Mary River Project 2020
Core Receiving Environment Monitoring Program Report

Part 1 of 3
(Sections 1 to 7)

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Mary River Project 2020
Core Receiving Environment Monitoring Program Report

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EXECUTIVE SUMMARY

The Mary River Project (the Project) is an operating high-grade iron mine located in the Qikiqtani Region of northern Baffin Island, Nunavut. Owned and operated by Baffinland Iron Mines Corporation (Baffinland), the mine began commercial operation in 2015. Mining activities at the Project include open pit ore extraction, ore haulage, stockpiling, crushing, and screening, followed by transport by truck to Milne Port for subsequent seasonal loading onto bulk carrier ships for transfer to international markets. No milling or additional processing of the ore is conducted on-site and therefore no tailings are produced at the Project. Mine waste management facilities at the mine site include a mine waste rock stockpile and surface runoff collection/containment ponds situated near the mine waste rock stockpile and ore stockpile areas. In addition to periodic discharge of treated effluent from these facilities to the Mary River system, other potential mine inputs to aquatic systems located adjacent to the Mine Site include runoff and dust from ore (crusher) stockpiles located within the Sheardown Lake catchment, treated sewage effluent discharge to Mary River, runoff and explosives residue deposition from quarry operations within the Camp Lake catchment, deposition of fugitive dust generated by mine activities, and general mine site runoff.

Under the terms and conditions of the Project's Type 'A' Water Licence issued by the Nunavut Water Board, Baffinland was required to develop and implement an Aquatic Effects Monitoring Plan (AEMP) at the Mine Site. In order to meet the AEMP objectives, Baffinland developed a Core Receiving Environment Monitoring Program (CREMP) to provide a basis for the evaluation of mine-related influences on water quality, sediment quality, and/or aquatic biota (including phytoplankton, benthic invertebrates, and fish). The primary receiving systems that serve as the focus for the CREMP include the Camp Lake system (i.e., Camp Lake tributaries 1 and 2, Camp Lake), the Sheardown Lake system (i.e., Sheardown Lake tributaries 1, 9, and 12, Sheardown Lake northwest basin, and Sheardown Lake southeast basin), and the Mary River and Mary Lake system. Potential mine related effects within the mine primary receiving systems have been assessed annually under the CREMP since the commencement of commercial mine operation in 2015 using a combination of comparisons to site-specific benchmarks for water and sediment quality developed for the AEMP and application of an effects-based approach using standard environmental effects monitoring techniques. Annual results from the CREMP are applied within a four-step Assessment Approach and Management Response Framework designed for the Mary River Project AEMP to then guide management response decisions related to changes in parameter concentrations and/or aquatic biota attributable to mine operations.

The results of the 2020 CREMP indicated mine-related influences on water and sediment quality at some of the primary receiving systems, but no ecologically significant, adverse, mine-related

effects to biota were identified at any of the receiving waterbodies based on comparisons to applicable reference and/or baseline conditions. Within the Camp Lake system, copper concentrations were elevated above site-specific AEMP water quality benchmarks at the north branch of Camp Lake Tributary 1 (CLT1) in 2020, but because this elevation in copper concentrations did not appear to be mine-related, a low action response to identify the source of copper to the CLT1 north branch using expanded water quality monitoring is recommended. At the CLT1 upper main stem, iron concentrations were elevated above AEMP water quality benchmarks, concentrations at reference creeks, and concentrations during baseline, indicating a mine-related change that prompted a low action response recommendation to establish assess effects on biota within the upper main stem through the establishment of benthic invertebrate community sampling stations. At Camp Lake Tributary 2, no changes in concentrations of AEMP benchmark parameters occurred relative to background or to baseline and no adverse biological effects were indicated in 2020, and thus no adjustments to the existing AEMP are recommended. At Camp Lake, arsenic concentrations were elevated within littoral sediment compared to reference lake sediments and to Camp Lake baseline data. No mine-related sources of arsenic to the Camp Lake system have been evident currently or in the past, and therefore a low action response to harmonize sediment quality and benthic invertebrate community monitoring stations using increased replication at littoral habitat of Camp Lake is recommended. No

Within the Sheardown Lake system, copper concentrations were elevated above site-specific AEMP water quality benchmarks at Sheardown Lake Tributary 1 (SDLT1) in 2020, but because this elevation in copper concentrations did not appear to be mine-related, a low action response is recommended to identify the source of copper to SDLT1 using expanded water quality monitoring. No mine-related changes to phytoplankton or benthic invertebrates were indicated at Sheardown Lake tributaries 9 and 12 in 2020, but because water quality is not monitored at these tributaries under the current AEMP, a low action response to add a water quality monitoring station at each of these two tributaries is recommended to improve the ability of the program to interpret biological data in the future. At the Sheardown Lake northwest (NW) and southeast (SE) basins, water quality consistently met AEMP benchmarks and, despite arsenic, chromium, iron, manganese, and/or nickel concentrations above AEMP benchmarks for sediment quality at one or both basins, concentrations of all these metals were comparable to those of background and/or basin-specific baseline indicating no mine-related change in metal concentrations. Because concentrations of metals in Sheardown Lake sediment were similar to those shown at the reference lake and/or baseline, it is recommended that consideration be given to updating the AEMP sediment quality benchmarks for Sheardown Lake to reflect both reference lake and baseline data.

Within the Mary River/Mary Lake system, no mine-related effects to water quality were indicated based on comparison to reference areas and to baseline data. An AEMP benchmark for sediment quality was exceeded for manganese at a single profundal station at Mary Lake in 2020, but based on the isolated occurrence of this exceedance and the fact that average manganese concentrations in sediment at Mary Lake were not elevated compared to concentrations at the reference lake or to those during baseline, no mine-related change in manganese concentrations were indicated at Mary Lake. Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no changes to AEMP monitoring at Mary River/Mary Lake are recommended.

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ACRONYMS AND ABBREVIATIONS

AEMP – Aquatic Effects Monitoring Plan

ANCOVA – Analysis-of-Covariance

ANOVA – Analysis-of-Variance

BCWQG – British Columbia Water Quality Guidelines

CES – Critical Effect Size

cm – Centimetre

CPUE – Catch-Per-Unit-Effort

CREMP – Core Receiving Environment Monitoring Program

CSQG – Canadian Sediment Quality Guidelines

CWQG – Canadian Water Quality Guidelines

dbRDA – Distance-Based Redundancy Analysis

DELT – Deformities, Erosions, Lesions, And Tumors

DOC – Dissolved Organic Carbon

DSS – Digital Sampling System

EEM – Environmental Effects Monitoring

ERP – Early Revenue Phase

FFG – Functional Feeding Group

GPS – Global Positioning System

HPG – Habit Preference Group

HSD – Honestly Significant Difference

KS – Kolmogorov-Smirnov

L – Litre

MDL – Method Detection Limit

MRTF – Mary River Tributary-F

Mt – Million Tonnes

NAD 83 – 1983 North American Datum

NSES – North Shore Environmental Services

NU – Nunavut

NWB – Nunavut Water Board

PEL – Probable Effect Level

PSQG – Ontario Provincial Sediment Quality Guidelines

PWQO – Ontario Provincial Water Quality Objectives

QA/QC – Quality Assurance/Quality Control

SD – Standard Deviation

SEL – Severe Effect Levels

SQG – Sediment Quality Guidelines

TDS – Total Dissolved Solids

TKN – Total Kjeldahl Nitrogen

TMAES – Trinity Minnow Aquatic Environmental Services

TOC – Total Organic Carbon

TSS – Total Suspended Solids

UTM – Universal Transverse Mercator

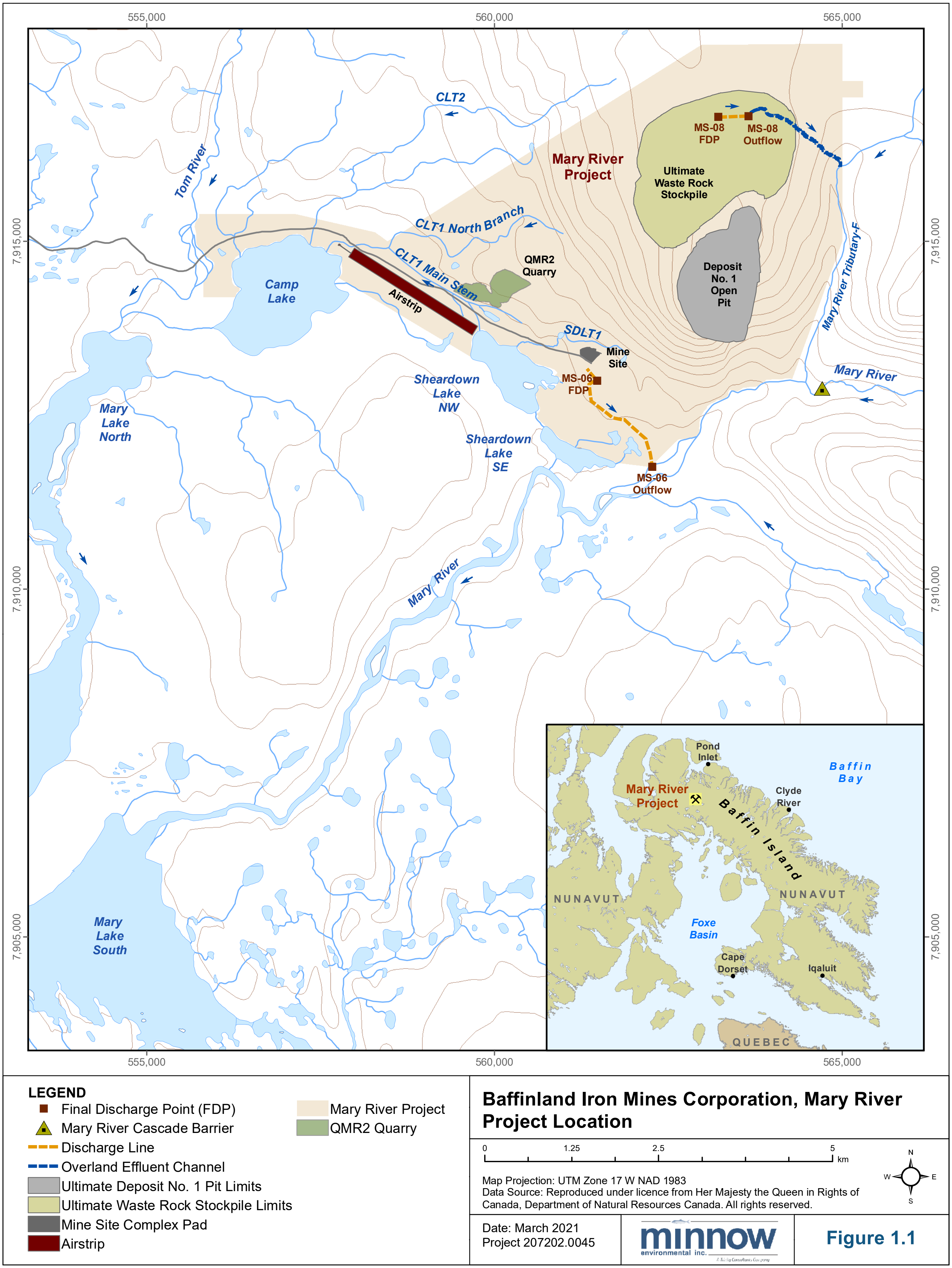
WQG – Water Quality Guidelines

YOY – Young-Of-The-Year

1 INTRODUCTION

The Mary River Project (the Project), owned and operated by Baffinland Iron Mines Corporation (Baffinland), is a high-grade iron ore mining operation located in the Qikiqtani Region of northern Baffin Island, Nunavut (NU) (Figure 1.1). Commercial open pit mining, including pit bench development, ore haulage, and ore stockpiling, as well as the crushing and screening of high-grade iron ore, commenced at the Project Mine Site in 2015. In the current mining phase, referred to as the Early Revenue Phase (ERP), up to 6 million tonnes (Mt) of crushed/screened ore is mined annually at the Project. Ore from the Project Mine Site is transported in haul trucks along the Milne Inlet Tote Road to Milne Port, located approximately 100 km north of the Mine Site, where it is stockpiled. At Milne Port, the ore is loaded onto bulk carrier ships for transport to international markets during the shipping season. No milling or additional ore processing is conducted at the Mine Site, and thus no tailings are produced at the Project. Mine waste management facilities at the Mary River Project thus consist simply of a mine waste rock stockpile and surface runoff collection/containment ponds currently situated near the mine waste rock stockpile and ore stockpile areas. In addition to periodic discharge of treated effluent from these facilities to the Mary River system, other potential mine inputs to aquatic systems located adjacent to the mine include runoff and dust from ore (crusher) stockpiles located on the Mine Site within the Sheardown Lake catchment, treated sewage effluent discharge to Mary River, runoff and explosives residue deposition from quarry operations to the Camp Lake catchment, deposition of fugitive dust generated by mine activities, and general Mine Site runoff.

Under the terms and conditions of the Project's Type 'A' Water Licence (No. 2AM-MRY1325 Amendment No. 1) issued by the Nunavut Water Board (NWB), Baffinland developed an Aquatic Effects Monitoring Plan (AEMP) for the Project. A key objective of the AEMP was to provide data and information to allow for the evaluation of short- and long-term effects of the Project on aquatic ecosystems. To meet this objective, Baffinland developed a Core Receiving Environment Monitoring Program (CREMP) to assess potential mine-related influences on water quality, sediment quality, and biota (including phytoplankton, benthic invertebrates, and fish) at aquatic environments located near the mine (Baffinland 2015; KP 2014; NSC 2014). The primary receiving systems that are the focus for the CREMP include the Camp Lake system (Tributaries 1 and 2, Camp Lake), the Sheardown Lake system (Tributaries 1, 9, and 12, Sheardown Lake northwest [NW], and Sheardown Lake southeast [SE]), Mary River, and Mary Lake (Figure 1.1). Over the initial five years of mine operation, the CREMP studies have indicated only minimal effects of Project operations on the water quality and sediment quality of receiving waterbodies. Potential effects were confined to single tributaries feeding into each of Camp and Sheardown lakes, as well as near the immediate outlet of these tributaries to each respective lake



Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 207202.0045 - AEMP\4 - GIS\Baffinland 2020 CEMP\20-45 Figure 1.1 Location.mxd

(Minnow 2016a, 2017, 2018, 2019). No adverse mine-related effects to phytoplankton, benthic invertebrates, or fish were indicated at any of the Camp Lake, Sheardown Lake, or Mary Lake systems from 2015 to 2019 based on comparisons to reference waterbodies and to available pre-mine baseline data for each lake system (Minnow 2016a, 2017, 2018, 2019).

This report presents the methods and results of the 2020 CREMP, including an evaluation of potential Project-related influences on chemical and biological conditions at mine-exposed waterbodies through the sixth full year of mine operation. As in the five previous years, the 2020 Mary River Project CREMP included water quality monitoring, sediment quality monitoring, phytoplankton monitoring, benthic invertebrate community assessment, and an arctic charr (*Salvelinus alpinus*) fish population assessment. The 2020 CREMP was implemented in accordance with the original study design (Baffinland 2015) with the exception of the continued use of a reference creek benthic invertebrate community study area added to the program in 2016 to provide improved ability for the evaluation of mine-related influences on stream biota (Minnow 2016b, 2017, 2018, 2019, 2020).

2 METHODS

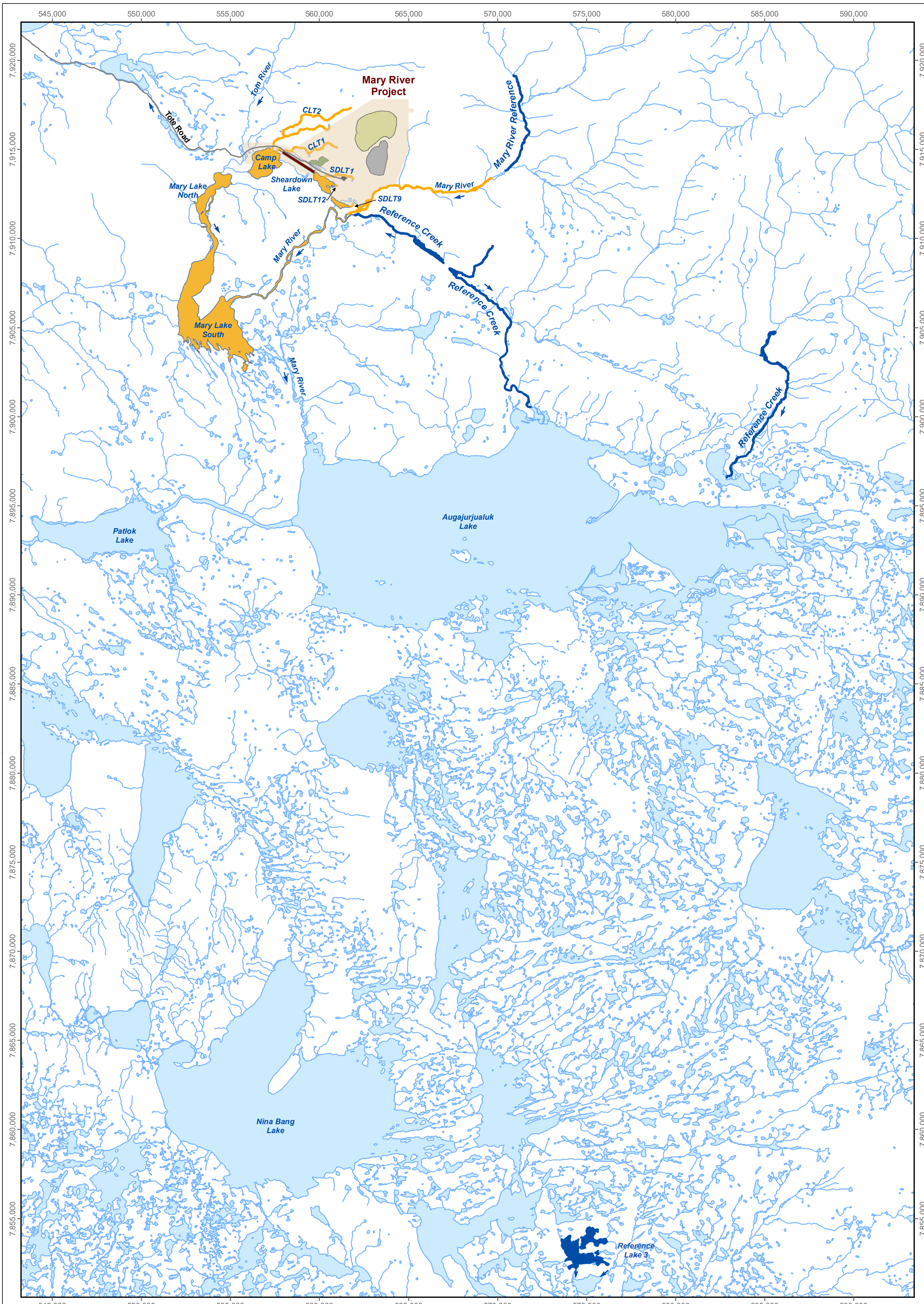
2.1 Overview

The CREMP includes water quality monitoring, sediment quality monitoring, phytoplankton (chlorophyll-a) monitoring, benthic invertebrate community assessment, and fish population assessment (Baffinland 2015). In 2020, water quality and phytoplankton monitoring were conducted by Baffinland environment department personnel over four separate sampling events, including a lake ice-cover event (April 12th to 24th) and open-water season events corresponding to Arctic spring (freshet), summer, and fall (June 2nd to 4th, July 28th to August 3rd, and August 26th to 30th, respectively). Sediment quality, benthic invertebrate community, and fish population sampling was conducted by Trinity Minnow Aquatic Environmental Services (TMAES) personnel with assistance from Baffinland environment department personnel from August 8th to 20th 2020, the seasonal timing of which was consistent with monitoring conducted for previous baseline (2005 to 2013), mine construction (2014), and mine operational (2015 to 2019) studies. Similar to previous CREMP studies, the 2020 study included field sampling and standard laboratory quality assurance/quality control (QA/QC) for the water quality and benthic invertebrate community study components to allow for an assessment of the overall quality of each respective data set (Appendix A).

The 2020 CREMP study areas included the same mine-exposed and reference waterbodies established in the original design documents (Baffinland 2015) and the same reference lake that was added to the program in 2015 (Figure 2.1). To simplify the discussion of results, the mine-exposed study areas were separated by lake catchment as follows:

- the Camp Lake system (Camp Lake Tributaries 1 and 2, and Camp Lake);
- the Sheardown Lake system (Sheardown Lake Tributaries 1, 9, and 12, Sheardown Lake NW, and Sheardown Lake SE); and,
- the Mary River/Mary Lake system.

Reference Lake 3, which served as a reference waterbody for lentic (lake) environments beginning in the 2015 CREMP study, was again used as the reference lake for the 2020 study. Reference Lake 3 is located approximately 62 km south of the Mine Site (Figure 2.1), well outside the area of mine influence. Streams used as reference areas in the current and previous CREMP included an unnamed tributary to the Mary River and two unnamed tributaries to Angajurjualuk Lake, all of which are located southeast of the Mine Site (Figure 2.1). Similar to previous CREMP studies, an area of Mary River located well upstream of current mine activity



LEGEND

- Reference Stream/River System
- Mine Exposed Stream/River System
- Reference Lake
- Mine Exposed Lake
- Ultimate Deposit No. 1 Pit Limits
- Ultimate Waste Rock Stockpile Limits
- Mine Site Complex Pad
- Airstrip
- QMR2 Quarry
- Mary River Project

Mary River Project CREMP Study Waterbodies

0 3.25 6.5 13 km

N E S W

Map Projection: UTM Zone 17N NAD 1983
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Figure 2.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 207202.0045 - AEMP\4 - GIS\Baffinland 2020 CEMP\20-45 Figure 2.1 Study Waterbodies.mxd (i.e., GO-09) served as a reference area for the mine-exposed portion of Mary River in the 2020 study (Figure 2.1).

2.2 Water Quality

2.2.1 General Design

Surface water quality monitoring was conducted by Baffinland environment department personnel at the sampling locations and frequencies stipulated in the CREMP design (Baffinland 2015). The surface water sampling was conducted at as many as 57 stations during each sampling event (Table 2.1; Figures 2.2 and 2.3) and included collection of *in situ* measurements and water chemistry data. The evaluation of potential mine-related effects on surface waters in the vicinity of the Project was based upon comparisons of those parameters for which AEMP benchmarks have been developed to applicable reference data, to available baseline data, and to guidelines that included site-specific AEMP benchmarks. The AEMP benchmarks were developed to aid in defining effects of the Project on surface water quality, and to guide management response decisions to elevations above the benchmarks within a four-step Assessment Approach and Management Response Framework (Baffinland 2015).

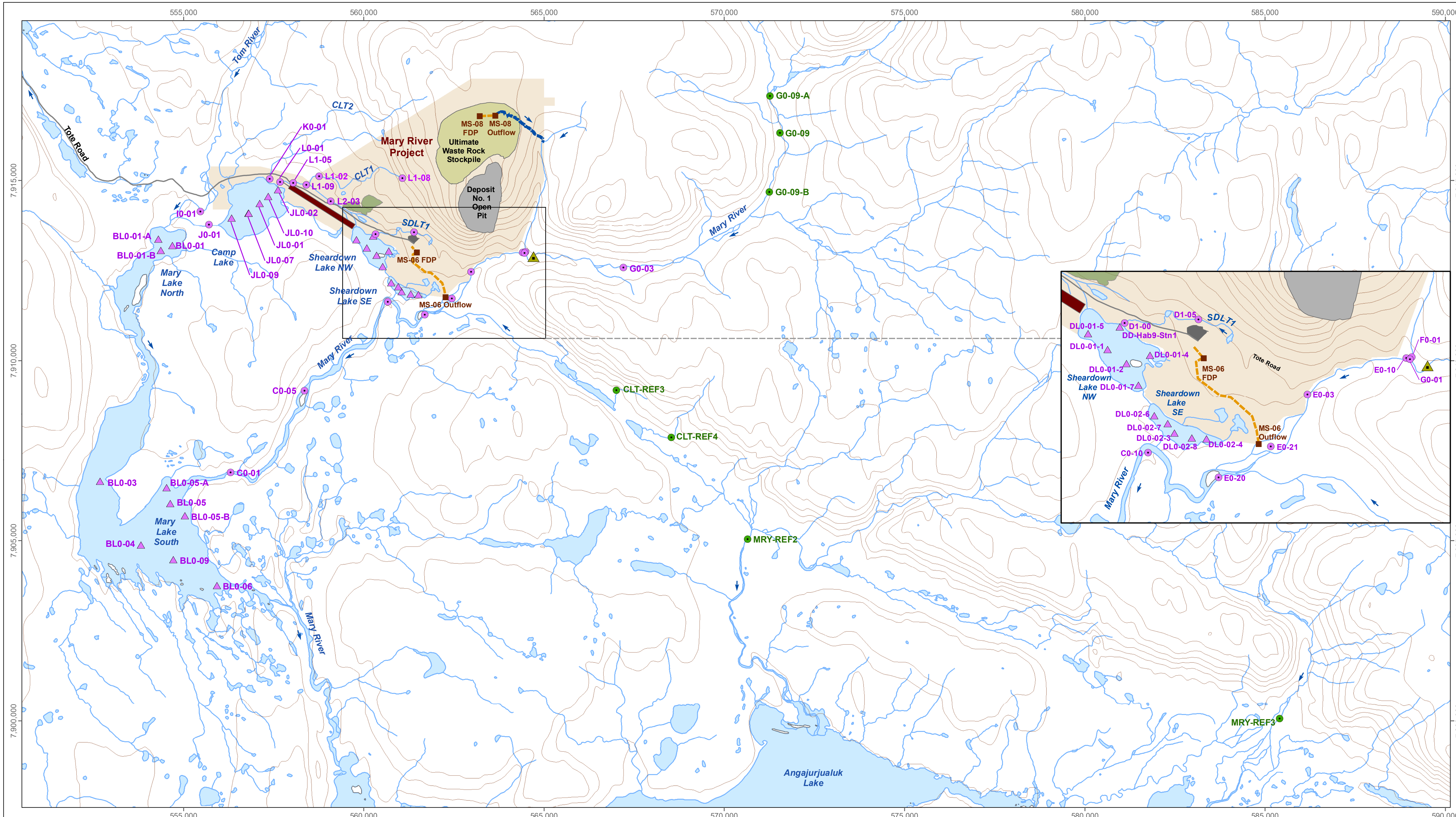
2.2.2 *In situ* Water Quality Measurement Data Collection and Analysis

In situ measurements of water temperature, dissolved oxygen , pH, specific conductance (i.e., temperature standardized measurement of conductivity), and turbidity were taken at the bottom of the water column at all lotic (i.e., creek, river) stations and as a vertical profile at one metre (m) intervals at each lentic (i.e., lake) water quality monitoring station during routine monitoring conducted by Baffinland personnel. These *in situ* measurements were also collected at the surface and bottom (i.e., approximately 30 centimetres [cm] above the water-sediment interface) at all lake benthic invertebrate community (benthic) stations during biological sampling conducted in August by TMAES personnel, except for turbidity measurements. The *in situ* measurements were collected using one of three YSI ProDSS (Digital Sampling System) meters equipped with a 4-Port sensor (YSI Inc., Yellow Springs, OH). Meter readings for pH, specific conductance, and turbidity were checked against standard solutions and calibrated as necessary the morning of the day in which sampling was to be completed, prior to field sampling. Dissolved oxygen concentration readings were checked and calibrated at greater frequency through each sampling day in response to changing sampling conditions (e.g., changes in elevation, barometric pressure, and/or ambient temperature). During the winter ice-cover sampling event, a gas-powered, 15-cm (6-inch) diameter ice auger was used to access the water column at lake water quality monitoring stations. Ice shavings were removed from the auger hole prior to the collection of

Table 2.1: Mary River Project CREMP Water Quality and Phytoplankton Monitoring Station Coordinates and Annual Sampling Schedule

Study System	Water Body	Station ID	UTM Zone 17N, NAD83		Ref. Data Set [a]	Sampling Season			
			Easting	Northing		Winter (Apr. - May)	Spring (June)	Summer (July)	Fall (Aug. - Sept.)
Reference Areas	Creek Reference	CLT-REF3	567004	7909174	na	-	✓	✓	✓
		CLT-REF4	568533	7907874		-	✓	✓	✓
		MRY-REF3	585407	7900061		-	✓	✓	✓
		MRY-REF2	570650	7905045		-	✓	✓	✓
	Reference Lake 3	REF-03-W1	575642	7852666	na	-	-	✓	✓
		REF-03-W2	574836	7852744		-	-	✓	✓
		REF-03-W3	574158	7853237		-	-	✓	✓
	Mary River Reference	G0-09-A	571264	7917344	na	-	✓	✓	✓
		G0-09	571546	7916317		-	✓	✓	✓
		G0-09-B	571248	7914682		-	✓	✓	✓
Camp Lake System	Camp Lake Tributaries	I0-01	555470	7914139	a	-	✓	✓	✓
		J0-01	555701	7913773		-	✓	✓	✓
		K0-01	557390	7915030		-	✓	✓	✓
		L0-01	557681	7914959		-	✓	✓	✓
		L1-02	558765	7915121		-	✓	✓	✓
		L1-05	558040	7914935		-	✓	✓	✓
		L1-08	561076	7915068		-	✓	✓	✓
		L1-09	558407	7914885		-	✓	✓	✓
		L2-03	559081	7914425		-	✓	✓	✓
	Camp Lake	JL0-01	557108	7914369	b	✓	-	✓	✓
		JL0-02	557615	7914750		✓	-	✓	✓
		JL0-07	556800	7914094		✓	-	✓	✓
		JL0-09	556335	7913955		✓	-	✓	✓
		JL0-10	557346	7914562		✓	-	✓	✓
Sheardown Lake System	Sheardown Tributary 1	D1-00	560329	7913512	a	-	✓	✓	✓
		D1-05	561397	7913558		-	✓	✓	✓
	Sheardown Lake NW	DD-Hab9-Stn1	560259	7913455	b	✓	-	✓	✓
		DL0-01-1	560080	7913128		✓	-	✓	✓
		DL0-01-2	560353	7912924		✓	-	✓	✓
		DL0-01-4	560695	7913043		✓	-	✓	✓
		DL0-01-5	559798	7913356		✓	-	✓	✓
		DL0-01-7	560525	7912609		✓	-	✓	✓
	Sheardown Lake SE	DL0-02-3	561046	7911915	b	✓	-	✓	✓
		DL0-02-4	561511	7911832		✓	-	✓	✓
		DL0-02-6	560756	7912167		✓	-	✓	✓
		DL0-02-7	560952	7912054		✓	-	✓	✓
		DL0-02-8	561301	7911846		✓	-	✓	✓
Mary River and Mary Lake System	Mary River	G0-03	567204	7912587	c	-	✓	✓	✓
		G0-01	564459	7912984		-	✓	✓	✓
		F0-01	564483	7913015		-	✓	✓	✓
		E0-21	562444	7911724		-	✓	✓	✓
		E0-20	561688	7911272		-	✓	✓	✓
		E0-10	564405	7913004		-	✓	✓	✓
		E0-03	562974	7912472		-	✓	✓	✓
		C0-10	560669	7911633		-	✓	✓	✓
		C0-05	558352	7909170		-	✓	✓	✓
		C0-01	556305	7906894		-	✓	✓	✓
	Mary Lake (North Basin)	BL0-01	554691	7913194	b	✓	-	✓	✓
		BL0-01-A	554300	7913378		✓	-	✓	✓
		BL0-01-B	554369	7913058		✓	-	✓	✓
	Mary Lake (South Basin)	BL0-03	552680	7906651	b	✓	-	✓	✓
		BL0-04	553817	7904886		✓	-	✓	✓
		BL0-05	554632	7906031		✓	-	✓	✓
		BL0-06	555924	7903760		✓	-	✓	✓
		BL0-05-A	554530	7906478		✓	-	✓	✓
		BL0-05-B	555034	7905692		✓	-	✓	✓
		BL0-09	554715	7904479		✓	-	✓	✓

[a] Reference data applicable to indicated study area include a - lotic reference stations; b - lentic reference stations; and, c - Mary River upstream stations.



LEGEND

Water Monitoring Stations
- Lake - Mine Exposed
- Stream - Mine Exposed
- Stream - Reference

- Final Discharge Point (FDP)
- Mary River Cascade Barrier
- Discharge Line
- Overland Effluent Channel

- Ultimate Deposit No. 1 Pit Limits
- Ultimate Waste Rock Stockpile Limits
- Mine Site Complex Pad
- Airstrip
- QMR2 Quarry

- Mary River Project
- Contours (20 m)

0 1.5 3 6
km

N W E S

Map Projection: UTM Zone 17N NAD 1983
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Mary River Project CREMP Routine Water Quality and Phytoplankton Monitoring Station Locations

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Figure 2.2

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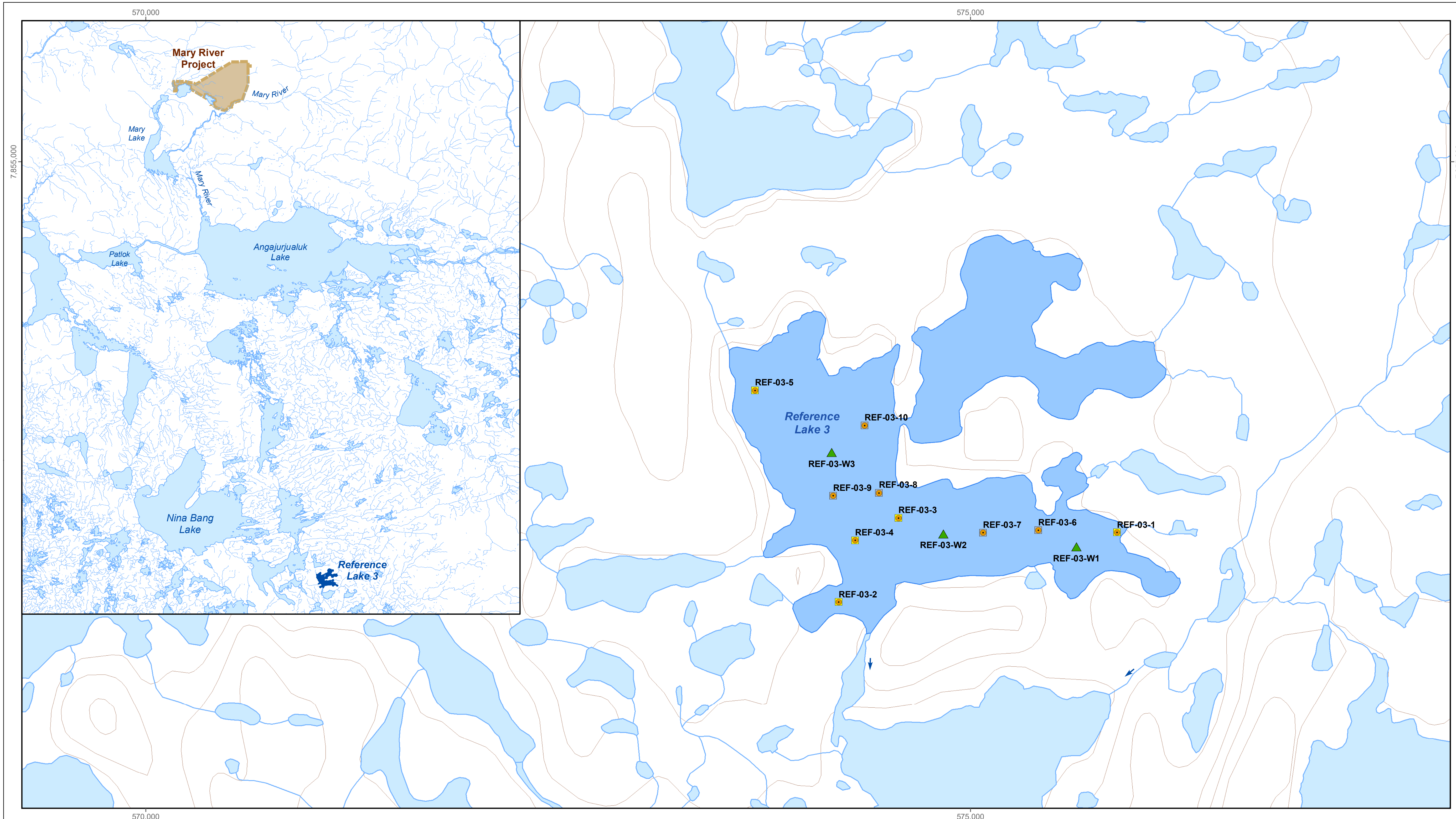

LEGEND

- Sediment and Benthic Monitoring Location
- Littoral Sampling Depth
- Profundal Sampling Depth
- Water Quality and Phytoplankton Monitoring Station
- Reference Lake

0 0.35 0.7 1.4 km

N W E S

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Mary River Project CREMP Reference Lake 3 Monitoring Station Locations

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Figure 2.3

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 207202.0045 - AEMP\4 - GIS\Baffinland 2020 CEMP\20-45 Figure 2.3 Reference Lake 3.mxd *in situ* measures. To avoid confounding influences associated with snow/ice melt in the auger hole, the *in situ* measurements were collected just below the ice layer. Additional supporting observations of water colour and clarity were recorded at the time of water quality and biological sampling at all benthic stations, and Secchi depth was measured at all lake stations using the methods outlined in Wetzel and Likens (2000).

In situ water quality data collected at the mine-exposed study streams, rivers, and lakes were compared to respective reference area data, applicable water quality guidelines (WQG[1]; dissolved oxygen concentrations and pH only), and, for pH and conductivity, baseline data. *In situ* water quality data were compared spatially within each system (i.e., from upstream- to downstream-most stations) using both qualitative and statistical approaches. For the statistical analysis, raw data and log-transformed data were assessed for normality and homogeneity of variance prior to conducting comparisons between (pair-wise) or among (multiple-group) applicable like-habitat mine-exposed and reference study area groups using Analysis-of-Variance (ANOVA). The selection of untransformed or log-transformed data was determined based on which data best met the assumptions of ANOVA. In instances where normality could not be achieved through data transformation, non-parametric Mann-Whitney U-tests and Kruskal-Wallis H-tests were used to conduct pair-wise and multiple-group comparisons, respectively, on rank transformed data. Similarly, in instances in which variances of normal data could not be homogenized by transformation, Student's t-tests assuming unequal variance were used for pair-wise comparisons. In cases in which multiple-group comparisons were conducted, normally distributed data were subject to Tukey's Honestly Significant Difference (HSD) and Tamhane's pair-wise *post hoc* tests for homogenous and non-homogenous data, respectively. All statistical comparisons were conducted using R programming (R Foundation for Statistical Computing, Vienna, Austria).

Vertical profiles of the *in situ* measurements taken from lake stations were plotted and visually assessed to evaluate potential thermal or chemical stratification and the corresponding depths associated with distinct layering. The occurrence of a thermocline was conservatively assessed as a ≥0.5˚C change in temperature per 1 m change in depth[2]. The vertical profile data collected at the mine-exposed study lakes were compared to those of the reference lake for each seasonal monitoring event using profile data averaged for each incremental depth below the water surface at each lake. At each study lake, spatial and seasonal differences in the vertical profile plots were

[1] Canadian Environmental Quality Guidelines (CCME 1999, 2019) were used as the primary source for WQG, including those for pH and dissolved oxygen concentrations.

[2] Wetzel (2001) defines the thermocline as a ≥1˚C change in temperature per 1 m change in depth. Through discussions regarding the CREMP in 2017, regulatory agencies requested that a ≥0.5˚C change in temperature per 1 m change in depth be used to conservatively define a thermally stratified condition.

evaluated to provide a better understanding of natural conditions and/or mine-related influences on within-lake water quality.

2.2.3 Water Chemistry Sampling and Data Analysis

Surface water chemistry samples were collected from both lotic and lentic environments (Table 2.1). At lotic stations, water chemistry samples were collected from approximately mid-water column by hand directly into pre-labeled sample bottles that were triple rinsed with ambient water. For samples requiring preservation, chemical preservatives were added to the samples before capping the bottles, or for sample bottles that were pre-dosed with chemical preservatives, the bottle was filled using a sample transferred from a separate bottle. At lentic stations, two water chemistry samples were collected, one approximately 1 m below the surface (or just below the ice layer for the winter sampling event) and the other from approximately 1 m above the bottom, using a non-metallic, vertically-oriented, 2.2 litre (L) TT Silicon Kemmerer bottle (Wildco Supply Co., Yulee, FL). During the winter sampling event, the water column was accessed at the same time and using the same methods as described above for the *in situ* measurements. Lake water collected using the Kemmerer bottle was transferred directly into sample bottles that had been pre-dosed with required chemical preservatives, where appropriate, except those requiring field filtration. In cases in which filtration of lotic and lentic station water samples was required (e.g., for dissolved metals), filtration was conducted in the field using methods consistent with AEMP standard operating procedures (Baffinland 2015).

Following collection, water chemistry samples were placed into coolers in the field and maintained at cool temperatures prior to shipment to the analytical laboratory. Water chemistry sampling QA/QC included trip blanks, field blanks, and the collection of equipment blanks and field duplicates at an approximate rate of 5% of the total number of samples collected for each CREMP sampling event (Appendix A). Water chemistry samples were shipped on ice to ALS Canada Ltd. (ALS; Waterloo, ON) for analysis of pH, conductivity, hardness, total suspended solids (TSS), total dissolved solids (TDS), anions (alkalinity, bromide, chloride, sulphate), nutrients (ammonia, nitrate, nitrite, total Kjeldahl nitrogen [TKN], total phosphorus), dissolved and total organic carbon (DOC and TOC, respectively), mercury, total and dissolved metals, and phenols using standard laboratory methods.

For parameters in which water chemistry AEMP benchmarks have been developed, data were compared: i) among mine-exposed and reference areas for each study lake catchment (Table 2.1); ii) spatially and seasonally at each mine-exposed waterbody; iii) to applicable WQG for the protection of aquatic life (Table 2.2) and/or to site-specific water quality benchmarks developed for the Mary River Project AEMP (Intrinsik 2014); and, iv) to baseline water quality data. For data screening, and to simplify discussion of results, parameter concentration

Table 2.2: Water Quality Guidelines Used for the Mary River Project 2015 to 2020 CREMP Studies

Parameters		Units	Water Quality Guideline (WQG)[a]	Criteria Source[a]	Supporting Information and/or Calculations Used to Derive Hardness Dependent Criteria
Conventionals	pH (lab)	pH	6.5 - 9.0	CWQG	-
Nutrients and Organics	Nitrate	mg/L	3	CWQG	-
	Nitrite	mg/L	0.06	CWQG	-
	Total Phosphorus	mg/L	0.020 or 0.030	PWQO	Total phosphorus objective is 0.030 mg/L for lotic (rivers, streams) environments, and 0.020 mg/L for lentic (lake) environments.
	Phenols	mg/L	0.001	PWQO	-
Anions	Chloride (Cl)	mg/L	120	CWQG	-
	Sulphate (SO_4)	mg/L	218	BCWQG	Sulphate guideline is hardness (mg/L $CaCO_3$) dependent as follows: 128 mg/L at 0 to 30 hardness, 218 mg/L at 31 to 75 hardness, 309 mg/L at 76 to 180 hardness, and 429 mg/L at 181 to 250 hardness. Sample-specific (mean) hardness was used for screening purposes. Value presented applicable to water with 75 mg/L hardness.
Total Metals	Aluminum (Al)	mg/L	0.100	CWQG	-
	Antimony (Sb)	mg/L	0.020	PWQO	-
	Arsenic (As)	mg/L	0.005	CWQG	-
	Beryllium (Be)	mg/L	0.011	PWQO	-
	Boron (B)	mg/L	1.5	CWQG	-
	Cadmium (Cd)	mg/L	0.00012	CWQG	Cadmium guideline is hardness (mg/L $CaCO_3$) dependent. For hardness between 17 and 280 mg/L, the cadmium guideline is calculated using the equation Cd (ug/L) = $10^{(0.83[\log(hardness)] - 2.46)}$. Sample-specific (mean) hardness was used for screening purposes. Value presented applicable to water with 75 mg/L hardness.
	Chromium (Cr)	mg/L	0.0089	CWQG	-
	Cobalt (Co)	mg/L	0.001	PWQO	-
	Copper (Cu)	mg/L	0.002	CWQG	Copper guideline is hardness (mg/L $CaCO_3$) dependent. At hardness <82 mg/L and >180 mg/L, the copper guideline is 2 and 4 ug/L, respectively. For hardness ranging from 82 to 180 mg/L, the copper guideline (ug/L) = 0.2 * $e^{(0.8545[\ln(hardness)] - 1.463)}$. Sample-specific (mean) hardness was used for screening purposes. Value presented applicable to water with 75 mg/L hardness.
	Iron (Fe)	mg/L	0.30	CWQG	-
	Lead (Pb)	mg/L	0.002	CWQG	Lead guideline is hardness (mg/L $CaCO_3$) dependent. At hardness <60 mg/L and >180 mg/L, the lead guideline is 1 and 7 ug/L, respectively. For hardness ranging from 60 to 180 mg/L, the lead guideline (ug/L) = $e^{(1.273[\ln(hardness)] - 4.705)}$. Sample-specific (mean) hardness was used for screening purposes. Value presented applicable to water with 75 mg/L hardness.
	Manganese (Mn)	mg/L	0.935	BCWQG	Manganese guideline is hardness (mg/L $CaCO_3$) dependent, and calculated using the equation Mn (ug/L) = 0.0044 * (hardness) + 0.605. Sample-specific (mean) hardness was used for screening purposes. Value presented applicable to water with hardness of 75 mg/L.
	Mercury (Hg)	mg/L	0.000026	CWQG	-
	Molybdenum (Mo)	mg/L	0.073	CWQG	-
	Nickel (Ni)	mg/L	0.077	CWQG	Nickel guideline is hardness (mg/L $CaCO_3$) dependent. At hardness <60 mg/L and >180 mg/L, the nickel guideline is 25 and 150 ug/L, respectively. For hardness ranging from 60 to 180 mg/L, the nickel guideline (ug/L) = $e^{(0.76[\ln(hardness)] + 1.06)}$. Sample-specific (mean) hardness was used for screening purposes. Value presented applicable to water with 75 mg/L hardness.
	Selenium (Se)	mg/L	0.001	CWQG	-
	Silver (Ag)	mg/L	0.00025	CWQG	-
	Thallium (Tl)	mg/L	0.0008	CWQG	-
	Tungsten	mg/L	0.030	PWQO	-
	Uranium (U)	mg/L	0.015	CWQG	-
	Vanadium (V)	mg/L	0.006	PWQO	-
	Zinc (Zn)	mg/L	0.030	CWQG	-

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME1999, 2019) was selected where a CCME guideline exists. Where no CCME guideline exists, the selected criteria is the lowest of either the Ontario Provincial Water Quality Objective (PWQO; OMOE 1994) or the British Columbia Water Quality Guideline (BCWQG; BCMOE 2019), as available.

enrichment factors were calculated as the mine-exposed area mean concentration divided by the respective reference station/area mean concentration. Similarly, for temporal comparisons, the parameter concentration enrichment factor was calculated by dividing the 2020 mean parameter concentration at a mine-exposed station/area by the baseline (2005 to 2013 data) mean concentration. The resulting enrichment factors were qualitatively assigned as slightly, moderately, or highly elevated compared to reference and/or baseline conditions using the categorization described in Table 2.3.

Table 2.3: Enrichment Factor Categories for Water and Sediment Chemistry Comparisons

Categories	Enrichment Factor Criterion
Slightly elevated	Concentration 3-fold to 5-fold higher at mine-exposed area versus the reference area or baseline data, as applicable.
Moderately elevated	Concentration 5-fold to 10-fold higher at mine-exposed area versus the reference area or baseline data, as applicable.
Highly elevated	Concentration ≥ 10-fold higher at effluent-exposed area versus the reference area or baseline data, as applicable.

Applicable WQG included the Canadian Water Quality Guidelines (CWQG; CCME 1999, 2019) or, for parameters with no CWQG, the most conservative (i.e., lowest) criterion available from established Ontario Provincial Water Quality Objectives (PWQO; OMOEE 1994) or British Columbia Water Quality Guidelines (BCWQG; BCMOE 2006, 2019). Water quality guidelines are abbreviated simply as 'WQG' in this report, although it is recognized that in certain cases the values presented may represent water quality 'objectives'. For WQGs that are hardness dependent, the hardness of the individual sample was used to calculate the WQG for the specific parameter according to established formulae (Table 2.2). Water chemistry data were also compared to site-specific water quality benchmarks developed for the Mary River Project AEMP (Intrinsik 2014). The AEMP water chemistry benchmarks were derived using an evaluation of background (i.e., baseline) water chemistry data together with existing generic WQGs that consider aquatic toxicity thresholds. These benchmarks were developed to inform management decisions under the AEMP assessment approach and management response framework (Baffinland 2015). An elevation in concentration of a parameter above the respective AEMP benchmark may trigger various actions (e.g., sampling design modifications, additional statistical assessment, considerations for mitigation, etc.) to better understand and potentially mitigate effects (Baffinland 2015). Water chemistry data for key parameters (i.e., parameters with AEMP benchmarks, or with concentrations that were higher at mine-exposed areas compared to reference areas) were plotted to evaluate changes in concentrations between baseline (2005 to 2013 data) and mine operational (2015 to 2020) years.

2.3 Sediment Quality

2.3.1 General Design

Sediment quality monitoring for the CREMP was designed to assess potential mine-related effects to the sediment of lake environments using a gradient-based approach (Baffinland 2015). Sediment quality sampling was conducted at five to ten stations per study lake for physical and chemical characterization as outlined under the CREMP, with additional characterization of physical sediment properties conducted at four to six stations per study lake to support the benthic invertebrate community analysis (Table 2.4; Figure 2.4). The lake sediment stations were designated as littoral or profundal based on a cut-off depth of 12 m, the value of which was used to define lake zonation during baseline characterization studies (KP 2014a, 2015). Sediment quality sampling was also conducted at three stations from each of the eight stream and five river study areas used to assess mine-related effects to benthic invertebrate communities (Table 2.5; Figure 2.4). Stream sediment sampling in the Camp Lake tributaries, Sheardown Lake tributaries, and Mary River is required every three years as outlined in the original CREMP design (KP 2014a; Baffinland 2015). All stream and river study areas were previously observed to contain limited depositional habitat and a general absence of substantial accumulation of fine sediments (KP 2015; Minnow 2016a,b, 2017, 2018). As a result, sediment sampling for chemical characterization was generally restricted to the shoreline and interstices of large, coarse substrate material (e.g., cobbles, boulders) within the applicable study areas. Similar to water quality, the evaluation of potential mine-related effects on sediments in Project area lakes focused on the use of established AEMP benchmarks to define Project-related effects.

2.3.2 Sample Collection and Laboratory Analysis

Sediment at the study lakes was collected for physical and chemical characterization using a gravity corer (Hoskin Scientific Ltd., Model E-777-00) outfitted with a clean 5.1 cm inside-diameter polycarbonate tube. From each retrieved core sample containing an intact, representative sediment-water interface, the top two cm of sediment was manually extruded upwards into a graded core collar, sectioned with a stainless-steel core knife, and placed into a pre-labeled plastic sample bag. Samples from three to four cores treated in this manner were composited to create a single sample at each station. Supporting measurements of total core sample length and depths of visually apparent redox boundaries/horizons, as well as notes regarding sediment texture and colour for each visible horizon, general sediment odour (e.g., hydrogen sulphide), and presence of algae or plants on or in the sediment, were recorded for each core sample. Sediment from stream/river (erosional) habitats was collected for chemical characterization using a stainless-steel spoon. Sediment sampling from erosional habitats focused on locations containing the finest grain sizes available, including channel margins and downstream of large

Table 2.4: Lake Sediment Quality and Benthic Invertebrate Community Monitoring Station Coordinates Used for the Mary River Project 2020 CREMP Study

Waterbody	Station Code	UTM Zone 17W		Sampling Habitat	Sample Type		
		Easting	Northing		Sediment Core[a]	Sediment petite-Ponar[a]	Benthic Invertebrate
Reference Lake 3	REF-03-1	575889	7852752	littoral	✓	-	✓
	REF-03-2	574200	7852330	littoral	✓	-	✓
	REF-03-3	574564	7852840	littoral	✓	-	✓
	REF-03-4	574301	7852705	littoral	✓	-	✓
	REF-03-5	573694	7853613	littoral	✓	-	✓
	REF-03-6	575411	7852766	profundal	✓	-	✓
	REF-03-7	575076	7852750	profundal	✓	-	✓
	REF-03-8	574445	7852992	profundal	✓	-	✓
	REF-03-9	574168	7852975	profundal	✓	-	✓
	REF-03-10	574358	7853400	profundal	✓	-	✓
Camp Lake	JLO-02	557627	7914748	littoral	✓	-	✓
	JLO-01	557092	7914370	profundal	✓	-	✓
	JLO-14	557246	7914224	profundal	✓	-	-
	JLO-17	556900	7914594	profundal	✓	-	-
	JLO-21	556926	7914911	littoral	-	✓	✓
	JLO-20	556750	7914850	littoral	-	✓	✓
	JLO-19	556587	7914801	littoral	-	✓	✓
	JLO-07	556803	7914095	profundal	✓	-	✓
	JLO-18	556357	7914706	littoral	-	✓	✓
	JLO-16	556335	7914470	profundal	✓	-	✓
	JLO-15	556542	7914184	profundal	✓	-	-
	JLO-11	556594	7913946	profundal	✓	-	✓
	JLO-13	556896	7913751	profundal	✓	-	-
	JLO-12	556378	7913728	profundal	✓	-	✓
Sheardown Lake Northwest (NW)	DLO-01-5	559806	7913348	profundal	✓	-	✓
	DLO-01-14	559821	7913328	profundal	-	✓	✓
	DLO-01-15	559884	7913340	profundal	-	✓	✓
	DD-HAB 9-STN2	560325	7913400	littoral	✓	-	-
	DLO-01-8	560338	7913192	littoral	✓	-	-
	DLO-01	560079	7913132	profundal	✓	-	-
	DLO-01-13	560151	7912997	profundal	✓	-	-
	DLO-01-2	560350	7912927	profundal	✓	-	✓
	DLO-01-12	560339	7912852	profundal	-	✓	✓
	DLO-01-9	560746	7913076	littoral	✓	-	✓
	DLO-01-4	560696	7913049	littoral	-	✓	✓
	DLO-01-3	560471	7912838	littoral	-	✓	✓
	DLO-01-11	560482	7912563	littoral	-	✓	✓
	DLO-01-10	560570	7912566	littoral	✓	-	✓
Sheardown Lake Southeast (SE)	DLO-02-1	560807	7912099	littoral	✓	-	✓
	DLO-02-11	561585	7911799	littoral	✓	-	✓
	DLO-02-10	561602	7911821	littoral	-	✓	✓
	DLO-02-4	561512	7911833	littoral	✓	-	✓
	DLO-02-12	561433	7911905	profundal	-	✓	✓
	DLO-02-9	561414	7911806	littoral	-	✓	✓
	DLO-02-8	561300	7911839	profundal	-	✓	✓
	DLO-02-13	561222	7911958	profundal	-	✓	✓
	DLO-02-2	561161	7911858	profundal	✓	-	✓
	DLO-02-3	561039	7911898	profundal	✓	-	✓
Mary Lake	BLO-01	554690	7913186	littoral	✓	-	✓
	BLO-16	553289	7908092	profundal	✓	-	-
	BLO-03	552679	7906660	profundal	✓	-	✓
	BLO-15	552723	7906419	profundal	-	✓	✓
	BLO-14	552688	7905282	profundal	✓	-	✓
	BLO-05	554635	7906033	profundal	-	✓	✓
	BLO-11	554942	7906033	littoral	-	✓	✓
	BLO-12	554644	7905742	profundal	✓	-	-
	BLO-13	553879	7905094	profundal	-	✓	✓
	BLO-04	553820	7904893	profundal	✓	-	✓
	BLO-10	555033	7905065	profundal	✓	-	-
	BLO-09	554707	7904486	profundal	✓	-	-
	BLO-08	555424	7904239	profundal	✓	-	-
	BLO-07	555767	7903583	littoral	-	✓	✓
	BLO-06	555925	7903771	littoral	✓	-	✓

[a] Sediment core samples analyzed for particle size, TOC and total metals. Petite-ponar sediment grab samples analyzed for particle size only.

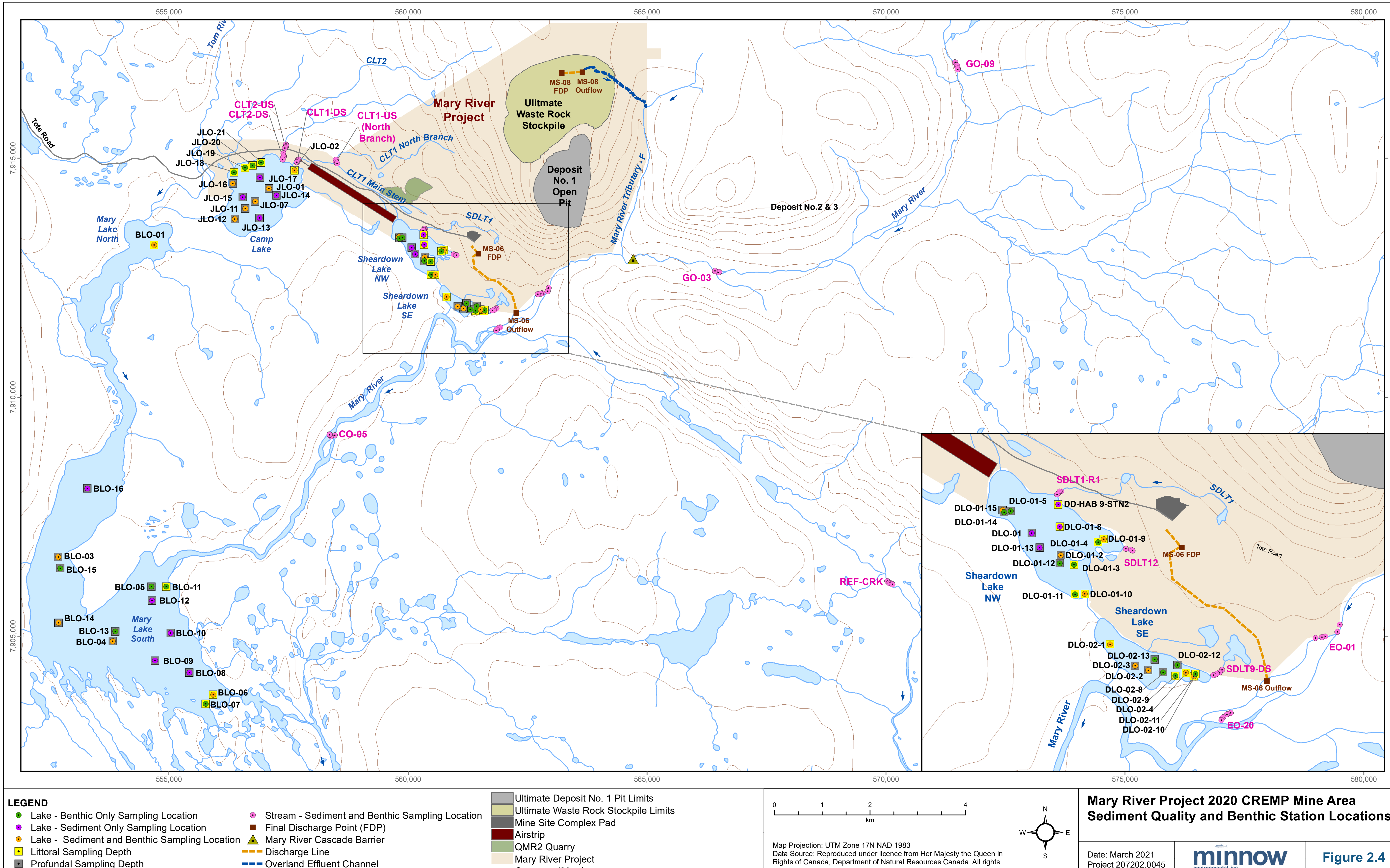

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Table 2.5: Stream and River Sediment and Benthic Invertebrate Community Monitoring Station Identifiers and Coordinates Used for the Mary River Project CREMP 2020 Study

Lake System	Waterbody	Station Code	Station Type	UTM Zone 17W, NAD83		Sediment Sample	Benthic Invertebrate
				Easting	Northing		
Angajurjualuk Lake	Unnamed Tributary	REF-CRK-B1	Reference	570025	7906148	✓	✓
		REF-CRK-B2	Reference	570060	7906115	-	✓
		REF-CRK-B3	Reference	570093	7906110	✓	✓
		REF-CRK-B4	Reference	570121	7906099	-	✓
		REF-CRK-B5	Reference	570137	7906086	✓	✓
Camp Lake	Camp Lake Tributary 1	CLT1-US-B1	Lightly Mine-Exposed	558502	7914967	✓	✓
		CLT1-US-B2	Lightly Mine-Exposed	558488	7914963	-	✓
		CLT1-US-B3	Lightly Mine-Exposed	558494	7914930	✓	✓
		CLT1-US-B4	Lightly Mine-Exposed	558509	7914903	-	✓
		CLT1-US-B5	Lightly Mine-Exposed	558517	7914890	✓	✓
		CLT1-DS-B1	Mine-Exposed	557710	7914978	✓	✓
		CLT1-DS-B2	Mine-Exposed	557693	7914957	-	✓
		CLT1-DS-B3	Mine-Exposed	557686	7914944	✓	✓
		CLT1-DS-B4	Mine-Exposed	557678	7914932	-	✓
		CLT1-DS-B5	Mine-Exposed	557672	7914917	✓	✓
	Camp Lake Tributary 2	CLT2-US-B1	Lightly Mine-Exposed	557441	7915291	✓	✓
		CLT2-US-B2	Lightly Mine-Exposed	557451	7915275	-	✓
		CLT2-US-B3	Lightly Mine-Exposed	557450	7915251	✓	✓
		CLT2-US-B4	Lightly Mine-Exposed	557441	7915237	-	✓
		CLT2-US-B5	Lightly Mine-Exposed	557423	7915215	✓	✓
		CLT2-DS-B1	Mine-Exposed	557392	7915104	✓	✓
		CLT2-DS-B2	Mine-Exposed	557398	7915053	-	✓
		CLT2-DS-B3	Mine-Exposed	557400	7915032	✓	✓
		CLT2-DS-B4	Mine-Exposed	557997	7915008	-	✓
		CLT2-DS-B5	Mine-Exposed	557377	7914971	✓	✓
Sheardown Lake Northwest (NW)	Sheardown Lake Tributary 1 (Reach 1)	SDLT1-R1-B1	Mine-Exposed	560352	7913522	✓	✓
		SDLT1-R1-B2	Mine-Exposed	560338	7913520	-	✓
		SDLT1-R1-B3	Mine-Exposed	560328	7913507	✓	✓
		SDLT1-R1-B4	Mine-Exposed	560320	7913497	-	✓
		SDLT1-R1-B5	Mine-Exposed	560313	7913493	✓	✓
	Sheardown Lake Tributary 12	SDLT12-B1	Mine-Exposed	560953	7912988	✓	✓
		SDLT12-B2	Mine-Exposed	561003	7912975	✓	✓
		SDLT12-B3	Mine-Exposed	561016	7912971	✓	✓
Sheardown Lake Southeast (SE)	Sheardown Lake Tributary 9	SDLT9-DS-B1	Mine-Exposed	561848	7911860	✓	✓
		SDLT9-DS-B2	Mine-Exposed	561825	7911838	-	✓
		SDLT9-DS-B3	Mine-Exposed	561798	7911824	✓	✓
		SDLT9-DS-B4	Mine-Exposed	561785	7911816	-	✓
		SDLT9-DS-B5	Mine-Exposed	561767	7911812	✓	✓
Mary Lake	Mary River	GO-09-B1	Reference	571447	7917010	✓	✓
		GO-09-B2	Reference	571479	7916946	-	✓
		GO-09-B3	Reference	571489	7916919	✓	✓
		GO-09-B4	Reference	571499	7916883	-	✓
		GO-09-B5	Reference	571503	7916858	✓	✓
		GO-03-B1	Mine-Exposed	566489	7912626	✓	✓
		GO-03-B2	Mine-Exposed	566509	7912616	-	✓
		GO-03-B3	Mine-Exposed	566491	7912605	✓	✓
		GO-03-B4	Mine-Exposed	566425	7912630	-	✓
		GO-03-B5	Mine-Exposed	566425	7912642	✓	✓
		EO-01-B1	Mine-Exposed	562944	7912281	✓	✓
		EO-01-B2	Mine-Exposed	562922	7912214	-	✓
		EO-01-B3	Mine-Exposed	562806	7912171	✓	✓
		EO-01-B4	Mine-Exposed	562778	7912165	-	✓
		EO-01-B5	Mine-Exposed	562717	7912158	✓	✓
		EO-20-B1	Mine-Exposed	561930	7911460	✓	✓
		EO-20-B2	Mine-Exposed	561895	7911447	-	✓
		EO-20-B3	Mine-Exposed	561858	7911420	✓	✓
		EO-20-B4	Mine-Exposed	561848	7911408	-	✓
		EO-20-B5	Mine-Exposed	561841	7911393	✓	✓
		CO-05-B1	Mine-Exposed	558465	7909208	✓	✓
		CO-05-B2	Mine-Exposed	558387	7909183	-	✓
		CO-05-B3	Mine-Exposed	558365	7909214	✓	✓
		CO-05-B4	Mine-Exposed	558355	7909224	-	✓
		CO-05-B5	Mine-Exposed	558359	7909209	✓	✓

boulders within the active channel. One sample, representing a composite of a variable number of spoonfuls, was collected directly into a pre-labelled plastic sample bag at each station. Following collection, all sediment samples were placed into a cooler, transported to the mine, and stored under cool conditions until shipment to the analytical laboratory.

Upon completion of the field program, sediment samples were shipped to ALS (Waterloo, ON) for analysis using standard laboratory methods. Physical characterization of samples included percent moisture and particle size analyses, and chemical characterization included analyses of TOC and total metals (including mercury).

2.3.3 Data Analysis

Sediment quality data from the mine-exposed lakes, creeks, and rivers were compared to like-habitat reference area data, applicable sediment quality guidelines/AEMP benchmarks and, when available, baseline sediment quality data. Sediment physical characteristics (i.e., moisture, particle size) and TOC data collected at study area lakes were summarized based on calculation of mean, standard deviation, standard error, minima, and maxima for littoral and profundal habitat. The data from the mine-exposed lakes were compared to the reference lake data using the same statistical tests, data transformations, test assumptions, and statistical software described previously for the statistical evaluation of *in situ* water quality (see Section 2.2.3).

The sediment chemistry data from the mine-exposed lakes were initially assessed to identify potential gradients in metal concentrations with distance from known or suspected sources of mine-related deposits to the lake. For each mine-exposed lake, creek, or river study area, data for each sediment chemistry parameter were separately averaged for each habitat type (e.g., littoral and profundal habitat in lakes) and then compared between like-habitat mine-exposed and reference areas using enrichment factors calculated and compared as described previously for evaluation of water chemistry (Section 2.2.3; Table 2.3). Sediment chemistry data collected at lake environments were compared to applicable Canadian Sediment Quality Guidelines (CSQG; CCME 1999) probable effect levels (PEL) or, for parameters with no CSQG, to Ontario Provincial Sediment Quality Guidelines (PSQG; OMOE 1993) severe effect levels (SEL), collectively referred to as 'SQG' throughout this document. The 2020 lake sediment chemistry data analyses included comparisons to Mary River Project AEMP sediment quality benchmarks that were derived using baseline sediment chemistry data for each mine-exposed lake and existing generic CSQG interim or PSQG lowest effect level sediment quality guidelines (Intrinsik 2014, 2015). As indicated previously, the AEMP benchmarks were developed to inform management decisions under the AEMP assessment approach and management response framework (Baffinland 2015). An increase in concentration above the

AEMP benchmark may trigger various actions to better understand and potentially mitigate effects (Baffinland 2015).

Sediment chemistry data for key parameters (i.e., parameters with concentrations that were notably higher at mine-exposed areas compared to the reference area, that have been identified as site-specific parameters of concern in previous studies, and/or those with concentrations above SQG and/or AEMP benchmarks) were plotted to evaluate potential changes in concentrations from 2020 relative to baseline (2005 to 2013) and earlier in the period of mine operation (2015 to 2019). In addition, as described previously, enrichment factors were calculated between the 2020 and baseline data for each individual study lake using the same calculation (and categorization description) as described previously (Section 2.2.3; Table 2.3).

The applicability of lotic sediment chemistry data to the interpretation of lotic benthic invertebrate community data was considered minimal given the fact that fine sediment composes much less than 5% of available substrate at the lotic environments (extrapolation of the data suggests that silt and clay compose less than 0.5% of available habitat) and that benthic invertebrates collected for the CREMP do not inhabit these fine sediments. By extension, because fish species inhabiting lotic environments largely rely on benthic invertebrates as a food source, the applicability of sediment chemistry monitoring data to understanding effects on fish was also considered minimal. Because sufficient amounts of fine sediment were able to be collected at only 3 of 23 lotic stations during the baseline period (KP 2014a,b), no temporal comparison of the stream/river sediment chemistry data was conducted.

2.4 Biological Assessment

2.4.1 Phytoplankton

The CREMP uses measures of aqueous chlorophyll-a concentrations to assess potential mine-related influences on phytoplankton. Because chlorophyll-a is the primary pigment of phytoplankton (i.e., algae and other photosynthetic microbiota suspended in the water column), aqueous chlorophyll-a concentrations are often used as a surrogate for evaluating the amount of photosynthetic microbiota in aquatic environments (Wetzel 2001). Chlorophyll-a samples were collected by Baffinland environmental department staff at the same stations and same time, using the same methods and equipment, as described for the collection of water chemistry samples (Table 2.1; Figures 2.2 and 2.3; Section 2.2.3). The chlorophyll-a samples were collected into 1 L glass amber bottles and maintained in a cool and dark environment prior to submission to ALS (Mary River On-Site Laboratory, NU). On the same day of collection, the on-site laboratory filtered the samples through a 0.45 micron cellulose acetate membrane filter assisted by a vacuum pump. Following filtration, the membrane filter was wrapped in aluminum foil, inserted into a labelled envelope, and then frozen. At the completion of field collections for the seasonal sampling event, the filters were shipped frozen to ALS in Waterloo, ON for chlorophyll-a analysis using standard methods. The field QA/QC applied during chlorophyll-a sampling was similar to that described for water chemistry sampling (see Section 2.2.3).

The CREMP study design also stipulates the collection of phytoplankton community samples for archiving (Baffinland 2015). If water quality, chlorophyll-a, and/or other biological components indicate potential mine-related effects on primary productivity at a specific mine-exposed waterbody, the phytoplankton community samples may be processed to further investigate the nature of potential mine-related effects on phytoplankton biomass and community structure (e.g., taxonomic composition, richness, density). To date, none of the archived phytoplankton community samples have been processed (2006 to 2019). In 2020, phytoplankton community samples were collected using the same methods described in the CREMP (Baffinland 2015) and, as in the past, these samples were not processed, but were archived for potential future use.

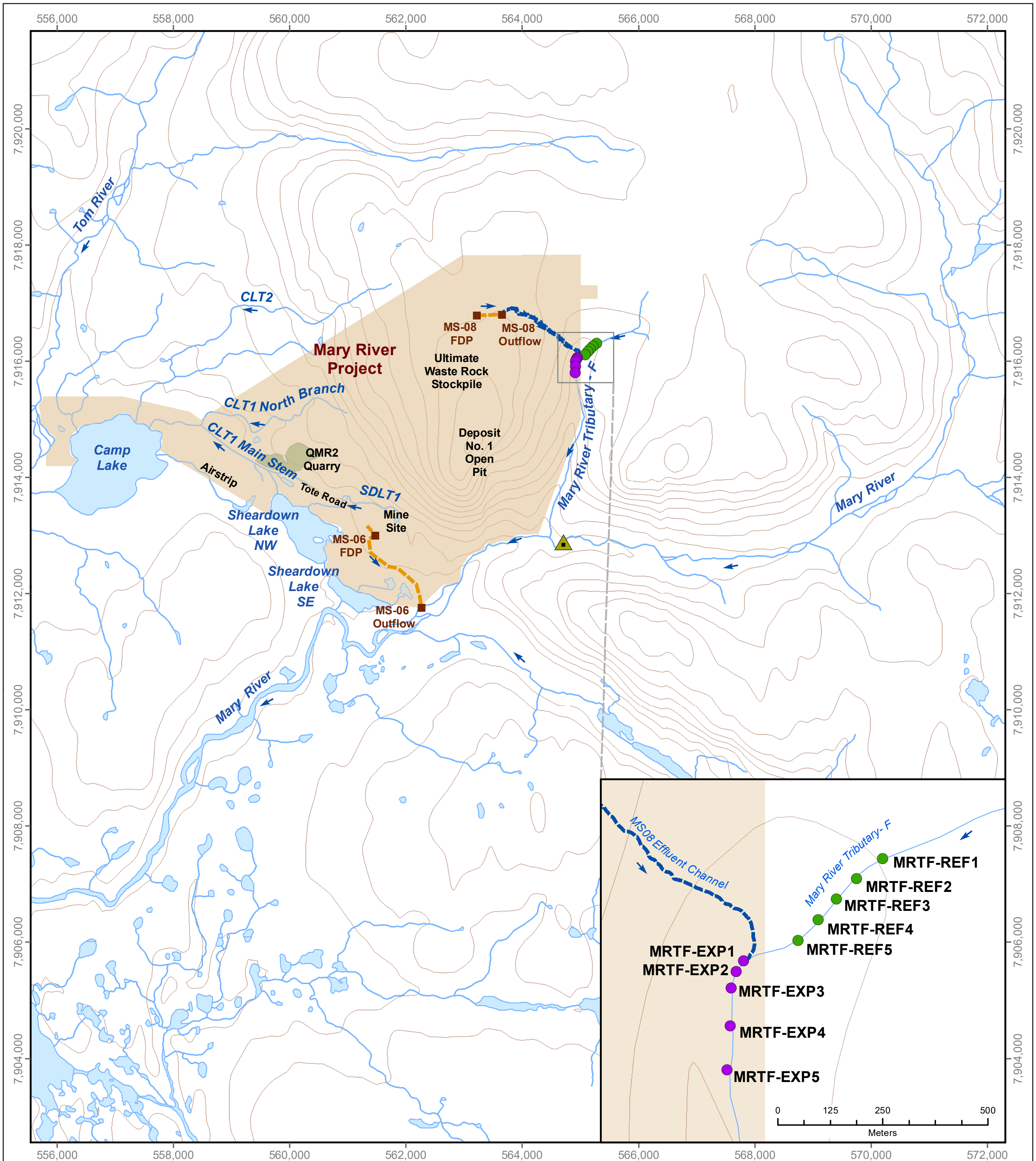
The analysis of aqueous chlorophyll-a concentrations closely mirrored the approach used to evaluate the water quality data. Chlorophyll-a concentrations were compared: i) between respective mine-exposed and reference areas; ii) spatially and seasonally at each mine-exposed waterbody; iii) to AEMP benchmarks; and, iv) to baseline data. Comparisons of chlorophyll-a concentrations between the mine-exposed and reference areas were based on both qualitative and statistical approaches, the latter of which was based on the same statistical tests, data transformations, test assumptions, statistical software, and alpha (p-value) for defining differences as described previously for statistical analysis of *in situ* water quality data (Section 2.2.2). An AEMP benchmark chlorophyll-a concentration of 3.7 µg/L was established for the Mary River Project (Baffinland 2015). The 2020 chlorophyll-a concentration data were compared to this benchmark to assist with the determination of potential mine-related enrichment effects at waterbodies influenced by mine operations. A mine-related effect on the productivity of a waterbody was defined as a chlorophyll-a concentration above the AEMP benchmark, the concentration measured in a representative reference area, and/or the respective waterbody baseline condition.

2.4.2 Benthic Invertebrate Community

2.4.2.1 General Design

The CREMP benthic invertebrate community (benthic) survey design outlines a habitat-based approach for characterizing potential mine-related effects to benthic biota of lotic (stream/river) and lentic (lake) environments (Baffinland 2015). Lotic areas sampled for benthic invertebrates included Camp Lake Tributaries 1 and 2 at historically established areas located upstream and downstream of the Milne Inlet Tote Road, Sheardown Lake Tributaries 1, 9, and 12 near their respective outlets, and Mary River upstream (two areas) and downstream (three areas) of the Mine Site (Table 2.5; Figure 2.4). Benthic samples were also collected at a reference creek located within the same unnamed tributary to Angajurjualuk Lake that is used for reference water quality sampling (Stations CLT-REF4 and MRY-REF2) as part of the 2020 CREMP to augment the original study design (Table 2.5; Figure 2.4). This reference creek, referred to as Unnamed Reference Creek herein, was initially sampled as part of the benthic invertebrate community assessment in the 2016 CREMP (see Minnow 2017). Environmental Effects Monitoring (EEM) benthic invertebrate community data collected at an unnamed tributary to Mary River (referred to as Mary River Tributary-F [MRTF]) downstream (effluent-exposed) and upstream (reference) of the primary mine effluent discharge have also been included in this CREMP report to consolidate all available benthic information for the mine receiving environment (Figure 2.5). Consistent with the federal EEM program, the CREMP incorporated sampling at five benthic stations at each lotic study area except for Sheardown Lake Tributary 12, where only three stations were sampled due to limited habitat available for sampling using conventional gear suitable for erosional habitat. As in studies conducted from 2015 to 2019, the level of replication used for lotic benthic sampling in 2020 was greater than specified under the original CREMP design to provide consistency with EEM standards (Minnow 2016a). To the extent possible, the same station locations used in previous studies were sampled in 2020 to provide continuity among historical baseline and recent studies.

In lentic environments, benthic sampling was conducted at the 40 previously established stations described in the CREMP study design among the four mine-exposed study lakes (i.e., ten stations in each of Camp, Sheardown NW, Sheardown SE and Mary lakes), as well as at the same ten stations established at Reference Lake 3 during the 2015 study (Table 2.4; Figures 2.3 and 2.4). Analysis of benthic data collected at Reference Lake 3 from 2015 to 2019 indicated that, similar to temperate lakes (Ward 1992), depth-related influences on benthic invertebrate community structure (e.g., density and richness) occur naturally in lakes of the study region (Minnow 2016a, 2017, 2018, 2019, 2020). Analysis of benthic data collected from Reference Lake 3 in 2020 provided on-going confirmation of the occurrence of natural depth-related influences on benthic invertebrate community structure in area lakes (Appendix B). Because of the occurrence of natural depth-related differences in benthic invertebrate communities, the benthic stations at each mine-exposed and reference lake were categorized as littoral zone (2-12 m depth) or profundal zone (>12 m depth) stations based on station depth (Table 2.4). To the extent possible, five littoral and five profundal stations were designated for each study lake



LEGEND

Benthic Invertebrate Station

- Effluent-exposed
- Reference
- Final Discharge Point (FDP)
- Mary River Cascade Barrier
- Discharge Line
- Overland Effluent Channel
- Mary River Project

Mary River Tributary-F Benthic Station Locations Used for the Mary River Project Second EEM Study, August 2020

0 1.5 3 6 km

N E S W

Map Projection: UTM Zone 17 WN NAD 1983

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Figure 2.5

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 207202.0045 - AEMP\4 - GIS\Baffinland 2020 CEMP\20-45 Figure 2.5 Benthic Station Locations.mxd based on the previously established suite of CREMP lentic benthic stations[3] to provide temporal continuity with the baseline studies and the original CREMP design (Table 2.4; Figure 2.4), as well as to allow data analysis in accordance with EEM standards. The sampling of five stations from each zone at each study area ensured adequate statistical power to detect ecologically meaningful differences in benthic metrics of ± two standard deviations (SDs) of a comparable reference area mean using an equal α and β of 0.10 (Environment Canada 2012).

2.4.2.2 Sample Collection and Laboratory Analysis

Two types of equipment and methods were used during the 2020 CREMP benthic survey to sample the different types of habitat encountered as follows:

- at **lotic (stream/river) stations** (i.e., predominantly cobble and/or gravel substrate in flowing waters), benthic samples were collected using a Surber sampler (0.0929 m^2 sampling area) outfitted with 500-µm mesh. At each erosional station, one sample representing a composite of three Surber sampler grabs (i.e., 0.279 m^2 area) was collected to ensure adequate representation of the habitat. A concerted effort was made to ensure that water velocity and substrate characteristics were comparable among respective mine-exposed and reference study area stations to minimize natural influences on community variability. Once all three sub-samples were collected at each station, all material gathered in the Surber sampler net was transferred to a plastic sampling jar which was labelled with both an external and internal station identifier.
- at **lentic (lake) stations** (i.e., predominantly soft silt-sand, silt, and/or clay substrates with variable amounts of organics), benthic sampling was conducted using a petite-Ponar grab sampler (15.24 x 15.24 cm; 0.023 m^2 sampling area). A single sample, consisting of a composite of five grabs (i.e., 0.115 m^2 sampling area) was collected at each station with care taken to ensure that each grab was acceptable (i.e., that the grab captured sufficient surface material and was full to each edge). Incomplete grabs were discarded. For each acceptable grab, the petite-Ponar was thoroughly rinsed and the material then field-sieved through 500-µm mesh. Following sieving of all five grabs, the retained material was carefully transferred into a plastic sampling jar which was labelled with both an external and internal station identifier.

Following collection, benthic samples were preserved to a level of 10% buffered formalin in ambient water. Supporting measurements and information collected at each replicate grab

[3] At Sheardown Lake SE, depths greater than 12 m are spatially limited, and thus the five deepest CREMP stations were designated as profundal despite one of the five being less than 12 m deep. At Mary Lake, six of the CREMP stations occurred at depths greater than 12 m and thus were all designated as profundal, with the four remaining stations designated as littoral.

location for lotic stations included sampling depth, water velocity, and description of aquatic vegetation/algae presence. In addition, *in situ* water quality at the bottom of the water column and collection/recording of global positioning system (GPS) coordinates was conducted at each lotic benthic station. Supporting information recorded at each lake benthic station included substrate description, presence of aquatic vegetation/algae, sampling depth, *in situ* water quality near the water column surface and bottom, and GPS coordinates. All GPS coordinates were collected in Universal Transverse Mercator (UTM) units using a hand-held portable Garmin GPS72 (Garmin International Inc., Olathe, KS) device based on 1983 North American Datum (NAD 83).

Benthic samples were submitted to and processed by Zeas Inc. (Nobleton, ON) using standard sorting methods. Upon arrival at the laboratory, a biological stain was added to each benthic sample to facilitate greater sorting accuracy. The samples were washed free of formalin in a 500 µm sieve and the remaining sample material was examined under a stereomicroscope at a magnification of at least ten times by a technician. Benthic invertebrates were removed from the sample debris and placed into vials containing 70% ethanol according to major taxonomic groups (i.e., order or family levels). A senior taxonomist later enumerated and identified the benthic organisms to the lowest practical level (typically genus or species) utilizing up-to-date taxonomic keys. The QA/QC conducted during the laboratory processing of benthic samples included organism recovery and sub-sampling checks on as many as 10% of the total samples collected for the 2020 CREMP (Appendix A).

2.4.2.3 Data Analysis

Benthic data were evaluated separately for lotic, lentic littoral, and lentic profundal habitat data sets. Benthic invertebrate communities were evaluated using summary metrics of mean invertebrate abundance (or “density”; average number of organisms per m^2), mean taxonomic richness (number of taxa, as identified to lowest practical level), Simpson’s Evenness Index, and the Bray-Curtis Index of Dissimilarity. Simpson’s Evenness was calculated using the Krebs method (Smith and Wilson 1996). Additional comparisons were conducted using percent composition of dominant/indicator taxa, functional feeding groups (FFG), and habit preference groups (HPG; percent composition of taxa and groups were calculated as the abundance of each respective group relative to the total number of organisms in the sample). Dominant/indicator taxonomic groups were defined as those groups representing, on average, greater than 5% of total organism abundance for a study area or any groups considered important indicators of environmental stress. The FFG and HPG were assigned based on Pennak (1989), Mandaville (2002), and/or Merritt et al. (2008) descriptions/designations for each taxon.

Statistical comparisons of benthic invertebrate community metrics and community composition endpoints, with the exception of Bray-Curtis Index, were conducted using the same tests described for the *in situ* water quality comparisons (see Section 2.2.2). Pair-wise differences between the mine-exposed and reference areas were preferentially tested using Student's t-tests on untransformed, normally distributed data. However, if data were determined to be non-normal, transformations including $\log_{10}$ and $\log_{10}(x+1)$ were applied to the data and evaluated for normality. The transformation that resulted in normal data with lowest skew and kurtosis values was then used for statistical testing using Students t-tests. In instances where normality could not be achieved through data transformation, non-parametric Mann-Whitney U-tests were used for the pair-wise comparisons on rank transformation. Statistical comparisons were conducted using R programming (R Foundation for Statistical Computing, Vienna, Austria). An effect on benthic invertebrate communities was defined as a significant difference between any paired mine-exposed and reference areas at a p-value of 0.10. For each endpoint that differed significantly, a magnitude of difference was calculated between study area means. Because the benthic survey was designed to have sufficient power to detect a difference (effect size) of ± two SD, the magnitude of the difference was calculated to reflect the number of reference mean standard deviations (SD_{REF}) using equations provided by Environment Canada (2012). A Critical Effect Size for the benthic invertebrate community study (CES_{BIC}) of ± 2 SD_{REF} was used to define ecologically relevant 'effects', which is analogous to differences beyond those expected to occur naturally between two areas that are uninfluenced by anthropogenic inputs (i.e., between pristine reference areas; see Munkittrick et al. 2009; Environment Canada 2012).

