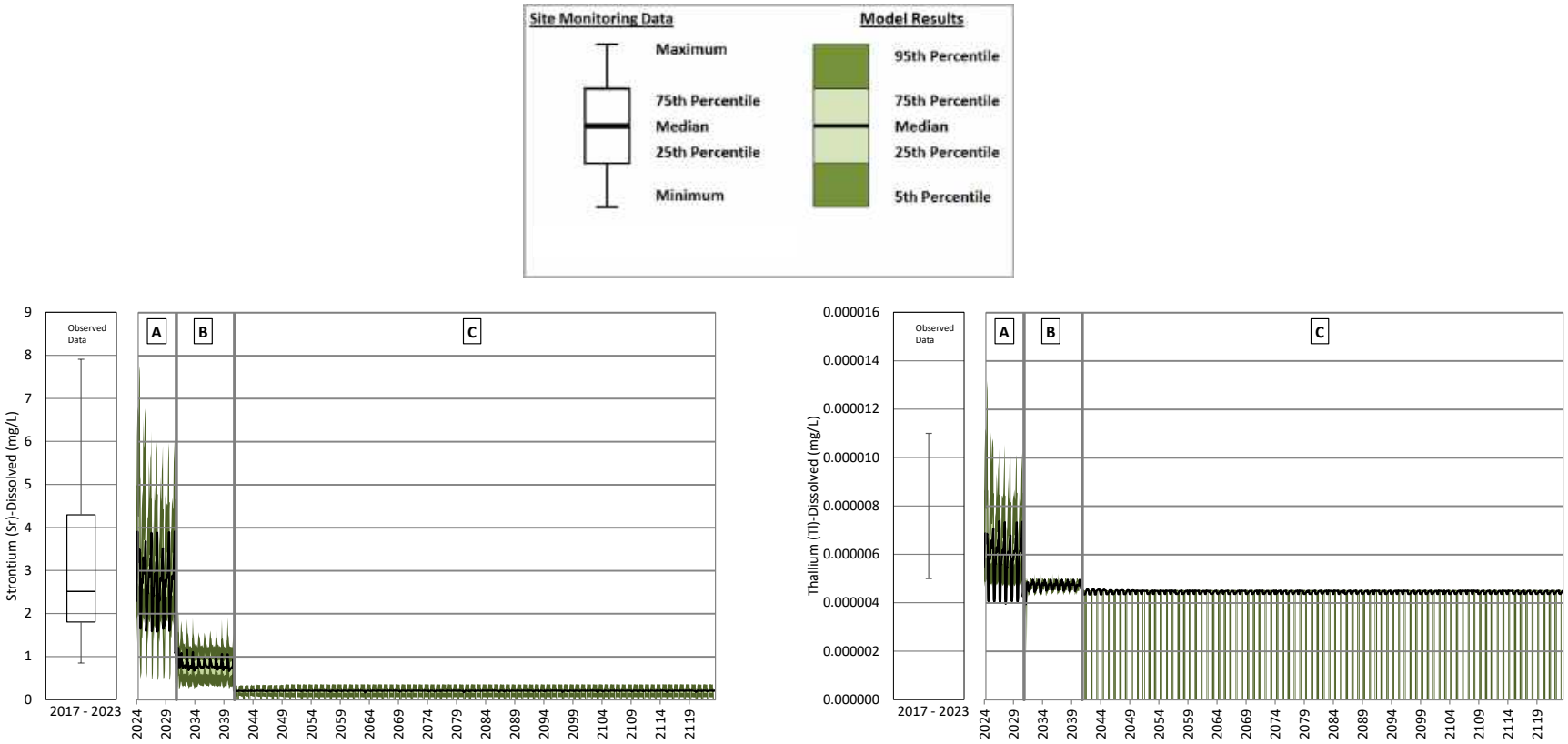
Figure B **95: Central Collection Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

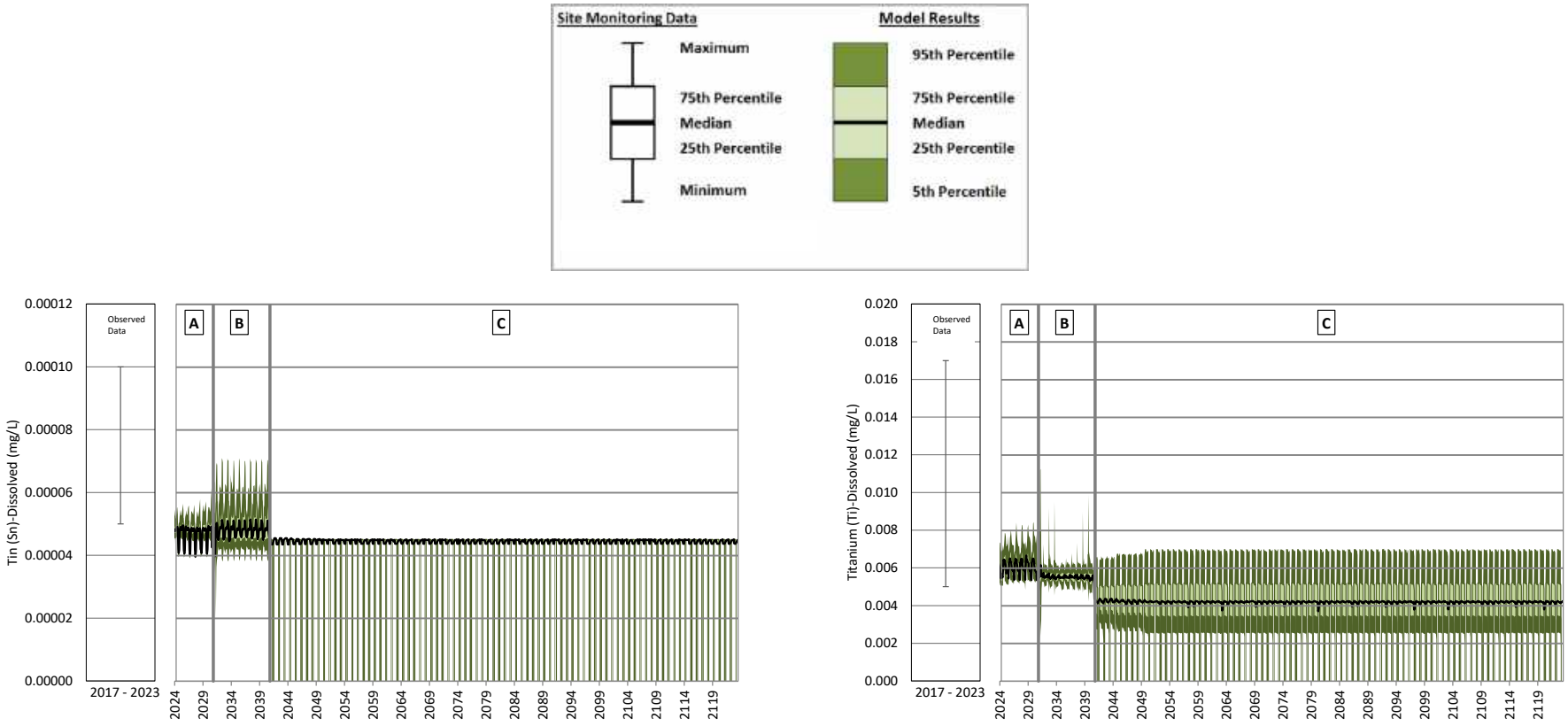
Figure B **96: Central Collection Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

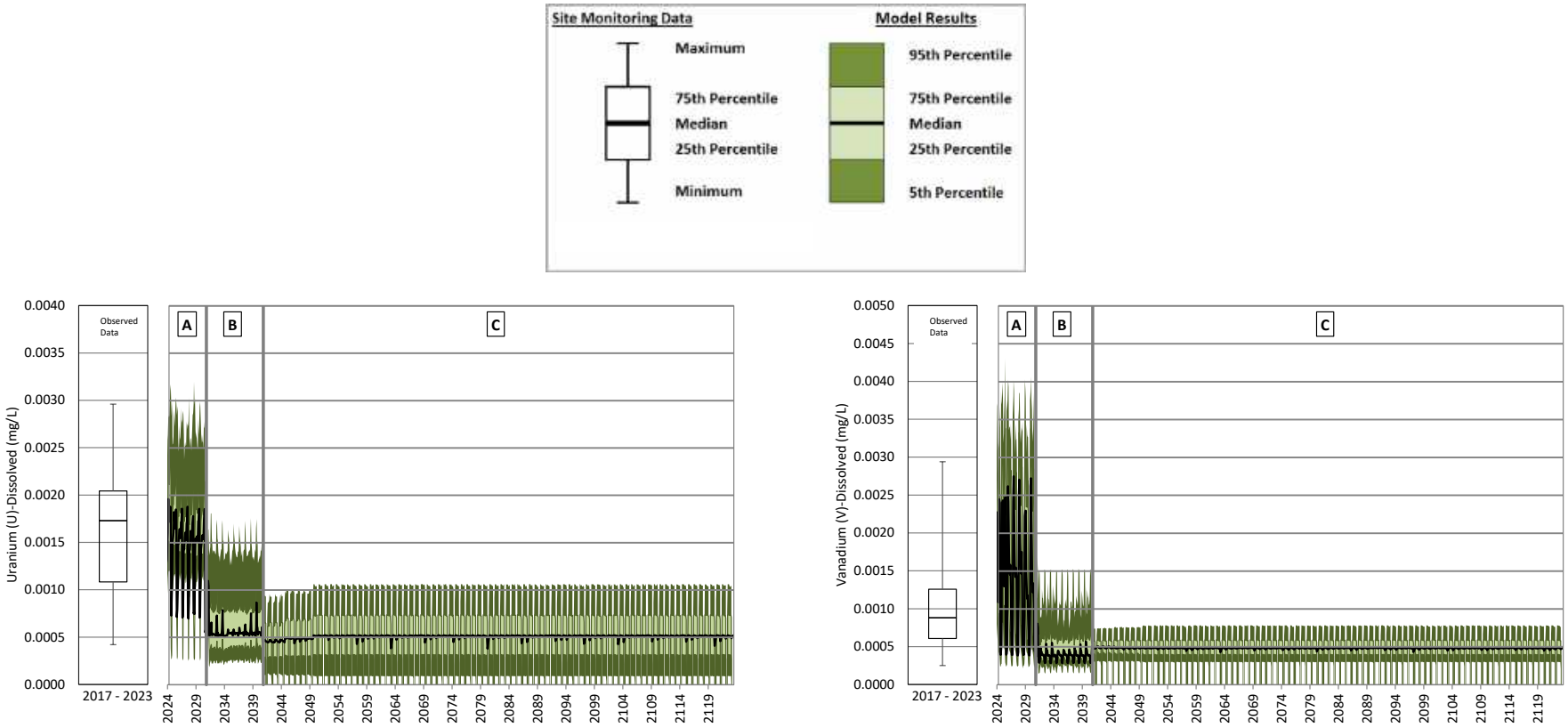
Figure B **97: Central Collection Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

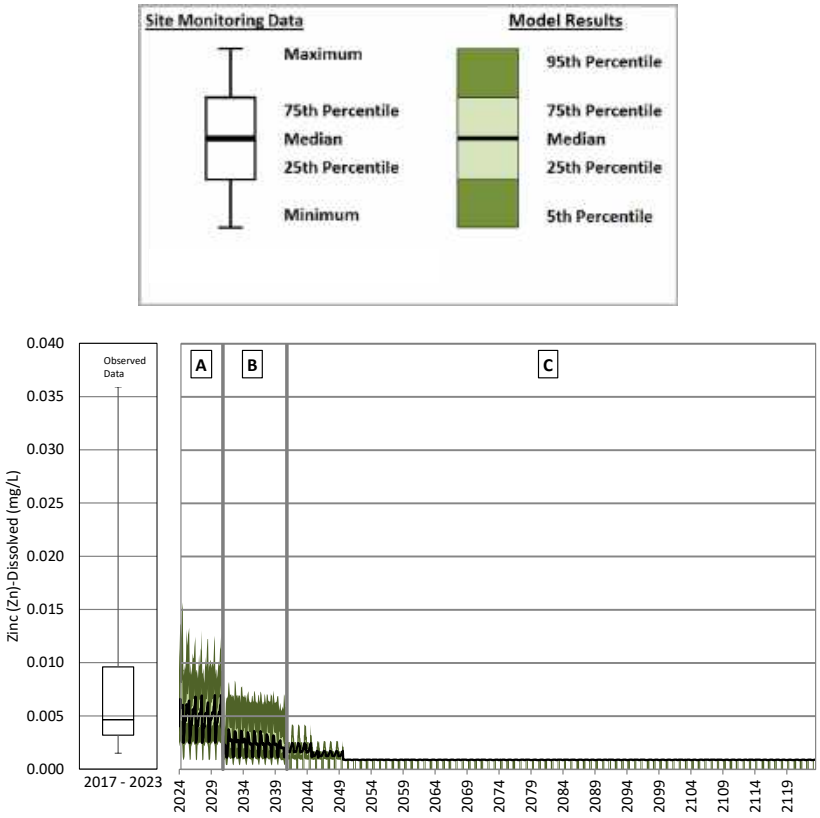
Figure B **98: Central Collection Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **99: Central Collection Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

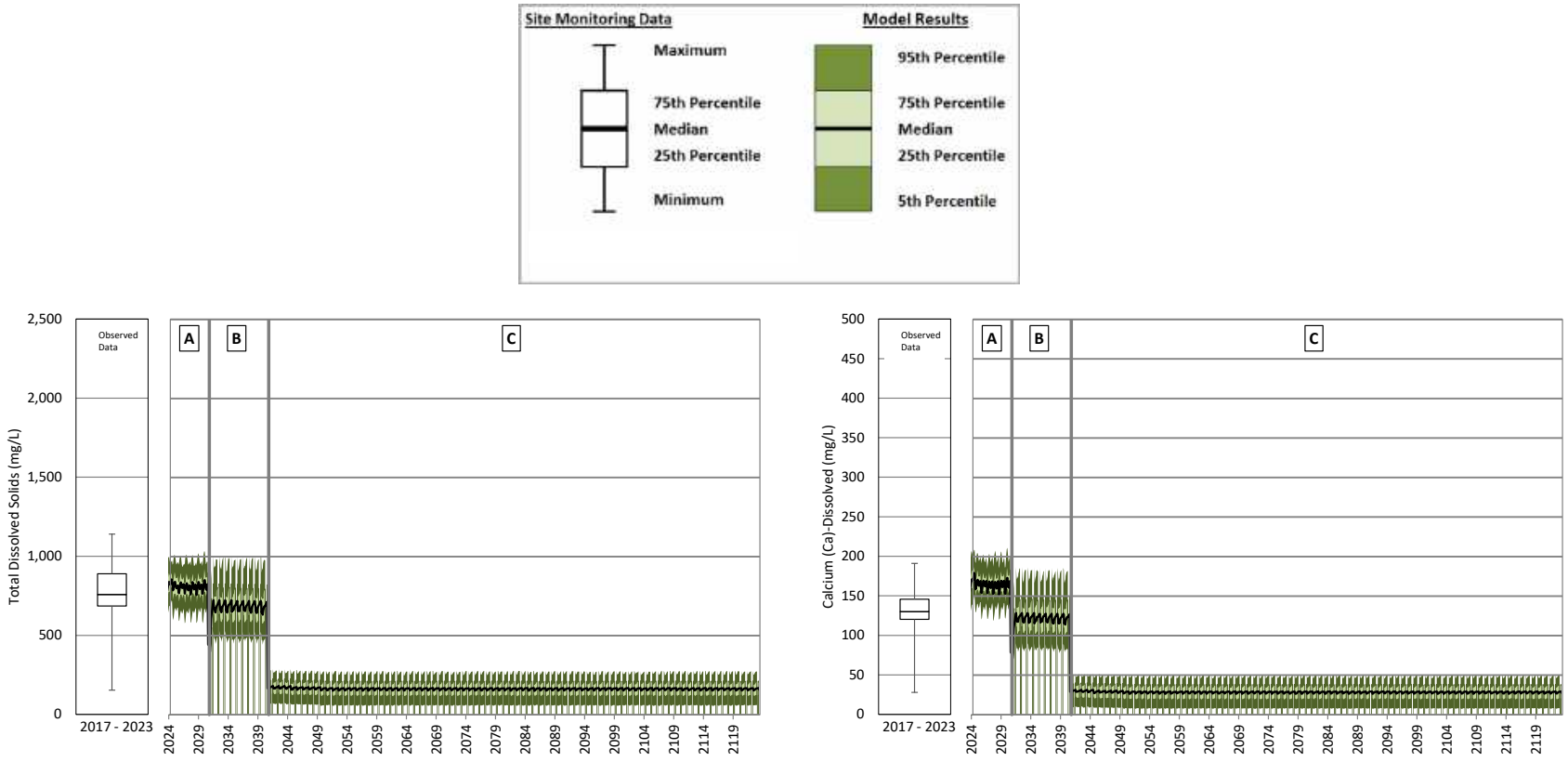


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **100: Central Collection Sump Operations, Closure and Post-closure – Dissolved Zinc**

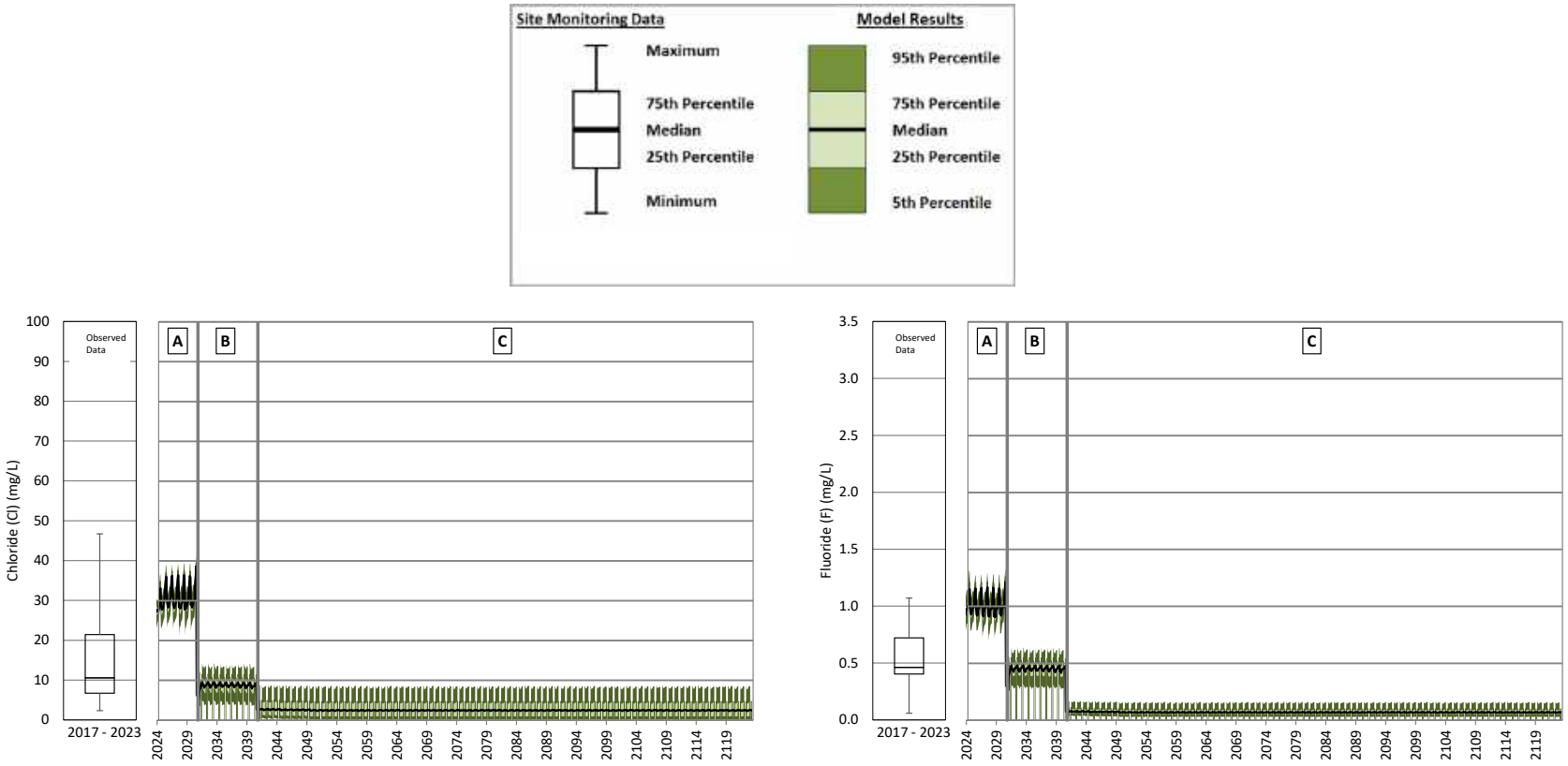
Tailings Storage Facility Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

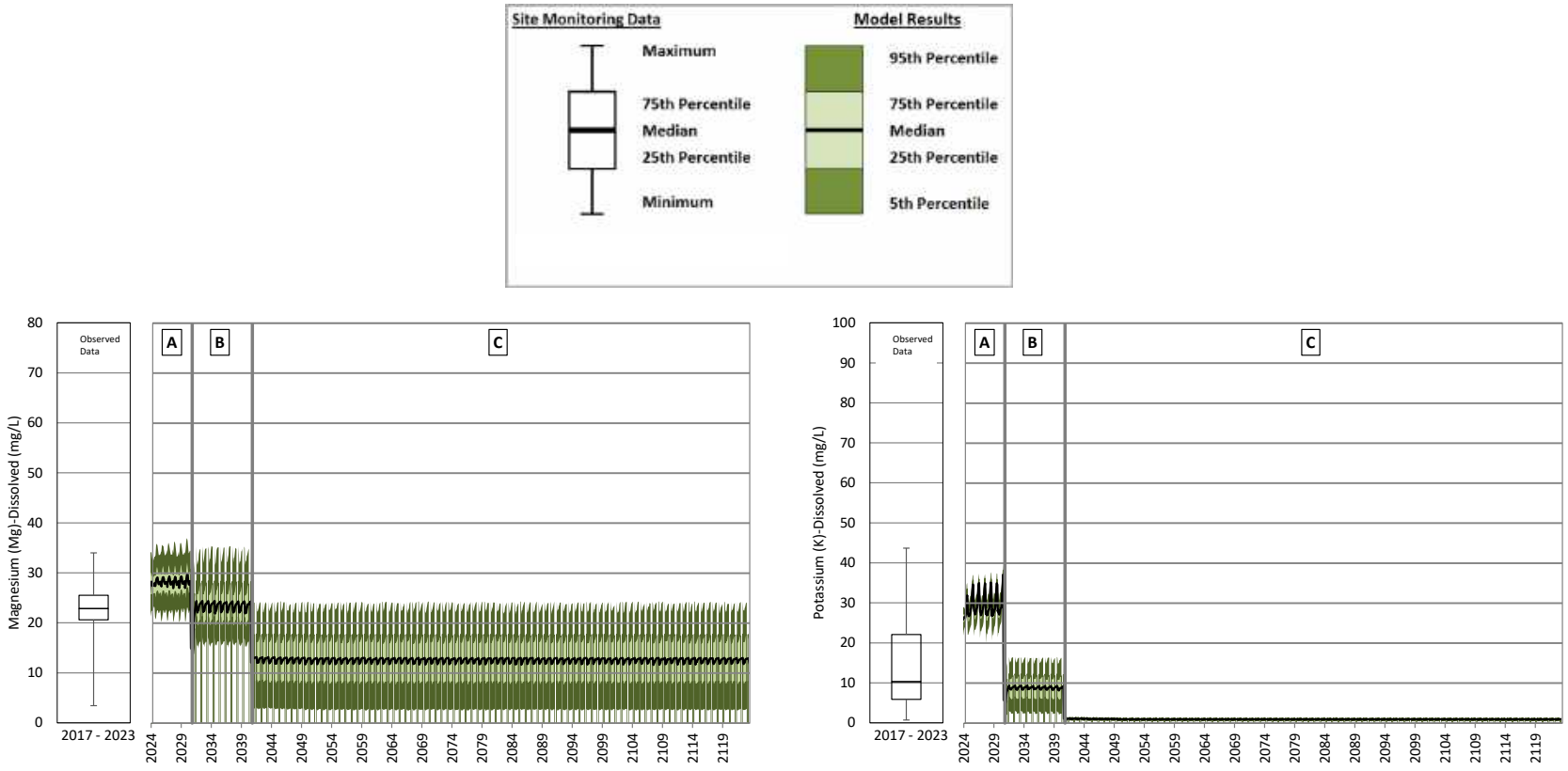
Figure B **101: Tailings Storage Facility Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

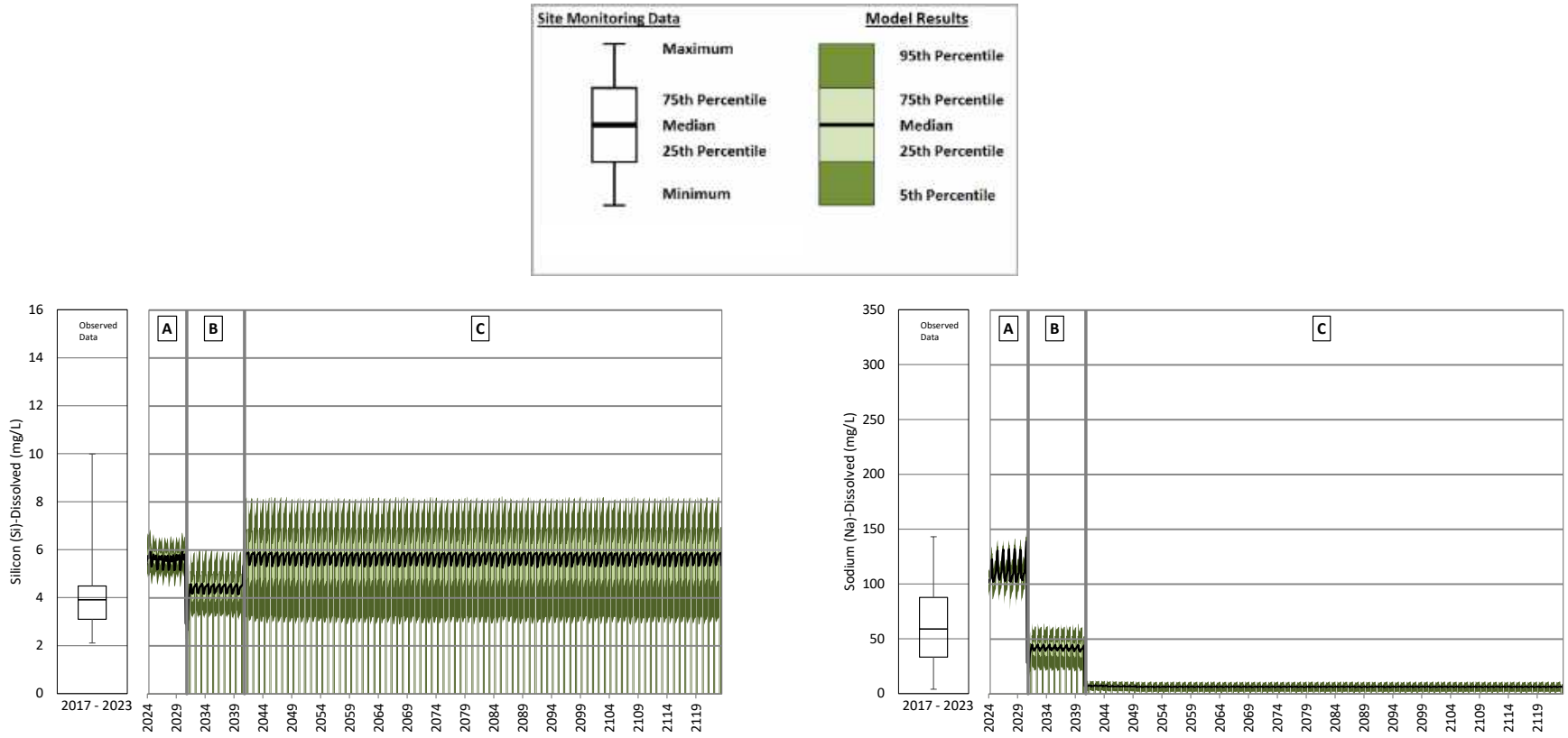
Figure B **102: Tailings Storage Facility Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

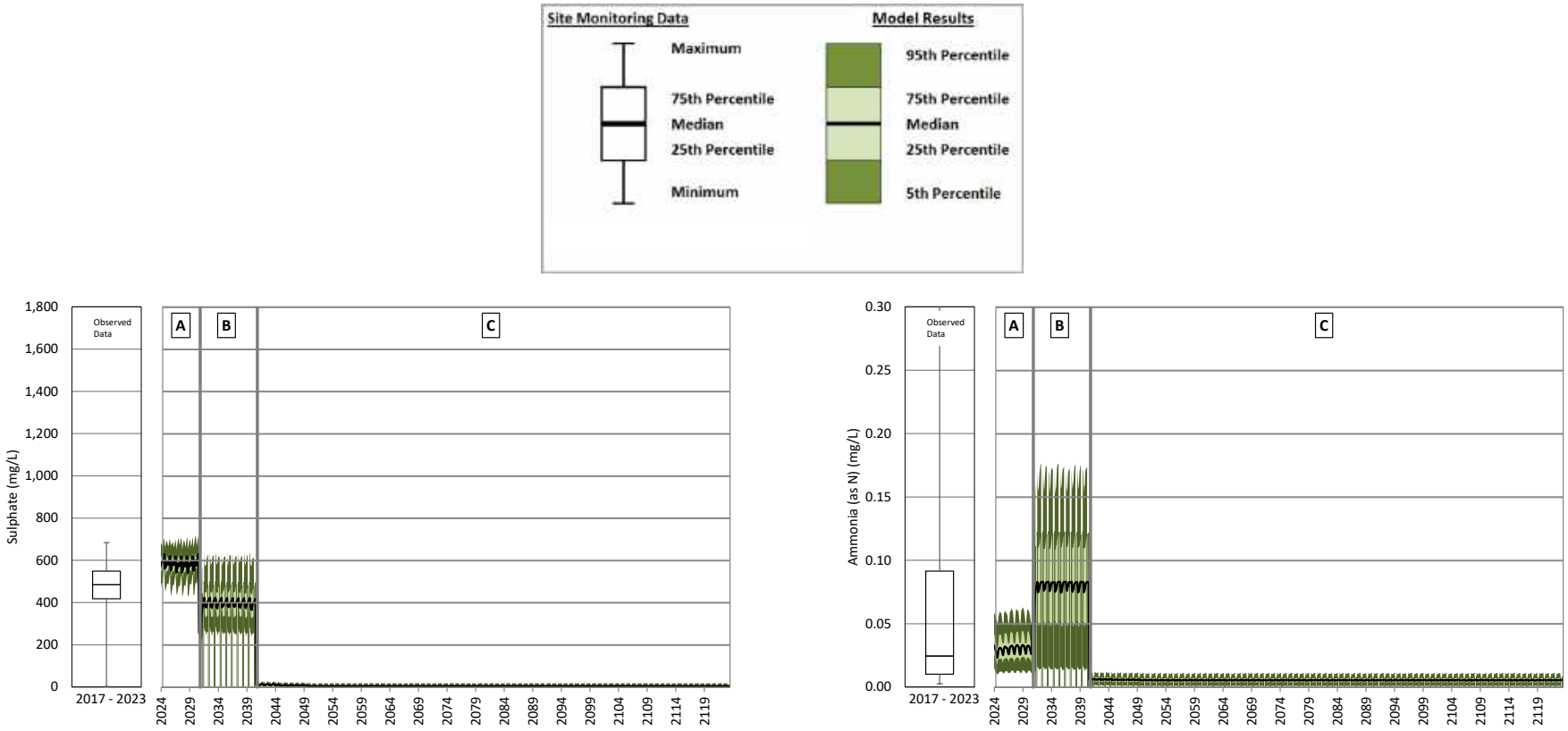
Figure B **103: Tailings Storage Facility Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The increase in silicon concentrations from closure to post-closure is caused by runoff from areas that were assigned the disturbed water quality input being reclaimed and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum silicon concentrations than the disturbed water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

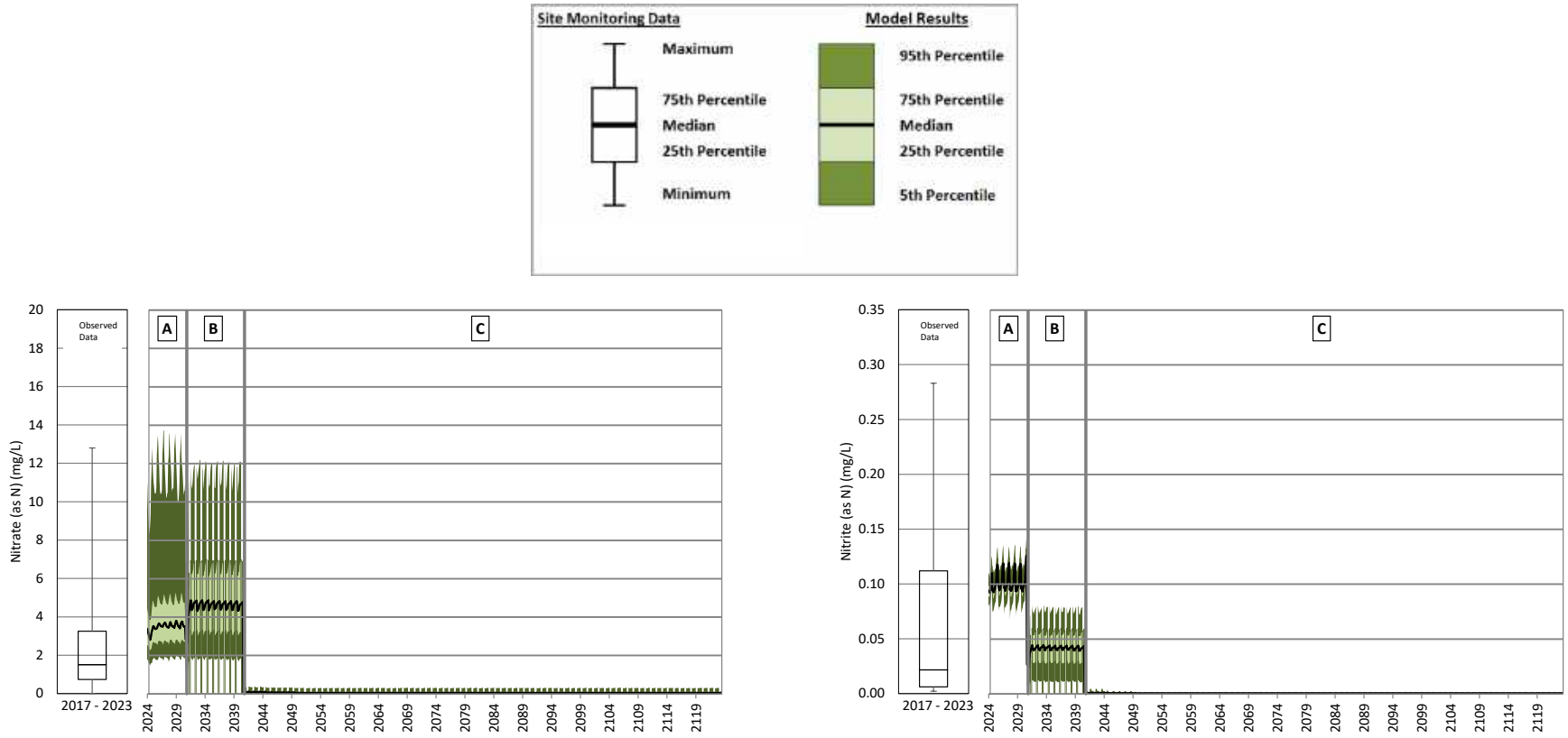
Figure B **104: Tailings Storage Facility Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: Sulphate concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in total ammonia concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the TSF. Lower total ammonia concentrations in the PETBP causes dilution of the total ammonia concentrations in the TSF during operations. Total ammonia concentrations decrease from closure to post-closure as runoff areas are remediated.

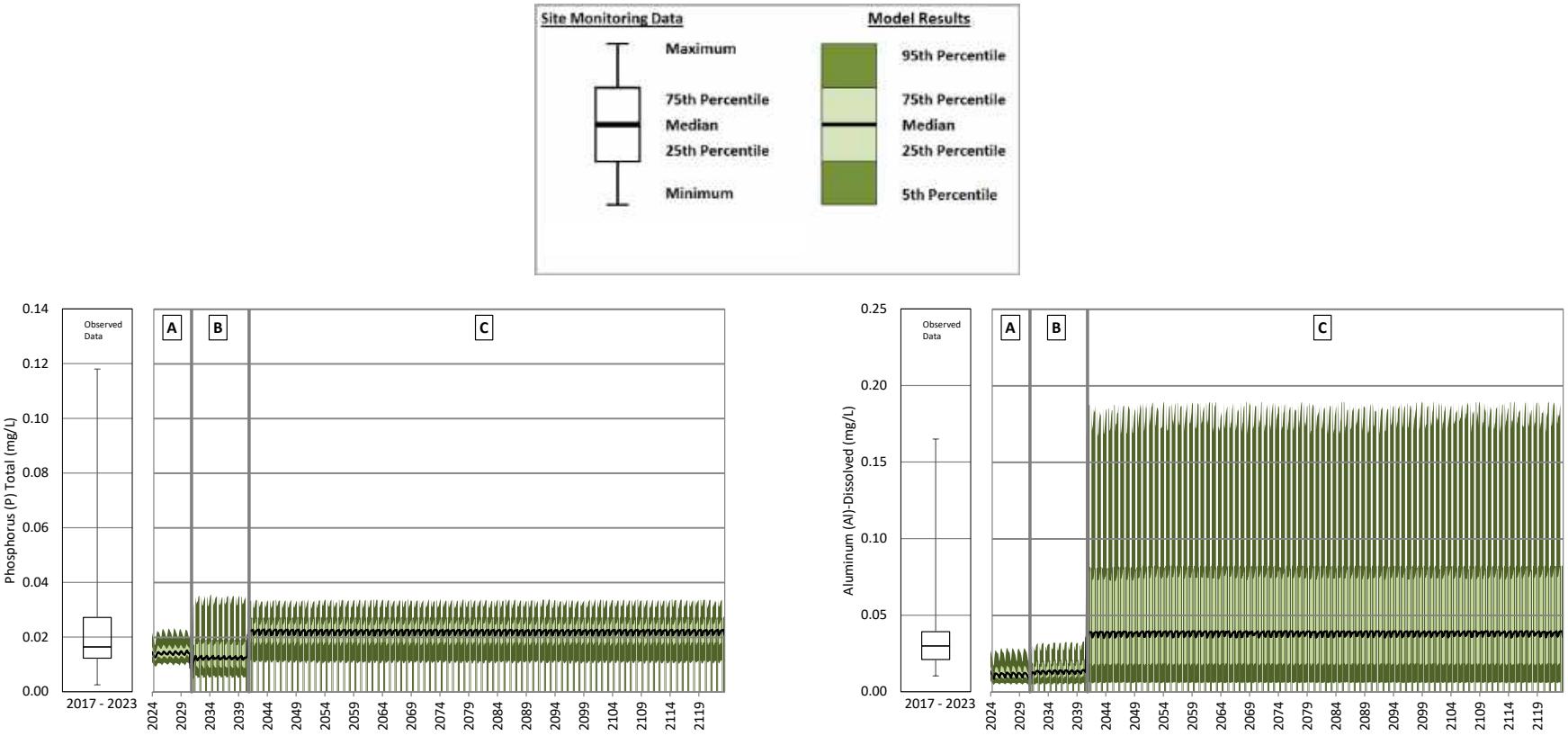
Figure B **105: Tailings Storage Facility Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The increase in nitrate concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the TSF. Lower nitrate concentrations in the PETBP causes dilution of the nitrate concentrations in the TSF during operations. Nitrate concentrations decrease from closure to post-closure as runoff areas are remediated. Nitrite concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

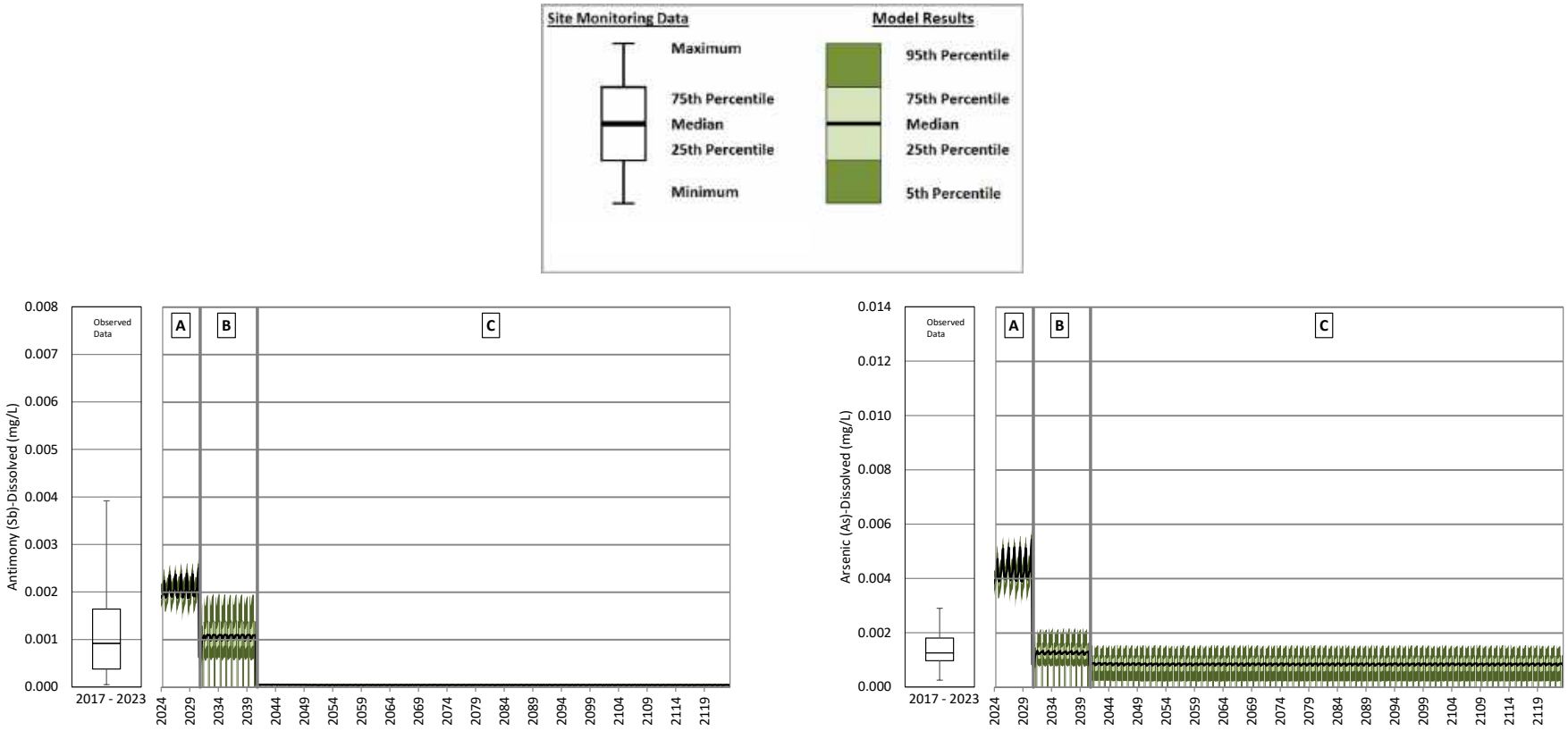
Figure B **106: Tailings Storage Facility Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

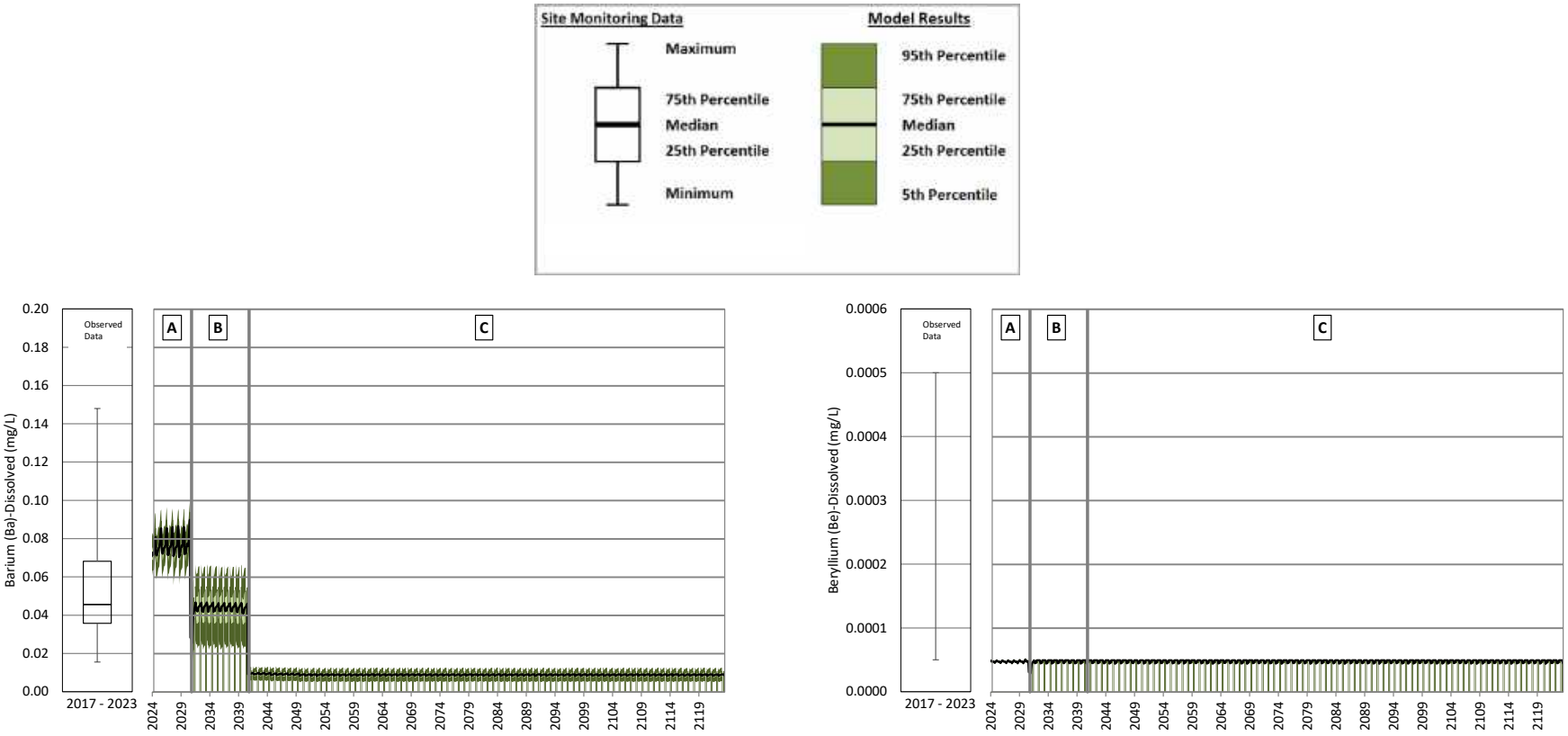
Figure B **107: Tailings Storage Facility Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

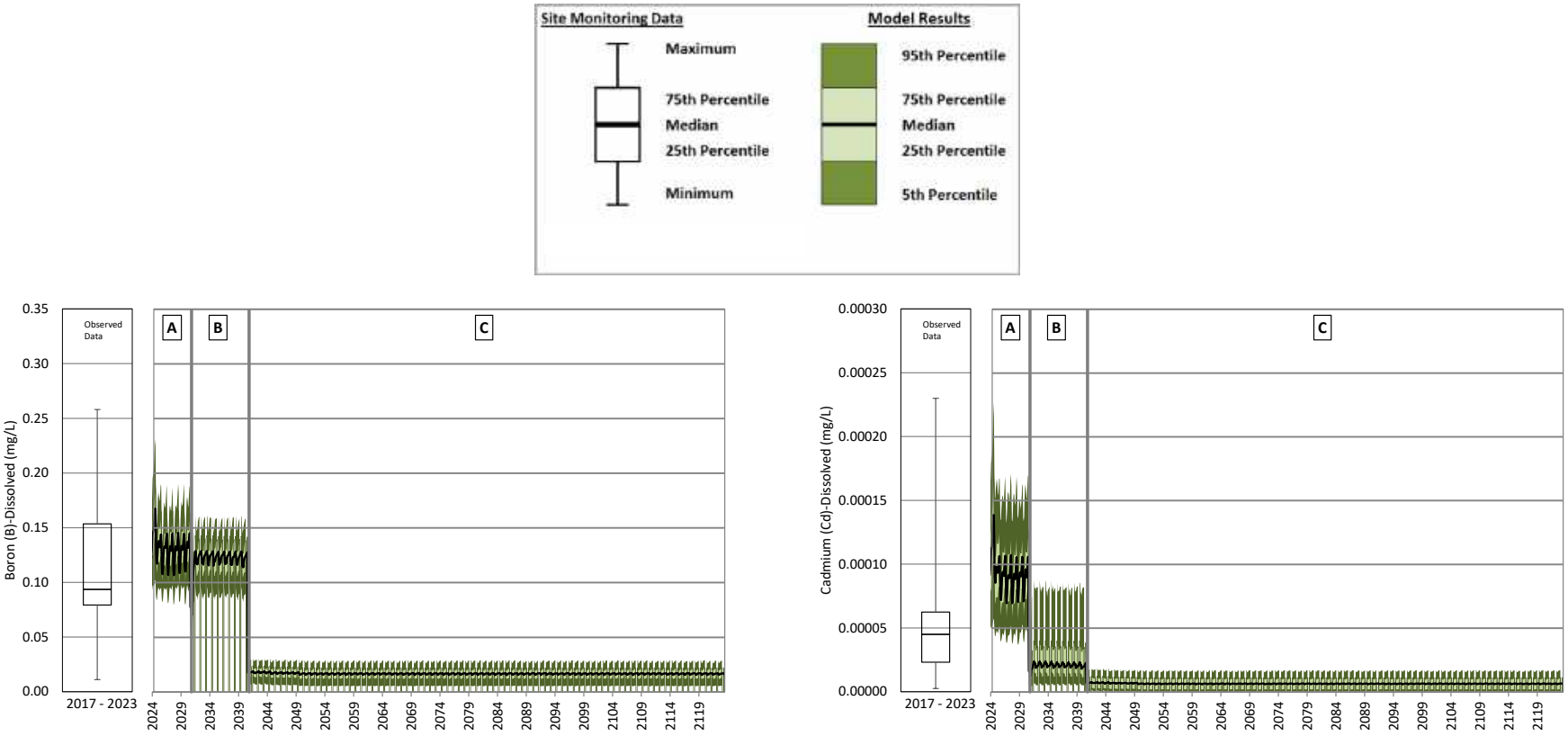
Figure B **108: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

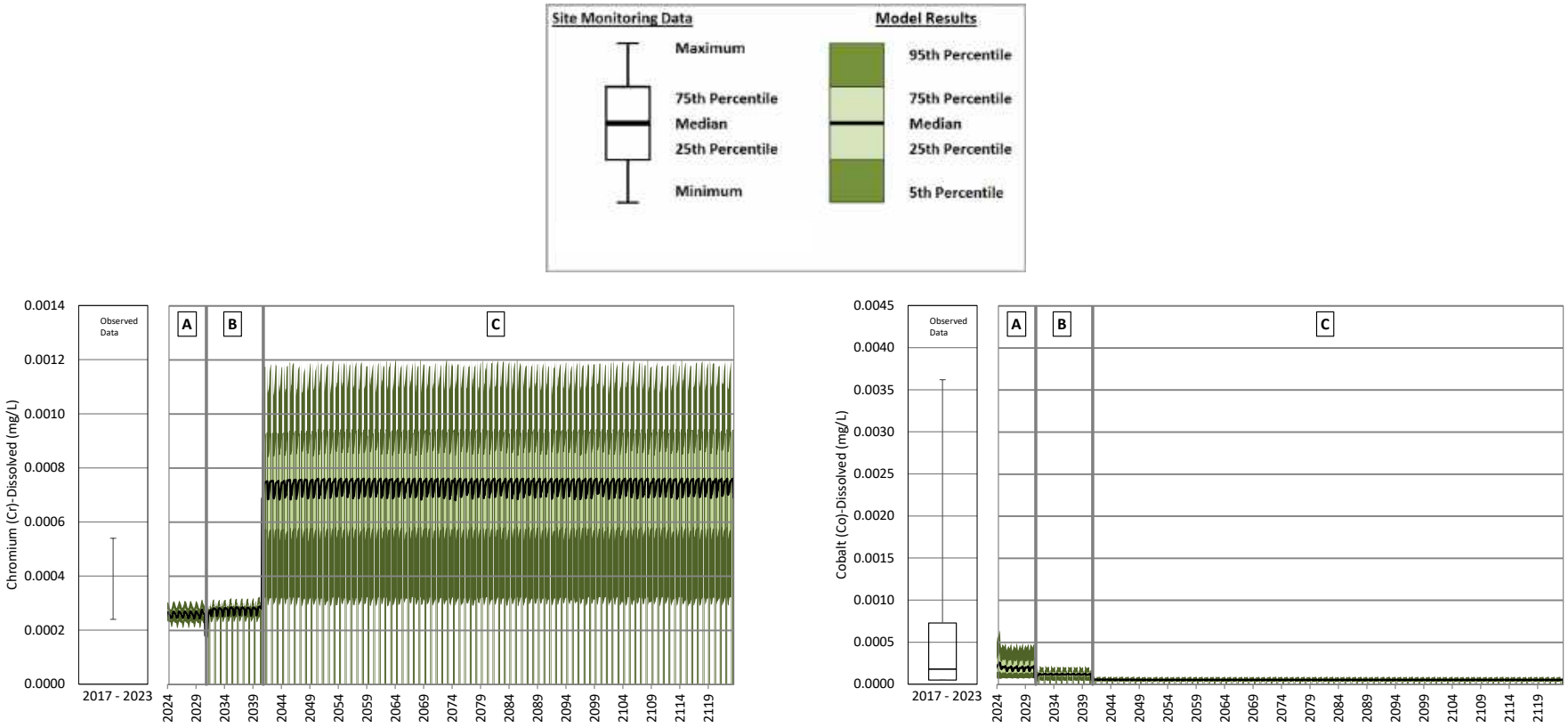
Figure B **109: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

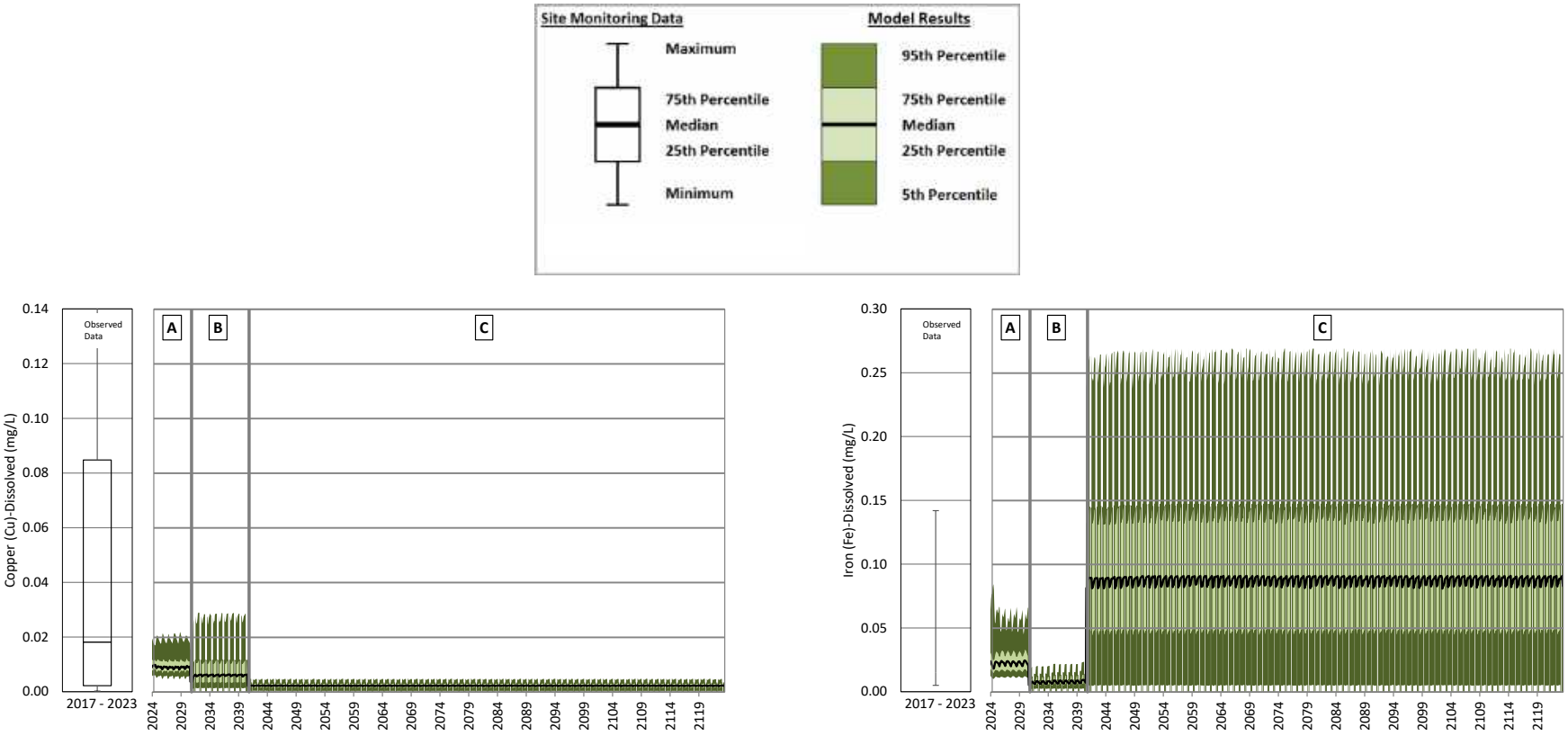
Figure B **110: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

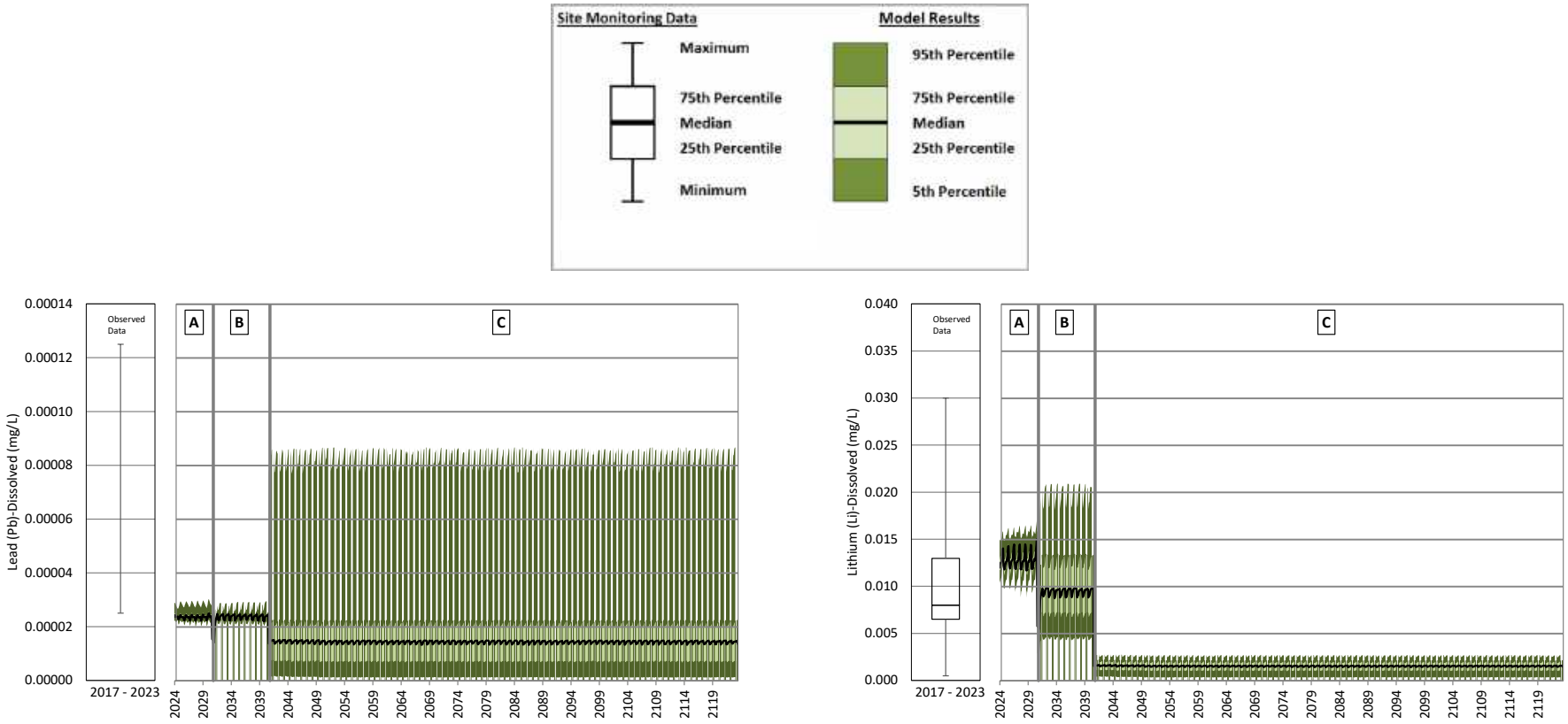
Figure B **111: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: The increase in dissolved copper concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the Tailings Storage Facility (TSF). Lower dissolved copper concentrations in the PETBP causes dilution of the dissolved copper concentrations in the TSF during operations. Dissolved copper concentrations decrease from closure to post-closure as runoff areas are remediated. The decrease in dissolved iron concentrations during closure is caused by the end of pumping from the PETBP to the TSF. Higher dissolved iron concentrations in the PETBP causes increased concentrations of dissolved iron concentrations in the TSF during operations. Dissolved iron concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input that has higher dissolved iron concentrations than contact water.

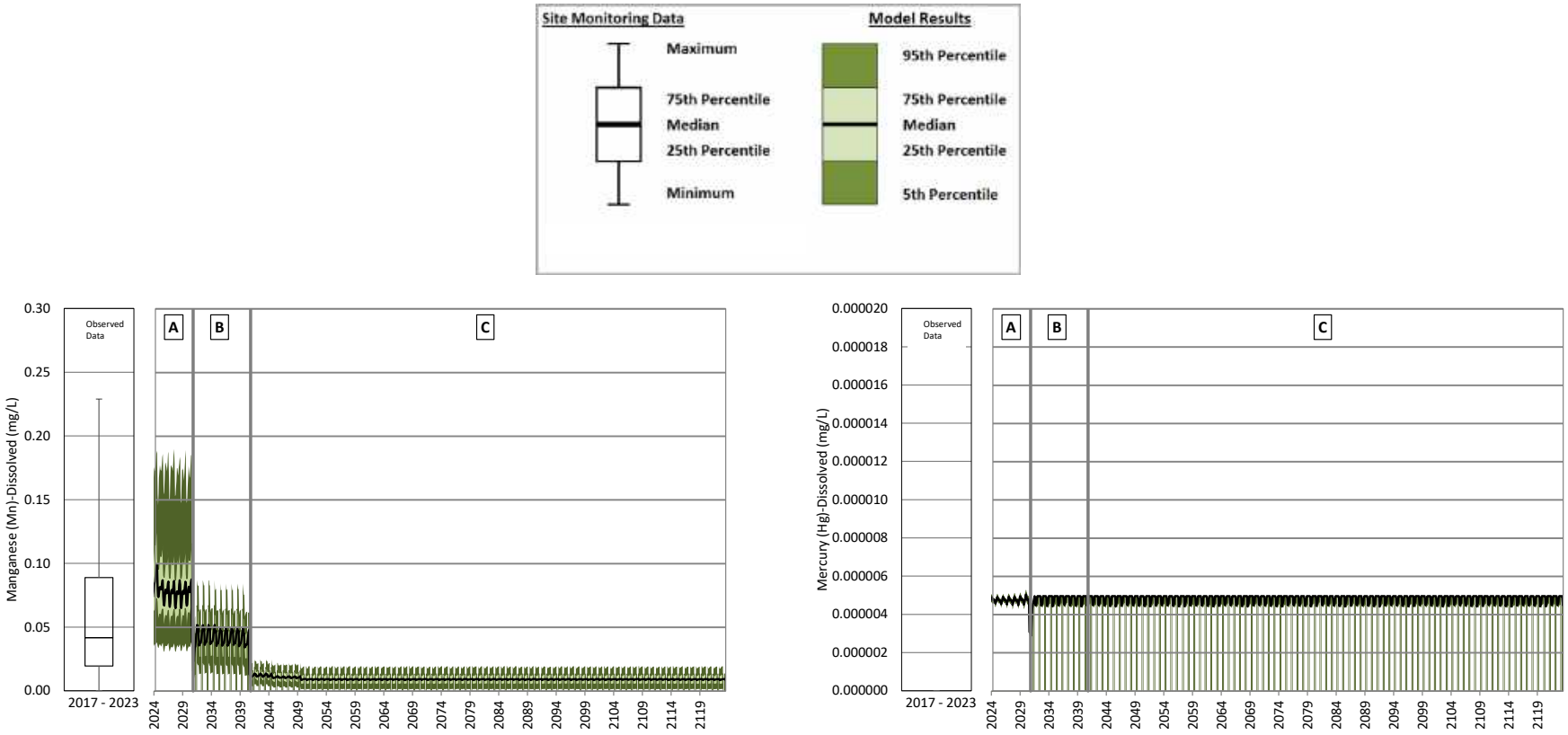
Figure B **112: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. The decrease in dissolved lithium concentrations from 2031 to 2032 is due to the end of pumping from the mill processing plant to the Tailings Storage Facility (TSF). The increase in dissolved lithium concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the TSF. Lower dissolved lithium concentrations in the PETBP causes dilution of the dissolved lithium concentrations in the TSF during operations. Dissolved lithium concentrations decrease from closure to post-closure as runoff areas are remediated.

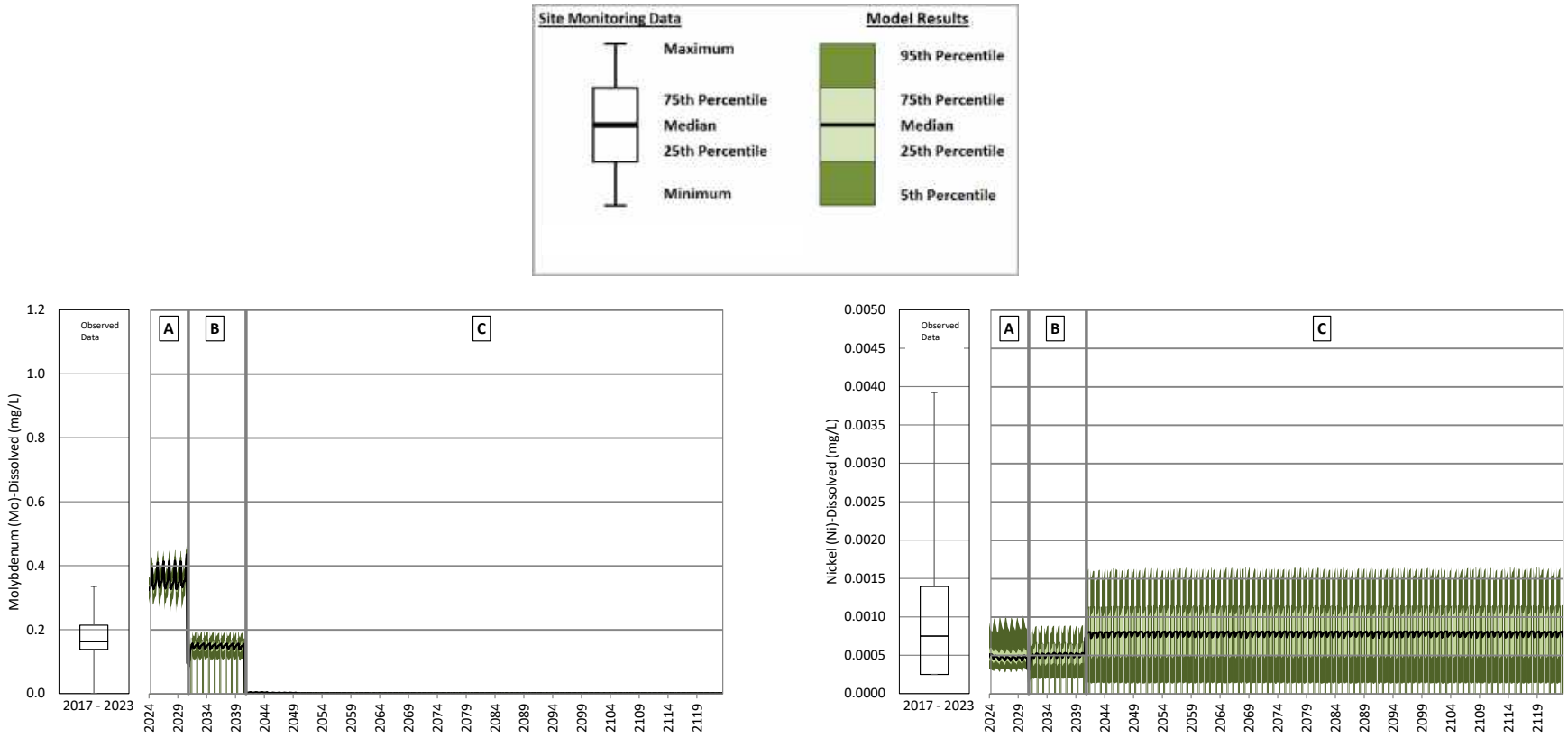
Figure B **113: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

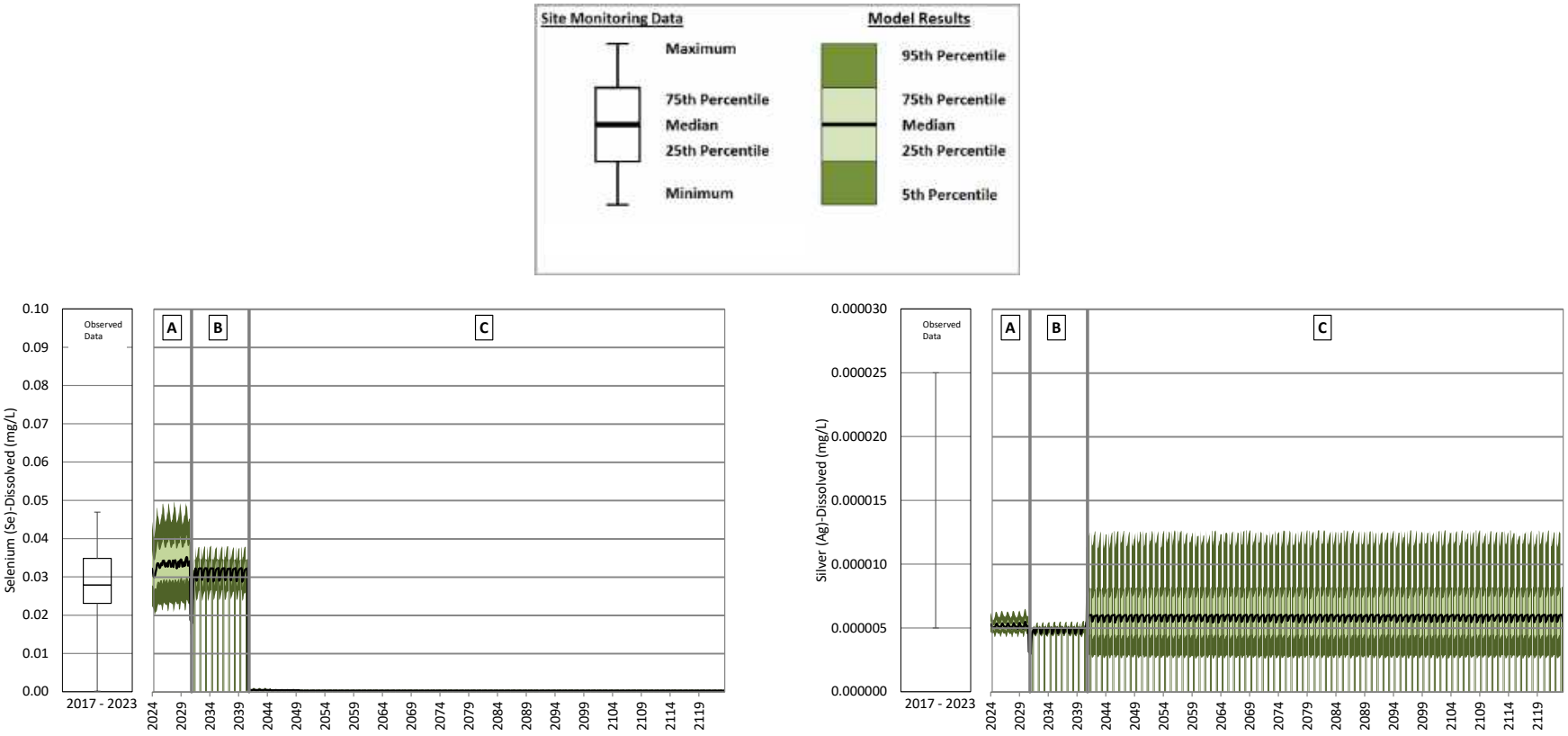
Figure B **114: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

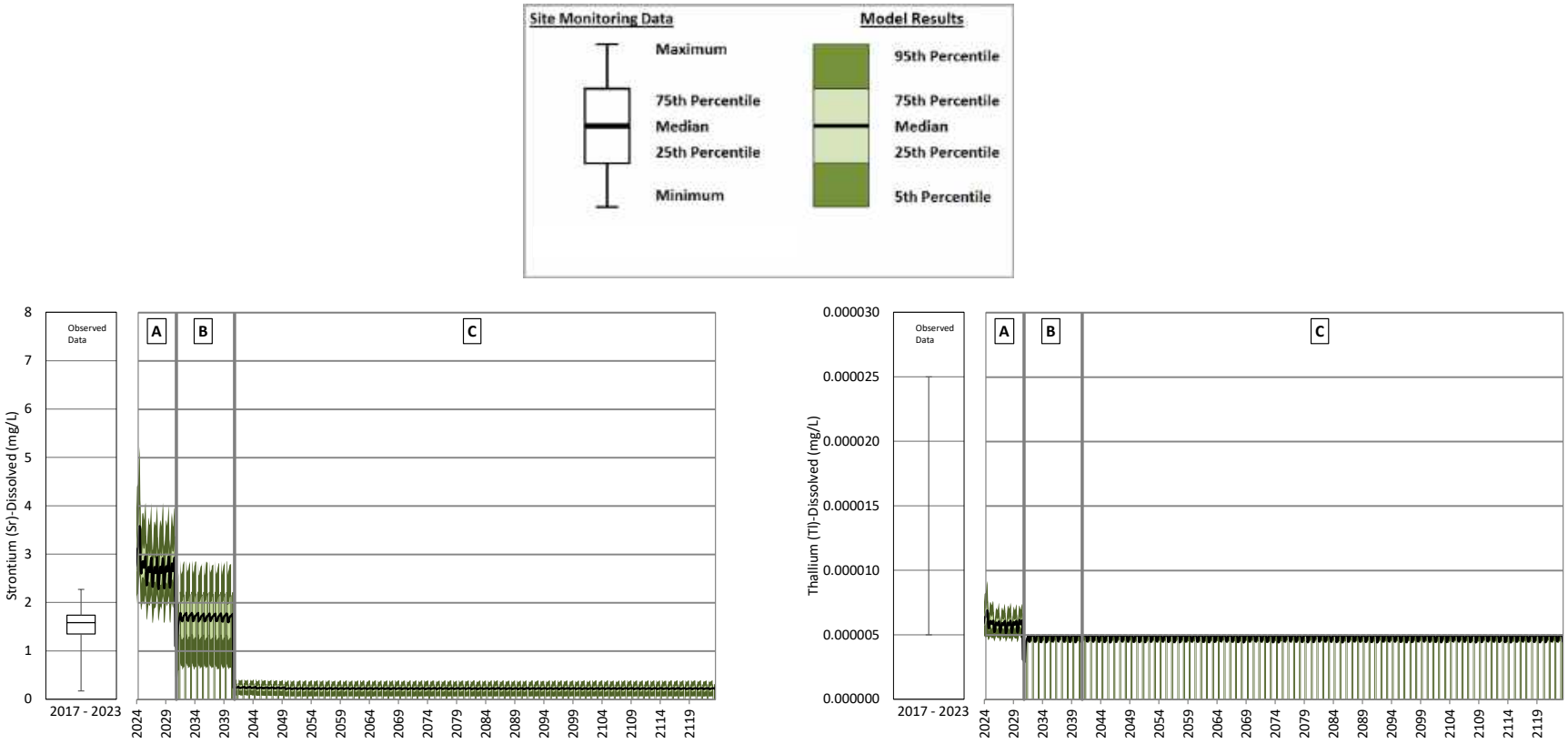
Figure B **115: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

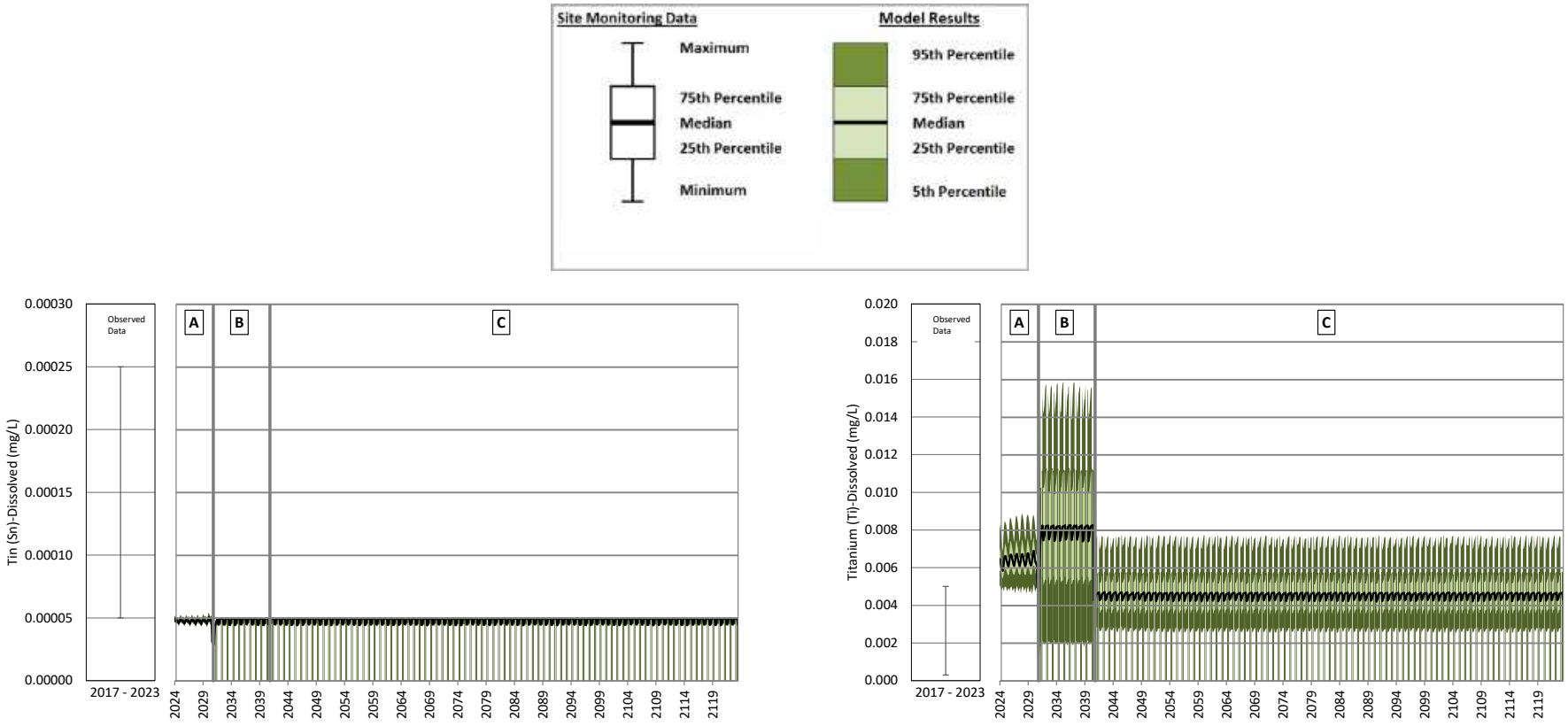
Figure B **116: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

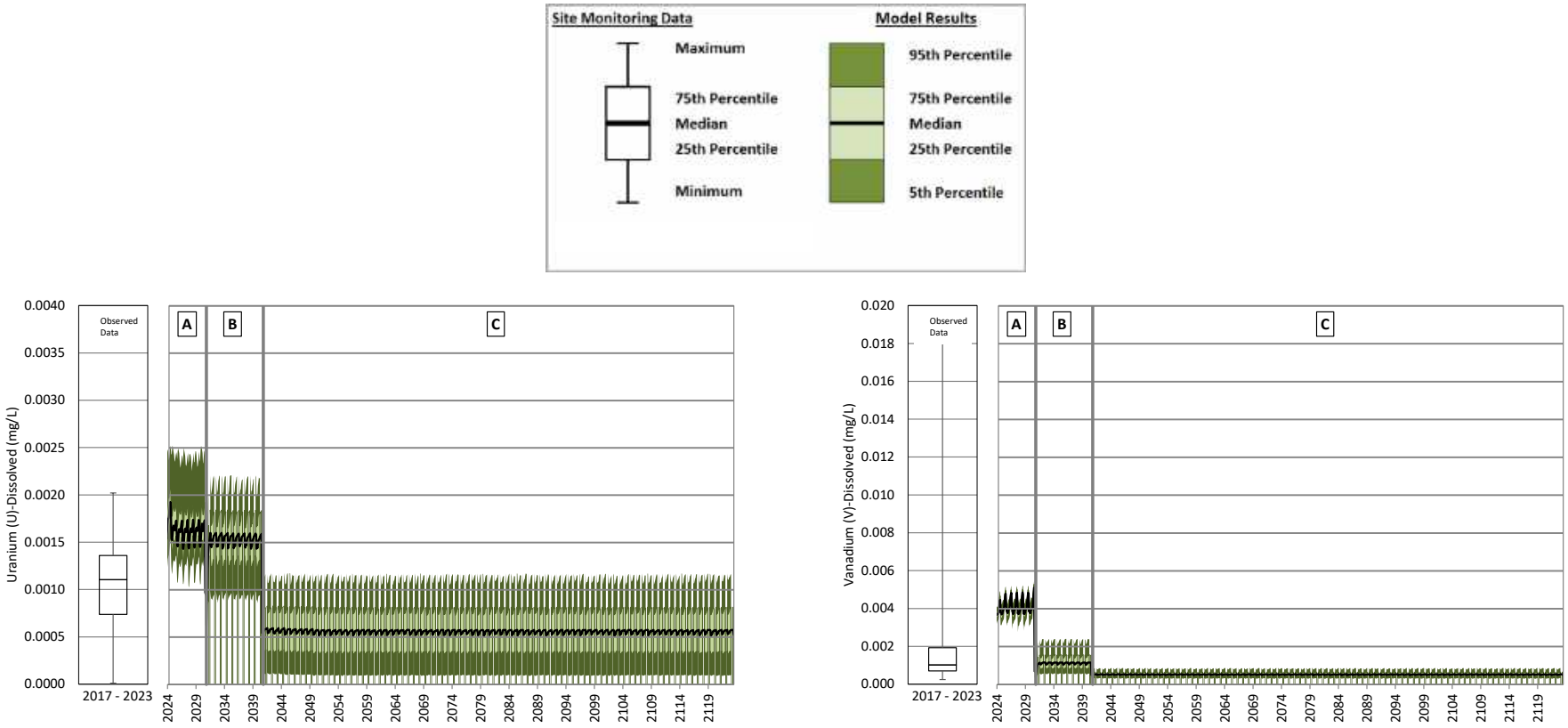
Figure B **117: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The increase in dissolved titanium concentrations during closure is caused by the end of pumping from the Perimeter Embankment Till Borrow Pond (PETBP) to the Tailings Storage Facility (TSF). Lower dissolved titanium concentrations in the PETBP causes dilution of the dissolved titanium concentrations in the TSF during operations. Dissolved titanium concentrations decrease from closure to post-closure as runoff areas are remediated.

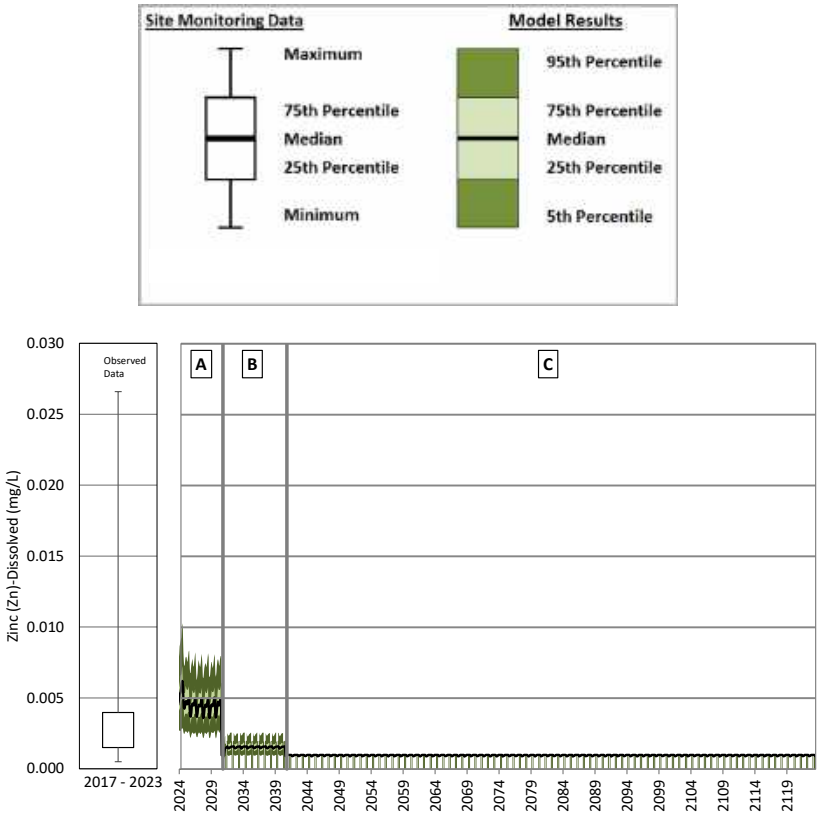
Figure B **118: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **119: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

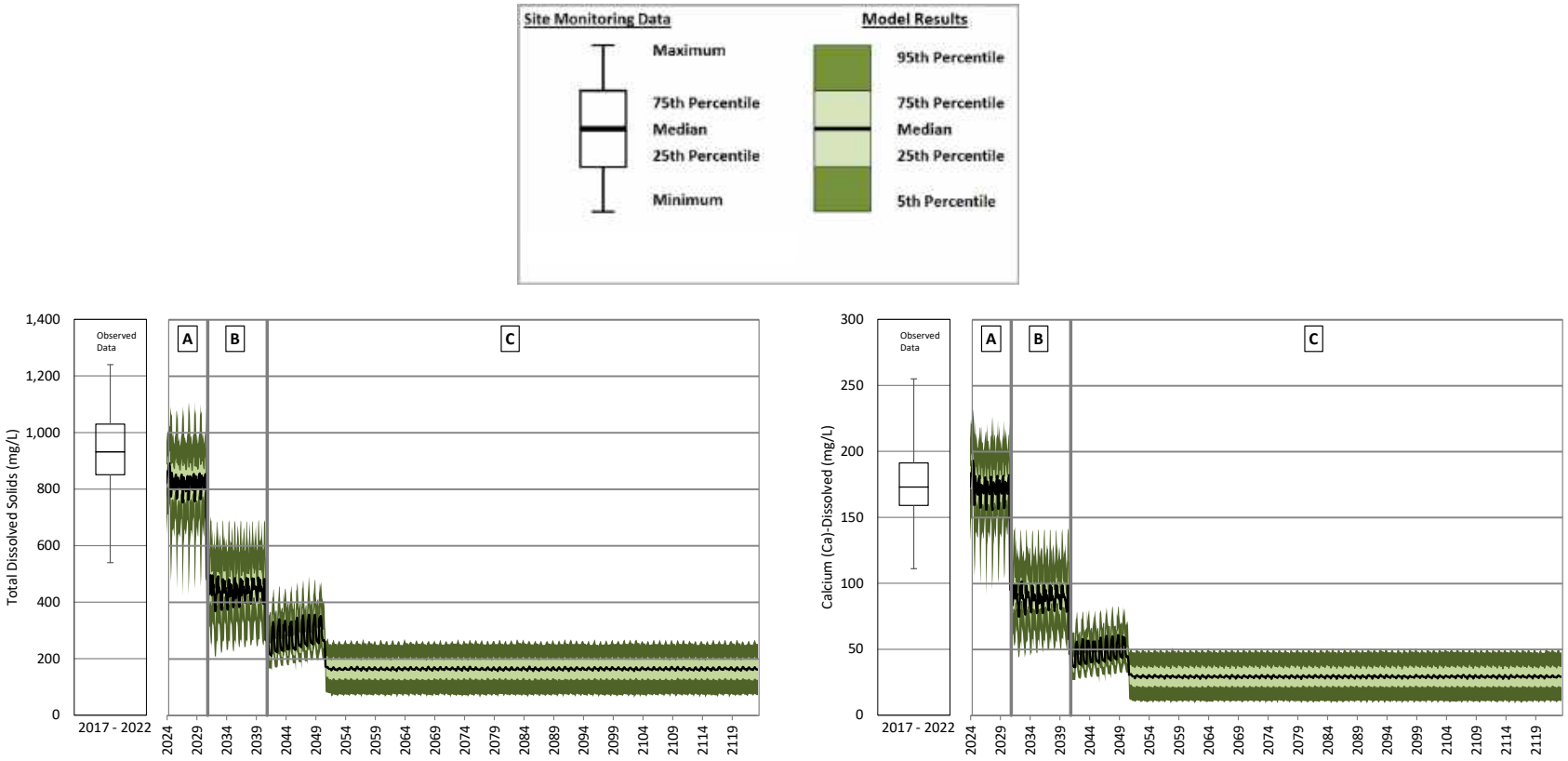


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **120: Tailings Storage Facility Operations, Closure and Post-closure – Dissolved Zinc**

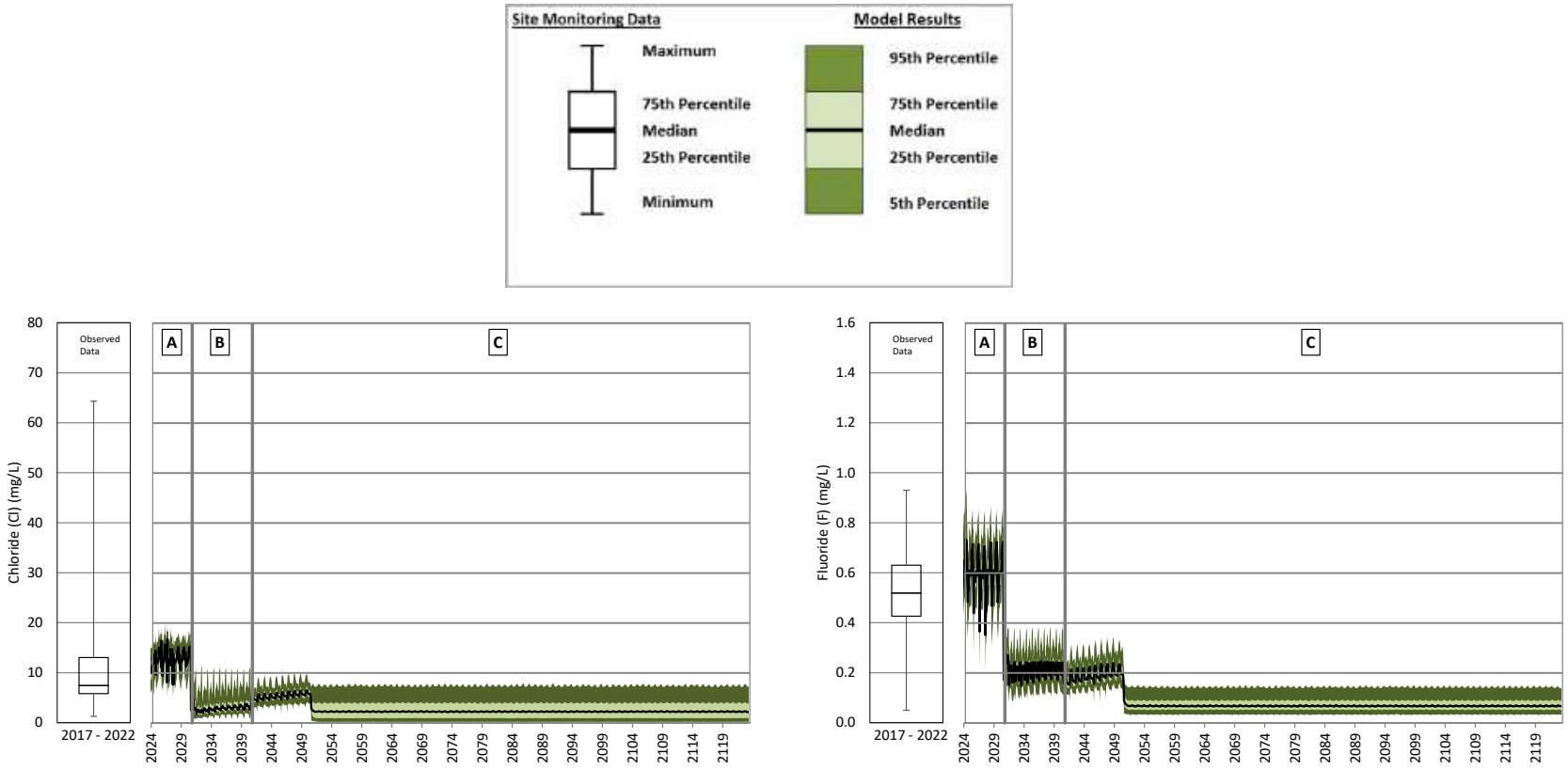
Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

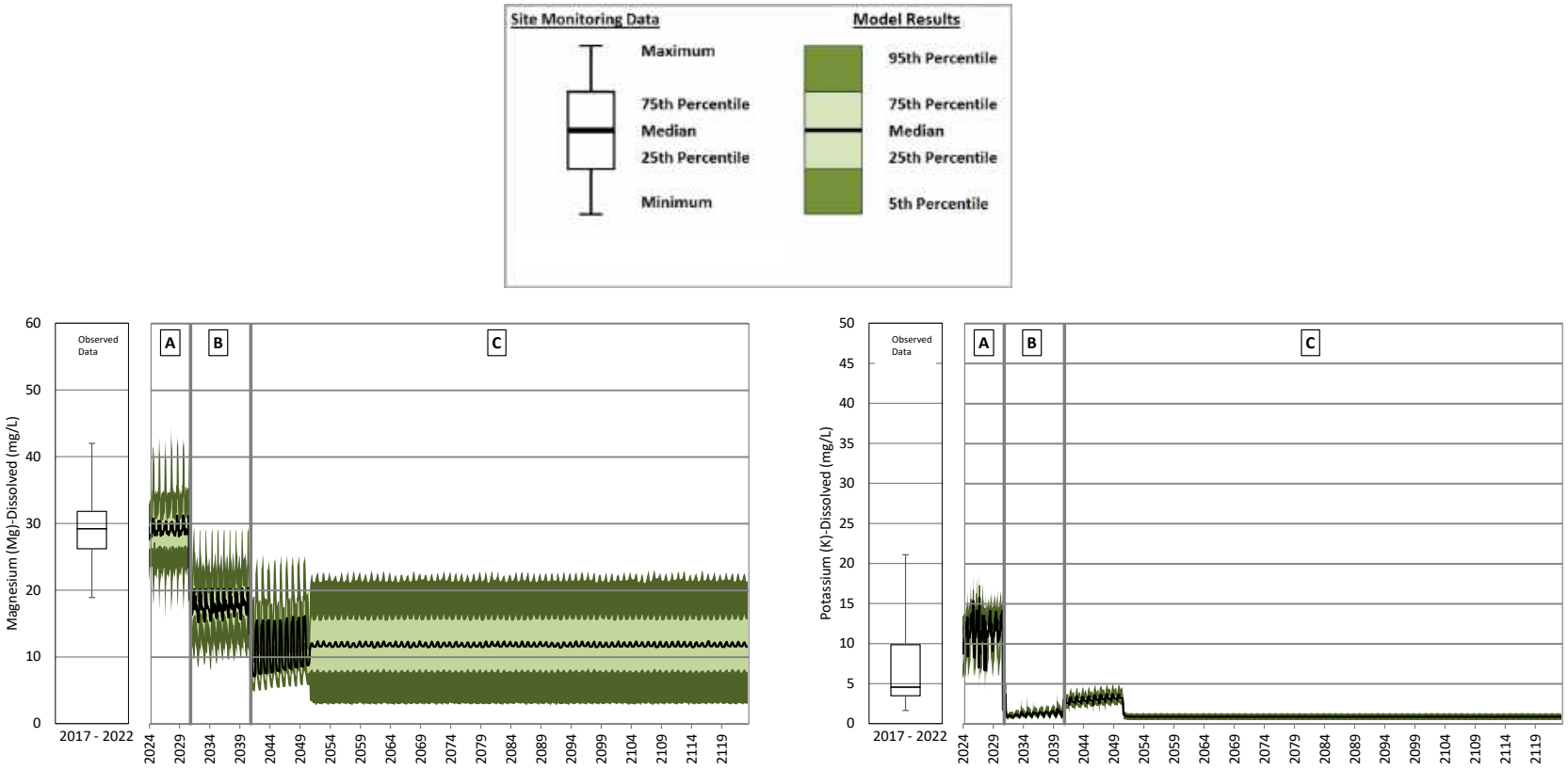
Figure B **121: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

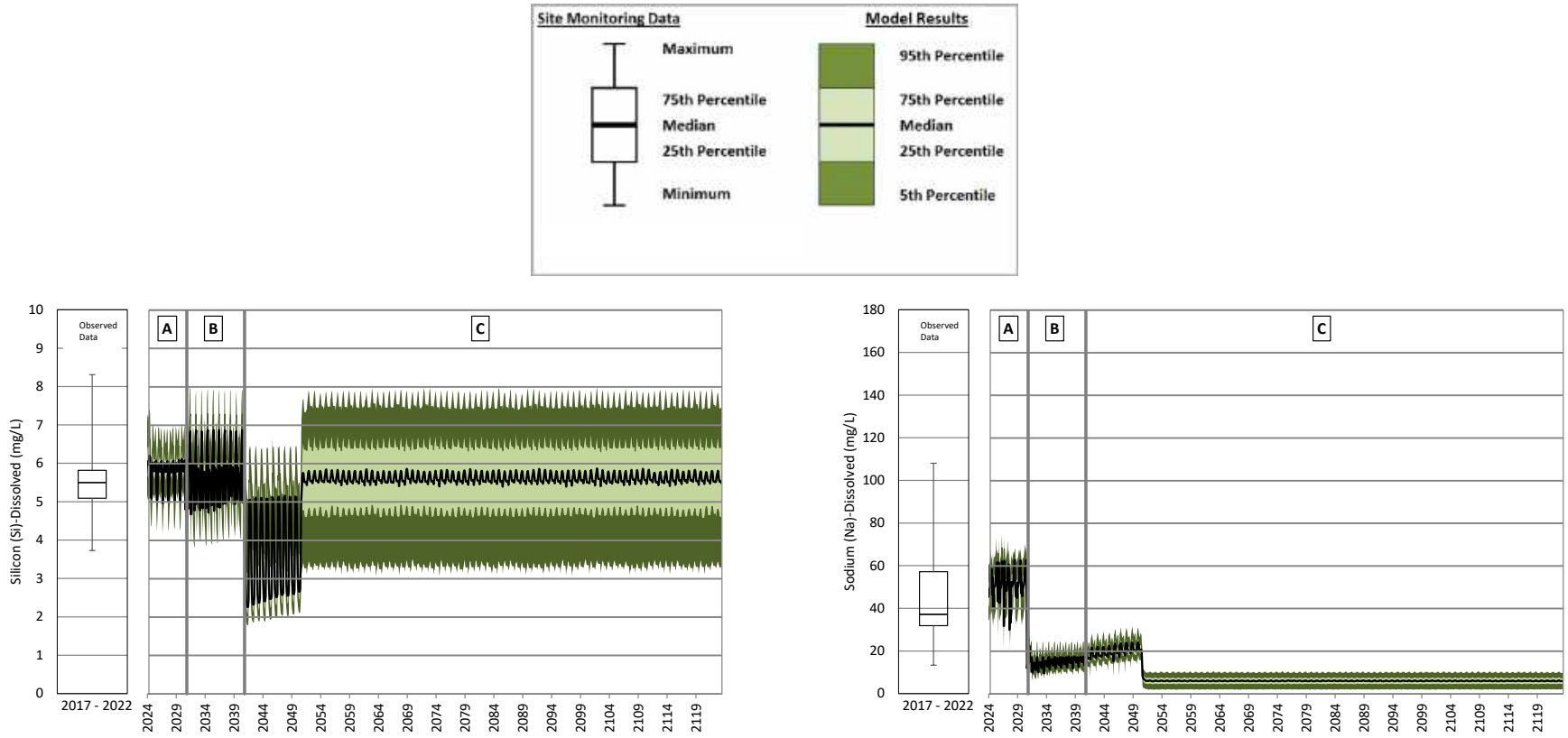
Figure B **122: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

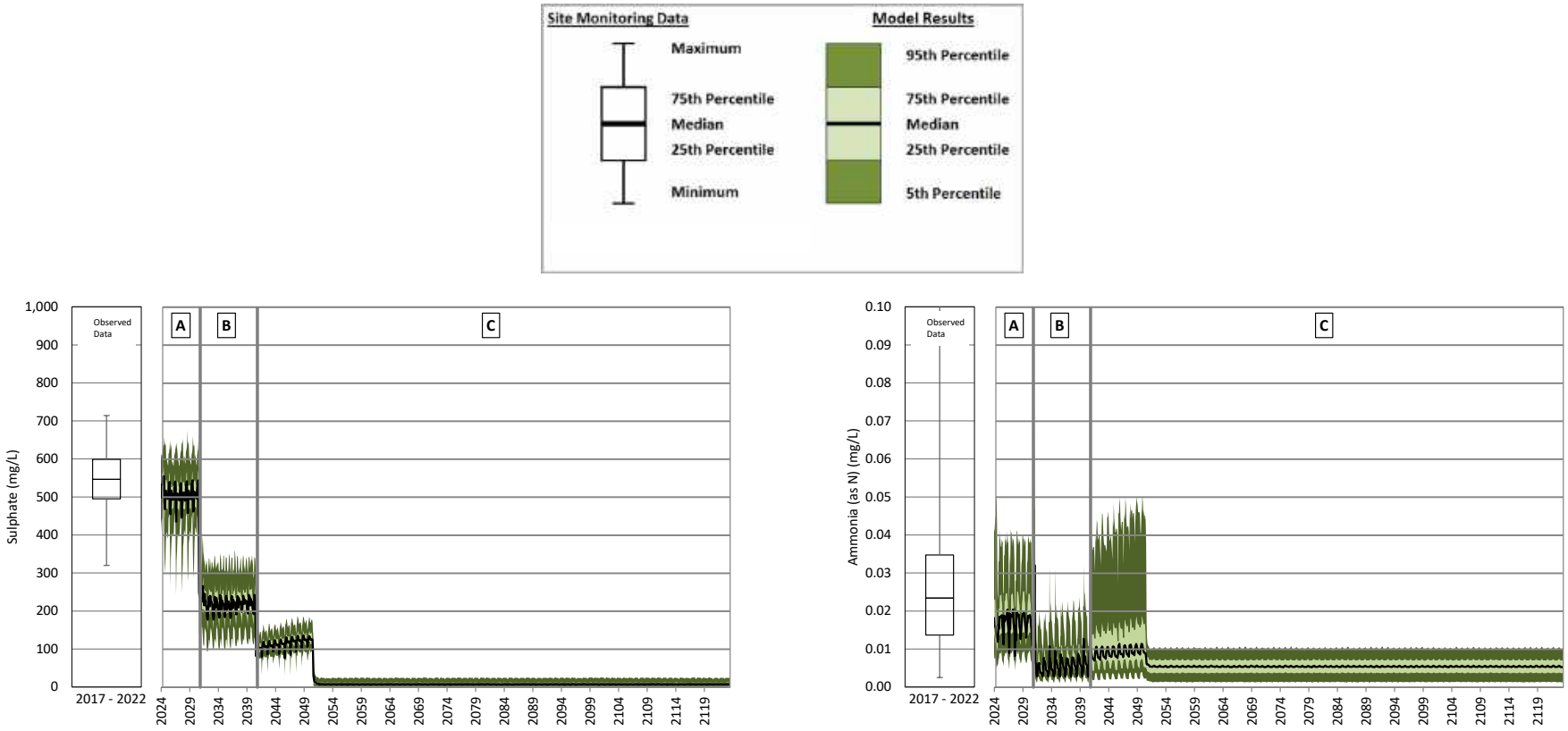
Figure B **123: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The increase in silicon concentrations from operations to closure and post-closure is caused by runoff from areas being reclaimed and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum silicon concentrations than the disturbed water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in sodium concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

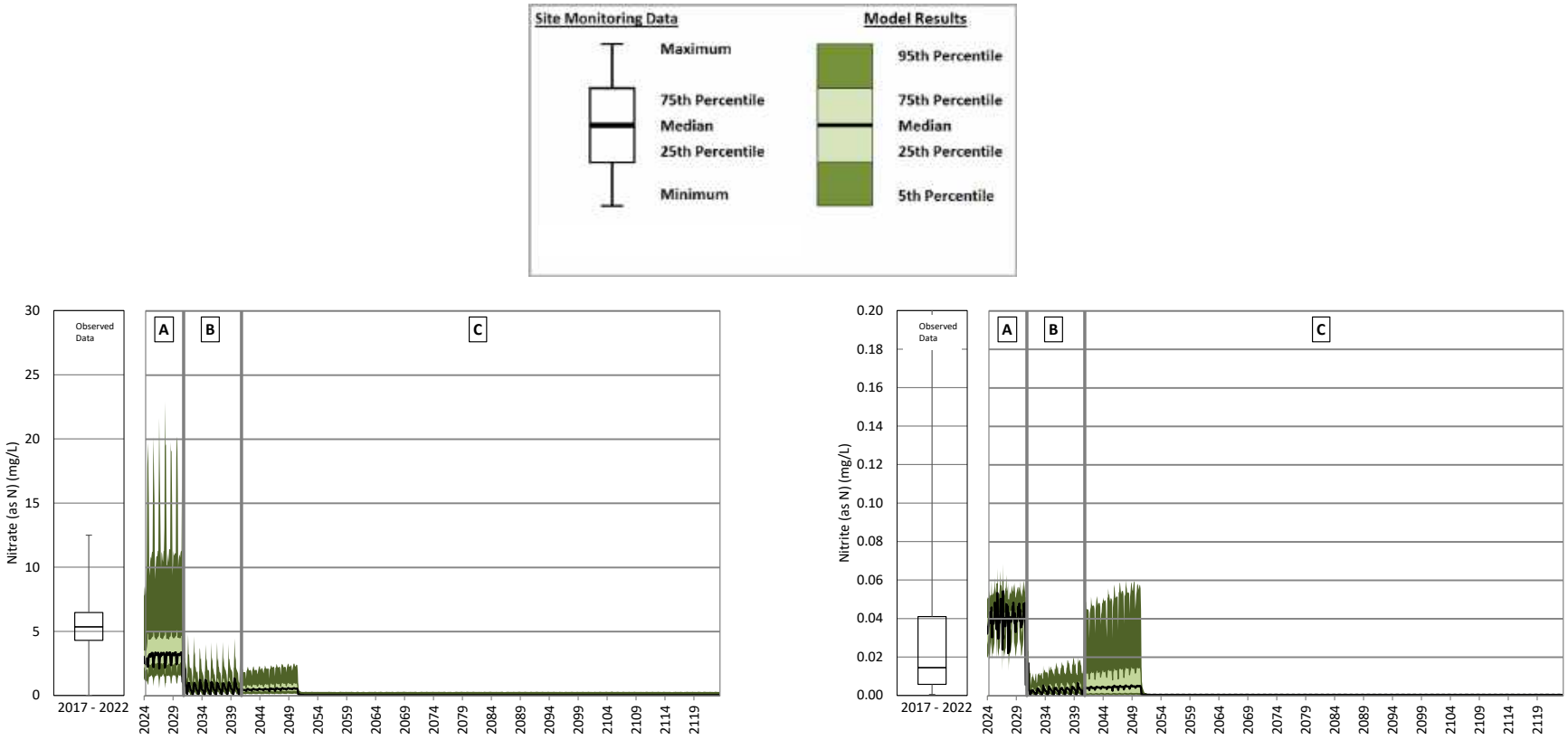
Figure B **124: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

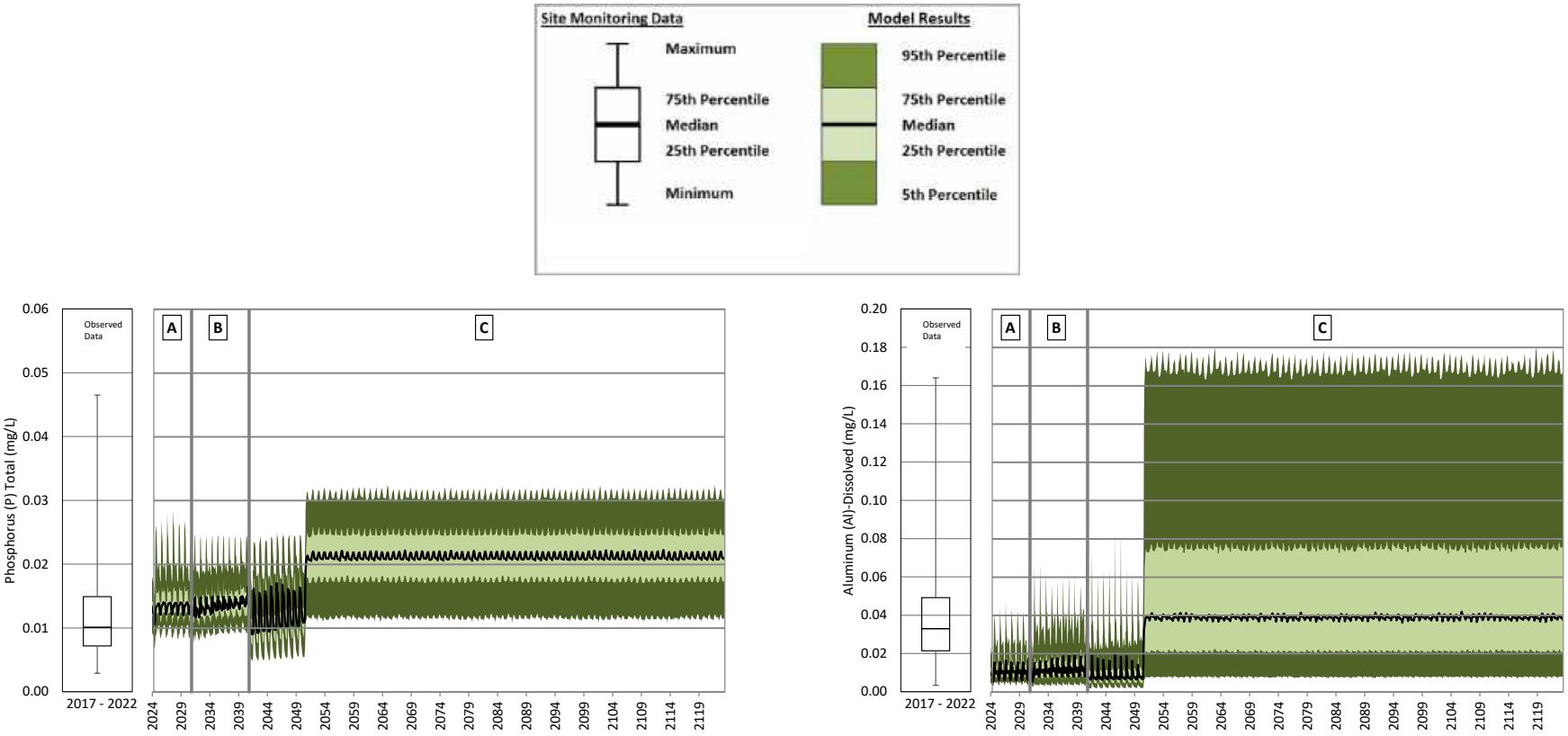
Figure B **125: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

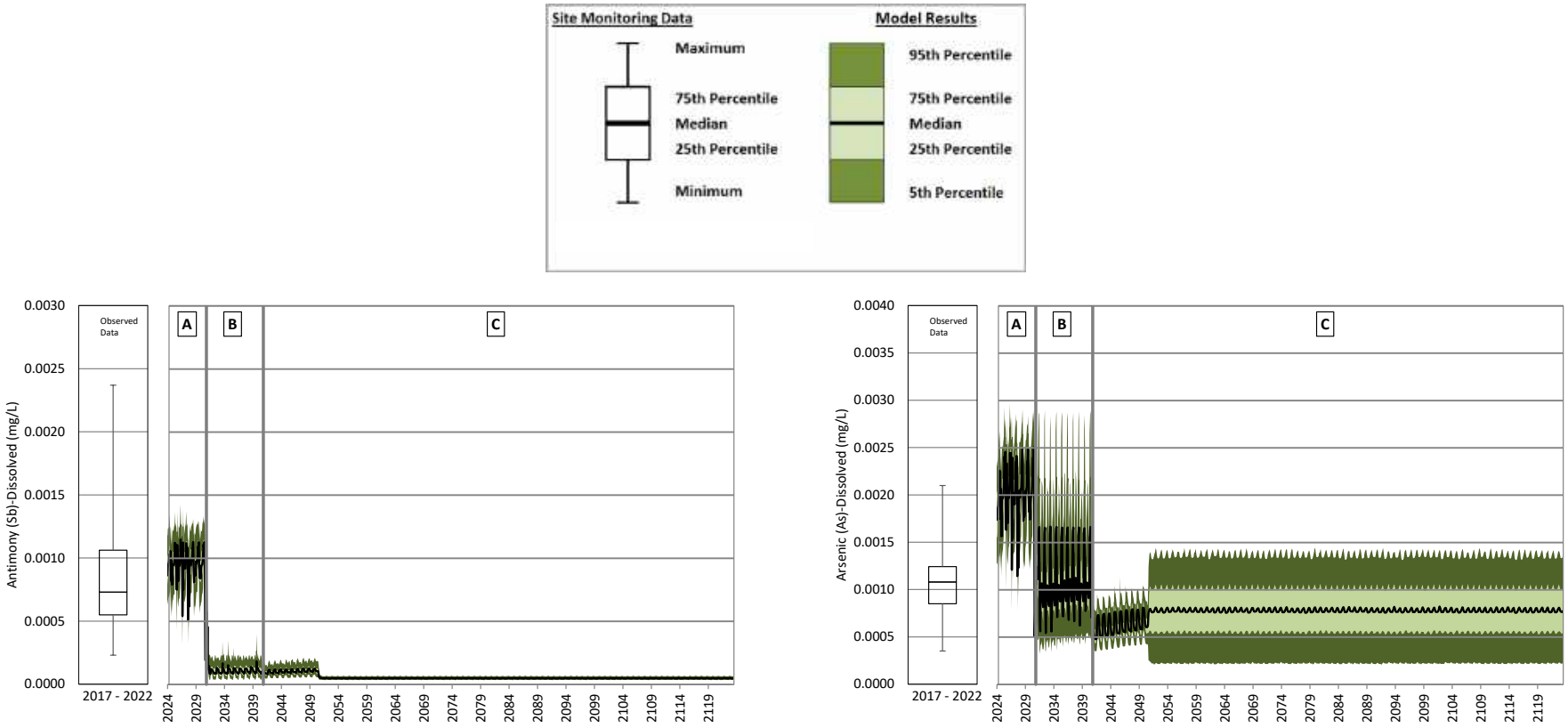
Figure B **126: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

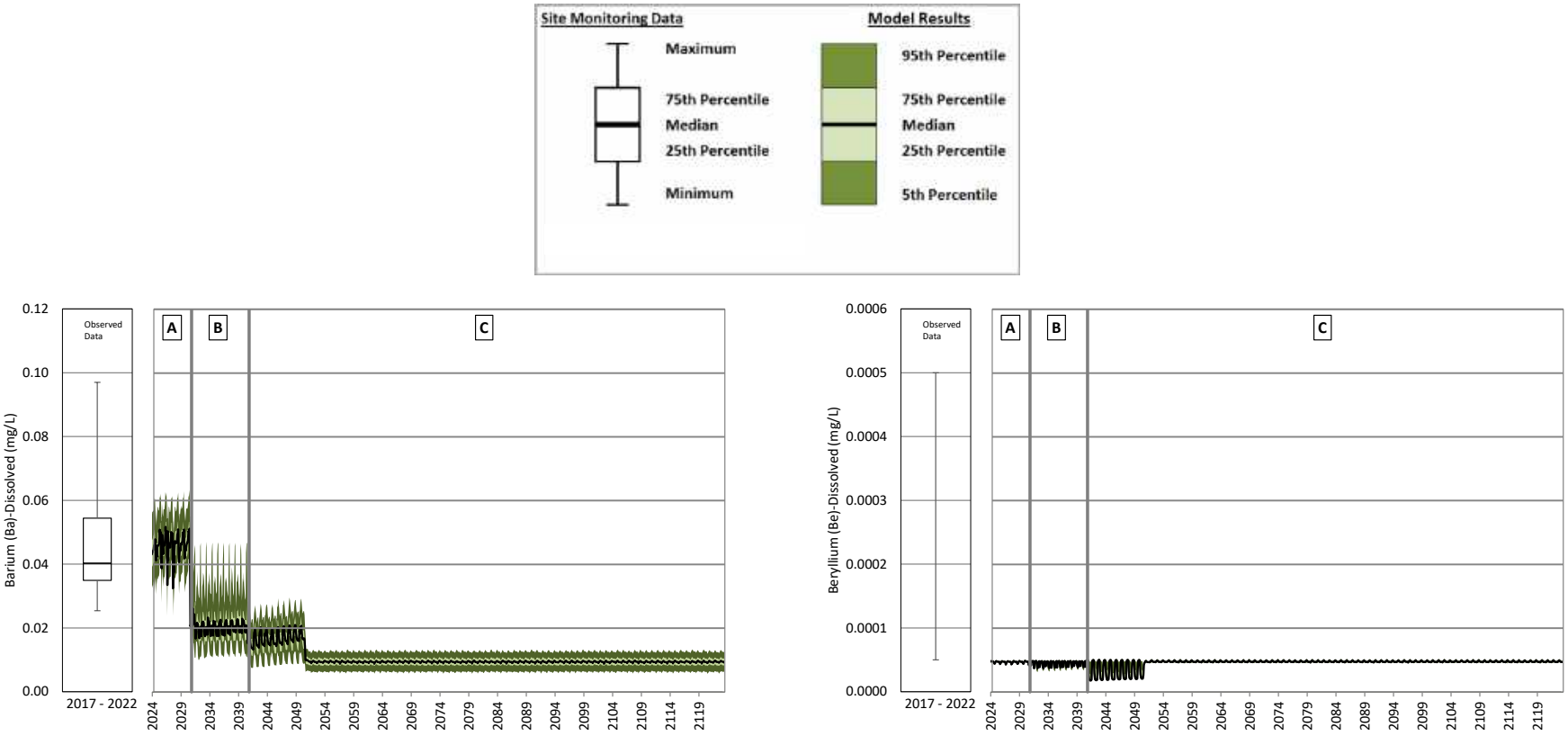
Figure B **127: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

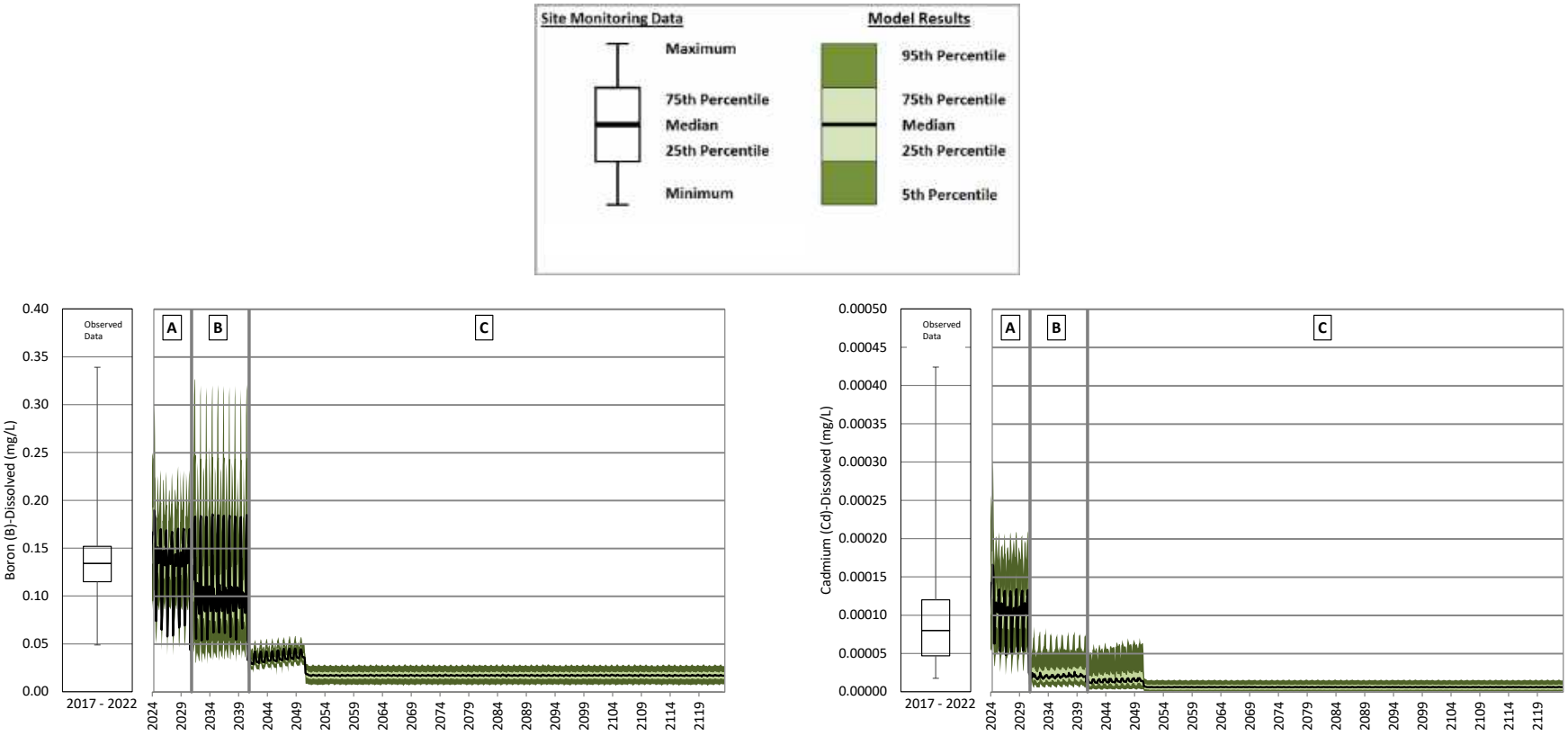
Figure B **128: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

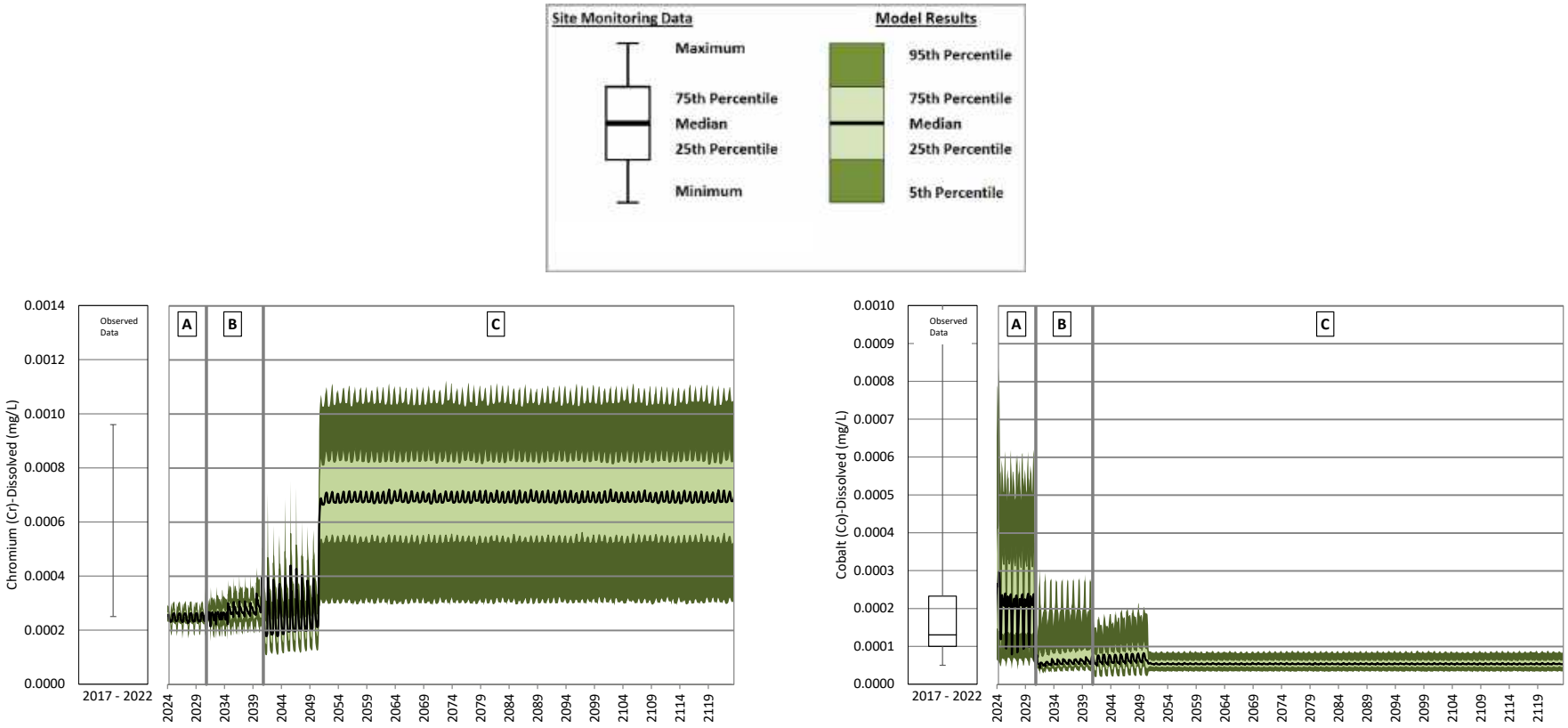
Figure B **129: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

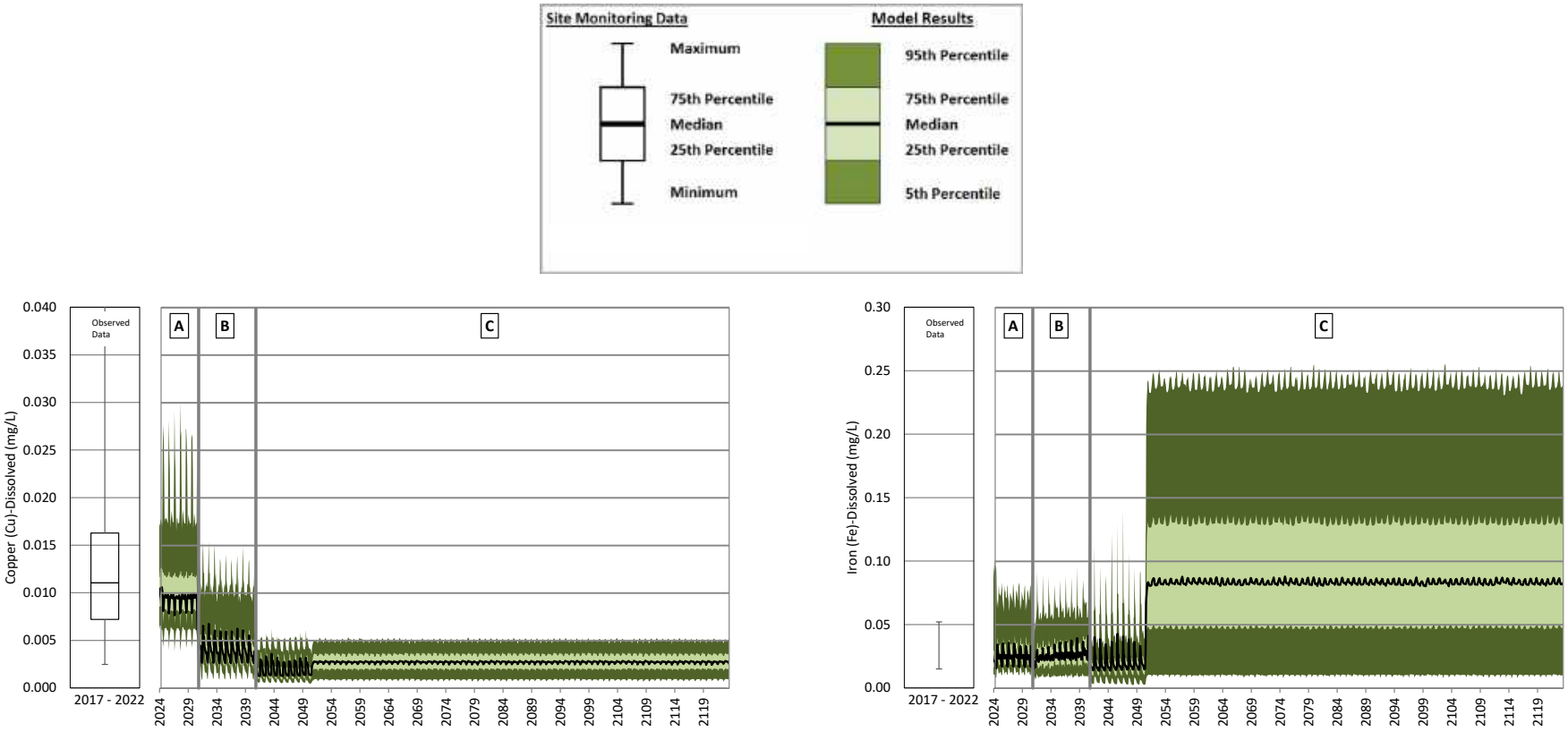
Figure B **130: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in cobalt concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

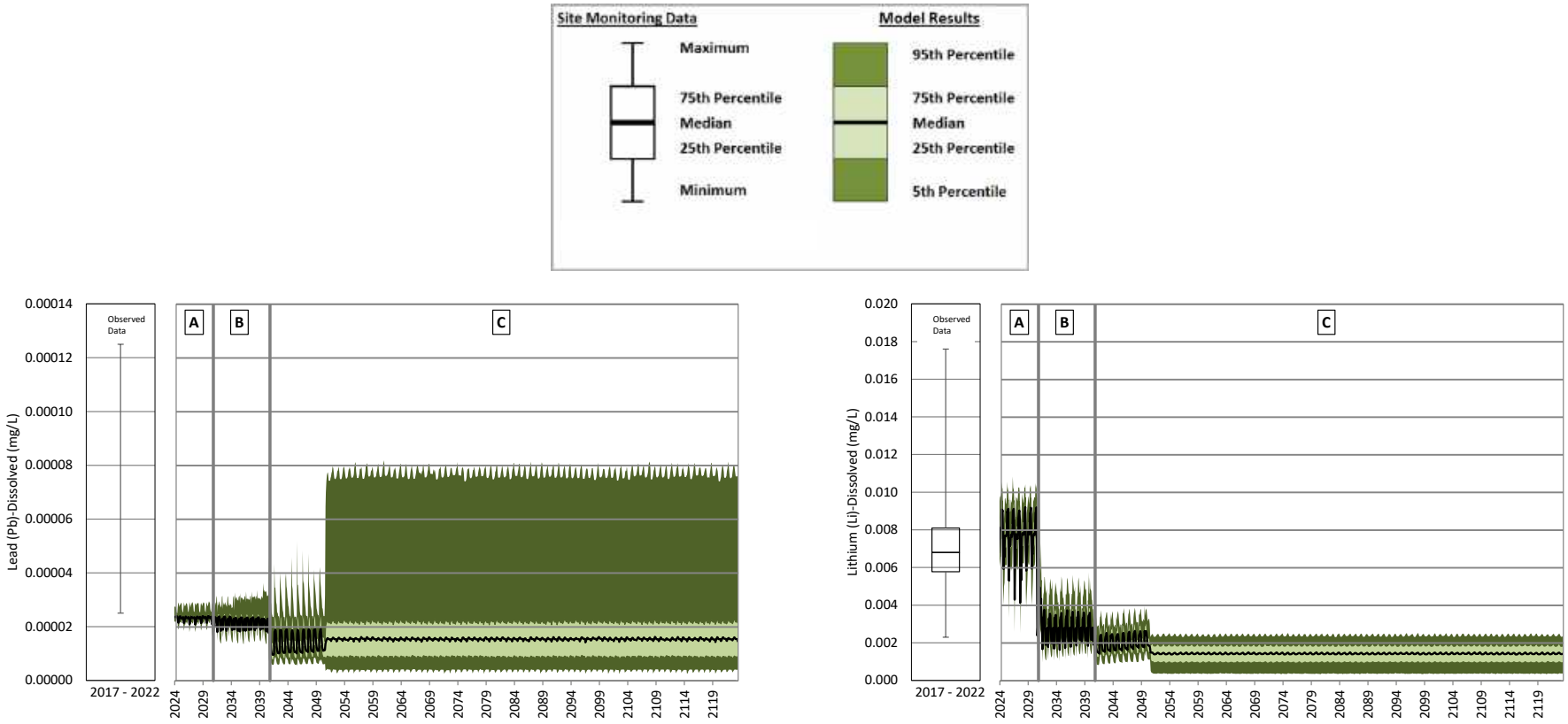
Figure B **131: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

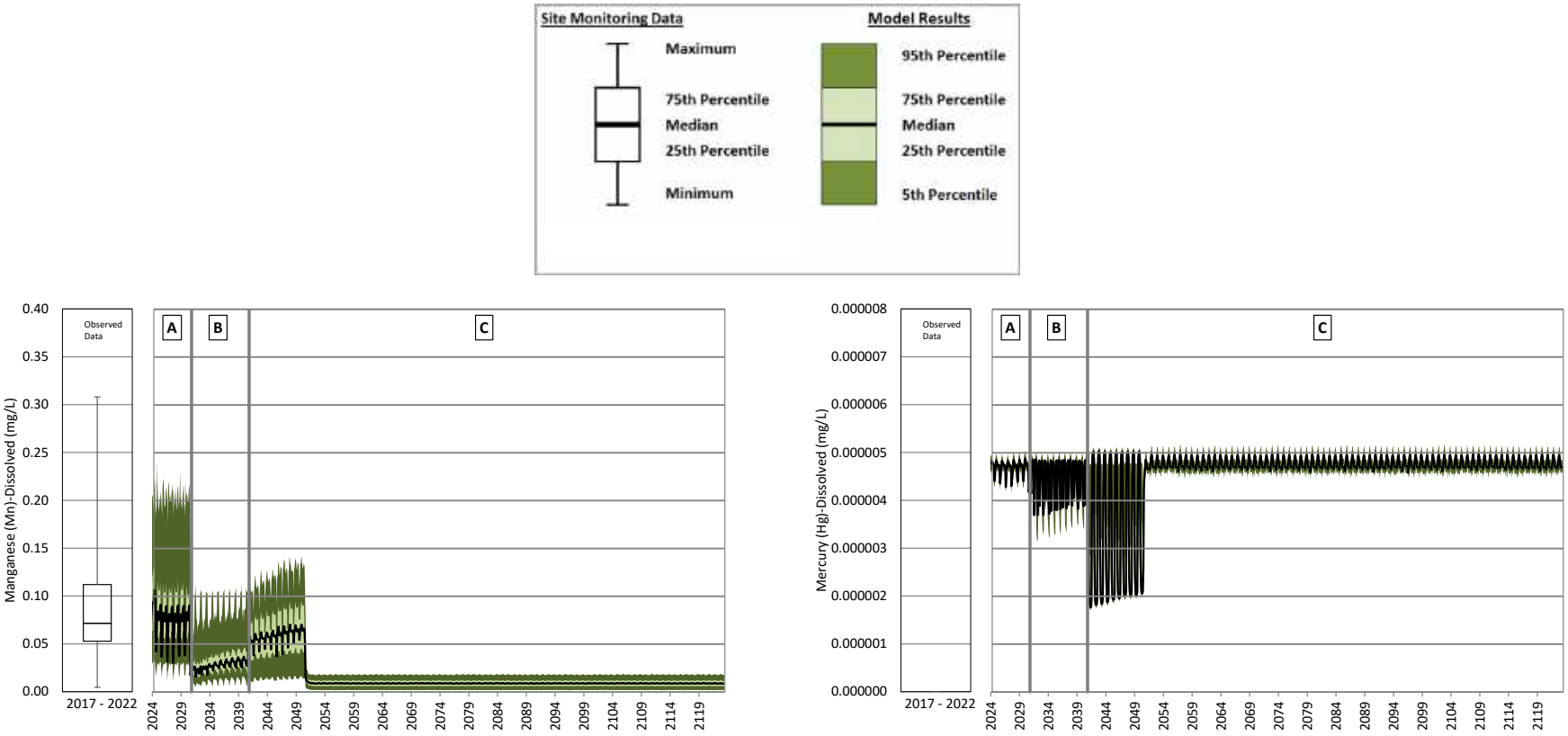
Figure B **132: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. The increase in lithium concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

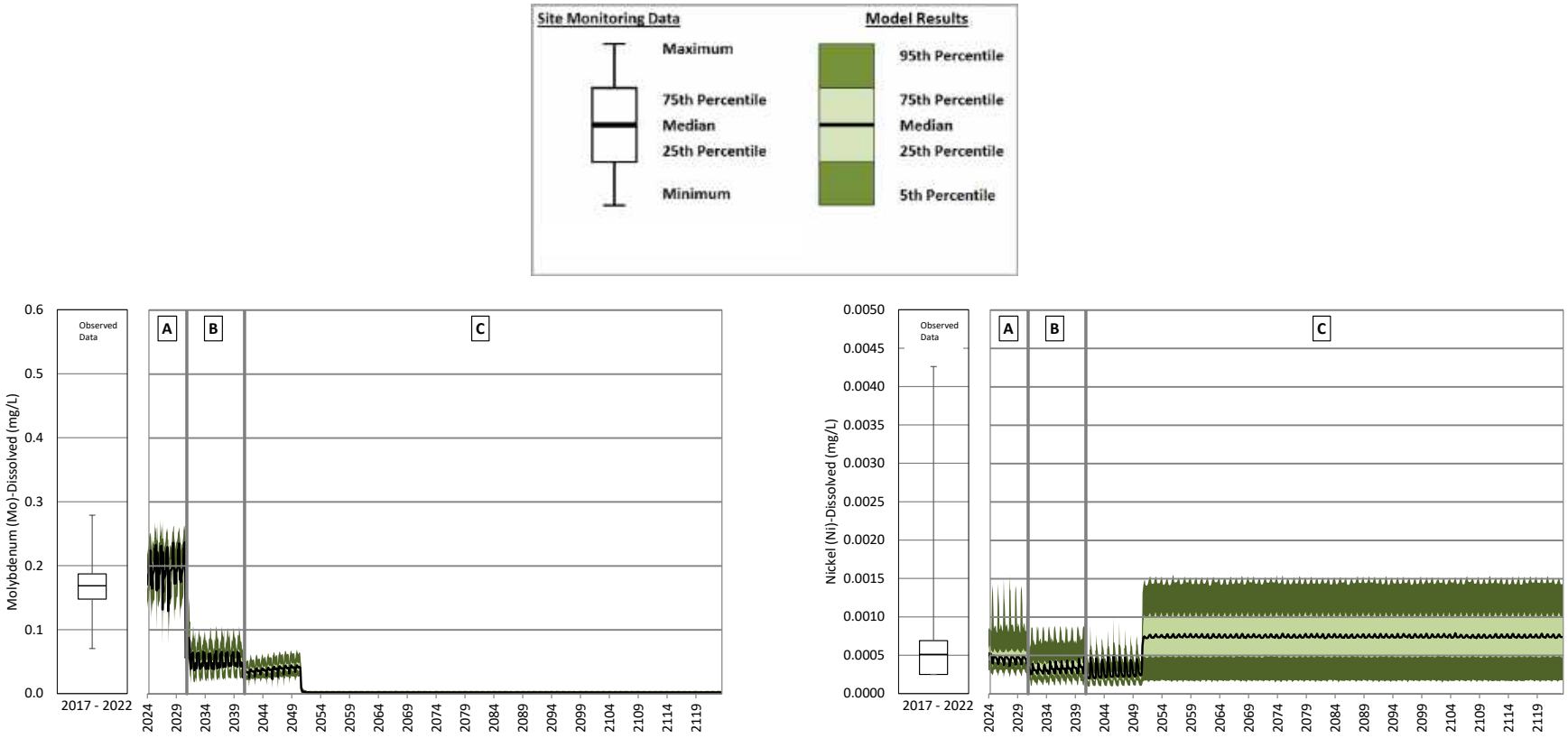
Figure B **133: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

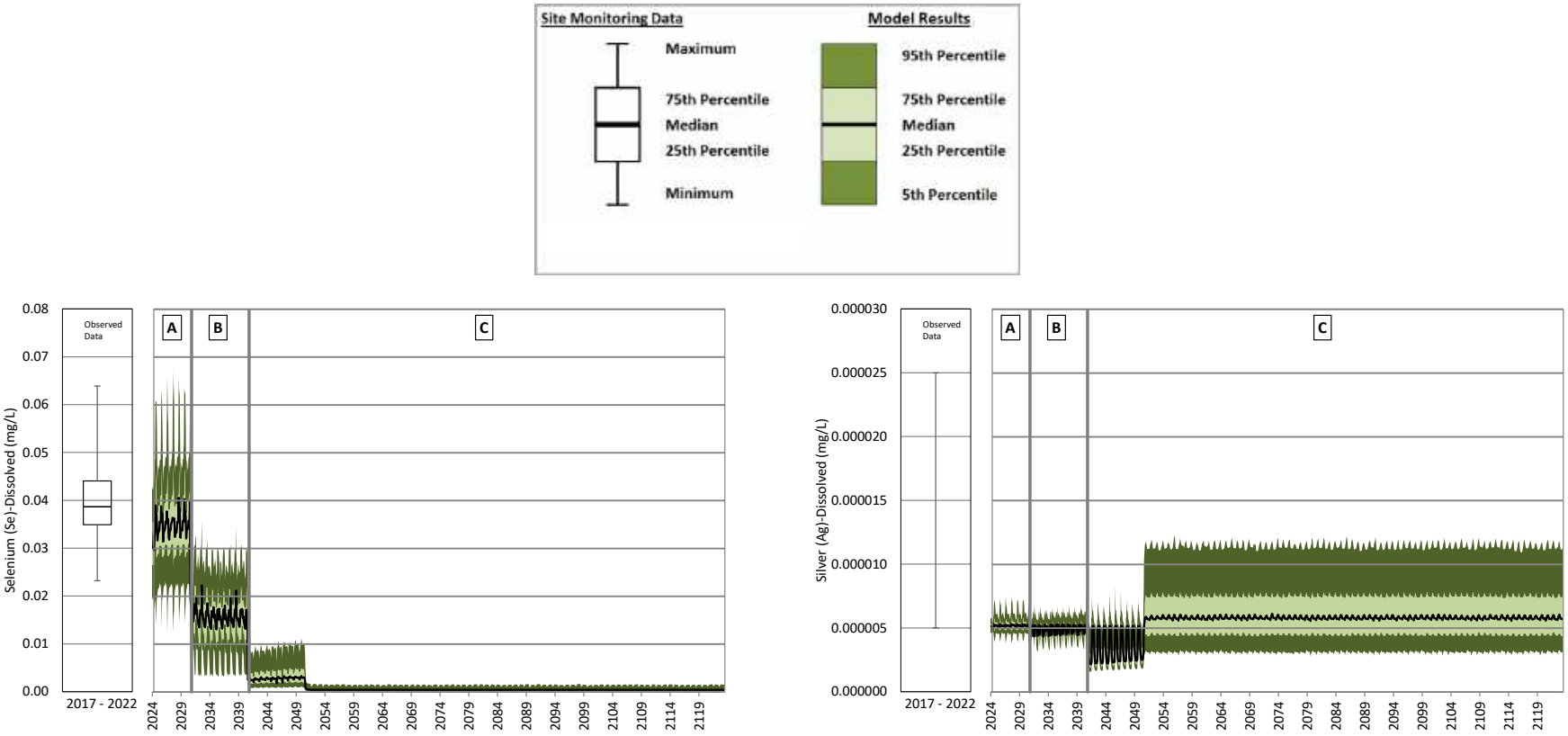
Figure B **134: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase in post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs. The increase in molybdenum concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

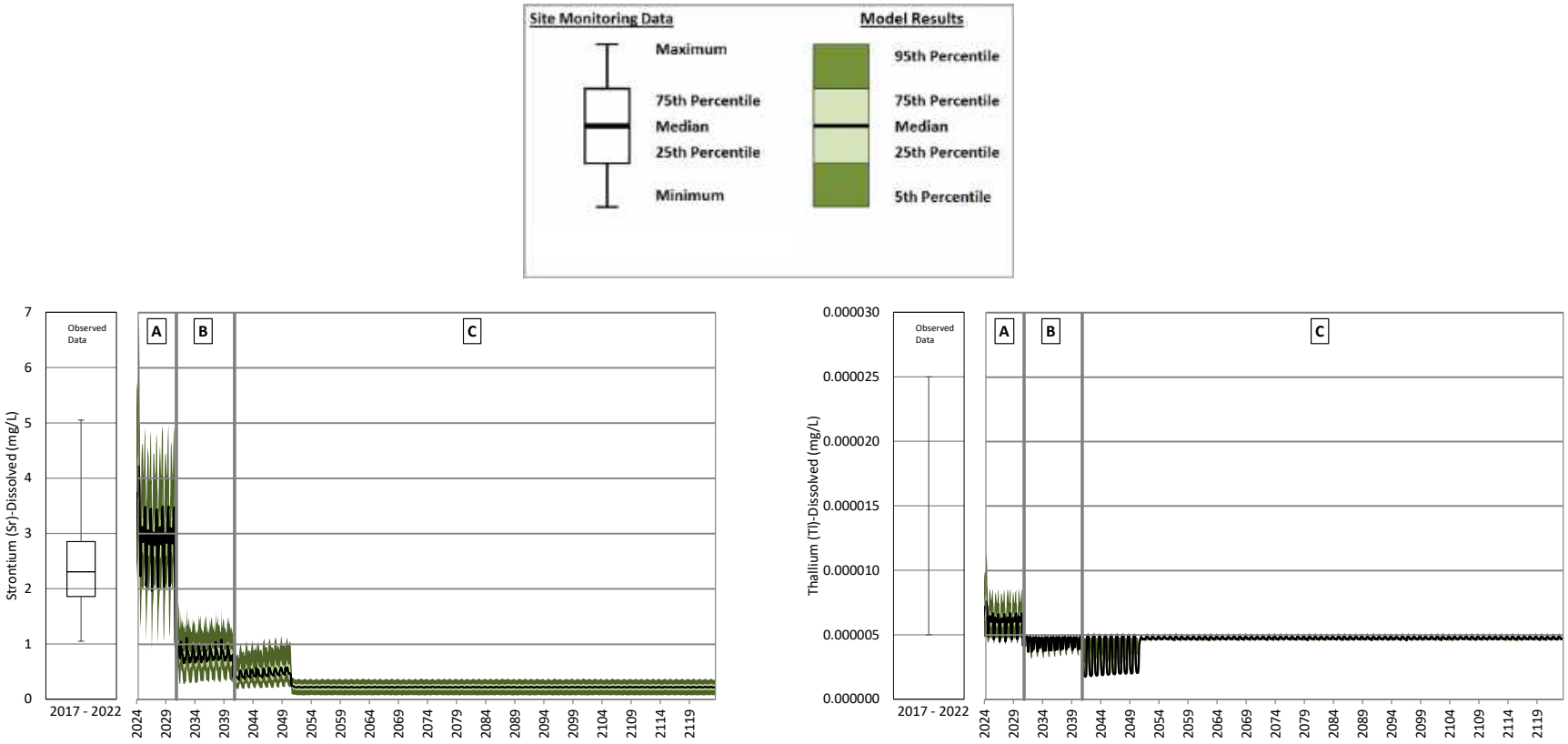
Figure B **135: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved silver concentrations increase in post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs. The increase in selenium concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

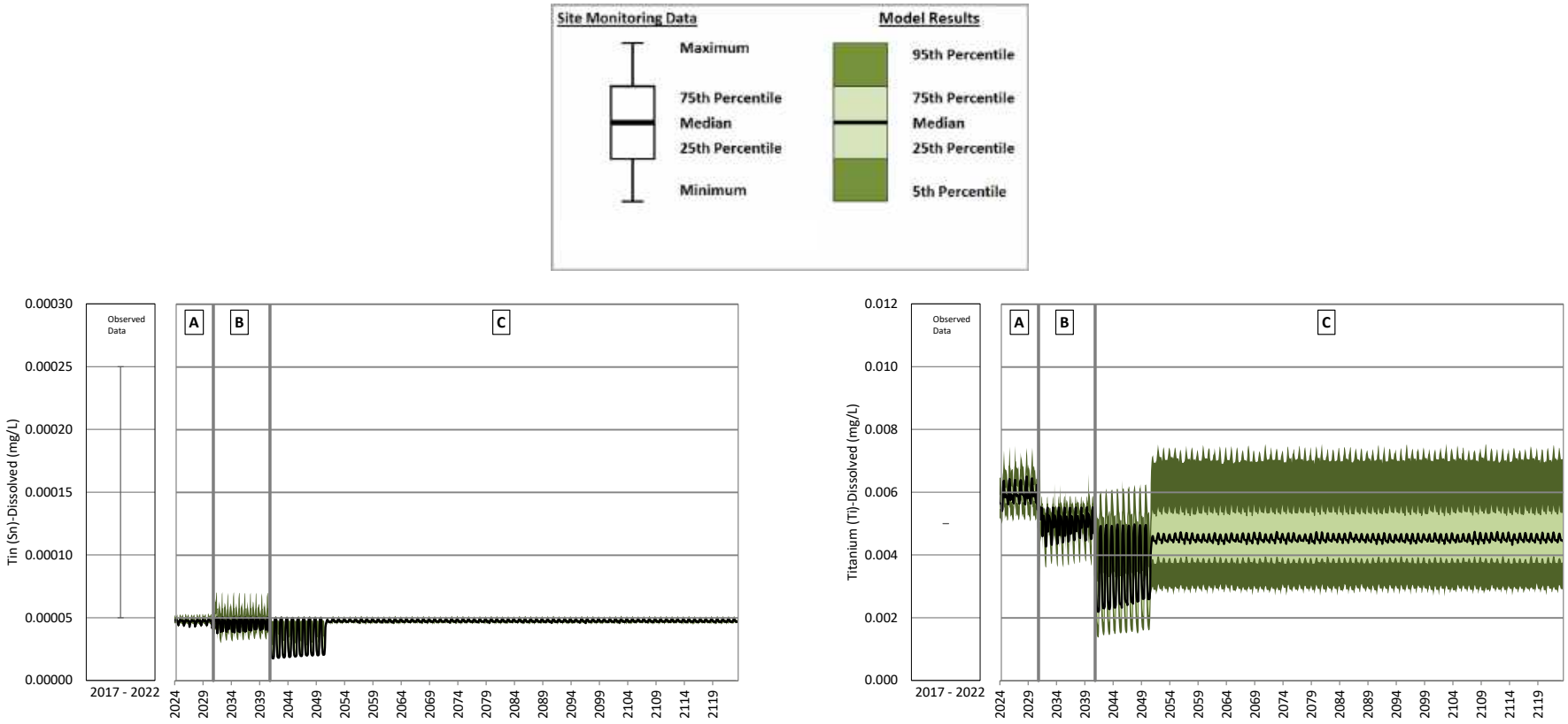
Figure B **136: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

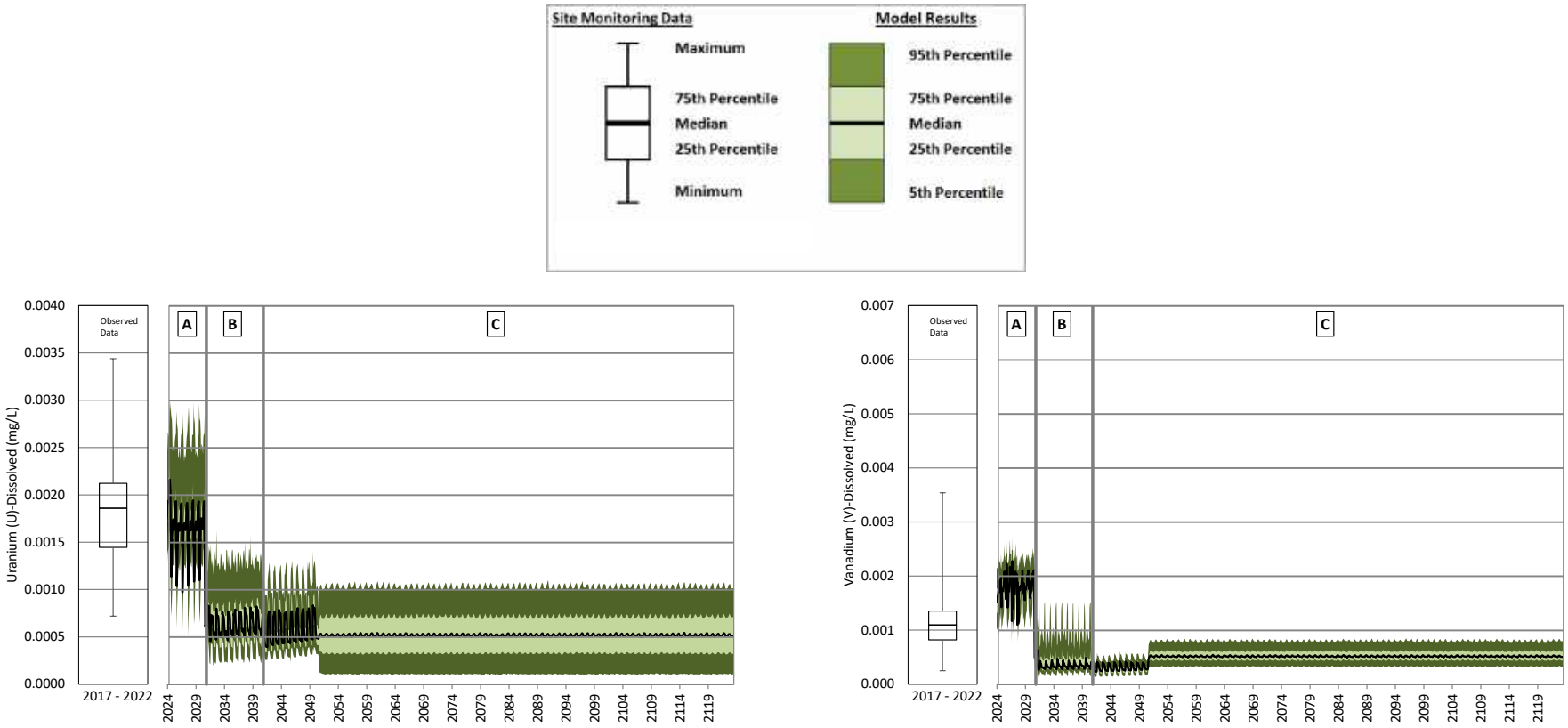
Figure B **137: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Dissolved titanium concentrations increase in post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the NAG waste rock and disturbed runoff water quality inputs. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

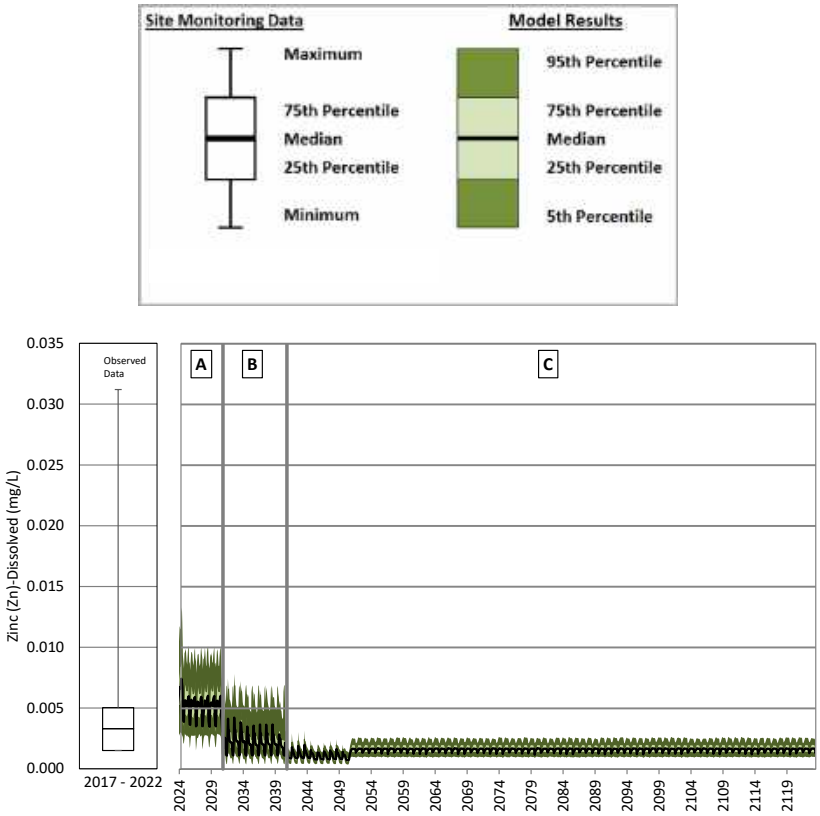
Figure B **138: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete. The increase in concentrations from 2041 to 2051 is caused by pumping from the MESCP to the PETBP which ends in 2051.

Figure B **139: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

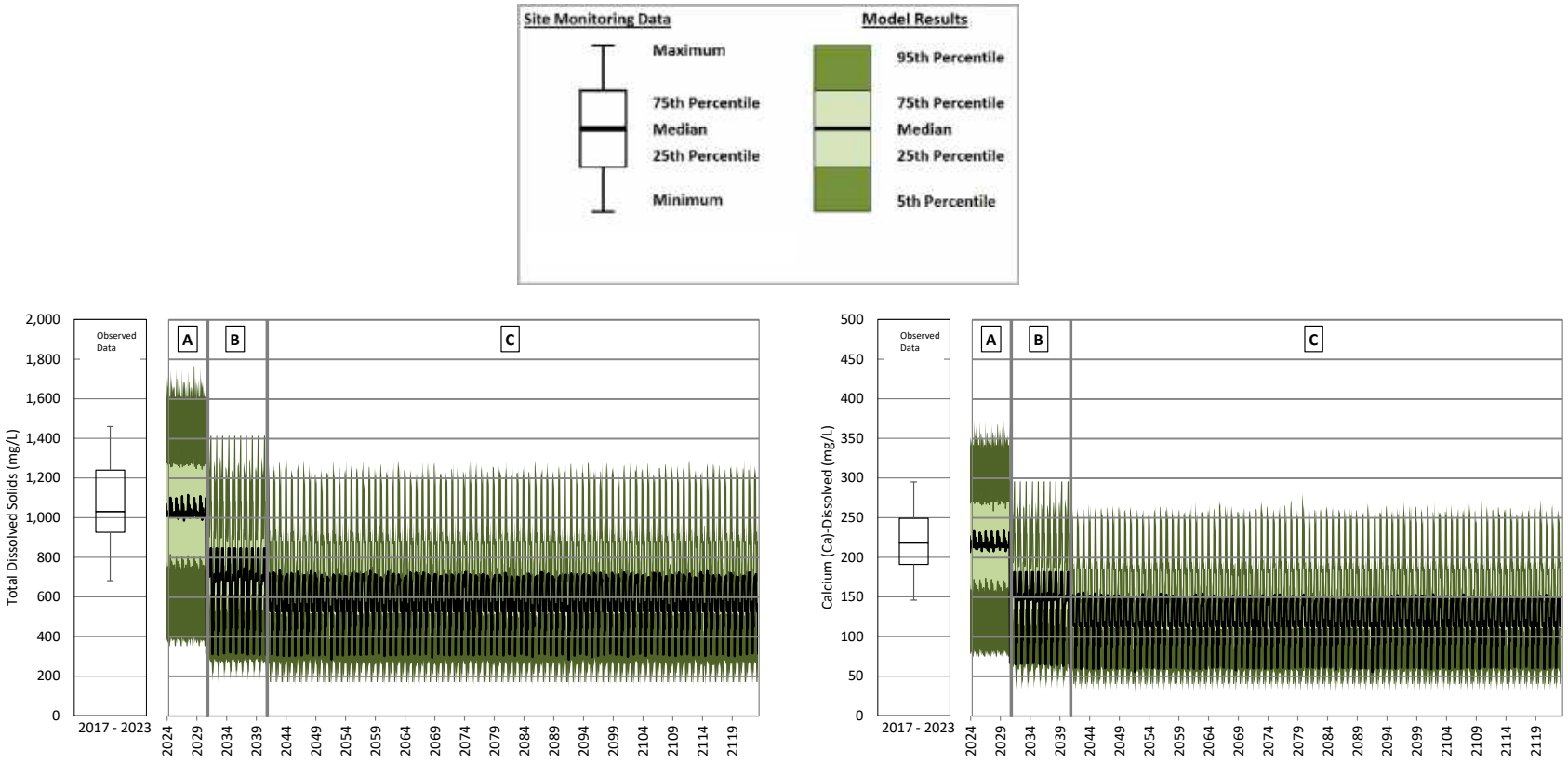


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **140: Perimeter Embankment Till Borrow Pond Operations, Closure and Post-closure – Dissolved Zinc**

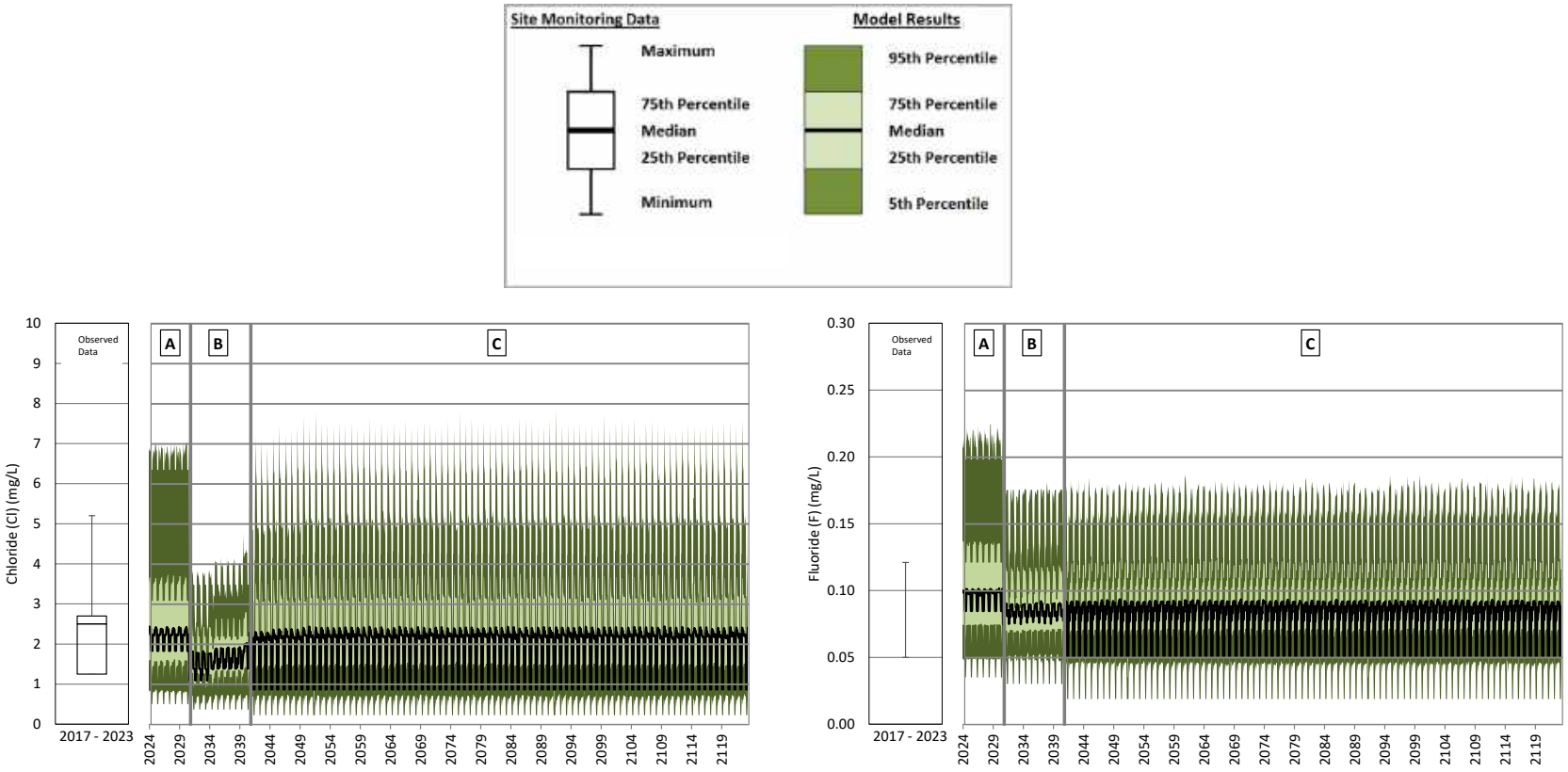
9K Sump Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

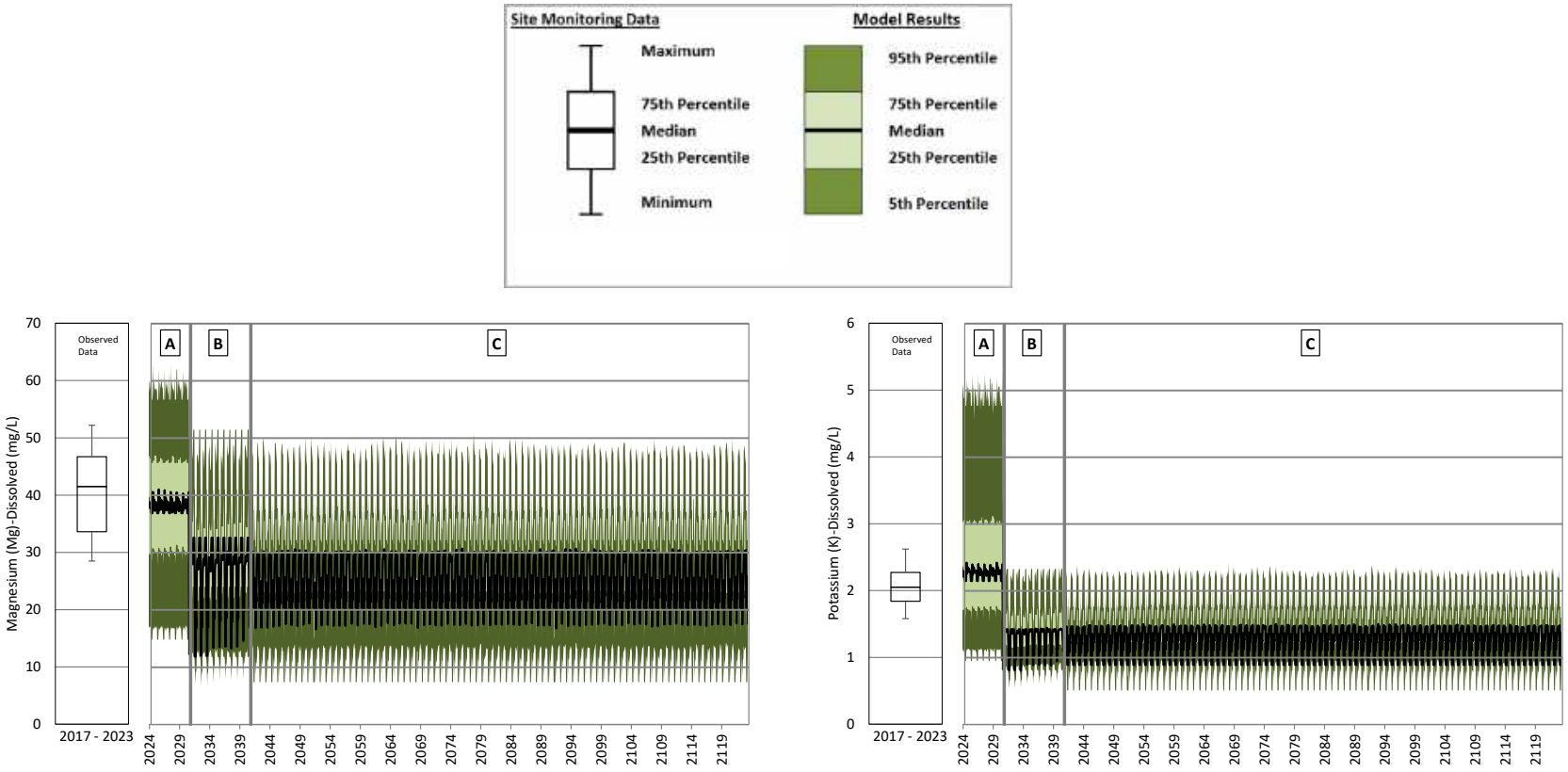
Figure B **141: 9K Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: Chloride concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for chloride than the disturbed runoff water quality input. Fluoride concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

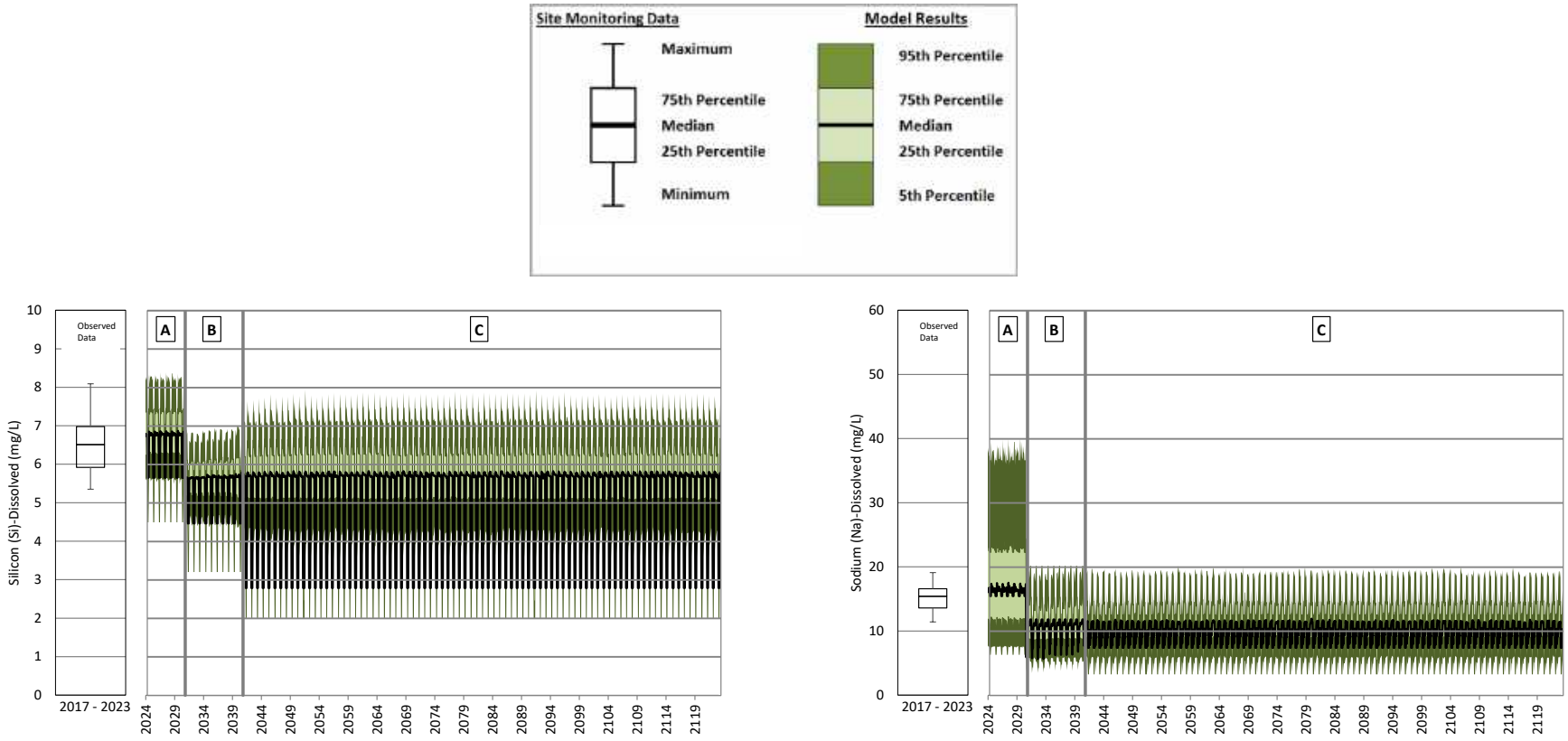
Figure B **142: 9K Sump Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

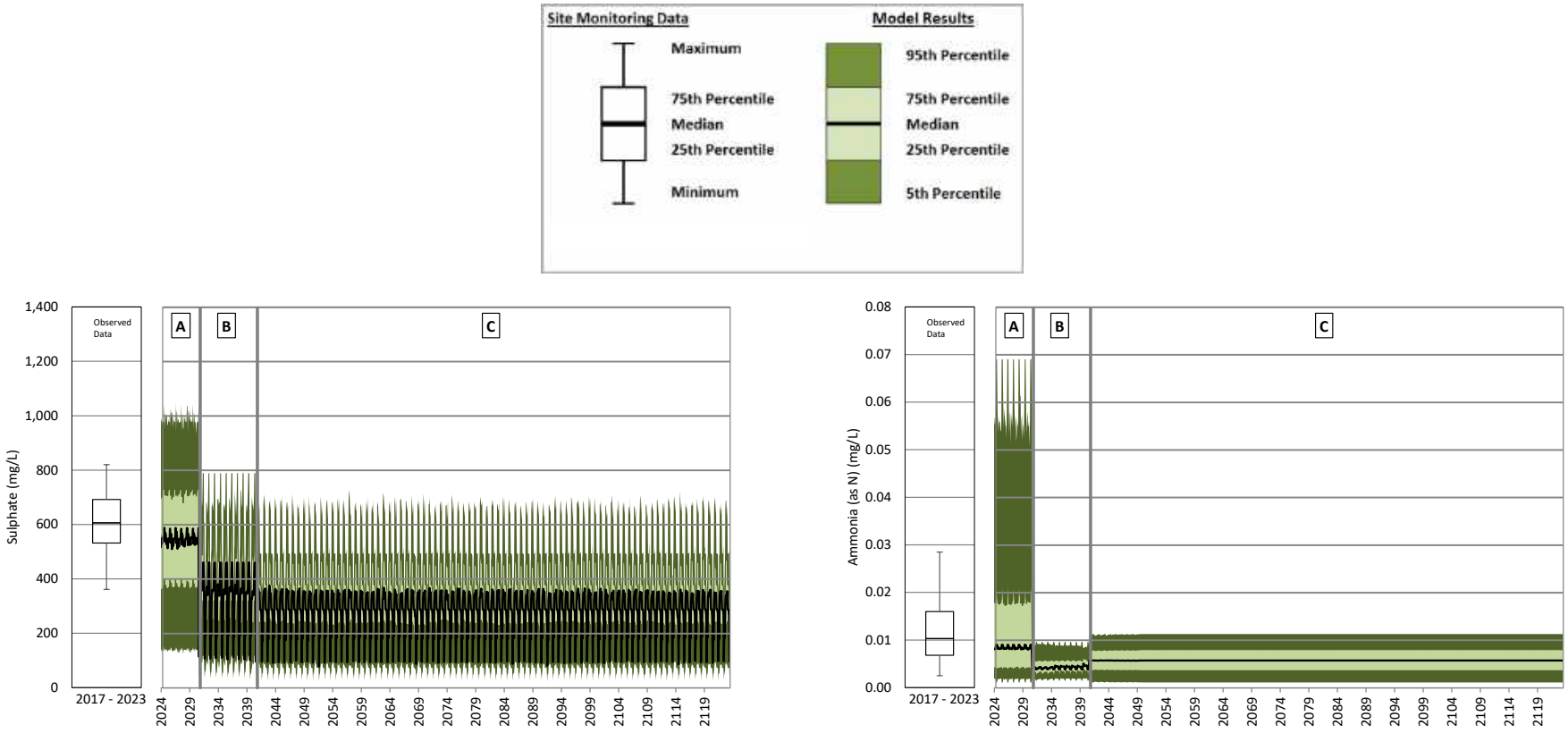
Figure B **143: 9K Sump Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: Silicon concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for silicon than the disturbed runoff water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

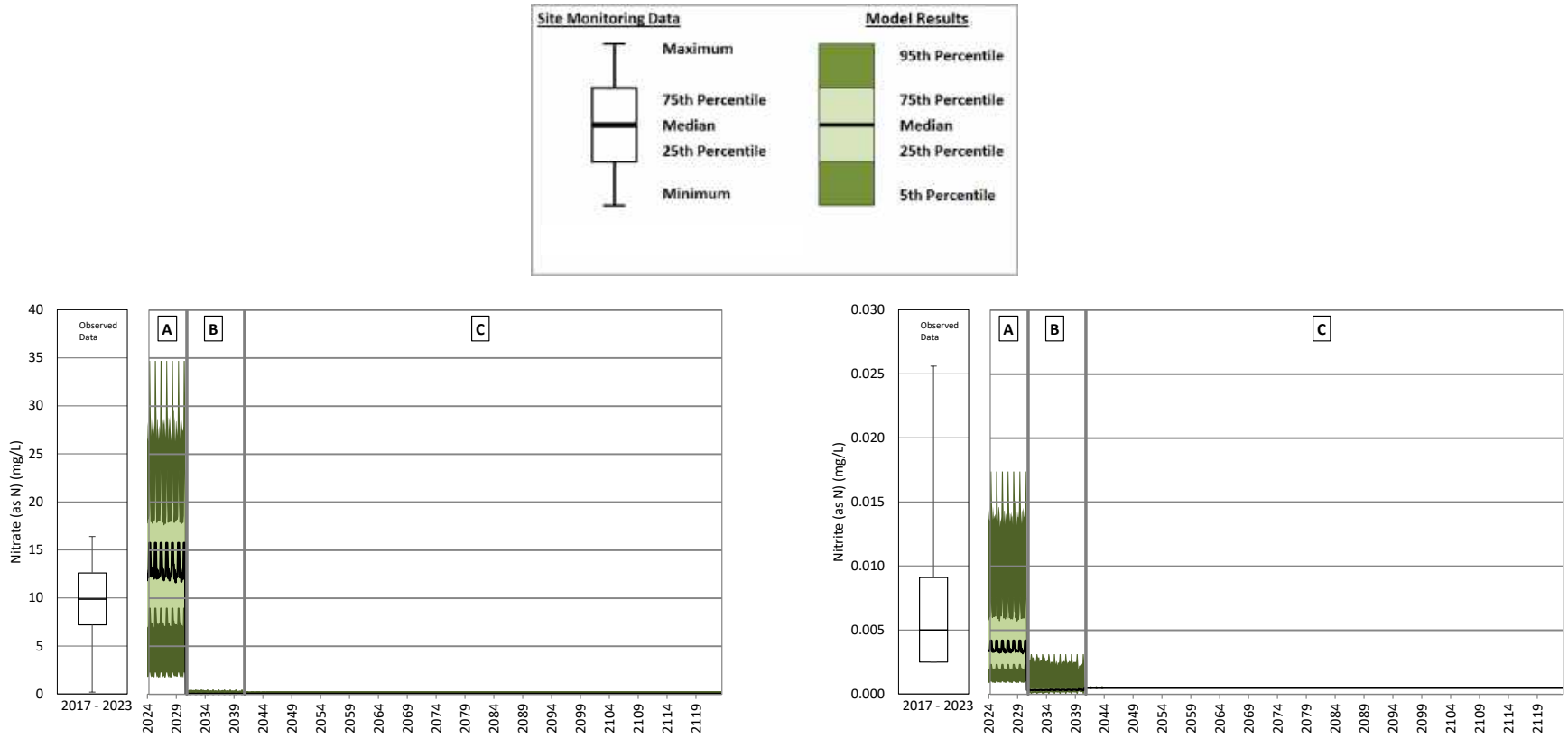
Figure B **144: 9K Sump Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: Sulphate concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Total ammonia concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total ammonia than the disturbed runoff water quality input.

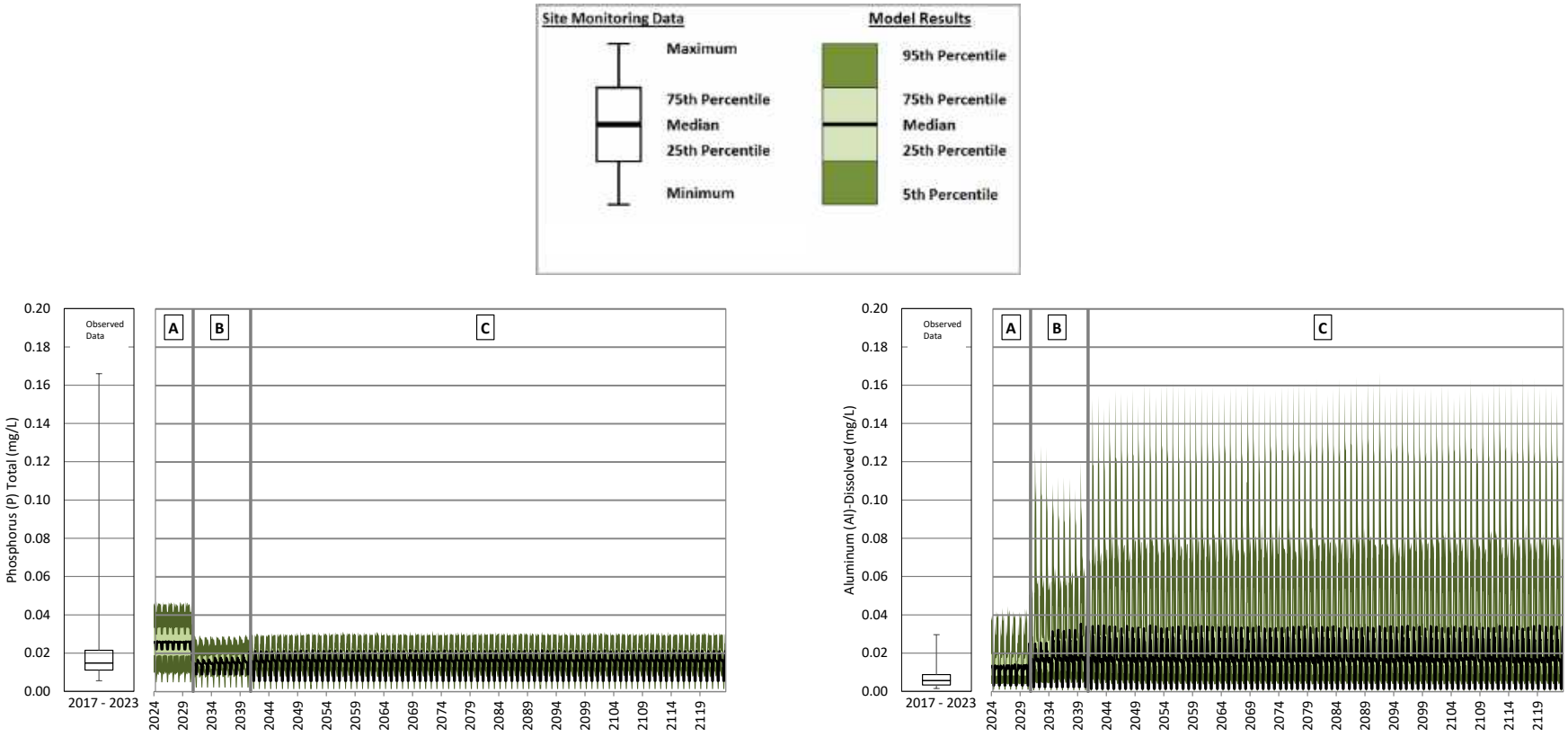
Figure B **145: 9K Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

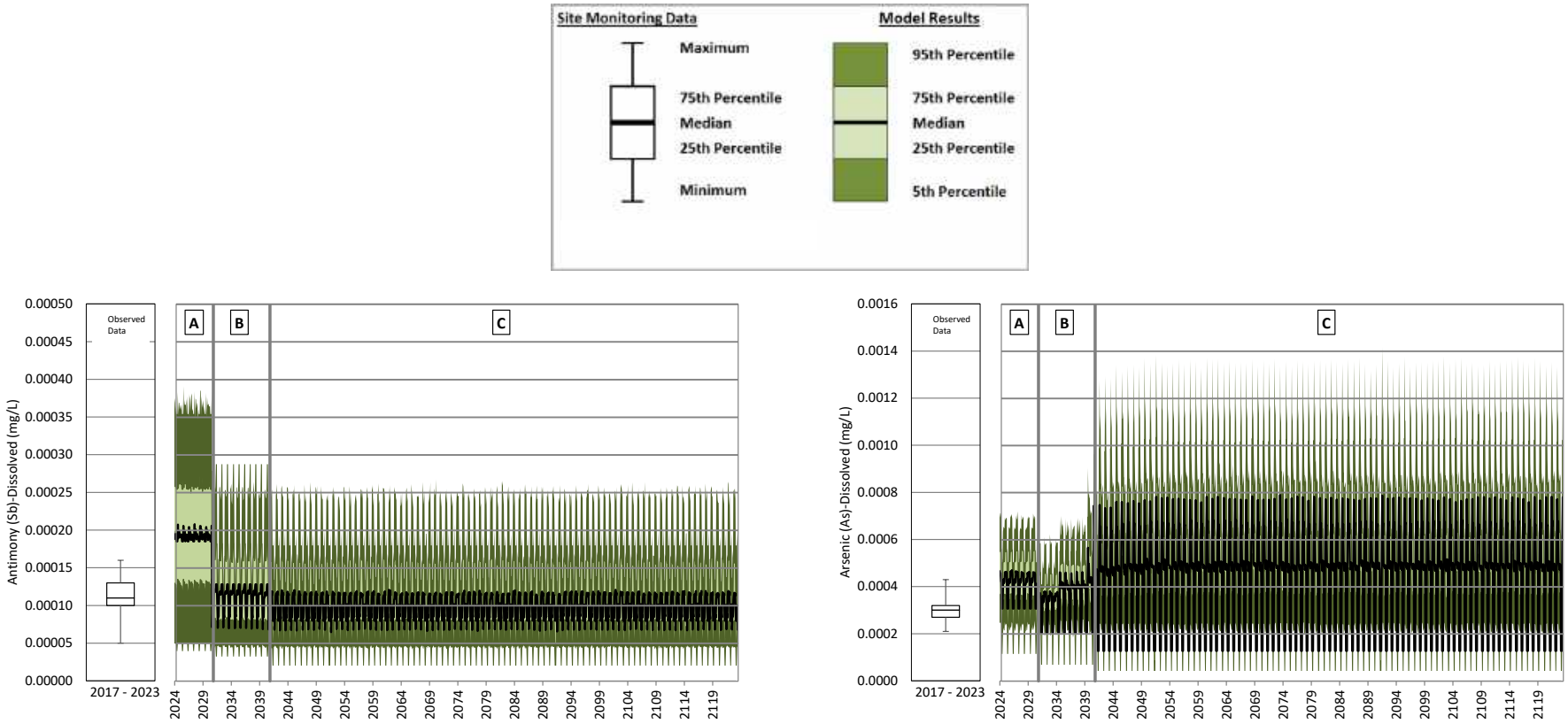
Figure B **146: 9K Sump Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

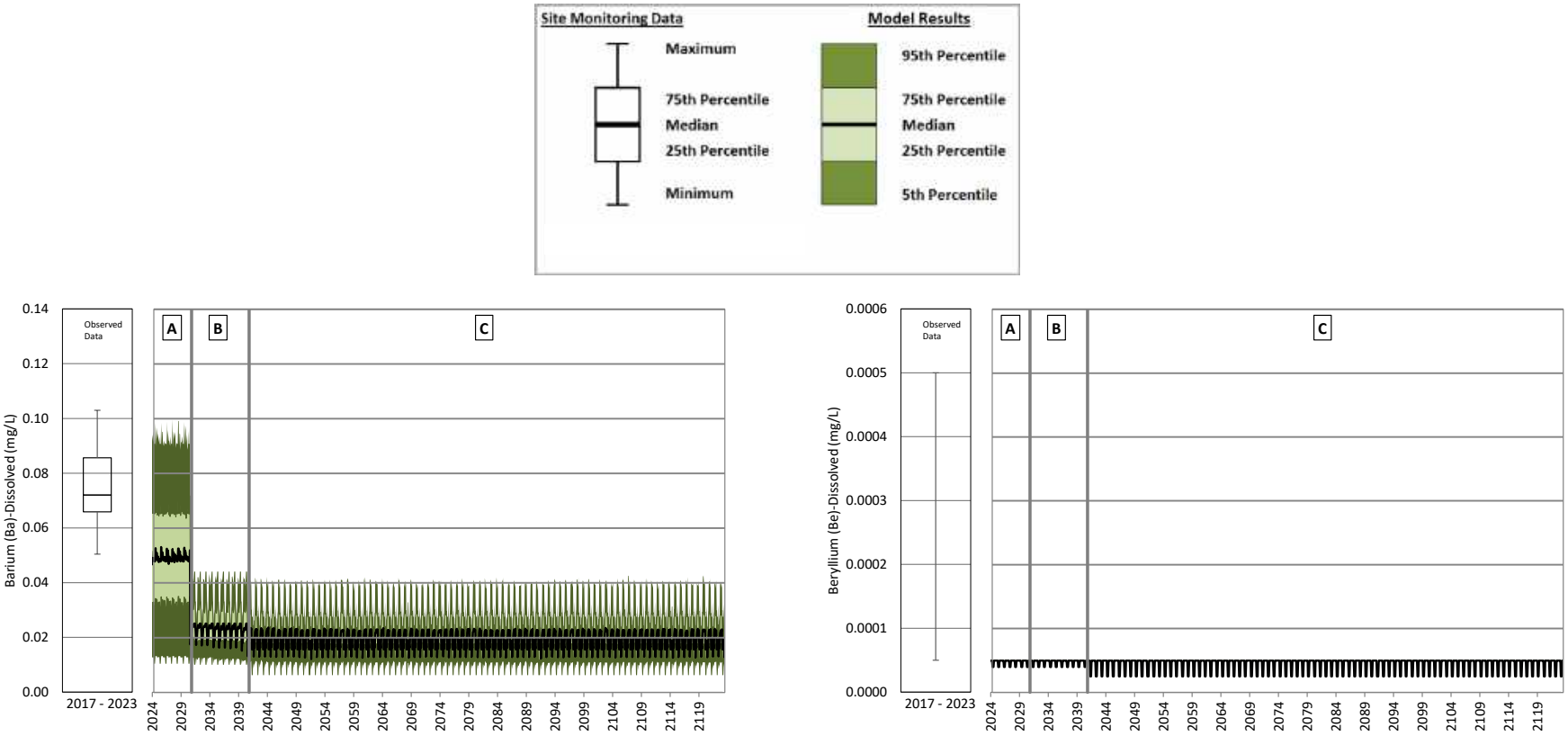
Figure B **147: 9K Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved antimony concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved arsenic concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved arsenic than the NAG waste rock and disturbed runoff water quality inputs.

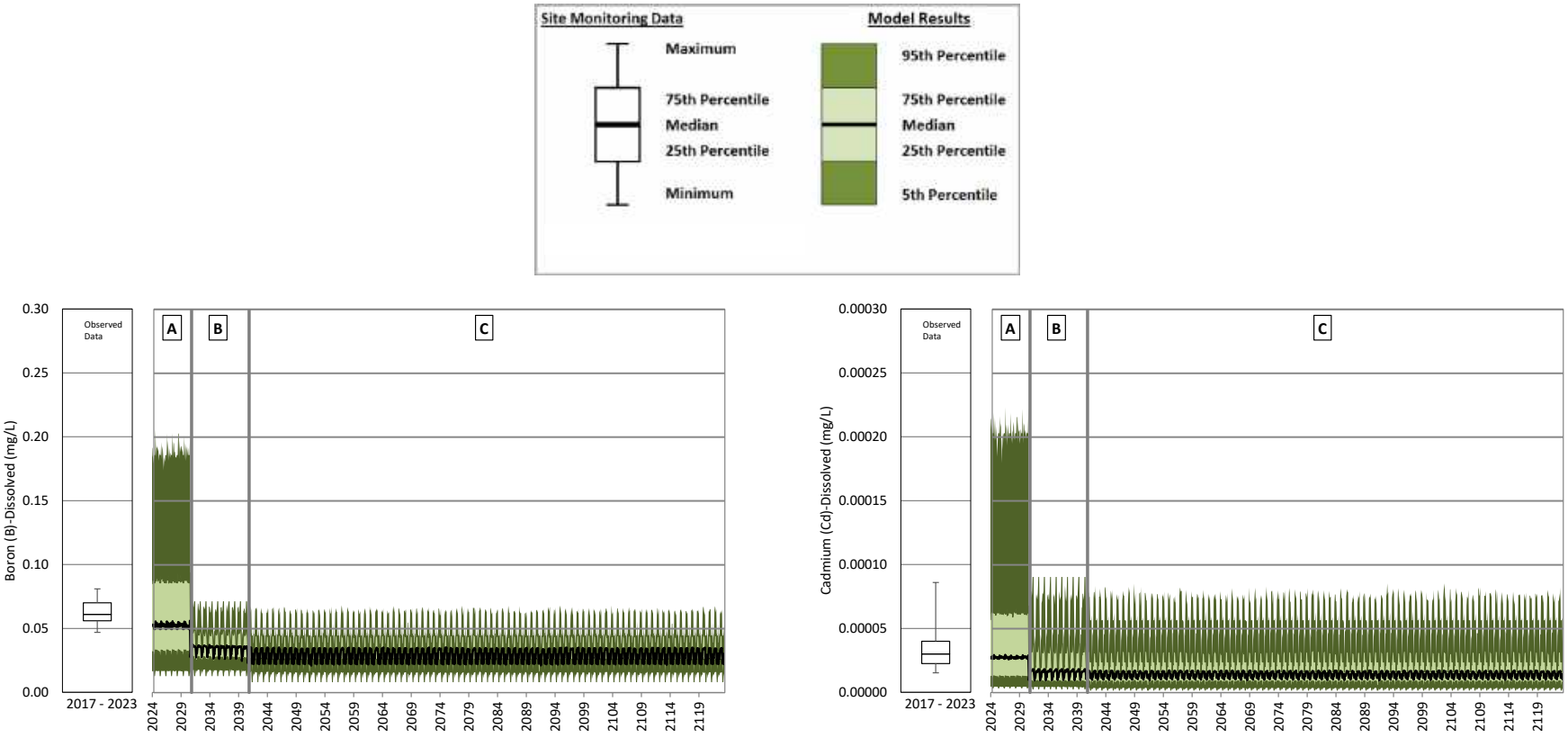
Figure B **148: 9K Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

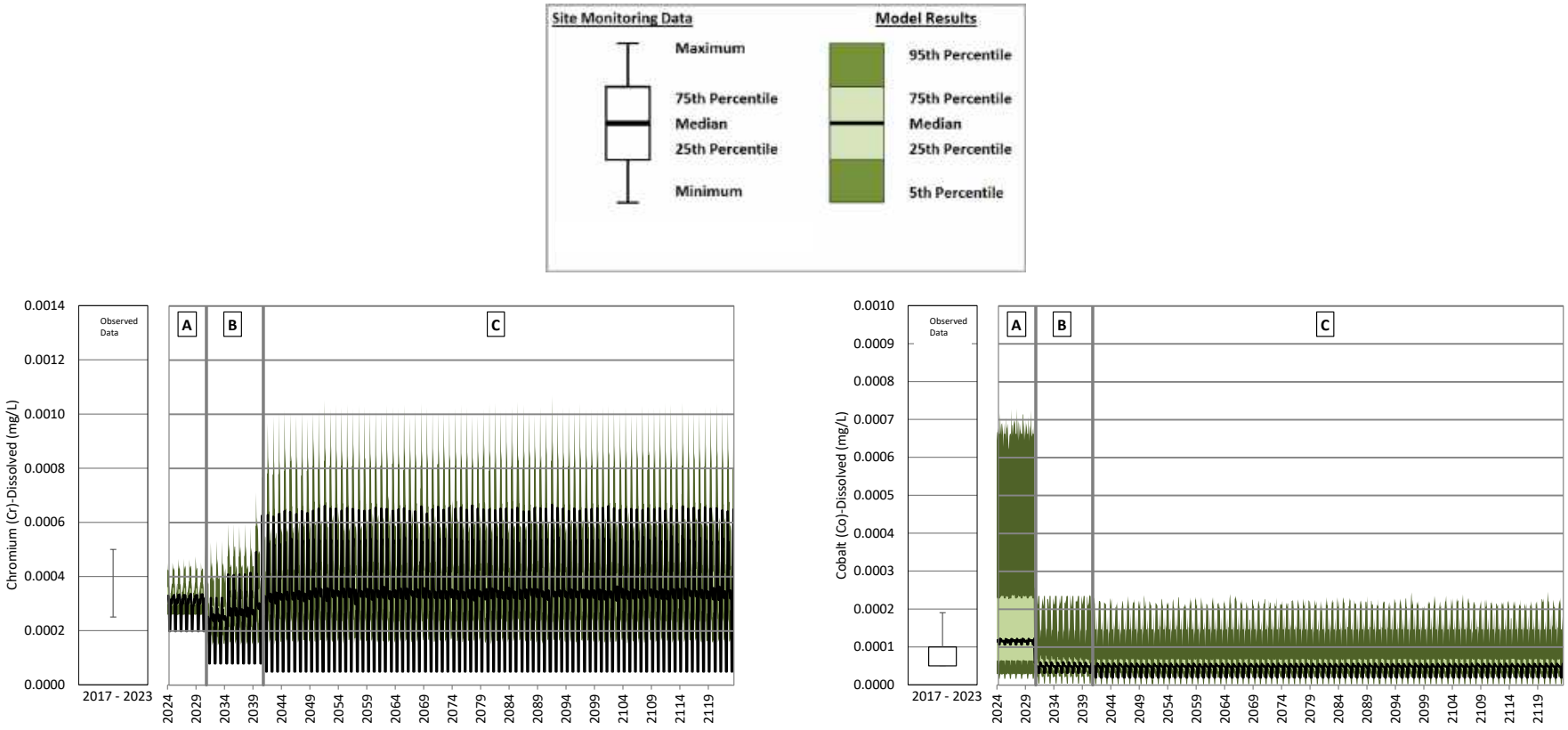
Figure B **149: 9K Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

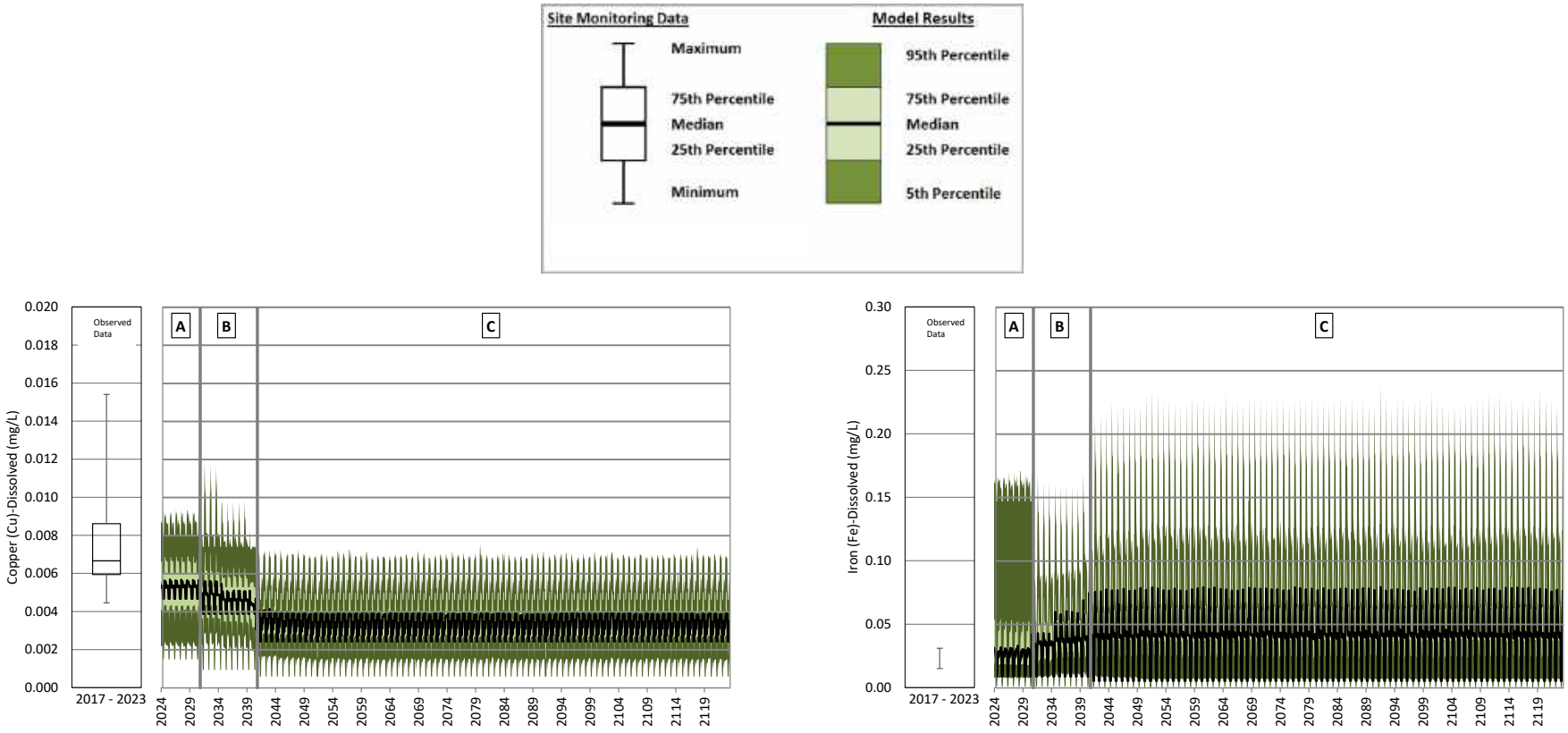
Figure B **150: 9K Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

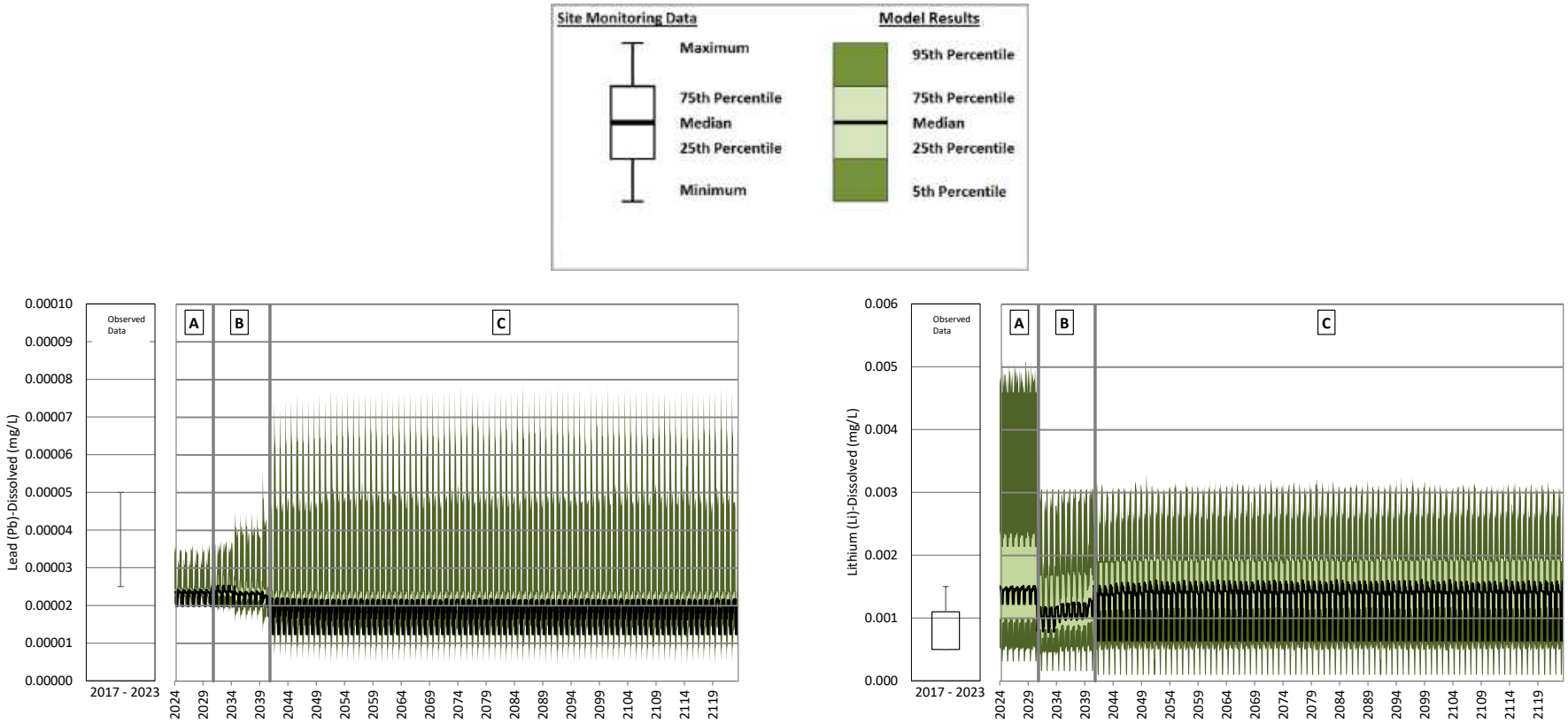
Figure B **151: 9K Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

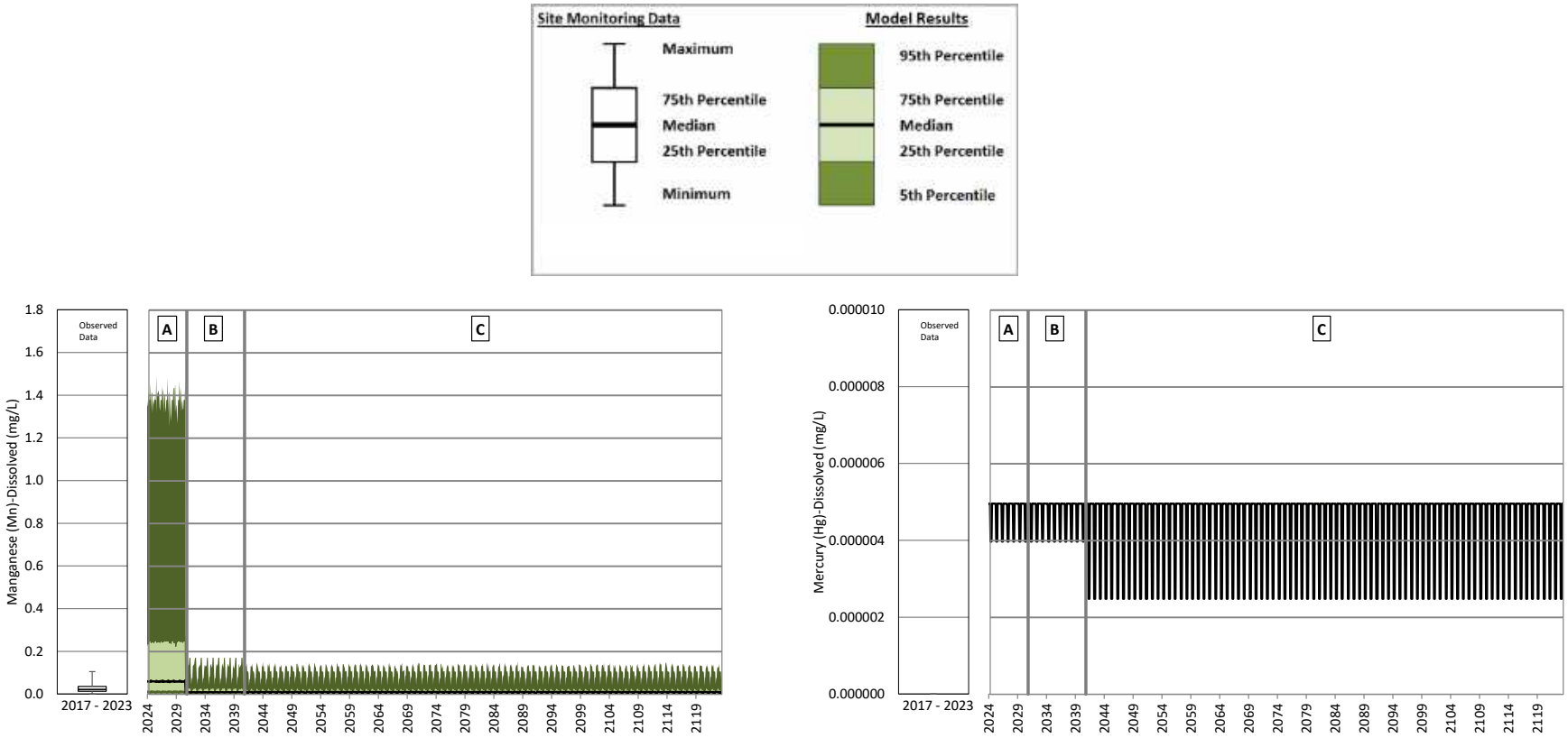
Figure B **152: 9K Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

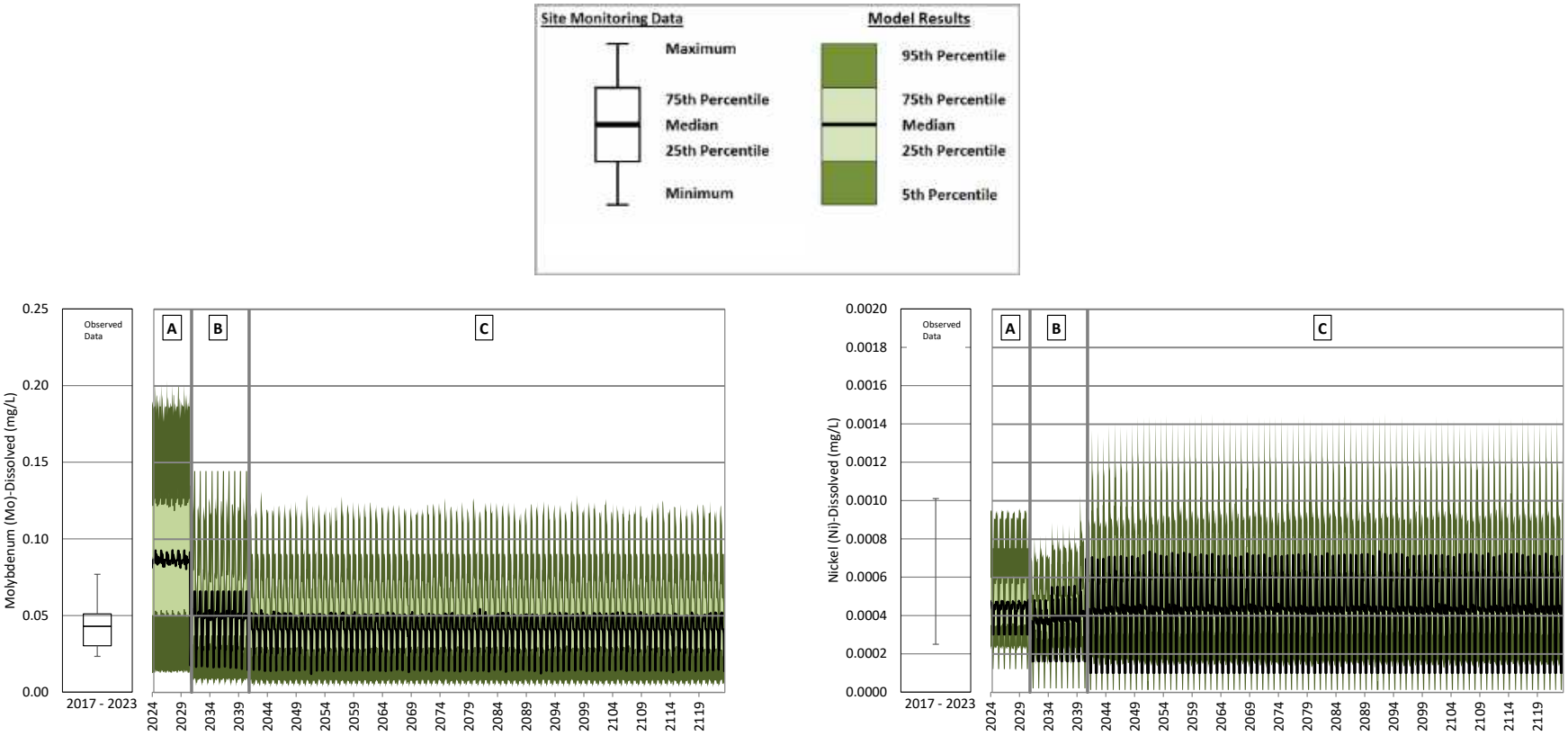
Figure B **153: 9K Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

. Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

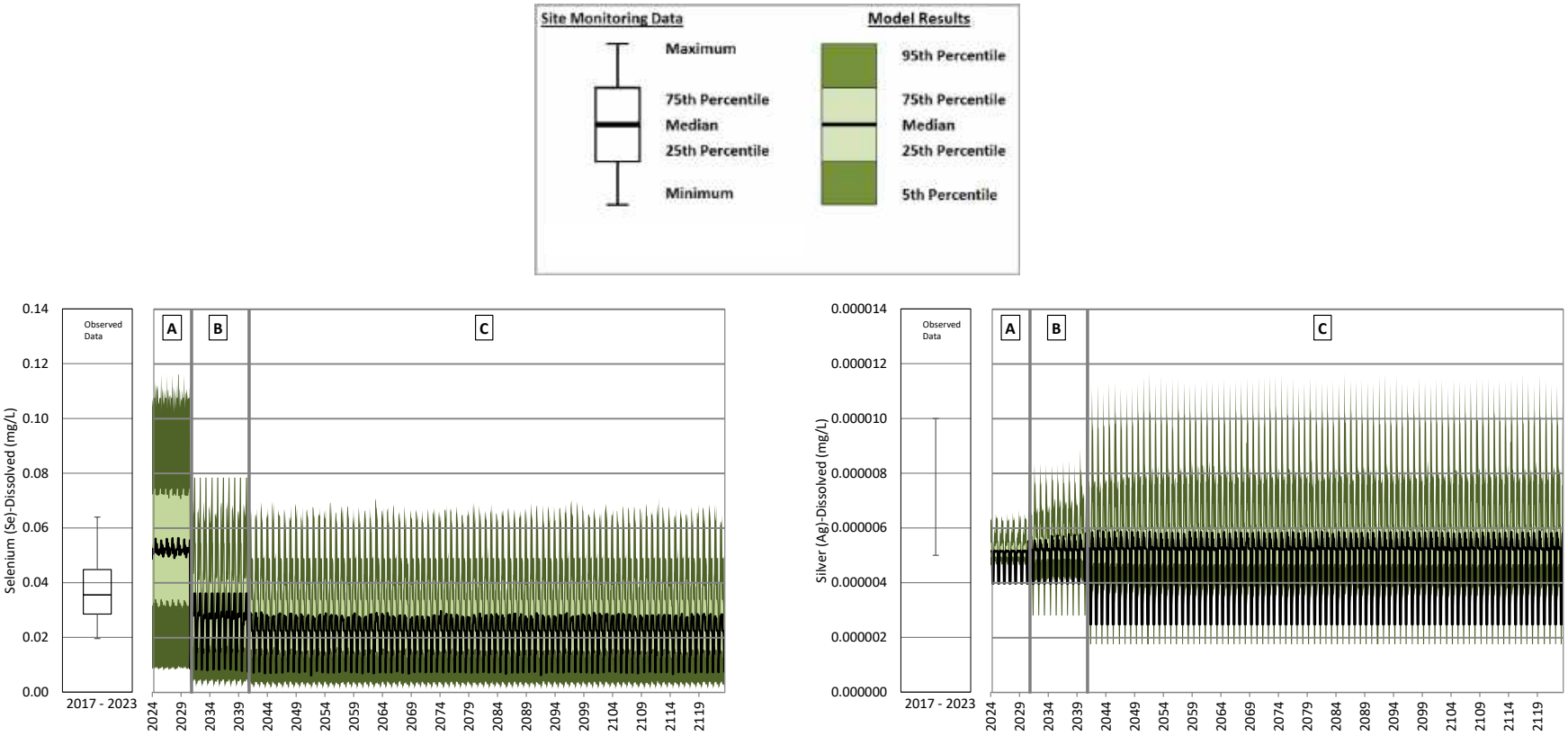
Figure B **154: 9K Sump Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

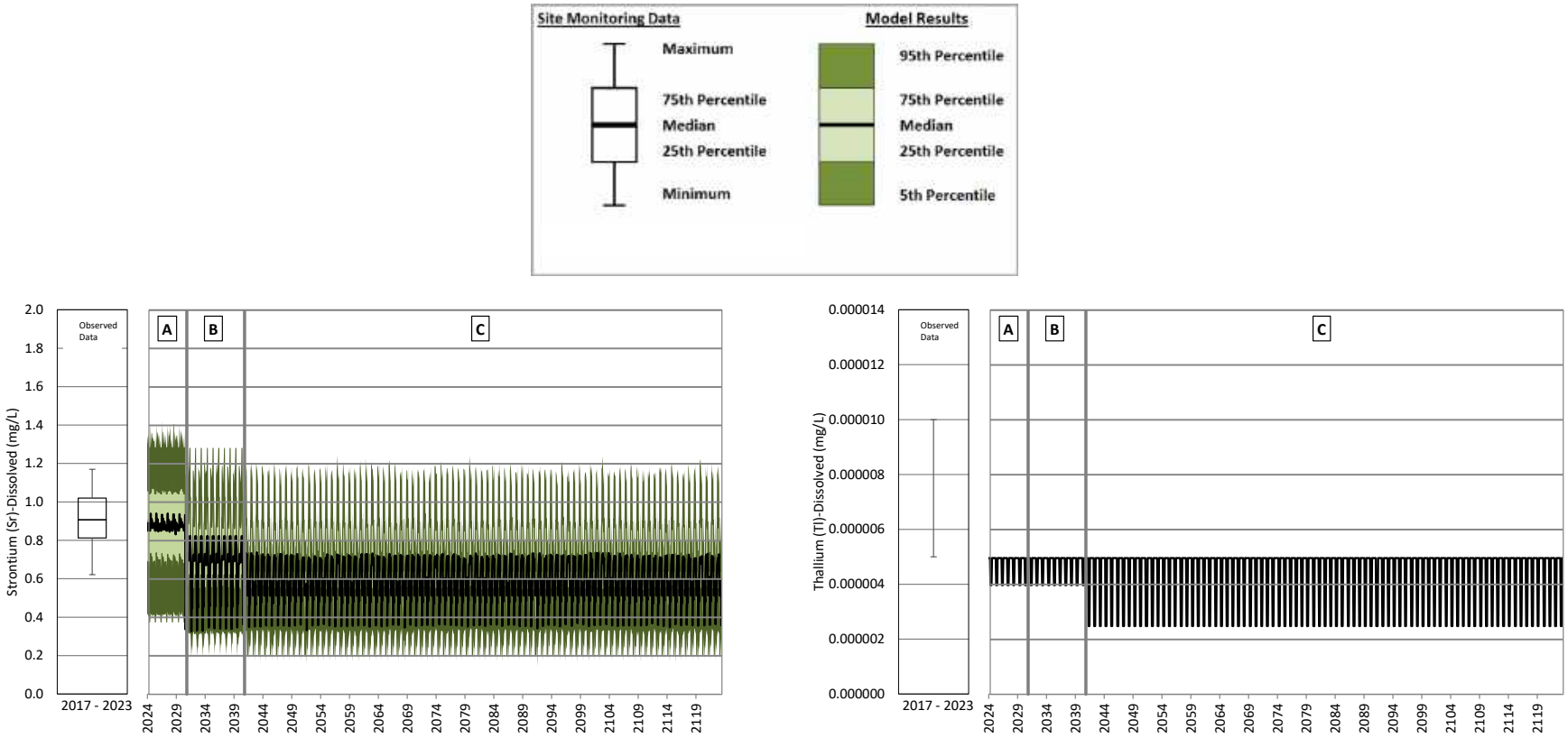
Figure B **155: 9K Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

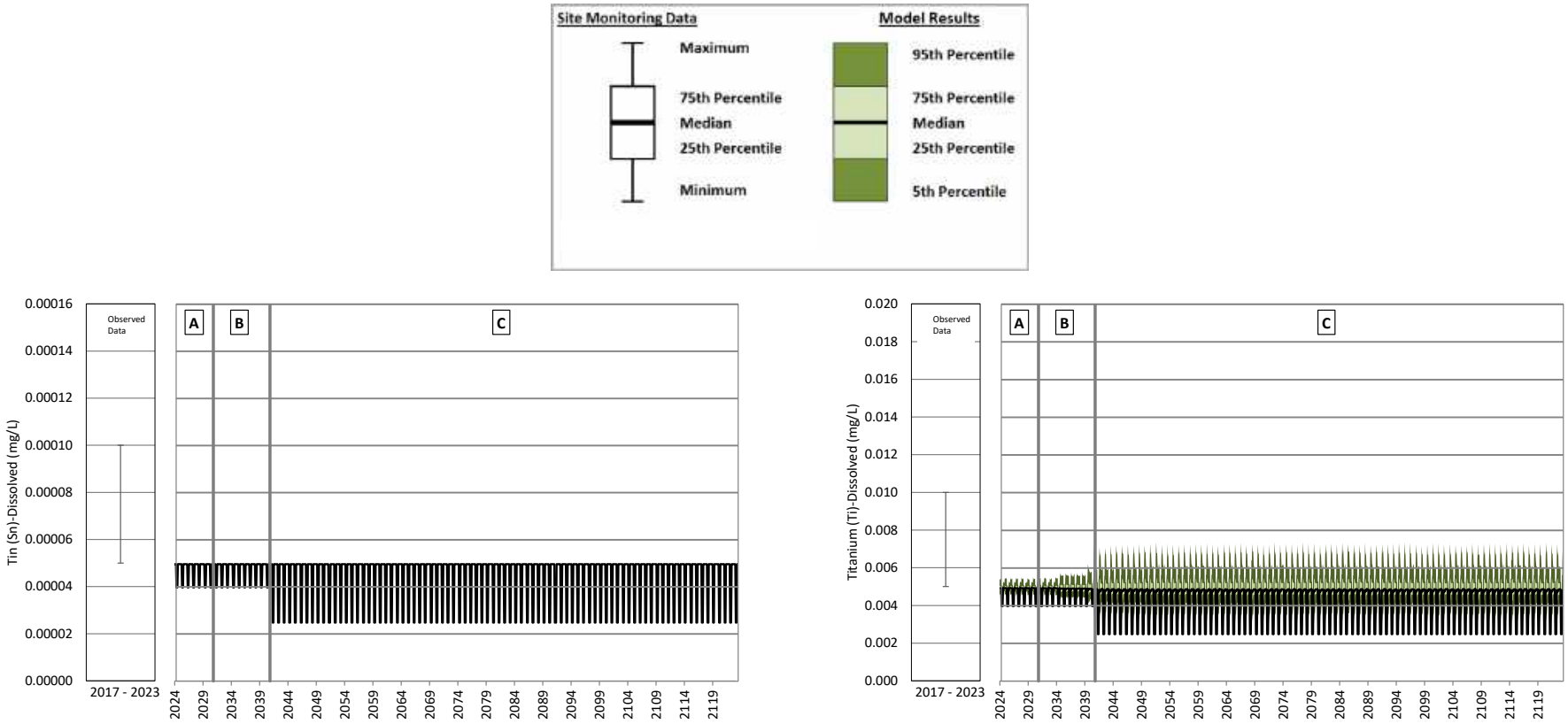
Figure B **156: 9K Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

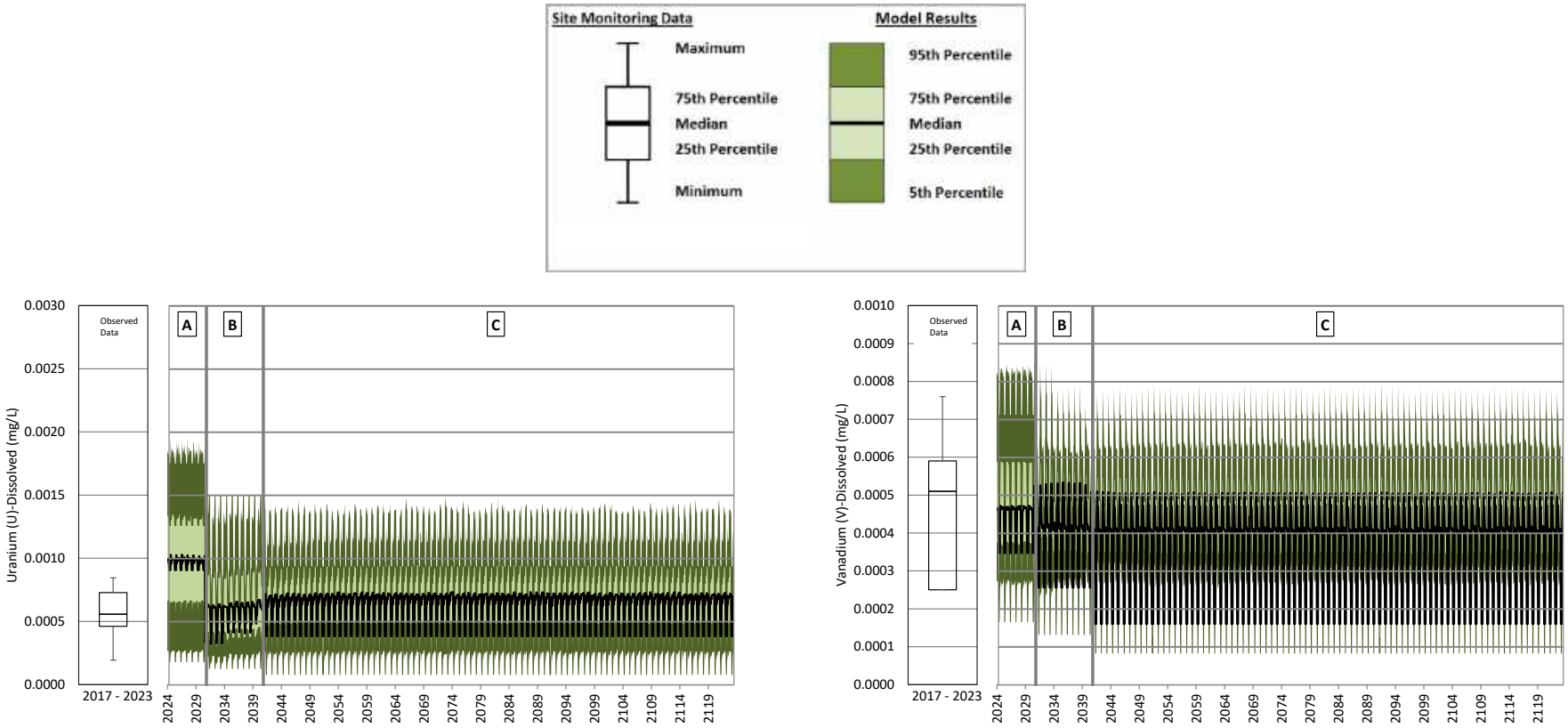
Figure B **157: 9K Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved titanium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the NAG waste rock and disturbed runoff water quality inputs.