The Bray-Curtis Index was used to evaluate community level differences between study areas, and was computed and assessed statistically using procedures recommended for federal EEM studies (i.e., Borcard and Legendre 2013). Specifically, community level differences between study areas were assessed in a pairwise fashion using ln-transformed abundance data, and with homogeneity of group variance calculated according to the PERMDISP2 procedure provided by Anderson (2006). A Mantel Test and distance-based Redundancy Analysis (dbRDA) was then used to determine potential differences in community structure between study areas using R statistical software (as per Borcard and Legendre 2013).

Temporal comparisons included statistical evaluations among the baseline and 2015 to 2020 data for primary benthic metrics (i.e., density, richness, Simpson's Evenness), dominant invertebrate groups, and FFG using univariate tests (e.g., ANOVA) and pair-wise *post hoc* tests. The temporal statistical comparisons were conducted using the same tests, transformations, assumptions, and software described above for the *in situ* water quality comparisons based on a multiple group analysis (see Section 2.2.2). Tukey's HSD *post hoc* tests were used in instances where normal data showed equal variance, and Tamhane's *post hoc* tests were used in instances where normal data showed unequal variance (for the multiple group temporal comparisons). Similar to the 2020 within-year statistical analyses, the magnitude of difference was calculated for endpoints that differed significantly between years in the *post hoc* tests, which was then compared to the benthic survey CES_{BIC} of within SDs of the baseline year mean (abbreviated as ±2 $SD_{BL\text{-}year}$).

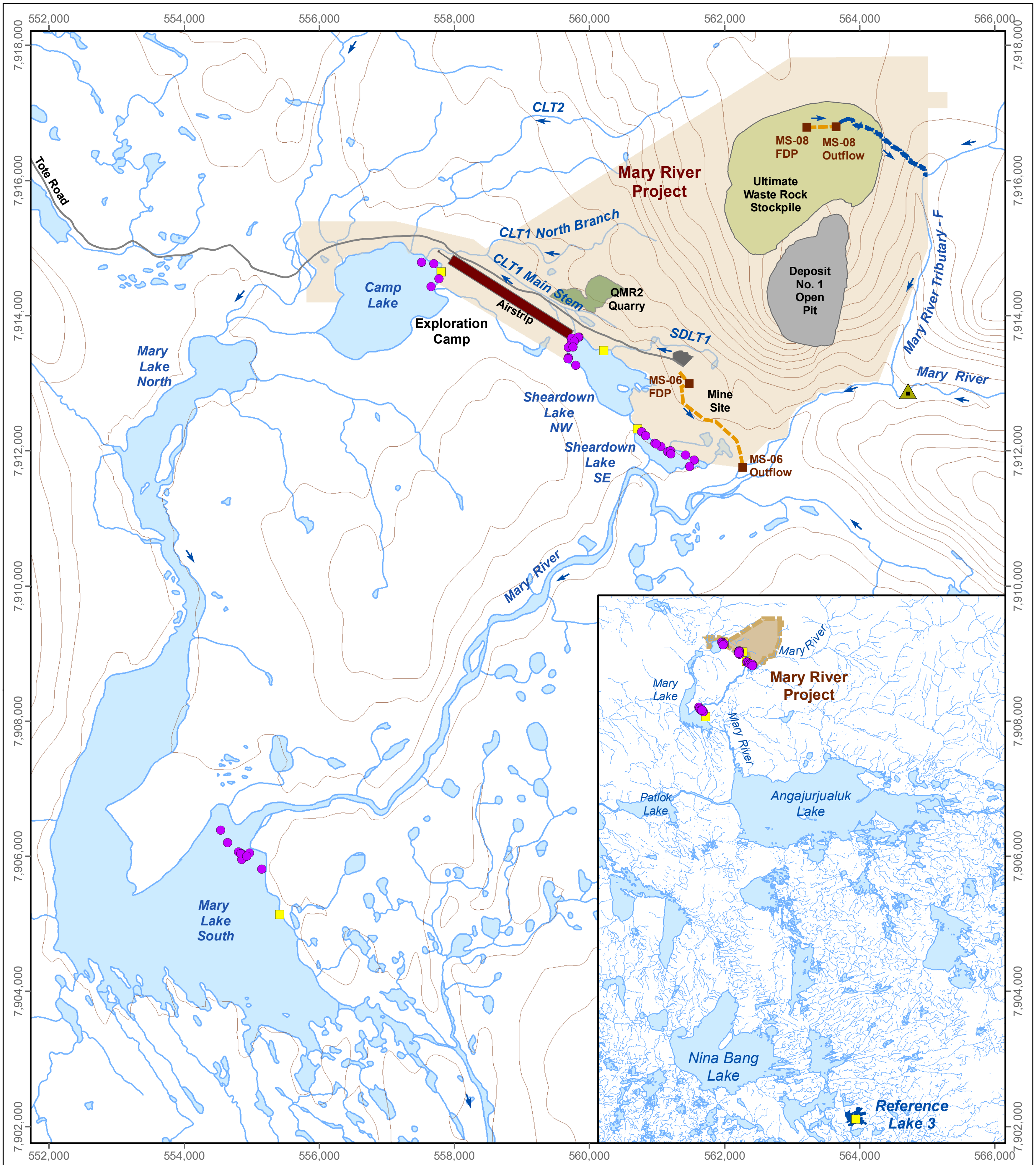
2.4.3 Fish Population

2.4.3.1 General Design

The CREMP fish population survey outlines a non-lethal sampling design to evaluate potential mine-related effects on the fish population (e.g., age structure, condition) at the mine-exposed lakes (Baffinland 2015). The fish population survey targeted arctic charr (*Salvelinus alpinus*) primarily because this species is the most abundant in the mine's regional lakes and sufficient baseline catch and measurement data exist to allow application of a before-after statistical evaluation. Arctic charr are also important as an Inuit subsistence food source. The approach employed for the CREMP fish population survey closely mirrored the recommended EEM approach for non-lethal sampling (Environment Canada 2012). Specifically, the fish population survey targeted the collection of approximately 100 arctic charr from nearshore lake habitat and 100 arctic charr from littoral/profundal lake habitat. The four mine-exposed study lakes used for the fish population survey were the same as those used to document baseline conditions, namely Camp, Sheardown NW, Sheardown SE, and Mary lakes (Figure 2.6). Unlike CREMP studies conducted from 2015 to 2017, enough arctic charr were captured at Reference Lake 3 nearshore and littoral/profundal areas to allow statistical evaluation of potential health effects on arctic charr populations at the mine-exposed lakes. Therefore, the 2020 CREMP fish population survey included separate comparisons of arctic charr collected at nearshore and littoral/profundal habitats between the mine-exposed lakes and reference lake, as well as comparisons of fish from nearshore and littoral/profundal zones of individual mine-exposed lakes before and after the commencement of the Mary River Project commercial mine operations. In addition to the CREMP data, EEM fish population survey and fish tissue data collected from Mary River near- and far-field mine-exposed areas, as well as an unnamed tributary to Angajurjualuk Lake in 2020 (Figure 2.7; Minnow 2020) have been summarized in this CREMP report to consolidate all available fish population information applicable to the mine receiving environment.

2.4.3.2 Sample Collection

Nearshore areas of study lakes used for the CREMP study and streams/rivers used for the EEM study were sampled for arctic charr using a battery powered backpack electrofishing unit (Model LR-24, Smith-Root Inc., Vancouver, WA). An electrofishing team, consisting of the



Mary River Project 2020 CREMP Fish Survey Sampling Locations

Map Projection: UTM Zone 17W NAD 1983
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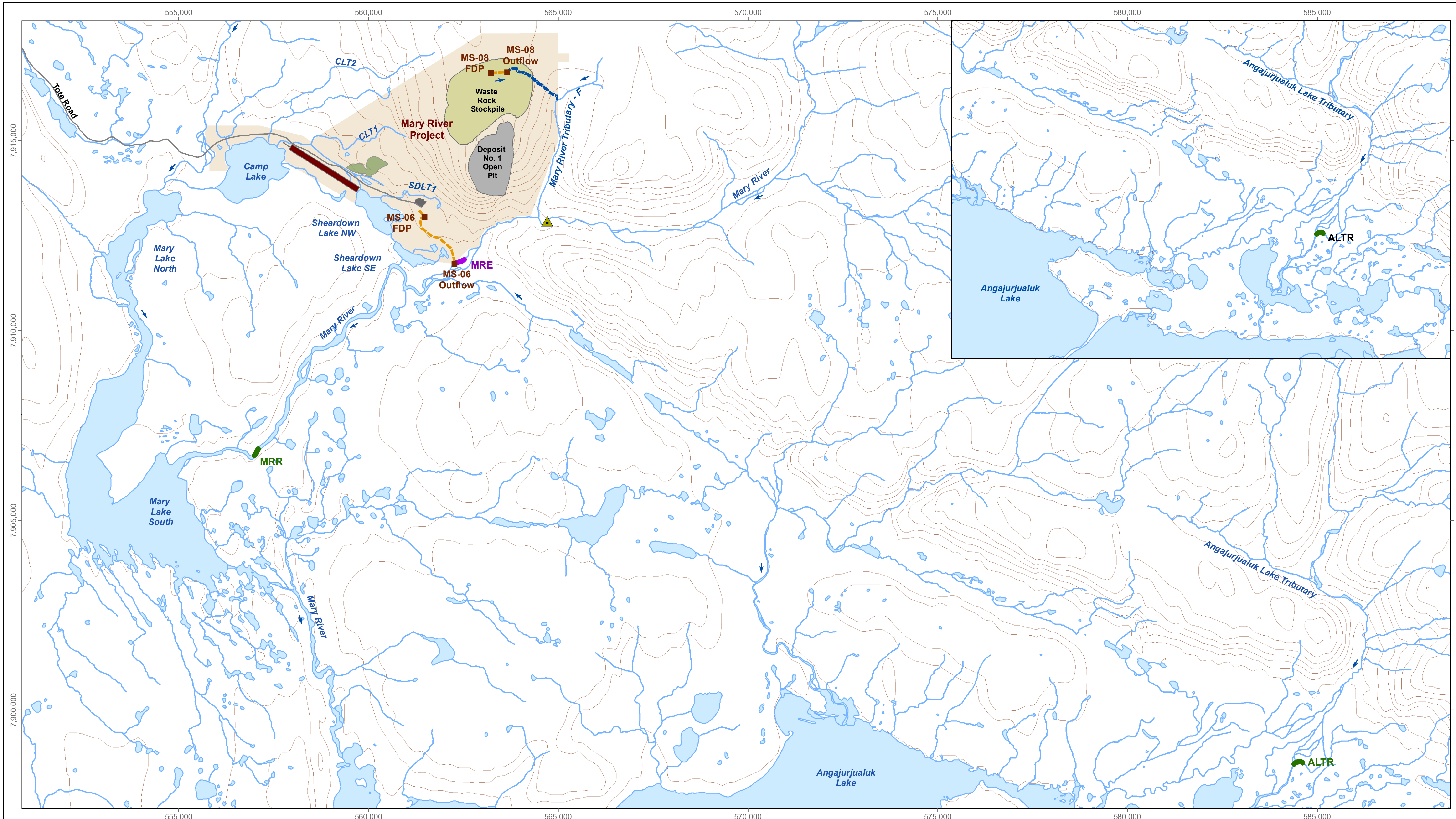
Figure 2.6

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 207202.0045 - AEMP\4 - GIS\Baffinland 2020 CEMP\20-45 Figure 2.6 Fish Survey Sampling Locations.mxd



LEGEND

Fish Survey Sampling Location

- Effluent-Exposed
- Reference
- Discharge Line
- Final Discharge Point (FDP)
- QMR2 Quarry
- Ultimate Deposit No. 1 Pit Limits
- Ultimate Waste Rock Stockpile Limits
- Mine Site Complex Pad
- Airstrip
- Mary River Project
- Contours (20 m)
- Tote Road

0 1.5 3 6 km

N W E S

Map Projection: UTM Zone 17 W NAD 1983
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Fish Survey Sampling Locations for the Mary River Project Second EEM, August 2020

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Figure 2.7

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Baffinland Iron Mines - 207202.0045 - AEMP\4 - GIS\Baffinland 2020 CEMP\20-45 Figure 2.7 Fish Survey Sampling Locations for the Mary River Project Second EEM.mxd backpack electrofisher operator and a single netter, conducted a single fishing pass at up to two shoreline reaches of each study lake and each lotic study area (Figure 2.6). The number of passes conducted at each lake/lotic study area was dependent upon catch success, with an additional pass required in instances where target sample numbers were not cumulatively attained. All fish captured during each pass were retained in buckets containing aerated water. At the conclusion of each pass, total fishing effort (i.e., electrofishing seconds) was recorded to allow calculation of time-standardized catch. All captured fish were identified to species and enumerated, following which any non-target species were released alive at the area of capture. All captured arctic charr were temporarily retained for processing using methods described in Section 2.4.3.3. For each electrofishing pass, GPS coordinates were recorded at the boundaries of each electrofishing reach.

Littoral/profundal areas of the study lakes were sampled for arctic charr using experimental (gang index) gill nets. Multiple-panel, 2 m high gill nets with total lengths ranging from 61 to 91 m (200’ to 300’) and bar mesh sizes ranging from 38 to 76 mm (1.5” to 3”) were set on the bottom for short durations (range from 0.5 to 2.9 hours per set; average of 1.4 hours) during daylight hours. Upon retrieval of each net, all captured fish were identified to species, enumerated, and processed (see below) separately for each individual gill net panel mesh size. For each gill net set, information including mesh size, duration of sampling, and GPS coordinates were recorded.

2.4.3.3 Field and Laboratory Processing

Following completion of each electrofishing pass and retrieval of each individual gill net panel, all captured arctic charr were subject to processing in the field. For all live captures, the external condition of each fish was assessed visually for the presence of any deformities, erosions, lesions, and tumors (DELT), in addition to evidence of external and/or internal parasites. All observations were recorded on field sheets, with supporting photographs taken as appropriate. Each fish was then subject to measurement of fork and total length to the nearest millimetre using a standard measuring board. Following length measurements, fish captured by electrofisher were individually weighed to the nearest milligram using an Ohaus Model 123 Scout-Pro analytical balance (Ohaus Corp., Pine Brook, NJ) with a surrounding draft shield. For arctic charr captured by gill net, individuals were weighed using Pesola™ spring scales (Pesola AG, Baar Switzerland) demarcated at intervals of 1 to 2% of the total scale range and providing accuracy of ±0.3% of the fish mass. The Pesola™ spring scale for individual weight measurement of gill-net captured fish was selected so that the fish weight was near the top of the scale’s range to ensure that measurements achieved a resolution near 1%. All live arctic charr that were not selected for the collection of aging structures were released near the location of capture following measurements.

As specified for EEM non-lethal fish population surveys (see Environment Canada 2012), approximately 10% of the targeted number of arctic charr captured using electrofishing methods were sacrificed for collection of age structures. Otoliths were removed from all sacrificed individuals for age determination. Upon removal, otoliths were wrapped separately in wax paper, placed inside envelopes labelled with the fish identification, and then dried for storage. Otoliths were shipped to North Shore Environmental Services (NSES; Thunder Bay, ON) for age determination. At the laboratory, otoliths were prepared for aging using a “crack and burn” method. The prepared samples were mounted on a glass slide using a mounting medium and examined under a compound microscope using transmitted light to determine fish age. For each otolith, the age and edge condition were recorded along with a confidence rating for the age determination.

2.4.3.4 Data Analysis

Fish community data from the mine-exposed and reference study areas were compared based on total catch and catch-per-unit-effort (CPUE) for each sampling method. Electrofishing CPUE was calculated as the number of fish captured per electrofishing minute for each lake nearshore or lotic study area, and gill netting CPUE was calculated as the number of fish captured per 100 metre·hours of net used for each study lake. Temporal comparison of fish community assemblage was conducted qualitatively using electrofishing CPUE and gill netting CPUE to evaluate relative changes in fish catches at mine area lakes between mine baseline and individual years of mine operation from 2015 to 2020.

Arctic charr population health was assessed separately for electrofishing and experimental gill netting data sets. Initial data analysis included the plotting of length frequency distributions so that, together with appropriate age data, young-of-the-year (YOY) individuals could be distinguished from the older juvenile/adult life stages (electrofishing data set), or various size/age classes could be distinguished from one another (gill netting data set). Where sample sizes allowed, the YOY age class was assessed separately from the older juvenile/adult age classes for lake nearshore fish survey endpoints. Fish size endpoints of fork length and fresh body weight were summarized by separately reporting mean, median, minimum, maximum, standard deviation, standard error, and sample size by age class (if possible) for each study area. Measurement endpoints were used as the basis for evaluating four response categories (survival, growth, reproduction, and energy storage; Table 2.6) according to the procedures outlined for EEM by Environment Canada (2012). Length-frequency distributions were compared between the mine-exposed lakes and the reference lake or between lotic study areas using data

Table 2.6: Fish Population Survey Endpoints Examined for the Mary River Project CREMP 2020 Study

Response Category	Endpoint	Statistical Procedure[c,d,e]	Critical Effect Size
Survival	Length-frequency distribution[a]	K-S Test	not applicable
Energy Use (size)	Size (fresh body weight)[b]	ANOVA	25%
	Size (fork length)[b]	ANOVA	25%
Energy Use (reproduction)	Relative abundance of YOY (% composition)[b]	K-S Test	not applicable
Energy Storage	Condition (body weight against length)[a]	ANCOVA	10%

[a] Endpoints used for determining "effects" as designated by statistically significant difference between mine-exposed and reference areas (Environment Canada 2012).

[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] ANOVA (Analysis of Variance) used except for non-normal data, where Mann Whitney U-tests were used.

[d] ANCOVA (Analysis of Covariance). 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).

[e] K-S Test (Kolmogorov-Smirnov test).

collected in 2020, and between the combined baseline period and 2020 for individual lakes (i.e., before-after analysis), using a non-parametric two-sample Kolmogorov-Smirnov (KS) test. Potential differences in reproductive success between paired study areas were based on evaluation of the relative proportion of arctic charr YOY between the mine-exposed and reference areas, and by comparing the results of KS tests conducted with and without YOY individuals included in the data sets.

Mean fork length and body weight were compared between mine-exposed and reference study areas using data collected in 2020, and between the mine baseline period and 2020. Data were evaluated for normality and homogeneity of variance before applying parametric statistical tests such as ANOVA. In cases where data did not meet the assumptions of ANOVA despite log-transformation, a non-parametric Mann-Whitney U-test was used to test for differences between study areas or study periods. Body weight at fork length (condition) was compared using Analysis-of-Covariance (ANCOVA). Prior to conducting the ANCOVA tests, scatter plots of all variable and covariate combinations were examined to identify outliers, leverage values, or other unusual data. The scatter plots were also examined to ensure that there was adequate overlap between the 2020 mine-exposed and reference area data, or between the 2020 mine-exposed and baseline data, and that there was a linear relationship between the variable and the covariate. To verify the existence of a linear relationship, each relationship was tested using linear regression analysis by area and evaluated at an alpha level of 0.05. If it was determined that there was no significant linear regression relationship between the variable and covariate for the 2020 mine-exposed area and the reference data or mine-exposed area baseline data, then the ANCOVA was not performed.

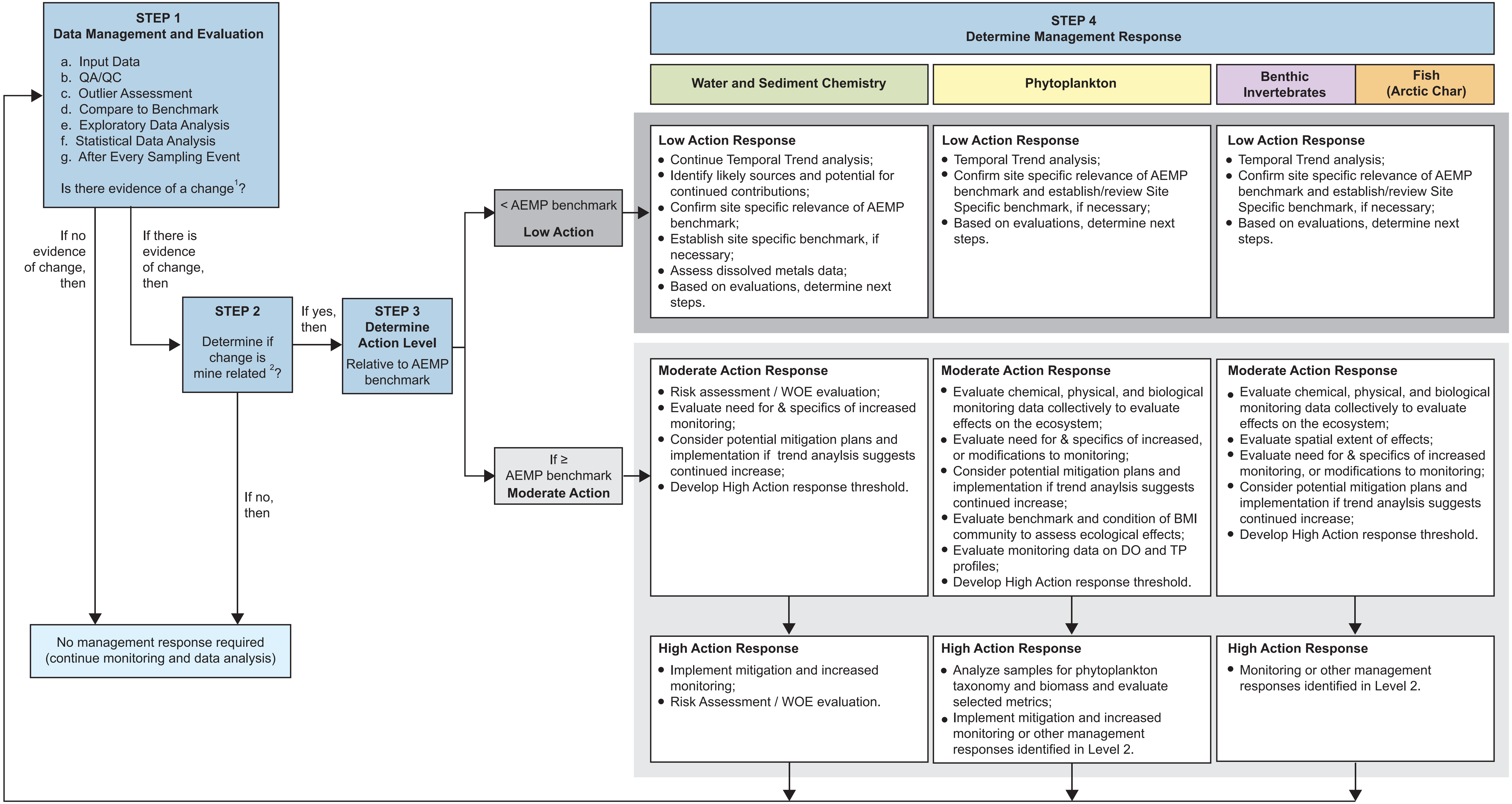
Once it was determined that ANCOVA could be used for statistical analysis, the first step in the ANCOVA was to test whether the slopes of the regression lines between data sets were equal. This was accomplished by including an interaction term (dependent × covariate) in the ANCOVA model and evaluating if the interaction term was significantly different, in which case the regression slopes would not be equal between data sets and the resulting ANCOVA would provide spurious results. In such cases, the options considered to determine if a full ANCOVA could proceed included 1) removal of influential points using Cook's distance and re-assessment of equality of slopes; and/or, 2) Coefficients of Determination that considered slopes equal regardless of an interaction effect (Environment Canada 2012). For the Coefficients of Determination, the full ANCOVA was completed to test for main effects, and if the r^2 value of both the parallel regression model (interaction term) and full regression model were greater than 0.8 and within 0.02 units in value, the full ANCOVA model was considered valid (Environment Canada 2012). If both methods proved unacceptable, a statistically significant interaction effect (slopes are not equal) was noted, and the magnitude of effect was estimated at both the minimum and maximum overlap of covariate variables between areas (Environment Canada 2012). If the interaction term was not significant (i.e., homogeneous slopes between the two populations), then the full ANCOVA model was run without the interaction term to test for differences in adjusted means between the two data sets. The adjusted mean was then used as an estimate of the population mean based on the value of the covariate in the ANCOVA model.

For endpoints showing significant differences, the magnitude of difference between 2020 mine-exposed and reference data or between 2020 and baseline data was calculated as described by Environment Canada (2012) using mean (ANOVA), adjusted mean (ANCOVA with no significant interaction), or predicted values (ANCOVA with significant interaction). The anti-log of the mean, adjusted mean, or predicted value was used in the equations for endpoints that were $\log_{10}$-transformed. If there was no significant difference between data sets, the minimum detectable effect size was calculated as a percent difference from the reference mean/mine-exposed baseline mean for ANOVA or adjusted reference mean/mine-exposed baseline mean for ANCOVA at alpha = beta = 0.10 using the square root of the mean square error (generated during either the ANOVA or ANCOVA procedures) as a measure of variability in the sample population based on formula provided by Environment Canada (2012). Finally, if outliers or leverage values were observed in a data set (or sets) upon examination of scatter plots and residuals, then the values were removed and ANOVA or ANCOVA tests were repeated and presented for both the complete and reduced data sets. Similar to the CES applied to the benthic invertebrate community survey, a magnitude of difference of ± 10% was applied for condition (CES_C), to define ecologically relevant differences consistent with those recommended for EEM (Table 2.6; Munkittrick et al. 2009; Environment Canada 2012).

Finally, an *a priori* power analysis was completed to determine appropriate fish sample sizes for future surveys as recommended by Environment Canada (2012). These analyses were completed based on the mean square error values generated during the ANOVA or ANCOVA procedures and were calculated with alpha and beta set equally at 0.10. Two main assumptions served as the basis for the power analysis. The first assumption was that the fish caught in each of the mine-exposed and reference areas in 2020, or at mine-exposed areas in 2020 and baseline, were representative of the population at large (i.e., similar distribution and variance with respect to the parameters examined). The second assumption was that the characteristics of the populations would not change substantially prior to the next study. The power analysis results were reported as the minimum sample size (number of fish/area) required to detect a given magnitude of difference (effect size) between the mine-exposed and reference area/baseline populations for each endpoint. The magnitude of difference was presented as a percentage decrease or increase of the reference area/baseline mean for each endpoint as measured during the fish population study using the observed pooled standard deviation of the residuals from ANOVA or parallel slope ANCOVA model.

2.5 Effects Assessment

The objective of the Mary River Project 2020 CREMP was to evaluate potential mine-related influences on chemical and biological conditions at aquatic environments located near the mine following the sixth full year of mine operation. The 2020 CREMP incorporated an effects-based approach that included standard EEM techniques to provide rigorous evaluation of potential mine-related effects at key waterbodies that receive mine-related deposits from various mine effluents, surface runoff, and aerial deposition of dust originating from mine operations. Under this approach, water quality and sediment quality data were used to support the interpretation of phytoplankton, benthic invertebrate community, and fish population survey data collected at mine-exposed areas of the Camp Lake, Sheardown Lake, Mary River, and Mary Lake systems. The evaluation of potential mine-related effects within these systems was based upon comparisons of the 2020 data to applicable reference data, to available baseline data, and to guidelines that included site-specific AEMP benchmarks. The latter were developed to guide management response decisions within a four-step Assessment Approach and Management Response Framework as outlined in the Mary River Project AEMP (Figure 2.8; Baffinland 2015). An effects determination was conducted for all key waterbodies located within each of the Camp Lake, Sheardown Lake, Mary River, and Mary Lake systems which included summarization of instances in which the Mary River Project AEMP benchmarks for water quality and sediment quality were exceeded at waterbodies examined under the CREMP. Based on weight-of-evidence that considered incidences in which the AEMP benchmarks were exceeded and corroboration of adverse influences on aquatic biota based on the results of biological monitoring, the effects determination identified potential biological effects at these waterbodies in 2020 and, where appropriate, provided recommendation(s) for future study to assist Baffinland with decisions regarding appropriate management actions.



Notes:
1. Statistical or qualitative change when compared to:
   a) benchmark,
   b) baseline values,
   c) temporal or spatial trends
2. Mine related changes are a result of the mine and associated facilities including but not limited to effects from effluent discharges and dust deposition that are distinguished from natural causes or variation.

Baffinland Mary River Project AEMP Data Assessment Approach and Response Framework

Date: March 2021
Project 207202.0045

minnow environmental inc.

Figure 2.8

3 CAMP LAKE SYSTEM

3.1 Camp Lake Tributary 1 (CLT1)

3.1.1 Water Quality

Camp Lake Tributary 1 (CLT1) dissolved oxygen was consistently near full saturation at the north branch and main stem stations during all spring, summer, and fall monitoring events, and were comparable to, or slightly higher than, concentrations at the reference creeks (Appendix Tables C.1 to C.3; Figure 3.1). In addition, dissolved oxygen concentrations at CLT1 north branch and lower main stem stations were above the WQG lowest acceptable concentration for early life stages of cold-water biota (i.e., 9.5 mg/L) at the time of biological sampling in August 2020 (Figure 3.1; Appendix Table C.12). No consistent spatial patterns in pH were shown with progression downstream through the CLT1 north branch (Stations L1-08 to L1-02) and main stem (Stations L2-03 to L0-01) stations for each of the spring, summer, and fall monitoring events (Appendix Tables C.1 to C.3). Although pH was significantly higher at CLT1 compared to Unnamed Reference Creek during the fall sampling event in August 2020, the pH at all CLT1 stations was consistently within WQG limits in 2020 in all spring, summer, and fall sampling events (Figure 3.1; Appendix Tables C.1 to C.3). No significant difference in pH was indicated between CLT1 north branch and lower main stem in August 2020, indicating no substantial influence of the Milne Inlet Tote Road on in-stream pH (Figure 3.1; Appendix Table C.12).

Specific conductance at CLT1 was generally highest in the upper main stem (Station L2-03) and lowest in the north branch (Stations L1-02 and L1-08), with intermediate values observed at the lower main stem stations reflecting mixing of these two branches and suggesting a potential mine-related source affecting water quality of the CLT1 upper main stem (Appendix Tables C.1 to C.3, and C.12). Specific conductance was consistently higher at CLT1 compared to the reference creek stations over the spring, summer, and fall sampling events in 2020 (Appendix Tables C.1 to C.3, and C.13), and was also significantly higher at CLT1 compared to Unnamed Reference Creek during the August 2020 biological study (Figure 3.1). No significant difference in specific conductance was indicated between the CLT1 north branch and lower main stem in August 2020 (Appendix Table C.12), suggesting that the source of elevated specific conductance was unrelated to the Milne Inlet Tote Road but rather was associated with the upper portion of the CLT1 system.

At the CLT1 north branch stations (L1-08 and L1-02), water chemistry met AEMP benchmarks and WQG in 2020 except for copper concentrations, which were elevated relative to one or both criteria during the spring, summer, and fall sampling events (Table 3.1; Appendix Table C.14). However, like most parameters, copper concentrations at the CLT1 north branch were not

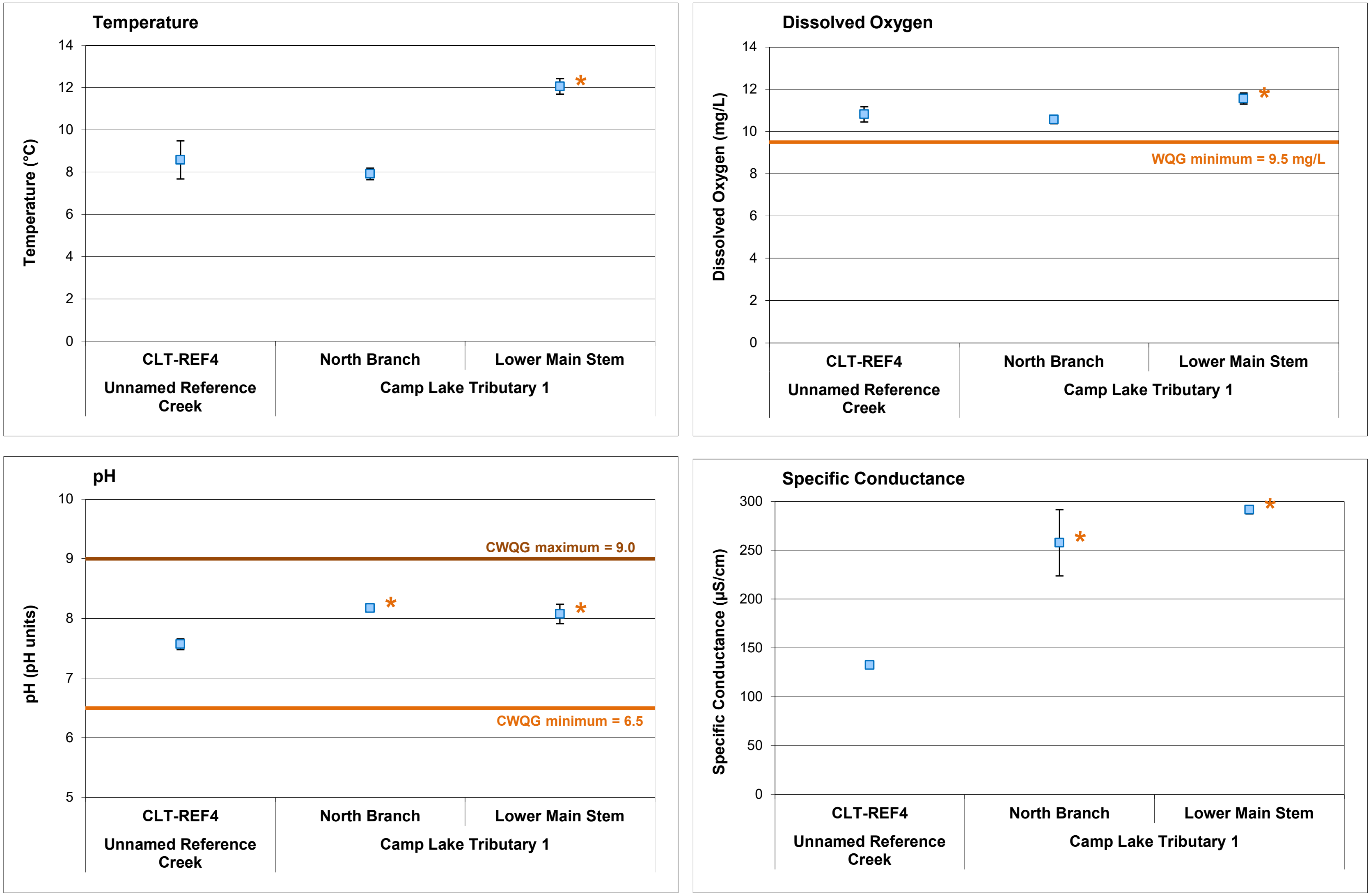


Figure 3.1: Comparison of In Situ Water Quality Variables (mean ± SD; n = 5) Measured at Camp Lake Tributary 1 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Note: An asterisk (*) next to data point indicates mean value differs significantly from the Unnamed Reference Creek mean.

Table 3.1: Mean Water Chemistry at Camp Lake Tributary 1 (CLT1) Monitoring Stations During Spring, Summer, and Fall, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Reference Creeks (n=4)			North Branch			Upper Main Stem (L2-03)			Lower Main Stem		
					Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	55	134	175	111	192	216	258	393	449	155	282	300
	pH (lab)	pH	6.5 - 9.0	-	7.63	8.01	8.05	8.04	8.14	8.14	8.16	8.01	8.11	8.19	8.23	8.23
	Hardness (as $CaCO_3$)	mg/L	-	-	23.6	57.05	82.6	52.2	90.5	112.5	103	147	191	70	128	149
	Total Suspended Solids (TSS)	mg/L	-	-	3.2	2.7	2	2.35	2	2	9.9	<2.0	<2.0	2.2	2.0	2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	85	85	99	86	101	54	158	191	236	110	132	110
	Turbidity	NTU	-	-	1.87	6.62	2.49	1.21	0.19	0.18	15.80	2.38	2.62	2.31	0.79	0.88
	Alkalinity (as $CaCO_3$)	mg/L	-	-	24	61	69	53	94	101	93	138	156	69	122	133
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.01	0.01225	0.01	0.01	0.01	0.016	0.064	0.024	0.036	0.010	0.010	0.013
	Nitrate	mg/L	3	3	0.020	0.062	0.076	0.051	0.074	0.075	1.03	1.520	1.710	0.149	0.280	0.350
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.005	0.005	0.005	0.0089	0.0099	0.0124	0.005	0.005	0.005
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.02	0.15	0.15	0.05	0.15	0.15	1.04	0.32	0.54	0.15	0.16	0.18
	Dissolved Organic Carbon	mg/L	-	-	1.93	3.44	2.31	2.65	3.01	2.51	4.79	6.01	8.00	3.41	4.76	3.79
	Total Organic Carbon	mg/L	-	-	2.23	3.05	2.14	3.50	3.85	2.86	5.87	7.48	6.86	4.68	5.51	4.08
	Total Phosphorus	mg/L	0.030^{α}	-	0.0045	0.0065	0.0039	0.0037	0.0030	0.003	0.0197	0.0093	<0.0030	0.0082	0.0031	0.0030
	Phenols	mg/L	0.004^{α}	-	0.0010	0.0010	0.0021	0.0010	0.0013	0.0010	<0.0010	0.0012	0.0018	0.0010	0.0010	0.0013
Anions	Bromide (Br)	`	-	-	0.10	0.1	0.1	0.1	0.1	0.1	<0.10	<0.10	<0.10	0.1	0.1	0.1
	Chloride (Cl)	mg/L	120	120	1.2	4.07	7.09	1.42	3.01	4.53	16.4	27.70	34.4	4.4	11.2	14.7
	Sulphate (SO_4)	mg/L	218^{β}	218	1.31	5.52	9.25	2.57	5.17	7.25	8.22	16.40	19.60	3.48	7.97	11.13
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0775	***0.3106***	0.0593	0.0194	0.0087	0.0080	***0.2700***	0.0495	0.0979	0.0566	0.0154	0.0124
	Antimony (Sb)	mg/L	0.020^{α}	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.00010	0.00013	0.00010	0.00010	0.00010	0.00010	0.00018	0.00015	0.00014	0.00010	0.00010	0.00010
	Barium (Ba)	mg/L	-	-	0.00362	0.00948	0.01031	0.00758	0.01215	0.01365	0.01240	0.01510	0.01800	0.00889	0.01470	0.01620
	Beryllium (Be)	mg/L	0.011^{α}	-	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005	<0.00050	<0.00050	<0.00050	0.0005	0.0005	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0003875	0.0005	0.0005	0.0005	0.0005	<0.00050	<0.00050	<0.00050	0.0005	0.0005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.01	0.010	0.010	0.010	0.017	0.025	0.023	0.010	0.012	0.012
	Cadmium (Cd)	mg/L	0.00012	0.00008	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	<0.000010	<0.000010	<0.000010	0.00001	0.00001	0.00001
	Calcium (Ca)	mg/L	-	-	4.9	11.8	16.5	10.2	17.8	21.8	20.6	29.4	35.7	14.1	25.3	28.1
	Chromium (Cr)	mg/L	0.0089	0.0089	0.00050	0.00082	0.00050	0.00050	0.00050	0.00050	0.00059	<0.00050	<0.00050	0.00050	0.00050	0.00050
	Cobalt (Co)	mg/L	0.0009^{α}	0.0040	0.00010	0.00016	0.00010	0.00010	0.00010	0.00010	0.00027	0.00019	0.00024	0.00010	0.00010	0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.00071	0.00115	0.00102	0.00206	***0.00222***	0.00216	0.00164	0.00134	0.00159	0.00185	0.00194	0.00196
	Iron (Fe)	mg/L	0.30	0.326	0.077	0.2425	0.06625	0.030	0.030	0.030	***0.420***	***0.423***	***0.522***	0.080	0.123	0.100
	Lead (Pb)	mg/L	0.001	0.001	0.000107	0.000226	0.000092	0.000053	0.000050	0.000050	0.000987	0.000092	0.000222	0.000102	0.000050	0.000050
	Lithium (Li)	mg/L	-	-	0.0010	0.0011	0.0010	0.0010	0.0013	0.0013	0.0033	0.0042	0.0042	0.0015	0.0026	0.0026
	Magnesium (Mg)	mg/L	-	-	2.86	6.7	9.6	6.4	11.2	13.9	13.1	19.1	24.2	8.8	15.7	18.2
	Manganese (Mn)	mg/L	0.935^{β}	-	0.00136	0.00300	0.00102	0.00078	0.00063	0.00061	0.01970	0.03230	0.03820	0.00338	0.00846	0.00766
	Mercury (Hg)	mg/L	0.000026	-	0.0000050	0.000005	0.000005	0.000005	0.000005	0.000005	<0.0000050	<0.0000050	<0.0000050	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00015	0.00045	0.00057	0.00050	0.00116	0.00127	0.00199	0.00361	0.00385	0.00073	0.00132	0.00148
	Nickel (Ni)	mg/L	0.025	0.025	0.00050	0.00070	0.00057	0.00055	0.00057	0.00057	0.00711	0.00139	0.00165	0.00082	0.00108	0.00100
	Potassium (K)	mg/L	-	-	0.45	0.93	1.04	1.43	2.30	2.56	2.85	4.05	4.40	1.67	2.64	2.80
	Selenium (Se)	mg/L	0.001	-	0.0010	0.0007625	0.001	0.001	0.001	0.001	<0.0010	<0.0010	<0.0010	0.001	0.001	0.001
	Silicon (Si)	mg/L	-	-	0.62	1.25	0.87	0.67	0.92	0.96	1.23	0.94	1.08	0.80	1.12	1.11
	Silver (Ag)	mg/L	0.00025	0.0001	0.000010	0.00002	0.00001	0.00001	0.00001	0.00001	<0.000010	<0.000010	<0.000010	0.00001	0.00001	0.00001
	Sodium (Na)	mg/L	-	-	0.83	2.76	3.97	0.68	1.52	1.84	9.30	16.00	19.00	2.43	5.82	7.00
	Strontium (Sr)	mg/L	-	-	0.00488	0.01391	0.01850	0.00630	0.01185	0.01465	0.02020	0.03110	0.03850	0.01100	0.02310	0.02707
	Thallium (Tl)	mg/L	0.0008	0.0008	0.00010	0.00008	0.00010	0.00010	0.00010	0.00010	<0.00010	<0.00010	<0.00010	0.00010	0.00010	0.00010
	Tin (Sn)	mg/L	-	-	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010	0.0001	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.011	0.0241	0.0100	0.0100	0.0100	0.0100	<0.010	<0.010	<0.010	0.0100	0.0100	0.0100
	Uranium (U)	mg/L	0.015	-	0.00045	0.00405	0.00737	0.00091	0.00454	0.00781	0.01500	0.02470	0.03320	0.00265	0.00736	0.01022
	Vanadium (V)	mg/L	0.006^{α}	0.006	0.0010	0.0012	0.0010	0.0010	0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0010	0.0010	0.0010
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.003	0.003	0.003	0.003	0.003	0.0034	<0.0030	<0.0030	0.003	0.003	0.0030

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake tributary system.

particularly elevated compared to the reference creek stations, with only total molybdenum and potassium concentrations showing slight elevation (i.e., 3- to 5-fold) at the CLT1 north branch but only during the spring sampling event in 2020 (Table 3.1; Appendix Tables C.14 and C.15). Total copper concentrations at the CLT1 north branch were, on average, higher in the spring of 2019 and 2020 compared to baseline, and in fall of all years of commercial mine production from 2015 to 2020 compared to baseline, but concentrations during summer were comparable between years of mine production from 2015 to 2020 and baseline (Appendix Figure C.2). Therefore, only a minor influence on water quality, reflected mainly by a slight elevation in copper concentrations, was indicated at the CLT1 north branch since commercial mine production commenced at the project in 2015.

At the CLT1 upper main stem (Station L2-03), mean concentrations of aluminum and iron were above their respective AEMP benchmarks in the spring sampling event and all spring, summer, and fall sampling events, respectively, in 2020 (Table 3.1). The total concentration of uranium was also elevated above WQG at the upper main stem in both summer and fall 2020 (Table 3.1). In addition to iron and uranium concentrations, chloride, nitrate, and total and dissolved manganese, molybdenum, and sodium concentrations were moderately (i.e., 5-fold to 10-fold) to highly (i.e., ≥10-fold) elevated at the CLT1 upper main stem compared to average concentrations at the reference creeks in two or more seasonal sampling events in 2020 (Table 3.1; Appendix Table C.15). Although total concentrations of aluminum and several other parameters were elevated at the CLT1 upper main stem during the spring sampling event compared to AEMP benchmarks and/or concentrations at the reference creeks, the elevation in these parameters appeared to be related to suspended minerals in the water column as indicated by elevated turbidity at the time of sampling (Appendix Table C.14).[4] In contrast, dissolved concentrations of iron, manganese, molybdenum, sodium, and uranium were moderately to highly elevated at the upper main stem in two or more seasonal sampling events in 2020, and thus elevations of these metals (and chloride and nitrate) appeared to reflect a mine-related source. Of those parameters with AEMP benchmarks, only iron, manganese, nitrate, and sulphate concentrations were elevated at the CLT1 upper main stem in 2020 compared to baseline, of which only the concentration of iron was above site-specific AEMP benchmarks (Appendix Figure C.2). Molybdenum and uranium concentrations, which do not have AEMP

[4] Total aluminum and iron concentrations were also above AEMP benchmarks and/or WQG at the MRY-REF3 lotic reference station in 2020, where higher turbidity typically occurs compared to the other reference creek stations (Appendix Table B.2). This suggested natural elevation of these metals in regional watercourses as a result, in part, of naturally greater amount of mineral/particulate matter suspended in the water at this station. Evaluation of dissolved concentrations of aluminum showed similar average concentrations between CLT1 stations and the reference creek stations, corroborating that total aluminum concentrations were associated with turbidity and suggesting that mine operations were not a key source of aluminum to the system (Appendix Tables C.4, C.16, and C.17).

benchmarks, also showed elevated concentrations at the CLT1 upper main stem in 2020 compared to baseline (Appendix Figure C.2).

At the CLT1 lower main stem (Stations L1-09, L1-05, and L0-01), water chemistry met all AEMP benchmarks and WQG over the duration of spring, summer, and fall sampling events in 2020, including for copper and iron concentrations which were elevated above the AEMP benchmarks at the north branch and upper main stem, respectively (Table 3.1; Appendix Table C.14). Nevertheless, manganese, nitrate, and uranium concentrations were moderately elevated at the CLT1 lower main stem compared to the reference creeks in one of the three seasonal sampling events in 2020 (Appendix Table C.15). Of those parameters with AEMP benchmarks, only copper, nitrate, and sulphate showed elevated concentrations in 2020 compared to baseline at the lower main stem (Appendix Figure C.2), of which the elevation in copper likely reflected a north branch source. Similar to the upper main stem, molybdenum and uranium concentrations, which do not have applicable AEMP benchmarks, were also elevated at the CLT1 lower main stem in 2020 compared to baseline (Appendix Figure C.2).

Higher iron, manganese, molybdenum, nitrate, and uranium concentrations at the CLT1 main stem and/or lower stem stations following the initiation of commercial mine operation potentially reflected blasting/excavating activity (including associated dust generation) at the Mine Site QMR2 Quarry[5], as well as fugitive dust generation from increased truck usage on the Milne Inlet Tote Road, compared to the baseline period. The relatively high concentrations of nitrate over years of mine operation at CLT1 were consistent with the deposition of explosives residue from blasting at the QMR2 Quarry as the source of these compounds. Concentrations of total molybdenum and uranium were highest at CLT1 main stem stations in 2019 and 2020 compared to all previous years of mine operation, but concentrations of these parameters generally remained well below WQG suggesting low potential for biological effects (Appendix Figure C.2). Overall, mine-related influences on water quality of the CLT1 were primarily reflected as elevated conductivity and concentrations of copper at the north branch, and elevated concentrations of nitrate, chloride, sulphate, and total metals including manganese, molybdenum, sodium, and uranium, at the upper main stem station. Despite elevation of parameter concentrations at the CLT1 north branch and upper main stem, none were elevated above applicable AEMP benchmarks or WQG at the lower main stem prior to discharge to Camp Lake.

3.1.2 Sediment Quality

In-stream substrate at CLT1 upstream (north branch; CLT1-US) and downstream (lower main stem; CLT1-DS) study areas was composed mainly of cobble material (i.e., substrate with

[5] The QMR2 quarry is used to provide material for mine infrastructure projects (e.g., road construction).

diameters of 6 to 25 cm), with sand constituting only a trace amount (i.e., <1%) of the material observed at the sediment surface (Minnow 2018). Sediment sampled for chemistry analysis at both CLT1 study areas was predominantly composed of medium-sized coarse sand (Appendix Table D.7). The TOC content of the sampled sediment was generally low (i.e., <2%) at both CLT1 study areas, but was elevated (i.e., 7.5 and 13.5-fold higher at CLT1-US and CLT1-DS, respectively) compared to average lotic reference conditions suggesting a slightly more depositional environment at CLT1 (Table 3.2; Appendix Tables D.8 to D.10).

Metal concentrations in sediment from CLT1-US and CLT1-DS were generally elevated compared to those measured at lotic reference areas (Appendix Table D.10). This was particularly the case for aluminum, barium, copper, magnesium, manganese, molybdenum, nickel, potassium, and zinc, for which mean concentrations were five-fold or greater at one or both of CLT1-US and CLT1-DS compared to the average at reference areas (Table 3.2; Appendix Table D.10). Of these metals, only manganese, molybdenum, and potassium, together with uranium and zirconium, occurred at concentrations 1.5 times or greater at the downstream area compared to the upstream area (Table 3.2), potentially reflecting an influence of the Milne Inlet Tote Road or other mine sources on metal concentrations in sediment at CLT1-DS. Despite higher metal concentrations in sediment at CLT1-US and CLT1-DS compared to average lotic reference conditions, concentrations of all metals were well below applicable SQG at both CLT1 study areas (Table 3.2; Appendix Tables D.8 and D.9).

3.1.3 Phytoplankton

Chlorophyll-a concentrations at the upper-most CLT1 north branch station (Station L1-08) were lower than the mean concentration among reference creeks for spring, summer, and fall sampling events in 2020 (Figure 3.2). However, chlorophyll-a concentrations farther downstream within the north branch (i.e., Station L1-02) were generally comparable to chlorophyll-a concentrations at the reference creeks for all seasonal sampling events, suggesting no marked differences in phytoplankton abundance between the CLT1 north branch and the reference creek stations (Figure 3.2).

Within the CLT1 main stem, chlorophyll-a concentrations were generally highest at upstream-most Station L2-03 during spring, summer, and fall sampling events in 2020 (Figure 3.2). On average, chlorophyll-a concentrations were higher, but did not differ significantly, between the CLT1 main stem and reference creek stations during the spring and fall sampling events, but were significantly lower at the CLT1 main stem during the summer sampling event (Appendix Table E.2). Relatively high chlorophyll-a concentrations at Station L2-03 and in the CLT1 lower main stem during spring and summer sampling events potentially reflected higher nutrient (e.g., nitrate) concentrations compared to the reference creeks (Appendix Tables

Table 3.2: Sediment Total Organic Carbon and Metal Concentrations at Camp Lake Tributary 1 (CLT1) and Lotic Reference Area Sediment Monitoring Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Lotic Reference Stations		Camp Lake Tributary 1	
			Unnamed Reference Creek (REFCRK; n = 3)	Mary River Reference (GO-09; n = 3)	Upstream CLT1-US (n = 3)	Downstream CLT1-DS (n = 3)
			Average ± SD	Average ± SD	Average ± SD	Average ± SD
TOC	%	10[α]	0.12 ± 0.035	0.11 ± 0.012	0.88 ± 0.20	1.57 ± 1.72
Aluminum (Al)	mg/kg	-	584 ± 185	2,757 ± 1,141	7,390 ± 537	5,847 ± 1,242
Antimony (Sb)	mg/kg	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
Arsenic (As)	mg/kg	17	0.22 ± 0.11	0.38 ± 0.10	0.69 ± 0.12	0.67 ± 0.17
Barium (Ba)	mg/kg	-	2.72 ± 0.722	12.6 ± 5.05	17.8 ± 3.22	26.2 ± 5.97
Beryllium (Be)	mg/kg	-	<0.10 ± 0	0.14 ± 0.040	0.28 ± 0.032	0.23 ± 0.045
Bismuth (Bi)	mg/kg	-	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0
Boron (B)	mg/kg	-	<5.0 ± 0	5.4 ± 0.75	9.3 ± 0.85	5.5 ± 0.81
Cadmium (Cd)	mg/kg	3.5	<0.020 ± 0	<0.020 ± 0	0.047 ± 0.0078	0.049 ± 0.0042
Calcium (Ca)	mg/kg	-	494 ± 249	2,750 ± 894	2,660 ± 230	3,703 ± 948
Chromium (Cr)	mg/kg	90	7.79 ± 5.39	13.6 ± 4.34	26.7 ± 2.40	21.2 ± 6.39
Cobalt (Co)	mg/kg	-	0.953 ± 0.558	2.40 ± 0.758	6.40 ± 0.864	5.27 ± 1.42
Copper (Cu)	mg/kg	110[α]	1.21 ± 0.899	4.45 ± 2.50	23.9 ± 11.1	11.6 ± 4.95
Iron (Fe)	mg/kg	40,000[α]	12,493 ± 9,700	11,063 ± 2,423	22,833 ± 5,773	26,533 ± 9,287
Lead (Pb)	mg/kg	91	1.49 ± 0.546	3.07 ± 0.857	4.13 ± 0.654	5.73 ± 2.39
Lithium (Li)	mg/kg	-	<2.0 ± 0	5.0 ± 2.3	11.2 ± 0.462	7.8 ± 1.4
Magnesium (Mg)	mg/kg	-	444 ± 165	2,810 ± 1,212	8,297 ± 274	6,910 ± 1,790
Manganese (Mn)	mg/kg	1,100[α,β]	27.4 ± 14.6	76 ± 29.4	167 ± 34	247 ± 73
Mercury (Hg)	mg/kg	0.486	<0.0050 ± 0	<0.0050 ± 0	0.0051 ± 0.00017	0.0059 ± 0.0015
Molybdenum (Mo)	mg/kg	-	<0.10 ± 0	0.11 ± 0.023	0.29 ± 0.080	1.07 ± 0.436
Nickel (Ni)	mg/kg	75[α,β]	1.76 ± 0.920	6.11 ± 1.99	18.9 ± 1.55	23.4 ± 9.28
Phosphorus (P)	mg/kg	2,000[α]	167 ± 98	350 ± 118	261 ± 27.8	235 ± 84.7
Potassium (K)	mg/kg	-	133 ± 42	750 ± 320	1,260 ± 120	2,127 ± 738
Selenium (Se)	mg/kg	-	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0
Silver (Ag)	mg/kg	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
Sodium (Na)	mg/kg	-	<50 ± 0	68 ± 21	78 ± 6.51	75 ± 22
Strontium (Sr)	mg/kg	-	2.00 ± 0.544	4.72 ± 1.01	2.85 ± 0.195	4.0 ± 1.13
Sulphur (S)	mg/kg	-	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0
Thallium (Tl)	mg/kg	-	<0.050 ± 0	0.068 ± 0.023	0.097 ± 0.021	0.122 ± 0.0321
Tin (Sn)	mg/kg	-	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0
Titanium (Ti)	mg/kg	-	83 ± 47	353 ± 123	442 ± 58	400 ± 60
Uranium (U)	mg/kg	-	0.479 ± 0.247	0.922 ± 0.298	0.898 ± 0.0956	1.52 ± 0.510
Vanadium (V)	mg/kg	-	16.8 ± 12.8	19.5 ± 5.06	24.3 ± 2.54	15.8 ± 4.95
Zinc (Zn)	mg/kg	315	3.0 ± 1.2	10.3 ± 4.31	18.9 ± 2.22	26.3 ± 6.40
Zirconium (Zr)	mg/kg	-	2.1 ± 0.91	5.8 ± 2.0	2.7 ± 0.10	4.7 ± 1.3

Indicates parameter concentration above SQG.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

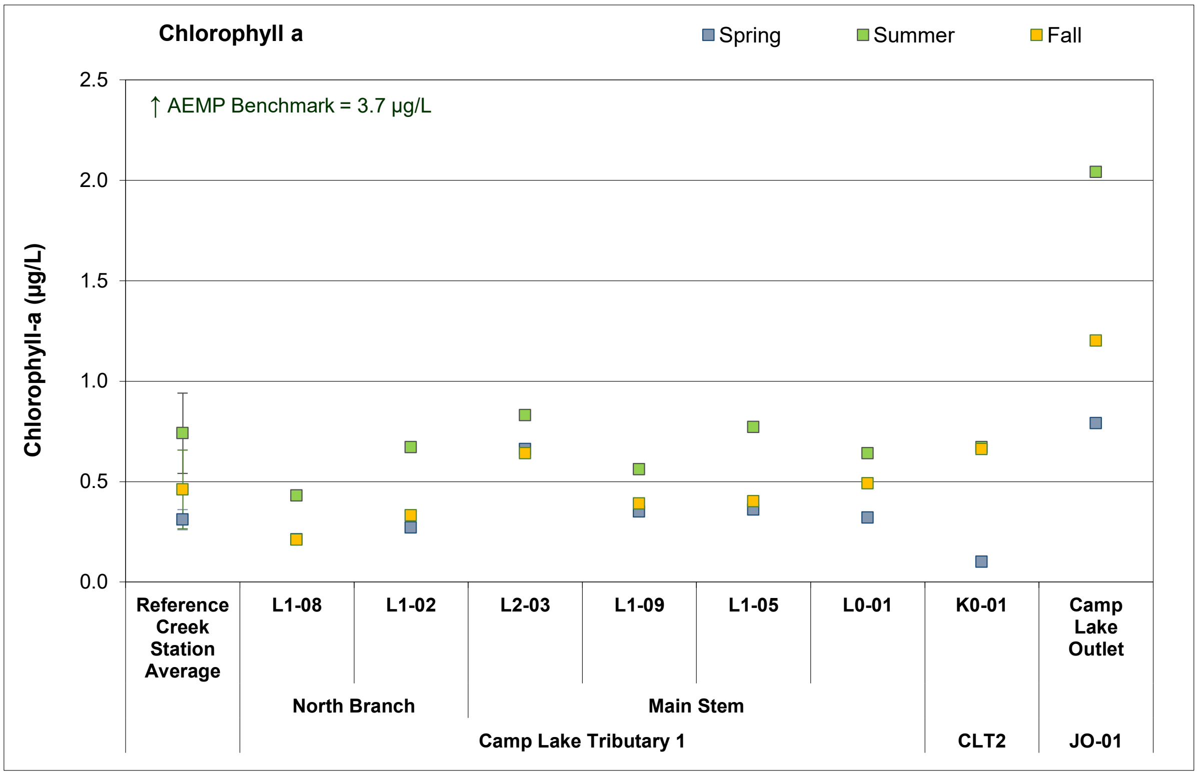


Figure 3.2: Chlorophyll-a Concentrations at Camp Lake Tributary 1 (CLT1) and Tributary 2 (CLT2) Phytoplankton Monitoring Stations, Mary River Project CREMP, 2020

C.14 and C.15). Nevertheless, chlorophyll-a concentrations at all CLT1 north branch and main stem monitoring stations were well below the AEMP benchmark of 3.7 µg/L for all seasonal sampling events in 2020 (Figure 3.2). Similar to the reference creek stations, chlorophyll-a concentrations at all CLT1 stations in 2020 suggested low (i.e., oligotrophic) phytoplankton productivity based on Dodds et al. (1998) trophic status classification for stream environments (i.e., chlorophyll-a < 10 µg/L). This trophic status classification was also consistent with an 'ultra-oligotrophic' to 'oligotrophic' WQG categorization (CCME 2020) for CLT1 based on aqueous total phosphorus concentrations typically less than 10 µg/L at each CLT1 north branch and main stem station during all spring, summer, and fall sampling events (Appendix Table C.14).

Chlorophyll-a concentrations at the CLT1 north branch in fall 2020 were similar to, or lower than, those observed in the fall during the baseline period (i.e., 2005 to 2013; Figure 3.3). At the CLT1 main stem, chlorophyll-a concentrations were higher in mine operational years from 2015 to 2020 than during the mine baseline period except for at the CLT1 mouth (Station L0-01; Figure 3.3). However, no pattern of increasing chlorophyll-a concentrations was indicated among the years of mine operation at any of the CLT1 north branch or lower main stem stations, and concentrations were continuously lower than the AEMP benchmark of 3.7 µg/L from 2015 to 2020 (Figure 3.3). Overall, the spatial and temporal analyses of chlorophyll-a concentrations suggested that the mine operation may have contributed to slightly higher phytoplankton abundance at CLT1 main stem stations during spring and fall sampling events, but not at the north branch or at the mouth of the main stem compared to reference conditions. As indicated above, higher phytoplankton abundance within the CLT1 main stem was consistent with the occurrence of higher aqueous nutrient concentrations (e.g., nitrate) compared to water quality at the reference creeks. This suggested that slightly greater phytoplankton abundance at the CLT1 main stem was the result of current mine operations and specifically, the introduction of nutrients to the system because of active quarrying at the QMR2 pit. Despite slightly greater phytoplankton abundance at the CLT1 main stem stations than at the reference creeks in spring and fall of 2020, the CLT1 north branch and main stem have remained 'oligotrophic' since the commencement of commercial mine operation in 2015.

3.1.4 Benthic Invertebrate Community

3.1.4.1 Upstream North Branch (CLT1 US)

Benthic invertebrate density at the CLT1 upstream (north branch) was significantly greater than at the reference creek, and no significant differences in richness and Simpson's Evenness were indicated between the CLT1 north branch and Unnamed Reference Creek study areas (Table 3.3; Appendix Figure F.1). Differences in benthic invertebrate community assemblage between the

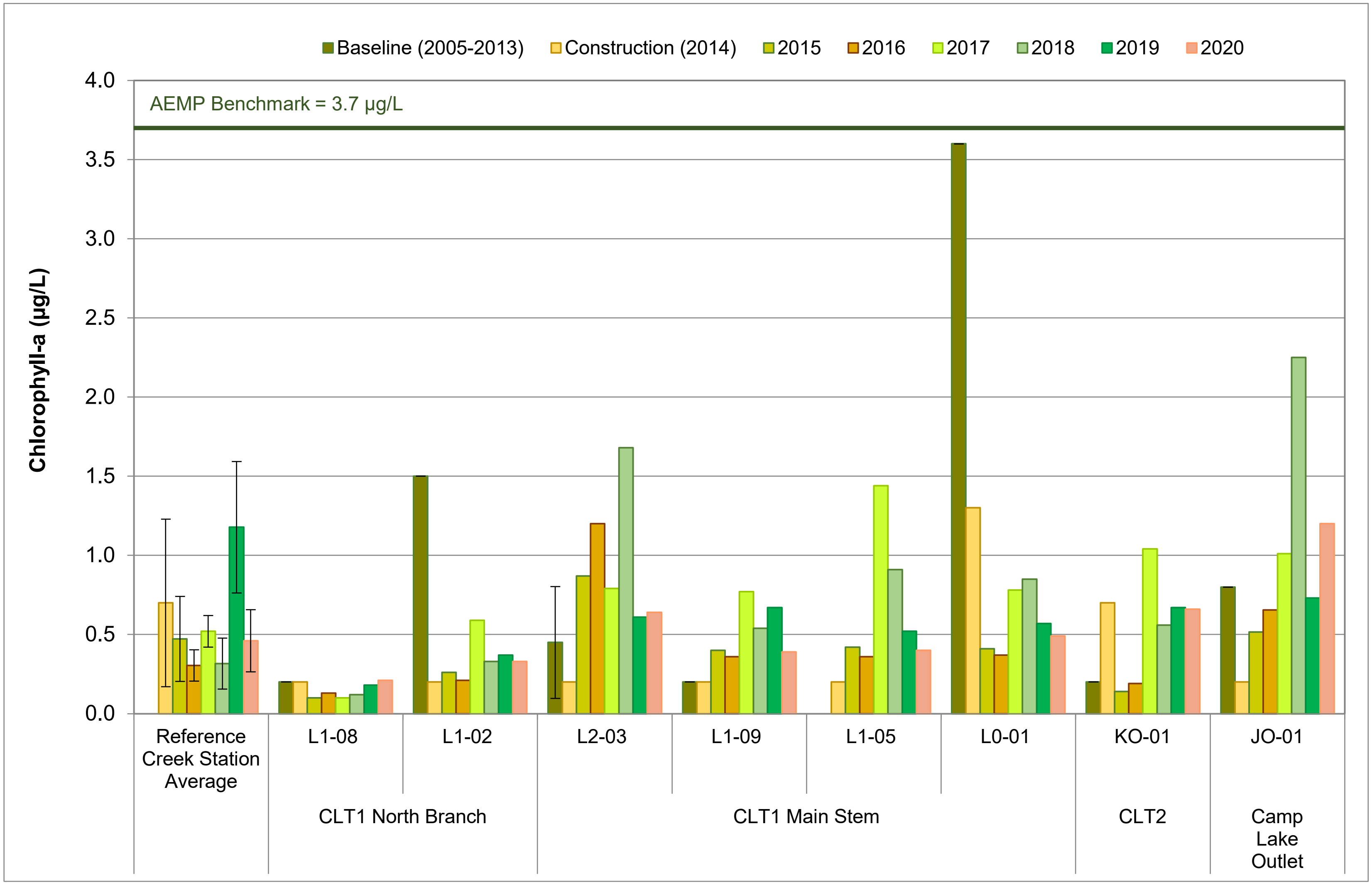


Figure 3.3: Temporal Comparison of Chlorophyll-a Concentrations at Camp Lake Tributary 1 (CLT-1) and Tributary 2 (CLT-2) for Mine Baseline (2005 to 2013), Construction (2014), and Operational (2015 to 2020) Periods during Fall

Note: Reference creek data represented by average (± SD; n = 4) calculated from CLT-REF and MRY-REF stations.

Table 3.3: Benthic Invertebrate Community Metric Statistical Comparison Results among Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 3-Area Comparison				Pair-wise, *post hoc* comparisons				
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Areas?	P-value	Study Area	Mean	Standard Deviation (SD)	Magnitude of Difference (Ref SD)	Pairwise Comparison
Density (No. per m²)	ANOVA	none	YES	0.009	Reference Creek	713	296	-	a
					CLT1 Upstream	1,635	711	3.1	b
					CLT1 Downstream	626	261	-0.3	a
Richness (No. of Taxa)	ANOVA	none	NO	0.358	Reference Creek	16.0	4.4	-	a
					CLT1 Upstream	19.2	2.5	0.7	a
					CLT1 Downstream	17.4	3.1	0.3	a
Simpson's Evenness	ANOVA	none	NO	0.216	Reference Creek	0.840	0.043	-	a
					CLT1 Upstream	0.884	0.032	1.0	a
					CLT1 Downstream	0.828	0.067	-0.3	a
Nemata (% of community)	ANOVA	log10(x+1)	NO	0.235	Reference Creek	0.7	1.3	-	a
					CLT1 Upstream	1.3	1.1	0.4	a
					CLT1 Downstream	2.1	1.0	1.0	a
Oligochaeta (% of community)	ANOVA	log10	YES	0.004	Reference Creek	1.9	1.5	-	a
					CLT1 Upstream	4.4	1.3	1.6	b
					CLT1 Downstream	11.5	8.4	6.5	b
Hydracarina (% of community)	ANOVA	log10(x+1)	NO	0.286	Reference Creek	4.5	3.7	-	a
					CLT1 Upstream	3.0	2.5	-0.4	a
					CLT1 Downstream	1.6	1.6	-0.8	a
Ostracoda (% of community)	K-W	rank	YES	0.005	Reference Creek	30.6	11.7	-	a
					CLT1 Upstream	0.5	0.6	-2.6	b
					CLT1 Downstream	0.1	0.2	-2.6	b
Chironomidae (% of community)	ANOVA	log10	YES	<0.001	Reference Creek	48.3	12.9	-	a
					CLT1 Upstream	81.7	7.9	2.6	b
					CLT1 Downstream	75.8	7.1	2.1	b
Metal Sensitive Chironomids (% of community)	ANOVA	log10(x+1)	YES	<0.001	Reference Creek	0.8	1.2	-	a
					CLT1 Upstream	13.8	4.7	10.5	b
					CLT1 Downstream	3.6	1.6	2.2	a
Simuliidae (% of community)	K-W	rank	YES	0.074	Reference Creek	9.8	8.6	-	a
					CLT1 Upstream	0.3	0.3	-1.1	b
					CLT1 Downstream	0.2	0.2	-1.1	b
Tipulidae (% of community)	K-W	rank	YES	0.048	Reference Creek	1.5	2.3	-	a
					CLT1 Upstream	7.4	6.2	2.6	b
					CLT1 Downstream	6.2	2.0	2.0	b
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	<0.001	Reference Creek	80.7	8.8	-	a
					CLT1 Upstream	58.5	8.9	-2.5	b
					CLT1 Downstream	81.6	4.5	0.1	a
Filterer FFG (% of community)	ANOVA	log10(x+1)	YES	0.099	Reference Creek	9.9	8.9	-	a
					CLT1 Upstream	4.4	5.3	-0.6	ab
					CLT1 Downstream	0.9	1.2	-1.0	b
Shredder FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	Reference Creek	2.8	2.7	-	a
					CLT1 Upstream	32.8	6.8	11.3	b
					CLT1 Downstream	14.1	4.2	4.3	c
Clinger HPG (% of community)	ANOVA	log10	YES	0.001	Reference Creek	15.8	7.7	-	a
					CLT1 Upstream	33.2	11.6	2.3	b
					CLT1 Downstream	10.3	2.9	-0.7	a
Sprawler HPG (% of community)	ANOVA	none	YES	<0.001	Reference Creek	79.4	6.6	-	a
					CLT1 Upstream	52.6	9.7	-4.1	b
					CLT1 Downstream	69.1	4.8	-1.6	a
Burrower FFG (% of community)	ANOVA	log10	YES	0.001	Reference Creek	4.8	3.3	-	a
					CLT1 Upstream	13.5	4.8	2.6	b
					CLT1 Downstream	20.6	7.4	4.8	b

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Blue shaded values indicate significant difference (ANOVA p-value ≤ 0.10) that was also outside of a Critical Effect Size of ±2 SD_{REF}, indicating that the difference between the mine-exposed area and reference area was ecologically meaningful.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

CLT1 north branch and Unnamed Reference Creek, as indicated by significantly differing Bray-Curtis Index (Appendix Table F.7), included ecologically significant[6] greater relative abundance of Chironomidae and Tipulidae dominant groups, and lower relative abundance of Ostracoda, at the CLT1 north branch (Table 3.3). Within the Chironomidae, an ecologically significantly higher relative abundance of metal-sensitive taxa was indicated at the CLT1 north branch than at the reference creek, indicating no adverse influences on biota related to metals within the watercourse. Key differences in FFGs and HPGs, including significantly higher relative abundance of the shredder FFG, clinger HPG, and burrower HPG at the CLT1 north branch, were consistent with greater amounts of in-stream vegetation (e.g., bryophyte mosses) than at the reference creek as reported in previous CREMP studies (e.g., Minnow 2020). No consistent ecologically significant differences in density, richness, Simpson's Evenness, dominant taxonomic groups, or FFGs were indicated at the CLT1 north branch in 2020 compared to baseline studies conducted in 2007 and 2011 (Appendix Tables F.8 and F.9; Appendix Figure F.2). Collectively, the 2020 data suggested that differences in benthic invertebrate community assemblage between the CLT1 north branch and Unnamed Reference Creek reflected differences in the types and/or abundance of in-stream vegetation between these study areas. This was supported by comparisons to baseline, which indicated no ecologically significant changes in benthic invertebrate community metrics at the CLT1 north branch since the commencement of commercial mine operations in 2015.

3.1.4.2 Downstream Lower Main Stem (CLT1 DS)

The benthic invertebrate community at the lower main stem of Camp Lake Tributary 1 (CLT1 DS), downstream of the Milne Inlet Tote Road crossing, did not differ significantly in density, richness, or Simpson's Evenness compared to Unnamed Reference Creek in 2020 (Table 3.3; Appendix Figure F.1). Differences in benthic invertebrate community assemblage between CLT1 DS and the reference creek, as indicated by significantly differing Bray-Curtis Index (Appendix Table F.7), included ecologically significant greater relative abundance of Oligochaeta, Chironomidae, and Tipulidae dominant groups, and lower relative abundance of Ostracoda, at CLT1 DS (Table 3.3). However, similar to the CLT1 north branch, no significant difference in the relative abundance of metal-sensitive Chironomidae and ecologically significant higher relative abundance of the shredder FFG and the burrower HPG occurred at CLT1 DS compared to the reference creek

[6] Ecological significance is defined as a magnitude of difference between the mine-exposed and reference area that is outside of a CES (CES_{BIC}) of ±2 reference area SDs (SD_{REF}) for the benthic invertebrate community metric. Differences outside of the CES_{BIC} are greater than those that would be expected to occur naturally (i.e., between two pristine reference areas), and thus require additional evaluation to determine whether the difference is mine-related considering the direction of response and taking a weight-of-evidence approach that considers the results from other study components (e.g., water chemistry) and benthic invertebrate community endpoints.

in 2020 (Table 3.3). This indicated that the differences in community features between CLT1 DS and Unnamed Reference Creek were unlikely associated with metal concentrations, but rather due to naturally differing habitat (e.g., food resources and/or substrate properties) between study areas. No consistent ecologically significant differences in density, richness, Simpson's Evenness, or dominant taxonomic groups, including the proportion of metal-sensitive chironomids, were indicated at the CLT1 lower main stem in 2020 compared to both of the 2007 and 2011 baseline studies (Appendix Table F.10; Appendix Figure F.2). A significantly higher relative abundance of the collector-gatherer FFG was generally shown at CLT1 DS since 2015 compared to baseline, potentially indicating a shift in food resources available to benthic invertebrates at the lower main stem area over time (Appendix Table F.11). However, the absence of consistent ecologically significant differences in the relative abundance of metal-sensitive taxa in years of mine operation compared to baseline suggested that the FFG differences over time were unrelated to differing metal concentrations.

Between the CLT1 study areas, benthic invertebrate density, shredder FFG relative abundance, and clinger HPG relative abundance were significantly lower downstream than upstream of the Milne Inlet Tote Road crossing, but no significant differences in richness, evenness, or dominant taxonomic groups were indicated between the downstream and upstream areas in 2020 (Table 3.3; Appendix Figure F.1). Similar to differences in community features between the CLT1 north branch and reference creek, these differences in community features between CLT1 study areas reflected lower abundance of in-stream vegetation (e.g., mosses), which serves as a key food resource and habitat for the shredder FFG and clinger HPG, respectively, at the downstream area compared to upstream of the Milne Inlet Tote Road crossing. Therefore, in-stream vegetation was the key contributor to differences in benthic invertebrate density and FFG and HPG composition between the CLT1 lower main stem and upstream study areas in 2020 rather than influences associated with the Milne Inlet Tote Road.

3.1.5 Effects Assessment and Recommendations

3.1.5.1 Upstream North Branch (CLT1 US)

At the CLT1 north branch, the following AEMP benchmarks were exceeded in 2020:

- Aqueous total copper concentration greater than the benchmark of 0.0022 mg/L in spring and summer (0.00221 mg/L and 0.00226 mg/L, respectively) at Station L1-08.

Copper concentrations at the CLT1 north branch in spring of 2019 and 2020, and in fall from 2015 to 2020, were slightly higher than concentrations in respective seasonal sampling events during baseline. However, copper concentrations at the CLT1 north branch during summer sampling events from 2015 to 2020 were comparable to baseline, but were also shown to be above the AEMP benchmark in 29% of samples taken (Appendix Figure C.2). In addition, copper concentrations in spring and fall during years of mine commercial production from 2015 to 2020 were comparable to those shown in summer during baseline. No substantial mine development has occurred in the CLT1 north branch watershed, and thus mine-related sources of copper to this portion of the watercourse potentially included fugitive dust. However, because copper concentrations farther downstream at the CLT1 main stem, closer to sources of dust generation, were below AEMP benchmarks, the source of copper to the CLT1 north branch was likely related natural minerology of the bedrock/overburden in the region of the mine. Metal concentrations in sediment of the CLT1 north branch were well below SQG. In addition, no adverse effects on phytoplankton (chlorophyll-a) or benthic invertebrates of the CLT1 north branch were indicated in 2020, nor during studies conducted since the commencement of commercial mine production in 2015, indicating that copper concentrations above the AEMP benchmark at the CLT1 north branch may not have been biologically available.

Following application of the Mary River Project AEMP Management Response Framework (Figure 2.8), uncertainty in whether a change in copper concentrations has occurred at the CLT1 north branch between the period of commercial mine production and baseline results in a low action response related to copper concentrations above the AEMP benchmark at this watercourse. An expanded spatial water quality sampling program implemented at the CLT1 north branch as a special investigation to identify whether the source(s) of copper to the watercourse reflect natural minerology of the bedrock/overburden within the watershed is recommended as an initial low action response.

3.1.5.2 Downstream Main Stem (CLT1 DS)

At the CLT1 main stem, the following AEMP benchmarks were exceeded in 2020:

- Aqueous total aluminum concentration was greater than the benchmark of 0.179 mg/L in spring at the upper main stem Station L2-03 (0.270 mg/L); and,
- Aqueous total iron concentration was greater than the benchmark of 0.326 mg/L at upper main stem Station L2-03 in spring, summer, and fall (0.420 mg/L, 0.423 mg/L, and 0.522 mg/L, respectively).

Concentrations of all parameters were below AEMP water quality benchmarks at all stations within the lower main stem (i.e., Stations L1-09, L0-05, and L0-01), and metal concentrations in sediment were below SQG at the CLT1 downstream area (CLT1 DS), in 2020. Elevation of total aluminum concentrations above the AEMP water quality benchmark at the upper main stem in spring 2020 was related to suspended mineral material in the water column as reflected by high turbidity in these samples. Because total aluminum concentrations at the CLT1 main stem in

2020 were not elevated compared to the reference creek nor to concentrations at the upper main stem during baseline, the source of aluminum to the CLT1 main stem was likely related to background minerology of material entering the system during spring runoff events. In contrast, iron concentrations at the CLT1 upper main stem in 2020 were elevated compared to concentrations at the reference creek and at CLT1 during baseline, suggesting a mine-related source of iron to the system. Relatively high iron concentrations at the CLT1 main stem following the initiation of commercial mine operation potentially reflected blasting/excavating activity (including associated dust generation) at the Mine Site QMR2 Quarry, as well as fugitive dust generation from increased truck usage on the Milne Inlet Tote Road, compared to the baseline period. Despite elevated iron concentrations at the CLT1 upper main stem, no adverse effects on phytoplankton and benthic invertebrates were indicated at the CLT1 downstream in 2020, suggesting that potential biological effects from elevated iron concentrations were likely limited only to the CLT1 upper main stem and did not extend to the lower main stem or Camp Lake.

Under the Mary River Project AEMP Data Management Response Framework (Figure 2.8), the determination of a mine-related change to a parameter concentration above the AEMP benchmark necessitates a management response (Steps 2 and 3). Because a mine-related elevation in iron concentrations occurred at the CLT1 upper main stem in 2020, but the spatial extent was limited and no biological effects were observed a short distance downstream, consideration for the establishment of benthic invertebrate community sampling stations at the CLT1 upper main stem, close to water quality Station L2-03, is recommended to evaluate possible effects on biota in this portion of the CLT1 system as a low action response.

3.2 Camp Lake Tributary 2 (CLT2)

3.2.1 Water Quality

Camp Lake Tributary 2 (CLT2) dissolved oxygen was consistently near full saturation at the time of spring, summer, and fall monitoring events, and concentrations were comparable to or slightly higher than those at the reference creeks (Appendix Tables C.1 to C.3; Figure 3.4). In addition, dissolved oxygen concentrations at CLT2 were well above the WQG lowest acceptable concentration for early life stages of cold-water biota (i.e., 9.5 mg/L) at the time of biological sampling in August 2020 (Figure 3.4; Appendix Table C.12). Aqueous pH at the CLT2 upstream and downstream study areas was generally slightly higher (i.e., more alkaline) than at the reference creeks but consistently well within WQG limits during the spring, summer, and fall sampling events in 2020 (Appendix Tables C.1 to C.3; Figure 3.4). No significant difference in pH was indicated between CLT2 study areas located downstream and upstream of the Milne Inlet Tote Road suggesting that this road crossing did not markedly influence the pH of CLT2 (Appendix Table C.19). *In situ* specific conductance was consistently higher at CLT2 compared

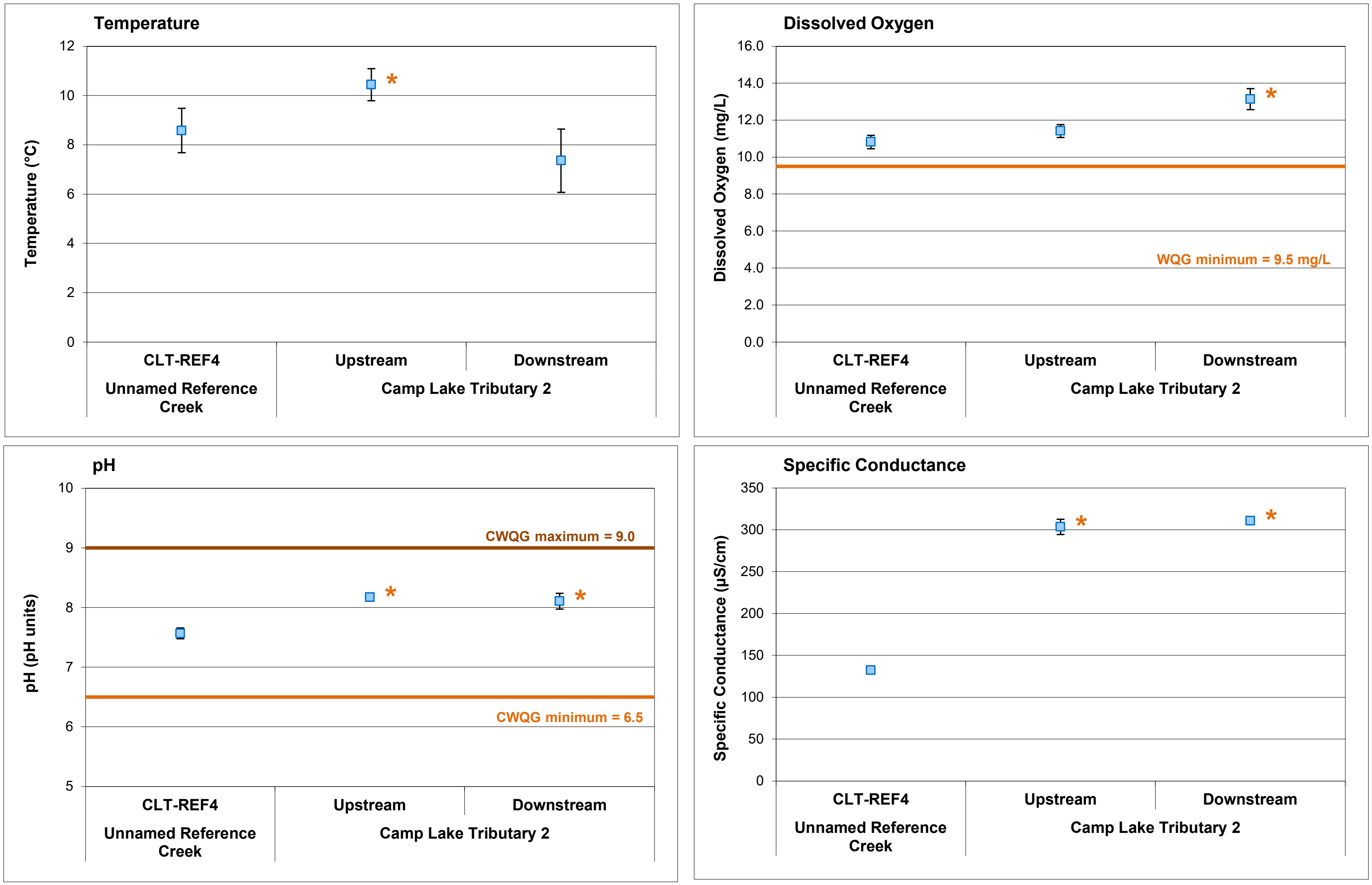


Figure 3.4: Comparison of *In Situ* Water Quality Variables (mean ± SD; n = 5) Measured at Camp Lake Tributary 2 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Note: An asterisk (*) next to data point indicates mean value differs significantly from the Unnamed Reference Creek mean.

to the reference creeks in 2020, and was also significantly higher downstream compared to upstream of the Milne Inlet Tote Road at CLT2 during August 2020 biological sampling (Figure 3.4; Appendix Table C.19), suggesting a slight influence of the road on water quality at CLT2.