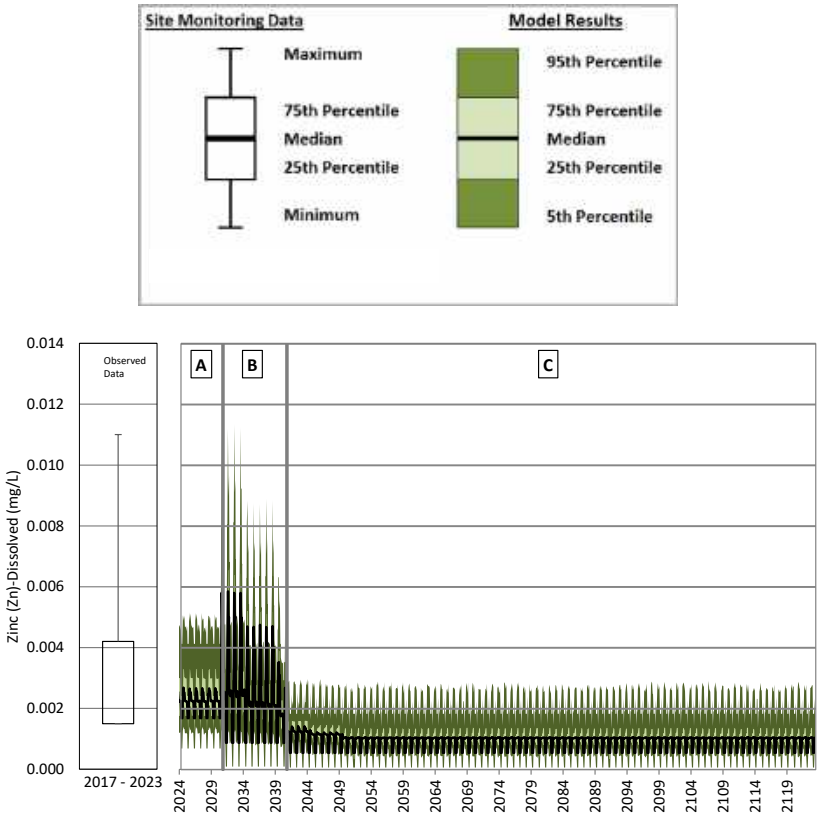
Figure B **158: 9K Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **159: 9K Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

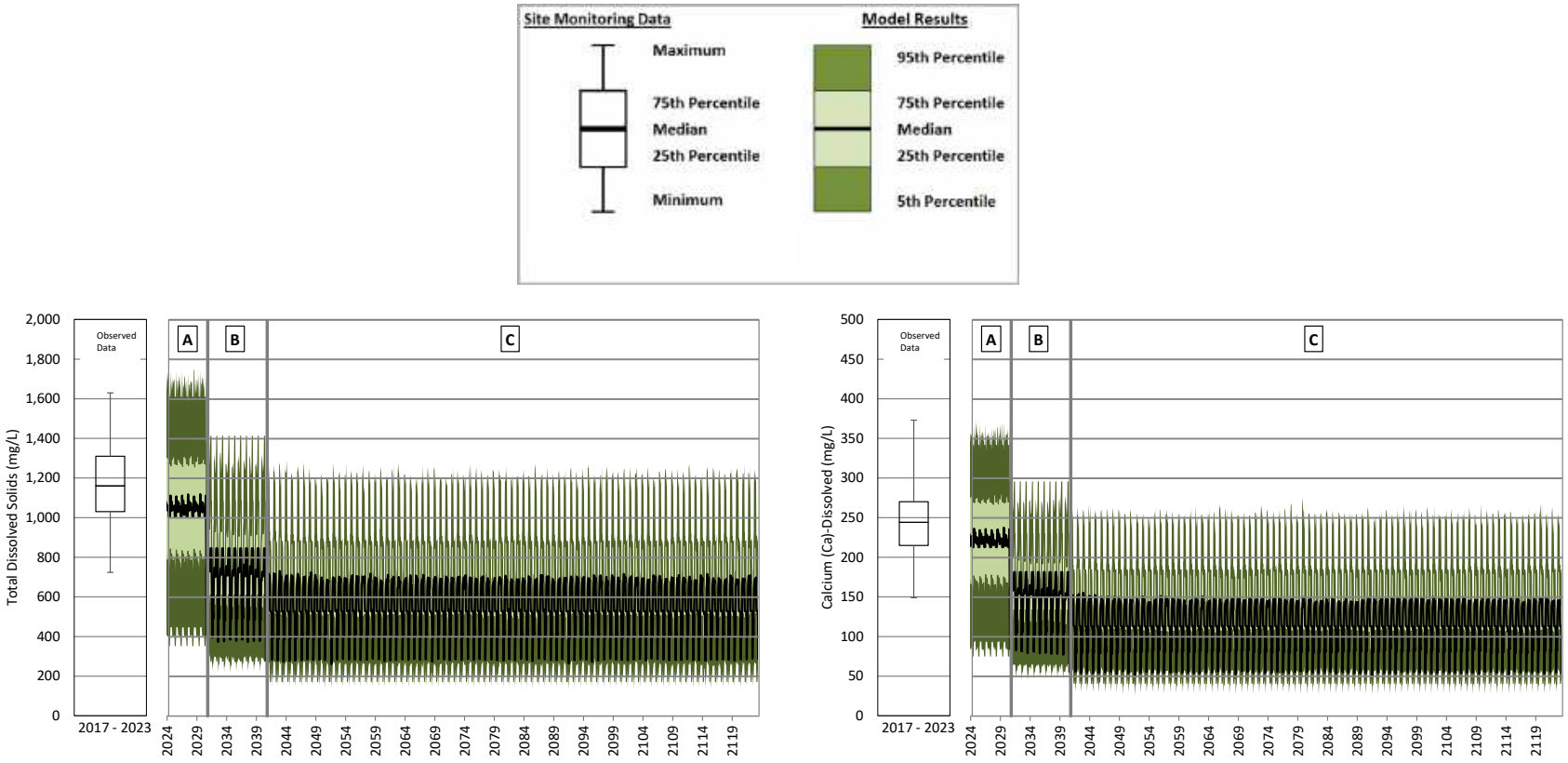


A = Operations; B = Closure; C = Post-closure

Note: Maximum dissolved zinc concentrations increase during closure when seepage from the Temporary NW PAG Stockpile changes from the PAG water quality input to the NAG water quality input. The NAG water quality input has higher dissolved zinc concentrations than the Pag water quality input. Dissolved zinc concentrations decrease from closure and post-closure as runoff areas are remediated.

Figure B **160: 9K Sump Operations, Closure and Post-closure – Dissolved Zinc**

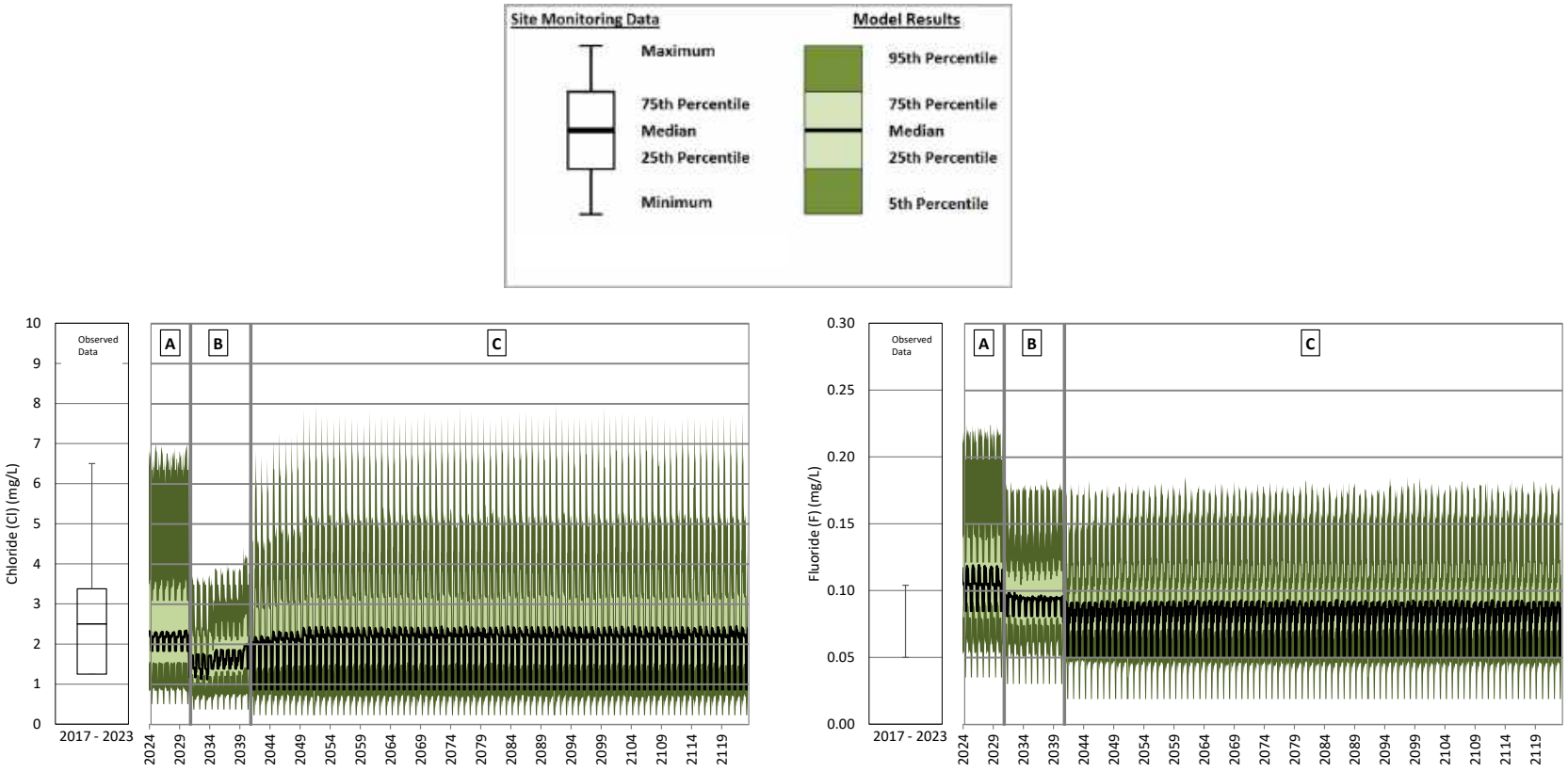
Northwest Sump Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

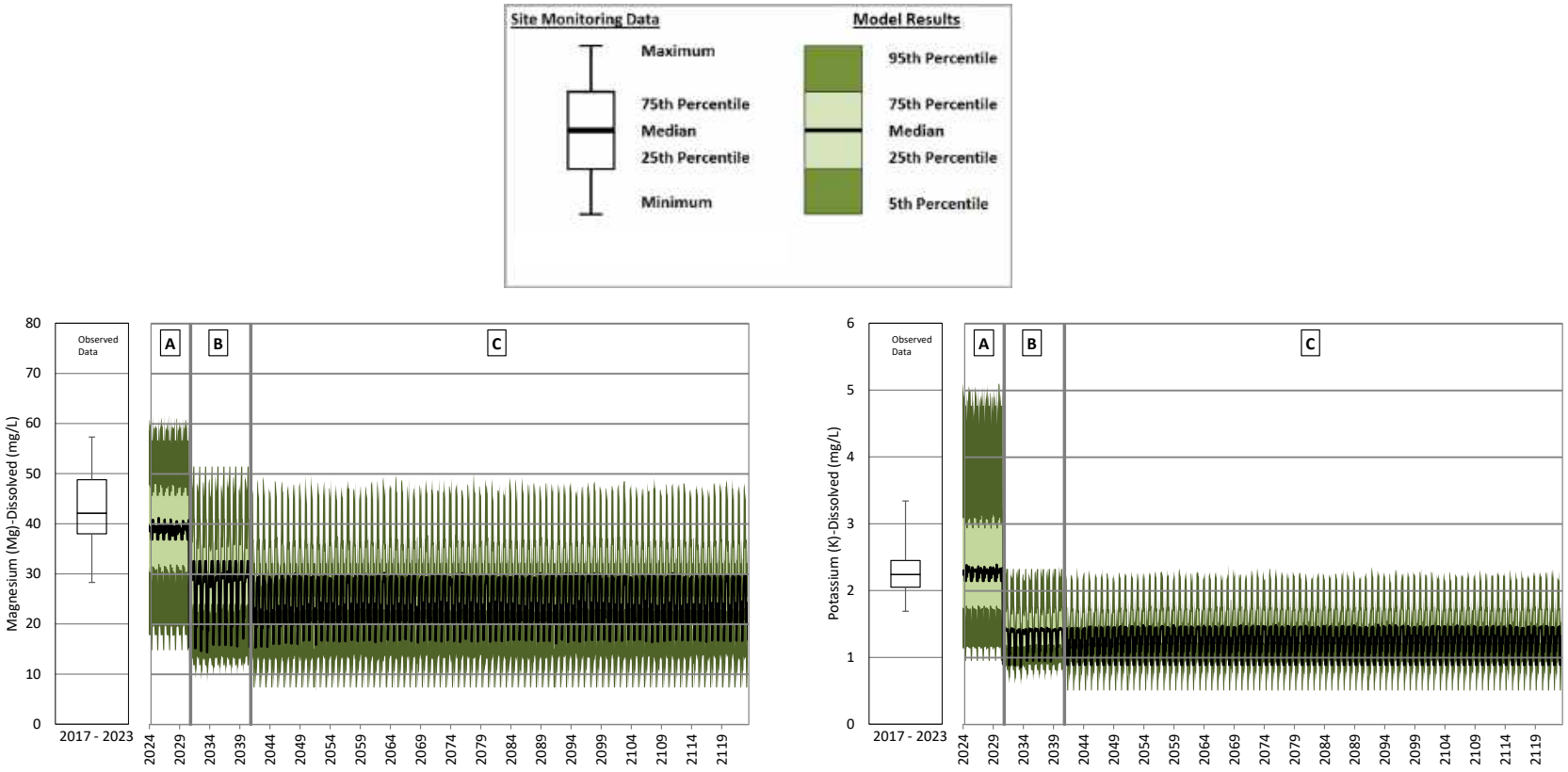
Figure B **161: Northwest Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: Chloride concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for chloride than the disturbed runoff water quality input. Fluoride concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

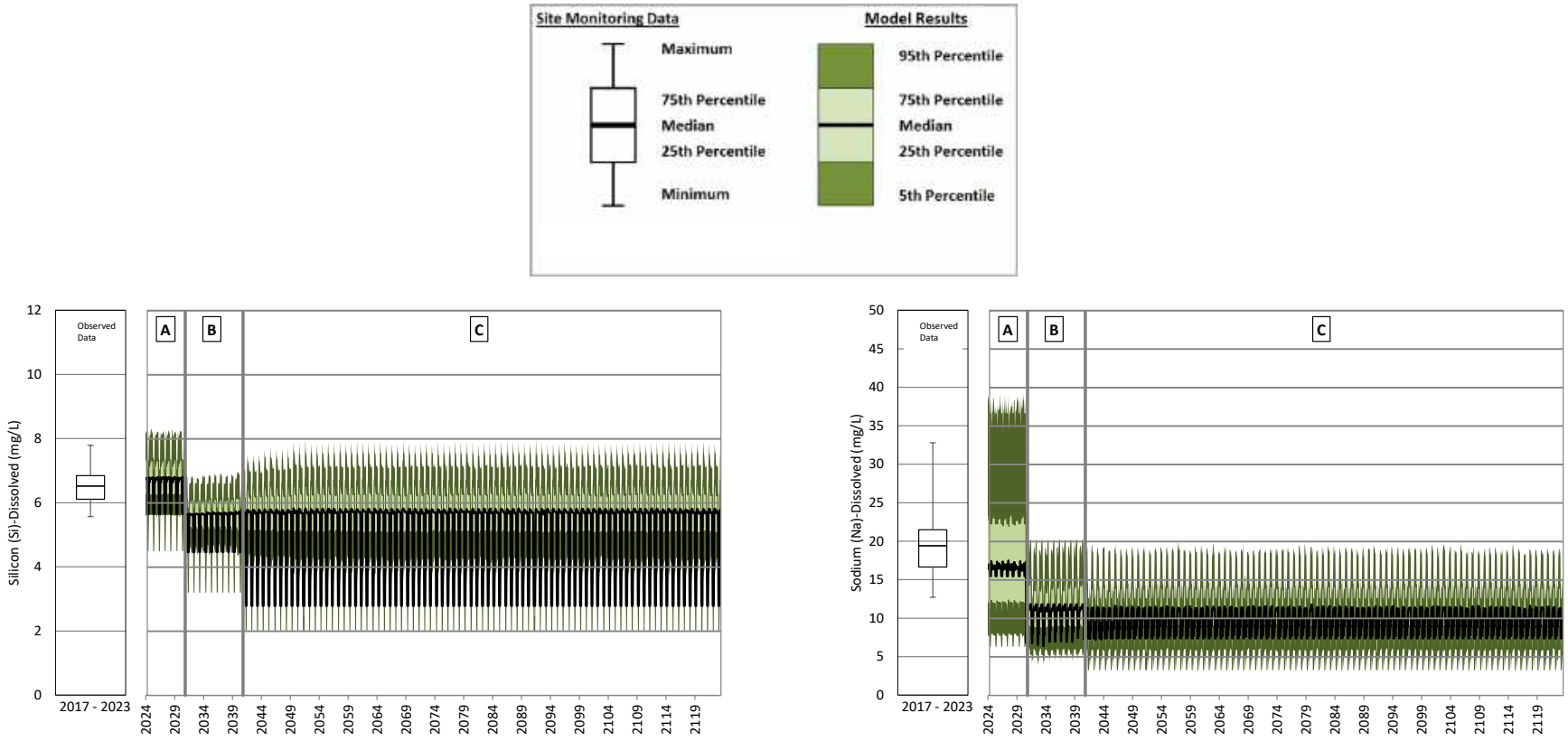
Figure B **162: Northwest Sump Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

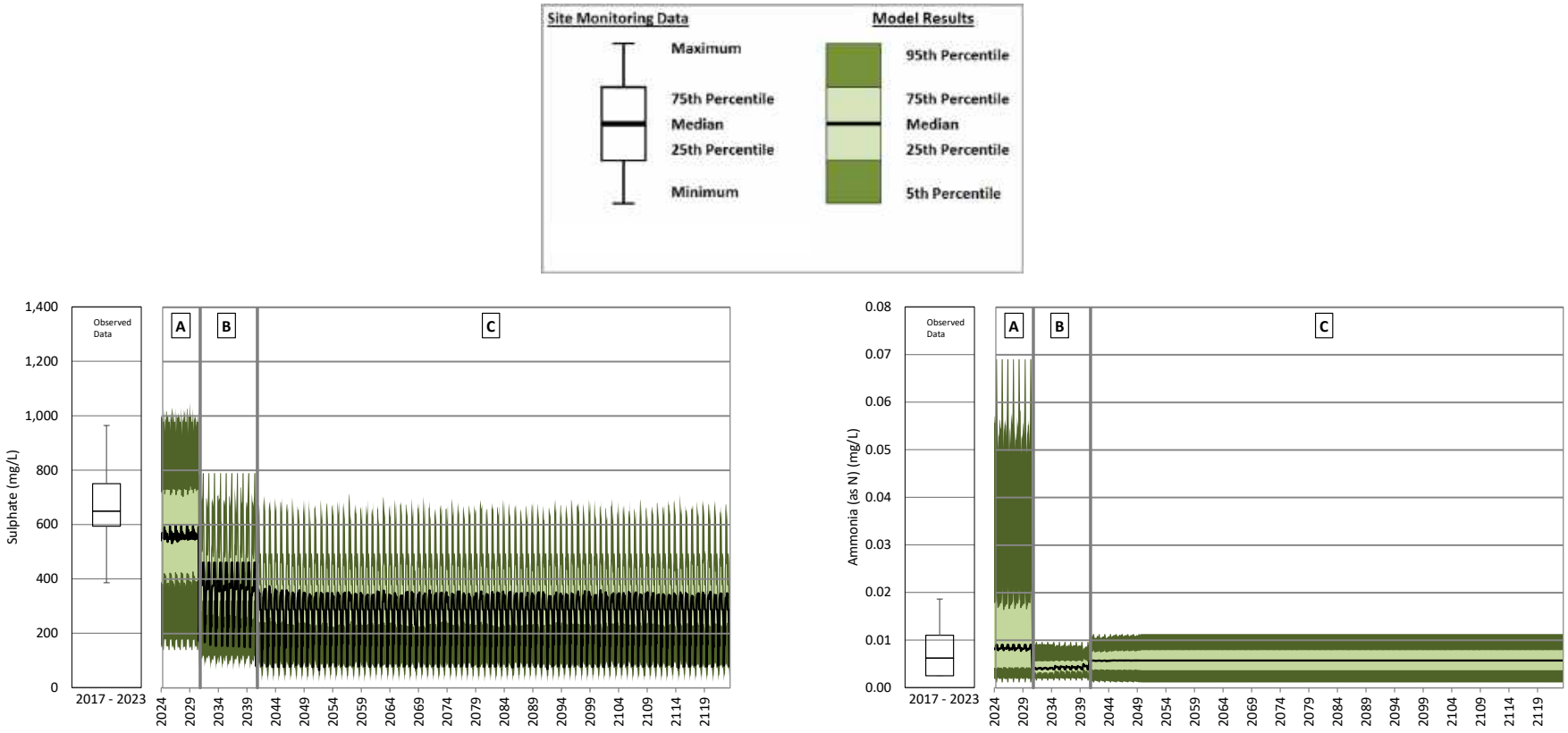
Figure B **163: Northwest Sump Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: Silicon concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for silicon than the disturbed runoff water quality input. Sodium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

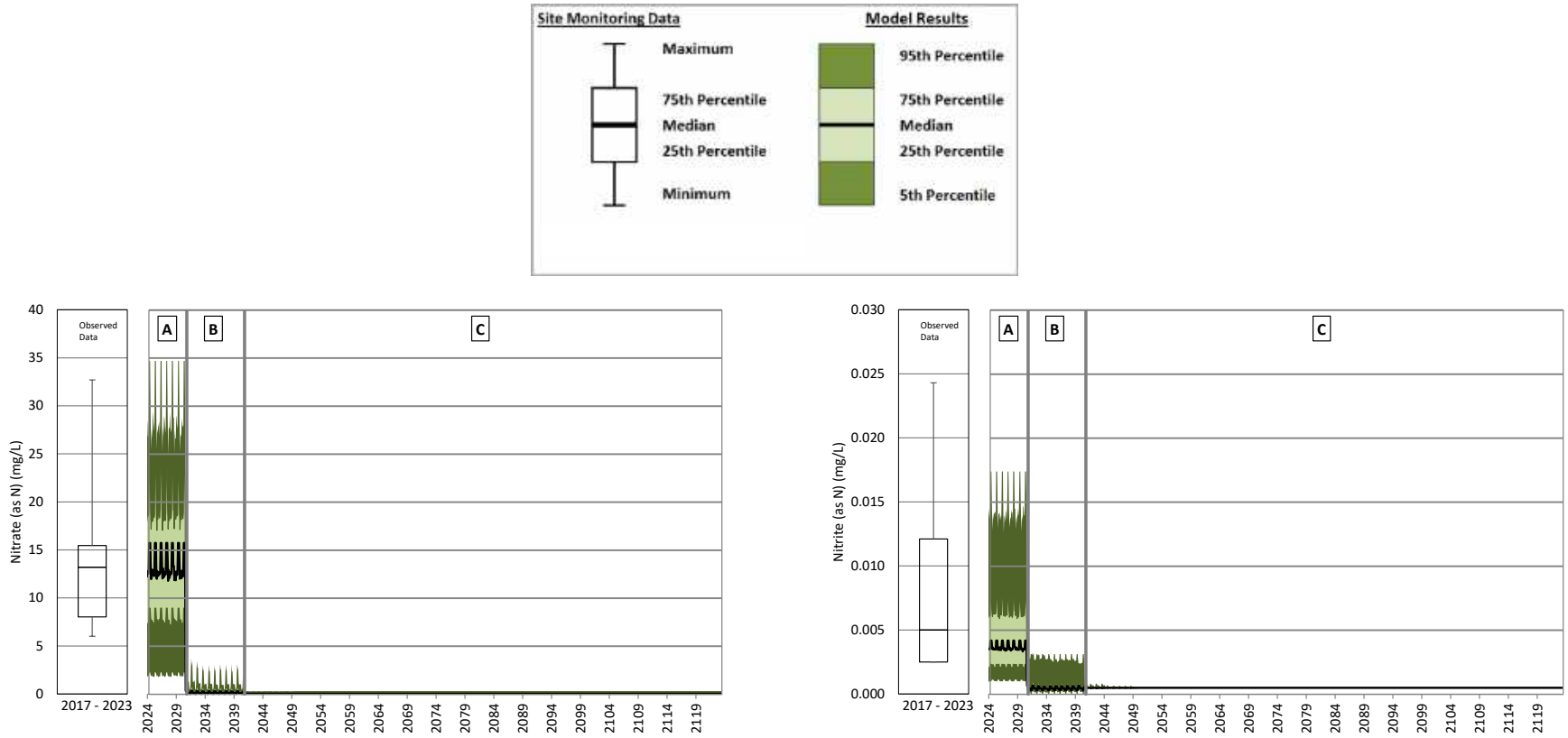
Figure B **164: Northwest Sump Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: Sulphate concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Total ammonia concentrations increase from closure to post-closure as disturbed runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total ammonia than the disturbed runoff water quality input.

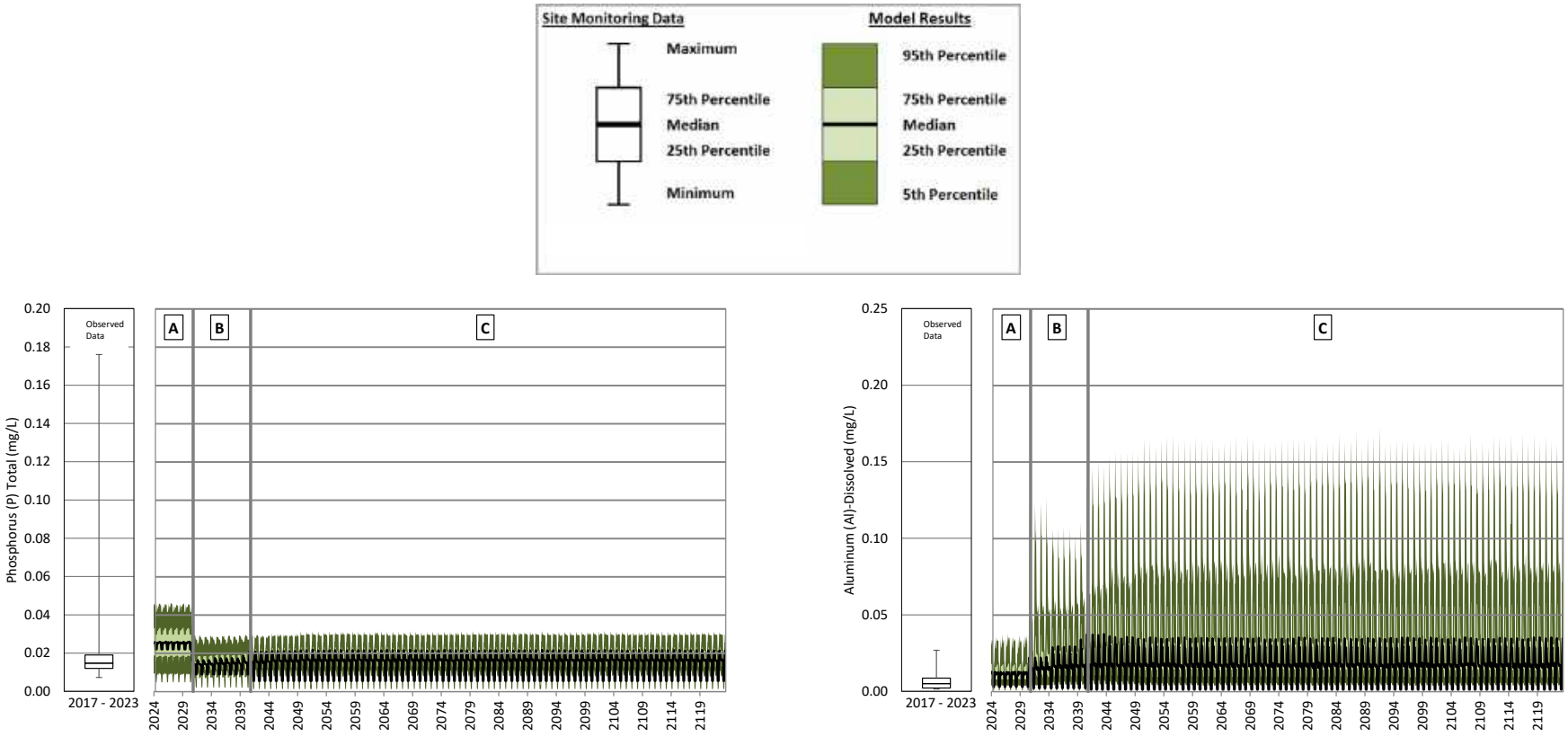
Figure B **165: Northwest Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

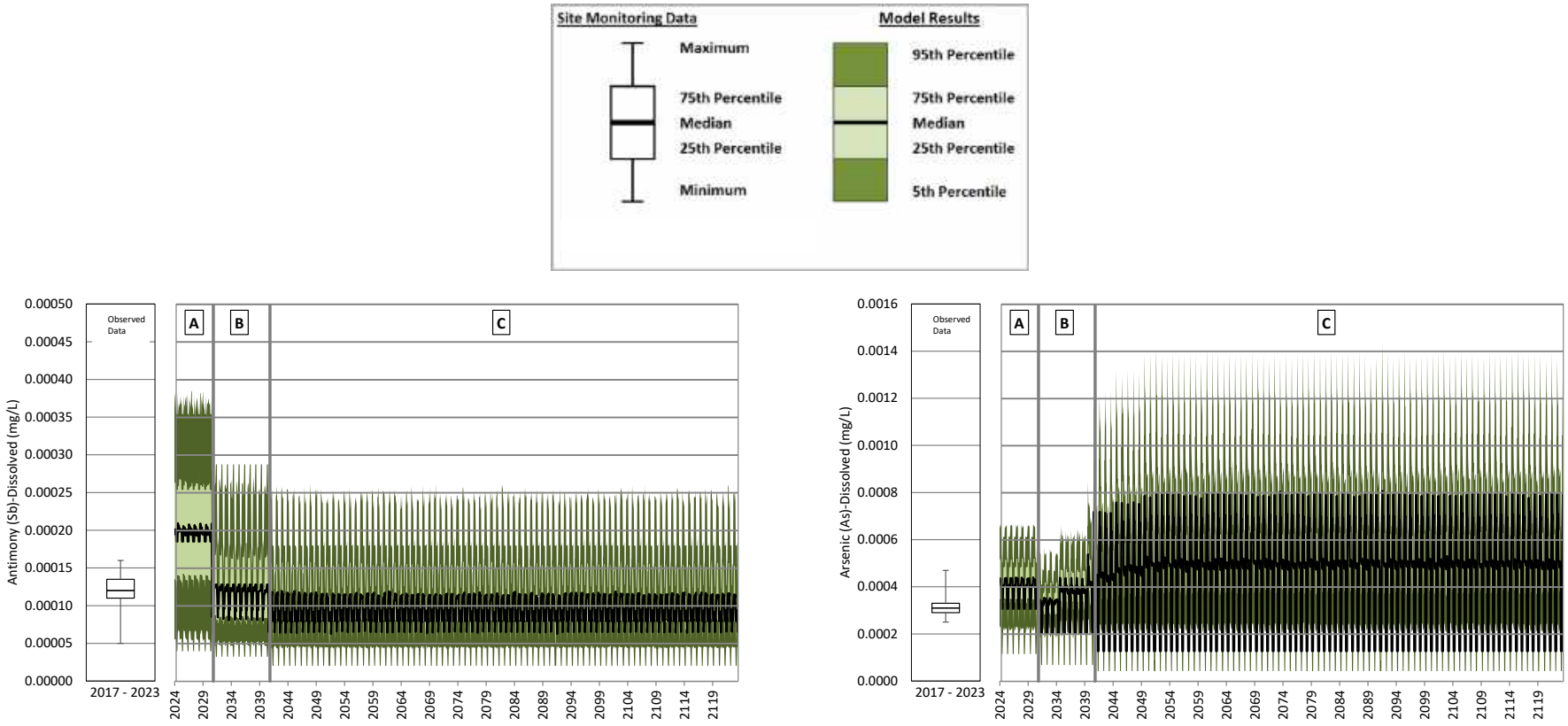
Figure B **166: Northwest Sump Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: Total phosphorus and dissolved aluminum concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the NAG waste rock and disturbed runoff water quality inputs.

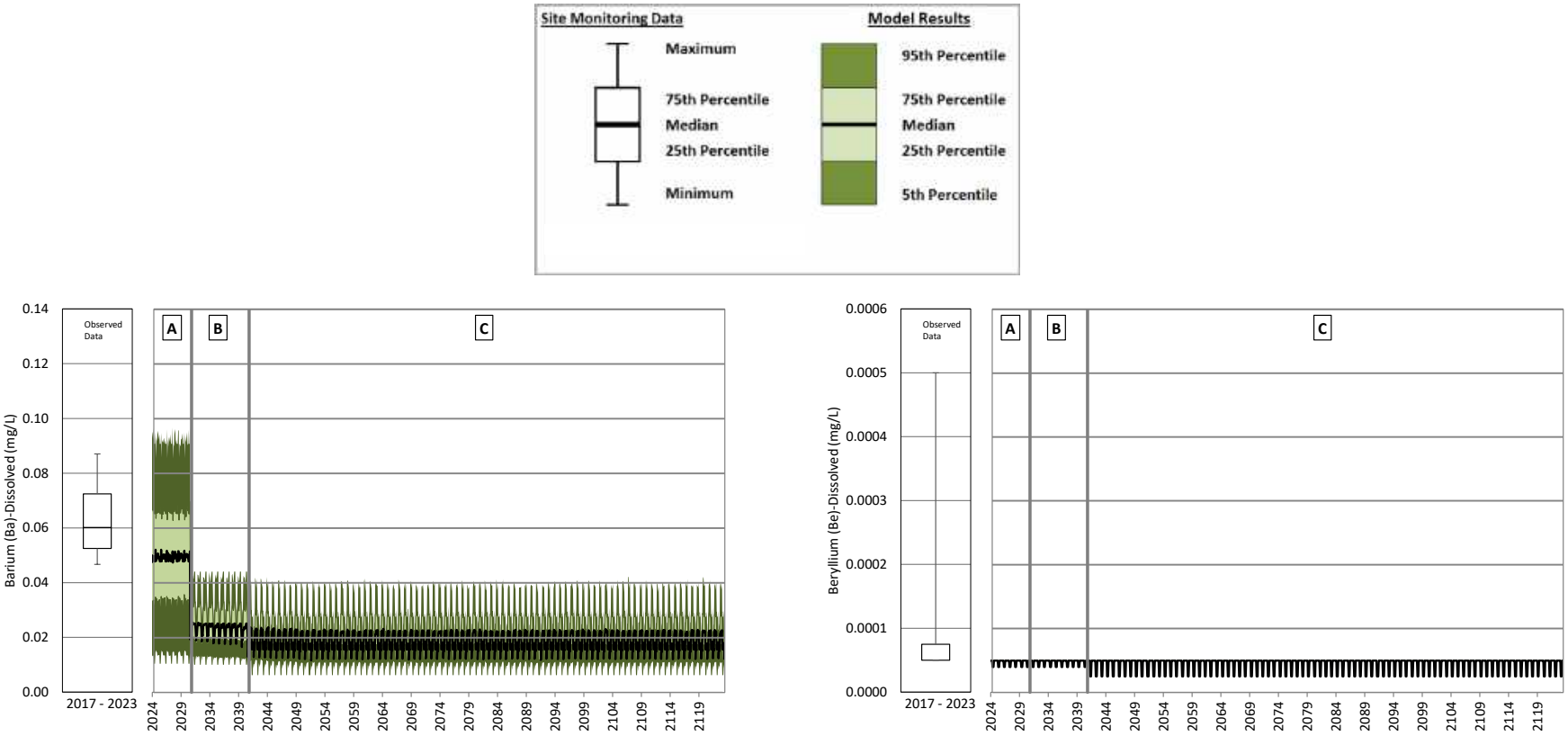
Figure B **167: Northwest Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved antimony concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved arsenic concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved arsenic than the NAG waste rock and disturbed runoff water quality inputs.

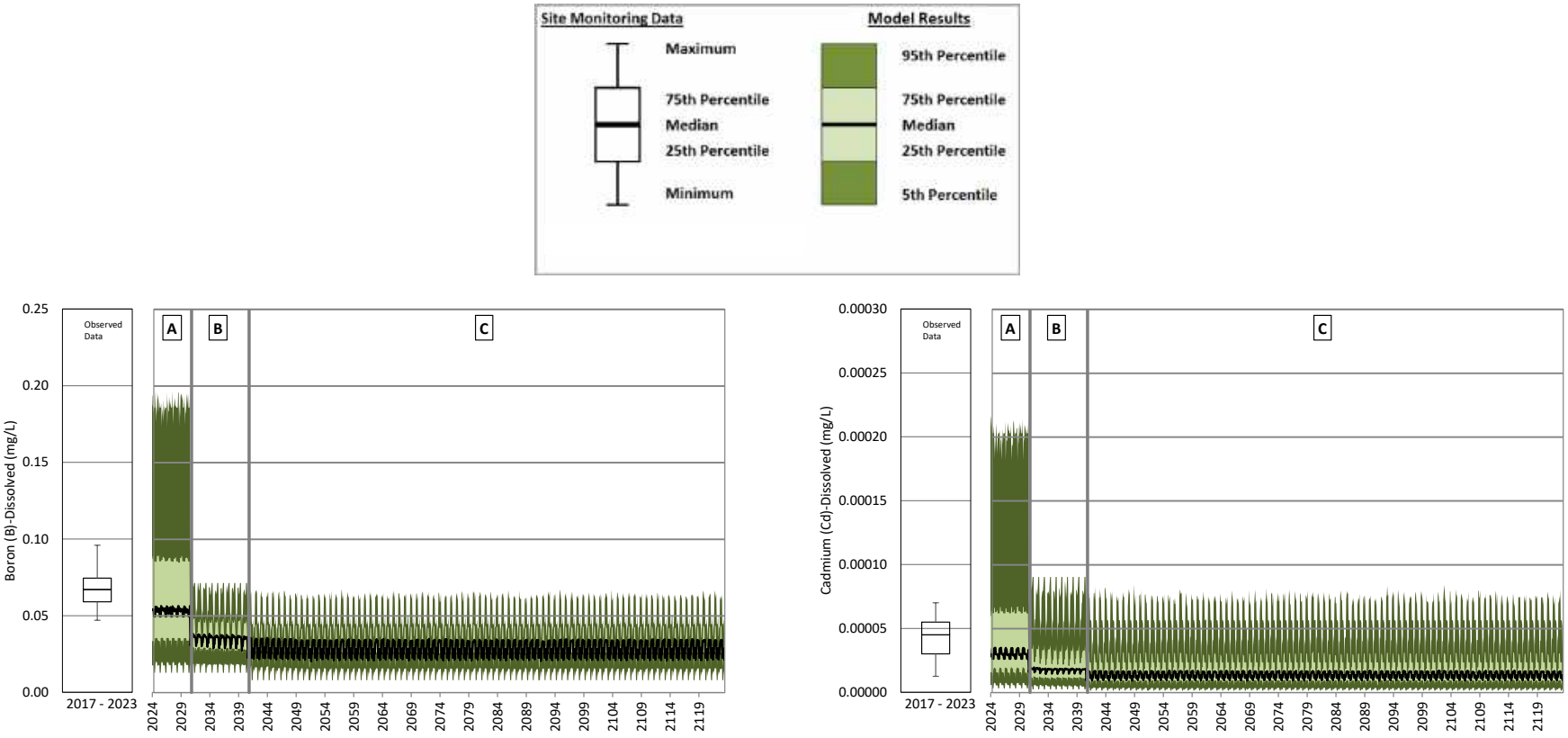
Figure B **168: Northwest Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

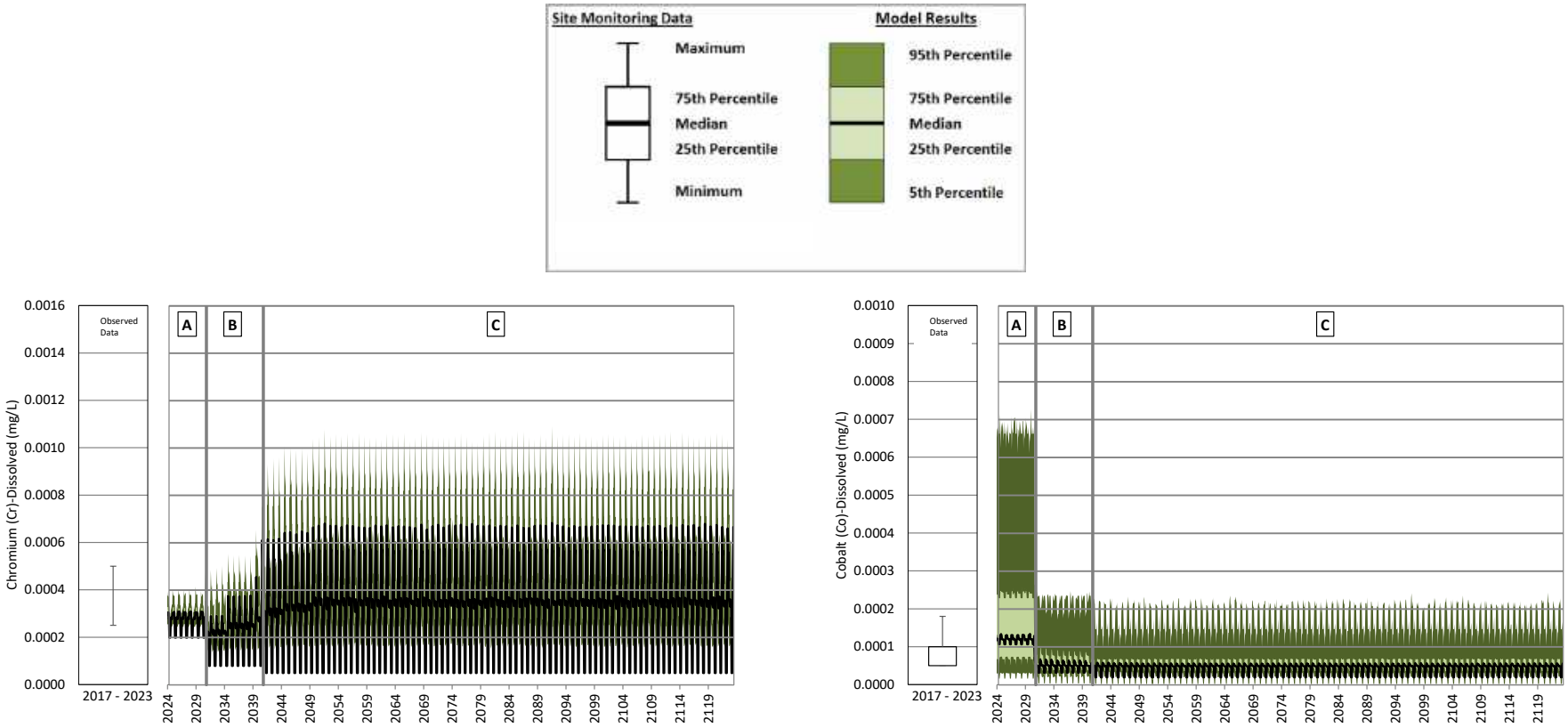
Figure B **169: Northwest Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

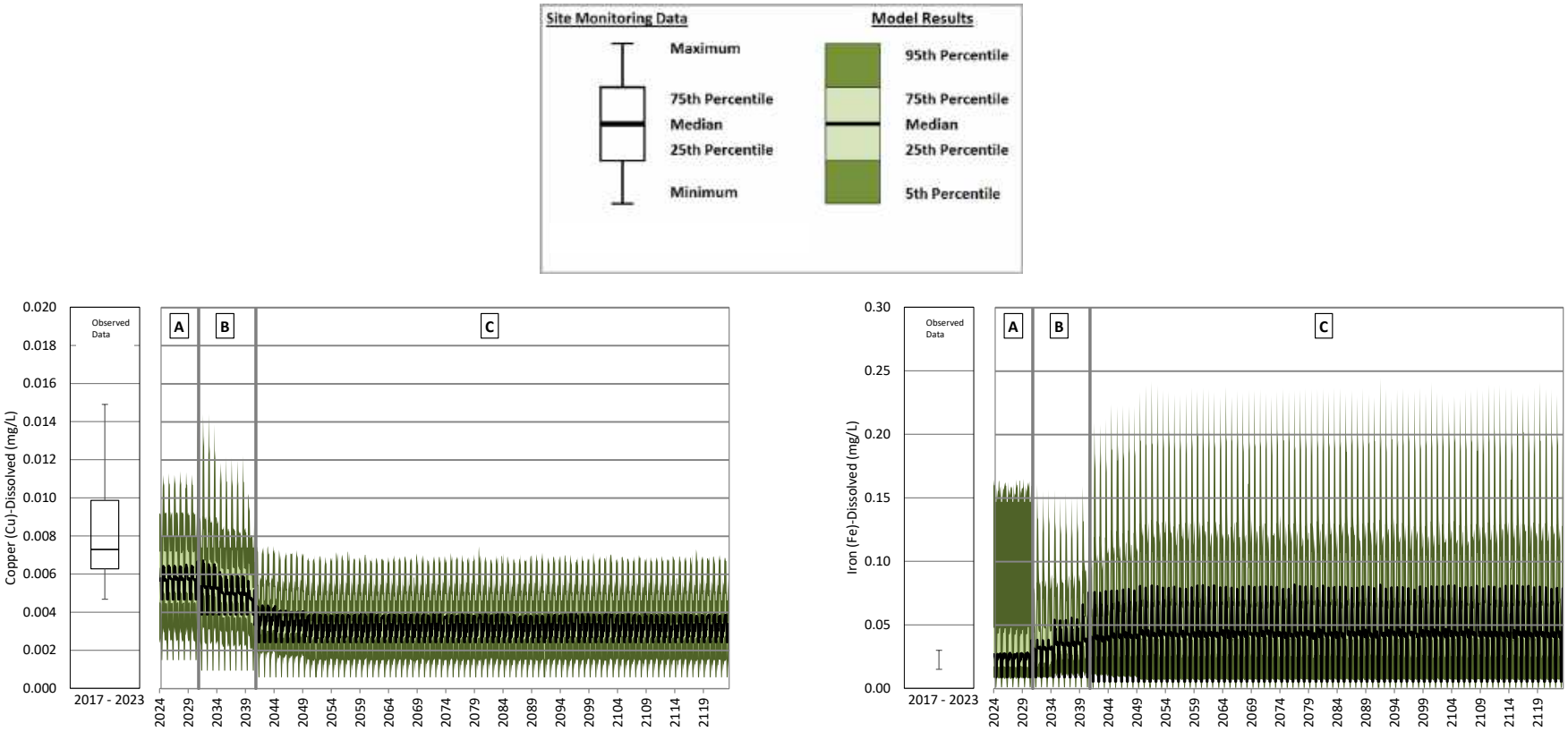
Figure B **170: Northwest Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved chromium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the NAG waste rock and disturbed runoff water quality inputs. Dissolved cobalt concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

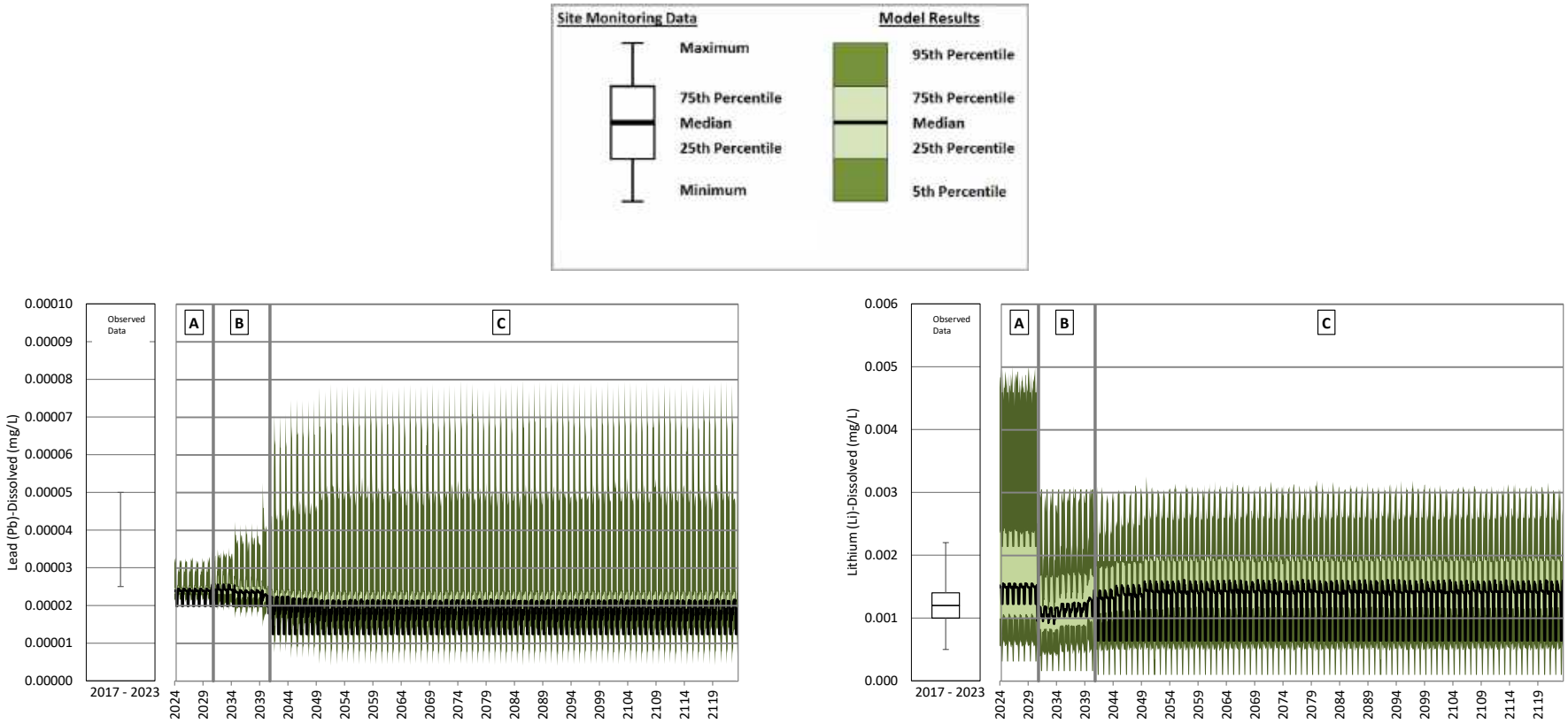
Figure B **171: Northwest Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved copper concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved iron concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed water quality input has higher concentrations for dissolved iron than the NAG waste rock and disturbed runoff water quality inputs.

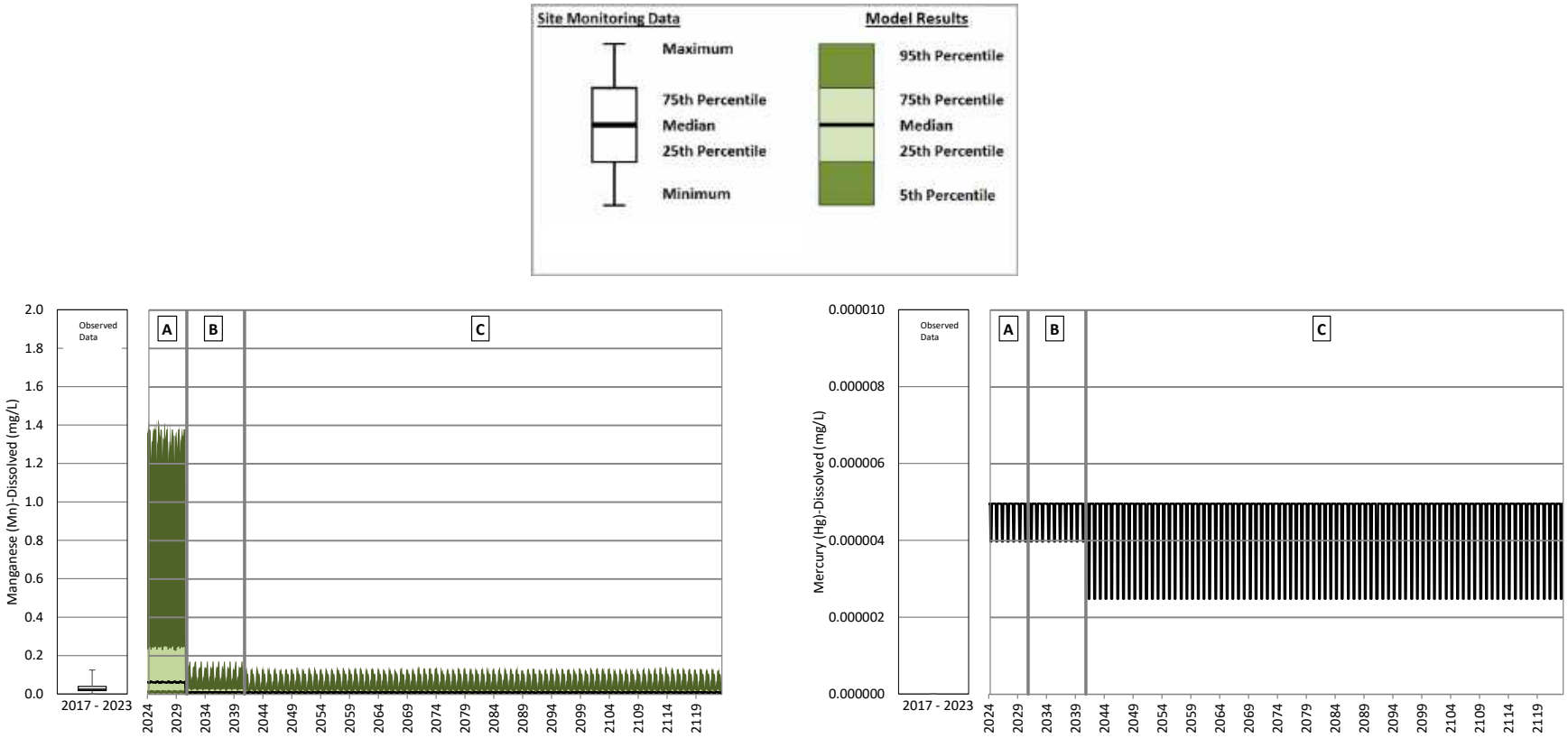
Figure B **172: Northwest Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved lead concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the NAG waste rock and disturbed runoff water quality inputs. Dissolved lithium concentrations decrease from operations to closure and post-closure as runoff areas are remediated.

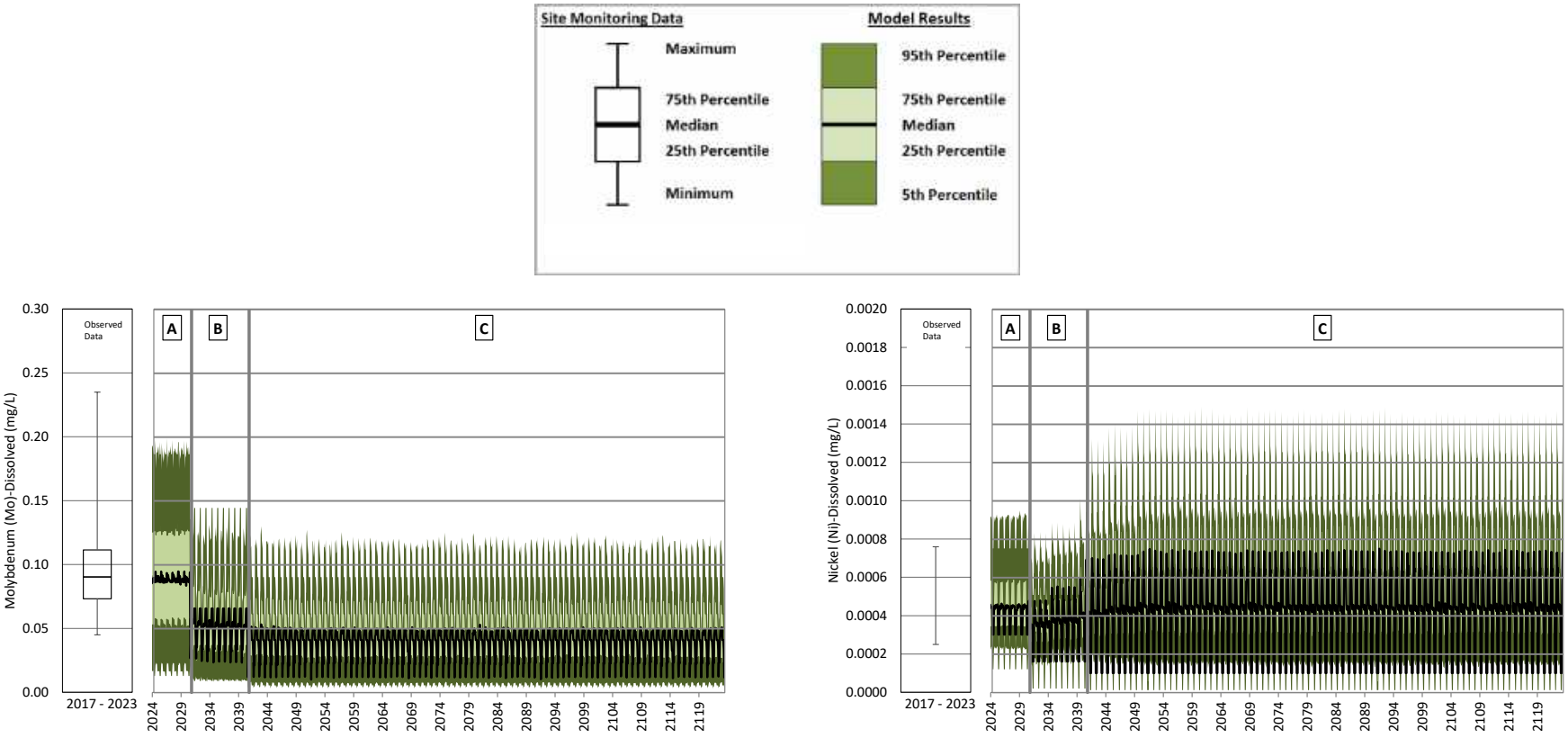
Figure B **173: Northwest Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

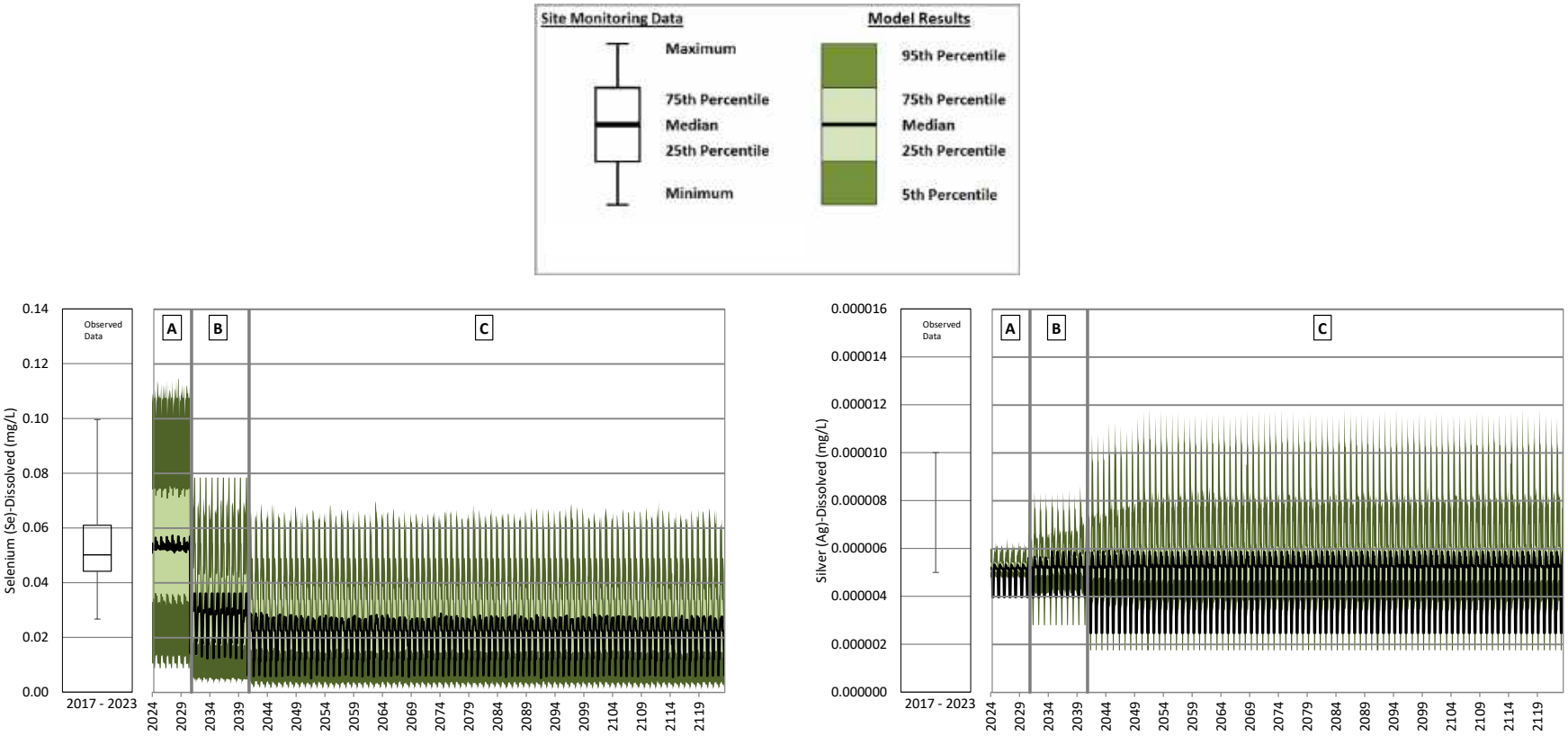
Figure B **174: Northwest Sump Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved molybdenum concentrations decrease from closure to post-closure as runoff areas are remediated. Dissolved nickel concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the NAG waste rock and disturbed runoff water quality inputs.

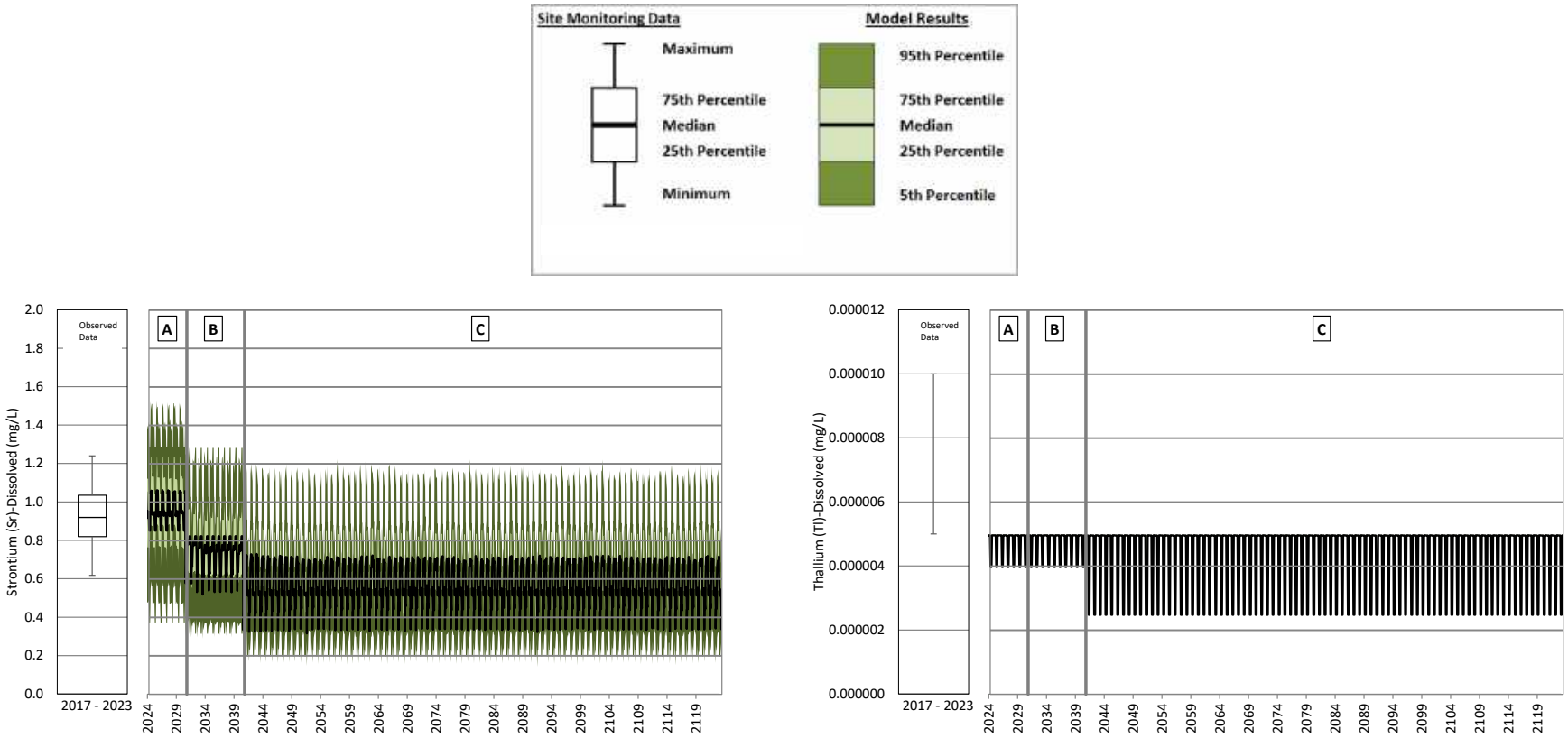
Figure B **175: Northwest Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved selenium concentrations decrease from operations to closure and post-closure as runoff areas are remediated. Dissolved silver concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the NAG waste rock and disturbed runoff water quality inputs.

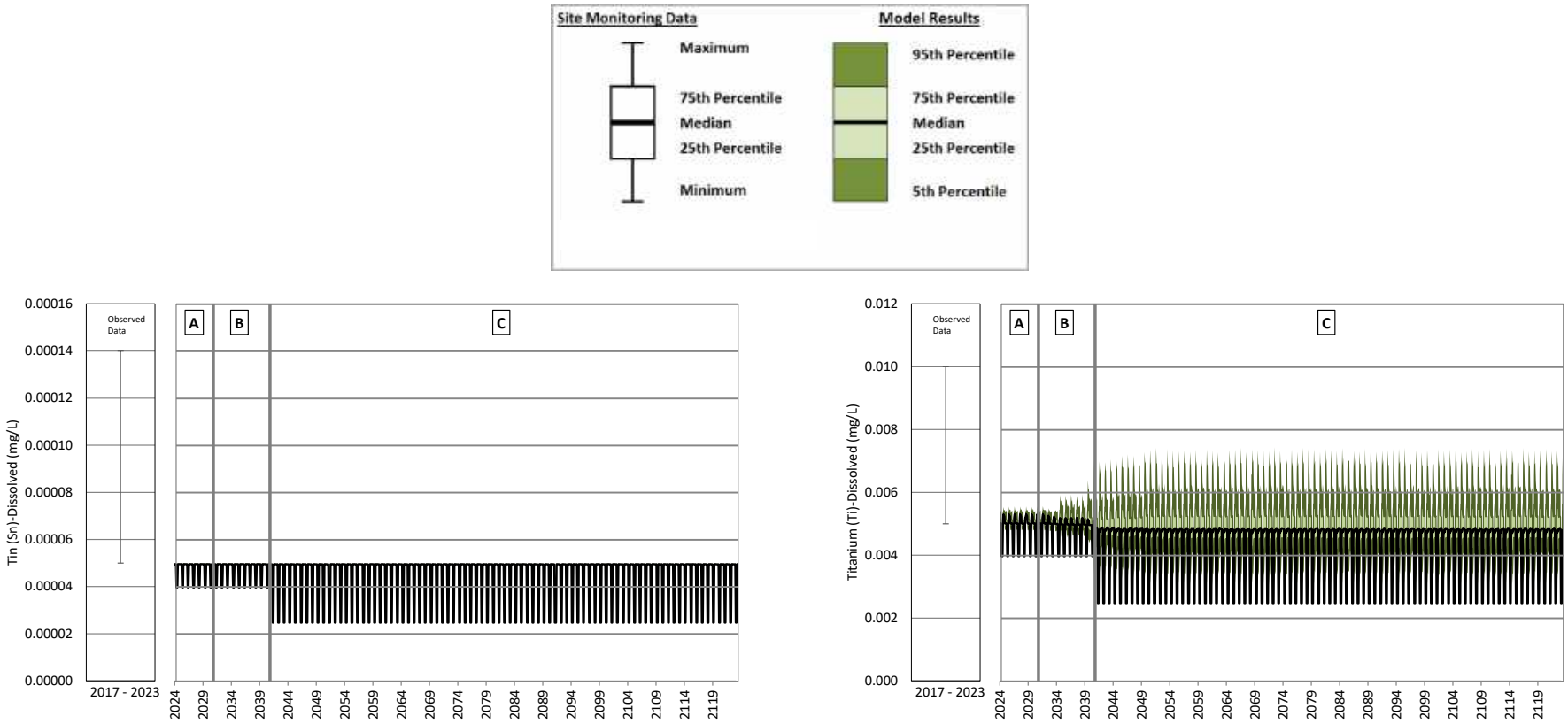
Figure B **176: Northwest Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

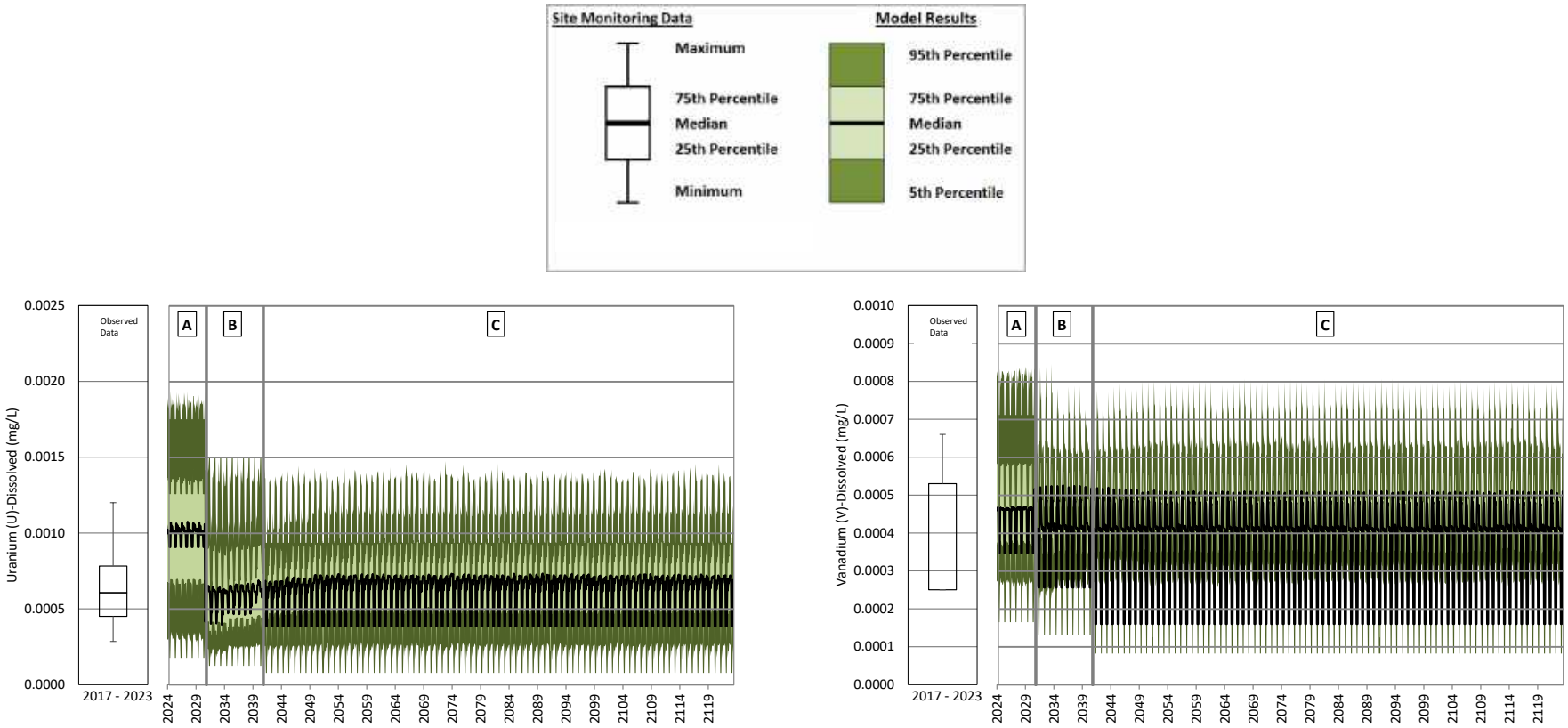
Figure B **177: Northwest Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: Dissolved titanium concentrations increase from operations to closure and post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the NAG waste rock and disturbed runoff water quality inputs.

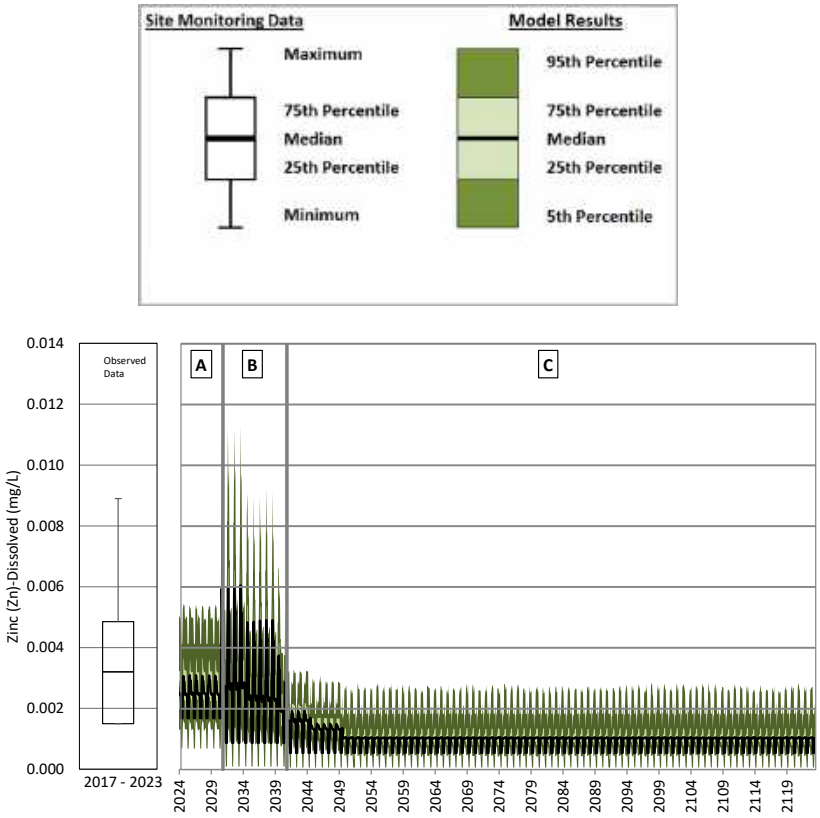
Figure B **178: Northwest Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **179: Northwest Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

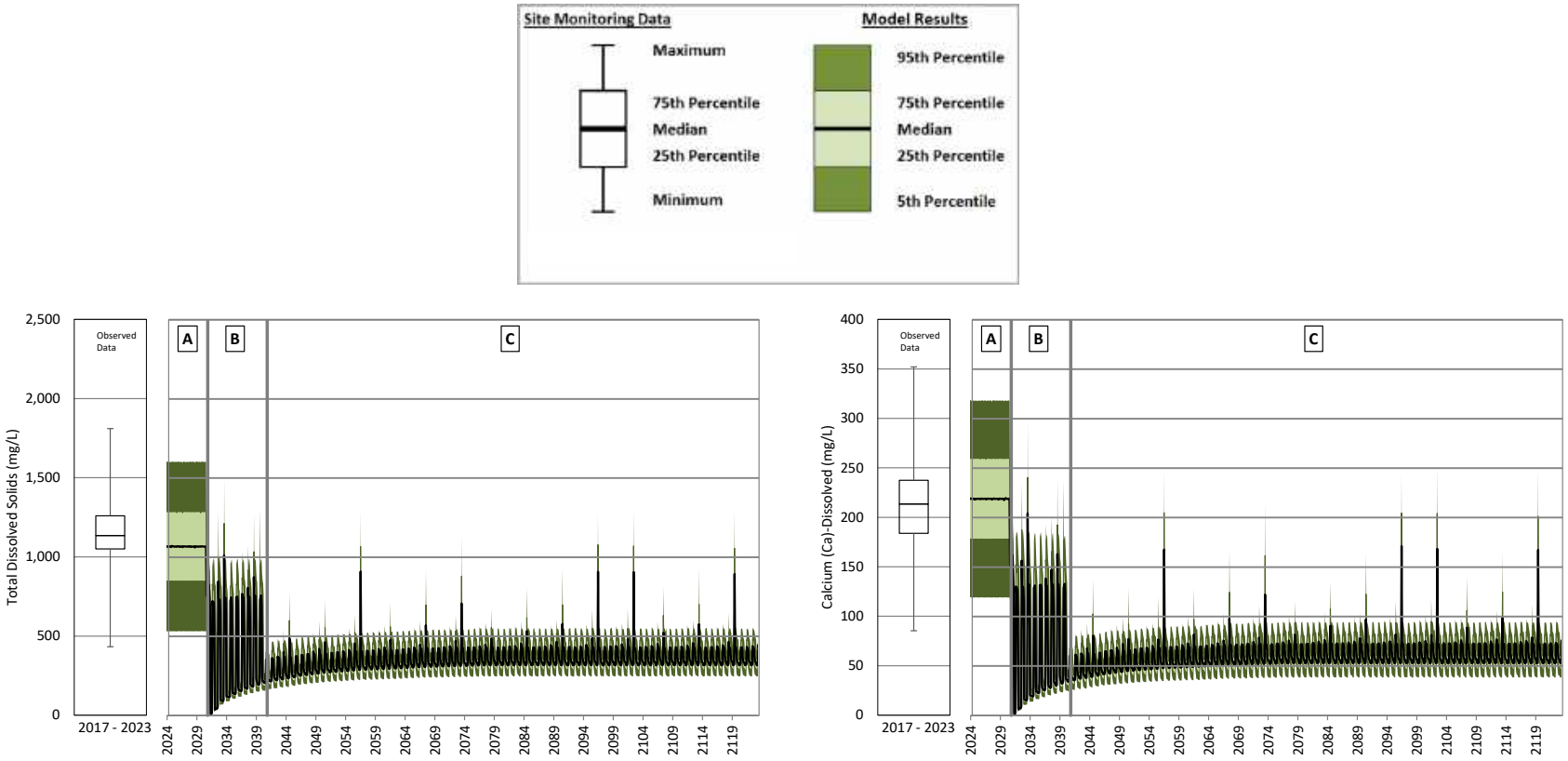


A = Operations; B = Closure; C = Post-closure

Note: Maximum dissolved zinc concentrations increase during closure when seepage from the Temporary NW PAG Stockpile changes from the PAG water quality input to the NAG water quality input. The NAG water quality input has higher dissolved sicn concentrations than the Pag water quality input. Dissolved zinc concentrations decrease from closure and post-closure as runoff areas are remediated.

Figure B **180: Northwest Sump Operations, Closure and Post-closure – Dissolved Zinc**

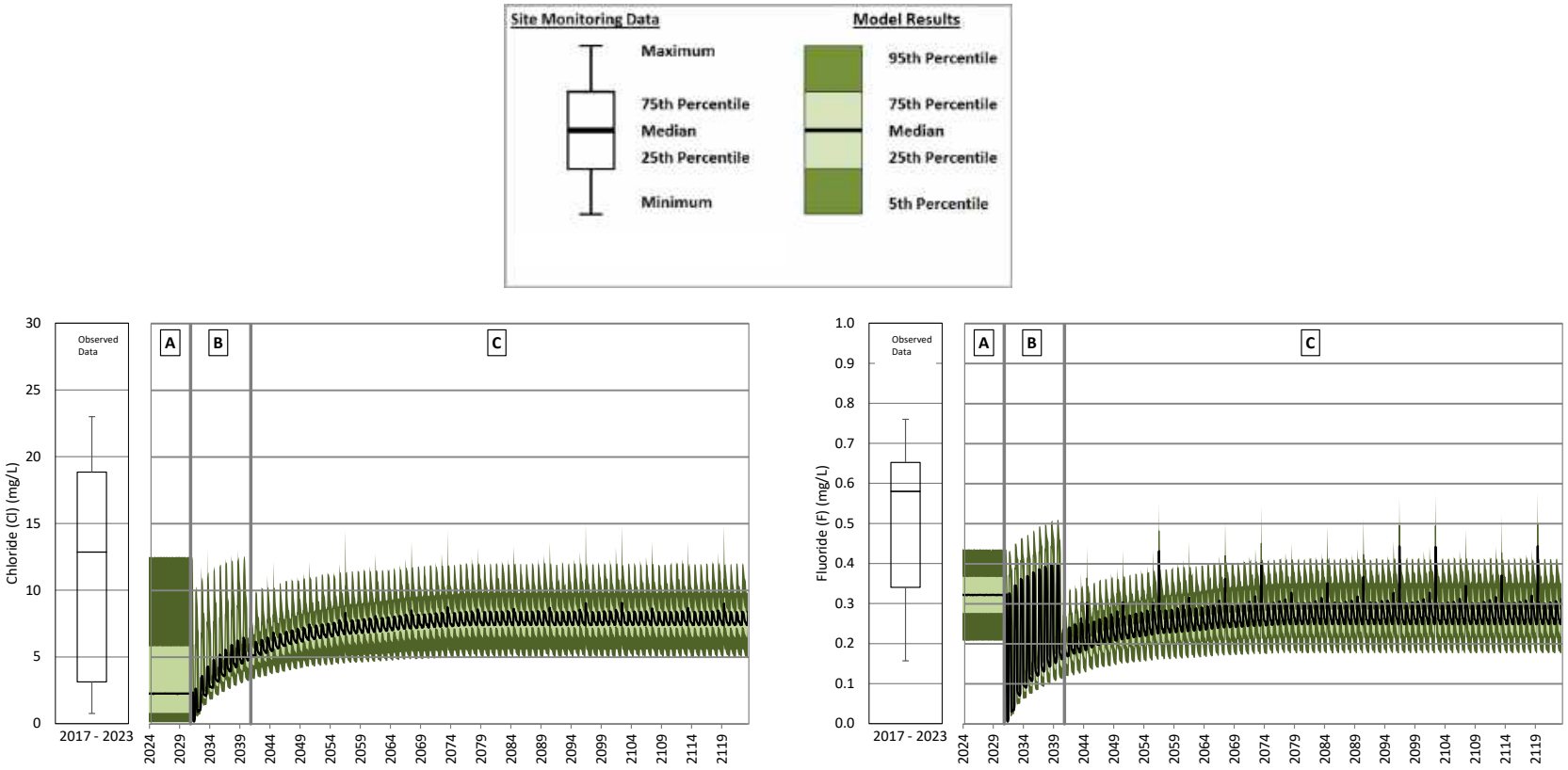
South Embankment Seepage Collection Pond Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

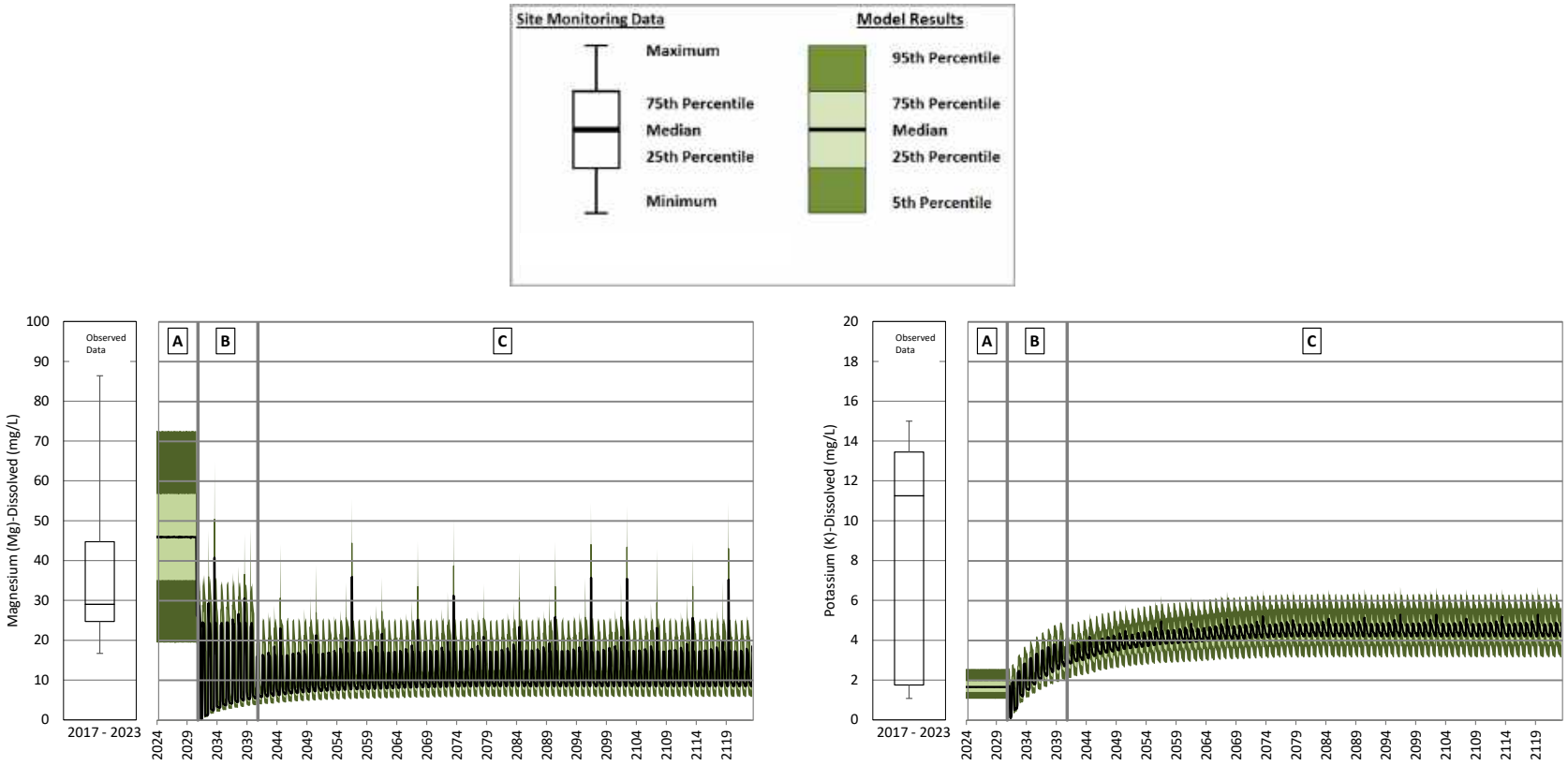
Figure B **181: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

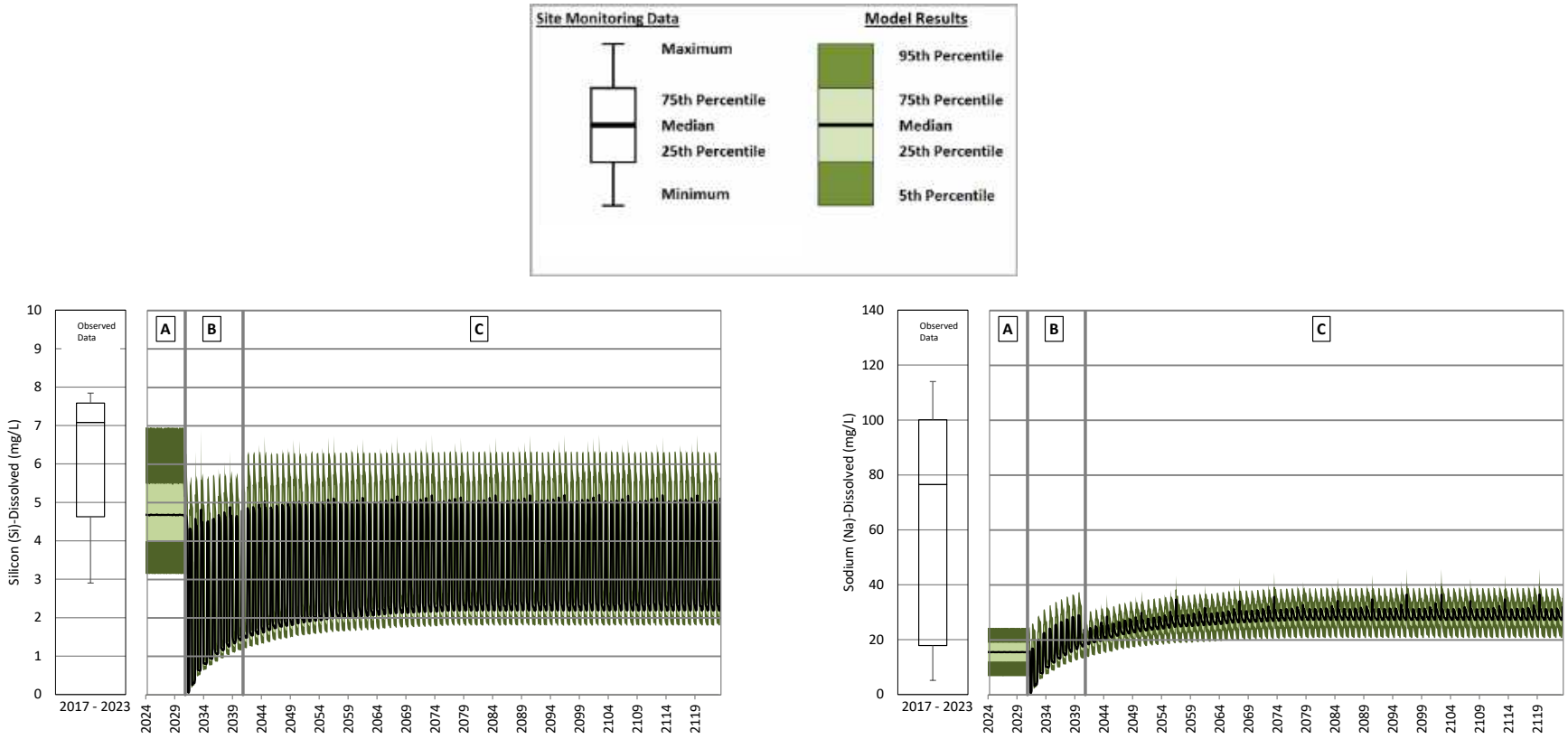
Figure B **182: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

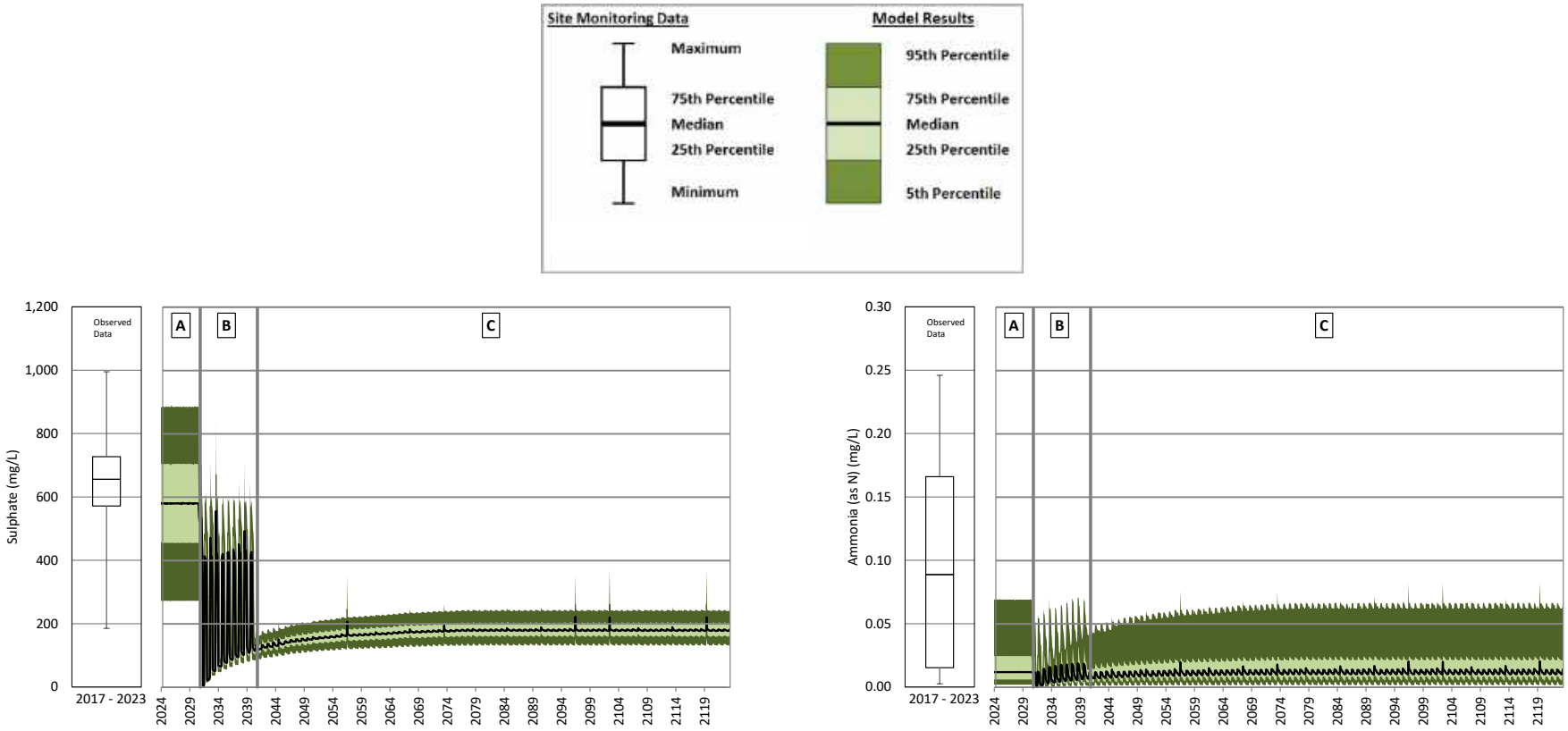
Figure B **183: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

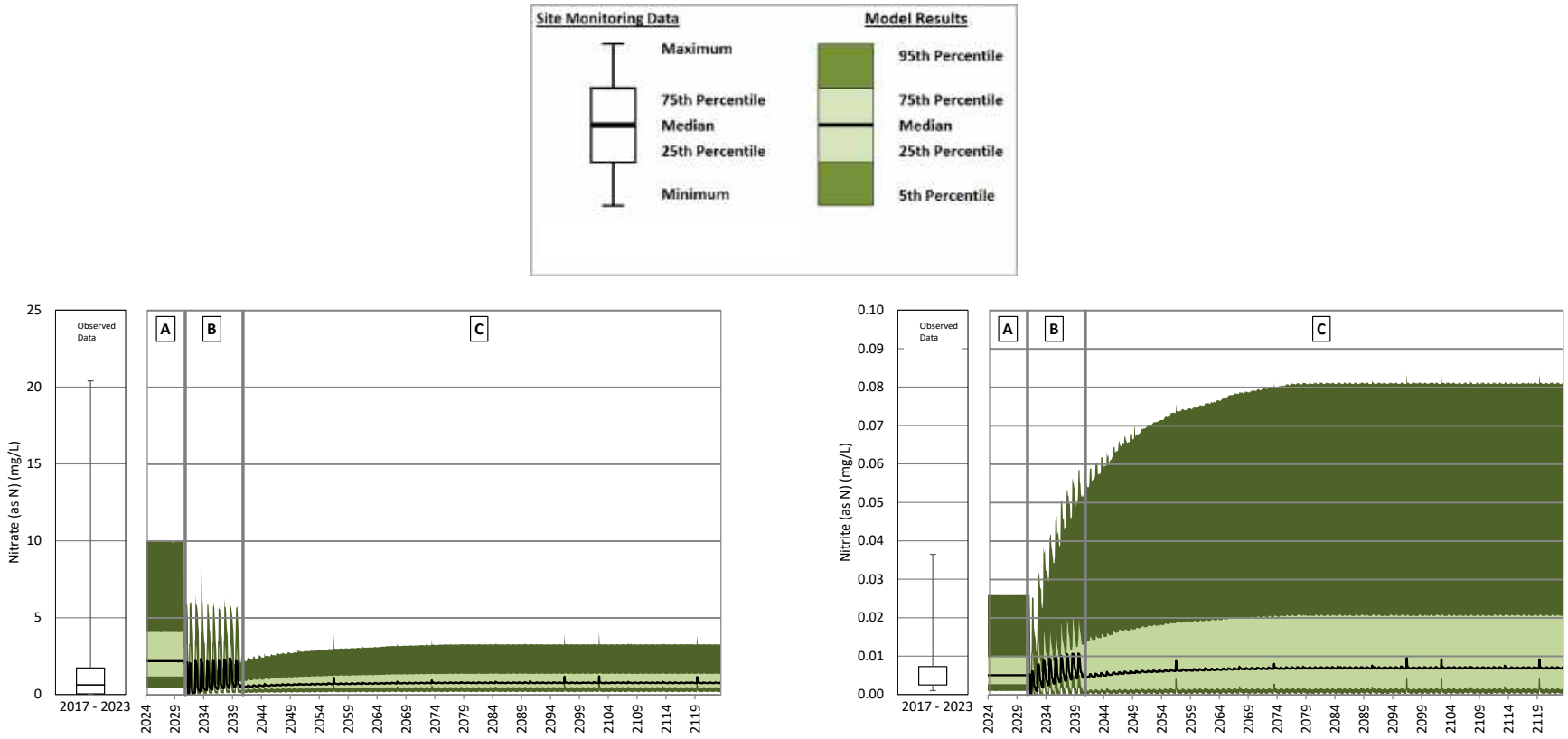
Figure B **184: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

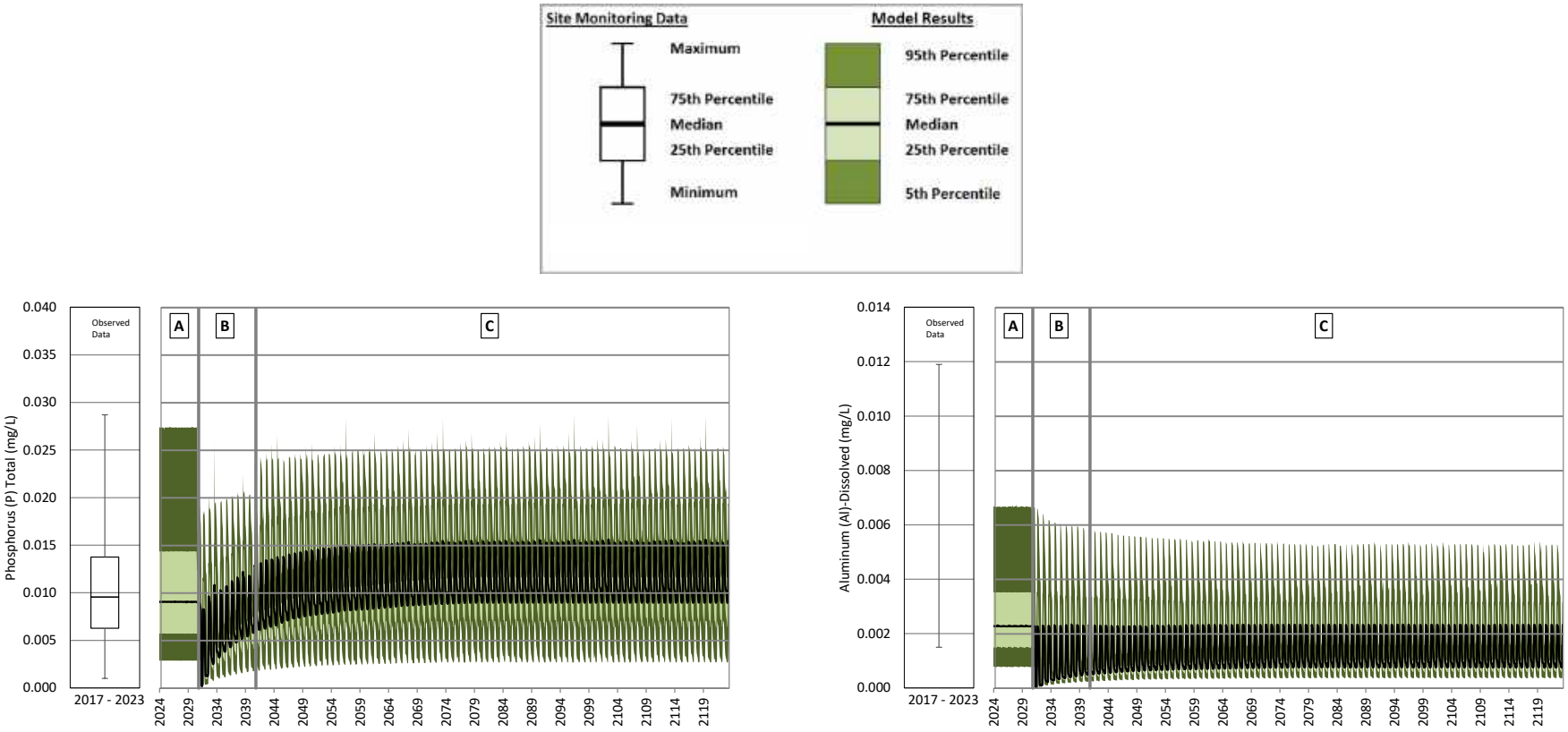
Figure B **185: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

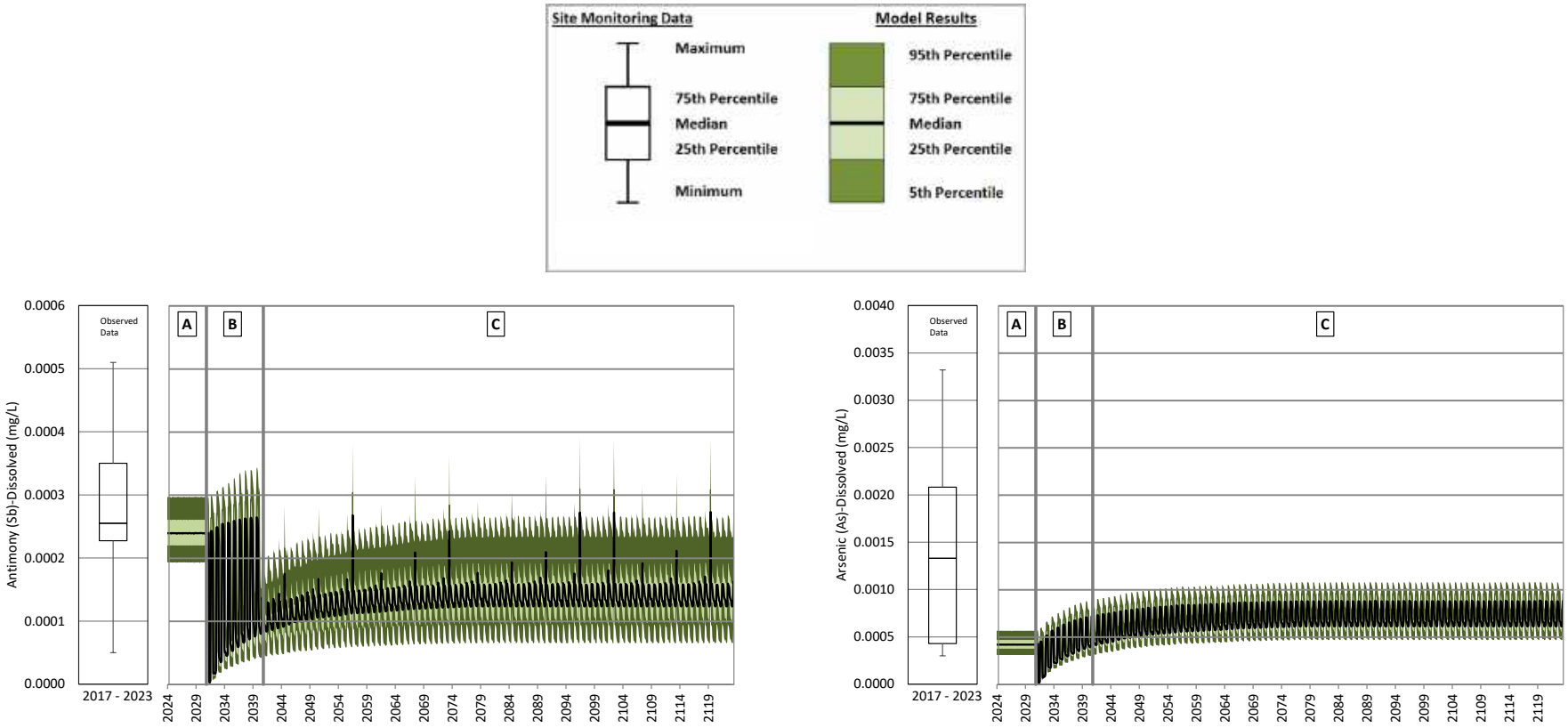
Figure B **186: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in total phosphorus concentrations from 2031 to 2074 and the decrease in dissolved aluminum concentrations are due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

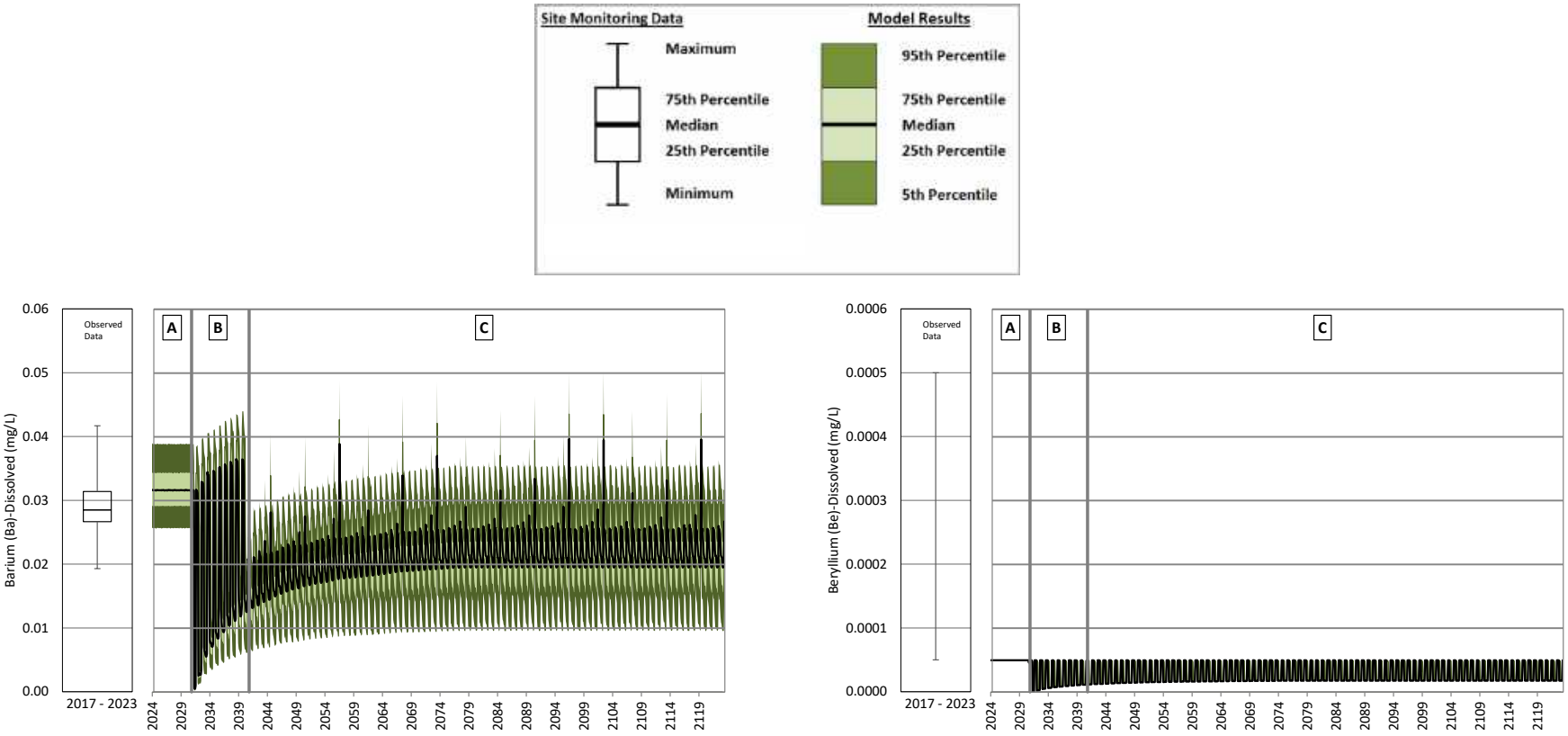
Figure B **187: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