Water chemistry at CLT2 (Station KO-01) met all AEMP benchmarks and WQG in spring, summer, and fall sampling events of 2020 (Table 3.4). Among those parameters with established AEMP benchmarks, nitrate and sulphate concentrations showed moderate elevation (i.e., 5--to 10-fold) at CLT2 compared to mean concentrations at the reference creeks, but only during the spring sampling event in 2020 (Appendix Table C.15).[7] Chloride and sulphate concentrations were the only parameters with established AEMP benchmarks that were higher at CLT2 in 2020 compared to baseline, but concentrations of both of these parameters remained well below the AEMP benchmarks since the commencement of commercial mine operations in 2015 (Appendix Figure C.3). In addition, concentrations of chloride and sulphate at CLT2 were similar to those observed at the reference creeks in 2020, suggesting a natural factor may have accounted for higher concentrations of these parameters at CLT2 since baseline. For those parameters without AEMP benchmarks, only sodium and total and dissolved uranium concentrations showed elevation at CLT2 in 2020 compared to baseline. In consideration of all spatial and temporal (baseline) comparisons, no marked mine-related influence on water quality was indicated within the CLT2 system in 2020.

3.2.2 Sediment Quality

Sediment from CLT2 upstream (CLT2-US) and downstream (CLT2-DS) study areas was visually characterized as medium-sized coarse sand (Appendix Table D.7). The in-stream substrate at both CLT2 study areas was composed mainly of cobble material (i.e., substrate diameter 6 to 25 cm), with sand constituting a trace amount (i.e., <1%) and approximately 5% of the material observed at the sediment surface of the upstream and downstream areas, respectively (Minnow 2018). Mean sediment TOC content was low (i.e., <0.5%) at both CLT2 study areas, but approximately 2 to 3 times greater than the mean TOC content in sediment sampled at the lotic reference areas (Table 3.5; Appendix Table D.10).

Similar to CLT1, mean concentrations of metals in sediment from CLT2 were generally elevated compared to those measured at the lotic reference areas (Appendix Table D.10). This was particularly the case for calcium, copper, magnesium, nickel, and potassium, for which mean concentrations were five-fold or greater at one or both of CLT2-US and CLT2-DS study areas compared to mean concentrations at the lotic reference areas (Table 3.5; Appendix Table D.10).

[7] This statement includes the evaluation of both total and dissolved metal concentrations.

Table 3.4: Mean Water Chemistry at Camp Lake Tributary 2 (CLT2) Monitoring Stations During Spring, Summer, and Fall, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Reference Creeks (n=4)			Camp Lake Tributary 2		
					Spring	Summer	Fall	Spring	Summer	Fall
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	55	134	175	154	300	345
	pH (lab)	pH	6.5 - 9.0	-	7.63	8.01	8.05	8.18	8.34	8.43
	Hardness (as $CaCO_3$)	mg/L	-	-	23.6	57.05	82.6	70	147	167
	Total Suspended Solids (TSS)	mg/L	-	-	3.2	2.7	2	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	85	85	99	120	153	192
	Turbidity	NTU	-	-	1.87	6.62	2.49	0.55	0.20	0.23
	Alkalinity (as $CaCO_3$)	mg/L	-	-	24	61	69	62	134	136
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.01	0.01225	0.01	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.020	0.062	0.076	0.135	0.047	0.148
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.02	0.15	0.15	0.14	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.93	3.44	2.31	2.81	3.88	3.08
	Total Organic Carbon	mg/L	-	-	2.23	3.05	2.14	3.86	4.36	3.50
	Total Phosphorus	mg/L	0.030$^{\alpha}$	-	0.0045	0.0065	0.0039	0.0075	<0.0030	<0.0030
	Phenols	mg/L	0.004$^{\alpha}$	-	0.0010	0.0010	0.0021	<0.0010	<0.0010	0.0017
Anions	Bromide (Br)	`	-	-	0.10	0.1	0.1	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.2	4.07	7.09	2.4	9.1	13.6
	Sulphate (SO_4)	mg/L	218$^{\beta}$	218	1.31	5.52	9.25	11.80	14.90	26.20
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0775	***0.3106***	0.0593	0.0229	0.0094	0.0089
	Antimony (Sb)	mg/L	0.020$^{\alpha}$	-	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	0.00010	0.00013	0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00362	0.00948	0.01031	0.00856	0.01550	0.01840
	Beryllium (Be)	mg/L	0.011$^{\alpha}$	-	0.0005	0.0004	0.0005	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0003875	0.0005	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.01	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	0.00001	0.00001	0.00001	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	4.9	11.8	16.5	13.9	27.6	31.8
	Chromium (Cr)	mg/L	0.0089	0.0089	0.00050	0.00082	0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009$^{\alpha}$	0.0040	0.00010	0.00016	0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.00071	0.00115	0.00102	0.00116	0.00159	0.00152
	Iron (Fe)	mg/L	0.30	0.326	0.077	0.2425	0.06625	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	0.000107	0.000226	0.000092	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0010	0.0011	0.0010	0.0012	0.0021	0.0019
	Magnesium (Mg)	mg/L	-	-	2.86	6.7	9.6	8.9	16.6	20.3
	Manganese (Mn)	mg/L	0.935$^{\beta}$	-	0.00136	0.00300	0.00102	0.00093	0.00230	0.00077
	Mercury (Hg)	mg/L	0.000026	-	0.0000050	0.000005	0.000005	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.00015	0.00045	0.00057	0.00031	0.00059	0.00073
	Nickel (Ni)	mg/L	0.025	0.025	0.00050	0.00070	0.00057	0.00052	0.00074	0.00065
	Potassium (K)	mg/L	-	-	0.45	0.93	1.04	1.20	2.10	2.45
	Selenium (Se)	mg/L	0.001	-	0.0010	0.0007625	0.001	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.62	1.25	0.87	0.67	0.86	0.72
	Silver (Ag)	mg/L	0.00025	0.0001	0.000010	0.00002	0.00001	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.83	2.76	3.97	1.85	5.68	7.36
	Strontium (Sr)	mg/L	-	-	0.00488	0.01391	0.01850	0.00886	0.01950	0.02210
	Thallium (Tl)	mg/L	0.0008	0.0008	0.00010	0.00008	0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	0.00010	0.0001	0.0001	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	0.011	0.0241	0.0100	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00045	0.00405	0.00737	0.00063	0.00326	0.00460
	Vanadium (V)	mg/L	0.006$^{\alpha}$	0.006	0.0010	0.0012	0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.003	0.003	<0.0030	<0.0030	<0.0030

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake tributary system.

Table 3.5: Sediment Total Organic Carbon and Metal Concentrations at Camp Lake Tributary 2 (CLT2) and Lotic Reference Area Sediment Monitoring Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Lotic Reference Stations		Camp Lake Tributary 2	
			Unnamed Reference Creek (REFCRK; n = 3)	Mary River Reference (GO-09; n = 3)	Upstream CLT2-US (n = 3)	Downstream CLT2-DS (n = 3)
			Average ± SD	Average ± SD	Average ± SD	Average ± SD
TOC	%	10[α]	0.12 ± 0.035	0.11 ± 0.012	0.33 ± 0.11	0.26 ± 0.19
Aluminum (Al)	µg/g	-	584 ± 185	2,757 ± 1,141	4,483 ± 2,188	3,057 ± 1,592
Antimony (Sb)	µg/g	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
Arsenic (As)	µg/g	17	0.22 ± 0.11	0.38 ± 0.10	0.74 ± 0.28	0.47 ± 0.16
Barium (Ba)	µg/g	-	2.72 ± 0.722	12.6 ± 5.05	15.9 ± 6.70	9.64 ± 4.36
Beryllium (Be)	µg/g	-	<0.10 ± 0	0.14 ± 0.040	0.19 ± 0.072	0.16 ± 0.056
Bismuth (Bi)	µg/g	-	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0
Boron (B)	µg/g	-	<5.0 ± 0	5.4 ± 0.75	5.3 ± 0.52	<5.0 ± 0
Cadmium (Cd)	µg/g	3.5	<0.020 ± 0	<0.020 ± 0	0.030 ± 0.0071	0.026 ± 0.0067
Calcium (Ca)	µg/g	-	494 ± 249	2,750 ± 894	5,277 ± 1,911	2,190 ± 851
Chromium (Cr)	µg/g	90	7.79 ± 5.39	13.6 ± 4.34	21.6 ± 7.03	15.2 ± 9.49
Cobalt (Co)	µg/g	-	0.953 ± 0.558	2.40 ± 0.758	4.45 ± 1.67	2.70 ± 1.41
Copper (Cu)	µg/g	110[α]	1.21 ± 0.899	4.45 ± 2.50	11.9 ± 4.15	7.46 ± 0.930
Iron (Fe)	µg/g	40,000[α]	12,493 ± 9,700	11,063 ± 2,423	18,067 ± 8,528	13,590 ± 8,265
Lead (Pb)	µg/g	91	1.49 ± 0.546	3.07 ± 0.857	3.49 ± 1.51	3.05 ± 0.879
Lithium (Li)	µg/g	-	<2.0 ± 0	5.0 ± 2.3	6.6 ± 2.6	4.1 ± 1.9
Magnesium (Mg)	µg/g	-	444 ± 165	2,810 ± 1,212	7,047 ± 2,826	4,073 ± 2,065
Manganese (Mn)	µg/g	1,100[α,β]	27.4 ± 14.6	75.7 ± 29.4	143 ± 40	102 ± 50.8
Mercury (Hg)	µg/g	0.486	<0.0050 ± 0	<0.0050 ± 0	<0.0050 ± 0	<0.0050 ± 0
Molybdenum (Mo)	µg/g	-	<0.10 ± 0	0.11 ± 0.023	0.34 ± 0.18	0.47 ± 0.41
Nickel (Ni)	µg/g	75[α,β]	1.76 ± 0.920	6.11 ± 1.99	15.3 ± 7.14	10.2 ± 4.79
Phosphorus (P)	µg/g	2,000[α]	167 ± 98	350 ± 118	254 ± 64	177 ± 68.0
Potassium (K)	µg/g	-	133 ± 42	750 ± 320	1,313 ± 881	1,077 ± 677
Selenium (Se)	µg/g	-	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0
Silver (Ag)	µg/g	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
Sodium (Na)	µg/g	-	<50 ± 0	68 ± 21	63 ± 21	60 ± 17
Strontium (Sr)	µg/g	-	2.00 ± 0.544	4.72 ± 1.01	3.86 ± 1.018	2.51 ± 0.633
Sulphur (S)	µg/g	-	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0
Thallium (Tl)	µg/g	-	<0.050 ± 0	0.068 ± 0.023	0.082 ± 0.043	0.070 ± 0.021
Tin (Sn)	µg/g	-	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0
Titanium (Ti)	µg/g	-	83.3 ± 47.4	353 ± 123	336 ± 147	248 ± 111
Uranium (U)	µg/g	-	0.5 ± 0.25	0.922 ± 0.298	0.743 ± 0.474	1.09 ± 0.332
Vanadium (V)	µg/g	-	16.8 ± 12.8	19.5 ± 5.06	16.5 ± 4.03	12.7 ± 8.70
Zinc (Zn)	µg/g	315	3.0 ± 1.2	10.3 ± 4.31	13.9 ± 7.48	17.7 ± 8.30
Zirconium (Zr)	µg/g	-	2.1 ± 0.91	5.8 ± 2.0	3.7 ± 1.3	3.4 ± 1.6

(grey box) Indicates parameter concentration above SQG.

Notes: TOC = total organic carbon; SQG = sediment quality guideline; n = number of samples; SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life, probable effects level (PEL; CCME 2020), except those indicated by reference mark. α = Ontario Provincial Sediment Quality Objective (PSQO), severe effect level (SEL; OMOE 1993). β = British Columbia Working SQG, PEL (BC ENV 2020).

Despite higher concentrations than at the lotic reference areas, no metals were present at concentrations 1.5 times or greater at the downstream area compared to the upstream area of CLT2 (Table 3.5), suggesting minimal influence of the Milne Port Tote Road on sediment quality at CLT2-DS. Concentrations of all metals were also well below applicable SQG at all CLT2 stations (Table 3.5; Appendix Tables D.11 and D.12). Notably, metal concentrations in sediment from CLT2 were almost always lower than those from CLT1, potentially indicating reduced mine-influence with increasing distance from the mine.

3.2.3 Phytoplankton

Chlorophyll-a concentrations at CLT2 (Station KO-01) were within the range observed at the reference creeks during summer and fall sampling events, but were lower than concentrations at the reference creeks during the spring sampling event in 2020 (Figure 3.2). Concentrations of nutrients, including total ammonia, nitrate, and total phosphorus, were similar or higher at CLT2 compared to the reference creek stations during the spring sampling event (Appendix Tables C.14 and C.15), and therefore the occurrence of lower chlorophyll-a concentrations at CLT2 in spring 2020 did not appear to be related to differing nutrient concentrations. In addition, concentrations of all parameters were below WQG at CLT2 in spring 2020, and thus the lower chlorophyll-a concentrations at CLT2 compared to the reference creeks may have reflected natural variability (Appendix Table C.14). Notably, chlorophyll-a concentrations were well below the AEMP benchmark of 3.7 µg/L for all sampling events in 2020 at CLT2 (Figure 3.2). Low phytoplankton productivity, indicative of oligotrophic conditions, was also suggested at CLT2 based on comparison of chlorophyll-a concentrations to Dodds et al (1998) trophic status classification for creek environments. This productivity classification was supported by CCME (2020) WQG categorization of oligotrophic based on mean aqueous total phosphorus concentrations below 10 µg/L at CLT2 during all spring, summer, and fall sampling events (Table 3.4; Appendix Table C.14). Higher chlorophyll-a concentrations occurred at CLT2 from 2017 to 2020 compared to the mine baseline period for the fall sampling event, but no increasing trend over time was suggested (Figure 3.3). For the reasons indicated above, higher chlorophyll-a concentrations at CLT2 in spring 2020 compared to the baseline period did not appear to be associated with a mine-related change in nutrient concentrations over time, and thus likely reflected natural seasonal/temporal variation in chlorophyll-a concentrations.

3.2.4 Benthic Invertebrate Community

Benthic invertebrate density and richness at both the upstream and downstream study areas of CLT2 did not differ significantly from Unnamed Reference Creek (Table 3.6; Appendix Figure F.3). Evenness at the CLT2 downstream area differed from the reference creek, but the magnitude of this difference was within the CES_{BIC} of ±2 SD_{REF} and positive (Table 3.6), indicating that this

Table 3.6: Benthic Invertebrate Community Metric Statistical Comparison Results among Camp Lake Tributary 2 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 3-Area Comparison				Pair-wise, *post hoc* comparisons				
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Areas?	P-value	Study Area	Mean	Standard Deviation (SD)	Magnitude of Difference (Ref SD)	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	NO	0.941	Reference Creek	713	296	-	a
					CLT2 Upstream	679	325	-0.1	a
					CLT2 Downstream	881	672	0.6	a
Richness (No. of Taxa)	ANOVA	none	NO	0.615	Reference Creek	16.0	4.4	-	a
					CLT2 Upstream	17.4	2.2	0.3	a
					CLT2 Downstream	18.6	5.1	0.6	a
Simpson's Evenness	K-W	rank	YES	0.039	Reference Creek	0.840	0.043	-	a
					CLT2 Upstream	0.879	0.058	0.9	ab
					CLT2 Downstream	0.921	0.033	1.9	b
Nemata (% of community)	K-W	rank	NO	0.215	Reference Creek	0.7	1.3	-	a
					CLT2 Upstream	0.5	0.7	-0.2	a
					CLT2 Downstream	8.2	15.8	5.9	a
Oligochaeta (% of community)	ANOVA	log10(x+1)	NO	0.181	Reference Creek	1.9	1.5	-	a
					CLT2 Upstream	15.3	19.0	9.0	a
					CLT2 Downstream	4.4	5.0	1.7	a
Hydracarina (% of community)	ANOVA	log10	NO	0.844	Reference Creek	4.5	3.7	-	a
					CLT2 Upstream	3.0	1.3	-0.4	a
					CLT2 Downstream	4.7	4.8	0.1	a
Ostracoda (% of community)	K-W	rank	YES	0.007	Reference Creek	30.6	11.7	-	a
					CLT2 Upstream	0.4	0.5	-2.6	b
					CLT2 Downstream	0.3	0.5	-2.6	b
Chironomidae (% of community)	ANOVA	log10	YES	0.024	Reference Creek	48.3	12.9	-	a
					CLT2 Upstream	70.4	14.2	1.7	b
					CLT2 Downstream	75.2	16.5	2.1	b
Metal Sensitive Chironomids (% of community)	ANOVA	log10(x+1)	YES	<0.001	Reference Creek	0.8	1.2	-	a
					CLT2 Upstream	5.7	3.5	3.9	b
					CLT2 Downstream	11.5	4.2	8.7	c
Simuliidae (% of community)	ANOVA	log10(x+1)	YES	0.068	Reference Creek	9.8	8.6	-	a
					CLT2 Upstream	1.9	1.7	-0.9	b
					CLT2 Downstream	3.1	1.9	-0.8	ab
Tipulidae (% of community)	K-W	rank	NO	0.482	Reference Creek	1.5	2.3	-	a
					CLT2 Upstream	1.8	1.0	0.1	a
					CLT2 Downstream	1.8	2.2	0.1	a
Collector-Gatherer FFG (% of community)	ANOVA	none	NO	0.849	Reference Creek	80.7	8.8	-	a
					CLT2 Upstream	80.5	11.6	0.0	a
					CLT2 Downstream	77.5	8.7	-0.4	a
Filterer FFG (% of community)	ANOVA	log10(x+1)	YES	0.069	Reference Creek	9.9	8.9	-	a
					CLT2 Upstream	1.7	1.5	-0.9	b
					CLT2 Downstream	3.1	2.1	-0.8	ab
Shredder FFG (% of community)	ANOVA	log10(x+1)	YES	0.037	Reference Creek	2.8	2.7	-	a
					CLT2 Upstream	8.5	3.1	2.1	ab
					CLT2 Downstream	11.2	7.0	3.2	b
Clinger HPG (% of community)	ANOVA	log10	NO	0.573	Reference Creek	15.8	7.7	-	a
					CLT2 Upstream	12.0	4.2	-0.5	a
					CLT2 Downstream	16.6	7.1	0.1	a
Sprawler HPG (% of community)	ANOVA	none	NO	0.222	Reference Creek	79.4	6.6	-	a
					CLT2 Upstream	65.1	17.6	-2.2	a
					CLT2 Downstream	66.3	14.1	-2.0	a
Burrower FFG (% of community)	ANOVA	log10	YES	0.044	Reference Creek	4.8	3.3	-	a
					CLT2 Upstream	22.9	16.2	5.5	b
					CLT2 Downstream	17.1	19.0	3.7	ab

[Grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[Blue box] Blue shaded values indicate significant difference (ANOVA p-value ≤ 0.10) that was also outside of a Critical Effect Size of ±2 SD_{REF}, indicating that the difference between the mine-exposed area and reference area was ecologically meaningful.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

difference was not ecologically significant nor indicative of an adverse response, respectively. Differences in community composition were indicated between CLT2 and Unnamed Reference Creek based on differing Bray-Curtis Index (Appendix Table F.7), of which the only ecologically significant differences included significantly higher and lower relative abundance of Chironomidae and Ostracoda dominant groups, respectively, at one or both CLT2 study areas compared to the reference creek (Table 3.6; Appendix Figure F.3). Ecologically significant higher relative abundance of metal-sensitive chironomids was indicated at CLT2 study areas compared to the reference creek (Table 3.6), suggesting that the community composition differences between watercourses were not likely related to metal concentrations. In addition, no ecologically significant differences in benthic invertebrate FFG and HPG were shown at both CLT2 study areas compared to the reference creek (Table 3.6), indicating no substantial differences in food resources and habitat conditions available to benthic invertebrates between CLT2 and Unnamed Reference Creek. No consistent ecologically significant differences in any benthic invertebrate community endpoints were indicated at either of the CLT2 upstream and downstream study areas over years of mine operation (2015 to 2020) compared to 2007 baseline data with the exception of routinely higher evenness at CLT2 (Appendix Tables F.15 and F.16; Appendix Figure F.4). Because high evenness is normally associated with a healthy distribution of benthic invertebrate taxa, the occurrence of significantly higher evenness at CLT2 on a routine basis from 2015 to 2020 compared to baseline was not consistent with an adverse influence related to recent mine operations. Overall, greater evenness and relative abundance of metal-sensitive taxa at CLT2 compared to the reference creek in 2020, as well as no consistent differences in density, richness, and relative abundance of dominant groups and FFG at the CLT2 study areas between mine operational and baseline periods indicated no adverse mine-related effects to benthic invertebrates at CLT2.

Between the CLT2 study areas, no significant differences in benthic invertebrate density, richness, evenness, and relative abundance of dominant taxonomic groups, FFGs, or HPGs were indicated between study areas located downstream and upstream of the Milne Inlet Tote Road crossing in 2020 (Table 3.6; Appendix Figure F.3). Therefore, no effects to benthic invertebrates were evident at CLT2 in 2020 as a result of potential influences associated with the Milne Inlet Tote Road.

3.2.5 Effects Assessment and Recommendations

Water chemistry at CLT2 met all AEMP benchmarks in 2020. In addition, sediment quality met all SQG, and no adverse effects on phytoplankton or benthic invertebrates were indicated at CLT2 in 2020. Under the Mary River Project AEMP Management Response Framework, the absence of a mine-related change in AEMP benchmark parameters over time (or compared to background) requires no further management response (Figure 2.8). Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no adjustment to the existing AEMP need be applied at CLT2 as part of the next monitoring program.

3.3 Camp Lake (JLO)

3.3.1 Water Quality

In situ water quality profiles conducted at Camp Lake showed no substantial spatial differences in water temperature, dissolved oxygen, pH or specific conductance with progression from the CLT1 inlet to the lake outlet during any of the winter, summer, or fall seasonal sampling events in 2020 (Appendix Figures C.4 to C.7). The 2020 Camp Lake water column profiles indicated a slight increase in temperature from surface to bottom (i.e., approximately 2˚C) during the winter sampling event, and a distinctly warmer surface layer extending to a depth of approximately 6 metres during the summer sampling event (Figure 3.5). The average temperature profiles at Camp Lake in summer and fall sampling events roughly mirrored those at Reference Lake 3 in 2020 (Figure 3.5). Water temperature near the bottom of the water column was significantly lower at littoral stations of Camp Lake than Reference Lake 3, but did not differ significantly between lakes at profundal stations sampled during August 2020 biological monitoring (Figure 3.6; Appendix Tables C.25).

Dissolved oxygen profiles conducted at Camp Lake in 2020 showed declining saturation levels with increased depth beginning at approximately 10 m below surface in the winter, but otherwise showed relatively minor changes from surface to bottom during the summer and fall that closely reflected the dissolved oxygen profiles observed at Reference Lake 3 (Figure 3.5). Although dissolved oxygen at the bottom of the water column was near full saturation at littoral and profundal sampling depths of Camp Lake, dissolved oxygen concentrations were significantly lower at Camp Lake than at Reference Lake 3 at the time of biological sampling in August 2020 (Figure 3.6; Appendix Table C.25). Dissolved oxygen concentrations at Camp Lake were well above the WQG minimum for the protection of sensitive stages of cold-water biota (i.e., 9.5 mg/L) during all seasonal sampling events in 2020 except at water depths greater than approximately 25 m in winter (Figure 3.6; Appendix Tables C.20 to C.22). This suggested that dissolved oxygen concentrations were not likely to be limiting to biota at Camp Lake for most of the year, except for the portion of the water column greater than 25 m deep during the winter.

In situ profiles showed decreasing pH with increased depth at Camp Lake and Reference Lake 3, with the changes in pH through the water column at both lakes appearing to coincide with changes in water temperature and, to a lesser extent, dissolved oxygen levels (Figure 3.5). Although pH

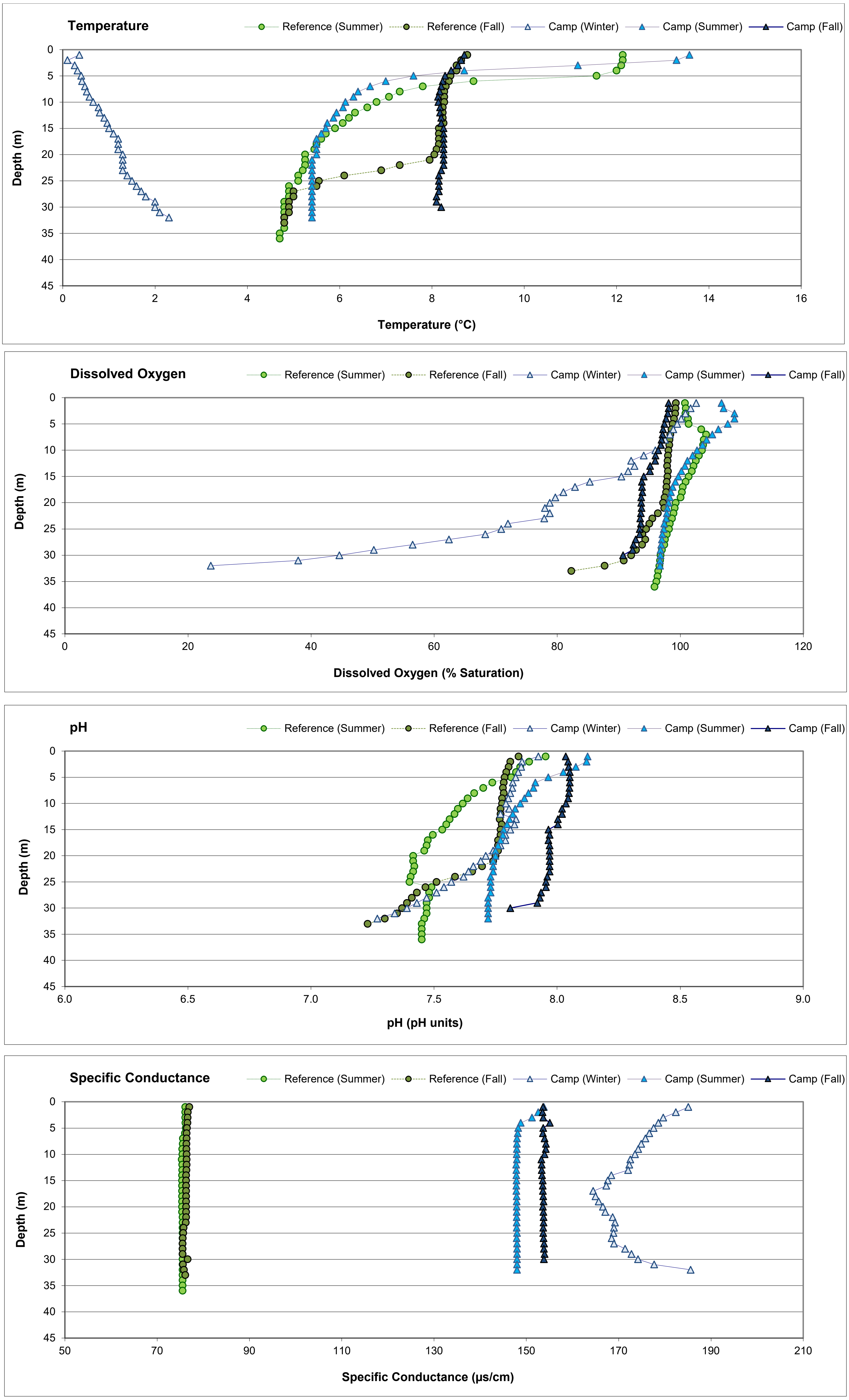


Figure 3.5: Average *In Situ* Water Quality with Depth from Surface at Camp Lake (JLO) Compared to Reference Lake 3 during Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

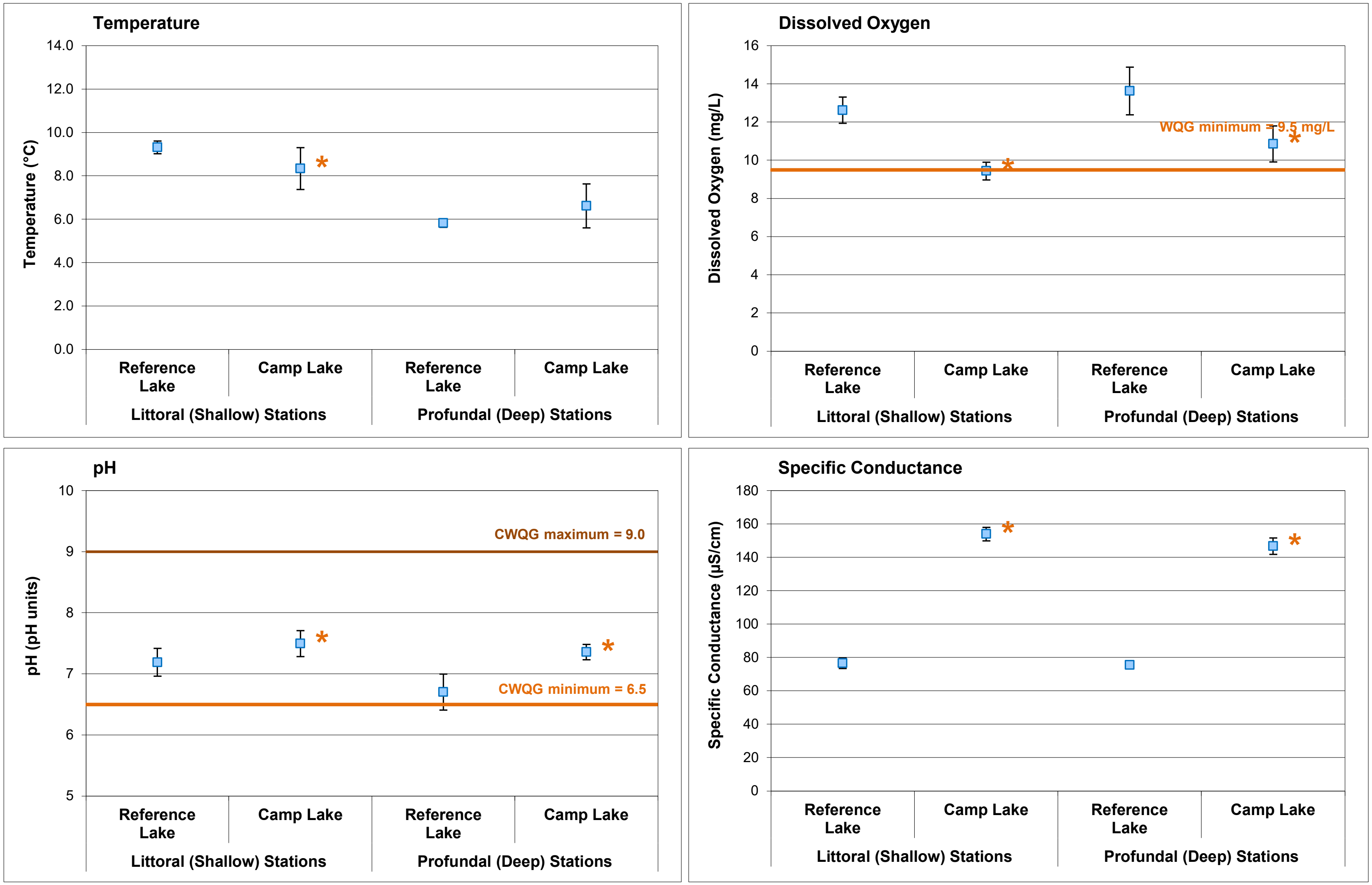


Figure 3.6: Comparison of *In Situ* Water Quality Variables (mean ± SD; n = 5) Measured at Camp Lake (JLO) and Reference Lake 3 (REF3) Littoral and Profundal Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Note: An asterisk (*) next to data point indicates mean value differs significantly from the Reference Lake 3 mean for the respective littoral or profundal station type.

near the bottom at littoral and profundal stations of Camp Lake were significantly higher than at the reference lake during the August 2020 biological study, the mean incremental difference in pH between lakes was small (i.e., 0.6 pH units) and all pH values were consistently within WQG limits (Figure 3.6, Appendix Table C.26), suggesting that the pH difference between lakes was not ecologically meaningful. Specific conductance profiles showed no marked step changes from the surface to bottom of the Camp Lake water column, indicating the absence of chemical stratification (Figure 3.5). Specific conductance was consistently higher at Camp Lake than at Reference Lake 3 in summer and fall 2020 (Figure 3.5), the difference of which was shown to be significant during the August 2020 biological study (Figure 3.6) and possibly reflected a mine-related influence on water quality. Secchi depth readings, which serve as a proxy for water clarity, were significantly lower at Camp Lake than at Reference Lake 3 during the August 2020 biological study (Appendix Figure C.8) indicating more suspended particulate material in waters of Camp Lake.

Water chemistry at Camp Lake met all AEMP benchmarks and WQG over the duration of spring, summer, and fall sampling events in 2020 (Table 3.7). Among those parameters with established AEMP benchmarks, aluminum and chloride concentrations were moderately (i.e., 5- to 10-fold) and slightly (i.e., 3- to 5-fold) elevated, respectively, at Camp Lake compared to the reference lake (Table 3.7; Appendix Table C.27). Of those parameters without AEMP benchmarks, only total and dissolved manganese, molybdenum, and uranium concentrations were slightly elevated at Camp Lake compared to the reference lake during summer and/or fall sampling events in 2020 (Appendix Tables C.27 and C.29). Concentrations of chloride, sulphate, and total aluminum were elevated at Camp Lake in 2020 compared to baseline, though only during winter and/or summer sampling events (Appendix Figure C.9; Appendix Tables C.27 and C.29). In addition, concentrations of each of these parameters were consistently well below AEMP benchmarks since commercial mine operations commenced in 2015 (Appendix Figure C.9). Overall, comparisons to Reference Lake 3 water chemistry in 2020 and to Camp Lake baseline water chemistry suggested slightly elevated concentrations of chloride, manganese, molybdenum, and uranium at Camp Lake in 2020 which reflected a slight mine-related influence on water quality of the lake. However, because concentrations of all parameters remained well below AEMP benchmarks and WQG since commercial mine operations commenced in 2015, including in 2020, no adverse effects on biota were expected at Camp Lake.

3.3.2 Sediment Quality

Surficial sediment (i.e., top 2 cm) collected at the Camp Lake coring stations in 2020 was primarily composed of silt and sand with low (i.e., 0.3 to 3.4%) TOC content (Figure 3.7; Appendix Table D.15). Surficial sediment at littoral stations of Camp Lake contained significantly more sand

Table 3.7: Mean Water Chemistry at Camp Lake (JLO) and Reference Lake 3 (REF3) Monitoring Stations[a] During Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

Parameters		Units	Water Quality Guideline (WQG)[b]	AEMP Benchmark[c]	Reference Lake 3 (n = 3)		Camp Lake Stations (n = 5)		
					Summer	Fall	Winter	Summer	Fall
Conventionals	Conductivity (lab)	umho/cm	-	-	79	79	179	154	142
	pH (lab)	pH	6.5 - 9.0	-	7.66	7.75	7.73	8.05	7.98
	Hardness (as $CaCO_3$)	mg/L	-	-	35	38	96	71	71
	Total Suspended Solids (TSS)	mg/L	-	-	2.0	2.0	2.0	2.0	2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	41	51	115	85	84
	Turbidity	NTU	-	-	0.15	0.15	0.13	0.78	0.31
	Alkalinity (as $CaCO_3$)	mg/L	-	-	46	34	80	67	64
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.010	0.014	0.019	0.005	0.011
	Nitrate	mg/L	3	3	0.020	0.020	0.054	0.043	0.030
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.001	0.005
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.15	0.16	0.19	0.11	0.16
	Dissolved Organic Carbon	mg/L	-	-	3.3	3.5	2.4	2.4	2.3
	Total Organic Carbon	mg/L	-	-	4.6	3.8	2.7	2.0	2.8
	Total Phosphorus	mg/L	0.020[α]	-	0.0041	0.0031	0.0044	0.0034	0.0039
	Phenols	mg/L	0.004[α]	-	0.0010	0.0011	0.0021	0.0028	0.0013
Anions	Bromide (Br)	mg/L	-	-	0.1	0.1	0.1	0.05	0.1
	Chloride (Cl)	mg/L	120	120	1.4	1.4	5.8	4.5	4.5
	Sulphate (SO_4)	mg/L	218[β]	218	3.6	3.6	5.1	4.6	4.6
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0031	0.0032	0.0119	0.0162	0.0049
	Antimony (Sb)	mg/L	0.020[α]	-	0.0001	0.0001	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.0001	0.0001	0.0001	0.0001	0.0001
	Barium (Ba)	mg/L	-	-	0.0064	0.0070	0.0089	0.0074	0.0068
	Beryllium (Be)	mg/L	0.011[α]	-	0.0005	0.0005	0.0005	0.0001	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0005	0.0005	0.00005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.01	0.01	0.01
	Cadmium (Cd)	mg/L	0.00012	0.00008	0.00001	0.00001	0.00001	0.000005	0.00001
	Calcium (Ca)	mg/L	-	-	7.2	7.2	18.6	14.0	13.7
	Chromium (Cr)	mg/L	0.0089	0.0089	0.0005	0.0005	0.0005	0.000117	0.0005
	Cobalt (Co)	mg/L	0.0009[α]	0.004	0.0001	0.0001	0.0001	0.0001	0.0001
	Copper (Cu)	mg/L	0.002	0.0022	0.00073	0.00075	0.00130	0.00091	0.00084
	Iron (Fe)	mg/L	0.30	0.326	0.03	0.03	0.03	0.03	0.03
	Lead (Pb)	mg/L	0.001	0.001	0.00005	0.00005	0.000068	0.00005	0.00005
	Lithium (Li)	mg/L	-	-	0.0010	0.0010	0.0016	0.0012	0.0011
	Magnesium (Mg)	mg/L	-	-	4.2	4.7	11.9	8.6	8.5
	Manganese (Mn)	mg/L	0.935[β]	-	0.00080	0.00068	0.00168	0.00290	0.00109
	Mercury (Hg)	mg/L	0.000026	-	0.000005	0.000005	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00013	0.00015	0.00048	0.00041	0.00037
	Nickel (Ni)	mg/L	0.025	0.025	0.00050	0.00050	0.00082	0.00055	0.00059
	Potassium (K)	mg/L	-	-	0.9	0.9	1.5	1.3	1.2
	Selenium (Se)	mg/L	0.001	-	0.001	0.001	0.001	0.0000516	0.001
	Silicon (Si)	mg/L	-	-	0.50	0.50	0.54	0.46	0.32
	Silver (Ag)	mg/L	0.00025	0.0001	0.00001	0.00001	0.00001	0.00001	0.00001
	Sodium (Na)	mg/L	-	-	0.9	1.0	2.6	1.9	1.9
	Strontium (Sr)	mg/L	-	-	0.0084	0.0082	0.0152	0.0113	0.0102
	Thallium (Tl)	mg/L	0.0008	0.0008	0.0001	0.0001	0.0001	0.00001	0.0001
	Tin (Sn)	mg/L	-	-	0.0001	0.0001	0.000104	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.01	0.01	0.01	0.000763	0.01
	Uranium (U)	mg/L	0.015	-	0.00032	0.00033	0.00128	0.00125	0.00120
	Vanadium (V)	mg/L	0.006[α]	0.006	0.0010	0.001	0.001	0.0005	0.001
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.003	0.00582	0.00529	0.003

(shaded) Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the applicable AEMP benchmark.

[a] Values presented are averages from samples taken from the surface and the bottom of the water column at each lake for the indicated season.

[b] Canadian Water Quality Guideline (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[c] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data (2006 to 2013) specific to Camp Lake.

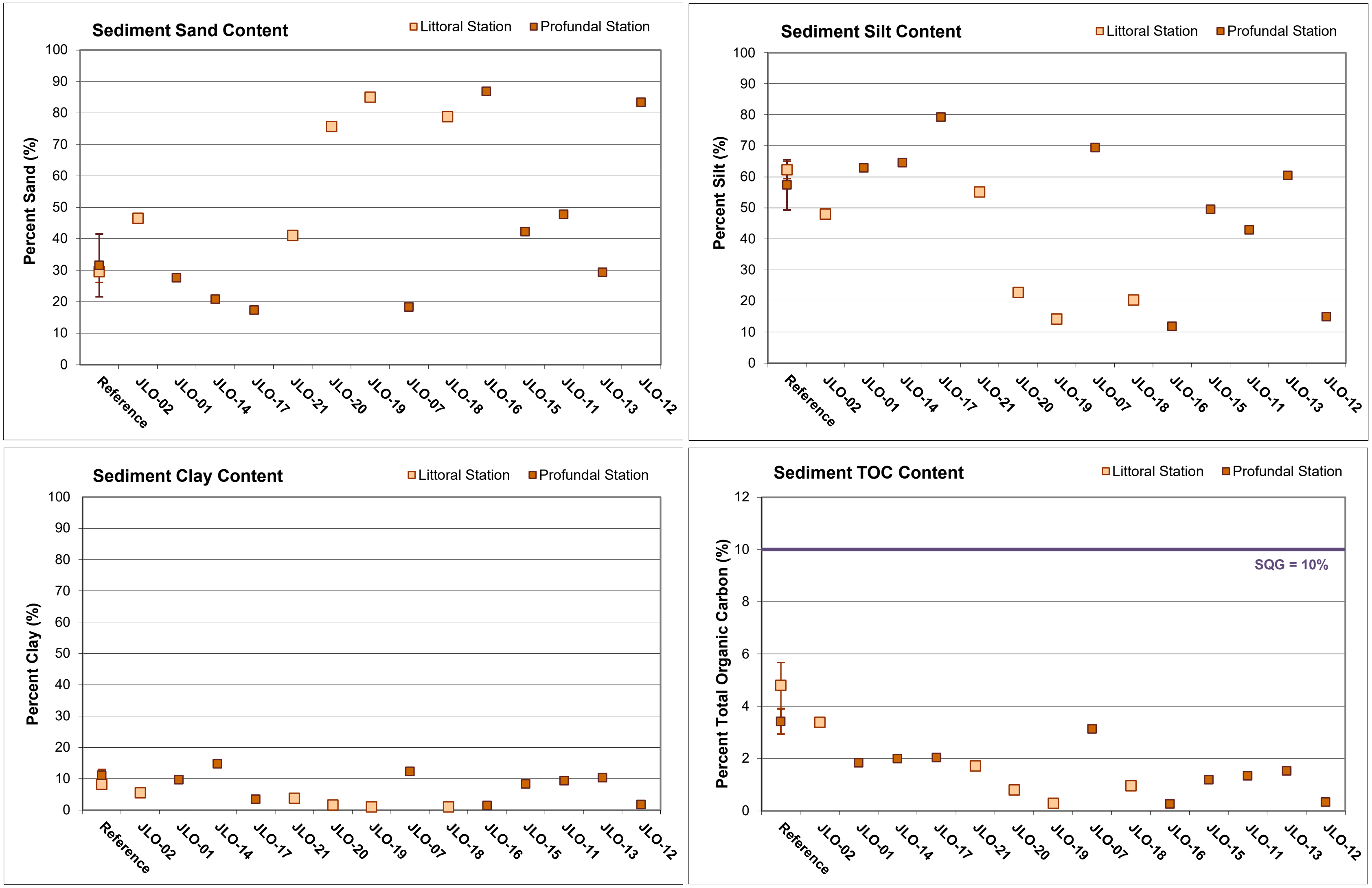


Figure 3.7: Sediment Particle Size and Total Organic Carbon (TOC) Content Comparisons among Camp Lake (JLO) Sediment Monitoring Stations and to Reference Lake 3 Averages (mean ± SE), Mary River Project CREMP, August 2020

and less silt and clay compared to Reference Lake 3 whereas the particle size of sediment from profundal areas of both lakes did not differ (Appendix Table D.16). The TOC in sediment at littoral and profundal stations of Camp Lake was significantly lower, and sediment was significantly more compact (i.e., lower moisture content), than at the reference lake (Figure 3.7; Appendix Table D.16). A surficial and/or sub-surface layer of oxidized material (likely iron hydroxide or oxy-hydroxides), visible as reddish-orange to orange-brown substrate, was observed in sediments at some Camp Lake stations (Appendix Tables D.13 and D.14). Similar observations of oxidized material were made at Reference Lake 3 (Appendix Tables D.3 and D.4), suggesting the natural occurrence of iron (oxy)hydroxides in the sediment of lakes within the mine local study area. Substrates of Camp Lake exhibited minor, sporadic blackening at sediment depths greater than 2 cm and sulphidic odour was detected in sediment from some stations, suggesting occasional incidence of reducing conditions within substrates of the lake. However, no strongly defined redox boundaries were identified visually in Camp Lake sediments in 2020 (Appendix Table D.14). Qualitative observations suggestive of reducing conditions in sediment were similar between Camp Lake and Reference Lake 3 in 2020 (Appendix Tables D.3, D.4, D.13, and D.14), which indicated that factors leading to these conditions were comparable between lakes.

Evidence of slightly higher concentrations of some metals (e.g., arsenic, copper, iron, molybdenum, nickel, uranium) in sediment at stations located closer to the CLT1 inlet were indicated compared to those located near the outlet of Camp Lake in 2020 (Appendix Table D.15). However, these spatial differences in metal concentrations were most likely attributable to higher TOC and smaller particle size in sediments from stations closest to the CLT1 inlet (Appendix Table D.15) as supported by observations of no spatial changes in water chemistry within Camp Lake. Metal concentrations in littoral and profundal sediment of Camp Lake were comparable (i.e., less than a factor of 3-fold higher) to those of the reference lake in 2020 (Table 3.8; Appendix Table D.17). Iron and manganese concentrations were above their respective SQG, and arsenic, iron, and nickel concentrations were higher than the Camp Lake AEMP benchmarks, in sediment from the Camp Lake littoral station in 2020 (Table 3.8). Mean concentrations of iron and copper were also above SQG and AEMP benchmarks, respectively, in littoral sediments at Reference Lake 3 (Table 3.8). Because station JL0-02 is located near the CLT1 inlet, this suggested that mine-influenced flow from this tributary potentially contributed to higher concentrations of the metals indicated above in sediment at this location. Although the mean concentration of manganese was above the SQG in profundal sediment from Camp Lake, the mean concentration of this metal, as well as iron, were also above SQG in profundal sediment at Reference Lake 3 (Table 3.8) indicating naturally high concentrations of these metals in sediments of the study area. Concentrations of arsenic, copper, iron, manganese,

Table 3.8: Sediment Total Organic Carbon and Metal Concentrations at Camp Lake (JLO) and Reference Lake 3 (REF3) Sediment Monitoring Stations, Mary River Project CREMP, August 2020

	Analyte	Units	SQG[a]	AEMP Benchmark[b]	Littoral Stations: Reference Lake (n = 5) Average ± SD	Littoral Stations: Camp Lake (n = 1)	Profundal Stations: Reference Lake (n = 5) Average ± SD	Profundal Stations: Camp Lake (n = 9) Average ± SD
TOC		%	10[α]	-	4.80 ± 1.96	3.39	3.42 ± 1.08	1.51 ± 0.889
Metals	Aluminum (Al)	mg/kg	-	-	16,880 ± 1,785	15,500	21,800 ± 2,185	15,303 ± 5,683
Metals	Antimony (Sb)	mg/kg	-	-	<0.10 ± 0	0.11	<0.10 ± 0	<0.10 ± 0
Metals	Arsenic (As)	mg/kg	17	5.9	3.53 ± 1.09	***9.03***	4.07 ± 0.397	5.54 ± 4.51
Metals	Barium (Ba)	mg/kg	-	-	117 ± 22	122	122 ± 18	82.7 ± 57.2
Metals	Beryllium (Be)	mg/kg	-	-	0.65 ± 0.073	0.78	0.80 ± 0.092	0.83 ± 0.33
Metals	Bismuth (Bi)	mg/kg	-	-	<0.20 ± 0	0.29	<0.20 ± 0	0.27 ± 0.056
Metals	Boron (B)	mg/kg	-	-	12.2 ± 0.853	17.8	14.7 ± 1.77	24.5 ± 10.4
Metals	Cadmium (Cd)	mg/kg	3.5	1.5	0.173 ± 0.047	0.269	0.148 ± 0.0172	0.159 ± 0.074
Metals	Calcium (Ca)	mg/kg	-	-	5,608 ± 1,247	5,650	5,010 ± 407	5,122 ± 2,362
Metals	Chromium (Cr)	mg/kg	90	98	54.3 ± 4.40	66.2	65.0 ± 6.64	64.6 ± 20.1
Metals	Cobalt (Co)	mg/kg	-	-	10.8 ± 1.64	18.4	15.2 ± 1.56	16.3 ± 5.62
Metals	Copper (Cu)	mg/kg	110[α]	50	***71.4*** ± 14.2	49.9	***83.8*** ± 11.1	39.6 ± 16.8
Metals	Iron (Fe)	mg/kg	40,000[α]	52,400	50,600 ± 24,939	***61,000***	45,080 ± 4,440	36,833 ± 15,000
Metals	Lead (Pb)	mg/kg	91	35	13.8 ± 0.799	18.9	16.7 ± 1.82	18.0 ± 7.48
Metals	Lithium (Li)	mg/kg	-	-	26.0 ± 2.51	22.4	33.7 ± 3.83	27.3 ± 10.3
Metals	Magnesium (Mg)	mg/kg	-	-	11,440 ± 814	13,400	14,180 ± 1,422	12,476 ± 2,881
Metals	Manganese (Mn)	mg/kg	1,100[α,β]	4,370	579 ± 258	1,410	1,230 ± 355	2,063 ± 2,299
Metals	Mercury (Hg)	mg/kg	0.486	0.17	0.0500 ± 0.0178	0.0530	0.0583 ± 0.0164	0.0404 ± 0.0233
Metals	Molybdenum (Mo)	mg/kg	-	-	4.44 ± 3.31	2.45	2.52 ± 0.273	1.52 ± 1.61
Metals	Nickel (Ni)	mg/kg	75[α,β]	72	40.0 ± 3.52	***72.5***	45.0 ± 4.54	61.0 ± 18.5
Metals	Phosphorus (P)	mg/kg	2,000[α]	1,580	1,167 ± 394	1,310	956 ± 47	1,037 ± 510
Metals	Potassium (K)	mg/kg	-	-	4,100 ± 453	4,100	5,338 ± 543	4,171 ± 1,725
Metals	Selenium (Se)	mg/kg	-	-	0.73 ± 0.31	0.49	0.61 ± 0.18	0.37 ± 0.135
Metals	Silver (Ag)	mg/kg	-	-	0.14 ± 0.047	0.12	0.20 ± 0.057	0.13 ± 0.043
Metals	Sodium (Na)	mg/kg	-	-	304 ± 32	203	369 ± 50	227 ± 125
Metals	Strontium (Sr)	mg/kg	-	-	11.6 ± 1.70	9.87	12.3 ± 1.24	12.4 ± 5.93
Metals	Sulphur (S)	mg/kg	-	-	1,400 ± 387	<1,000	1,140 ± 195	1,789 ± 2,367
Metals	Thallium (Tl)	mg/kg	-	-	0.379 ± 0.0415	0.467	0.594 ± 0.094	0.435 ± 0.183
Metals	Tin (Sn)	mg/kg	-	-	<2.0 ± 0	<2.0	<2.0 ± 0	<2.0 ± 0
Metals	Titanium (Ti)	mg/kg	-	-	1,006 ± 109	833	1,136 ± 50	816 ± 259
Metals	Uranium (U)	mg/kg	-	-	11.0 ± 2.41	7.39	19.7 ± 3.76	5.04 ± 2.51
Metals	Vanadium (V)	mg/kg	-	-	54.1 ± 5.40	54.3	63.4 ± 4.89	52.5 ± 18.5
Metals	Zinc (Zn)	mg/kg	315	135	73.1 ± 7.83	59.4	83.8 ± 8.52	50.2 ± 19.2
Metals	Zirconium (Zr)	mg/kg	-	-	4.5 ± 1.0	7.8	3.9 ± 0.32	5.4 ± 3.6

(shaded) Indicates parameter concentration above SQG.
BOLD Indicates parameter concentration above the AEMP Benchmark.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013). The indicated values are specific to Camp Lake.

nickel, and phosphorus were above respective Camp Lake AEMP benchmarks in sediment at some profundal stations of Camp Lake, but on average, were below the applicable benchmarks (Table 3.8; Appendix Table D.15). Of these metals, average concentrations of copper were also above the Camp Lake AEMP benchmark in profundal sediment at Reference Lake 3 (Table 3.8), providing further support for naturally elevated concentrations of copper in sediment.

Mean metal concentrations in sediment from Camp Lake littoral and profundal stations were comparable between 2020 and the baseline period for each respective station type (Appendix Table D.17). The only exception was a slightly higher (i.e., 3-fold greater) arsenic concentration in sediment from the single Camp Lake littoral station in 2020 (Figure 3.8; Appendix Table D.17).[8] Metal concentrations in sediment from Camp Lake littoral and profundal stations in 2020 were typically within the range of those observed from 2015 to 2019 (Figure 3.8). In addition, except for slightly higher mean concentrations of arsenic, calcium, and manganese, there was no evidence of consistently higher metal concentrations in Camp Lake sediments over the 2015 to 2020 period of mine operation relative to baseline (Figure 3.8). Overall, no substantial changes in sediment chemistry have been observed at Camp Lake following the commencement of mine operations in 2015.

3.3.3 Phytoplankton

Camp Lake chlorophyll-a concentrations showed no clear spatial gradients with distance from the CLT1 inlet to the lake outlet stations in 2020 (Figure 3.9). Chlorophyll-a concentrations were significantly lower in winter compared to summer and fall at Camp Lake in 2020 (Figure 3.9; Appendix Table E.6). Chlorophyll-a concentrations at Camp Lake did not differ significantly from those at Reference Lake 3 in the summer sampling event, but were significantly higher at Camp Lake in the fall sampling event (Appendix Tables E.7 and E.8). However, chlorophyll-a concentrations at Camp Lake were consistently well below the AEMP benchmark of 3.7 µg/L during all winter, summer, and fall sampling events in 2020 (Figure 3.9). Average chlorophyll-a concentrations at Camp Lake suggested relatively low phytoplankton abundance and an 'oligotrophic' status based on comparison to Wetzel (2001) lake trophic classifications using chlorophyll-a concentrations. This trophic status classification was also consistent with an ultra-oligotrophic to oligotrophic WQG (CCME 2020) categorization for Camp Lake based on

[8] Boron concentrations in sediment from 2015 to 2020 were considerably higher (i.e., 10- to 70-fold) than those reported during both the baseline and 2014 studies at all mine-exposed lakes. The lack of any distinct gradient in the magnitude of the elevation in boron concentrations among stations within each lake and among study lakes suggested that the stark contrast in boron concentrations between recent data and data collected prior to 2015 was likely due to laboratory-based analytical differences.

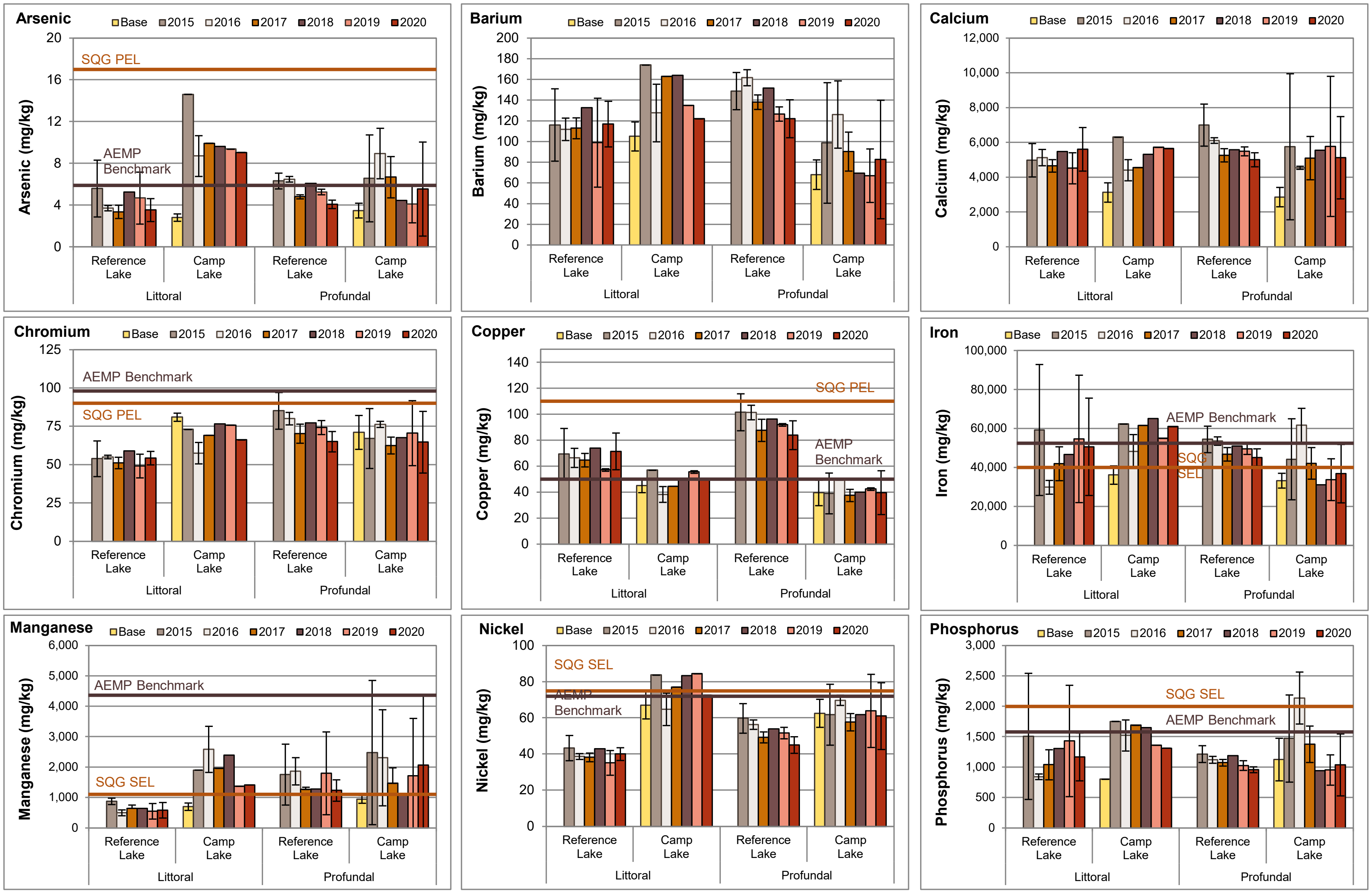


Figure 3.8: Temporal Comparison of Sediment Metal Concentrations (mean ± SD) at Littoral and Profundal Stations of Camp Lake and Reference Lake 3 for Mine Baseline (2005 to 2013) and Operational (2015 to 2020) Periods

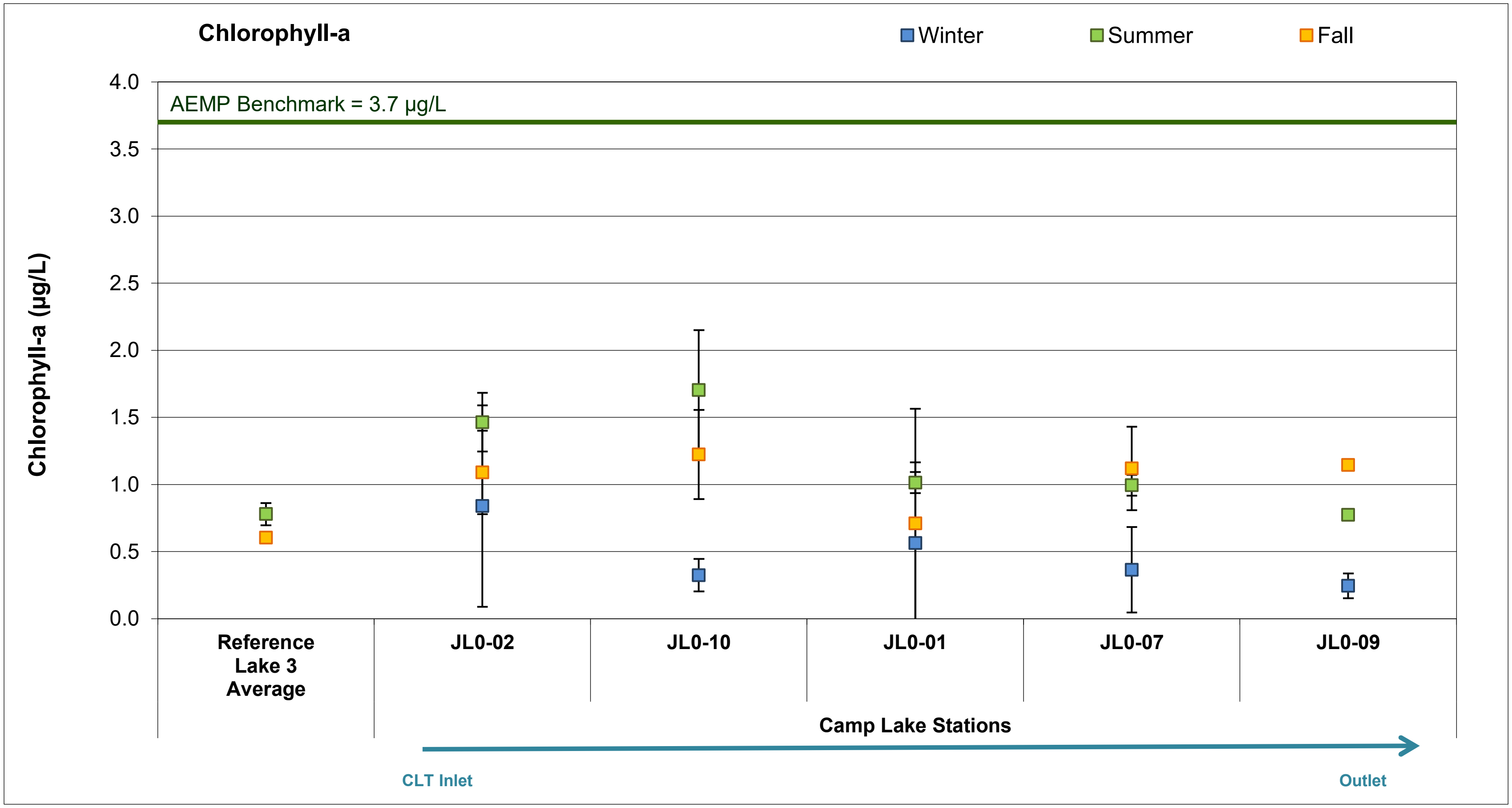


Figure 3.9: Chlorophyll a Concentrations at Camp Lake (JLO) Phytoplankton Monitoring Stations, Mary River Project CREMP, 2020

Notes: Values are averages of samples taken from the surface and the bottom of the water column at each station. Reference values represent mean ± standard deviation (n = 3). Reference Lake 3 was not sampled in winter 2020.

mean aqueous total phosphorus concentrations below 10 µg/L for all seasonal sampling events (Table 3.7; Appendix Table C.26).

Temporal comparisons of the Camp Lake chlorophyll-a data did not indicate any consistent significant differences between years of mine construction (2014) and mine operation (2015 to 2020) for seasonal data collected in winter, summer, or fall (Figure 3.10). The lack of any consistent directional changes in chlorophyll-a concentrations for any given season among years was consistent with no substantial changes in nutrient (e.g., nitrate) concentrations and water quality generally achieving WQG at Camp Lake for the six years since mine operations commenced. No chlorophyll-a baseline (2005 to 2013) data are available for Camp Lake, precluding comparisons to conditions prior to the mine construction period.

3.3.4 Benthic Invertebrate Community

Benthic invertebrate density was significantly higher at littoral and profundal habitat of Camp Lake compared to like-habitat stations at Reference Lake 3 (Tables 3.9 and 3.10). For both habitat types, the difference was ecologically significant based on the magnitude being outside of the CES_{BIC} of ±2 SD_{REF}. No significant differences in richness or evenness were indicated between Camp Lake and the reference lake for either littoral or profundal habitat (Tables 3.9 and 3.10). Bray-Curtis Index differed significantly between Camp Lake and Reference Lake 3 for both littoral and profundal habitat types (Appendix Table F.21), indicating benthic invertebrate community structural differences between lakes. No ecologically significant differences in relative abundance of metal-sensitive Chironomidae were indicated between Camp Lake and Reference Lake 3 (Tables 3.9 and 3.10), which was consistent with metal concentrations in water and sediment of Camp Lake generally below applicable guidelines (Tables 3.7 and 3.8).[9] Therefore, the difference(s) in community structure between lakes appeared unrelated to metal concentrations.

The key differences in benthic invertebrate community composition between Camp Lake and Reference Lake 3 included significantly higher and lower relative abundance of Chironomidae and Ostracoda dominant groups, respectively, at littoral habitat of Camp Lake (Tables 3.9 and 3.10). No ecologically significant differences in FFGs were indicated between Camp Lake and the reference lake (Tables 3.9 and 3.10), suggesting a similar food resource base for benthic invertebrates between lakes. However, an ecologically significant higher relative abundance of the burrower HPG was present at Camp Lake compared to Reference Lake 3 (Tables 3.9

[9] Although mean concentrations of iron and manganese in sediment were above SQG at Camp Lake, the concentrations of these metals in sediment of the reference lake were also above SQG (Table 3.8), indicating natural elevation of iron and manganese in lakes of the study area.

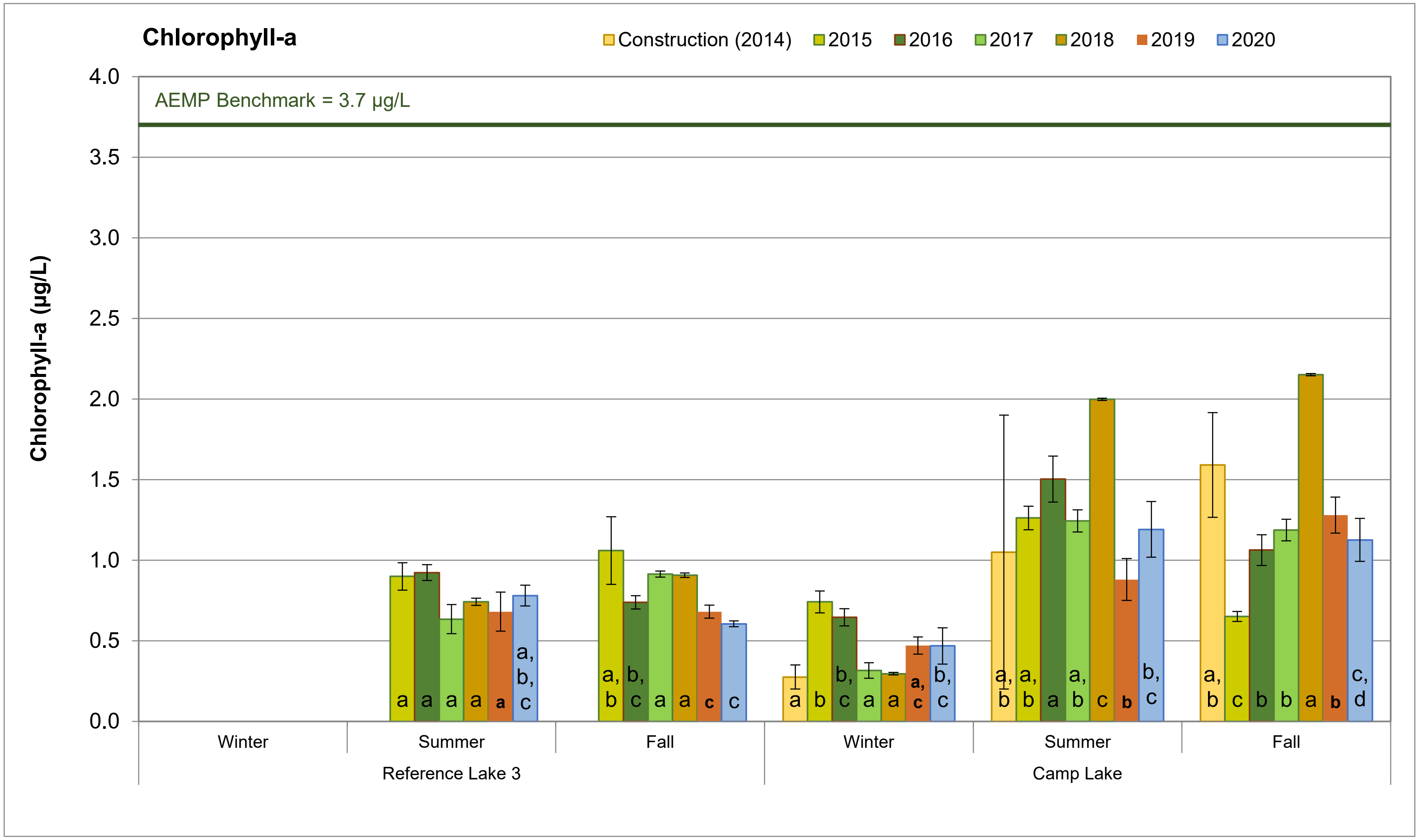


Figure 3.10: Temporal Comparison of Chlorophyll-a Concentrations Among Seasons between Camp Lake and Reference Lake 3 for Mine Construction (2014) and Operational (2015 to 2020) Periods (mean ± SE)

Note: Bars with the same letter at the base do not differ significantly between years for the applicable season

Table 3.9: Benthic Invertebrate Community Statistical Comparison Results between Camp Lake (JLO) and Reference Lake 3 for Littoral Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Littoral Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	YES	0.003	8.3	Reference Lake 3	1,571	430	193	1,190	1,474	2,310
						Camp Lake Littoral	5,122	2,202	985	2,000	5,474	8,052
Richness (Number of Taxa)	t-equal	log10	NO	0.150	0.8	Reference Lake 3	14.6	2.5	1.1	13.0	14.0	19.0
						Camp Lake Littoral	16.6	1.7	0.7	14.0	17.0	18.0
Simpson's Evenness (E)	t-equal	none	NO	0.378	0.3	Reference Lake 3	0.810	0.110	0.049	0.630	0.847	0.923
						Camp Lake Littoral	0.842	0.044	0.020	0.773	0.858	0.889
Shannon Diversity	t-equal	log10	NO	0.559	0.2	Reference Lake 3	2.710	0.526	0.235	2.080	2.730	3.510
						Camp Lake Littoral	2.820	0.129	0.058	2.700	2.770	3.010
Hydracarina (%)	t-equal	log10	NO	0.568	-1.2	Reference Lake 3	5.3	2.6	1.2	3.5	4.4	9.9
						Camp Lake Littoral	2.0	2.4	1.1	0.3	1.0	6.0
Ostracoda (%)	Mann-Whitney	rank	YES	0.008	-2.5	Reference Lake 3	37.9	14.5	6.5	26.7	36.2	62.6
						Camp Lake Littoral	2.0	1.6	0.7	0.0	2.1	4.1
Chironomidae (%)	Mann-Whitney	rank	YES	0.008	2.6	Reference Lake 3	52.6	15.6	7.0	26.9	59.0	66.4
						Camp Lake Littoral	92.9	2.0	0.9	90.8	92.9	95.8
Metal-Sensitive Chironomidae (%)	t-equal	none	NO	0.882	0.2	Reference Lake 3	28.8	9.5	4.3	15.6	32.5	38.7
						Camp Lake Littoral	30.3	19.7	8.8	9.7	33.7	56.9
Collector-Gatherers (%)	t-equal	log10	NO	0.440	-0.5	Reference Lake 3	63.1	11.4	5.1	53.6	60.3	81.5
						Camp Lake Littoral	56.9	17.7	7.9	34.0	54.9	83.4
Filterers (%)	t-equal	none	NO	0.804	0.3	Reference Lake 3	27.1	9.8	4.4	14.4	29.2	38.0
						Camp Lake Littoral	29.7	20.2	9.0	7.0	33.7	56.2
Shredders (%)	t-unequal	none	YES	0.088	-1.0	Reference Lake 3	3.9	3.3	1.5	0.6	3.2	7.4
						Camp Lake Littoral	0.5	0.7	0.3	0.0	0.2	1.6
Clingers (%)	t-equal	none	NO	0.742	-0.4	Reference Lake 3	31.9	9.3	4.2	17.9	33.5	41.6
						Camp Lake Littoral	28.6	19.7	8.8	4.6	25.5	56.2
Sprawlers (%)	t-equal	log10	YES	0.046	-1.8	Reference Lake 3	57.9	12.1	5.4	41.0	57.2	73.8
						Camp Lake Littoral	36.7	17.8	8.0	22.0	26.6	65.0
Burrowers (%)	t-equal	log10	YES	0.002	5.0	Reference Lake 3	10.2	4.9	2.2	4.6	8.3	17.3
						Camp Lake Littoral	34.7	12.5	5.6	21.8	31.1	55.3

Grey shading indicates statistically significant difference between study areas based on p-value≤ 0.10.

Blue shaded values indicate significant difference (ANOVA p-value ≤ 0.10) that was also outside of a Critical Effect Size of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Table 3.10: Benthic Invertebrate Community Statistical Comparison Results between Camp Lake (JLO) and Reference Lake 3 for Profundal Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Profundal Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	YES	0.005	6.4	Reference Lake 3	479	142	63	336	491	681
						Camp Lake Profundal	1,383	656	293	621	1,138	2,345
Richness (Number of Taxa)	t-equal	log10	NO	0.125	1.8	Reference Lake 3	7.0	1.9	0.8	5.0	8.0	9.0
						Camp Lake Profundal	10.4	4.5	2.0	7.0	8.0	18.0
Simpson's Evenness (E)	t-equal	log10	NO	0.346	-1.3	Reference Lake 3	0.731	0.045	0.020	0.689	0.721	0.795
						Camp Lake Profundal	0.673	0.151	0.068	0.512	0.643	0.901
Shannon Diversity	t-equal	log10	NO	0.623	1.2	Reference Lake 3	1.800	0.196	0.088	1.580	1.720	2.030
						Camp Lake Profundal	2.040	0.750	0.336	1.350	2.000	3.280
Hydracarina (%)	t-equal	log10(x+1)	NO	0.494	-0.5	Reference Lake 3	2.8	2.0	0.9	0.0	3.5	5.1
						Camp Lake Profundal	1.9	2.2	1.0	0.0	1.4	5.6
Ostracoda (%)	t-equal	log10(x+1)	NO	0.386	-0.8	Reference Lake 3	8.6	4.1	1.8	3.5	7.7	14.5
						Camp Lake Profundal	5.5	7.1	3.2	0.0	1.5	17.3
Chironomidae (%)	t-equal	none	NO	0.484	0.7	Reference Lake 3	87.9	4.2	1.9	82.3	87.2	92.7
						Camp Lake Profundal	91.0	8.4	3.8	77.6	90.8	98.5
Metal-Sensitive Chironomidae (%)	t-equal	none	YES	0.049	-1.1	Reference Lake 3	31.5	17.6	7.9	7.9	38.0	49.3
						Camp Lake Profundal	11.9	6.9	3.1	1.9	11.1	18.5
Collector-Gatherers (%)	t-equal	log10	YES	0.020	1.6	Reference Lake 3	62.9	15.0	6.7	45.4	56.1	79.0
						Camp Lake Profundal	87.0	9.5	4.3	75.1	90.1	99.3
Filterers (%)	t-equal	none	YES	0.037	-1.2	Reference Lake 3	30.7	17.5	7.8	7.9	38.0	49.3
						Camp Lake Profundal	9.4	7.4	3.3	0.4	9.1	18.5
Shredders (%)	t-unequal	log10(x+1)	NO	0.119	-0.9	Reference Lake 3	2.2	2.3	1.0	0.0	2.5	5.3
						Camp Lake Profundal	0.2	0.5	0.2	0.0	0.0	1.1
Clingers (%)	t-equal	none	YES	0.046	-1.2	Reference Lake 3	33.5	16.9	7.6	13.1	41.5	52.8
						Camp Lake Profundal	12.4	10.6	4.8	0.4	15.4	25.5
Sprawlers (%)	t-unequal	log10	NO	0.267	-0.9	Reference Lake 3	64.8	16.2	7.2	45.5	58.5	87.0
						Camp Lake Profundal	50.0	40.2	18.0	12.3	40.1	93.0
Burrowers (%)	t-unequal	log10(x+1)	YES	0.057	12.4	Reference Lake 3	1.7	2.9	1.3	0.0	0.0	6.7
						Camp Lake Profundal	37.5	32.3	14.4	5.6	34.4	72.3

Grey shading indicates statistically significant difference between study areas based on p-value≤ 0.10.

Blue shaded values indicate significant difference (ANOVA p-value ≤ 0.10) that was also outside of a Critical Effect Size of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

and 3.10). This difference in HPG between lakes may have reflected the occurrence of more compact (i.e., lower moisture content), sandier sediment at Camp Lake (Appendix Table F.18). Substrate compactness is an important factor influencing inhabitation by burrowing invertebrates (Ward 1992), and thus greater substrate compactness may have accounted for the subtle benthic invertebrate community assemblage differences at Camp Lake compared to Reference Lake 3. Overall, markedly higher benthic invertebrate density without accompanying differences in richness, evenness, and FFG at Camp Lake compared to Reference Lake 3 suggested that Camp Lake was more biologically productive.

No consistent significant differences in general community effect indicators of density, richness, and evenness were indicated at littoral and profundal habitats of Camp Lake over years of mine operation (2015 to 2020) compared to baseline (2007, 2013; Appendix Tables F.22 and F.23; Appendix Figures F.5 and F.6). Similarly, benthic invertebrate dominant taxonomic groups and FFGs over years of mine operation from 2015 to 2020 did not differ significantly from baseline at littoral habitat at Camp Lake (Appendix Table F.22). At profundal habitat of Camp Lake, the relative abundance of metal-sensitive chironomids and the filterer FFG were routinely significantly lower at magnitudes outside of the CES_{BIC} of ±2 SD_{REF} over years of mine operation compared to the 2007 baseline data, but not to the 2013 baseline data (Appendix Table F.23). This indicated that the study-to-study differences in community features at profundal stations of Camp Lake were likely the result of sampling artifacts (e.g., differences in sampling station locations and/or replication among studies) or natural temporal variability among studies and was not related to potential influences from mine operation. Therefore, consistent with only minor changes in water and sediment quality since the mine baseline period, no ecologically significant differences in benthic invertebrate community features were indicated at littoral and profundal habitat of Camp Lake following the commencement of commercial mine operation in 2015.

3.3.5 Fish Population

3.3.5.1 Camp Lake Fish Community

The fish community at Camp Lake was composed of arctic charr (*Salvelinus alpinus*) and ninespine stickleback (*Pungitius*; Table 3.11), reflecting the same fish species observed previously (Minnow 2020). Higher CPUE for arctic charr and ninespine stickleback occurred at Camp Lake compared to Reference Lake 3 suggesting greater densities of both species at Camp Lake (Table 3.11). The higher density of fish at Camp Lake compared to Reference Lake 3 may be linked to greater productivity within Camp Lake based on higher chlorophyll-a concentrations in water (indicative of greater phytoplankton density) and greater benthic invertebrate density. Electrofishing CPUE for arctic charr at Camp Lake in 2020 was within the range observed during baseline studies (2007 to 2013) and over the five previous years

Table 3.11: Fish Catch and Community Summary from Backpack Electrofishing and Gill Netting Conducted at Camp Lake (JLO) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Lake	Method [a]		Arctic Charr	Ninespine Stickleback	Total by Method	Total No. of Species
Reference Lake 3	Electrofishing	No. Caught	134	1	135	2
		CPUE	2.09	0.016	2.11	
	Gill netting	No. Caught	69	0	69	
		CPUE	0.956	0	0.956	
Camp Lake	Electrofishing	No. Caught	109	18	127	2
		CPUE	4.93	0.814	5.75	
	Gill netting	No. Caught	94	0	94	
		CPUE	14.8	0	14.8	

[a] Catch-per-unit-effort (CPUE) for electrofishing represents the number of fish captured per electrofishing minute, and for gill netting represents the number of fish captured per 100 m hours of net deployed.

since mine operation commenced (Figure 3.11). In contrast, the CPUE associated with gill netting at Camp Lake in 2020 was substantially greater than baseline and earlier years of mine operations (Figure 3.12). An increase in the gill netting CPUE (almost three times greater than 2019) was also observed at Reference Lake 3 in 2020 (Figure 3.11). Higher gill netting CPUE in 2020 at both Camp Lake and Reference Lake 3 compared to previous studies likely reflected slightly earlier sampling timing in 2020 which, due to warmer water temperatures, may have resulted in greater fish movement and thus higher catches. Because electrofishing is an 'active' fish collection method, the similarity in electrofishing CPUE between 2020 and baseline, and between 2020 and other years of mine operation, suggested no substantial changes in within-lake fish densities at either lake and supported the notion that slight difference in sampling timing among years likely accounted for higher gill netting CPUE in 2020.

3.3.5.2 Camp Lake Fish Population Assessment

Nearshore Arctic Charr

A total of 100 arctic charr were sampled from the nearshore habitat of each of Camp Lake and Reference Lake 3 in August 2020. Arctic charr YOY were distinguished from older (non-YOY) age classes at both lakes using a fork length of 4.3 cm based on the evaluation of length-frequency distributions coupled with supporting age determinations (Figure 3.12; Appendix Tables G.4 and G.5) and historical evaluations (Minnow 2020). Due to limited capture of YOY in Camp Lake (i.e., only 2 of 100 individuals), statistical comparisons focused only on non-YOY individuals. The length-frequency distribution for the nearshore arctic charr differed significantly between Camp Lake and Reference Lake 3 (Table 3.12; Appendix Table G.6) based on fewer YOY and smaller-sized individuals captured at Camp Lake (Figure 3.12). Non-YOY arctic charr from Camp Lake were significantly longer (8%) and heavier (44%) than those from Reference Lake 3 (Table 3.12; Appendix Table G.6). Condition (i.e., weight-at-length) of non-YOY was significantly greater for arctic charr captured at Camp Lake than those from the reference lake, although the magnitude of this difference (7%) was within the CES of ±10% (referred to herein as CES_C), suggesting that this difference was not ecologically significant (Table 3.12; Appendix Table G.6).

Arctic charr non-YOY at Camp Lake were almost consistently significantly longer and heavier than at Reference Lake 3 from 2015 to 2020, indicating consistent presence of larger juveniles at Camp Lake (Table 3.12). In contrast, condition of non-YOY arctic charr showed no consistent differences, and no consistent direction of differences, between Camp Lake and the reference lake from 2015 to 2020 (Table 3.12) suggesting no appreciable differences in fish health between lakes. The length-frequency distribution of non-YOY arctic charr collected from nearshore habitats in 2020 differed from the (2013) baseline study at Camp Lake (Table 3.12).

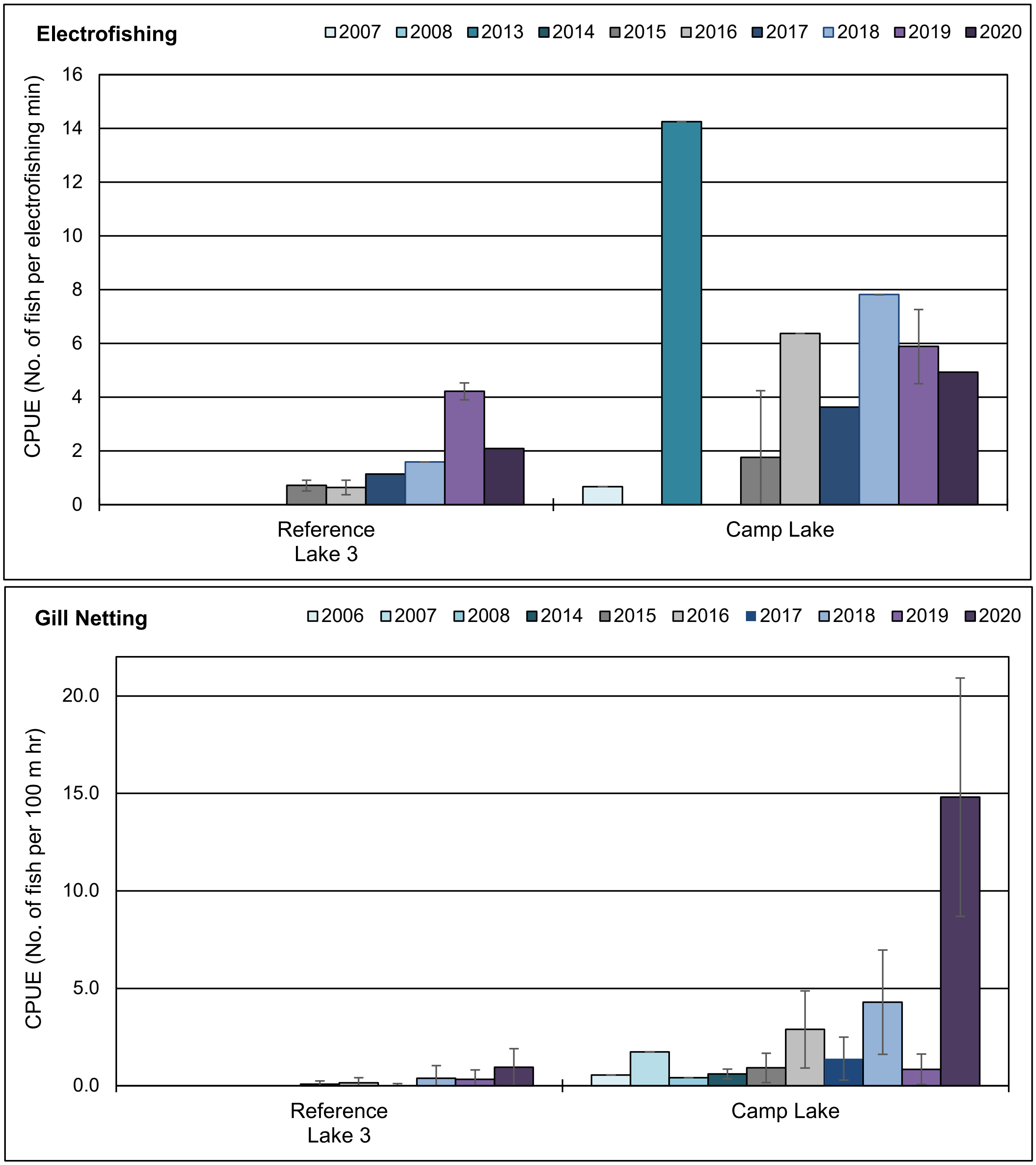


Figure 3.11: Catch-per-unit-effort (CPUE; mean ± SD) of Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Camp Lake (JLO) and Reference Lake 3 (REF3), Mary River Project CREMP, 2006 to 2020

Note: Data presented for fish sampling conducted in fall during baseline (2006, 2007, 2008, 2013), construction (2014) and operational (2015 to 2020) mine phases.

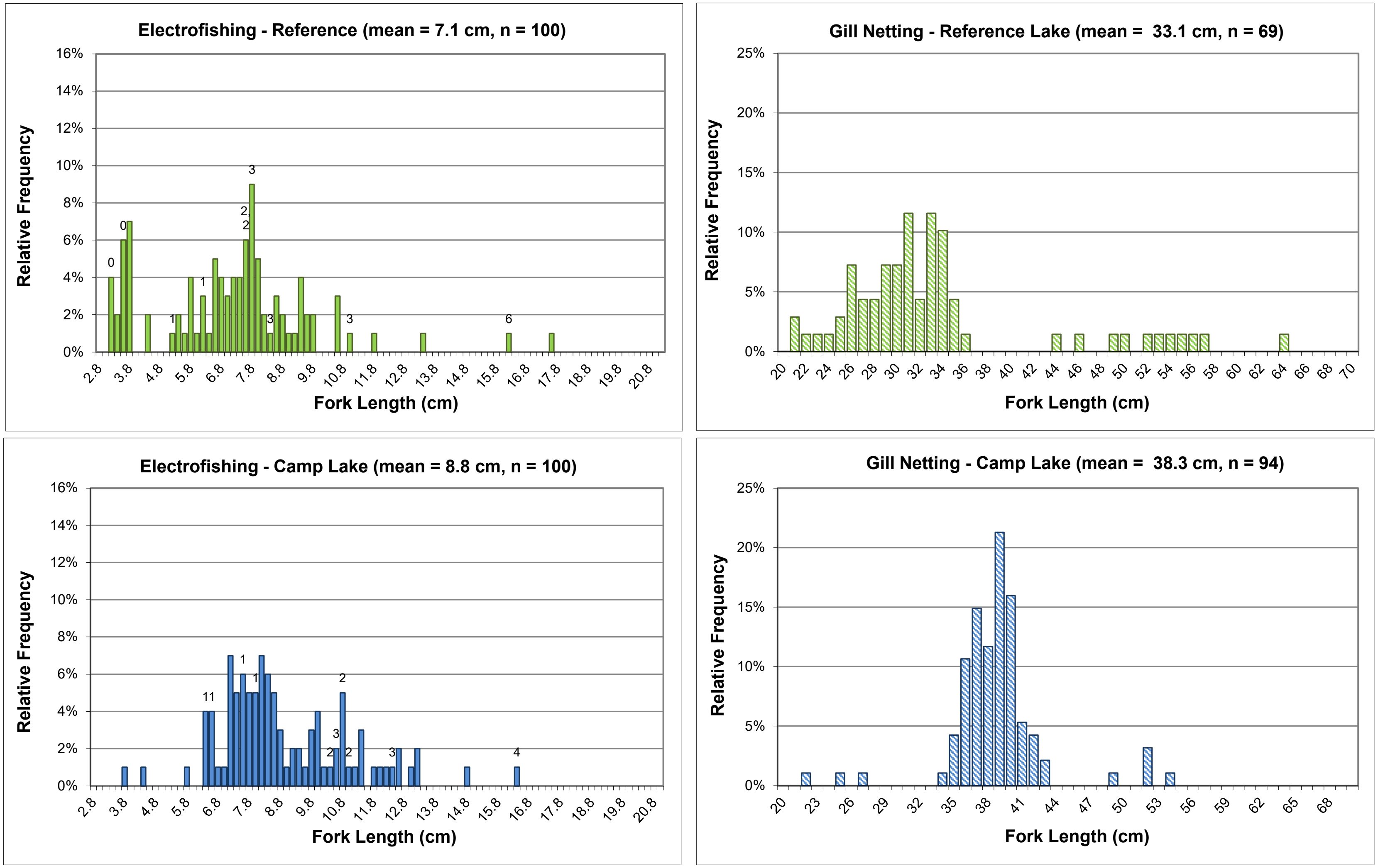


Figure 3.12: Length-Frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Camp Lake (JLO) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Note: Fish ages are shown above the bars, where available.

Table 3.12: Summary of Statistical Results for Arctic Charr Population Comparisons between Camp Lake and Reference Lake 3 from 2015 to 2020, and between Camp Lake Mine Operational and Baseline Period Data, for Fish Captured by Electrofishing and Gill Netting Methods, Mary River Project CREMP

Data Set by Sampling Method	Response Category	Endpoint	Statistically Significant Differences Observed? [a]											
			versus Reference Lake 3						versus Camp Lake baseline period data [b]					
			2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
Nearshore Electrofishing	Survival	Length-Frequency Distribution	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**
		Age	No	No	No	-	-	-	-	-	-	-	-	-
	Energy Use (non-YOY)	Size (mean fork length)	**Yes (+41%)**	No	**Yes (+17%)**	**Yes (+40%)**	**Yes (+10%)**	**Yes (+8%)**	**Yes (-15%)**	**Yes (-32%)**	**Yes (-35%)**	**Yes (-28%)**	No	**Yes (-22%)**
		Size (mean weight)	**Yes (+176%)**	No	**Yes (+51%)**	**Yes (+135%)**	**Yes (+29%)**	**Yes (+44%)**	**Yes (-42%)**	**Yes (-71%)**	**Yes (-74%)**	**Yes (-56%)**	No	**Yes (-52%)**
	Energy Storage (non-YOY)	Condition (body weight-at-fork length)	No	**Yes (-6%)**	No	**Yes (-14%)**	**Yes (-7%)**	**Yes (+7%)**	**Yes (-6%)**	**Yes (-10%)**	**Yes (-10%)**	**Yes (-9%)**	**Yes (-11%)**	No
Littoral/Profundal Gill Netting [c]	Survival	Length Frequency Distribution	-	-	-	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
		Age	-	-	-	-	-	-	**Yes (+48%)**	**Yes (+58%)**	**Yes (+ 46%)**	-	-	-
	Energy Use	Size (mean fork length)	-	-	-	**Yes (+10%)**	**Yes (+28%)**	**Yes (+24%)**	**Yes (+6%)**	No	**Yes (+12%)**	**Yes (+15%)**	**Yes (+17%)**	**Yes (+19%)**
		Size (mean weight)	-	-	-	**Yes (+46%)**	**Yes (+130%)**	**Yes (+129%)**	No	No	**Yes (+37%)**	**Yes (+46%)**	**Yes (+44%)**	**Yes (+47%)**
	Energy Storage	Condition (body weight-at-fork length)	-	-	-	**Yes (+12%)**	**Yes (+6%)**	**Yes (+18%)**	No	**Yes (-3%)**	No	No	No	No

BOLD indicates a significant difference related to the comparison.

[a] Values in parentheses indicate direction and magnitude of any significant differences.

[b] Baseline period data included 2013 nearshore electrofishing data and 2006, 2008, and 2013 littoral/profundal gill netting data. nc = non-calculable magnitude.

[c] Due to low catches of arctic charr in gill nets at Reference Lake 3 in 2015, 2016, and 2017, no comparison of fish health was conducted for gill netted fish.

Similar to most previous years of mine operation, non-YOY arctic charr from Camp Lake were significantly shorter and lighter in 2020 than during baseline, but unlike most years, showed no difference in condition between 2020 and baseline (Table 3.12; Appendix Table G.7). Overall, the absence of consistent differences in non-YOY condition between Camp Lake and Reference Lake 3 since 2015, and occurrence of differences near ecologically meaningful thresholds in non-YOY condition at Camp Lake between mine operational and baseline studies, suggested no effects on the health of non-YOY arctic charr at Camp Lake since mine operations commenced in 2015.

Littoral/Profundal Arctic Charr

A total of 94 and 69 arctic charr were sampled from littoral/profundal habitat of Camp Lake and Reference Lake 3, respectively, in August 2020. The length-frequency distribution for littoral/ profundal arctic charr differed significantly between Camp Lake and Reference Lake 3, reflecting the occurrence of relatively larger fish at Camp Lake (Table 3.12; Figure 3.12). Littoral/profundal arctic charr from Camp Lake were significantly longer (24%) and heavier (129%) and had greater body condition (18%) than those captured at the reference lake (Table 3.12; Appendix Table G.6). The absolute magnitude of difference in condition between Camp Lake and Reference Lake 3 was greater than the CES_C of 10%, suggesting an ecologically significant difference. Larger body size and greater body condition of littoral/profundal arctic charr at Camp Lake relative to Reference Lake 3 were consistent with results in the two previous years (Table 3.12), suggesting an on-going difference between these populations.

A significant difference in length-frequency distribution of littoral/profundal arctic charr from Camp Lake was observed between 2020 and the combined baseline data set (i.e., 2006, 2007, and 2008 studies; Table 3.12). Although fork length and body weight were significantly greater for littoral/profundal arctic charr captured at Camp Lake in 2020 and most other years in which the mine was operational compared to the baseline period, no significant differences in body condition have generally been indicated since 2015 (Table 3.12). The occurrence of consistently larger littoral/profundal arctic charr at Camp Lake during mine operational years compared to the reference lake and Camp Lake baseline data, as well as greater condition and no differences in condition in littoral/profundal arctic charr compared to the reference lake and Camp Lake baseline data, respectively, collectively indicated no effects on the health of spawning-sized arctic charr at Camp Lake since mine operations commenced in 2015.

3.3.6 Effects Assessment and Recommendations

At Camp Lake, the following AEMP benchmarks were exceeded in 2020:

- Arsenic concentration in sediment was greater than the benchmark or 5.9 mg/kg at the single Camp Lake littoral monitoring station (JL0-02);
- Iron concentration in sediment was greater than the benchmark of 52,400 mg/kg at the single Camp Lake littoral monitoring station (JL0-02);
- Nickel concentration in sediment was greater than the benchmark of 72 mg/kg at the single Camp Lake littoral monitoring station (JL0-02); and,
- Arsenic, copper, iron, manganese, nickel, and phosphorus concentrations in sediment were above respective benchmarks at individual stations, but on average were below these benchmarks among the Camp Lake profundal stations.

Arsenic concentrations in sediment at the Camp Lake littoral station in 2020 were markedly higher than at the reference lake and compared to baseline, but showed no substantial change from 2015 to 2020 suggesting no on-going source of arsenic to sediment at this station. Although iron concentrations in sediment at the Camp Lake littoral station in 2020 were elevated compared to baseline, similar concentrations of iron were observed in littoral sediment at the reference lake suggesting naturally high background concentrations. Similarly, although nickel concentrations in sediment at the Camp Lake littoral station were elevated compared to concentrations at the reference lake in 2020, no substantial change in nickel concentrations had occurred between 2020 and baseline. At profundal habitat of Camp Lake in 2020, mean concentrations of arsenic, copper, iron, manganese, nickel, and phosphorus in sediment were all comparable to mean concentrations observed at the reference lake, as well as to Camp Lake baseline data, suggesting no changes over time. Thus, only the concentration of arsenic at the Camp Lake littoral station in 2020 was elevated compared to concentrations observed in sediment both at the reference lake in 2020 and at the Camp Lake littoral station at the time of baseline.

No AEMP water quality benchmarks were exceeded at Camp Lake during spring, summer, or fall sampling events in 2020.[10] In addition, no adverse effects on phytoplankton, benthic invertebrates, nor on fish (arctic charr) health were indicated at Camp Lake in 2020 based on comparisons to reference lake conditions and to Camp Lake baseline data. Considering these results within the Mary River Project AEMP Management Response Framework, the potential change in arsenic concentrations in sediment at the littoral station of Camp Lake warrants a low action response. Arsenic concentrations in water at CLT1, CLT2, and Camp Lake have consistently been near or below laboratory Method Detection Limits (MDL) since 2015, and thus

[10] The reported concentration of zinc at the Station JL0-07 surface was above the AEMP benchmark during the summer sampling event but this result appeared to be an anomaly based on an order of magnitude difference in concentration between this station and data reported for all other Camp Lake stations in summer 2020 (Appendix Table C.26).

the mine did not appear to be a source of arsenic to the Camp Lake system. Under the current AEMP, sediment chemistry sampling is conducted only at a single littoral station at Camp Lake (Baffinland 2015), and therefore the current AEMP does not adequately capture variability in sediment chemistry at littoral habitat of Camp Lake. Moreover, sediment chemistry sampling under the current AEMP is not always conducted at the same locations at which benthic invertebrate community sampling is conducted, precluding linkages to be drawn between sediment chemistry and biological responses. Accordingly, as per recommendations provided in the past by Minnow (2016b), a low action response of harmonizing lake sediment quality and benthic invertebrate monitoring stations, focusing primarily on littoral habitat, is recommended to improve the ability of the program to evaluate mine-related effects to biota and potentially allow linkages to be determined between metal concentrations in sediment and benthic invertebrate responses.

4 SHEARDOWN LAKE SYSTEM

4.1 Sheardown Lake Tributaries (SDLT1, SDLT12, and SDLT9)

4.1.1 Water Quality

Dissolved oxygen was consistently near full saturation at each of the Sheardown Lake tributaries during spring, summer, and fall sampling events in 2020 (Appendix Tables C.1 to C.3). Dissolved oxygen concentrations at Sheardown Lake Tributary 1 (SDLT1) and Sheardown Lake Tributary 9 (SDLT9) did not differ significantly from those at Unnamed Reference Creek during the August 2020 biological study (Figure 4.1). Although dissolved oxygen concentrations were significantly lower at Sheardown Lake Tributary 12 (SDLT12) than at Unnamed Reference Creek, the dissolved oxygen concentrations at SDLT12, and both other Sheardown Lake tributaries, were well above the WQG minimum for supporting sensitive life stages of cold-water biota (i.e., 9.5 mg/L) during the August 2020 biological study (Figure 4.1; Appendix Table C.31). *In situ* pH was significantly higher at SDLT1 and SDLT12 compared to Unnamed Reference Creek, whereas pH at SDLT9 did not differ significantly from that at the reference creek during the August 2020 biological study (Figure 4.1). Despite minor differences in pH among the Sheardown Lake tributaries, pH was consistently within WQG limits at each of the Sheardown Lake tributaries and thus slight dissimilarity in pH among areas was unlikely to be ecologically meaningful. Specific conductance at each of the Sheardown Lake tributaries was significantly higher than at Unnamed Reference Creek during the August 2020 biological study (Figure 4.1; Appendix Table C.32). Because specific conductance often serves as an indication of mine-associated influences on water quality (e.g., Environment Canada 2012), these observations suggested a potential mine-related influence on water quality of the SDLT1, SDLT9, and SDLT12 watercourses.

Sheardown Lake Tributary 1 (SDLT1) is the only tributary of the Sheardown Lake system at which routine water chemistry monitoring is conducted, with one monitoring station established in each of the upper and lower reaches of the tributary (i.e., Stations D1-05 and D1-00, respectively; Figure 2.2). Water chemistry of SDLT1 met AEMP benchmarks and WQG in spring, summer, and fall sampling events of 2020 except copper concentrations, which on average were elevated relative to both criteria for all sampling events (Table 4.1; Appendix Table C.33). Among parameters with established AEMP benchmarks, mean chloride, copper, nitrate, and sulphate concentrations were elevated at SDLT1 compared to the reference creeks during at least one sampling event in 2020, with nitrate and sulphate elevated by greatest factors (Table 4.1; Appendix Table C.35). For parameters without AEMP benchmarks, concentrations of total and dissolved molybdenum, potassium, and uranium, and concentrations of dissolved manganese,

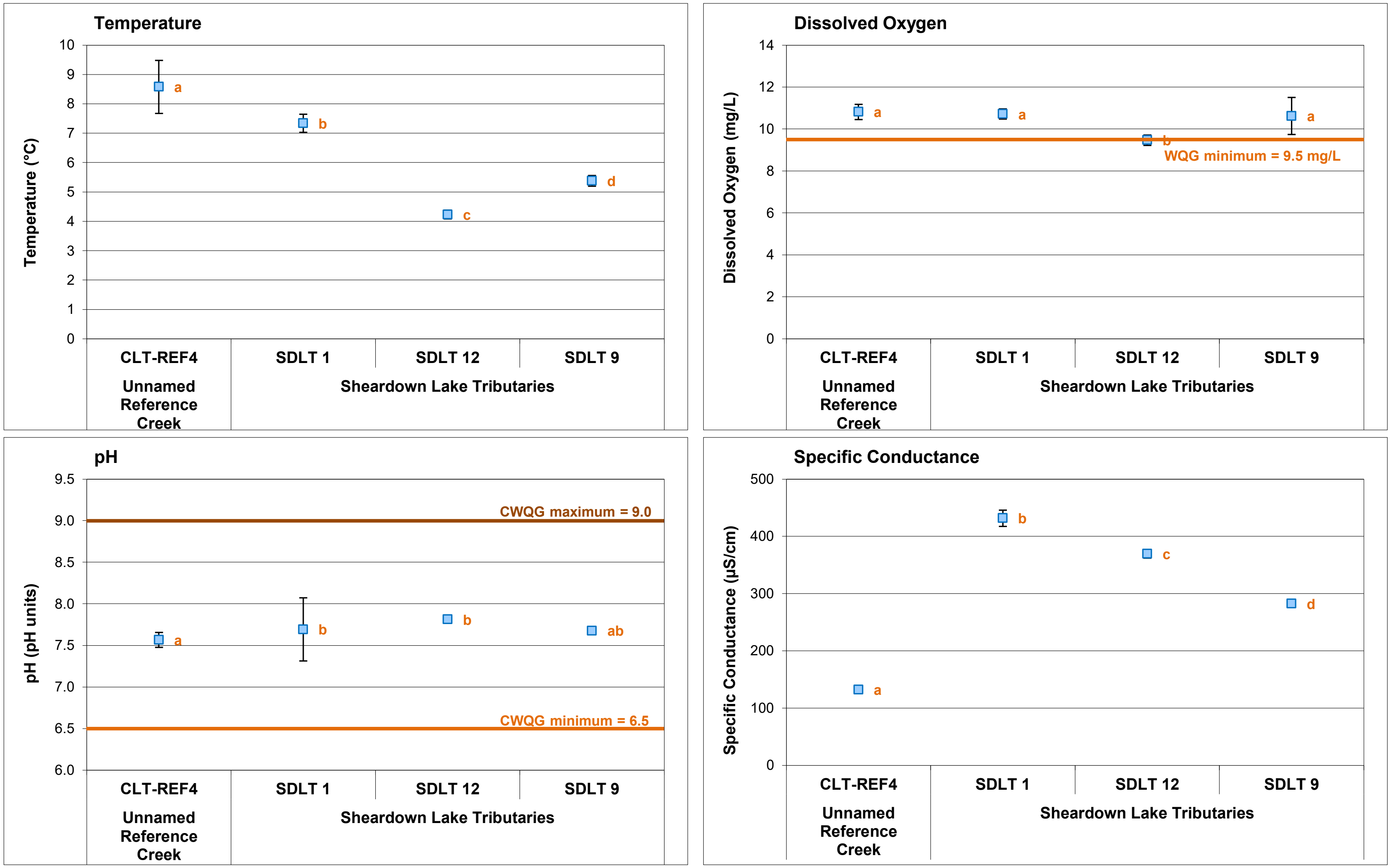


Figure 4.1: Comparison of *In Situ* Water Quality Variables (mean ± SD; n = 5) Measured at Sheardown Lake Tributaries (SDLT) and Unnamed Reference Creek Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Note: The same letter(s) next to data points indicate study area values do not differ significantly.

Table 4.1: Mean Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Monitoring Stations in Spring, Summer, and Fall, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Bench-mark[b]	Reference Creek (n = 4)			Sheardown Lake Tributary 1 (n = 2)		
					Spring	Summer	Fall	Spring	Summer	Fall
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	55	134	175	217	338	309
	pH (lab)	pH	6.5 - 9.0	-	7.63	8.01	8.05	8.07	7.94	8.07
	Hardness (as $CaCO_3$)	mg/L	-	-	24	57	83	100	152	155
	Total Suspended Solids	mg/L	-	-	3.2	2.7	2	2.6	2	2
	Total Dissolved Solids	mg/L	-	-	85	85	99	122	198	172
	Turbidity	NTU	-	-	1.87	6.62	2.49	5.37	0.57	0.20
	Alkalinity (as $CaCO_3$)	mg/L	-	-	24	61	69	74	112	111
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.010	0.012	0.010	0.010	0.010	0.010
	Nitrate	mg/L	3	3	0.020	0.062	0.076	0.416	0.900	0.701
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.005	0.005	0.005
	Total Kjeldahl Nitrogen	mg/L	-	-	0.02	0.15	0.15	0.15	0.18	0.23
	Dissolved Organic Carbon	mg/L	-	-	1.9	3.4	2.3	3.4	3.8	3.1
	Total Organic Carbon	mg/L	-	-	2.2	3.1	2.1	4.8	4.9	3.4
	Total Phosphorus	mg/L	0.030$^{\alpha}$	-	0.0045	0.0065	0.0039	0.0058	0.0267	0.0030
	Phenols	mg/L	0.004$^{\alpha}$	-	0.0010	0.0010	0.0021	0.0018	0.0010	0.0013
Anions	Bromide (Br)	mg/L	-	-	0.1	0.1	0.1	0.1	0.1	0.1
	Chloride (Cl)	mg/L	120	120	1.2	4.1	7.1	4.2	8.0	8.4
	Sulphate (SO_4)	mg/L	218$^{\beta}$	218	1.3	5.5	9.2	26.3	52.1	32.3
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.078	***0.311***	0.059	0.095	0.011	0.011
	Antimony (Sb)	mg/L	0.020$^{\alpha}$	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.00010	0.0001275	0.0001	0.0001	0.0001	0.0001
	Barium (Ba)	mg/L	-	-	0.0036	0.0095	0.0103	0.0107	0.0151	0.0147
	Beryllium (Be)	mg/L	0.011$^{\alpha}$	-	0.0005	0.0004	0.0005	0.0005	0.0005	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0003875	0.0005	0.0005	0.0005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.010	0.010	0.013	0.016	0.016
	Cadmium (Cd)	mg/L	0.00012	0.00008	0.00001	0.000009	0.000010	0.000026	0.000025	0.000025
	Calcium (Ca)	mg/L	-	-	4.9	11.8	16.5	17.5	27.1	27.5
	Chromium (Cr)	mg/L	0.0089	0.00856	0.00050	0.00082	0.0005	0.0005	0.0005	0.0005
	Cobalt (Co)	mg/L	0.0009$^{\alpha}$	0.004	0.00010	0.0001575	0.0001	0.00011	0.00011	0.0001
	Copper (Cu)	mg/L	0.002	0.0022	0.0007	0.0011	0.0010	***0.0029***	***0.0024***	***0.0023***
	Iron (Fe)	mg/L	0.30	0.326	0.077	0.243	0.066	0.131	0.089	0.061
	Lead (Pb)	mg/L	0.001	0.001	0.00011	0.00023	0.00009	0.00023	0.00005	0.00005
	Lithium (Li)	mg/L	-	-	0.0010	0.0011	0.0010	0.0019	0.0020	0.0019
	Magnesium (Mg)	mg/L	-	-	2.86	6.7	9.6	13.0	20.7	20.4
	Manganese (Mn)	mg/L	0.935$^{\beta}$	-	0.00136	0.00300	0.00102	0.00462	0.00539	0.00293
	Mercury (Hg)	mg/L	0.000026	-	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00015	0.00045	0.00057	0.00351	0.00390	0.00495
	Nickel (Ni)	mg/L	0.025	0.025	0.0005	0.0007	0.0006	0.0015	0.0013	0.0012
	Potassium (K)	mg/L	-	-	0.45	0.93	1.04	2.44	2.84	3.06
	Selenium (Se)	mg/L	0.001	-	0.001	0.0007625	0.001	0.001	0.001	0.001
	Silicon (Si)	mg/L	-	-	0.62	1.25	0.87	1.39	1.42	1.43
	Silver (Ag)	mg/L	0.00025	0.0001	0.00001	0.00002	0.00001	0.00001	0.00001	0.00001
	Sodium (Na)	mg/L	-	-	0.83	2.76	3.97	2.46	3.90	4.20
	Strontium (Sr)	mg/L	-	-	0.0049	0.0139	0.0185	0.0142	0.0200	0.0187
	Thallium (Tl)	mg/L	0.0008	0.0008	0.00010	0.00008	0.00010	0.00010	0.00010	0.00010
	Tin (Sn)	mg/L	-	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.0108	0.0241	0.0100	0.0100	0.0100	0.0100
	Uranium (U)	mg/L	0.015	-	0.00045	0.00405	0.00737	0.00371	0.00789	0.01430
	Vanadium (V)	mg/L	0.006$^{\alpha}$	0.006	0.00100	0.00115	0.00100	0.00100	0.00100	0.00100
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.003	0.003	0.0063	0.00565	0.00485

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Canadian Water Quality Guideline except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]) and β (British Columbia Water Quality Guideline [BCWQG]). See Table 2.3 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data adopted from Camp Lake Tributaries.

were moderately (i.e., 5- to 10-fold) to highly (i.e., ≥10-fold) elevated at SDLT1 compared to the reference creeks in at least one of the spring, summer, or fall 2020 sampling events (Appendix Table C.35). Highest elevation in parameter concentrations typically occurred during the spring sampling event (Appendix Tables C.34 and C.35). In addition, higher parameter concentrations were generally observed at lower SDLT1 compared to upper SDLT1, suggesting that additional inputs of metals to SDLT1 occurred with distance downstream of the headwaters at the main mine camp (Appendix Table C.34).

Despite total copper concentrations above the AEMP benchmark and WQG at SDLT1 in 2020, the concentrations of copper during each seasonal sampling event were comparable to those reported at SDLT1 during baseline (Appendix Figure C.11; Appendix Table C.34), suggesting that copper concentrations were naturally high within this tributary prior to commencement of mine operations in 2015. Among the other parameters with established AEMP benchmarks, nitrate and sulphate concentrations were most consistently elevated at SDLT1 in 2020 (and other years of mine operation) compared to baseline (Appendix Figure C.11; Appendix Table C.33). For parameters without AEMP benchmarks, sodium and uranium were the only parameters with elevated concentrations for more than one of the three seasonal sampling events at SDLT1 in 2020 compared to baseline (Appendix Table C.33; Appendix Figure C.11). Overall, the key mine-related influences on water quality of SDLT1 based on comparisons to the reference creeks and baseline included elevated specific conductance and concentrations of molybdenum, nitrate, sulphate, and uranium, although none of the latter four parameters were observed at concentrations above applicable AEMP benchmarks and/or WQG.

4.1.2 Sediment Quality

Sediment from SDLT1 was visually characterized as reddish-brown silt, whereas sediment from SDLT12 was mainly coarse sand and gravel, and sediment from SDLT9 was medium-sized coarse sand (Appendix Table D.18). Natural in-stream substrate at tributaries SDLT1 and SDLT12 is composed almost entirely of cobble and boulder material, but smaller particles tend to deposit interstitially in slow flowing areas and along the shoreline at both tributaries (Minnow 2018). In contrast, small cobble is the primary substrate type at SDLT9, but sand can constitute as much as 5 to 10% of the surficial bed material in this tributary (Minnow 2018). Sediment TOC content was low (i.e., <1%) in samples collected from SDLT1 and SDLT12, but slightly higher (0.8 to 4.0%) in samples from SDLT9 (Appendix Tables D.19, D.21, and D.22). Sediment TOC content was 6-fold higher (on average) at SDLT1 and SDLT12 than observed at lotic reference areas, but 17-fold higher at SDLT9 (Table 4.2; Appendix Table D.20). This suggested a more depositional environment and/or greater suspended sediment loads at the three Sheardown Lake tributaries compared to reference conditions.

Table 4.2: Sediment Total Organic Carbon and Metal Concentrations at Sheardown Lake Tributaries (SDLT1, 12, and 9) and Applicable Reference Creek and River Sediment Monitoring Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Lotic Reference Stations	Sheardown Lake Tributaries		
			Unnamed Reference Creek (REFCRK; n = 3)	Sheardown Trib 1 SDLT1 (n = 3)	Sheardown Trib 12 SDLT12 (n = 3)	Sheardown Trib 9 SDLT9 (n = 3)
			Average ± SD	Average ± SD	Average ± SD	Average ± SD
TOC	%	10^{α}	0.12 ± 0.035	0.76 ± 0.19	0.75 ± 0.19	2.03 ± 1.69
Aluminum (Al)	mg/kg	-	584 ± 185	15,967 ± 1,601	8,153 ± 807	6,997 ± 3,386
Antimony (Sb)	mg/kg	-	<0.10 ± 0	0.17 ± 0.057	0.22 ± 0.023	0.11 ± 0.012
Arsenic (As)	mg/kg	17	0.22 ± 0.11	3.29 ± 1.13	5.83 ± 1.00	1.65 ± 1.15
Barium (Ba)	mg/kg	-	2.72 ± 0.722	63.6 ± 13.2	17.1 ± 6.11	32.2 ± 19.4
Beryllium (Be)	mg/kg	-	<0.10 ± 0	0.65 ± 0.042	0.68 ± 0.020	0.32 ± 0.20
Bismuth (Bi)	mg/kg	-	<0.20 ± 0	0.48 ± 0.16	0.25 ± 0.040	0.22 ± 0.035
Boron (B)	mg/kg	-	<5.0 ± 0	6.8 ± 1.1	5.5 ± 0.68	8.50 ± 6.06
Cadmium (Cd)	mg/kg	3.5	<0.020 ± 0	0.143 ± 0.0261	0.051 ± 0.011	0.064 ± 0.040
Calcium (Ca)	mg/kg	-	494 ± 249	3,790 ± 1,060	1,223 ± 643	2,920 ± 1,974
Chromium (Cr)	mg/kg	90	7.79 ± 5.39	33.7 ± 2.25	30.6 ± 0.643	22.7 ± 10.3
Cobalt (Co)	mg/kg	-	0.953 ± 0.558	13.3 ± 1.37	14.6 ± 0.751	6.24 ± 3.07
Copper (Cu)	mg/kg	110^{α}	1.21 ± 0.899	24.0 ± 2.16	19.4 ± 0.656	15.7 ± 11.3
Iron (Fe)	mg/kg	$40,000^{\alpha}$	12,493 ± 9,700	152,667 ± 33,546	345,000 ± 53,731	60,133 ± 40,945
Lead (Pb)	mg/kg	91	1.49 ± 0.546	12.4 ± 0.666	5.48 ± 1.05	5.48 ± 3.02
Lithium (Li)	mg/kg	-	<2.0 ± 0	17.8 ± 1.20	8.17 ± 1.69	7.67 ± 3.50
Magnesium (Mg)	mg/kg	-	444 ± 165	14,000 ± 2,166	5,790 ± 957	6,017 ± 3,033
Manganese (Mn)	mg/kg	$1,100^{\alpha,\beta}$	27.4 ± 14.6	681 ± 51	810 ± 103.9	294 ± 175
Mercury (Hg)	mg/kg	0.486	<0.0050 ± 0	0.0065 ± 0.00067	0.0052 ± 0.00029	0.0120 ± 0.0069
Molybdenum (Mo)	mg/kg	-	<0.10 ± 0	5.73 ± 1.33	3.82 ± 0.248	1.82 ± 1.27
Nickel (Ni)	mg/kg	$75^{\alpha,\beta}$	1.76 ± 0.920	33.1 ± 1.14	36.4 ± 1.70	24.5 ± 14.8
Phosphorus (P)	mg/kg	$2,000^{\alpha}$	167 ± 98	344 ± 50	252 ± 51	428 ± 155
Potassium (K)	mg/kg	-	133 ± 42	5,817 ± 801	800 ± 385	1,597 ± 827
Selenium (Se)	mg/kg	-	<0.20 ± 0	0.21 ± 0.012	0.27 ± 0.061	0.27 ± 0.12
Silver (Ag)	mg/kg	-	<0.10 ± 0	0.12 ± 0.021	0.10 ± 0	<0.10 ± 0
Sodium (Na)	mg/kg	-	<50 ± 0	126 ± 29	<50 ± 0	63 ± 22
Strontium (Sr)	mg/kg	-	2.00 ± 0.544	3.9 ± 0.49	2.1 ± 0.56	4.06 ± 1.73
Sulphur (S)	mg/kg	-	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0
Thallium (Tl)	mg/kg	-	<0.050 ± 0	0.271 ± 0.0278	0.068 ± 0.017	0.153 ± 0.0785
Tin (Sn)	mg/kg	-	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0
Titanium (Ti)	mg/kg	-	83 ± 47	821 ± 134	218 ± 69	485 ± 139
Uranium (U)	mg/kg	-	0.479 ± 0.247	4.35 ± 1.408	2.33 ± 0.395	1.28 ± 0.946
Vanadium (V)	mg/kg	-	16.8 ± 12.8	27.7 ± 3.64	15.6 ± 1.15	18.0 ± 8.10
Zinc (Zn)	mg/kg	315	3.0 ± 1.2	75.8 ± 8.90	25.2 ± 5.67	23.1 ± 12.5
Zirconium (Zr)	mg/kg	-	2.1 ± 0.91	9.0 ± 1.9	3.5 ± 0.38	2.9 ± 2.1

[shaded box] Indicates parameter concentration above SQG.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Mean concentrations of metals in sediment from both SDLT1 and SDLT12 were generally elevated compared to mean concentrations at lotic reference areas (Table 4.2; Appendix Table D.20). In particular, concentrations of aluminum, arsenic, barium, cobalt, copper, iron, magnesium, manganese, molybdenum, nickel, potassium, and zinc were highly elevated (i.e., ≥10-fold higher) in sediment from one or both of these tributaries compared to the lotic reference areas (Appendix Table D.20). In part, elevated metal concentrations in sediment from SDLT1 and SDLT12 may reflect finer substrate sizes and more depositional features of these tributaries compared to that observed at the lotic reference areas. On average, metal concentrations in sediment from SDLT1 and SDLT12 were below applicable SQG except for iron, which occurred at mean concentrations approximately four- and nine-times higher than the SQG, respectively, at these tributaries (Table 4.2; Appendix Tables D.19 and D.21). Sediment from SDLT9 had highly elevated concentrations of molybdenum relative to mean concentrations at the lotic reference areas, whereas mean concentrations of several other metals including aluminum, arsenic, barium, copper, iron, magnesium, manganese, nickel, and potassium were only moderately higher (i.e., 5-fold to 10-fold) at SDLT9 (Appendix Table D.20). Similar to the other Sheardown Lake tributaries, concentrations of all metals except iron (which was only 1.5 times greater than the SQG, on average) were well below SQG at SDLT9 (Table 4.2; Appendix Table D.22).

4.1.3 Phytoplankton

Among the Sheardown Lake tributaries, phytoplankton (chlorophyll-a) monitoring is conducted only at SDLT1 as part of the Mary River Project CREMP (Table 2.1). Chlorophyll-a concentrations were lower at upper SDLT1 (Station D1 05) compared to near the creek mouth (Station D1 00) during each of the spring, summer, and fall sampling events in 2020 (Figure 4.2). Nitrate, phosphorus, and TKN concentrations were consistently the same or higher near the mouth of SDLT1 in 2020 (Appendix Table C.34), and thus higher chlorophyll-a concentrations near the mouth was in line with typical responses of phytoplankton to higher nutrient concentrations. Chlorophyll-a concentrations at SDLT1 were within the range of variability observed among reference creeks in spring and summer sampling events, but were considerably lower compared to the reference creeks in the summer sampling event (Figure 4.2). Although the latter may have reflected a mine-related influence on phytoplankton abundance occurring seasonally at lower SDLT1, chlorophyll-a concentrations were unusually high at the reference creeks in the summer of 2020 compared to previous years, and thus may not reflect the norm. For all sampling events in 2020, chlorophyll-a concentrations were well below the AEMP benchmark of 3.7 µg/L at both of the SDLT1 monitoring stations (Figure 4.2). Similar to the reference creeks and Camp Lake tributaries, chlorophyll-a concentrations at SDLT1 were suggestive of oligotrophic, low productivity conditions based on Dodds et al (1998) trophic status

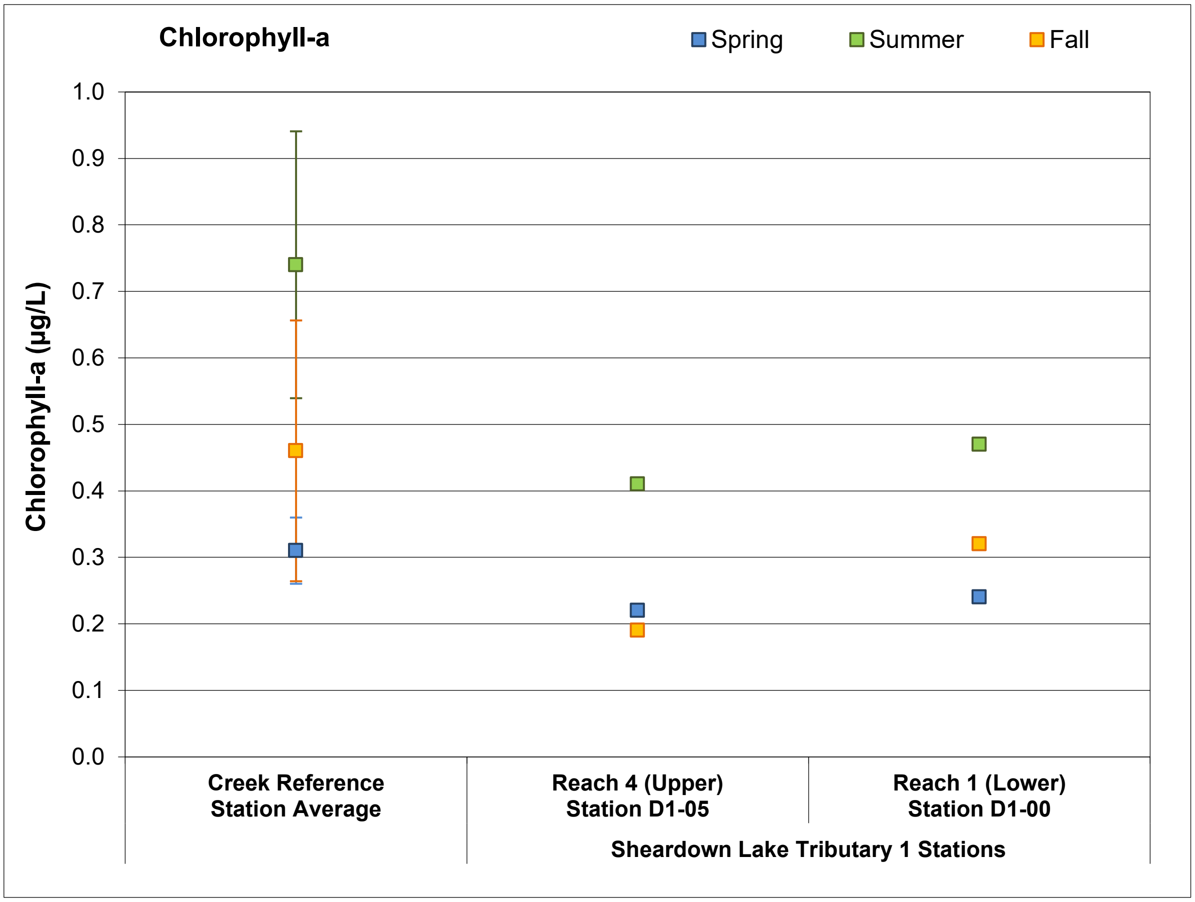


Figure 4.2: Chlorophyll-a Concentrations at Sheardown Lake Tributary 1 Phytoplankton Monitoring Stations, Mary River Project CREMP, 2020

Note: Reference creek data represented by average (± SD; n = 4) calculated from CLT-REF and MRY-REF stations.

classification for stream environments (i.e., chlorophyll-a concentration <10 µg/L). Relatively low chlorophyll-a concentrations at SDLT1 stations in 2020 were also consistent with an oligotrophic categorization using CWQG (CCME 2020) categorization based on aqueous phosphorus concentrations (i.e., concentrations below 10 µg/L; Table 4.1; Appendix Table C.33).

Chlorophyll-a concentrations at SDLT1 stations in fall 2020 were similar to those during the baseline period (Figure 4.3). In addition, no consistent directional changes in chlorophyll-a concentrations were shown at the SDLT1 stations during fall sampling events over the mine baseline (2005 to 2013), construction (2014), and operational (2015 to 2020) periods (Figure 4.3). These results suggested no adverse mine-related influences on phytoplankton productivity at SDLT1 over the past six years of mine operation.

4.1.4 Benthic Invertebrate Community

4.1.4.1 Sheardown Lake Tributary 1 (SDLT1)

The benthic invertebrate community at the lower reach of SDLT1, near the outlet to Sheardown Lake NW, showed significantly lower evenness and significant differences in composition (as indicated by Bray-Curtis Index) compared to Unnamed Reference Creek in 2020 (Table 4.3; Appendix Table F.29). Marked differences in community composition between SDLT1 and the reference creek included significantly higher relative abundance of Nemata and Chironomidae, and significantly lower relative abundance of Hydracarina, Ostracoda, and Simuliidae at SDLT1 (Table 4.3). However, an ecologically significant higher relative abundance of metal-sensitive Chironomidae occurred at SDLT1 compared to Unnamed Reference Creek (Table 4.3), suggesting that metals were not biologically available and/or were not a large contributor to community composition differences between SDLT1 and the reference creek. This result was consistent with concentrations of all metals below WQG at SDLT1, except copper which was slightly above the WQG, in 2020 (Table 4.1). Ecologically significant higher relative abundance of the shredder FFG was indicated at SDLT1 compared to Unnamed Reference Creek, suggesting a greater amount of in-stream vegetation and/or organic debris at SDLT1. In addition, ecologically significant higher relative abundance of the burrower HPG was shown at SDLT1 compared to the reference creek (Table 4.3), possibly indicating physical habitat alteration associated with sedimentation had affected benthic invertebrate community composition at SDLT1 relative to reference conditions.

No consistent ecologically significant differences in density, richness, or evenness were indicated at SDLT1 over years of mine operation (2015 to 2020) compared to baseline (Appendix Figure F.7; Appendix Table F.30). Similarly, no ecologically significant differences in the relative abundance of any dominant taxonomic groups were consistently indicated over years

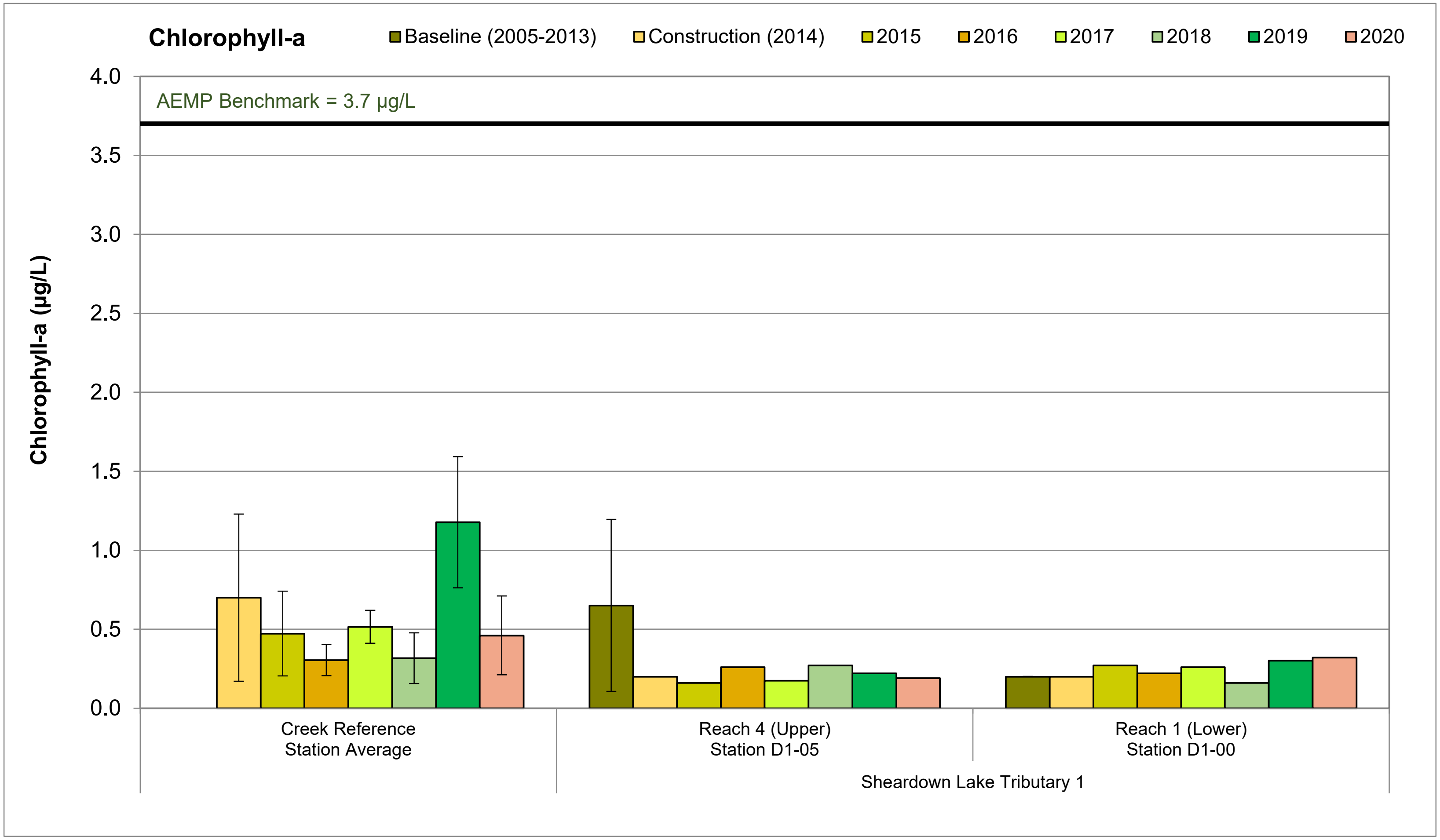


Figure 4.3: Temporal Comparison of Chlorophyll-a Concentrations at Sheardown Lake Tributary 1 for Mine Baseline (2005 to 2013), Construction (2014), and Operational (2015 to 2020) Periods in the Fall, Mary River Project CREMP

Note: Reference creek data represented by average (± SD; n = 4) calculated from CLT-REF and MRY-REF stations.

Table 4.3: Benthic Invertebrate Community Metric Statistical Comparison Results among the Sheardown Lake Tributaries and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 4-Area Comparison				Pair-wise, *post hoc* comparisons				
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Areas?	P-value	Study Area	Mean	Standard Deviation (SD)	Magnitude of Difference (Ref SD)	Different from Reference Creek?
Density (No. per m^2)	ANOVA	log10	YES	0.050	Reference Creek	713	296	-	-
					SDLT1	679	625	-0.1	NO
					SDLT12	1,318	26	2.0	NO
					SDLT9	1,601	841	3.0	YES
Richness (No. of Taxa)	ANOVA	none	NO	0.350	Reference Creek	16.0	4.4	-	-
					SDLT1	13.4	2.9	-0.6	NO
					SDLT12	17.3	4.2	0.3	NO
					SDLT9	18.0	4.7	0.5	NO
Simpson's Evenness	ANOVA	none	YES	0.019	Reference Creek	0.840	0.043	-	-
					SDLT1	0.722	0.097	-2.7	YES
					SDLT12	0.832	0.063	-0.2	NO
					SDLT9	0.855	0.024	0.3	NO
Nemata (% of community)	ANOVA	log10(x+1)	YES	0.016	Reference Creek	0.7	1.3	-	-
					SDLT1	6.2	3.6	4.3	YES
					SDLT12	5.4	1.7	3.7	YES
					SDLT9	3.1	2.3	1.8	NO
Hydracarina (% of community)	K-W	rank	YES	0.004	Reference Creek	4.5	3.7	-	-
					SDLT1	1.1	0.9	-0.9	YES
					SDLT12	0.2	0.2	-1.2	YES
					SDLT9	4.2	1.8	-0.1	NO
Ostracoda (% of community)	K-W	rank	YES	0.001	Reference Creek	30.6	11.7	-	-
					SDLT1	0.0	0.1	-2.6	YES
					SDLT12	0.6	0.1	-2.6	YES
					SDLT9	8.2	2.6	-1.9	NO
Chironomidae (% of community)	ANOVA	none	YES	<0.001	Reference Creek	48.3	12.9	-	-
					SDLT1	85.0	6.9	2.8	YES
					SDLT12	88.6	2.1	3.1	YES
					SDLT9	70.3	4.3	1.7	YES
Metal Sensitive Chironomids (% of community)	ANOVA	log10(x+1)	YES	0.002	Reference Creek	0.8	1.2	-	-
					SDLT1	10.5	5.3	7.9	YES
					SDLT12	0.5	0.4	-0.3	NO
					SDLT9	3.2	3.6	1.9	NO
Simuliidae (% of community)	ANOVA	log10(x+1)	YES	0.020	Reference Creek	9.8	8.6	-	-
					SDLT1	0.0	0.0	-1.1	YES
					SDLT12	0.0	0.0	-1.1	YES
					SDLT9	0.5	0.9	-1.1	YES
Tipulidae (% of community)	ANOVA	log10(x+1)	NO	0.218	Reference Creek	1.5	2.3	-	-
					SDLT1	3.9	2.5	1.0	NO
					SDLT12	1.5	0.7	0.0	NO
					SDLT9	3.1	1.3	0.7	NO
Collector-Gatherer FFG (% of community)	ANOVA	log10	YES	0.002	Reference Creek	80.7	8.8	-	-
					SDLT1	79.4	7.0	-0.1	NO
					SDLT12	82.2	1.4	0.2	NO
					SDLT9	63.1	6.9	-2.0	YES
Shredder FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	Reference Creek	2.8	2.7	-	-
					SDLT1	15.8	6.4	4.9	YES
					SDLT12	16.9	1.8	5.3	YES
					SDLT9	29.8	6.8	10.2	YES
Clinger HPG (% of community)	ANOVA	log10	YES	0.010	Reference Creek	15.8	7.7	-	-
					SDLT1	15.1	5.7	-0.1	NO
					SDLT12	16.3	1.9	0.1	NO
					SDLT9	33.4	8.1	2.3	YES
Sprawler HPG (% of community)	ANOVA	none	YES	<0.001	Reference Creek	79.4	6.6	-	-
					SDLT1	72.1	6.0	-1.1	NO
					SDLT12	73.8	0.3	-0.8	NO
					SDLT9	53.0	9.9	-4.0	YES
Burrower FFG (% of community)	ANOVA	log10	YES	0.032	Reference Creek	4.8	3.3	-	-
					SDLT1	12.5	5.8	2.3	YES
					SDLT12	9.9	1.6	1.5	YES
					SDLT9	8.1	2.8	1.0	YES

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Blue shaded values indicate significant difference (ANOVA p-value ≤ 0.10) that was also outside of a Critical Effect Size of ±2 SD_{REF}, indicating that the difference between the mine-exposed area and reference area was ecologically meaningful.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

of mine operation compared to both years of baseline at SDLT1 (Appendix Table F.30).[11] However, consistent differences in FFG composition that included significantly higher relative abundance of collector-gatherers and significantly lower relative abundance of filterers and shredders at SDLT1 beginning in 2018 and 2019, respectively, compared to baseline potentially indicated a shift in the benthic invertebrate food base during more recent years of mine operation. Interestingly, the relative abundance of these FFG at SDLT1 since 2018 has more closely reflected the FFG composition at the reference creek, suggesting that the benthic invertebrate food base at SDLT1 more recently reflects the reference condition than was observed during baseline.

4.1.4.2 Sheardown Lake Tributary 12 (SDLT12)

Benthic invertebrate density, richness, and evenness at SDLT12 did not differ significantly compared to Unnamed Reference Creek, but benthic invertebrate community compositional differences were indicated between SDLT12 and the reference creek in 2020 based on significantly differing Bray-Curtis Index (Table 4.3; Appendix Table F.29). Similar to SDLT1, the differences in community composition included significantly higher relative abundance of Nemata, Chironomidae, shredder FFG, and burrower HPG, and significantly lower relative abundance of Hydracarina, Ostracoda, and Simuliidae, at SDLT12 compared to Unnamed Reference Creek (Table 4.3). However, no significant differences in the relative abundance of metal-sensitive Chironomidae were indicated at SDLT12 compared to the reference creek in 2020 (Table 4.3). In addition, no ecologically significant differences in benthic invertebrate density, richness, evenness, and relative abundance of any dominant taxonomic groups or FFG were consistently indicated at SDLT12 over years of mine operation compared to baseline (Appendix Table F.32; Appendix Figure F.8). The dominant taxon at SDLT12 was the midge *Diplocladius*, which is characteristic of small, cool, slow-flowing or still streams (Armitage et al. 1995; Namayandeh et al 2016). Much lower densities of this midge were present at the reference creek (compare Appendix Tables F.4 and F.31), which suggested that the existence of significantly slower water velocity at SDLT12 compared to Unnamed Reference Creek (Appendix Table F.26) likely accounted for the differences in benthic invertebrate community composition shown between these creeks. Overall, no adverse influences of the mine on benthic invertebrate community structure or food resources were indicated at SDLT12 in 2020 and since the commencement of commercial mine operations in 2015.

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[11] Although the relative abundance of Tipulidae at SDLT1 was consistently significantly lower in years of mine operation compared to baseline data collected in 2008, no significant difference in the relative abundance of this group was indicated in years of mine operation relative to baseline data collected in 2013. In addition, the relative abundance of Tipulidae at SDLT1 from 2016 to 2020 was comparable to that shown at the reference creek in 2020, suggesting that the relative abundance of this group during baseline in 2008 was unusually high.

4.1.4.3 Sheardown Lake Tributary 9 (SDLT9)

Benthic invertebrate density was significantly higher at SDLT9 compared to Unnamed Reference Creek, the magnitude of which was outside of the CES_{BIC} of ±2 SD_{REF} (Table 4.3). In addition, richness, evenness, and relative abundance of all dominant groups, including metal-sensitive Chironomidae, did not differ significantly between SDLT9 and the reference creek at magnitudes considered ecologically meaningful (Table 4.3). Ecologically significant lower relative abundance of collector-gatherer FFG and sprawler HPG, and ecologically significant higher relative abundance of shredder FFG and clinger HPG, were indicated at SDLT9 compared to the reference creek in 2020 (Table 4.3). However, the relative abundance of all FFG, as well as benthic invertebrate density, richness, evenness, and relative abundance of all dominant taxonomic groups, showed no consistent differences over years of mine operation compared to baseline at SDLT9 (Appendix Table F.34; Appendix Figure F.9), indicating that the differences in FFG between SDLT9 and the reference creek in 2020 reflected natural phenomena. For instance, a higher relative abundance of the shredder FFG was consistent with field observations of greater amounts of rooted in-stream vegetation and organic debris, the primary food source for shredders, at SDLT9 compared to the reference creek (Appendix Table F.24). In turn, this suggested that differing amounts and/or types of organic material accounted for the differences in benthic invertebrate community composition between SDLT9 and the reference creek. Overall, no adverse influences of the mine on the benthic invertebrate community structure of SDLT12 were indicated since the commencement of commercial mine operations in 2015, including in 2020.

4.1.5 Effects Assessment and Recommendations

At the SDLT1, the following AEMP benchmarks were exceeded in 2020:

- Aqueous total copper concentration greater than the benchmark of 0.0022 mg/L in spring, summer, and fall monitoring events (i.e., mean of 0.0029 mg/L, 0.0024 mg/L, and 0.0023 mg/L, respectively).

Although copper concentrations at SDLT1 were, on average, slightly higher than at the reference creeks in 2020, the concentration of copper in 2020 was closely comparable to those reported during baseline suggesting natural elevation. Given the proximity to mine operations and evidence of sedimentation, a mine-related source of copper to SDLT1 seems likely, but because no elevation in copper concentrations was indicated at SDLT1 from 2015 to 2020 compared to baseline conditions, copper concentrations at SDLT1 may just naturally be similar to the AEMP benchmark. Biological monitoring conducted at SDLT1 in 2020 indicated no adverse effects to phytoplankton or benthic invertebrates, potentially reflecting copper concentrations at, or just marginally above, the WQG. Because no adverse effects to biota were associated with copper concentrations above the AEMP benchmark at SDLT1, a low action response to identify the likely source(s) of copper to the system is recommended to meet obligations under the AEMP Management Response Framework.

Benthic invertebrate community monitoring at SDLT12 and SDLT9 indicated no adverse influences of the mine on the benthic invertebrate community structure of either watercourse since the commencement of commercial mine operations in 2015, including in 2020. Under the AEMP Management Response Framework, no adjustment to the existing AEMP need be applied at SDLT12 and SDLT9 for the next monitoring program due to the absence of any mine-related changes shown in the benthic invertebrate community shown between the mine-operational period and baseline at these tributaries. However, because routine water quality monitoring is not conducted at either SDLT12 or SDLT9 under the current AEMP (Baffinland 2015), linkages between water chemistry and biological responses are not possible. Therefore, it is recommended that a water quality monitoring station be established at each of these watercourses and that the same AEMP water quality monitoring program implemented at SDLT1 be conducted at SDLT12 and SDLT9 in the future in order to provide water chemistry data to support the interpretation of biological data.

4.2 Sheardown Lake Northwest (DLO-1)

4.2.1 Water Quality

Water quality profiles of *in situ* water temperature, dissolved oxygen, pH, and specific conductance conducted at Sheardown Lake NW in 2020 showed no substantial station-to-station differences during any of the winter, summer, or fall sampling events (Appendix Figures C.12 to C.15). A warmer surface layer was indicated at Sheardown Lake NW during the summer sampling event in 2020 that extended to a depth of approximately 6 metres, but no complete thermal stratification developed in summer or during the winter or fall sampling events (Figure 4.4). Thermal changes with depth at Sheardown Lake NW were very similar to the patterns shown at Reference Lake 3 during the summer and fall sampling events in 2020 (Figure 4.4). The average water temperature at the bottom of the water column at Sheardown Lake NW littoral stations was significantly cooler than at Reference Lake 3 during the August 2020 biological study, but no differences in bottom water temperature were indicated between lakes at profundal sampling depths (Figure 4.5). Dissolved oxygen profiles at Sheardown Lake NW showed a distinct oxycline in winter and from depths of 4 to 11 metres in summer, but no oxycline was evident in fall indicating well mixed conditions (Figure 4.4). The general pattern in dissolved oxygen profiles at Sheardown Lake NW in summer and fall sampling events were similar to those observed at Reference Lake 3 in 2020 (Figure 4.4). Dissolved oxygen concentrations near the bottom of the water column were significantly lower at Sheardown Lake NW littoral and profundal

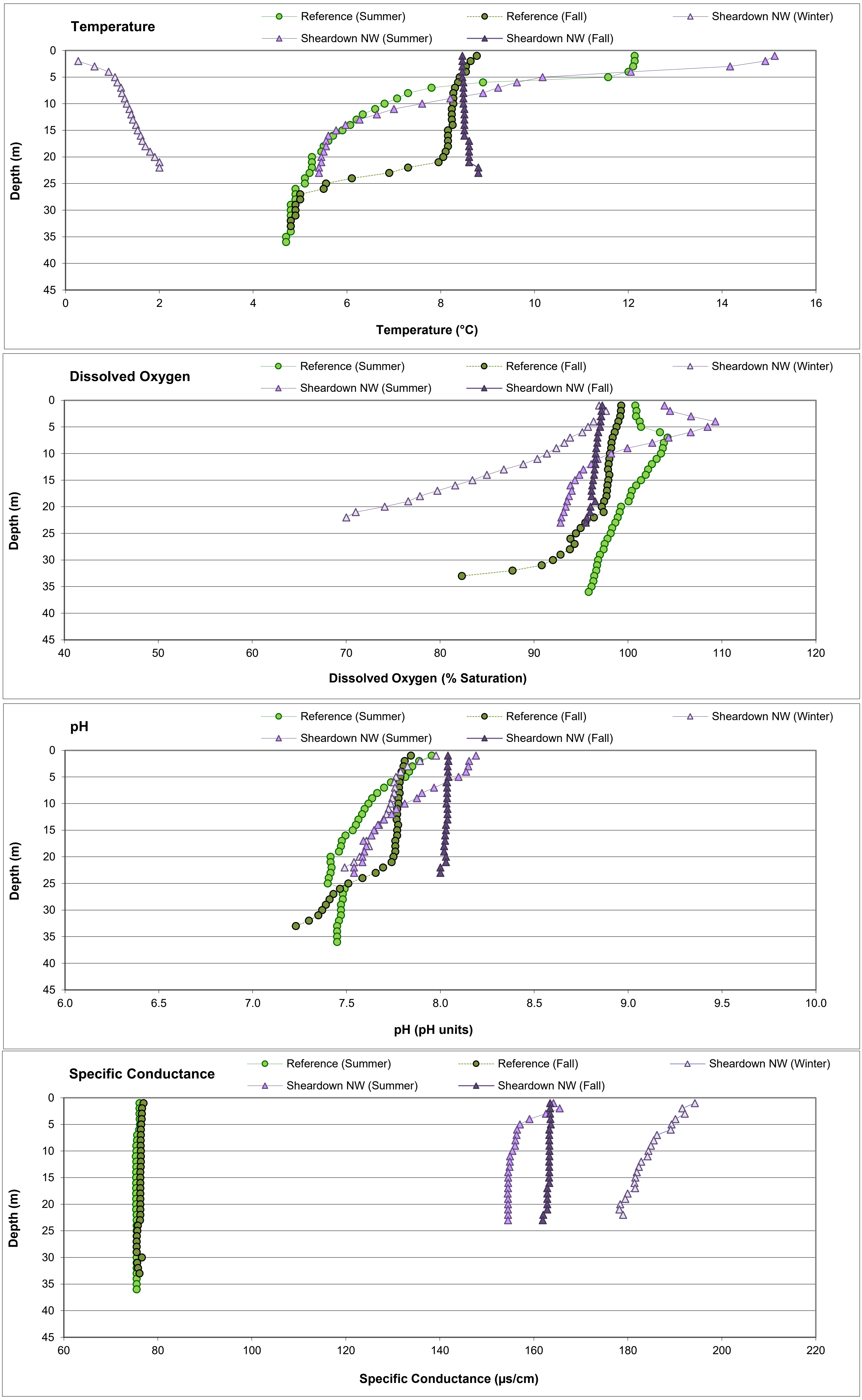

Figure 4.4: Average *In Situ* Water Quality with Depth from Surface at Sheardown Lake NW (DLO-01) Compared to Reference Lake 3 during Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

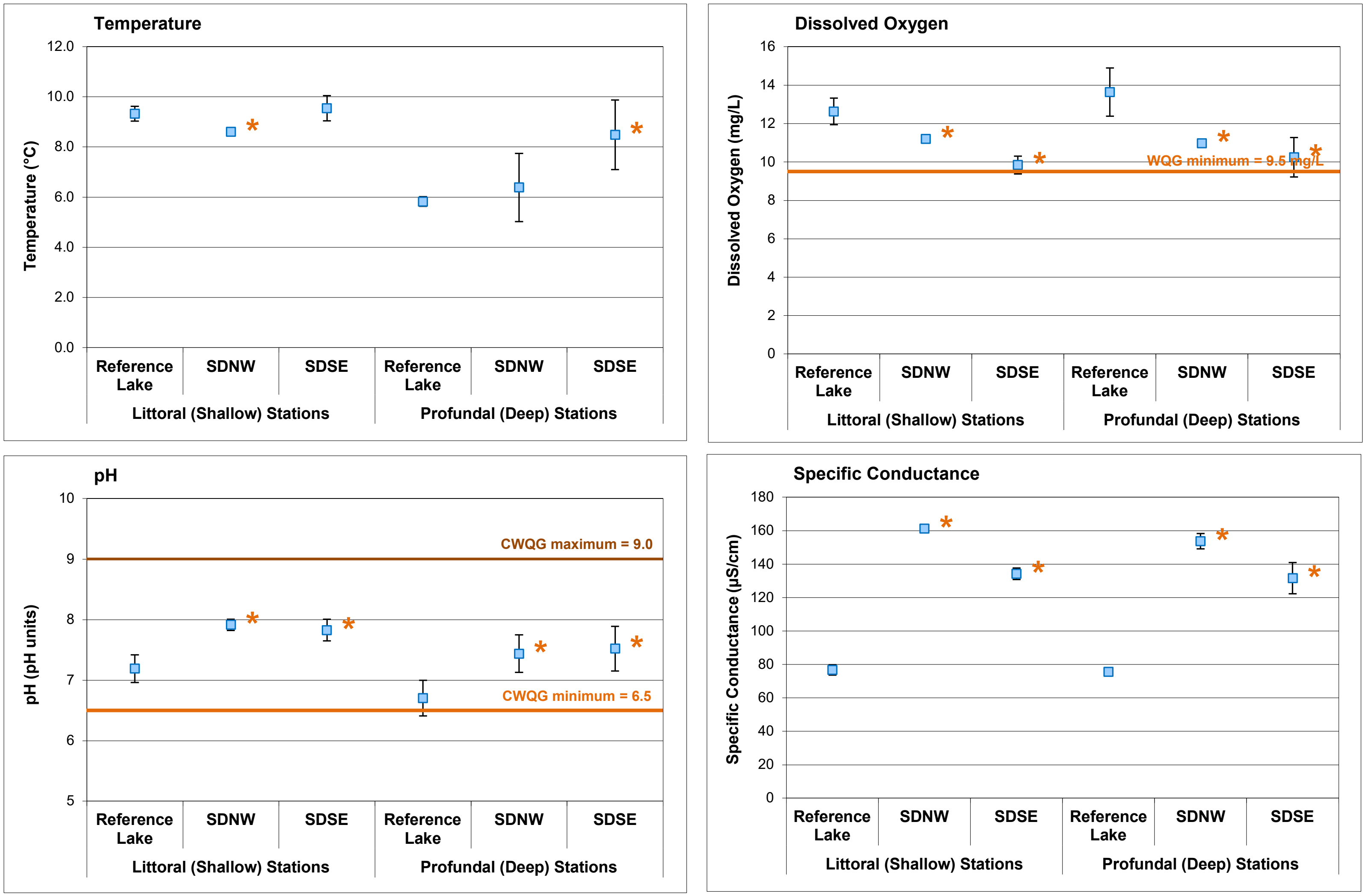

Figure 4.5: Comparison of *In Situ* Water Quality Variables (mean ± SD; n = 5) Measured at Sheardown Lake Basins (SDNW and SDSE) and Reference Lake 3 (REF3) Littoral and Profundal Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Note: An asterisk (*) next to data point indicates mean value differs significantly from the Reference Lake 3 mean for the respective littoral or profundal station type.

stations than like habitat stations at Reference Lake 3 during the August 2020 biological study (Figure 4.5). However, mean dissolved oxygen concentrations were above the WQG of 9.5 mg/L near the bottom at littoral and profundal stations of Sheardown Lake NW during biological monitoring in August 2020 (Figure 4.5; Appendix Table C.40).

Water column profiles showed decreasing pH with increased depth at Sheardown Lake NW and Reference Lake 3 in 2020, with the changes in pH through the water column at both lakes appearing to coincide with changes in water temperature (Figure 4.4). The pH near the bottom at littoral and profundal stations of Sheardown Lake NW were significantly higher than at respective habitats at the reference lake during the August 2020 biological study (Figure 4.5). However, the mean incremental difference in bottom pH between lakes was less than a pH unit, and pH values were consistently within WQG limits at Sheardown Lake NW (Figure 4.5; Appendix Table C.40), suggesting that the pH difference between lakes was not ecologically meaningful. Specific conductance profiles at Sheardown Lake NW showed no distinct changes with depth during any of the winter, summer, or fall sampling events in 2020, and exhibited similar patterns to those observed at Reference Lake 3 (Figure 4.4). Specific conductance near the bottom of the water column was significantly higher at Sheardown Lake NW littoral and profundal stations compared to the reference lake (Figure 4.5; Appendix Table C.40). Water clarity, as determined through evaluation of Secchi depth, was significantly lower at Sheardown Lake NW than at the reference lake at the time of the August 2020 biological study (Appendix Figure C.8).

Water chemistry at Sheardown Lake NW met all AEMP benchmarks and WQG over the duration of spring, summer, and fall sampling events in 2020 (Table 4.4). Among those parameters with established AEMP benchmarks, aluminum, chloride, nitrate, and sulphate concentrations were elevated by factors greater than three at Sheardown Lake NW compared to the reference lake during the summer and fall sampling events (Table 4.4; Appendix Table C.43). Of those parameters without AEMP benchmarks, turbidity, total manganese concentrations, and total and dissolved molybdenum and uranium concentrations were elevated at Sheardown Lake NW compared to the reference lake during summer and/or fall sampling events in 2020 (Appendix Tables C.43 and C.45). Similar to previous studies, elevated total aluminum and manganese concentrations at Sheardown Lake NW compared to the reference lake in 2020 were associated with suspended material that contributed to elevated turbidity at Sheardown Lake NW (Table 4.4; Appendix Table C.42). Naturally high turbidity[12] at Sheardown Lake NW may reflect backflow received from Mary River that contains relatively high amounts of suspended aluminum--and manganese-bearing particulate minerals. Similar concentrations of dissolved

[12] Turbidity at Sheardown Lake NW in 2020 was comparable to turbidity shown at the lake during baseline (Appendix Table C.44), suggesting that greater turbidity at this lake compared to Reference Lake 3 reflects a natural phenomenon.

Table 4.4: Mean Water Chemistry at Sheardown Lake NW (DLO-01) and Reference Lake 3 (REF3) Monitoring Stations[a] During Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[b]	AEMP Benchmark[c]	Reference Lake 3 (n = 3)		Sheardown Lake NW Stations (n = 5)		
					Summer	Fall	Winter	Summer	Fall
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	79	79	191	164	166
	pH (lab)	pH	6.5 - 9.0	-	7.66	7.75	7.65	7.99	8.02
	Hardness (as $CaCO_3$)	mg/L	-	-	35	38	97	76	80
	Total Suspended Solids (TSS)	mg/L	-	-	2.0	2.0	2.0	2.5	2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	41	51	118	93	92
	Turbidity	NTU	-	-	0.15	0.15	0.12	0.84	0.55
	Alkalinity (as $CaCO_3$)	mg/L	-	-	46	34	76	59	74
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.010	0.014	0.025	0.005	0.012
	Nitrate	mg/L	3	3	0.020	0.020	0.211	0.219	0.211
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.001	0.005
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.15	0.16	0.17	0.12	0.16
	Dissolved Organic Carbon	mg/L	-	-	3.3	3.5	2.7	1.8	2.0
	Total Organic Carbon	mg/L	-	-	4.6	3.8	3.8	1.8	2.5
	Total Phosphorus	mg/L	0.020^{α}	-	0.004	0.003	0.007	0.005	0.007
	Phenols	mg/L	0.004^{α}	-	0.0010	0.0011	0.002	0.0018	0.002
Anions	Bromide (Br)	mg/L	-	-	0.1	0.1	0.1	0.05	0.1
	Chloride (Cl)	mg/L	120	120	1.4	1.4	5.2	4.2	4.5
	Sulphate (SO_4)	mg/L	218^{β}	218	3.6	3.6	17.1	14.7	15.2
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[d]	0.0031	0.003	0.005	0.016	0.011
	Antimony (Sb)	mg/L	0.020^{α}	-	0.0001	0.0001	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.0001	0.0001	0.0001	0.0001	0.0001
	Barium (Ba)	mg/L	-	-	0.0064	0.00696	0.00919	0.00759	0.00819
	Beryllium (Be)	mg/L	0.011^{α}	-	0.0005	0.0005	0.0005	0.0001	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0005	0.0005	0.00005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.0115	0.01225	0.0135
	Cadmium (Cd)	mg/L	0.00012	0.00009	0.00001	0.00001	0.00001	0.000005	0.00001
	Calcium (Ca)	mg/L	-	-	7.2	7.2	18.7	14.1	15.5
	Chromium (Cr)	mg/L	0.0089	0.0089	0.0005	0.0005	0.0005	0.0001	0.0005
	Cobalt (Co)	mg/L	0.0009^{α}	0.004	0.0001	0.0001	0.0001	0.0001	0.0001
	Copper (Cu)	mg/L	0.002	0.0024	0.00073	0.0008	0.0010	0.0009	0.0008
	Iron (Fe)	mg/L	0.30	0.300	0.03	0.03	0.03	0.02	0.03
	Lead (Pb)	mg/L	0.001	0.001	0.00005	0.00005	0.00005	0.00005	0.00005
	Lithium (Li)	mg/L	-	-	0.0010	0.001	0.0015	0.0014	0.0015
	Magnesium (Mg)	mg/L	-	-	4.2	4.7	11.9	9.2	10.1
	Manganese (Mn)	mg/L	0.935^{β}	-	0.00080	0.00068	0.00075	0.00283	0.00132
	Mercury (Hg)	mg/L	0.000026	-	0.000005	0.000005	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00013	0.00015	0.00120	0.00097	0.00101
	Nickel (Ni)	mg/L	0.025	0.025	0.00050	0.00050	0.00080	0.00072	0.00069
	Potassium (K)	mg/L	-	-	0.9	0.90	1.64	1.33	1.38
	Selenium (Se)	mg/L	0.001	-	0.001	0.001	0.001	0.000052	0.001
	Silicon (Si)	mg/L	-	-	0.50	0.50	0.62	0.63	0.56
	Silver (Ag)	mg/L	0.00025	0.0001	0.00001	0.00001	0.00001	0.00001	0.00001
	Sodium (Na)	mg/L	-	-	0.9	0.96	2.25	1.83	1.96
	Strontium (Sr)	mg/L	-	-	0.0084	0.0082	0.0132	0.0104	0.0108
	Thallium (Tl)	mg/L	0.0008	0.0008	0.0001	0.0001	0.0001	0.00001	0.0001
	Tin (Sn)	mg/L	-	-	0.0001	0.0001	0.0001	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.010	0.010	0.010	0.001	0.010
	Uranium (U)	mg/L	0.015	-	0.00032	0.00033	0.00143	0.00135	0.00153
	Vanadium (V)	mg/L	0.006^{α}	0.006	0.0010	0.001	0.001	0.0005	0.001
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.003	0.003	0.003	0.003

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Values presented are averages from samples taken from the surface and the bottom of the water column at each lake for the indicated season.

[b] Canadian Water Quality Guideline (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[c] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake NW.

[d] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively (Intrinsik 2013).

aluminum and manganese between Sheardown Lake NW and Reference Lake 3 in 2020 (and historically) suggested that the mine was unlikely to be the source of these metals (Appendix Tables C.43 and C.45). Sulphate was the only parameter among those with established AEMP benchmarks that was elevated in 2020 compared to baseline at Sheardown Lake NW (Appendix Figure C.16), as were dissolved molybdenum and uranium concentrations among those parameters without AEMP benchmarks (Appendix Tables C.42 and C.44). Overall, a slight mine-related influence on water quality of Sheardown Lake NW was indicated in 2020 as reflected by elevated concentrations of chloride, molybdenum, nitrate, sulphate, and uranium. However, concentrations of all parameters remained well below AEMP benchmarks and WQG since commercial mine operations commenced in 2015, and therefore no adverse biological effects were expected at Sheardown Lake NW.

4.2.2 Sediment Quality

Surficial sediment in Sheardown Lake NW was primarily composed of silt, except at littoral station DLO-01-10, which contained 93% sand (Figure 4.6; Appendix Table D.25). Except for a slightly higher percentage of clay in sediments from profundal stations in Sheardown Lake NW, no differences in sediment particle size were noted relative to stations sharing like-habitat at Reference Lake 3 (Appendix Table D.26). The TOC content in sediment from littoral and profundal stations at Sheardown Lake NW was significantly lower, and sediment was significantly more compact (i.e., lower moisture content), than at the reference lake (Appendix Table D.26). Similar to observations at Reference Lake 3 and Camp Lake, reddish-brown oxidized material was observed on the surface of Sheardown Lake NW sediments at sine stations (Appendix Tables D.23 and D.24). This material occasionally occurred as a thin, distinct layer that was likely principally composed of iron (oxy)hydroxide precipitate. Substrate of Sheardown Lake NW exhibited some blackening (or unusually dark colouration), and traces of a sulphidic odour at some stations at the time of the August 2020 sampling event (Appendix Tables D.23 and D.24), suggesting the occurrence of reducing conditions in the sediment similar to that observed at the reference lake (Appendix Tables D.3 and D.4).

No consistent spatial differences in sediment metal concentrations occurred between Sheardown Lake NW stations located nearest to key tributary inlets (e.g., SDLT1 and SDLT12) and those located near the lake outlet in 2020 (Appendix Table D.25). Although arsenic, cadmium, iron, nickel, and uranium concentrations were highest in sediment at the Sheardown Lake NW station located closest to the outlet of SDLT1 (i.e., Station DD-HAB 9-STN2), higher concentrations of these metals may be related to high TOC content at this location (Appendix Table D.25). Sheardown Lake Tributary 1 was previously identified as a source of iron loadings to the lake (Section 4.1.2), so elevated iron concentrations at this location are not unexpected. Mean metal

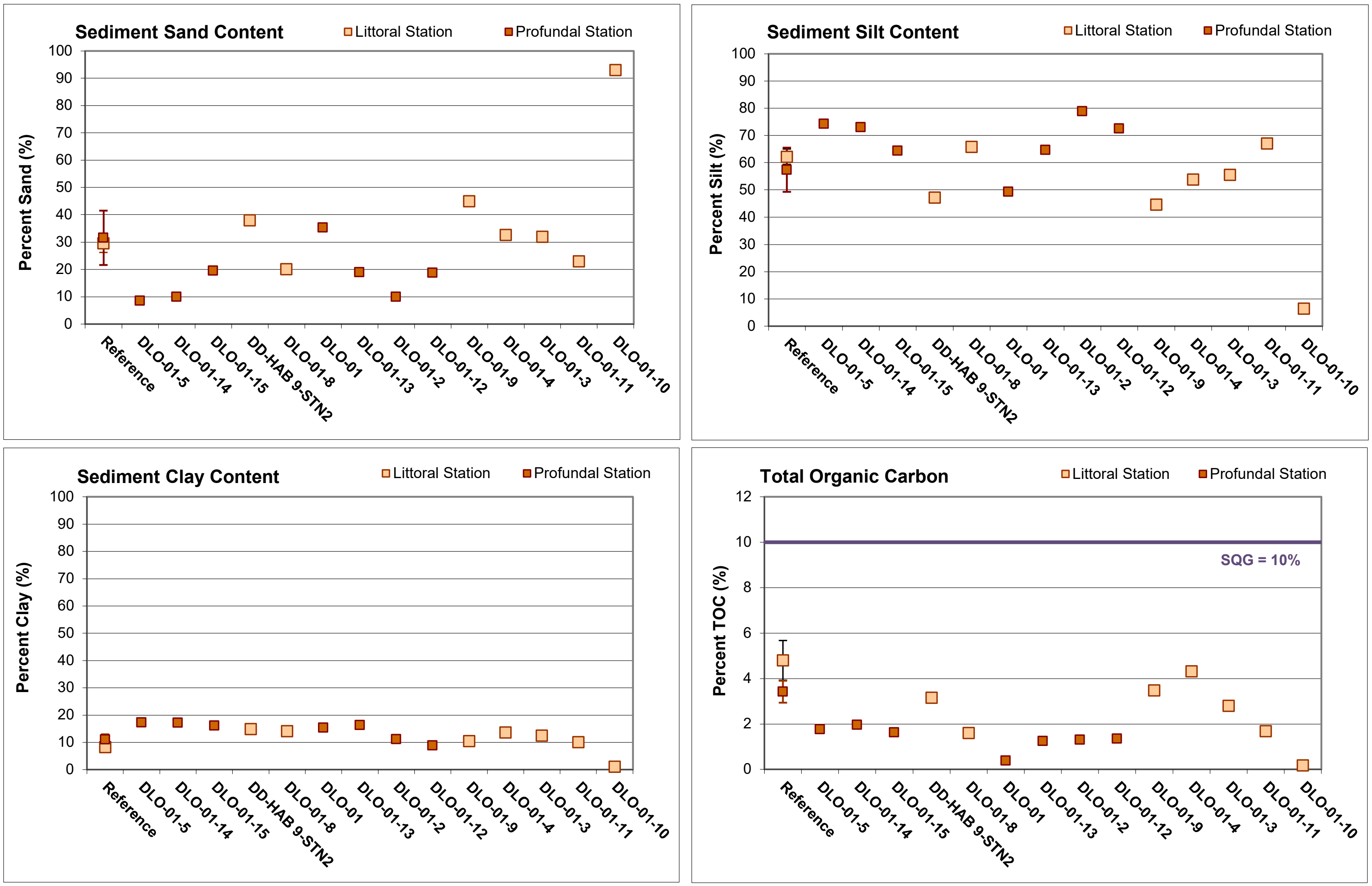

Figure 4.6: Sediment Particle Size and Total Organic Carbon (TOC) Content Comparisons among Sheardown Lake NW (DLO-01) Sediment Monitoring Stations and Reference Lake 3 (mean ± SE), Mary River Project CREMP, August 2020

concentrations in littoral and profundal sediment of Sheardown Lake NW were very similar to mean concentrations observed at like-habitat in Reference Lake 3, the only exception being slightly elevated (i.e., 3- to 5-fold higher) mean concentration of manganese at the Sheardown Lake NW profundal stations (Table 4.5; Appendix Table D.27). Although average concentrations of iron were above SQG in sediment from littoral stations in Sheardown Lake NW, the average concentration of iron was also above the SQG in sediment from Reference Lake 3 indicating naturally elevated concentrations of iron (Table 4.5). Nickel was also above the SQG in sediment from one littoral station in Sheardown Lake NW (Appendix Table D.25). In addition to iron, manganese was above the SQG in profundal sediments from Sheardown Lake NW and the reference lake, indicating manganese is also naturally elevated in the study area (Table 4.5). Only the mean concentration of manganese in profundal sediment of Sheardown Lake NW was above the lake-specific AEMP benchmark, whereas at the reference lake, mean concentrations of copper, iron, and manganese were elevated above the Sheardown Lake NW AEMP benchmarks in littoral and profundal sediments (Table 4.5).

Metal concentrations in sediment from Sheardown Lake NW in 2020 were comparable to those observed during the mine baseline (2005 to 2013) period (Figure 4.7; Appendix Table D.27).[13] On average, metal concentrations in sediment of Sheardown Lake NW in 2020 were within the range of those observed from 2015 to 2019, except for manganese at the profundal stations where concentrations were higher than historically (although the variability in concentrations among sampling stations was substantial, as indicated by the high standard deviation; Figure 4.7). No continual increase in mean concentrations of any metals were apparent from 2015 to 2020 at the Sheardown Lake NW littoral or profundal stations, including for manganese (Figure 4.7). Overall, no substantial changes in sediment metal concentrations of Sheardown Lake NW have occurred since the commencement of mine operations in 2015.

4.2.3 Phytoplankton

Chlorophyll-a concentrations at Sheardown Lake NW showed no consistent spatial gradients with progression towards the lake outlet among the winter, summer, and fall sampling events in 2020 (Figure 4.8). Chlorophyll-a concentrations differed significantly among seasons at Sheardown Lake NW, with highest and lowest concentrations observed in summer and winter, respectively (Appendix Tables E.5 and E.6) reflecting similar occurrence of highest chlorophyll-a concentrations in the summer sampling event at the reference lake (Appendix Table B.7).