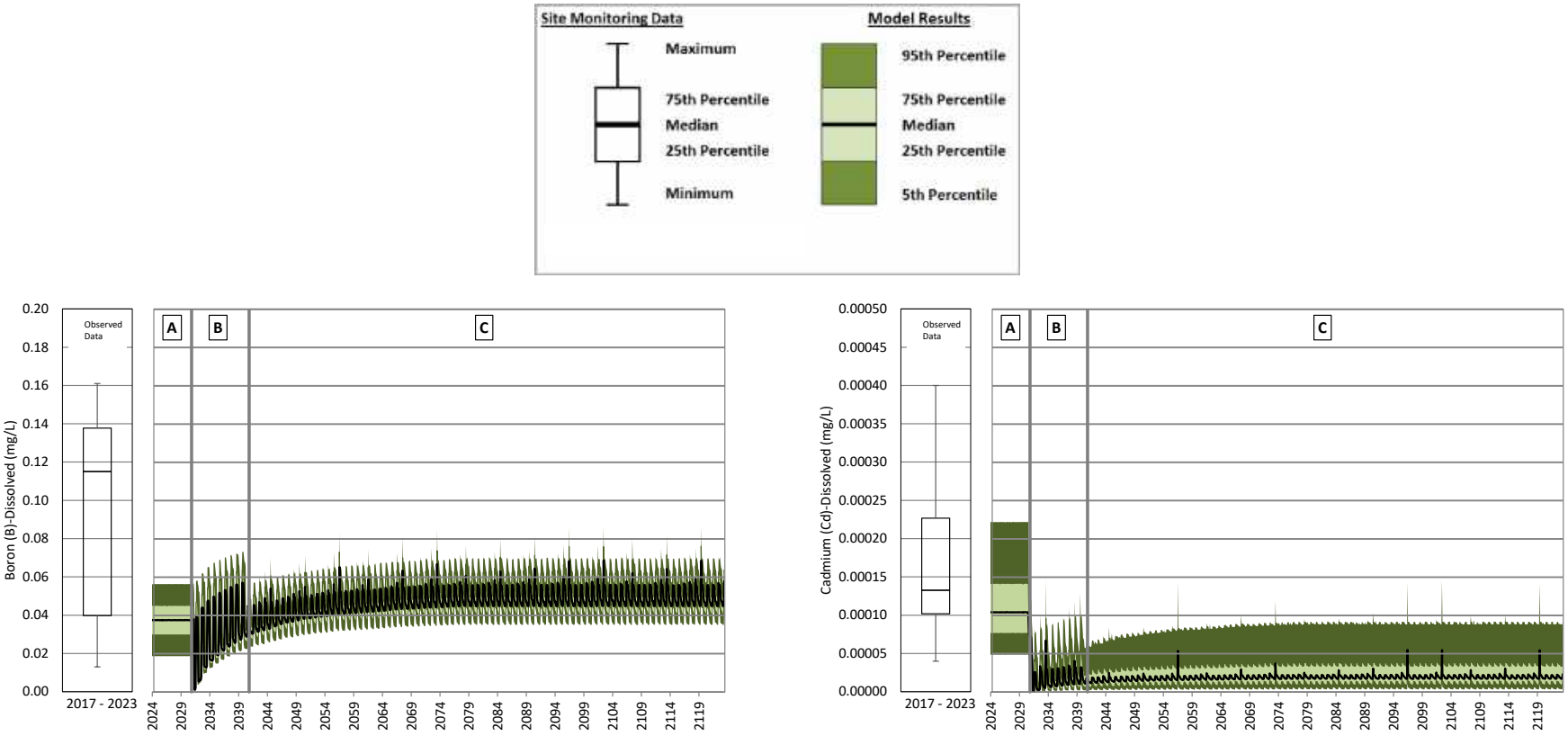
Figure B **188: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

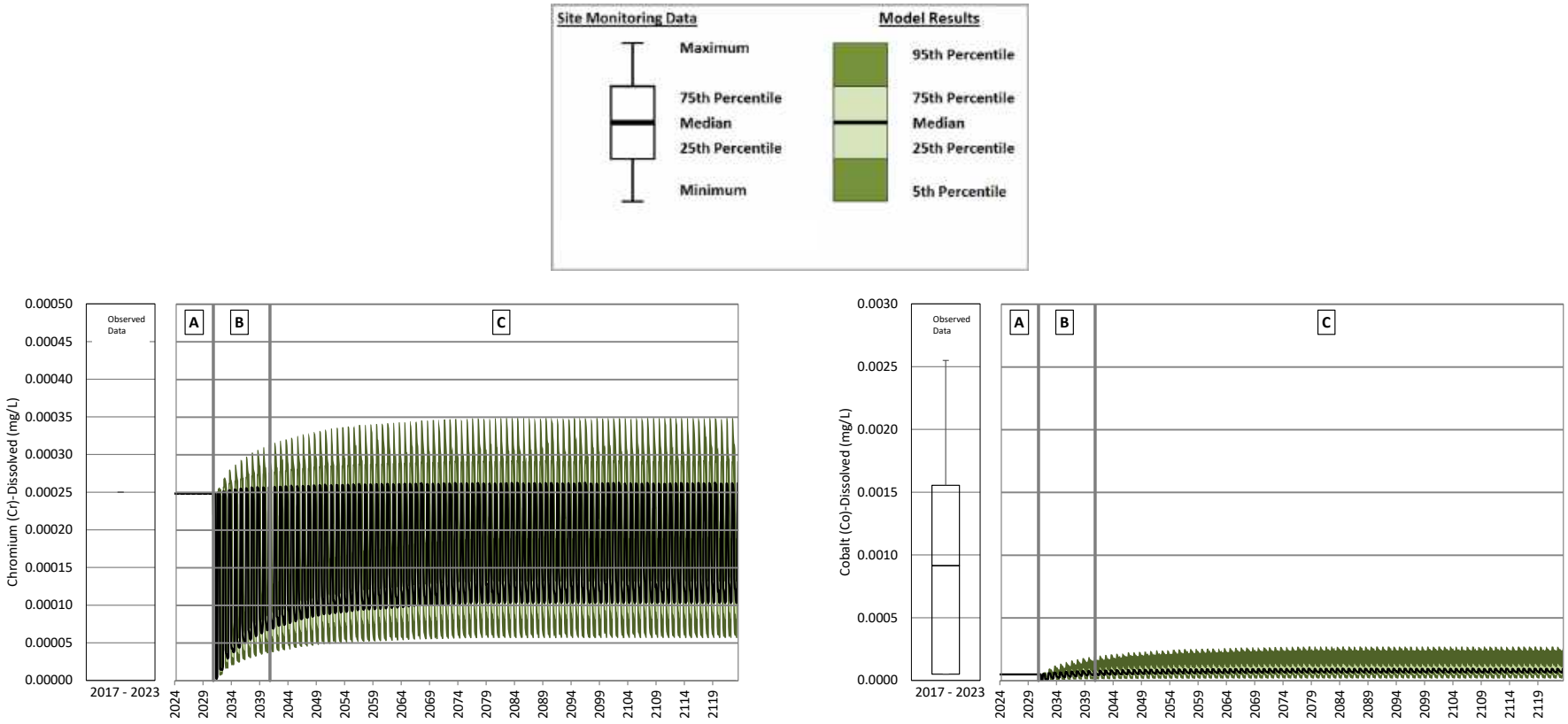
Figure B **189: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

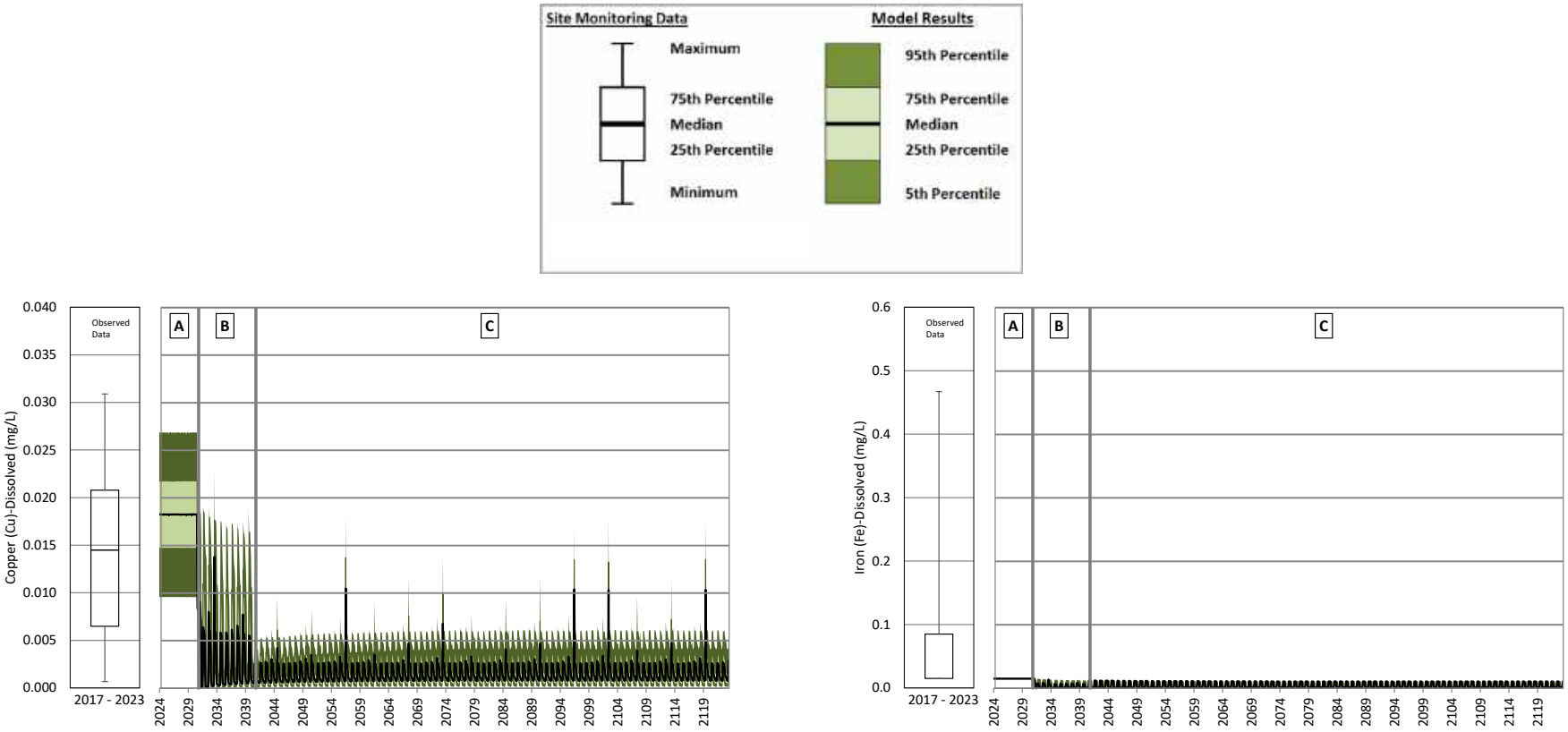
Figure B **190: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

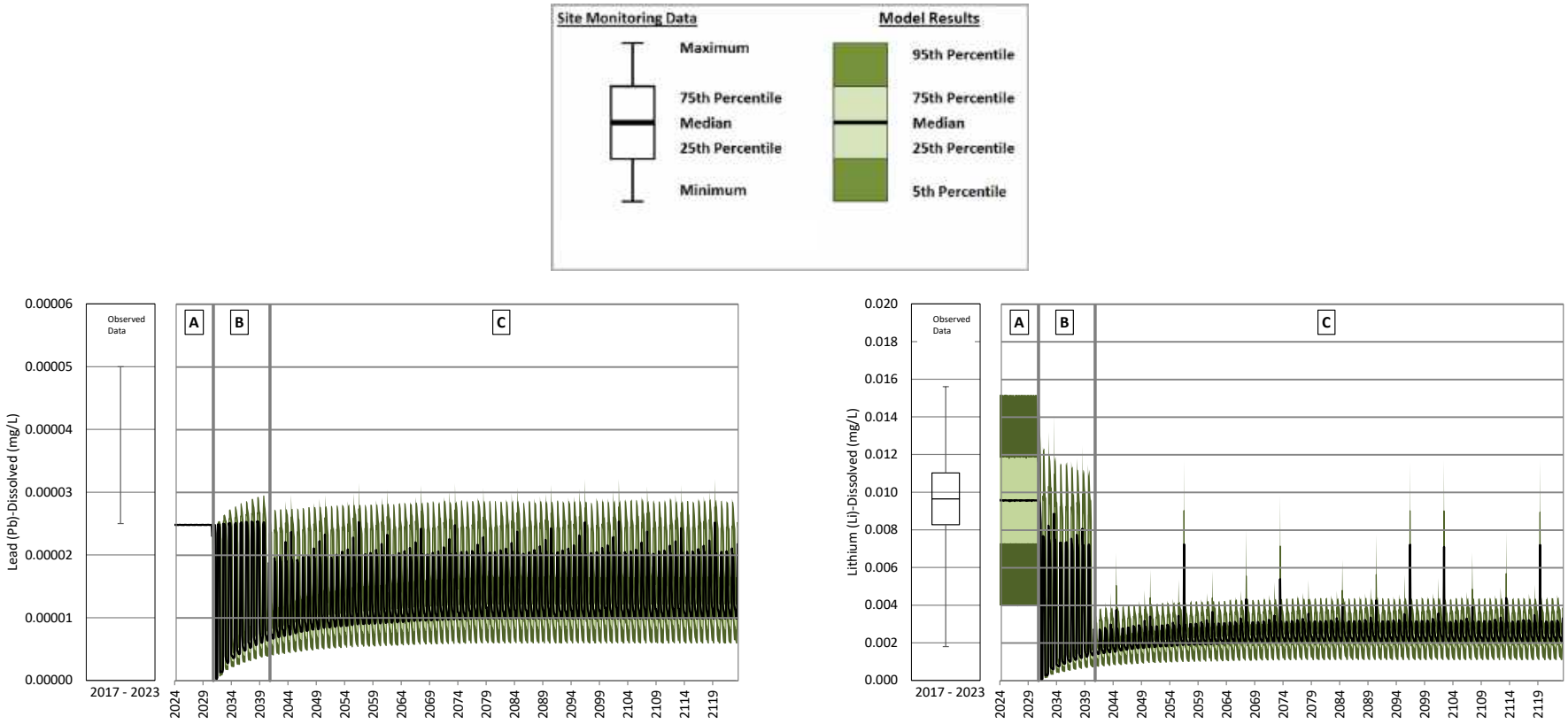
Figure B **191: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

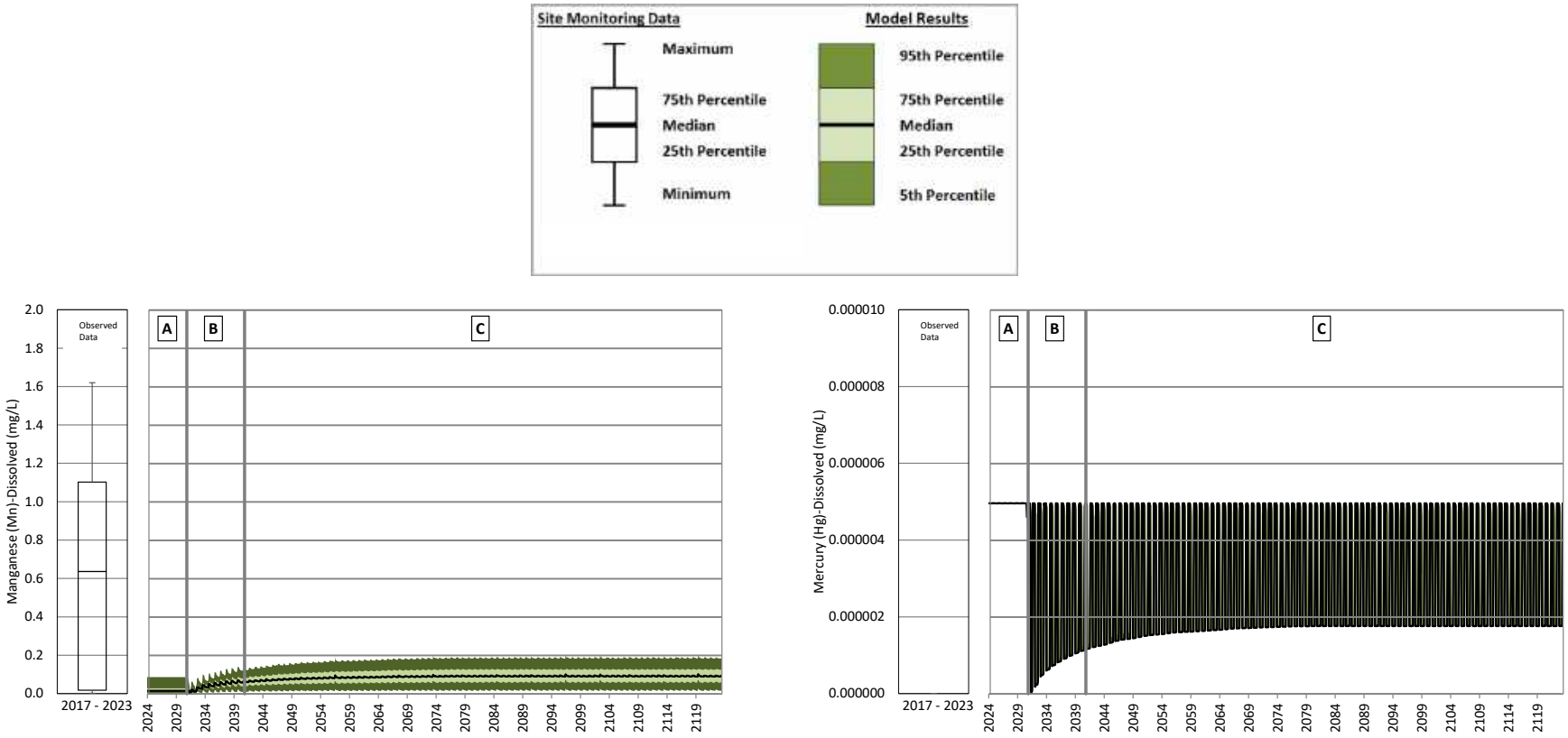
Figure B **192: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

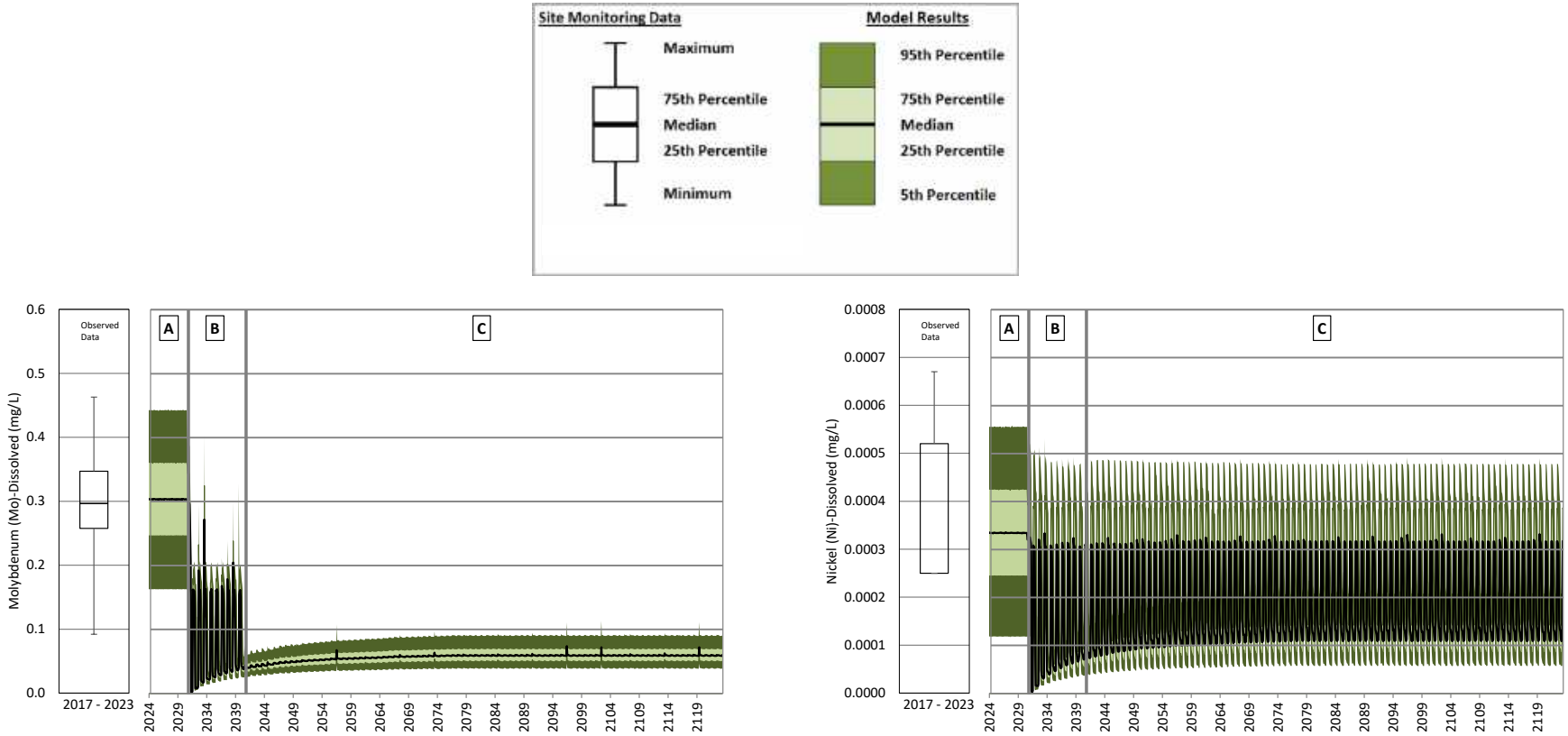
Figure B **193: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

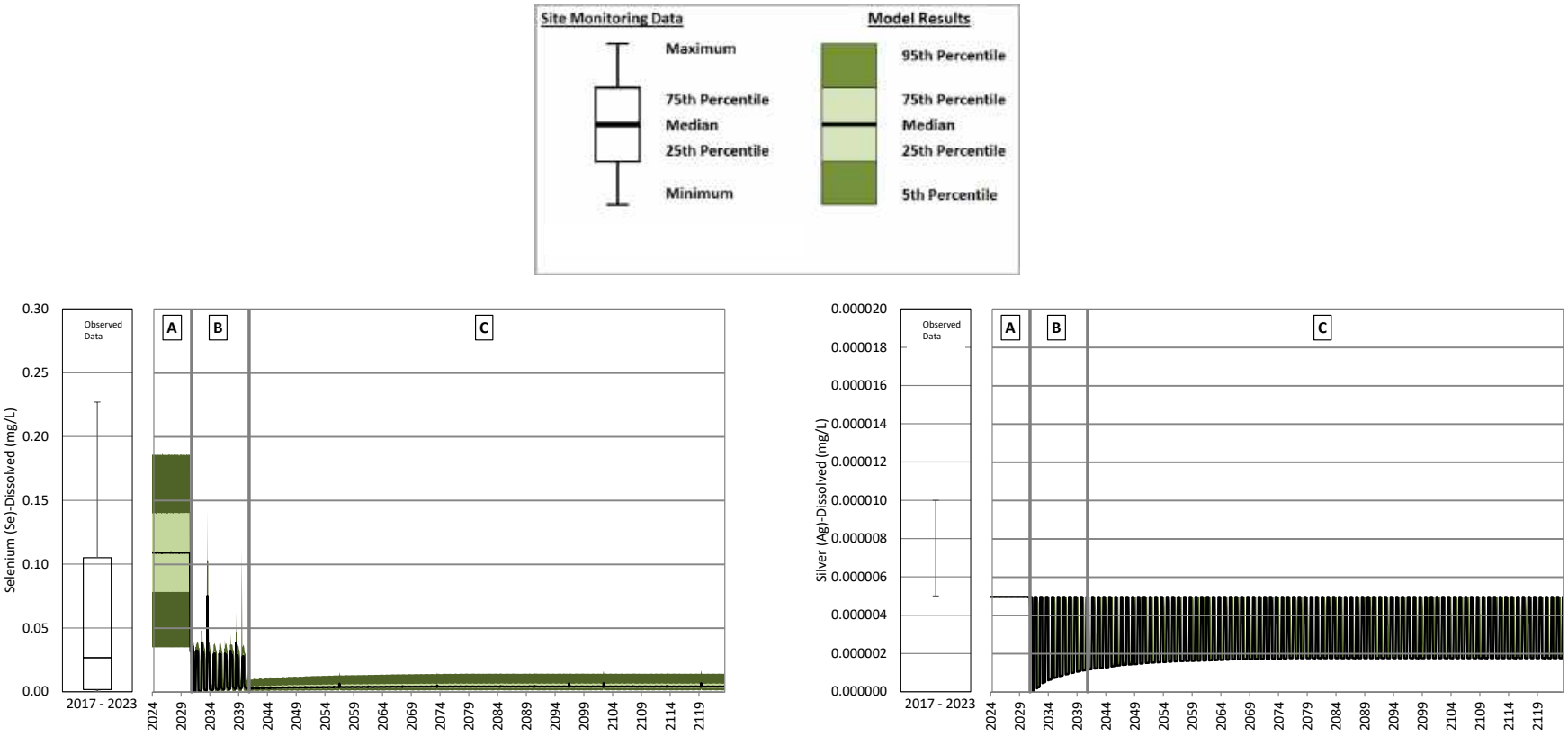
Figure B **194: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

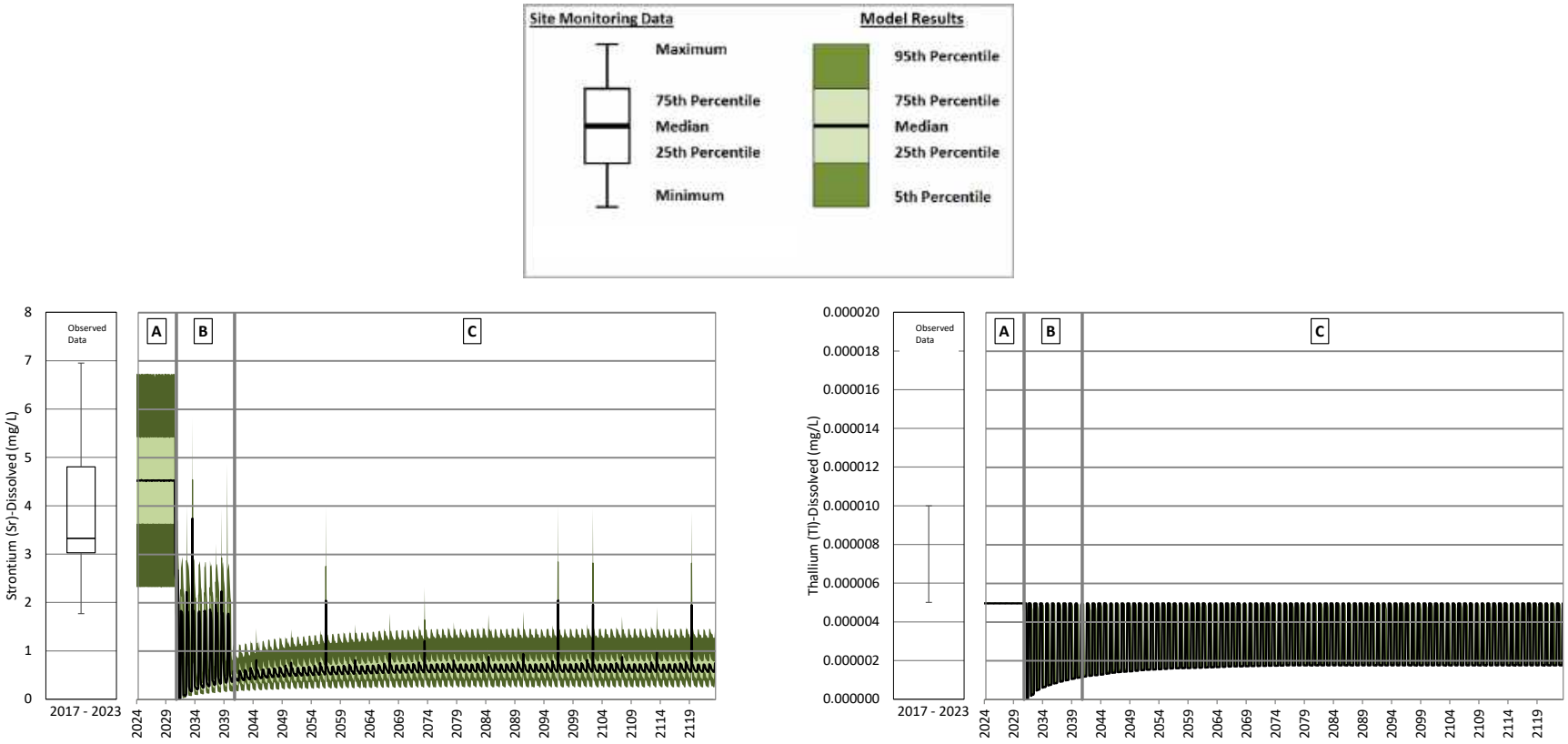
Figure B **195: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

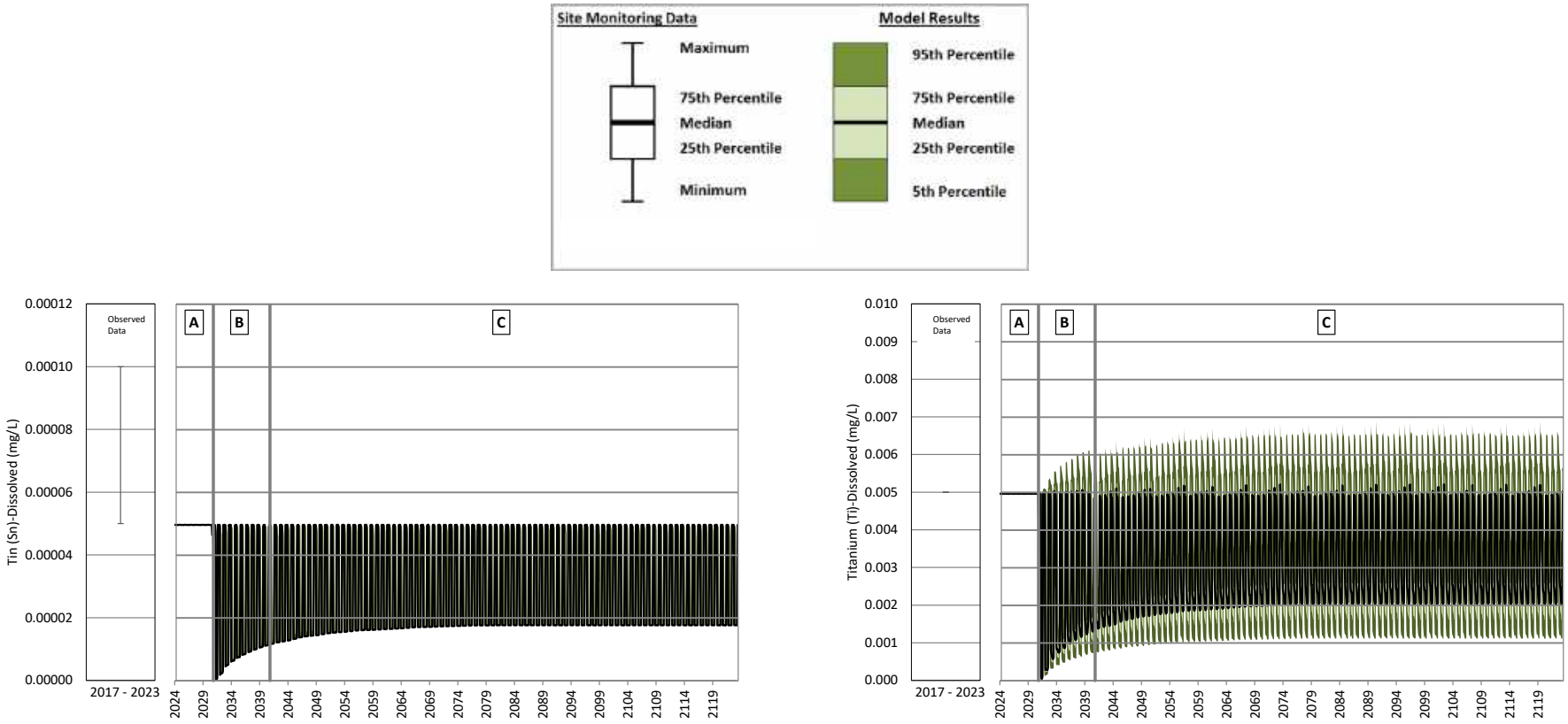
Figure B **196: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

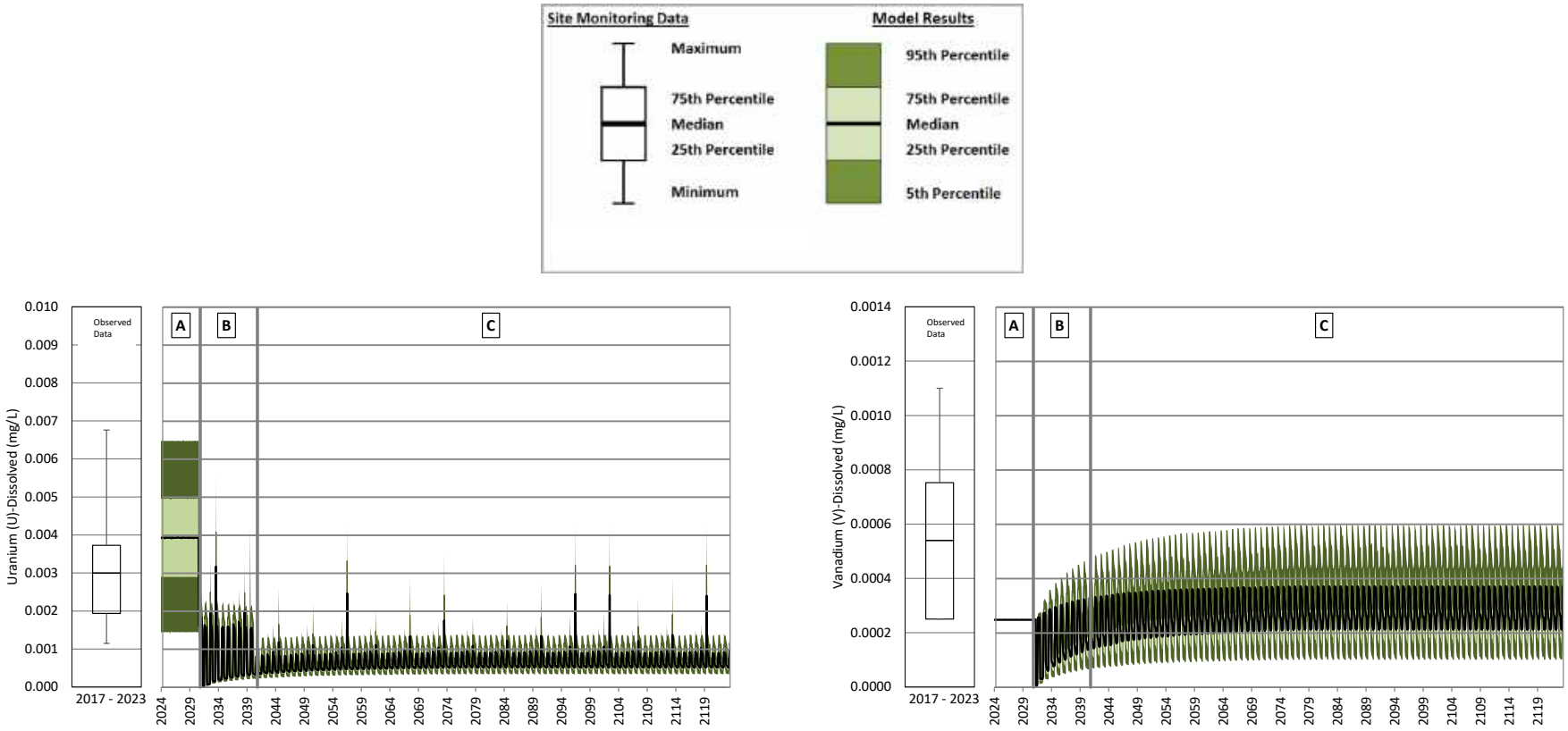
Figure B **197: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

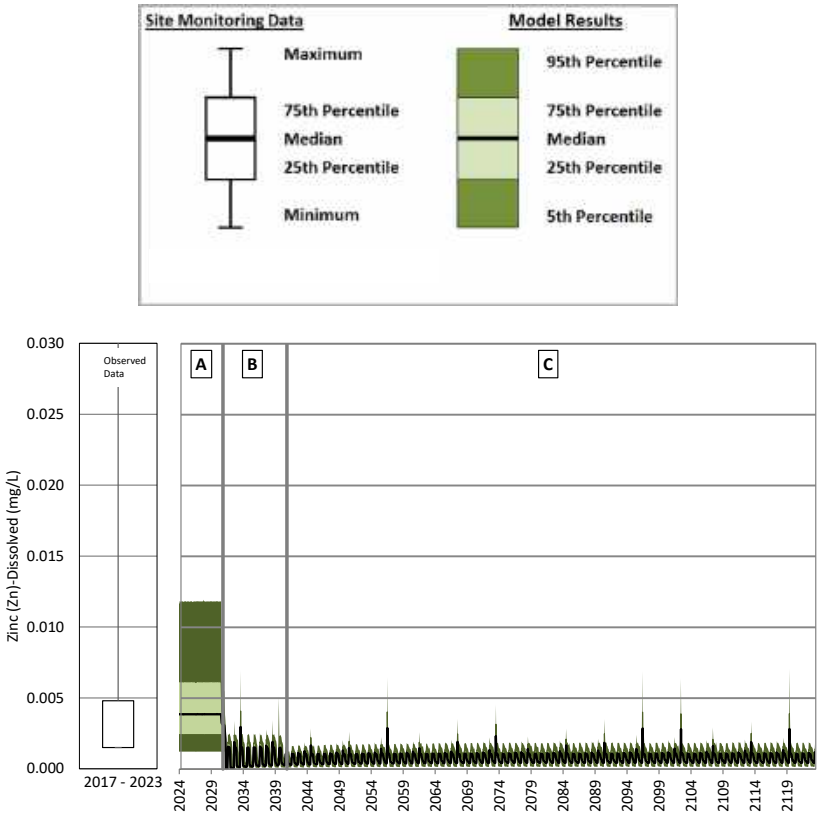
Figure B **198: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **199: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

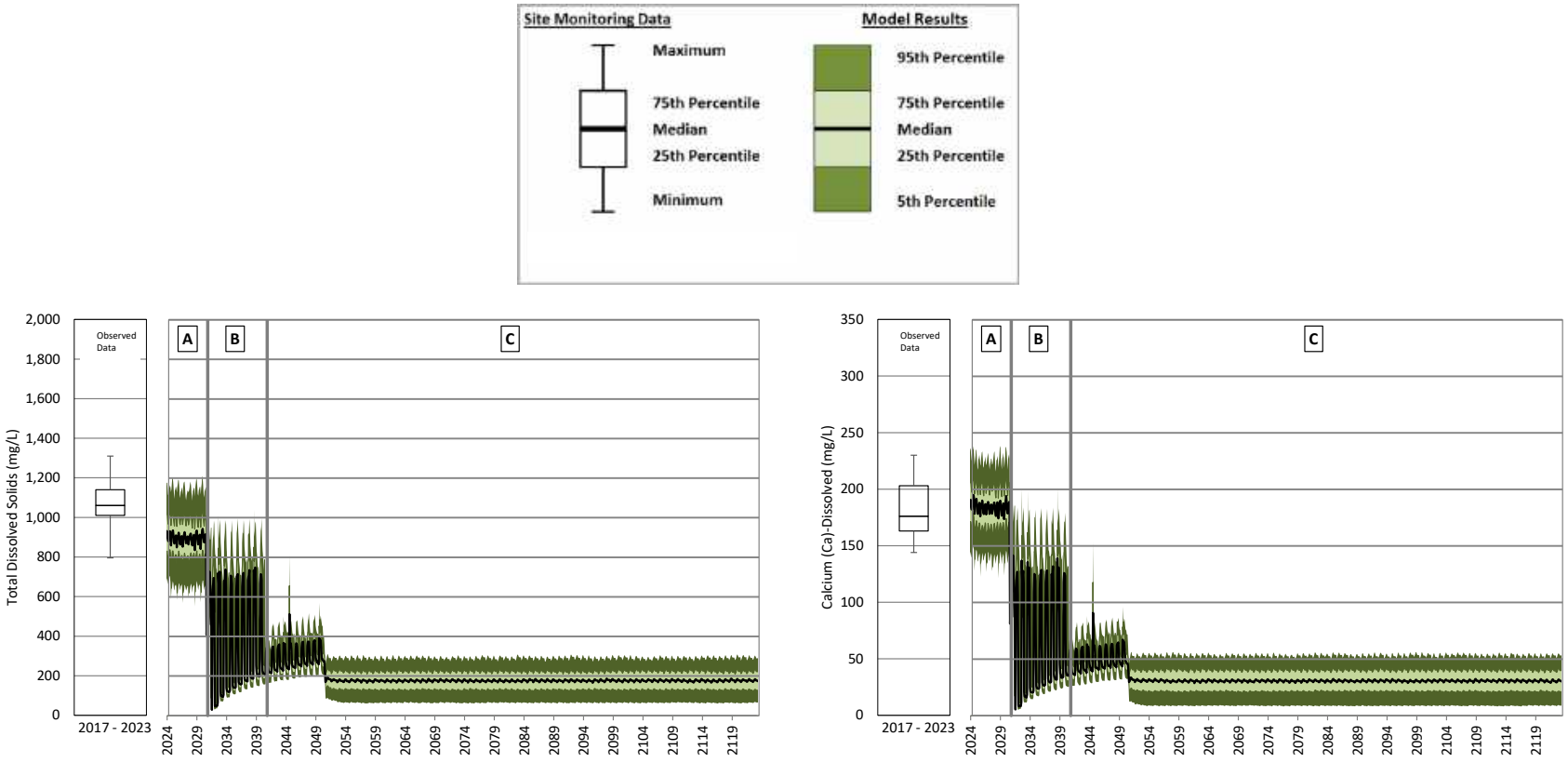


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

Figure B **200: South Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Zinc**

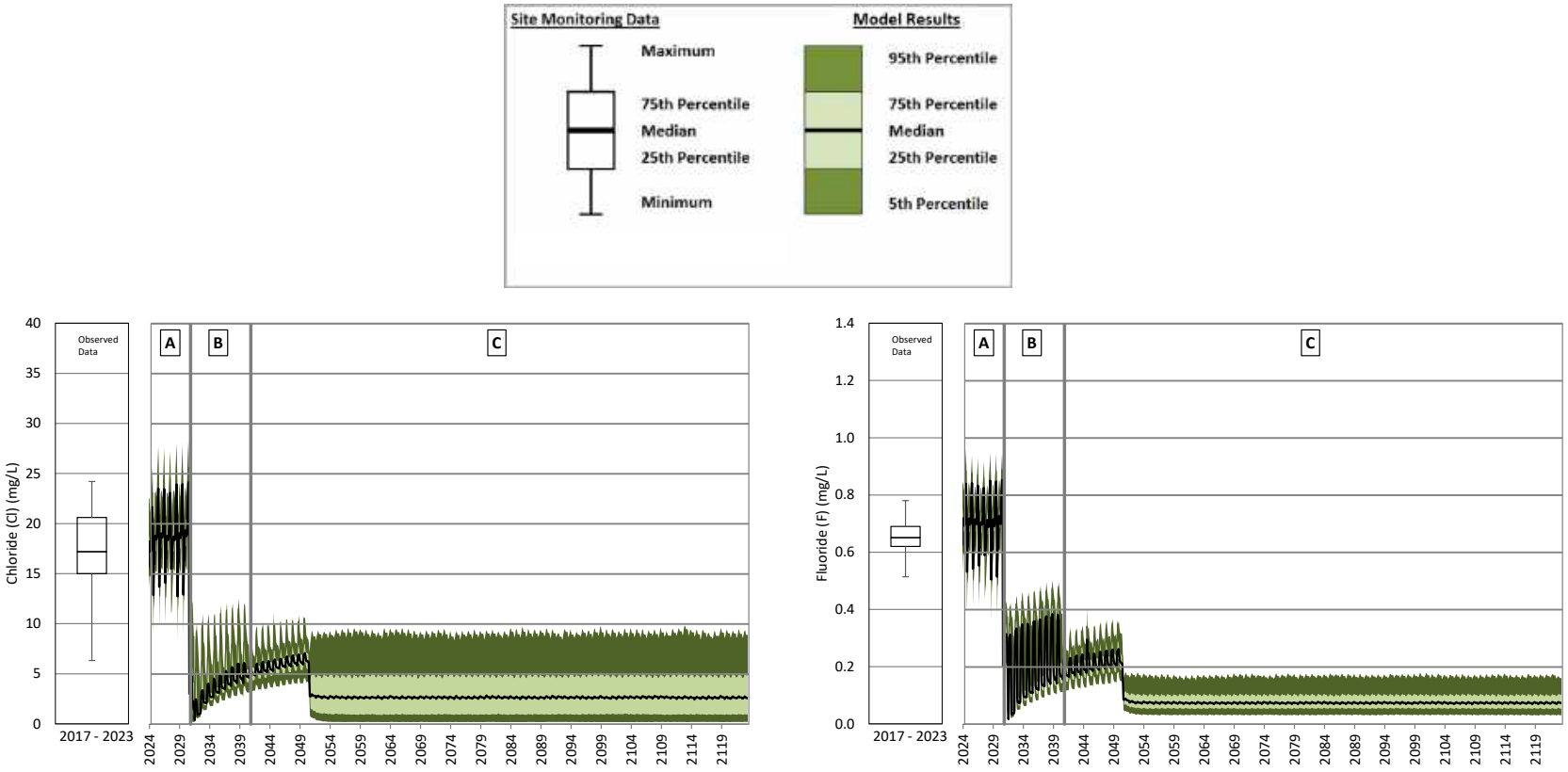
Main Embankment Seepage Collection Pond Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

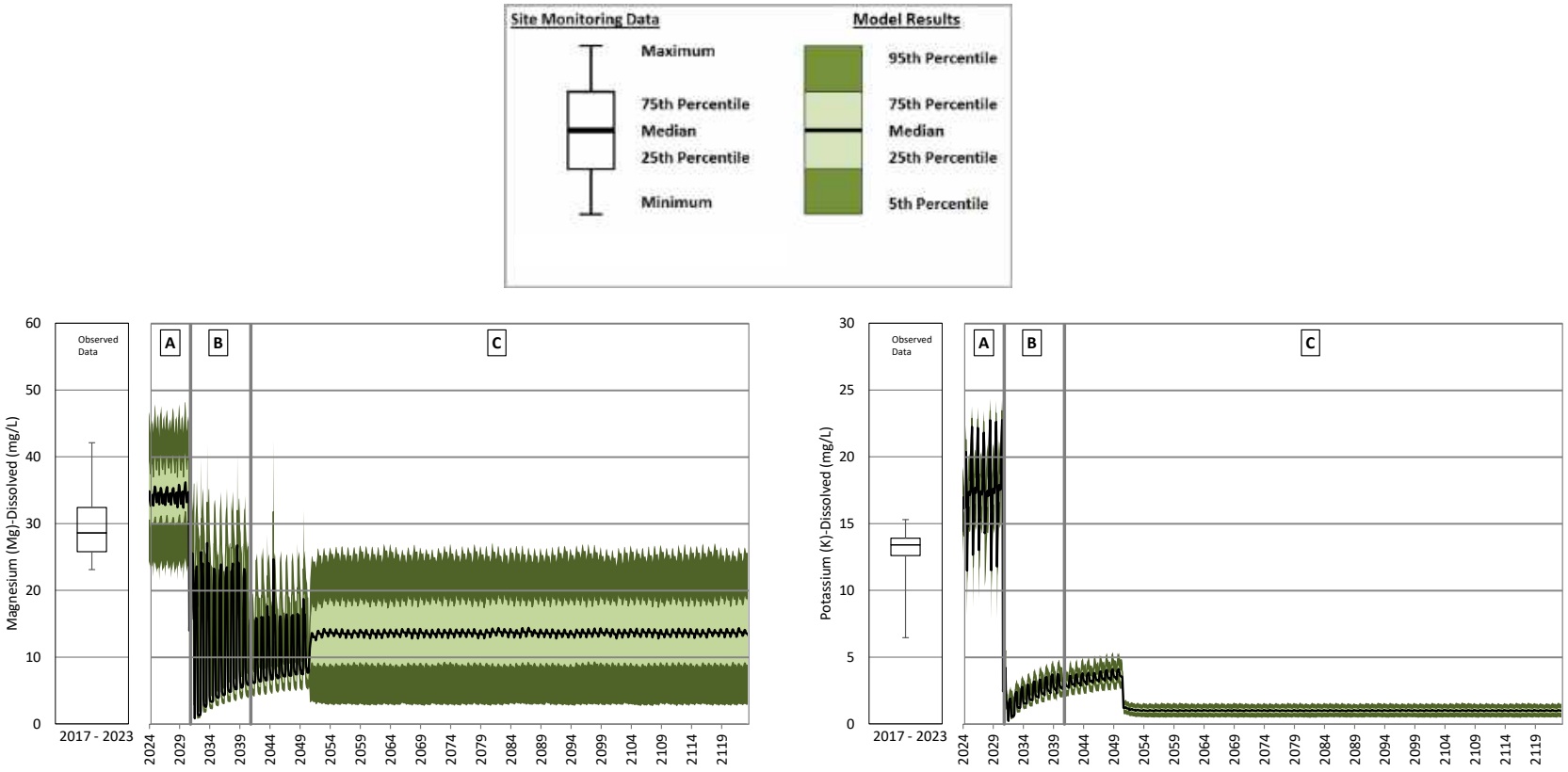
Figure B **201: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

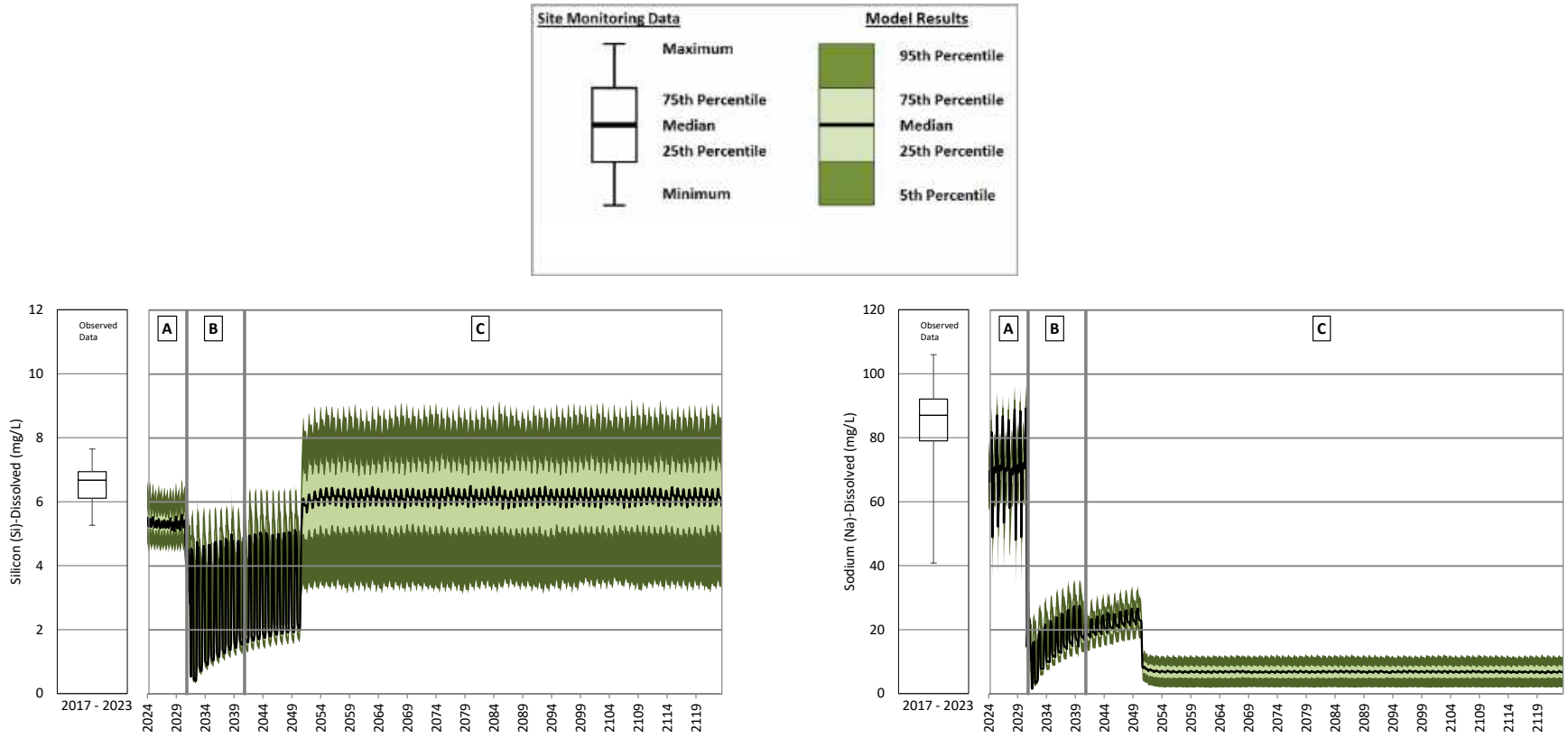
Figure B **202: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

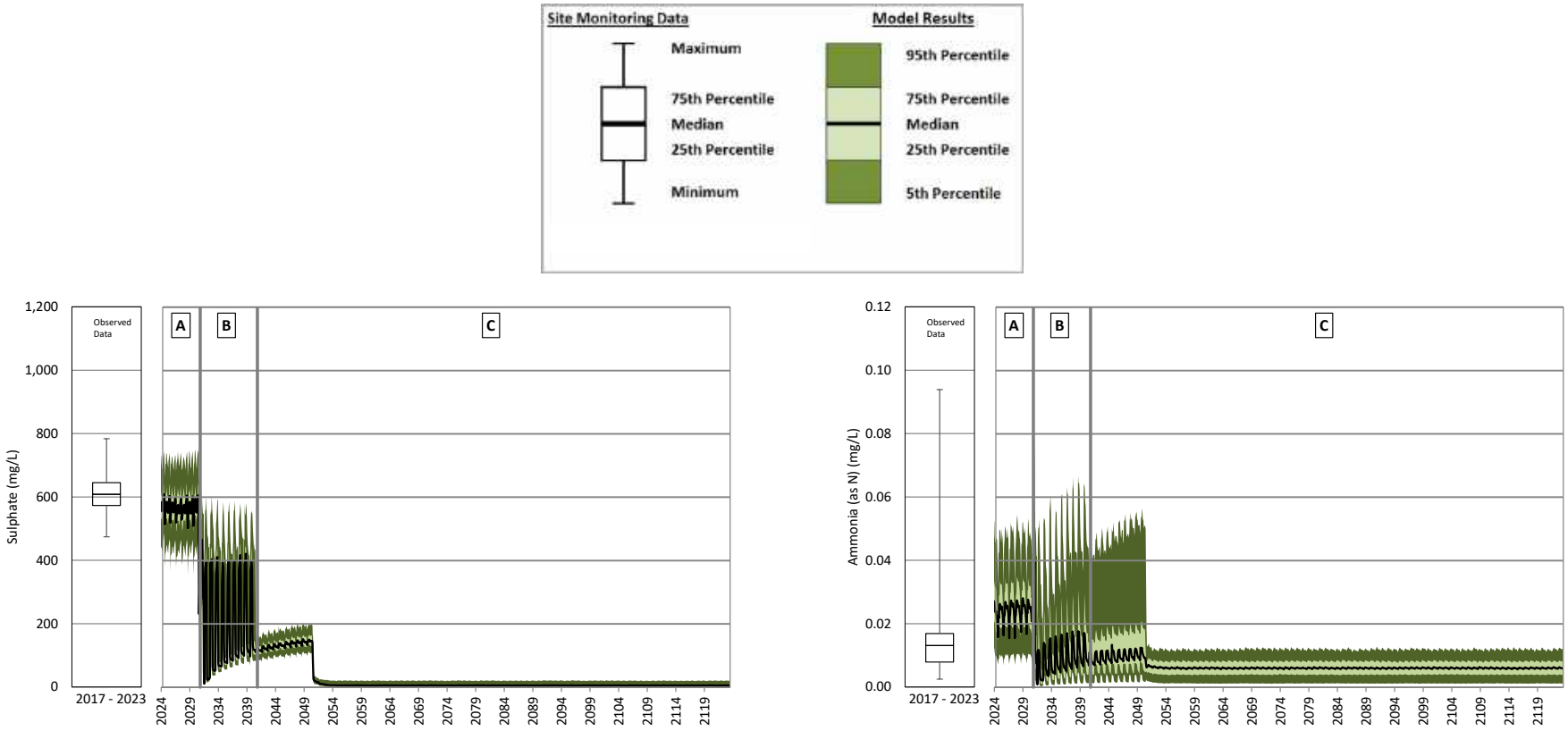
Figure B **203: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Silicon concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for silicon than the disturbed runoff water quality input.

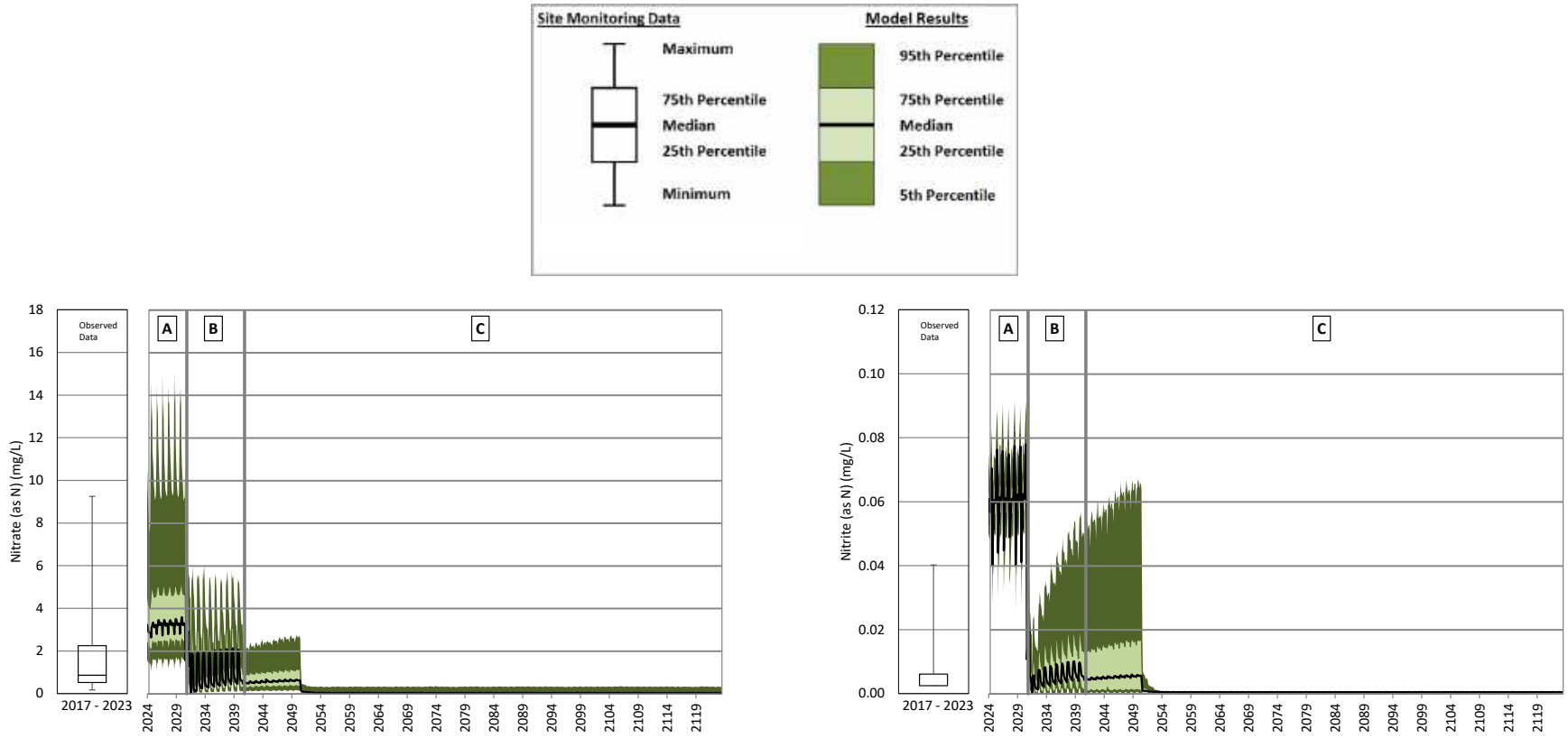
Figure B **204: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

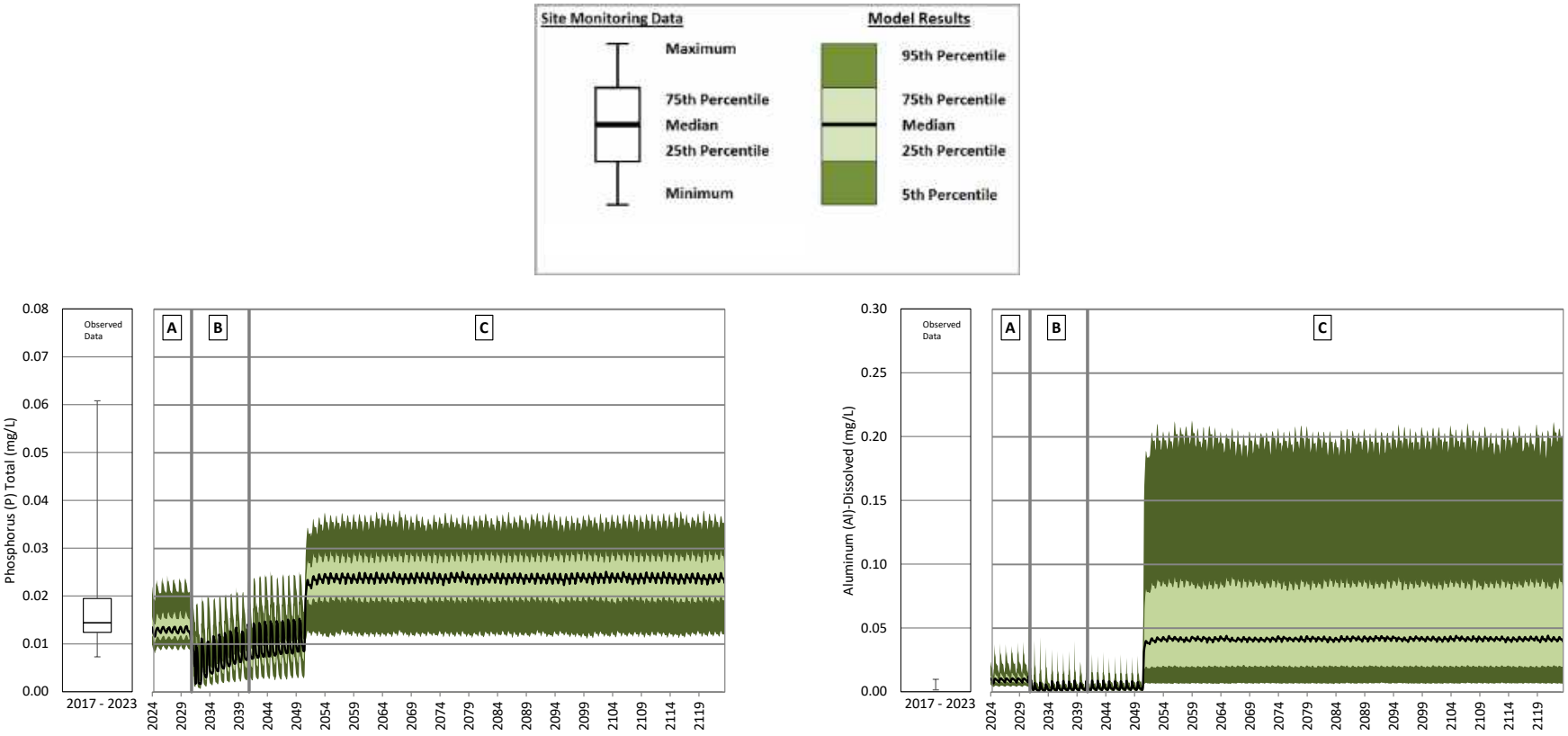
Figure B **205: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

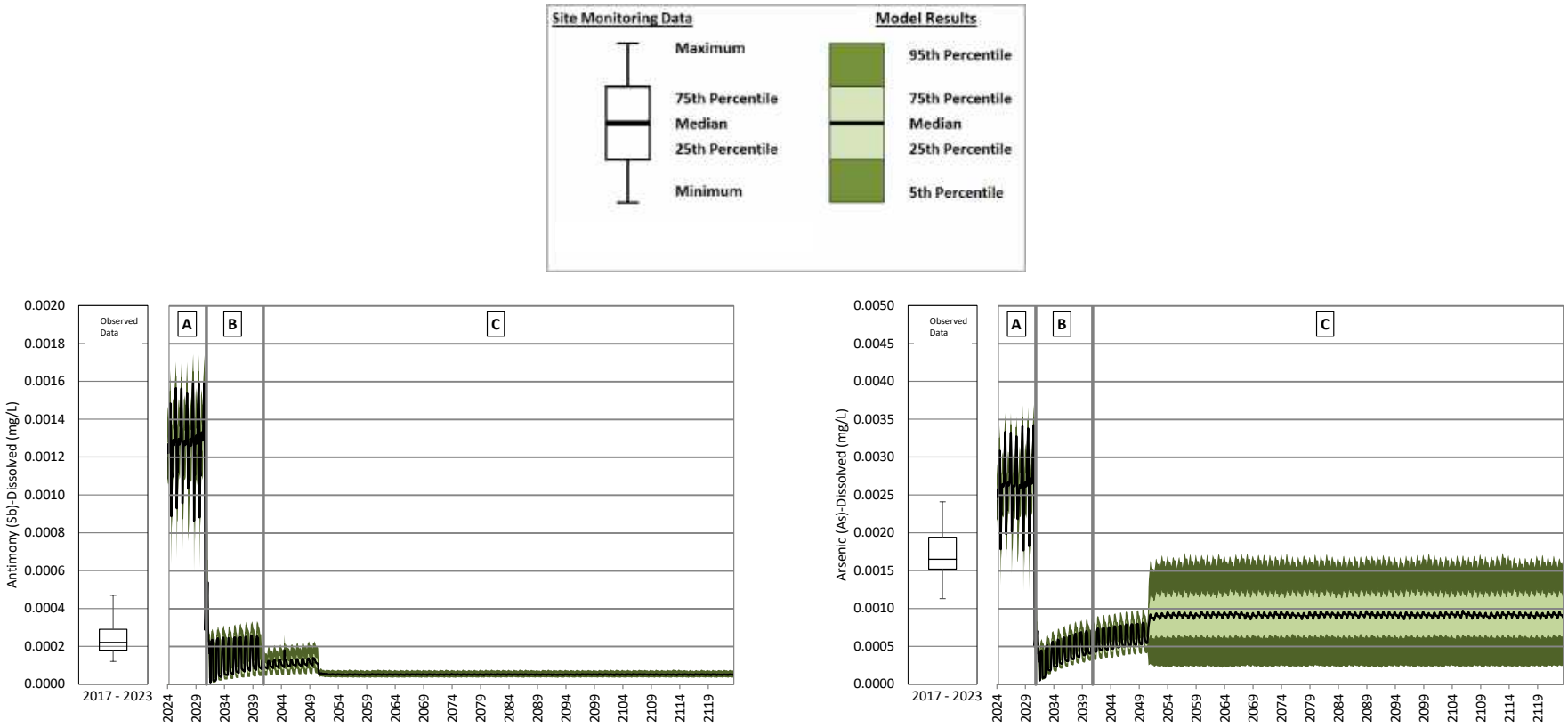
Figure B **206: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Total phosphorus and dissolved aluminum concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolvedaluminum than the disturbed runoff water quality input.

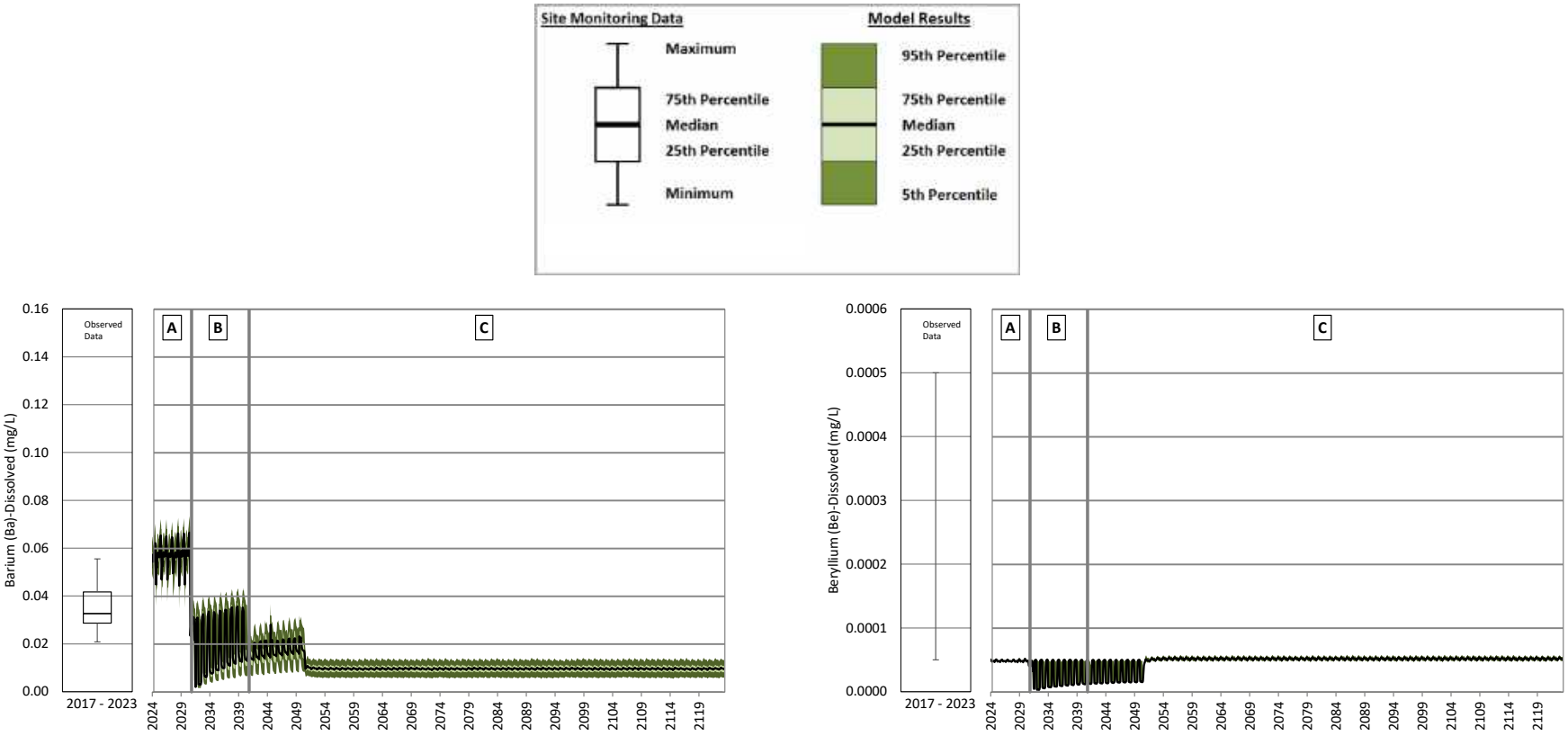
Figure B **207: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved arsenic concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved arsenic than the disturbed runoff water quality input. .

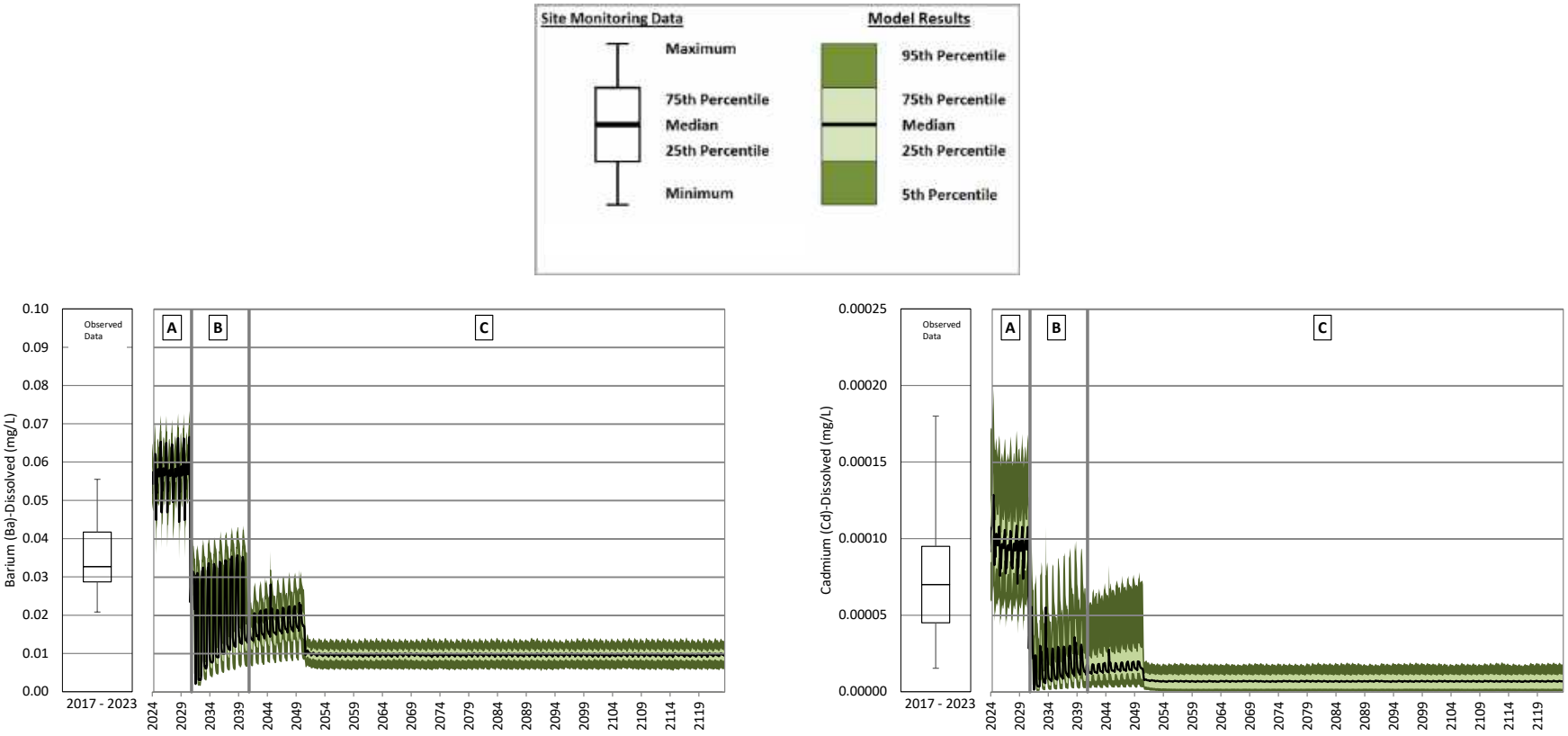
Figure B **208: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

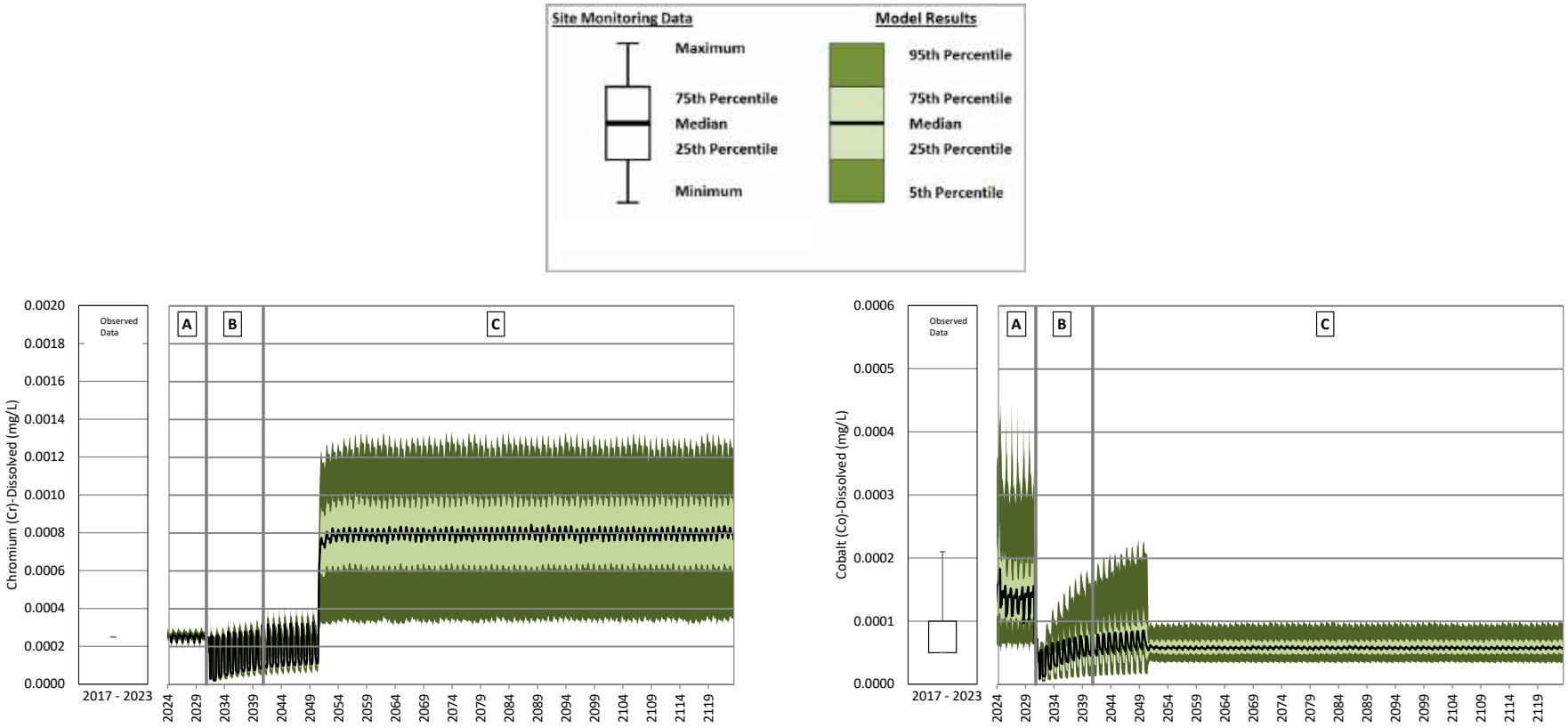
Figure B **209: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

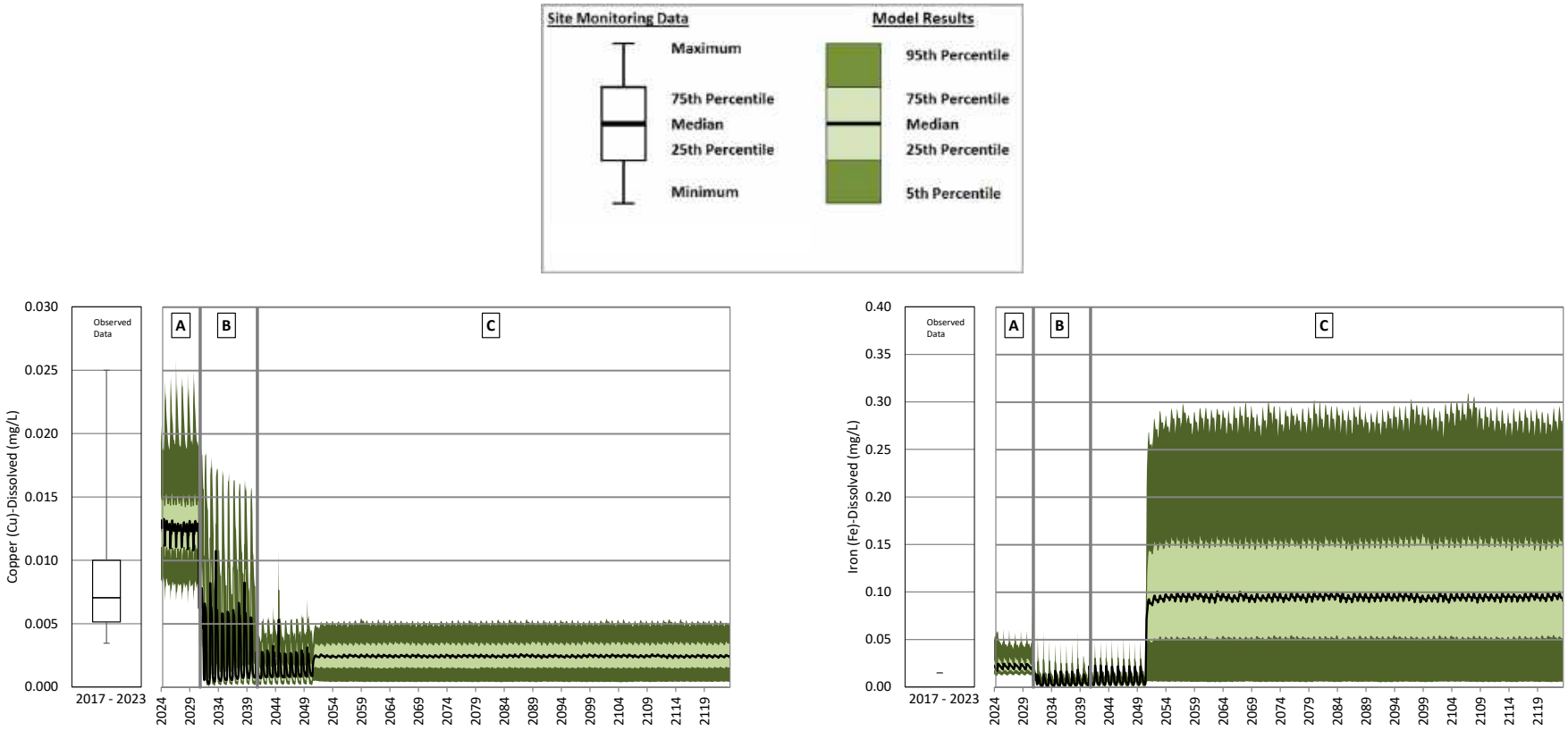
Figure B **210: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved chromium concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the disturbed runoff water quality input.

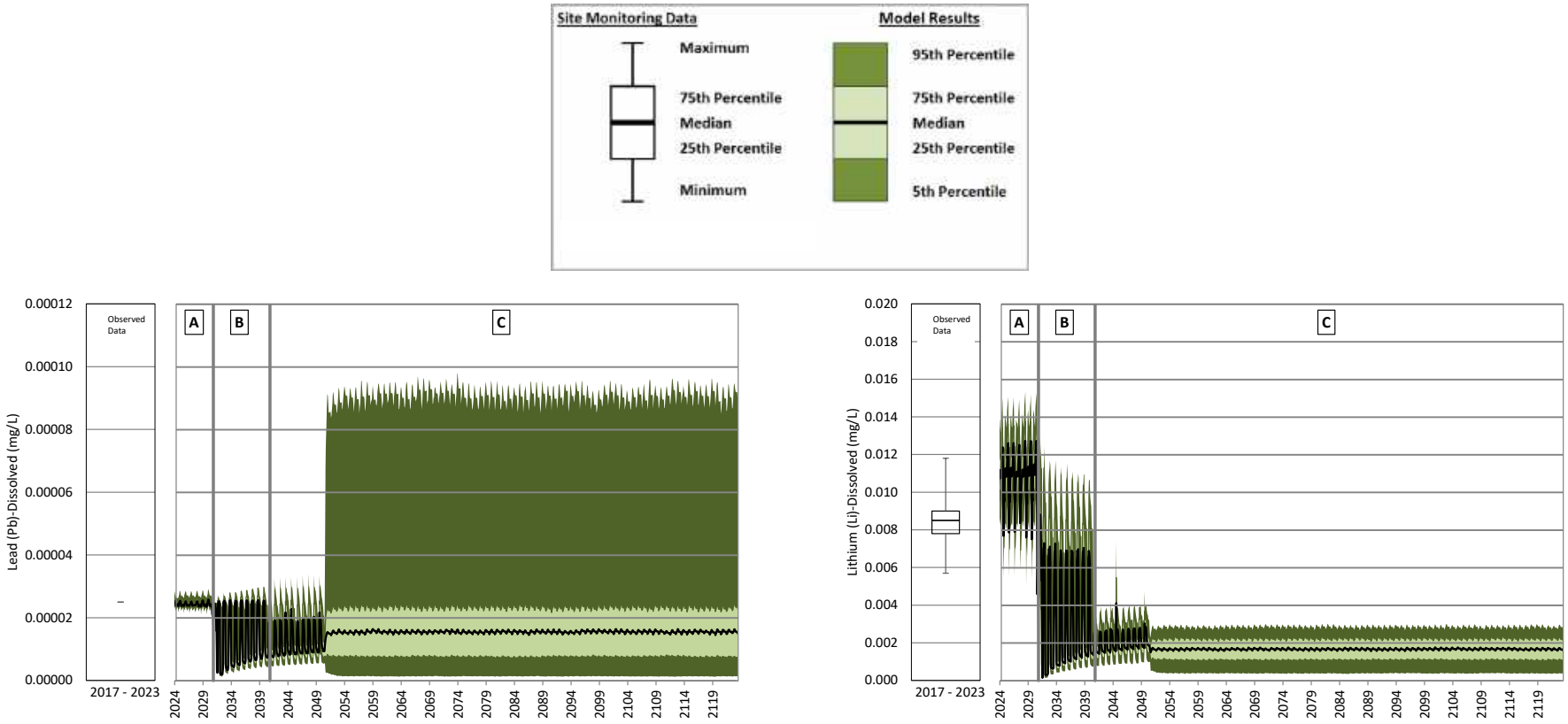
Figure B **211: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved iron concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the disturbed runoff water quality input.

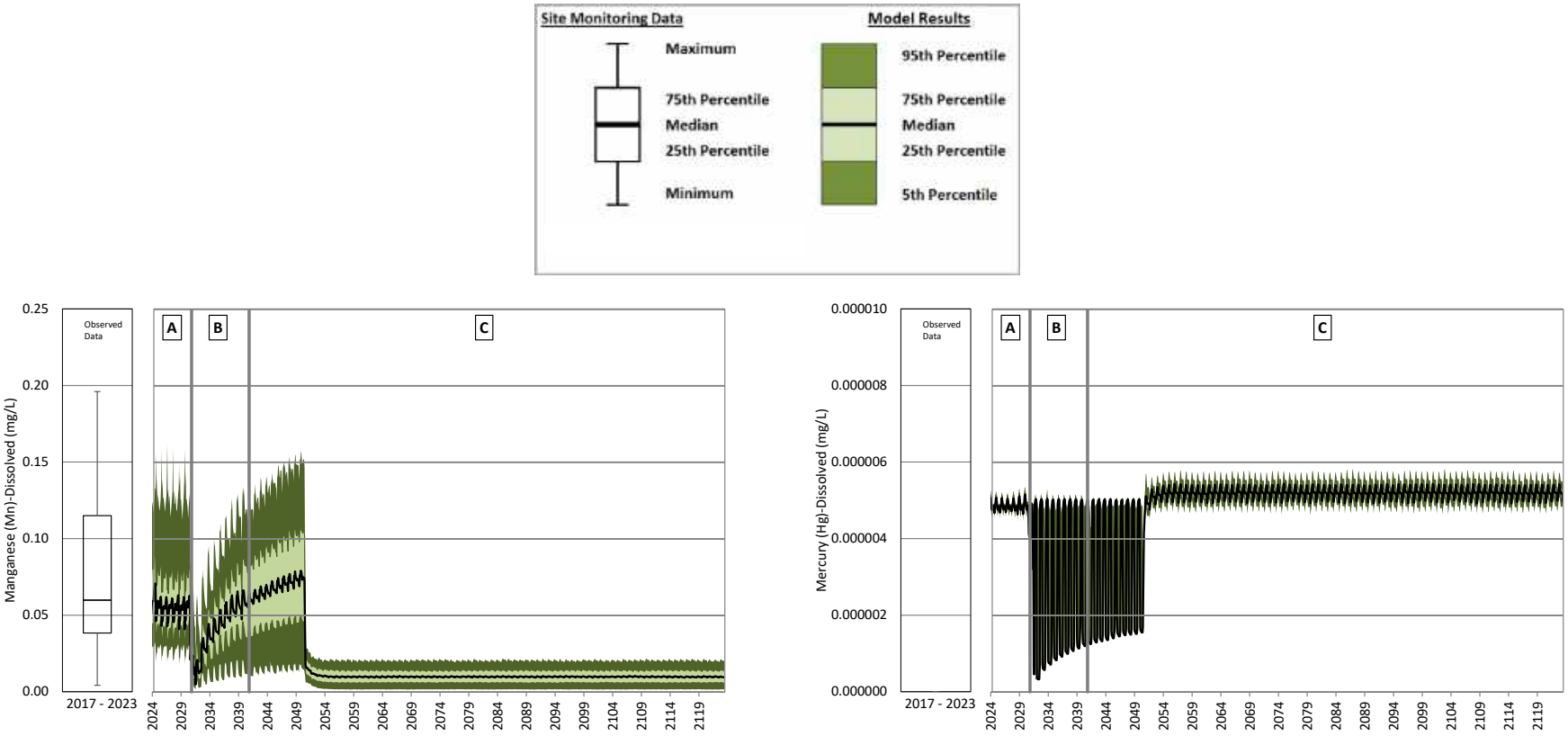
Figure B **212: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved lead concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved lead than the disturbed runoff water quality input.

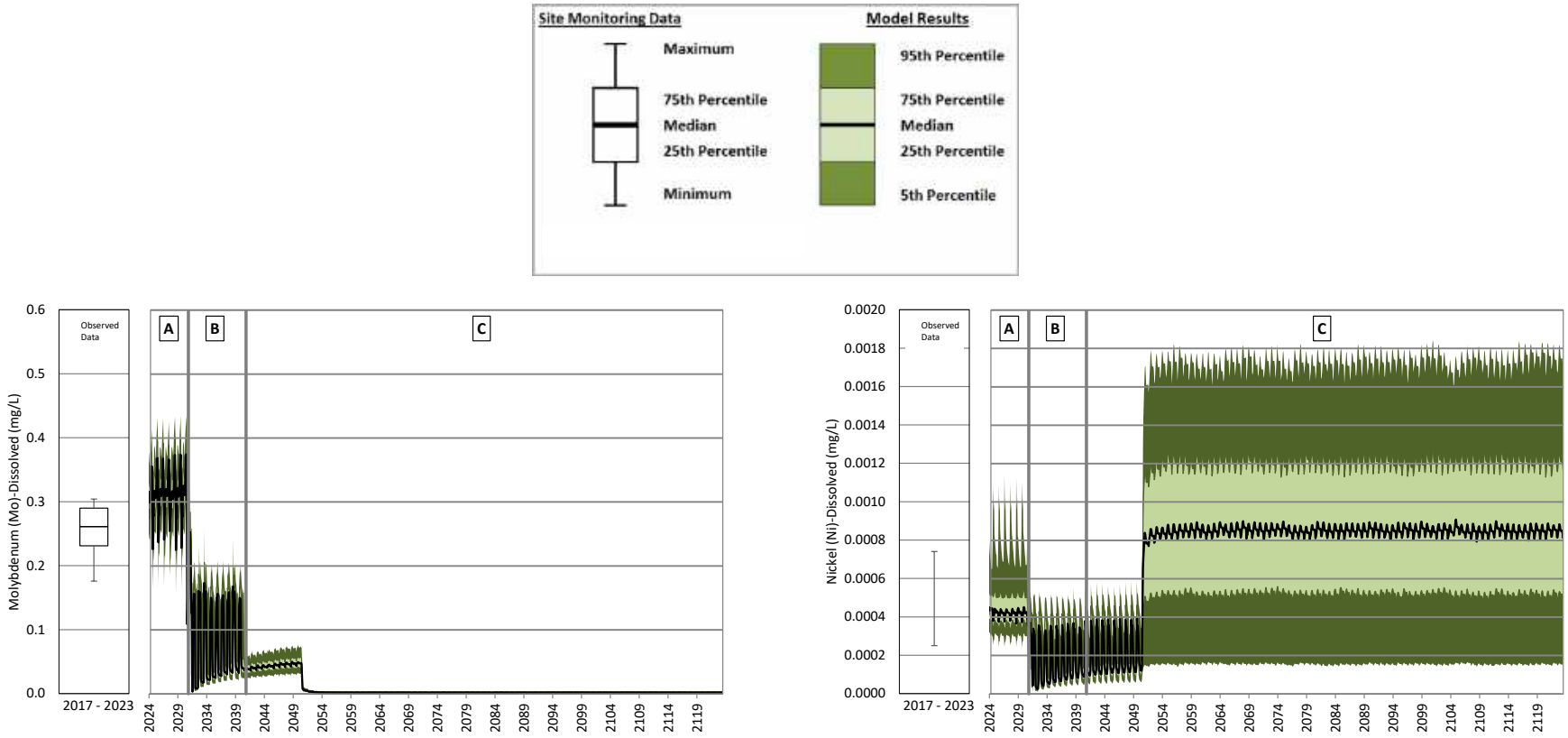
Figure B **213: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

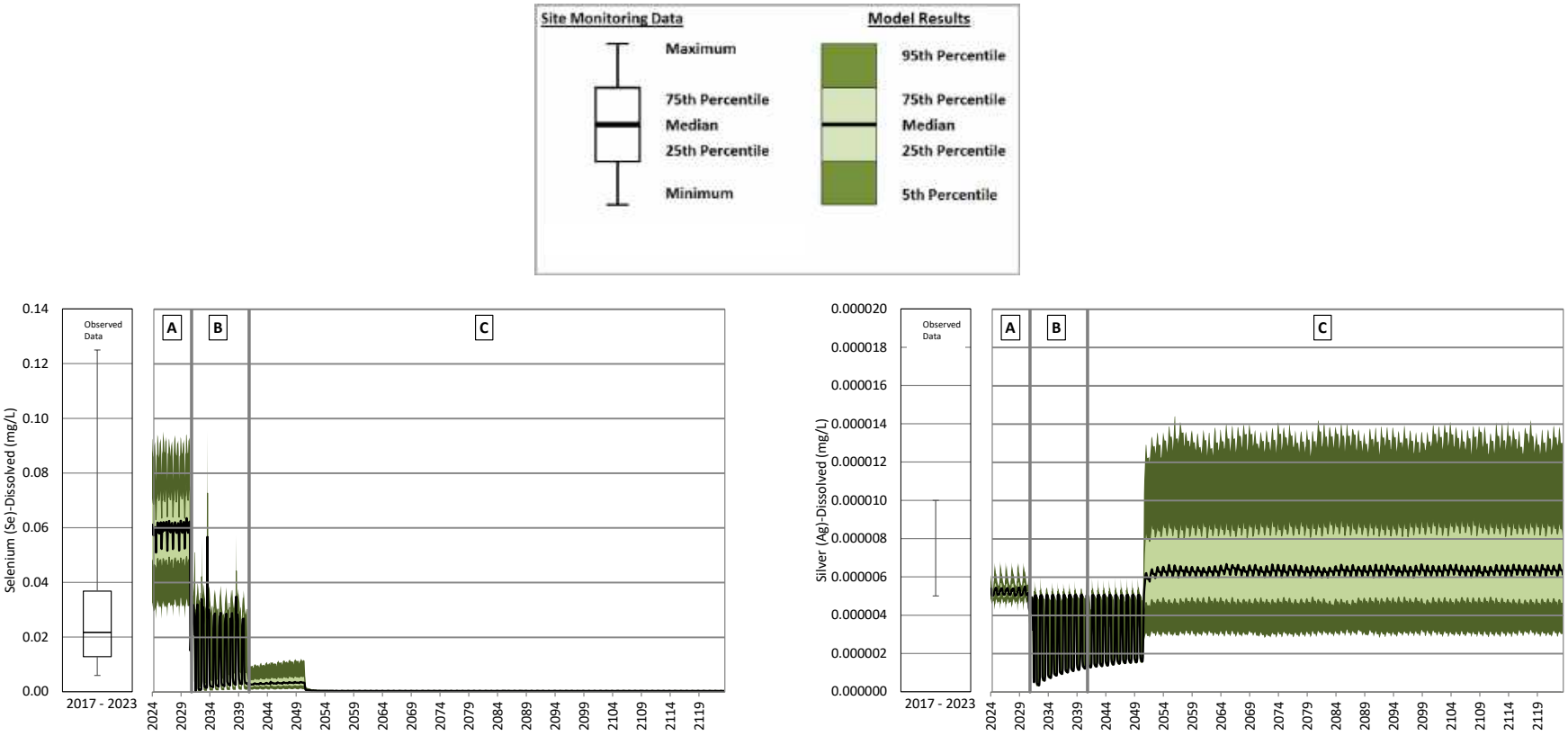
Figure B **214: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved nickel concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the disturbed runoff water quality input.

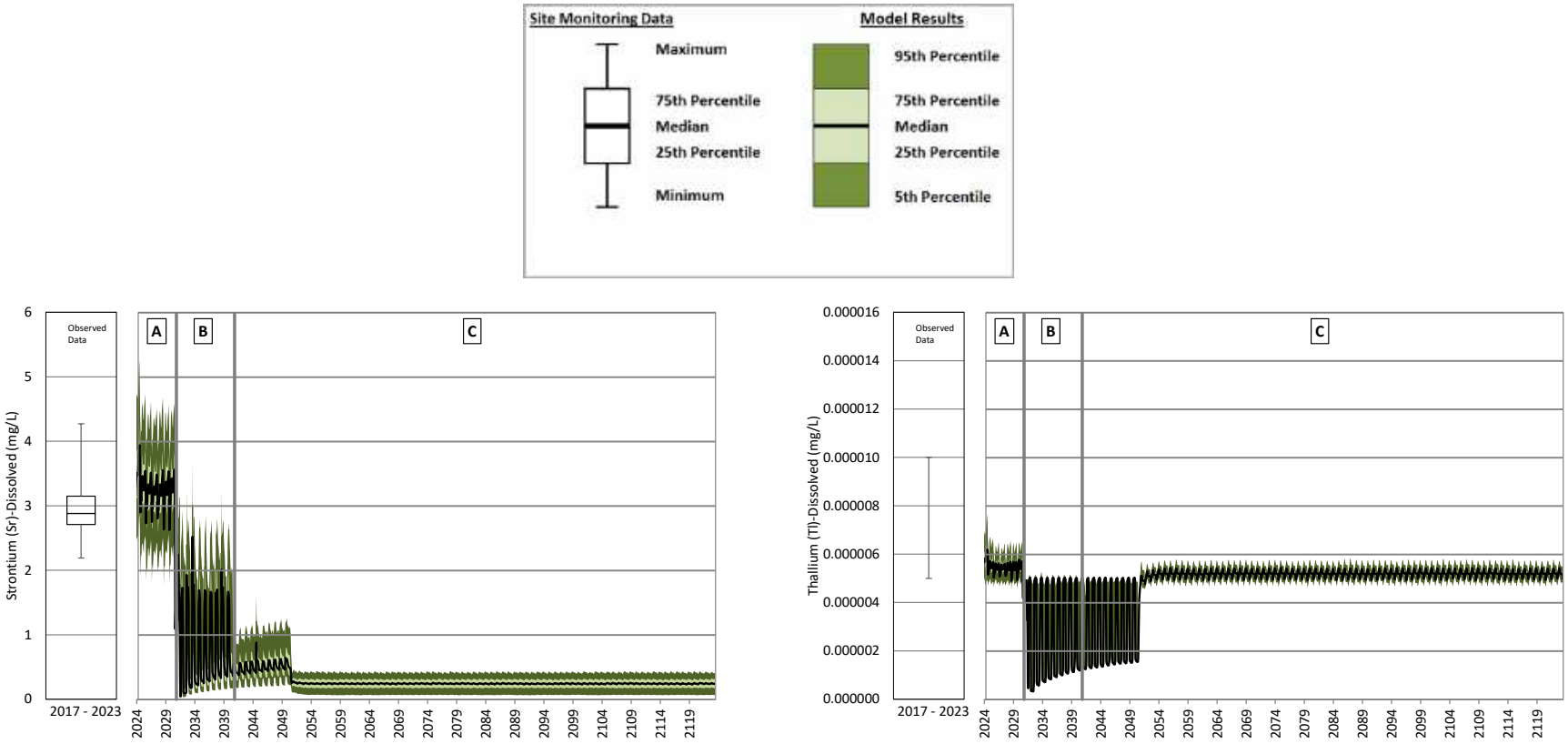
Figure B **215: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved silver concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the disturbed runoff water quality input.

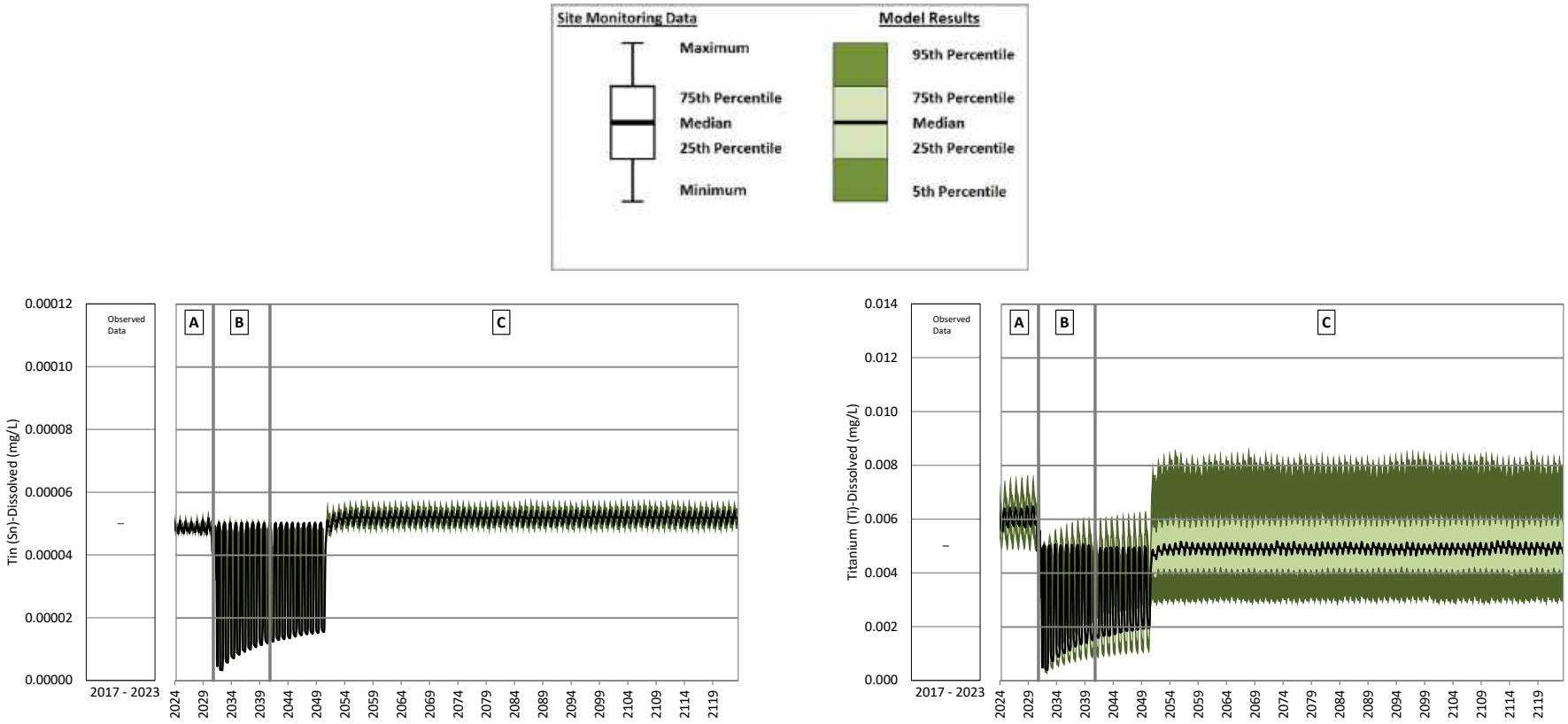
Figure B **216: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

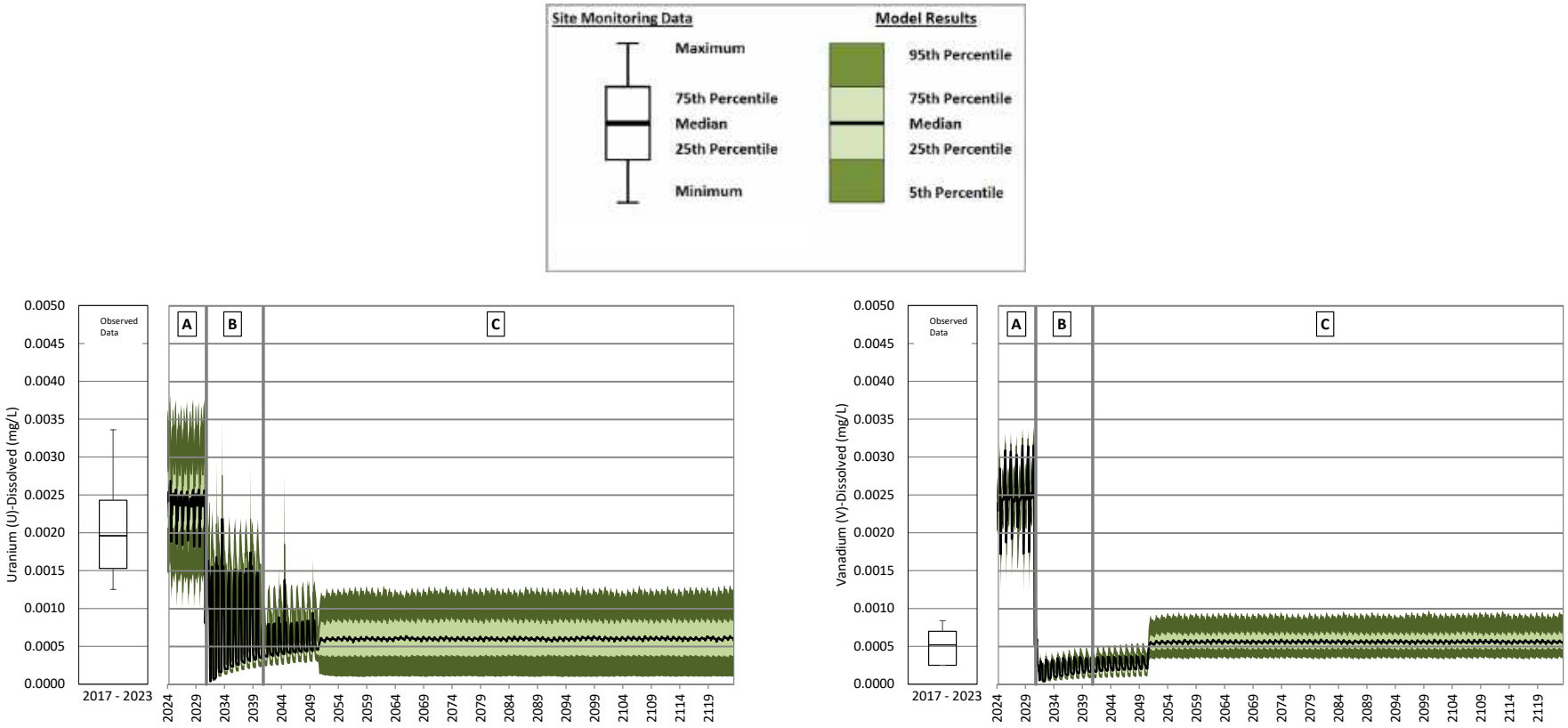
Figure B **217: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved titanium concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved titanium than the disturbed runoff water quality input.

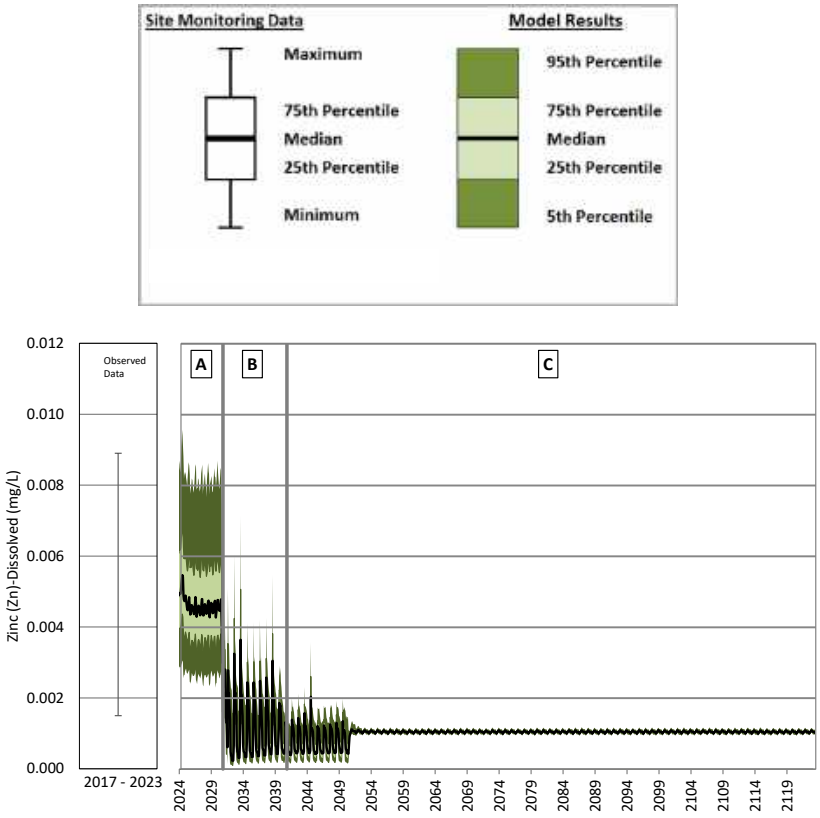
Figure B **218: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051. Dissolved vanadium concentrations increase ten years after the start of post-closure as mine site areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved vanadium than the disturbed runoff water quality input.

Figure B **219: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

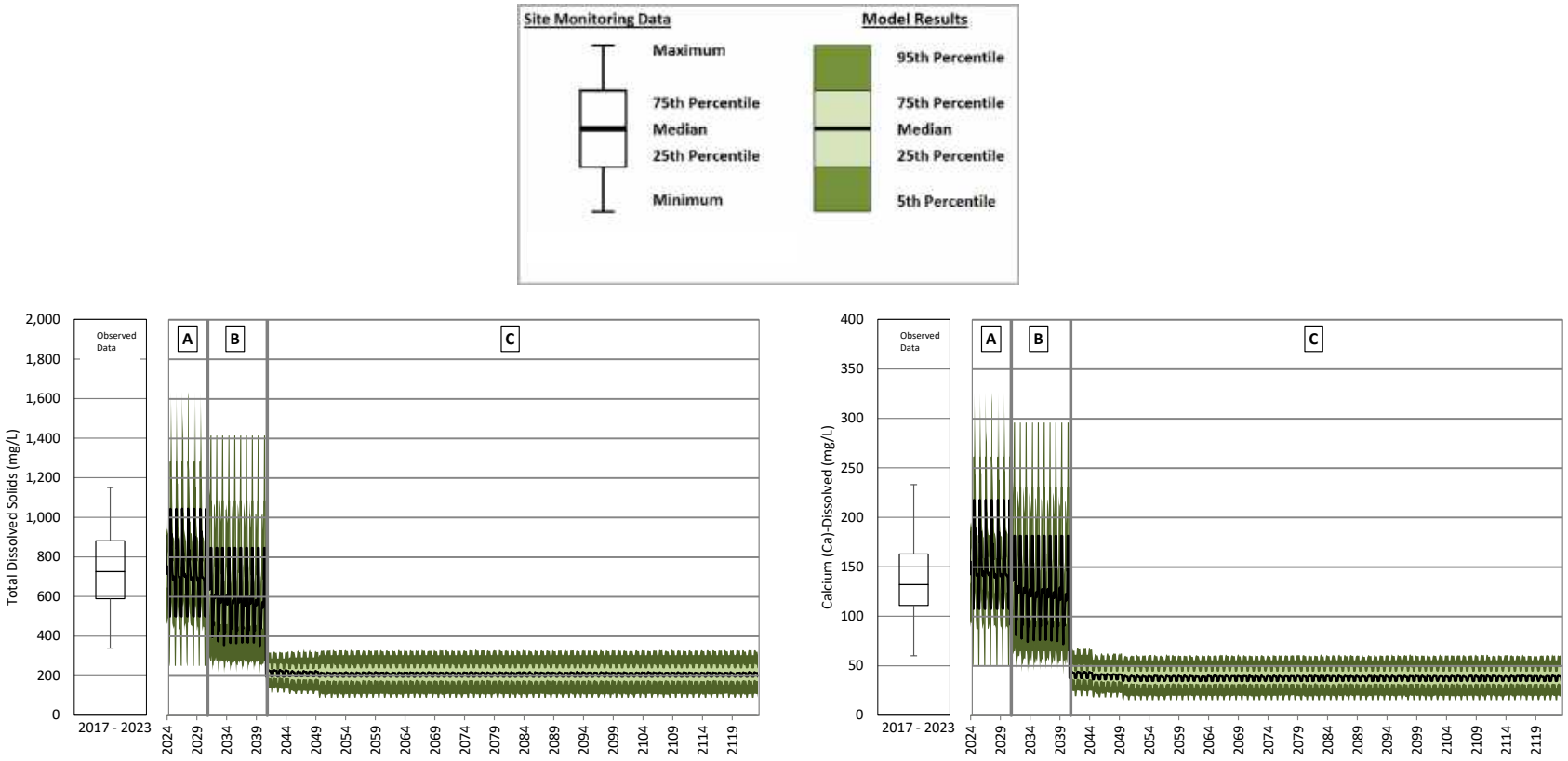


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and post-closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2051 is due to pumping from the SESCP to the MESCP which ends in 2051.