[13] See footnote 6 regarding differences in the concentration of boron in sediment between baseline and recent CREMP studies.

Table 4.5: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Sheardown Lake NW (DLO-01) and Reference Lake 3 (REF3) Sediment Monitoring Stations, Mary River Project CREMP, August 2020

Parameter		Units	SQG[a]	AEMP Benchmark[b] (NW, SE)	Littoral		Profundal	
					Reference Lake (n = 5)	Sheardown Lake NW (n = 4)	Reference Lake (n = 5)	Sheardown Lake NW (n = 4)
					Average ± SD	Average ± SD	Average ± SD	Average ± SD
TOC		%	10[α]	-	4.80 ± 1.96	2.10 ± 1.39	3.42 ± 1.08	1.17 ± 0.576
Metals	Aluminum (Al)	mg/kg	-	-	16,880 ± 1,785	15,635 ± 8,686	21,800 ± 2,185	20,675 ± 3,970
	Antimony (Sb)	mg/kg	-	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
	Arsenic (As)	mg/kg	17	6.2, 5.9	3.53 ± 1.09	4.05 ± 2.84	4.07 ± 0.397	3.72 ± 0.66
	Barium (Ba)	mg/kg	-	-	117 ± 22.0	87 ± 58	122 ± 18.3	110 ± 41
	Beryllium (Be)	mg/kg	-	-	0.65 ± 0.073	0.88 ± 0.48	0.80 ± 0.092	0.98 ± 0.176
	Bismuth (Bi)	mg/kg	-	-	<0.20 ± 0	0.23 ± 0.024	<0.20 ± 0	0.24 ± 0.04
	Boron (B)	mg/kg	-	-	12.2 ± 0.853	25.8 ± 14.1	14.7 ± 1.77	29.9 ± 5.78
	Cadmium (Cd)	mg/kg	3.5	1.5, 1.5	0.173 ± 0.047	0.252 ± 0.177	0.148 ± 0.0172	0.253 ± 0.046
	Calcium (Ca)	mg/kg	-	-	5,608 ± 1,247	4,023 ± 1,857	5,010 ± 407	4,270 ± 593
	Chromium (Cr)	mg/kg	90	97, 79	54.3 ± 4.40	60.1 ± 30.9	65.0 ± 6.64	71.3 ± 11.41
	Cobalt (Co)	mg/kg	-	-	10.8 ± 1.64	11.5 ± 6.39	15.2 ± 1.56	15.9 ± 3.32
	Copper (Cu)	mg/kg	110	58, 56	71.4 ± 14.2	38.0 ± 21.8	***83.8*** ± 11.1	42.5 ± 6.55
	Iron (Fe)	mg/kg	40,000[α]	52,200, 34,400	***50,600*** ± 24,939	41,200 ± 21,466	45,080 ± 4,440	43,350 ± 12,934
	Lead (Pb)	mg/kg	91.3	35	13.8 ± 0.799	16.5 ± 8.55	16.7 ± 1.82	19.7 ± 3.94
	Lithium (Li)	mg/kg	-	-	26.0 ± 2.51	29.6 ± 16.3	33.7 ± 3.83	33.2 ± 6.59
	Magnesium (Mg)	mg/kg	-	-	11,440 ± 814	9,930 ± 5,277	14,180 ± 1,422	13,105 ± 2,514
	Manganese (Mn)	mg/kg	1,100[α,β]	4,530, 657	579 ± 258	526 ± 380	***1,230*** ± 355	***5,291*** ± 5,948
	Mercury (Hg)	mg/kg	0.486	0.17	0.0500 ± 0.0178	0.0306 ± 0.0198	0.0583 ± 0.0164	0.0332 ± 0.01397
	Molybdenum (Mo)	mg/kg	-	-	4.44 ± 3.31	3.08 ± 1.93	2.52 ± 0.273	5.22 ± 4.69
	Nickel (Ni)	mg/kg	75[α,β]	77, 66	40.0 ± 3.52	56.1 ± 31.1	45.0 ± 4.54	61.4 ± 9.82
	Phosphorus (P)	mg/kg	2,000[α]	1,958, 1,278	1,167 ± 394	832 ± 379	956 ± 47.3	900 ± 94.6
	Potassium (K)	mg/kg	-	-	4,100 ± 453	4,168 ± 2,333	5,338 ± 543	5,288 ± 1,043
	Selenium (Se)	mg/kg	-	-	0.73 ± 0.31	0.37 ± 0.15	0.61 ± 0.18	0.32 ± 0.11
	Silver (Ag)	mg/kg	-	-	0.14 ± 0.047	0.16 ± 0.042	0.20 ± 0.057	0.16 ± 0.024
	Sodium (Na)	mg/kg	-	-	304.2 ± 32	232 ± 122	369 ± 50	283 ± 50
	Strontium (Sr)	mg/kg	-	-	11.6 ± 1.70	9.45 ± 3.72	12.3 ± 1.24	11.40 ± 1.50
	Sulphur (S)	mg/kg	-	-	1,400 ± 387	<1,000 ± 0	1,140 ± 195	<1,000 ± 0
	Thallium (Tl)	mg/kg	-	-	0.379 ± 0.0415	0.419 ± 0.242	0.594 ± 0.094	0.514 ± 0.1225
	Tin (Sn)	mg/kg	-	-	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0
	Titanium (Ti)	mg/kg	-	-	1,006 ± 109	934 ± 472	1,136 ± 50	1,194 ± 210.5
	Uranium (U)	mg/kg	-	-	11.0 ± 2.41	6.17 ± 3.68	19.7 ± 3.76	6.37 ± 1.212
	Vanadium (V)	mg/kg	-	-	54.1 ± 5.40	45.8 ± 23.4	63.4 ± 4.89	56.7 ± 9.97
	Zinc (Zn)	mg/kg	315	135	73.1 ± 7.83	53.5 ± 29.0	83.8 ± 8.52	63.3 ± 11.80
	Zirconium (Zr)	mg/kg	-	-	4.5 ± 1.0	10.1 ± 6.4	3.9 ± 0.32	7.03 ± 1.68

[shaded] Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD Indicates parameter concentration above the AEMP Benchmark.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020)

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to the Sheardown Lake basins

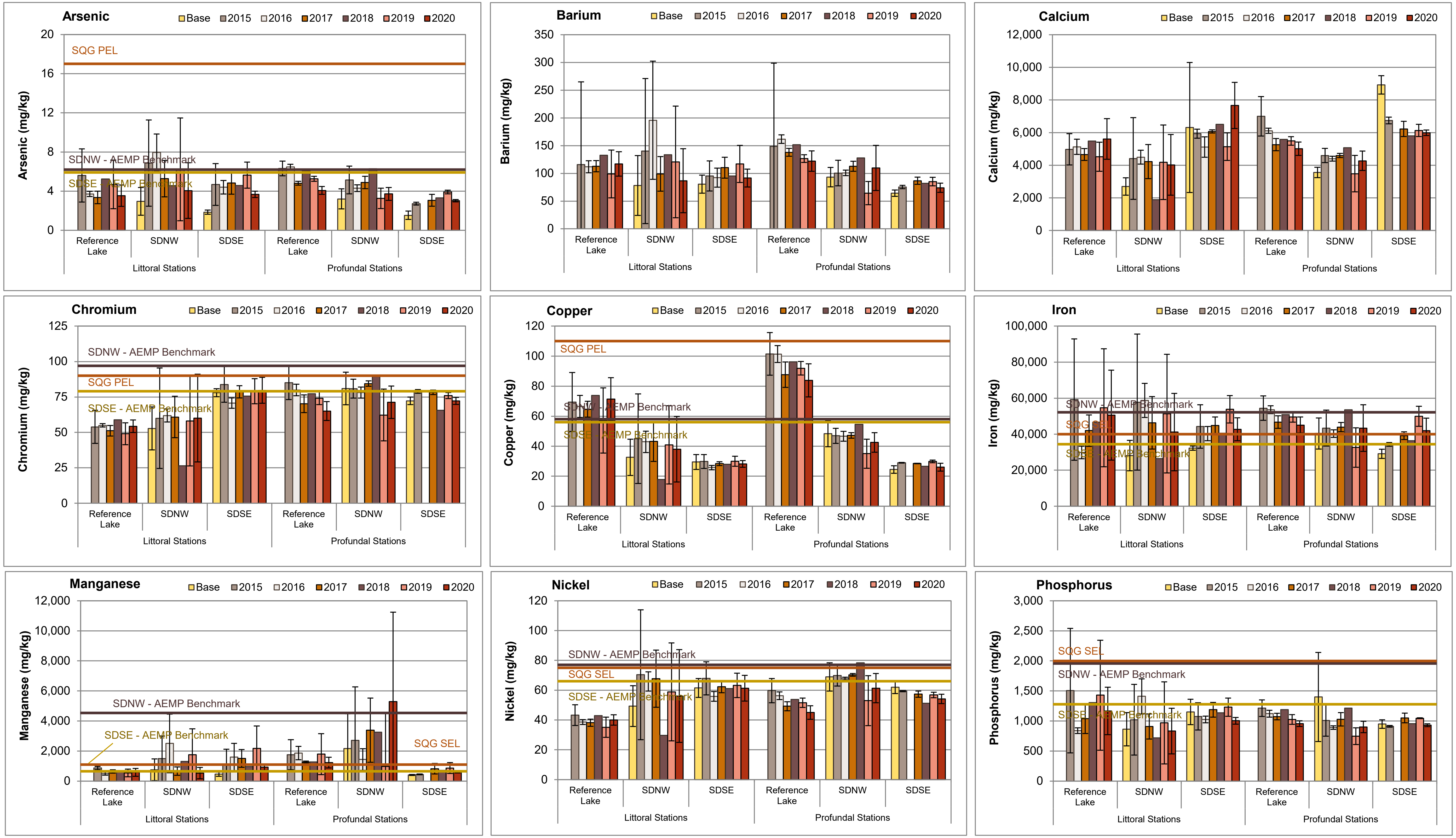

Figure 4.7: Temporal Comparison of Sediment Metal Concentrations (mean ± SD) at Littoral and Profundal Stations of Sheardown Lake NW (SDNW), Sheardown Lake SE (SDSE), and Reference Lake 3 for Mine Baseline (2005 to 2013) and Operational (2015 to 2020) Periods

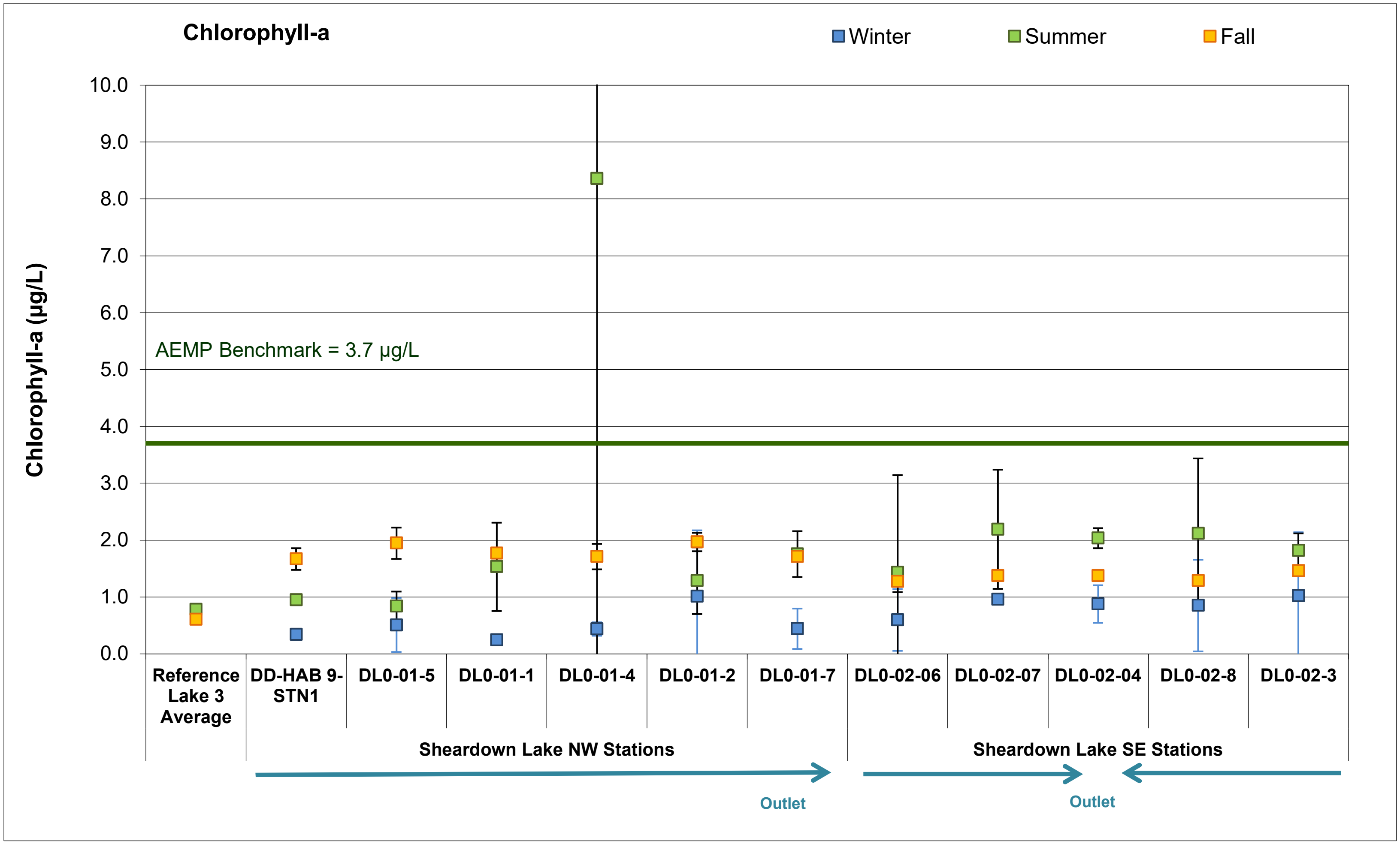

Figure 4.8: Chlorophyll-a Concentrations at Sheardown Lake NW (DLO-1) and Sheardown Lake SE (DLO-2) Phytoplankton Monitoring Stations, Mary River Project CREMP, 2020

Notes: Values are averages of samples taken from the surface and the bottom of the water column at each station. Reference values are expressed as mean ± standard deviation (n = 3). Reference Lake 3 was not sampled in winter 2020.

Although chlorophyll-a concentrations were significantly higher at Sheardown Lake NW compared to Reference Lake 3 for both the summer and fall sampling events in 2020 (Appendix Tables E.7 and E.8), chlorophyll-a concentrations during each of the winter, summer, and fall sampling events at Sheardown Lake NW were well below the AEMP benchmark of 3.7 µg/L for all samples except one sample in July (Figure 4.8). For the sample that exceeded the benchmark, the chlorophyll-a concentration (15 µg/L) was an order of magnitude higher than any other sample collected in the lake on the same day, suggesting a sampling or laboratory analysis issue rather than an actual increase in phytoplankton abundance. Chlorophyll-a concentrations at Sheardown Lake NW were suggestive of an ‘oligotrophic’ status using Wetzel (2001) lake trophic status classifications. This trophic status classification was consistent with an oligotrophic categorization for Sheardown Lake NW using CWQG (CCME 2020) classifications based on aqueous total phosphorus concentrations near the surface (i.e., concentrations below 10 µg/L; Table 4.4; Appendix Table C.42).

Chlorophyll-a concentrations at Sheardown Lake NW in 2020 were within the ranges shown among years of mine construction (2014) and previous mine operation (2015 to 2019), and showed no consistent direction of changes for any of the winter, summer, or fall seasons (Figure 4.9; Appendix Table E.11). This suggested no ecologically meaningful changes in the trophic status of Sheardown Lake NW since the onset of mine operations in 2015. No chlorophyll-a data are available for Sheardown Lake NW over the mine baseline period (2005 to 2013), precluding comparisons of Sheardown Lake NW chlorophyll-a data to the period prior to mine construction.

4.2.4 Benthic Invertebrate Community

Benthic invertebrate density was significantly higher at littoral and profundal habitats of Sheardown Lake NW compared to like-habitat at Reference Lake 3 at magnitudes outside of the CES_{BIC} of ±2 SD_{REF} (Tables 4.6 and 4.7). Although no significant differences in richness or evenness were indicated between Sheardown Lake NW and the reference lake for either littoral or profundal habitat (Tables 4.6 and 4.7), Bray-Curtis Index differed significantly between Sheardown Lake NW and Reference Lake 3 for both habitat types (Appendix Table F.21). Because no ecologically significant differences (i.e., CES_{BIC} outside of ±2 SD_{REF}) in the relative abundance of any dominant taxonomic groups were indicated between Sheardown Lake NW and the reference lake for either habitat type (Tables 4.6 and 4.7), the difference in Bray-Curtis Index between lakes likely reflected substantially higher benthic invertebrate density at Sheardown Lake NW. The occurrence of higher benthic invertebrate density without an accompanying difference in evenness or dominant taxonomic groups suggested that Sheardown Lake NW was simply more productive than Reference Lake 3. This was supported by the

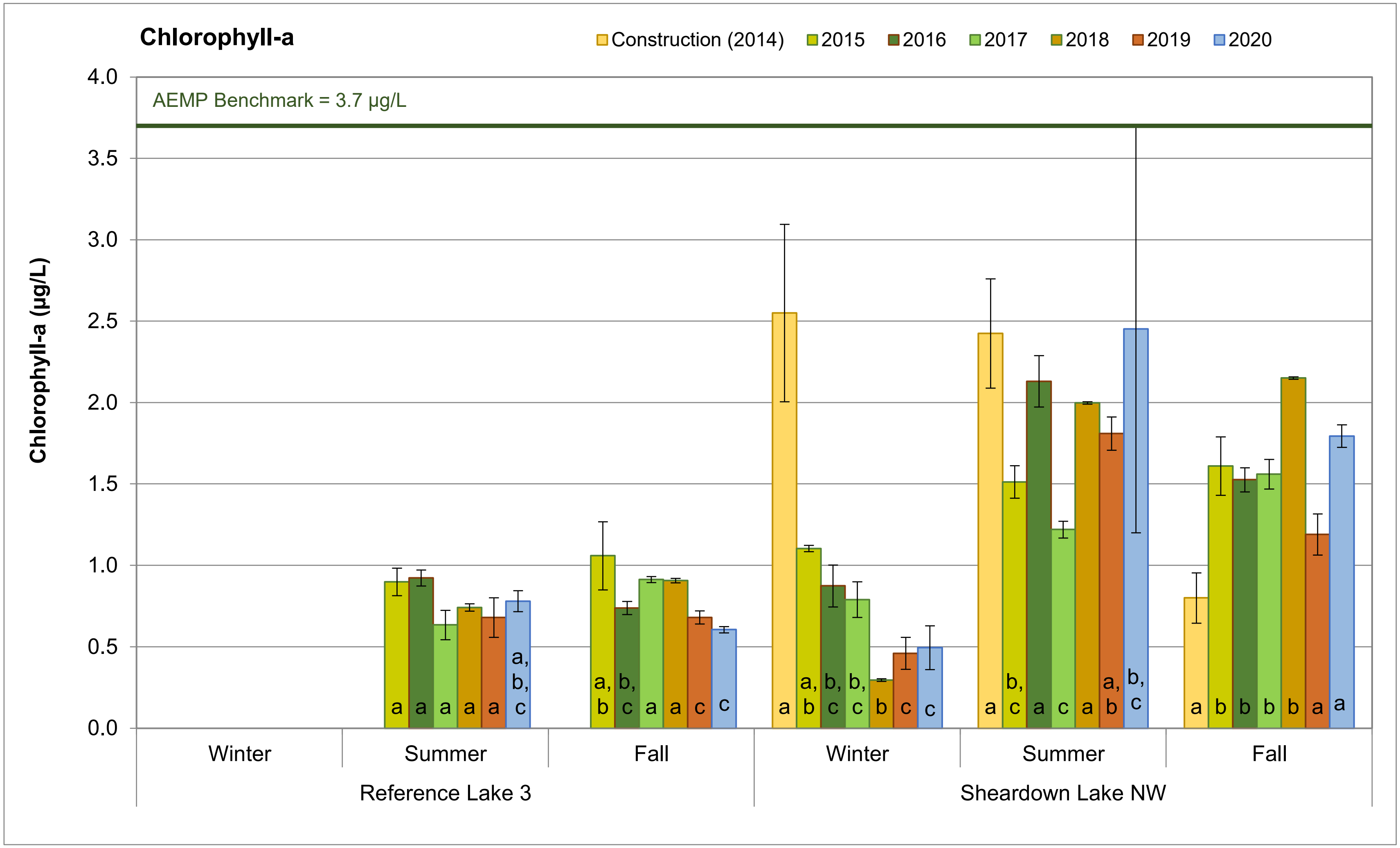

Figure 4.9: Temporal Comparison of Chlorophyll-a Concentrations Among Seasons between Sheardown Lake NW and Reference Lake 3 for Mine Construction (2014) and Operational (2015 to 2020) Periods (mean ± SE)

Note: Bars with the same letter at the base do not differ significantly between years for the applicable season.

Table 4.6: Benthic Invertebrate Community Statistical Comparison Results between Sheardown Lake NW (DLO-01) and Reference Lake 3 for Littoral Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Littoral Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	YES	0.003	11.8	Reference Lake 3	1,571	430	193	1,190	1,474	2,310
						Sheardown NW Littoral	6,631	3,914	1,750	2,250	6,457	12,500
Richness (Number of Taxa)	Mann Whitney	rank	NO	0.202	0.3	Reference Lake 3	14.6	2.5	1.1	13.0	14.0	19.0
						Sheardown NW Littoral	15.4	1.1	0.5	14.0	15.0	17.0
Simpson's Evenness (E)	t-equal	none	NO	0.515	-0.3	Reference Lake 3	0.810	0.110	0.049	0.630	0.847	0.923
						Sheardown NW Littoral	0.773	0.055	0.025	0.718	0.762	0.854
Shannon Diversity	t-equal	log10	NO	0.301	-0.6	Reference Lake 3	2.710	0.526	0.235	2.080	2.730	3.510
						Sheardown NW Littoral	2.410	0.217	0.097	2.260	2.280	2.760
Hydracarina (%)	t-equal	log10	YES	0.065	-1.0	Reference Lake 3	5.3	2.6	1.2	3.5	4.4	9.9
						Sheardown NW Littoral	2.6	3.5	1.6	0.2	0.3	8.1
Ostracoda (%)	t-equal	log10	NO	0.118	-0.8	Reference Lake 3	37.9	14.5	6.5	26.7	36.2	62.6
						Sheardown NW Littoral	25.6	8.6	3.8	13.9	28.0	36.0
Chironomidae (%)	t-equal	none	YES	0.060	1.1	Reference Lake 3	52.6	15.6	7.0	26.9	59.0	66.4
						Sheardown NW Littoral	70.4	9.3	4.2	60.5	70.1	83.7
Metal-Sensitive Chironomidae (%)	t-equal	log10	NO	0.101	-1.4	Reference Lake 3	28.8	9.5	4.3	15.6	32.5	38.7
						Sheardown NW Littoral	15.4	14.3	6.4	2.3	14.4	36.4
Collector-Gatherers (%)	t-equal	none	NO	0.114	1.3	Reference Lake 3	63.1	11.4	5.1	53.6	60.3	81.5
						Sheardown NW Littoral	77.5	14.1	6.3	54.2	83.5	90.8
Filterers (%)	t-equal	log10	NO	0.114	-1.3	Reference Lake 3	27.1	9.8	4.4	14.4	29.2	38.0
						Sheardown NW Littoral	14.6	14.5	6.5	1.3	13.2	36.0
Shredders (%)	t-unequal	none	YES	0.068	-1.1	Reference Lake 3	3.9	3.3	1.5	0.6	3.2	7.4
						Sheardown NW Littoral	0.2	0.2	0.1	0.0	0.0	0.4
Clingers (%)	t-equal	none	YES	< 0.001	-2.5	Reference Lake 3	31.9	9.3	4.2	17.9	33.5	41.6
						Sheardown NW Littoral	8.5	3.8	1.7	3.7	9.6	12.5
Sprawlers (%)	t-equal	none	NO	0.176	-0.8	Reference Lake 3	57.9	12.1	5.4	41.0	57.2	73.8
						Sheardown NW Littoral	48.4	7.7	3.5	40.3	47.1	57.5
Burrowers (%)	t-equal	log10	YES	< 0.001	6.7	Reference Lake 3	10.2	4.9	2.2	4.6	8.3	17.3
						Sheardown NW Littoral	43.1	8.5	3.8	32.4	41.7	54.2

Grey shading indicates statistically significant difference between study areas based on p-value less than 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Table 4.7: Benthic Invertebrate Community Statistical Comparison Results between Sheardown Lake NW (DLO-01) and Reference Lake 3 for Profundal Habitat Stations, Mary River Project CREMP, August 2019

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Profundal Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-unequal	none	YES	0.021	6.0	Reference Lake 3	479	142	63	336	491	681
						Sheardown NW Profundal	1,326	527	236	802	1,345	2,034
Richness (Number of Taxa)	t-equal	log10	NO	0.581	0.4	Reference Lake 3	7.0	1.9	0.8	5.0	8.0	9.0
						Sheardown NW Profundal	7.8	2.5	1.1	6.0	7.0	12.0
Simpson's Evenness (E)	t-equal	none	NO	0.103	-5.5	Reference Lake 3	0.731	0.045	0.020	0.689	0.721	0.795
						Sheardown NW Profundal	0.486	0.295	0.132	0.236	0.324	0.872
Shannon Diversity	t-equal	log10	NO	0.199	-1.9	Reference Lake 3	1.800	0.196	0.088	1.580	1.720	2.030
						Sheardown NW Profundal	1.420	0.891	0.398	0.677	0.961	2.720
Hydracarina (%)	t-equal	log10(x+1)	NO	0.839	-0.1	Reference Lake 3	2.8	2.0	0.9	0.0	3.5	5.1
						Sheardown NW Profundal	2.6	0.9	0.4	1.3	3.1	3.2
Ostracoda (%)	t-equal	none	NO	0.434	-0.5	Reference Lake 3	8.6	4.1	1.8	3.5	7.7	14.5
						Sheardown NW Profundal	6.6	3.9	1.7	1.1	5.9	11.7
Chironomidae (%)	t-equal	log10	NO	0.268	0.7	Reference Lake 3	87.9	4.2	1.9	82.3	87.2	92.7
						Sheardown NW Profundal	90.8	3.7	1.7	86.2	91.0	95.7
Metal-Sensitive Chironomidae (%)	t-equal	log10	YES	0.002	-1.6	Reference Lake 3	31.5	17.6	7.9	7.9	38.0	49.3
						Sheardown NW Profundal	4.0	4.0	1.8	1.3	2.6	11.1
Collector-Gatherers (%)	t-equal	none	YES	0.003	1.9	Reference Lake 3	62.9	15.0	6.7	45.4	56.1	79.0
						Sheardown NW Profundal	91.9	3.5	1.6	86.8	91.7	96.6
Filterers (%)	t-equal	none	YES	0.008	-1.6	Reference Lake 3	30.7	17.5	7.8	7.9	38.0	49.3
						Sheardown NW Profundal	2.4	4.9	2.2	0.0	0.0	11.1
Clingers (%)	t-equal	log10	YES	0.003	-1.7	Reference Lake 3	33.5	16.9	7.6	13.1	41.5	52.8
						Sheardown NW Profundal	5.2	4.2	1.9	1.3	3.2	12.1
Sprawlers (%)	t-equal	none	NO	0.786	0.3	Reference Lake 3	64.8	16.2	7.2	45.5	58.5	87.0
						Sheardown NW Profundal	69.9	36.7	16.4	16.1	94.2	97.5
Burrowers (%)	t-equal	log10(x+1)	NO	0.146	8.1	Reference Lake 3	1.7	2.9	1.3	0.0	0.0	6.7
						Sheardown NW Profundal	24.9	32.6	14.6	1.3	2.6	71.8

Grey shading indicates a statistically significant difference between study areas based on p-value less than 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

occurrence of no ecologically significant differences in the relative abundance of metal-sensitive chironomids and FFG between lakes (Tables 4.6 and 4.7), which indicated no sediment metal-related influences or effects to available food resources, respectively, on the benthic invertebrate community of Sheardown Lake NW in 2020. Similar to Camp Lake, sediment at Sheardown Lake NW littoral and profundal stations was significantly more compact (i.e., lower moisture content) than like-habitat stations at the reference lake, which potentially contributed to differences in relative abundance of HPG between lakes (Tables 4.6 and 4.7; Appendix Table F.35).

No significant differences in benthic invertebrate density, richness, evenness, relative abundance of dominant groups, and relative abundance of FFG were consistently shown for Sheardown Lake NW littoral stations over years of mine operation (2015 to 2020) compared to baseline studies conducted in 2007, 2008, and 2013 (Appendix Figure F.10; Appendix Table F.37). At profundal stations of Sheardown Lake NW, only the relative abundance of metal-sensitive Chironomidae routinely differed significantly between the mine operational period and both years of mine baseline (Appendix Table F.38). However, because greater relative abundance of metal-sensitive Chironomidae were observed in years of mine operation compared to baseline (Appendix Figure F.11), this temporal difference was not indicative of an adverse effect on the benthic invertebrate community at Sheardown Lake NW. Therefore, consistent with no substantial changes in water and sediment quality since the mine baseline period, no significant differences in benthic invertebrate community features were indicated at littoral and profundal habitat of Sheardown Lake NW since the commencement of commercial mine operation in 2015.

4.2.5 Fish Population

4.2.5.1 Sheardown Lake NW Fish Community

The fish community of Sheardown Lake NW included arctic charr and ninespine stickleback in 2020 (Table 4.8), reflecting the same fish species that were observed historically (Minnow 2020). Arctic charr and ninespine stickleback CPUE were higher at Sheardown Lake NW than at the reference lake in 2020 (Table 4.8), suggesting higher densities and/or productivity of these species at Sheardown Lake NW. A greater relative abundance of fish, together with higher chlorophyll-a concentrations and greater benthic invertebrate density, suggested that overall biological productivity was higher at Sheardown Lake NW than at Reference Lake 3. Arctic charr electrofishing CPUE at Sheardown Lake NW in 2020 was within the range observed over the mine baseline period (2007 to 2013) and previous years of mine operation (2015 to 2019; Figure 4.10). Gill netting CPUE for arctic charr in 2020 was also within the range observed during baseline, but slightly greater than the previous five years of mine operation (Figure 4.10). The similarities in CPUE among study years suggested that the relative abundance of arctic charr

Table 4.8: Fish Catch and Community Summary from Backpack Electrofishing and Gill Netting Conducted at Sheardown Lake NW (DLO-01), Sheardown Lake SE (DLO-02) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Lake	Method [a]		Arctic Charr	Ninespine Stickleback	Total by Method	Total No. of Species
Reference Lake 3	Electrofishing	No. Caught	134	1	135	2
		CPUE	2.09	0.016	2.11	
	Gill netting	No. Caught	0	0	0	
		CPUE	0.956	0	0.956	
Sheardown Lake Northwest	Electrofishing	No. Caught	118	6	124	2
		CPUE	4.46	0.227	4.69	
	Gill netting	No. Caught	98	0	98	
		CPUE	3.34	0	3.34	
Sheardown Lake Southeast	Electrofishing	No. Caught	115	63	178	2
		CPUE	4.28	2.35	6.63	
	Gill netting	No. Caught	107	0	107	
		CPUE	3.81	0	3.81	

[a] Catch-per-unit-effort (CPUE) for electrofishing represents the number of fish captured per electrofishing minute, and for gill netting represents the number of fish captured per 100 m hours of net.

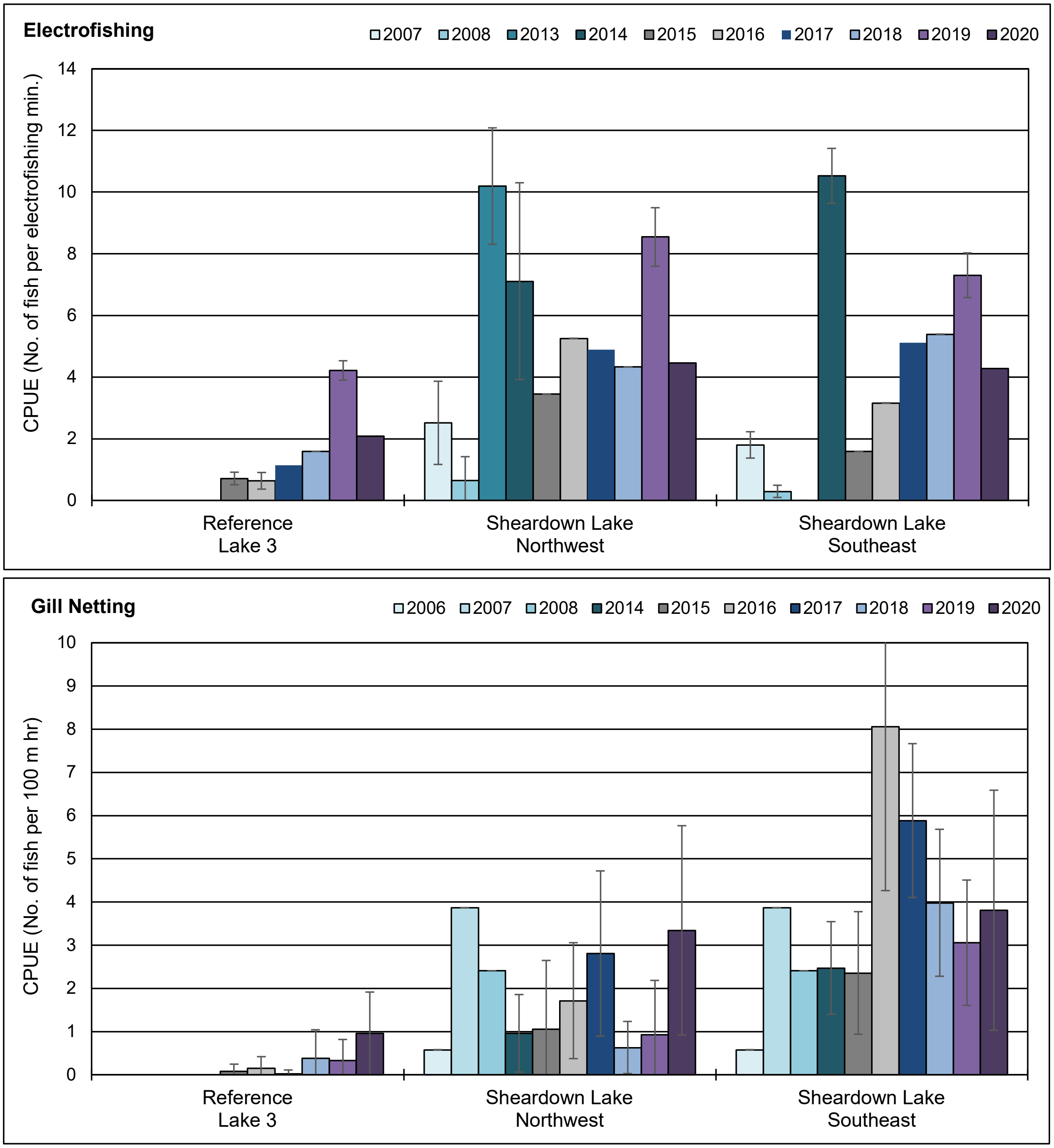

Figure 4.10: Catch-per-unit-effort (CPUE; mean ± SD) of Arctic Charr Captured by Back-pack Electrofishing and Gill Netting at Sheardown Lake NW (DLO-01) and Sheardown Lake SE (DLO-02), Mary River Project CREMP, 2006 to 2020

Notes: Data presented for fish sampling conducted in fall during baseline (2006, 2007, 2008, 2013), construction (2014) and operational (2015 to 2020) mine phases. Lake basins (i.e., NW or SE) were not differentiated historically for baseline gill netting catches.

at the nearshore and littoral/profundal habitats of Sheardown Lake NW has remained similar over time, suggesting the mine has not influenced the size of the arctic charr population in the lake.

4.2.5.2 Sheardown Lake NW Fish Population Assessment

Nearshore Arctic Charr

A total of 100 arctic charr were captured from nearshore habitat of each of Sheardown Lake NW and Reference Lake 3 in August 2020. Distinguishing arctic charr YOY from the older, non-YOY age class was possible using a fork length cut-off of 4.8 cm and 4.3 cm for the Sheardown Lake NW and Reference Lake 3 data sets, respectively, based on evaluation of length-frequency distributions coupled with supporting age determinations (Figure 4.11; Appendix Tables G.4 and G.13). Because greater than ten YOY arctic charr were identified from the Sheardown Lake NW and Reference Lake 3 populations, statistical comparisons of health endpoints were completed separately on both the YOY and non-YOY populations. Length-frequency distributions for the nearshore arctic charr (based on the full dataset, and non-YOY only) differed significantly between Sheardown Lake NW and Reference Lake 3 (Table 4.9). This was primarily due to a greater number of non-YOY and larger fish being captured at Sheardown Lake NW compared to the reference lake (Figure 4.11). Both YOY and non-YOY arctic charr from nearshore habitats in Sheardown Lake NW were significantly larger and had greater condition than those from the reference lake (Table 4.9; Appendix Table G.14). However, the magnitudes of the differences in condition between lakes for both the YOY and noy-YOY populations were not considered ecologically significant because they were within CES_C (i.e., ±10%; Table 4.9; Appendix Table G.14).

Temporal comparisons of nearshore arctic charr populations between Sheardown Lake NW and Reference Lake 3 generally indicated non-YOY were significantly larger but showed no consistent difference/direction of difference in condition at Sheardown Lake NW since 2015 (Table 4.9). Although the lengths and weights of non-YOY arctic charr in years of mine operation (i.e., 2015 to 2020) have not differed consistently relative to the baseline period at Sheardown Lake NW, the condition of non-YOY arctic charr in all years of mine operation has been significantly lower than baseline at magnitudes near or outside of CES_C (i.e., ±10%; Table 4.9). The inconsistent response of non-YOY arctic charr between Sheardown Lake NW and Reference Lake 3 since 2015 compared to between years of mine operation and baseline at Sheardown Lake NW resulted in uncertainty as to whether current mine operations have affected non-YOY arctic charr health at Sheardown Lake NW.

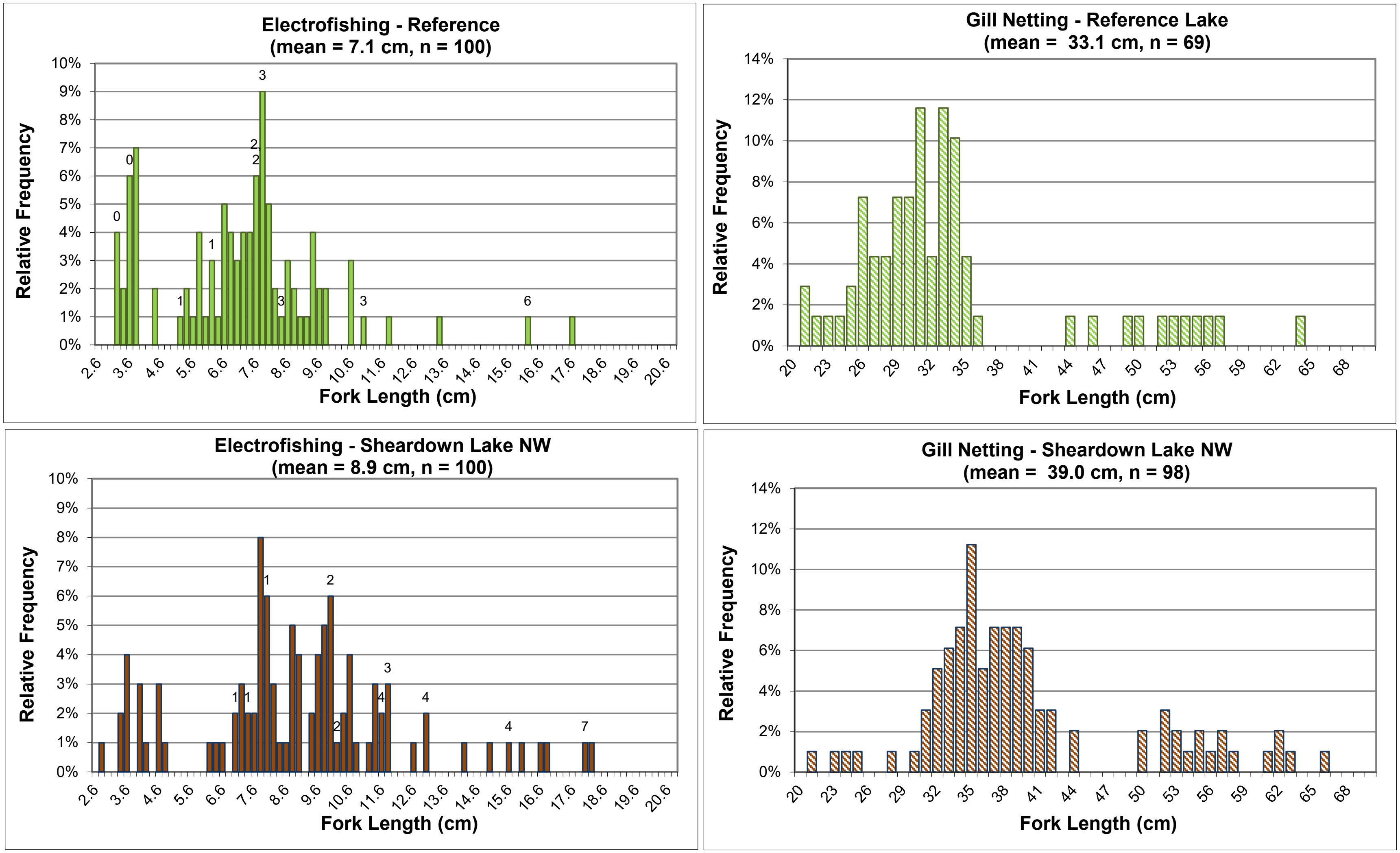

Figure 4.11: Length-Frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Sheardown Lake NW (DLO-01) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Note: Fish ages are shown above the bars, where available.

Table 4.9: Summary of Statistical Results for Arctic Charr Population Comparisons between Sheardown Lake NW and Reference Lake 3 from 2015 to 2020, and between Sheardown Lake NW Mine Operational and Baseline Period Data, for Fish Captured by Electrofishing and Gill Netting Methods, Mary River Project CREMP

Data Set by Sampling Method	Response Category	Endpoint	Statistically Significant Differences Observed? [a]											
			versus Reference Lake 3						versus Sheardown Lake NW baseline period data [b]					
			2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
Nearshore Electrofishing	Survival	Length-Frequency Distribution	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
		Age	No	No	No	-	-	-	No	-	-	-	-	-
	Energy Use (non-YOY)	Size (mean fork length)	**Yes (+29%)**	**Yes (+17%)**	**Yes (+20%)**	**Yes (+24%)**	**Yes (-10%)**	**Yes (+22%)**	No	No	No	**Yes (-12%)**	No	**Yes (+13%)**
		Size (mean weight)	**Yes (+121%)**	**Yes (+60%)**	No	**Yes (+83%)**	**Yes (-24%)**	**Yes (+99%)**	No	**Yes (-29%)**	No	**Yes (-50%)**	No	No
	Energy Storage (non-YOY)	Condition (body weight-at-fork length)	**Yes (+3%)**	No	**Yes (+7%)**	**Yes (-5%)**	**Yes (+4%)**	**Yes (+10%)**	**Yes (-13%)**	**Yes (-12%)**	**Yes (-9%)**	**Yes (-10%)**	**Yes (-13%)**	**Yes (-9%)**
Littoral/Profundal Gill Netting [c]	Survival	Length Frequency Distribution	-	-	-	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	**Yes**	No
		Age	-	-	-	-	-	-	**Yes (-35%)**	**Yes (-28%)**	**Yes (-26%)**	-	-	-
	Energy Use	Size (mean fork length)	-	-	-	No	**Yes (+22%)**	**Yes (+18%)**	**Yes (-21%)**	**Yes (-14%)**	**Yes (-6%)**	No	No	No
		Size (mean weight)	-	-	-	No	**Yes (+92%)**	**Yes (+94%)**	**Yes (-47%)**	**Yes (-31%)**	**Yes (-9%)**	No	No	No
		Growth (fork length-at-age)	-	-	-	-	-	-	No	No	No	-	-	-
		Growth (weight-at-age)	-	-	-	-	-	-	No	No	**Yes (+24%)**	-	-	-
	Energy Storage	Condition (body weight-at-fork length)	-	-	-	**Yes (+4%)**	No	**Yes (+11%)**	**Yes (+8%)**	**Yes (+11%)**	**Yes (+6%)**	No	No	No

BOLD indicates a significant difference related to the comparison.

[a] Values in parentheses indicate direction and magnitude of any significant differences.

[b] Baseline period data included 2002, 2005, 2006, 2008, and 2013 nearshore electrofishing data and 2006, 2008 and 2013 littoral/profundal gill netting data.

[c] Due to low catches of arctic charr in gill nets at Reference Lake 3 in 2015, 2016, and 2017, no comparison of fish health was conducted for gill netted fish.

Littoral/Profundal Arctic Charr

A total of 98 and 69 arctic charr were sampled from littoral/profundal habitat of Sheardown Lake NW and Reference Lake 3, respectively, in August 2020. The length-frequency distribution for littoral/profundal arctic charr differed significantly between lakes based on greater numbers of larger fish captured at Sheardown Lake NW (Table 4.9; Figure 4.11). Arctic charr captured by gill net at Sheardown Lake NW in 2020 were significantly larger and had greater condition than those captured at Reference Lake 3 (Table 4.9; Appendix Table G.18). The magnitude of difference in condition (11%) was slightly outside of the CES_C of ±10%, suggesting a potentially ecologically meaningful difference.

The differences in size and condition of arctic charr captured from littoral/profundal habitat between Sheardown Lake NW and Reference Lake 3 in 2020 were similar to the differences shown in 2018 and/or 2019, suggesting no appreciable changes in health of littoral/profundal arctic charr at Sheardown Lake NW over time. No significant differences in body size or condition of arctic charr captured from littoral/profundal habitat of Sheardown Lake NW were observed from 2018 to 2020 relative to the baseline period (Table 4.9; Appendix Figure G.10; Appendix Table G.18). From 2015 to 2017, arctic charr sampled from littoral/profundal habitat of Sheardown Lake NW were significantly shorter, lighter, and of greater condition than those captured during the baseline period (Table 4.9). The absence of differences in size and condition of arctic charr from Sheardown Lake NW over the 2018 to 2020 period compared to baseline appeared to reflect closer comparability in fish size between the most recent studies and baseline. In turn, this suggested that assessment of littoral/profundal arctic charr health should use sampling methods that reduce variability in the size of fish sampled to assess potential mine-related effects. Nevertheless, the general absence of consistent ecologically significant differences in condition of arctic charr captured at littoral/profundal areas of Sheardown Lake NW from 2018 to 2020 compared to Reference Lake 3 and Sheardown Lake NW baseline suggested no adverse mine-related influences on the adult arctic charr population of the lake as a result of mine operations.

4.2.6 Effects Assessment and Recommendations

At Sheardown Lake NW, the following AEMP benchmarks were exceeded in 2020:

- Arsenic concentration in sediment was greater than the benchmark of 6.2 mg/kg at one littoral monitoring station (DD-HAB 9-STN2), although the average concentration of arsenic in sediment at littoral stations was below this benchmark;
- Iron concentration in sediment was greater than the benchmark of 52,200 mg/kg at one littoral station (DD-HAB 9-STN2) and one profundal station (DL0-01-5), although average

concentrations of iron in sediment at littoral and profundal stations were below this benchmark;

- Manganese concentration in sediment was greater than the benchmark of 4,530 mg/kg at two profundal stations (DL0-01-2 and DL0-01-5), although the average concentration of manganese in sediment at profundal stations was below this benchmark; and,
- Nickel concentration in sediment was greater than the benchmark of 77 mg/kg at one littoral monitoring station (DD-HAB 9-STN2), although the average concentration of nickel in sediment at littoral stations was below this benchmark.

No AEMP benchmarks for water quality were exceeded over the duration of spring, summer, and fall sampling events in 2020 at Sheardown Lake NW. Lake-specific AEMP benchmarks for sediment quality were exceeded for arsenic, iron, manganese, and nickel at as many as one littoral station and two profundal stations in 2020, but none of these metals were elevated in the sediment of Sheardown Lake NW compared to the reference lake and to concentrations at Sheardown Lake NW during baseline. No adverse effects to phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at Sheardown Lake NW in 2020 based on comparisons to reference conditions and to Sheardown Lake NW baseline conditions. Because no mine-related changes in metal concentrations occurred in sediment at Sheardown Lake NW in 2020, and no adverse effects to biota were associated with concentrations of metals above AEMP benchmarks for sediment quality, a low action response is recommended to meet obligations under the AEMP Management Response Framework for Sheardown Lake NW. Specifically, it is recommended that, because concentrations of metals in Sheardown Lake NW sediment have been similar to those shown at the reference lake, consideration should be given to updating the AEMP sediment quality benchmarks for Sheardown Lake NW to reflect not only baseline data, but also reference lake data.

4.3 Sheardown Lake Southeast (DLO-2)

4.3.1 Water Quality

Vertical profiles of *in situ* water temperature, dissolved oxygen, pH and specific conductance conducted at Sheardown Lake SE showed no substantial within-season station-to-station differences during any of the winter, summer, or fall sampling events in 2020 (Appendix Figures C.17 to C.20). Distinctly cooler water temperature was indicated with depth at the Sheardown Lake SE basin in the summer, as well as at depths greater than 10 metres in the fall, that roughly mirrored gradients observed at Reference Lake 3 during both seasons in 2020 (Figure 4.12). The average water temperature at the bottom of the water column at Sheardown Lake SE littoral stations did not differ significantly from that at the reference lake, unlike at profundal stations

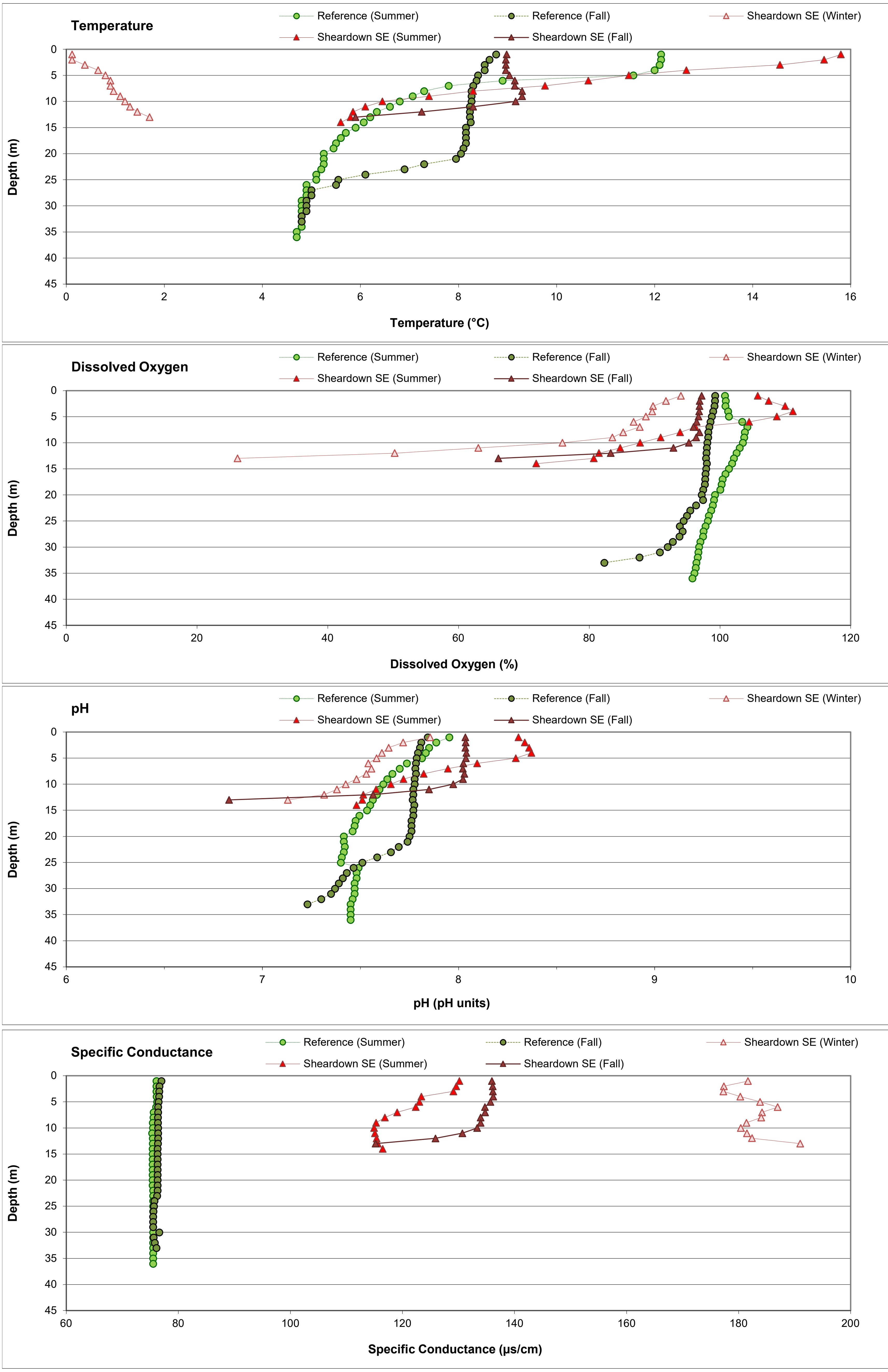

Figure 4.12: **Average *In Situ* Water Quality with Depth from Surface at Sheardown Lake SE (DLO-02) Compared to Reference Lake 3 during Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020**

where the water temperature was significantly warmer than at Reference Lake 3 during the August 2020 biological study (Figure 4.5; Appendix Table C.51). Sheardown Lake SE is a smaller and shallower waterbody than Reference Lake 3 (see Figure 2.1; Appendix Table B.1), and therefore heat distribution patterns (i.e., thermal profiles) may be expected to differ naturally between these lakes. Dissolved oxygen profiles conducted at Sheardown Lake SE in 2020 showed a gradient of decreasing saturation levels with increased depth in all but the fall sampling event (Figure 4.12). Dissolved oxygen concentrations near the bottom of the water column were significantly lower at Sheardown Lake SE littoral and profundal stations than like habitat stations at the reference lake during the August 2020 biological study (Figure 4.5). However, mean dissolved oxygen concentrations were above the WQG for the protection of sensitive populations of cold-water species (i.e., 9.5 mg/L) near the bottom at littoral and profundal stations of Sheardown Lake SE at the time of biological monitoring (Figure 4.5; Appendix Table C.51).

Water column profiles showed decreasing pH with increased depth at Sheardown Lake SE and Reference Lake 3 during winter and summer sampling events in 2020, with the changes in pH through the water column at both lakes appearing to coincide with changes in water temperature during each given season (Figure 4.12). The pH near the bottom of the water column at littoral and profundal stations of Sheardown Lake SE were significantly higher than at respective stations at the reference lake during the August 2020 biological study (Figure 4.5). However, the mean incremental difference in bottom pH between lakes was less than a pH unit, and pH values were consistently within WQG limits at Sheardown Lake SE (Figure 4.5; Appendix Table C.51), suggesting that the pH difference between lakes was not ecologically meaningful. Specific conductance at Sheardown Lake SE differed between the bottom and surface of the water column in all seasons (Figure 4.12), and was significantly higher at the littoral and profundal stations of Sheardown Lake SE than at Reference Lake 3 during the August 2020 biological study (Figure 4.5). Secchi depth at Sheardown Lake SE was significantly lower, indicating lower water clarity, than at the reference lake during the August 2020 biological study (Appendix Figure C.8; Appendix Tables C.51). Indeed, water clarity at Sheardown Lake SE was the lowest among all study lakes used for the CREMP in 2020 and historically, which is hypothesized to reflect backflow containing naturally high suspended sediment received from Mary River.

Water chemistry at Sheardown Lake SE met all AEMP benchmarks and WQG over the duration of spring, summer, and fall sampling events in 2020 (Table 4.10). Among those parameters with established AEMP benchmarks, aluminum and nitrate concentrations were elevated by factors greater than three at Sheardown Lake SE compared to Reference Lake 3 during the summer and fall sampling events (Table 4.10; Appendix Table C.43). Of those parameters without AEMP benchmarks, turbidity and total and dissolved manganese, molybdenum, and uranium

Table 4.10: Mean Water Chemistry at Sheardown Lake SE (DLO-02) and Reference Lake 3 (REF3) Monitoring Stations[a] During Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[b]	AEMP Benchmark[c]	Reference Lake 3 (n = 3)		Sheardown Lake SE Stations (n = 5)		
					Summer	Fall	Winter	Summer	Fall
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	79	79	194	128	142
	pH (lab)	pH	6.5 - 9.0	-	7.66	7.75	7.44	8.02	8.01
	Hardness (as $CaCO_3$)	mg/L	-	-	35	38	101	60	68
	Total Suspended Solids (TSS)	mg/L	-	-	2.0	2.0	2.0	2.0	2.2
	Total Dissolved Solids (TDS)	mg/L	-	-	41	51	129	69	77
	Turbidity	NTU	-	-	0.15	0.15	0.23	0.94	2.32
	Alkalinity (as $CaCO_3$)	mg/L	-	-	46	34	79	49	56
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.010	0.014	0.018	0.007	0.013
	Nitrate	mg/L	3	3	0.020	0.020	0.230	0.095	0.089
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.002	0.005
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.15	0.16	0.15	0.13	0.15
	Dissolved Organic Carbon	mg/L	-	-	3.3	3.5	2.7	2.0	2.1
	Total Organic Carbon	mg/L	-	-	4.6	3.8	2.7	1.7	2.4
	Total Phosphorus	mg/L	0.020$^{\alpha}$	-	0.004	0.003	0.004	0.006	0.009
	Phenols	mg/L	0.004$^{\alpha}$	-	0.0010	0.0011	0.001	0.0026	0.001
Anions	Bromide (Br)	mg/L	-	-	0.1	0.1	0.1	0.05	0.1
	Chloride (Cl)	mg/L	120	120	1.4	1.4	5.4	3.3	3.9
	Sulphate (SO_4)	mg/L	218$^{\beta}$	218	3.6	3.6	12.4	9.2	9.6
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[d]	0.0031	0.003	0.006	0.026	0.064
	Antimony (Sb)	mg/L	0.020$^{\alpha}$	-	0.0001	0.0001	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.0001	0.0001	0.000101	0.0001	0.0001
	Barium (Ba)	mg/L	-	-	0.0064	0.00696	0.01100	0.00641	0.00776
	Beryllium (Be)	mg/L	0.011$^{\alpha}$	-	0.0005	0.0005	0.0005	0.0001	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0005	0.0005	0.00005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.0116	0.01	0.0114
	Cadmium (Cd)	mg/L	0.00012	0.00009	0.00001	0.00001	0.00001	0.000005	0.00001
	Calcium (Ca)	mg/L	-	-	7.2	7.2	19.1	11.3	13.4
	Chromium (Cr)	mg/L	0.0089	0.0089	0.0005	0.0005	0.0005	0.00013	0.0005
	Cobalt (Co)	mg/L	0.0009$^{\alpha}$	0.004	0.0001	0.0001	0.0001	0.0001	0.0001
	Copper (Cu)	mg/L	0.002	0.0024	0.00073	0.0008	0.0010	0.0008	0.0009
	Iron (Fe)	mg/L	0.300	0.300	0.030	0.030	0.030	0.034	0.064
	Lead (Pb)	mg/L	0.001	0.001	0.00005	0.00005	0.00005	0.00005	0.00006
	Lithium (Li)	mg/L	-	-	0.0010	0.001	0.0013	0.0011	0.0013
	Magnesium (Mg)	mg/L	-	-	4.2	4.7	12.9	6.9	8.3
	Manganese (Mn)	mg/L	0.935$^{\beta}$	-	0.00080	0.00068	0.00233	0.00526	0.00361
	Mercury (Hg)	mg/L	0.000026	-	0.000005	0.000005	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00013	0.00015	0.00083	0.00063	0.00064
	Nickel (Ni)	mg/L	0.025	0.025	0.00050	0.00050	0.00083	0.00059	0.00061
	Potassium (K)	mg/L	-	-	0.9	0.90	1.69	1.03	1.15
	Selenium (Se)	mg/L	0.001	-	0.001	0.001	0.001	0.00005	0.001
	Silicon (Si)	mg/L	-	-	0.50	0.50	0.74	0.55	0.50
	Silver (Ag)	mg/L	0.00025	0.0001	0.00001	0.00001	0.00001	0.00001	0.00001
	Sodium (Na)	mg/L	-	-	0.9	0.96	2.46	1.37	1.71
	Strontium (Sr)	mg/L	-	-	0.0084	0.0082	0.0156	0.0086	0.0102
	Thallium (Tl)	mg/L	0.0008	0.0008	0.0001	0.0001	0.0001	0.00001	0.0001
	Tin (Sn)	mg/L	-	-	0.0001	0.0001	0.0001	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.010	0.010	0.010	0.001	0.010
	Uranium (U)	mg/L	0.015	-	0.00032	0.00033	0.00135	0.00089	0.00118
	Vanadium (V)	mg/L	0.006$^{\alpha}$	0.006	0.0010	0.001	0.001	0.0005	0.001
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.003	0.004	0.003	0.003

[grey box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Values presented are averages from samples taken from the surface and the bottom of the water column at each lake for the indicated season.

[b] Canadian Water Quality Guideline (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[c] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake NW.

[d] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively (Intrinsik 2013).

concentrations were elevated at Sheardown Lake SE compared to the reference lake during summer and/or fall sampling events in 2020 (Appendix Tables C.43 and C.54). Similar to the northwest basin of the lake, elevated total aluminum concentrations at Sheardown Lake SE compared to the reference lake in 2020 were associated with influences on water quality of the lake due to backflow received from Mary River that contributed to elevated turbidity at Sheardown Lake SE (Table 4.10; Appendix Table C.43).[9] Similar dissolved aluminum concentrations between Sheardown Lake SE and the reference lake in 2020 (and historically) suggested that the mine was unlikely to be the source of aluminum (Appendix Table C.54). Sulphate was the only parameter among those with established AEMP benchmarks that was elevated in 2020 compared to baseline at Sheardown Lake SE (Appendix Figure C.21), as was dissolved molybdenum concentrations among those parameters without AEMP benchmarks (Appendix Tables C.43 and C.54). Overall, a slight mine-related influence on water quality of Sheardown Lake SE was indicated in 2020 as reflected by elevated concentrations of manganese, molybdenum, nitrate, sulphate, and uranium. With the exception of manganese, concentrations of these parameters were also elevated at Sheardown Lake NW, suggesting a common mine-related source. However, concentrations of all parameters remained well below AEMP benchmarks and WQG at Sheardown Lake SE since commercial mine operations commenced in 2015, and therefore no adverse effects to biota were expected at the southeast basin of Sheardown Lake.

4.3.2 Sediment Quality

Surficial sediment at Sheardown Lake SE was primarily composed of silt with low (i.e., <2%) TOC content (Figure 4.13; Appendix Table D.30). Substrate at littoral stations of Sheardown Lake SE contained significantly less sand, moisture, and TOC content, and significantly greater silt and clay content, compared to littoral stations at Reference Lake 3 (Appendix Table D.31). Sediments from profundal stations at Sheardown Lake SE also had lower TOC and moisture content compared to profundal stations at Reference Lake 3, but no significant differences in particle size occurred (Appendix Table D.31). The relatively high proportion of fines in substrate of Sheardown Lake SE is potentially due to the receipt of Mary River backflow during high flow periods, which can be expected to result in the deposition of high quantities of naturally suspended, fine-grained material. Similar to observations at the other mine-exposed lakes and the reference lake, iron (oxy)hydroxide material was visible in surficial and/or sub-surface substrate at some Sheardown Lake SE stations, in some cases occurring as a thin, distinct layer or floc (Appendix Tables D.28 and D.29). Below the surficial layer, substrates at Sheardown Lake SE exhibited some sporadic blackening suggesting development of reducing conditions; however, no distinct redox boundary was observed (Appendix Tables D.28 and D.29). Observations regarding reducing sediment conditions at Sheardown Lake SE were similar to

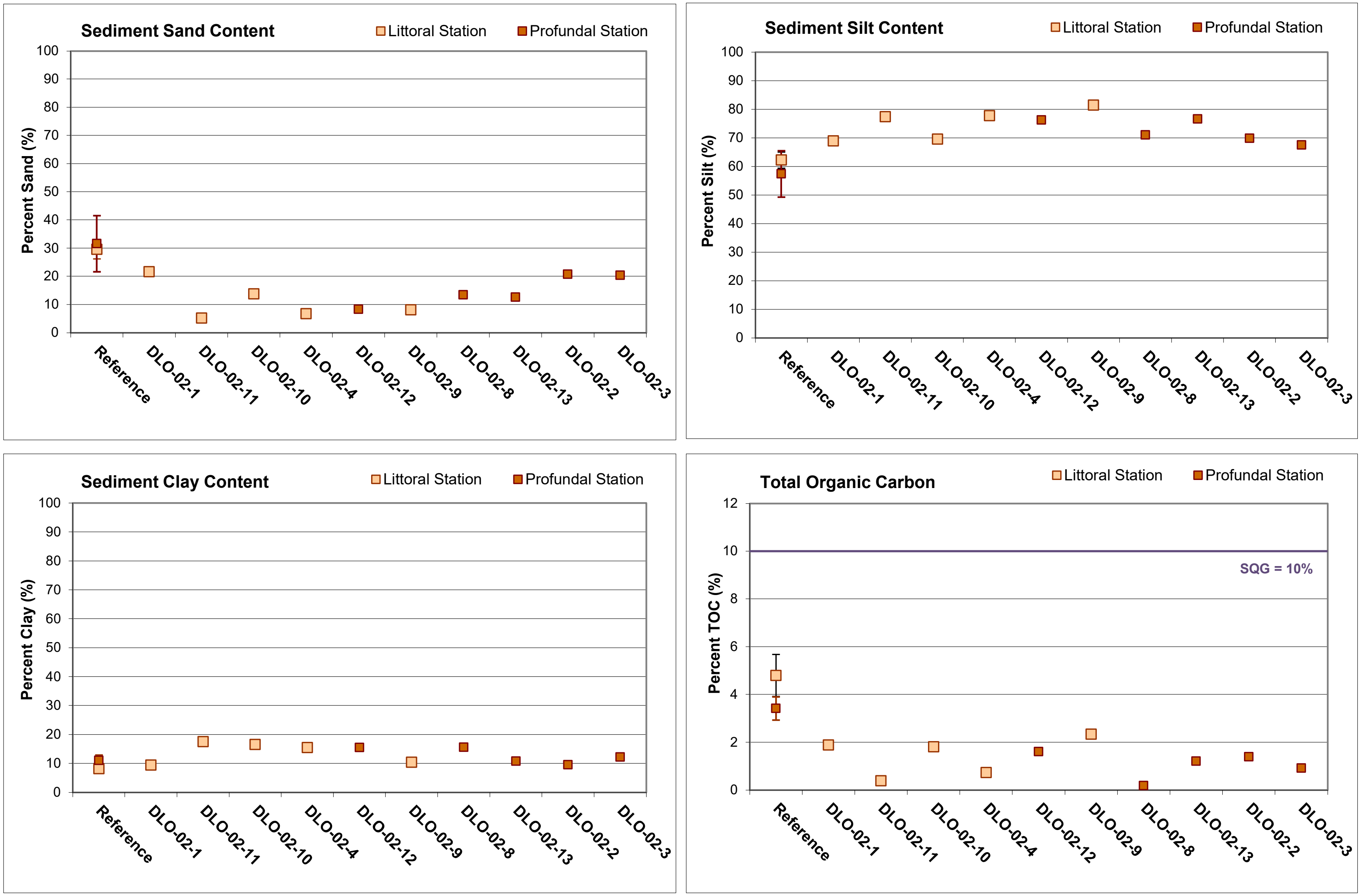

Figure 4.13: Sediment Particle Size and Total Organic Carbon (TOC) Content Comparisons among Sheardown Lake SE (DLO-02) Sediment Monitoring Stations and Reference Lake 3 Averages (mean ± SE), Mary River Project CREMP, August 2020

those made at Reference Lake 3 (Appendix Tables D.3, D.4, D.28, and D.29), suggesting that factors leading to reduced sediment conditions were comparable between lakes.

Metal concentrations in sediment at Sheardown Lake SE showed no clear spatial gradients with progression towards the lake outlet in 2020, suggesting no point sources of metals to the lake (Appendix Table D.30). Metal concentrations were, on average, similar to those observed for like-habitat stations at Reference Lake 3, except for a slight elevation (i.e., 3- to 5-fold) of zirconium concentrations in sediment from Sheardown Lake SE (Table 4.11; Appendix Table D.32). On average, concentrations of iron were above the SQG in Sheardown Lake SE (Table 4.11; Appendix Table D.30). Mean concentrations of iron, as well as chromium and manganese (the latter two metals in sediment from littoral stations only), were also above AEMP benchmarks in sediment in 2020 (Table 4.11; Appendix Table D.30). However, as indicated previously, average concentrations of iron and manganese were also above SQG and AEMP benchmarks at littoral and/or profundal stations of Reference Lake 3 (Table 4.11). This suggested that the elevation of iron and manganese concentrations in sediment relative to SQG and lake-specific AEMP benchmarks may be a natural phenomenon at lakes within the local study area of the mine.

Metal concentrations in sediment of littoral and profundal habitat at Sheardown Lake SE in 2020 were comparable to concentrations observed in the mine baseline period (2005 to 2013), and were also within respective ranges observed in previous years of mine operations (i.e., 2015 to 2019; Figure 4.7; Appendix Table D.32).[14] Thus, no substantial changes to metal concentrations in sediments at Sheardown Lake SE were indicated since the commencement of commercial mine operations in 2015.

4.3.3 Phytoplankton

Chlorophyll-a concentrations at Sheardown Lake SE showed no spatial gradients with closer proximity to the lake outlet during any of the winter, summer, or fall sampling events in 2020 (Figure 4.8). Chlorophyll-a concentrations did not differ significantly between the summer and fall sampling events in 2020, but concentrations in winter were significantly lower than the two open-water seasons (Appendix Table E.6). Similar to Sheardown Lake NW, chlorophyll-a concentrations at Sheardown Lake SE were significantly greater than at the reference lake for both the summer and fall sampling events in 2020 (Appendix Table E.7 and E.8), but concentrations were well below the AEMP benchmark of 3.7 µg/L at all stations and for all sampling events (Figure 4.8). On average, chlorophyll-a concentrations at Sheardown Lake SE

[14] See footnote 8 regarding differences in the concentration of boron in sediment between baseline and recent CREMP studies.

Table 4.11: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Sheardown Lake SE (DLO-02), and Reference Lake 3 (REF3) Sediment Monitoring Stations, Mary River Project CREMP, August 2020

Parameter		Units	SQG[a]	AEMP Benchmark[b] (NW, SE)	Littoral		Profundal	
					Reference Lake (n = 5)	Sheardown Lake SE (n = 3)	Reference Lake (n = 5)	Sheardown Lake SE (n = 2)
					Average ± SD	Average ± SD	Average ± SD	Average ± SD
TOC		%	10[α]	-	4.80 ± 1.96	1.43 ± 0.828	3.42 ± 1.08	1.06 ± 0.332
Metals	Aluminum (Al)	mg/kg	-	-	16,880 ± 1,785	17,400 ± 1,114	21,800 ± 2,185	17,550 ± 1,909
	Antimony (Sb)	mg/kg	-	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
	Arsenic (As)	mg/kg	17	6.2, 5.9	3.53 ± 1.09	3.67 ± 0.326	4.07 ± 0.397	3.03 ± 0.120
	Barium (Ba)	mg/kg	-	-	117 ± 22.0	92 ± 16	122 ± 18.3	74 ± 8.2
	Beryllium (Be)	mg/kg	-	-	0.65 ± 0.073	0.87 ± 0.079	0.80 ± 0.092	0.84 ± 0.078
	Bismuth (Bi)	mg/kg	-	-	<0.20 ± 0	0.24 ± 0.031	<0.20 ± 0	0.22 ± 0.021
	Boron (B)	mg/kg	-	-	12.2 ± 0.853	22.3 ± 3.35	14.7 ± 1.77	20.8 ± 2.12
	Cadmium (Cd)	mg/kg	3.5	1.5, 1.5	0.173 ± 0.047	0.102 ± 0.0106	0.148 ± 0.0172	0.090 ± 0.016
	Calcium (Ca)	mg/kg	-	-	5,608 ± 1,247	7,663 ± 1,413	5,010 ± 407	5,990 ± 170
	Chromium (Cr)	mg/kg	90	97, 79	54.3 ± 4.40	***79.7*** ± 9.13	65.0 ± 6.64	72.3 ± 2.47
	Cobalt (Co)	mg/kg	-	-	10.8 ± 1.64	13.7 ± 0.289	15.2 ± 1.56	13.3 ± 0.990
	Copper (Cu)	mg/kg	110	58, 56	71.4 ± 14.2	28.2 ± 2.26	***83.8*** ± 11.1	26.1 ± 2.62
	Iron (Fe)	mg/kg	40,000[α]	52,200, 34,400	***50,600*** ± 24,939	***42,733*** ± 6,352	45,080 ± 4,440	***41,950*** ± 7,000
	Lead (Pb)	mg/kg	91.3	35	13.8 ± 0.799	17.4 ± 1.93	16.7 ± 1.82	15.4 ± 1.273
	Lithium (Li)	mg/kg	-	-	26.0 ± 2.51	32.6 ± 1.88	33.7 ± 3.83	32.2 ± 2.40
	Magnesium (Mg)	mg/kg	-	-	11,440 ± 814	15,400 ± 2,095	14,180 ± 1,422	13,800 ± 1,414
	Manganese (Mn)	mg/kg	1,100[α,β]	4,530, 657	579 ± 258	***925*** ± 206	***1,230*** ± 355	602 ± 60.8
	Mercury (Hg)	mg/kg	0.486	0.17	0.0500 ± 0.0178	0.0215 ± 0.00044	0.0583 ± 0.0164	0.0204 ± 0.0059
	Molybdenum (Mo)	mg/kg	-	-	4.44 ± 3.31	1.50 ± 0.280	2.52 ± 0.273	1.40 ± 0.184
	Nickel (Ni)	mg/kg	75[α,β]	77, 66	40.0 ± 3.52	61.3 ± 8.62	45.0 ± 4.54	54.2 ± 3.18
	Phosphorus (P)	mg/kg	2,000[α]	1,958, 1,278	1,167 ± 394	1,004 ± 55.7	956 ± 47.3	929 ± 24.0
	Potassium (K)	mg/kg	-	-	4,100 ± 453	4,343 ± 340	5,338 ± 543	4,565 ± 728
	Selenium (Se)	mg/kg	-	-	0.73 ± 0.31	0.20 ± 0.01	0.61 ± 0.18	0.21 ± 0.0071
	Silver (Ag)	mg/kg	-	-	0.14 ± 0.047	0.12 ± 0.006	0.20 ± 0.057	0.12 ± 0.0141
	Sodium (Na)	mg/kg	-	-	304.2 ± 32	279 ± 31	369 ± 50	261 ± 13.4
	Strontium (Sr)	mg/kg	-	-	11.6 ± 1.70	11.7 ± 1.277	12.3 ± 1.24	10.7 ± 0.778
	Sulphur (S)	mg/kg	-	-	1,400 ± 387	<1,000 ± 0	1,140 ± 195	<1,000 ± 0
	Thallium (Tl)	mg/kg	-	-	0.379 ± 0.0415	0.415 ± 0.0598	0.594 ± 0.094	0.364 ± 0.0361
	Tin (Sn)	mg/kg	-	-	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0
	Titanium (Ti)	mg/kg	-	-	1,006 ± 109	1,303 ± 85	1,136 ± 50	1,290 ± 0.0
	Uranium (U)	mg/kg	-	-	11.0 ± 2.41	5.03 ± 0.431	19.7 ± 3.76	4.86 ± 0.658
	Vanadium (V)	mg/kg	-	-	54.1 ± 5.40	51.0 ± 3.97	63.4 ± 4.89	48.3 ± 1.63
	Zinc (Zn)	mg/kg	315	135	73.1 ± 7.83	57.3 ± 1.85	83.8 ± 8.52	54.8 ± 6.43
	Zirconium (Zr)	mg/kg	-	-	4.5 ± 1.0	17.6 ± 1.8	3.9 ± 0.32	17.9 ± 1.8

(shaded) Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD Indicates parameter concentration above the AEMP Benchmark.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to the Sheardown Lake basins

indicated an ‘oligotrophic’ status as defined by Wetzel (2001). This trophic status classification was consistent with an oligotrophic categorization for Sheardown Lake SE based on CWQG (CCME 2020) trophic classifications as defined by total phosphorus concentrations (i.e., average concentrations below 10 µg/L; Table 4.10; Appendix Table C.54).

Chlorophyll-a concentrations did not indicate any consistent direction of significant differences between 2020 and the mine construction (2014) period or previous years of mine operation (2015 to 2019) for winter, summer, and fall seasons (Figure 4.14; Appendix Table E.13). The variability in chlorophyll-a concentrations among years at Sheardown Lake SE may reflect the combination of mine-related influences and variable influence of Mary River on Sheardown Lake SE water levels, hydraulic retention time, and/or chemistry among years/seasons. For instance, Mary River discharges into or drains Sheardown Lake SE during high and low flow periods, respectively, the nature of which may affect phytoplankton abundance and/or community structure. No chlorophyll-a baseline (2005 to 2013) data are available for Sheardown Lake SE, precluding comparisons to conditions prior to the mine construction period.

4.3.4 Benthic Invertebrate Community

Benthic invertebrate density was significantly higher at littoral and profundal habitats, and richness was significantly higher at profundal habitat, of Sheardown Lake SE compared to like-habitat stations at Reference Lake 3, the differences of which were at magnitudes outside of the CES_{BIC} of ±2 SD_{REF} (Tables 4.12 and 4.13). In addition to these differences, benthic invertebrate community compositional differences were indicated between Sheardown Lake SE and Reference Lake 3 based on significantly differing Bray-Curtis Index for both littoral and profundal habitat types (Appendix Table F.21). However, the only ecologically significant differences in dominant taxonomic groups included higher and lower relative abundance of Chironomidae and Ostracoda, respectively, at littoral stations of Sheardown Lake SE compared to Reference Lake 3 (Table 4.12). No differences in dominant taxonomic groups were indicated between Sheardown Lake SE and the reference lake in 2020 (Tables 4.12 and 4.13). Similar to Sheardown Lake NW, the occurrence of higher benthic invertebrate density without an accompanying difference in evenness or existence of a significantly lower relative abundance of metal-sensitive taxa suggested that Sheardown Lake SE was simply more productive than Reference Lake 3, and was not adversely influenced by mine operations in 2020.

Similar to the other mine-exposed lakes, sediment at littoral and profundal stations of Sheardown Lake SE was significantly more compact (i.e., lower moisture content) than like-habitat stations at the reference lake (Appendix Table F.39). The occurrence of more stable, compact sediment likely accounted for an ecologically significant higher relative abundance of the burrower HPG at Sheardown Lake SE compared to the reference lake (Tables 4.12 and 4.13). In addition to

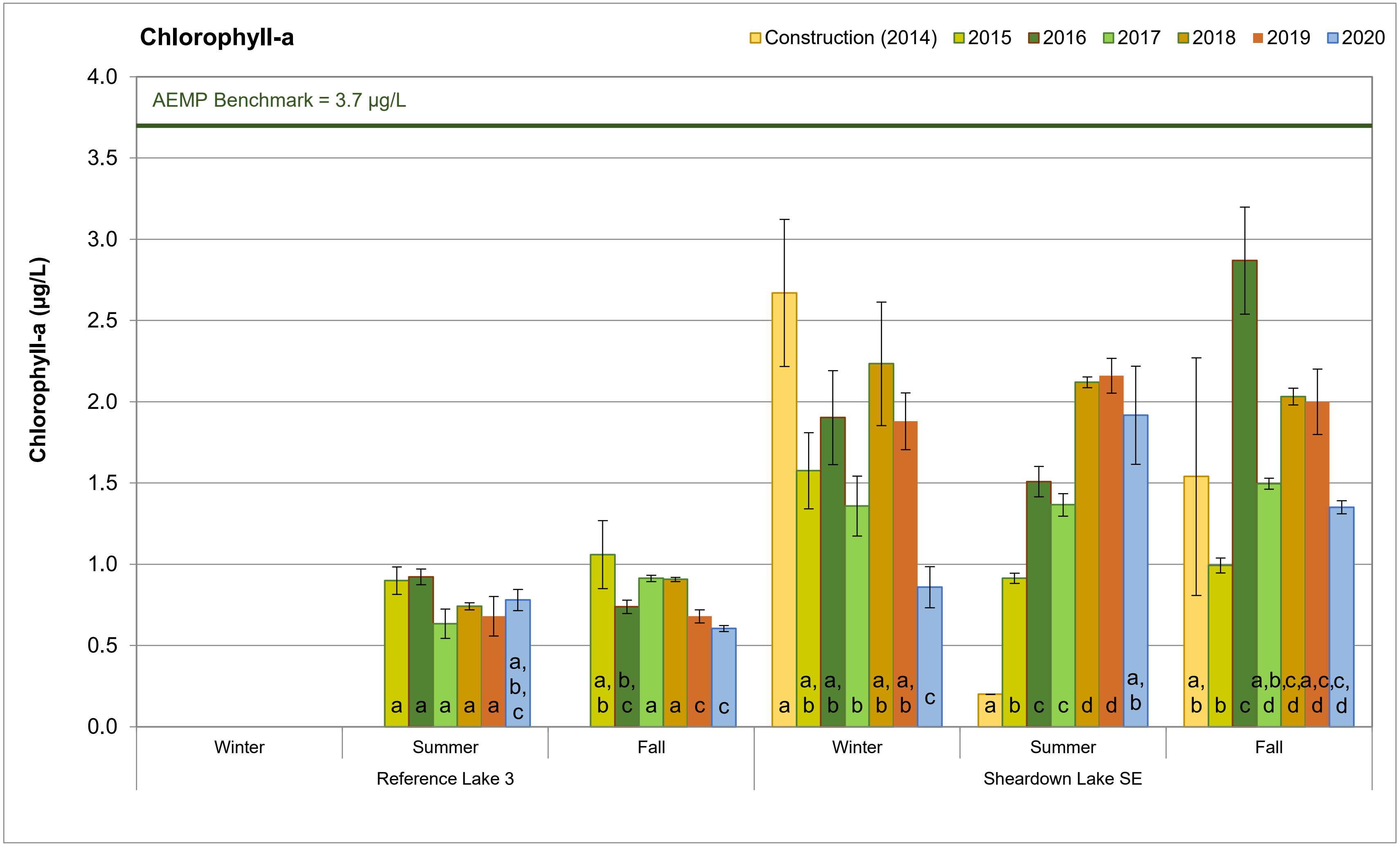

Figure 4.14: Temporal Comparison of Chlorophyll-a Concentrations Among Seasons between Sheardown Lake SE and Reference Lake 3 for Mine Construction (2014) and Operational (2015 to 2020) Periods (mean ± SE)

Note: Bars with the same letter at the base do not differ significantly between years for the applicable season.