Figure B **220: Main Embankment Seepage Collection Pond Operations, Closure and Post-closure – Dissolved Zinc**

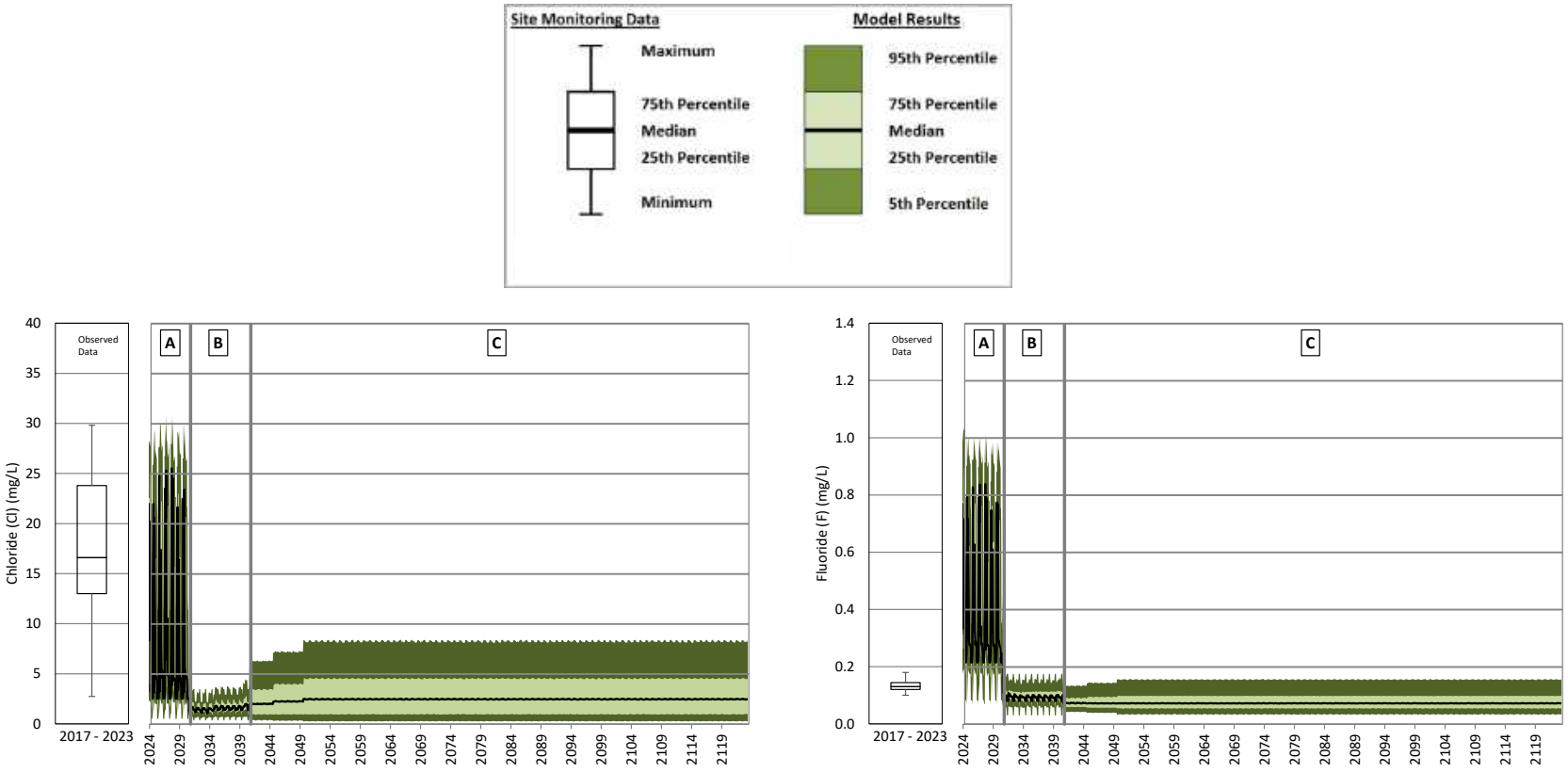
Mine Drainage Creek Sump Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

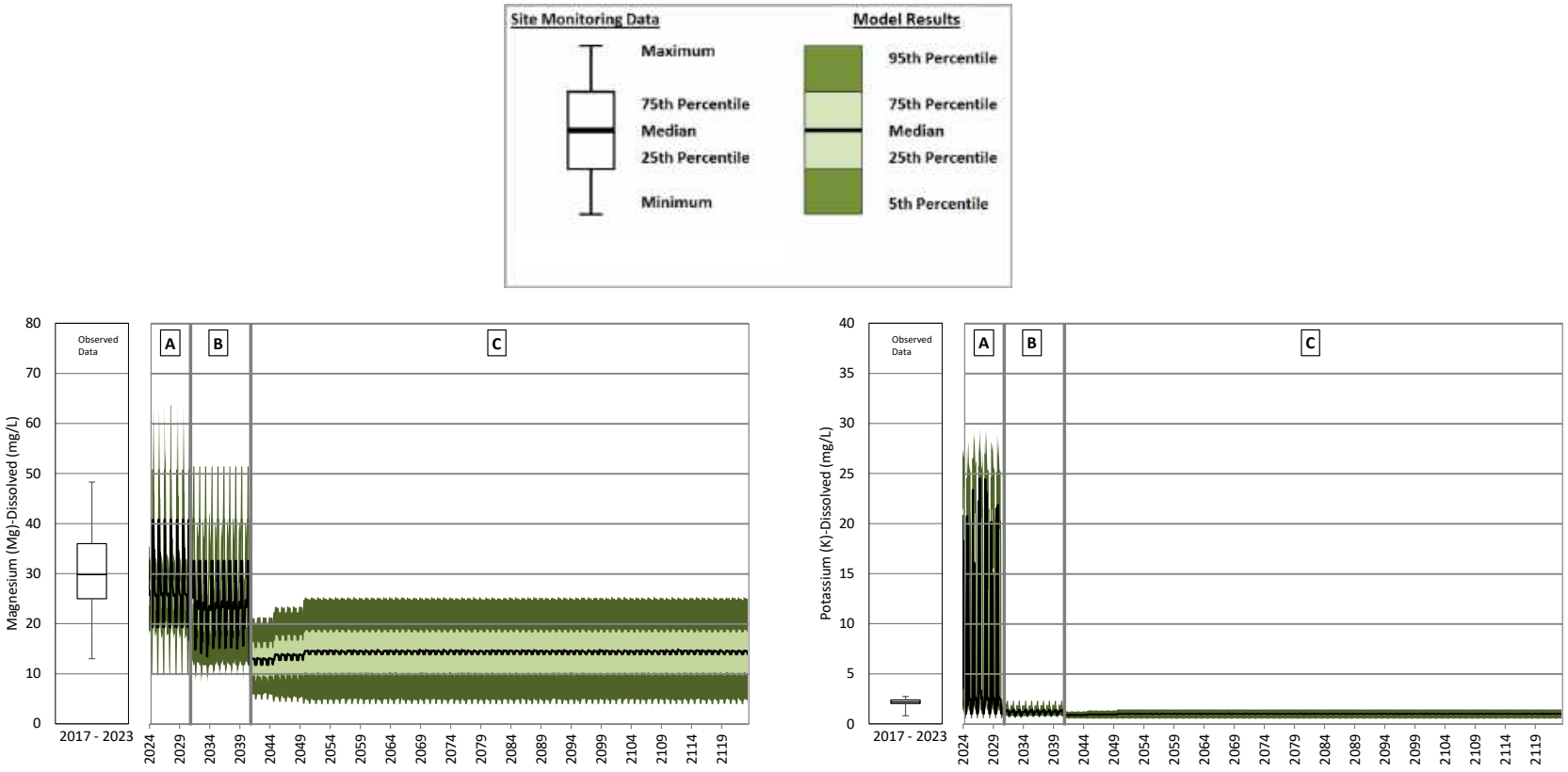
Figure B **221: Mine Drainage Creek Sump Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Chloride and fluoride concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for chloride and fluoride than the disturbed runoff water quality inputs.

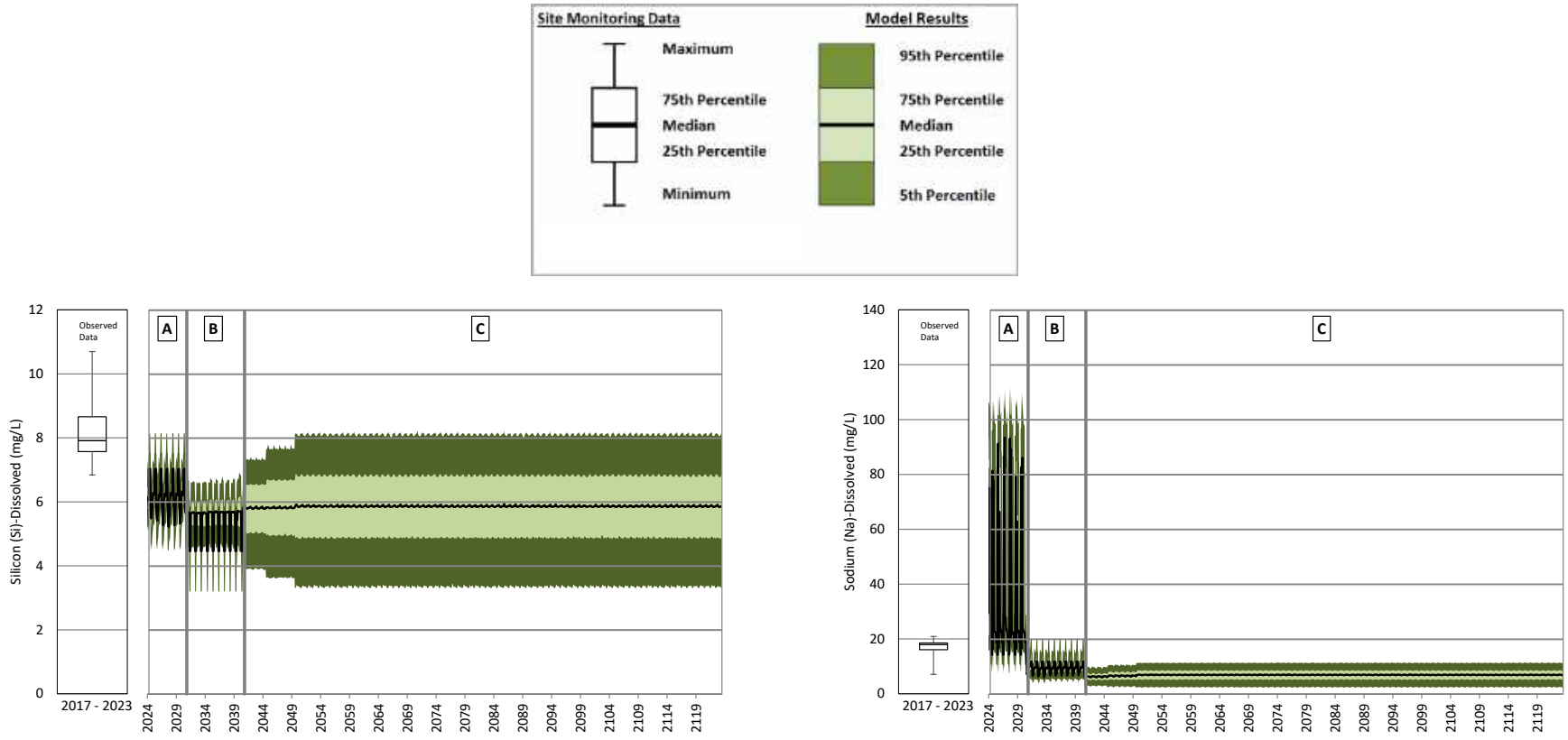
Figure B **222: Mine Drainage Creek Sump Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Magnesium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for magnesium than the disturbed runoff water quality inputs.

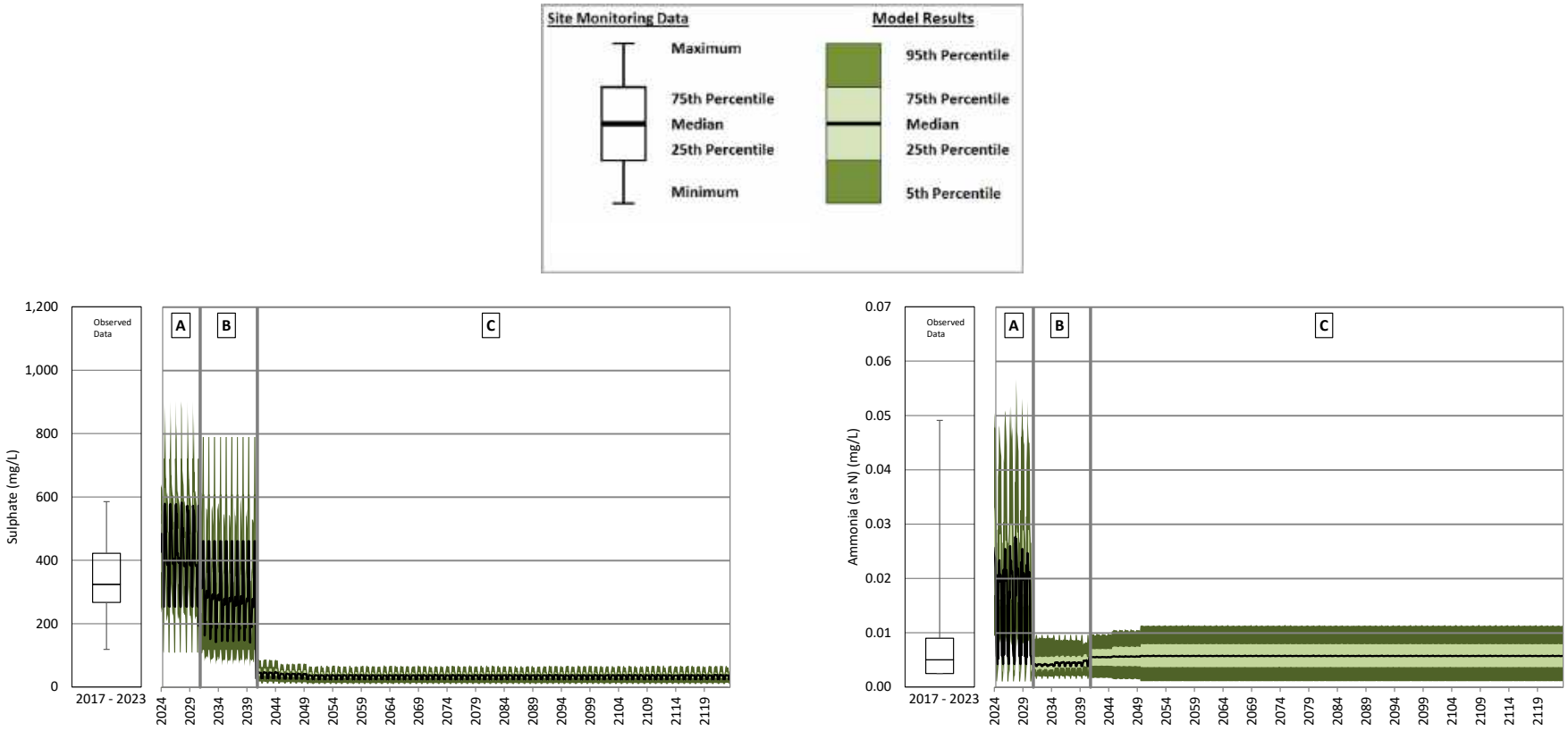
Figure B **223: Mine Drainage Creek Sump Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Silicon concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for silicon than the disturbed runoff water quality inputs.

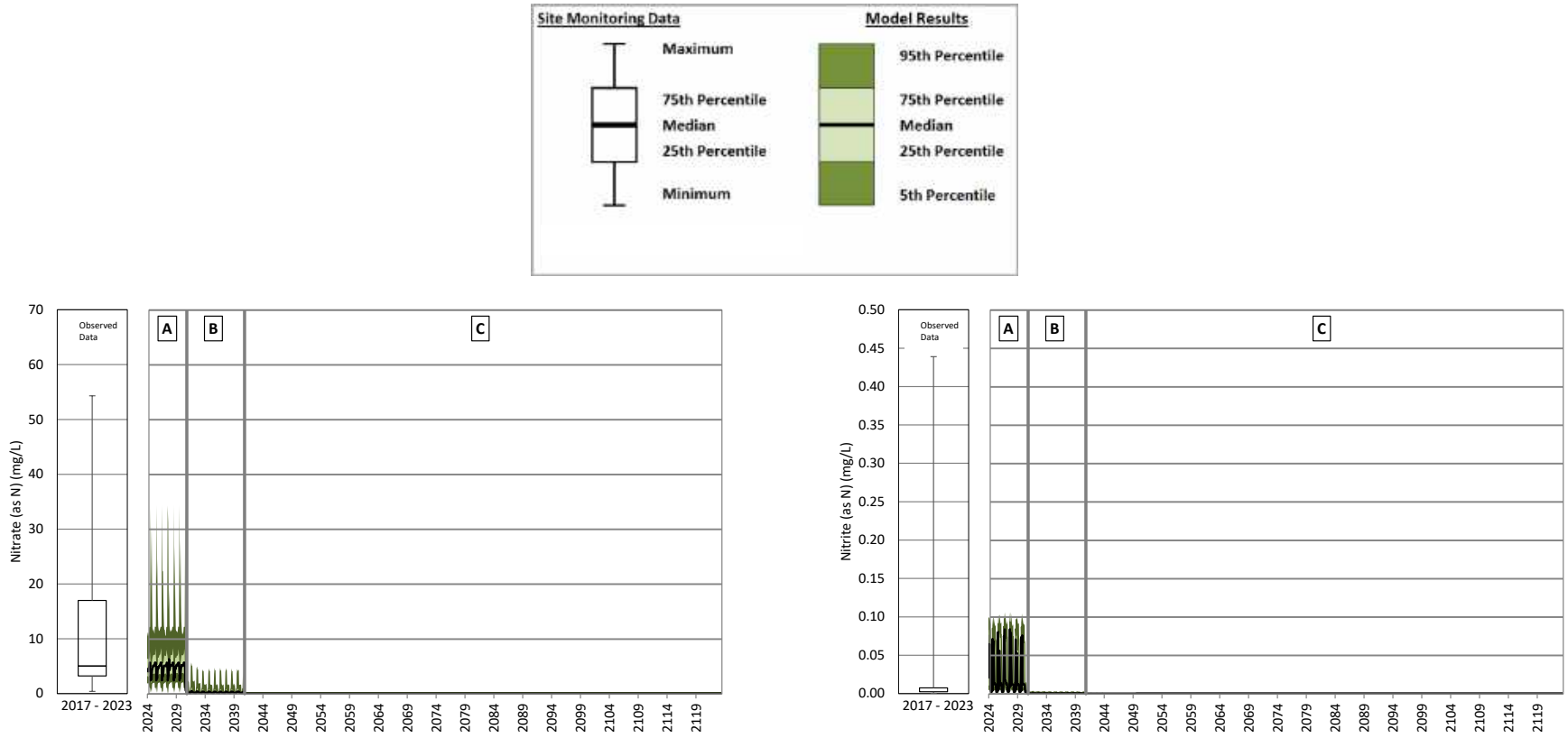
Figure B **224: Mine Drainage Creek Sump Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total ammonia concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for total ammonia than the disturbed runoff water quality inputs.

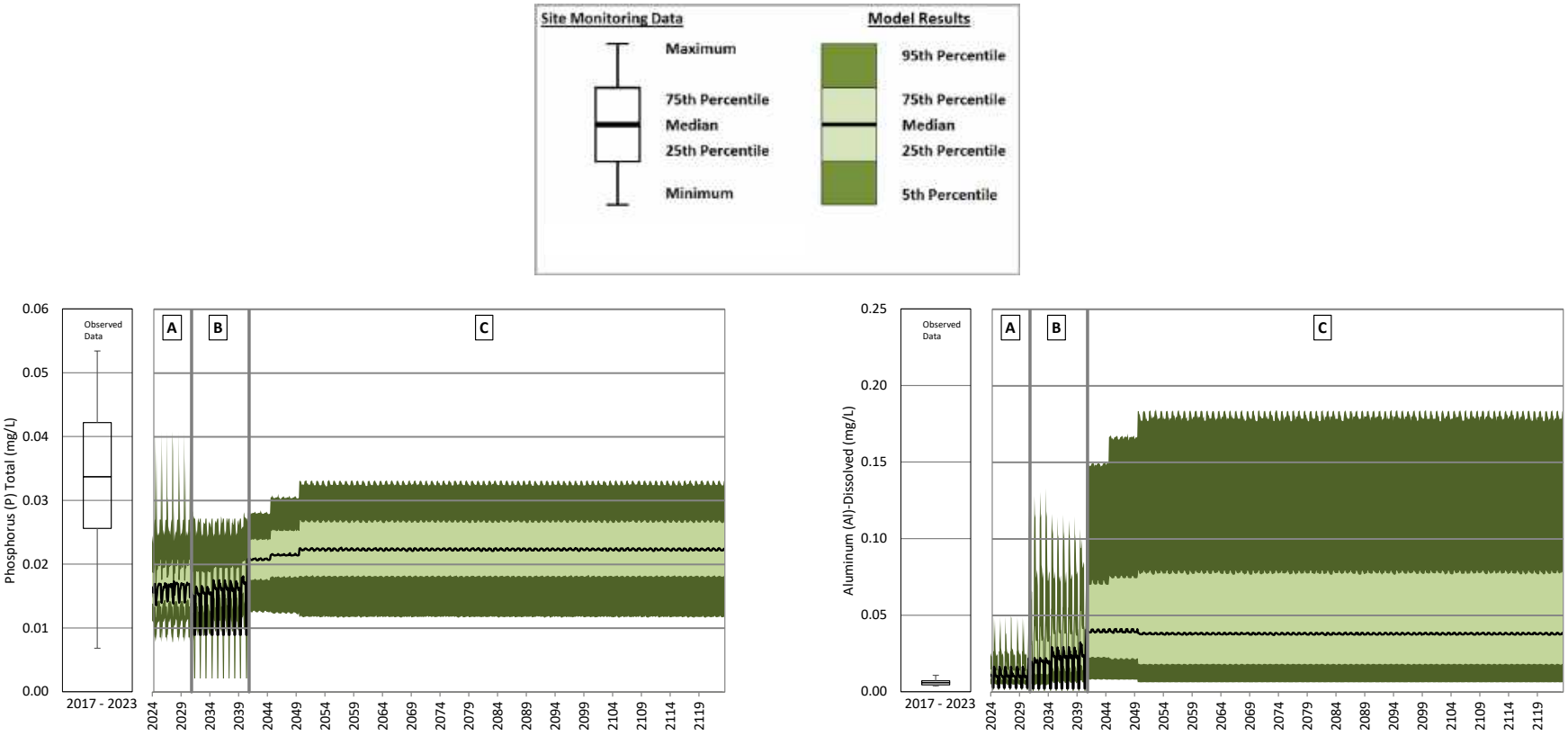
Figure B **225: Mine Drainage Creek Sump Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

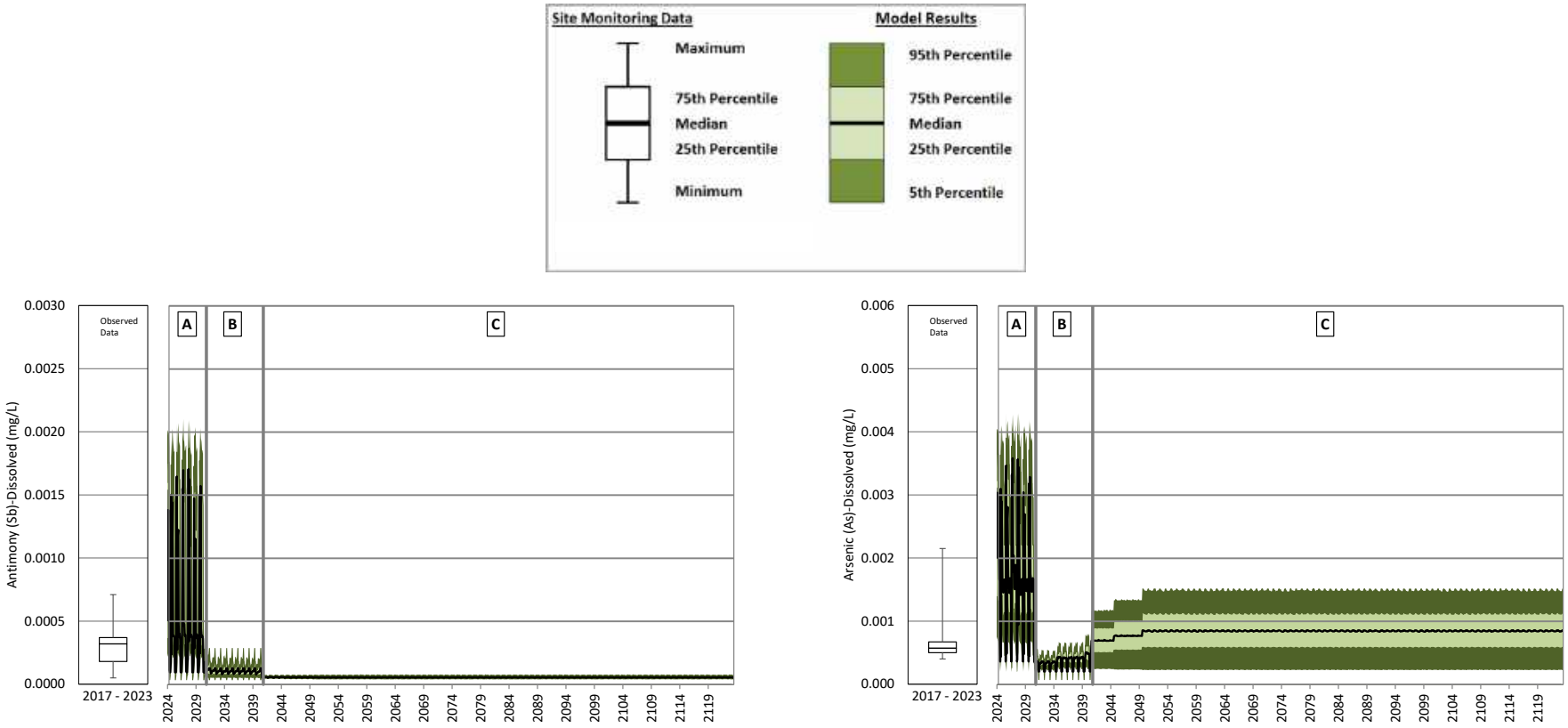
Figure B **226: Mine Drainage Creek Sump Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total phosphorus and dissolved aluminum concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the disturbed runoff and NAG waste rock water quality inputs.

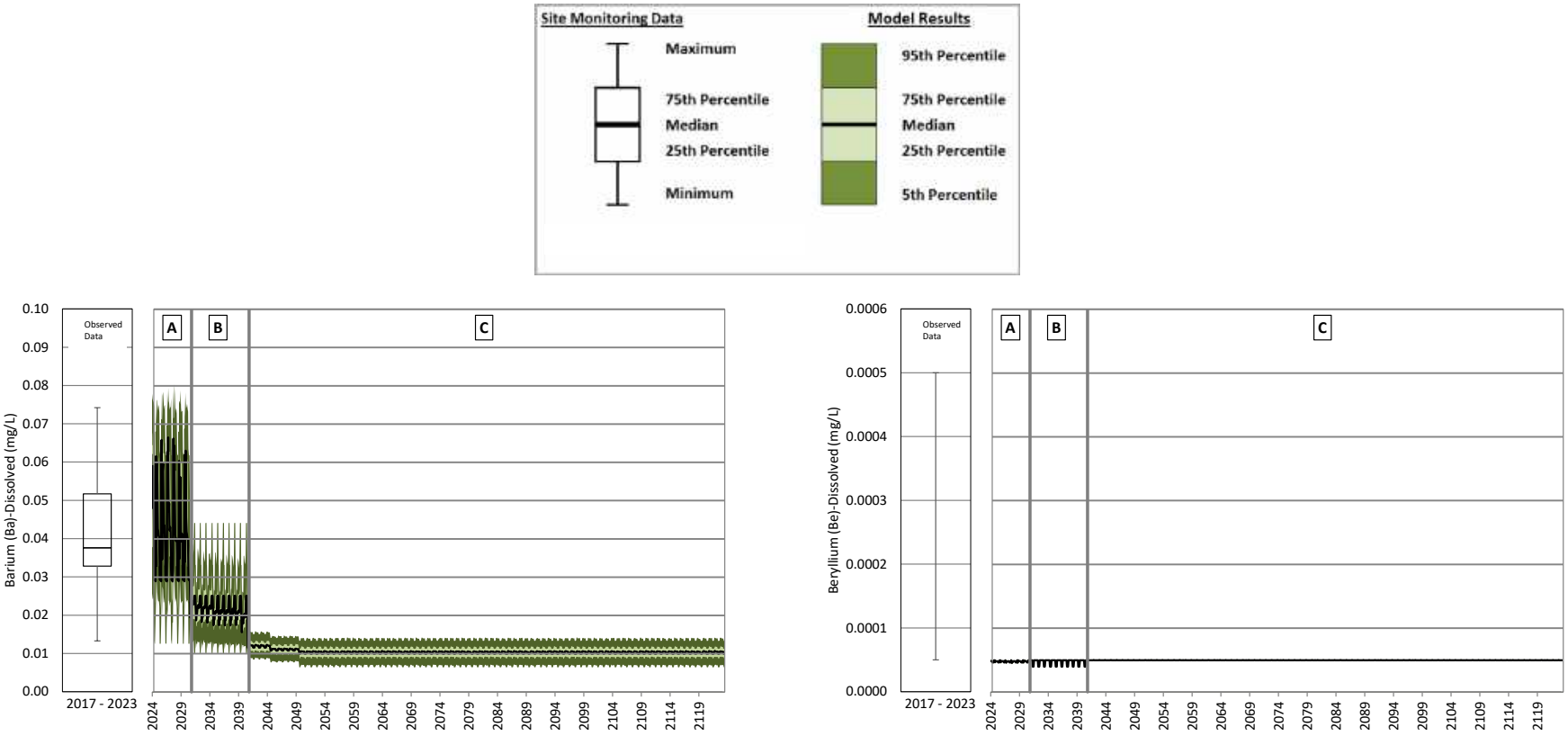
Figure B **227: Mine Drainage Creek Sump Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved arsenic concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved arsenic than the disturbed runoff water quality inputs.

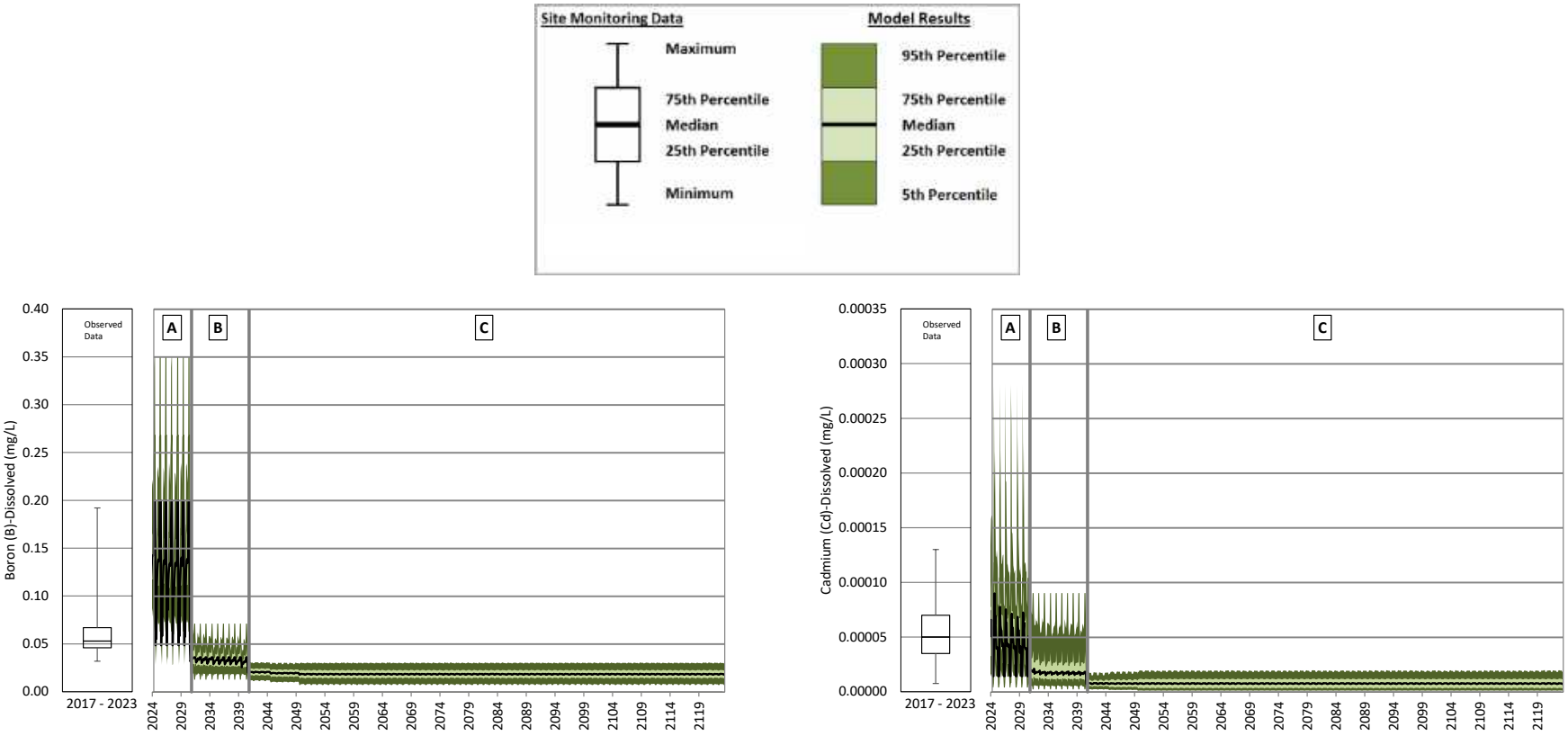
Figure B **228: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

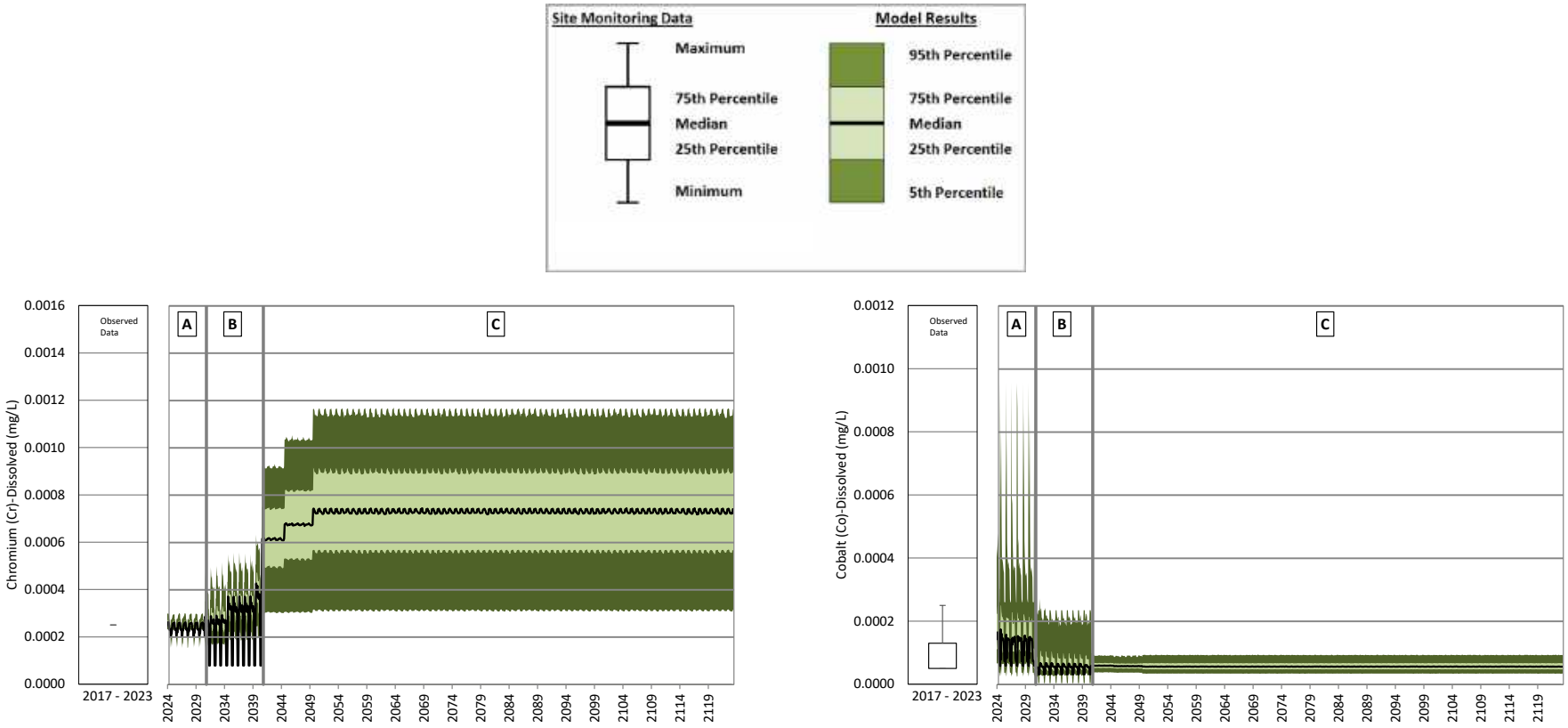
Figure B **229: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

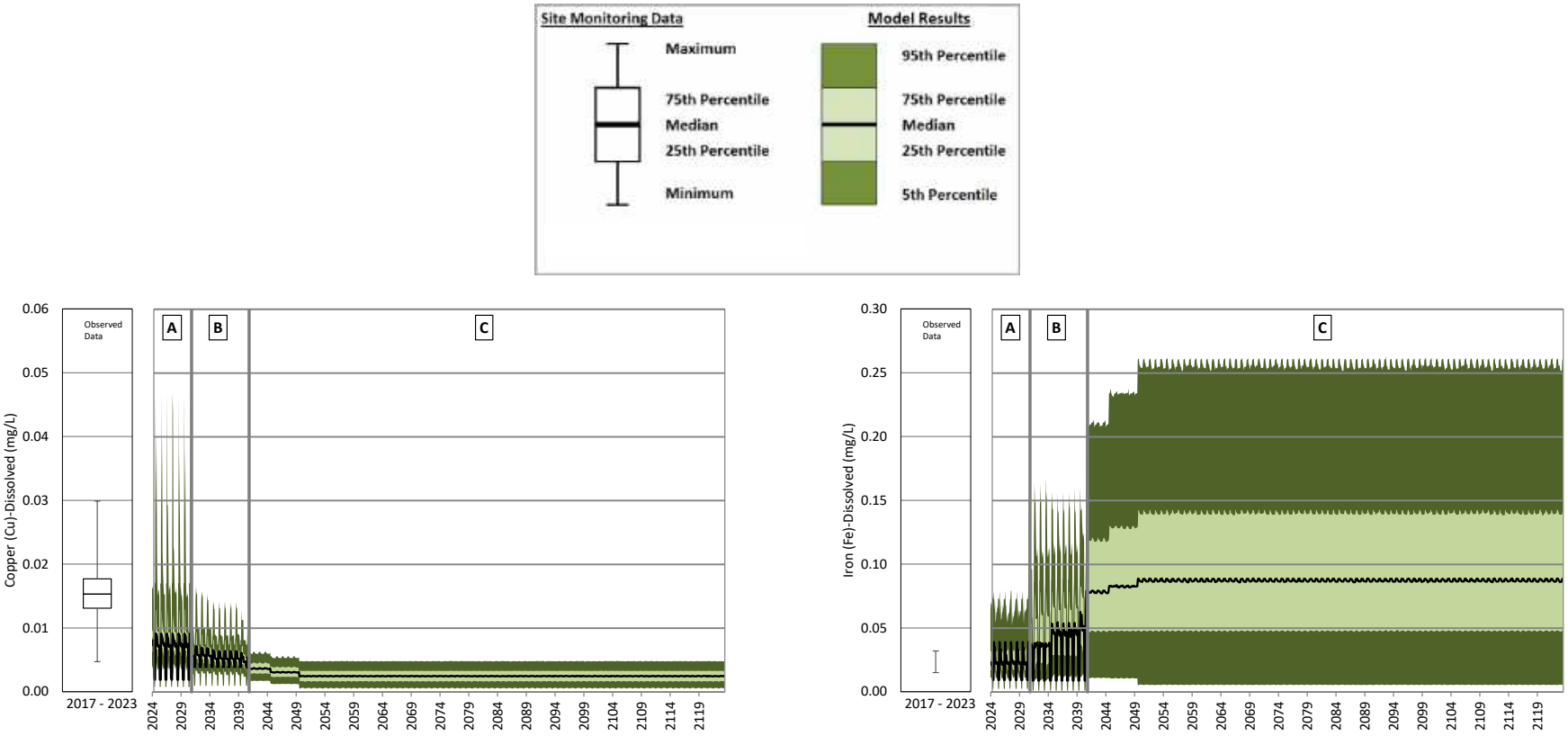
Figure B **230: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved chromium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the disturbed runoff and NAG waste rock water quality inputs.

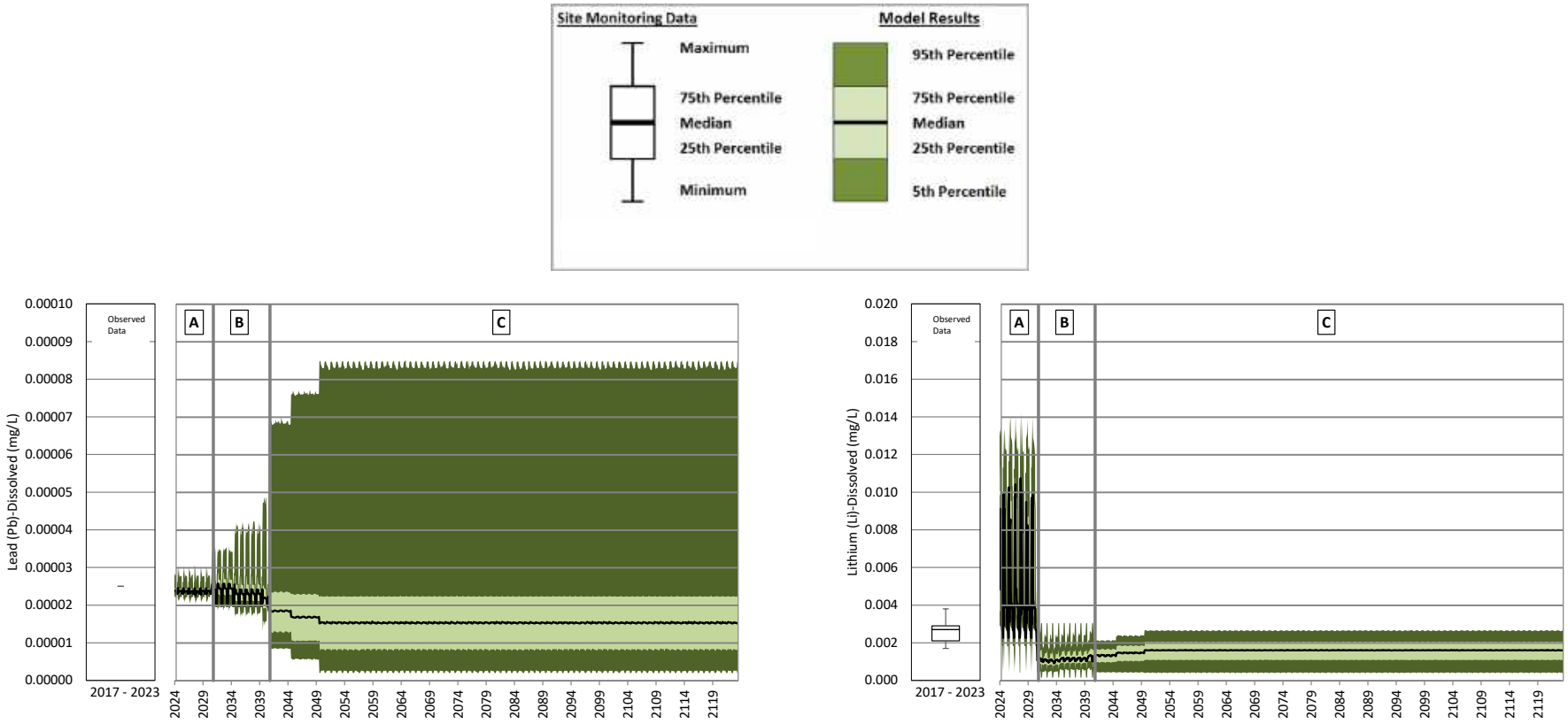
Figure B **231: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved iron concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the disturbed runoff water quality inputs.

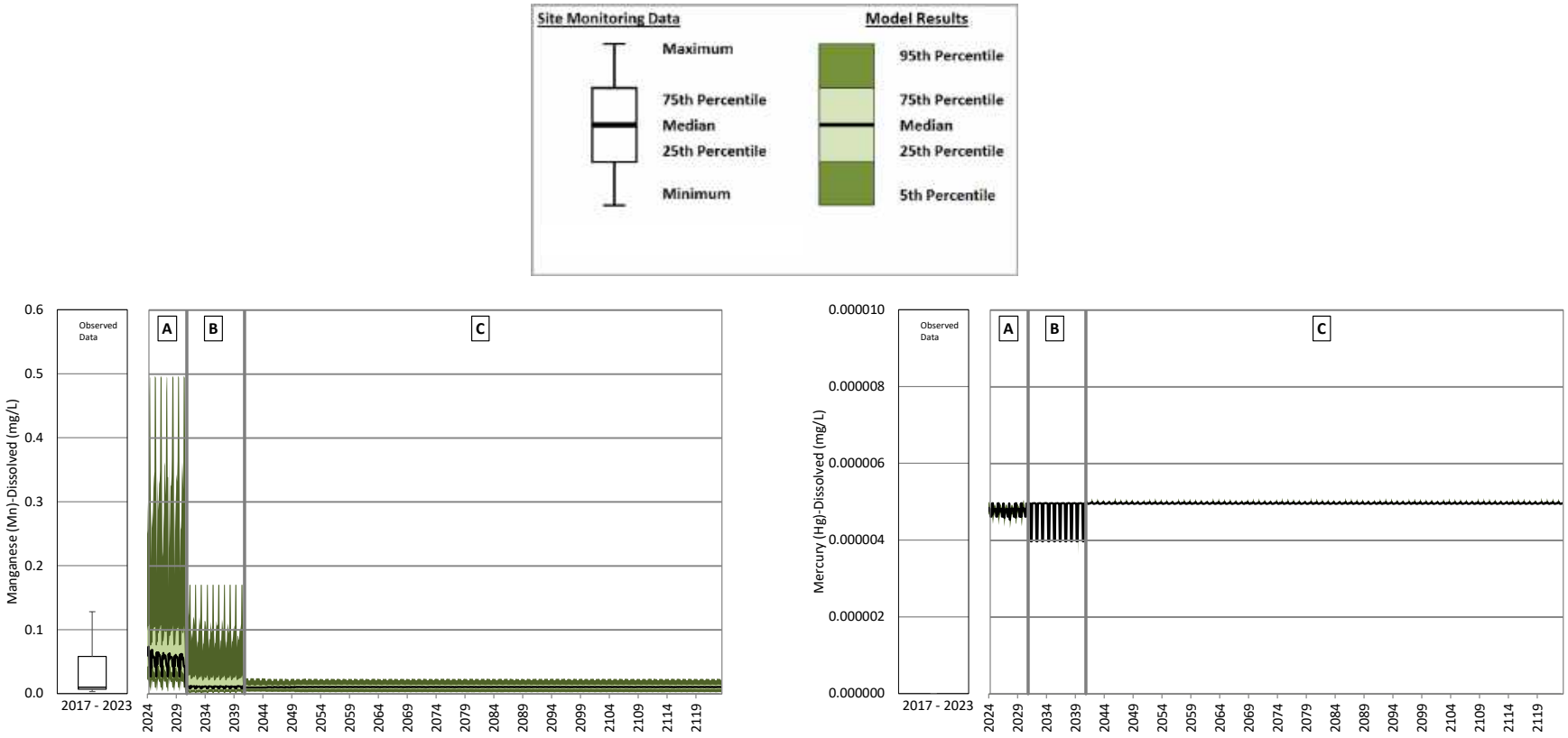
Figure B **232: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved lead and lithium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved lead and lithium than the disturbed runoff water quality inputs.

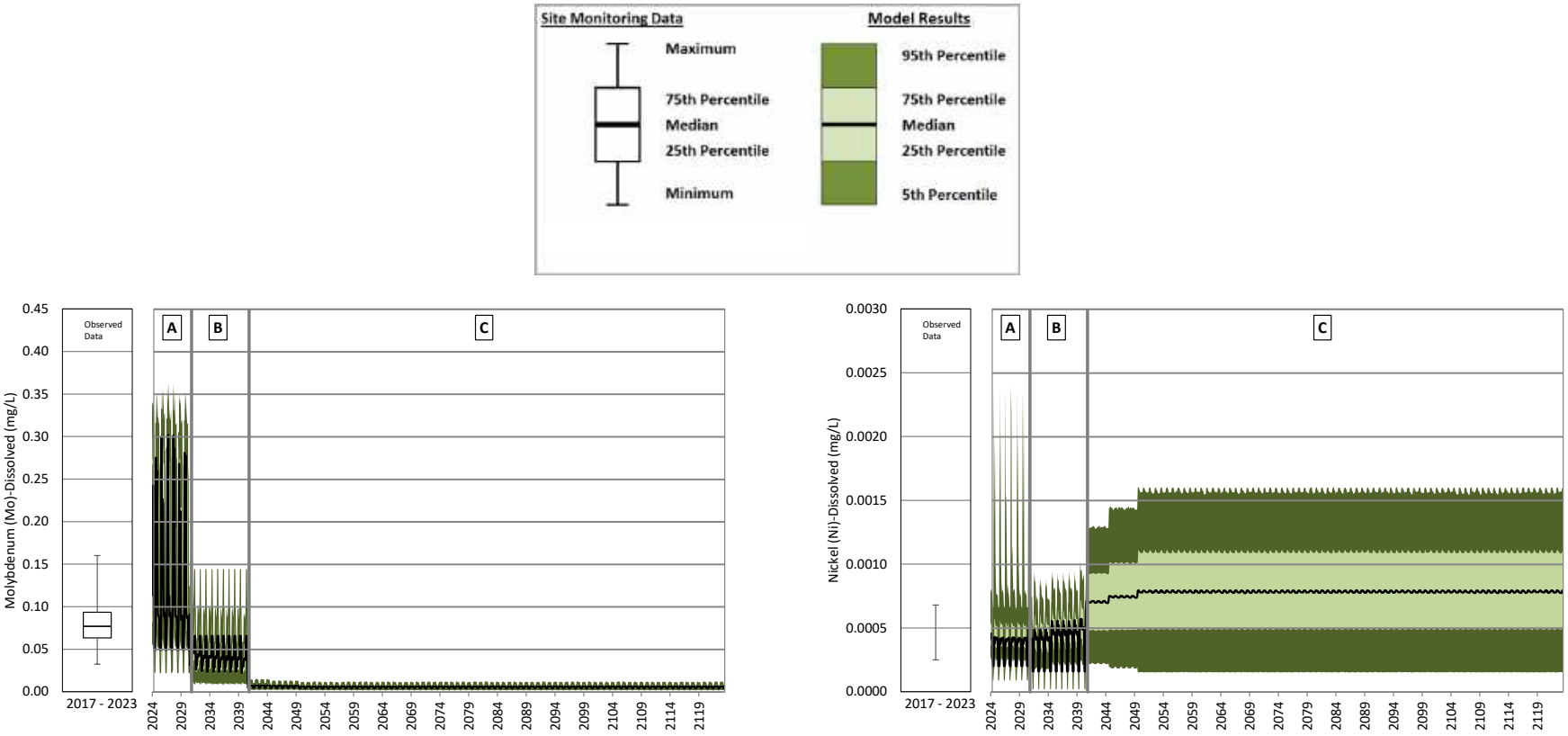
Figure B **233: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

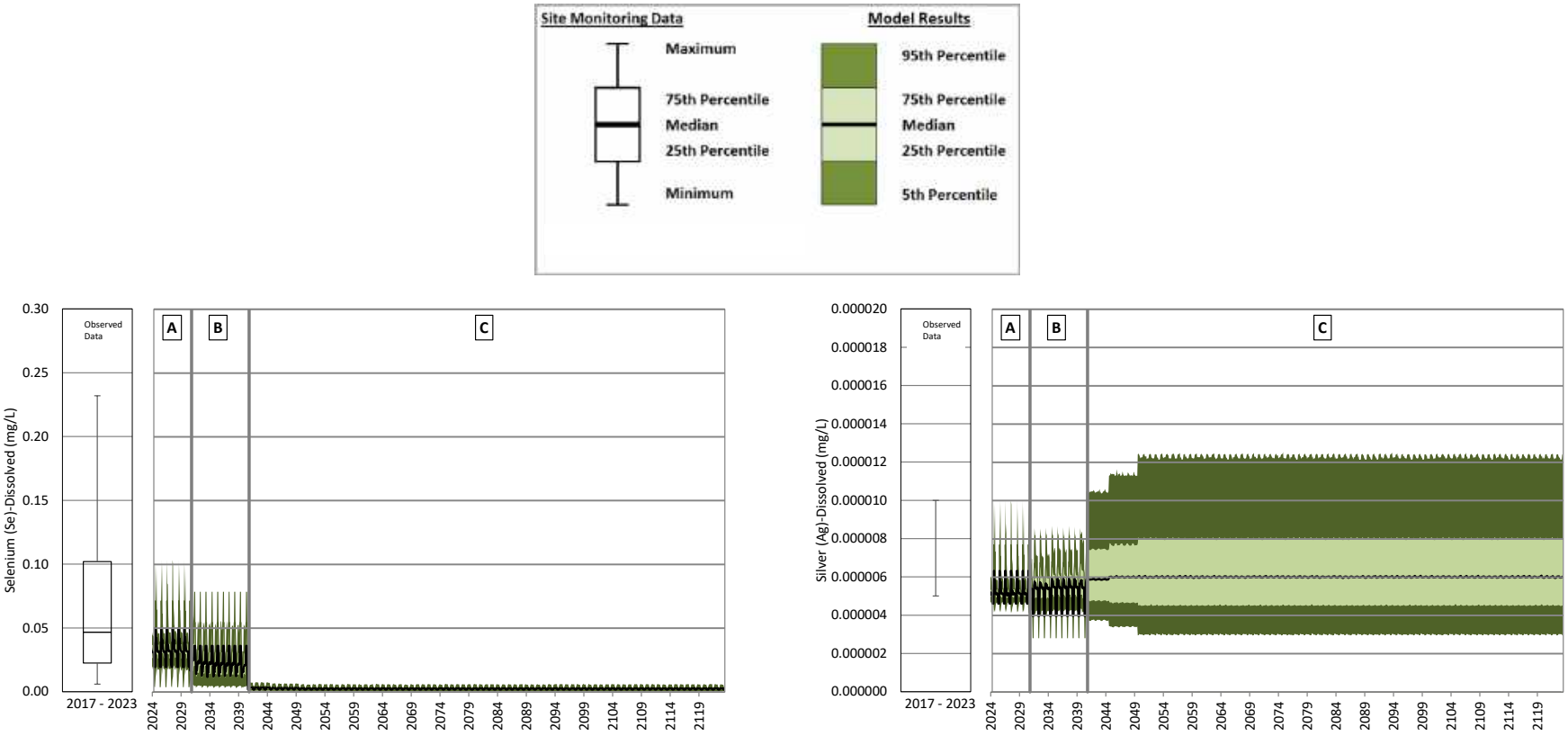
Figure B **234: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved nickel concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the disturbed runoff water quality inputs.

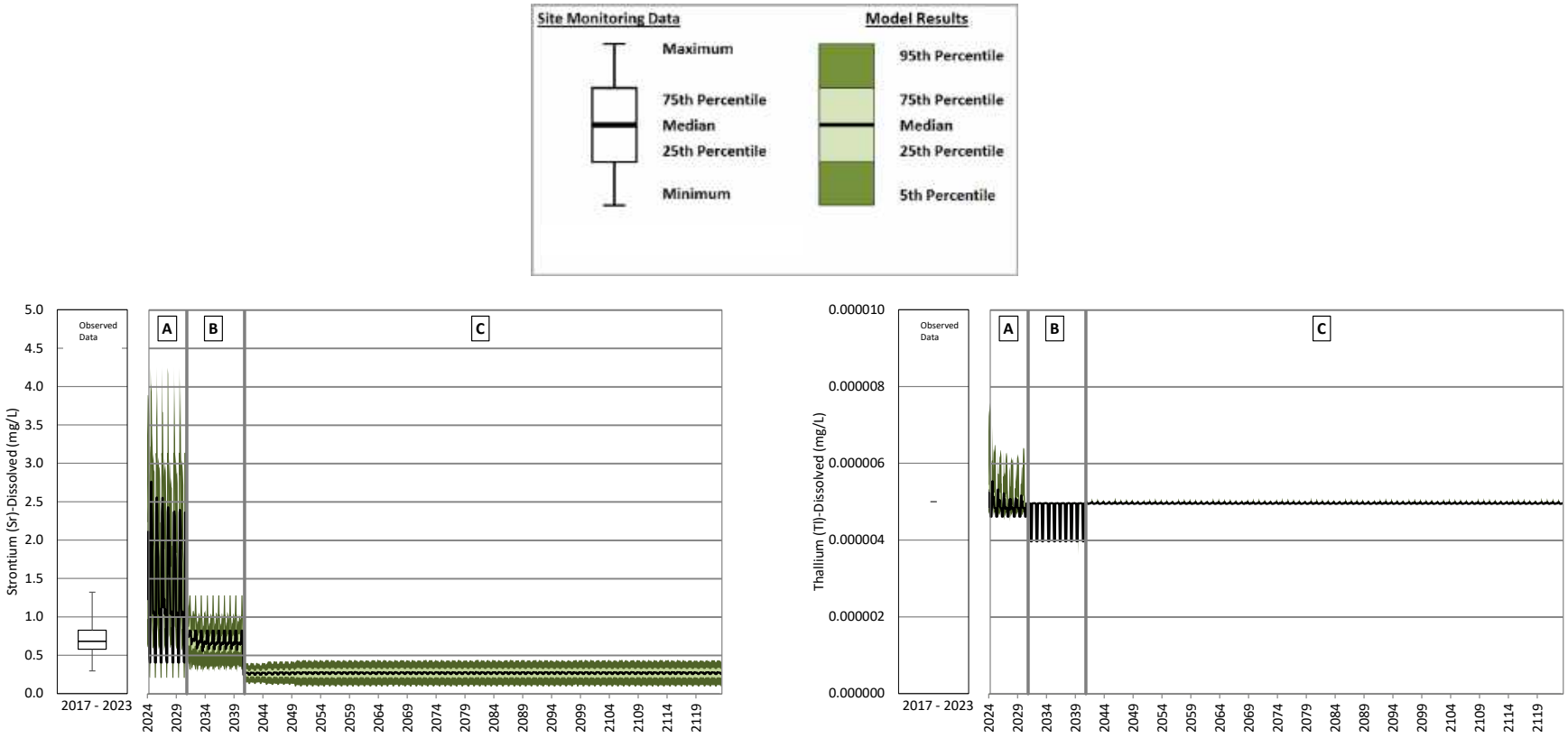
Figure B **235: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved silver concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the disturbed runoff water quality inputs.

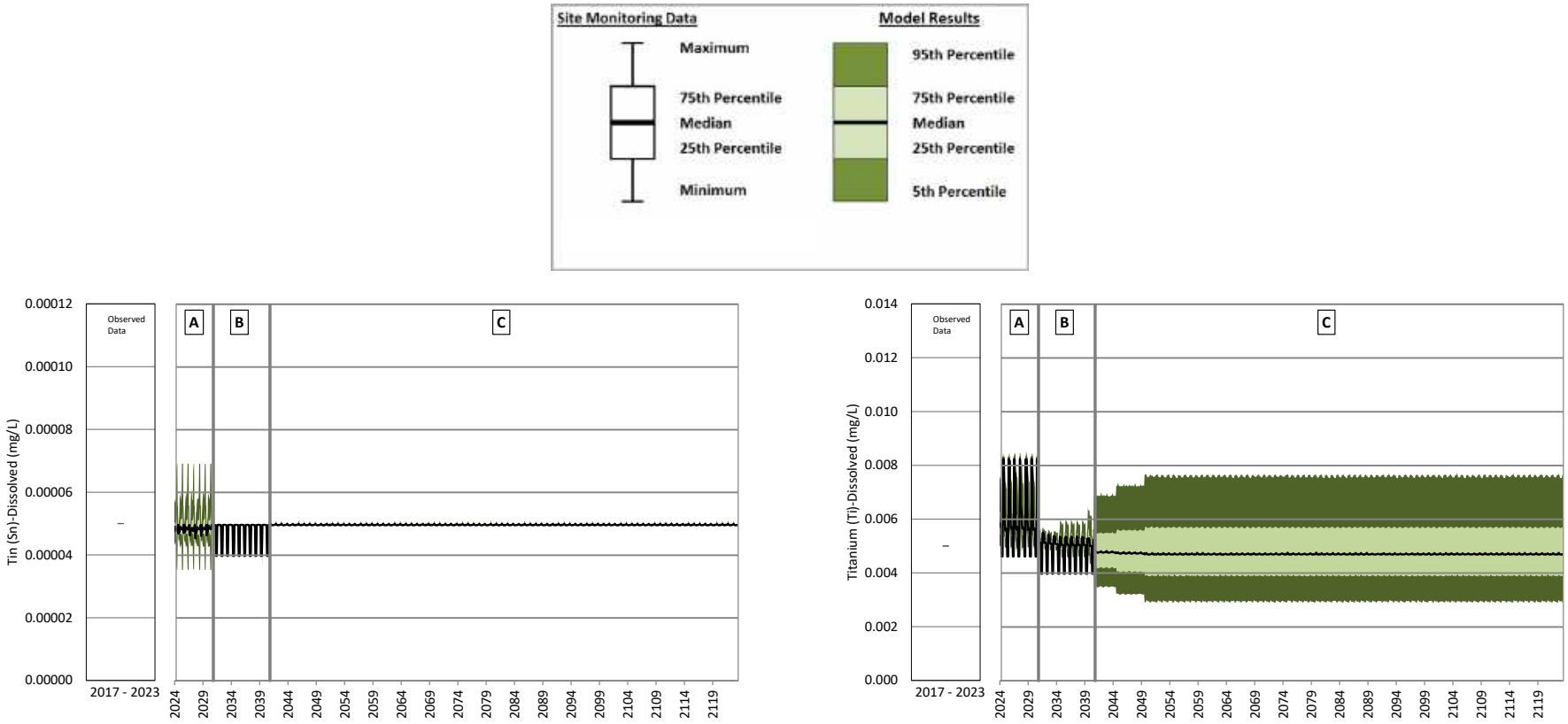
Figure B **236: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

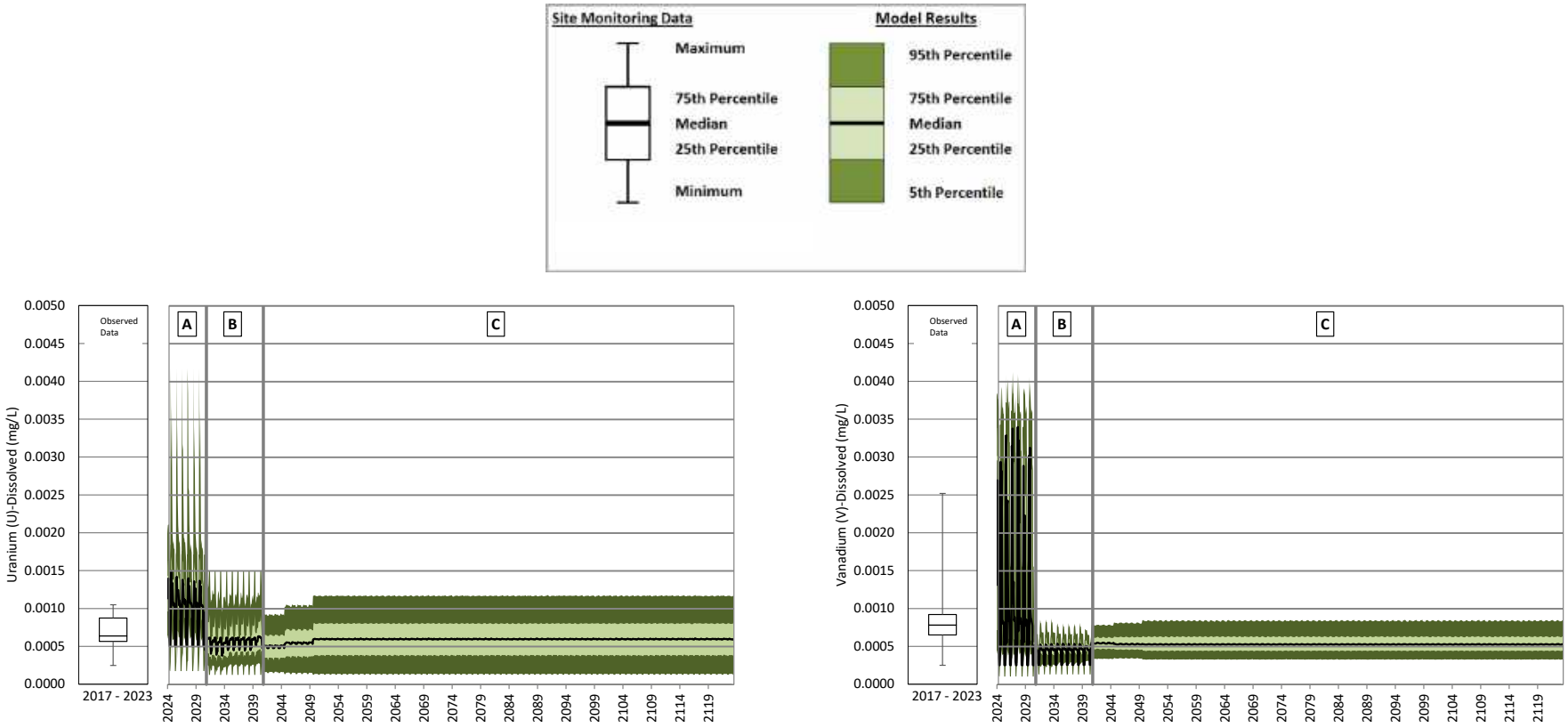
Figure B **237: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved titanium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved titanium than the disturbed runoff water quality inputs.

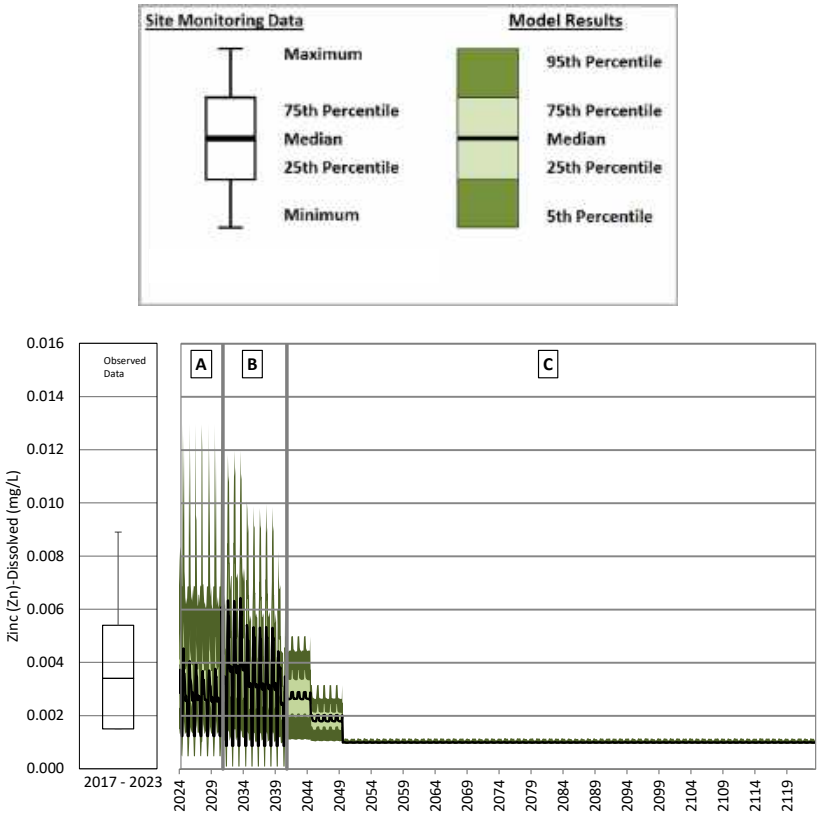
Figure B **238: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved uranium and dissolved vanadium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved uranium and vanadium than the disturbed runoff water quality inputs.

Figure B **239: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**

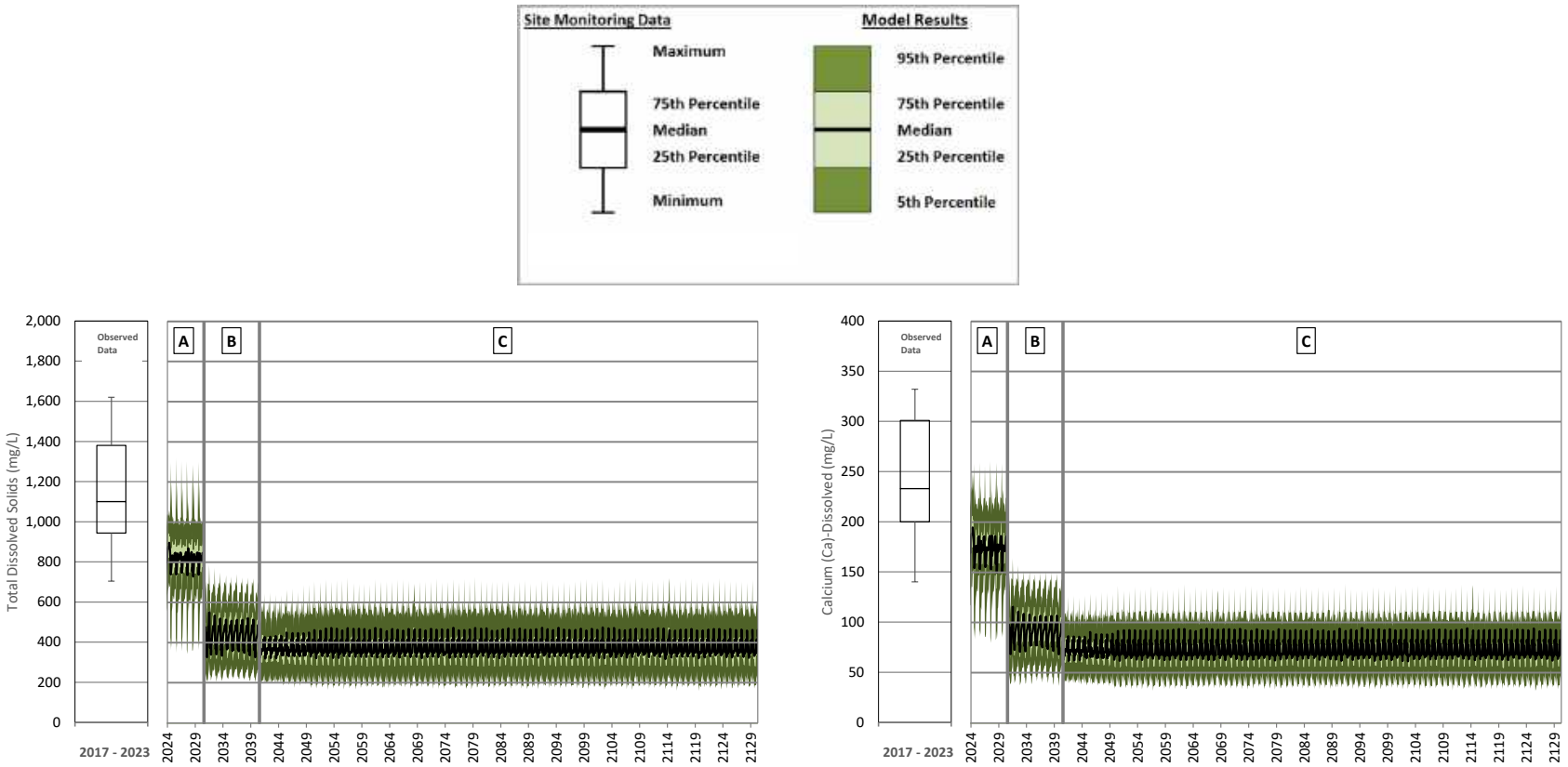


A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **240: Mine Drainage Creek Sump Operations, Closure and Post-closure – Dissolved Zinc**

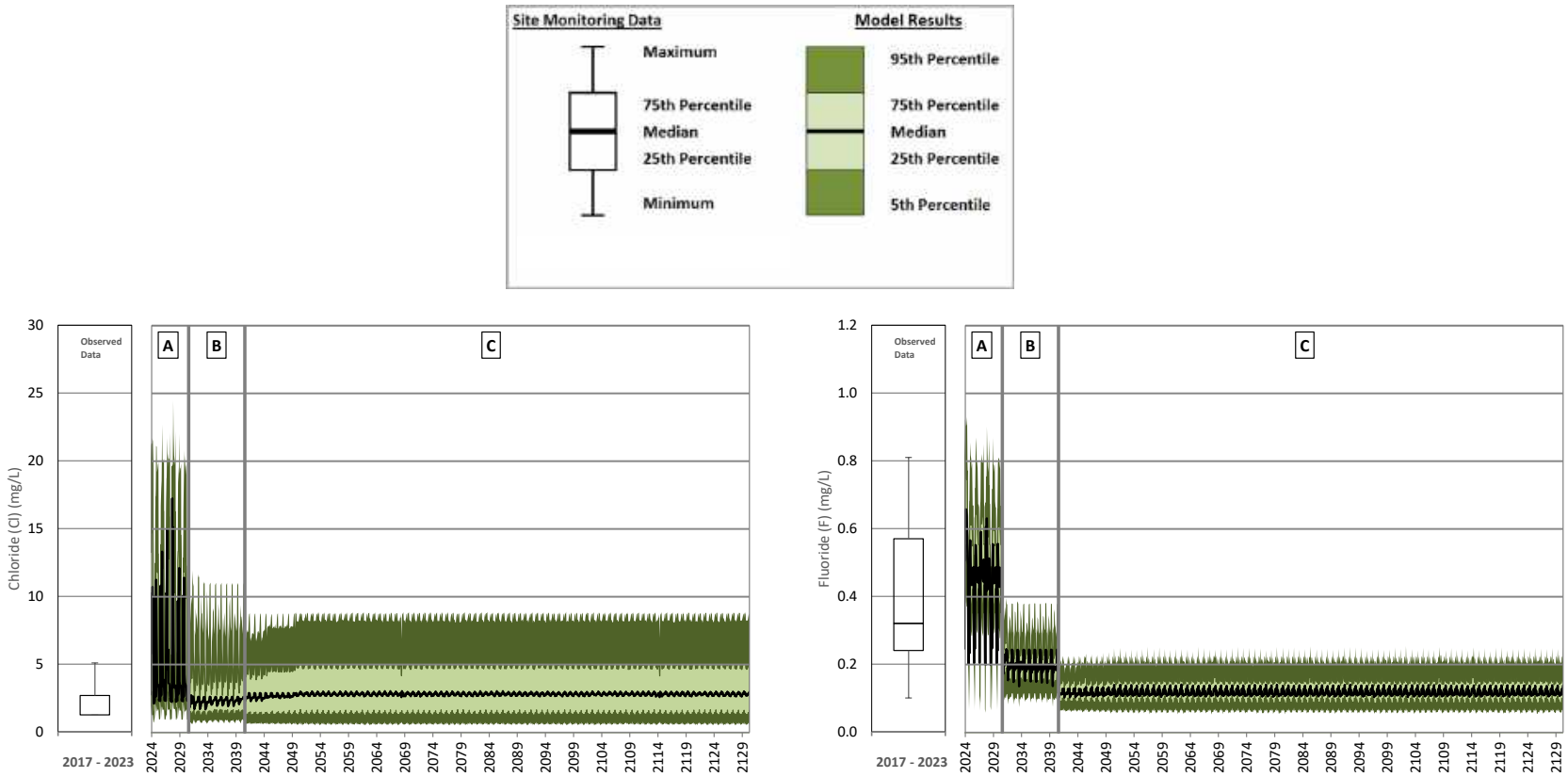
Long Ditch Operations, Closure and Post-closure



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

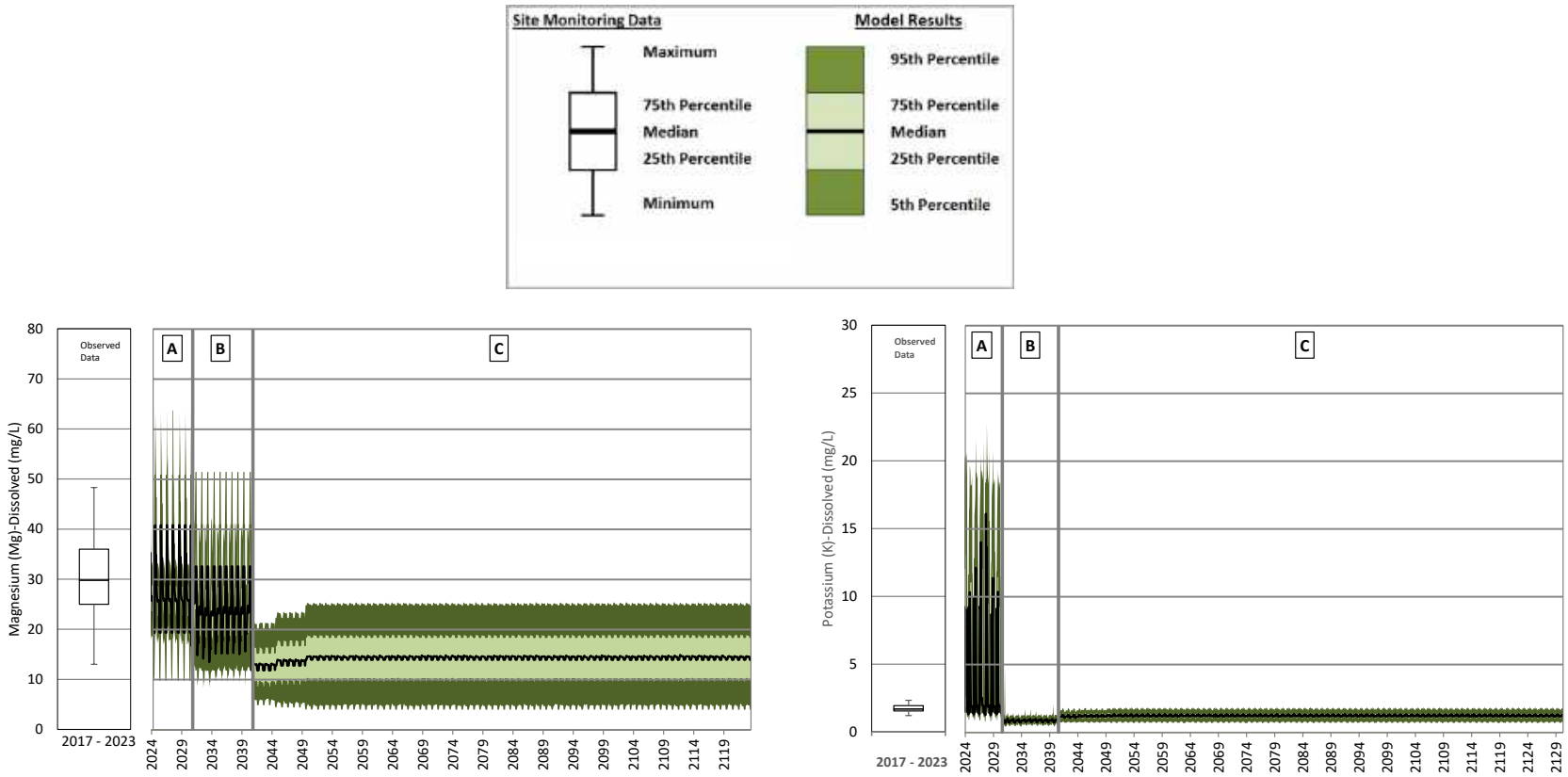
Figure B **241: Long Ditch Operations, Closure and Post-closure – Total Dissolved Solids and Calcium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Chloride and fluoride concentrations increase from closure to post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for chloride and fluoride than the disturbed runoff water quality inputs.

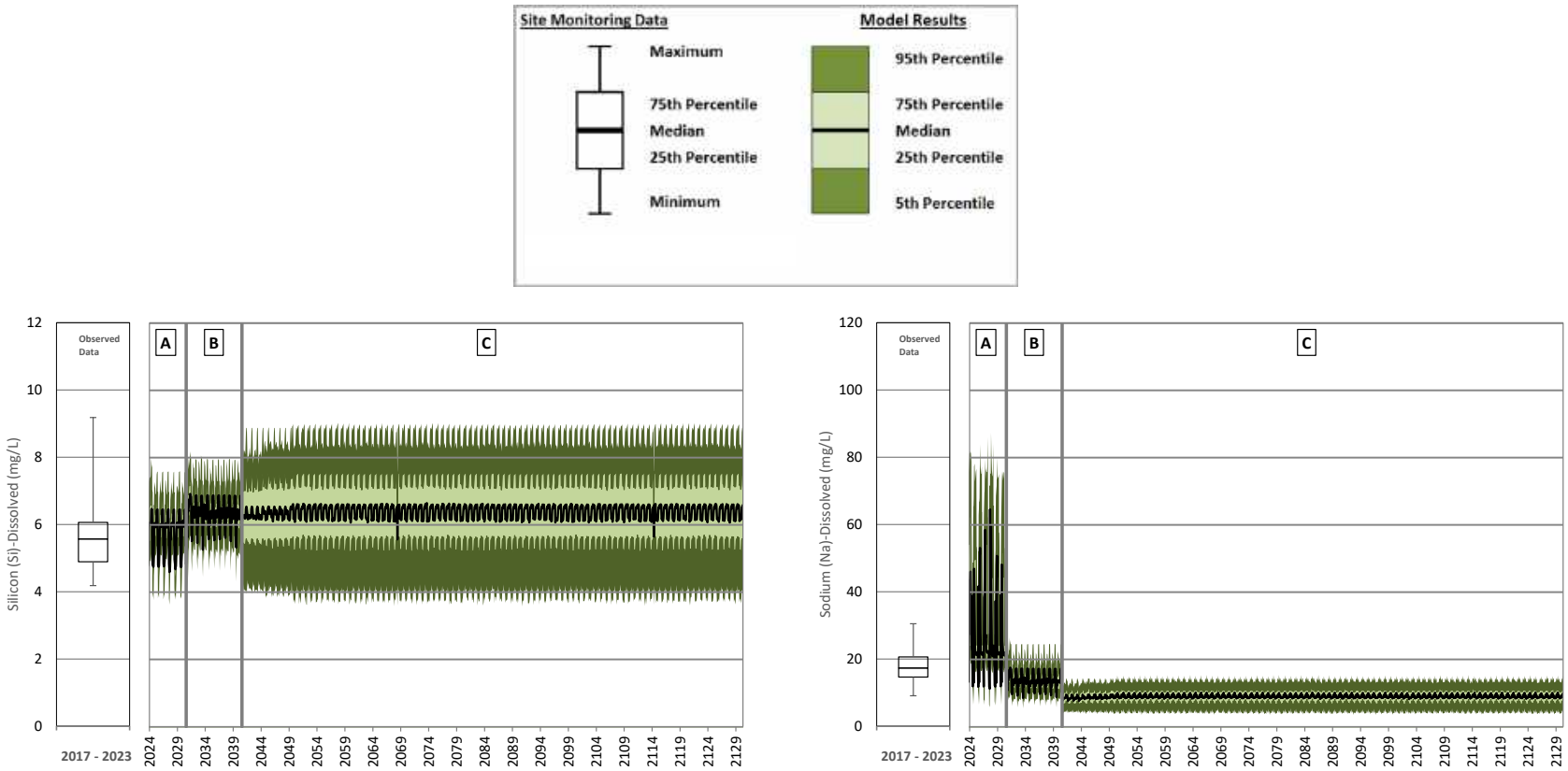
Figure B **242: Long Ditch Operations, Closure and Post-closure – Chloride and Fluoride**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Magnesium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for magnesium than the disturbed runoff water quality inputs.

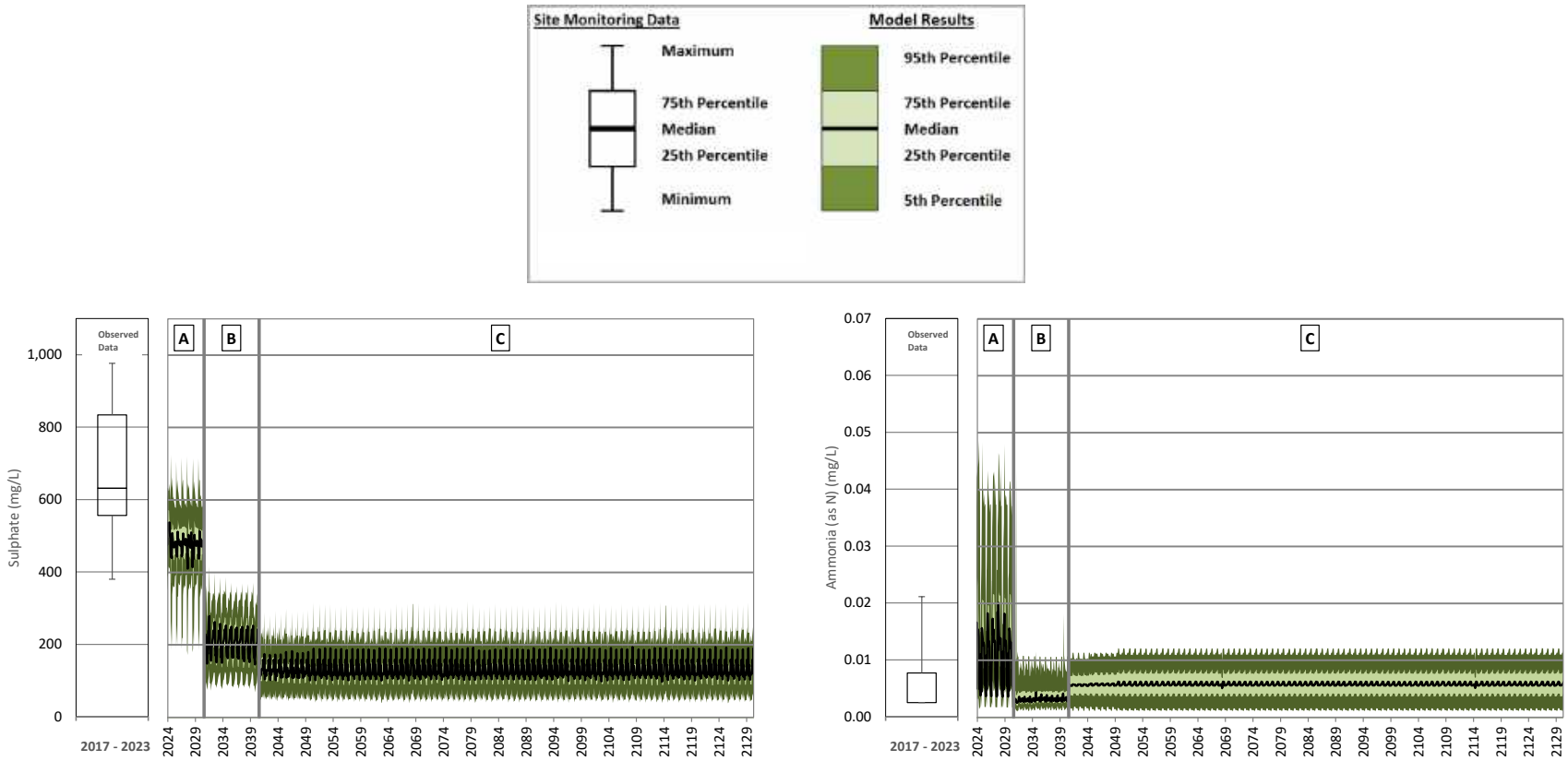
Figure B **243: Long Ditch Operations, Closure and Post-closure – Magnesium and Potassium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Silicon concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for silicon than the disturbed runoff water quality inputs.

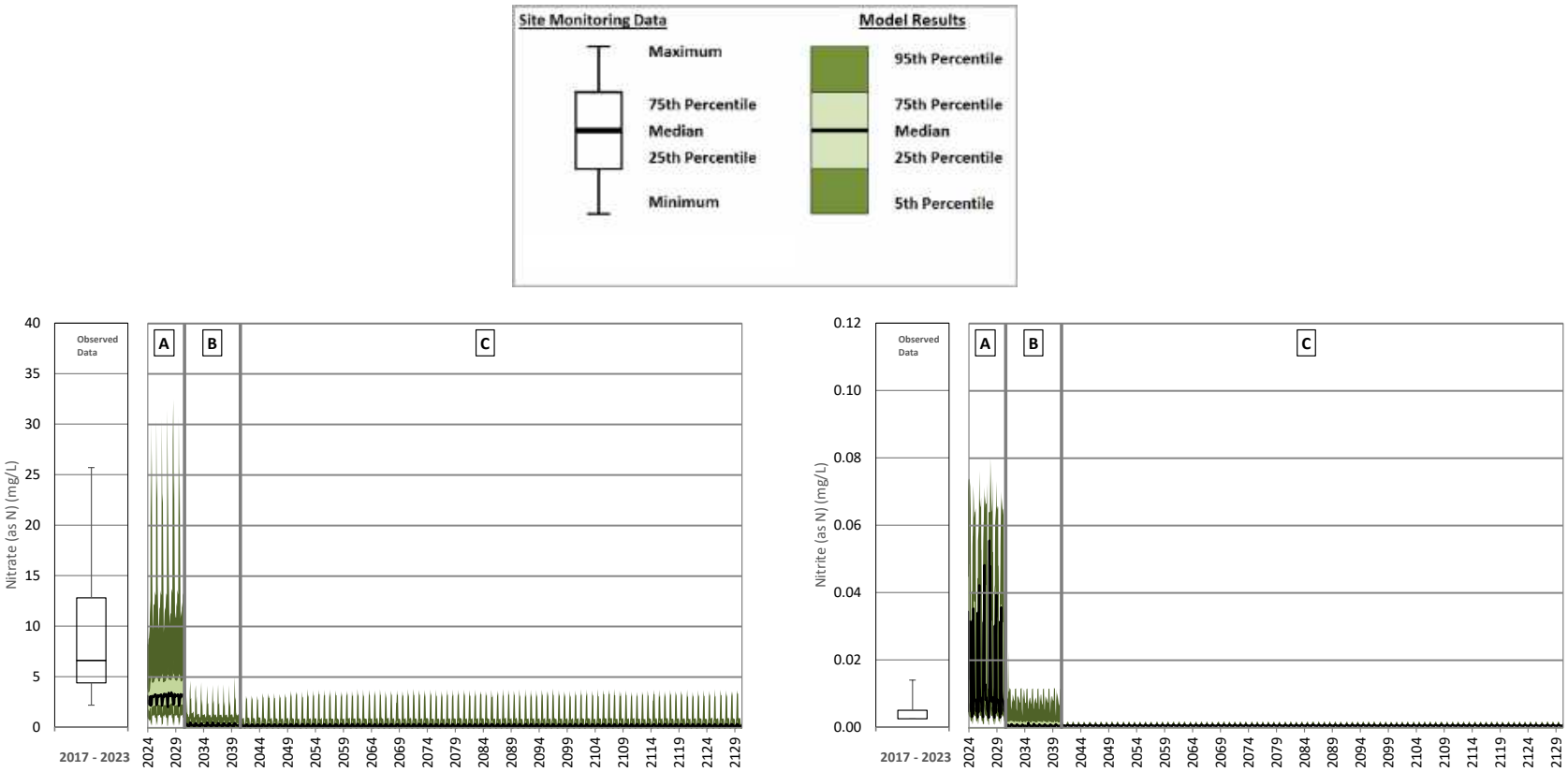
Figure B **244: Long Ditch Operations, Closure and Post-closure – Silicon and Sodium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total ammonia concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for total ammonia than the disturbed runoff water quality inputs.

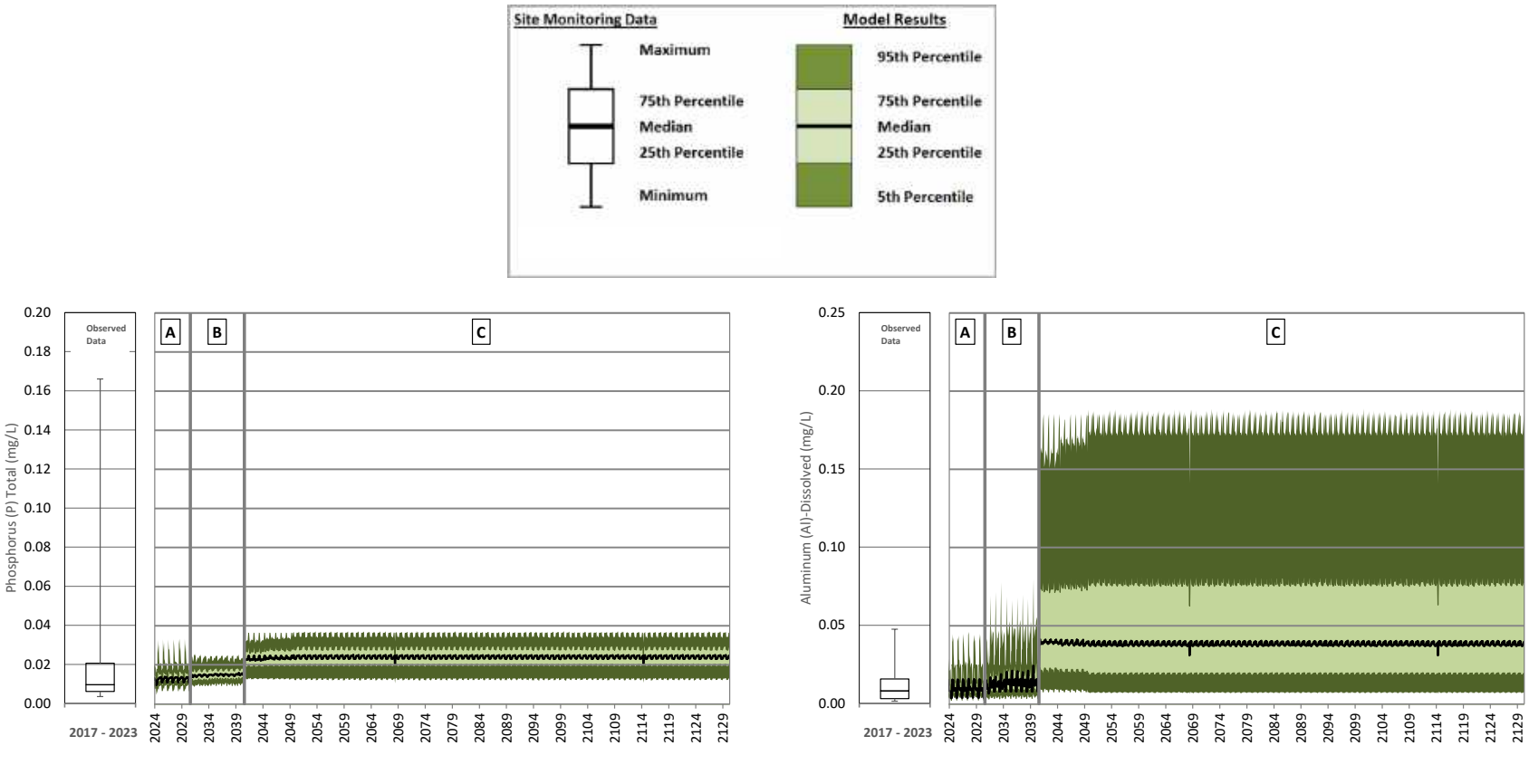
Figure B **245: Long Ditch Operations, Closure and Post-closure – Sulphate and Total Ammonia**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

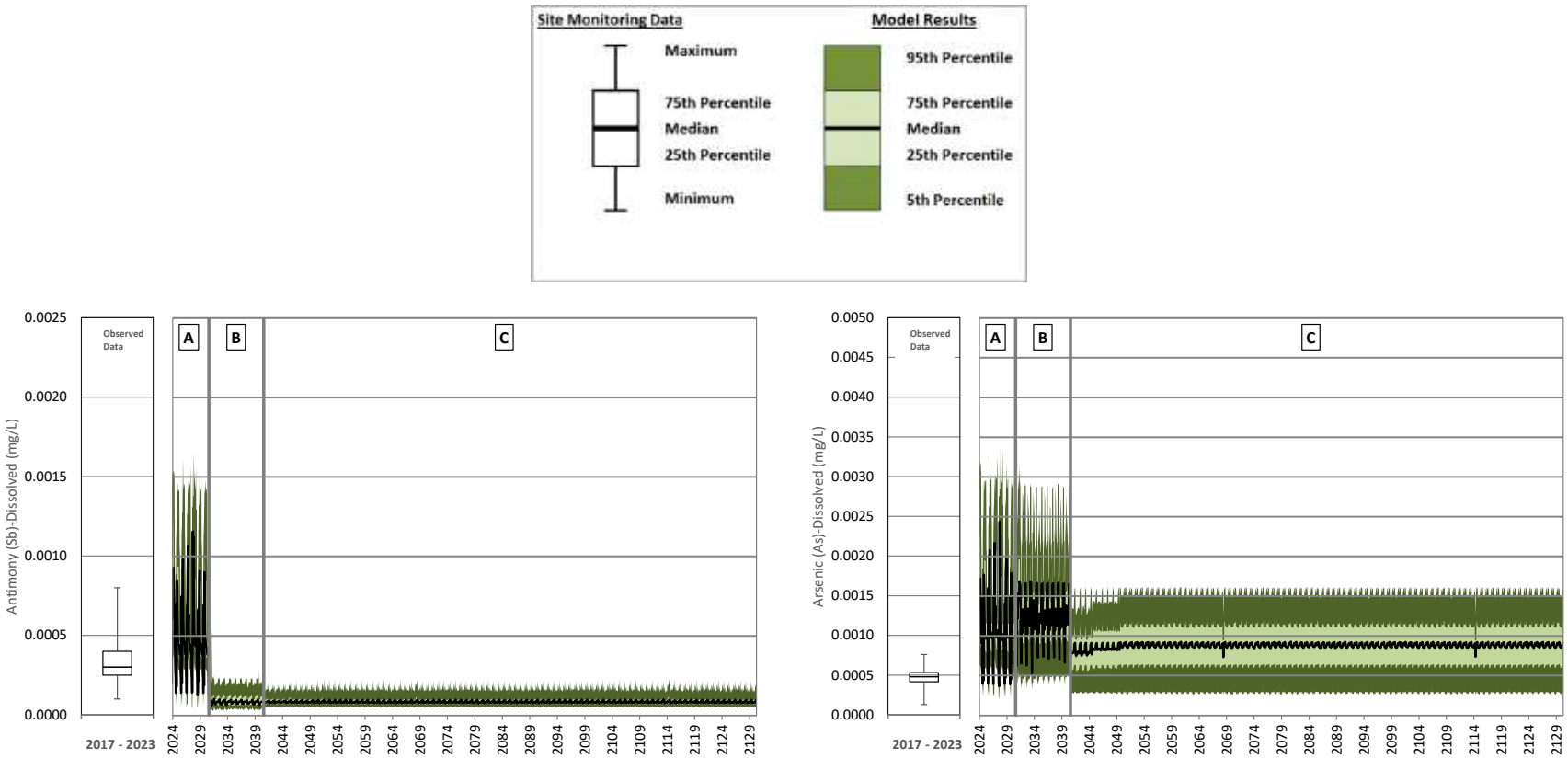
Figure B **246: Long Ditch Operations, Closure and Post-closure – Nitrate and Nitrite**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Total phosphorus and dissolved aluminum concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for total phosphorus and dissolved aluminum than the disturbed runoff and NAG waste rock water quality inputs.

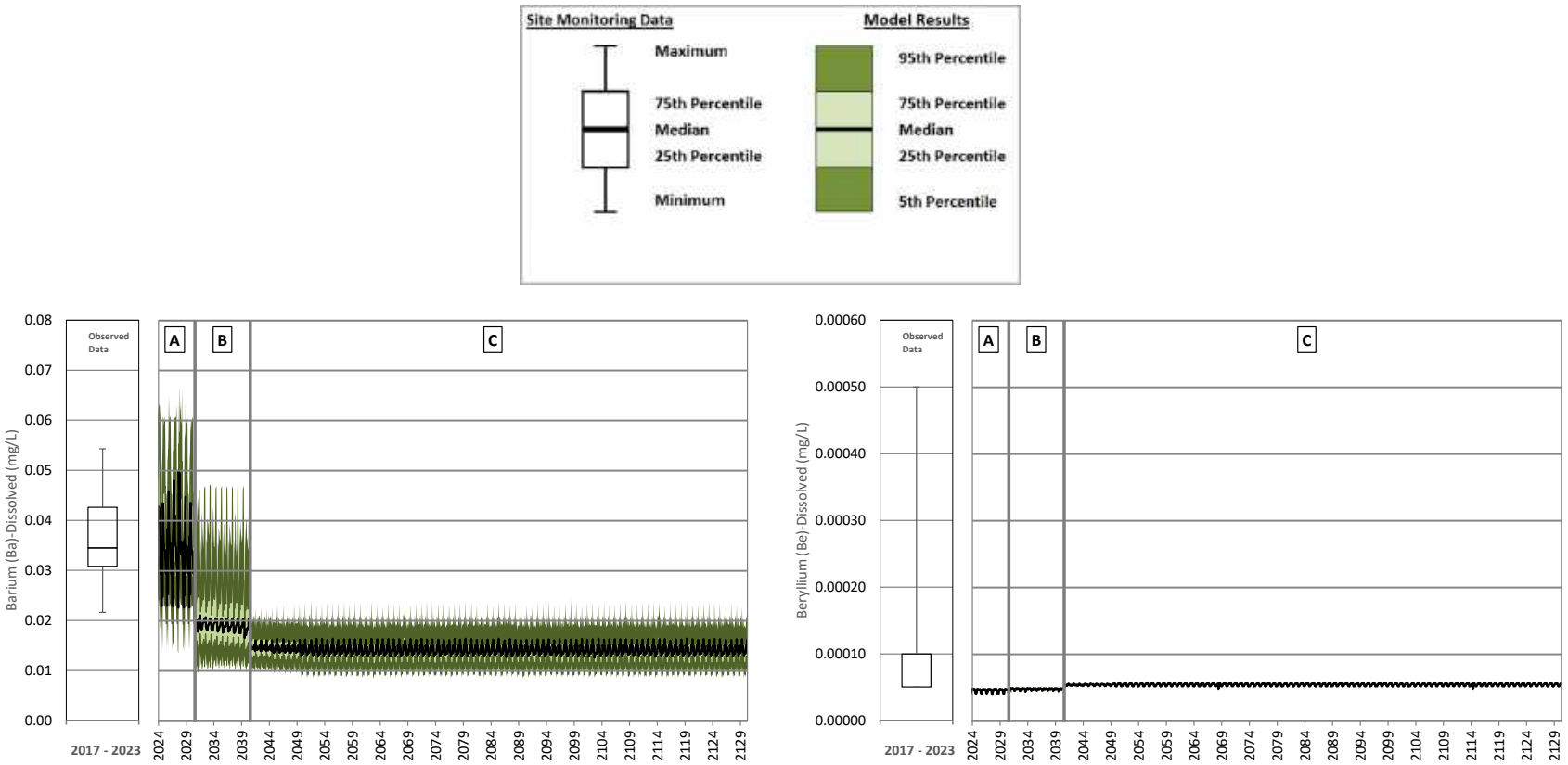
Figure B **247: Long Ditch Operations, Closure and Post-closure – Total Phosphorus and Dissolved Aluminum**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved arsenic concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved arsenic than the disturbed runoff water quality inputs.

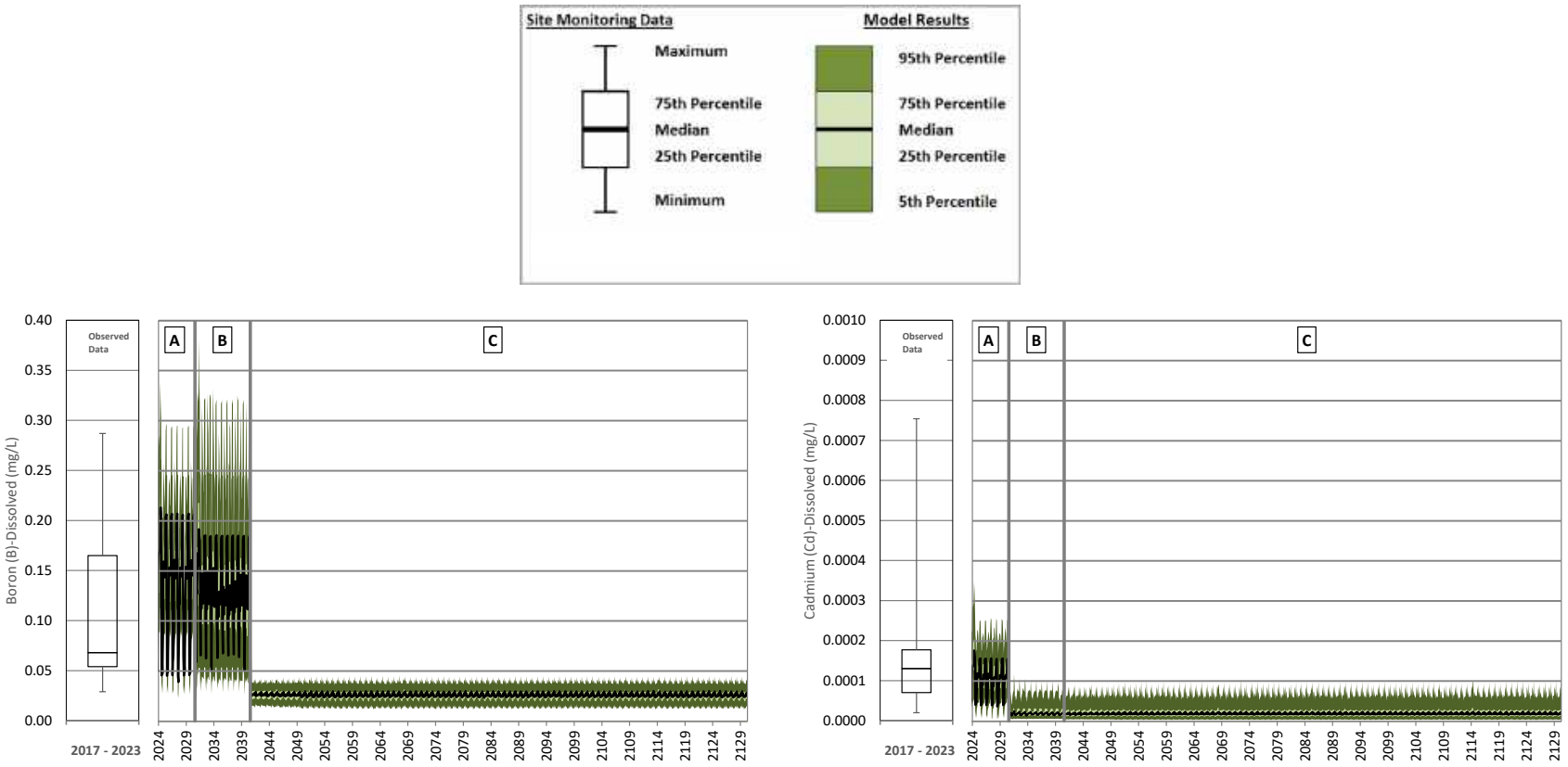
Figure B **248: Long Ditch Operations, Closure and Post-closure – Dissolved Antimony and Dissolved Arsenic**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

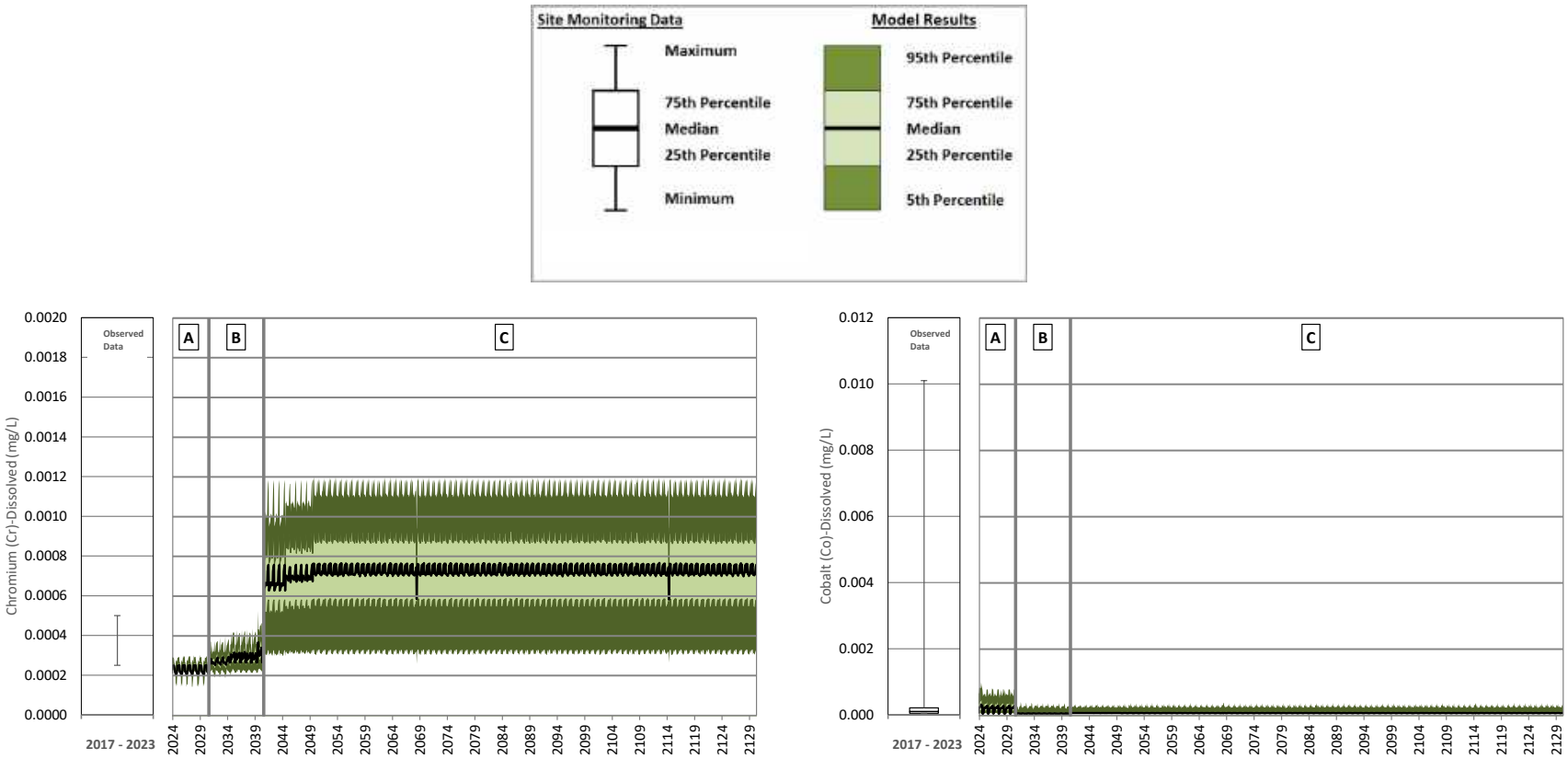
Figure B **249: Long Ditch Operations, Closure and Post-closure – Dissolved Barium and Dissolved Beryllium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

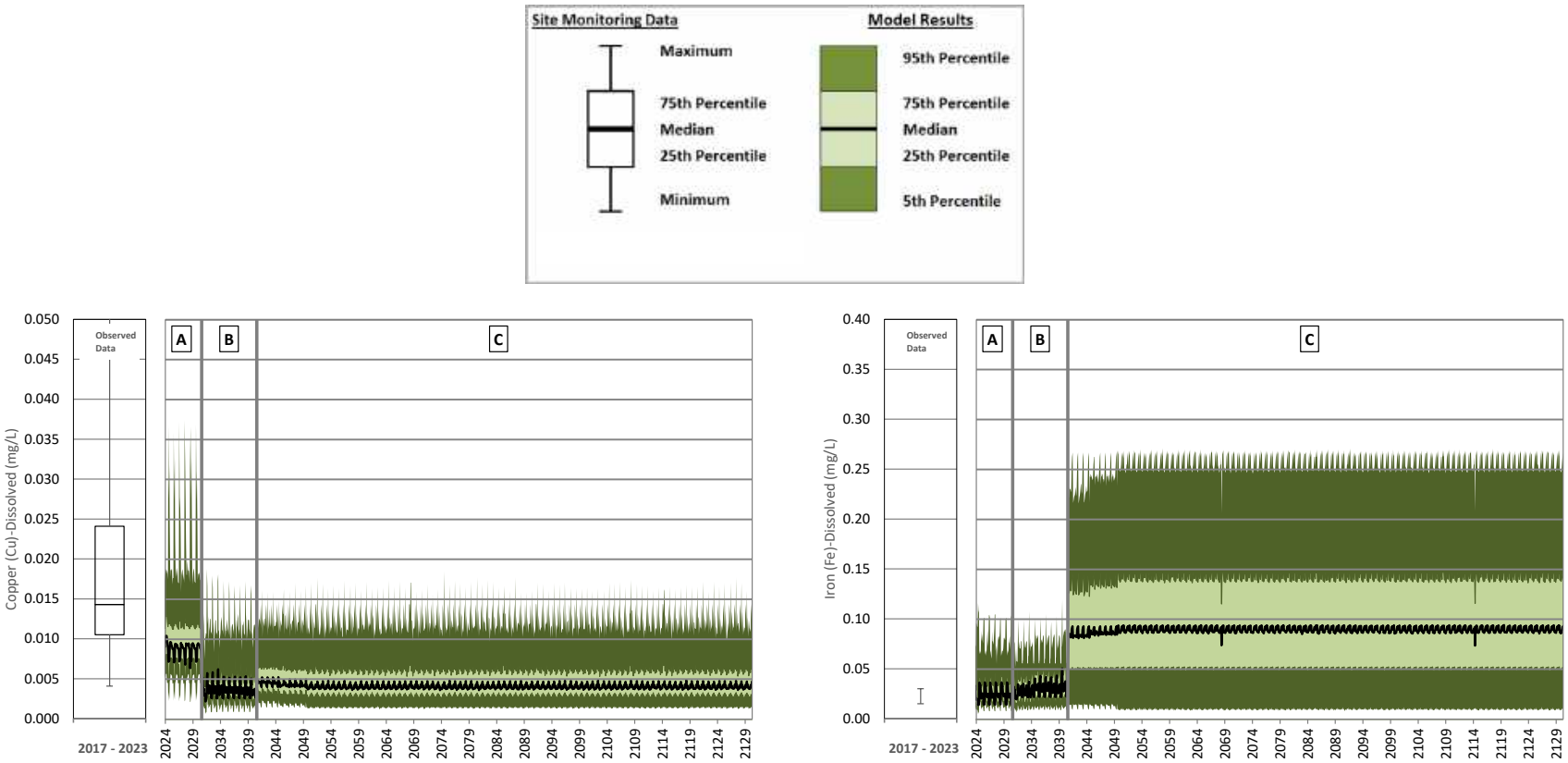
Figure B **250: Long Ditch Operations, Closure and Post-closure – Dissolved Boron and Dissolved Cadmium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved chromium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved chromium than the disturbed runoff and NAG waste rock water quality inputs.