Table 4.12: Benthic Invertebrate Community Statistical Comparison Results between Sheardown Lake SE (DLO-02) and Reference Lake 3 for Littoral Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Littoral Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	YES	< 0.001	8.9	Reference Lake 3	1,571	430	193	1,190	1,474	2,310
						Sheardown SE Littoral	5,407	1,391	622	3,216	5,509	6,914
Richness (Number of Taxa)	t-equal	log10	NO	0.305	-1.0	Reference Lake 3	14.6	2.5	1.1	13.0	14.0	19.0
						Sheardown SE Littoral	12.2	1.6	0.7	10.0	13.0	14.0
Simpson's Evenness (E)	t-equal	none	NO	0.799	0.1	Reference Lake 3	0.810	0.110	0.049	0.630	0.847	0.923
						Sheardown SE Littoral	0.826	0.068	0.031	0.722	0.827	0.911
Shannon Diversity	t-equal	log10	NO	0.547	-0.4	Reference Lake 3	2.710	0.526	0.235	2.080	2.730	3.510
						Sheardown SE Littoral	2.520	0.261	0.117	2.220	2.570	2.830
Hydracarina (%)	t-equal	log10	NO	0.167	-0.7	Reference Lake 3	5.3	2.6	1.2	3.5	4.4	9.9
						Sheardown SE Littoral	3.4	2.4	1.1	1.0	2.7	5.9
Ostracoda (%)	t-equal	log10	YES	< 0.001	-2.1	Reference Lake 3	37.9	14.5	6.5	26.7	36.2	62.6
						Sheardown SE Littoral	6.8	3.5	1.6	2.3	8.1	10.3
Chironomidae (%)	t-equal	none	YES	0.001	2.3	Reference Lake 3	52.6	15.6	7.0	26.9	59.0	66.4
						Sheardown SE Littoral	89.2	5.1	2.3	81.9	89.0	96.4
Metal-Sensitive Chironomidae (%)	t-equal	none	YES	0.012	-1.7	Reference Lake 3	28.8	9.5	4.3	15.6	32.5	38.7
						Sheardown SE Littoral	12.3	6.5	2.9	3.0	15.1	19.5
Collector-Gatherers (%)	t-equal	log10	NO	0.258	-0.8	Reference Lake 3	63.1	11.4	5.1	53.6	60.3	81.5
						Sheardown SE Littoral	54.0	14.9	6.7	40.3	50.6	75.3
Filterers (%)	t-equal	none	YES	0.022	-1.5	Reference Lake 3	27.1	9.8	4.4	14.4	29.2	38.0
						Sheardown SE Littoral	12.3	6.5	2.9	3.0	15.1	19.5
Shredders (%)	t-unequal	none	YES	0.060	-1.2	Reference Lake 3	3.9	3.3	1.5	0.6	3.2	7.4
						Sheardown SE Littoral	0.0	0.0	0.0	0.0	0.0	0.0
Clingers (%)	t-equal	none	YES	0.011	-1.8	Reference Lake 3	31.9	9.3	4.2	17.9	33.5	41.6
						Sheardown SE Littoral	15.5	6.4	2.9	4.7	18.1	20.9
Sprawlers (%)	t-equal	log10	NO	0.267	-0.7	Reference Lake 3	57.9	12.1	5.4	41.0	57.2	73.8
						Sheardown SE Littoral	49.7	9.0	4.0	42.4	46.5	65.3
Burrowers (%)	t-equal	none	YES	0.004	5.0	Reference Lake 3	10.2	4.9	2.2	4.6	8.3	17.3
						Sheardown SE Littoral	34.8	13.1	5.9	16.6	35.1	52.9

Grey shading indicates statistically significant difference between study areas based on p-value less than 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Table 4.13: Benthic Invertebrate Community Statistical Comparison Results between Sheardown Lake SE (DLO-02) and Reference Lake 3 for Profundal Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Profundal Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	YES	< 0.001	23.9	Reference Lake 3	479	142	63	336	491	681
						Sheardown SE Profundal	3,869	1,304	583	3,026	3,336	6,164
Richness (Number of Taxa)	t-equal	none	YES	0.034	2.4	Reference Lake 3	7.0	1.9	0.8	5.0	8.0	9.0
						Sheardown SE Profundal	11.4	3.4	1.5	6.0	12.0	15.0
Simpson's Evenness (E)	t-equal	none	NO	0.429	0.9	Reference Lake 3	0.731	0.045	0.020	0.689	0.721	0.795
						Sheardown SE Profundal	0.772	0.099	0.045	0.619	0.806	0.869
Shannon Diversity	t-equal	none	NO	0.101	2.3	Reference Lake 3	1.800	0.196	0.088	1.580	1.720	2.030
						Sheardown SE Profundal	2.250	0.501	0.224	1.670	2.570	2.670
Hydracarina (%)	t-equal	none	NO	0.434	-0.4	Reference Lake 3	2.8	2.0	0.9	0.0	3.5	5.1
						Sheardown SE Profundal	1.9	1.3	0.6	0.3	2.5	3.1
Ostracoda (%)	t-equal	log10	NO	0.177	-0.8	Reference Lake 3	8.6	4.1	1.8	3.5	7.7	14.5
						Sheardown SE Profundal	5.3	5.1	2.3	0.5	5.7	13.0
Chironomidae (%)	t-equal	none	NO	0.202	1.1	Reference Lake 3	87.9	4.2	1.9	82.3	87.2	92.7
						Sheardown SE Profundal	92.5	6.2	2.8	84.1	91.2	98.9
Metal-Sensitive Chironomidae (%)	t-equal	none	NO	0.191	-0.7	Reference Lake 3	31.5	17.6	7.9	7.9	38.0	49.3
						Sheardown SE Profundal	19.9	4.7	2.1	11.8	21.6	24.0
Collector-Gatherers (%)	t-equal	log10	NO	0.292	-0.7	Reference Lake 3	62.9	15.0	6.7	45.4	56.1	79.0
						Sheardown SE Profundal	52.5	14.5	6.5	33.6	52.1	70.6
Filterers (%)	t-equal	none	NO	0.212	-0.6	Reference Lake 3	30.7	17.5	7.8	7.9	38.0	49.3
						Sheardown SE Profundal	19.7	4.7	2.1	11.8	21.6	23.8
Clingers (%)	t-equal	none	NO	0.142	-0.8	Reference Lake 3	33.5	16.9	7.6	13.1	41.5	52.8
						Sheardown SE Profundal	20.5	5.3	2.4	12.3	21.7	26.9
Sprawlers (%)	t-equal	log10	YES	0.041	-1.7	Reference Lake 3	64.8	16.2	7.2	45.5	58.5	87.0
						Sheardown SE Profundal	36.9	17.8	8.0	16.8	37.4	55.1
Burrowers (%)	t-unequal	log10(x+1)	YES	0.007	14.2	Reference Lake 3	1.7	2.9	1.3	0.0	0.0	6.7
						Sheardown SE Profundal	42.6	21.3	9.5	19.4	43.0	66.3

Grey shading indicates statistically significant difference between study areas based on p-value less than 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

differences in sediment properties between lakes, significantly shallower 'profundal' sampling depths at Sheardown Lake SE likely contributed to the differences in benthic invertebrate community features compared to the reference lake (Appendix Table F.39). Natural depth-related influences on benthic invertebrate community structure that include lower density and richness at greater depth in lake environments are well documented (Ward 1992; Armitage et al. 1995), and were consistently evident at Reference Lake 3 from 2015 to 2020 (Appendix B) indicating similar patterns in pristine lakes of the Mary River Project region. The maximum depth of Sheardown Lake SE is approximately 14 m (Minnow 2018). Because profundal habitat for the Mary River Project CREMP is defined as water depths ≥12 m, benthic invertebrate community data collected from profundal depths of Sheardown Lake SE (average station depth of 12 m) are not directly comparable to those at Reference Lake 3, where the mean depth of profundal stations is 21 m (Appendix Table F.39). Therefore, the differences in benthic invertebrate community endpoints shown between Sheardown Lake SE and the reference lake in 2020 likely reflected a combination of naturally greater productivity, naturally more compact sediment, and naturally shallower 'profundal' sampling depths at Sheardown Lake SE. Moreover, no ecologically significant effects on the relative abundance of metal-sensitive Chironomidae were indicated at Sheardown Lake SE in 2020, suggesting no metal-related influences on the benthic invertebrate community of the lake.

Benthic invertebrate density was routinely significantly lower at Sheardown Lake SE in years of mine operation compared to baseline (Appendix Tables F.41 and F.42). However, no ecologically significant differences in richness, evenness, relative abundance of dominant taxonomic groups, or relative abundance of HPG were consistently shown at littoral or profundal habitat of Sheardown Lake SE over the 2015 to 2020 period of mine operation compared to baseline (Appendix Figures F.12 and F.13; Appendix Tables F.41 and F.42). Because density was the only benthic invertebrate community metric that consistently differed between the mine-operational and baseline period, natural temporal variability among studies (and in particular, high density during the 2007 and 2013 baseline studies) likely accounted for the difference in benthic invertebrate density at Sheardown Lake SE between these periods. Overall, consistent with no substantial differences in water and sediment quality since the mine baseline period, no ecologically significant differences in benthic invertebrate community features were indicated at littoral and profundal habitat of Sheardown Lake SE following the commencement of mine operation in 2015.

4.3.5 Fish Population

4.3.5.1 Sheardown Lake SE Fish Community

The Sheardown Lake SE fish community was composed of arctic charr and ninespine stickleback in 2020 (Table 4.8), the same fish species as observed in previous years (Minnow 2020). Total fish CPUE was greater at Sheardown Lake SE than Reference Lake 3, suggesting higher densities and/or productivity of both arctic charr and ninespine stickleback at Sheardown Lake SE (Table 4.8). Consistent with the other mine-exposed lakes, greater numbers of arctic charr, together with greater density of benthic invertebrates, suggested that productivity was higher at Sheardown Lake SE than at Reference Lake 3. Electrofishing and gill netting CPUE at Sheardown Lake SE in 2020 were both within respective ranges observed during the previous five years of mine operation (i.e., 2015 to 2019), and were generally greater than in baseline studies (i.e., 2006 through 2008; Figure 4.10). Based on these data, arctic charr abundance at nearshore and littoral/profundal habitats may be comparable to, or potentially greater than, baseline at Sheardown Lake SE indicating that the mine has not adversely influenced the number of arctic charr in the lake.

4.3.5.2 Sheardown Lake SE Fish Population Assessment

Nearshore Arctic Charr

A total of 100 arctic charr were captured from nearshore habitat at each of Sheardown Lake SE and Reference Lake 3 in August 2020. Arctic charr YOY were distinguished from non-YOY using fork length cut-offs of 5.1 cm and 4.3 cm for the Sheardown Lake SE and Reference Lake 3 data sets, respectively, based on evaluation of length-frequency distributions coupled with supporting age determinations (Figure 4.15; Appendix Tables G.4 and G.19). Because greater than ten YOY arctic charr were identified from the Sheardown Lake SE and Reference Lake 3 populations, statistical comparisons of health endpoints were completed separately on both the YOY and non-YOY populations. The length-frequency distribution for the whole population of nearshore arctic charr did not differ significantly between Sheardown Lake SE and Reference Lake 3; however, a difference was noted when comparing non-YOY between the two lakes (Appendix Table G.20). This difference reflected slightly larger non-YOY fish captured at Sheardown Lake SE compared to the reference lake (Figure 4.15). Arctic charr YOY and non-YOY from nearshore areas of Sheardown Lake SE were significantly larger and had greater condition than those from Reference Lake 3 (Table 4.14; Appendix Table G.20). The absolute magnitudes of difference in condition were greater than the CES_C of 10% for both age classes at Sheardown Lake SE, suggesting that the differences may be ecologically significant (Table 4.14; Appendix Table G.20).

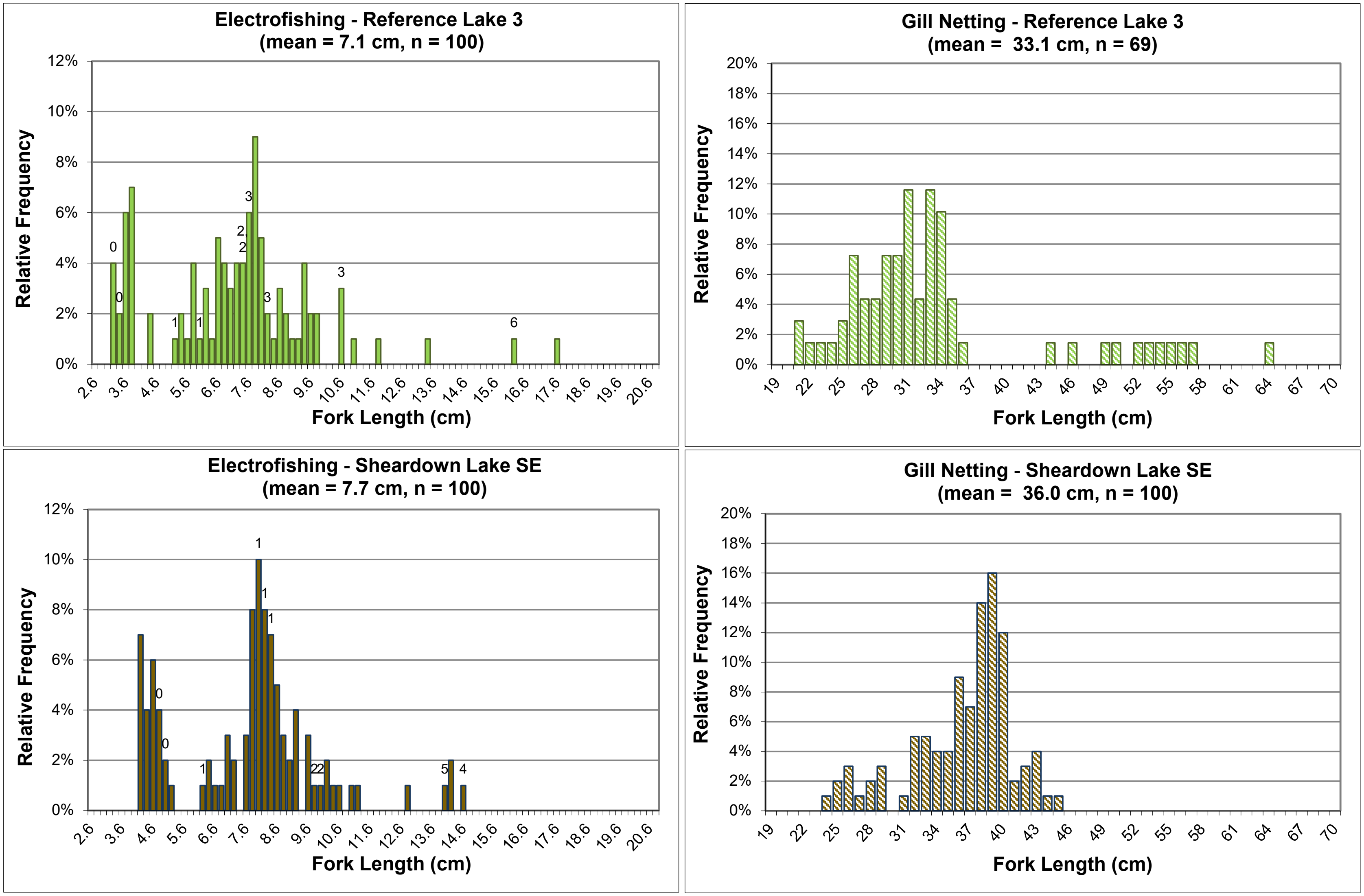

Figure 4.15: Length-Frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Sheardown Lake SE (DLO-02) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Note: Fish ages are shown above the bars, where available.

Table 4.14: Summary of Statistical Results for Arctic Charr Population Comparisons between Sheardown Lake SE and Reference Lake 3 from 2015 to 2020, and between Sheardown Lake SE Mine Operational and Baseline Period Data, for Fish Captured by Electrofishing and Gill Netting Methods, Mary River Project CREMP

Data Set by Sampling Method	Response Category	Endpoint	Statistically Significant Differences Observed? [a]											
			versus Reference Lake 3						versus Sheardown Lake SE baseline period data [b]					
			2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
Nearshore Electrofishing	Survival	Length-Frequency Distribution	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**
		Age	No	No	No	-	-	-	**Yes (+273%)**	-	-	-	-	-
	Energy Use (non-YOY)	Size (mean fork length)	No	No	**Yes (+12%)**	**Yes (+21%)**	**Yes (-28%)**	**Yes (+7%)**	**Yes (+7%)**	**Yes (-15%)**	**Yes (+19%)**	**Yes (-47%)**	No	**Yes (+30%)**
		Size (mean weight)	No	No	**Yes (+55%)**	**Yes (+59%)**	**Yes (-59%)**	**Yes (+53%)**	No	**Yes (-43%)**	**Yes (+54%)**	No	No	**Yes (+117%)**
	Energy Storage (non-YOY)	Condition (body weight-at-fork length)	**Yes (+4%)**	No	**Yes (+9%)**	**Yes (-13%)**	**Yes (+4%)**	**Yes (+14%)**	**Yes (-14%)**	**Yes (-16%)**	No	**Yes (-15%)**	**Yes (-13%)**	No
Littoral/Profundal Gill Netting [c]	Survival	Length Frequency Distribution	-	-	-	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	No	No
		Age	-	-	-	-	-	-	**Yes (-13%)**	No	No	-	-	-
	Energy Use	Size (mean fork length)	-	-	-	No	**Yes (+23%)**	**Yes (+21%)**	**Yes (-9%)**	**Yes (-7%)**	**Yes (-5%)**	**Yes (-4%)**	**Yes (-2%)**	No
		Size (mean weight)	-	-	-	No	**Yes (+102%)**	**Yes (+107%)**	**Yes (-26%)**	**Yes (-20%)**	**Yes (-16%)**	**Yes (-16%)**	**Yes (-11%)**	**Yes (-7.0%)**
		Growth (fork length-at-age)	-	-	-	-	-	-	No	No	No	-	-	-
		Growth (weight-at-age)	-	-	-	-	-	-	**Yes (+18%)**	**Yes (+24%)**	No	-	-	-
	Energy Storage	Condition (body weight-at-fork length)	-	-	-	**Yes (+7%)**	No	**Yes (+14%)**	No	No	**Yes (-6%)**	**Yes (-7%)**	**Yes (-6%)**	**Yes (-5.0%)**

BOLD indicates a significant difference related to the comparison.

[a] Values in parentheses indicate direction and magnitude of any significant differences.

[b] Baseline period data included 2007 nearshore electrofishing data and 2007 and 2008 littoral/profundal gill netting data.

[c] Due to low catches of arctic charr in gill nets at Reference Lake 3 in 2015, 2016, and 2017, no comparison of fish health was conducted for gill netted fish.

No consistent directional differences in size or condition were observed in non-YOY arctic charr from nearshore habitat of Sheardown Lake SE compared to the reference lake from 2015 to 2020, although most often larger fish of slightly greater condition occurred at Sheardown Lake SE over this period (Table 4.14). Although before-after analysis of data collected at Sheardown Lake SE in 2020 (mine operation) and 2007 (baseline) was conducted (Appendix Table G.7), poor accuracy in fresh body weight measurements during baseline sampling precluded meaningful data interpretation, and therefore these results were not discussed herein. Overall, the differences in nearshore non-YOY arctic charr size and condition between Sheardown Lake SE and Reference Lake 3 likely reflected natural variability between the two populations over time.

Littoral/Profundal Arctic Charr

A total of 100 and 69 arctic charr were sampled from littoral/profundal habitat of Sheardown Lake SE and Reference Lake 3, respectively, in August 2020. The length-frequency distribution for littoral/profundal arctic charr differed significantly between lakes due to more larger fish being captured at Sheardown Lake SE (Table 4.14; Figure 4.15). Littoral/profundal arctic charr from Sheardown Lake SE were significantly longer, heavier, and had greater condition than those from Reference Lake 3 (Table 4.14; Appendix Table G.24). The absolute magnitude of difference in condition was also above the CES_C of 10%, suggesting potential ecological significance (Table 4.14; Appendix Table G.20).

The differences in size and condition of arctic charr captured from littoral/profundal habitat between Sheardown Lake NW and Reference Lake 3 in 2020 were similar to the differences shown in 2018 and/or 2019, suggesting no appreciable changes in health of littoral/profundal arctic charr at Sheardown Lake NW over time. No difference in length-frequency distribution of arctic charr captured from littoral/profundal habitat of Sheardown Lake SE was shown between 2020 and baseline, although differences were reported historically (Table 4.14). Arctic charr sampled from littoral/profundal habitat of Sheardown Lake SE in years of mine operation (i.e., 2015 to 2020) have almost consistently been smaller than those captured at the time of the mine baseline, but significantly lower condition has only occurred compared to baseline since 2017 (Table 4.14). Differences in arctic charr condition from 2015 to 2020 at Sheardown Lake SE, relative to Reference Lake 3 or Sheardown Lake SE baseline, were generally absent or not ecologically meaningful based on the magnitude of difference being within the CES_C of ±10% (Table 4.14). In turn, this suggested no adverse influences on adult arctic charr at Sheardown Lake SE through the first six years of mine operation.

4.3.6 Effects Assessment and Recommendations

At Sheardown Lake SE, the following AEMP benchmarks were exceeded in 2020:

- Chromium concentration in sediment, on average, was greater than the benchmark of 79 mg/kg at littoral stations;
- Iron concentration in sediment, on average, was greater than the benchmark of 34,400 mg/kg at littoral and profundal stations;
- Manganese concentration in sediment was, on average, greater than the benchmark of 657 mg/kg at littoral stations; and,
- Nickel concentration in sediment was greater than the benchmark of 66 mg/kg at one littoral monitoring station (DL0-02-11), although the average concentration of nickel in sediment at littoral stations was below this benchmark.

No AEMP benchmarks for water quality were exceeded over the duration of spring, summer, and fall sampling events in 2020 at Sheardown Lake SE. Lake-specific AEMP benchmarks for sediment quality were exceeded for chromium, iron, manganese, and nickel concentrations at Sheardown Lake SE in 2020. However, none of these metals occurred at concentrations in sediment of Sheardown Lake SE that were elevated compared to the reference lake, or to concentrations shown at Sheardown Lake SE during the baseline period. In addition, concentrations of these metals were above the Sheardown Lake SE AEMP benchmarks in sediment at the reference lake, suggesting naturally high concentrations of each of the indicated metals in sediments of area lakes. Notably, AEMP benchmarks established for sediment quality at Sheardown Lake SE tend to be lower than SQG, and are generally lower than AEMP benchmarks established for the other mine-exposed lakes (Baffinland 2015). No adverse effects to phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at Sheardown Lake SE in 2020 based on comparisons to reference conditions and to applicable Sheardown Lake SE baseline conditions. Because no mine-related changes in metal concentrations occurred in sediment at Sheardown Lake SE in 2020 and no adverse effects to biota were associated with concentrations of metals above AEMP benchmarks for sediment quality, a low action response is recommended to meet obligations under the AEMP Management Response Framework. Specifically, it is recommended that the relevance of site-specific sediment quality AEMP benchmarks for Sheardown Lake SE be assessed and, if necessary, determined anew taking into consideration data from the reference lake and applicable SQG.

5 MARY RIVER AND MARY LAKE SYSTEM

5.1 Mary River Tributary-F

5.1.1 Water Quality

Mary River Tributary-F (MRTF) dissolved oxygen concentrations did not differ significantly between areas located downstream and upstream of the MS-08 effluent discharge channel (effluent-exposed and reference areas, respectively) and were well above the WQG lowest acceptable concentration for sensitive early life stages of cold-water biota (i.e., 9.5 mg/L) at both areas at the time of EEM sampling (i.e., August 2020). Although pH and specific conductance were each significantly higher at the effluent-exposed area than at the reference area of MRTF, the mean incremental difference between areas for each of these parameters was very small and pH values were well within the WQG acceptable range for the protection of aquatic life (i.e., between 6.5 and 9.0) at the time of EEM sampling. The proportion of effluent within MRTF immediately below the effluent channel confluence was estimated as 2.6% on average, under flow conditions at the time of EEM sampling, based on extrapolation using measures of specific conductance collected in the field (Minnow 2021).

Water chemistry at MRTF met all AEMP benchmarks over the duration of spring, summer, and fall sampling events in 2020 (Table 5.1). Although concentrations of total aluminum and phosphorus were above applicable WQG in spring at the effluent-exposed area of MRTF (i.e., Station F0-01), concentrations of these parameters were also above WQG at reference areas indicating naturally elevated concentrations of aluminum and phosphorus within regional watercourses (Table 5.1). Among those parameters with established AEMP benchmarks, nitrate and sulphate concentrations were consistently elevated at MRTF compared to the Mary River reference area (i.e., G0-09 series stations) in all spring, summer, and fall sampling events (Appendix Tables C.59 and C.61), but remained at concentrations well below AEMP benchmarks and WQG (Table 5.1). Nitrate and sulphate concentrations were also elevated in summer and fall sampling events from 2018 to 2020 compared to baseline at MRTF (Appendix Figure C.23). No other parameters were observed at concentrations that were continually elevated at MRTF in 2020 compared to reference conditions through all seasons, nor compared to baseline, except that total and dissolved concentrations of manganese were elevated compared to reference conditions during the spring sampling event in 2020 (Appendix Tables C.59 and C.61; Appendix Figure C.23). Overall, a slight mine-related influence on water quality was indicated by elevated concentrations of nitrate and sulphate at MRTF in 2020, but concentrations of these parameters (and all others) were routinely well below AEMP benchmarks and WQG since commercial mine operations commenced in 2015.

Table 5.1: Mean Water Chemistry at Mary River Monitoring Stations During Spring, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	G0-09 Reference (n = 3)			G0 Upstream (n = 2)			Mary River Tributary F			E0 Adjacent (n = 4)			C0 Downstream (n = 3)		
					Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer	Fall
Conventionals	Conductivity (lab)	umho/cm	-	-	61	186	248	45	171	228	108	345	403	53	178	245	57	176	234
	pH (lab)	pH	6.5 - 9.0	-	7.74	8.22	8.33	7.64	8.14	8.48	7.89	8.30	8.32	7.67	8.17	8.19	7.66	8.22	8.17
	Hardness (as $CaCO_3$)	mg/L	-	-	28	81	120	20	74	106	49.9	166	211	24	77	117	25	75	112
	Total Suspended Solids (TSS)	mg/L	-	-	2	12.6	2.1	14.6	10.25	2.8	9.8	<2.0	<2.0	8.5	12.5	2.5	7.7	15.1	2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	66	97	129	66	103	119	90	190	224	74	116	128	73	107	127
	Turbidity	NTU	-	-	4.3	26.3	2.8	7.3	34.5	4.7	2.2	0.4	0.6	6.3	38.6	6.2	8.5	29.5	3.3
	Alkalinity (as $CaCO_3$)	mg/L	-	-	29	80	103	21	78	91	39	122	132	27	83	95	24	82	94
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.010	0.010	0.01	0.01	0.01	0.01	<0.010	<0.010	<0.010	0.010	0.010	0.010	0.010	0.010	0.011
	Nitrate	mg/L	3	3	0.021	0.147	0.103	0.030	0.101	0.163	0.187	0.714	1.090	0.043	0.133	0.259	0.089	0.171	0.229
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.005	0.005	0.005	<0.0050	<0.0050	<0.0050	0.005	0.005	0.005	0.005	0.005	0.005
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.15	0.15	0.15	0.15	0.15	0.15	<0.15	0.32	0.16	0.15	0.15	0.17	0.15	0.15	0.15
	Dissolved Organic Carbon	mg/L	-	-	1.6	4.0	2.6	2.3	4.0	2.3	2.1	1.7	2.0	2.2	3.0	2.2	2.2	2.6	2.3
	Total Organic Carbon	mg/L	-	-	2.2	2.9	2.4	2.7	2.8	2.3	2.9	2.7	2.3	2.9	3.2	2.3	3.3	3.3	2.6
	Total Phosphorus	mg/L	0.020[α]	-	0.0121	0.0215	0.0034	0.0557	0.0225	0.0038	0.0377	<0.0030	<0.0030	0.0480	0.0240	0.0046	0.0365	0.0230	0.0073
	Phenols	mg/L	0.004[α]	-	0.0015	0.0012	0.0010	0.0010	0.0010	0.0010	<0.0010	<0.0010	<0.0010	0.0012	0.0010	0.0010	0.0011	0.0010	0.0010
Anions	Bromide (Br)	mg/L	-	-	0.1	0.1	0.1	0.1	0.1	0.1	<0.10	<0.10	<0.10	0.1	0.1	0.1	0.1	0.1	0.1
	Chloride (Cl)	mg/L	120	120	1.0	8.9	11.8	1.6	7.8	13.2	1.3	13.7	11.7	1.1	7.6	12.7	1.4	7.5	11.7
	Sulphate (SO_4)	mg/L	218[β]	218	0.7	5.5	6.7	0.6	4.9	7.0	11.8	36.0	60.7	2.9	6.4	12.1	2.6	6.1	10.4
Total Metals	Aluminum (Al)	mg/L	0.100	0.966	0.121	***1.046***	0.087	0.230	***1.330***	0.148	0.170	0.034	0.041	0.216	***1.071***	0.173	0.204	***1.202***	0.121
	Antimony (Sb)	mg/L	0.020[α]	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.00011	0.00021	0.0001	0.000115	0.000245	0.00010	<0.00010	<0.00010	<0.00010	0.00010	0.00022	0.00010	0.00010	0.00023	0.00010
	Barium (Ba)	mg/L	-	-	0.0049	0.0159	0.0140	0.0052	0.0178	0.0148	0.0054	0.0165	0.0179	0.0048	0.0160	0.0158	0.0051	0.0156	0.0148
	Beryllium (Be)	mg/L	0.011[α]	-	0.0005	0.0001	0.0005	0.0005	0.0001	0.0005	<0.00050	<0.00010	<0.00050	0.0005	0.0001	0.0005	0.0005	0.0001	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.00005	0.0005	0.0005	0.00005	0.0005	<0.00050	<0.000050	<0.00050	0.0005	0.00005	0.0005	0.0005	0.00005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.01	0.01	0.01	0.01	<0.010	<0.010	<0.010	0.01	0.01	0.01	0.01	0.01	0.01
	Cadmium (Cd)	mg/L	0.00012	0.00006	0.000028	0.000005	0.000010	0.00001	0.00001	0.00001	<0.000010	<0.0000050	<0.000010	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
	Calcium (Ca)	mg/L	-	-	6.2	16.0	23.9	4.8	14.5	21.4	9.4	29.4	36.7	4.8	15.4	23.1	5.2	15.2	21.9
	Chromium (Cr)	mg/L	0.0089	0.0089	0.0005	0.00198	0.00050	0.00057	0.00260	0.00050	<0.00050	<0.00050	<0.00050	0.00050	0.00225	0.00050	0.00050	0.00185	0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	0.00010	0.00042	0.00010	0.00017	0.00054	0.00010	0.00016	<0.00010	0.00017	0.00011	0.00047	0.00010	0.00010	0.00041	0.00010
	Copper (Cu)	mg/L	0.002	0.0024	***0.0027***	0.0021	0.0010	0.0009	***0.0025***	0.0012	0.0005	<0.0010	0.0009	0.0007	0.0023	0.0013	0.0008	0.0021	0.0011
	Iron (Fe)	mg/L	0.30	0.874	0.104	***0.941***	0.080	0.281	***1.215***	0.125	0.202	0.028	0.050	0.201	***0.961***	0.176	0.181	***0.920***	0.111
	Lead (Pb)	mg/L	0.001	0.001	0.00023	0.00073	0.00009	0.00034	0.00089	0.00013	0.00021	<0.000050	<0.000050	0.00021	0.00075	0.00017	0.00020	0.00074	0.00009
	Lithium (Li)	mg/L	-	-	0.0010	0.0020	0.0010	0.0010	0.0024	0.0010	<0.0010	0.0026	0.0018	0.0010	0.0021	0.0011	0.0010	0.0020	0.0010
	Magnesium (Mg)	mg/L	-	-	3.4	9.0	13.3	2.6	8.8	12.4	6.7	21.4	27.8	3.1	9.1	13.8	3.2	9.1	13.1
	Manganese (Mn)	mg/L	0.935[β]	-	0.0025	0.0119	0.0013	0.0072	0.0146	0.0017	0.0091	0.0010	0.0018	0.0049	0.0123	0.0024	0.0050	0.0132	0.0024
	Mercury (Hg)	mg/L	0.000026	-	0.000005	0.000005	0.000005	0.000005	0.00000505	0.000005	<0.0000050	<0.0000050	<0.0000050	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00007	0.00043	0.00043	0.00005	0.00038	0.00049	0.00010	0.00049	0.00041	0.00007	0.00055	0.00059	0.00011	0.00040	0.00059
	Nickel (Ni)	mg/L	0.025	0.025	0.00146	0.00144	0.00050	0.00057	0.00204	0.00051	<0.00050	0.00057	<0.00050	0.00050	0.00183	0.00062	0.00056	0.00167	0.00071
	Potassium (K)	mg/L	-	-	0.61	1.65	1.45	0.51	1.71	1.50	0.65	1.81	1.69	0.51	1.62	1.55	0.59	1.56	1.47
	Selenium (Se)	mg/L	0.001	-	0.001	0.00005	0.001	0.001	0.00005	0.001	<0.0010	0.00007	<0.0010	0.001	0.00005	0.001	0.001	0.00005	0.001
	Silicon (Si)	mg/L	-	-	0.69	2.25	0.95	0.76	2.71	0.98	0.64	1.00	1.09	0.77	2.30	1.11	0.75	2.37	0.97
	Silver (Ag)	mg/L	0.00025	0.0001	0.00001	0.00005	0.00001	0.00001	0.00005	0.00001	<0.000010	<0.000050	<0.000010	0.00001	0.00005	0.00001	0.00001	0.00005	0.00001
	Sodium (Na)	mg/L	-	-	0.9	4.6	5.8	0.6	4.0	5.8	0.4	3.2	3.4	0.6	3.8	5.6	0.8	3.9	5.2
	Strontium (Sr)	mg/L	-	-	0.0054	0.0214	0.0252	0.0046	0.0188	0.0244	0.0099	0.0414	0.0373	0.0051	0.0194	0.0257	0.0048	0.0192	0.0237
	Thallium (Tl)	mg/L	0.0008	0.0008	0.00010	0.00002	0.00010	0.00010	0.00003	0.00010	<0.00010	<0.000010	<0.00010	0.00010	0.00003	0.00010	0.00010	0.00003	0.00010
	Tin (Sn)	mg/L	-	-	0.0004	0.0001	0.0001	0.0001	0.0001	0.0001	<0.00010	<0.00010	<0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.010	0.065	0.010	0.015	0.082	0.010	0.011	0.002	<0.010	0.012	0.065	0.011	0.010	0.074	0.010
	Uranium (U)	mg/L	0.015	-	0.0004	0.0054	0.0072	0.0003	0.0040	0.0065	0.0003	0.0037	0.0048	0.0003	0.0039	0.0061	0.0003	0.0036	0.0054
	Vanadium (V)	mg/L	0.006[α]	0.006	0.0010	0.00192	0.00100	0.00100	0.00247	0.00100	<0.0010	<0.00050	<0.0010	0.00100	0.00206	0.00100	0.00100	0.00178	0.00100
	Zinc (Zn)	mg/L	0.030	0.030	0.013	0.009	0.003	0.003	0.0037	0.003	<0.0030	<0.0030	<0.0030	0.003	0.0041	0.0146	0.0034	0.0031	0.0030

(shaded) Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Mary River

5.1.2 Phytoplankton

Chlorophyll-a concentrations at MRTF were comparable to those reported at upstream reference stations during individual spring, summer, and fall sampling events in 2020 (Appendix Table E.14), and were well below the AEMP benchmark of 3.7 µg/L for each of these sampling events. Low phytoplankton productivity, indicative of oligotrophic conditions, was suggested at MRTF based on comparison of chlorophyll-a concentrations to Dodds et al (1998) trophic status classification for creek environments. Overall, no mine-related influences on phytoplankton density were suggested at MRTF in 2020 based on the chlorophyll-a concentration data.

5.1.3 Benthic Invertebrate Community

No ecologically significant differences in benthic invertebrate density and richness were indicated between the MRTF effluent-exposed and reference study areas during the August 2020 EEM study (Table 5.2)[15]. Significantly higher evenness at the MRTF effluent-exposed area compared to the reference area, as well as significantly differing Bray-Curtis Index between these areas, indicated differing benthic invertebrate assemblages between the effluent-exposed and reference areas of MRTF. The primary difference in community composition between the effluent-exposed and reference areas of MRTF was a significantly lower relative abundance of Chironomidae at the effluent-exposed area, including those considered metal-sensitive (Table 5.2). A lower relative abundance of metal-sensitive Chironomidae at the effluent-exposed area suggested that the difference in benthic invertebrate assemblage between areas was potentially related to mine effluent, but because aqueous metal concentrations at MRTF were mostly below WQG (Table 5.1), a factor (or factors) other than metal concentrations likely accounted for the differences in assemblage between the MRTF study areas. For instance, a significantly higher relative abundance of the filterer FFG at the MRTF effluent-exposed area suggested that organic inputs from the effluent channel may have contributed to community composition differences relative to the MRTF upstream reference area (Minnow 2020). Overall, influences of mine operations on the benthic invertebrate community of MRTF remained uncertain following the August 2020 EEM study, but did not appear to be related to metal concentrations originating from mine effluent and/or operations.

[15] Under the MDMER, metrics of richness, Simpson's Evenness, and Bray-Curtis Index are calculated using family-level taxonomy, and thus the MRTF benthic invertebrate community results discussed herein evaluated metrics calculated using this level of taxonomy. For all monitoring conducted for the Mary River Project CREMP, the above metrics were calculated using lowest-practical-level taxonomy.

Table 5.2: Benthic Invertebrate Community Metric Statistical Comparisons Between Mary River Tributary-F (MRTF) Mine-Exposed (EXP) and Reference (REF) Areas, Mary River Project Second EEM Study, August 2020

Endpoint			Data Transformation	Test	Test P-value	MCT[a]		MOD (REF_{SD})
						REF	EXP	
EEM Effect Indicators		Density (No./m²)	log10	tequal	0.009	324	87.3	-1.6
		Richness (No. of Taxa)	log10	tequal	0.151	12.6	9.17	ns
		Simpson's Evenness	log10	tequal	0.087	0.372	0.538	1
Group Percentage (%)	Taxa	Chironomidae	log10	tequal	0.029	76.3	52.8	-3.9
		Metal Sensitive Chironomidae	log10	tequal	0.005	50.8	21.0	-4.1
		Simuliidae	log10(x+1)	tunequal	0.118	2.8	19.2	ns
		Tipulidae	log10(x+1)	tequal	0.996	16.3	16.2	ns
	FFG	Collector-Gatherer	log10	tunequal	0.054	77.3	53.5	-3.5
		Filterer	log10(x+1)	tequal	0.07	3.3	20.3	11.4

(grey) P-value < 0.1.
(blue) P-value < 0.1 and MOD < -2.
(green) P-value < 0.1 and MOD > 2.

Note: MOD = Magnitude of Difference = (MCT_{Exp} - $MCT_{Ref)}$/SD_{Ref}. FFG = Functional Feeding Group.

[a] MCT = Measure of Central Tendency; MCT reported as median for rank-transformed data and as back-transformed mean for all other cases.

5.1.4 Effects Assessment and Recommendations

Water chemistry at MRTF (Station F0-01) met all AEMP benchmarks consistently over the duration of spring, summer, and fall sampling events in 2020, and for parameters with established AEMP benchmarks, no changes in concentrations were shown relative to baseline. No adverse effects on phytoplankton were indicated at MRTF in 2020. Biological sampling conducted at MRTF to meet MDMER obligations suggested some differences in benthic invertebrate community assemblages between effluent-exposed and reference areas, but these differences did not appear to be related to metal concentrations originating from mine effluent and/or mine operations (Minnow 2021). Under the Mary River Project AEMP Management Response Framework, the absence of a mine-related change in AEMP benchmark parameters over time (or compared to background) requires no further management response (Figure 2.8). Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and to baseline, and no adverse biological effects related to metals were indicated in 2020, no adjustment to the existing AEMP need be applied at MRTF as part of the next monitoring program.

5.2 Mary River

5.2.1 Water Quality

Dissolved oxygen in water at Mary River stations was consistently at or above saturation during all spring, summer, and fall monitoring events, and showed comparable saturation among the G0 09 series reference stations and stations adjacent to (E0 series) and downstream (C0 series) of the Mary River Project for each respective seasonal sampling event in 2020 (Figure 5.1; Appendix Tables C.1 to C.3). Dissolved oxygen concentrations were significantly higher at Mary River benthic study areas located adjacent to (E0-01, E0-20) and downstream (C0-05) of the mine than at the upstream (G0-09, G0-03) study areas in August 2020, suggesting no increased oxygen demand associated with mine operations (Appendix Figure C.22; Appendix Table C.56). In addition, dissolved oxygen concentrations were consistently well above WQG acceptable levels for sensitive life stages of cold-water biota (i.e., 9.5 mg/L) at all Mary River stations in spring, summer, and fall of 2020 (Figure 5.1; Appendix Figure C.18; Appendix Table C.55), indicating that slight differences in dissolved oxygen concentrations among the Mary River study areas were not likely to be ecologically meaningful.

In situ pH at all Mary River mine-exposed stations was generally comparable to pH at the G0-09 series reference stations during the spring, summer, and fall sampling events in 2020 (Figure 5.1). Although significant differences in pH were indicated between area E0-20 adjacent to the mine and the G0-09 reference area, the mean incremental difference in pH between these areas was

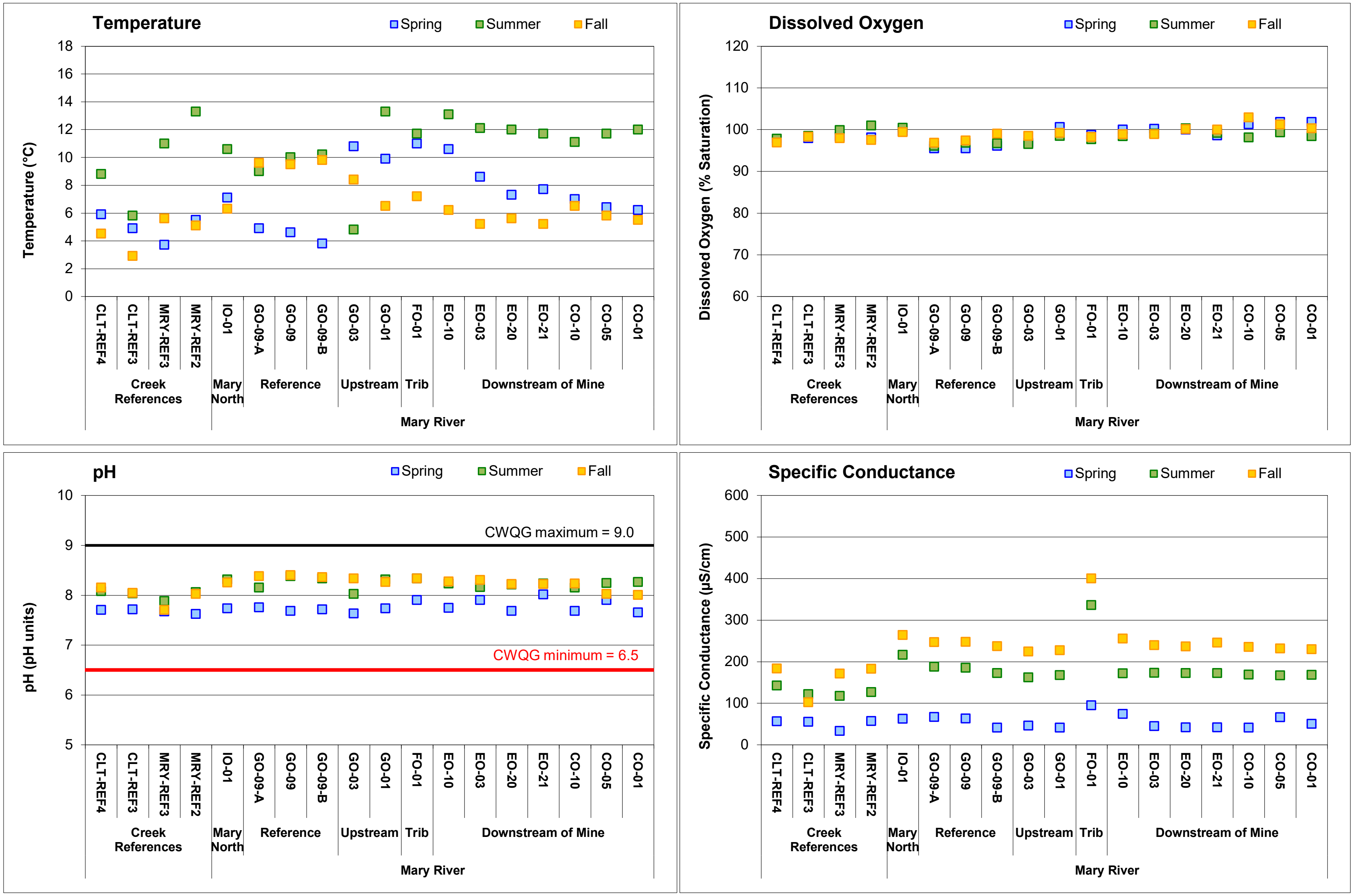

Figure 5.1: Comparison of *In Situ* Water Quality Variables Measured at Mary River Water Quality Monitoring Stations in Spring, Summer, and Fall 2020, Mary River Project CREMP

less than a pH unit, and pH at all Mary River areas were consistently within WQG limits (Figure 5.1; Appendix Table C.57), suggesting that any pH differences among the Mary River study areas were not likely to be ecologically meaningful. Specific conductance was consistently lowest in spring and highest in fall at all Mary River stations (Figure 5.1), reflecting natural seasonal differences related to proportion of flow from surface runoff (e.g., spring snowmelt) and baseflow/groundwater sources. Specific conductance was considerably higher at Mary River Tributary-F than at all other monitoring stations, which suggested that this tributary was a key source of mine-related inputs to Mary River (e.g., MS-08 effluent; Figure 5.1). Within Mary River, specific conductance was significantly higher in the portion of the river adjacent to the mine (immediately downstream of the MRTF confluence) at E0 series stations, but not downstream of the mine at the C0 series sampling locations at the time of biological monitoring in August 2020 (Appendix Figure C.22; Appendix Table C.57), suggesting that mine-related influences on Mary River water quality were of limited spatial scale.

Within Mary River, mean concentrations of aluminum and iron were above their respective AEMP benchmarks at stations located adjacent to (E0 series) and downstream of (C0 series) the mine in 2020, but only during the summer sampling event (Table 5.1). In addition, mean concentrations of total aluminum, copper, and phosphorus were above applicable WQG in spring, summer, and/or fall sampling events in 2020 at the E0 and C0 series stations (Table 5.1). However, in all cases in which the AEMP benchmarks and WQG were exceeded at areas adjacent to and downstream of the mine, the mean concentrations for each of these parameters were similar or higher, and above applicable AEMP benchmark and WQG values, at the Mary River reference stations (G0-09 series) and/or other upstream stations (G0 series) for each given seasonal sampling event (Table 5.1).[16] Relatively high concentrations of these parameters within Mary River at the time of the summer sampling event relative to the spring and fall sampling events appeared to be associated with highly turbid sampling conditions in the summer (Table 5.1). Concentrations of aluminum, copper, iron, and phosphorus were lower at MRTF than at the Mary River reference and mine-exposed stations (Table 5.1), suggesting that this mine-exposed tributary was not a substantial source of these parameters in 2020. Among those parameters with established AEMP benchmarks, nitrate and sulphate concentrations were elevated by factors greater than three only at Station E0-10, downstream of the confluence with MRTF, and only during the spring and fall sampling events in 2020 (Appendix Table C.62). Therefore, elevation in concentrations of nitrate and sulphate in Mary River appeared to be associated with mine deposits to MRTF (e.g., MS-08 effluent). Nitrate, and sulphate to a lesser

[16] Previous CREMP studies also showed total aluminum concentrations above respective WQG and/or AEMP benchmarks at Mary River GO series reference stations, indicating naturally high concentrations of this metal in Mary River.

extent, were also the only two parameters that were elevated at Mary River stations adjacent to (E0 series) and downstream of (C0 series) the mine in 2020 compared to baseline that also did not show an elevation over time at the Mary River reference area (Appendix Figure C.23), indicating that higher concentrations of these parameters was mine-related. Overall, no marked influences on water quality of Mary River were indicated in 2020 as a result of mine operations except for slight enrichment of nitrate and sulphate concentrations near the mine, although to levels that remained well below AEMP benchmarks.

5.2.2 Sediment Quality

Deposited sediment sampled from Mary River study areas was mostly medium-sized coarse sand and some gravel (Appendix Table D.33). Substrate among the Mary River study areas was largely composed of cobble and boulder material with minimal amounts of sand and finer material except at the downstream-most study area C0-05, where medium-sized sand composed approximately 65% of the surficial in-stream substrate (Minnow 2018). Silt precipitate and/or deposits were generally absent from all Mary River mine-exposed study areas during the August 2020 sampling event (Appendix Table D.33). Sediment TOC content was low (i.e., <0.2%) at all Mary River study areas, and generally did not differ between the mine-exposed areas and the upstream reference area (G0-09), suggesting similar depositional characteristics among the Mary River study areas (Table 5.3; Appendix Table D.36).

Metal concentrations in sediment from all Mary River study areas were highly comparable (Table 5.3; Appendix Table D.36). The only notable difference was a slight elevation (i.e., 3-fold) in the concentration of molybdenum at E0-20 compared to the average concentration at the upstream G0-09 reference area (Table 5.3; Appendix Table D.36). Concentrations of metals in deposited sediment were also well below applicable SQG at all Mary River study areas (Table 5.3; Appendix Tables D.34, D.35, and D.37 to D.39).

5.2.3 Phytoplankton

Chlorophyll-a concentrations at Mary River stations located downstream of the mine were generally within the range of, or slightly higher, than the G0 series river reference stations and/or creek reference stations during the 2020 spring, summer, and fall sampling events (Figure 5.2). Chlorophyll-a concentrations were consistently well below the AEMP benchmark of 3.7 µg/L during all winter, summer, and fall sampling events at all Mary River sampling stations in 2020, and were suggestive of low (i.e., oligotrophic) phytoplankton productivity based on Dodds et al (1998) trophic status classification for stream environments. Therefore, no adverse mine-related influences on phytoplankton abundance were indicated at Mary River in 2020. Low to moderate phytoplankton productivity was expected for Mary River reference and mine-exposed stations in

Table 5.3: Sediment Total Organic Carbon and Metal Concentrations at Mary River Mine-Exposed and Reference (GO-09) Sediment Monitoring Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Mary River Reference (GO-09; n = 3)	Upstream GO-03 (n = 3)	Mary River Mine-Exposed Areas		
					Adjacent EO-01 (n = 3)	Adjacent EO-20 (n = 3)	Downstream CO-05 (n = 3)
			Average ± SD	Average ± SD	Average ± SD	Average ± SD	Average ± SD
TOC	%	10^{α}	0.11 ± 0.012	0.11 ± 0.012	0.11 ± 0.010	0.19 ± 0.10	0.12 ± 0.015
Aluminum (Al)	mg/kg	-	2,757 ± 1,141	2,000 ± 688	2,407 ± 438	4,217 ± 2,456	2,468 ± 1,366
Antimony (Sb)	mg/kg	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0
Arsenic (As)	mg/kg	17	0.38 ± 0.10	1.10 ± 1.15	0.41 ± 0.059	0.62 ± 0.12	0.37 ± 0.27
Barium (Ba)	mg/kg	-	12.6 ± 5.05	9.39 ± 3.05	11.3 ± 1.92	20.7 ± 9.70	10.2 ± 5.51
Beryllium (Be)	mg/kg	-	0.14 ± 0.040	0.11 ± 0.023	0.11 ± 0.010	0.24 ± 0.19	0.13 ± 0.044
Bismuth (Bi)	mg/kg	-	<0.20 ± 0	<0.20 ± 0	0.24 ± 0.075	0.30 ± 0.18	<0.20 ± 0
Boron (B)	mg/kg	-	5.4 ± 0.75	<5.0 ± 0	<5.0 ± 0	6.7 ± 2.9	<5.0 ± 0
Cadmium (Cd)	mg/kg	3.5	<0.020 ± 0	<0.020 ± 0	0.026 ± 0.0053	0.038 ± 0.020	<0.020 ± 0
Calcium (Ca)	mg/kg	-	2,750 ± 894	2,080 ± 249	2,353 ± 454	2,887 ± 1,147	2,046 ± 1,384
Chromium (Cr)	mg/kg	90	13.6 ± 4.34	13.7 ± 3.49	18.7 ± 10.8	26.1 ± 5.37	14.1 ± 10.9
Cobalt (Co)	mg/kg	-	2.40 ± 0.758	1.96 ± 0.468	2.58 ± 0.850	3.88 ± 1.21	2.32 ± 1.45
Copper (Cu)	mg/kg	110^{α}	4.45 ± 2.50	2.78 ± 1.01	4.05 ± 0.215	7.40 ± 2.27	3.14 ± 1.84
Iron (Fe)	mg/kg	$40{,}000^{\alpha}$	11,063 ± 2,423	13,633 ± 3,099	16,950 ± 13,939	19,233 ± 6,401	6,443 ± 4,132
Lead (Pb)	mg/kg	91	3.07 ± 0.857	2.74 ± 0.567	2.78 ± 0.477	4.27 ± 1.48	2.30 ± 1.00
Lithium (Li)	mg/kg	-	5.0 ± 2.3	3.5 ± 1.2	3.4 ± 0.57	6.33 ± 4.44	4.8 ± 2.9
Magnesium (Mg)	mg/kg	-	2,810 ± 1,212	1,793 ± 389	2,630 ± 251	4,440 ± 2,669	3,380 ± 2,370
Manganese (Mn)	mg/kg	$1{,}100^{\alpha,\beta}$	76 ± 29.4	58.6 ± 14.3	85.4 ± 25.4	137 ± 39	72.5 ± 41.1
Mercury (Hg)	mg/kg	0.486	<0.0050 ± 0	0.0050 ± 0.00006	<0.005 ± 0	<0.0050 ± 0	<0.0050 ± 0
Molybdenum (Mo)	mg/kg	-	0.11 ± 0.023	<0.10 ± 0	0.20 ± 0.085	0.36 ± 0.20	0.12 ± 0.025
Nickel (Ni)	mg/kg	$75^{\alpha,\beta}$	6.11 ± 1.99	4.83 ± 1.12	8.27 ± 2.03	16.7 ± 6.30	14.2 ± 12.9
Phosphorus (P)	mg/kg	$2{,}000^{\alpha}$	350 ± 118	400 ± 50.5	383 ± 136	376 ± 76	270 ± 167
Potassium (K)	mg/kg	-	750 ± 320	507 ± 189	617 ± 129	1,167 ± 650	517 ± 297
Selenium (Se)	mg/kg	-	<0.20 ± 0	<0.20 ± 0	<0.20 ± 0	0.20 ± 0	<0.20 ± 0
Silver (Ag)	mg/kg	-	<0.10 ± 0	<0.10 ± 0	<0.10 ± 0	0.13 ± 0.046	<0.10 ± 0
Sodium (Na)	mg/kg	-	68 ± 21	<50 ± 9	<50 ± 0	67 ± 29	57 ± 12
Strontium (Sr)	mg/kg	-	4.72 ± 1.01	3.99 ± 0.183	3.75 ± 0.376	4.69 ± 1.69	3.28 ± 1.30
Sulphur (S)	mg/kg	-	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0	<1,000 ± 0
Thallium (Tl)	mg/kg	-	0.068 ± 0.023	0.053 ± 0.0058	<0.050 ± 0	0.086 ± 0.048	0.062 ± 0.0061
Tin (Sn)	mg/kg	-	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0	<2.0 ± 0
Titanium (Ti)	mg/kg	-	353 ± 123	263 ± 50	294 ± 21	396 ± 133	255 ± 141
Uranium (U)	mg/kg	-	0.922 ± 0.298	0.822 ± 0.199	0.785 ± 0.189	1.09 ± 0.328	0.725 ± 0.586
Vanadium (V)	mg/kg	-	19.5 ± 5.06	23.8 ± 4.93	22.7 ± 18.3	25.9 ± 9.83	9.26 ± 5.56
Zinc (Zn)	mg/kg	315	10.3 ± 4.31	7.8 ± 2.3	10.3 ± 1.04	17.0 ± 7.91	9.17 ± 5.46
Zirconium (Zr)	mg/kg	-	5.8 ± 2.0	4.4 ± 1.4	3.8 ± 0.49	5.7 ± 3.1	3.1 ± 1.5

[grey box] Indicates parameter concentration above SQG.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

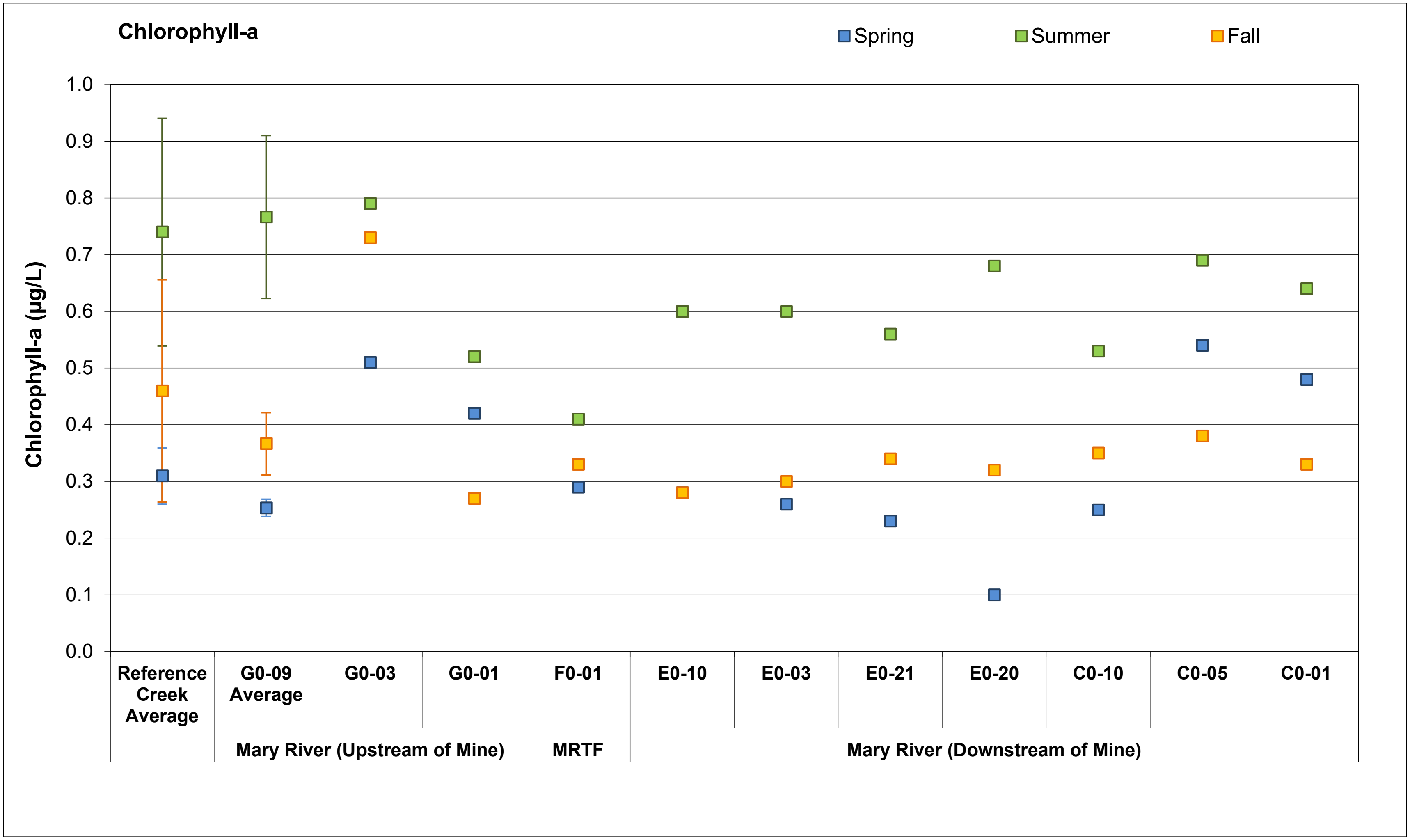

Figure 5.2: Chlorophyll-a Concentrations at Mary River Phytoplankton Monitoring Stations Located Upstream and Downstream of the Mine, Mary River Project CREMP, 2020

Note: Reference creek data represented by average (± SD; n = 4) calculated from CLT-REF and MRY-REF stations.

2020 given 'oligotrophic' to 'mesotrophic' productivity categorizations based on CWQG classifications that use total phosphorus concentrations to define trophic status (Table 5.1; Appendix Table C.58).

Chlorophyll-a concentrations at Mary River mine-exposed and reference stations in fall 2020 were generally similar to those shown at the time of baseline and previous years of mine operation (Figure 5.3). Chlorophyll-a concentrations in fall 2020 were not disproportionately higher or lower compared to baseline at the mine-exposed stations of Mary River compared to the reference stations, suggesting no adverse change/differences in phytoplankton abundance due to mine-related influences over time.

5.2.4 Benthic Invertebrate Community

The Mary River benthic invertebrate community assessment included a spatial statistical analysis of endpoints among an upstream reference area (G0-09), an upstream area with limited mine exposure (G0-03), two near-field mine-exposed areas located near the mine (E0-01, E0 20), and a far-field cumulative effects mine-exposed area located downstream of the mine (C0-05; see Table 2.5). At the Mary River G0-03 study area, no ecologically significant differences in benthic invertebrate density, richness, evenness, and relative abundance of metal-sensitive taxa were indicated compared to the G0-09 reference area, suggesting no marked influences of the mine operation on the benthic invertebrate community. Some differences in community assemblage were suggested between G0-03 and G0-09 study areas by differing Bray-Curtis Index (Appendix Table F.51) and significantly higher and lower relative abundance of Hydracarina and Chironomidae groups, respectively, at G0-03 in 2020 (Table 5.4). However, the relative abundance of these groups at G0-03 in 2020 did not differ significantly from baseline (Appendix Table F.50), suggesting that the differences in assemblage between G0-03 and G0-09 study areas in 2020 reflected natural variability.

At the near-field mine exposed study areas (i.e., E0-01 and E0-20), no ecologically significant differences in density, richness, evenness, and the proportion of metal-sensitive Chironomidae were indicated relative to the reference study area (Table 5.4; Appendix Table F.50). Differing Bray-Curtis Index suggested differing community composition between the E0 and G0-09 study areas, but no significant differences in the relative abundance of any dominant groups were indicated in 2020 (Table 5.4; Appendix Table F.51). Rather, the differences in community composition at E0-01 and E0-20 compared to the G0-09 reference area appeared to reflect lower relative abundance of the collector-gatherer FFG and the sprawler HPG at one or both of the E0 study areas (Appendix Table F.50), potentially indicating habitat differences between the E0 and G0-09 study areas. No ecologically significant differences in density, richness, evenness (E0-20 study area only) and relative abundance of dominant

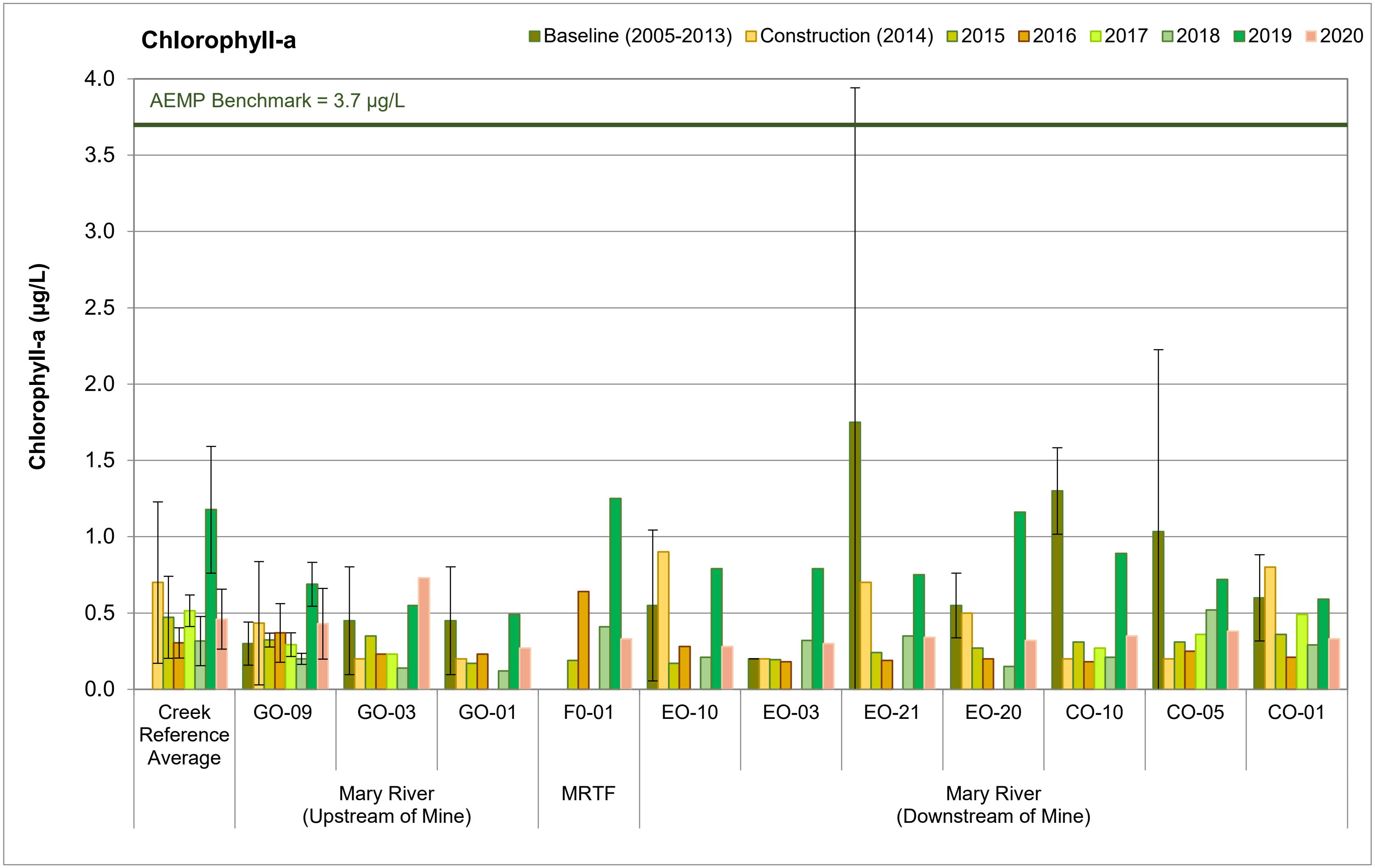

Figure 5.3: Temporal Comparison of Chlorophyll-a Concentrations at Mary River Stations for Mine Baseline (2005 to 2013), Construction (2014), and Operational (2015 to 2020) Periods during the Fall

Note: Reference creek data represented by average (± SD; n = 4) calculated from CLT-REF and MRY-REF stations.

Table 5.4: Benthic Invertebrate Community Metric Statistical Comparison Results among Mary River Reference (GO-09), Upstream (GO-03), and Mine-Exposed (EO-01, EO-20, CO-05) Study Areas, Mary River Project CREMP, August 2020

Metric	Data Transform-ation	Overall 5-Area Comparison		Pair-wise, post-hoc comparisons[a]				
		Significant Difference Among Areas?	P-value	Area	Mean	Standard Deviation	Effect Size vs. GO-09 Reference	Pairwise Comparison
Density (No. per m^2)	rank	YES	0.019	GO-09 Ref	886	831	-	a
				GO-03	196	95.3	-0.8	b
				EO-01	513	420	-0.4	a
				EO-20	1,441	553	0.7	a
				CO-05	906	818	0.0	a
Richness (No. of Taxa)	none	NO	0.710	GO-09 Ref	15.0	2.0	-	a
				GO-03	13.6	3.3	-0.7	a
				EO-01	15.6	2.1	0.3	a
				EO-20	14.0	2.6	-0.5	a
				CO-05	14.2	2.2	-0.4	a
Simpson's Evenness	rank	YES	0.036	GO-09 Ref	0.826	0.153	-	ab
				GO-03	0.918	0.024	0.6	a
				EO-01	0.913	0.016	0.6	a
				EO-20	0.868	0.046	0.3	b
				CO-05	0.839	0.048	0.1	b
Hydracarina (% of community)	rank	YES	0.058	GO-09 Ref	1.1	1.3	-	a
				GO-03	4.3	3.1	2.4	b
				EO-01	3.1	2.9	1.5	ab
				EO-20	0.8	0.4	-0.2	a
				CO-05	6.0	4.9	3.8	b
Chironomidae (% of community)	none	YES	0.002	GO-09 Ref	89.6	5.1	-	a
				GO-03	69.9	13.6	-3.9	b
				EO-01	88.2	9.2	-0.3	a
				EO-20	95.5	2.5	1.2	a
				CO-05	84.8	8.0	-0.9	a
Tipulidae (% of community)	rank	YES	0.003	GO-09 Ref	1.2	0.5	-	b
				G0-03	6.2	5.1	10.6	b
				E0-01	5.7	4.3	9.5	b
				E0-20	0.6	0.9	-1.4	b
				C0-05	1.4	0.9	0.3	b
Metal Sensitive Chironomidae (% of community)	log10	YES	0.043	GO-09 Ref	32.0	23.7	-	a
				GO-03	12.3	5.8	-0.8	ab
				EO-01	11.0	2.5	-0.9	ab
				EO-20	9.4	9.1	-1.0	b
				CO-05	19.4	9.6	-0.5	ab

[grey box] Indicates a significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Post-hoc analysis of 1-way ANOVA among all areas protected for multiple comparisons.

taxonomic groups (including metal-sensitive Chironomids) were indicated between mine operational years (2015 to 2020) and baseline (2007) at either of the E0 near-field study areas (Appendix Tables F.54 and F.56). Although evenness has consistently been significantly higher at an absolute magnitude greater than 2 SDREF in years of mine operation compared to baseline at the E0-01 study area, higher evenness is not associated with an adverse influence and thus was not consistent with effects to the benthic invertebrate community normally attributed to mine operations.

At far-field mine-exposed area CO-05, no ecologically significant differences in benthic invertebrate density, richness, evenness, and relative abundance of metal-sensitive taxa were indicated compared to the G0-09 reference area, suggesting no marked influences of the mine operation on the benthic invertebrate community. Although differences in community assemblage were suggested between the C0-05 and G0-09 study areas by differing Bray-Curtis Index (Appendix Table F.51), only a significantly higher relative abundance of Hydracarina was indicated between these study areas in 2020 (Table 5.4). No ecologically significant differences in density, richness, evenness, and dominant taxonomic groups were indicated at C0-05 for all years of mine operation (2015 to 2020) compared to one or both years of baseline period data (2007 and 2011; Appendix Table F.58). Therefore, no adverse effects of mine-operations on the benthic invertebrate community at Mary River C0-05 were indicated since the commencement of commercial mine operations in 2015.

5.2.5 Fish Community and Population Health

The fish community of Mary River was composed of arctic charr and low numbers of ninespine stickleback, and was comparable to the Angajurjualuk Lake Tributary reference area during the EEM fish survey in August 2020 in terms of both species composition and fish abundance as reflected by CPUE (Table 5.5). Similar fish species composition was indicated within Mary River between EEM studies conducted in 2017 and 2020, and although arctic charr CPUE was higher in 2020, this likely reflected lower water levels resulting in improved sampling efficiency compared to the 2017 study (Minnow 2021).

The length-frequency distribution of arctic charr captured at Mary River adjacent to the mine differed significantly from the distribution shown at the Angajurjualuk Lake Tributary reference area, but did not differ significantly from the distribution shown farther downstream in Mary River near Mary Lake (Table 5.6). Similar length-at-age relationships were indicated for arctic charr sampled at Mary River adjacent to the mine compared to the Angajurjualuk Lake Tributary reference area and Mary River near the outlet to Mary Lake, suggesting that the difference in arctic charr length-frequency distribution between Mary River and Angajurjualuk Lake Tributary was a sampling artifact (Minnow 2021). No significant differences in length, weight, growth

Table 5.5: Summary of Fish Catches at Mary River Project Second EEM Study Fish Population Study Areas, August 2020

Study Area	Total Effort		Summary Statistic Endpoint	Fish Species			Catch Summary	
	Distance Sampled (m)	Electrofishing Seconds		Arctic Char		Ninespine Stickleback	Totals	Total No. Species
				YOY [b]	Non-YOY [b]			
Angajurjualuk Lake Tributary Reference (ALTR)	234	2,226	Total No. Caught	0	104	2	**106**	**2**
			CPUE[a]	0	2.80	0.05	**2.86**	
Mary River Reference (MRR)	200	2,972	Total No. Caught	0	122	35	**157**	**2**
			CPUE[a]	0	2.46	0.71	**3.17**	
Mary River Effluent-Exposed (MRE)	228	2,241	Total No. Caught	0	122	0	**122**	**1**
			CPUE[a]	0	3.27	0	**3.27**	

[a] Electrofishing catch-per-unit-effort (CPUE) represents number of fish captured per minute of electrofishing.

[b] Young-of-the-year (YOY).

Table 5.6: Summary of Arctic Charr Endpoint Statistical Comparison Results Between Effluent-Exposed and Reference Areas Used for the Mary River Project First and Second EEM Studies, August 2017 and 2020

Endpoint [a]	Applicable Critical Effect Size	Sample Size	Statistically Significant Differences Observed?[b]				
			First EEM (2017)		Second EEM (2020)		
			Test	MRE vs MRR	Test	MRE vs ALTR	MRE vs MRR
Survival (Age Frequency Distribution)*	none	100[c]	K-S	No	K-S	**Yes (-22%)**	No
Survival (Age)*	± 25%	20	n/a	n/a	K-W	**Yes (+50%)**	No
Body Size (Fork Length)	none	100[c]	t-test	No	K-W	**Yes (+12%)**	No
		20	n/a	n/a	ANOVA	No	No
Body Size (Body Weight)	none	100	t-test	No	K-W	**Yes (+36%)**	No
		20	n/a	n/a	ANOVA	No	No
Energy Usage (Length-at-age)	none	20	n/a	n/a	ANCOVA	No	No
Energy Usage (Weight-at-age)*	± 25%	20	n/a	n/a	ANCOVA	No	No
Energy Storage (liver weight at body weight)*	± 25%	20	n/a	n/a	ANOVA	No	No
Energy Storage (condition)*	± 10%	100[c]	ANCOVA	**Yes (-4.5%)**	ANCOVA	No	No
		20	n/a	n/a	ANCOVA	No	No

[Shaded box] Indicates an absolute magnitude of difference (MOD) greater than applicable Critical Effect Size for fish population survey EEM effect indicators.

Notes: YOY = young-of-the year; MRR = Mary River reference area; MRE = Mary River effluent-exposed area; ALTR = Angajurjualuk Lake Tributary reference area; n/a indicates endpoint not applicable (i.e., endpoint associated with lethal sampling).

[a] Endpoints denoted with an asterisk represent primary EEM endpoints used for the determination of "effects" for a lethal fish population study.

[b] Information provided indicates whether a significant difference occurred between areas (**yes**/no) and the magnitude of difference for any differences (in parentheses).

[c] Sample size varied between areas. In First Study, n=100 at the effluent-exposed and reference area. In Second Study, n=108 for length measures and 100 for weight and condition measures at the effluent-exposed area, and n=100 at the reference areas.

(i.e., body weight-at-age), relative liver size (i.e., liver weight-at-body weight), or condition (i.e., body weight-at-fork length) were indicated for arctic charr sampled at Mary River adjacent to the mine compared to those sampled at either the Angajurjualuk Lake Tributary reference area or Mary River near the outlet to Mary Lake (Table 5.6). In addition, no externally visible abnormalities or parasitic infections were observed on any arctic charr captured at the Mary River effluent exposed area (Minnow 2021). Muscle tissue selenium concentrations in arctic charr captured at Mary River did not differ significantly to those captured at the Angajurjualuk Lake Tributary reference area, and were well below the USEPA (2016) chronic effects criterion of 11.3 mg/kg dry weight for protection of aquatic life (Figure 5.4), suggesting reproductive impairments (e.g., deformities, mortality) to Mary River arctic charr were highly unlikely. Overall, the absence of any significant differences in EEM effect indicators related to growth, relative liver size, condition, and tissue selenium concentrations in arctic charr captured at Mary River compared to applicable reference areas indicated no marked influence of mine operations on the health of arctic charr at Mary River in 2020 (Minnow 2021).

5.2.6 Effects Assessment and Recommendations

At Mary River, the following AEMP benchmarks were exceeded in 2020:

- Aluminum concentration in water was greater than the benchmark of 0.966 mg/L adjacent to (i.e., E0-series stations) and downstream of (i.e., C0-series stations) of the mine during the summer sampling event;
- Copper concentration in in water was greater than the benchmark of 0.0024 mg/L adjacent to (i.e., E0-series stations) and downstream of (i.e., C0-series stations) of the mine during the summer sampling event;
- Iron concentration in water was greater than the benchmark of 0.874 mg/L adjacent to (i.e., E0-series stations) and downstream of (i.e., C0-series stations) of the mine during the summer sampling event; and,
- Lead concentration in water was greater than the benchmark of 0.001 mg/L adjacent to (i.e., E0-series stations) the mine during the summer sampling event.

Within Mary River, concentrations of aluminum, copper, iron, and lead were above respective AEMP benchmarks at stations located adjacent to the mine (i.e., E0 series stations) and, with the exception of lead, downstream of the mine (C0 series) in 2020, but only during the summer

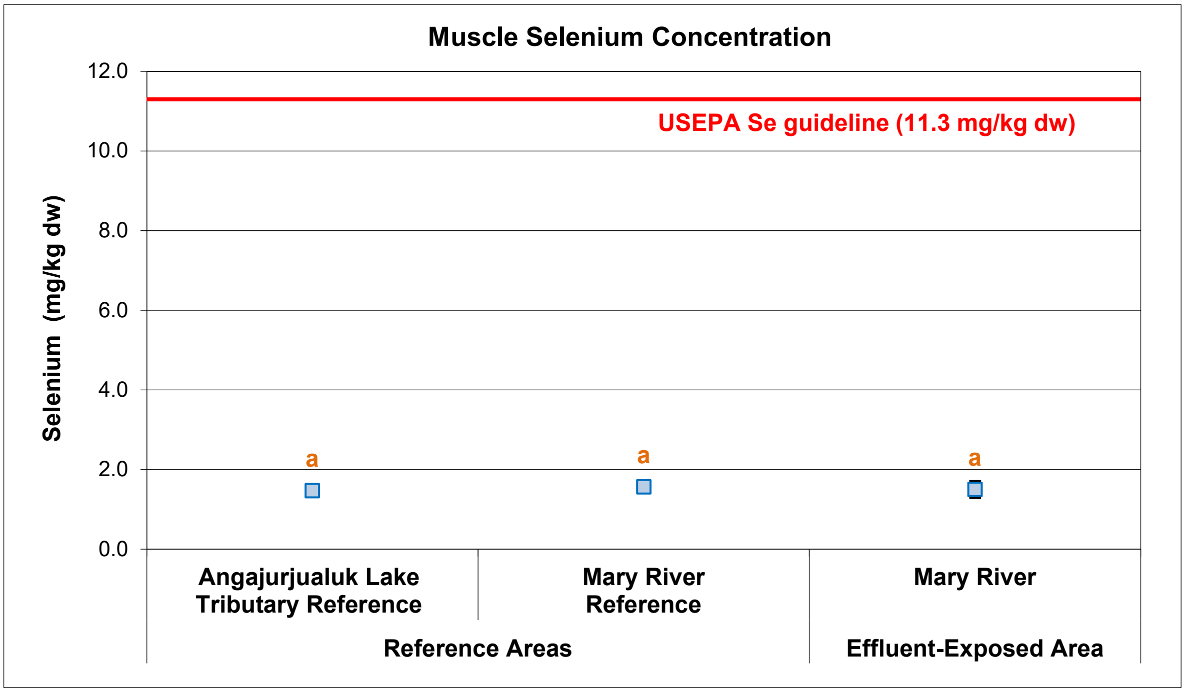

Figure 5.4: Selenium Concentrations (mean ± SD; n = 8) in Dorsal Muscle Tissue of Arctic Charr Captured at Mary River Effluent-Exposed and Reference Study Areas During the Second EEM Study, August 2020

Note: Data points with the same letters do not differ significantly.

sampling event.[17] However, in all cases in which the AEMP benchmarks were exceeded, the concentrations for each of these parameters were similar or higher, and above applicable AEMP benchmarks, at the Mary River reference stations (G0-09 series) and/or upstream stations (G0 series) at the time of the summer sampling event.[18] Relatively high concentrations of these parameters within Mary River at the time of the summer sampling event appeared to be associated with highly turbid conditions compared to the spring and fall sampling events. Concentrations of aluminum, copper, iron, and lead in water at Mary River stations located adjacent to and downstream of the mine in 2020 were comparable to concentrations at each station in each season during baseline. Therefore, no mine-related changes to parameter concentrations were indicated at Mary River mine-exposed stations in 2020 compared to the reference stations and to Mary River baseline data. In addition, metal concentrations in sediment were well below SQG, and no adverse effects on phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at all Mary River mine-exposed areas in 2020. Under the Mary River Project AEMP Management Response Framework, the absence of a mine-related change in AEMP benchmark parameters over time (or compared to background) requires no further management response (Figure 2.8). Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no management response (i.e., alteration of existing AEMP) is required for Mary River as part of the next monitoring program.

5.3 Mary Lake

5.3.1 Water Quality

Water quality profiles conducted at the north and south basins of Mary Lake showed similar patterns in water temperature from the surface to bottom as those shown at Reference Lake 3 for summer and fall sampling events in 2020 (Figures 5.5 and 5.6). At the north basin, development of an epilimnion occurred through the surficial 5 m and a hypolimnion was evident at depths greater than approximately 11 m in the fall (Figure 5.5). No distinct thermal layering was evident at the north basin of Mary Lake in the winter and fall, or at the south basin for any seasons although a clear gradient in water temperature was evident in summer (Figures 5.5 and 5.6).

[17] The reported concentration of zinc at Station E0-03 was above the AEMP benchmark during the summer sampling event but this result appeared to be an anomaly based on an order of magnitude difference in concentration between this station and data reported for all other Mary River stations in summer 2020 (Appendix Table C.59).

[18] Cadmium, copper, and zinc concentrations in water were above AEMP benchmarks at the Mary River upstream reference stations (i.e., Station G0-09) in spring 2020, indicating the potential for natural elevation of these parameters in Mary River adjacent to and downstream of the mine.