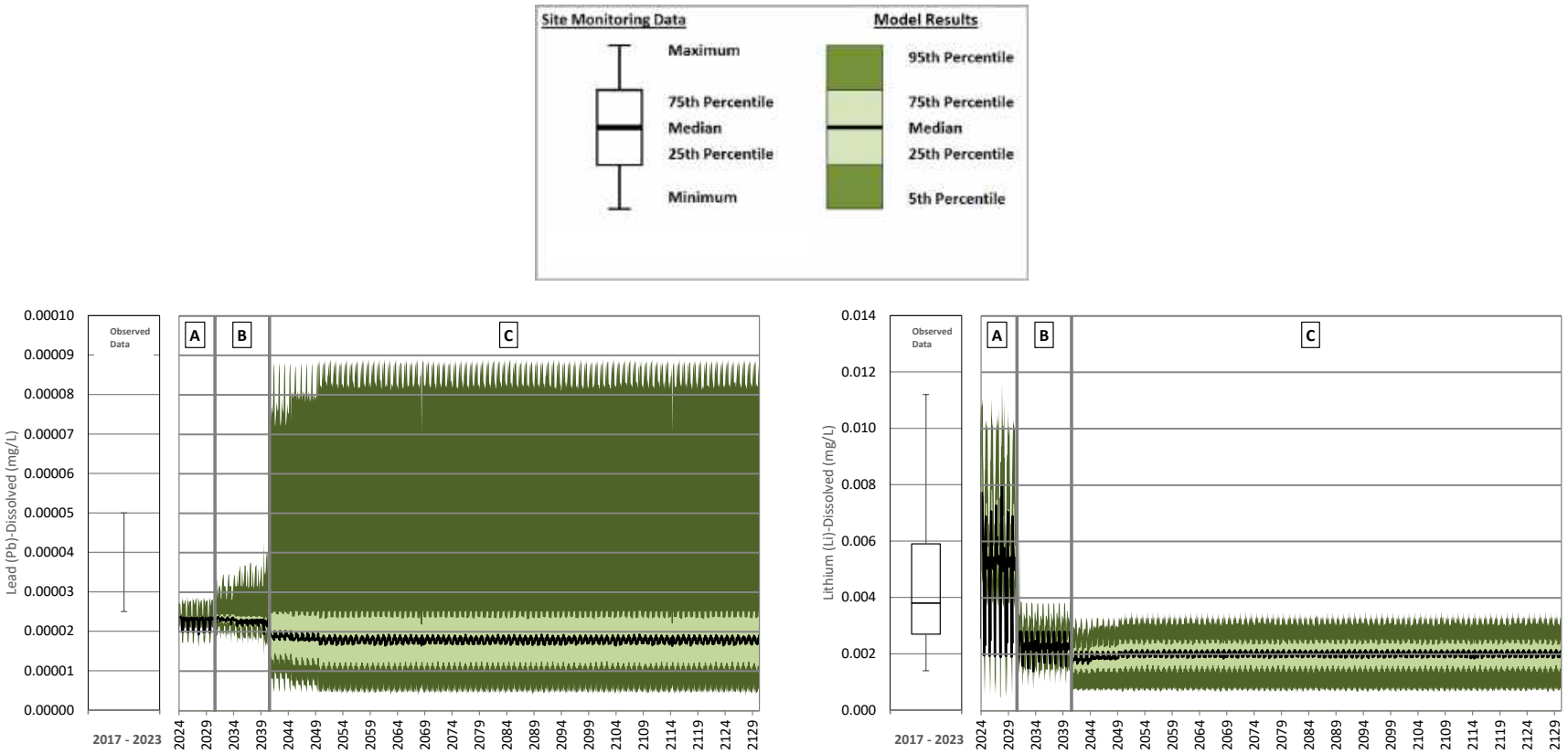
Figure B **251: Long Ditch Operations, Closure and Post-closure – Dissolved Chromium and Dissolved Cobalt**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved iron concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved iron than the disturbed runoff water quality inputs.

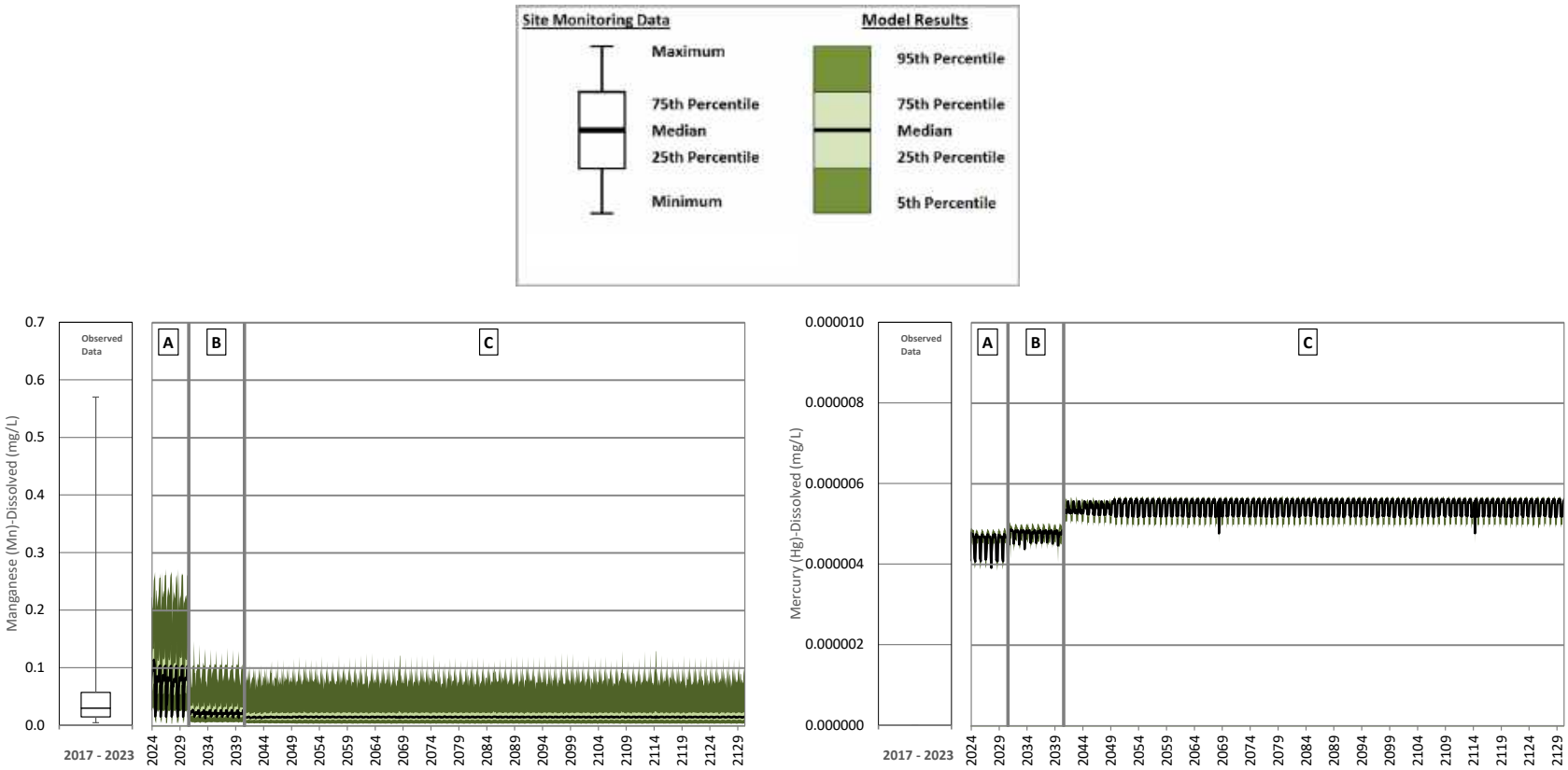
Figure B **252: Long Ditch Operations, Closure and Post-closure – Dissolved Copper and Dissolved Iron**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved lead and lithium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved lead and lithium than the disturbed runoff water quality inputs.

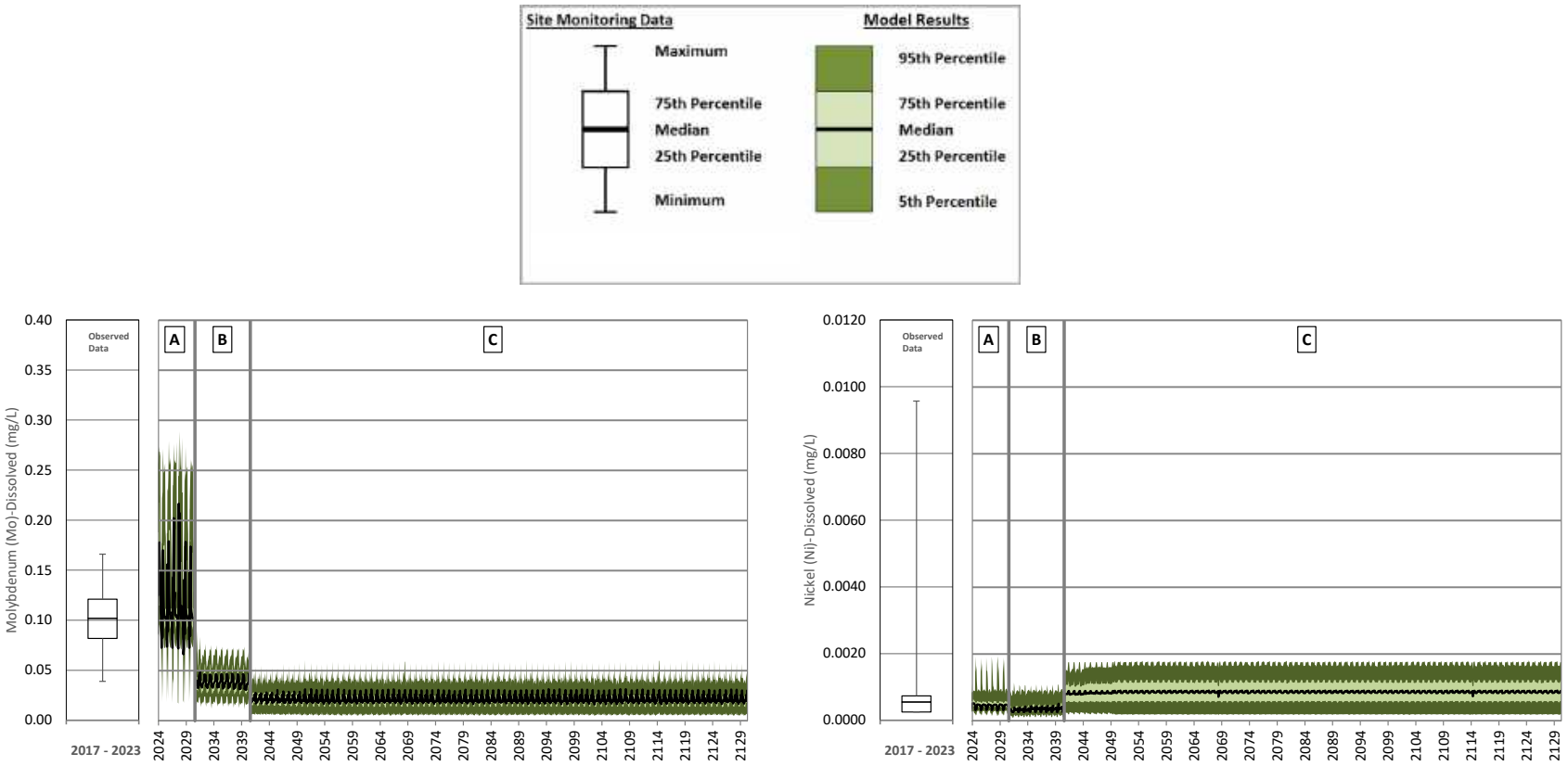
Figure B **253: Long Ditch Operations, Closure and Post-closure – Dissolved Lead and Dissolved Lithium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

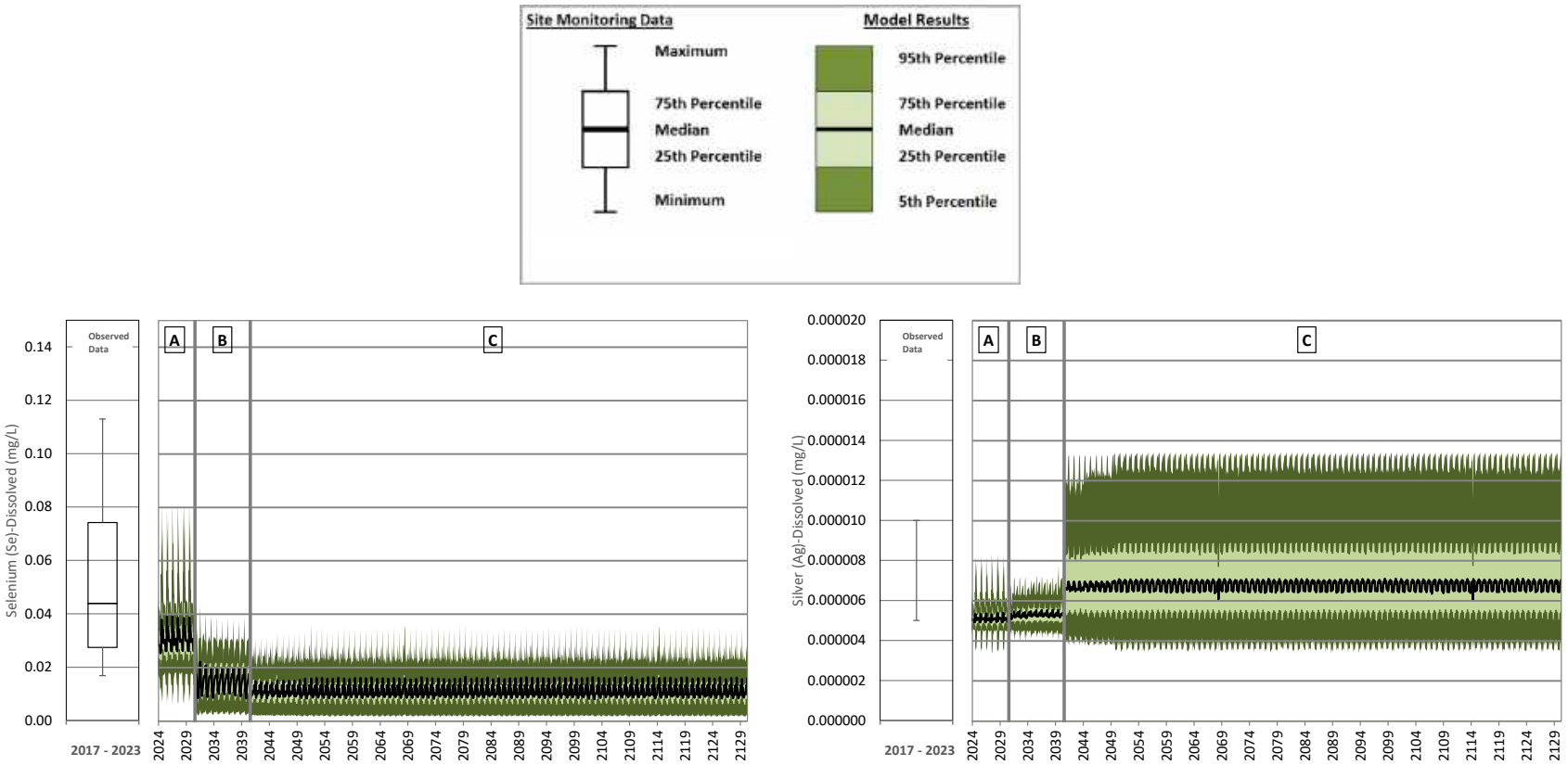
Figure B **254: Long Ditch Operations, Closure and Post-closure – Dissolved Manganese and Dissolved Mercury**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved nickel concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved nickel than the disturbed runoff water quality inputs.

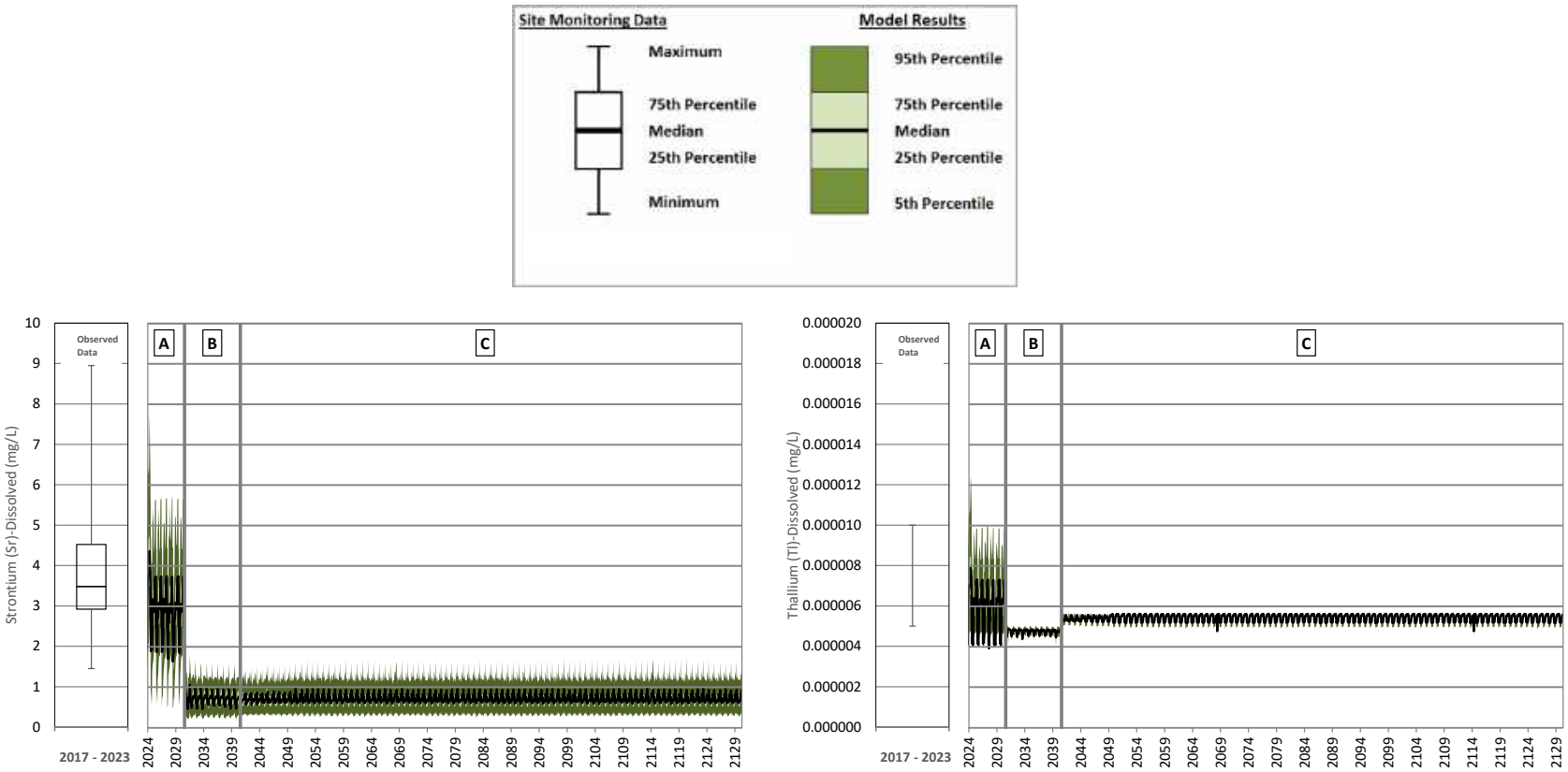
Figure B **255: Long Ditch Operations, Closure and Post-closure – Dissolved Molybdenum and Dissolved Nickel**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved silver concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved silver than the disturbed runoff water quality inputs.

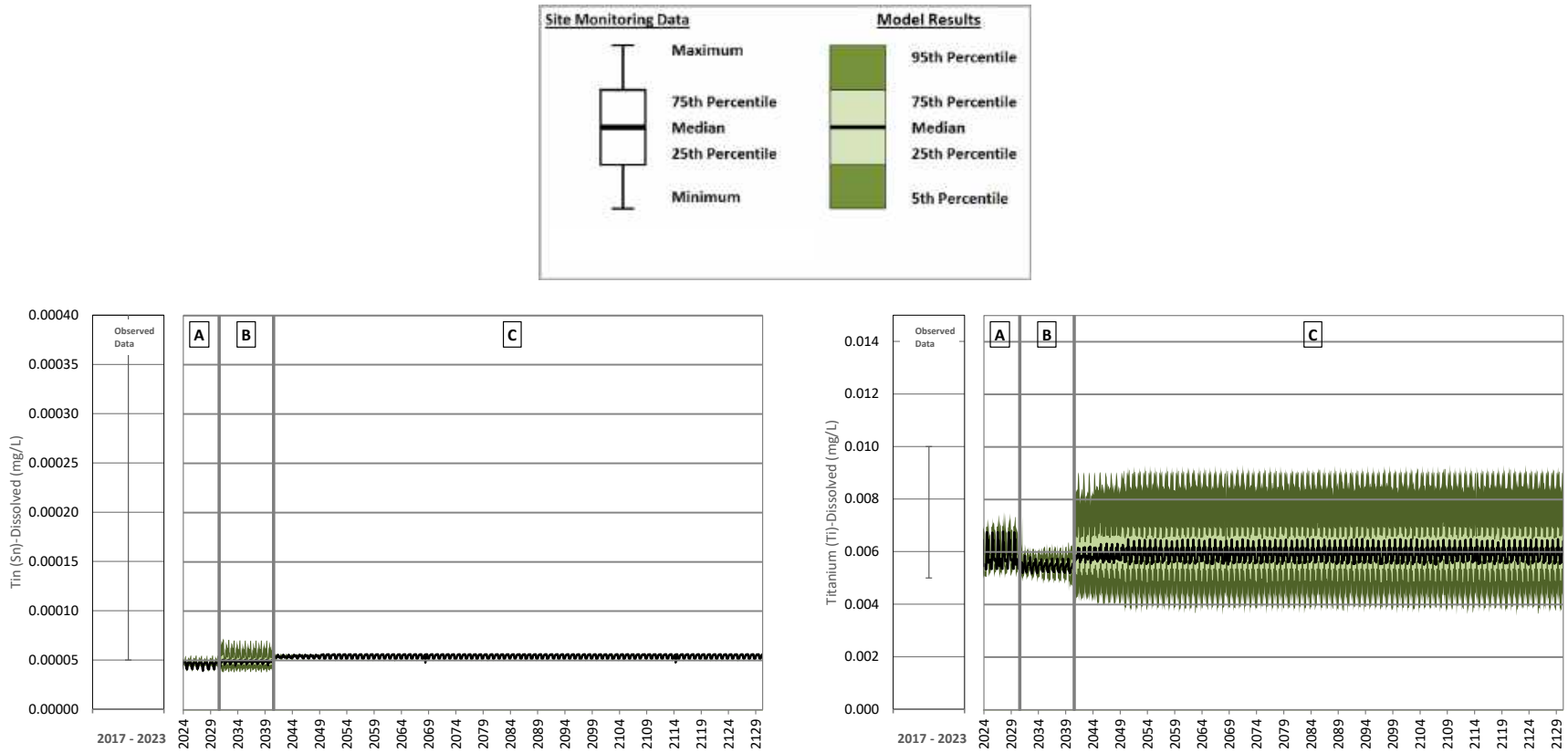
Figure B **256: Long Ditch Operations, Closure and Post-closure – Dissolved Selenium and Dissolved Silver**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. The increase in concentrations from 2031 to 2074 is due to decreases in the proportion of the seepage from the TSF to the SESCP that maintains an unsaturated water quality based on hydrogeologic modelling of seepage from the facility.

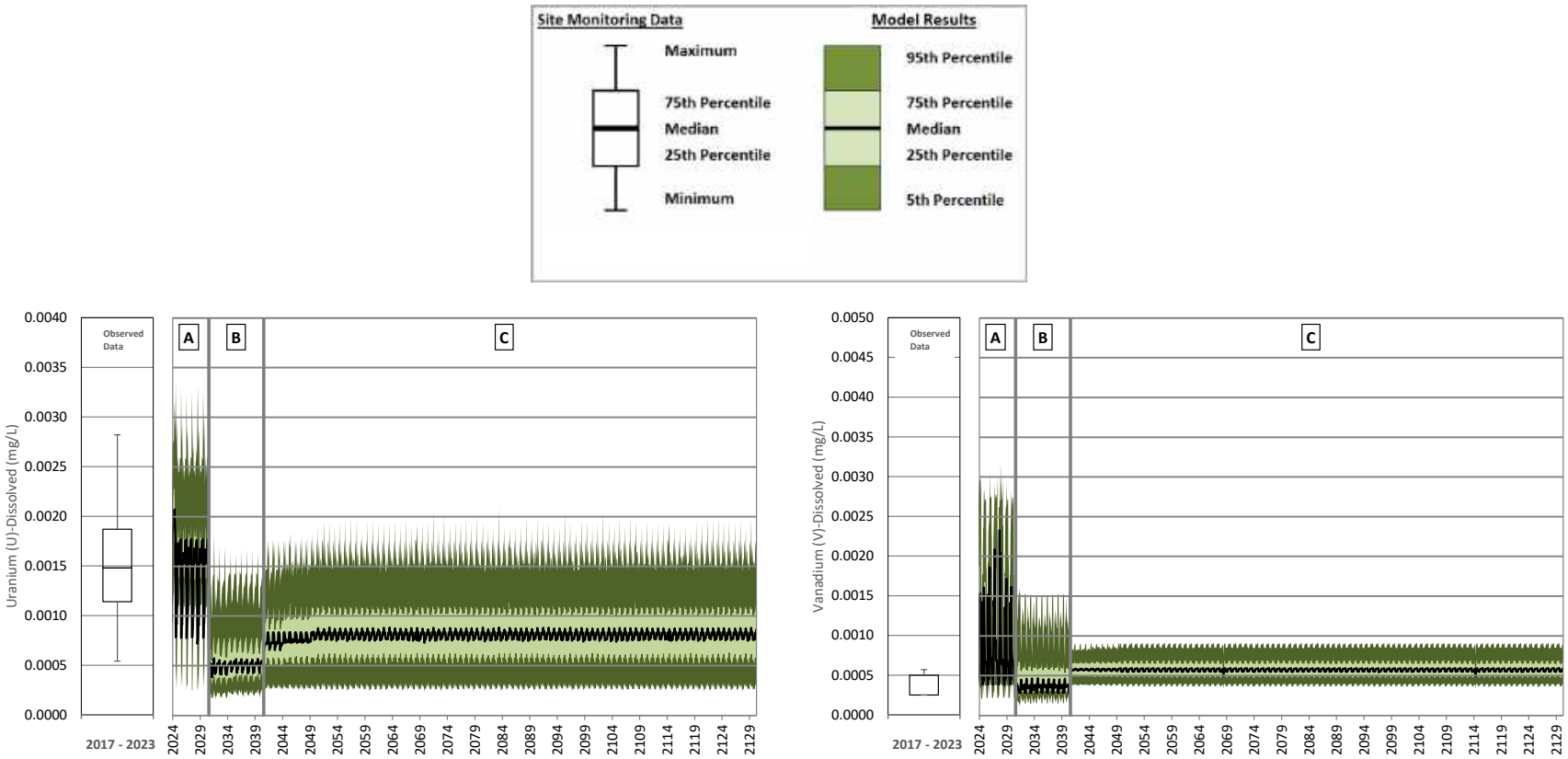
Figure B **257: Long Ditch Operations, Closure and Post-closure – Dissolved Strontium and Dissolved Thallium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved titanium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher maximum concentrations for dissolved titanium than the disturbed runoff water quality inputs.

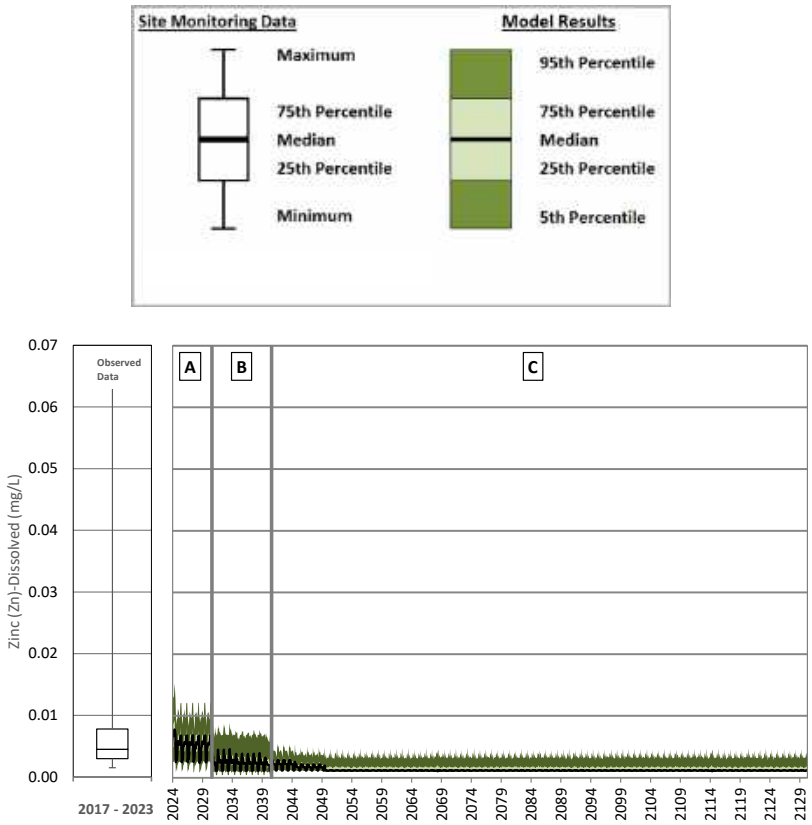
Figure B **258: Long Ditch Operations, Closure and Post-closure – Dissolved Tin and Dissolved Titanium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure is caused by the reclamation of runoff areas. Dissolved uranium and dissolved vanadium concentrations increase from the start of post-closure as runoff areas are remediated and assigned the undisturbed runoff water quality input. The undisturbed runoff water quality input has higher concentrations for dissolved uranium and vanadium than the disturbed runoff water quality inputs.

Figure B **259: Long Ditch Operations, Closure and Post-closure – Dissolved Uranium and Dissolved Vanadium**



A = Operations; B = Closure; C = Post-closure

Note: The change in concentrations from operations to closure and into early post-closure is caused by reclamation of mine site areas. Predicted concentrations reach a steady state 10 years after the start of post-closure when reclamation of the mine site areas is complete.

Figure B **260: Long Ditch Operations, Closure and Post-closure – Dissolved Zinc**



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APPENDIX 9-4B: 2024 Water Management Plan Remodeling Summary

TECHNICAL MEMORANDUM

DATE March 21, 2024 **Reference No.** CA0020527.4505-025-TM-Rev0-31146

TO Matt O'Leary
Mount Polley Mining Corporation

FROM Gonzalo Donoso and Jesse Maddaloni **EMAIL gonzalo.donoso@wsp.com; jesse.maddaloni@wsp.com**

2024 WATER MANAGEMENT PLAN REMODELING SUMMARY

1.0 INTRODUCTION

Mount Polley Mining Corporation (MPMC) retained WSP Canada Inc. (WSP) to address a new M-200 permit requirement, introduced in May 2023, to provide a Water Management Plan (WMP) for the Mount Polley Mine (the Mine) annually (by March 31). A 2023 WMP has been recently produced by WSP Canada Inc. (WSP 2023) in December 2023 regarding the Mine's proposed Springer Expansion operations phase. Since the production of that WMP, MPMC is installing new water transfer infrastructure on-site that was not considered in the 2023 WMP. The new transfer infrastructure allows greater transfer capacity to Wight Pit before contact water reaches the Tailings Storage Facility (TSF). This technical memorandum describes the transfer capacity changes made in the model, presents updated water balance and water quality model results, compares revised results to 2023 WMP results, and discusses the overall impact to water management during operations due to these transfer changes.

This transfer capacity change will impact the water balance results presented in the 2023 WMP, notably the amount of water temporarily retained in Wight Pit and the TSF. The 2024 remodeling has not resulted in any major water quality concentration changes between revised predictions and the predictions presented in the 2023 WMP. Some water quality parameter concentrations are modeled to increase or decrease compared to 2023 WMP results, but these revised 2024 predictions do not impact which parameters are considered constituents of concern (COC).

This technical memorandum is to be submitted with the 2023 WMP to satisfy the M-200 annual WMP submission for 2024.

2.0 MODEL CHANGES

Water balance flow diagrams are presented in Attachment 1, which show the configuration of water balance models and summarize the model element names discussed below. Figure 1 in Attachment 1 shows the water balance model configuration for the Mine during operations assumed in the 2023 WMP. Figure 2 in Attachment 1 shows the water balance model configuration for the Mine during operations assumed for this 2024 WMP remodeling update.

The following parameter changes have been made in the water balance model for the purpose of this 2024 WMP remodeling update:

- Pumping pipeline capacity to Wight Pit, model element P30. The P30 transfer no longer intakes from the Tailings Storage Facility (TSF) and now intakes from the Southeast Rock Disposal Site (SERDS) sump. This allows mine contact water to be transferred to Wight Pit for storage before reaching the TSF. The P30 transfer still discharges to Wight Pit. In the 2023 WMP model, the P30 maximum transfer capacity was set at 10,000 m3/day. For this 2024 remodeling update, the P30 maximum transfer capacity has been increased to 55,200 m3/day. MPMC also has the ability to relocate the P30 intake from the SERDS sump to the Central Collection Sump (CCS), if desired, which is located downstream of the SERDS sump (downstream by gravity). Both intake positions allow transfer of contact water to Wight Pit before the water enters the TSF.
- Pumping pipeline addition from Long Ditch to SERDS sump, model element P36. This added transfer allows contact water collected in Long Ditch to be pumped to the SERDS sump, and ultimately to Wight Pit. For this 2024 remodeling update, the P36 maximum transfer capacity has been set at 14,400 m3/day.
- Pumping pipeline capacity from Wight Pit to Long Ditch, model element P21. In the 2023 WMP, the P21 maximum transfer capacity was set at 14,088 m^3/day. For this 2024 remodeling update, the P21 maximum transfer capacity has been set at 32,488 m^3/day.
- Some pumps are shared between P30 and P21. During freshet, pumps are allocated to P30 to transfer contact water to Wight Pit. During Wight Pit dewatering (following freshet), some pumps are re-allocated to P21 to allow treatment of contact water stored in Wight Pit. Logic has been added to the water balance model for this 2024 remodeling update to prevent P21 simultaneously operating while P30 is operational.

All other parameters, inputs, and assumptions remain as described in the 2023 WMP.

3.0 MODEL RESULTS

The Site-Wide Water Balance Model (SWWBM) and Site-Wide Water Quality Model (SWWQM) were re-run for the estimated operational phase of the Mine (May 2, 2023 to March 31, 2031) with the model changes noted in Section 2.0.

The SWWBM and SWWQM use stochastic model elements, allowing uncertainty to be represented in model input data. This stochastic analysis is described in detail in Section 4.3.1.5 of the 2023 WMP, including a description of interpreting percentile category results from the stochastic analysis. For this 2024 model re-run, the stochastic generator was set to perform 1,000 realizations to create a sample size that was sufficiently large to account for a range of conceivable climatic scenarios for this analysis.

3.1 Water Balance

Results presented here should be directly compared to the corresponding results in the 2023 WMP in Section 4.3.3. Results are presented for quantity of site discharge (annual volume requiring treatment and discharge), water volume stored in the TSF, and water volume stored in Wight Pit. Results for water volume in Springer Pit and Cariboo Pit are not presented, as these values are not notably impacted by the current model changes.

3.1.1 Quantity of Discharge

The Mine has a positive contact water balance, meaning that treated water discharge from the Mine is required every year to not store excess contact water year over year. This estimated annual volume is shown in Table 1 for the 2024 remodeling and should be compared to annual volumes shown in Table 34 of the 2023 WMP.

Table 1: WTP Annual Volume Requiring Treatment during Operations (M-m^3)

Year	Annual Volume Requiring Treatment at WTP (M-m^3)		
	50th Percentile	90th percentile	99.5th percentile
2023[(a)]	4.52	4.93	5.88
2024	4.52	5.89	7.22
2025	3.30	4.57	6.31
2026	3.35	4.59	6.13
2027	3.36	4.77	6.27
2028	3.40	4.77	6.49
2029	3.40	4.68	6.00
2030	3.31	4.63	6.20
2031	5.52	7.27	9.81

(a) Model simulation start date: May 2, 2023.

If annual treatment volume estimates for individual years are compared, then moderate differences can be seen between the 2023 WMP volume estimates and the estimates shown in Table 1. Due to the SWWBM having stochastic climate inputs, differences on a yearly basis can occur, as randomized inputs may not align for specific years. It is more appropriate to consider the average of values across all operational years instead of comparing individual years during the operational period.

The average volumes across the proposed operational years for each percentile category differ by 5% or less between the Table 1 2024 remodeling results and the corresponding results in Table 34 of the 2023 WMP. The model changes discussed in Section 2 do not result in a notable change to the estimated annual discharge volume.

3.1.2 Tailings Storage Facility

The estimated volume of water stored in the TSF is a SWWBM result that is impacted by the model changes discussed in Section 2, as contact water is modeled to be diverted to Wight Pit before reaching the TSF. Table 2 and Figure 1 show the estimated TSF water volume resulting from the 2024 remodeling. TSF water volume estimates from the 2024 remodeling shown in Table 2 and Figure 1 should be compared to the TSF water volume estimates shown in Table 35 and Figure 17 of the 2023 WMP, respectively.

Table 2: TSF Water Volume during Operations (M-m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	1.22	1.32	1.41
	Average	1.46	1.53	1.71
	Maximum	1.60	1.70	2.53

Note: Table values do not include 2023 model results seen in Figure 1, as starting year model results are impacted by model starting conditions and are not reflective of average conditions during the operational period.

For all percentile categories, maximum TSF water volume is reduced in the 2024 remodeling estimates compared to the 2023 WMP estimates. This is due to contact water now being pumped to Wight Pit prior to reaching the TSF.

Table 2 results are shown graphically in Figure 1. Maximum TSF water volume in the first modeled year of operation (2023) is shown higher in Figure 1 than listed in Table 2, only due to the high TSF volume assumed for the model starting condition. Annual TSF volume for the remainder of the proposed operations years beyond the starting condition coincides with the values shown in Table 2.

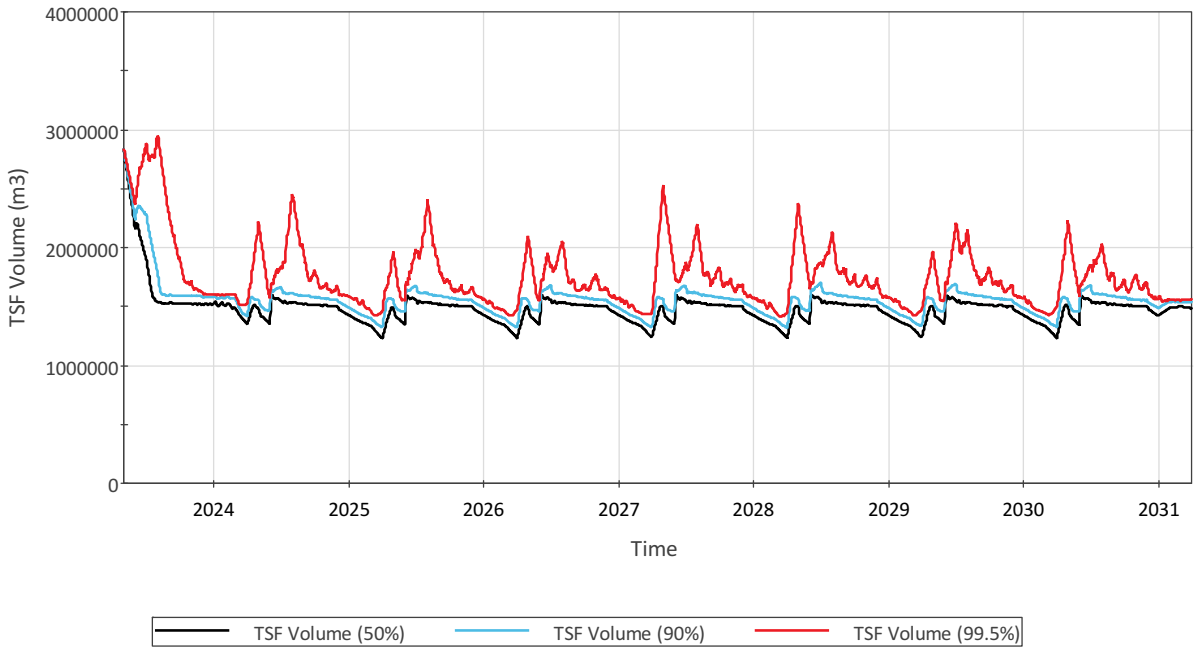


Figure 1: TSF Water Volume during Operations

3.1.3 Wight Pit

The estimated volume of water stored in Wight Pit is a SWWBM result that is impacted by the model changes discussed in Section 2. Table 3 and Figure 2 show the estimated Wight Pit water volume resulting from the 2024 remodeling. Wight Pit water volume estimates from the 2024 remodeling shown in Table 3 and Figure 2 should be compared to the Wight Pit water volume estimates shown in Table 38 and Figure 19 of the 2023 WMP, respectively.

Table 3: Wight Pit Water Volume (M-m^3)

Phase	Bound	50th Percentile	90th Percentile	99.5th Percentile
Operations	Minimum	0	0	0
	Average	0.63	0.98	1.58
	Maximum	3.58	3.69	3.78

Wight Pit average and maximum volume estimates for all percentile categories are increased in the 2024 remodeling estimates compared to the 2023 WMP estimates. This is due to additional contact water now being pumped to Wight Pit prior to reaching the TSF.

Table 3 results are shown graphically in Figure 2. Figure 2 below, compared to Figure 19 in the 2023 WMP, shows increased Wight Pit water volumes for all percentile categories. Even though water volumes are estimated to increase in Wight Pit, transfer capacity is still sufficient to empty Wight Pit of contact water annually, even for the estimated 99.5th percentile category.

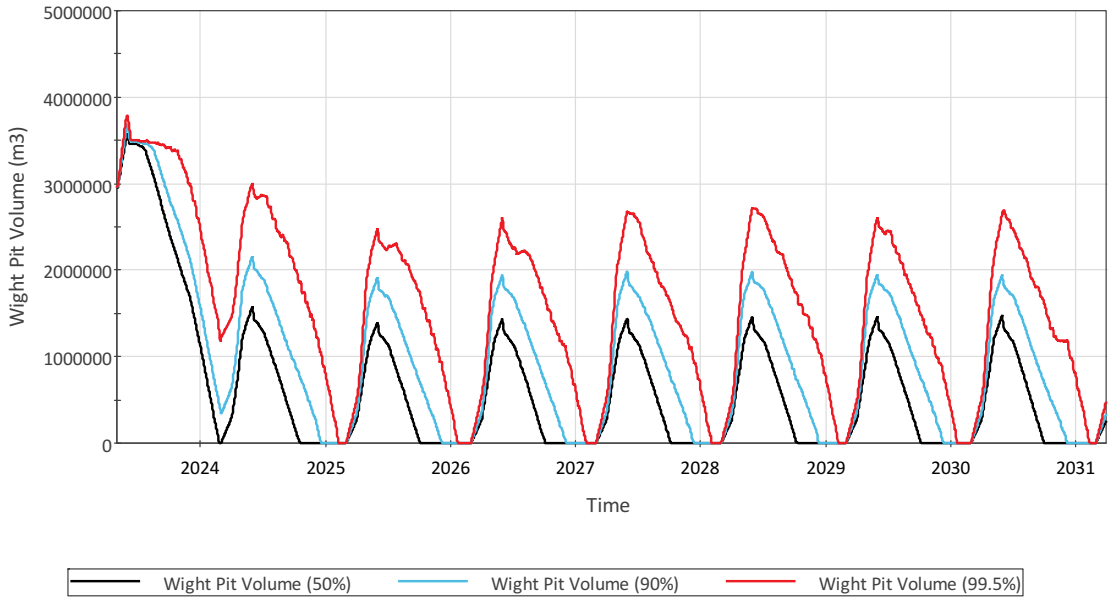


Figure 2: Wight Pit Water Volume during Operations

3.2 Water Quality and Water Treatment

The SWWQM was re-run for the anticipated operational phase of the Mine with the model changes noted in Section 2.0. All of the same water quality predictions were modeled compared to the water quality predictions presented in the 2023 WMP. No water quality source terms were adjusted for this 2024 remodeling, only the pumping capacity changes noted in Section 2; therefore, only a select portion of water quality modeling results are presented in this 2024 remodeling summary: at the Water Treatment Plant (WTP) inlet.

Water quality results are presented in Table 4, showing the maximum of 95th percentile predictions for the Perimeter Embankment Till Borrow Pond (PETBP), which is the single influent source to the WTP, and discharges to the only contact water discharge point from the Mine. The 2024 remodeling results shown in Table 4 should be compared to the PETBP water quality predictions shown in Table 46 of the 2023 WMP, which are repeated here in Table 4 (values within square brackets). Results for the PETBP are presented here as this location represents the central point in which all contact water is collected prior to treatment and discharge from the Mine to the receiving environment. Minor changes to water quality predictions may exist at other collection points at the Mine, but presenting results for the PETBP indicate any water quality changes that may affect contact water treatment prior to discharge to the receiving environment.

Table 4: Predicted Water Quality Concentrations and Permit Limits for Treatment During Operations

Parameter	Unit	EMA Permit 11678 WTP Discharge Limit	PETBP – Maximum of 95th Percentile Predicted Concentrations [Results from 2023 WMP]
Major Ions			
Total Sulphate	mg/L	1,100	790 [681]
Nutrients			
Total Ammonia	mg/L (as N)	1.30	0.05 [0.06]
Total Nitrate	mg/L (as N)	34	16 [23]
Total Phosphorus	mg/L	0.09	0.03 [0.03]
Total Metals			
Arsenic	mg/L	0.028	0.004 [0.003]
Chromium	mg/L	0.004	0.001 [0.001]
Copper	mg/L	0.033	**0.190 [0.190]**
Iron	mg/L	1.00	0.58 [0.58]
Manganese	mg/L	3.4	0.22 [0.26]
Molybdenum	mg/L	0.36	0.32 [0.28]
Selenium	mg/L	0.075	**0.087** [0.074]
Zinc	mg/L	0.059	0.013 [0.019]
Dissolved Metals			
Cadmium	mg/L	0.00034	0.00026 **[0.00036]**

Note(s):

1. **Bold and underlined** values exceed permitted discharge limits. These EMA Permit 11678 discharge limits apply to the effluent of the WTP, and not to the PETBP (WTP influent). PETBP water quality predictions are shown to demonstrate the requirement for treatment of a water quality parameter. The SWWBM was developed to predict water quality conservatively; where uncertainty exists in the model inputs, the inputs are selected such that under-prediction would be minimized. Thus, over-prediction is generally expected.
2. Values in square brackets are SWWQM water quality predictions from the 2023 WMP (WSP 2023) and are maximum of 95th percentile predicted concentrations in the PETBP.

The 2024 remodeling has not resulted in any major water quality concentration changes between the predictions shown in Table 4 and the predictions presented in the 2023 WMP. Some water quality parameter concentrations are modeled to increase or decrease compared to 2023 WMP results, but these revised 2024 predictions do not impact which parameters are considered COCs. Total copper and total selenium remain as COCs, same as discussed in the 2023 WMP, and the same COC mitigation strategies apply as were discussed in the 2023 WMP (discussed in Section 4.7.1 in the 2023 WMP Rev0). Dissolved cadmium is no longer predicted to require treatment, which is supported by monitoring data for dissolved cadmium remaining below permit limit, also as discussed in the 2023 WMP.

3.3 Overall Impact to Water Management

The resulting impact of the water transfer changes at the Mine to the overall water management at the Mine is minor, mainly affecting the quantity of water temporarily retained in the TSF and Wight Pit, with less water stored in the TSF and more water stored in Wight Pit. The transfer changes do not notably impact the predicted quantity of water requiring treatment and discharge from the Mine, nor do they notably impact the predicted water quality experienced at the WTP or the mitigation strategies for COCs. The overall water management plan discussed in the 2023 WMP remains valid, with major water quantity volume differences as discussed in this memorandum.

4.0 CLOSURE

The reader is referred to the Study Limitations section, which follows the text and forms an integral part of this memorandum.

We trust the above meets your present requirements. If you have any questions or requirements, please contact the undersigned.

WSP Canada Inc.





Gonzalo Donoso, P.Eng., M.Sc.
Water Resources Engineer

Jesse Maddaloni, P.Eng., M.A.Sc.
Senior Mechanical Engineer

GD/JDM/ar/anr

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Engineers & Geoscientists BC

Attachment 1: Model Schematic Figures

https://golderassociates.sharepoint.com/sites/10023g/ca00205274505 deliverables/002_issued/025-tm-31146-2024 wmp remodeling summary/rev0/ca0020527.4505-025-tm-rev0-31146-2024 wmp remodeling summary 21mar_24.docx

REFERENCE

WSP (WSP Canada Inc.) WSP 2023. Mount Polley Mine. Springer Expansion LOM Plan – Water Management Plan. Ref No. 23590671-091-R-Rev0-31191. December 4, 2023.

STUDY LIMITATIONS

WSP Canada Inc. (WSP) has prepared this document in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practising under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this document. No warranty, express or implied, is made.

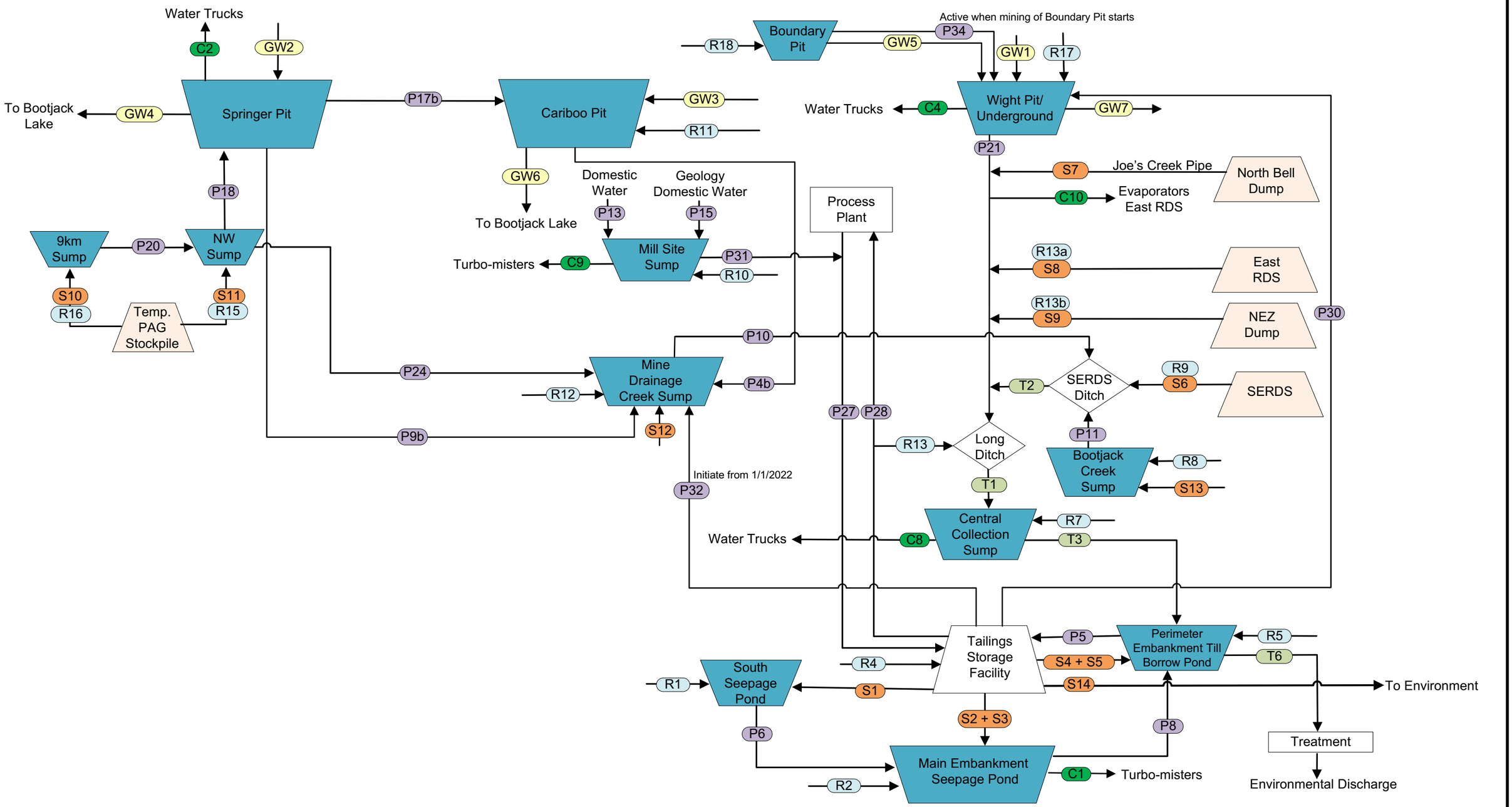
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ATTACHMENT 1

Model Schematic Figures



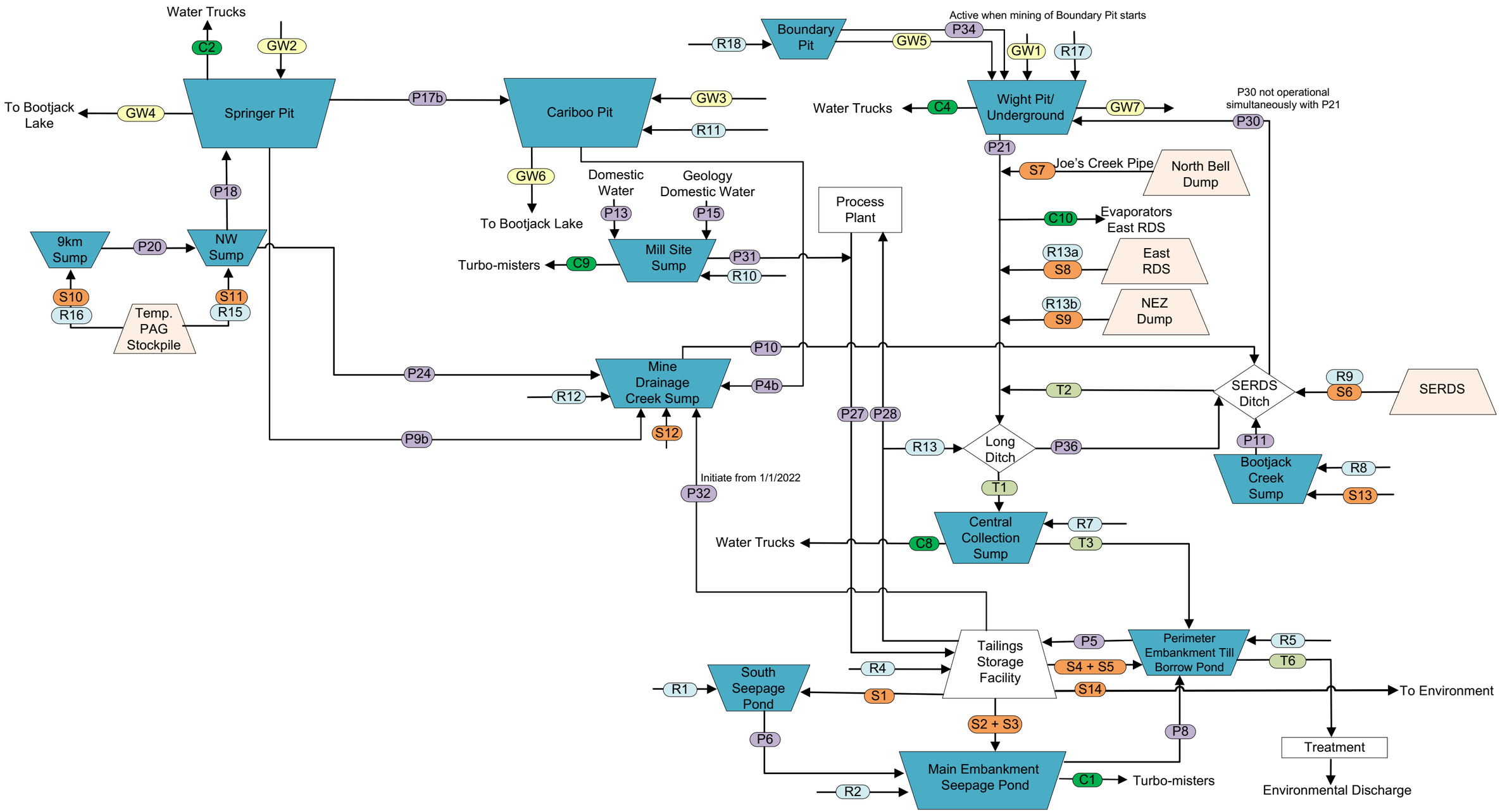
Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	1 March 2024
CHECKED	GD
DATE	1 March 2024
SCALE	Not to Scale
PROJECT No	CA0020527.4505/31146
FIGURE No	1
REV No	0

TITLE

Springer Expansion LOM Site Wide Water Balance
Operational Phase Flow Diagram
2 May 2023 – 31 March 2031



Runoff (R)
Seepage Flow (S)
Water consumption (C)
Pumped Flows (P)
Groundwater Flows (GW)
Transfer Flows (T)
Flow Path

Note:
(a) Evaporation and Direct Precipitation are modelled for all ponds, but are not shown on this diagram.
(b) Flow quantity may fluctuate based on the year/phase of the model.

CLIENT	Mount Polley Mining Corporation
DRAWN	SC
DATE	1 March 2024
CHECKED	GD
DATE	1 March 2024
SCALE	Not to Scale
PROJECT No	CA0020527.4505/31146
FIGURE No	2
REV No	0

TITLE

2024 Water Management Plan Remodeling Update
Site Wide Water Balance Operational Phase Flow Diagram
2 May 2023 – 31 March 2031

APPENDIX 9-5: 2023 11678 BAT Assessment Plan

TECHNICAL MEMORANDUM

DATE 31 January 2023 **Reference No.** 22514095-114-TM-Rev0-39142

TO Don Parsons
Mount Polley Mining Corporation

FROM Jesse Maddaloni and Darryl Howard **EMAIL Jesse.Maddaloni@wsp.com; Darryl.Howard@wsp.com**

2023 11678 BAT ASSESSMENT PLAN – MOUNT POLLEY MINE

1.0 INTRODUCTION

This technical memorandum (memo) outlines tasks proposed by WSP Canada Inc. (WSP) to be carried out over 2023 regarding water treatment for the Mount Polley Mine, including progression of the water treatment study program in fulfillment of EMA Permit 11678 Section 2.11.1(a); specifically that the permittee must submit to the director for approval by 31 January of each year a study plan that details bench and pilot scale testing that will be undertaken. Proposed tasks are a continuation of existing work regarding several technologies and topics related to water treatment for the site. A description of previously undertaken water treatment work is not provided, nor is an overview of the overall water management or treatment plan for the site; this memo assumes that the reader is familiar with previous water treatment work carried out.

2.0 WATER TREATMENT INVENTORY AND FRAMEWORK

Mount Polley Mining Corporation (MPMC) has been progressing and evaluating multiple technologies to support the treatment of identified constituents of concern (COCs) and to support potential decentralized water treatment and discharge during closure/post-closure. Various studies have been completed over several years to support these efforts as an important component of treatment technology development. An inventory of treatment technologies and a summary of their development is presented in Table 1, including high-level anticipated timelines for future development.

Good engineering practice typically requires a project to follow a standardized engineering design process for the selection and progressive refinement of the final project concept. A project progresses from a pre-concept phase for the identification of multiple treatment options, through concept, pre-feasibility, and feasibility phases to project execution. Generally, the engineering studies performed for each of these project phases are supported by test work that progresses from proof-of-concept and detailed bench-scale testing to pilot-scale and demonstration scale test work. Some of the treatment technologies tested may not progress to the next stage of development. For example, a treatment technology may be eliminated if its treatment capacity is insufficient to treat the forecasted volumes. This framework takes a staged approach, such that input assumptions, design, and cost for the total system can be refined as each stage is completed and the information that the plan relies on becomes more certain. This allows input assumptions to be less conservative as they become more accurate with accumulated knowledge. The technology development stages presented in Table 1 align with this approach. Additional details regarding this project development framework and how it aligns with the BC Ministry of Environment and Climate Change Strategy's BAT policy is provided in MPMC's 2020 Water Management Plan.

This memo assumes that the reader is familiar with the technologies listed in Table 1. Detailed descriptions of the technologies and associated process flow schematics can be found in MPMC's 202 Water Management Plan.

Table 1: Treatment Technology Inventory and Stage of Development

Technology / Stage of Development	Targeted COCs	Proof-of-Concept Bench-Scale Testing	Detailed Bench-Scale Testing	Pilot-Scale Testing	Demo-Scale Testing	Full-Scale Execution	Work Carried Out to Date
Actiflo	TSS, total copper					→	Bench and full-scale testing.
Lime Treatment	Dissolved copper					→	Already in-use, technology development not applicable.
TMT Treatment	Dissolved copper	→	→	→	2023–24	2024–25	Bench and full-scale testing. Toxicity evaluation.
Pit-Lake Treatment	Selenium, nitrate	→	→	2023–24	2025–26	2027–29	Preliminary concept design and proof-of-concept bench-scale testing. Pilot-scale testing workplan.
Saturated Rock Fill (SRF)	Selenium, nitrate	→	2023–24	2025–26	2027–28	2029–31	Concept design, proof-of-concept bench-scale testing, detailed bench-scale testing workplan, and long-term substrate leach testing. Wight Pit SRF assessments.
Packed Bed Reactor (PBR)	Selenium, nitrate	→	2023–24	2025–26	2027–28	2029–31	Concept design, proof-of-concept bench-scale testing, and detailed bench scale testing workplan (in progress).
Biochemical Reactor (BCR)	Selenium, nitrate	→	→				Concept design and proof-of-concept bench-scale testing.
Submerged Sand Reactor (SSR)	Selenium, nitrate	→					Screening analysis.
Constructed Wetland Treatment (CWT)	Selenium, nitrate	→	→	→	2023–24	2025–27	Concept design, bench-scale testing, and on-site pilot scale testing (by others).

Implemented → Under Consideration → Eliminated/Paused →

Table 1 provides a summary of the development stage of the treatment technologies implemented or being considered for operations, closure, and post-closure. Future work is anticipated for any technology still under consideration that has not achieved full-scale implementation. Permitting to support technology development, although not specifically listed in Table 1, is assumed required before all onsite pilot-scale, demonstration-scale, and full-scale execution phases. The timelines presented in Table 1 are indicative only should not be relied upon for detailed schedule planning.

3.0 PROPOSED 2023 WATER TREATMENT SCOPE

3.1 SRF and PBR Detailed Bench Scale Testing

This task involves progressing Saturated Rock Fill (SRF) and Packed Bed Reactor (PBR) treatment technologies through the detailed bench scale laboratory testing phase for both technologies. The SRF and PBR technologies have already successfully progressed through preliminary bench scale testing to confirm the efficacy of these systems to achieve treatment objectives at that scale. In addition, a long-term bench scale test was performed to determine the impact of substrate leaching in the SRF reactor. The next phase of development is detailed bench scale testing to establish the system parameters for subsequent pilot scale test work. Planning for these detailed bench tests has been undertaken in 2022 with the actual test proposed for 2023.

Assumptions:

- Laboratory work will be carried out in WSP's Langley water treatment laboratory.
- MPMC will need to supply and ship test influent water with target influent water quality characteristics. MPMC will also need to supply suitable SRF and PBR reactor media, verified in the months prior to beginning the tests.
- SRK will provide the results of any geochemical testing undertaken regarding the SRF/PBR media substrate intended for the tests (see Scope Item 2.2), prior to selecting the media for detailed bench scale tests.
- The total test schedule is estimated at 45 weeks for each test, preferably occurring simultaneously.

Deliverable:

- Following lab work completion for each technology, WSP will provide a report for each test that outlines the results of the test and provides recommendations for subsequent pilot scale test work.

3.2 SRF Media Substrate Characterization

This task was begun in 2022 but was not concluded, as it was waiting on completion of the SRF long-term leach test as a key input to the geochemical characterization. The completion report from the long-term leach test is now drafted and under review by MPMC and this substrate characterization task is proposed for execution in 2023.

This task involves both geochemical and geotechnical characterization of the waste rock media that is intended to be used as reactor substrate in future passive treatment systems using the Saturated Rock Fill (SRF) or Packed Bed Reactor (PBR) technologies. Geochemical characterization is understood to be carried out by SRK, MPMC's geochemistry consultant and geotechnical testing will occur in WSP's Burnaby geotechnical laboratory. A technical memorandum will be provided by WSP regarding the geotechnical testing.

Assumptions:

- Geochemical testing and reporting are assumed to be carried out by SRK, following SRK's review of the SRF long-term leach test report.
- MPMC will provide suitable media for testing, pre-screened to 25-80mm, and shipped to WSP or SRK on request or directly to the appropriate laboratory as requested.

Deliverable:

- WSP will provide a brief technical memorandum that summarizes the results of the geotechnical laboratory testing.
- It is assumed that SRK will provide a separate deliverable, available to WSP for inclusion as an appendix to reports.

3.3 Pit-Lake Treatment

Pit-lake treatment is currently assumed as a component of the closure/post-closure treatment system. Pilot-scale pit-lake treatment work was anticipated for Cariboo pit, but recent mine operational changes have resulted in the draining of both Springer and Cariboo pits and pit-lake treatment trials are no longer feasible at these locations. Operational changes have also resulted in Wight pit being filled. The previous pilot-scale study designed for Cariboo pit is proposed to be redesigned for Wight pit if operational conditions in the near future are deemed appropriate, further advancing the development of this treatment technology.

Assumptions:

- It is assumed that conditions in Wight Pit would be suitable for a pit-lake treatment pilot-scale trial and would remain suitable for the required duration of the trial.
- It is assumed that constituents-of-interest would be present in suitable concentrations to allow the pit-lake treatment trial.

Deliverable:

- WSP will provide a revised pilot-scale pit-lake treatment study plan, modified for Wight Pit.

3.4 Flocculant Management Plan

The revised EMA Permit 11678 (revised December 2022) requires that MPMC produce a Flocculant Management Plan (FMP) regarding the use of flocculants and coagulants (settling aids) at their Veolia water treatment plant. The permit requires drafting of the FMP in 2023, with review of the FMP every 5 years thereafter. The FMP is to be submitted with the Annual Report. WSP proposes to prepare the FMP on behalf of MPMC.

The permit details several requirements of the FMP, including describing the planned use of settling aids at the water treatment plant, usage rates, monitoring and inspection expectations, toxicity prevention, and defined procedures for settling aid dosage targets.

Assumptions:

- WSP will produce the FMP according to the requirements stated in the EMA Permit 11678.
- MPMC will provide a timely response to WSP's information request regarding MPMC information required to produce the plan.
- The FMP will include discussion of currently used flocculants and coagulants at the treatment plant and will rely, in part, on information prepared by Golder (now WSP) regarding dosage and toxicity.

Deliverable:

- WSP will provide a Flocculant Management Plan that addresses the permit requirements, based on a plain language, lay person interpretation of the permit requirements.

3.5 Distributed Treatment Comparison

This task involves an options assessment comparing distributed passive/semi-passive water treatment to centralized treatment using Actiflo with potential additional components targeting copper (pit-lake pre-treatment, enhanced settling post treatment, TMT use). These are the two options identified by the BAT assessment for closure. Given the recent proposed modifications to EMA Permit 11678, the direct requirement of investigating passive and semi-passive water treatment technologies for distributed discharge has been removed from the permit. Selenium is modeled to be a parameter of concern during closure, with potential concentrations above permit limits; however, historic observations from site show selenium consistently below permit limits and it is unknown whether treatment systems targeting selenium would be required during closure. Previous work has assumed that selenium may be an issue, based on geochemical predictions (hence development of passive treatment technologies), with investigation into selenium-targeting passive treatment also being a permit requirement.

This assessment would compare anticipated costs of these systems, as well as benefits, drawbacks, uncertainties, and risks. The result of this assessment would provide direction on which water treatment activities should be undertaken to support closure under the revised permit requirements.

Assumptions:

- Conceptual level costing (AACE Class 5) would be used for the assessment.
- Conceptual level sizing for treatment options would be provided to support the costing.
- Centralized and distributed flow rates and water quality would be based on the most recent water balance and water quality modeling carried out for the 2022 Mine Plan and Reclamation Plan Update.

Deliverable:

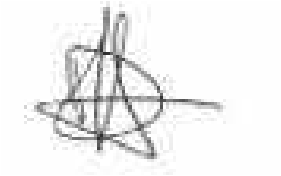
- A technical memorandum would be produced that summarizes the option comparison and provides recommendations for future treatment investigation to support closure.

4.0 CLOSURE

We trust that the information provided herein is sufficient for your needs at this time. If you have any questions or need additional information, please do not hesitate to contact us.

WSP Canada Inc.





Jesse Maddaloni, MASc, P.Eng.
Senior Mechanical Engineer

Darryl Howard, BSc (Chem Eng.), PMP
Senior Consultant (Mne Water Treatment)

JDM/DH/ar

https://golderassociates.sharepoint.com/sites/10023g/22514095 deliverables/002_issued/114-tm-39142-water treatment work plan/rev0_final/22514095-114-tm-rev0-39142-bat_assessment_plan_2023-31jan_23.docx

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APPENDIX 9-6: 2021 Discharge Management Plan

Mount Polley Mining Corporation
an Imperial Metals company
Box 12 • Likely, BC V0L 1N0 • T 250.790.2215 • F 250.790.2613

2021 Annual Discharge Plan

Submitted to:

Ministry of Environment and Climate Change Strategy
Environmental Protection Division
Mining Operations

and

Environment Canada

Prepared by:

Mount Polley Mining Corporation
Environmental Department

Box 12, Likely BC
V0L 1N0

(250) 790-2215

Date: Dec. 15, 2021

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APPENDIX A

Evaluation of Background Conditions, Mine Water Loading and Remaining Assimilative Capacity in Quesnel Lake – Mount Polley Mine

APPENDIX B

Evaluation of Background Water Quality Data in Quesnel Lake

APPENDIX C

Verification of Near Field Modelling in Quesnel Lake – Mount Polley Mine. Technical Memo

Document Revision and Review Control

Rev. No.	Revision	Date	Approved
0	Original	2018	CH
1	Annual review, updated dates	2019	AL
2	Annual review, updated dates	2020	AL
3	Annual review, added document revision/review table, updated dates	2021	GH

1 Introduction

1.1 Overview

On December 31, 2020, Mount Polley Mining Corporation (MPMC) received an amendment to Permit 11678 issued by the British Columbia (BC) Ministry of Environment and Climate Change Strategy (ENV) under the BC *Environmental Management Act* (*EMA*). The amendment authorizes, among other things, the discharge of treated effluent from the Mount Polley mine (the "Mine") site runoff and seepage collection water management systems until December 31, 2022 which reflects the operations phase contemplated under the currently authorized mine plan. The following effluent discharge locations were authorized:

- Quesnel Lake via direct pipeline until December 31, 2022.

This 2021 Annual Discharge Plan, required under Section 2.6 of *EMA* Permit 11678 is required to outline, among other items, the expected volume, timing, and quality of effluent released to Quesnel Lake, and plan the discharge in such a manner that avoids "pollution", as defined in *EMA* and as determined by the simple evaluation of parameter concentrations at the edge of the Initial Dilution Zone (IDZ) in Quesnel Lake. Parameter concentrations at the edge of the IDZ will be monitored using a model-based approach as part of a Trigger Response Plan (TRP) designed such that three key priorities (in order) will be met:

1. Protection of human safety (specifically, the safety of Mount Polley Mining Corporation Environmental Department monitors),
2. Protection of the environment and compliance with environmental laws, and
3. Related to bullet 2, the TRP has been designed to reflect the importance for MPMC to be able to effectively manage its site water balance so that it does not accumulate impounded water. The management of site water while minimizing water impoundment has been identified as an important priority not only by MPMC but also by First Nations, Ministry of Energy and Mines, BC ENV and our Independent Expert Review Panel (IERP).

These key priorities helped form the premises for the TRP and subsequent actions. Two major premises have formed the basis of the development of the TRP:

1. The TRP and the actions it contains must be implementable.
2. Modelling of dilution in the Quesnel Lake IDZ can reasonably rely on the near-field dispersion model (CORMIX – Golder) and far-field hydrodynamic model (Tetra Tech EBA) developed for Quesnel Lake.

This model-based TRP approach is in keeping with input from ENV and will help alleviate some of the safety concerns associated with sampling in inclement weather while providing reliable estimates of water quality at the edge of the IDZ.

The Mine's effluent discharge is also regulated by the *Metal and Diamond Mining Effluent Regulations* (*MDMER*) under the Federal *Fisheries Act*. This Plan has been developed for submission to ENV and Environment and Climate Change Canada (ECCC) to satisfy the applicable requirements of both *EMA* Permit 11678 and the *MDMER*.

1.2 EMA Permit 11678 Conditions

This Plan considers EMA Permit 11678 conditions and requirements pertaining to the Plan, as stipulated in *EMA* Permit 11678. Table 1 summarizes MPMC's mitigative and compliance responses to *EMA* Permit 11678 requirements which include:

- An outline of the expected volume, timing, and duration of effluent released to Quesnel Lake;
- Consideration or account of recent hydrology and snowpack information, mine water balance information, Polley Lake discharge control, and background water quality information;
- Demonstrate how the BCWQGs set out in column 2 of Table 1 of the permit will be met at the Edge of the IDZ in Quesnel Lake;
- A maximum turbidity target(s), as measured at the outlet of the treatment plant, which requires immediate reporting to the Director should the turbidity target(s) be exceeded for longer than one hour in duration;
- A trigger and response plan for treatment system shutdown(s), and/or for suspension or reduction of discharge, and for the resumption of the discharge, if the effluent discharge limits at the outlet of the treatment plant cannot be met, or if an objective for the Edge of Quesnel Lake IDZ cannot be met;
- Identification of the sources of mine water and the percent of each source in the total effluent discharge for each day;
- Demonstrate how the discharge will be managed to minimize suspended solids deposition into Quesnel Lake; and,
- Identification of equipment, including calibration and maintenance schedules related to continuous measurements of flow, turbidity, specific conductance and temperature.

Table 1. Requirements and Summary of Compliance and Mitigative Actions.

EMA Permit Requirement	MPMC Mitigative and Compliance Response
An outline of the expected volume, timing, and duration of effluent released to Quesnel Lake	Timing and volume for effluent discharge to Quesnel Lake depends on current climate conditions. Discharge will be managed via the MPMC Tailings Storage Facility (TSF) and the on-site Water Manager. Discharge volume will remain within permit limits.
Consideration or account of hydrology and snowpack information, mine water balance information, Polley Lake discharge control, and background water quality information	See Section 3.1 of this Annual Discharge Plan.
Demonstrate how the objectives set out in column 2 of Table 1 in the permit will be met at the Edge of the IDZ in Quesnel Lake	See Section 4.2 of this Annual Discharge Plan
A maximum turbidity target(s), as measured at the outlet of the treatment plant, which requires immediate reporting to the Director should the turbidity target(s) be exceeded for longer than one hour in duration	See Section 4.3 of this Annual Discharge Plan
A trigger and response plan for treatment system shutdown(s), and/or for suspension or reduction of discharge, and for the resumption of the discharge, if the effluent discharge limits at the outlet of the treatment plant cannot be met, or if an objective for the Edge of Quesnel Lake IDZ cannot be met	See Section 5.1 of this Annual Discharge Plan
Identification of the sources of mine water and the percent of each source in the total effluent discharge for each day	With regard to the source of effluent, this information is outlined in detail in the Technical Assessment Report (TAR) prepared in support of the *EMA* Permit 11678 application for the Long-term Water Management Plan (LTWMP) for the Mine site (the LTWMP being the subject of the April 7, 2017 amendment of *EMA* Permit 11678). A key consideration to this is in Appendix C of the TAR (Derivation of Geochemical Source Terms, SRK 2016). The similarities of the mineralized zones, including their host rocks, indicate that source terms can be appropriately developed on a site-wide basis rather than considering significant differences between the zones.
Demonstrate how the discharge will be managed to minimize suspended solids deposition into Quesnel Lake	See Section 3.4. of this Annual Discharge Plan

EMA Permit Requirement	MPMC Mitigative and Compliance Response
Identification of equipment, including calibration and maintenance related to continuous measurements of flow, turbidity, specific conductance and temperature.	See Section 3.5, Table 3. Summary of equipment, maintenance and calibration for continuous site measurements. of this Annual Discharge Plan

2 Effluent Treatment & Discharge System

2.1 Discharge System Components

Mine contact water is collected in a system of ditches located around the Mine site. The water, primarily rain and snow melt, ultimately reports to the Perimeter Embankment Till Borrow Pond (PETBP) from which it is pumped to the Water Treatment Plant (WTP). Treated contact water leaving the WTP flows by gravity through a buried 24" HDPE pipe to Quesnel Lake. At Quesnel Lake, the water is discharged into the lake through two twin diffusers (4 ports in total) with each of the twin diffusers located at depths of 45 meters and 50 meters.

In summary, the major infrastructure components associated with the collection, treatment, and discharge of mine contact water are:

1. Mine site contact water collection system (site-wide ditch system, sumps and pumps)
2. The PETBP
3. Veolia Actiflo^{TM} water treatment plant
4. 24" pipeline from the Veolia Actiflo^{TM} water treatment plant to Quesnel Lake
5. 2 depth staggered, dual port (4 ports in total), submerged diffusers in Quesnel Lake

The construction of the pipeline from the Veolia Actiflo^{TM} water treatment plant to the outfall of the Quesnel Lake diffusers was completed on November 24, 2017. All other works are as before, and were completed in the fall of 2015.

2.2 Water Treatment Plan (WTP)

As outlined in the LTWMP TAR site contact water, primarily originating as rain and snow melt, is conveyed through a site-wide ditch system to the PETBP (Golder 2016a). Water from the PETBP is pumped to the Veolia Actiflo^{TM} WTP, which is operated by qualified personnel 24/7. The Actiflo system is a flocculation/clarifier system which makes use of sand-ballasted lamellar settling to remove suspended solids present in the contact water. The WTP doses the raw water with coagulant to a tank where a polymer is injected to create floc particles. Microsand is added to ballast the flocculants, which move on to another tank that allows them to swell and mature. The water flows to the next stage, which uses lamella to clarify the water and promote fast settling of the microsand ballasted sludge. The clarified water is discharged and the sludge is separated from the microsand, the microsand being recycled for reuse. An in-line turbidity meter measures the turbidity every ten seconds and estimates the total suspended solids (TSS) using a calibrated algorithm based on a site-specific correlation between turbidity and TSS. If the effluent TSS is above 13 milligrams per liter (mg/L) for 1 minute there is an audible and visible alarm. If the effluent TSS is over 14 mg/L instantaneously, an alarm sounds to alert the operator and the WTP automatically goes into recirculation mode and ceases discharge to the pipeline.

2.3 Discharge System Locations

The diffusers, each of which are fitted with a "Y" splitter to two ports, are located at depth in Quesnel Lake at the following coordinates:

- 5,817,932 N and 601,747 E, and 5,817,935 N and 601,785 E.

3 Discharge Plan

3.1 Hydrology

The Mine area is drained by three main watersheds: Hazeltine Creek at Quesnel Lake, Edney Creek at Quesnel Lake, and Morehead Lake. The Hazeltine Creek watershed includes Polley Lake and the upstream Frypan Lake, and conveys all water from Polley Lake, the east side of the Mine area, and the area surrounding the Mine's TSF.

MPMC maintains a hydrological monitoring station on upper Hazeltine Creek that was originally installed by the Water Survey of Canada (08KH027). In general, the hydrology of Hazeltine Creek (and by extension, the Mine area), can be described as snowmelt-driven, with the majority of annual runoff occurring during freshet. Measured hydrology data for 2016 and early 2017 is included in Table 2, and compared to historic averages for rainfall (Golder 2016b), snowpack (estimated from Golder 2016b), snowmelt (estimated from Golder 2016b) and evaporation (Golder 2016b).

Table 2. Hydrology data including actual data from 2016 and early 2017, rolling average data from 2016 and early 2017, and historic averages for comparison.

Month	Rainfall (mm)			Snowpack (mm SWE)			Snowmelt (mm SWE)			Evaporation (mm)		
	Actual Data	Rolling Average	Historic Average	Actual Data	Rolling Average	Historic Average	Actual Data	Rolling Average	Historic Average	Actual Data	Rolling Average	Historic Average
Jan-16	31.5	2.9	50.8	167.0	144.0	150.0	1.0	N/A	0.0	7.6	7.0	0.0
Feb-16	26.4	6.8	37.5	219.0	170.0	187.0	54.0	N/A	0.0	18.0	17.0	0.0
Mar-16	17.2	10.8	42.8	50.0	174.0	200.0	170.0	N/A	10.0	45.2	34.0	0.0
Apr-16	33.9	61.6	49.5	0.0	23.0	21.0	50.0	N/A	188.0	95.8	86.0	0.0
May-16	51.0	52.2	53.5	0.0	0.0	0.0	0.0	N/A	10.0	125.3	67.0	52.0
Jun-16	66.2	68.8	78.2	0.0	0.0	0.0	0.0	N/A	0.0	133.1	104.0	94.3
Jul-16	76.3	51.7	58.9	0.0	0.0	0.0	0.0	N/A	0.0	113.1	111.0	102.0
Aug-16	19.5	31.0	52.2	0.0	0.0	0.0	0.0	N/A	0.0	125.3	95.0	88.8
Sep-16	91.4	41.2	48.2	0.0	0.0	0.0	0.0	N/A	0.0	54.8	49.0	48.1
Oct-16	93.2	50.7	58.2	0.0	0.0	0.0	0.0	N/A	0.0	17.2	20.0	18.2
Nov-16	24.3	33.5	53.5	29.0	17.0	13.0	20.0	N/A	13.0	15.1	7.0	0.3
Dec-16	0.0	3.6	85.6	86.0	107.0	99.0	0.0	N/A	0.0	2.6	5.0	0.0
Jan-17	0.0	2.7	50.8	130.0	143.0	150.0	11.0	N/A	0.0	5.0	6.0	0.0
Feb-17	0.0	6.2	37.5	135.0	168.0	187.0	13.0	N/A	0.0	13.7	16.0	0.0
Mar-17	0.0	9.9	42.8	75.0	168.0	200.0	99.0	N/A	10.0	38.8	35.0	0.0

Snowpack measured as Snow Water Equivalent (SWE) at month end
mm = millimetres

3.2 Mine Water Balance

Contact water from roads, haul roads, waste rock dumps, and other Mine areas is managed by a series of ditches, sumps and pumps. Currently (June 2020), any contact water that requires storage on site (i.e., when flows exceed those able to be treated and discharged) is pumped to the TSF. Tailings and process water from the Mill report by gravity to the TSF.

The WTP sources water from the PETBP. Treated water from the WTP is discharged by gravity to Quesnel Lake via the installed pipeline (completed November 2017) to the two outfall pipes. Effluent discharge to the Hazeltine Creek channel ceased as of September 30, 2017. A map of the water collection infrastructure is provided in Figure 1.

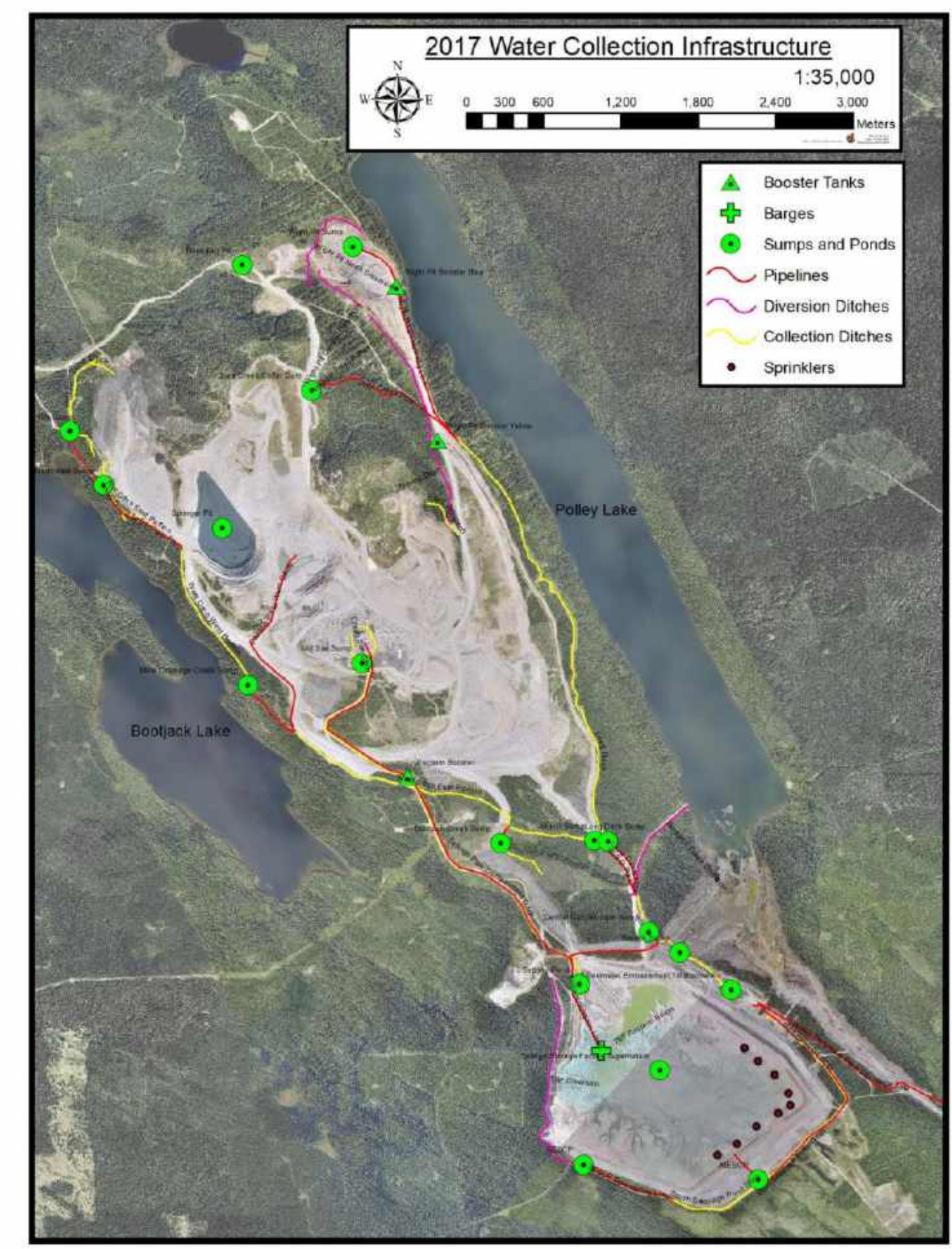


Figure 1. Water management infrastructure at the Mine.

3.3 Expected Volume, Timing, and Duration of Effluent Discharge

MPMC will discharge treated water in 2020 within the confines of *EMA* Permit 11678. Discharge of treated water to Quesnel Lake is limited to a maximum volume of 52,000 m^3/day, with an annual average of 29,000 m^3/day (Sections 1.2.1 and 1.2.2 of *EMA* Permit 11678). Discharge volumes are based on the maximum authorized instantaneous discharge rate of 0.6 m^3/s and maximum authorized annual average discharge rate of 0.33 m^3/s, respectively. The primary water sources for the WTP will be excess water collected and conveyed to the PETBP by the site contact water management systems and any water temporarily detained in the TSF.

With regard to snowpack, water volumes from snowpack and rainfall are aggregated in the maximum permitted discharge volumes, all of which report to Quesnel Lake through the subsurface diffusers and are subject to the flow limits imposed by the permit.

3.4 Management of Suspended Solids

The primary control method to minimize the discharge of suspended solids into Quesnel Lake is the WTP which is an active treatment system designed to remove suspended solids from influent water (Section 2.2).

The secondary method of reducing suspended solids and to reduce the potential for adverse effect on water quality is the utilization of significant engineered erosion control (e.g., armouring) as source control. These Best Management Practices (BMPs) are installed and constructed in the site-wide open flow ditch system. The mine also has an erosion and sediment control management plan for the whole of site.

3.5 Water Treatment

As detailed in Section 2.2, the main component of the treatment system is the Veolia Actiflo™ treatment plant, model ACP-650. The Actiflo™ clarifier system uses sand-ballasted settling to remove suspended solids present in the inflow (influent) water. The quality of influent water and effluent water is monitored within the treatment plant by a number of sensors, meters, and controllers. Table 3Table 3 provides a summary of equipment in the WTP, including calibration and maintenance equipment related to continuous measurements of flow, turbidity, and temperature.

Table 3. Summary of equipment, maintenance and calibration for continuous site measurements.

Equipment Type and Location	**Model Number**	**Calibration and Maintenance Requirements**
Turbidity Meter: Influent Pipe	HACH SS6 Surface Scatter Turbidimeter	Scheduled, periodic maintenance requirements of the SS6 Turbidimeter are minimal. Standardization checks should be performed on a monthly basis. Calibration should be performed at least every four (4) months by one of the methods provided in the Instrument Manual. Operation calibrates and checks weekly.
Electromagnetic Flowmeter: Effluent Pipe	Siemens Sitrans F M MAG 5100 W	The device is maintenance-free, although a periodic inspection must be carried out to check: • Ambient conditions • Seal integrity of the process connections, cable entries, and cover screws • Reliability of power supply, lightning protection, and grounds If required, Siemens will recalibrate the sensor using one of the calibration methods included in the Operating Instruction Manual.
Turbidity Sensor: Clarifier Tank	HACH Solitax® model TS-LINE sc	There are no maintenance requirements for the sensor once installed. Calibration for turbidity uses Formazin or StabCal® standard. Calibration for total suspended solids (TSS) is based on gravimetric TSS analysis with a correction factor. Operation calibrates and checks weekly.

Equipment Type and Location	Model Number	Calibration and Maintenance Requirements
pH Sensor (includes temperature and conductivity): Clarifier Tank	HACH Ryton® Sensor model DPD1R1	Maintenance requirements for the pH Sensor include cleaning the sensor and inspecting the sensor for damage every 90 days. Instructions on how to clean the sensor are in the User Manual. Automatic calibration identifies the buffer table corresponding to the chosen buffer and automatically calibrates the probe after it stabilizes. Alternatively, a manual calibration is performed by placing the pH Sensor in any buffer or sample with a known value and then entering that known value into the controller. Operation calibrates and checks weekly.
Flowmeter Signal Converter: Influent Pipe	Krohne IFC 010 Signal Converter	This is a signal converter and does not require any maintenance or calibration.
Universal Controller: Main Plant Controls	HACH sc200™	This is a signal controller and does not require any maintenance or calibration.

It should be noted that the WTP generates small volumes of sludge (precipitate) during active treatment. This material reports to a holding tank and is then pumped to a pond adjacent to the WTP. Typically, TSS is reduced from approximately 12 mg/L (influent) to approximately 7 mg/L (effluent) so 5 mg/L is considered "waste". This equates to approximately 5 m^3/1,000,000 m^3 of treated water. The sludge requires no further treatment as it is chemically inert.

3.6 Shutdown Criteria

The primary shutdown criterion for the WTP is based on TSS in the effluent. If TSS in the effluent reaches 14 mg/L, discharge to the pipeline is suspended until the level of TSS in the effluent drops to below this value. This is monitored using the automated in-line turbidity sensor and process logic controller, that will put the WTP into a recirculation mode if the limit is exceeded and then water is diverted back into the PETBP.

The secondary shutdown criterion is if laboratory analysis indicates an exceedance of any water quality parameters listed in Section 1.2.4 of *EMA* Permit 11678 at the end-of-pipe (as represented by the discharge from the WTP). Shutdown in that circumstance is operator-induced. In the event that water quality parameters at the edge of the IDZ (mid and near bottom samples) in Quesnel Lake (IDZ) exceed the quantities for those parameters set out in the final column in Table 4, the monitoring, reporting and response procedure will follow the TRP, described in more detail in Section Exceedances: Trigger Response Plan5.1 of this Plan. Sampling at the edge of the IDZ will only take place four times per year for ongoing model verification. It should be noted that the primary fail-safe to avoid any water quality exceedance with the end-of-pipe discharge or criteria listed in Table 4 at the IDZ is shutdown of the WTP, or, for shorter duration events an automated switch-over of the plant to a recirculation mode. Troubleshooting or additional monitoring would occur to identify and mitigate any problems leading to an increase in constituent levels at the end-of-pipe or the IDZ before the WTP would resume operations (Section 5.15).

4 Protection of the Receiving Environment

4.1 Background Water Quality

Background water quality in Quesnel Lake is summarized in Table 4 below.

In the last version of the Annual Discharge Plan (submitted on July 30, 2018 and approved on September 6, 2018), MPMC proposed to change the background water quality reference site from QUL-120a to QUL-2a (Table 4) as it has been shown to be not significantly different from location QUL-120a and poses less of a safety concern for sampling access (Golder 2018b). Location QUL-2a is the closest upgradient site to the discharge and water quality at a depth of 40 m was shown to be a better representation of what would be measured at the IDZ in Quesnel Lake in the absence of a discharge.

As summarized in the technical memo on evaluating background water quality data in Quesnel Lake (Golder, 2018b), all parameters at QUL-2a during 2016, met the Edge of Quesnel Lake IDZ limits established under Section 1.2.4 of *EMA* Permit 11678 with the exception of total copper, which was over the guideline in one sample and total phosphorus which was over the guideline in one sample.

Table 4. 2017 Background water quality information for Quesnel Lake (QUL-2a, 2017 data)

Parameter	Minimum	Average	Maximum	Edge of Quesnel Lake IDZ[1]
pH (in situ) (relative units)	7.83	7.90	7.95	n/a
Temperature (in situ) (Degrees Celsius)	2.70	7.22	17.83	n/a
Conductivity (in situ) (µs/cm)	97	108	120	n/a
Turbidity (in situ) (NTU)	0.17	0.35	1.30	n/a
Hardness (as $CaCO_3$) (mg/L)	47.4	51.7	54.3	n/a
Dissolved Oxygen (in situ) (mg/L)	8.7	11.1	12.7	n/a
Total Dissolved Solids (mg/L)	58	72	94	n/a
Total Suspended Solids (mg/L)	0.50	0.54	1.10	n/a
Total Sulphate (mg/L)	5.99	6.82	8.41	218
Total Ammonia (as N) (mg/L)	0.0025	0.0028	0.0085	0.18
Total Nitrate (as N) (mg/L)	0.047	0.124	0.154	3.0
Total Nitrite (as N) (mg/L)	0.0005	0.000535714	0.0015	0.02
Total Phosphorus (P) (mg/L)	0.001	0.001921429	0.005	0.01
Fluoride (F) (mg/L)	0.028	0.032	0.035	1.0
Total Arsenic (As) (mg/L)	0.00005	0.000107143	0.00014	0.005
Total Chromium (Cr) (mg/L)	0.00025	0.00025	0.00025	0.001
Total Copper (Cu) (mg/L)	0.00025	0.0008175	0.00205	0.0022 (30-day rolling average)
Total Iron (Fe) (mg/L)	0.015	0.017	0.037	1.0
Dissolved Iron (Fe) (mg/L)	0.015	0.015	0.015	0.35
Total Manganese (Mn) (mg/L)	0.0008	0.0013	0.0031	0.84
Total Molybdenum (Mo) (mg/L)	0.0002	0.000435786	0.000974	0.05
Total Silver (Ag) (mg/L)	0.000005	0.000005	0.000005	0.00005
Total Selenium (Se) (mg/L)	0.000077	0.000120	0.000209	0.002
Total Zinc (Zn) (mg/L)	0.0015	0.002132143	0.005	0.0075
Dissolved Aluminum (Al) (mg/L)	0.0047	0.006153571	0.0097	0.05
Dissolved Cadmium (Cd) (mg/L)	0.0000025	0.0000025	0.0000025	0.00013

(1) Edge of Quesnel Lake IDZ limits as established under Section 1.2.4 of EMA Permit 11678

Notes – where value is above the MDL, 0.5x the MDL is used in calculation, where values are all below MDL, then MDL is presented.

– DLs were substituted with 1/2 DL.

4.2 Predicted Water Quality

The TAR (Golder 2016a) included measures to manage the following water conveyances:

- Collection and temporary storage of all site contact water in the TSF
- Springer Pit dewatering
- Discharge of up to 0.6 m^3/s instantaneously and 0.33 m^3/s averaged annually of treated effluent to Quesnel Lake, via direct pipeline and two twin diffusers installed below the thermocline in Quesnel Lake (during the Quesnel Lake Discharge)

As part of the TAR, a water quality model was developed to predict the treated effluent chemistry of site discharge during operations and to evaluate the influence of the effluent discharge on Quesnel Lake (Golder 2016a). The model was developed using the GoldSim Contaminant Transport Module (GoldSim 2010). GoldSim is a graphical, object-oriented mathematical model where all input parameters and functions are defined by the user and are built as individual objects or elements linked together by mathematical expressions. The object-based nature of the model is designed to facilitate understanding of the various factors which control an engineered or natural system and predict the future performance of the system.

In GoldSim, each flow that could influence water quality was itemized and assigned a chemical profile based on site water quality monitoring data. The model was designed to track the volume and the mass load in the effluent discharge based on each water source (e.g., site runoff or pumped Mine flows) contributing to the discharge. Based on the quantity of these two parameters, the discharge water quality was calculated. A treatment efficiency was applied to the predicted discharge water qualities to evaluate the concentration of each parameter in the treated effluent.

The model was run stochastically using a Monte Carlo approach to bracket the range of effluent qualities that could occur. A probability distribution function was assigned to each source that could influence the discharge water quality and the model was run for 1,000 realizations on a monthly timestep, allowing the model to generate 1,000 unique values for each input. At each timestep, median and 95th percentile concentrations were calculated based on the 1,000 simulated values (referred to as "Scenario 1"). To account for potential changes in water chemistry over the long-term, a source-term based model was also used to simulate concentrations using the same water balance model (referred to as "Scenario 2").

The results of the model, accounting for treatment efficiency, were proposed as the effluent limits to be included in the application for amendment of *EMA* Permit 11678 for the Quesnel Lake Discharge. Depending on the water quality constituent, either Scenario 1 or Scenario 2 was used. In either case, the proposed *EMA* Permit 11678 limits were calculated such that treated effluent would not cause an exceedance of BC Water Quality Guidelines (WQGs) at the edge of the IDZ in Quesnel Lake, provided that natural conditions beyond MPMC's control do not cause WQG exceedances. It was assumed that such natural occurrences would be evaluated through monitoring associated with the Response Framework, which is part of the approved 2016 Comprehensive Environmental Monitoring Plan (CEMP) (MPMC 2018).

A Cornell Mixing Zone Expert System (CORMIX) model was developed to evaluate near-field concentrations within the Quesnel Lake IDZ, and a hydrodynamic model was also developed for Quesnel Lake (Tetra Tech 2015) to evaluate the concentrations of modelled parameters beyond the edge of the IDZ. Both models considered seasonality in the inputs with respect to effluent and ambient temperature and total dissolved solids (as they relate to water density) and wind currents (as they affect water currents). Both models predicted a wide range of dilution factors under various weather conditions, and the cautionary value of 40 was adopted for the TAR, reflecting the lower end of the range of predictions. In the TAR, the predicted dilution factor in the mixing zone in Quesnel Lake was applied to the proposed *EMA* Permit 11678 concentration limits to predict the concentrations beyond the edge of the IDZ. The resultant concentrations formed the basis of the impact assessment in the TAR. The outcomes of this assessment indicated the following:

- The predicted effluent was not acutely toxic; and
- The predicted concentrations at the edge of the IDZ in Quesnel Lake would not result in adverse effects to surface water quality.

Based on the information provided above, ENV approved the proposed effluent limits included in the TAR (Section 1.2.4 of *EMA* Permit 11678).

Discharge of treated site contact water from the Mine began on December 1, 2015, in accordance with the amendment of *EMA* Permit 11678 (November 29, 2015). Monitoring of the discharge and surface water quality has validated three of the models used to derive *EMA* Permit 11678 limits (water balance model, water quality model, and dispersion model). Based on this model validation, there is a high level of confidence that the effluent limits proposed in the TAR will not result in concentrations at the edge of the IDZ that are greater than BCWQGs. As part of the 2020 annual water management, it is expected that the BCWQGs will continue to be met at the edge of the IDZ in Quesnel Lake if MPMC continues to operate within the current end-of-pipe *EMA* Permit 11678 limits (Golder 2016b). While the effluent is not expected to result in water at the edge of the IDZ not meeting the BCWQGs, should background waters exceed the BCWQGs as they occasionally do because of, for example, seasonal events in tributary streams, then the water at the edge of the IDZ would reflect such natural lake conditions rather than the effluent discharge. MPMC will continue to sample at QUL-58 in accordance with the CEMP.

MPMC has previously attempted to locate the plume while in the field and, as expected (the model predicts a <3% chance of locating it), could not find a plume signature at the edge of the IDZ. MPMC has consulted with Tetra Tech who provided some additional advice and efforts based on that advice will be made towards plume identification while sampling. The challenges in identifying the plume in the field reflect the dispersion that is occurring.

In addition to being used for establishing the effluent limits included in the TAR, dispersion models will be used as part of the TRP to model dilution in the Quesnel Lake IDZ to determine compliance and to verify that water and effluent management by MPMC remains protective of the environment and compliant with environmental statutes. This model-based approach for the TRP will provide reliable water quality estimates at the IDZ while mitigating the safety risk associated with obtaining samples in the IDZ when it is unsafe to do so. The Quesnel Lake surface sample location at the edge of the IDZ (QUL-58), while appropriate as a monitoring point, is not a suitable compliance point as there are many other influences unrelated to the WTP discharge (especially in winter). An updated model validation shows that modelled dilution factors previously determined for *EMA* Permit 11678 amendment are still suitable for their intended use and that the overall dilution factor achieved by the effluent infrastructure is protective of Quesnel Lake (Golder 2018c).

An analysis of remaining assimilative capacity at the IDZ, taking into account contemporary background conditions and observed effluent has shown that while background concentrations limit some parameters and treated effluent limits others, the combination of background and effluent loading does not suggest exceedances to receiving environment limits set out in the final column of Table 4 (Golder 2018a). The results of the analysis showed that 14 of the 18 constituents remained below the receiving environment limits set out in the final column of Table 4 when viewed in aggregate (and therefore below BCWQGs at the IDZ) and the remaining constituents showed assimilative capacity on all days but one, for total copper, which fell to about 10% due to higher than normal Quesnel Lake background conditions.

Part of the monitoring approach will include ongoing analysis of the assimilative capacity at the IDZ, which demonstrates the relative loading percentages of background concentrations and effluent loading in comparison to the permit limit (Golder 2018a). Assimilative capacity will be monitored for all 18 constituents and reported through the use of a loading chart (Figure 2) in the quarterly report.

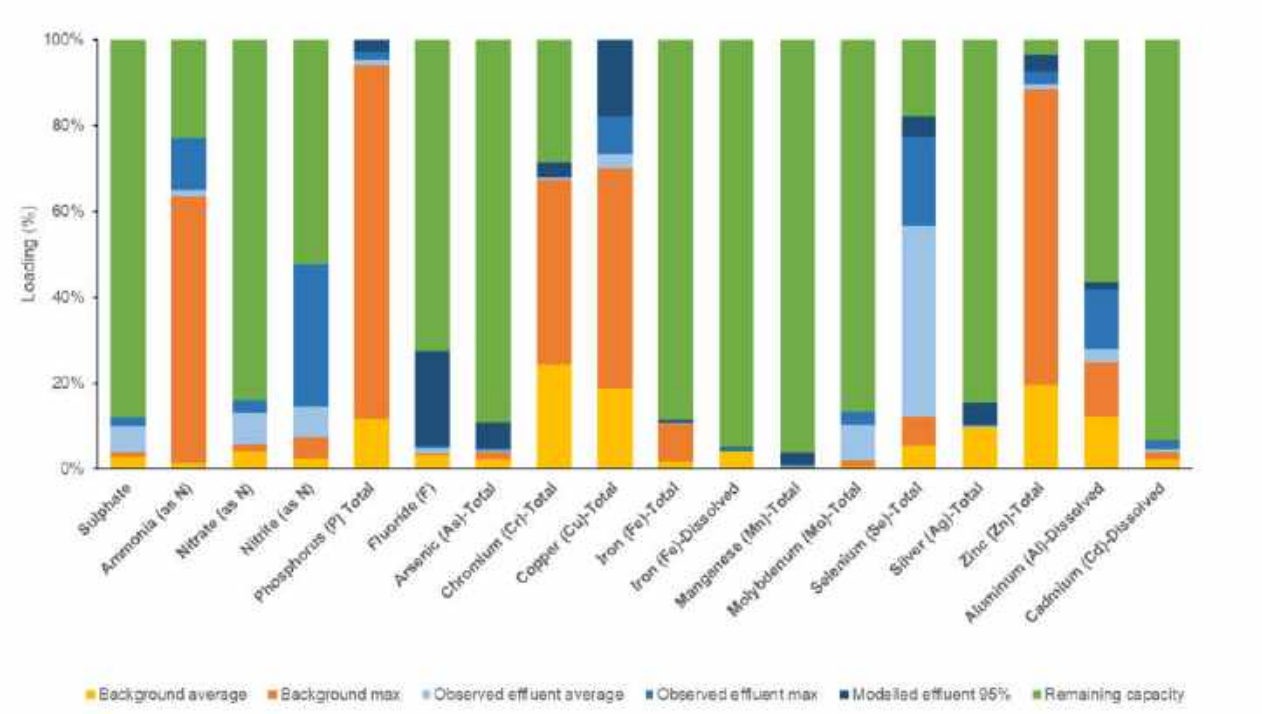


Figure 2. Calculated Assimilative Capacity of Constituents with Permit Limits

Interpretation of the loading chart must take into account that, while background concentrations tend to limit some parameters, treated effluent discharge tends to limit others. As well, when conservatively viewed in aggregate, constituents appear close to the receiving environment limits set out in the final column of Table 4 than when viewing the loading chart across individual days for a particular constituent.

Triggers will apply at the IDZ against the sampling completed four times per year (and subsequent sampling thereafter with respect to actions under the TRP), although it must be acknowledged that the data collected may not be representative of effluent discharge influences due to inputs from other sources (for example Horsefly River) that MPMC has no control over or responsibility for. This is detailed in the TRP in Section 5.1 of this Plan.

4.3 Turbidity Target Levels

MPMC has set target levels for turbidity at the edge of the IDZ in Quesnel Lake based on BCWQGs. Turbidity in Quesnel Lake should not exceed 5 NTU above the background on a 24-hour average basis, or 2 NTU above the background on a 30-day average basis (based on an average of five samples collected in 30 days). The first point of turbidity control remains at source where the water treatment plant monitors turbidity every 10 seconds with cautionary trigger levels programmed into the process logic controller. The system is automated such that if source turbidity is exceeded, the plant goes into recirculation mode (i.e., automatically stops discharging).

Regular monitoring and comparison to these levels is performed by MPMC. Further details of planned monitoring are presented in the CEMP (MPMC 2018).

5 Exceedances and Reporting

5.1 Exceedances: Trigger Response Plan

As detailed in the TAR (Golder 2016a), derivation of the effluent permit limits was based on attainment of Best Achievable Technology (BAT), attainment of the BCWQGs at the edge of the IDZ in Quesnel Lake and absence of acute lethality at the end-of-pipe. As such, compliance will be determined as follows:

- End-of-pipe (HAD-3): compliance with the effluent limits in EMA Permit 11678
- Quesnel Lake IDZ: execution of the Trigger and Response Plan set out in Section Edge of Quesnel Lake Initial Dilution Zone5.1.2 of this Annual Discharge Plan.

The model-based TRP approach helps to address several of the safety concerns associated with sampling in inclement weather while providing reliable but cautionary estimates of water quality at the edge of the IDZ. An updated model validation shows that modelled dilution factors previously determined for *EMA* Permit 11678 amendment continue to provide reasonable, though conservative predictions of water quality at the IDZ and that the overall dilution factor achieved by the effluent infrastructure is protective of Quesnel Lake (Golder 2018c).

Sampling in Quesnel Lake may be impeded if safety is considered to be a concern. If predicted/actual winds exceed 10 kilometres per hour (km/h), forecasted/actual thunderstorms or whitecaps are observed, sampling will not occur due to safety concerns. Strong winds that create greater than usual water currents also have the potential to prevent the collection of representative samples. During winter months, the West Arm of Quesnel Lake is often frozen over, partially frozen, or if it remains unfrozen, other vessels are typically absent. The presence of other mariners on the water is the main first response system that is used by the Canadian Coast Guard as part of vessel safety systems and absence of other mariners therefore increases safety risks (by increasing consequence) when on the water.

Modelling of dilution in the Quesnel Lake IDZ can reasonably rely on the near-field dispersion model (CORMIX – Golder) and far-field hydrodynamic model (Tetra Tech EBA) developed for Quesnel Lake. This provides a suitable means for effluent and receiving environment management that is not predicated on putting staff at risk. Ongoing confirmation of the suitability of this approach is also enabled through periodic monitoring when conditions safely allow.

It is normal for effluent volume and quality to fluctuate based on conditions of mining operations, weather, analytical precision and natural factors. Accordingly, a margin of safety between expected quality and permit limits has been incorporated into the modeling for the TAR and ultimately *EMA* Permit 11678 limits at the end-of-pipe. Considering this, the following TRP is conservatively protective of the environment (i.e., the approach is cautionary).

MPMC maintains a data management system that can be used for data monitoring purposes. All compliance and internal triggers are established in the database and an alert is automatically emailed to the Environmental Superintendent (and other qualified personnel) should an exceedance of a limit occur. As outlined in the CEMP, laboratory analytical data is uploaded to the database as soon as it is made available to the mine (or on the first working day thereafter).

Trigger response will be based on automatic exceedance alerts triggered by end-of-pipe (HAD-3) limit exceedances and on sampling undertaken at QUL-58 four times per year. Sampling at QUL-58 in combination with 5-sample 30-day frequency end-of-pipe (HAD-3) sampling will also be used in model verification.

Whenever safely possible, attempts will be made to sample at reference sites (QUL-2a and QUL-120a) during model verification.

Reference sites for background conditions have previously been QUL-120a and QUL-2a. However, location QUL-2a will be preferentially used due to better accessibility and safety. QUL-120a will be sampled annually.

Error! Reference source not found. provides a diagrammatic representation of the TRP decision-making process for end-of-pipe limits and Figure 4 provides a graphical representation of the TRP decision-making process for the receiving environment IDZ limits.

5.1.1 Effluent Limits (end-of-pipe)

MPMC maintains an end-of-pipe sampling point at the outlet of the WTP referenced as HAD-3 (EMS code E304230). This sample location is monitored at a 5-sample 30-day frequency as outlined in the CEMP (MPMC 2018). Samples are collected and shipped to a certified laboratory as outlined in the most current version of the Quality Assurance Manual, and required by Section 3.8.1 of *EMA* Permit 11678. It should be noted that under Levels 1 and 2, samples collected on the weekend (Friday to Sunday) cannot be shipped to the laboratory until the following Monday.

5.1.1.1 Level 1 Trigger: End-of-Pipe (HAD-3) 80% Early Warning Threshold– Monitoring and Response

Level 1 monitoring and response is undertaken should any parameter listed in Section 1.2.4 of *EMA* Permit 11678 exceed 80% of the discharge limit in the permit (with the exception of pH).

Level 1 monitoring and response is triggered when a database alert (automatically issued) indicates an exceedance of the 80% discharge limit. When this alert is received, the following response plan is initiated (flow chart representation in **Error! Reference source not found.**):

- Step 1: Collect effluent sample at HAD-3 and send for analysis.
- Step 2: Compare HAD-3 sample results to permit limits.
    - If sampling indicates levels less than 80%, proceed to Step 7.
    - If sampling indicates levels remain at or above 80%, proceed to Step 3.
- Step 3: Reduce discharge flows by 20% of the discharge at the time of the increased parameter values.
- Step 4: Review influent (E19) water quality data and compare to historic values.
- Step 5: Notify ENV Director of the Level 1 Alert.
- Step 6: Investigate cause and short term trends of rise in parameter values. Return to Step 1.
- Step 7: Once sampling indicates levels less than 80%, resume normal operations.
- Step 8: Document exceedance of the 80% target and investigation results in monthly report.

Sample(s) at HAD-3 will be collected as soon as reasonably possible. A "Priority" request will be made to the lab on any such additional sample such that turn around time to receive analytical results for the sample is reduced to two or three business days. It should be noted that samples collected on the weekend (Friday to Sunday) cannot be shipped to the laboratory until the following Monday.

5.1.1.2 Level 2: End-of-Pipe (HAD-3) Permit Exceedance – Monitoring and Response

Level 2 monitoring and response is undertaken should any parameter, listed in Section 1.2.4 of *EMA* Permit 11678, exceed the compliance limit.

The Level 2 trigger is initiated by a database alert (automatically issued), or when review of the data indicates an exceedance of a permit limit. When this alert is received, the following response plan is initiated (flow chart representation in Figure 3):

- Step 1: Place WTP in recirculation mode or shut down (following internal communication plan)
- Step 2: Notify ENV Director of exceedance
- Step 3: Collect samples of influent (E19) and effluent (HAD-3) and send for analysis. If weather conditions allow, collect sample at Quesnel Lake IDZ (QUL-58) and send for analysis.
    - Step 3a: If exceedance at QUL-58, proceed to Level 3 Alert (flow chart representation in Figure 4). If no exceedance, take no further action.
    - Step 3b: Compare HAD-3 sample results to permit limits.
        - If sampling indicates levels less than 80%, proceed to Step 5.
        - If sampling indicates levels at or above 80%, proceed to Step 3 of the Level 1 Alert.
        - If sampling indicates levels exceeding the permit limits, proceed to Step 4.
- Step 4: Investigate influent water quality and water treatment plant operations to determine cause of exceedance.
- Step 5: Notify ENV Director, and communicate progress and findings of investigation throughout the process.
- Step 6: Resume normal operation.
- Step 7: Submit exceedance investigation report to ENV Director

Sample(s) at HAD-3 will be collected as soon as reasonably possible. Sample(s) at QUL-58 will be collected as soon as reasonably possible, weather and safety permitting. A "Priority" request will be made to the laboratory on any such additional sample such that turn around time to receive analytical results for the sample is reduced to two or three business days. Since sampling at QUL-58 may not be possible for safety reasons, resumption of the discharge during a Level 2 Alert will be dependent on the effluent (HAD-3) meeting the permit limits in Section 1.2.4. Concurrently, an investigation will be implemented to determine the cause of the exceedance of the permit limit.

Once the monitoring and the investigation has been completed, a report will be submitted to the Director as outlined in *EMA* Permit 11678 Section 4.3. This report will include:

a) All relevant test results related to the exceedance event(s),
b) An explanation of the most probable cause(s) of the exceedance(s), and
c) A plan to prevent similar exceedance(s).

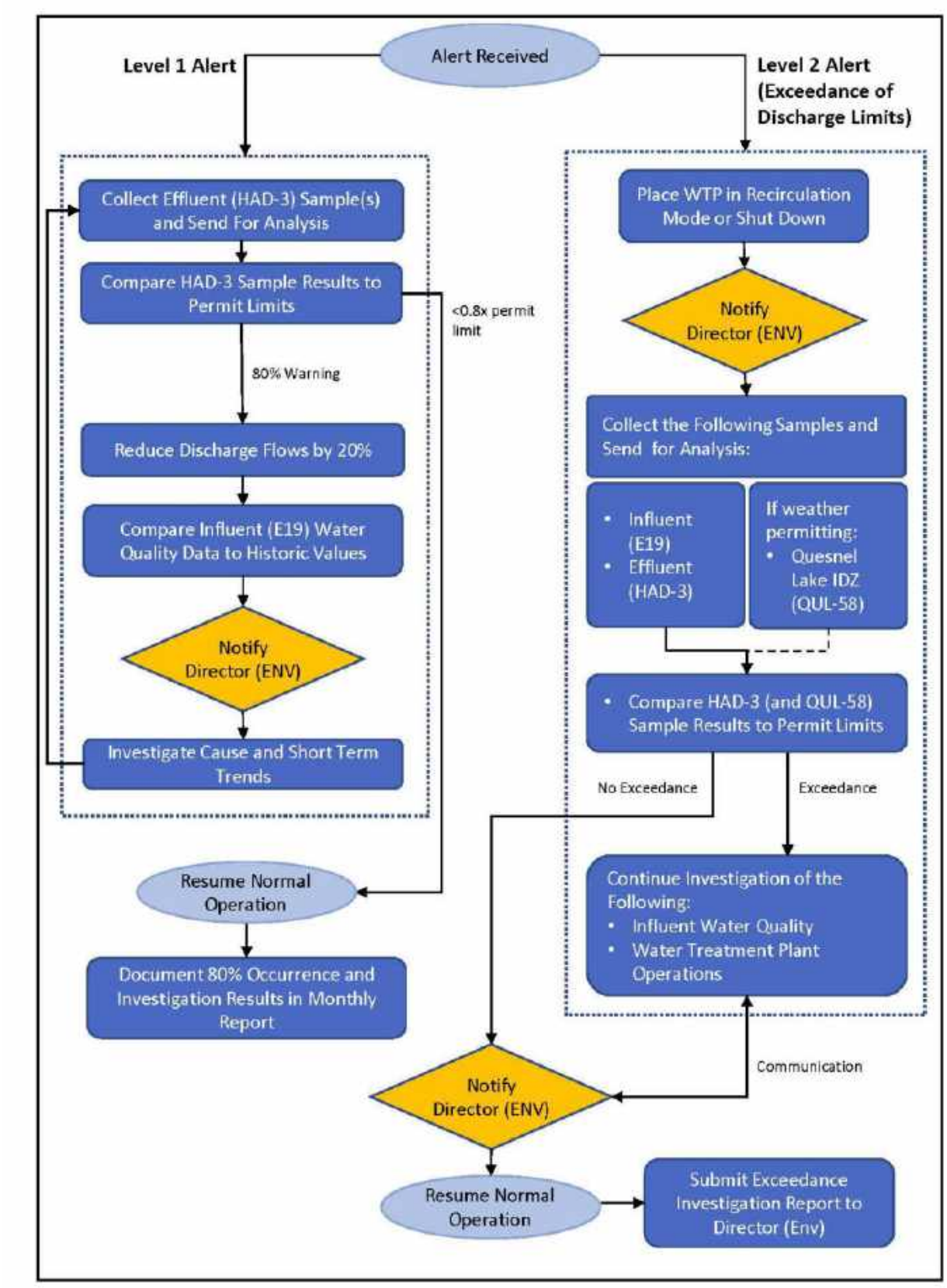


Figure 3. Flow chart representation of the TRP decision-making process for the treated effluent (end-of-pipe)

5.1.2 Edge of Quesnel Lake Initial Dilution Zone

MPMC maintains a sampling point at the edge of the IDZ referenced as QUL-58 (EMS code E304876). This sample location is monitored four times per year, as outlined in the CEMP (MPMC 2018). Samples are collected and shipped to a certified laboratory as outlined in the most current version of the Quality Assurance Manual, which is required by Section 3.8.1 of *EMA* Permit 11678. Ongoing sampling at QUL-58 will serve as a model verification for the near-field dispersion model (CORMIX – Golder).

5.1.2.1 Level 3: Exceedance of Receiving Environment Trigger Levels - Monitoring and Response

Level 3 monitoring and response is undertaken if any parameter listed in Section 1.2.4 of *EMA* Permit 11678 exceeds the receiving environment trigger levels set out in the right-most column of Table 4. Monitoring and response is triggered when a sample taken at QUL-58, either as part of routine sampling or following a Level 2 Alert, indicates an exceedance of these trigger levels. When this alert is received, the following response plan is initiated (flow chart representation in Figure 4):

- Step 1: Place WTP in recirculation mode or shut down (following internal communication plan)
- Step 2: Notify ENV Director of exceedance
- Step 3: Determine if weather conditions allow samples to be taken on Quesnel Lake safely.
    - If yes, sample QUL-58 and QUL-2a and send for analysis.
    - If no, use HAD-3 sample and most recent QUL-2a sample to model water quality at QUL-58.
- Step 4: Compare modelled and measured (if available) QUL-58 results to receiving environment trigger levels.
    - If exceedance, proceed to Step 5.
    - If no exceedance, proceed to Step 8.
- Step 5: Continue investigation of Quesnel Lake water quality by comparing current water quality data to historic data and modelled (TAR) data and dilution modelling.
- Step 6: Use water quality data and dilution modelling to determine discharge rate based on assimilative capacity.
- Step 7: Based on data, and subject to any directions the Director may give:
    - If the data does not support resuming operations, return to Step 5.
    - Resume operation. If discharge rate is less than permitted discharge rate, return to Step 3 and repeat the analysis. Otherwise, proceed to Step 10.
- Step 8: Notify ENV Director.
- Step 9: Resume normal operation.
- Step 10: Submit exceedance investigation report to ENV Director.

Sample(s) at QUL-58 and at QUL-2a (background) will be collected as soon as reasonably possible, weather permitting. A "Priority" request will be made to the lab so that turn around time to receive analytical results for the sample is reduced to two or three business days. It should be noted that samples collected on the weekend (Friday to Sunday) cannot be shipped until the following Monday.

A review and comparison of the re-sample data with parameter concentrations at the reference station QUL-2a (located in the West Arm of Quesnel Lake), which will serve as a reference comparison, shall be made, and the Relative Percent Difference (RPD) shall be calculated.

- If the RPD is ≤ 20%, the sampling results are considered to be analytically indistinguishable from the reference concentrations. The dilution capacity of Quesnel Lake will be assumed to be diminished and discharge will only be resumed as described below.

- If the RPD is > 20%, then a review of the existing monitoring data for the effluent discharge, the edge of the IDZ, and other monitoring points outside the IDZ in the receiving environment (e.g., QUL-2a, Edney Creek, Hazeltine Creek) shall be undertaken. This review shall include an evaluation of the estimated dilution at the edge of the IDZ. The estimated dilution shall be compared with the dilution factors predicted in the TAR.
- If the dilution is less than the minimum dilution predicted in the TAR:
    - An evaluation of the effluent and ambient conditions shall be undertaken to resolve the discrepancy. Depending on the outcome, the evaluation may include an inspection of the outfall pipes and diffuser ports to confirm that they are intact.
    - MPMC shall investigate and present the findings to the ENV Environmental Protection Director identifying the likely cause of the low dilution and its remedy.
    - MPMC shall provide an Interim Discharge Plan to the ENV Environmental Protection Director that outlines interim measures to be undertaken by MPMC to manage the water balance in accordance with EMA Permit 11678 and any requirements under *Mines Act* Permit M-200.
- If the dilution is greater than the minimum dilution predicted in the TAR, it is assumed that background concentrations are elevated and the dilution capacity of Quesnel Lake is diminished. Discharge will be resumed only when resampling the effluent discharge (while in recirculation mode) and resampling at QUL-58 indicate that the receiving environment trigger levels can be met using the minimum dilution predicted in the TAR (i.e., the dilution capacity of Quesnel Lake is no longer predicted to be diminished). The flow rate of the effluent discharge can be managed accordingly depending on the sampling results.

When monitoring and analysis has determined the WTP is effectively treating water to meet the end-of-pipe permit limit, and the dilution model indicates that the IDZ does not exceed the Edge of the IDZ trigger levels in Table 4, the Director will be notified and the WTP effluent will be redirected to the discharge pipeline.

Once the monitoring and the investigation has been completed, a report will be submitted to the Director as outlined in EMA Permit 11678 Section 4.3. This report will include:

- All relevant test results related to the exceedance event(s),
- An explanation of the most probable cause(s) of the exceedance(s), and
- A plan to prevent similar exceedance(s).

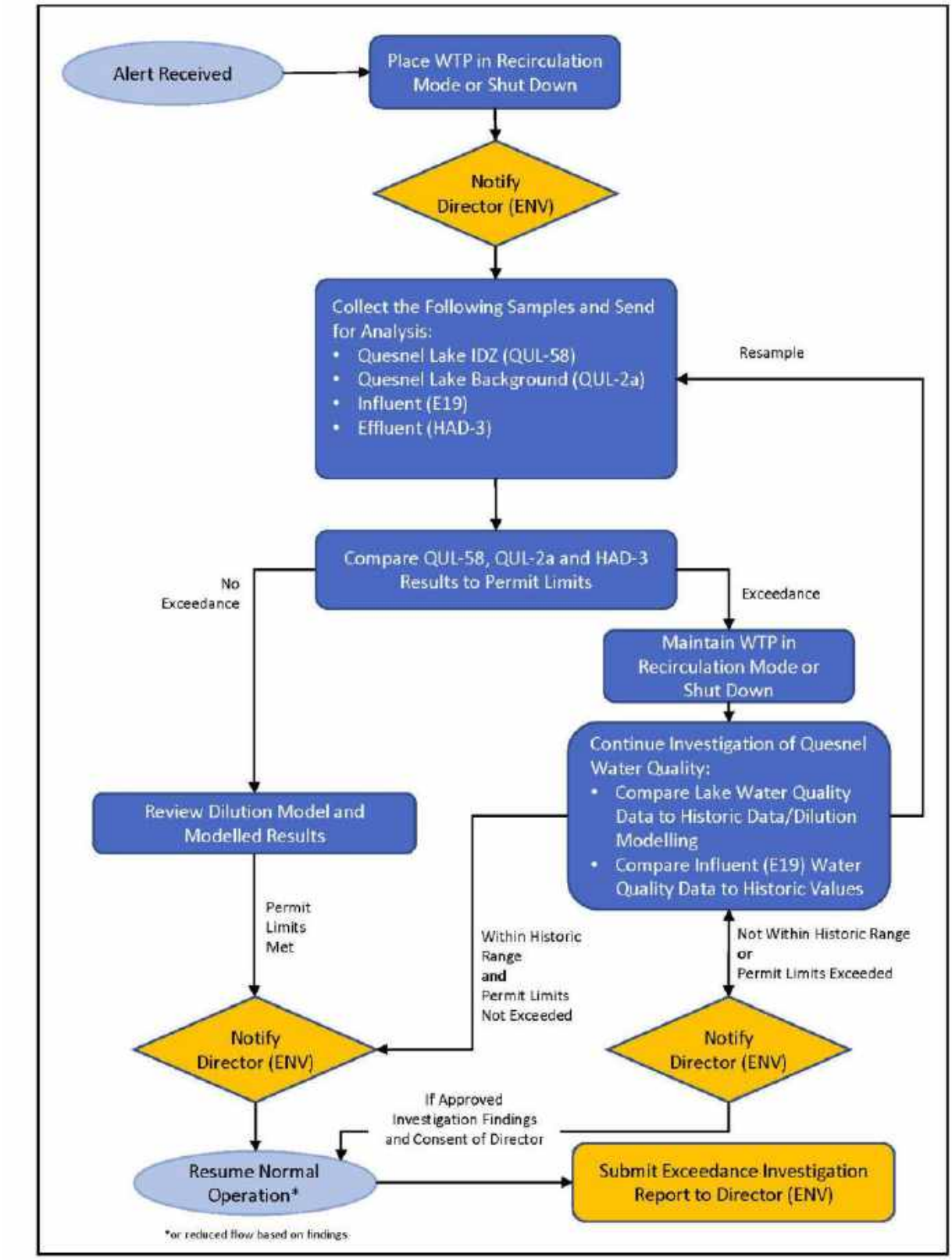


Figure 4. Flow chart representation of the TRP decision-making process for the receiving environment IDZ limits

5.2 Reporting: Ministry of Environment

In accordance with Section 4.0 of *EMA* Permit 11678, MPMC will submit required reports for each month that discharge occurs. Report shall include at a minimum:

- The volume of treated effluent discharged,
- a summary of continuous Turbidity readings of the treated effluent discharged, and
- the most recently available water quality results for the effluent discharged, including toxicity.
- Each monthly report shall be submitted within seven days of the end of previous month via email to EnvAuthorizationsReporting@gov.bc.ca.
- Each monthly report shall also contain and present all data submitted in the previous 2 monthly reports in a manner that would identify potential trends.

Any toxicity test failures, as defined and described in Section 4.4 of *EMA* Permit 11678, shall be reported to the ENV Environmental Protection Director as stipulated below. A sample is considered to have failed the specific toxicity test if:

- **96-hr LC50 Rainbow Trout:** Using 100% effluent concentration, more than 50% of the fish die within a 96 hour test period,
- **48-hr LC50 Daphnia magna:** Using 100% effluent concentration, more than 50% of the organisms die within a 48 hour test period,
- **7-day Ceriodaphnia dubia reproduction**: The water is determine to cause greater than 25% inhibition of survival and reproduction; or
- **7-day ELS toxicity test with a salmonid fish**: The water is determined to cause greater than 25% non-viable embryos.

MPMC will also notify the ENV Director of any non-compliance and take appropriate remedial action. MPMC will provide written confirmation of all non-compliance events within 24 hours of the original notification to the Director, and will follow up with a written report within 30 days, as described in Section 4.3 of *EMA* Permit 11678. In the case of the Edge of Quesnel Lake IDZ limits as outlined in Table 4, MPMC will notify the ENV Director of any exceedance and take appropriate action as outlined under the TRP (Section 5.1.2). MPMC will provide written confirmation of all Edge of Quesnel Lake IDZ limit exceedance events with 24 hours of the original notification to the Director, and will follow up with a written report on the steps taken under the TRP (Section 5.1.2) within 30 days and prior to resuming effluent discharge.

5.3 Reporting: Environment Canada

As required under *MDMER* Section 24 (1-2), the Inspector will be notified if effluent monitoring results show that concentrations exceed those limits for the parameters specified in *MDMER* Schedule 4; if the effluent is outside the pH range of 6.5 to 9.5; or, if the effluent is acutely lethal (greater than 50% mortality at 100% effluent concentration). A written report to the Inspector will follow within 30 days of the tests being completed.

If the effluent is determined to be acutely lethal, the effluent water quality samples will be characterized without delay and additional acute lethality sampling will be conducted as required under *MDMER* Section 15.

If deposits outside of the normal course of events occur, acute lethality testing will be completed as required by *MDMER* Section 14 (1). A written report meeting the requirements outlined in *MDMER* Section 31 will be submitted to the Inspector within 30 days.

5.4 Reporting: Local Communities

Reporting of any actions under this Plan will be in accordance with the Communication Plan developed under Section 2.11 of *EMA* Permit 11678.

6 References

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APPENDIX 9-7: Invasive Plant Management Plan

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Environmental Management Plan:

Invasive Plant Management Plan

Last Update: March 29, 2017

Document Review and Revision Control

Rev. No.	Review/Revision	Date	Author
0	Original	January 2014	GH
1	Update of site specific components and plans	July 9, 2015	KM
2	Update of site specific components and plans; updated to reflect current government regulations/documents; added document tracking and formatting to be consistent with other MPMC EMPs	March 29, 2016	KM
3	Annual Review	Dec. 2020	GH

1 Introduction

The BC Ministry of Forest, Lands and Natural Resource Operations (as per the British Columbia [BC] Inter-Ministry Invasive Plant Working Group) defines invasive plants as “non-native (alien) plants whose introduction into BC cause, or are likely to cause, economic or environmental damage, or harm to human health” (MFLNRO, 2014). The Invasive Species Council of BC has a similar definition, and notes that invasive plants can establish quickly and easily on both disturbed and un-disturbed sites, causing widespread negative economic, social, and environmental impacts (ISCBC, 2015).

Mining operations result in disturbed areas, which can be susceptible to invasion of invasive plants. Such invasions have the potential to hinder reclamation efforts or interfere with regional invasive plant management programs. To manage this risk, Mount Polley Mining Corporation (MPMC) has developed this Invasive Plant Management Plan (the “Plan”). The purpose of the Plan is to outline procedures for the prevention and, if necessary, control (mitigation) of the establishment of invasive plants or noxious weeds in the Mount Polley Mine (the “Mine”) area throughout the Mine project life, including closure.

1.1 Regulatory Framework

The BC *Weed Control Act* (RSBC, 1996) requires owners or occupiers of crown and private lands in BC (excluding those under federal jurisdiction) to control listed noxious weeds. As such, MPMC is under legal obligation to control these species. At the time of last update of this Plan, the BC Proposed Prohibited Noxious Weeds List (MFLNRO, 2016) was the most up to date applicable listing.

As per the BC *Mines Act* Section 10.7, mine land surfaces must be reclaimed to an approved end land use at closure, excluding lands that are not to be reclaimed, and the average land capability should be equal to or greater than the average land capability present prior to mining. While these requirements do not specifically mention invasive plants, they are inherently included; given the undesirable nature of invasive plants, their associated negative environmental and economic impacts, and the fact that invasive plants are non-native, such species are likely inconsistent with closure revegetation objectives and could result in a mining company not meeting their closure revegetation targets.

In addition, under MPMC’s *Mines Act* Permit M-200, the following additional specific conditions apply to invasive species management at the site:

- The Permittee shall manage and control invasive species that establish on the site and shall take reasonable efforts to ensure that invasive species do not move from the site to adjacent areas.
- The Permittee shall ensure that all seed mixes are certified as weed-free.
- Revegetation species shall be selected based on the principles of ecological succession and traditional use and cultural significance, including all reasonable efforts to use only native species unless short-lived agronomic species are required to temporarily control erosion or prevent ingress of invasive species.

While not associated with regulatory requirements, the Cariboo Chilcotin Coast Invasive Plant Council (CCCIPC) is a non-profit organization that coordinates the invasive plant management efforts of government agencies, individuals, communities and industry sectors, and promotes awareness and education about invasive plants in the region. Each year, the CCCIPC produces an Annual Strategic Plan (http://cccipc.ca/index.php/S=0/resources/regional-strategic-plans/) which incorporates provincial requirements (e.g., noxious weeds listings) and is to be used as a guide for invasive plant management activities and resource allocation in region.

2 Objectives

As described above, the purpose of the Plan is to outline procedures for the prevention and, if necessary, mitigation of the establishment of invasive plants or noxious weeds in the Mount Polley Mine area throughout the Mine project life and closure. The specific objectives are to:

- Control invasive plant establishment on the site, such that reclamation objectives are achieved. Reclamation objectives include establishing self-sustaining vegetative covers on disturbed areas at the Mine site with native vegetation this is appropriate to the target site series and consequently promotes the target end land use(s); and
- Implement invasive plant control measures consistent with the Regional Strategic Plan and the BC Proposed Prohibited Noxious Weeds List.

This Plan applies to the operations footprint of the Mine as well as areas being rehabilitated following the tailings dam embankment breach. However, only the Mine site is regulated under the BC *Mines Act* and associated items (e.g., permit requirements and land capability requirements) do not apply to breach rehabilitation areas. Instead, reclamation revegetation objectives for the breach area will be defined by the Remediation Plan due for submission in the third quarter of 2017.

The Plan follows the Plan, Do, Check, and Act cycle developed by the International Standards Organization guidelines. The cycle is described as follows:

- **PLAN** - identifies potential sources of invasive plant ingress that may challenge achieving the objectives of the program;
- **DO** - documents the prevention and control management practices in place at the Mine;
- **CHECK** - describes the monitoring procedures and methods for evaluating monitoring results against the objectives; and
- **ACT** - describes review of the management program and update of procedures based on monitoring results in order to promote its continuous improvement and mitigate identified deficiencies.

3 Plan: Identification of Potential Sources of Invasive Plant Ingress

Mining activities can facilitate the introduction or spread of invasive plants by removing native vegetation, which decreases competition for weedy plants, and creating exposed soil in disturbed areas. Exposed areas create a soil bed which may allow invasive plants to establish. These areas include:

- Soil stockpiles and areas from which the soil was salvaged;
- Soil applied to reclamation areas;
- Road and powerline construction and maintenance activities; and
- Exposed areas around the Mill site, maintenance areas and other associated infrastructure.

Table 1 provides an overview of potential sources of invasive plant ingress to the site. Each potential source is classified into if control is possible or not. If control is not possible, for example the movement of wildlife or wind transport of seed, only prevention methods (and, if necessary, mitigation measures) are applicable to management.

Table 1 Potential sources of invasive plant ingress and/or spread at the Mount Polley Mine site

Category	Source	Control Method Possible
Animals	Livestock	×
	Wildlife	×
Natural spread	Wind (long-distance)	×
	Rhizome spread or seed drop (short-distance)	✓ (within Mine site only)
Human-mediated spread	People – on-site (e.g., employees, and contractors)	✓
	People – off-site (e.g., tourists and recreationists; spread to areas immediately adjacent to site)	×
	Vehicles and equipment – on-site	✓
	Vehicles and equipment – off-site (spread to areas immediately adjacent to site)	×
Reclamation Activities	Application of soil from contaminated soil stockpiles	✓
	Use of contaminated seed or soil amendments	✓
	Use of contaminated soil amendments	✓

4 Do: Prevention and Control Measures

4.1 Preventative Measures

The primary goal involved in managing invasive plant infestations in the project area is to carry out mining activities in a manner that prevents the introduction or spread of invasive plants and supports the ability to establish desired species during site reclamation activities.

MPMC is to implement the following best management practices for preventing invasive plant establishment on disturbed areas at the Mine, which are to minimize disturbance during all phases of the mining operation in order to limit the availability of exposed, un-vegetated ground to invasive plant seed deposition; and establish a vegetative cover as soon as possible after ground disturbance. Specifics for establishing ground cover vegetation are as follows:

- Seed ground disturbed due to construction or mining activity with a rapidly establishing seed mix for erosion protection and invasive plant control if reclamation of the area is not imminent. Active areas (e.g., open pits or areas without appropriate substrates for vegetation growth) at the Mine do not require invasive plant control as vegetation does not have a chance to become established;
- Seed soil stockpiles; water management features such as ditches and sediment pond berms; borrow pits; road edges; powerline access roads and power pole installation sites; inactive sections of mill site areas, storage and equipment yards; and generally any disturbed ground where invasive plant establishment is possible;
- Use only high quality grade seed in the reclamation and interim invasive plant control seed mixtures. Low quality grade seed may contain a higher portion of weed seed in the seed lot. At minimum, ensure that the seed used for revegetation is of the grade Common #1 Forage Mixture or Canada No. 1 Ground Cover Mixture.
- Assess soil amendments that may contain invasive plant seeds or propagules. This is currently only applicable to biosolids, and MPMC's supplier (Metro Vancouver) tests the material to verify that invasive plant seeds are not present.

MPMC typically conducts a seeding program annually in the spring and/or fall, and any disturbed areas (as described above) or areas that were previously seeded but lack appropriate native vegetative cover, should be added to the list of areas to be seeded.

4.2 Control Measures

If monitoring results (Section 5) show areas of invasive species infestation that are not consistent with the objectives of this Plan (Section 2), available control or mitigation options for managing established invasive plants include mechanical, biological, and chemical methods.

Mechanical methods include:

- Hand weeding or pulling (if plants are hand-pulled, propagules are to be removed from the site and disposed of in a way that does not allow the spread of seeds. i.e., burned, not composted);
- Mowing or cutting; and
- Burning.

Biological control agents are natural organisms that are another option for reducing invasive species populations. Typically, they are insects, nematodes, fungi or viruses that infect or invade the invasive plants and weaken the target species by decreasing seed production and reducing density. Biological control is only an option for select invasive species

Chemical control through application of herbicides will be the method of last resort because applications are limited by proximity to watercourses and can potentially have detrimental effects on native vegetation.

In addition to these mitigation methods, contingency control programs that could be reviewed for feasibility and implemented are:

- Inspection and/or cleaning of vehicles or equipment coming from offsite or moving from an infested area to an uninfested area within the site;
- Refraining from driving through areas infested with invasive plants;
- Limiting road maintenance to the road surface to retain vegetation along the roadsides;
- Keeping equipment yards and vehicle storage facilities free of invasive plants; and
- Training personnel on preventing invasive plant spread by checking and removing seeds from clothing and equipment.

It is important to note that majority of the invasive plants observed at the Mine are designated in the CCCIPC Regional Strategic Plans as “established” or are designated as non-native species (not invasive species), and management options are not implemented regionally because control of these species is not currently feasible. As such, MPMC does not actively manage these species, unless they are directly impeding reclamation efforts. These aforementioned control measures are listed as options for future use, as required, and are currently not a routine component of MPMC’s invasive plant management activities, as the Plan objectives are being met without their use.

Mitigation measures will focus on the “new invaders” and “containment” categories, as well as any “established” species if they are directly impeding reclamation efforts. Consistent with the Regional Strategic Plan, the treatment goal for “new invaders” is eradication (elimination of all individuals and their propagules), while the treatment objective for species listed for “containment” is prevention of invasive

plants from spreading to uninfested areas. For species that are impeding reclamation revegetation, but are regionally listed under “containment” or “established” categories, the primary option will be suppression (reduction in plant population size and abundance). These control measures generally follow the following process, based on the level of infestation:

1. Prevent new infestations from becoming established;
2. Eradicate small or isolated “satellite” infestations;
3. Contain the perimeter of large “core” infestations; and
4. Suppress the interior of large “core” infestations.

If control measures area applied in the future, any sites that have treatments applied will be monitored through the established methods (described in Section 5) in subsequent years to assess if treatment measures have been successful.

5 Check: Monitoring Program

The MPMC invasive plant monitoring program includes visual surveys conducted in combination with routine assessments of progressive reclamation sites and annual soil stockpiles inspections; invasive plant species present and their percent cover are documented and compiled with revegetation results.

In addition, more formal invasive plant inventories are to be conducted routinely at the Mine site. These inventories should encompass disturbed areas, including any that are undergoing reclamation, as well as adjacent undisturbed areas from which invasive plants could ingress. Inventories may be conducted by MPMC Environmental Department staff with sufficient expertise or an external consultant. Each inventory should include the following items, with the results presented in a report:

- Surveying and mapping of infestation locations, with a focus on reclamation areas and soil stockpiles;
- Identification of invasive plant species present;
- Assessment of the degree of invasive plant growth, distribution, and density present at infestation sites;
- Assessment of success of any prevention and control measures that were previously implemented;
- Recommendations for any prevention and control measures that should be implemented; and
- Recommendations for when the next inventory should be conducted.

Where possible, all assessments and inventories should take place in the late spring/early summer so that eradication measures can be undertaken prior to seed dispersal in late summer/early fall. Alternatively, assessments and inventories can be conducted in mid to late summer, when plants are readily identifiable, with interpretation of results to take place over winter and management applications to be implemented early the following growing season.

6 Act: Program Review and Continuous Improvement

Each year, the results of invasive species monitoring should be reviewed with respect to the objectives outlined in Section 2, and the Plan and associated site invasive plant management activities should be updated accordingly. Specific items that should be reviewed and associated actions are listed in Table 2. When the Plan is updated, it is to be submitted to the Ministry of Energy and Mine with the Annual Environmental and Reclamation Report. In addition, an update on invasive plant monitoring, prevention

and control activities at the Mine (including any pertinent results from progressive reclamation and soil stockpile inspections, and site invasive plant inventory reports) is to be included in the Annual Environmental and Reclamation Report each year.

Table 2 Invasive plant management program review process

Item to Review	Associated Actions
Verify that all seed mixes used were certified weed-free (i.e., comply with Canadian Food Inspection Agency standards).	If seed utilized is not certified weed-free (or invasive plants were suspected to be present in the seed mixtures used): • Change seed suppliers and/or seed mixtures.
Verify that all soil amendments (where appropriate) were tested to confirm they did not contain invasive plant propagules or seeds.	If soil amendments were not tested: • Conduct post-application assessments for any soil amendments not tested; • Discontinue use of any soil amendments not tested until appropriate testing has been completed; and • Plan appropriately to test all amendments prior to use in the future.
Verify that no invasive plants identified in monitoring are on provincial noxious weed lists.	If any noxious weeds are identified: • Implement appropriate control measures (Section 4.2), with the objective of eradication; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that all invasive plants identified in monitoring are being managed according to the most recent CCCIPC Annual Strategic Plan.	If invasive plant management is inconsistent with the Regional Strategic Plan: • Implement prevention and/or control actions (Section 4) until management actions are consistent with the Regional Strategic Plan; and • Ensure that measures taken are monitored as per the program in Section 5.
Verify that results from reclamation revegetation assessments are consistent with closure objectives (with respect to species composition and/or functional groups). If results are not consistent, verify that invasive plants are not a constraining factor. The prioritization matrix in Figure 1 can be used to aid in separating innocuous from disruptive species in reclamation areas and prioritize management actions accordingly.	If invasive plants are identified as a constraint to meeting revegetation objectives: • Delineate the specific species and areas of concern; • Implement prevention and/or control actions (Section 4) appropriate for the level of infestation, the life history of the identified invasive plants, and available control options; and • Ensure that measures taken and target native reclamation species are monitored in the identified reclamation areas as per the program in Section 5.

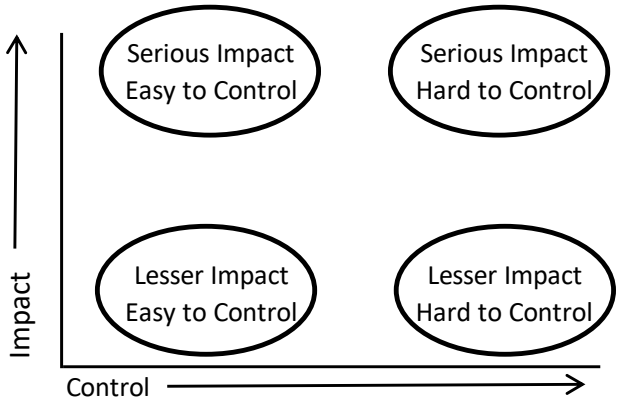


Figure 1 Invasive plant management prioritization matrix (adapted from USFWS, 2009)

7 Responsibilities

Responsible individuals for implementing this Plan are described below.

Environmental Superintendent or designate (e.g., Environmental Supervisor):

- Be knowledgeable of, adhere to, and coordinate implementation of all aspects of this Plan;
- Ensure all other responsible individuals have reviewed the most up to date version of this Plan;
- Ensure this Plan and monitoring data are reviewed annually and updated accordingly, with updates submitted in the Annual Environmental and Reclamation Report and appropriate management actions implemented;
- Be aware of high level mine planning to ensure that seeding of disturbed areas can be done in a timely manner and transport of soil is appropriately managed;
- Review updates to the MPMC *Mines Act* Permit 11678, BC *Mines* Act, CCCIPC Regional Strategic Plan and provincial noxious weed lists and regulations;
- Schedule and assign staff or external contractors to carry out all requirements of this Plan, including monitoring programs and reporting;
- Plan and budget for necessary invasive plant control measures;
- Obtain and permits or authorizations required for control measures that are implemented; and
- Ensure that individuals conducting monitoring, data interpretation, reporting, and planning and implantation of prevention and control measures have appropriate training.

Qualified individual conducting monitoring and reporting (e.g., Environmental Technician, contractor):

- Be knowledgeable of and adhere to all aspects of this Plan;
- Conduct assigned activities, such that all requirements of this Plan (at minimum) are met; and
- Have appropriate training and expertise for assigned components of this Plan.

Staff or contractors conducting control measures

- Have appropriate training and expertise for prevention and control actions they are implementing.

Mine Planning Engineer and General Foreman:

- Notify the Environmental Superintendent or designate of planned disturbances and any transport of soil materials;
- Where possible, minimize the disturbance of vegetated areas; and
- Transmit relevant information related to the aforementioned points to the Mine Operations Supervisors.

Mine Operations Supervisors:

- Supervise operators such that new disturbances and soil handling are conducted as planned.

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APPENDIX 9-8: Wildlife Management Plan

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Wildlife Management Plan

Submitted to:

BC Ministry of Environment and Climate Change Strategy
Environmental Protection Division
South Interior Region – Cariboo

Prepared by:

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Prepared for:

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Environmental Department

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Date: March 11, 2021

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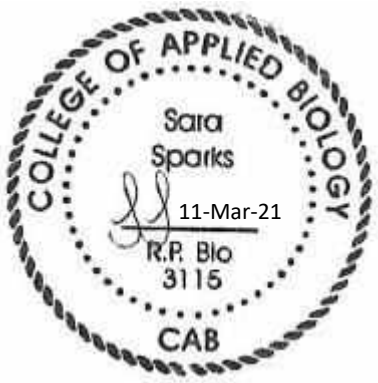
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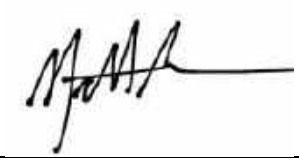
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1 INTRODUCTION

The Wildlife Management Plan (the Plan) was developed for the Mount Polley Mining Corporation (MPMC) for all operational activities of the Mount Polley Mine (the Facility). The Facility is located approximately 100 km northeast of the city of Williams Lake, British Columbia (BC), near the town of Likely, BC. For the purposes of this Plan, the term 'wildlife' will collectively refer to mammals, birds, amphibians, reptiles, and fish unless otherwise specified.

The objectives of the Plan are to:

- Meet the requirements of permits approved under the *Environmental Management Act* and *Mines Act*, in addition to all relevant provincial and federal wildlife regulations,
- Develop guidelines for minimizing the potential for mine-related impacts to wildlife at the Facility and its surrounding areas, with emphasis on protecting wildlife that have been designated as a *Species at Risk*,
- Describe concrete measures for how mine personnel can help minimize wildlife impacts through implementing best management practices, following protocols for specific types of wildlife encounters, and documenting and reporting observations,
- Ensure wildlife management is incorporated into the long-term goals of the Facility through comprehensive monitoring programs and reporting plans, recommendations for reclamation and closure planning, stakeholder consultation, and incorporation of adaptive management.

The Plan is a living document that may be periodically updated as new information becomes available or as authorizations and regulations change.

1.1 PERMIT REQUIREMENTS

The Plan is a component of the Comprehensive Environmental Management Plan (CEMP) which is a requirement of Permit 11678 issued under the provision of the *Environmental Management Act* (SBC 2003, c. 53.) by the BC Ministry of Environment and Climate Change Strategy (ECCCS, 2020). The implementation of wildlife monitoring programs that track the progress of wildlife and wildlife habitat impacted by mine-related activities is one of the objectives of the CEMP and is addressed in Section 5.4 of the Plan.

The Plan also addresses conditions outlined in the M-200 Permit issued under the provision of the *Mines Act* (RSBC 1996, c. 293) by the BC Ministry of Energy, Mines and Low Carbon Innovation, formerly known as the Ministry of Energy, Mines and Petroleum Resources (MEMPR, 2020). Conditions under the M-200 Permit include restrictions and requirements that protect wildlife and personnel (Section 5.3.1) and ensure wildlife habitat is incorporated into long-term land use goals during reclamation and closure planning (Section 5.5).

1.2 PROVINCIAL AND FEDERAL REGULATIONS

All phases of the Facility, including construction, operation, decommissioning, and reclamation, are regulated under the BC *Environmental Management Act* (EMA), BC *Mines Act*, as well as other legislation implemented by the BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development (MFLNRORD) as outlined in MPMC (2019). The following provincial and federal *Acts* are additional legislation specifically relevant to wildlife and wildlife habitat:

- BC *Wildlife Act,*
- BC *Forest and Range Practices Act,*
- BC *Water Sustainability Act,*
- Canada's *Migratory Birds Convention Act,* and
- Canada's *Species at Risk Act.*

Not all the relevant *Acts* will be applicable for every activity carried out by MPMC. For further information on how the *Acts* relate to the management of specific wildlife and activities, refer to Section 3.0.

2 FACILITY DESCRIPTION

The Facility represents the permitted areas of the mine where most mine-related activities occur, as shown in Figure 1 of MEMPR (2020). The Facility generally includes:

- The tailings storage facility (TSF),
- The crusher and mill processing site, and,
- Operations areas (open pits, waste rock dumps, stockpiles, roads, etc.).

The Facility has been in a temporary Care and Maintenance phase since May 31, 2019. Care and Maintenance operations are focused primarily on general site maintenance to ensure that all pumps, sumps and water management systems are functioning as intended. Eleven full time employees work in four shifts, including day and night shifts. Environmental monitoring and sampling activities continue to be followed during the Care and Maintenance phase, as required by all permits. For further details regarding Facility operations, refer to the CEMP (MPMC, 2019).

2.1 TAILINGS STORAGE FACILITY (TSF)

The TSF at the Facility consists of tailings material and a single embankment made up of three dams, including the Main Embankment, Perimeter Embankment, and the South Embankment. During the TSF embankment failure that occurred on August 4, 2014, water (both supernatant and interstitial) was released from the TSF, resulting in much of the tailings within the TSF being exposed to the elements (i.e., no longer submerged).

The embankment failure of the Mount Polley TSF resulted in the deposition of tailings between Polley Lake and Hazeltine Creek (known as the Polley Flats); for the purpose of this Plan, the impacted areas between Polley Lake and Hazeltine Creek are also referred to as the Surrounding Areas (see Section 2.4).

2.2 CRUSHER AND MILL PROCESSING SITE

The crusher and mill processing site are comprised of the crusher and mill building, the coarse ore pile, tertiary pile, fine ore (mill feed) pile, and pebble pile. No crushing operations are conducted during the Care and Maintenance period.

2.3 PITS

Open pits at the Facility include the Cariboo and Springer Pits, while the waste rock dumps include the Temporary Northwest Potential Acid-Generating (PAG) Stockpile, North East Zone (NEZ) Rock Dump and the South East Rock Dump (SERD). Mineral extraction activities are not occurring during the Care and Maintenance period.

2.4 SURROUNDING AREAS

Surrounding Areas are defined as the areas outside the Facility (i.e., permitted mine area) that were impacted by the TSF embankment failure (Section 2.1), including Polley Flats and the Hazeltine Creek Corridor, which are now subject to ongoing remedial works and monitoring (Golder, 2017; MPMC, 2019). For the purpose of this Plan, the Surrounding Area will also refer to the primary road networks that connect to the Facility, such as the Morehead-Bootjack Forest Service Road (FSR), Gavin Lake Road, and Mitchell Bay Road.

The Surrounding Area is characterized by Interior Cedar Hemlock (ICH) biogeoclimatic (BEC) zone vegetation, which consists of Western red cedar, Douglas-fir, hybrid spruce, and subalpine fir, with a lesser presence of trembling aspen, black cottonwood, and paper birch (MPMC, 2019). Much of the area has previously been harvested in commercial logging operations and is currently used for cattle grazing (MPMC, 2019).

2.4.1 Polley Flats

Polley Flats is located south of Polley Lake and east of the TSF embankment failure (Section 2.1). Prior to the TSF embankment failure, Polley Flats was an established wetland with a riparian vegetation community that encompassed approximately 900 m of the upstream portion of Hazeltine Creek, where it immediately drained from Polley Lake. The wetland, Hazeltine Creek corridor, and their associated riparian vegetation were significantly impacted by the release of water and tailings during the TSF embankment failure. The release deposited large volumes of mine-related materials into the Polley Flats wetland area and Hazeltine Creek corridor, stripping the riparian vegetation and native soil (Golder, 2017). Since the TSF embankment failure, MPMC has been conducting ongoing remediation of Polley Flats, including removal of tailings, wetland reconstruction, earth mounding, soil placement, planting native seeds, shrubs, and trees, and installing coarse woody debris (CWD; Golder, 2017; MPMC, 2019). Multiple avian nest boxes were also installed to increase nesting sites for secondary cavity-nesting species, such as Tree Swallows and Mountain Bluebirds.

2.4.2 Hazeltine Creek Corridor

Hazeltine Creek (WSC: 160-585700) commences from the southern point of Polley Lake (WSC: 160-585700) and subsequently drains southeast for 8.5 km before terminating at Quesnel Lake (WSC: 160). Edney Creek (WSC: 160-5857-038) and Bootjack Creek (WSC: 160-5857-487) are tributaries of Hazeltine

Creek and are located approximately 1 km and 8.5 km upstream of the confluence of Hazeltine Creek and Quesnel Lake (Pedersen, 1998; Province of BC, 2021).

Hazeltine Creek provided extensive spawning habitat for Sockeye Salmon and Rainbow Trout prior to the TSF embankment failure (Pedersen, 1998). Following the TSF embankment failure, Hazeltine and Edney Creek were re-channelized and armoured, and engineered log structures were installed to improve fish rearing habitat (Golder, 2017). Passive wetland (sediment settling) ponds were constructed near the Quesnel Lake confluence to improve water quality and increase wildlife forage (Golder, 2017). Rehabilitation of the riparian habitat was initiated by planting native trees, shrubs, and seeds, and by using landscape techniques to improve site growing conditions, such as mounding soil, spreading CWD, and adding mulch (Golder, 2017).

3 WILDLIFE REGULATION OVERVIEW

The following provincial and federal regulations are the most relevant legislation applicable to wildlife and wildlife habitat during the life of the mine and, along with the applicable permit conditions, are the foundation for the guiding principles in this document. Not all provincial and federal legislation will be applicable for every operational activity at the Facility. If there are any concerns regarding whether a specific activity will contravene one of the following regulations in this section, personnel should consult with the Operations Supervisor or Accountable Facility Representative for further clarification and guidance.

3.1.1 BC *Wildlife Act*

The BC *Wildlife Act* protects almost all vertebrate species from direct harm, except from activities that are authorized under regulation. The *Wildlife Act* includes provisions for wildlife prohibitions and authorizations, where applicable, such as:

- Hunting and trapping,
- Angling,
- Beaver dam removal,
- Attracting dangerous wildlife,
- Wildlife capture,
- Birds, nests and eggs,
- Transportation of wildlife,
- Accidental killing of wildlife,
- Destruction of animals,
- Endangered wildlife (Species at Risk), and
- Fines and penalties.

Section 34 of the BC *Wildlife Act* also provides specific instructions for the protection of birds, nests, and eggs, including for bird species not adopted under Canada's *Migratory Bird Convention Act* (MBCA). Under this section, it is an offence to possess, take, injure, molest, or destroy a bird, its egg, and its nest when occupied (*Wildlife Act*, RSBC 1996, c. 488., s. 34). Nests belonging to an eagle, peregrine falcon, gyrfalcon,

osprey, heron, or burrowing owl are also protected year-round regardless of occupancy (*Wildlife Act*, RSBC 1996, c. 488., s. 34).

Prior to initiating any activity that may be in contravention of the BC *Wildlife Act*, authorization under a provincial permit would be required. A permit associated with the listed activities under the *Act* are typically only authorized if the activity does not contravene a federal act (e.g., *MBCA*).

The Minister responsible for the BC *Wildlife Act* may designate a wildlife species as a *Species at Risk* subject to additional protection under the *Act*. Most species that have been designated as a *Species at Risk* in BC by the responsible Minister have been designated through Provincial Order under the BC *Forest and Range Practices Act* (FRPA) to enable conditions that will protect these species during forest and range activities on Crown land (see Section 3.1.2). However, only four species to date have been designated as a *Species at Risk* under the BC *Wildlife Act*. Refer to Table 1 in Section 4.0 for a list of the designated *Species at Risk* under the *Act* which have been previously documented in the Cariboo Region.

Mine activities that have the potential to impact wildlife should occur within the applicable timing windows, where possible, to avoid contravention of the BC *Wildlife Act* (see Section 5.1).

3.1.2 BC *Forest and Range Practices Act* (FRPA)

The Minister responsible for the BC *Wildlife Act* has the authority to issue a Provincial Order that identifies wildlife species that may require management and protection during activities that occur on Crown Land (Section 3.1.1). To date, most of these Orders have been established under Sections 11 and 13 of the *Government Actions Regulations* (BC Reg. 582/2004) of FRPA (SBC 2002, c. 69.). Wildlife species protected under FRPA through Provincial Order fall into one of two categories, including *Species at Risk* and Ungulates. Species in one of these two categories are subject to additional protection under FRPA during forest and range activities on Crown land through management of habitat areas, ungulate winter ranges, and implementation of general wildlife measures associated with the target species. A third category for *Regionally Important Wildlife* is still under consideration by the Minister.

The Order for the Ungulate category currently includes elk (*Cervus canadensis*), moose (*Alces americanus*), and three populations of Caribou (*Rangifer tarandus*), including the boreal, southern mountain, and northern mountain populations. For a summary of wildlife species that have been designated as a *Species at Risk* under FRPA in the Cariboo Region, refer to Table 1 in Section 4.0.

Activities governed by FRPA generally include timber harvesting, road construction, road maintenance, road use, road deactivation, silviculture treatments, collection of botanical forest products, fire use, control and suppression, or activities carried out under the BC *Forest Act*, a special use permit, or a road use permit (*Forest and Range Practices Act*, SBC 2002, c. 69.). Not all mining activity is expected to fall into the prescribed categories governed by FRPA; however, should any activity undertaken by the mine fall under FRPA's mandate, additional protection measures for the species identified by the Orders may apply.

3.1.3 BC *Water Sustainability Act* (WSA)

The BC *Water Sustainability Act* (WSA) provides protection for aquatic systems and fish habitat and includes mechanisms for authorizations to conduct work activities in and around streams (*Water Sustainability Act*, SBC 2014, c. 15.). Additional provisions for protecting and reducing risk to sensitive streams that contain fish are outlined in Sections 18 – 20 of the *Water Sustainability Regulation* (BC Reg. 36/2016). Work activities occurring in, or around, streams should target the appropriate Fisheries Timing Window to reduce the risk to aquatic organisms (see Section 5.1). Consultation with a Qualified Environmental Professional (QEP) may be required if additional instream mitigation is requested as part of the authorization to conduct the works.

3.1.4 Canada's *Species at Risk Act* (SARA)

Additional prohibitions may apply for species that have been designated as extirpated, endangered, or threatened under Schedule 1 of Canada's *Species at Risk Act* (SARA). It is prohibited to kill, harm, harass, capture, take, possess, collect, buy, sell, or trade any species listed under Schedule 1 of the *Act* (*Species at Risk Act*, SC 2002, c. 29., s. 32.). In addition, the damage or destruction of the residence (e.g., den, nest, etc.), or any part of the critical habitat of a listed species, is prohibited for endangered or threatened species, or for extirpated species that have a recovery strategy that recommends its reintroduction into the wild (*Species at Risk Act*, SC 2002, c. 29., s. 33., s. 58.). Critical habitat is defined as, "the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the recovery strategy or in an action plan for the species" (*Species at Risk Act*, SC 2002, c. 29., s. 2(1).).

Except for listed aquatic species and listed bird species also protected under Canada's MBCA, prohibitions under SARA apply on federal lands only. However, a Federal Order can be issued to the Province by the Governor in Council requesting further intervention for a SARA-listed species on non-federal lands. Therefore, most terrestrial species that are listed under Schedule 1 of SARA, including their associated residence and critical habitat, fall within the jurisdiction of the Province and will be subject to protection measures that will vary depending on the recovery strategy for that species, scope of works, habitat present, and whether the species is part of a Federal Order that requires the Province to adopt the prohibitions of SARA on non-federal lands.

For a summary of wildlife species adopted under Schedule 1 of SARA that have been documented in the Cariboo Region, refer to Table 1 in Section 4.0.

3.1.5 Canada's *Migratory Bird Convention Act* (MBCA)

The MBCA protects most birds in Canada (including non-migratory species) through provisions outlined in the *Migratory Birds Regulations* (MBR) which stipulate that an individual must not (CRC, c. 1035., s. 5(1)):

- Capture, kill, take, injure or harass a migratory bird (i.e., a bird listed under the *Act*),
- Destroy, take or disturb an egg; or,
- Damage, destroy, remove or disturb a nest, nest shelter, eider duck shelter or duck box.

Permits authorizing some of the actions listed in Section 5(1) of the MBR is possible to obtain for certain activities, such as scientific research. However, there is no permitting process to undertake an activity that

may incidentally result in one of the actions outlined in Section 5(1) of the MBR, such as vegetation clearing. Therefore, incidental disturbance to breeding birds protected under the MBCA, including their eggs, young, and nests, constitutes a non-compliance under the MBCA. The best method of avoiding a non-compliance under the MBCA is to avoid work activities in an area where birds are actively breeding (see Section 5.1.2). When this option is not feasible, there are risk-management strategies that may be utilized as outlined in Section 5.2.1.

4 SPECIES AT RISK

In BC*, Species at Risk* are collectively managed under the BC *Wildlife Act*, the BC *FRPA*, and Canada's *SARA.* Wildlife that are designated as a *Species at Risk* may fall under one or more of these *Acts*. Prohibitions that may apply for species protected under these *Acts* are summarized in Section 3.0.

A list of *Species at Risk* adopted under provincial and/or federal legislation were narrowed down to highlight species that have the potential to occur at the Facility and in the Surrounding Areas, or within the Cariboo Region (BC CDC, 2021). However, *Species at Risk* that were determined to be primarily habitat specialists based on elevation or vegetation requirements (e.g., Bunchgrass BEC zone) in the Cariboo Region were excluded from the final list. Refer to Table 1 for the list of *Species at Risk* that were determined to have the highest potential of occurring at the Facility or in the Surrounding Areas.

Most species in Table 1 are not anticipated to be encountered on the grounds of the Facility. Instead, species in Table 1 are more likely to be encountered in transit to the mine, or in the Surrounding Areas. The exception may include barn swallows or *Myotis* (bat) species attempting to utilize anthropogenic structures for nesting and hibernacula. Refer to Section 5.2 for guidelines regarding wildlife encounters that have a higher potential of occurring at the Facility.

A number of wildlife species have been identified by the BC Conservation Data Centre as vulnerable (i.e., Blue or Red-listed) but have not yet been legally adopted under any statute. For a list of these species, refer to Appendix A.

Table 1. *Species at Risk* adopted under the BC *Wildlife Act*, BC *Forest and Range Practices Act* (FRPA), and/or Schedule 1 of Canada's *Species at Risk Act* (SARA)[1]

Wildlife Species			Adopted under Act? (YES / no)			Conservation Status	
English Name	Scientific Name	Category	FRPA	Wildlife Act	SARA	BC List[2]	SARA[3]
American Badger	*Taxidea taxus*	Mammal	YES	no	YES	Red	E (2018)
American White Pelican	*Pelecanus erythrorhynchos*	Bird	YES	YES	no	Red	no status
Barn Swallow	*Hirundo rustica*	Bird	no	no	YES	Blue	T (2017)
Black Swift	*Cypseloides niger*	Bird	no	no	YES	Blue	E (2019)
Bobolink[4]	*Dolichonyx oryzivorus*	Bird	no	no	YES	Blue	T (2017)
Bull Trout	*Salvelinus confluentus*	Fish	YES	no	no	Blue	no status
Caribou (Southern Mountain Pop.)	*Rangifer tarandus pop. 1*	Mammal	YES	no	YES	Red	T (2003)
Common Nighthawk	*Chordeiles minor*	Bird	no	no	YES	Yellow	T (2010)
Evening Grosbeak	*Coccothraustes vespertinus*	Bird	no	no	YES	Yellow	SC (2019)
Fisher	*Pekania pennanti*	Mammal	YES	no	no	no status	no status
Flammulated Owl[4]	*Psiloscops flammeolus*	Bird	YES	no	YES	Blue	SC (2003)
Great Blue Heron, *herodias* subspecies	*Ardea herodias herodias*	Bird	YES	no	no	Blue	no status
Grizzly Bear	*Ursus arctos*	Mammal	YES	no	YES	Blue	SC (2018)
Lewis's Woodpecker	*Melanerpes lewis*	Bird	YES	no	YES	Blue	T (2012)
Little Brown Myotis	*Myotis lucifugus*	Mammal	no	no	YES	Yellow	E (2014)
Long-billed Curlew	*Numenius americanus*	Bird	YES	no	YES	Blue	SC (2005)
Northern Myotis	*Myotis septentrionalis*	Mammal	no	no	YES	Blue	E (2014)
Olive-sided Flycatcher	*Contopus cooperi*	Bird	no	no	YES	Blue	T (2010)
Painted Turtle - Intermountain - Rocky Mountain Population	*Chrysemys picta pop. 2*	Reptile	no	no	YES	Blue	SC (2007)
Red-necked Phalarope	*Phalaropus lobatus*	Bird	no	no	YES	Blue	SC (2019)
Rusty Blackbird	*Euphagus carolinus*	Bird	no	no	YES	Blue	SC (2009)
Sharp-tailed Grouse, *columbianus* subspecies	*Tympanuchus phasianellus columbianus*	Bird	YES	no	no	Blue	no status
Short-eared Owl	*Asio flammeus*	Bird	YES	no	YES	Blue	SC (2012)
Western Grebe	*Aechmophorus occidentalis*	Bird	no	no	YES	Red	SC (2017)
Western Toad	*Anaxyrus boreas*	Amphibian	no	no	YES	Yellow	SC (2018)
Wolverine	*Gulo gulo*	Mammal	no	no	YES	no status	SC (2018)
Yellow-breasted Chat[4]	*Icteria virens*	Bird	YES	no	YES	Red	E (2003)

[1] BC CDC Search criteria: Vertebrates AND SARA Schedule 1 Status: True OR Identified Wildlife Status: True AND Area of Interest: User Defined Polygon. The exported BC CDC list was further filtered by comparing the results to the CDC mapped locations, COSEWIC distribution maps, and Habitat Wizard wildlife observation points.

[2] Based on Status designated by BC Conservation Data Centre – Yellow = Least Risk, Blue = Special Concern, Red = Endangered/Threatened.

[3] Based on Status designated under SARA – SC = Special Concern, T = Threatened, E = Endangered. The year the status was adopted is in brackets.

[4] These species are at the northern extent of their range but may occur periodically in the region as vagrants.

5 WILDLIFE MANAGEMENT

5.1 TIMING WINDOWS

Reduced Risk Timing Windows for fish and wildlife are intended to provide specific timing windows to target during operational planning to lower the potential for impacts to fish and wildlife. Least risk timing windows typically coincide with the breeding period for a given species, although they may also encompass other life history activities, such as juvenile dispersal and migration events. These timing windows do not guarantee that there will be zero risk to fish and wildlife during these periods, and do not authorize anyone to conduct or participate in activities that are contrary to any statute.

5.1.1 Fisheries Timing Window

To reduce the risk of contravening the WSA (see Section 3.1.3), all work activities that occur instream should utilize the appropriate fisheries timing window for the region. Fisheries timing windows (also referred to as in-stream work windows) apply to all fish-bearing streams and watercourses that have direct connectivity to fish-bearing waters downstream. Within the Central Cariboo District, all streams located at elevations less than 1325 m have a reduced risk timing window of **July 22 – August 15** to account for the presence of both spring and fall spawning fish species occupying the system (Province of BC, 2004). However, this timing window does not necessarily protect anadromous salmonids in freshwater systems; therefore, the regional Department of Fisheries and Oceans (DFO) should be consulted prior to working in any streams where salmon may be present to determine whether adjustments to the reduced risk timing window is required.

If instream works must occur outside the fisheries timing window, a Change Approval authorization may be required through MFLNRORD. In addition, the implementation of risk-management strategies under the direction of a QEP may be a condition of authorization.

5.1.2 Bird Nesting Window

To reduce the risk of contravening the BC *Wildlife Act* (see Section 3.1.1) and MBCA (see Section 3.1.5), any activity that may impact breeding birds, including their eggs and nests, should be conducted outside of the peak breeding period for birds in the region; for example, vegetation clearing or removal of buildings that birds are actively nesting on. The least-risk period for nesting birds in the region is from **August 12 – April 14,** which is the period when less than 5% of the majority of actively breeding birds in forest and wetland habitat are expected to be present within the region (ECCCS, 2018). In addition, any nest belonging to an eagle, peregrine falcon, gyrfalcon, osprey, heron, or burrowing owl is protected year-round regardless of whether the nest is active (*Wildlife Act*, RSBC 1996, c. 488., s. 34). Should an **inactive** nest belonging to one of these species require removal, authorization through MFLNRORD would be required.

If the peak nesting period cannot be avoided, additional risk-management strategies may be required under the direction of a QEP (see Section 5.2.1).

5.1.3 Amphibian and Reptile Window

An amphibian and reptile timing window has not been formally developed for the Cariboo Region. However, to avoid contravention of the BC *Wildlife Act* (see Section 4.1.1), operational activities should avoid areas where amphibian and reptile species have been confirmed hibernating, breeding or migrating. All amphibian species native to the Cariboo region require different habitat types (both aquatic and terrestrial) at different times of the year. Adult amphibians breed and lay eggs in freshwater, where they hatch into aquatic larvae, that grow and metamorphose into semiterrestrial juveniles. Highest risk periods for amphibians are typically related to movement of individuals between different habitat types, including migration of adults between aquatic breeding habitat and upland foraging or overwinter sites, or dispersal of juvenile amphibians from aquatic breeding sites to nearby terrestrial habitats. Although reptiles in the region, such as the Western Painted Turtle, Common Garter Snake, and Wandering Garter Snake, do not breed aquatically, their life history is also characterized by seasonal movements between different habitats. Due to both groups' heavy reliance on, and association with, freshwater habitats, any work in and around wetlands, streams, or small water bodies (including water-filled ditches), may also pose a risk of harm to individuals or damage to habitat. The highest risk period for amphibians and reptiles occurs between April 1 and September 30, when individuals of these species are expected to be active on the landscape (i.e., not hibernating) (BC MOE, 2017). Therefore, the reduced risk timing window for amphibians and reptiles is estimated to be **October 1 – March 31** for the Cariboo Region.

If amphibians or reptiles have the potential to be impacted by an activity, such as a clearing and grubbing, the completion of a survey under the direction of a QEP may be required to determine if amphibians, reptiles, or their habitats, are present, and/or at risk. If amphibians or reptiles cannot be avoided, a salvage that has been authorized by MFLNRORD through a General Wildlife Permit may be required so that amphibians or reptiles can be safely translocated from the site to nearby suitable habitat.

5.2 WILDLIFE ENCOUNTERS

To avoid contravention of the relevant wildlife legislation outlined in Section 3.0, wildlife-specific strategies may be required during human-wildlife encounters at the Facility, or within the Surrounding Areas. In most circumstances, allowing the animal to leave the area and reporting the incident to the Operations Supervisor or Accountable Facility Representative, will be the best course of action. In certain situations, further mitigation may be required based on the time of year, status of the species, and nature of the anticipated work activity. Individuals should consult with the Operations Supervisor or Accountable Facility Representative if they have any questions regarding protocols for a particular situation that involves a wildlife encounter. Additional in-house training may be required for some personnel to ensure they have the skills to safely handle human-wildlife conflicts, such as bear encounters, and identify sensitive wildlife features.

5.2.1 Birds

The majority of birds in BC are collectively protected under the BC *Wildlife Act*, Canada *MBCA*, and/or Canada's SARA, which generally acknowledge that birds are most vulnerable during the breeding period when adults are caring for nests, eggs, and young (see Sections 3.1.1 and 3.1.5). The following mitigation measures will be implemented if actively breeding birds are encountered at the Facility or in the Surrounding Areas:

- The destruction or disruption of migratory birds, nests, and eggs, is prohibited, including during travel to and from work sites. If destruction or disruption occurs in the form of incidental harm (i.e., unintentional), the incident will be immediately reported to the Operations Supervisor or Accountable Facility Representative.
- To reduce the risk of encountering and disturbing breeding birds, any activity that has the potential to disturb and harm birds, nests, eggs, or young, should be completed outside of the peak avian breeding period for the region (see Section 5.1.2). Vegetation clearing would be a common example of this.
- Report any active bird nests, or repeat observations of breeding pairs, to the Operations Supervisor or Accountable Facility Representative. Birds that are observed at the same location on consecutive days, hover in close proximity to humans, or display agitated behaviour such as persistent alarm-calling or dive-bombing (i.e., swooping down close, before veering away) are evidence that a breeding pair and nest may be present.
- If an active nest or established breeding pair continue to occupy an area of the Facility where the presence of personnel is only periodic and work activity is not constantly occurring (e.g., water sampling), the Accountable Facility Representative may recommend the installation of a buffer around the nest site to signal to other crew members to avoid the area to reduce disturbance. Only the periphery of the buffer should be marked and never the nest or nest tree, itself. Common buffer sizes used according to different avian groups, include (MFLNRO, 2013; MFLNRO, 2014):
    - Songbirds – 30 m radius,
    - Waterfowl – 100 m radius,
    - Swallow colonies – 50 m radius, and
    - Raptors: 100 – 500 m radius (species dependent)
- If an active nest or established breeding pair continue to occupy an area of the Facility where personnel will be regularly present for mine activities that occur for an extended period of time (e.g., geotechnical drilling), or the species is determined to be a designated *Species at Risk* from Table 1, the Accountable Facility Representative may consult with a QEP to determine the most suitable mitigation measures appropriate for the species, habitat, and magnitude of the anticipated disturbance.
- Report the presence of any stick nests to the Operations Supervisor or Accountable Facility Representative since some stick nests are protected year-round regardless of occupancy (see Section 3.1.1).
- Any birds nesting on anthropogenic structures (e.g., barn swallows and cliff swallows) must be allowed to finish nesting once nesting has commenced. If a building with intact barn swallow nests has been scheduled for demolition or removal outside the peak breeding period, consultation with MFLNRORD will be required since barn swallows (and their nests) are protected under Schedule 1 of SARA (see Section 3.1.4).

5.2.2 Mammals

Small and large mammals are regularly documented at the Facility, including black bears, coyotes, lynx, moose, and mule deer. Although the presence of some mammal species on the mine is to be expected due to the remote location of the Facility, the objective is to minimize interactions and, thereby, risks to personnel and animals. The following measures will be implemented if mammals are encountered at the Facility or in the Surrounding Areas:

- Reduce driving speeds to avoid a potential collision with mammal species, especially during hours at dawn and dusk when wildlife activity is heightened, and along known wildlife migration corridors; refer to Section 5.3.2 for further guidelines to prevent wildlife-vehicle collisions.
- Avoid approaching or feeding any mammal species. Food and waste should be securely stored in buildings, approved waste receptacles, or vehicles at all times; Refer to Section 5.3.3 for further guidelines on how to manage for wildlife attractants.
- If a mammal is a designated *Species at Risk* (e.g., caribou), as listed in Table 1 (Section 4.0), disturbance should be reduced to a minimum until the animal has left the area. If driving, temporarily stop the vehicle or pull over if it is safe to do so. If the animal has occupied a work area where mine activities are occurring, temporarily suspend works until the animal has moved out of the work area. All sightings of *Species at Risk* at the Facility should be reported to the Operations Supervisor or Accountable Facility Representative as soon as possible. If repeated observations of a *Species at Risk* occur at a specific location at the Facility, or in the Surrounding Areas, consultation with a QEP may be required to determine the appropriate course of action for that species.
- If a suspected residence (e.g., den or borrow) of a mammal species is encountered, a GPS coordinate will be collected (if possible) and the location will be immediately reported to the Operations Supervisor or Accountable Facility Representative. If there is evidence the suspected residence of a large mammal species is active due to the presence of recent scat, hair, and/or tracks, the crew will immediately leave the area of the residence until further instructions can be provided by the Accountable Facility Representative.
- If a kill site (e.g., carcass locations that will attract wildlife) or mineral lick (e.g., an area where ungulates regularly congregate to obtain mineral nutrients) is discovered, immediately report the location to the Operations Supervisor or Accountable Facility Representative.
- If conflict wildlife, such as habituated bears or cougars, are observed at the Facility or in the Surrounding Areas, the observation should be reported to the Operations Supervisor or Accountable Facility Representative so that the regional Conservation Officer Service can be notified. Personnel should never attempt to engage with conflict wildlife.
- Mine personnel and visitors whose job responsibilities may place them in a situation where a bear encounter is possible must have bear safety awareness training and be trained on how to safely carry and deploy bear deterrents, such as bear spray.

5.2.3 Bats

Fourteen species of bat have the potential to occur within the Cariboo region, including the Northern Myotis and Little Brown Myotis which are both designated as Endangered under Schedule 1 of Canada's *SARA* (Section 4.0). Both the Northern Myotis and Little Brown Myotis have the potential to occur at the Facility or within the Surrounding Areas. Summer roost sites and winter hibernation sites (i.e., hibernacula) are critical for most bats to carry out their sensitive life stages (BC MOE, 2016), and therefore, preservation of these sites is important for the conservation of these species. Roosts may be found in the cavities or loose bark of trees, rock crevices, caves, cliffs, and anthropogenic structures, such as buildings and bridges (BC MOE, 2016).

The following measures will be implemented if bat presence is suspected or confirmed at the Facility or in the Surrounding Areas:

- If the presence of a bat roost or hibernacula is suspected at the Facility or in the Surrounding Areas, a GPS coordinate will be collected (if possible) and the location will be reported to the Operations Supervisor or Accountable Facility Representative.
- If the presence of a bat roost or hibernacula is suspected in an area scheduled for vegetation removal, further instruction will be required from the Accountable Facility Representative. A survey by a QEP may be necessary prior to initiating the works.
- If a natural cave feature is identified, a GPS coordinate will be collected (if possible) and the location will be reported to the Operations Supervisor or Accountable Facility Representative. No personnel shall attempt to enter a natural cave feature that has been identified.
- If bats are observed utilizing an anthropogenic structure at the Facility, the location will be reported to the Operations Supervisor or Accountable Facility Representative. Further recommendation for mitigation may be provided by the Accountable Facility Representative if there is concern bats and personnel will be in close proximity during work activities.
- Prior to removal of any buildings or structures at the Facility, a survey may be required by a QEP to ensure the building or structure is not being utilized by a designated *Species at Risk*, such as the Little Brown Myotis, which are known to use anthropogenic structures for roosting and overwintering.

5.2.4 Amphibians and Reptiles

Amphibians and reptiles rely on aquatic and terrestrial habitat to carry out their necessary biological functions. However, Western Toads and Painted Turtles are particularly vulnerable to road mortality due to the distance the two species will travel between breeding and overwintering grounds in the spring and fall (PWTWG, 2014; BC MOE, 2017); both are a designated *Species at Risk* in Table 1 (Section 4.0). Large congregations of Western Toads adults or juveniles crossing roadways can be a common phenomenon where roads bisect crucial aquatic (breeding) habitat and suitable upland (overwintering) habitat (PWTWG, 2014). In contrast, Painted Turtles rely on suitable aquatic habitat for overwintering and move to terrestrial habitats in the spring to breed (BC MOE, 2017). Painted Turtles exist in significantly lower numbers in the Cariboo Region compared to other amphibian and reptile species and should be reported if observed (BC MOE, 2017). The Common and Wandering garter snake have the potential to occur at the Facility and in the Surrounding Areas, and both species den communally in hibernacula.

Aquatic habitat, particularly riparian and wetland, are present in the Surrounding Areas around the Facility and, therefore, personnel should be aware that amphibians and reptiles have the potential to be present on commute roads. The following measures will be implemented to reduce the risk to amphibians and reptiles:

- Mine activities will consider the reduced-risk window for amphibians and reptiles during project planning, as outlined in Section 5.1.3. Activities that occur outside the reduced-risk window should determine the level of risk to amphibians and reptiles at the project location prior to commencing.
- If mine activities are occurring outside the reduced risk window in an area that has been determined to be high-risk for the presence of amphibians and reptiles, the Accountable Facility Representative may request that additional mitigation is implemented at the site, such as temporary installation of exclusion fencing to keep amphibians and reptiles out of the area of disturbance.
- If amphibians and reptiles are occurring inside the boundaries of the work site, an amphibian and reptile salvage may be required by a QEP under the authorization of a Wildlife Permit through MFLNRORD. Handling of amphibians and reptiles by unauthorized personnel is prohibited due to the potential to transfer disease between individuals and incidentally cause harm.
- Observations of large aggregations of amphibians, including migrations across roadways, will be immediately reported to the Operations Supervisor or Accountable Facility Representative so that further mitigation can be implemented, as necessary. Mitigation may include ensuring all personnel are aware to avoid that location, posting signage, installing temporary exclusion fencing, or having a QEP conduct an authorized salvage. The same procedures apply for a single observation of a Painted Turtle, which occur in lower numbers. Aggregations of snakes may indicate the presence of a hibernacula, which should also be similarly reported.
- Mine activities must not disturb any wetlands, streams or water features, including small, ephemeral (temporary) pools and water-filled ditches, as such habitats can provide important breeding, foraging, and hydration sites for amphibians.
- Any activities near aquatic habitats should protect shallow water areas and their vegetation from trampling and other disturbance; these areas serve as breeding habitat and cover for many amphibians.

5.3 General Best Management Practices

5.3.1 General Restrictions

To ensure compliance with Section D-12 of the M-200 permit, the following provisions and restrictions apply:

- No hunting or shooting shall occur within any area encompassed by the mine permit,
- No fishing or hunting shall occur while on company business, or while commuting to and from the mine for all MPMC personnel and contractors,

- Any exclusion fencing (e.g., electric fencing) that is installed shall be regularly maintained to ensure it is effectively functioning at all times that people are present on site.

To ensure compliance with all relevant wildlife regulations (Section 3.0), the following general provisions and restrictions apply:

- Feeding wildlife is strictly prohibited and is a direct violation of the BC *Wildlife Act* (Section 3.1.1). Feeding wildlife may result in wildlife becoming attracted to human foods and habituated to human presence, which can result in the creation of 'conflict wildlife' and have serious consequences for the animal and other people.
- Cooking outside and using outdoor cooking appliances is prohibited.
- Littering is prohibited. All garbage, including organic wastes (e.g., banana peels, pear cores, etc.), should be stored in wildlife-proof temporary containers and removed and appropriately disposed of off-site (see Section 5.3.3).
- Harassment of wildlife is strictly prohibited and is also a direct violation of the BC *Wildlife Act*. Harassment of wildlife can lead to the abandonment of habitat or the disruption of critical activities (e.g., nesting), and may result in injury to wildlife and/or humans.
- All potentially sensitive wildlife features, including bird nests, dens, roosts, hibernacula, kill sites (e.g., carcass locations that will attract wildlife), and mineral licks (e.g., an area where ungulates regularly congregate to obtain mineral nutrients) will be reported to the Operations Supervisor or Accountable Facility Representative. The Accountable Facility Representative may implement measures to avoid or reduce adverse effects to known wildlife features from mine-related activities, which could include restricting the knowledge of the feature location to reduce traffic at the site and prevent vandalism.

5.3.2 Equipment and Vehicles

To reduce incidents of wildlife-vehicle collisions and near-misses at the Facility, the following general provisions and restrictions apply:

- The Accountable Facility Representative will be familiar with the BC Wildlife Collision Prevention Program (http://www.wildlifecollisions.ca/Default.aspx) and will be responsible for ensuring all mine personnel and visitors are orientated on best management practices for preventing wildlife collisions.
- When travelling to and from the mine, Facility personnel and visitors are required to report incidental wildlife observations. This information will be valuable in identifying areas where potential wildlife-vehicle collisions have a higher chance of occurring.
- Road signage that informs mine personnel (and other road users) to be attentive for wildlife will be established, as necessary. Signage will be placed where potential collisions are predicted (e.g., at known wildlife crossings, blind hills, blind corners, etc.) or have already occurred. All Facility personnel and visitors must obey traffics signs.
- On public gravel or forest service roads, the maximum speed limit is 60 km/hour or per posted signage. During poor road conditions when visibility and traction are reduced, personnel are encouraged to slow down and drive safely to the conditions.

- The maximum speed limit on the mine property is 40 km/hour in ideal driving conditions.
- Wildlife has the right-of-way, except in select circumstances when it is unsafe to apply the brake or come to a complete stop. When wildlife is present on a road, slow down or stop and allow the animal(s) to depart the roadway.
- Limit access to deactivated trails, seasonally or permanently, using signage and high visibility barricades.
- Report wildlife remains observed along access roads at the Facility, and in the Surrounding Areas, to the Operations Supervisor or Accountable Facility Representative. Wildlife carcasses have the potential to lure other wildlife onto the roadway, which may result in an increased likelihood of wildlife-vehicle collisions. MPMC will relay reports of wildlife remains along highways to the regional Conservation Officer Service.
- Wildlife-vehicle collisions that cause injury or death to wildlife must be reported immediately. If an animal is killed as a result of a vehicle collision, the Accountable Facility Representative will notify the regional Conservation Officer Service so the remains can be removed from the road in a timely fashion, suitably disposed of, and documented in an Incident Report. The RCMP must be notified if damage is greater than $1,000 or if there are human injuries. If an animal is injured as a result of a vehicle collision, the Accountable Facility Representative will contact the regional Conservation Officer Service to determine the best course of action (e.g., animal destruction). Some injured animals may present a safety hazard (e.g., bears, moose, deer, etc.); consequently, personnel should not approach injured animals.
- A near-miss animal-vehicle collision will be reported as an “incident” as this information will be important for determining high-risk collision areas that may require warning signage.

5.3.3 Waste Management

Garbage and food waste are wildlife attractants which may lure and create conflict wildlife, such as bears, foxes, and coyotes. In addition, wildlife attractants may include vegetation growing along the roadside (e.g., grasses), chemicals (e.g., gasoline), waste containers (e.g., empty fuel cannisters), and wildlife remains. Conflict wildlife can create unsafe working conditions for personnel and result in damage to facility structures and equipment.

The following waste management measures will be followed to reduce wildlife conflicts related to food waste and garbage:

- Adhere to the guidelines outlined in the General Restrictions (Section 5.3.1).
- Food waste, sewage, and mechanical maintenance waste (e.g., motor oil) will be handled and disposed of appropriately under the direction of the Accountable Facility Representative.
- Temporary recycling and garbage containers shall not be placed or stored outside.
- Wildlife incidents related to garbage or human food attractants will be promptly reported to the Accountable Facility Representative.
- Waste disposed of incorrectly will be reported promptly to the Accountable Facility Representative. The Accountable Facility Representative will affirm that any inappropriately disposed of waste, within and around the Facility, is correctly disposed of.

- Regular site inspections will be conducted of waste transfer areas to ensure site cleanliness, adequate bear-proofing features, and to document improper garbage storage.
- When seeding along road corridors is required at the Facility, the Accountable Facility Representative will select seed mixes that do not contain wildlife attractants (e.g., clover), as these can result in an increase in animal-vehicle collisions.

5.3.4 Reporting Wildlife Observations and Incidents

Observations of wildlife or wildlife incidents by mine personnel and visitors must be documented and reported to the Accountable Facility Representative. An observation is defined as physical observations of wildlife or identification of signs that wildlife may be present in the area (e.g., nests, scat, tracks, dens, etc.). An incident may include animal-vehicle collisions, strange behavior (e.g., the animal behaving aggressively or losing its fear of humans), close encounters on foot or within a vehicle, or witnessing deceased or wounded animals.

Reports of wildlife observations and incidents provide information that can help determine:

- Hazardous circumstances requiring intervention (e.g., conflict wildlife).
- Whether notification to the regional Conservation Officer Service is required (e.g., roadkill).
- If there are deficiencies in the conflict wildlife mitigation and waste management measures.
- Areas along roadways that are potential hotspots for animal-vehicle collisions and, thus, require warning signs.

5.3.4.1 Wildlife Observations

Observations of wildlife and wildlife habitat features (e.g., nests, dens, wildlife trees, cavities, etc.), provide important data on wildlife habitat usage and behavior patterns at the Facility and in the Surrounding Areas. Wildlife observations will be collected and documented by the Operations Supervisor who will forward the information to the Accountable Facility Representative. All observations will be reviewed to assess the potential for conflict wildlife and to ensure current guidelines are sufficient in protecting personnel and wildlife. Wildlife observations will be included in MPMC's annual reporting.

Most wildlife and wildlife habitat observations will be discussed at health and safety meetings. However, the location of sensitive wildlife habitat features (e.g., mineral licks) may be disclosed to a restricted number of mine personnel at the discretion of the Accountable Facility Representative.

5.3.4.2 Wildlife Incidents

Mine personnel and visitors are required to promptly notify wildlife incidents to the Operations Supervisor or Accountable Facility Representative, who may request the completion of an Incident Report. Incident Reports regarding wildlife will be reviewed for any evidence of conflict wildlife development, to ensure current guidelines are sufficient in protecting personnel and wildlife, and for annual reporting purposes.

5.4 WILDLIFE MONITORING

In accordance with the permit requirements outlined in Section 1.1, monitoring programs will be developed to evaluate the effects of mining-related activities on wildlife and wildlife habitat at the Facility and in the Surrounding Areas. Wildlife monitoring will also help determine the success of remediation works completed at Polley Flats and the Hazeltine Creek Corridor, as well as the success of any future remediation that is implemented to achieve long-term reclamation and closure objectives. All monitoring programs will incorporate adaptive management to optimize procedures and outcomes as new information becomes available. The design and development of specialized projects may be done in consultation with QEPs, as required.

An Ecological Risk Assessment was conducted for Polley Flats and the Hazeltine Creek Corridor in 2017 to determine the potential impact of heavy metals on biological receptors and to determine the direction of future remediation and monitoring efforts (Golder, 2016). The assessment determined that the risk of metal uptake was low in aquatic and terrestrial systems and was less likely to cause adverse impacts to wildlife than the effects of the physical disruption to functional habitat (Golder, 2016). For further details regarding wildlife monitoring requirements, refer to the CEMP (MPMC, 2019).

5.5 RECLAMATION PLANNING

MPMC has identified wildlife habitat as one of the primary land-use objectives during reclamation and closure planning, which will fulfill the requirements outlined in Section E-2 of the M-200 permit. Reclamation initiatives will utilize a variety of different strategies to achieve self-sustaining ecosystems that will create long-term habitat for wildlife, including soil amendments to improve soil conditions, revegetation of native species, enhanced landscape features that attract wildlife, and construction of habitat systems that provide ecosystem functions for many species. For further details on how wildlife habitat will be incorporated into long-term reclamation and closure planning, refer to the *Reclamation and Closure Plan Update* by MPMC (2017).

5.6 REPORTING REQUIREMENTS

A summary of the effectiveness of the Plan will be included in the annual reclamation report. In addition, summary reports of wildlife-related mitigation measures, incidents, and observations will be generated annually and will form the basis of adaptive management strategies to address compliance issues and conflict wildlife. These summary reports will be provided to MFLNRORD, First Nations, and community stakeholders upon request (Section 7.0).

6 RESPONSIBILITIES

The following sections summarize the responsibilities held by each of the employment levels at the Facility as they pertain to this Plan.

6.1 SENIOR MANAGEMENT REPRESENTATIVE: MINE MANAGER

The Senior Management Representative, or designate, is responsible for:

- Ensuring the required resources are in place to execute the Plan,
- Submitting the results of the Plan to all relevant Provincial agencies and First Nations groups.

6.2 ACCOUNTABLE FACILITY REPRESENTATIVE: ACTING GENERAL MANAGER

The Accountable Facility Representative, or designate, is responsible for:

- Reviewing the effectiveness of the current wildlife management measures at the Facility,
- Scheduling and coordinating the implementation of measures outlined in the Plan, and,
- Training site personnel and contractors on the Plan and ensuring best management practices are implemented,
- Ensuring additional in-house training is provided regarding protocols for wildlife encounters and sensitive wildlife features for personnel and contractors who may require it,
- Consolidating and reviewing all documentation and data regarding incidental wildlife observations, wildlife encounters, conflict-wildlife, sensitive wildlife features, and the presence of *Species at Risk* on site; this information will be reported to the Mine Manager,
- Communication of additional wildlife mitigation strategies that may be required prior to the initiation or continuation of mine activities.

6.3 OPERATIONS SUPERVISOR: GENERAL FOREMAN

The Operations Supervisor, or designate, is responsible for:

- Reviewing the effectiveness of the current Plan,
- Collecting all documentation and data from personnel regarding incidental wildlife observations, wildlife encounters, conflict-wildlife, sensitive wildlife features, and the presence of *Species at Risk*; this information will be forwarded to the Accountable Facility Representative,
- Implementation of additional wildlife mitigation strategies that may be required prior to the initiation or continuation of mine activities.

6.4 FACILITY PERSONNEL AND CONTRACTORS

All Facility Personnel and Contractors are responsible for:

- Following all the measures and guidelines outlined in this Plan and addressing any questions or concerns with the Operations Supervisor,
- Reporting all wildlife observations to the Operations Supervisor,
- Submitting a wildlife incident report in the event of a wildlife-collision or encounter with conflict-wildlife.

6.5 TECHNICAL SERVICES SUPERINTENDENT

The Technical Services Superintendent is responsible for:

- Providing feedback on the effectiveness of the current Plan at the Facility,
- Conducting internal audits of the guidelines and measures outlined in the Plan at the Facility,
- Coordinating external audits of the Plan at the Facility,
- Coordinating the wildlife monitoring programs, and,
- Reporting the results of the audits and monitoring programs to the regulatory authorities.

7 STAKEHOLDER CONSULTATION

In accordance with the MPMC Communication Plan as a condition of Permit 11678, environmental data will be shared with the Xatśūll First Nation, Williams Lake First Nation, Cariboo Regional District, and the Community of Likely. First Nation and community stakeholders will be provided avenues for discussing and communicating concerns regarding the Plan, including the implementation and results of the wildlife monitoring programs. For further details regarding First Nation and community stakeholder participation, refer to the *Communication Plan* by MPMC (2016).

8 ADAPTIVE MANAGEMENT

The Plan will be continually adapted based on the results of ongoing wildlife monitoring programs, reclamation planning, incident and summary reports, and employee education programs. The adaptive management framework recognizes that new information obtained from those sources of information should be used to inform future planning, decision-making, mitigation, and program design to help MPMC maintain compliance. An annual review of the Plan to determine the potential need for revisions will also be required to ensure adaptive management strategies can be successfully identified and integrated.

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Appendix A

Table of Wildlife Species with a Conservation Status in the BC Cariboo Region not legally Adopted under any Statute

Wildlife species documented in the BC Cariboo Region that have been given a conservation status by the BC Conservation Data Centre and/or the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) but have not been legally adopted under any statute[1]

Wildlife Species			Conservation Status	
English Name	**Scientific Name**	**Category**	**BC List[2]**	**COSEWIC[3]**
American Avocet	*Recurvirostra americana*	Bird	Blue	no status
American Bittern	*Botaurus lentiginosus*	Bird	Blue	no status
American Golden-Plover[4]	*Pluvialis dominica*	Bird	Blue	no status
Black-crowned Night-heron[4]	*Nycticorax nycticorax*	Bird	Blue	no status
Broad-winged Hawk[4]	*Buteo platypterus*	Bird	Blue	no status
California Gull[4]	*Larus californicus*	Bird	Blue	no status
Caspian Tern[4]	*Hydroprogne caspia*	Bird	Blue	NAR (1999)
Double-crested Cormorant[4]	Phalacrocorax auritus	Bird	Blue	NAR (1978)
Eared Grebe	*Podiceps nigricollis*	Bird	Blue	no status
Green Heron[4]	*Butorides virescens*	Bird	Blue	no status
Gyrfalcon[4]	*Falco rusticolus*	Bird	Blue	NAR (1987)
Horned Lark, *merrilli* subspecies[4]	*Eremophila alpestris merrilli*	Bird	Blue	no status
Northern Goshawk, *atricapillus* subspecies	*Accipiter gentilis atricapillus*	Bird	Blue	NAR (1995)
Rough-legged Hawk	*Buteo lagopus*	Bird	Blue	NAR (1995)
Short-billed Dowitcher[4]	*Limnodromus griseus*	Bird	Blue	no status
Surf Scoter[4]	*Melanitta perspicillata*	Bird	Blue	no status
Swainson's Hawk	*Buteo swainsoni*	Bird	Red	no status
Townsend's Big-eared Bat[4]	*Corynorhinus townsendii*	Mammal	Blue	no status
Tundra Swan	*Cygnus columbianus*	Bird	Blue	no status
Upland Sandpiper[4]	*Bartramia longicauda*	Bird	Red	no status
White-throated Swift[4]	*Aeronautes saxatalis*	Bird	Blue	no status

[1] BC CDC Search criteria: Vertebrates AND BC Conservation Status: Red (Extirpation, Endangered, or Threatened) OR Blue (Special Concern) AND Area of Interest: User Defined Polygon. The exported BC CDC list was further filtered by comparing the results to the CDC mapped locations, distribution maps, and Habitat Wizard wildlife observation points.

[2] Based on Status designated by the BC Conservation Data Centre: Blue = Special Concern, Red = Endangered/Threatened.

[3] Based on Status designated by the Committee on the Status of Endangered Wildlife in Canada: NAR = Not at Risk. The year the status was adopted is in brackets.

[4] These species are either at the northern extent of their range and occur infrequently in the region, or are more likely to occur while on migration or as vagrants.

APPENDIX 9-9: Chance Find Management Plan

REPORT

Chance Find Management Plan

Living Document

Submitted to:

Mount Polley Mining Corporation

PO Box 12
Likely BC V0L 1N0

Submitted by:

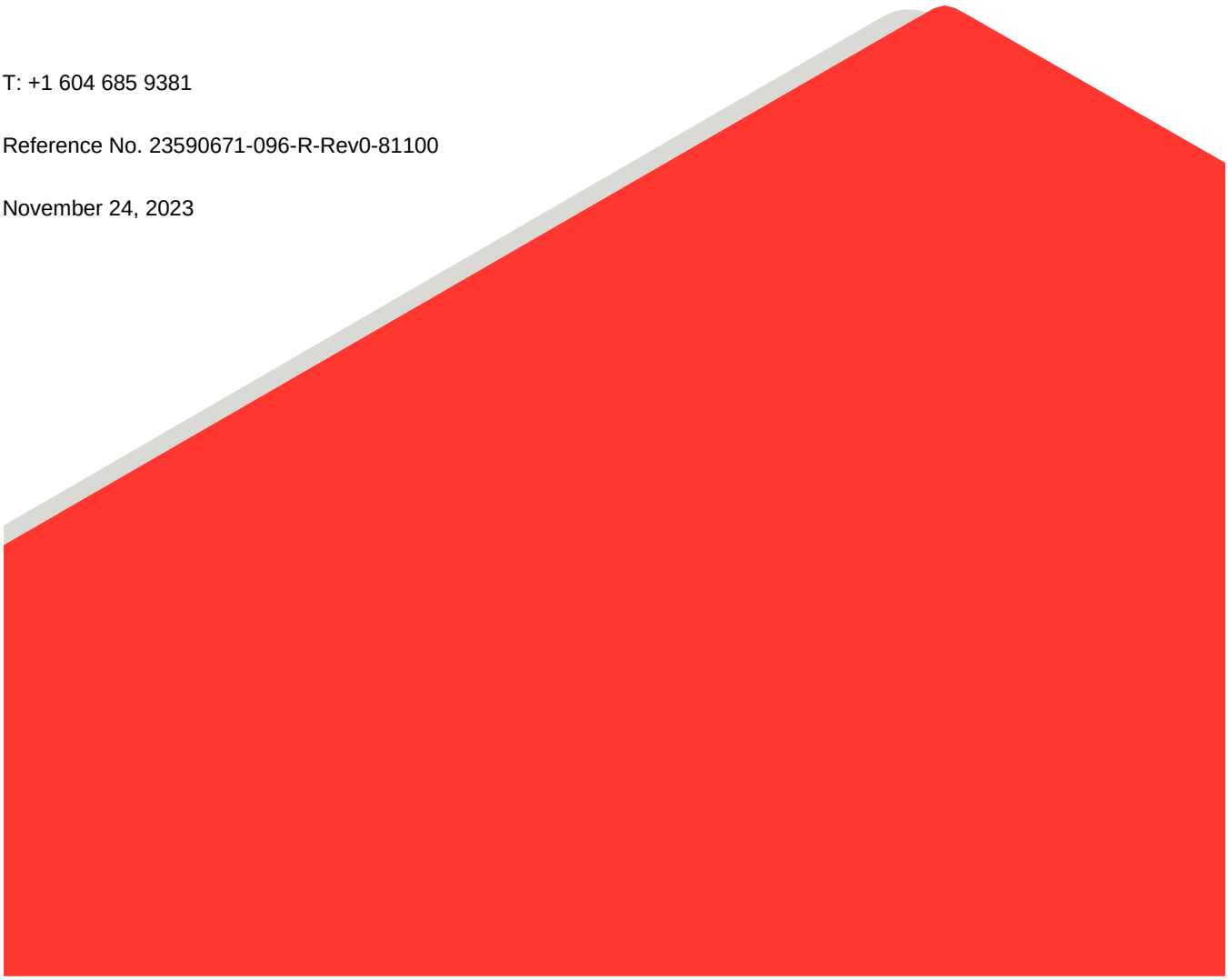
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Reference No. 23590671-096-R-Rev0-81100

November 24, 2023



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1.0 INTRODUCTION

This document provides guidance and a communication plan in the event that Mount Polley Mining Corporation (Mount Polley) project activities inadvertently disturb or uncover archaeological deposits, human remains, or objects of historical importance.

Legislative protection for British Columbia's archaeological and heritage resources is provided by the *Heritage Conservation Act* (HCA) (R.S.B.C. 1996, Chapter 187). Under the HCA, a permit is required to search for or alter heritage sites or objects that represent physical evidence of human habitation or use before 1846. Certain site types, including burial places and rock art that have heritage value, are protected regardless of age, and heritage wrecks are protected if two or more years have passed from the date that the vessel or aircraft sank, was washed ashore or crashed. Sites that post-date 1846 are not automatically protected but may be afforded protection by an Order-In-Council, based on the site's heritage value to British Columbia, a community, or an aboriginal people.

Mount Polley engages in a variety of activities that require ground disturbance. Activities that may result in disturbance to a known heritage site require an Alteration Permit pursuant to Section 12.4 of the HCA. The permit will outline procedures for archaeological work during Project activities, if required. Such permits currently take approximately 32 weeks to procure and therefore planning for the management of such sites should take place well in advance of the commencement of disturbance. In most cases, disturbance would result from ground altering activities, but above-ground works could impact heritage sites such as structures, rock cairns, culturally modified trees, or other features.

Mount Polley projects also have the potential to disturb currently unrecorded heritage sites. The following step-by-step procedure is intended to guide Mount Polley in case heritage resources are unexpectedly encountered during project activities. The procedure includes basic archaeological site recognition criteria and reporting procedures. If archaeological assessment or monitoring is required as the result of a chance find, a Heritage Inspection Permit will be required under Section 12.2 of the HCA. A Heritage Inspection Permit will be obtained for the Mount Polley to facilitate chance find responses without delay.

2.0 DEFINITIONS

The following definitions apply to the content of this management plan:

Table 1: Definition of Terms

Term	Definition
Archaeology	The science concerned with the discovery and interpretation of the human past through the study of physical remains.
Archaeological Site	Any place where physical evidence of past human activity is found.
Artifact	Any object that has been modified or manufactured by humans. Artifacts can include tools, weapons, ornaments, utensils, and sculptures.
Cache Pit	Circular depressions, usually less than 3 metres in diameter, used for storing goods or food.
Chance Find	Heritage material that is unexpectedly encountered, typically during project-related activities.
Culturally Modified Tree	A tree that has been intentionally altered by Indigenous people through their traditional use of forest resources (for food, manufacture, or medicinal purposes) or in order to mark a trail
Heritage Site	Land, including land covered by water, that has heritage value to British Columbia, a community or an aboriginal people.
Heritage Value	The historical, cultural, aesthetic, scientific or educational worth or usefulness of a site or object.
Historical	Refers to a time period during which there are written records. This period of time is also referred to as post-contact. “Post Contact” refers to the time after the arrival of Europeans.
Petroglyph	An image that has been carved, incised, engraved, pecked, or ground into the surface of a rock.
Pictograph	An image that has been painted on a rock using organic and mineral pigments.
Rock cairn	A deliberately constructed pile of stones forming a mound, often marking a burial place.

3.0 SITE RECOGNITION CRITERIA

The following lists some criteria that may signal the presence of an archaeological or burial site. The list is not exhaustive, but it includes site indicators that may be expected within the Mount Polley mine site area. The Basic Archaeological Site Identification Guide (Appendix A) provides more detailed descriptions and photographs.

Archaeological Site Indicators

- Artifacts such as stone, bone, or antler tools. Artifacts may be formed implements, such as arrowheads or spear points (also known as projectile points), or simply scatters of chipped/flaked stone. Be aware of concentrations of chipped stone materials that are not otherwise present in the project area (e.g., dacite, tourmalinite, argillite, chert, chalcedony, obsidian).
- Rock art, specifically pictographs (paintings on stone) or petroglyphs (images pecked in stone).
- Small circular depressions (about 1 m to 4 m across) representing pit ovens, cache pits etc. – particularly if associated with trails, or if found in clusters.
- Large circular or oval depressions, representing house-pits.
- Buried or exposed hearths, represented by localized dense concentrations of charcoal and/or ash sometimes associated with fire broken rock, burnt bone, or soil.
- Caves or rock overhangs.
- Trails of possible heritage significance.
- Culturally modified trees, such as blazes and bark removal scars.

Burial Places

- Human remains.
- Stone cairns.
- Earthen mounds.
- Shallow depressions or low mounds at the base of talus slopes.
- Rectangular or oval depressions.

4.0 CHANCE FIND PROCEDURES FOR HERITAGE RESOURCES

4.1 Archaeological Sites or Objects

Step 1: If known or suspected archaeological deposits or objects are encountered, stop work immediately. Secure the find location.

Step 2: Contact the Chief Compliance Officer and the Environmental Coordinator. The Environmental Coordinator will contact a professional archaeologist for further guidance (see Sections 5.0 and 6.0). Do not move or otherwise disturb the artifacts or site deposits. Do not resume work until directed by the Environmental Coordinator. Be prepared to transmit detailed location information and images of the find/location (see form in Appendix C).

Step 3: The archaeologist will advise on further action.

Initial Action

Depending on the nature of the situation, one of the following responses is likely:

- Based on information provided by the on-site representative, it may be decided that there are no further concerns, allowing project activities to continue as planned.
- A field visit by an archaeologist may be recommended. If the find is confirmed to be of archaeological concern, the archaeologist will provide direction about the interim management of impacts at the location, including the staking or flagging off the affected location.
- The archaeologist will notify the Archaeology Branch and the appropriate Indigenous communities of the find. The Archaeology Branch will recommend follow-up actions, primarily through discussions with Mount Polley, Indigenous communities, and the archaeologist. The archaeologist will advise the Environmental Coordinator regarding the resumption of project activities at the location.

Follow-up Action

- The archaeologist will implement any follow-up actions recommended by the Archaeology Branch, including but not limited to, the filing of a British Columbia Archaeological Site Registration Form for entry to the Provincial Heritage Register and archaeological investigations or monitoring.
- Findings or incidents involving heritage resources will be reported to the Environmental Coordinator and documented in Mount Polley's Environmental Management System.

4.2 Human Remains

Should suspected human remains be identified during project activities, the following responses are required. See Appendix B for Archaeology Branch Found Human Remains Policy.

Step 1: If known or suspected human remains are encountered, **stop work immediately**. Immediately notify the Environmental Coordinator and the Chief Compliance Officer. Do not move or otherwise disturb the remains or artifacts present. Take notes of the incident and be prepared to transmit detailed information and a description of the find.

Step 2: Secure the site. If the site is in a busy location or has high public visibility, assign an employee to stand watch until the local policing authority or archaeologist arrives to prevent additional disturbance or removal of evidence. Ensure that the remains are treated with dignity and respect by all those at the scene, including limiting photography to that required by the local policing authority and the archaeologist. Cover any exposed remains with plastic sheeting, plain paper, or other clean and appropriate covering to protect them. Do not backfill.

Step 3: The Environmental Coordinator will contact the Project Archaeologist (see Sections 5.0 and 6.0). Do not move or otherwise disturb the remains or associated artifacts or sediments. Do not resume work until directed by the Project Archaeologist. If some remains may have been placed in a spoil pile, do not move the pile or continue to use it. If material thought to contain remains has been removed from site, try to isolate the spoil at its new location and discontinue further disturbance of the spoil until it can be more thoroughly examined by an archaeologist or forensic specialist. The archaeologist will contact the local policing authority, if necessary, as described below.

Step 4: A qualified archaeologist will advise on further action if the remains are archaeological in nature.

Initial Action

Depending on the nature of the situation, one of the following responses is likely:

- Based on a telephone description of the encounter and review of available images, it may be determined that the remains are not human, and project activities may continue as planned.
- Based on a telephone description of the encounter and review of available images, it may be determined that the remains are likely human, and the archaeologist will contact the local policing authority and the Coroner's Office. The Coroner will determine whether the remains are human, and, if human, whether they are of forensic concern.
- If forensic, the local policing authority will assume management of the scene and liaise directly with the Environmental Coordinator and Chief Compliance Officer.

If archaeological, the archaeologist will notify the Environmental Coordinator and the Chief Compliance Officer, the Archaeology Branch, and all Indigenous communities with an interest in the area. Consultations will follow to establish an appropriate procedure for handling the remains according to cultural protocols. The Archaeology Branch Policy for Found Human Remains (Appendix A) may be used to guide the discussions.

- If the remains are not of Indigenous ancestry, the archaeologist will notify cultural groups identified by the Archaeology Branch and will attempt to identify and contact an organization representing that cultural group.
- The Archaeology Branch, in consultation with the Environmental Coordinator, the Indigenous community or other cultural group (if applicable) and the archaeologist, will determine follow-up procedures, including:
  - Interim management of project impacts and activities at the location, including the staking or flagging-off of the affected location.
  - The need for complete documentation of the burial site.
  - Appropriate treatment of the human remains.
  - Management of future project activities.

Follow-up Action

- Report findings or incidents involving heritage resources to Mount Polley's Environmental Management System.
- The archaeologist will implement any follow-up actions recommended by the Archaeology Branch, including but not limited to, the filing of a British Columbia Archaeological Site Registration Form for entry to the Provincial Heritage Register.

5.0 COMMUNICATIONS PROTOCOL

- All communications should be made using email or telephone and should be documented, with written follow-up to concerned parties.
- All face-to-face meetings are to be documented, with minutes prepared for review and finalization by all parties.
- The proceedings of all meetings are confidential among the parties to the meeting and are not to be distributed.
- All media queries will be directed to the Environmental Coordinator who will notify the Company spokesman.
- All queries from Indigenous community members with an identified interest at the site will be directed to their Chief and Council or other designated organization. All other queries from Indigenous community members will be directed to the Environmental Coordinator.
- Site safety and security is the responsibility of Mount Polley; when implementing safety or security measures, input from the Archaeology Branch and the Project Archaeologist should be sought to help ensure additional impacts to the burial place do not inadvertently occur.

6.0 CONTACT NAMES AND NUMBERS

Table 2: Contact Name and Numbers – Current October 2023

Organization	Name	Title	Contact Information
Mount Polley	Gabriel Holmes	Environmental Coordinator	gholmes@mountpolley.com Mobile: +1 250-364-4939 Mine Site: +1 250-790-2215
Mount Polley	Don Parsons	Chief Compliance Officer	don.parsons@imperialmetals.com Direct: +1 604-488-2652 Mobile: +1 778-836-2652
Archaeology Branch	TBD	Project Officer (HCA Permit TBD)	TBD (update when known)
Williams Lake RCMP	n/a	n/a	575 Borland St Non-emergency Direct: +1 250 392-8707
WSP Canada Inc.	Chris Dodd	Senior Archaeologist	Chris.Dodd@wsp.com Mobile: +1 604-315-1351
WSP Canada Inc.	Andrew Mason	Senior Principal Archaeologist	Andrew.Mason2@wsp.com Mobile: +1 604-417-4259

7.0 LIMITATIONS AND USE OF CHANCE FIND MANAGEMENT PLAN

This document was prepared by WSP Canada Inc. for the exclusive use of Mount Polley and their contractors. Consistent with the intent of the *Heritage Conservation Act*, Mount Polley is advised that if unanticipated cultural materials or features are encountered during construction, all work in the immediate area should cease, and the guidelines for archaeological chance find management, as presented above, should be implemented.

Any use, reliance, or decisions made by third parties on the basis of this report are the sole responsibility of such third parties. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions or actions based on this report.

8.0 CLOSURE

The reader is referred to the Study Limitations section, which precedes the text and forms an integral part of this report.

We trust that the information contained in this report meets your present requirements. Please contact us if you have any questions or concerns regarding the above.

WSP Canada Inc.





Chris Dodd, BA, RPCA
Senior Archaeologist

Andrew Mason, MA, RPCA
Senior Principal Archaeologist

CD/ARM/lih/hp/sw

https://golderassociates.sharepoint.com/sites/10023g/23590671 deliverables/002_issued/096-r-81131-chance find management plan/rev0/23590671-096-r-rev0-81100-mount polley cfmp 24nov_23.docx

APPENDIX A

Basic Archaeological Site Identification

BASIC ARCHAEOLOGICAL SITE IDENTIFICATION GUIDE

Common criteria that may signal the presence of an archaeological site are noted below. The examples are not exhaustive but includes common site indicators that may be encountered within the Mount Polley Mining Corporation area of operations.

Artifact or Artifact Scatter

Portable object(s) manufactured or modified by human beings. These items may include chipped or ground stone objects or implements made from bone or antler (Photos 1 to 6).

Look for: Obviously formed stone objects or pieces of stone that have been chipped and/or ground in a non-natural way. Bone and antler artifacts will exhibit obvious modification (i.e., cutting, shaping, incision, etc.).

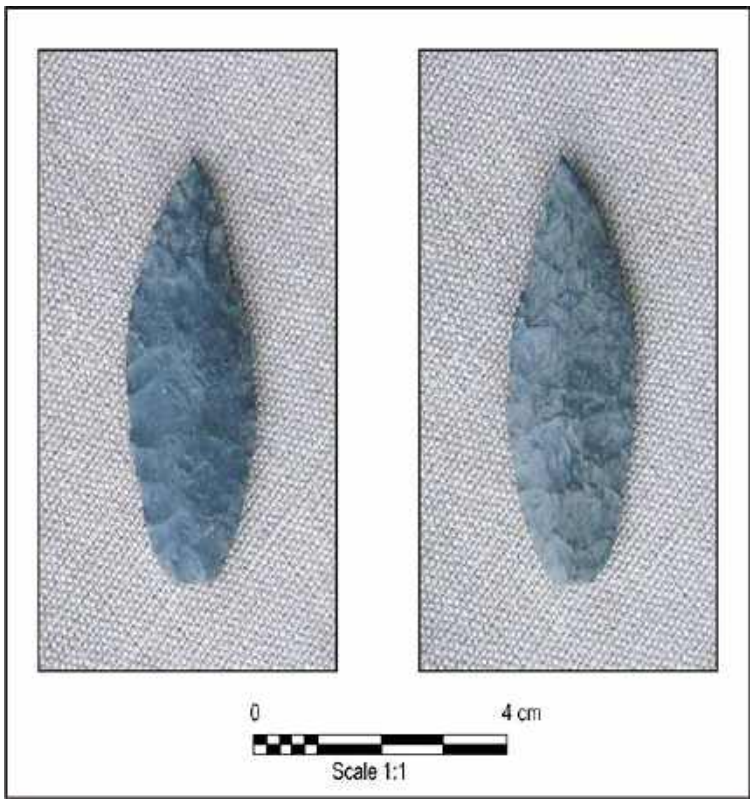


Photo 1: Projectile Point (© WSP Canada Inc.)



Photo 2: Scraper, Projectile Point, Key-shaped Drill (© WSP Canada Inc.)



Photo 3: Obsidian Knife. Obsidian is Volcanic Glass and is Extremely Sharp (© WSP Canada Inc.)



Photo 4: Bone and Antler Artifacts (© WSP Canada Inc.)



Photo 5: Pecked Stone Hand Maul (hammer) (© WSP Canada Inc.)



Photo 6: Chipped Stone Artifacts (flakes) (© WSP Canada Inc.)

Rock Art

Pictographs are paintings on rock and are the most common form of rock art in the region. The paint is often a mixture of ochre and rendered animal fat and is applied using a finger or stylus (Photo 7).



Photo 7: Pictograph (© WSP Canada Inc.)

Cultural Depressions

Cultural depressions range in size and function and may include: small circular depressions (about 1 m to 4 m across) representing pit ovens or food caches – particularly if associated with trails, or if found in clusters; and, large circular depressions (about 5 m to 20 m across) representing house-pits (Photos 8 to 10).



Photo 8: House-pit Depression (© WSP Canada Inc.)



Photo 9: Roasting or Cache Pit (© WSP Canada Inc.)



Photo 10: Roasting Pit in Profile (© Adam Gray)

Fire Cracked Rock (FCR) and Hearth Features

Fire cracked rock (FCR) is heat fractured stone resulting from rapid or alternate heating and cooling in campfires, or when using heated rocks to boil water in boiling pits. FCR is often associated with resource processing and/or food preparation (Photo 11). Hearth features are the remains of camp fires, indicates by dark stained soil, often with charcoal and ash (Photo 12).

Look for: concentrations of fractured rock, either in a hearth formation or dispersed with signs of being burnt in a fire, such as heavily oxidized surfaces sometimes reddish in color.



Photo 11: Fire Cracked Rock (© Andrew Mason)



Photo 12: Buried Fire Hearth (© WSP Canada Inc.)

Aboriginal Trails

Trails are often located in creek valleys and over saddles and ridges. Trails are often in association with other heritage sites such as campsites containing stone or bone artifacts, FCR, hearth features or cache pits (Photo 13).



Photo 13: Aboriginal Trail (© WSP Canada Inc.)

Burial Places

Burials take numerous forms which may include rock cairns, mound burials, and rectangular or oval depressions; however, many burial sites have no surface expression (Photos 14 and 15).



Photo 14: Burial Mounds (© WSP Canada Inc.)



Photo 15: Burial Cairn (© Andrew Mason)

APPENDIX B

Archaeology Branch Found Human Remains Policy

FOUND HUMAN REMAINS

Issued: September 22, 1999

Purpose

The purpose of this directive on found human remains is to provide guidelines to Archaeology Branch staff, archaeologists, other agencies and the public as to branch procedures for handling human remains that may be protected under the *Heritage Conservation Act* (1996, RSBC, Chap. 187), and to facilitate the respectful treatment of these remains.

Mandate

Pursuant to section 13(2)(b) of the *Heritage Conservation Act* (HCA), a permit is required under section 12 or 14 before a person can undertake any actions affecting a burial place of historical or archaeological value, human remains or associated heritage objects.

Authority

The Director of the Archaeology Branch and the Manager, Permitting and Assessment Section, have been authorized to exercise the powers of the Minister to issue permits under sections 12(2) and 14(2), as well as ministerial orders under section 14(4) where necessary for emergency conservation purposes.

Policy Statement

Upon notification of the discovery of human remains that are not of forensic concern, the Archaeology Branch will take steps to facilitate the respectful handling and disposition of those remains within the limits of existing funds and program priorities.

Procedures

The following procedures will normally apply in cases where human remains are discovered fortuitously through various land altering activities such as house renovations, road construction or natural erosion; or during archaeological studies conducted under an *HCA* permit:

1) Fortuitous Discoveries

In cases where the branch has been notified that human remains have been discovered by chance, the following procedures should normally apply:

- The Coroner's Office and local policing authority should be notified as soon as possible.
- The Coroner's Office should determine whether the matter is of contemporary forensic concern. The branch may provide information and advice that may assist in this determination.
- If the Coroner's Office determines the reported remains are not of forensic concern, the branch will attempt to facilitate disposition of the remain.
- If a cultural affiliation for the remains can be reasonably determined, the branch will attempt to contact an organization representing that cultural group.
- If remains are determined to be of aboriginal ancestry, the branch will attempt to contact the relevant First Nation(s).
- Generally, if remains are still interred and are under no immediate threat of further disturbance, they will not be excavated or removed.
- If the remains have been partially or completely removed, the branch will facilitate disposition.
- If removal of the remains is determined to be appropriate, they will be removed under authority of a permit issued pursuant to section 12 or 14, or an order under section 14 of the *HCA*, respecting the expressed wishes of the cultural group(s) represented to the extent this may be known or feasible.
- If circumstances warrant, the branch may arrange for a qualified physical anthropologist or an archaeologist with training in human osteology to provide an assessment of the reported remains in order to implement appropriate conservation measures.
- Analysis should be limited to basic recording and in-field observations until consultation between the branch and appropriate cultural group(s) has been concluded.