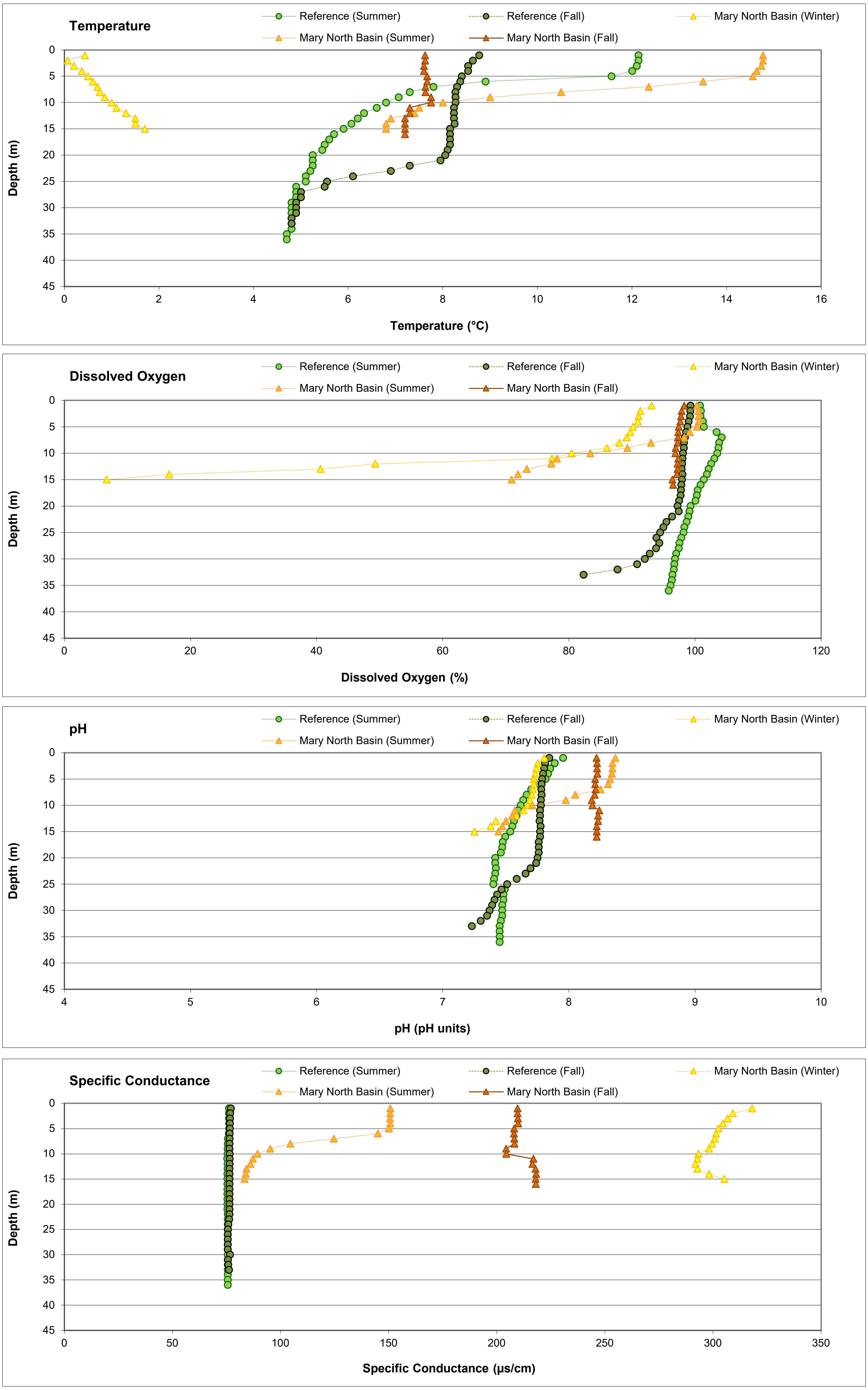

Figure 5.5: Average *In Situ* Water Quality with Depth from Surface at the Mary Lake North Basin (BLO) Compared to Reference Lake 3 during Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

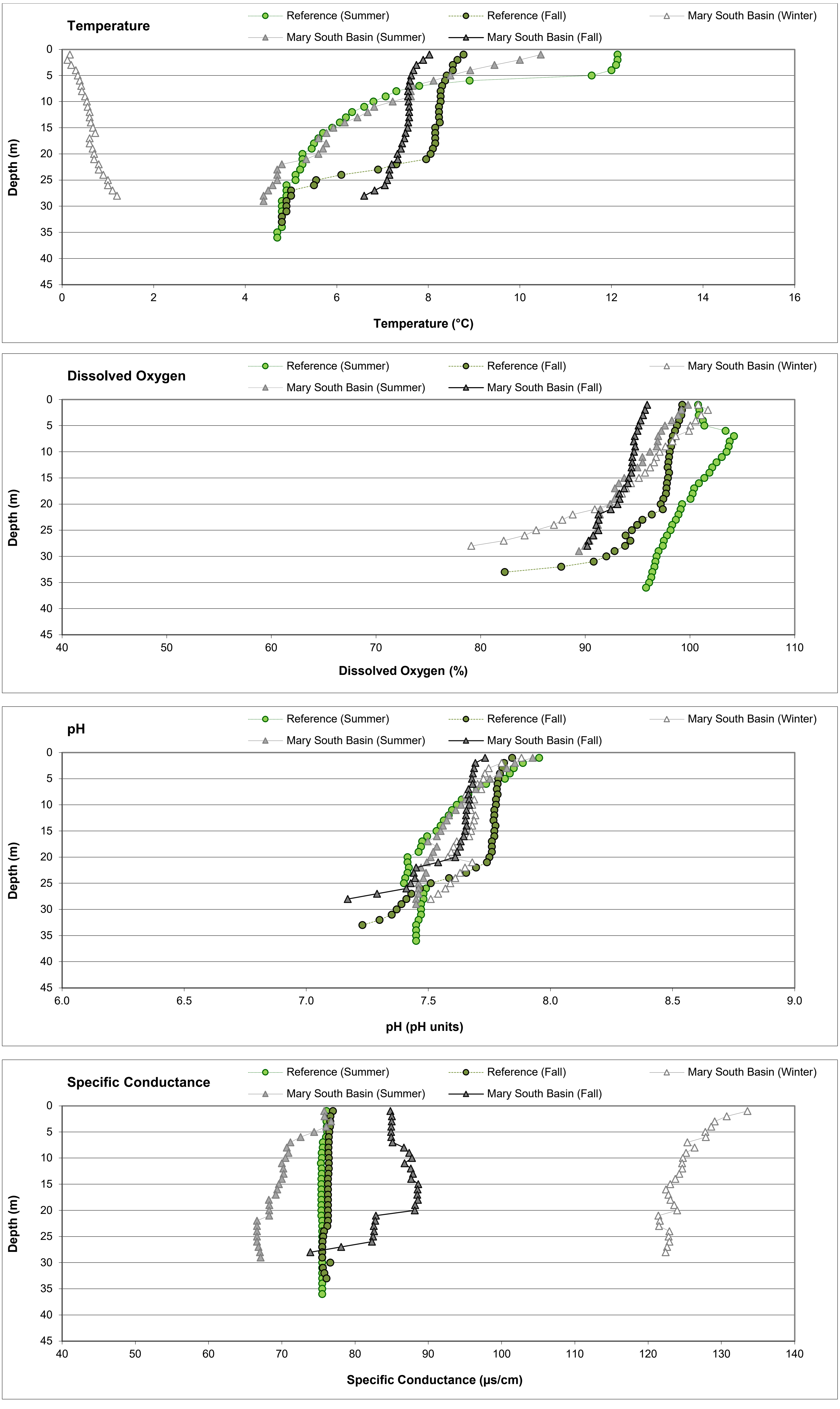

Figure 5.6: Average *In Situ* Water Quality with Depth from Surface at the Mary Lake South Basin (BLO) Compared to Reference Lake 3 during Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

Water temperatures at the bottom of the water column at Mary Lake littoral and profundal stations did not differ significantly from those at like-habitat stations of Reference Lake 3 during the August 2020 biological study (Figure 5.7; Appendix Table C.65). Dissolved oxygen profiles showed the development of moderate to strong oxyclines extending through the entire water column at both the Mary Lake north and south basins for winter and summer sampling events in 2020 (Figures 5.5 and 5.6). The dissolved oxygen profiles conducted during summer and fall at Mary Lake mirrored similar profiles at the reference lake except for in summer at the north basin. Dissolved oxygen concentrations near the bottom of the water column were significantly lower at Mary Lake littoral and profundal stations than like-habitat stations at the reference lake during the August 2020 biological study. However, dissolved oxygen concentrations were above the WQG for the protection of sensitive populations of cold-water species (i.e., 9.5 mg/L) at all littoral and profundal stations of Mary Lake during the August 2020 study (Figure 5.7; Appendix Table C.65).

Water column profiles showed slightly decreasing pH with increased depth at Mary Lake north and south basins, comparable to those at Reference Lake 3, during winter and summer sampling events in 2020, with the changes in pH through the water column at both lakes appearing to coincide with changes in water temperature during each given season (Figures 5.5 and 5.6). The pH near the bottom of the water column at littoral stations of Mary Lake did not differ significantly from the reference lake, but was significantly higher at profundal stations of Mary Lake compared to the reference lake during the August 2020 biological study (Figure 5.7). The mean incremental difference in bottom pH at profundal stations between lakes was small (less than a pH unit) and pH was consistently within WQG limits at all Mary Lake stations (Figure 5.7, Appendix Table C.65), and therefore this pH difference between lakes was not ecologically meaningful. Specific conductance was substantially higher at the north basin compared to the south basin of Mary Lake (Figures 5.5 and 5.6; Appendix Figure C.28), likely reflecting natural differences in dominant inflow sources to Mary Lake (i.e., Tom River inflow to the north basin, and the Mary River inflow to the south basin) and natural differences in geochemistry associated with these inflows. Specific conductance profiles showed variable changes from the surface to bottom of the water column at the north basin, but were relatively uniform at the south basin, over winter, summer, and fall sampling events in 2020 (Appendix Figure C.28). The differences between basins may have reflected differing influence associated with the dominant inflows to the lake and the station location relative to these inflows. Specific conductance near the bottom of the water column at littoral and profundal stations of Mary Lake did not differ significantly from like-habitat stations at Reference Lake 3 during the August 2020 biological study (Figure 5.7). Water clarity, as determined using Secchi depth

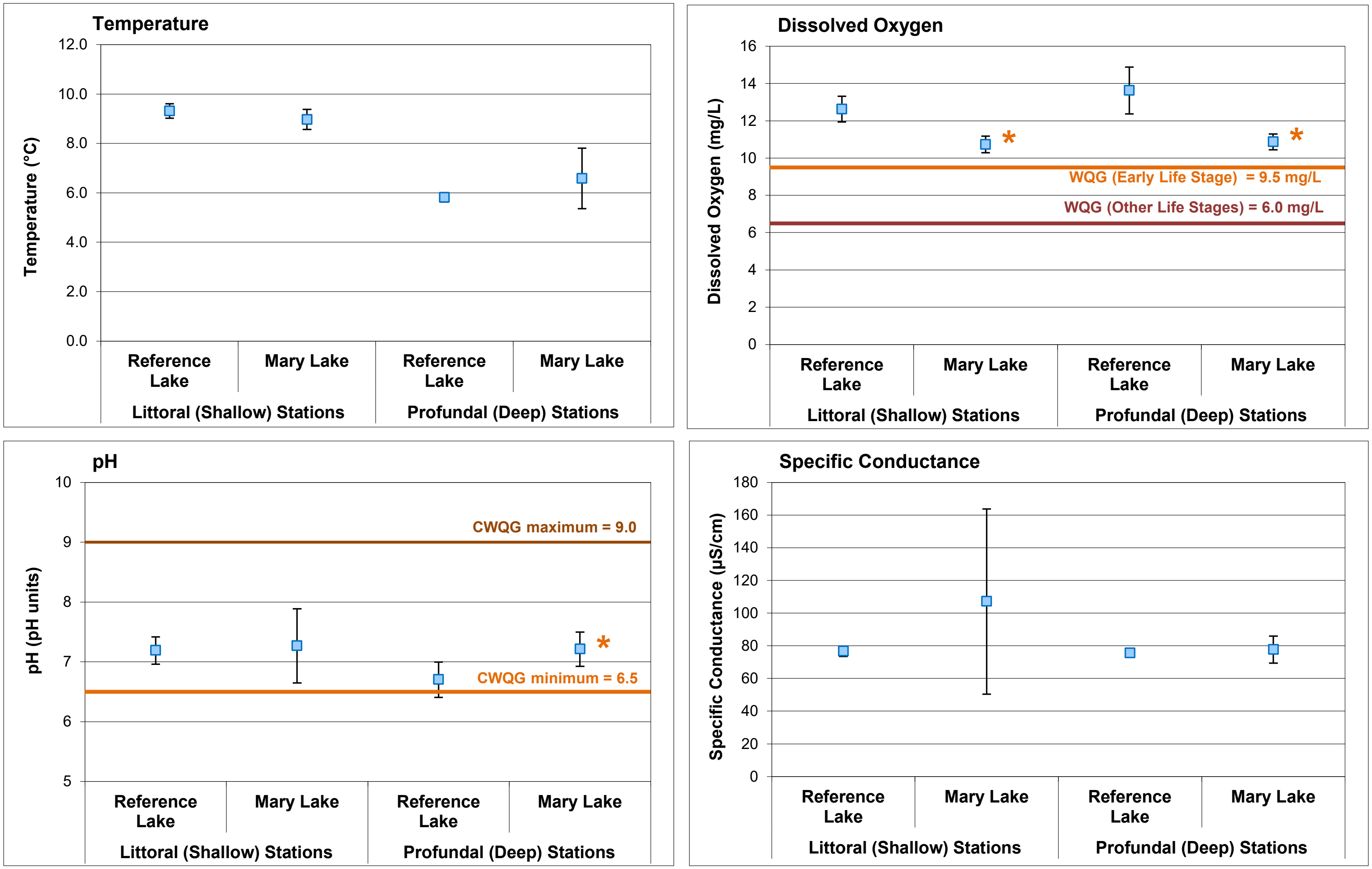

Figure 5.7: Comparison of *In Situ* Water Quality Variables (mean ± SD) Measured at Mary Lake (BLO) and Reference Lake 3 (REF3) Littoral and Profundal Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Note: An asterisk (*) next to data point indicates mean value differs significantly from the Reference Lake 3 mean for the respective littoral or profundal station type.

readings, was significantly lower at Mary Lake compared to Reference Lake 3 in August 2020 (Appendix Table C.64; Appendix Figure C.8).

Water chemistry at Mary Lake north and south basins met all AEMP benchmarks and WQG over the duration of spring, summer, and fall sampling events in 2020 (Table 5.7). Among those parameters with established AEMP benchmarks, chloride concentrations were elevated at the north basin, and aluminum concentrations were elevated at both the north and south basins of Mary Lake compared to Reference Lake 3 in the summer and fall sampling events (Table 5.7; Appendix Table C.69). Of those parameters without AEMP benchmarks, turbidity was elevated at the north and south basins of Mary Lake, and total and dissolved manganese and uranium concentrations were elevated at the north basin of Mary Lake compared to the reference lake in both summer and fall sampling events in 2020 (Appendix Tables C.67). Similar to the Sheardown Lake system, elevated total aluminum concentrations at Mary Lake compared to the reference lake in 2020 were connected to naturally higher turbidity at Mary Lake and thus was unrelated to the mine operations.[19] Average concentrations of all parameters, including those with or without established AEMP benchmarks and, for metals, whether in total or dissolved form, were comparable between 2020 and baseline for the Mary River north basin and south basin (Appendix Figure C.29; Appendix Tables C.68, C.70, C.72, and C.73). Overall, mine-related influences on water quality of Mary Lake in 2020 included a slight elevation in chloride, manganese, and uranium concentrations compared to the reference lake. However, the occurrence of water quality below AEMP benchmarks and lack of water chemistry changes over time suggested no adverse mine-related influences on water chemistry of Mary Lake since the initiation of commercial mine operations in 2015.

5.3.2 Sediment Quality

Surficial sediment of the Mary Lake north basin (BLO-01) was mainly composed of silt with low TOC content (Figure 5.8; Appendix Table D.42). Sediments from the Mary Lake south basin also had low TOC content (i.e., <1.5%) and were predominantly composed of silt except at stations BLO-03 (profundal) and BLO-11 (littoral), which contained 92% and 79% sand, respectively (Figure 5.8; Appendix Table D.42). Substrate from Mary Lake was similar to that of Reference Lake 3 in terms of particle size, but had significantly lower TOC and moisture

[19] Turbidity at Mary Lake in 2020 was comparable to turbidity shown at the lake during baseline (Appendix Table C.69), suggesting that greater turbidity at this lake compared to Reference Lake 3 reflected natural phenomena. The occurrence of similar dissolved concentrations of aluminum between Mary Lake and Reference Lake 3 in 2020 (and historically) indicated that aluminum was associated with particulate material suspended in the water column, and thus was unlikely to be associated with mine-related source.

Table 5.7: Mean Water Chemistry at Mary Lake North Basin (BL0-01) and South Basin (BL0) Monitoring Stations[a], During Winter, Summer, and Fall Sampling Events, Mary River Project CREMP, 2020

Parameters		Units	Water Quality Guideline (WQG)[b]	AEMP Benchmark[c]	Reference Lake 3 (n = 3)		Mary Lake North Basin Stations (n = 3)			Mary Lake South Basin Stations (n = 7)		
					Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall
Conventionals	Conductivity (lab)	umho/cm	-	-	79	79	303	136	221	129	78	88
	pH (lab)	pH	6.5 - 9.0	-	7.66	7.75	7.66	8.11	8.21	7.65	7.66	7.73
	Hardness (as $CaCO_3$)	mg/L	-	-	35	38	156	63	106	67	34	41
	Total Suspended Solids (TSS)	mg/L	-	-	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.1
	Total Dissolved Solids (TDS)	mg/L	-	-	41	51	178	83	130	85	50	52
	Turbidity	NTU	-	-	0.15	0.1	0.1	0.9	0.6	0.1	2.0	1.4
	Alkalinity (as $CaCO_3$)	mg/L	-	-	46	34	132	61	96	59	43	38
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.010	0.014	0.010	0.010	0.010	0.010	0.010	0.010
	Nitrate	mg/L	3	3	0.020	0.020	0.119	0.008	0.044	0.052	0.037	0.043
	Nitrite	mg/L	0.06	0.06	0.005	0.005	0.005	0.001	0.005	0.005	0.008	0.005
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.15	0.16	0.16	0.11	0.16	0.16	0.15	0.15
	Dissolved Organic Carbon	mg/L	-	-	3.3	3.5	3.5	2.3	2.8	3.1	2.2	1.9
	Total Organic Carbon	mg/L	-	-	4.6	3.8	4.9	1.7	10.5	3.6	3.0	2.3
	Total Phosphorus	mg/L	0.020[α]	-	0.004	0.003	0.003	0.005	0.008	0.003	0.005	0.005
	Phenols	mg/L	0.004[α]	-	0.0010	0.001	0.002	0.001	0.001	0.0016	0.0010	0.0011
Anions	Bromide (Br)	mg/L	-	-	0.10	0.10	0.10	0.05	0.10	0.10	0.16	0.10
	Chloride (Cl)	mg/L	120	120	1.4	1.37	17.52	4.18	9.42	4.56	2.75	3.40
	Sulphate (SO_4)	mg/L	218[β]	218	3.6	3.64	7.32	1.86	4.02	3.87	1.84	2.34
Total Metals	Aluminum (Al)	mg/L	0.100	0.130	0.0031	0.0032	0.0035	0.0254	0.0199	0.0061	0.0648	0.0383
	Antimony (Sb)	mg/L	0.020[α]	-	0.0001	0.00010	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Arsenic (As)	mg/L	0.005	0.005	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Barium (Ba)	mg/L	-	-	0.0064	0.0070	0.0145	0.0071	0.0107	0.0070	0.0046	0.0051
	Beryllium (Be)	mg/L	0.011[α]	-	0.0005	0.0005	0.0005	0.0001	0.0005	0.0005	0.0005	0.0005
	Bismuth (Bi)	mg/L	-	-	0.0005	0.0005	0.0005	0.00005	0.0005	0.0005	0.0005	0.0005
	Boron (B)	mg/L	1.5	-	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Cadmium (Cd)	mg/L	0.00012	0.00006	0.00001	0.00001	0.00001	0.000005	0.00001	0.00001	0.00001	0.00001
	Calcium (Ca)	mg/L	-	-	7.2	7.2	31.1	12.7	21.3	13.0	7.0	7.9
	Chromium (Cr)	mg/L	0.0089	0.0089	0.0005	0.0005	0.00050	0.00013	0.00050	0.0005	0.0005	0.0005
	Cobalt (Co)	mg/L	0.0009[α]	0.004	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Copper (Cu)	mg/L	0.002	0.0024	0.00073	0.00075	0.00115	0.00092	0.00097	0.00074	0.00059	0.00059
	Iron (Fe)	mg/L	0.30	0.326	0.03	0.030	0.032	0.055	0.030	0.030	0.065	0.040
	Lead (Pb)	mg/L	0.001	0.001	0.00005	0.00005	0.00005	0.00005	0.00005	0.000050	0.000071	0.000050
	Lithium (Li)	mg/L	-	-	0.0010	0.0010	0.0014	0.0010	0.0014	0.0010	0.0010	0.0010
	Magnesium (Mg)	mg/L	-	-	4.24	4.7	19.3	7.7	12.7	7.8	4.1	4.9
	Manganese (Mn)	mg/L	0.935[β]	-	0.00080	0.00068	0.00392	0.00421	0.00240	0.00051	0.00201	0.00115
	Mercury (Hg)	mg/L	0.000026	-	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005	0.000005
	Molybdenum (Mo)	mg/L	0.073	-	0.00013	0.00015	0.00037	0.00020	0.00032	0.00024	0.00100	0.00017
	Nickel (Ni)	mg/L	0.025	0.025	0.00050	0.00050	0.00075	0.00052	0.00050	0.00050	0.00050	0.00050
	Potassium (K)	mg/L	-	-	0.86	0.90	1.41	0.87	1.16	0.84	0.57	0.63
	Selenium (Se)	mg/L	0.001	-	0.001	0.001	0.001	0.00005	0.001	0.001	0.001	0.001
	Silicon (Si)	mg/L	-	-	0.495	0.50	1.51	0.67	0.74	0.61	0.53	0.49
	Silver (Ag)	mg/L	0.00025	0.0001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001	0.00001
	Sodium (Na)	mg/L	-	-	0.89	0.96	6.88	2.38	4.33	2.10	1.29	1.60
	Strontium (Sr)	mg/L	-	-	0.0084	0.0082	0.0224	0.0098	0.0163	0.0115	0.0062	0.0070
	Thallium (Tl)	mg/L	0.0008	0.0008	0.00010	0.0001	0.0001	0.0000	0.0001	0.0001	0.0001	0.0001
	Tin (Sn)	mg/L	-	-	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
	Titanium (Ti)	mg/L	-	-	0.01	0.0100	0.0100	0.0009	0.01	0.01	0.01	0.01
	Uranium (U)	mg/L	0.015	-	0.0003	0.0003	0.0045	0.0012	0.00344	0.00135	0.00070	0.00097
	Vanadium (V)	mg/L	0.006[α]	0.006	0.0010	0.0010	0.0010	0.0005	0.0010	0.0010	0.0010	0.0010
	Zinc (Zn)	mg/L	0.030	0.030	0.0030	0.0030	0.0030	0.0030	0.003	0.003	0.004	0.003

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Values presented are averages from samples taken from the surface and the bottom of the water column at each lake for the indicated season

[b] Canadian Water Quality Guideline (CCME 1999, 2017) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2017). See Table 2.2 for information regarding WQG criteria.

[c] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data (2006 to 2013) specific to Mary Lake.

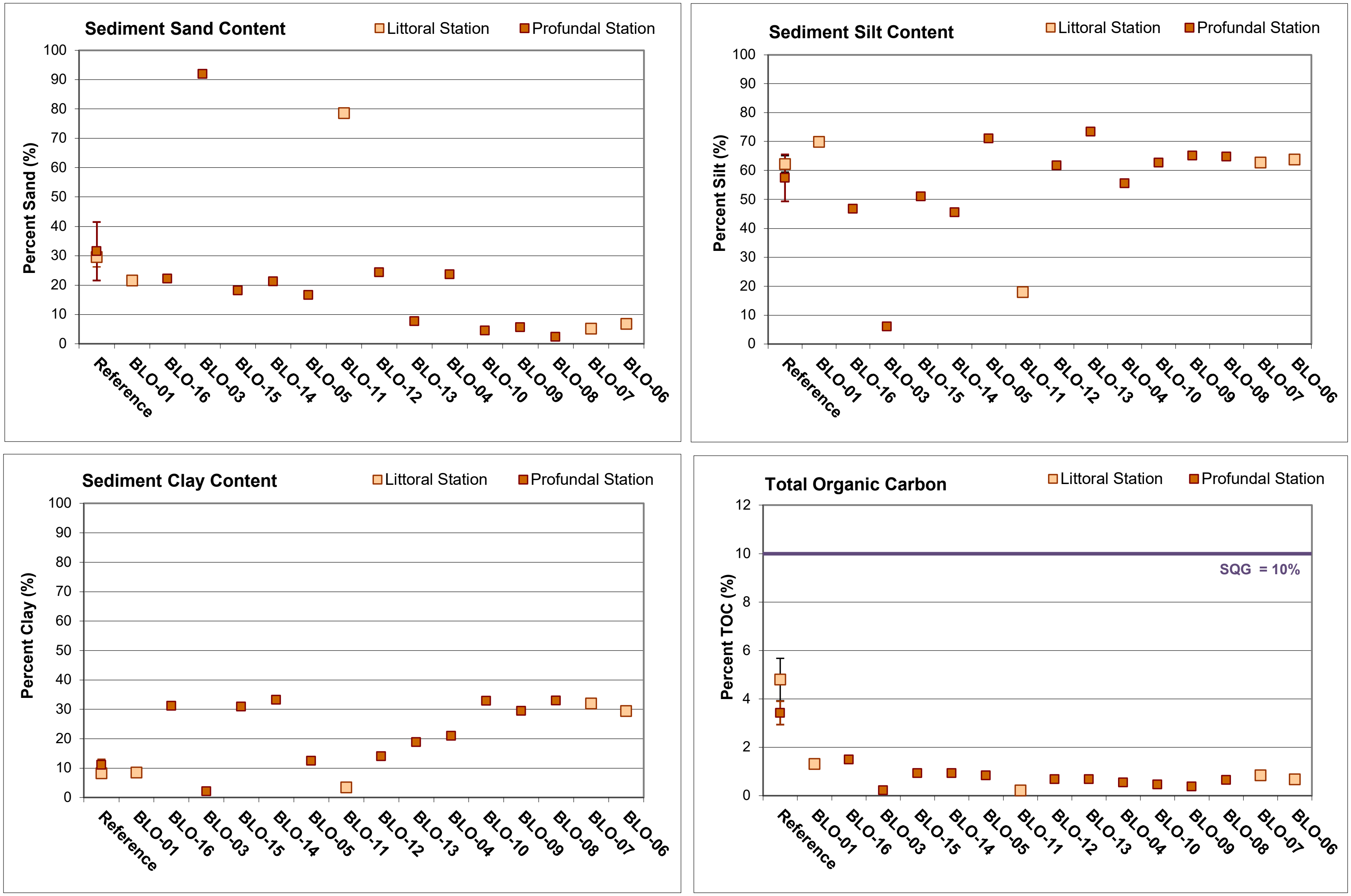

Figure 5.8: Sediment Particle Size and Total Organic Carbon (TOC) Content Comparisons among Mary Lake (BLO) Sediment Monitoring Stations and to Reference Lake 3 (mean ± SE), Mary River Project CREMP, August 2020

content for both littoral and profundal habitat (Appendix Table D.43). Reddish-brown coloured iron (oxy)hydroxide material was evident at various sediment sampling locations throughout Mary Lake (Appendix Tables D.40 and D.41), mirroring similar observations at Reference Lake 3 and the other mine-exposed lakes where such material was commonly visible as a thin, distinct layer or floc on or within surficial sediment. Substrate of Mary Lake also commonly contained sub-surface blackening/dark colouration indicating the presence of reduced sediment, but no distinct redox boundaries were observed (Appendix Tables D.40 and D.41). Similar sub-surface reducing conditions were observed in sediment of the reference lake, including the absence of distinct redox boundaries (Appendix Tables D.3 and D.4), suggesting that factors leading to reduced sediment conditions were comparable between lakes.

Metal concentrations in sediment at Mary Lake were comparable to those of Reference Lake 3 in 2020 except for slightly (i.e., 3- to 5-fold) higher concentrations of zirconium at both littoral and profundal habitat (Appendix Table D.44). At the lone Mary Lake north basin station (i.e., BLO-01), concentrations of all metals in sediment were below applicable SQG and lake-specific AEMP benchmarks except for manganese, which exceeded the SQG only (Table 5.8). In the south basin, concentrations of chromium and iron in sediment from the littoral station, and mean manganese concentrations in sediments from the profundal stations, were above applicable SQG but not lake-specific AEMP benchmarks (Table 5.8). Metal concentrations in sediment at the Mary Lake south basin showed no spatial gradients with progression from the Mary River inlet to the lake outlet among the profundal stations (Appendix Table D.42).[20] As indicated previously, mean concentrations of iron and manganese were elevated above SQG in sediment at the reference lake (Table 5.8), suggesting that concentrations of iron and manganese above SQG at Mary Lake likely reflected a natural condition unrelated to mine activity.

Metal concentrations in sediment at littoral and profundal stations of Mary Lake in 2020 have not changed substantially from those observed during the mine baseline (2005 to 2013) period (Figure 5.9; Appendix Table D.44).[21] On average, metal concentrations in sediment from Mary Lake were within the range of those observed from 2015 to 2019 and there was no evidence of an increasing trend over time for any metals (Figure 5.9). Overall, no changes in metal concentrations in sediment were apparent in sediments at Mary Lake since the initiation of commercial mine operations in 2015.

[20] Spatially, the order of sediment quality from closest to Mary River to the lake outlet were as follows: BLO-12, BLO-10, BLO-09, BLO-08, and BLO-06 (Figure 2.4). All of these stations, except BLO-06, were profundal.

[21] See footnote 6 regarding differences in the concentration of boron in sediment between baseline and recent CREMP studies.

Table 5.8: Sediment Total Organic Carbon and Metal Concentrations at Mary Lake North Basin (BLO-01) and South Basin (BLO), and Reference Lake 3 (REF3) Sediment Monitoring Stations, Mary River Project CREMP, August 2020

	Parameter	Units	SQG[a]	AEMP Benchmark[b]	Littoral: Reference Lake (n = 5) Average ± SD	Littoral: Mary Lake North (n = 1)	Littoral: Mary Lake South (n = 1)	Profundal: Reference Lake (n = 5) Average ± SD	Profundal: Mary Lake (South Basin) (n = 8) Average ± SD
TOC		%	10[α]	-	4.80 ± 1.96	1.31	0.68	3.42 ± 1.08	0.71 ± 0.34
Metals	Aluminum (Al)	mg/kg	-	-	16,880 ± 1,785	15,000	29,600	21,800 ± 2,185	22,616 ± 2,156
	Antimony (Sb)	mg/kg	-	-	<0.10 ± 0	<0.10	<0.10	<0.10 ± 0	<0.10 ± 0
	Arsenic (As)	mg/kg	17	5.9	3.53 ± 1.09	4.82	3.47	4.07 ± 0.397	3.09 ± 0.43
	Barium (Ba)	mg/kg	-	-	117 ± 22.0	79.2	104	122 ± 18.3	86.3 ± 7.97
	Beryllium (Be)	mg/kg	-	-	0.65 ± 0.073	0.72	1.33	0.80 ± 0.092	1.02 ± 0.10
	Bismuth (Bi)	mg/kg	-	-	<0.20 ± 0	<0.20	0.23	<0.20 ± 0	0.24 ± 0.0092
	Boron (B)	mg/kg	-	-	12.2 ± 0.853	18.9	43.9	14.7 ± 1.77	30.1 ± 2.29
	Cadmium (Cd)	mg/kg	3.5	1.5	0.173 ± 0.047	0.108	0.145	0.148 ± 0.0172	0.138 ± 0.0117
	Calcium (Ca)	mg/kg	-	-	5,608 ± 1,247	7,720	5,310	5,010 ± 407	4,213 ± 662
	Chromium (Cr)	mg/kg	90	98	54.3 ± 4.40	60.6	94.1	65.0 ± 6.64	79.6 ± 7.46
	Cobalt (Co)	mg/kg	-	-	10.8 ± 1.64	14.0	18.7	15.2 ± 1.56	15.8 ± 1.30
	Copper (Cu)	mg/kg	110	50	***71.4*** ± 14.2	27.8	36.0	***83.8*** ± 11.1	31.3 ± 3.16
	Iron (Fe)	mg/kg	40,000[α]	52,400	50,600 ± 24,939	34,500	46,600	45,080 ± 4,440	39,013 ± 3,068
	Lead (Pb)	mg/kg	91.3	35	13.8 ± 0.799	14.5	25.5	16.7 ± 1.82	20.6 ± 2.15
	Lithium (Li)	mg/kg	-	-	26.0 ± 2.51	29.2	50.7	33.7 ± 3.83	39.5 ± 4.06
	Magnesium (Mg)	mg/kg	-	-	11,440 ± 814	14,500	18,700	14,180 ± 1,422	15,421 ± 1,463
	Manganese (Mn)	mg/kg	1,100[α,β]	4,370	579 ± 258	1,350	778	1,230 ± 355	1,693 ± 268
	Mercury (Hg)	mg/kg	0.486	0.170	0.0500 ± 0.0178	0.0293	0.0541	0.0583 ± 0.0164	0.0527 ± 0.0074
	Molybdenum (Mo)	mg/kg	-	-	4.4 ± 3.31	0.52	0.92	2.52 ± 0.273	0.98 ± 0.14
	Nickel (Ni)	mg/kg	75[α,β]	72	40.0 ± 3.52	51.7	62.0	45.0 ± 4.54	57.8 ± 5.11
	Phosphorus (P)	mg/kg	2,000[α]	1,580	1,167 ± 394	1,100	849	956 ± 47	855 ± 82
	Potassium (K)	mg/kg	-	-	4,100 ± 453	3,470	7,650	5,338 ± 543	5,685 ± 579
	Selenium (Se)	mg/kg	-	-	0.73 ± 0.31	<0.20	0.26	0.61 ± 0.18	0.24 ± 0.008
	Silver (Ag)	mg/kg	-	-	0.14 ± 0.047	<0.10	0.16	0.20 ± 0.057	0.15 ± 0.0104
	Sodium (Na)	mg/kg	-	-	304 ± 32	238	453	369 ± 50	354 ± 35
	Strontium (Sr)	mg/kg	-	-	11.6 ± 1.70	11.1	16.7	12.3 ± 1.24	13.5 ± 1.18
	Sulphur (S)	mg/kg	-	-	1,400 ± 387	<1,000	<1,000	1,140 ± 195	<1,000 ± 0
	Thallium (Tl)	mg/kg	-	-	0.379 ± 0.0415	0.298	0.603	0.594 ± 0.094	0.461 ± 0.0472
	Tin (Sn)	mg/kg	-	-	<2.0 ± 0	<2.0	<2.0	<2.0 ± 0	<2.0 ± 0
	Titanium (Ti)	mg/kg	-	-	1,006 ± 109	978	1,970	1,136 ± 50	1,466 ± 142
	Uranium (U)	mg/kg	-	-	11.0 ± 2.41	3.35	8.48	19.7 ± 3.76	7.13 ± 0.771
	Vanadium (V)	mg/kg	-	-	54.1 ± 5.40	48.0	78.6	63.4 ± 4.89	61.7 ± 5.63
	Zinc (Zn)	mg/kg	315	135	73.1 ± 7.83	48.1	86.2	83.8 ± 8.52	67.4 ± 6.56
	Zirconium (Zr)	mg/kg	-	-	4.5 ± 1.0	10.4	25.9	3.9 ± 0.32	20.4 ± 2.7

[shaded] Indicates parameter concentration above SQG.
BOLD Indicates parameter concentration above the AEMP Benchmark.

Notes: TOC = total organic carbon. SQG = sediment quality guideline. n = number of samples. SD = standard deviation.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013). The indicated values are specific to Mary Lake.

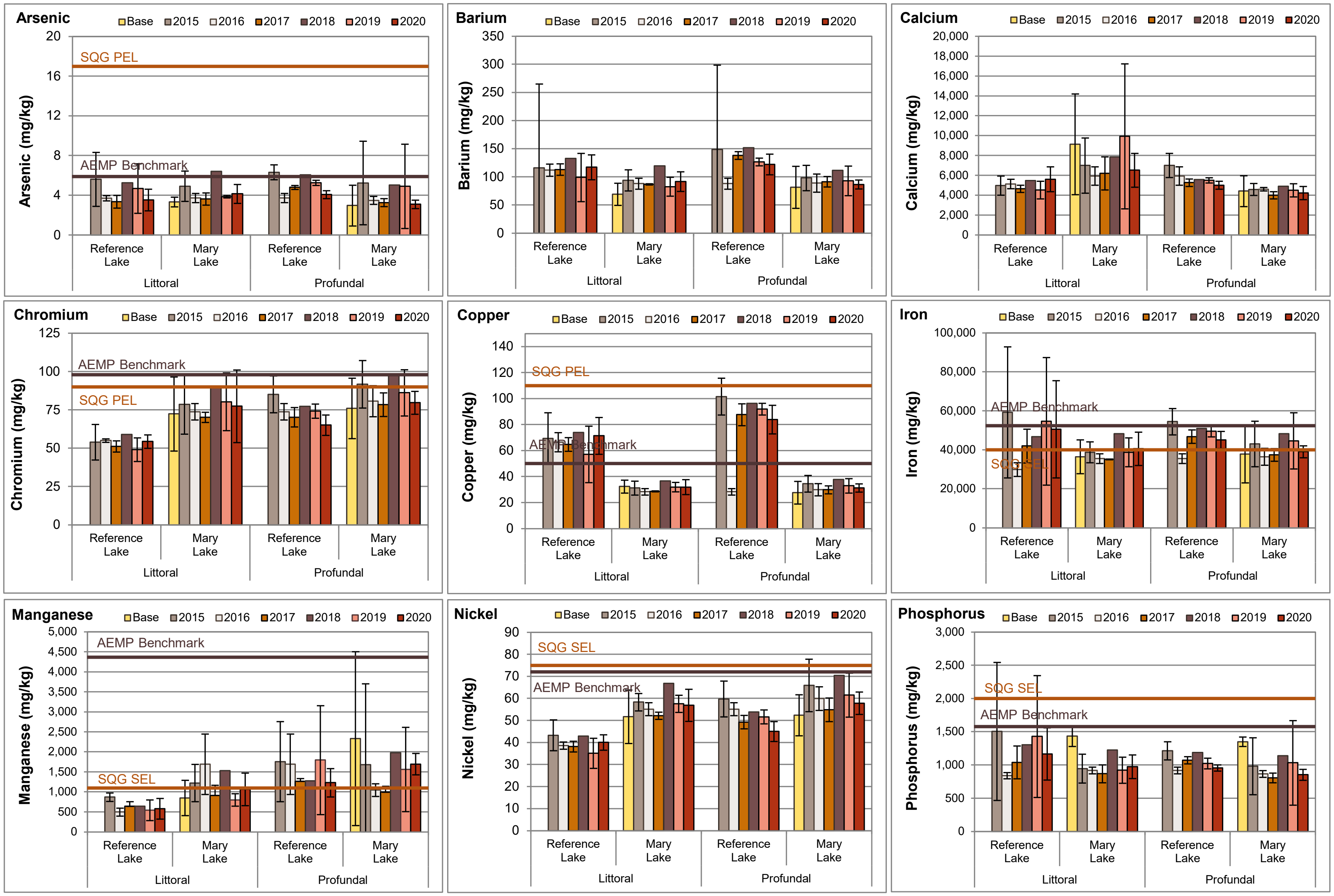

Figure 5.9: Temporal Comparison of Sediment Metal Concentrations (mean ± SD) at Littoral and Profundal Stations of Mary Lake and Reference Lake 3 for Mine Baseline (2005 to 2013) and Operational (2015 to 2020) Periods

5.3.3 Phytoplankton

Chlorophyll-a concentrations at Mary Lake showed no spatial gradients with distance from either the Tom River inlet or the Mary River inlet towards the lake outlet during any of the winter, summer, or fall sampling events in 2020 (Figure 5.10). Chlorophyll-a concentrations were typically lowest in winter and highest in summer at both the north and south basins of Mary Lake (Figure 5.10). Chlorophyll-a concentrations at the Mary Lake north basin did not differ significantly from those at Reference Lake 3 in fall and summer, or between the Mary Lake south basin and Reference Lake 3 in the fall sampling event, but concentrations at the south basin were significantly higher than at the reference lake at the time of the summer sampling event (Appendix Tables E.7 and E.8). Chlorophyll-a concentrations at the Mary Lake north and south basins were well below the AEMP benchmark of 3.7 µg/L during all winter, summer, and fall sampling events in 2020 (Figure 5.10) and reflected an 'oligotrophic' primary productivity categorization based on Wetzel (2001) classification. This oligotrophic categorization agreed with CWQG trophic status classification that is based on average aqueous total phosphorus concentrations below 10 µg/L (Table 5.7; Appendix Tables C.68 and C.72).

Temporal comparison of Mary Lake chlorophyll-a concentrations, conducted separately for the north and south basins, did not indicate any consistent direction of significant differences between the 2019 data and data from the mine construction (2014) period or previous years of mine operation (2015 to 2019) during any of the winter, summer, or fall seasons (Figure 5.11; Appendix Figure E.1). In addition, annual average chlorophyll-a concentrations have not shown any consistent direction of change (i.e., increase or decrease) over time since the mine was constructed in 2014 (Figure 5.11; Appendix Figure E.1) suggesting no substantial changes in the trophic status of the lake since mine operations commenced at the Mary River Project. No chlorophyll-a baseline (2005 to 2013) data are available for Mary Lake, precluding comparisons to conditions prior to mine construction.

5.3.4 Benthic Invertebrate Community

Benthic invertebrate density, richness, and evenness at littoral and profundal habitat of Mary Lake did not differ significantly compared to like-habitat stations at Reference Lake 3 in 2020 (Tables 5.9 and 5.10). Benthic invertebrate community compositional differences were indicated between Mary Lake and Reference Lake 3 based on significantly differing Bray-Curtis Index for both littoral and profundal habitat types (Appendix Table F.21), but no significant differences in dominant taxonomic groups were indicated between Mary Lake and the reference lake for either habitat (Tables 5.9 and 5.10). Rather, significantly lower relative abundance of the filterer FFG and the clinger HPG at Mary Lake littoral and profundal stations compared to like-habitat stations at Reference Lake 3 (Tables 5.9 and 5.10) suggested that differences in the community

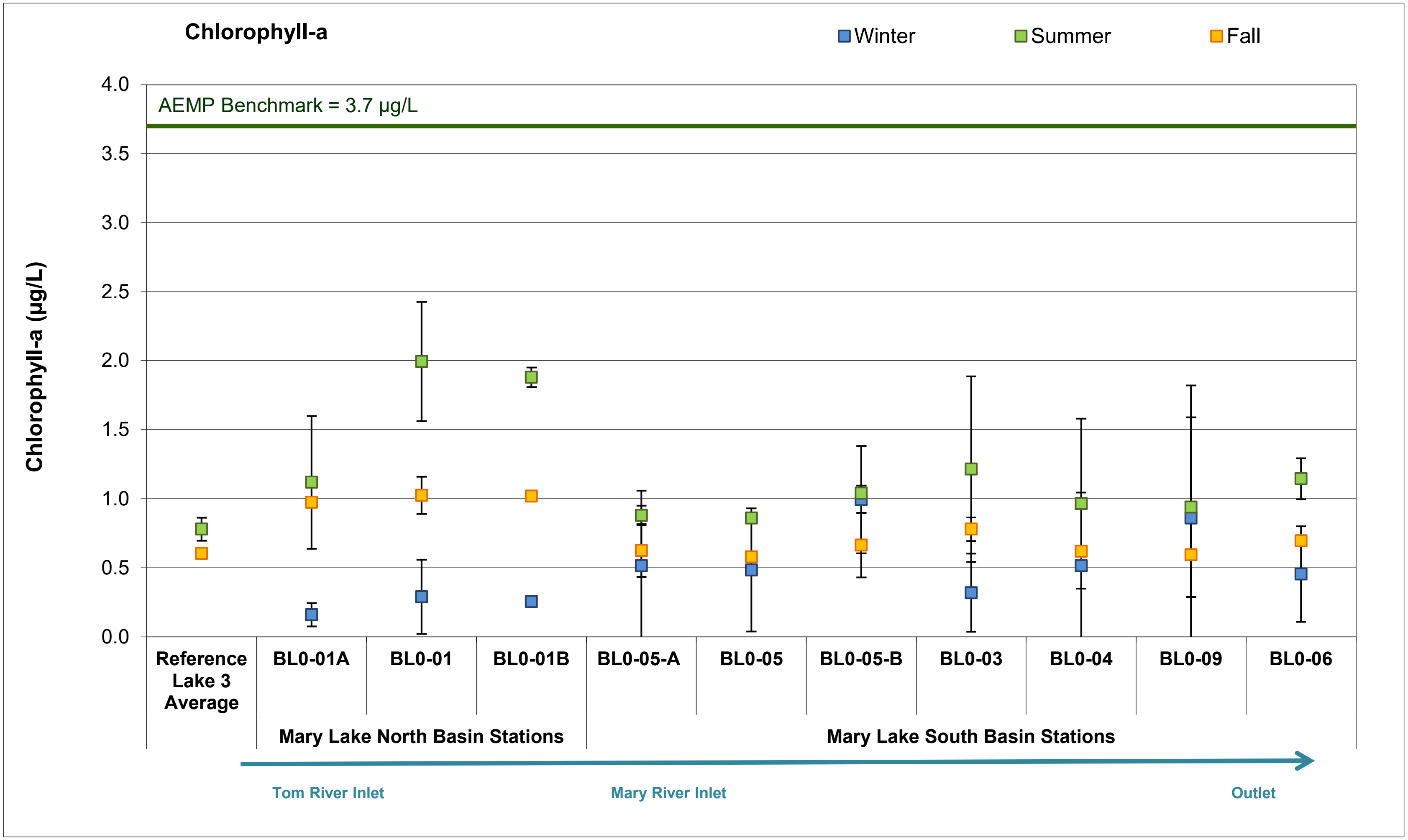

Figure 5.10: Chlorophyll-a Concentrations at Mary Lake (BLO) Phytoplankton Monitoring Stations, Mary River Project CREMP, 2020

Notes: Values presented are averages of samples taken from the surface and the bottom of the water column at each station. Reference lake values represent mean ± standard deviation (n = 3). Reference Lake 3 was not sampled in winter 2020.

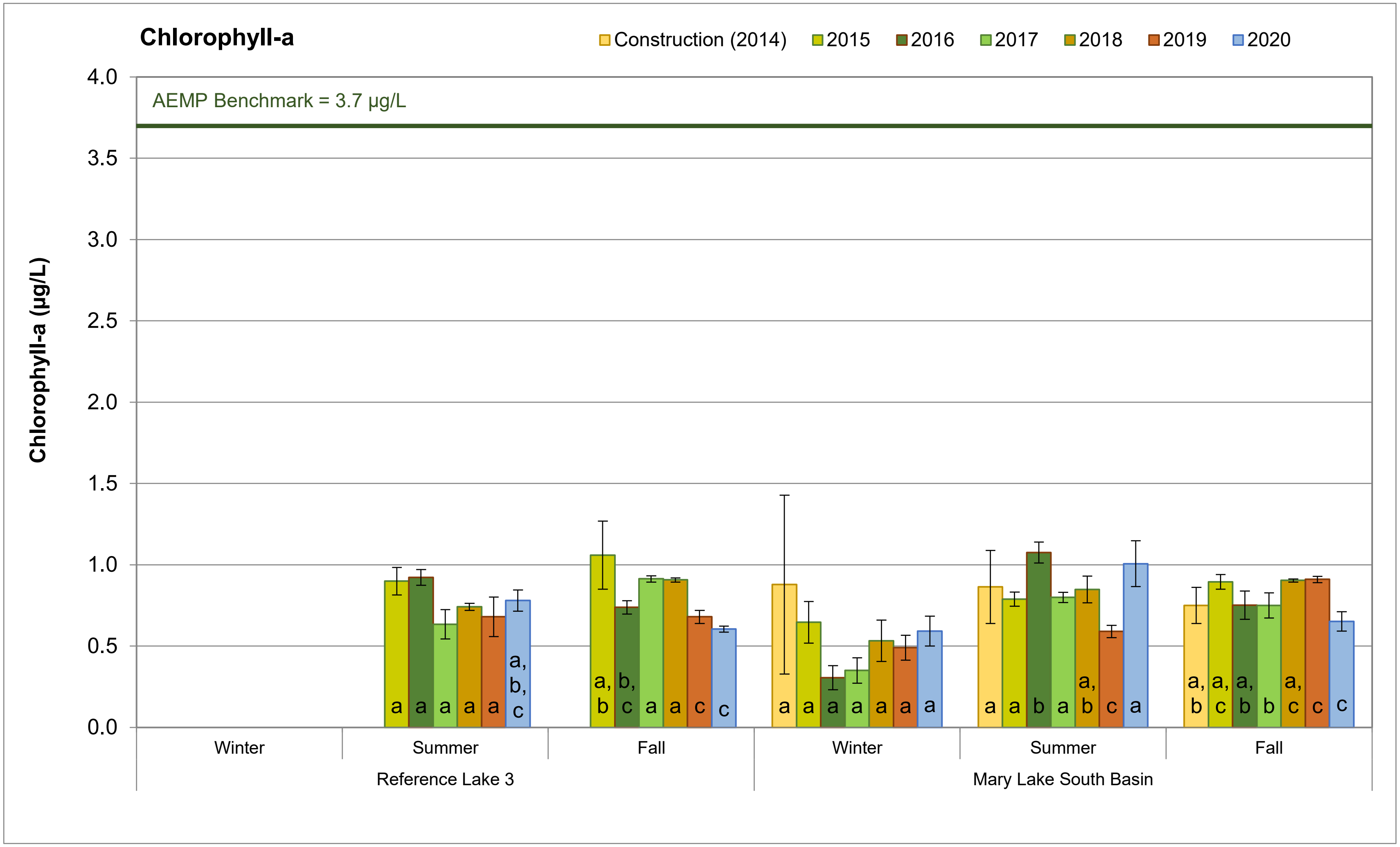

Figure 5.11: Temporal Comparison of Chlorophyll-a Concentrations Among Seasons between the Mary Lake South Basin and Reference Lake 3 for Mine Construction (2014) and Operational (2015 to 2020) Periods (mean ± SE)

Note: Bars with the same letter at the base do not differ significantly between years for the applicable season.

Table 5.9: Benthic Invertebrate Community Statistical Comparison Results between Mary Lake (BLO) and Reference Lake 3 for Littoral Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Littoral Habitat	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	tunequal	log10	NO	0.401	5.8	Reference Lake 3	1,571	430	193	1,190	1,474	2,310
						Mary Lake Littoral	4,086	3,955	1,978	966	3,017	9,345
Richness (Number of Taxa)	t-unequal	log10	NO	0.244	-1.2	Reference Lake 3	14.6	2.5	1.1	13.0	14.0	19.0
						Mary Lake Littoral	11.5	4.2	2.1	7.0	11.5	16.0
Simpson's Evenness (E)	t-equal	none	NO	0.464	-0.4	Reference Lake 3	0.810	0.110	0.049	0.630	0.847	0.923
						Mary Lake Littoral	0.765	0.041	0.021	0.707	0.775	0.802
Hydracarina (%)	t-equal	log10	NO	0.241	-0.6	Reference Lake 3	5.3	2.6	1.2	3.5	4.4	9.9
						Mary Lake Littoral	3.7	2.9	1.4	1.7	2.7	7.8
Ostracoda (%)	t-equal	log10	NO	0.606	0.3	Reference Lake 3	37.9	14.5	6.5	26.7	36.2	62.6
						Mary Lake Littoral	42.7	12.7	6.4	23.8	48.2	50.7
Chironomidae (%)	t-equal	none	NO	0.987	0.0	Reference Lake 3	52.6	15.6	7.0	26.9	59.0	66.4
						Mary Lake Littoral	52.5	14.7	7.4	43.8	45.8	74.4
Metal-Sensitive Chironomidae (%)	t-equal	none	YES	0.008	-2.2	Reference Lake 3	28.8	9.5	4.3	15.6	32.5	38.7
						Mary Lake Littoral	8.1	6.6	3.3	3.9	5.2	17.9
Collector-Gatherers (%)	t-equal	none	NO	0.661	0.5	Reference Lake 3	63.1	11.4	5.1	53.6	60.3	81.5
						Mary Lake Littoral	68.8	24.9	12.5	34.5	73.2	94.1
Filterers (%)	t-equal	log10(x+1)	YES	0.009	-2.2	Reference Lake 3	27.1	9.8	4.4	14.4	29.2	38.0
						Mary Lake Littoral	5.5	8.3	4.2	0.0	2.1	17.6
Shredders (%)	t-unequal	none	YES	0.064	-1.1	Reference Lake 3	3.9	3.3	1.5	0.6	3.2	7.4
						Mary Lake Littoral	0.1	0.2	0.1	0.0	0.0	0.4
Clingers (%)	t-equal	log10	YES	0.004	-2.5	Reference Lake 3	31.9	9.3	4.2	17.9	33.5	41.6
						Mary Lake Littoral	8.7	6.2	3.1	3.6	6.8	17.6
Sprawlers (%)	t-equal	log10	YES	0.033	1.9	Reference Lake 3	57.9	12.1	5.4	41.0	57.2	73.8
						Mary Lake Littoral	80.7	11.8	5.9	65.6	83.6	90.2
Burrowers (%)	t-equal	log10	NO	0.582	0.1	Reference Lake 3	10.2	4.9	2.2	4.6	8.3	17.3
						Mary Lake Littoral	10.6	12.1	6.1	2.3	5.7	28.5

Grey shading indicates statistically significant difference between study areas based on p-value ≤ 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Table 5.10: Benthic Invertebrate Community Statistical Comparison Results between Mary Lake (BLO) and Reference Lake 3 for Profundal Habitat Stations, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Study Lake Profundal Habitat	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	NO	0.308	2.1	Reference Lake 3	479	142	63	336	491	681
						Mary Lake Profundal	779	452	184	216	625	1,362
Richness (Number of Taxa)	t-equal	log10	NO	0.814	0.3	Reference Lake 3	7.0	1.9	0.8	5.0	8.0	9.0
						Mary Lake Profundal	7.5	2.8	1.2	5.0	6.0	12.0
Simpson's Evenness (E)	t-unequal	none	NO	0.140	-3.2	Reference Lake 3	0.731	0.045	0.020	0.689	0.721	0.795
						Mary Lake Profundal	0.586	0.201	0.082	0.322	0.564	0.834
Hydracarina (%)	t-equal	log10(x+1)	NO	0.166	0.9	Reference Lake 3	2.8	2.0	0.9	0.0	3.5	5.1
						Mary Lake Profundal	4.7	2.1	0.9	2.5	4.3	8.0
Ostracoda (%)	t-unequal	log10	NO	0.810	3.6	Reference Lake 3	8.6	4.1	1.8	3.5	7.7	14.5
						Mary Lake Profundal	23.4	28.9	11.8	1.3	14.2	76.0
Chironomidae (%)	Mann Whitney	rank	NO	0.792	-4.0	Reference Lake 3	87.9	4.2	1.9	82.3	87.2	92.7
						Mary Lake Profundal	71.3	30.2	12.3	16.0	80.5	94.6
Metal-Sensitive Chironomidae (%)	t-equal	none	YES	0.007	-1.5	Reference Lake 3	31.5	17.6	7.9	7.9	38.0	49.3
						Mary Lake Profundal	5.6	5.2	2.1	0.0	4.1	14.7
Collector-Gatherers (%)	t-equal	none	YES	0.006	1.6	Reference Lake 3	62.9	15.0	6.7	45.4	56.1	79.0
						Mary Lake Profundal	86.6	5.9	2.4	76.3	87.7	92.1
Filterers (%)	t-equal	log10(x+1)	YES	0.004	-1.6	Reference Lake 3	30.7	17.5	7.8	7.9	38.0	49.3
						Mary Lake Profundal	3.2	5.3	2.2	0.0	0.7	13.6
Shredders (%)	t-equal	log10(x+1)	NO	0.261	-0.7	Reference Lake 3	2.2	2.3	1.0	0.0	2.5	5.3
						Mary Lake Profundal	0.8	1.9	0.8	0.0	0.0	4.5
Clingers (%)	t-equal	log10	YES	0.036	-1.2	Reference Lake 3	33.5	16.9	7.6	13.1	41.5	52.8
						Mary Lake Profundal	12.5	11.1	4.5	2.7	9.1	32.0
Sprawlers (%)	Mann Whitney	rank	NO	0.177	0.7	Reference Lake 3	64.8	16.2	7.2	45.5	58.5	87.0
						Mary Lake Profundal	75.5	32.9	13.4	9.3	88.5	93.8
Burrowers (%)	Mann Whitney	rank	NO	0.191	3.6	Reference Lake 3	1.7	2.9	1.3	0.0	0.0	6.7
						Mary Lake Profundal	12.0	23.0	9.4	0.0	3.4	58.7

Grey shading indicates statistically significant difference between study areas based on p-value ≤ 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD_{REF}, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

between lakes reflected slight differences in dominant food resources available to benthic invertebrates and/or physical habitat features, respectively. Although the relative abundance of metal-sensitive Chironomidae was significantly lower at Mary Lake than at Reference Lake 3 (Tables 5.9 and 5.10), metal concentrations in water and sediment of Mary Lake were comparable to those at the reference lake (Tables 5.7 and 5.8), suggesting that differences in benthic invertebrate community features between lakes were not related to metal concentrations.

No significant differences in benthic invertebrate density, richness, evenness, relative abundance of dominant groups, and relative abundance of FFG were shown consistently at Mary Lake littoral and profundal habitat over years of mine operation (2015 to 2020) compared to baseline (Appendix Figures F.15 and F.16; Appendix Tables F.61 and F.62). In addition, no significant differences in the relative abundance of metal-sensitive Chironomidae were indicated for years of mine-operation relative to baseline (Appendix Tables F.61 and F.62), indicating that the differences in the relative abundance of this group between Mary Lake and Reference Lake 3 in 2020 likely reflected natural variability. Therefore, consistent with no substantial changes in water and sediment quality since the mine baseline period, no ecologically significant changes in benthic invertebrate community features were indicated at littoral and profundal habitat of Mary Lake since the commencement of commercial mine operation in 2015.

5.3.5 Fish Population

5.3.5.1 Mary Lake (South) Fish Community

Arctic charr and ninespine stickleback were captured in Mary Lake in 2020 (Table 5.6), consistent with the previous five years of sampling (Minnow 2020). Electrofishing and gill netting CPUE were each higher at Mary Lake than at Reference Lake 3 (Table 5.11), suggesting greater densities and/or productivity of both arctic charr and ninespine stickleback at Mary Lake. Consistent with the other mine-exposed lakes, greater numbers of arctic charr together with greater density of benthic invertebrates suggested that overall biological productivity was higher at Mary Lake than at Reference Lake 3. Arctic charr CPUE associated with electrofishing in 2020 at Mary Lake was comparable to highest CPUE from other years of mine operation and substantially greater than baseline monitoring conducted in 2008 (Figure 5.12). Gill netting CPUE at Mary Lake in 2020 was within the range of observed during previous years of mine operation (2015 to 2019), and also greater than CPUE during baseline (2006 and 2007; Figure 5.12). Based on the CPUE data, arctic charr abundances at nearshore and littoral/profundal habitats of Mary Lake were likely comparable to or greater than during the baseline period, indicating no mine-related influences on arctic charr abundance in the lake.

Table 5.11: Fish Catch and Community Summary from Backpack Electrofishing and Gill Netting Conducted at Mary Lake (BLO) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Lake	Method [a]		Arctic Charr	Ninespine Stickleback	Total by Method	Total No. of Species
Reference Lake 3	Electrofishing	No. Caught	134	1	135	2
		CPUE	2.09	0.016	2.11	
	Gill netting	No. Caught	69	0	69	
		CPUE	0.956	0	0.956	
Mary Lake	Electrofishing	No. Caught	105	26	131	2
		CPUE	3.01	0.746	3.76	
	Gill netting	No. Caught	94	0	94	
		CPUE	4.60	0	4.60	

[a] Catch-per-unit-effort (CPUE) for electrofishing represents the number of fish captured per electrofishing minute, and for gill netting represents the number of fish captured per 100 m hours of net.

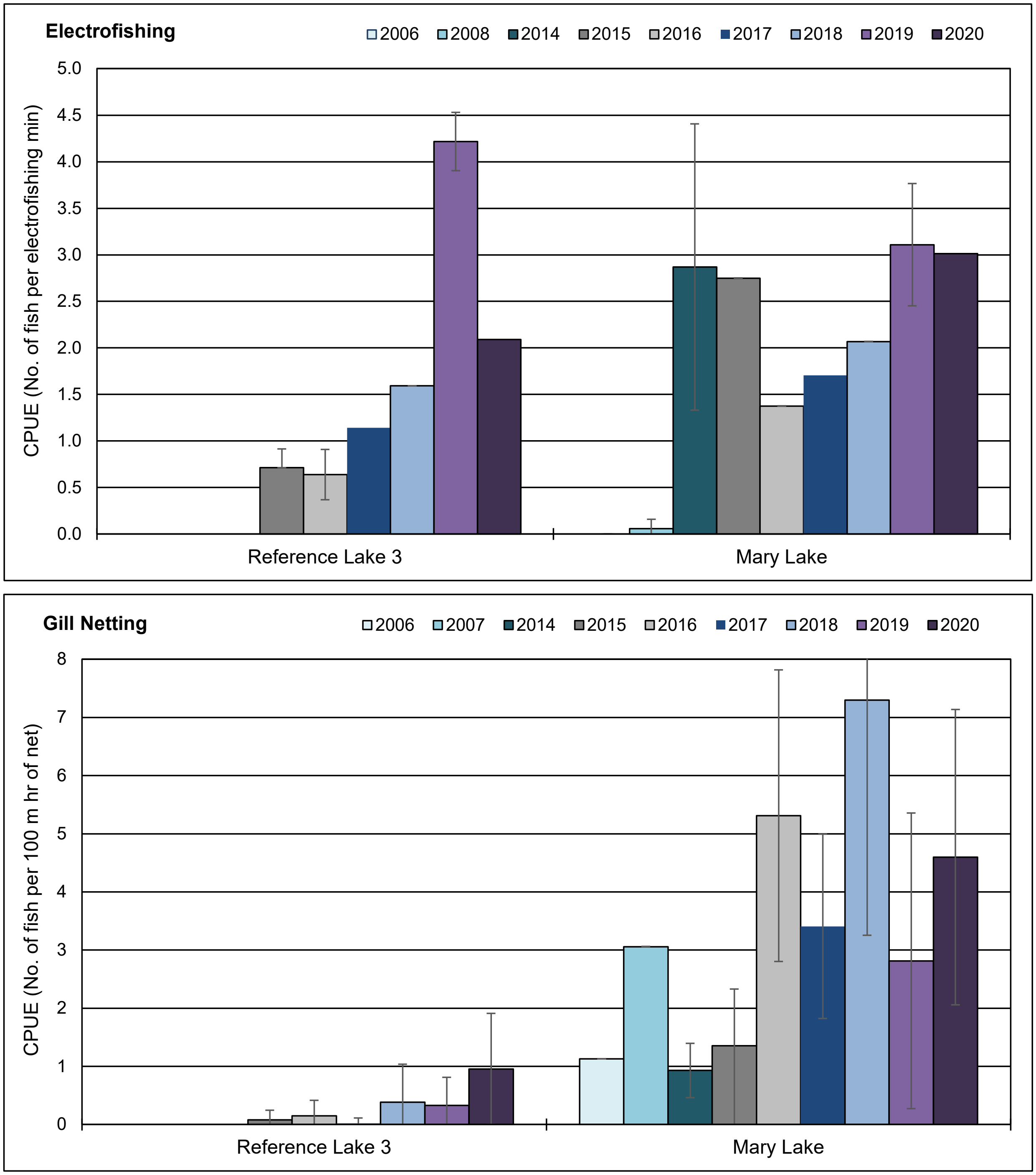

Figure 5.12: Catch-per-unit-effort (CPUE; mean ± SD) of Arctic Charr Captured by Back-pack Electrofishing and Gill Netting at Mary Lake (BLO), Mary River Project CREMP, 2006 to 2020

Note: Data presented for fish sampling conducted in fall during baseline (2006, 2007), construction (2014), and operational (2015 to 2020) mine phases.

5.3.5.2 Mary Lake (South) Fish Population Assessment

Nearshore Arctic Charr

A total of 100 arctic charr were captured from nearshore habitats in each of Mary Lake and Reference Lake 3 in August 2020. Arctic charr YOY were distinguished from non-YOY using fork length cut-offs of 4.1 cm and 4.3 cm for the Mary Lake and Reference Lake 3 data sets, respectively, based on evaluation of length-frequency distributions coupled with supporting age determinations (Figure 5.13; Appendix Tables G.4 and G.25). However, due to small sample sizes of nearshore arctic charr YOY at Mary Lake (i.e., only two individuals), statistical comparisons of fish health endpoints were conducted using the non-YOY population only. Arctic charr of nearshore habitat showed differing length-frequency distributions between Mary Lake and Reference Lake 3, reflecting fewer YOY and a more limited size distribution of fish at Mary Lake compared to the reference lake (Table 5.12; Figure 5.13; Appendix Table G.26). Arctic charr non-YOY from Mary Lake were similar in size to reference lake fish, and although condition of non-YOY was significantly greater at Mary Lake than at the reference lake, the magnitude of this difference was well within the CES_C of ±10% indicating that this difference was not ecologically meaningful (Table 5.12; Appendix Table G.26). No consistent differences in size or condition of non-YOY arctic charr from nearshore habitat of Mary Lake relative were indicated relative to the reference lake from 2015 to 2020, suggesting that differences between lakes over time reflected natural variability (Table 5.12). No nearshore arctic charr baseline data were collected at Mary Lake, precluding data analysis using a before-after design. Collectively, the data indicated no adverse effects on arctic charr from nearshore areas in Mary Lake since the commencement of mine operations in 2015.

Littoral/Profundal Arctic Charr

A total of 94 and 69 arctic charr were sampled from littoral/profundal habitat of Mary Lake and Reference Lake 3, respectively, in August 2020. The length-frequency distribution for littoral/profundal arctic charr differed significantly between lakes due to a greater number of larger fish being caught at Mary Lake (Table 5.12; Figure 5.13; Appendix Table G.30). Arctic charr sampled from littoral/profundal habitat of Mary Lake were also significantly longer, heavier, and of greater condition than those from Reference Lake 3 in 2020 (Table 5.12; Appendix Table G.30). The absolute magnitude of difference in body condition was greater than the CES_C of 10%, suggesting that this difference may be ecologically significant (Table 5.12; Appendix Table G.30). An on-going significant difference in length-frequency distribution was the only consistent difference shown for arctic charr captured from littoral/profundal habitat of Mary Lake from 2015 to 2020 compared to the reference lake data for the same period and Mary Lake baseline data (Table 5.12; Appendix Table G.30). No consistent differences in arctic charr size and condition

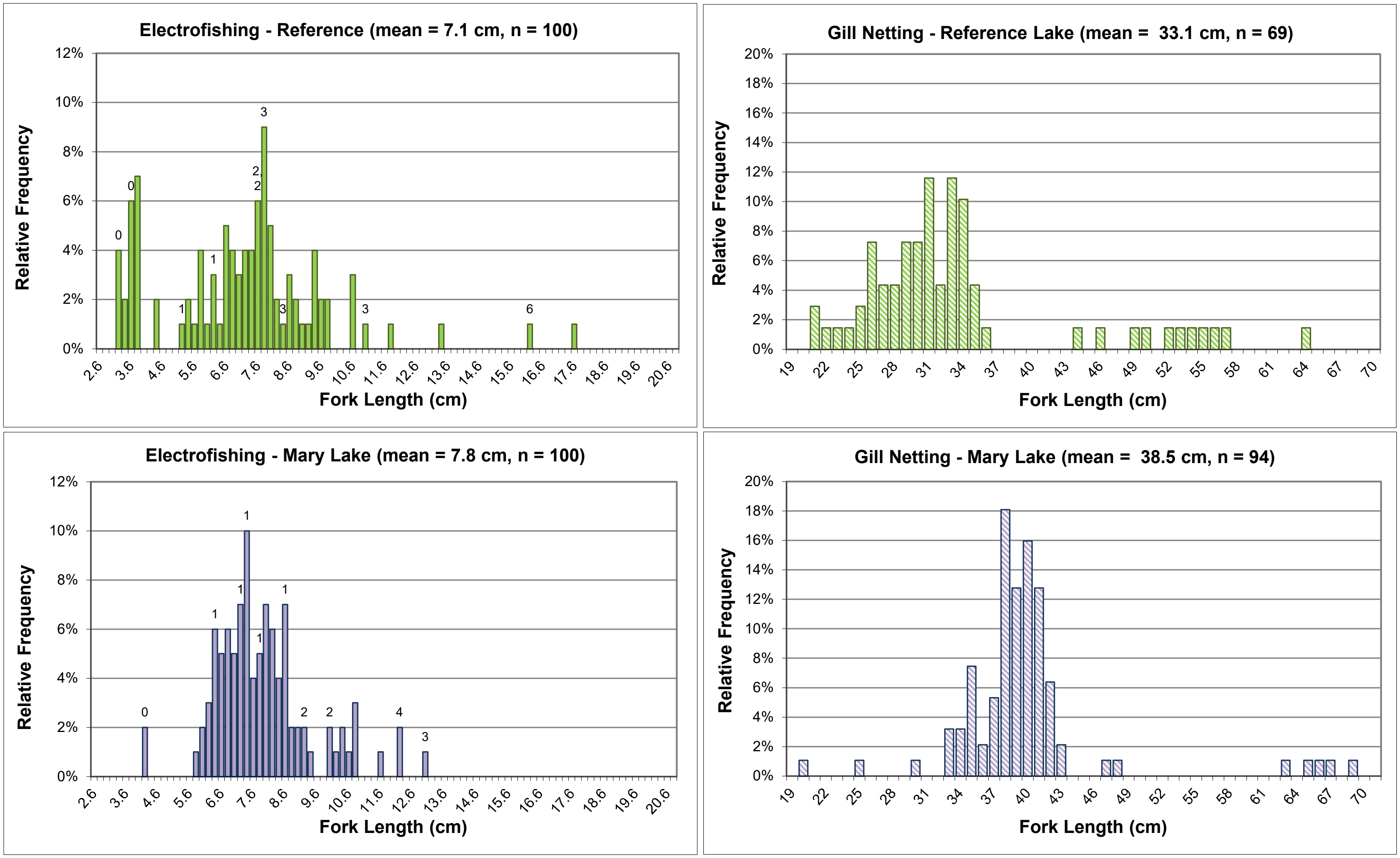

Figure 5.13: Length-Frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Mary Lake (BLO) and Reference Lake 3 (REF3), Mary River Project CREMP, August 2020

Note: Fish ages are shown above the bars, where available

Table 5.12: Summary of Statistical Results for Arctic Charr Population Comparisons between Mary Lake and Reference Lake 3 from 2015 to 2020, and between Mary Lake Mine Operational and Baseline Period Data, for Fish Captured by Electrofishing and Gill Netting Methods

Data Set by Sampling Method	Response Category	Endpoint	Statistically Significant Differences Observed? [a]											
			versus Reference Lake 3						versus Mary Lake baseline period data [b]					
			2015	2016	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
Electrofishing Samples	Survival	Length-Frequency Distribution	No	**Yes**	**Yes**	**Yes**	**Yes**	**Yes (-27%)**	-	-	-	-	-	-
		Age	**Yes (-43%)**	No	No	-	-	-	-	-	-	-	-	-
	Energy Use (non-YOY)	Size (mean fork length)	No	No	**Yes (+17%)**	**Yes (+10%)**	**Yes (-27%)**	No	-	-	-	-	-	-
		Size (mean weight)	No	No	**Yes (+51%)**	No	**Yes (-61%)**	No	-	-	-	-	-	-
	Energy Storage (non-YOY)	Condition (body weight-at-fork length)	**Yes (+3%)**	No	No	**Yes (-8%)**	**Yes (+4%)**	**Yes (+2.6%)**	-	-	-	-	-	-
Gill Netting Samples [c]	Survival	Length Frequency Distribution	-	-	-	**Yes**	**Yes**	**Yes (-64%)**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes**	**Yes (+21%)**
		Age	-	-	-	-	-	-	No	**Yes (-14%)**	No	-	-	-
	Energy Use	Size (mean fork length)	-	-	-	**Yes (+12%)**	**Yes (+24%)**	**Yes (+23%)**	**Yes (+6%)**	No	**Yes (-5%)**	No	**Yes (-4%)**	No
		Size (mean weight)	-	-	-	**Yes (+51%)**	**Yes (+96%)**	**Yes (+118%)**	**Yes (+19%)**	No	**Yes (-9%)**	No	**Yes (-14%)**	No
		Growth (fork length-at-age)	-	-	-	-	-	-	No	**Yes (nc)**	No	-	-	-
		Growth (weight-at-age)	-	-	-	-	-	-	No	**Yes (nc)**	No	-	-	-
	Energy Storage	Condition (body weight-at-fork length)	-	-	-	**Yes (+3%)**	**Yes (+3%)**	**Yes (+14%)**	No	**Yes (+3%)**	**Yes (+5%)**	**Yes (-3%)**	**Yes (-5%)**	No

BOLD indicates a significant difference related to the comparison.

[a] Values in parentheses indicate direction and magnitude of any significant differences.

[b] No baseline period data collected for nearshore electrofishing; baseline period littoral/profundal gill netting data included combined 2006 and 2007 information.

[c] Due to low catches of arctic charr in gill nets at Reference Lake 3 in 2015, 2016, and 2017, no comparison of fish health was conducted for gill netted fish.

endpoints for fish captured at littoral/profundal habitat of Mary Lake have occurred from 2015 to 2020 compared to baseline (Table 5.12). This suggested that natural and/or sampling variability likely accounted for the variable differences in arctic charr health endpoints between years of mine operation and baseline at Mary Lake.

5.3.6 Effects Assessment and Recommendations

At Mary Lake, the following AEMP benchmark was exceeded in 2020:

- Manganese concentration in sediment was greater than the benchmark of 4,370 mg/kg at one profundal monitoring station (BL0-09), although the average concentration of manganese in sediment at profundal stations was below this benchmark.

The AEMP benchmarks for sediment quality were exceeded only at a single profundal station and only for a single parameter (manganese) at Mary Lake in 2020. The isolated occurrence of this exceedance, and the fact that average manganese concentrations in sediment at Mary Lake were not particularly elevated compared to concentrations at the reference lake or to those at Mary Lake during baseline, indicated no mine-related change in manganese concentrations at Mary Lake since commercial mine operations commenced in 2015. No AEMP benchmarks for water quality were exceeded over the duration of spring, summer, and fall sampling events in 2020 at Mary Lake. In addition, no adverse effects on phytoplankton, benthic invertebrates, nor on fish (arctic charr) health were indicated at Mary Lake in 2020 based on comparisons to reference lake conditions and to Mary Lake baseline data. Under the Mary River Project AEMP Management Response Framework, the absence of a mine-related change in AEMP benchmark parameters over time (or compared to background) requires no further management response (Figure 2.8). Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no management response (i.e., alteration of existing AEMP) is required for Mary Lake as part of the next monitoring program.

6 CONCLUSIONS

6.1 Overview

The objective of the Mary River Project 2020 CREMP was to evaluate potential mine-related influences on chemical and biological conditions at aquatic environments located near the mine following the sixth full year of mine operation. The CREMP employs an effects-based approach that includes standard environmental effects monitoring (EEM) techniques that were conducted as the basis for determining potential mine-related effects at key receiving waterbodies. Under this approach, water quality and sediment quality data were used to support the interpretation of phytoplankton, benthic invertebrate community, and fish population survey data collected at mine-exposed areas of the Camp Lake, Sheardown Lake, Mary River and Mary Lake systems. The evaluation of potential mine-related effects within these systems was based upon comparisons of the 2020 data to applicable reference data, baseline data, and to guidelines that included site-specific AEMP benchmarks. The latter were developed to guide management response decisions within a four-step Management Response Framework as outlined in the Mary River Project AEMP (Baffinland 2015). An effects determination was conducted for all key waterbodies located within each of the Camp Lake, Sheardown Lake, Mary River, and Mary Lake systems, which was based on weight-of-evidence that considered incidences in which the AEMP benchmarks were exceeded and a commensurate adverse influence on aquatic biota occurred. Where appropriate, recommendations for future study were provided to assist Baffinland with decisions regarding appropriate management actions for cases in which AEMP benchmarks were not achieved. Potential mine-related effects identified in the 2020 CREMP are provided separately below for the Camp, Sheardown and Mary River/Lake systems.

6.2 Camp Lake System

Within the Camp Lake system, AEMP monitoring is conducted at Camp Lake Tributary 1 (CLT1), Camp Lake Tributary 2 (CLT2), and Camp Lake (JL0). At CLT1, AEMP water quality benchmarks were exceeded in 2020 for copper at the north branch, and for aluminum and iron at the main stem portions of the system (Table 6.1). Copper concentrations at the CLT1 north branch were elevated compared to concentrations at reference creeks, but were comparable to those shown during baseline. Although elevated aluminum concentrations at the CLT1 main stem were not attributable to mine operations, iron concentrations at the CLT1 upper main stem in 2020 were elevated compared to those at reference creeks and to baseline suggesting a potential mine-related influence on CLT1 water quality. Metal concentrations in sediment at CLT1 were well below SQG. In addition, no adverse effects on phytoplankton (chlorophyll-a) or benthic invertebrates were indicated at CLT1 in 2020 compared to reference creek and CLT1 baseline

Table 6.1: Summary of AEMP Benchmark Exceedances and Effects Determination for the Mary River Project 2020 CREMP and Monitoring Recommendations Based on the Results

Waterbody	AEMP Benchmark Exceedance	Effects Determination Summary	Recommendation
Camp Lake Tributary 1 (North Branch)	Aqueous total copper concentration greater than 0.0022 mg/L benchmark in spring and summer at the north branch (0.00221 mg/L and 0.00226 mg/L, respectively).	Copper concentrations at the north branch were comparable to those during baseline. No adverse effects on phytoplankton or benthic invertebrates based on comparisons to reference data and to baseline data.	Low action response includes an expanded spatial water quality sampling program to identify the source(s) of copper to the watercourse.
Camp Lake Tributary 1 (Main Stem)	Aqueous total aluminum concentration greater than 0.179 mg/L benchmark in spring at upper main stem (0.270 mg/L). Aqueous total iron concentration greater than 0.326 mg/L benchmark in spring, summer, and fall at upper main stem (0.420 mg/L, 0.423 mg/L, and 0.522 mg/L, respectively).	Aluminum concentrations at CLT1 upper main stem were comparable to reference creeks and to baseline, and thus the change was not mine-related. Iron concentrations at CLT1 upper main stem were higher than background and reference, suggesting a mine-related change. No adverse effects on phytoplankton or benthic invertebrates based on comparisons to reference data and to baseline data at the CLT1 lower main stem.	Low action response includes establishing benthic invertebrate community monitoring stations at CLT1 upper main stem to evaluate/track effects to biota.
Camp Lake Tributary 2	Water quality met all AEMP benchmarks in 2020.	No adverse effects on phytoplankton or benthic invertebrates based on comparisons to reference data and to baseline data.	No changes recommended to monitoring program for CLT2 based on comparison to AEMP benchmarks.
Camp Lake	Sediment arsenic concentration > 5.9 mg/kg benchmark at single littoral monitoring station (9.0 mg/kg). Sediment iron concentration > 52,400 mg/kg benchmark at single littoral monitoring station (61,000 mg/kg). Sediment nickel concentration > 72 mg/kg benchmark at single littoral monitoring station (72.5 mg/kg). Sediment arsenic, copper, iron, manganese, nickel, and phosphorus concentrations above respective benchmarks at individual stations, but below benchmarks on average, at profundal stations.	No AEMP water quality benchmarks were exceeded at Camp Lake in 2020. For all parameters except arsenic, no change in parameter concentration in sediment was shown compared to background and/or baseline, indicating the change was not mine-related. Sediment chemistry is monitored only at a single littoral station at Camp Lake under the AEMP, and thus it is unclear whether the change in arsenic concentration is mine-related (e.g., no identifiable source of arsenic). No adverse effects on phytoplankton, benthic invertebrates, or fish compared to reference data and to baseline conditions.	Low action response to harmonize lake sediment quality and benthic invertebrate monitoring stations, focusing primarily on littoral habitat, to improve the ability of the program to evaluate changes in metal concentrations in littoral sediment and to track mine-related effects to biota.
Sheardown Lake Tributary 1	Aqueous total copper concentration greater than 0.0022 mg/L benchmark in spring, summer, and fall (0.0029 mg/L, 0.0024, and 0.0023 mg/L, respectively).	Copper concentrations at SDLT1 were comparable to those during baseline. No adverse effects on phytoplankton or benthic invertebrates based on comparisons to reference data and to baseline data.	Low action response includes an expanded spatial water quality sampling program to identify the source(s) of copper to the watercourse.
Sheardown Lake Tributaries 9 and 12	Water quality met all AEMP benchmarks in 2020.	No ecologically significant and/or adverse effects on phytoplankton or benthic invertebrate community endpoints based on comparisons to reference data and to baseline data.	Low action response to add water quality monitoring stations to each of these tributaries to assist in determination of effects to biota in the future.
Sheardown Lake Northwest and Southeast basins	Arsenic concentration in sediment greater than AEMP benchmark. Chromium concentration in sediment greater than AEMP benchmark. Iron concentration in sediment greater than AEMP benchmark. Manganese concentration in sediment greater than AEMP benchmark. Nickel concentration in sediment greater than AEMP benchmark.	No AEMP water quality benchmarks were exceeded at Sheardown Lake in 2020. For all parameters, no change in concentration in sediment was shown compared to background and/or baseline, indicating the change was not mine-related.	Low action response to examine the relevance of site-specific sediment quality AEMP benchmarks for Sheardown Lake SE and, if necessary, establish new AEMP benchmarks taking into consideration data from the reference lake and applicable sediment quality guidelines.
Mary River	Aluminum concentration in water greater than AEMP benchmark in summer. Copper concentration in water greater than AEMP benchmark in summer. Iron concentration in water greater than AEMP benchmark in summer. Lead concentration in water greater than AEMP benchmark in summer.	Concentrations of metals in water of Mary River during the summer occurred as a result of high turbidity in 2020, and were comparable to background and/or baseline indicating that the elevated concentrations in 2020 were not mine-related. No adverse effects on phytoplankton, benthic invertebrates, or fish were indicated at Mary River compared to reference data or to baseline conditions.	No changes recommended to monitoring program for Mary River due to exceedances of AEMP benchmarks.
Mary Lake	Manganese concentration in sediment greater than AEMP benchmark at a single profundal station.	No AEMP water quality benchmarks were exceeded at Mary Lake in 2020. Isolated occurrence of this exceedance, and the fact that average concentrations of manganese in sediment were comparable to background and baseline, indicated that change was not mine-related. No adverse effects on phytoplankton, benthic invertebrates, or fish compared to reference data and to baseline conditions.	No changes recommended to monitoring program for Mary Lake due to exceedance of AEMP benchmark.

conditions. Applying the Mary River Project AEMP Management Response Framework, low action responses including implementation of an expanded spatial water quality sampling program to identify the source(s) of copper to the CLT1 north branch, and establishment of benthic invertebrate community sampling stations to evaluate possible mine-related effects on biota in the upper main stem portion of CLT1, are recommended.

At CLT2, water chemistry met all AEMP benchmarks, sediment quality met all SQG, and no adverse effects on phytoplankton or benthic invertebrates were indicated relative to reference creek conditions and CLT2 baseline data in 2020. Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no adjustments to the existing AEMP are recommended.

At Camp Lake, no AEMP water quality benchmarks were exceeded, but arsenic concentrations in sediment at a single littoral station that were above the AEMP sediment quality benchmark possibly indicated a mine-related change in 2020 relative to background and/or baseline conditions (Table 6.1). No adverse effects on phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at Camp Lake in 2020 based on comparisons to reference lake conditions and to Camp Lake baseline data. No identifiable mine-related sources of arsenic to the Camp Lake system were evident, and the current AEMP does not adequately capture variability in sediment chemistry at littoral habitat of Camp Lake. Considering arsenic concentrations in sediment, sources of arsenic to the system, and the current AEMP design, a low action response is recommended at Camp Lake under the AEMP Management Response Framework. To this end, harmonizing lake sediment quality and benthic invertebrate community monitoring stations, focusing on littoral habitat, is recommended to improve the ability of the program to evaluate mine-related effects to sediment quality at littoral areas and to potentially allow linkages to be determined between metal concentrations in sediment and benthic invertebrate community responses in the future.

6.3 Sheardown Lake System

Within the Sheardown Lake system, AEMP monitoring is conducted at Sheardown Lake Tributaries 1, 12, and 9 (SDLT1, SDLT12, and SDLT9, respectively), Sheardown Lake NW (DL0-01) and Sheardown Lake SE (DL0-02). At the Sheardown Lake tributaries, AEMP water quality benchmarks were exceeded in 2020 for copper at SDLT1 (Table 6.1), but because no elevation in copper concentrations was indicated compared to baseline conditions, copper concentrations naturally appeared to be near the AEMP benchmark at this tributary. No adverse effects to phytoplankton or benthic invertebrates were indicated at SDLT1 or at either SDLT12 or SDLT9 in 2020 based on comparison to reference creek concentrations and respective Sheardown Lake Tributary baseline data. Because no adverse effects to biota were associated with copper concentrations above the AEMP benchmark at SDLT1, a low action response to identify the likely source(s) of copper to the system is recommended to meet obligations under the AEMP Management Response Framework. Although no mine-related changes to phytoplankton or benthic invertebrates were indicated at SDLT12 and SDLT9 in 2020, a low action response to add a water quality monitoring station at each of these two tributaries under the AEMP is recommended to improve the ability of the program to interpret biological data in the future.

At Sheardown Lake NW, no AEMP benchmarks for water quality were exceeded in 2020. Lake-specific AEMP benchmarks for sediment quality were exceeded for arsenic, iron, manganese, and nickel in 2020, but none of these metals were elevated in the sediment of Sheardown Lake NW compared to the reference lake and to concentrations at Sheardown Lake NW during baseline (Table 6.1). No adverse effects to phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at Sheardown Lake NW in 2020 based on comparisons to reference conditions and to Sheardown Lake NW baseline conditions. Because no mine-related changes in metal concentrations occurred in sediment at Sheardown Lake NW in 2020, and no adverse effects to biota were associated with concentrations of metals above AEMP sediment quality benchmarks, a low action response is recommended to meet obligations under the AEMP Management Response Framework. Specifically, it is recommended that, because concentrations of metals in Sheardown Lake NW sediment have been similar to those shown at the reference lake, consideration should be given to updating the AEMP sediment quality benchmarks for Sheardown Lake NW to reflect not only baseline data, but also reference lake data.

At Sheardown Lake SE, no AEMP benchmarks for water quality were exceeded in 2020. Lake-specific AEMP benchmarks for sediment quality were exceeded for chromium, iron, manganese, and nickel concentrations at Sheardown Lake SE in 2020 (Table 6.1). However, none of these metals occurred at concentrations in sediment of Sheardown Lake SE that were elevated compared to the reference lake, or to concentrations shown at Sheardown Lake SE during the baseline period. In addition, concentrations of these metals were above the Sheardown Lake SE AEMP benchmarks in sediment at the reference lake, suggesting naturally high concentrations of each of the indicated metals in sediments of area lakes. No adverse effects to phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at Sheardown Lake SE in 2020 based on comparisons to reference conditions and to applicable Sheardown Lake SE baseline conditions. Because no mine-related changes in metal concentrations occurred in sediment at Sheardown Lake SE in 2020 and no adverse effects to biota were associated with concentrations of metals above AEMP benchmarks for sediment quality, a low action response is recommended to meet obligations under the AEMP Management Response Framework. Specifically, it is recommended that the relevance of site-specific sediment quality AEMP benchmarks for Sheardown Lake SE be assessed and, if necessary, determined anew taking into consideration data from the reference lake and applicable sediment quality guidelines.