2) Permitted Archaeological Projects

In cases where human remains are encountered in the course of a permitted project, the Archaeology Branch should be contacted as soon as possible.

- The remains are to be handled in accordance with the methods specified in the permit, respecting the expressed wishes of the cultural group(s) represented, to the extent that these may be known or feasible.
- If the permit does not specify how remains are to be handled and if the cultural affiliation of the remains can be reasonably determined, the field director or permit-holder should attempt to contact an organization representing that group. The permit-holder or field director should advise the branch of the organization contacted, and any wishes expressed by that organization.
- The branch, in consultation with the appropriate cultural group(s), will determine disposition of the remains.
- Analysis should be limited to basic recording and in-field observations, until consultation between the branch and appropriate cultural group(s) has been concluded.

APPENDIX C

Archaeological Chance Find Documentation Form

Archaeological Chance Find Documentation	
Date and Time:	Location:
Time Work Stopped (if applicable):	UTM:
Recorder's Name:	Project Site:
Department/Company:	Find Surveyed (Y/N):
Position:	Depth Below Surface:
Incident Number/Site Number (if applicable):	
Archaeological Site Type:	
Disturbance Information:	Sketch Map:
Stratigraphic Information:	
Photographs Attached (Y/N): Site Map Attached (Y/N):	(include dimensions)
Name and Signature of Supervisor(s)/Manager(s):	
Follow-up Actions (if required):	
Communication Documentation (record: name, date, time, contact information, and details of conversation): (attach separate sheet if necessary)	



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APPENDIX 9-10: Mine Emergency Response Plan



Mount Polley Mining Corporation

an Imperial Metals company

Emergency Response Plan

This is a CONTROLLED Document.

Copies should not be made without the consent of the Safety department.

Revision August 2021

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1 OVERVIEW

1.1 Scope

Being prepared for a mine site emergency is critical in order to effectively respond and control any unexpected occurrence.

The following Mine Emergency Response Plan has been designed and developed for Mount Polley mine to coordinate and effectively respond to any and all mine emergencies.

This is a requirement of the Health, Safety and Reclamation Code for Mines in British Columbia (HSRC) 3.7.1

1.2 Definition of an Emergency

A current or imminent situation that requires prompt coordination of actions of trained personnel to protect health, safety, or welfare of people and to limit damage to property and to the environment.

1.3 Goals

- To identify and ensure adequate resources are available on site and off site in order to facilitate effective emergency response.
- To introduce and train management in the roles of the "Control Group"
- To introduce and train workers in the relevance of the Mine Emergency Response Plan.
- To ensure and maintain a high standard of emergency response training for mine personnel.

1.4 Training

For the ERP Training Program to be successful, with adequate revision of this Plan, it is necessary to establish a Drill Program. The Health and Safety, Environmental and any other operational areas will take part in the drills.

All personnel assigned specific duties within this plan shall review pertinent sections of the plan

All personnel in positions of leadership shall be trained in the Incident Command System

Emergency Response Drill Schedule

- LEVEL 1 Once every 6 months - Area specific evacuation practice
- LEVEL 2 Once every year / Mine Site wide Involving the Mine Rescue Team (ERT)
- LEVEL 3 Once every two years / Involving the ERT and Activating the Emergency Operation Centre

2 EMERGENCY RESPONSE PLAN MANAGEMENT

Mount Polley Mining Corporation shall designate an Emergency Response Plan Coordinator and Emergency Response Planning Committee who shall oversee the development, review and implementation of the Emergency Response Plan.

2.1 Emergency Response Plan Coordinator

The Emergency Response Plan Coordinator shall normally be the Senior Safety Coordinator or his designate.

2.2 Plan Audits and Revisions

The emergency response planning group will be comprised of the Mount Polley Occupational Health, Safety and Environment Committee members.

The ERP Planning Committee shall review the emergency response plan annually. The Emergency Response Plan shall also be reviewed following any incident, to determine if the planned response procedures were adequate or require revision. The planning committee shall be chaired by the Emergency Response Plan Coordinator.

Date	Rev.#	Revision	Originator
July 2019	#0	N/A	M Dyment
July 2020	#1		M Dyment
Aug 2020	#2		M Dyment
Dec 2020	#3	E2 Propane plan	M Dyment
Aug 2021	#4	Contact info	M Dyment

2.3 Emergency Response Plan Distribution

The Emergency Response Plan will be maintained as a secure document with limited printed copies. Digital copies will be stored on the Mount Polley Microsoft Teams network at General\Emergency Response Plans\Surface. Printed copies will be maintained in the following locations:

Copy	**Location**
1	Emergency Operations Center – 2nd Floor Boardroom
2	On-call Binder – Reception Desk
3	Mine Manager

3 COMMUNICATIONS

3.1 Level of Emergency

Mount Polley Mine Incident Reporting Policy requires that all levels of emergencies be reported immediately. Based on the level of emergency the Incident Commander and Safety Representative shall be notified as required.

EMERGENCY RESPONSE LEVELS
Level 1 "Low": Green
A "Low Level" emergency can be controlled by area personnel from the affected area.
Level 2 "Medium": Yellow
A "Medium Level" emergency cannot be handled by the personnel of the affected area. The Mine Rescue Team is required. It does not exceed the resources of the site. The Emergency Operations Group should be activated.
Level 3 "High": Red
A "High Level" incident is one which exceeds the resources available at the site and outside help, such as government, industry and or corporate, is required.

The highest severity rating for any individual risk factor determines the overall severity rating of the emergency.

3.2 Emergency Communications

EMERGENCY COMMUNICATION / INCIDENT NOTIFICATION

EMPLOYEE / BYSTANDER

Emergency Communications

1. By Radio on area radio frequency EMERGENCY – EMERGENCY –EMERGENCY - I have an Emergency
2. Report significant details of the incident

Provide the following information:

1. Your name, area and company
2. Location of the Emergency
3. Description of the Emergency
4. Number of injured persons if any and their health condition
5. Telephone number or radio frequency you will be monitoring
6. **Notify your Supervisor immediately**
    - DO NOT CALL the local media to report the emergency
    - DO NOT CALL the family or friends of the persons involved in the emergency (Management will take charge of making such calls)
    - DO NOT CALL the government agencies (Management will take charge of making such calls)

SUPERVISOR

On Scene Commander (OSC), Senior Area Supervisor present at the scene:

1. Confirms/Determines the Level or Emergency: Level 1 GREEN / 2 YELLOW / 3 RED
2. Informs Safety of the resources needed at the scene
3. Directs the on-scene activities
4. Initiates the dispatch of site based resources for the appropriate response:
    - Site Mine Rescue Personnel
    - First Aid
    - The on-call Health and Safety representative.
5. Contacts the Mine Manager or designate senior on call or the next higher level to report the Level of Emergency and response needs.

MANAGER

Manager
Incident Commander (IC), Mine Manager or Designate:

1. Confirms or Determines the Level of Emergency & assumes command at pre-designated Emergency Operations Center (2nd floor Boardroom).
2. Responsible for the overall management of an emergency.
3. Evaluates the emergency and determines the required level of response.
4. Confirms or initiates the dispatch of the resources for the appropriate response:
    - Site Mine Rescue personnel
    - First Aid
    - Ministry of Energy, Mines and Low Carbon Innovation
        - Senior Inspector of Mines, Health and Safety
    - RCMP - 911
    - BC Ambulance - 911
    - Forestry Fire Service etc.- 1-800-663-5555
    - Emergency Management BC – 1-800-663-3456
    - Williams Lake First Nation, Xatśūll First Nation

INITIAL RADIO AND TASK PROCEDURES WHEN AN EMERGENCY IS DECLARED
When an Emergency is called:
• **Radio Silence -** All non-essential radio communication are immediately ceased. Radio silence will remain in effect until lifted by the Incident Commander
• **Pit Operations 1 – Channel 5 -** is reserved for Emergency Incident Reporting, Management & High Priority Communications only
• **All Employees Monitor Pit Ops 1** to stay informed of the incident and listen for updates & instructions. Maintain radio silence unless you have a Priority Message
• **Cease High Risk Activities** in the initial stages of any reported emergency until a status can be determined by Management
• **Wait For Instruction -** Communications may be done with briefness on regular assigned channels to ask or receive instructions from your immediate Supervisor &/or Management
• **Prolonged Work Interruptions** will be at the discretion of the Incident Commander or his designate
• **Evacuation Ordered -** Proceed to designated Muster Points and report to your supervisor

3.3 Mount Polley Mine Radio Frequencies

Mount Polley Radio Communications				
Radio Channel	Area	Receive Mhz	Transmit Mhz	Full Private Line Mhz
Channel 5	Emergency/First-Aid	167.910	170.430	114.8
Channel 1	Tailings	170.670	170.670	
Channel 2	Mill	170.790	170.790	
Channel 3	Not Used			
Channel 4	Old Bootjack FSR	153.635	153.635	
Channel 5	Pit Ops 1 - Repeater	167.910	170.430	114.8
Channel 6	Pit Ops 2 – Repeater	162.075	167.055	131.8
Channel 7	Pit Talk Around	167.910	167.910	
Channel 8	Maintenance	166.020	166.020	
RR 25	Bootjack FSR	151.310	151.310	

3.4 Critical Personnel Contact Phone Numbers

Title	Name	Contact Information			
Interim General Manager	Don Parsons	Home:		Cell:	(778) 836-2652
		Office:	(604) 488-2652	Radio:	Channel 5
		E-mail:	Don.Parsons@ImperialMetals.com		
Technical Services Superintendent	Matt O'Leary	Home:		Cell:	(250) 274-0658
		Office:	(236) 317-4938	Radio:	Channel 5
		E-mail:	Mathieu.OLeary@MountPolley.com		
Mine Operations Superintendent	Joe Grant	Home:	(250) 296-4447	Cell:	(250) 644-0975
		Office:	(236) 317 4936	Radio:	Channel 5
		E-mail:	Joe.Grant@MountPolley.com		
Environmental Supervisor	Matt O'Leary	Home:		Cell:	(250) 274-0658
		Office:	(236) 317-4938	Radio:	Channel 5
		E-mail:	Mathieu.OLeary@MountPolley.com		
Mill Manager	Doug Ablett	Home:		Cell:	(250) 303-1479
		Office:	(236)317 4949	Radio:	Channel 5
		E-mail:	Doug.Ablett@MountPolley.com		
Safety Officer	Murray Dyment	Home:		Cell:	
		Office:	(236) 317-4940	Radio:	Channel 5
		E-mail:	Murray.Dyment@MountPolley.com		
Corporate President and CEO	Brian Kynoch	Home:		Cell:	(778) 836-7441
		Office:	(604) 488 2654	Radio:	
		E-mail:	Brian.Kynoch@ImperialMetals.com		
Corporate COO	Don Parsons	Home:		Cell:	(778) 836-2652
		Office:	(604) 488-2652	Radio:	
		E-mail:	Don.Parsons@ImperialMetals.com		

3.5 Outside Agency Critical Contact Numbers

Phone Numbers		
Agency Name	Primary Contact	Contact Information
Ministry of Energy, Mines and Low Carbon Innovation	*Phone: 1-888-348-0299*	*Email: MineIncidents@gov.bc.ca*
	Chris LeClair	778-220-2076 (Cell) 250-312-6728 (Office)
	Rory Cumming	250- 371- 7328 (Cell)
	Allan Chan	250-320-2948 (Cell) 250-312-6710 (Office)
Emergency Management BC	24 Hour Contact	1-800-663-3456
CANUTEC	**24 Hour Contact**	1-613-996-6666
BC Ministry of Environment	**Email**	EnvironmentalCompliance@gov.bc.ca
RCMP Williams Lake	**Emergency Contact** Non-Emergency Contact	**911** 250- 392-6211
BC Ambulance	**Emergency Contact**	911
Cariboo Memorial Hospital	**Emergency Department**	**250-392-4411 Ext 4000**
BC Wildfire Service	**Emergency Contact**	**1-800-663-5555**
Cariboo Regional District	**24 Hour EOC Emergency Contact**	**1-800-665-1636 and press 5**
T'exelc First Nation (Williams Lake First Nation)	Chief	250-302-1883 (Cell) 778-417-0194 (Office)
	Natural Resource Manager	250-305-8025 (Cell) 778-417-0191 (Office)
Xatśūll First Nation (Soda Creek Indian Band)	Chief	250-267-7464 (Cell) 250-989-2323 ext 125 (Office)
	Natural Resource Manager	250-267-7185 (Cell) 250-989-2323 ext 121 (Office) nrmanager@xatsull.com
Highland Helicopters Ltd	Williams Lake Base Quesnel Base	250-398-7142 250-249-9660

3.6 Media and Public Relations

During an emergency it is critical that all media and public communication be managed so that only accurate and required information is communicated to outside groups. All media and public communications will be handled by the Mine Manager or Designate. All requests for information shall be directed to Mine Manager or Designate. In the event of an emergency involving personal injury, specific focus should be given to notification of family members prior to public release.

The Shut Down of site external communications shall be determined by Mine Manager or Designate

4 PERSONNEL DUTIES AND RESPONSIBILITIES

4.1 General Responsibilities of Personnel

Anyone first finding or recognizing an emergency situation that would be cause for evacuation shall;

- Immediately report the emergency, pull the fire alarm and evacuate the building.
- Notify the supervisor of the emergency situation.
- Provide help until the appropriate response personnel arrive.
- Never place yourself or others in danger, especially during fires, electrical or chemical emergencies.
- If an alarm is sounded or you are instructed to do so, evacuate the area to designated assembly points and stay there until the "**All Clear**" signal is given.
- If an evacuation takes place, make sure you and any visitors you are responsible for are accounted for.
- If safe to do so, ensure that shutdown procedures for your area are completed prior to evacuation.

General Procedure G50 Evacuation Procedure shall be followed.

4.2 First aid Attendant

In the event of an emergency, the first aid attendant shall take over primary care of any injured workers. If Mine Rescue trained personnel are in command of an incident scene, the first aid attendant will take over care of the injured workers once the Mine Rescue personnel confirms the area is safe to approach.

4.3 Mine Rescue

4.3.1 Emergency Response Coordinator

The Emergency Response Coordinator or his designate must be contactable at all times, both during office hours and after hours. During office hours, the coordinator must be in close proximity to a radio or telephone.

The Emergency Response Coordinator will liaise with Incident Commander, Mine Rescue Personnel and Coordinate assistance for the incident and disseminates warnings and information as required.

Upon notification of an emergency The Emergency Response Coordinator will:

- Immediately report to the Emergency Operations Center
- Proceed to the mine rescue station and organize the emergency response personnel

- Coordinate the gathering of all required equipment and vehicles
- Ensure all required personal protective equipment is identified and utilized
- Brief the Mine Rescue personnel regarding the nature of the emergency and assigned duties
- Ensure that proper communication is established and maintained with all active Mine Rescue personnel throughout operation
- Ensure that a complete record is kept regarding assignments, communications and de-briefing

The Mine Rescue Personnel will seek the Emergency Response Coordinators approval prior to commencing any interventions that could endanger either Mine Rescue Team Members or other personnel.

4.3.2 Mine Rescue Team Captain

The Mine Rescue Team Captain reports directly to the Emergency Response Coordinator in an emergency. The Mine Rescue Team Captain directs the actions of the mine rescue team to rescue trapped or injured workers, protect the mine property from further damage, and rehab the affected area and equipment. The Captain has the right to refuse any task he considers an unacceptable risk to the team. The Mine Rescue Team Captain will be responsible for:

- knowing the Mine Recue Team Members available on site;
- knowing the locations and status of rescue vehicles;
- the direction and safety of team members during emergency situations.

4.3.3 Mine Rescue Personnel

In the event of an emergency all Mine Rescue Team Members report directly to the Mine Rescue Team Captain in the mine rescue training center for briefing. Once assessment of the incident has been completed by the Team Captain any team members not required will be returned to their duties and shall remain on call until needed or the incident has been controlled.

> **3.7.5 HSRC** The manager of an open pit mine employing more than 25 persons per shift shall ensure that
> (1) there is one fully trained and equipped mine rescue team, and
> (2) on every shift where more than 10 persons are working, there are four persons trained in mine rescue procedures.

4.3.4 Mine Rescue Equipment

An updated copy of the mine rescue equipment inventory shall be maintained in the mine rescue training center and on the mine rescue truck. These mine rescue inventories shall be inspected on a monthly basis with any changes to the inventory list being completed as soon as discrepancies are found. The Safety Officer will maintain these lists.

4.3.5 Mutual Aid

Mount Polley Mining Corporation does not currently have a Mutual Aid agreement.

All costs pertaining to rendering assistance from other mines or jurisdictions are the responsibility of the mine seeking assistance.

5 EMERGENCY INCIDENT COMMAND

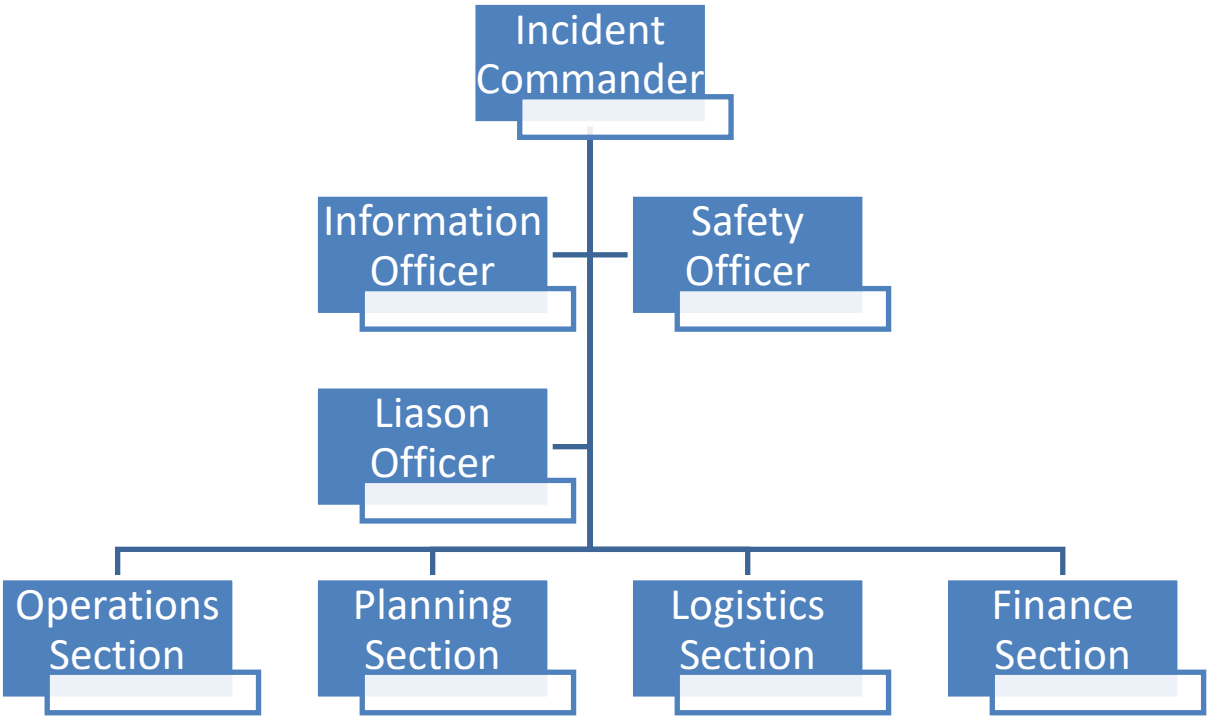
5.1 Incident Command Roles "Control Group"

Incident Command System (ICS)

- In charge of all aspects of emergency management
- Performing command activities, such as establishing commander and the Incident Command Post
- Protecting life and property
- Setting objectives, strategies and incident action plan
- Controlling and accounting for personnel and equipment resources
- Establishing and maintaining an effective liaison with outside agencies and organizations

With the exception of the Incident Commander (IC), who shall always be designated, the following positions may be implemented by the Incident Commander based on the scope and requirements of the emergency. In smaller incidents the roles may be performed by the IC, but larger incidents may require the IC to establish Sections whose activities are to support the IC.

5.2 ICS - Chain of Command Flow Chart



The Incident Commander will assign personnel to these positions.

6 EMERGENCY IDENTIFICATION, PREVENTION AND PROTECTION

6.1 General Evacuation

When an emergency occurs that is significant enough to affect the health and safety of employees in any work area, an evacuation of all areas may be required.

6.1.1 Responsibilities of Personnel

- Know the location of all the emergency exits in your work area, particularly the nearest one to you.
- When the alarm for the evacuation of your area is sounded and/or the notification is given by your supervisor, immediately stop what you are doing and go, in an orderly manner, directly to the areas designated Muster Point.
- When you leave your work site, CLOSE ALL DOORS AND WINDOWS. If you have enough time, close valves, shut off equipment, computers, office equipment and lights; safeguard confidential information by locking desks and file cabinets.
- If you are the last person to leave the area, check that all work areas are emptied of personnel, provided that circumstances and time allow you to do so.
- Personnel that work in critical areas of the process must perform the emergency shutdown procedures established for these areas.
- **WALK, DON'T RUN**. In an emergency, move fast but don't run. Remain in control, do not panic.
- Avoid smoke-filled environments. If a space that is full of smoke is the only exit route, crawl, escape through a window or if safe to do so remain in position and notify your supervisor of your location.
- Go to the muster Point assigned to your **work area**. Make sure that you establish contact with your supervisor (or the designated person) as soon as possible.
- Those people who know of lost personnel should immediately inform their supervisor.
- Do not re-enter the evacuated area or return to the scene of emergency to offer aid, unless the Incident Commander specifically requests your presence.

6.1.2 Muster Points

The Muster Points are designed to be used by personnel during an evacuation due to an emergency. Accommodations will be made to avoid exposure of the evacuees to the inclemency of the weather.

The following areas are designated Muster Points in the event of an emergency:

- **Outside Mine Rescue Training Center**
  All workers assigned to duties in the mill building, warehouse, admin
  Back-up Location: Employee parking lot
- **Outside the Crusher Maintenance shop**
  All workers assigned to duties in the Crusher building, Crusher Maintenance shop
  Back-up Location: Employee parking lot
- **South East Rock Dump (SERD)**
  All workers assigned to duties in the Pit and around the Tailings Storage Facility including The Water Treatment Plant
  Back-up Location: In-Pit Washrooms

In the event that an identified muster point cannot be used due to safety concerns the Incident Commander will designate alternate locations.
Generally a Muster Point is defined as an area that is:

- A minimum of 15 meters distance from the affected facility
- Located against the wind and uphill

6.1.3 Accounting for Personnel

All personnel working onsite shall sign in and out at the Mine Access Gate House.

The supervisor or most senior employee will be responsible for accounting for the personnel under their charge. This is done by performing the following steps:

- Ensuring that all the personnel leave their work area during the evacuation.
- When they have reached the designated Muster Point, perform a headcount of all personnel (employees, contractors, visitors, etc.) who were within the work area at the time of the emergency.
- The Daily Sign-In Sheet will be used for accounting of personnel during emergency situations. Once the head count has been completed, the supervisor must report any discrepancies in personnel, including any missing personnel and/or any individuals that normally work elsewhere.
- In turn, each supervisor will report to their next level of management until personnel information reaches the senior management person for each department at the assembly area.
- The senior management person for each department will account for all departmental personnel. This accounting should include all employees, contractors, delivery personnel, temporaries, and visitors under their supervision.

- Once all personnel have been accounted for the senior department representative shall communicate this information with Incident Command and Emergency Response Coordinator
- Departmental management at each assembly area should communicate with each other to determine the location of any missing personnel.
- If personnel are deemed to be missing, the Incident Commander and Emergency Response Coordinator should be contacted immediately.
- All supervisors shall keep their groups together at their respective assembly areas until the Incident Commander gives further instructions.

6.1.4 Search and Rescue

If a building has been evacuated, personnel shall not re-enter the building until the all clear signal is given, or directed to do so by the Incident Commander.

Mine Rescue trained personnel are permitted to enter an area that has been evacuated to perform search and rescue before the all-clear signal is given. Search and rescue is the responsibilities of the Mine Rescue personnel and will be conducted in accordance with their standard operating guidelines. The Mine Rescue Team Captain may enlist support from the Area Supervisor or their designate for knowledge of the area.

Note: There will be no search and rescue undertaken unless an adequate backup personnel are ready and standing by.

6.1.5 Pit Evacuation

Notification to evacuate the pit will be made through radios and may only be authorized by the supervisor. Instructions will be given for the operations personnel in charge of vehicles to move to the Assembly Points that have been determined to pose no danger.

The personnel who do not have any vehicle or do not have access to one (such as operators of drills, blasting equipment, etc.) will be picked up by light vehicles. It is very important that these workers wait at the designated Muster Point safely outside the emergency area.

6.1.6 Site Evacuation

The decision to conduct a full site evacuation will be made by the Incident Commander. The Incident Command Team will be responsible for arranging transportation off of the property.

- The Incident Commander must determine the final location of the evacuees.
- Transportation for the personnel must be coordinated.
- The headcount should be confirmed to ensure all personnel are accounted for.

Access and Egress to the Mine site

In the event that mine access road prevents any entry or egress of the mine site, the Incident Commander will refer to Appendix A – Site Evacuation Routes for alternate site evacuation routes. If all of these routes are compromised then other options, such as helicopter evacuation shall be considered.

6.1.7 End of the Emergency and Return to Work

The evacuated area must be left free of dangers. The Mine Rescue trained personnel will conduct a thorough inspection of the evacuated facilities. If there was a fire or if damage is found in the structures, the area must be inspected by Maintenance and Health and Safety personnel to determine if the area is safe to be occupied.

Once the area has been declared to be safe, the On Scene Commander will notify the Incident Commander of this circumstance so that he proceeds to stop the emergency signal. The Incident Commander will transmit the order to stop the emergency signal through all channels. Transmission will include a description of the evacuated areas with the key phrase:

"All clear"/you can return to the area".

This message must be repeated three consecutive times.

The employees may return to their work once the transmission of the end of the emergency has concluded.

A debriefing will be completed at the end of all emergencies. The debriefing session will be documented to address what was completed correctly and what improvements are needed. The Emergency Response Plan will be reviewed and, if necessary, revision made.

6.2 Medical Emergencies

6.2.1 Responsibilities

First on Scene Persons Duties

- Prior to accessing the scene ensure the area is safe. If unsafe to approach, immediate contact the supervisor to report the conditions.
- Quickly assess the situation determining the number of injured persons, the severity of injuries and what resources may be required to deal with the emergency situation.
- Immediately inform the area supervisor of the incident, including required resources.
- Give the supervisor the following information:
  - Your name
  - The location of the accident
  - The number of injured persons
  - The nature of the injuries
  - The best route to be used to approach the accident location
- The supervisor will contact the Incident Commander in order to dispatch the Mine Rescue Team.
- Do not move the injured unless they are in imminent danger.

- Restrict access to the scene by any unauthorized individuals and ensure security of any evidence.

On-Scene Commanders Duties

- At all times ensure the safety of personnel and emergency responders.
- Assess the accident scene.
- Contact the Incident Commander to apprise them of the situation, notify them of what additional resources may be required, and update the information whenever the situation changes or additional information becomes available.
- Have someone present assist you with the communications and recording of information & times. (Assign a Log Keeper)
- Control access to and preserve the emergency scene

- Note and record all details of the incident as soon as possible
- Prepare a report of the incident
- Get the names of eyewitnesses and others who may have relevant information.

Emergency Response Team Duties

- Respond to the scene as directed by the on scene or Incident Commander
- Apply appropriate care following protocols outline in training
- Initiate the request for any off-site resources as required (BC Ambulance, Fire Department)
- The Emergency Response Team Captain or Medic will keep the Emergency Response Coordinator or Incident Commander informed of any required resources
- Provide medical assistance and/or evacuate the patients(s) safely and quickly
- Preserve evidence and scene security

6.2.2 Transportation

MPMC procedure G03 Medical Evacuation shall be followed when any injured worker requires medical evacuation, either to meet BC Ambulance Service or to a medical facility.

6.2.3 Fatality

Personal injuries that result in fatalities require special action due to local law and conditions. If the injured party is clearly and definitely deceased, the remains are not to be moved until authorization is received from the RCMP, or the Coroner. Mount Polley Mine Manager or Designate is responsible for notifying the RCMP, Coroner and Ministry of Energy, Mines and Low Carbon Innovation (EMLI).

Due to the nature of fatalities, special emphasis shall be placed on securing the incident scene and all evidence. This shall be done to support investigating the accident, determining the causes and taking the necessary steps to prevent any reoccurrence.

All fatalities will be investigated by a Special Investigation Team made up of:

- The General Manager or his designate.
- The Superintendent of the Area Affected.
- The Senior Safety Coordinator
- The employee's supervisor
- JOHSEC Co-Chairs (Joint Occupation, Health, Safety and Environment Committee)
- Others, as determined by the General Manager / Health & Safety and as circumstances require, e.g. technical advisors

Work Related Fatality – Supervisors Duties

- The Supervisor ensures the barricading of the area surrounding the accident scene to guarantee evidence is preserved.
- The Supervisor ensures that the Health & Safety personnel are notified immediately.
- The Supervisor shall notify promptly the following people:
  - His immediate Supervisor
  - The Area Superintendent
  - Incident Commander
- The supervisor will confine the information to the facts of the accident, having made positive identification of the deceased. Radio discussions of the accident will be minimized and names will not be broadcast.
- The supervisor will preserve the accident scene and all physical information until relieved of this responsibility by the Health & Safety Representative, or employee he designated, or the Area Superintendent. Accident site visits will be limited to only necessary emergency response personnel, managers, and regulatory officials as required.
- The supervisor is responsible for completing a preliminary report of the accident. The Investigation Team will complete and distribute the final report as appropriate.

Work Related Fatality- Health and Safety Duties

- Ensure that the scene is properly preserved, documented and evidence collected.
- Health & Safety will initiate legal reporting, to all agencies that have authorization in the case. The Senior Safety Coordinator or his designate will follow up to ensure that appropriate notifications have taken place.
- The Senior Safety Coordinator will inform Mount Polley Mining Corporation's Senior Management.
- The Senior Safety Coordinator and other necessary management personnel will conduct a briefing session, if possible, with representatives from the local authorities prior to their inspection of the accident scene.
- The Senior Safety Coordinator will serve as a member of the Special Investigation Team.

- After all investigations have been completed, the Senior Safety Coordinator will prepare a final report of the accident in writing to the General Manager, and area Superintendents. He will also include copies to be sent to the local authorities after approval.
- No information will be given to any other source or agency without authorization from the General Manager.

Work Related Fatality – Department Superintendent Duties

- Ensure that the scene of the accident is secured and that no evidence can be tampered with
- Advise promptly the facts of the fatality to the Incident Commander.
- Stand ready to act as required or directed by the Incident Commander.
- Serve as a member of the Special Investigation Team.

Work Related Fatality – General Manager Duties

- Inform Mount Polley senior management and executive team of the occurrence.
- Ensure notification of the appropriate authorities is underway:
    - RCMP
    - Coroner
    - Ministry of Energy, Mines and Low Carbon Innovation
        - Local Inspector
        - Chief Inspector
    - Local JOHSEC (Joint Occupation, Health, Safety and Environment Committee)
- Ensure notification of next of kin occurs as soon as authorities allow
- Once the emergency is under control, the General Manager or his designate will visit the accident scene to assist in the investigation.
- The Incident Commander will return the accident site to its operational condition as soon as possible, being consistent with the requirements of Health, Safety and Reclamation Code.

6.3 Fire Emergencies

At all times be familiar with the evacuation routes of your work area. The best way to protect yourself is to be able to quickly evacuate a work area in the event of a fire or other emergency. Prior to fighting any fire, ensure that it is within the scope of your training and that you maintain a suitable exit route at all times. Large fire will be managed by the site Mine Rescue/Emergency Response Teams.

6.3.1 Fire Prevention

Automatic Fire Alarm: Site buildings are monitored through a fire alarm system. This system will activate and signal through audible bells and sirens for area evacuation.

Monthly fire suppression systems and handheld fire extinguisher inspections are essential to ensure the integrity of all systems.

Scheduled maintenance and repairs are imperative in order to maintain the integrity of fire suppression systems. Particular attention to housekeeping and observing the National Fire Code will ensure that fire protection remains effective at all times.
Combustibles shall not be stored inside buildings unless they are part of a work process.
Flammable materials such as paints and aerosols shall be stored in approved and appropriate storage cabinets.
Fire Extinguisher training: personnel shall be trained and familiar with safe use and application of Hand Held Fire Extinguishers.

6.3.2 Reporting and Extinguishing Small Fires

The site is equipped with hand-held fire extinguishers and fire hydrants for occupant first-response use on small fires. The initial response should be as follows:

- Warn occupants in the immediate fire area.
- Activate a fire alarm if one is nearby
- Activate any fire suppression systems that may be available.
- Attempt to extinguish the fire with a handheld fire extinguisher or fire hydrant if safe to do so.
- Notify the area supervisor via the appropriate radio channel.

Other Actions

- Relevant Supervisor is responsible for making sure that their area is evacuated.
- Regardless of the size of the fire, building occupants must assemble immediately at a designated Muster Point.
- All supervisors shall keep their groups together at their respective assembly areas until the Incident Commander gives further instructions.

6.3.3 Uncontrolled Fires

The following procedures apply to small fires that cannot be extinguished or fires that pose danger to human life/property or production.

- Warn occupants in the immediate fire area.
- Activate a fire alarm if one is nearby
- Activate any fire suppression systems that may be available.
- Notify area supervisor.
- Notify Mine Rescue trained personnel of the location and extent of the fire.

Mine Rescue Team (ERT)

- Responds to the emergency with the relevant equipment.
- Isolate the area and evacuate as many people as possible.
- Ensure rescue of trapped or injured workers.
- Provide firefighter measures within scope of training and request outside resources if required.

Isolating Utilities

The Incident Commander shall instruct the Mill Maintenance and Electrical department to Shut off and isolate power and other utilities to the fire area that could hinder emergency response.

Water Sources

- One of the most important factors to consider when fighting fire shall be maintaining an adequate supply of water and ensuring that alternate sources are readily available.

6.3.4 Wild Land Fires

Any range fire on mine property should be immediately reported to the area Supervisor. The area supervisor shall be responsible for summoning the help needed to extinguish the fire if necessary.

All responses to the fire will be coordinated by the Area Supervisor & Incident Commander. Response should be limited to extinguishing a small fire in its early stages. If the fire cannot be contained with the resources of the mine, response will be limited to protection of mine property.

The Site Manager should be notified of any major fire, or a fire that threatens life or mine property.

The main aim in responding to a Rangeland Fire is to:

- Report it to the area supervisor and Incident Command
- Evaluate the danger to personnel and infrastructure.
- Continual monitoring of the fire for direction, speed, size, smoke, etc.
- Allocation of resources as needed.
- Evacuate to a safe place accounting for all persons on site.
- Help with fire in area as situation warrants and as directed by Incident Command

BC Wildfire Service (BCFS) Wildfire Management Branch

The Wildfire Management Branch has the resources and personnel that are specially training to deal with wildfires. If required, the Incident Commander should initiate contact with the BC Wildfire Service as soon as possible during a wildfire event.

BC Wildfire Service contact line - 1-800-663-5555 or *5555 from a cellular phone

6.4 Hazardous Materials and Chemicals

6.4.1 Spill

For detailed information on Hazardous Materials and Chemical spills see the Spill Response Manual Appendix D

6.4.2 Training

Personnel assigned spill clean up duties must be trained in Hazardous Materials Spill Cleanup

6.4.3 Main Response Elements

Any reportable leak, spill, or release outside containment areas must be reported to the Environmental Department immediately. All external notification and reporting shall be conducted by the Environmental Superintendent or their designate. Containment and cleanup activities shall only be performed as directed by Environmental personnel.

6.4.4 Find and identify

- Mitigate the source of the spill
- Establish communications system
- Collect information
- Isolate the Emergency Scene

6.4.5 Notify

Hazardous Materials spills must be reported to the Environmental Department immediately.

6.4.6 Spill Assessment

See; Spill Response Manual 2019 Appendix D

6.5 Vehicle Incidents

There is a potential for vehicle accidents involving multiple casualties on the Mine-Access road. There would be a reasonably high risk of multiple casualties taking into consideration the volume of traffic and the mode of transportation, that being buses and multi-passenger vehicles.

Access control

One of the early priorities would be to prevent access to the scene by assigning 2 persons as guards, one at each end of the mine access road.
Travel into and out of the mine can then be restricted to essential and key personnel.

Emergency Response Personnel

If indeed there are multiple casualties it may be necessary for additional outside medical help. It would take a minimum of 1 hour for help to arrive from Williams Lake and if available, 30 minutes response from Likely; therefore, it is of the utmost importance that a “Triage station” be established so that casualties can be transported in the order of emergency medical importance.

Transportation

Consideration must be given to the situation where there are multiple casualties needing transportation to medical facilities in Williams Lake. If this is the case it may be necessary to facilitate the use of crew cabs or other multi-passenger vehicles as long as they can provide the necessary comfort for the casualties
The Designated First Aid Attendant is to respond to Medical Emergencies.
Where injuries require Medical Treatment follow procedure G03 Medical Evacuation
Where there are multiple casualties it may be necessary to establish a "Triage station" so that casualties can be transported in the order of emergency medical importance.

6.6 Land Movement

6.6.1 Prevention of Burial

Either a shift boss or a qualified person will examine dumps or stockpiles prior to any work being performed. Dumps, Stockpiles and Pit Walls will be monitored at intervals not to exceed four hours while in use.

The conditions noted shall be recorded in the daily logbook. Items of concern include:

6.6.1.1 Dumps and Stockpiles:

- Cracks appearing on the dump floor or face.
- Subsidence of the dump floor.
- Material hanging up on the face of the dump.
- Water flows or pooling

6.6.1.2 Pit Walls:

- Cracks developing along or near the edge.
- Cracks in the face.
- Overhangs developing on the bench face.
- Water flowing into the rock

If any of the above items are observed contact the Shift boss who will inspect the site and determine what actions are to be taken. In the event that the area appears unsafe do not enter and contact the Shift boss immediately for direction.

If cracks are observed on the rock dump floor the area shall be blocked off and monitored to determine if additional movement is occurring. Dumping in the area shall not recommence until the Shift Boss gives approval.

Overburden and soils piles will slough and compact as they are being built. Dumping shall take place back from the edge and dozed over. If bulging of the face or curved cracks are observed dumping shall cease in the area and the area shall be monitored for additional movement. Dumping in the area shall not recommence until the Shift Boss gives approval.

6.7 Tailings Storage Facility

6.7.1 Potential Emergencies

For detailed information on potential Tailings Storage Facility Emergencies see: MOUNT POLLEY MINE TAILINGS STORAGE FACILITY EMERGENCY PREPAREDNESS AND RESPONSE PLAN.

Located at the Mount Polley Microsoft Teams network at General \ Emergency Response Plans \ Tailings Storage Facility

6.8 Weather Related Emergencies and Natural Disasters

In severe weather, seismic, or other natural disaster situations personnel will keep away from high risk areas created by the condition.

Examples are:

- High winds or earth movement/permafrost subsidence - Stay away from power lines, high walls, and embankments that may be affected.
- Extreme precipitation (heavy snow or rain fall) - Keep personnel and equipment out of possible voids & high drift zones or flood areas in the case of heavy rain
- Heavy snow - Maintain accessibility for personnel and emergency equipment
- Lightning - Keep personnel out of non-protected elevated areas and other high-risk situations.

In the event of any severe weather conditions or other natural disaster situations the Mine Manager or Designate shall be notified.

6.9 Unplanned Explosions

Unscheduled Explosion – First on Scene Duties

- Call the relevant supervisor, report the situation, and follow their instructions.
- Assess the situation. Evacuate the affected area. Move to a safe vantage position. Do not endanger yourself or other rescuers.
- Stop all operations in the area until it is safe to resume.
- If there is anyone injured, follow the procedures herein for Injuries / Medical Accidents.
- If there is anyone in need of rescue, identify the need for the Mine Rescue team.
- Remain at the safe vantage position until relieved by the Supervisor and authorized to leave.
- Ensure that the Department Manager is informed of the emergency via radio or telephone.

Unscheduled Explosion - Supervisors Duties

- In the event of an unplanned detonation, ensure that the area is evacuated and secured. DO NOT ENTER the area except to rescue an injured person and then only if safe to re-enter (If possible, efforts should be made to get the Mine Rescue Team to the scene.)

- Proceed to a safe vantage position. Confirm the assessment of the situation with the First on Scene Person.
- Co-ordinate the immediate emergency response from the safe vantage position.
- Together with the Area Manager, decide on the Level of Emergency (LOE) warranted by the situation. Be prepared to change this if the situation escalates or diminishes in severity.
- Establish controls on all roads leading to the area.
- Prepare access to the scene for emergency services vehicles when it is safe for them to enter the area, and direct them to the scene.
- Ensure that the following personnel have been notified: Mine Operations Manager, Mine Operations Assistant Superintendent, Senior Safety Coordinator.
- See that the Mine Rescue Team is supported in their immediate response requirements.
- With the On Scene Commander, decide if additional off-site emergency services are required.
- When the situation is stabilized, assist the Manager with the investigation of the emergency.
- Ensure the area is secured.

Unscheduled Explosion – Area Superintendent Responsibilities

- Proceed to the scene of the emergency, if it is safe to do so, for an initial assessment.
- Consider secondary explosions, toxic gases, and structural collapses.
- Co-ordinate the response of various on-site specialists such as medical, fire, environmental, Mine Rescue Team, etc.
- Advise the Emergency Operations Group with details of the emergency, the immediate response taken, and if any risks remain.
- When the situation has stabilized, conduct an investigation of the causes, effects and response to the explosion, and prepare a written report.
- Security shall be assigned to control access to the affected area.

6.10 Bomb Threat

6.10.1 Bomb Threat - General Guidelines Procedures

Threat recipient:

- Make every effort to remain calm and relaxed.
- Record the call, if recording equipment is available.
- If a recording cannot be made, try to transfer the caller to the emergency number where a recording can be made.
- If unsuccessful, follow the guidelines in the Bomb/Threatening Call Record sheet to obtain as much information as possible from the person making the threat. **Attached at Appendix A**
- If the threat is in written form, put the letter and envelope in a plastic cover and refrain from unnecessary handling.

- Inform the Senior Safety Coordinator and Area Manager immediately after receiving the threat and wait for further instructions.
- If the caller indicates that the bomb is in the building that you are occupying, immediately start the evacuation process, taking the notes made during the threat call with you.

Observer of item suspected as a Bomb:

- Do not touch the device.
- Inform the Area manager as well as the Senior Safety Coordinator
- Start the orderly evacuation of the immediate area.

6.10.2 Responsibilities

On-Scene Commander's Duties

- Notify Internal Security and consider advice from the RCMP.
- Assess the situation and decide the following:
  - If a full or partial evacuation, or none at all, is warranted.
  - If a search is warranted and can be safely done.
  - When it is safe to reoccupy the site or office.
- Make sure everyone is accounted for at the designated assembly point for that area.

Mine Rescue Team Duties

- The Mine Rescue Team will respond with an ambulance, (if available) and appropriate rescue and firefighting equipment. These units will stand-by at the Incident Staging area where the On-Scene Commander (OSC) is located, at least 300 meters from the suspect device or location of threat.
- In the event of a detonation, when deemed safe to do so, normal Emergency Response procedures will be carried out.
- The Mine Rescue Team will provide the required fire/rescue/medical/search and recovery services and any other services as needed.
- The Mine Rescue Team does not participate in securing the bomb.

7 MINE WATER SUPPLY SYSTEM

- Mine site tap water is untreated and is not considered drinkable, bottled drinking water is provided and all sink tap locations are signed with “DO NOT DRINK TAP WATER”.
- Bottled Drinking water provided to site by Cool Clear Water, Williams Lake.
- All Mount Polley’s water samples are tested by ALS CANADA LTD.
- When maintenance tasks are required and unable to be completed by onsite personnel, then resources will be drawn from outside contractors.
- Interior health can be contacted in any emergency scenario to help with health risk assessments.



7.1 Potential Emergencies

7.1.1 Mechanical / Electrical water system failure

- Contact the General Manager or his designate (On Call Manager)
- Limit water usage on mine site
- Arrange for potable water to be trucked to site until the water well supply system is returned to operational condition
- Arrange for Sanitary stations
- Affect repairs

7.1.2 Water sampling test results outside acceptable parameters.

- Shut down water supply system
- Contact the General Manager or his designate (On Call Manager)
- Arrange for potable water to be trucked to site until the water well supply system is returned to operational condition
- Arrange for Sanitary stations
- Identify source of contamination
- Disinfect well system if applicable

8 MINE SITE ACCESS CONTROL DURING EMERGENCY OPERATIONS

During an emergency, access to the mine site shall be limited to persons and equipment necessary for support of the management of the incident. In order to facilitate site access control a guard will be positioned at a location on the Bootjack FSR that allows for traffic control. This position will normally be at KM 8 of the Bootjack FSR.

The following materials will be needed when deploying site access control:

- A log book to record all personnel being granted access to the site. This log shall record date, check-in/out time, name and company name
- Reliable communication with mine site
- Lighting for night operation
- Traffic control devices, reflective cones, flagging tape and/or barricades
- Warning signage for vehicle operators

Appendix A – Site Evacuation Routes - A



Appendix A – Site Evacuation Routes - B



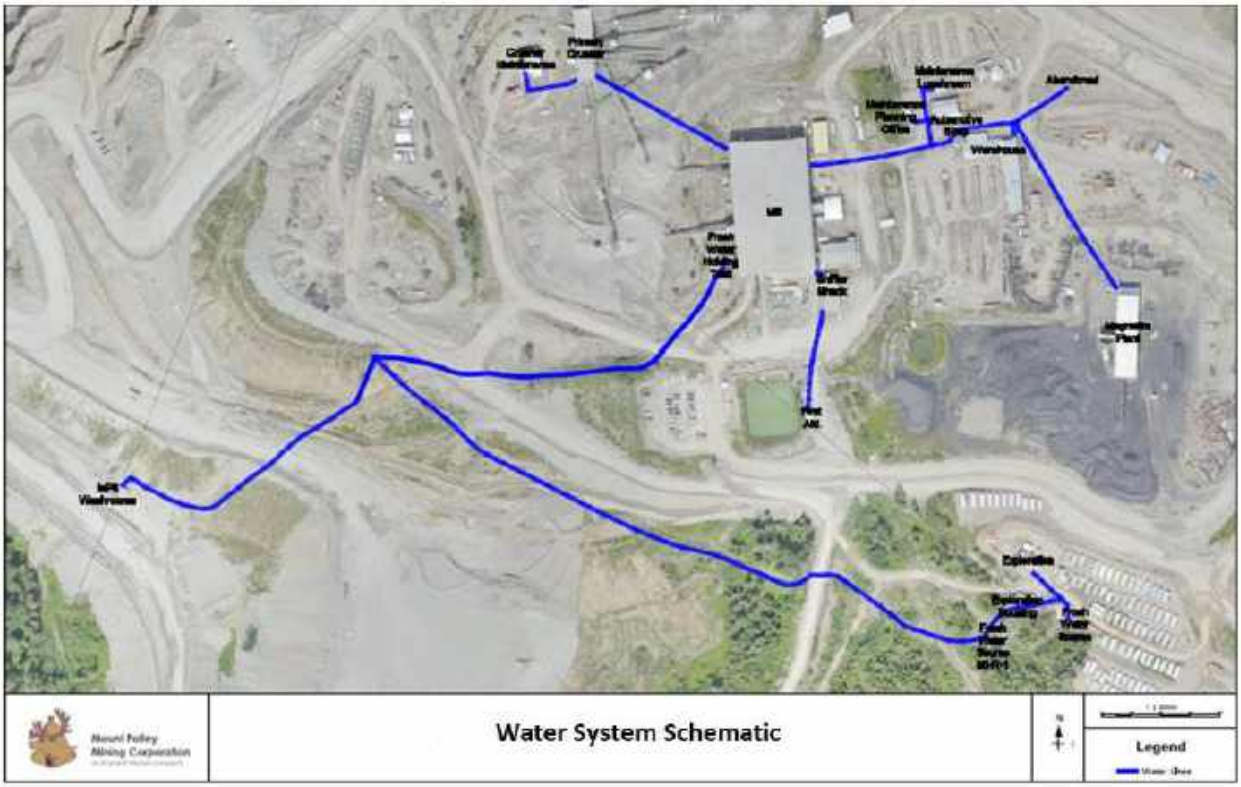
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Appendix B - Mill Building Evacuation Routes



Appendix C – Water System Site Schematic



Appendix D – Emergency Spill Response Contingency Plan

Mount Polley

Mining Corporation



Emergency Spill Response Contingency Plan

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  - Radioactive Materials .....
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Mount Polley Mining Corporation
EMERGENCY RESPONSE PLAN

EFFECTIVE DATE: February 2005

REVISION DATE: March 2013, April 2014, March 2016, July 2019 , Aug 2020

1. Overview

1.1. Policy:

To ensure preparedness and to maximize valuable time in case of an emergency.

To confirm Mount Polley Mining Corporation commitment to operating its business at the highest standards to protect the health and safety of workers, the public, and the environment.

1.2. Definition of an Emergency

A current or imminent situation that requires prompt coordination of actions of trained persons to protect health, safety, or welfare of people and to limit damage to property and to the environment.

1.3. Definition of a Reportable Spill

- A release or discharge into the environment, not authorized under the BC *Environmental Management Act* of a substance in an amount equal to or greater than the amount listed in Appendix E.
- A release of mine influenced water of any volume (outside of permitted effluent discharge volumes) is reportable.
- A release or deposit any deleterious substance in any water.

1.4. Legal Definition:

A spill means any polluting substance whether gaseous, liquid or solid that, in the opinion of the minister, is capable of causing pollution if it were to:

- Escape into the air
- Be spilled onto any land or into any body of water, or
- Escape onto any land or into any body of water.

1.5. Objectives:

1. Ensure compliance with B.C. Environmental Management Act: Part 7
2. Ensure compliance with the Federal Metal Mining Effluent Regulation.
3. Ensure compliance with the Federal Transportation of Dangerous Goods Act.
4. Ensure compliance with the Federal Fisheries Act.
5. Outlines response strategies to spills of potentially hazardous substances at or near the mine-site.
6. Facilitate the rapid deployment of trained personnel to deal with spills so that the environmental impact and risk are minimized.
7. Provides Guidelines for Communicating environmental incidents and issues to corporate management
8. Ensure that responsible personnel are:

- Familiar with the Emergency Spill Response Contingency Plan.
- Aware and are trained in the potential hazards associated with the Plan.
- Understand and are trained in the responsibilities of Team Members.
- Locations of spill containment materials.
- Action Plan for respective substances.
- Reporting procedures.

1.6. Plan Audits and Revisions:

The Environmental Superintendent is responsible for conducting an annual review of this plan and revising it when necessary.

1.7. Training:

It is the responsibility of the Mine Manger or Designate, with the assistance of the Safety Department, to organize, coordinate and conduct training sessions of the mine-site Emergency Response Team Members.

2. Contact Numbers

2.1. Critical Personnel Contact Phone Numbers

For Critical Personnel Contact Phone Numbers see Critical Personnel Contact Phone Numbers Section 3.4 Mount Polley Mining Corporation Emergency Response Plan

2.2. Agency Critical Contact Phone Numbers

For Agency Critical Contact Phone Numbers see Outside Agency Critical Contact Numbers Section 3.5 Mount Polley Mining Corporation Emergency Response Plan

Government Agencies:

Emergency Management BC: 24 hour service:	**1-800-663-3456**
BC Ministry of Environment	
EnvironmentalCompliance@gov.bc.ca	
Ministry of Health (non-emergency health information)	811
Spill Response Advice:	
Canutec (Canadian Transport Emergency Centre)	1-613-996-6666
Canwest Propane	1 800-943-7678
Orica (Williams Lake)	1-250-398-2611
Quadra Chemical Reagent	1-604-940-2830
	1-888-940-2830
Anachemia Science	1-800-361-0209
Brenntag Canada Inc.	1-800-661-1830
	1-604-685-5036
Commercial Clean-Up Services:	
Triple P Sanitation:	1-250-392-4414
Gord's Septic Services	1-250-392-4647

Orville's Septic Service	1-250-395-4638
Arrow Transport	1-250-571-7764

2.3. Regulatory Reporting Numbers

The Emergency Contingency Plan Control Officer/Designate must contact Emergency Management BC.

1-800-663-3456

This is a 24-hour toll free number.

The Emergency Management BC Program staff will notify all concerned agencies, including the following, as appropriate:

BC Ministry of Environment	EnvironmentalCompliance@gov.bc.ca
Ministry of Health.	1-800-663-7867
Environment Canada (24hEmergency – report to BC Ministry of Justice)	1-800-663-3456
Environment Canada (Vancouver Office)	1-604-664-9100
Soda Creek Indian Band	1-250-989-2323
Williams Lake Indian Band	1-250-296-3507
BC Mines Inspector	1778-220-5852

3. Spills

3.1. Potential Spill Materials:

1. Gasoline
2. Diesel Fuel
3. Waste Oil
4. Coolant
5. Hydraulic Fluid
6. Mill Tailings
7. Propane
8. Lime
9. Mill Reagent NaHS
10. Acids
11. MIBC (W22)
12. Concentrate
13. Mine Influenced Water
14. Till/mud/soil/rock
15. IPAC

3.2. Potential Spill Types:

1. Minor spills from equipment due to leaks.
2. Minor spills from containers being damaged or knocked over.
3. Minor/Major spills from fueling stations.
4. Major spills from storage tanks outside the Mill.
5. Major spills from storage tanks inside the Mill.
6. Major spills form transportation and delivery vehicles.
7. Spills from slurry tailings line.
8. Releases of mine influenced water from water collection or transportation facilities.

3.3. Potential Spill Locations:

1. General Mine-site grounds.
2. Mill Building and surrounding areas.
3. Fueling station.
4. Access road to mine site.
5. Access road around mine site.
6. Open Pits.
7. Ditches and pipeline routes.
8. Water storage sumps and ponds.
9. Creeks, lakes and surface water bodies in and around the mine site, including the Hazeltine Creek effluent discharge site.

3.4. Spill Response Materials Locations

1. Light vehicle fuel island (Warehouse).
2. Fuel Island (beside the Crusher).
3. Maintenance areas (Pit Shop, Finning/Shovel Crew Laydown)
4. Springer Pit.(MDG)
5. Warehouse (Entrance and in yard, with spare materials in stock).
6. Lower Hazeltine
7. Reach 3 Creek Construction
8. Cold-Water Pump location (Weir)
9. 9K Sump
10. Mine Drainage Sump
11. CCS Sump
12. South Seepage Sump

3.5. Spill Assessment Potential

Transportation:

The area of greatest vulnerability for spills is transport related incidents resulting from road conditions, and mechanical failures. Contingency plans are filed by the Shipper of the transport company with Transport Canada and drivers are required to be in possession of these files in order to address these types of incidents.
Ensure that Shipping Paper is carried in the cabin of the transport vehicle.

The Company:

Undertakes to provide information to the Shipper on avoidance of poor road conditions and rescheduling of deliveries, if necessary.
Ensures to maintain the mine road conditions in as favourable condition as possible.
Provides the manpower and equipment required to control and minimize the effects on the environment.

Fuels:
Standard procedures are in effect for the safe unloading of fuels to storage tanks and safety berms are provided to contain spills at the storage facilities.
Emergency Contingency Plans for effective response to spills are addressed in this document.

Lime:
Unloading of granular quicklime from bulk tank trucks can result in spillage. These spillages, if any, will be cleaned up with a front-end loader and disposed of.

Explosives:
Transport, handling and transfer of explosives are addressed within the Emergency Contingency plan of this document. Explosive materials storage is in separate containers and conform to the Ministry of Mines and Transport Canada standards.

Tailings:
The tailings lines are protected by against vehicle collision. The pipeline is also contained in a ditch along the access road to the tailings pond.

Mine Influenced Water:
Site water collection sumps, ponds, and ditches, water transport pipes, and the Hazeltine Creek Discharge System, all have the potential to release water into the environment, possibly entering surface water bodies. Breaches may occur due extreme runoff events, physical damage to pipes or other facilities, or pump failure.

Hazeltine Creek Effluent Discharge System

The installation of continuous monitoring for conductivity, temperature, and flow provides employees with immediate notification of changes in the discharge. As well, the emergency “shut down” system will prevent the discharge of water which exceeds the set limits for continuous monitoring as defined by Mount Polley Mining Corp. the Metal Mines Effluent Permit, and Ministry of Environment PE-11678.

Pump failure triggers emergency "shut down" and all storage tanks are designed to overflow into existing effluent storage facilities.

Other Consumables:
All consumables are contained within their original shipment containers prior to transfer to end user containers. End user spillage Emergency Contingency Plans are addressed in this document.

4. Response

4.1. Contact Group

Spills of chemicals, fuels and other substances may occur as isolated events or they may occur with other emergencies such as fire, explosion, natural causes or accident.

A number of response personnel may be involved to protect mine property and the health and safety of mine personnel and the public.

The key persons involved during a spill occurrence would be as follows:

- The person discovering the spill, and his/her Supervisor.
- The General Manager or his designate (who may be the On-Call Supervisor if the General Manger cannot be reached outside of regular hours).
- The Area Superintendent.
- The Safety Department.
- Mine Rescue trained personnel
- The clean-up crews.

The responsibilities of key personnel are outlined in the Personnel Responsibilities section.

Applicable telephone numbers are kept current and posted at the mine-site.

4.2. First-On-The-Scene Personnel Responsibilities

4.2.1. Person discovering the spill:

- Assess the hazard to one's own health and safety and to others in the vicinity.

- If the risk of gas poisoning exists ensure to conduct atmospheric testing with the appropriate equipment prior to entry.

- If fire or explosion hazards are perceived immediately retreat to safe distance.

4.2.2. In both these situations:

- Barricade/Flag the area.
- Place physical guards at a safe distance.
- Warn others in the immediate vicinity of the situation.
- Notify the Area Supervisor IMMEDIATELY following initial response action.
- Arrange for appropriate operating equipment to be shut down, if applicable, to minimize the extent of the spill.
- If warranted, notify designated First Aid Attendant for first aid.
- Firefighting response will be trained site personnel backed up by Mine Rescue trained personnel.
- The Supervisor or the person discovering the spill with the following information must contact the General Manager or his designate IMMEDIATELY following initial response action:

  - Name of person discovering the spill.
  - The time of the spill.
  - The location of the spill.
  - The type of substance spilled.
  - The quantity of material been spilled.
  - The cause of the spill.
  - The weather conditions.
  - Perceived potential for hazard, and any injury to aquatic systems, wildlife or people.
  - Actions already taken.
  - Whether a fire or explosion hazard is deemed to exist.
  - Personnel already notified.
  - If the spill is contained.
  - Any environmental effects that have or could occur.
  - Any injuries.

Note:

Ensure every remedial action is taken safely and efficiently to stop and/or minimize the extent of the spill.

The Supervisor must remain in place to direct personnel and equipment upon instructions from the Command Post.

4.3. Levels of Emergency

Level 1- A spill that is **below the external reportable quantity** or an emergency where the **potential health and safety risks are low** (no employees are injured). Incidents that can be cleaned up or resolved with little impact on the mine and or environment. No command post is necessary in such an incident.

Level 2- A spill that is **above the external reportable quantity** or an emergency whereby the **health and safety of staff member(s) may be jeopardized**. It is a spill that requires the initiation of the emergency measures. No external help is needed in this situation but a command post may need to be established.

Level 3- A spill that is **above the external reportable quantity** or an emergency where there is **great potential health and safety risks**. There may be casualties. This type of emergency requires internal and (may require) external intervention. A command post may be set up both onsite and offsite.

	Is the spill above external report quantity?	**Potential Health and Safety Risk**	**Emergency Operations Center**	**External Support**
Level 1	**No**	**Low**	**No**	**No**
Level 2	**Yes**	**Maybe**	**Maybe**	**No**
Level 3	**Yes**	**Yes**	**Yes**	**Maybe / yes**

4.4. Main Response Elements

Find and Identify

Mitigate the source of the spill
Establish Communication System
Collect Information
Isolate the Emergency Scene

Notify

Site supervisors, managers, and employees (according to procedures outlined in this document)
Regulatory bodies and agencies as required (Ministry of Environment, Environment Canada, Provincial Emergency Program), if required.
Soda Creek Indian Band and Williams Lake Indian Band, if required.
Notification to public and media, if required.

Ensure Public Health and Safety Protection

Work with appropriate first responders
- Mine Rescue Team and site First Aid attendants
- Ambulance
- Fire Department
- Police
- Search and Rescue

Environmental Protection

Establish Spill Plan
Manage spill response equipment and resources
Conduct spill material clean up

Terminate the Incident

Complete an incident report

4.5. Personnel Responsibilities

General Manager/Designate:

Deploy response crews and equipment operators to undertake the actual clean-up and supervise their work. Notifies Corporate, Emergency Management BC, First Nations groups, and Media.

Maintain responsibility for the activities at the site of the spill.

Maintain contact with and co-ordinate work with the Environmental Superintendent, Terminates the Incident, conducts brief**.**

- Notifies Government Agencies.
- Monitors Environmental Impact.
- Establishes decontamination measures with safety coordinator.
- Update the Spill Contingency Plan as required, for all potentially hazardous materials, accurate names of personnel and phone numbers.
- Plan and co-ordinate required skills.
- Be responsible for assessing new spill hazards as they develop and take preventative actions, whether covered in the manual or not.
- Check and maintain the operating status of required response equipment, which may be required at a spill.
- Train emergency response personnel with respect to their duties, or work with the Safety Department to do so.

Superintendent of Affected Area:

- Has authority to direct response operations.
- Needs to clear incident action plan with the General Manager (or designate).
- Determines level of Incident.
- Assigns Command Post if necessary.
- Executes the incident action plan.
- Enforces worker safety and environmental protection.
- Briefs team on specific assignment.

Communications

Responsible for the communication and emergency assistance

Notifies emergency response personnel by telephone or radio in the event of an emergency

- Assigns scribe
- Records incident details and subsequent developments as they occur.
- Responsible for establishing communication and emergency assistance.
- Establishes external support system (if required)
- Assisting Safety Supervisor.
- Maintains communication contact with the work parties via walkie-talkies, signal horns, or other means

Health and Safety:

- Advises the incident commander on all aspects of health and safety on the site.
- Recommends stopping the work if any of the work operations threaten worker or public safety.
- Ensure proper PPE is used and maintained.
- Controls entry and exit at the access control points.
- Monitors onsite hazards and conditions.
- Enforces the Buddy system.
- Control the decontamination of all equipment, personnel and samples from the contaminated areas.
- Assist In the disposal of contaminated clothing and materials.
- Advise medical personnel of potential exposures and consequences.

4.6. Emergency Response Team Members:

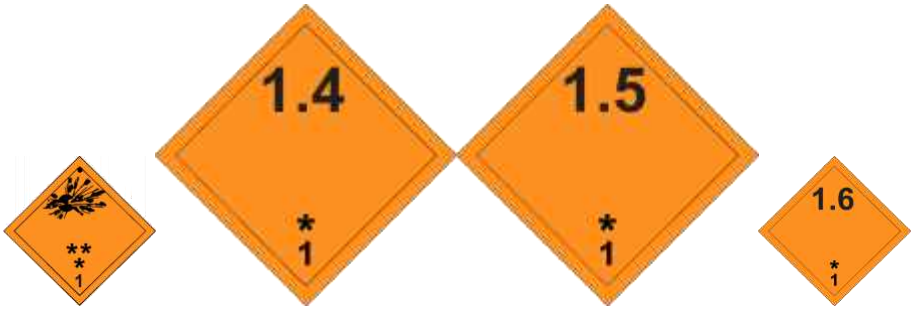
- Consult the Mine Emergency Response Plan to review the site plan relative to building location of the spilled material and specific location of the material within the building/site.
- Consult the appropriate ACTION PLAN contained in this document, to review the properties of the spilled material and recommended response actions.
- If further information is required, contact one of the resource services listed in Heading 2 of this document.
- Assess the spill requirements for manpower, equipment, materials, tools and protective gear to contain the spill, in consideration of the resources available.
- Mobilize these resources and take responsibility for implementation of the response actions in the spill site.
- If the spill is too large or complex to be handled entirely by the Company's resources, call an appropriate group or agency listed on page 3 of this document.
- Contact the Area Superintendent to determine what, if any, sampling should be done and to discuss the spill and any environmental implications.

- Once the initial response action is underway, contact the General Manager or designate to review the situation and strategy.

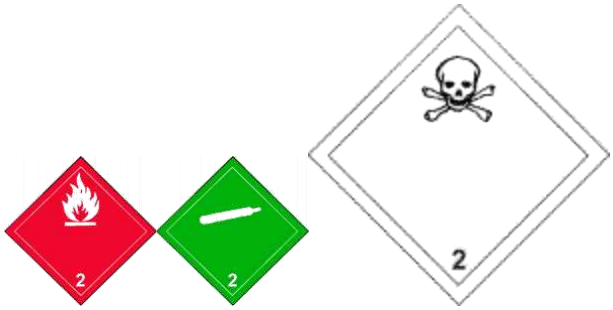
Appendix A

Federal and provincial legislation provide for the regulation of an extensive list of products, substances or organisms classified as dangerous. The products fall into one of nine classes:

- Class 1 explosives



- Class 2 gases



- Class 3 flammable liquids



- Class 4 flammable solids, spontaneously combustibles and substances that, on contact with water, emit flammable gases



- Class 5 oxidizing substances and organic peroxides



- Class 6 poisonous (toxic) and infectious substances





- Class 7 radioactive materials



- Class 8 corrosives



- Class 9 miscellaneous products or substances
  - miscellaneous identified dangerous goods
  - certain specified goods considered dangerous to the environment
  - dangerous

Appendix B

Hazardous Material Response Plan

H**azardous Material Response Plan**

Hazardous Materials Checklist

1. Isolate the Area and Deny Entry
   - ❑ Determine the Hazard Area Involved
   - ❑ Establish Control of the Hazard Area
   - ❑ Determine Incident Control Zones (Hot, Warm, Cold)
   - ❑ Advise All Units of Area to be Isolated

2. Identify and Verify the Materials Involved
   - ❑ Obtain Shipping Papers or Facility Documents (*only if safely possible*)
   - ❑ Write Down All Information Obtained
   - ❑ Verify the Source and Accuracy of all Information

3. Hazard and Risk Assessment
   - ❑ Evaluate the Following Concerns

     Health Physical Properties

     Flammability Chemical Properties

     Reactivity

   - ❑ Assess Container Integrity (Stress, Breach, Release, etc.)
   - ❑ Determine all Exposures
   - ❑ Estimate Likely Harm Without Intervention

4. Evaluate Protective Clothing and Equipment
    - ❑ Determine Proper Type and Level of Protective Clothing Required

Note: Structural Fire-Fighting Clothing Will Not Provide Protection

5. Coordinate Information and Resources

- ❑ Coordinate Information Between All Branches/Divisions/Groups
- ❑ Conduct Briefing of All Division/Group Officers to Develop Tactical Options
- ❑ Advise Incident Commander of Tactical Options and Recommendations

6. Control, Containment and Confinement

- ❑ Review Tactical Options With Entry Personnel
- ❑ Coordinated All Operations With the Safety Officer
    - ❑ Will Decontamination be Required After Entry Operations?
        - ❑ Yes Implement **Decontamination Procedures Prior to Entry**
        - ❑ No Continue

7. Decontamination Procedures
    - ❑ Decontamination Procedures Determined and Verified
    - ❑ Decon Area In Place and Fully Staffed

8. Entry Team Procedures

    (SOP's of the department supplying the hazardous materials technicians shall be used for all entries)

9. Termination Procedures

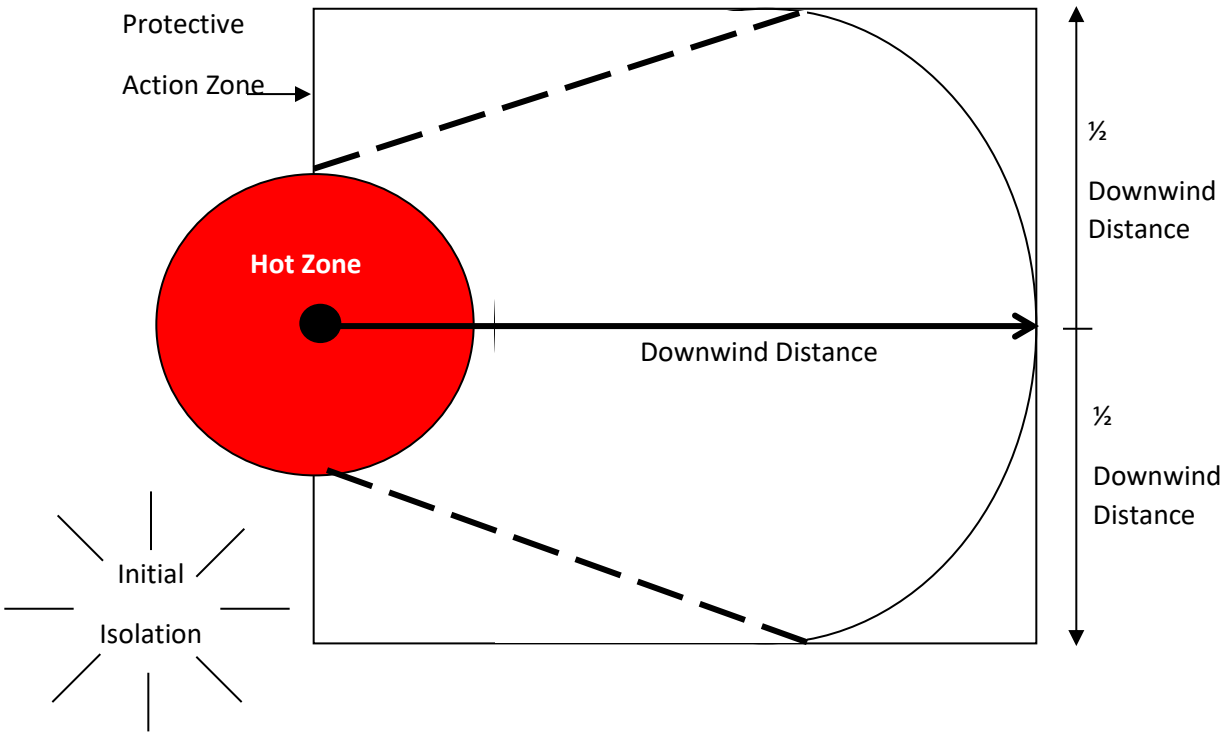
- ❑ Ensure All Personnel Are Briefed as Necessary
- ❑ Signs and Symptoms of Exposure Provided
- ❑ Personnel Exposures Documented

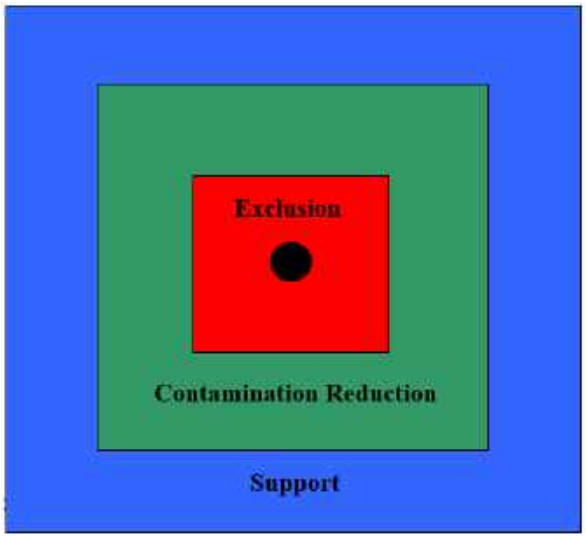
Initial Isolation/Protective Action

Hot- Exclusion Zone. Entry Team only

Warm- Decontamination, Properly trained & equipped personnel only

Cold- Staging & Operations





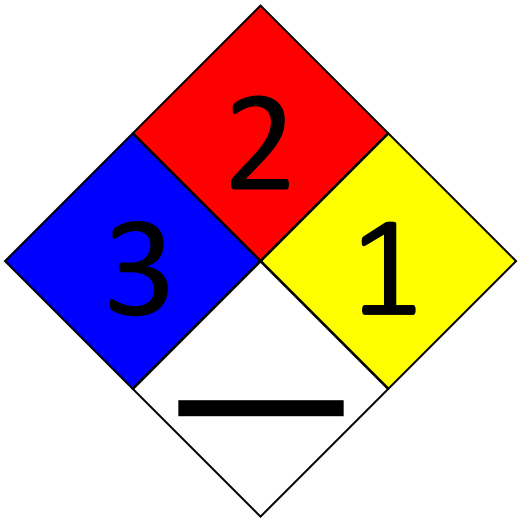
NFPA 704 HazMat*

Classification

Health Hazard
4-Deadlly
3-Extreme danger
2-Hazardous
1-Slightly hazardous
0-Normal material

Flammability
0-4

Fire Hazard
Flash Points
4-Below 73 F
3-Below 100 F
2-Below 200 F
1-Above 200 F
0-Will not burn



Health
0-4

Reactivity
0-4

(*Not intended to identify non-emergency health hazards)

Specific Hazard

Oxidizer	OXY
Acid	ACID
Alkali	ALK
Corrosive	COR
Simple Asphyxiant	SA
Use NO WATER	W
Radiation Hazard	

Reactivity
4-May detonate
3-Shock and heat
may detonate
2-Violent Chemical change
1-Unstable if heated
0-Stable

Mount Polley Mining Corporation
EMERGENCY RESPONSE PLAN

Hazardous Materials Response Plan

Response Guide by TDG Hazardous Classification

Environmental Canada's Transportation of Dangerous Goods Act divides hazardous materials into nine major hazard classes. A hazard class is a group of materials that share a common major hazardous property, i.e., radioactivity, flammability, etc. These hazard classes include:

Class 1-Explosives

Class 2-Compressed Gases

Class 3-Flammable Liquids

Class 4-Flammable Solids

Class 5-Oxidizers

Class 6-Poisonous and Infectious Substances

Class 7-Radioactive Materials

Class 8-Corrosives

Class 9-Miscellaneous Hazardous Materials

Notes:

- In some emergency response procedures for TDG hazard classes, a distinction is made between bulk or package quantities. Packing Groups indicate the degree of danger of a product or substance, and are always shown in Roman Numerals: **I great danger, II moderate danger, III minor danger**

- Class 9, "Miscellaneous Hazardous Materials," refers to those materials that are hazardous but do not meet criteria for inclusion in the aforementioned classes.

Note: The material presented in this Response Guide has been written in accordance with industry standards. However, this guide cannot anticipate all possible emergency events or situations and emergency responses and therefore cannot be used without the competent review of the emergency response team and plant management. Conditions may develop in operations where standard methods will not suffice and nothing in this guide shall be interpreted as an obstacle to the experience, initiative, and ingenuity of the responders in overcoming the complexities that exist under actual emergency conditions. Responders should use all available resources to determine the appropriate strategies and tactics.

Class 1: Explosives

Definition

An explosive is any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion, e.g., with a substantial instantaneous release of gas and heat.

General Emergency Response Procedures

1. Identify the material involved.
2. Keep non-essential people away (includes non-essential emergency service personnel).
3. Establish control zones (isolate area and deny entry).
4. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.
5. Wear positive pressure SCBA and full protective clothing.
6. Avoid exposure to smoke, fumes, vapors, dust, or direct contact. The combustion products of some propellant explosives are poisonous.

7. Do not allow personnel to touch or move explosives. Explosives should be moved only under the advice and supervision of trained explosive personnel.

8. Contact local police or military bomb units.

9. When a hazmat team is requested to respond to a bomb threat involving hazardous materials, under no circumstances will the hazmat team conduct building or area searches even when hazardous materials are involved. The hazmat team will stage in a safe area, but not less than 200 meters feet from the incident scene.

10. The hazmat team will act as a technical resource for the bomb unit. This may involve the loaning of chemical protective clothing to bomb unit personnel, assistance in dressing, researching chemical data, etc.

Emergency Response Procedures-Fire

1. Do not fight fire in cargo or storage area containing explosives. Withdraw from the area and let the fire burn.

2. If a fire is near explosives, efforts should be taken to prevent the fire from reaching the explosives. For fires involving the motor, cab, or tires of vehicles transporting explosives, flood the area with water.

3. The application of water to burning Class A or B explosives may cause an explosion.

4. Evacuate the area:

    - Class A Explosives – 800 m in all directions.
    - Class B Explosives – 800 m in all directions.
    - Class C Explosives – 450 m in all directions.
    - Blasting Agents- 800 m in all directions.

5. Do not overhaul areas where explosives have burned or exploded.

6. Explosives that have been exposed to heat may be very shock sensitive. Keep all personnel away and do not move these containers.

7. When explosives are involved in fire or serious accidents on the roadways, Canutec (613) 996-6666 should be notified.

Class 2: Flammable Compressed Gases

Definition

A flammable material or mixture having a vapor pressure exceeding 40 psi absolute at 100° F.

General Emergency Response Procedures

1. Identify the material involved.
2. Keep non-essential people away (includes non-essential emergency service personnel.)
3. Establish control zones (isolate area and deny entry).
4. Stay upwind and keep out of low areas.
5. Ventilate confined areas before entering.
6. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.
7. Avoid exposure to gas.
8. Since the application of water to pools of liquefied gas will increase the vaporization rate, this is not usually a recommended practice.
9. If a tank truck or tank car is involved in fire, isolate 800 m in all directions.
10. Determine and implement appropriate decontamination procedures for personnel and equipment.
11. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Do not extinguish the fire unless the flow of gas can be stopped. The recommended means of extinguishing is to stop the flow.

2. If a leaking tank is involved in fire, cooling the tank with water may reduce the internal pressure and the rate of leakage. If sufficient water is available, use water spray to cool the tanks and adjacent combustibles affected by the heat of the fire. For massive fires, use unmanned monitors. If this is not possible, withdraw from the area and let the fire burn.

3. Un-insulated pressure tanks may rupture violently if there is flame impingement on the vapor space at the top of the tank. If it can be done safely, remove all vehicles or containers not already burning.

4. Let tank, car, tank truck or storage tanks burn unless leak can be stopped.

5. Stay away from the ends of the tank exposed to heat or flame impingement.

6. Observe tanks for evidence of bulging or red hot spots in the metal, and listen for a rising sound from venting safety devices. These indicate that the tank may fail.

Emergency Response Procedures-Spill or Leak

1. Extinguish all sources of ignition in the vicinity (vehicles, traffic light control boxes, machinery, tar pots, etc.).

2. Flammable gases may be heavier or lighter than air. Determine the vapor density of the material from reference sources and use combustible gas detectors to determine the boundary of the gases. Survey the area where the gases are likely to accumulate. Common lighter-than-air flammable gases include:

    - Hydrogen
    - Acetylene
    - Hydrogen cyanide
    - Ammonia

- Methane
- Natural Gas
- Carbon Monoxide
- Ethylene (ethane)
- Propane is heaver and will tend to migrate to low laying areas. (Density 1.5)

3. Flammable gases may ignite and flash back to the opening from which the gas originated.

4. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas detector indicates the presence of flammable gases.

5. Do not enter the gas cloud. Be aware that the flammable gases extend beyond any visible cloud.

6. Water spray can be used to absorb water miscible gases, and water spray or explosion proof fans can be used to disperse gas clouds. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

7. If it can be done safely, locate all leaks and close valves or otherwise reduce the amount of leakage.

8. If it can be done safely, move undamaged containers to a safe area, being careful to avoid sparks or friction.

9. Post guards and keep spectators at least 800 m away from leaks from tank cars, tank trucks, or large storage tanks containing compressed gas, liquefied gas, and cryogenics.

10. Wrecking operations or transfer of product should not begin until all the gas is dispersed. Confirmation of gas dispersal should be done with a combustible gas detector.

11. To prevent the build-up of static electricity, bond and ground the containers and equipment before product transfer.

12. Cutting torches or spark generating saws must not be used on the shell of empty or loaded cars or containers.

13. Empty tanks or tanks containing residue should be regarded as containing an ignitable gas-air mixture.

Class 3: Flammable Liquids

Definition

A liquid having a flash point below 140° F.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Stay upwind and keep out of low areas.

5. Eliminate ignition sources.

6. Ventilate confined areas before entering.

7. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all flammable liquid incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.
8. Avoid exposure to smoke, fumes, vapors, or direct contact.

9. If spilled material has entered storm, sewer, or water systems, notify the proper authority.

    - Maps should be used to determine the direction of flow and destination (outflow) of the system. Consideration should be given to dyking the storm, sewer, or water system ahead of the flow.

    - It may be appropriate to apply foam not only at the spill site, but also into the storm, sewer, or water system.

- To lessen the chances of ignition, it may be advisable to apply foam ahead of the flowing spill, either into storm drains or manholes down flow from the spill or down flow on the surface of open storm, sewer, or water systems.

10. If a tank truck or tank car is involved in fire, isolate 800 m in all directions.

11. Most flammable liquids float on water. Therefore, the application of water to a spill area may enable the flammable liquid to spread beyond the boundaries of the original incident.

12. The vapors of all flammable liquids are heavier than air. Therefore, in addition to eliminating ignition sources in the immediate spill area, the downwind area and adjacent low areas should be checked for sources of ignition and accumulations of flammable vapors.

13. Consider the need for additional resources and equipment (dyking material, absorbents, foam, over pack, containers, transfer equipment, private cleanup contractors, etc.).

14. Request sufficient foam supplies.

15. Determine and implement appropriate decontamination procedures for personnel and equipment.

16. Consult CANUTEC (1-613 996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. For small fires, use dry chemical, CO2, the appropriate foam or water spray.

2. For large fires use the appropriate foam or water spray. Water may be ineffective on low flash point flammable liquids.

3. If sufficient water is available, use water spray to cool tanks and adjacent combustibles affected by the heat of the fire. For massive fire, use unmanned monitors. If this is not possible, withdraw from the area and let the fire burn.

4. If it can be done safely, remove any vehicles or containers not already burning.

5. Dig trenches or build dikes in the path of the burning liquids to confine the fire and protect exposures.

6. If vapors are burning at the valves, do not extinguish the fire unless re-ignition can be prevented.

7. Observe tanks for evidence of bulging or red hot spots in the metal. Listen for pinging sounds or loud noises from the tank that increases in intensity. Withdraw immediately in case or rising sound from venting safety device or discoloration of tank. These indicate that the tank may fail.

8. Do not puncture or rupture the shell of a transport vehicle involved in a fire as this may liberate more flammable liquid and extend the fire.

9. If safety relief valves are obstructed, try to reposition the tank to allow the valves to function properly, but only if this can be done safely.

Emergency Response Procedures-Spill or Leak

1. Extinguish or eliminate all sources of ignition in the vicinity (traffic light control boxes, machinery, vehicles, tar pots, etc.). Use combustible gas detectors to determine the boundaries of the vapors.

2. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas detector indicated the presence or flammable vapors.

3. Keep oxidizing materials away from spilled flammable liquids.

4. Post guards and keep spectators at least 800 m away for leaks from tank cars, tank trucks or large storage containers.

5. Dig trenches or build dikes ahead of the flow to confine the spill for later disposal or recovery.

6. Do not allow flammable liquids to enter storm, sewer, or water systems.

7. Cover flammable liquids with appropriate foam to blanket the surface and reduce the rate of evaporation. When ambient temperatures are less than 100° F, combustible liquids will usually

not require blanketing to reduce vapors. Do not permit the runoff to enter storm, sewer, or water systems.

8. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

9. If it can be done safely, attempt to close valves or otherwise reduce the amount of leakage.

10. Since most flammable liquids float, for leaks near the bottom of the tank, water may be added to the tank to float the flammable liquid if the leak cannot be controlled or stopped. The water flow can be adjusted so that only water leaks out and the flammable liquid does not overflow the tank. This will provide time to offload the remaining flammable liquid.

11. Wrecking operations or transfer of product should not begin until the area is determined safe. A combustible gas detector should be used to check the area continually during the entire operation.

12. To prevent the buildup of static electricity, bond and ground containers and equipment before product transfer.

13. Empty tanks and tanks containing residue should be regarded as containing an ignitable vapor-air mixture.

14. Cutting torches or spark generating saws must not be used on the shell of empty or loaded cars or containers.

15. If it can be done safely, move undamaged containers to a safe area, being careful to avoid sparks or friction.

16. Do not separate tractor units from their trailer, as the support gear on the trailer may fail.

Class 4: Flammable Solids

Definition

Any solid material, other an explosive, which under conditions normally incident to transportation is likely to cause fires through friction or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently it creates a serious transportation hazard.

Included in this class are spontaneously combustible and water reactive materials. Two materials shipped in bulk that can cause major problems for responders are phosphorous and sodium.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Stay upwind and keep out of low areas.

5. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.

6. Avoid exposure to smoke, fumes, vapors, or direct contact. Toxic products may be produced from contact with water, heat, and other substances.

7. Consider the need for additional resources and equipment (dyking material, absorbents, foam, over pack containers, transfer equipment, private cleanup contractors, etc.).

8. If spilled material has entered storm or sewer systems, notify the proper authority.

9. Determine and implement appropriate decontamination procedures for personnel and equipment.

10. Consult CANUTEC (1-613 996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Do not use water or foam on water-reactive materials.

2. If it can be done safely, remove containers from fire area.

3. Chemical reference sources will indicate appropriate extinguishing agents. Agents such as dry chemical, soda ash, lime, or sand may be appropriate for use on water-reactive materials, but they must be moisture-free.

4. Water may be used to cool containers exposed to fire, but if the water contacts water-reactive materials, the incident could escalate rapidly.

Emergency Response Procedures-Spill or Leak

1. Keep ignition sources away.

2. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.

3. If it can be done safely, attempt to close valves, plug, reposition containers, or otherwise reduce the amount of leakage.

4. Keep water-reactive materials dry and do not get water inside containers containing water-reactive materials.

5. Keep material out of storm, sewer, and water systems.

6. Dig trenches or build dikes around spills of water-reactive or environmentally damaging materials to prevent water from reaching them.

7. Powder spills can be covered with a plastic sheet or tarp to minimize spreading and prevent water/moisture contact.
   Warning: If the sun is shining directly on the plastic sheeting, moisture may collect on the underside of the sheeting, producing a reaction with water reactive materials.

Class 5: Oxidizers and Organic Peroxides

Definition

An oxidizer is a substance that yields oxygen readily to stimulate the combustion of other material.

Organic peroxide is an organic derivative of the inorganic compound hydrogen peroxide where organic radicals have replaced one or more of the hydrogen atoms. Organic peroxides readily release oxygen to stimulate the combustion of other materials.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Stay upwind and keep out of low areas.

5. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents. In some cases, chemical protective clothing carried by the hazmat team will be required for the safe handling of the incident.

6. Ventilate confined areas before entering.

7. Avoid exposure to smoke, fumes, dust, vapors, or direct contact. Burning oxidizers frequently produces toxic products.

8. Caution should be exercised when water is used on oxidizers, as most oxidizers are water-soluble and will produce solutions that can impregnate wood and other organic combustibles. Upon drying, these materials can spontaneously ignite and burn vigorously.

9. In accidents involving chlorates and other oxidizing materials, care is necessary to prevent ignition by friction or contact with acids.

10. When chlorates are mixed with organic matter, or even dust, a flammable mixture is formed.

11. Chlorates mixed with finely divided combustible material may burn with explosive violence.

12. Leaking of nitric acid, perchloric acid, or hydrogen peroxide may cause fire. These materials are also corrosive.

13. Organic peroxides generally have the special property that if they are heated beyond their transportation temperatures; they are likely to detonate.

14. Consider the need for additional resources and equipment (dyking materials, absorbents, foam, over pack containers, transfer equipment, private cleanup contractors, etc.)

15. If spilled material has entered storm or sewer systems, notify the proper authority.

16. Determine and implement appropriate decontamination procedures for personnel and equipment.

17. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. If it can be done safely, remove any containers not already burning.

2. Cool affected containers with flooding quantities of water. For massive fires, use unmanned monitors. If this is not possible, withdraw and let the fire burn. Runoff water must be contained for later analysis and proper disposal.

Emergency Response Procedures-Spill or Leak

1. Keep flammables, combustibles and organic materials away from spilled material.
2. Avoid contact with spilled material.

3. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition in the area.

4. If it can be done safely, attempt to close valves, plug, or otherwise reduce the amount of leakage.

5. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

6. Keep material out of storm, sewer, and water systems.

7. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal.

8. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.

Class 6: Pesticides and Poisons

Definition

Pesticides are chemical agents used to destroy pests.

Poisons are substances that, through chemical action, usually kill, injure, or impair an organism.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency personnel).

3. Establish control zones (isolate area and deny entry).

4. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for all incidents.

- Due to the construction and materials used for firefighter turnout clothing, the clothing may actually absorb and hold the pesticide or poison if contact with the smoke, fumes, dust, vapors, or material occurs. The firefighter would be re-exposed each time the clothing were worn if proper decontamination operations were not performed.

- In most incidents involving pesticides or poisons, the chemical protective clothing carried on the hazmat team will be required for safe handling of the incident.

5. Stay upwind and keep out of low area. If you can smell pesticide, you are too close and not sufficiently protected.

6. Avoid exposure to smoke, fumes, vapors, dust or direct contact.

7. Determine signs and symptoms of exposure and advise all personnel operating at the site. Some symptoms may not become present for up to 48 hours following exposure.

8. Ventilate confined areas before entering. It is not advisable for fire personnel to enter tanks or other confined spaces that contain or have contained pesticides and/or poisons.

9. If spilled material has entered storm, sewer, or water systems, notify the proper authority. Maps should be used to determine the direction of flow and destination (outflow) of the system. Consideration should be given to dyking ahead of the flow.

10. Determine and implement appropriate decontamination procedures for personnel and equipment.

11. Flush any contacted material from skin or clothing immediately.

12. Remove and isolate any contaminated clothing at the site and avoid spreading contamination to non-contaminated areas.

13. Consult CANUTEC (1-416-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Consider protecting exposures and allow the fire to burn. This may create less of a hazard to people and the environment, especially if runoff cannot be confined.

2. For small fires, use dry chemical, CO2, water spray or the appropriate foam.

3. For large fires use the appropriate foam or water spray.

4. Do not extinguish fire unless the flow can be stopped.

5. If sufficient water is available, use water spray to cool containers exposed to the fire.

6. Dike fire control water for later analysis and/or disposal.

Emergency Response Procedures-Spill or Leak

1. For a liquid pesticide spill, extinguish or eliminate all sources of ignition in the vicinity as many pesticides have flammable liquids as the carrier of the poison. Use combustible gas detectors to determine the boundary of the vapors if the pesticide is a flammable.
2. Do not allow vehicles or other sources of ignition in the area as long as the combustible gas detector indicates the presence of flammable vapors.

3. If it can be done safely, attempt to close valves, plug, or otherwise reduce the amount of leakage.

4. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer or water systems.

5. Keep material out of storm, sewer, and water systems.

6. Dig trenches or build dikes ahead of the flow to confine the spill for later disposal or recovery.

7. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.

Class 6: Infectious Substances

Definition

Substances or materials hosting or contaminated by communicable pathogens. Examples include medical waste, laboratory samples, etc.

General Emergency Response Procedures

1. Identify the materials involved. Infectious substances include the red infectious waste bags and "sharps" containers from hospitals (sharps containers are used for the disposal of needles and other sharp instruments). Caution should be used if these containers are encountered.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Wear positive pressure SCBA and chemical protective clothing. Firefighter protective clothing will not provide adequate protection for all incidents involving infectious substances. The chemical protective clothing carried on the hazmat team may be required for safe handling of the incident.

5. Stay upwind and keep out of low areas.

6. Avoid exposure to smoke, fumes, vapors, or dust. Do not contact damaged containers or spilled material. Virus and disease-bearing substances are often present.

7. If leakage is discovered in transit, the vehicle must not be moved and the area must be isolated.

8. If spilled material has entered storm or sewer systems, notify the proper authority.

9. Implement appropriate decontamination procedures. A freshly mixed 10% or stronger bleach/water solution is an effective decontamination solution for most infectious substance exposures.

Emergency Response Procedures-Fire

1. If it can be done safely, remove containers from the fire area. Do not touch or move damaged containers.

2. Use dry chemical, soda ash, or lime for small fires.

Emergency Response Procedures-Spill or Leak

1. Cover damaged containers or spill area with dampened towel or rag, and keep wet with liquid bleach.

    - To decontaminate the area and equipment, a garden sprayer with a 10% bleach/water solution can used to spray exposed surfaces.

    - Recently mixed bleach/water solutions should be used, as premixed solutions lose their strength after a few days.

2. Dike spills for later disposal.

3. Keep material out of storm, sewer and water systems.

Class 7: Radioactive Materials

Definition

Radioactive materials contain charged particles (ions) and have a specific gravity greater than 0.002 microcuries per gram. These charged particles may cause damage to molecules, cells, or tissues. Atoms that emit ionizing radiation are said to be radioactive; radioactivity is the process whereby atomic changes, known as decay or disintegration, occur through the emission of ionizing radiation.

General Emergency Response Procedures

1. Identify the materials involved. Radioactive materials are often shipped in lead containers.

2. Keep people as far away as practical, at least 50 m upwind.

3. Establish control zones (isolate area and deny entry). Use radiation-monitoring devices to determine control zones and assess areas for contamination.

4. Wear positive pressure SCBA and full protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for radioactive incidents.

5. Avoid exposure to smoke, fumes, vapors, dusts or direct contact.

6. All personnel should utilize dosimeters. Zero dosimeters prior to use.

7. Entry should not be made until appropriate radiological personnel are on scene and the degree of radiation is known.

8. Enter Exclusion Zone only to save a life, and limit entry into the Exclusion Zone to the shortest possible time.

9. If spilled material has entered storm, sewer, or water systems, notify the proper authority.

10. Implement appropriate decontamination procedures for personnel and equipment.

11. Delay clean up until arrival or instructions of qualified radiation personnel.

12. Equipment used in the Exclusion Zone shall not be removed until appropriate decontamination procedures have been performed and the equipment has been monitored and declared clean.

13. Contact a radiological team for assistance and equipment.

14. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Do not move-damaged containers, but undamaged containers should be moved to a safe area if it can be done safely.

2. Assume the fire involves radioactive materials.

3. Avoid exposure to smoke, fumes, or dust. Airborne contamination is a great cause of concern for emergency responders. Stay upwind from the fire area.

4. Evacuate downwind area.
5. The fire should be extinguished as quickly as possible, with a minimum amount of water. Try not to disturb the radioactive containers.

6. Fight fire from a maximum distance. Do not allow personnel into the area after fire knockdown.

7. For massive fires, use unmanned monitors.

8. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal.

9. The fire area should not be overhead.

Emergency Response Procedures-Spill or Leak

1. Do not touch damaged containers or contact the spilled material.

2. Prevent spread of spilled material and keep it out of water systems and sewers. Dike far ahead of large spills to confine the material for later disposal.

Class 8: Corrosives

Definition

Any liquid or solid, including powders, that can destroy tissue, or a liquid that has a severe corrosion rate on steel or aluminum.

General Emergency Response Procedures

1. Identify the materials involved.

2. Keep non-essential people away (this includes non-essential emergency service personnel).

3. Establish control zones (isolate area and deny entry).

4. Wear positive pressure SCBA and chemical protective clothing. This is a minimum level of protective clothing and will not provide adequate protection for corrosive incidents. The chemical protective clothing carried by the hazmat team may be required for the safe handling of most incidents involving corrosives.

5. Stay upwind and keep out of low areas.

6. Avoid exposure to smoke, fumes, vapors, dusts, or direct contact. Highly toxic fumes are often present.

7. Ventilate confined areas before entering.
8. Consider the need for additional resources and equipment (dyking material, absorbents, over pack containers, transfer equipment, private cleanup contractors, etc.).

9. If spilled material has entered storm or sewer systems, notify the proper authority.

10. Determine and implement appropriate decontamination procedures for personnel and equipment.

11. Consult CANUTEC (1-613-996-6666) for product information and assistance.

Emergency Response Procedures-Fire

1. Many corrosive chemicals react violently with water, liberating heat and toxic gases.

2. If it can be done safely, remove undamaged containers from the fire area.

3. Do not get water inside the container.

4. Use water to cool containers that are exposed to flame until well after the fire is out. Do not allow water to get inside container.

Emergency Response Procedures-Spill or Leak

1. Avoid contact with spilled material.

2. Extinguish all sources of ignition in the vicinity. Do not allow vehicles or other sources of ignition into the area.

3. Do not apply water unless directed to do so. Contact with water may cause the generation of large quantities of vapors and heat.

4. Do not get water inside the container.

5. Water spray can be used to absorb water miscible vapors, and water spray or explosion-proof fans can be used to disperse vapors. Do not get water inside containers and do not put water on leak or spill area. Runoff must be contained for later analysis and possible disposal. Do not permit the runoff to enter storm, sewer, or water systems.

6. Keep combustibles (wood, paper, oil, etc.) away from spilled material.

7. If it can be done safely, attempt to close valves, plug, or otherwise reduce the amount of leakage.

8. Dig trenches or build dikes ahead of the flow to contain the spill for later disposal or recovery.

9. Powder spills can be covered with a plastic sheet or tarp to minimize spreading.

10. Keep material out of storm, sewer, or water systems.

11. Do not attempt neutralization. Neutralization may cause the production of vapors and heat, creating additional problems.

12. Do not attempt dilution. The quantity of water required to dilute one gallon of concentrated acid to a neutral pH of 7 is in the hundreds of thousands of gallons.

Specific Action Plan

Propane (UN1978)

Regulated by Environment and Climate Change Canada (ECCC) for the E2 regulations.

Uses

Fuel source for heating mine buildings such as mill, pit shop, warehouse and water treatment plant. Also used as fuel for forklift trucks

Location

Main Storage tank on east side of Mill building (Max storage capacity is 110,000 litres)

Water Treatment Plant Tank (Max storage capacity is 60,000 litres)

Properties

EXTREMELY FLAMMABLE.

Will be easily ignited by heat, sparks or flames.

Will form explosive mixtures with air.

Vapors from Propane are initially heavier than air and spread along ground.

Vapors may travel to source of ignition and flash back.

GASES UNDER PRESSURE- COMPRESSED GAS

Cylinders exposed to fire may vent and release flammable gas through pressure relief devices.

Containers may explode when heated.

Ruptured cylinders may rocket.

HEALTH

Vapors may cause dizziness or asphyxiation without warning.

Some may be irritating if inhaled at high concentrations.

Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite.

Fire may produce irritating and/or toxic gases.

SAFETY

Keep away from heat, sparks, open flames, and hot surfaces.

No smoking.

Stay upwind, uphill and/or upstream.

Propane gas is heavier than air and will spread along the ground and collect in low or confined areas

DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.

PROTECTIVE CLOTHING

Wear positive pressure self-contained breathing apparatus (SCBA).

Structural firefighters' protective clothing provides limited thermal protection.

Always wear thermal protective clothing when handling refrigerated/cryogenic liquids.

EVACUATION

Small Spill

Spill or leak- Evacuate area for at least 100 meters (330 feet) in all directions.

Large Spill

Consider initial downwind evacuation for at least 800 meters (1/2 mile).



Evacuation map – Propane

FIRE

If tank or tank truck is involved in a fire, consider initial evacuation for 1600 meters in all directions.

ALWAYS stay away from tanks engulfed in fire.

SMALL FIRE

Dry chemical or CO2.

LARGE FIRE

For massive fire Evacuate from area and let fire burn.

Fight fire from maximum distance.

Water spray or fog.

If it can be done safely, move undamaged containers away from the area around the fire.

Cool containers with flooding quantities of water until well after fire is out.

Do not direct water at source of leak or safety devices; icing may occur.

Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.

BLEVE (BOILING LIQUID EXPANDING VAPOR EXPLOSION)

A BLEVE occurs when a fire impinged or damaged tank fails to contain its internal pressure and explodes with a sudden product release.

The main hazards from a BLEVE are:

Fire: If the released substance is ignited, there is an immediate fireball.

Thermal radiation: At a distance of about 4 times the radius of a fireball, the heat radiated from a fireball is enough to burn exposed skin in 2 seconds. Wearing protective clothing limits the thermal radiation dose.

Blast: A concussive force caused by the sudden release of the pressurized substance. For a BLEVE occurring out in the open, the blast strength at a distance of 4 times the radius of a fireball can break window glass and may cause minor damage to buildings.

Projectiles: Tank failure can throw metal fragments over large distances. These fragments can and have been deadly.

The danger decreases as you move away from the BLEVE centre. The furthest-reaching hazard is projectiles

For additional information on Propane Hazards refer to Transport Canada Emergency Response Guidebook and Propane Safety Data Sheet (SDS)

Consult CANUTEC (1-613-996-6666) for product information and assistance.

SPILL OR LEAK

ELIMINATE all ignition sources (no smoking, flares, sparks or flames) from immediate area.

All equipment used when handling the product must be grounded.

Do not touch or walk through spilled material.

Stop leak if you can do it without risk.

If possible, turn leaking containers so that gas escapes rather than liquid.

Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material.

Do not direct water at spill or source of leak.

Prevent spreading of vapors through sewers, ventilation systems and confined areas.

Isolate area until gas has dispersed.

FIRST AID

Call 911 or emergency medical service.

Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Move victim to fresh air if it can be done safely.

Give artificial respiration if victim is not breathing.

Administer oxygen if breathing is difficult.

Remove and isolate contaminated clothing and shoes.

Clothing frozen to the skin should be thawed before being removed.

In case of contact with liquefied gas, thaw frosted parts with lukewarm water.

In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin.

Keep victim calm and warm.

Specific Action Plan

LIME

PROPERTIES:

White powder to granular.

Very alkaline; very corrosive to eye surfaces.

Effects of acute exposure - corrosive.

Effects of chronic exposure are burns, ulceration, and blindness.

ACTION STEPS:

Report spill.

Stop source if possible.

Contain spill materials.

Protect area.

Remove material.

Reclaim area.

Complete spill report.

NOTIFICATION:

Immediately notify the Area Supervisor.

INITIAL SPILL RESPONSE:

Stop spill at source, if possible.

Avoid dusting.

Keep spilled lime dry.

Prevent from entering watercourses.

If mixed with water, dyke and contain the milk of lime.

HAZARDS and ENVIRONMENTAL THREATS:

Heat generated when mixed with water.

Strong alkaline - protect self from exposure, especially eyes.

No environmental hazard.

ACTION FOR FIRE:

Shovel and contain dry material in containers.

Dyke and contain milk of lime and pump into proper mill circuit.

DISPOSAL:

Dispose of recovered solids by recycling material through the crushing circuit to the mill process.

Specific Action Plan

TAILINGS OR CONCENTRATES

PROPERTIES:

Maybe toxic when ingested and or the fumes, if any, are inhaled from residual milling components.

HAZARDS and ENVIRONMENTAL THREATS:

Will cover and kill vegetation.

May exhibit ARD properties overtime.

ACTION STEPS:

Report spill.

Stop source, if possible.

Contain spill, if possible.

Protect area.

NOTIFICATION:

Immediately notify your Area Supervisor.

INITIAL SPILL RESPONSE:

Stop the flow, if possible.

Prevent spills from entering watercourses

Contain spilled liquid using sand, straw, or commercial absorbents.

If raining cover with tarps

ACTION FOR FIRE:

Slightly flammable

RECOVERY:

Pump or scoop up material.

If necessary, contaminated soil should be excavated.

DISPOSAL:

Recovered spilled materials and contaminated soils should be disposed of in the tailing storage facility

Specific Action Plan

MINE INFLUENCED WATER
(NOT RELATED TO HAZELTINE CREEK DISCHARGE SYSTEM)

PROPERTIES:

Water that has been affected by mining or mineral processing and may contain elevated levels of metals, suspended solids, reagents, and other parameters, or a pH outside of the natural range.

HAZARDS and ENVIRONMENTAL THREATS:

May have a detrimental effect on aquatic or terrestrial environments and organisms. May cause erosion and deposition of sediment (on land or in creeks).

ACTION STEPS:

Report spill.

Stop source, if possible.

Contain spill, if possible.

Protect area.

NOTIFICATION:

Immediately notify your Area Superintendent.

INITIAL SPILL RESPONSE:

Stop the release using water diversions or pumps, or contain water using berms or sumps.

Prevent spills from entering watercourses.

If watercourses are affected, conduct full suite and in situ sampling upstream and downstream of the release point.

Use sediment and erosion control methods including, but not limited to, straw, sediment fence, and geotextiles and retention ponds to minimize erosion and limit sediment transport by water.

RECOVERY:

Pump any water out of emergency sumps or water storage facilities.

Re-vegetate any eroded areas.

Review root causes of the release, and implement changes to prevent a re-occurrence.

Specific Action Plan

MINE INFLUENCED WATER
(RELATED TO WTP Discharge System)

PROPERTIES:

Water that has been affected by mining or mineral processing and may contain elevated levels of metals, suspended solids, reagents, and other parameters, or a pH outside of the natural range.

HAZARDS and ENVIRONMENTAL THREATS:

May have a detrimental effect on aquatic or terrestrial environments and organisms. May cause erosion and deposition of sediment in the creek and alter creek morphology.

SYSTEM SPILL PREVENTION MECHANISMS:

In the event that trigger thresholds for conductivity, temperature or flow are exceeded in continuous monitoring of the discharge effluent, a warning will be issued to the Mill Control Room immediately through the Man Machine Interface. These trigger levels (set below permitted allowable levels) allow for the discharge system to be shut off or discharge rates reduced before any guidelines are exceeded.

Pump failure triggers an automatic “shut off”, and water storage tanks have automatic (and manual) overflow systems that drain water into existing effluent storage facilities.

NOTIFICATION:

Immediately notify the Area Superintendent.

In addition to regulatory notifications required for releases of mine influenced water, the Ministry of Environment must be notified of discharge guideline exceedances and Environment Canada must be notified (as outlined in Mount Polley Mining Corp.’s *Annual Discharge Plan,* PE-11678, and the Metal Mining Effluent Regulations).

INITIAL SPILL RESPONSE:

Immediately stop effluent discharge using the manual shut off valves (and tank drains if necessary).

If the release is due to physical damage to the discharge line, if possible, stop the release using water diversions, berms, sumps or pumps to prevent water from entering watercourses, and use sediment and erosion control materials and methods, such as straw, sediment fence, geotextiles, and retention ponds to minimize erosion and limit sediment transport by water.

If watercourses are affected, conduct full suite and in situ sampling upstream and downstream of the release point.

RECOVERY:

Pump any water out of emergency sumps or water storage facilities.

Re-vegetate any eroded areas.

Review root causes of the release, and implement changes to prevent a re-occurrence.

Specific Action Plan

RELEASE OF TILL/MUD/SOIL/ROCK

PROPERTIES:

Any form of rock, soil, or till, including mud and suspended till.

HAZARDS and ENVIRONMENTAL THREATS:

May cause deposition or morphological changes to watercourses and increase turbidity. May disturb vegetated areas and promote erosion. May have a detrimental effect on terrestrial or aquatic environments and organisms. Large transfers of material may be hazardous for humans.

ACTION STEPS:

Report incident.

Stop source, if possible and if area is safe.

Contain material, if possible and if area is safe.

Protect area.

NOTIFICATION:

Immediately notify your Area Superintendent.

INITIAL RESPONSE:

Stop the release using methods including berms or containment sumps.

Take action to protect any infrastructure or prevent further incidents (example: shut off water in dewatering pipelines that may be affected).

Prevent material from entering watercourses.

If watercourses are affected, conduct full suite and in situ sampling upstream and downstream of the release point.

Use sediment and erosion control methods including, but not limited to, straw, sediment fence, and geotextiles and retention ponds to minimize erosion and limit sediment transport by water.

RECOVERY:

Move material, as possible and as required (example: away from infrastructure).

Install long-term sediment and erosion control works, including re-vegetation of any eroded areas.

Restore aquatic habitats, as required.

Review root causes of the release, and implement changes to prevent a re-occurrence

Appendix C Protocol for Corporate Reporting of an Environmental Incident

A) Protocol for Corporate Reporting of an Environmental Incident:

1) Corporate reporting of an "environmental incident" is required when:

(a) Any environmental incident occurs that:

- Poses a serious or imminent threat to human health or to the environment.
- Precipitates an immediate, external reporting requirement to regulatory authorities.
- Requires a minimum expenditure of $Cdn25, 000 in materials and/or offsite technical or legal support.
- Is subject of an inquiry from the media.

(b) Any environmental event occurs when:

- An administrative or judicial enforcement action is taken.
- A notice of a citizen suit or other significant complaint from the public is received.
- A private lawsuit premised on personal injury or property damage is filed.
- A civil or criminal action is taken against any Mount Polley Mining Corp. employee, manager, officer or Director.

2) Protocol for Report

(a) The Area Superintendent will immediately notify the General Manager (or his designate).

(b) The general manager will notify the Company President. (CP)

(c) Consultation with the general manager will determine the extent of legal counsel involvement.

(d) The Area Superintendent will prepare a " Preliminary Draft Incident Report for the General Manager to authorize and fax as soon as possible to the CP. The "Final Incident Report" will be submitted once the investigation of the incident is complete.

B) Protocol for Communicating Environmental Issue

1) Corporate communication of an "environmental issue" is required when:

(a) A situation arises or an event occurs that has, in the opinion of the Area Superintendent, the potential to become an Environmental Incident as defined above.

2) Protocol for Communicating and Environmental Issue.

(a) When an issue becomes apparent, the Area Superintendent will inform the General Manager.

(b) Actions plans to mitigate a possible incident will be developed and approved by the General Manager.

(c) The General Manager will keep the CP informed of any issues with the potential to become " Incidents".

Appendix D Preliminary Incident Report

PRELIMINARY INCIDENT REPORT

Mount Polley Mining Corporation
Environmental Incident Report

Date of Incident:	**Date Incident Reported:**
Incident:	
Department:	**Supervisor:**

DESCRIPTION OF INCIDENT: (include detailed timeline of events)	
Date	
Time	
Time	
Time	
Time	

Include figures as required.
Maps
photos

NEXT STEPS:
Internal Root Cause Analysis

Environmental Assessment and Monitoring
Review of required monitoring
Long Term Mitigation
If required.
Signature of Area Supervisor: _____
Copies: Include names of all recipients of report

Appendix E Reportable Levels for Certain Substances

Item	Column 1	Column 2
	Substance spilled	**Specified amount**
1 **Ammonium Nitrate**	Class 1, Explosives as defined in section 2.9 of the Federal Regulations	Any quantity that could pose a danger to public safety or 50 kg
2	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	10 kg
4 **Propane**	Class 2.1, Flammable Gases, other than natural gas, as defined in section 2.14 (a) of the Federal Regulations	10 kg
3	Class 2.2 Non-Flammable and Non-Toxic Gases as defined in section 2.14 (b) of the Federal Regulations	10 kg
4	Class 2.3, Toxic Gases as defined in section 2.14 (c) of the Federal Regulations	5 kg
5 **Gasoline, MIBC, Diesel**	Class 3, Flammable Liquids as defined in section 2.18 of the Federal Regulations	100 L
6	Class 4, Flammable Solids as defined in section 2.20 of the Federal Regulations	25 kg
7 **NaHS**	Class 5.1, Oxidizing Substances as defined in section 2.24 (a) of the Federal Regulations	50 kg or 50 L
8	Class 5.2, Organic Peroxides as defined in section 2.24 (b) of the Federal Regulations	1 kg or 1 L
9	Class 6.1, Toxic Substances as defined in section 2.27 (a) of the Federal Regulations	5 kg or 5 L
10	Class 6.2, Infectious Substances as defined in section 2.27 (b) of the Federal Regulations	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment

11	Class 7, Radioactive Materials as defined in section 2.37 of the Federal Regulations	Any quantity that could pose a danger to public safety and an emission level greater than the emission level established in section 20 of the "Packaging and Transport of Nuclear Substances Regulations"
12 **Acids**	Class 8, Corrosives as defined in section 2.40 of the Federal Regulations	5 kg or 5 L
13	Class 9, Miscellaneous Products, Substances or Organisms as defined in section 2.43 of the Federal Regulations	25 kg or 25 L
14	waste containing dioxin as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
15	leachable toxic waste as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
16	waste containing polycyclic aromatic hydrocarbons as defined in section 1 of the hazardous Waste Regulation	5 kg or 5 L
17	waste asbestos as defined in section 1 of the Hazardous Waste Regulation	50 kg
18 **Waste Oil**	waste oil as defined in section 1 of the Hazardous Waste Regulation	100 L
19	waste containing a pest control product as defined in section 1 of the Hazardous Waste Regulation	5 kg or 5 L
20	PCB Wastes as defined in section 1 of the Hazardous Waste Regulation	25 kg or 25 L
21	waste containing tetrachloroethylene as defined in section 1 of the Hazardous Waste Regulation	50 kg or 50 L
22	biomedical waste as defined in section 1 of the Hazardous Waste Regulation	1 kg or 1 L, or less if the waste poses a danger to public safety or the environment
23 **Concentrate, Tailings, Lime**	A hazardous waste as defined in section 1 of the Hazardous Waste Regulation and not covered under items 1 – 22	25 kg or 25 L

24	A substance, not covered by items 1 to 23, that can cause pollution	200 kg or 200 L
25	Natural gas	10 kg, if there is a breakage in a pipeline or fitting operated above 100 psi that results in a sudden and uncontrolled release of natural gas