6.4 Mary River and Mary Lake Systems

Within the Mary River and Mary Lake systems, AEMP monitoring is conducted at Mary River Tributary-F (MRTF), Mary River, and Mary Lake (BL0). At MRTF, no AEMP benchmarks for water quality were exceeded in 2020, and for parameters with established AEMP benchmarks, no changes in concentrations were shown relative to baseline. No adverse effects on phytoplankton were indicated at MRTF in 2020. Biological sampling conducted at MRTF to meet MDMER obligations suggested some differences in benthic invertebrate community assemblages between effluent-exposed and reference areas, but these differences did not appear to be related to metal concentrations originating from mine effluent and/or mine operations (Minnow 2021). Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and to baseline, and no adverse biological effects related to metals were indicated in 2020, no changes to the existing sampling program at MRTF are recommended.

At Mary River, concentrations of aluminum, copper, iron, and lead were above respective AEMP benchmarks at stations located adjacent to the mine (i.e., E0 series stations) and, with the exception of lead, downstream of the mine (C0 series) in 2020 (Table 6.1). However, the concentrations for each of these parameters were similar or higher, and above applicable AEMP benchmarks, at the Mary River reference stations (G0-09 series) and/or upstream stations (G0 series), reflecting highly turbid sampling conditions that occurred in 2020. No mine-related changes to parameter concentrations were indicated at Mary River mine-exposed stations in 2020 compared to the reference stations and to Mary River baseline data. In addition, metal concentrations in sediment were well below SQG, and no adverse effects on phytoplankton, benthic invertebrates, and fish (arctic charr) health were indicated at all Mary River mine-exposed areas in 2020. Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no changes to AEMP monitoring at Mary River are recommended as per the AEMP Management Response Framework.

At Mary Lake, no AEMP benchmarks for water quality were exceeded in 2020. Lake-specific AEMP benchmarks for sediment quality were exceeded for manganese concentrations at a single profundal station in 2020 (Table 6.1). The isolated occurrence of this exceedance, and the fact that average manganese concentrations in sediment at Mary Lake were not elevated compared to concentrations at the reference lake or to those at Mary Lake during baseline, indicated no mine-related change in manganese concentrations at Mary Lake since commercial mine operations commenced in 2015. No adverse effects on phytoplankton, benthic invertebrates, nor on fish (arctic charr) health were indicated at Mary Lake in 2020 based on comparisons to reference lake conditions and to Mary Lake baseline data. Because no changes in concentrations of AEMP benchmark parameters occurred relative to background and baseline and no adverse biological effects were indicated in 2020, no changes to AEMP monitoring at Mary Lake are recommended as per the AEMP Management Response Framework.

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Mary River Project 2020
Core Receiving Environment Monitoring Program Report

Part 2 of 3
(Appendices A to D)

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APPENDIX A
DATA QUALITY REVIEW

APPENDIX A DATA QUALITY REVIEW

LIST OF TABLES

A1 INTRODUCTION

Data Quality Review (DQR) was conducted on data collected as part of the Mary River Project 2020 CREMP to define the overall quality of the data collected for the program, and by extension, the confidence with which the data could be used to derive conclusions. A variety of factors can influence the physical, chemical, and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Depending on the magnitude of these influences, inaccuracy or imprecision have the potential to affect the reliability of conclusions drawn from the available data. Therefore, it is important to ensure that programs incorporate appropriate steps to control the non-natural sources of data variability (i.e., minimize the variability that does not reflect natural spatial and temporal variability in the environment) and thus assure the quality of the data.

The Mary River Project 2020 CREMP DQR involved comparison of field performance to generic environmental study data quality objectives (DQO) for the evaluation of sample blanks, data precision, and data accuracy. DQO were established *a priori* to reflect reasonable and achievable performance expectations. Overall, the intent of comparing data to DQO was not to reject any measurement that did not meet the DQO, but rather to evaluate whether, based on the available data and using a weight-of-evidence approach, the field and/or analytical sample data adequately reflected actual conditions and thus could be used with confidence to derive study conclusions. Using this approach, questionable data received more scrutiny to determine what effect, if any, this had on interpretation of results within the context of this project. Quality Control (QC) samples assessed for the Mary River Project CREMP included water sample trip blanks, field blanks, equipment blanks, and field duplicates, and verification of the accuracy of sub-sampling and organism recovery for the benthic invertebrate component, defined as follows:

- **Blanks** (water quality samples) are samples of deionized water and/or appropriate reagent(s) that are handled and analyzed the same way as regular samples. Blank samples reflect contamination that occurred from the equipment (in the case of equipment blanks), in the field (in the case of trip or field blanks), or in the laboratory (in the case of laboratory or method blanks). Analyte concentrations should be non--detectable, although a data quality objective of five times the laboratory reportable detection limit (RDL) allowed for slight “noise” around the detection limit.
- **Trip Blanks** are meant to detect any widespread contamination resulting from the container (including caps) and preservative during transport and storage. A trip blank is a bottle set to which deionized water has been added in a laboratory prior to

the field sample collections, which is transported with the regular sample bottles in the field, and remains unopened throughout the trip.

- **Field Blanks** mimic the sampling and preservative process but do not come in contact with ambient water. Field blanks are exposed to the sampling environment at the sample site. Consequently, they provide information on contamination resulting from the handling technique and through exposure to the atmosphere. They are processed in the same manner as the associated field samples (i.e., they are exposed to all the same potential sources of contamination as the field sample), including handling and, in some cases, filtration and/or preservation.
- **Equipment Blanks** are samples of deionized water collected from the sampling equipment following decontamination (i.e., rinsing of the sampling device using deionized water) in the field between sampling stations and/or events. These blanks are useful in identifying cross contamination of samples in the field as a result of the sampling device.
- **Field Duplicates** (water quality samples) are sub-sample pairs collected from randomly selected field stations using identical collection and handling methods that are then analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory. The data from field duplicate samples reflect natural variability, as well as the variability associated with sample collection methods, and therefore provide a measure of field precision.
- **Sub-Sampling Checks** (benthic invertebrate community samples) are used when excessive sample volume and/or organism density results in only a fraction of the original sample being analyzed. By comparing the numbers of benthic invertebrates recovered between at least two sub-samples, this measure provides an evaluation of how effective the sub-sampling method was in evenly dividing the original sample during processing in the laboratory. Therefore, sub-sampling error provides a measure of analytical precision. The processing of entire samples in representative sample fractions also allows an evaluation of sub-sampling accuracy.
- **Organism Recovery Checks** (benthic invertebrate community samples) involve the re-processing of previously sorted material from a randomly selected sample to determine the number of invertebrates that were not recovered during the original sample processing. The reprocessing is conducted by an analyst not involved during the original processing to reduce bias. This check allows the determination of accuracy through assessment of recovery efficiency.

A2 RESULTS

A2.1 Water Quality

A2.1.1 Sample Blanks

Trip blank samples were taken on field sampling campaigns a total of nine times during the 2020 CREMP, including two during the winter lake monitoring event (April), one during the spring stream monitoring event (early July), three during the summer lake/stream monitoring event (late July/early August), and three during the fall lake/stream monitoring event (late August). Of the 755 total analyses conducted on the trip blank samples, only 11 (1.5%) resulted in analyte detection above the trip blank DQO of less than five-times the laboratory reporting limit (LRL; Appendix Table A.1). No parameters showed concentrations that were consistently elevated above the trip blank DQO among sampling events, or between total and dissolved sample fractions (metals only; Appendix Table A.1), suggesting no widespread contamination from the bottle, bottle caps, or preservative or through the transport of the samples.

Field blank samples were assessed a total of eight times during the 2020 CREMP, including two during the winter lake monitoring event, one during the spring stream monitoring event, two during the summer lake/stream monitoring event, and three during the fall lake/stream monitoring event. Of the 678 determinations made, 32 (4.7%) resulted in analyte detections above the DQO of less than five-times the laboratory LRL (Appendix Table A.2). The majority of these exceedances were from a single sample collected during the fall lake/stream monitoring event (JLO-01-S02), which had 26 of the 32 detections above the DQO (Appendix Table A.2). Overall, with the exception of the fall lake/stream sample (JLO-01-S02), frequency of detected parameter concentrations in field blanks was low, no pervasive contamination of samples resulting from the handling technique or through exposure to the atmosphere was suggested by the field blank analyses.

Equipment blank samples were collected a total of six times during the 2020 CREMP, including two during the winter lake monitoring event, two during the summer lake monitoring event, and three during the fall lake monitoring event. Of the 503 determinations conducted, 3 (0.60%) resulted in analyte detection above the DQO of less than five-times the laboratory LRL (Appendix Table A.3). Due to the infrequency of detected parameter concentrations in field equipment blanks, minimal cross contamination of samples likely occurred in the field due to the use of the sampling device itself and/or the field sampling procedures.

Table A.1: Water Sample Trip Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2020

Client Sample ID		Lowest LRL[a]	DL0-02-04-S03	DL0-01-02-S03	G0-09-A03	BLO-01-A-B03	REF3-02-S03	GO-0303	BLO-05-B-B03	REF3-01-B03	E0-2103
Date Sampled			14-Apr-2020	17-Apr-2020	4-Jul-2020	30-Jul-2020	2-Aug-2020	2-Aug-2020	28-Aug-2020	29-Aug-2020	28-Aug-2020
Time Sampled			13:40	10:15	11:35	11:00	10:00	10:15	14:20	10:05	11:28
ALS Sample ID			L2436713-2	L2438141-2	L2470180-26	L2482114-7	L2482822-8	L2482823-2	L2496051-11	L2496136-7	L2496071-15
	Units										
Physical Tests											
Conductivity	umhos/cm	3	<3.0	<3.0	<3.0	7.2	7.9	<3.0	<3.0	<3.0	<3.0
Hardness (as $CaCO_3$)	mg/L	0.500	<0.50	<0.50	<0.50	1.58	1.48	<0.50	<0.50	<0.50	<0.50
Total Suspended Solids	mg/L	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Dissolved Solids	mg/L	10.0	<10	13	74	18	<10	<10	<10	11	<10
Turbidity	NTU	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients (Water)											
Alkalinity, Total (as $CaCO_3$)	mg/L	10.0	<10	<10	<10	2.9	<10	<10	<10	<10	<10
Ammonia, Total (as N)	mg/L	0.0100	<0.010	<0.010	0.012	<0.0050	<0.010	<0.010	<0.010	0.026	0.014
Bromide (Br)	mg/L	0.100	<0.10	<0.10	<0.10	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	<0.50	0.64	0.68	<0.50	<0.50	<0.50	<0.50
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	<0.021		0.03	<0.021	<0.021	<0.021	<0.021
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	0.0319	0.030	<0.020	<0.020	<0.020	<0.020
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	<0.0050	<0.0010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	<0.15	<0.050	<0.15	<0.15	<0.15	<0.15	<0.15
Phosphorus, Total	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0020	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Sulfate (SO_4)	mg/L	0.300	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	1.62	1.24	0.68	<0.50	<0.50	1.00	<0.50	0.54	0.95
Total Organic Carbon	mg/L	0.500	1.18	2.98	1.46	<0.50	1.55	1.61	1.00	1.01	1.07
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0034	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	0.000156	<0.000050	<0.000050	0.00015	0.000155	0.000086	<0.000050	<0.000050	<0.000050
Beryllium (Be)	mg/L	0.000100	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	0.105	<0.050	<0.050	0.308	0.305	<0.050	<0.050	<0.050	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.010	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	0.199	0.187	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	0.000120	<0.000070	<0.000070	<0.00010	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)	mg/L	0.0000500	0.000139	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.0500	<0.20	<0.20	<0.20	0.199	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	0.857	0.752	<0.050	<0.050	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	0.00028	0.00026	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.00030	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	0.0011	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	0.00016	0.000142	<0.000050	0.000079	<0.000050	<0.000050
Beryllium (Be)	mg/L	0.000100	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	0.058	<0.050	<0.050	0.315	0.292	<0.050	<0.050	<0.050	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00020	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.010	<0.030	<0.030	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	0.192	0.183	<0.050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.00010	<0.000070	<0.000070	<0.000070	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.0500	<0.20	<0.20	<0.20	0.199	<0.20	<0.20	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	0.062	<0.10	<0.10	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	0.829	0.763	<0.050	<0.050	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	0.00027	0.00029	<0.00010	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.00030	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000013
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	0.0012	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	<0.0010	0.0022	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	0.0012	0.0033
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	<0.10	<0.10	<0.10	0.11	0.22	0.24	<0.10	<0.10	0.11
Phaeophytin a	µg/L	0.200	0.22	0.24	0.26	0.40	0.92	0.99	0.43	0.28	0.50

(shaded) Parameter concentration did not meet the data quality objective of ≤ 5x the LRL.

Note: LRL = Laboratory Reporting Limit.

[a] For some analytes, a range of LRLs were achieved in different laboratory reports. Each blank was compared to the LRL applicable to that sample.

Table A.2: Water Sample Field Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2020

Parameter	Units	Lowest LRL[a]	DL0-02-03-S02	BL0-01-S02	L1-08-02	JLO-02-S02	DLO-02-08-S02	JLO-01-S02	DLO-01-04-S02	L1-0902
			15-Apr-2020	19-Apr-2020	4-Jul-2020	29-Jul-2020	28-Jul-2020	30-Aug-2020	27-Aug-2020	30-Aug-2020
			9:45	10:20	9:45	13:30	11:40	9:30	10:00	8:25
			L2437255-2	L2438194-2	L2470180-22	L2481531-2	L2480819-19	L2496168-1	L2495475-5	L2496202-3
Physical Tests	**Units**									
Conductivity	umhos/cm	3	<3.0	<3.0	<3.0	5.5	<2.0	155	<3.0	<3.0
Hardness (as $CaCO_3$)	mg/L	10.0	<0.50	<0.50	<0.50	1.43	0.83	78.7	<0.50	<0.50
pH	pH units	-	6.67	5.91	6.75	6.55	6.59	8.09	6.06	6.38
Total Suspended Solids	mg/L	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Dissolved Solids	mg/L	20.0	20	13	43	12	<10	171	<10	74
Turbidity	NTU	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	0.27	<0.10	<0.10
Anions and Nutrients (Water)										
Alkalinity, Total (as $CaCO_3$)	mg/L	10.0	<10	<10	<10	2.7	1.4	70	<10	<10
Ammonia, Total (as N)	mg/L	0.0200	<0.010	<0.010	<0.010	<0.0050	<0.0050	<0.010	<0.010	<0.010
Bromide (Br)	mg/L	0.100	<0.10	<0.10	<0.10	<0.050	<0.050	<0.10	<0.10	<0.10
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	<0.50	<0.50	<0.50	4.87	<0.50	<0.50
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021	<0.021			0.032	<0.021	<0.021
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	<0.020	0.0226	<0.0050	0.032	<0.020	<0.020
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	<0.0050	<0.0010	<0.0010	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	<0.15	<0.050	<0.050	<0.15	<0.15	<0.15
Phosphorus, Total	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0020	<0.0020	<0.0030	<0.0030	<0.0030
Sulfate (SO_4)	mg/L	0.300	<0.30	<0.30	<0.30	<0.30	<0.30	4.76	<0.30	<0.30
Organic / Inorganic Carbon (Water)										
Dissolved Organic Carbon	mg/L	0.500	0.88	1.23	<0.50	<0.50	<0.50	2.5	<0.50	0.89
Total Organic Carbon	mg/L	0.500	1.06	2.69	1.30	0.57	<0.50	3.23	0.89	1.09
Total Metals (Water)										
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0049	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	0.00015	0.00017	0.00742	0.000103	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	<0.050	<0.050	0.286	0.207	15.3	<0.050	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00088	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.010	<0.010	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	0.172	0.0904	9.45	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.00010	<0.00010	0.00121	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000397	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00059	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	0.125	<0.050	1.31	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	0.35	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	0.553	0.096	2.11	<0.050	<0.050
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	0.00024	<0.00020	0.0111	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.00030	<0.00030	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00133	<0.000010	0.000013
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals (Water)										
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0010	<0.0010	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	0.00015	<0.00010	0.00763	0.000093	<0.000050
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	<0.050	<0.050	0.294	0.185	15.5	<0.050	0.108
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00020	<0.00020	0.00087	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.030	<0.010	<0.010	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.050	0.170	0.0891	9.73	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.000070	<0.00010	<0.00010	0.000151	<0.000070	<0.000070
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00039	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00061	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.20	0.130	<0.050	1.33	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.050	<0.050	0.34	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	0.551	0.112	2.24	<0.050	0.062
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	0.00026	0.00022	0.0111	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.00030	<0.00030	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.00133	<0.000010	0.000014
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0010	<0.0010	<0.0030	<0.0030	<0.0030
Aggregate Organics (Water)										
Phenols (4AAP)	mg/L	0.00100	<0.0010	0.0028	<0.0010	0.0037	0.0024	<0.0010	<0.0010	<0.0010
Plant Pigments (Water)										
Chlorophyll a	ug/L	0.100	<0.10	<0.10	<0.10	0.13	0.29	1.45	0.12	<0.10
Phaeophytin a	ug/L	0.200	0.22	0.23	0.26	0.50	1.30	1.01	0.52	0.28

[grey shading] Parameter concentration did not meet the data quality objective of≤ 5x the LRL.

Note: LRL = Laboratory Reporting Limit.

[a] For some analytes, a range of LRLs were achieved in different laboratory reports. Each blank was compared to the LRL applicable to that sample.

Table A.3: Water Sample Equipment Blank Results with Reference to Data Quality Objectives, Mary River CREMP, 2020

Client Sample ID		Lowest LRL[a]	JL0-0204	BL0-05-A04	DD-HAB9-STN-1-S04	REF3-03-B04	JLO-02-B04	DLO-02-04-S04
Date Sampled			12-Apr-2020	21-Apr-2020	28-Jul-2020	2-Aug-2020	30-Aug-2020	26-Aug-2020
ALS Sample ID			L2436314-1	L2439027-7	L2480819-14	L2482822-7	L2496168-12	L2494774-12
	Units							
Physical Tests								
Conductivity	umhos/cm	3	<3.0	<3.0	<2.0	<3.0	<3.0	<3.0
Hardness (as $CaCO_3$)	mg/L	10.0	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Total Suspended Solids	mg/L	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Dissolved Solids	mg/L	20.0	<10	25	<10	<10	81	<10
Turbidity	NTU	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Anions and Nutrients (Water)								
Alkalinity, Total (as $CaCO_3$)	mg/L	10.0	<10	<10	<1.0	<10	<10	<10
Ammonia, Total (as N)	mg/L	0.0200	<0.010	<0.010	<0.0050	<0.010	<0.010	<0.010
Bromide (Br)	mg/L	0.100	<0.10	<0.10	<0.050	<0.10	<0.10	<0.10
Chloride (Cl)	mg/L	0.500	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Nitrate and Nitrite as N	mg/L	0.0210	<0.021	<0.021		<0.021	<0.021	0.099
Nitrate (as N)	mg/L	0.0200	<0.020	<0.020	<0.0050	<0.020	<0.020	0.099
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	<0.0010	<0.0050	<0.0050	<0.0050
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	<0.15	<0.050	<0.15	<0.15	<0.15
Phosphorus, Total	mg/L	0.00300	<0.0030	<0.0030	<0.0020	<0.0030	0.004	0.003
Sulfate (SO_4)	mg/L	0.300	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Organic / Inorganic Carbon (Water)								
Dissolved Organic Carbon	mg/L	0.500	<0.50	1.25	<0.50	0.54	0.50	0.56
Total Organic Carbon	mg/L	0.500	<0.50	2.49	<0.50	2.16	1.22	0.92
Total Metals (Water)								
Aluminum (Al)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	<0.000050	<0.00010	<0.000050	0.000062	0.00164
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.000050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	0.076	<0.050
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.010	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.0050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	<0.000070	<0.00010	<0.000070	<0.000070	0.000113
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.050	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	<0.050	<0.050	<0.050	0.117	0.109
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	0.00011
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.000010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.00030	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals (Water)								
Aluminum (Al)	mg/L	0.00300	<0.0030	0.0031	<0.0010	<0.0030	<0.0030	<0.0030
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Barium (Ba)	mg/L	0.0000500	<0.000050	0.0000950	<0.00010	0.000051	0.000070	0.000078
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	<0.000050	<0.00050	<0.00050	<0.00050
Boron (B)	mg/L	0.0100	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010
Calcium (Ca)	mg/L	0.0500	<0.050	<0.050	<0.050	0.061	0.067	0.051
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Copper (Cu)	mg/L	0.000500	<0.00050	<0.00050	<0.00020	<0.00050	<0.00050	<0.00050
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	<0.010	<0.030	<0.030	<0.030
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Lithium (Li)	mg/L	0.00100	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Magnesium (Mg)	mg/L	0.0500	<0.050	<0.050	<0.0050	<0.050	<0.050	<0.050
Manganese (Mn)	mg/L	0.0000700	<0.000070	0.000074	<0.00010	<0.000070	<0.000070	0.000106
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
Molybdenum (Mo)	mg/L	0.0000500	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
Nickel (Ni)	mg/L	0.000500	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Potassium (K)	mg/L	0.200	<0.20	<0.20	<0.050	<0.20	<0.20	<0.20
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010
Silicon (Si)	mg/L	0.100	<0.10	<0.10	<0.050	<0.10	<0.10	<0.10
Silver (Ag)	mg/L	0.0000100	<0.000010	0.000019	<0.000010	<0.000010	<0.000010	<0.000010
Sodium (Na)	mg/L	0.0500	<0.050	0.061	<0.050	<0.050	0.124	0.110
Strontium (Sr)	mg/L	0.000100	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	<0.000010	<0.00010	<0.00010	<0.00010
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	<0.00030	<0.010	<0.010	<0.010
Uranium (U)	mg/L	0.0000100	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.0010
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	<0.0010	<0.0030	<0.0030	<0.0030
Aggregate Organics (Water)								
Phenols (4AAP)	mg/L	0.00100	<0.0010	0.0023	0.0018	0.0012	<0.0010	<0.0010
Plant Pigments (Water)								
Chlorophyll a	µg/L	0.100	<0.10	<0.10	1.72	0.23	<0.10	<0.10
Phaeophytin a	µg/L	0.200	0.14	0.31	1.15	0.99	0.26	0.22

[shaded box] Parameter did not meet the data quality objective of ≤ 5x the RDL.

Note: LDL = Laboratory Reporting Limit.

[a] For some analytes, a range of LRLs were achieved in different laboratory reports. Each blank was compared to the LRL applicable to that sample.

A2.1.2 Precision – Field Duplicates

In total, eight field duplicates were collected over the course of the 2020 CREMP water quality monitoring, including two during the winter lake monitoring event, one during the spring stream monitoring event, three during the summer stream/lake monitoring event, and two during the fall stream/lake monitoring event. In general, close agreement in parameter concentrations was observed between duplicate samples, with 94% of field duplicate analyte pairs meeting the water quality field duplicate DQO of ≤25% Relative Percent Difference (RPD) in parameter concentrations of the 608 duplicate analyses conducted (Appendix Table A.4). Total phosphorus, total lead, dissolved aluminum, and chlorophyll a were the key parameters that most frequently did not meet the DQO between duplicate samples (Appendix Table A.4). In some cases in which DQO were not met, measured concentrations in one or both duplicate samples were close to the LRL (i.e., two- to three-times the LRL) such that small differences in concentrations between duplicate samples resulted in relatively high RPD. No seasonal patterns were suggested for those duplicate samples in which concentrations in duplicate samples failed to achieve the DQO, suggesting no consistent methodological issues. Overall, in the majority of cases, and for key parameters of concern, the RPD in analyte concentrations was sufficiently low as to not affect interpretation of the data.

A2.2 Benthic Invertebrate Community Samples

A2.2.1 Subsampling Accuracy

Sub-sampling of benthic invertebrate community samples was conducted on 25 of 63 stream samples (40%) and 50 of 50 lake samples (100%; total of 66% for the 2020 project). The sorted fraction for these samples was mainly 100% (whole; 77% of all samples) and 50% (half; 23% of all samples) of the sample material evaluated (average of 89%; Appendix Table A.5a,b). Sub-sampling error estimates indicated that, on average, precision and accuracy of the sub-sampled benthic invertebrate community samples met the DQO of ≤ 20% (Appendix Table A.6a,b). This indicated that precision and accuracy for sub-sampling of the benthic invertebrate community samples was acceptable.

A2.2.2 Organism Recovery

Sorting efficiency (i.e., percent recovery) of benthic invertebrate samples was high, averaging 97% for lotic samples (6 samples) and 99% for lentic samples (5 samples; Appendix Tables A.7a,b). Sorting efficiency for these samples achieved the DQO of ≥ 90% recovery, and therefore the benthic invertebrate community sample recovery was considered acceptable.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2020

Sample ID	Units	LRL	JL0-07-S	JL0-07-S01	RPD	JL0-02-S	JL0-02-S01	RPD	F0-01	F0-0101	RPD
Date Sampled			13-Apr-2020	13-Apr-2020		12-Apr-2020	12-Apr-2020		3-Jul-2020	3-Jul-2020	
ALS Sample ID			L2436315-5	L2436315-6		L2436314-2	L2436314-3		L2470180-16	L2470180-17	
Conductivity	umhos/cm	3	176	176	0	186	188	1.1	108	107	0.93
Hardness (as $CaCO_3$)	mg/L	10.0	96	96.3	0.31	102	103	1.0	49.9	48.2	3.5
pH	pH units	0.100	7.82	7.82	0	7.90	7.91	0	7.89	7.95	0.76
Total Suspended Solids	mg/L	2	<2.0	<2.0	-	<2.0	<2.0	-	9.8	9.7	1.0
Total Dissolved Solids	mg/L	20.0	128	113	12	93	81	14	90	99	10
Turbidity	NTU	0.100	0.14	0.12	15	0.13	0.19	38	2.19	2.49	13
Anions and Nutrients (Water)											
Alkalinity, Total (as $CaCO_3$)	mg/L	10.0	79	80	1.3	84	84	0	39	39	0
Ammonia, Total (as N)	mg/L	0.0200	0.020	0.021	4.9	0.042	0.020	71	<0.010	<0.010	-
Bromide (Br)	mg/L	0.100	<0.10	<0.10	-	<0.10	<0.10	-	<0.10	<0.10	-
Chloride (Cl)	mg/L	0.500	5.39	5.51	2.2	5.73	5.72	0.17	1.34	1.47	9.3
Nitrate and Nitrite as N	mg/L	0.0210	0.031	0.034	9.2	0.096	0.03	105	0.187	0.285	42
Nitrate (as N)	mg/L	0.0200	0.031	0.034	9.2	0.096	0.030	105	0.187	0.285	42
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	-	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Total Kjeldahl Nitrogen	mg/L	0.150	0.17	0.27	45	<0.15	<0.15	-	<0.15	<0.15	-
Phosphorus, Total	mg/L	0.00300	0.0043	0.0035	21	0.0092	0.0036	88	0.0377	0.0261	36
Sulfate (SO_4)	mg/L	0.300	5.01	5.02	0	5.53	5.31	4.1	11.8	11.7	1
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	2.24	2.20	1.8	2.20	2.61	17	2.12	1.90	11
Total Organic Carbon	mg/L	0.500	2.64	2.66	0.75	3.00	2.77	8.0	2.94	2.72	7.8
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0539	0.0060	160	0.0183	0.0157	15	0.170	0.168	1.2
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Barium (Ba)	mg/L	0.0000500	0.00904	0.00906	0.22	0.00918	0.00890	3.1	0.00544	0.00556	2.2
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Boron (B)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Cadmium (Cd)	mg/L	0.0000100	0.000016	<0.000010	46	0.000017	<0.000010	52	<0.000010	<0.000010	-
Calcium (Ca)	mg/L	0.0500	19.1	18.4	3.7	19.7	19.3	2.1	9.35	9.13	2.4
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	0.00016	0.00014	13
Copper (Cu)	mg/L	0.000500	0.00195	0.00113	53	0.00142	0.00118	18	0.00051	0.00052	1.9
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	-	<0.030	<0.030	-	0.202	0.202	0
Lead (Pb)	mg/L	0.0000500	0.000091	<0.000050	58	0.000108	0.000053	68	0.000212	0.000159	29
Lithium (Li)	mg/L	0.00100	0.0019	0.0016	17	0.0016	0.0016	0	<0.0010	<0.0010	-
Magnesium (Mg)	mg/L	0.0500	11.8	11.9	0.84	12.4	12.2	2	6.67	6.59	1.2
Manganese (Mn)	mg/L	0.0000700	0.00123	0.000262	130	0.000479	0.000304	45	0.00905	0.00911	0.66
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum (Mo)	mg/L	0.0000500	0.000584	0.000459	24	0.000505	0.000476	5.9	0.000099	0.000110	11
Nickel (Ni)	mg/L	0.000500	0.00098	0.00078	23	0.00087	0.00081	7.1	<0.00050	<0.00050	-
Potassium (K)	mg/L	0.200	1.57	1.53	2.6	1.61	1.57	2.5	0.65	0.64	1.6
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Silicon (Si)	mg/L	0.100	0.43	0.40	7.2	0.42	0.42	0	0.64	0.66	3.1
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium (Na)	mg/L	0.0500	2.64	2.47	6.7	2.56	2.53	1.2	0.439	0.419	4.7
Strontium (Sr)	mg/L	0.000100	0.0153	0.0147	4.0	0.0156	0.0153	1.9	0.00994	0.00933	6.3
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Tin (Sn)	mg/L	0.000100	0.00014	<0.00010	33	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-	0.011	0.011	0
Uranium (U)	mg/L	0.0000100	0.00132	0.00129	2.3	0.00134	0.00133	0.7	0.000349	0.000331	5.3
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Zinc (Zn)	mg/L	0.00300	0.0304	<0.0030	164	0.0032	<0.0030	6.5	<0.0030	<0.0030	-
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	<0.0030	0.0048	46	0.0033	0.0031	6	0.0099	0.0088	12
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Barium (Ba)	mg/L	0.0000500	0.00879	0.00883	0.45	0.00931	0.00941	1.1	0.00405	0.00391	3.5
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Boron (B)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Calcium (Ca)	mg/L	0.0500	18.4	19.1	3.7	19.7	20.1	2.0	9.23	8.95	3.1
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper (Cu)	mg/L	0.000500	0.00108	0.00115	6.3	0.00117	0.00109	7.1	<0.00050	<0.00050	-
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	-	<0.030	<0.030	-	<0.030	<0.030	-
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Lithium (Li)	mg/L	0.00100	0.0019	0.0019	0	0.0018	0.0019	5.4	<0.0010	<0.0010	-
Magnesium (Mg)	mg/L	0.0500	12.1	11.8	2.5	12.8	12.9	0.78	6.51	6.27	3.8
Manganese (Mn)	mg/L	0.0000700	0.000143	0.000175	20	0.000222	0.000206	7.5	0.00240	0.00242	0.83
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum (Mo)	mg/L	0.0000500	0.000474	0.000497	4.7	0.000478	0.000487	1.9	0.000111	0.000118	6.1
Nickel (Ni)	mg/L	0.000500	0.00072	0.00077	6.7	0.00082	0.00079	3.7	<0.00050	<0.00050	-
Potassium (K)	mg/L	0.200	1.54	1.54	0	1.65	1.64	0.61	0.57	0.55	3.6
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Silicon (Si)	mg/L	0.100	0.42	0.42	0	0.43	0.44	2.3	0.420	0.400	4.9
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium (Na)	mg/L	0.0500	2.43	2.50	2.8	2.60	2.62	0.8	0.433	0.412	5.0
Strontium (Sr)	mg/L	0.000100	0.0150	0.0149	0.67	0.0154	0.0157	1.9	0.00971	0.00910	6.5
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Uranium (U)	mg/L	0.0000100	0.00130	0.00129	0.77	0.00140	0.00141	0.7	0.000309	0.000306	1.0
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Zinc (Zn)	mg/L	0.00300	<0.0030	0.0035	-	<0.0030	<0.0030	-	<0.0030	<0.0030	-
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	<0.0010	<0.0010	-	0.0115	<0.0010	-	<0.0010	<0.0010	-
Plant Pigments (Water)											
Chlorophyll a	μg/L	0.100	0.59	0.55	7.0	1.37	1.99	37	0.29	0.32	9.8
Phaeophytin a	μg/L	0.100	0.54	0.49	9.7	0.68	0.94	32	0.34	0.35	2.9

(shaded) Values exceeding the DQO of ≤ 25% RPD.

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. LDL = Laboratory Detection Limit, RPD = Relative Percent Difference, DQO = Data Quality Objective.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2020

Sample ID	Units	LRL	DLO-02-03-S	DLO-02-03-S01	RPD	BLO-03-S	BLO-03-S01	RPD	FO-01	FO-0101	RPD
Date Sampled			28-Jul-2020	28-Jul-2020		31-Jul-2020	31-Jul-2020		1-Aug-2020	1-Aug-2020	
ALS Sample ID			L2480819-5	L2480819-3		L2482716-1	L2482716-2		L2482803-5	L2482803-6	
Conductivity	umhos/cm	3	131	132	0.76	78.0	77.7	0.39	345	347	0.58
Hardness (as $CaCO_3$)	mg/L	10.0	63.1	63.1	0	35.3	33.9	4.0	166	164	1.2
pH	pH units	0.100	8.24	8.21	0	7.89	7.82	0.89	8.30	8.30	0
Total Suspended Solids	mg/L	2	<2.0	<2.0	-	<2.0	<2.0	-	<2.0	<2.0	-
Total Dissolved Solids	mg/L	20.0	69	76	10	46	43	6.7	190	195	2.6
Turbidity	NTU	0.100	0.72	0.81	12	1.13	1.15	1.8	0.41	0.40	2.5
Anions and Nutrients (Water)											
Alkalinity, Total (as $CaCO_3$)	mg/L	10.0	50.6	49.7	1.8	44	43	2.3	122	121	0.82
Ammonia, Total (as N)	mg/L	0.0200	<0.0050	<0.0050	-	<0.010	<0.010	-	<0.010	<0.010	-
Bromide (Br)	mg/L	0.100	<0.050	<0.050	-	<0.10	<0.10	-	<0.10	<0.10	-
Chloride (Cl)	mg/L	0.500	3.36	3.36	0	2.59	2.56	1.2	13.7	13.7	0
Nitrate and Nitrite as N	mg/L	0.0210	-	-	-	<0.021	<0.021	-	0.714	0.715	0
Nitrate (as N)	mg/L	0.0200	0.0781	0.0788	0.89	<0.020	<0.020	-	0.714	0.715	0
Nitrite (as N)	mg/L	0.00500	0.0014	0.0024	53	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Total Kjeldahl Nitrogen	mg/L	0.150	0.126	0.125	0.80	<0.15	<0.15	-	0.32	0.40	22
Phosphorus, Total	mg/L	0.00300	0.0085	0.0043	66	0.0032	0.0048	40	<0.0030	<0.0030	-
Sulfate (SO_4)	mg/L	0.300	9.66	9.68	0	1.60	1.65	3.1	36.0	36.0	0
Organic / Inorganic Carbon (Water)											
Dissolved Organic Carbon	mg/L	0.500	1.56	1.67	6.8	2.36	2.57	8.5	1.69	1.73	2.3
Total Organic Carbon	mg/L	0.500	1.79	1.62	10	2.02	3.02	40	2.74	2.83	3.2
Total Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0192	0.0194	1.0	0.0391	0.0266	38	0.0337	0.0348	3.2
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Barium (Ba)	mg/L	0.0000500	0.00650	0.00648	0	0.00465	0.00435	6.7	0.0165	0.0157	5.0
Beryllium (Be)	mg/L	0.000500	<0.00010	<0.00010	-	<0.00050	<0.00050	-	<0.00010	<0.00010	-
Bismuth (Bi)	mg/L	0.000500	<0.000050	<0.000050	-	<0.00050	<0.00050	-	<0.000050	<0.000050	-
Boron (B)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-	<0.010	<0.010	-
Cadmium (Cd)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.000010	<0.000010	-	<0.0000050	<0.0000050	-
Calcium (Ca)	mg/L	0.0500	11.7	11.5	1.7	7.01	6.95	0.86	29.4	29.0	1.4
Chromium (Cr)	mg/L	0.000500	0.00012	0.00010	18	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper (Cu)	mg/L	0.000500	0.00077	0.00075	2.6	0.00060	0.00058	3.4	<0.0010	<0.0010	-
Iron (Fe)	mg/L	0.0300	0.023	0.024	4.3	0.041	0.036	13	0.028	0.030	6.9
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Lithium (Li)	mg/L	0.00100	0.0011	0.0011	0	<0.0010	<0.0010	-	0.0026	0.0027	3.8
Magnesium (Mg)	mg/L	0.0500	7.04	6.81	3.3	4.40	4.25	3.5	21.4	20.5	4.3
Manganese (Mn)	mg/L	0.0000700	0.00335	0.00337	0.60	0.00184	0.00172	6.7	0.00103	0.00100	3.0
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum (Mo)	mg/L	0.0000500	0.000662	0.000657	0.76	0.000114	0.000125	9.2	0.000491	0.000486	1.0
Nickel (Ni)	mg/L	0.000500	0.00063	0.00063	0	<0.00050	<0.00050	-	0.00057	0.00051	11
Potassium (K)	mg/L	0.200	1.04	1.01	2.9	0.58	0.55	5.3	1.81	1.75	3.4
Selenium (Se)	mg/L	0.00100	<0.000050	<0.000050	-	<0.0010	<0.0010	-	0.000070	0.000063	11
Silicon (Si)	mg/L	0.100	0.48	0.48	0	0.45	0.41	9.3	1.00	1.05	4.9
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000050	<0.000050	-
Sodium (Na)	mg/L	0.0500	1.40	1.36	2.9	1.34	1.24	7.8	3.23	3.09	4.4
Strontium (Sr)	mg/L	0.000100	0.00897	0.00876	2.4	0.00584	0.00591	1.2	0.0414	0.0408	1.5
Thallium (Tl)	mg/L	0.000100	<0.000010	<0.000010	-	<0.00010	<0.00010	-	<0.000010	<0.000010	-
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium (Ti)	mg/L	0.0100	0.00081	0.00091	12	<0.010	<0.010	-	0.00167	0.00185	10
Uranium (U)	mg/L	0.0000100	0.000931	0.00096	2.5	0.000642	0.000637	0.78	0.00369	0.00358	3.0
Vanadium (V)	mg/L	0.00100	<0.00050	<0.00050	-	<0.0010	<0.0010	-	<0.00050	<0.00050	-
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	-	<0.0030	<0.0030	-	<0.0030	0.0059	65
Dissolved Metals (Water)											
Aluminum (Al)	mg/L	0.00300	0.0091	0.0057	46	0.0111	0.0090	21	0.0067	0.0063	6.2
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Barium (Ba)	mg/L	0.0000500	0.00677	0.00666	1.6	0.00444	0.00405	9.2	0.0168	0.0164	2.4
Beryllium (Be)	mg/L	0.000500	<0.00010	<0.00010	-	<0.00050	<0.00050	-	<0.00010	<0.00010	-
Bismuth (Bi)	mg/L	0.000500	<0.000050	<0.000050	-	<0.00050	<0.00050	-	<0.000050	<0.000050	-
Boron (B)	mg/L	0.0100	0.010	0.011	10	<0.010	<0.010	-	<0.010	<0.010	-
Cadmium (Cd)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.000010	<0.000010	-	<0.0000050	<0.0000050	-
Calcium (Ca)	mg/L	0.0500	12.0	12.1	0.83	6.71	6.91	2.9	30.8	31.0	0.65
Chromium (Cr)	mg/L	0.000500	<0.00010	<0.00010	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper (Cu)	mg/L	0.000500	0.00072	0.00071	1.4	0.00058	0.00052	11	0.00100	0.00094	6.2
Iron (Fe)	mg/L	0.0300	<0.010	<0.010	-	<0.030	<0.030	-	<0.010	<0.010	-
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Lithium (Li)	mg/L	0.00100	0.0010	0.0011	10	<0.0010	<0.0010	-	0.0032	0.0035	9.0
Magnesium (Mg)	mg/L	0.0500	8.06	7.96	1.2	4.51	4.04	11	21.6	21.1	2.3
Manganese (Mn)	mg/L	0.0000700	0.00056	0.00055	1.8	0.000416	0.000342	20	<0.00050	<0.00050	-
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum (Mo)	mg/L	0.0000500	0.000593	0.000599	1.0	0.000109	0.000113	3.6	0.000561	0.000562	0.18
Nickel (Ni)	mg/L	0.000500	0.00051	<0.00050	2.0	<0.00050	<0.00050	-	0.00054	0.00051	5.7
Potassium (K)	mg/L	0.200	1.07	1.06	0.94	0.63	0.52	19	1.83	1.78	2.8
Selenium (Se)	mg/L	0.00100	<0.000050	<0.000050	-	<0.0010	<0.0010	-	0.000082	0.000079	3.7
Silicon (Si)	mg/L	0.100	0.407	0.415	1.9	0.39	0.39	0	1.10	1.10	0
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000050	<0.000050	-
Sodium (Na)	mg/L	0.0500	1.55	1.48	4.6	1.36	1.21	12	3.32	3.21	3.4
Strontium (Sr)	mg/L	0.000100	0.00850	0.00860	1.2	0.00562	0.00566	0.71	0.0430	0.0439	2.1
Thallium (Tl)	mg/L	0.000100	<0.000010	<0.000010	-	<0.00010	<0.00010	-	0.000010	<0.000010	-
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium (Ti)	mg/L	0.0100	<0.00030	<0.00030	-	<0.010	<0.010	-	<0.00030	<0.00030	-
Uranium (U)	mg/L	0.0000100	0.000904	0.000885	2.1	0.000583	0.000604	3.5	0.00373	0.00371	0.54
Vanadium (V)	mg/L	0.00100	<0.00050	<0.00050	-	<0.0010	<0.0010	-	<0.00050	<0.00050	-
Zinc (Zn)	mg/L	0.00300	<0.0010	<0.0010	-	<0.0030	<0.0030	-	<0.0010	<0.0010	-
Aggregate Organics (Water)											
Phenols (4AAP)	mg/L	0.00100	0.0022	0.0025	13	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Plant Pigments (Water)											
Chlorophyll a	µg/L	0.100	1.60	2.56	46	1.69	2.18	25	0.41	0.43	4.8
Phaeophytin a	µg/L	0.100	1.93	2.37	20	1.48	1.68	13	1.02	1.05	2.9

[shaded] Values exceeding the DQO of ≤ 25% RPD.

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. LDL = Laboratory Detection Limit, RPD = Relative Percent Difference, DQO = Data Quality Objective.

Figure A.4: Water Sample Field Duplicate Results with Reference to the Data Quality Objective, Mary River CREMP, 2020

Sample ID	Units	LRL	DLO-02-06-B	DLO-02-06-B01	RPD	BLO-01B-S	BLO-01B-S01	RPD
Date Sampled			26-Aug-2020	26-Aug-2020		27-Aug-2020	27-Aug-2020	
ALS Sample ID			L2494774-6	L2494774-7		L2495476-3	L2495476-5	
Conductivity	umhos/cm	3	142	141	0.71	217	229	5.4
Hardness (as $CaCO_3$)	mg/L	10.0	68.7	67.5	1.8	106	105	0.95
pH	pH units	0.100	8.03	8.01	0.25	8.18	8.22	0.49
Total Suspended Solids	mg/L	2	2.6	<2.0	26	<2.0	<2.0	-
Total Dissolved Solids	mg/L	20.0	75	75	0	129	133	3.1
Turbidity	NTU	0.100	2.16	2.27	5.0	0.67	0.77	14
Anions and Nutrients (Water)								
Alkalinity, Total (as $CaCO_3$)	mg/L	10.0	56	57	1.8	96	98	2.1
Ammonia, Total (as N)	mg/L	0.0200	0.011	0.011	0	<0.010	0.028	95
Bromide (Br)	mg/L	0.100	<0.10	<0.10	-	<0.10	<0.10	-
Chloride (Cl)	mg/L	0.500	3.92	3.93	0.25	9.51	9.48	0.32
Nitrate and Nitrite as N	mg/L	0.0210	0.079	0.082	3.7	0.037	0.038	2.7
Nitrate (as N)	mg/L	0.0200	0.079	0.082	3.7	0.037	0.038	2.7
Nitrite (as N)	mg/L	0.00500	<0.0050	<0.0050	-	<0.0050	<0.0050	-
Total Kjeldahl Nitrogen	mg/L	0.150	<0.15	0.19	24	0.17	0.19	11
Phosphorus, Total	mg/L	0.00300	0.0079	0.0063	23	0.0066	0.0116	55
Sulfate (SO_4)	mg/L	0.300	9.76	9.79	0	4.02	4.05	0.74
Organic / Inorganic Carbon (Water)								
Dissolved Organic Carbon	mg/L	0.500	2.53	2.07	20	2.35	2.36	0
Total Organic Carbon	mg/L	0.500	2.41	2.44	1.2	24.8	2.88	158
Total Metals (Water)								
Aluminum (Al)	mg/L	0.00300	0.0585	0.0594	1.5	0.0178	0.0200	12
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Barium (Ba)	mg/L	0.0000500	0.00767	0.00775	1.0	0.0107	0.0111	3.7
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Boron (B)	mg/L	0.0100	0.012	0.013	8.0	<0.010	<0.010	-
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Calcium (Ca)	mg/L	0.0500	13.5	13.5	0	21.2	22.0	3.7
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper (Cu)	mg/L	0.000500	0.000820	0.000800	2.5	0.00097	0.00098	1.0
Iron (Fe)	mg/L	0.0300	0.0610	0.0610	0	<0.030	<0.030	-
Lead (Pb)	mg/L	0.0000500	0.0000550	0.0000510	7.5	<0.000050	<0.000050	-
Lithium (Li)	mg/L	0.00100	0.0014	0.0015	6.9	0.0013	0.0014	7.4
Magnesium (Mg)	mg/L	0.0500	8.35	8.53	2.1	12.5	12.7	1.6
Manganese (Mn)	mg/L	0.0000700	0.00345	0.00328	5.1	0.00238	0.00237	0.42
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum (Mo)	mg/L	0.0000500	0.000645	0.000647	0.31	0.000317	0.000316	0.32
Nickel (Ni)	mg/L	0.000500	0.00060	0.00064	6.5	<0.00050	0.00052	3.9
Potassium (K)	mg/L	0.200	1.15	1.16	0.87	1.15	1.16	0.87
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Silicon (Si)	mg/L	0.100	0.49	0.51	4.0	0.74	0.71	4.1
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium (Na)	mg/L	0.0500	1.75	1.71	2.3	4.38	4.35	0.69
Strontium (Sr)	mg/L	0.000100	0.0101	0.0103	2.0	0.0166	0.0168	1.2
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-
Uranium (U)	mg/L	0.0000100	0.00121	0.00119	1.7	0.00348	0.00345	0.87
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	-	<0.0030	<0.0030	-
Dissolved Metals (Water)								
Aluminum (Al)	mg/L	0.00300	0.0132	0.0105	23	0.0045	0.0071	45
Antimony (Sb)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic (As)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Barium (Ba)	mg/L	0.0000500	0.00727	0.00724	0.41	0.0108	0.011	1.8
Beryllium (Be)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Bismuth (Bi)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Boron (B)	mg/L	0.0100	0.012	0.012	0	<0.010	<0.010	-
Cadmium (Cd)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Calcium (Ca)	mg/L	0.0500	13.5	13.4	0.74	21.8	21.1	3.3
Chromium (Cr)	mg/L	0.000500	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Cobalt (Co)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Copper (Cu)	mg/L	0.000500	0.00075	0.00073	2.7	0.00096	0.00101	5.1
Iron (Fe)	mg/L	0.0300	<0.030	<0.030	-	<0.030	<0.030	-
Lead (Pb)	mg/L	0.0000500	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Lithium (Li)	mg/L	0.00100	0.0013	0.0013	0	0.0013	0.0012	8.0
Magnesium (Mg)	mg/L	0.0500	8.48	8.29	2.3	12.5	12.8	2.4
Manganese (Mn)	mg/L	0.0000700	0.000525	0.000518	1.3	0.000479	0.000547	13
Mercury (Hg)	mg/L	0.0000100	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum (Mo)	mg/L	0.0000500	0.000626	0.000643	2.7	0.000306	0.000322	5.1
Nickel (Ni)	mg/L	0.000500	0.00052	0.00054	3.8	<0.00050	0.00051	2.0
Potassium (K)	mg/L	0.200	1.15	1.11	3.5	1.14	1.17	2.6
Selenium (Se)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Silicon (Si)	mg/L	0.100	0.41	0.38	7.6	0.7	0.72	2.8
Silver (Ag)	mg/L	0.0000100	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium (Na)	mg/L	0.0500	1.76	1.72	2.3	4.38	4.44	1.4
Strontium (Sr)	mg/L	0.000100	0.0101	0.0100	1.0	0.0161	0.0167	3.7
Thallium (Tl)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Tin (Sn)	mg/L	0.000100	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium (Ti)	mg/L	0.0100	<0.010	<0.010	-	<0.010	<0.010	-
Uranium (U)	mg/L	0.0000100	0.00117	0.00117	0	0.00341	0.00341	0
Vanadium (V)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Zinc (Zn)	mg/L	0.00300	<0.0030	<0.0030	-	<0.0030	<0.0030	-
Aggregate Organics (Water)								
Phenols (4AAP)	mg/L	0.00100	<0.0010	<0.0010	-	<0.0010	0.0073	152
Plant Pigments (Water)								
Chlorophyll a	µg/L	0.100	1.14	1.41	21	1.02	1.14	11
Phaeophytin a	µg/L	0.100	0.68	0.92	30	0.82	0.86	4.8

(shaded) Values exceeding the DQO of ≤ 25% RPD.

Notes: The RPD was calculated using <LRL results at the LRL if one result in a duplicate pair was below the LRL. The RPD was not calculated if both results were <LRL. LDL = Laboratory Detection Limit, RPD = Relative Percent Difference, DQO = Data Quality Objective.

Table A.5: Proportion of Benthic Invertebrates Samples Sorted for the 2020 CREMP

(a) Lotic (creek and river) samples

Station	Fraction	Station	Fraction	Station	Fraction	Station	Fraction Sorted	Station	Fraction
CLT1-US-B1	Whole	CLT1-DS-B2	Whole	CLT2-US-B3	Whole	CLT2-DS-B4	Whole	REF-CRK-B5	Whole
CLT1-US-B2	Whole[a]	CLT1-DS-B3	Whole	CLT2-US-B4	Whole	CLT2-DS-B5	Whole	-	-
CLT1-US-B3	1/2[a]	CLT1-DS-B4	Whole	CLT2-US-B5	Whole	REF-CRK-B1	Whole	-	-
CLT1-US-B4	Whole	CLT1-DS-B5	Whole	CLT2-DS-B1	1/2	REF-CRK-B2	Whole	-	-
CLT1-US-B5	Whole	CLT2-US-B1	Whole	CLT2-DS-B2	Whole	REF-CRK-B3	Whole	-	-
CLT1-DS-B1	Whole	CLT2-US-B2	Whole	CLT2-DS-B3	Whole	REF-CRK-B4	Whole	-	-

(b) Lentic (lake) samples

Station	Fraction	Station	Fraction	Station	Fraction	Station	Fraction Sorted	Station	Fraction
REF-03-01	Whole	BLO-04	Whole	DLO-01-09	1/2	DLO-02-10	1/2	JLO-20	Whole
REF-03-02	1/2	BLO-05	1/2	DLO-01-10	1/2	DLO-02-11	1/2	JLO-21	1/2
REF-03-03	Whole	BLO-06	Whole	DLO-01-11	Whole	DLO-02-12	Whole	-	-
REF-03-04	Whole	BLO-07	Whole	DLO-01-12	Whole	DLO-02-13	Whole	-	-
REF-03-05	Whole	BLO-11	1/2	DLO-01-14	1/2	JLO-01	Whole	-	-
REF-03-06	Whole	BLO-13	Whole	DLO-01-15	Whole	JLO-02	1/2	-	-
REF-03-07	Whole	BLO-14	Whole	DLO-02-01	Whole	JLO-07	Whole	-	-
REF-03-08	Whole	BLO-15	Whole	DLO-02-02	Whole	JLO-11	1/2	-	-
REF-03-09	Whole	DLO-01-02	Whole	DLO-02-03	Whole	JLO-12	Whole	-	-
REF-03-10	Whole	DLO-01-03	1/2	DLO-02-04	1/2	JLO-16	Whole	-	-
BLO-01	Whole[a]	DLO-01-04	1/2	DLO-02-08	Whole	JLO-18	1/2	-	-
BLO-03	Whole	DLO-01-05	Whole	DLO-02-09	Whole[a]	JLO-19	Whole[a]	-	-

[a] Two halves were sorted for subsampling error.

__QA/QC Notes:__ Pupae were not counted toward total number of taxa unless they were the sole representative of their taxa group. Immatures were not counted toward total number of taxa unless they were the sole representative of their taxa group. The exceptions to this rule are immature tubificidae with and without hairs. Immature oligochaetes are counted as taxa as the probability of the immature being a unique taxa is high. Indeterminates are unique taxa that could not be identified further for whatever reason, e.g., (small, damaged). Densities expressed per sampled area.

Table A.6: Subsampling Error for Benthic Invertebrate Community Samples, 2020 CREMP

(a) Lotic (creek and river) samples

Station	Whole Organisms	No. of Organisms in Fraction 1	No. of Organisms in Fraction 2	No. of Organisms in Fraction 3	No. of Organisms in Fraction 4	Actual Density*	Precision		Accuracy	
							% range		min	max
CLT1-US-B2	-	282	304	-	-	586	7.2	-	3.8	-

(b) Lentic (lake) samples

Station	Whole Organisms	No. of Organisms in Fraction 1	No. of Organisms in Fraction 2	No. of Organisms in Fraction 3	No. of Organisms in Fraction	Actual Density*	Precision		Accuracy	
							% range		min	max
BLO-01	0	285	286	-	-	571	0.3	-	0.2	-
DLO-02-09	0	315	324	-	-	639	2.8	-	1.4	-
JLO-19	0	306	329	-	-	635	7.0	-	3.6	-

Notes: whole large organisms excluded in calculations; min = minimum absolute % error; max = maximum absolute % error.

Table A.7: Percent Recovery from Benthic Invertebrate Samples, Mary River Project CREMP, 2020

(a) Lotic (creek and river) samples

Station	Number of Organisms Recovered	Number of Organisms in Re-sort	Percent Recovery
CLT1-US-B5	278	300	92.7%
CLT2-US-B3	307	314	97.8%
REF-CRK-B5	160	168	95.2%
SDLT1-R1-B2	235	237	99.2%
GO-03-B1	42	43	97.7%
GO-09-B2	97	98	99.0%
		Average % Recovery	**96.9%**

Notes: All samples were sorted in their entirety. The Chironomidae genera of *Pseudosmittia* has been split into *Pseudosmittia* and *Hydrosmittia.*

__QA/QC Notes (all sampling areas):__ Pupae were not counted toward total number of taxa unless they were the sole representative of their taxa group. Immatures were not counted toward total number of taxa unless they were the sole representative of their taxa group. The exceptions to this rule are immature tubificidae with and without hairs. Immature oligochaetes are counted as taxa as the probability of the immature being a unique taxa is high. Indeterminates are unique taxa that could not be identified further for whatever reason, e.g., (small, damaged). Densities expressed per sampled area.

(b) Lentic (lake) samples

Station	Number of Organisms Recovered	Number of Organisms in Re-sort	Percent Recovery
BLO-01	568	571	99.5%
DLO-01-05	95	96	99.0%
DLO-02-08	350	351	99.7%
DLO-02-12	383	387	99.0%
JLO-16	188	195	96.4%
		Average % Recovery	**98.7%**

A3 DATA QUALITY STATEMENT

The DQR results generally indicated that the water and benthic invertebrate community data were of acceptable quality. Few water quality parameters did not meet acceptable DQO. In general, most parameters that did not meet respective DQO typically showed very low margins of error relative to respective criteria and/or were observed at low concentrations often near LRL which led to relatively small incremental differences in concentrations between replicates resulting in failure to meet DQO. The benthic invertebrate community data quality was also acceptable, meeting all precision, accuracy, and percent recovery benchmarks. Overall, the data associated with the 2020 CREMP were considered defensible and acceptable for interpretation and derivation of conclusions with a good level of confidence.

APPENDIX B

REFERENCE AREA DESCRIPTIVE OVERVIEW

APPENDIX B OVERVIEW OF REFERENCE CONDITIONS

B1 INTRODUCTION

The initial review of background (reference) data collected from lotic (i.e., creeks and rivers) and lentic (i.e., lakes) study areas as part of the 2015 Mary River Project CREMP revealed naturally elevated metal concentrations above guidelines and significant differences in benthic community endpoints between reference lake littoral and profundal habitats (Minnow 2016a). Therefore, this overview of reference conditions is included to provide context and perspective regarding water quality, sediment quality, phytoplankton (chlorophyll-a), benthic invertebrate community, and fish population characteristics at the CREMP reference study areas. Key implications of reference area features towards the evaluation of potential mine-related effects at mine-exposed waterbodies were also identified as part of this reference area overview.

B2 HABITAT

B2.1 Creek/Tributary Environments

Four reference creek/tributary (reference creek) stations were established among two unnamed tributaries to Angajurjualuk Lake (Stations CLT-REF4, MRY-REF2, and MRY-REF3) and one unnamed tributary to Mary River (Station CLT-REF3) during the Mary River Project CREMP in 2014 (see Figure 2.2). These stations were intended to provide reference information for the creek water quality and phytoplankton monitoring components of the CREMP, and have been used as such in the six studies conducted since commercial mine operations commenced at the Mary River Project (i.e., 2015 to 2020; see Table 2.1). From 2016 to 2020, habitat conditions at the western tributary to Angajurjualuk Lake that is used for Baffinland CREMP water quality monitoring (Stations CLT-REF4 and MRY-REF) were deemed comparable to habitat conditions at the Camp Lake and Sheardown Lake tributaries. Therefore, this tributary served as a benthic reference creek (REF-CRK) for comparisons involving the various mine-exposed tributaries as part of the 2016 to 2020 annual CREMP studies (see Figure 2.4), and herein has been referred to as Unnamed Reference Creek.

The reference creeks/tributaries are moderate gradient lotic systems characterized predominantly by riffle-run and riffle-rapid stream morphology, with pools occurring rarely reflecting localized topography and associated gradient. The wetted width and depth of the benthic reference tributary averaged 11.1 m and 0.09 m, respectively, during sampling conducted in August 2017 (Minnow 2018a). The corresponding water velocities across a representative riffle area of the benthic reference tributary ranged from 0.02 to 0.52 m/s in August 2017 (average of 0.28 m/s; Minnow 2018a). As for most small lotic systems in the region, surface flow at all of the CREMP reference tributaries is limited to months in which average ambient air temperatures are near or above freezing (i.e., June to September). The substrate at the reference tributaries is composed mainly of cobble and large pebble (i.e., 50 to 256 mm diameter), with surficial areas of sand generally limited to less than 10% of stream area (Minnow 2018a). In-stream vegetation at the reference tributaries is sparse, and generally includes a relatively thin layer of surficial algae/periphyton attached to relatively stable substrate.

B2.2 River Environments

The area of Mary River located upstream of the mine lease property is only minimally influenced by Mary River Project mining activity (i.e., low amounts of dust deposition; see Baffinland 2015). Therefore, this area has been considered representative of background (reference) conditions for the mine-exposed stations/study areas situated farther downstream on the Mary River under the CREMP (Baffinland 2015; KP 2014a,b, 2015; NSC 2014). Water quality, phytoplankton productivity, and benthic invertebrate community (benthic) data collected at the Mary River reference area, referred to as G0-09 (including water quality stations G0-09A, G0-09 and G0-09B), has been used in comparisons to areas of the Mary River that are potentially influenced by mine activity. Mary River study area G0-03 also currently serves as a reference area, but potential advancement of the Mary River Project to include the Deposit 2 ore body would result in this area becoming a near-field mine-exposed area in the future.

The Mary River reference area is a moderate gradient erosional environment characterized mainly by riffle and run stream morphology. Depending on flow conditions, average wetted width and average depth of the Mary River reference area has ranged from 30 to 55 m and 0.20 to 0.36 m, respectively, in studies conducted by Minnow (2017, 2018a) during the month of August. On average, the corresponding water velocities across representative riffle areas of the G0-09 benthic study area have ranged from 0.20 to 0.47 m/s during these studies. The substrate at the G0-09 reference area is composed mainly of boulder and cobble, with roughly equal proportion of pebble, gravel, and sand composing the surficial substrate at much of the remaining area (Minnow 2018a). In-stream vegetation at the Mary River G0-09 reference area is sparse, and generally includes a relatively thin layer of periphyton and/or scarce bryophytes (moss) growth on the upper surface of physically stable substrate.

B2.3 Lake Environments

A geographically expansive reconnaissance survey of local study area (LSA) lakes was conducted in 2014 to identify a waterbody that could potentially serve as a suitable reference area for the mine-exposed lakes (i.e., Camp, Sheardown NW, Sheardown SE, and Mary lakes; NSC 2015). The key criteria for the selection of the suitable reference lake included a waterbody with similar surface area, maximum water depth, substrate features, and fish species composition as the mine-exposed lakes, in addition to also being uninfluenced by current or past mining activity. Based on the results of this survey, Reference Lake 3 was selected to represent reference conditions for the mine-exposed lakes beginning in 2015 as part of the Mary River Project CREMP studies (Appendix Table B.1).

Reference Lake 3 is an unnamed lake located approximately 62 km south of the Mary River Project (see Figures 2.1 and 2.3), well outside the area of mine influence. Reference Lake 3 is a headwater lake that is characterized by a relatively complex morphology that includes three basins and connection to a separate lake by a short, shallow channel (see Figure 2.3). The three basins reach approximately 15 m, 30 m, and 36 m in depth with progression from east to west, and the average depth of Reference Lake 3 is approximately 11.8 m (Appendix Table B.1). The outlet of Reference Lake 3, located off the south-central portion of the lake, drains into a large boulder field through which flow can occur largely as sub-surface drainage. Substrate along the shoreline and shallow littoral areas of Reference Lake 3 is composed mainly of large boulder and cobble that is commonly interrupted by areas of bedrock. Substrate of the deeper littoral and profundal areas of Reference Lake 3 is almost exclusively represented by silt loam containing approximately 15 to 35% fine sand (by dry weight) and a moderate organic carbon content of approximately 5%. No substantial aquatic plant beds have been observed at Reference Lake 3, with fish cover provided predominantly by the rocky substrates along the shoreline and shallow littoral zone of the lake.

Table B.1: Physical Characteristics for Mine-Exposed Lakes and Reference Lake 3

Lake Feature	**Mine-Exposed Lakes**				**Reference Lake**
	Camp	Sheardown NW	Sheardown SE	Mary	Reference Lake 3
Drainage Basin Area (km^2)	26.5	6.6	8.9	663.4	23.2
Lake Area (km^2)	2.21	0.68	0.25	13.6	2.05
Drainage Basin: Lake Area Ratio	11.98	9.66	35.6	48.8	11.32
Mean Depth (m)	13.0	12.1	7.4	-	11.8
Maximum Depth (m)	35.1	30.1	14.8	40.0	38.3
Volume (1,000,000 m^3)	27.5	8.18	1.8	156.4	22.6
Hydraulic Retention Time (days)	416 ± 184	511 ± 213	83 ± 35	75 ± 29	-

B3 WATER QUALITY

B3.1 Creek/Tributary Environments

Water chemistry at the reference creek stations met most applicable WQG and AEMP benchmarks for lotic environments in 2020, the exceptions to which included concentrations of total aluminum, total copper, and total iron (Appendix Table B.2). Concentrations of aluminum were elevated at reference creek station MRY-REF3 during spring, summer, and fall monitoring events in 2020 (Appendix Table B.2). Total copper and total iron concentrations were also elevated at station MRY-REF3 during the summer monitoring event. As reported in past studies, the occurrence of elevated concentrations of aluminum and iron at the reference creek stations appeared to be associated with naturally high turbidity at the time that samples were collected (Appendix Table B.2), which suggested that elevated turbidity and a corresponding elevation in aluminum and iron concentrations occur naturally in regional watercourses.

Water chemistry at the reference creek stations showed distinct seasonal changes for some parameters (Appendix Figure B.1; Appendix Table B.2). In general, conductivity and concentrations of conductivity, chloride, sulphate and metals were lowest in spring, intermediate in the summer, and highest during the fall in 2020 (Appendix Table B.2; Appendix Figure B.1). This pattern almost certainly reflected dilution from snow melt and precipitation-related sources, with the lowest parameter concentrations typically associated with the spring freshet conditions, and highest parameter concentrations generally associated with low precipitation/streamflow conditions later in the open water season. Previous baseline and 2015 to 2019 water quality monitoring conducted at reference creek stations showed similar seasonal patterns (KP 2014b; Minnow 2016a, 2017, 2018a, 2019, 2020). Temporal comparison of mean water chemistry for the reference creek stations indicated that water chemistry at the reference creek stations was relatively consistent year-to-year taking seasonal sampling timing into account for most parameters (Appendix Figure C.2), with higher parameter concentrations occurring during periods of low flow. Overall, the reference creek stations were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on water chemistry at mine-exposed creek/tributary receiving environments taking seasonality into consideration.

B3.2 River Environments

Water chemistry at the Mary River reference stations (G0-09 series) showed elevated concentrations of total aluminum, copper, iron, lead, zinc, and phosphorus at one or more stations during at least one monitoring event in spring, summer, and fall 2020 compared to

Table B.2: Water Chemistry at Reference Creek Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark	Spring Sampling Event				Summer Sampling Event				Fall Sampling Event			
					CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2
					4-Jul-2020	4-Jul-2020	4-Jul-2020	4-Jul-2020	3-Aug-2020	3-Aug-2020	3-Aug-2020	3-Aug-2020	29-Aug-2020	29-Aug-2020	29-Aug-2020	29-Aug-2020
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	61.0	59.5	35.6	62.2	148	126	121	141	186	164	173	178
	pH (lab)	pH	6.5 - 9.0	-	7.83	7.79	7.18	7.70	8.12	7.93	7.86	8.13	8.17	8.02	7.89	8.12
	Hardness (as $CaCO_3$)	mg/L	-	-	27.8	27.4	12.4	26.8	66.3	57.8	44.3	59.8	93.7	83.8	67.4	85.5
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	6.8	<2.0	<2.0	<2.0	4.8	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	96	88	69	87	89	79	88	82	105	88	108	95
	Turbidity	NTU	-	-	1.06	0.49	5.16	0.77	0.29	0.74	24.3	1.15	0.37	0.40	7.82	1.36
	Alkalinity (as $CaCO_3$)	mg/L	-	-	29	28	<10	29	73	67	39	65	88	74	39	74
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	<0.020	<0.020	<0.020	<0.020	0.045	0.046	0.126	0.029	0.038	0.109	0.128	0.028
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.021	<0.021	<0.021	<0.021	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.71	2.13	1.80	2.06	1.81	4.90	4.27	2.79	1.83	2.66	2.12	2.62
	Total Organic Carbon	mg/L	-	-	1.97	2.34	2.26	2.33	2.26	3.54	3.06	3.35	1.95	2.32	1.86	2.42
	Total Phosphorus	mg/L	0.020[α]	-	<0.0030	<0.0030	0.0091	<0.0030	<0.0030	<0.0030	0.0169	<0.0030	<0.0030	<0.0030	0.0066	<0.0030
	Phenols	mg/L	0.004[α]	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0031	<0.0010	0.0032	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	0.51	0.53	2.32	1.51	1.57	1.37	8.69	4.64	2.27	2.33	16.0	7.76
	Sulphate (SO_4)	mg/L	218[β]	218	0.68	0.89	2.75	0.90	2.87	3.78	11.8	3.64	4.93	7.62	19.0	5.43
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0508	0.0221	***0.202***	0.0351	0.0096	0.0228	***1.16***	0.0501	0.0170	0.0166	0.137	0.0666
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00021	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00289	0.00342	0.00491	0.00327	0.00595	0.00674	0.0169	0.00834	0.00719	0.00844	0.0153	0.0103
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	5.85	5.47	2.74	5.44	13.9	11.3	9.05	12.9	18.5	16.2	14.0	17.1
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00178	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00033	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	<0.00050	0.00089	0.00084	0.00062	0.00057	0.00114	0.0022	0.00068	0.00064	0.00130	0.00140	0.00075
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	0.217	<0.030	<0.030	0.044	***0.856***	0.040	<0.030	0.031	0.160	0.044
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	0.000083	0.000245	<0.000050	<0.000050	0.000090	0.000714	<0.000050	<0.000050	<0.000050	0.000218	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	-	-	3.32	3.31	1.50	3.31	7.79	7.04	4.72	7.22	10.7	10.1	7.20	10.3
	Manganese (Mn)	mg/L	0.935[β]	-	0.000397	0.000485	0.00377	0.000777	0.000099	0.00115	0.00991	0.000839	0.000106	0.00100	0.00200	0.000957
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000096	0.000303	0.000112	0.000082	0.000372	0.000708	0.000473	0.000264	0.000507	0.000895	0.000563	0.000332
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00067	0.00111	<0.00050	<0.00050	0.00076	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.40	0.44	0.52	0.45	0.69	0.74	1.39	0.89	0.82	0.96	1.33	1.06
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.57	0.63	0.78	0.49	0.66	0.92	2.56	0.87	0.59	0.91	1.13	0.85
	Silver (Ag)	mg/L	0.00025	0.0001	<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 (Na)	mg/L	-	-	0.598	0.585	1.15	0.995	2.35	1.60	4.34	2.75	3.23	2.09	6.53	4.02
	Strontium (Sr)	mg/L	-	-	0.00468	0.00384	0.00634	0.00467	0.0116	0.00824	0.0229	0.0129	0.0154	0.0114	0.0310	0.0162
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.000023	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	0.013	<0.010	<0.010	<0.010	0.0665	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.000509	0.000450	0.000491	0.000331	0.00802	0.00414	0.00180	0.00222	0.0138	0.00849	0.00337	0.00381
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.00161	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

(shaded) Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above AEMP benchmark applicable to the mine lotic receiving environments.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]) and β (British Columbia Water Quality Guideline [BCWQG]). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intinsik (2013) using background water quality data. The values are specific to the Camp Lake system.

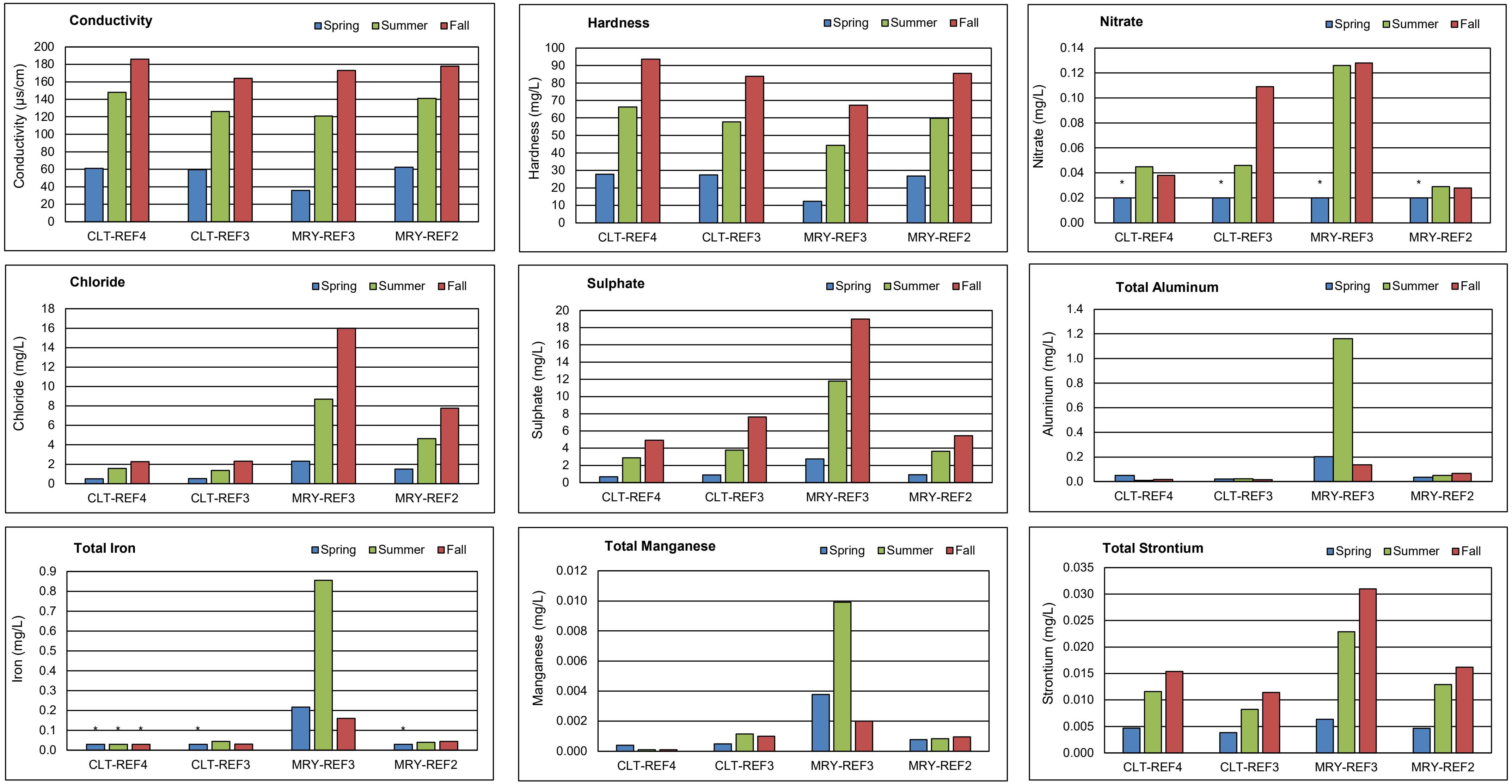


Figure B.1: Seasonal Variation in Water Chemistry at Stream/Tributary Reference Stations, Mary River Project CREMP, 2020

Note: Asterisk (*) indicates that the parameter concentration was below the laboratory reportable detection limit.

WQG and/or AEMP benchmarks (Appendix Table B.3). As in previous CREMP studies, the WQG and/or AEMP benchmarks for aluminum and iron were generally exceeded at the Mary River reference area under highly turbid conditions (i.e., ≥ 5 NTU), with the magnitude of elevation appearing to correlate closely with higher turbidity (Appendix Table B.3). Comparison of the ratio between dissolved and total concentrations of aluminum indicated that a high proportion of aluminum was in the total (particulate) fraction (compare Appendix Tables B.3 and C.60), which can be expected for metals associated with suspended particulate matter. Therefore, naturally high turbidity (and specifically, the chemical composition of suspended particulate matter) within the Mary River system can be expected to result in total concentrations of metals such as aluminum and iron being above WQG and/or AEMP benchmarks.

Water chemistry at the Mary River reference stations showed distinct seasonal changes for conservative parameters including conductivity, hardness, chloride, sodium, and sulphate (Appendix Figure B.2; Appendix Table B.3). These seasonal changes in parameter concentrations were consistent with those observed at the reference creek stations in 2020, and in previous baseline (2005 to 2013), and 2015 to 2019 water quality monitoring data collected at the Mary River G0-09 series reference stations (KP 2014b; Minnow 2016a, 2017, 2018a, 2019, 2020). The seasonal changes in the Mary River reference station parameter concentrations likely reflected greater dilution during the spring snowmelt period, and consecutively lower surface runoff inputs during the summer and fall periods. Temporal comparison of the Mary River G0-09 series reference station water chemistry indicated that concentrations of chloride, iron, molybdenum, nickel, and uranium were elevated at the G0-09 series stations in 2020 compared to baseline and most previous years of mine operation (Appendix Figure C.23). Higher concentrations of these parameters in fall 2020 potentially reflected a drier than normal fall season, and corroborated that higher parameter concentrations may occur naturally during periods of low flow. Overall, the Mary River reference stations were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on water chemistry at the Mary River mine-exposed study areas taking seasonality into consideration.

B3.3 Lake Environments (Reference Lake 3)

In situ water temperature profiles conducted at Reference Lake 3 indicated thermally stratified conditions in the summer and fall of 2020 (Appendix Figure B.3). During the summer, the epilimnion extended to approximately 5 m below surface and the hypolimnion was established at depths greater than approximately 11 m, whereas in the fall, the corresponding depths for the epilimnion and hypolimnion were approximately the upper 21 m and depths below

Table B.3: Water Chemistry at Mary River GO-09 Series Reference Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark	Spring Sampling Event			Summer Sampling Event			Fall Sampling Event		
					G0-09-A 4-Jul-2020	G0-09 4-Jul-2020	G0-09-B 4-Jul-2020	G0-09-A 3-Aug-2020	G0-09 2-Aug-2020	G0-09-B 2-Aug-2020	G0-09-A 28-Aug-2020	G0-09 28-Aug-2020	G0-09-B 28-Aug-2020
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	72.0	67.2	44.4	189	190	180	252	250	243
	pH (lab)	pH	6.5 - 9.0	-	7.83	7.83	7.55	8.22	8.23	8.22	8.34	8.37	8.29
	Hardness (as $CaCO_3$)	mg/L	-	-	32.5	31.7	19	84.4	83.2	75.7	126	123	110
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	6.8	21.2	9.8	<2.0	<2.0	2.4
	Total Dissolved Solids (TDS)	mg/L	-	-	60	69	70	114	93	83	134	127	127
	Turbidity	NTU	-	-	1.17	2.60	9.05	16.3	37.2	25.5	0.36	3.06	4.96
	Alkalinity (as $CaCO_3$)	mg/L	-	-	35	32	21	84	80	76	111	105	94
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	<0.020	<0.020	0.022	0.139	0.156	0.145	0.026	0.103	0.180
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.021	<0.021	0.022	<0.15	0.16	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.84	1.56	1.50	3.68	4.53	3.81	2.55	2.62	2.59
	Total Organic Carbon	mg/L	-	-	2.55	2.12	2.03	2.9	2.5	3.4	2.55	2.30	2.31
	Total Phosphorus	mg/L	0.020[α]	-	0.0205	0.0036	0.0122	0.0220	0.0243	0.0182	<0.0030	0.0035	0.0036
	Phenols	mg/L	0.004[α]	-	0.0025	<0.0010	<0.0010	<0.0010	0.0013	0.0012	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.05	0.94	1.11	9.45	8.36	8.94	9.45	11.6	14.4
	Sulphate (SO_4)	mg/L	218[β]	218	0.67	0.73	0.65	5.69	5.19	5.63	4.96	7.03	7.99
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0551	0.112	***0.197***	***0.868***	***1.27***	***1.00***	0.0116	0.107	0.143
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	0.00012	<0.00010	0.00018	0.00025	0.00020	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00462	0.00530	0.00474	0.0155	0.0171	0.0152	0.0134	0.0140	0.0145
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	0.000064	<0.000010	0.0000063	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	6.95	7.30	4.21	16.4	16.7	15.0	24.8	24.7	22.2
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	0.00167	0.00256	0.00171	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	0.00034	0.00056	0.00036	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.00056	***0.00670***	0.00092	0.0019	***0.0024***	0.0019	0.00085	0.00102	0.00123
	Iron (Fe)	mg/L	0.30	0.326	<0.030	0.102	0.181	***0.748***	***1.22***	***0.855***	<0.030	0.084	0.127
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	0.000387	0.000260	0.000587	0.000934	0.000661	<0.000050	0.000084	0.000130
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	<0.0010	0.0018	0.0023	0.0018	<0.0010	<0.0010	0.0010
	Magnesium (Mg)	mg/L	-	-	4.06	3.66	2.43	9.03	9.37	8.63	13.9	13.4	12.5
	Manganese (Mn)	mg/L	0.935[β]	-	0.000824	0.00299	0.00376	0.00948	0.0160	0.0101	0.000498	0.00133	0.00202
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000068	0.000087	0.000060	0.000458	0.000399	0.000434	0.000313	0.000447	0.000544
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00338	<0.00050	0.00121	0.00180	0.00130	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.53	0.76	0.53	1.62	1.69	1.63	1.30	1.44	1.61
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.67	0.66	0.73	1.93	2.72	2.11	0.88	0.94	1.03
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000050	<0.000050	<0.000050	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.783	1.02	0.818	4.94	4.29	4.58	4.77	5.77	6.95
	Strontium (Sr)	mg/L	-	-	0.00571	0.00584	0.00465	0.0225	0.0211	0.0207	0.0228	0.0259	0.0270
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	0.000021	0.000030	0.000021	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	0.00101	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	0.010	0.0518	0.0837	0.0593	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.000441	0.000389	0.000304	0.00584	0.00522	0.00509	0.00673	0.00720	0.00776
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	0.00161	0.00240	0.00176	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	***0.0320***	0.0033	0.0197	0.0032	<0.0030	<0.0030	<0.0030	<0.0030

[shaded] Indicates parameter concentration above the applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]) and β (British Columbia Water Quality Guideline [BCWQG]). See Table 2.2 for information regar

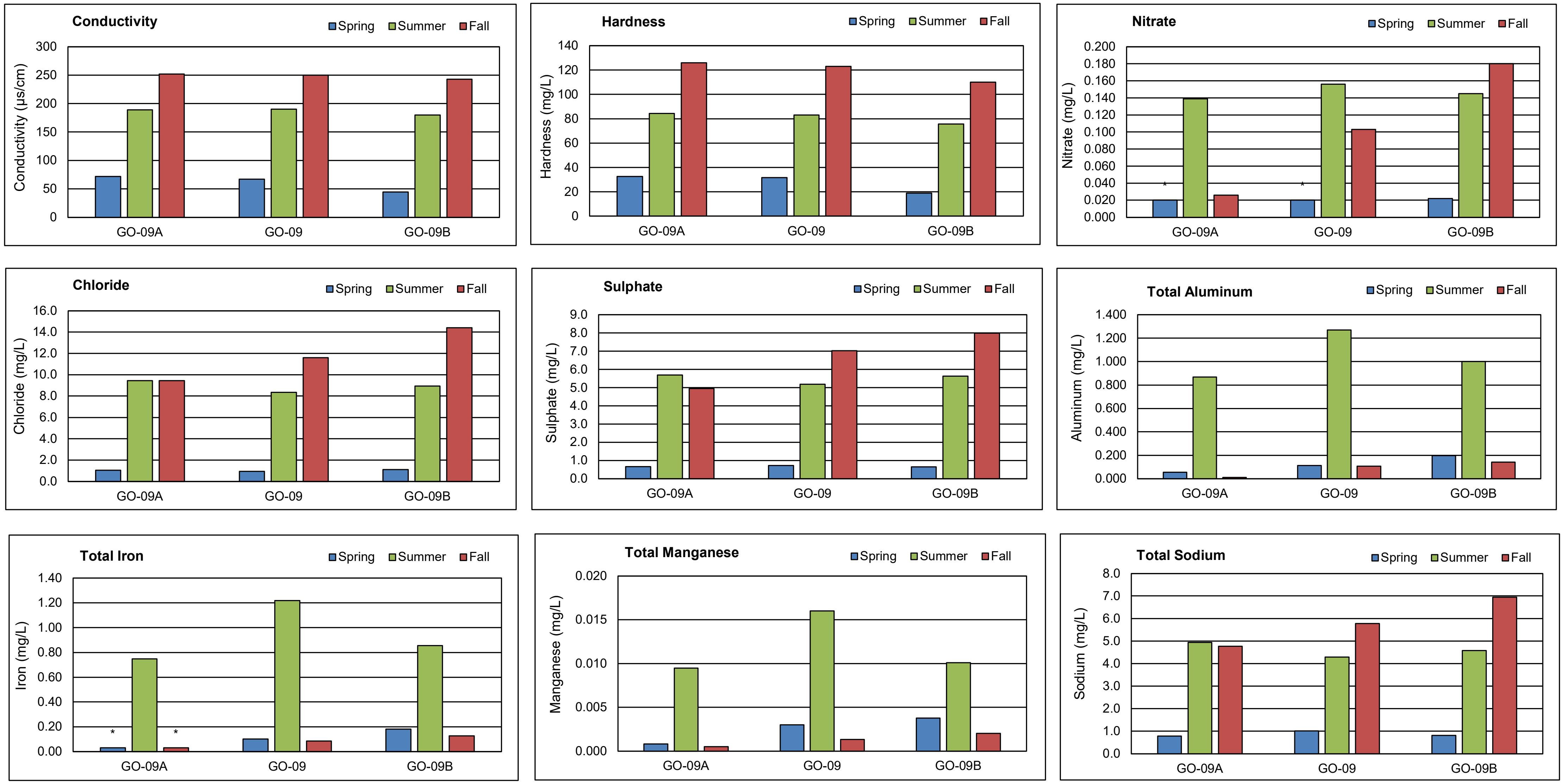


Figure B.2: Seasonal Variation in Water Chemistry at Mary River GO-09 Reference Stations, Mary River Project CREMP, 2020

Note: Asterisk (*) indicates that the parameter concentration was below the laboratory reportable detection limit.

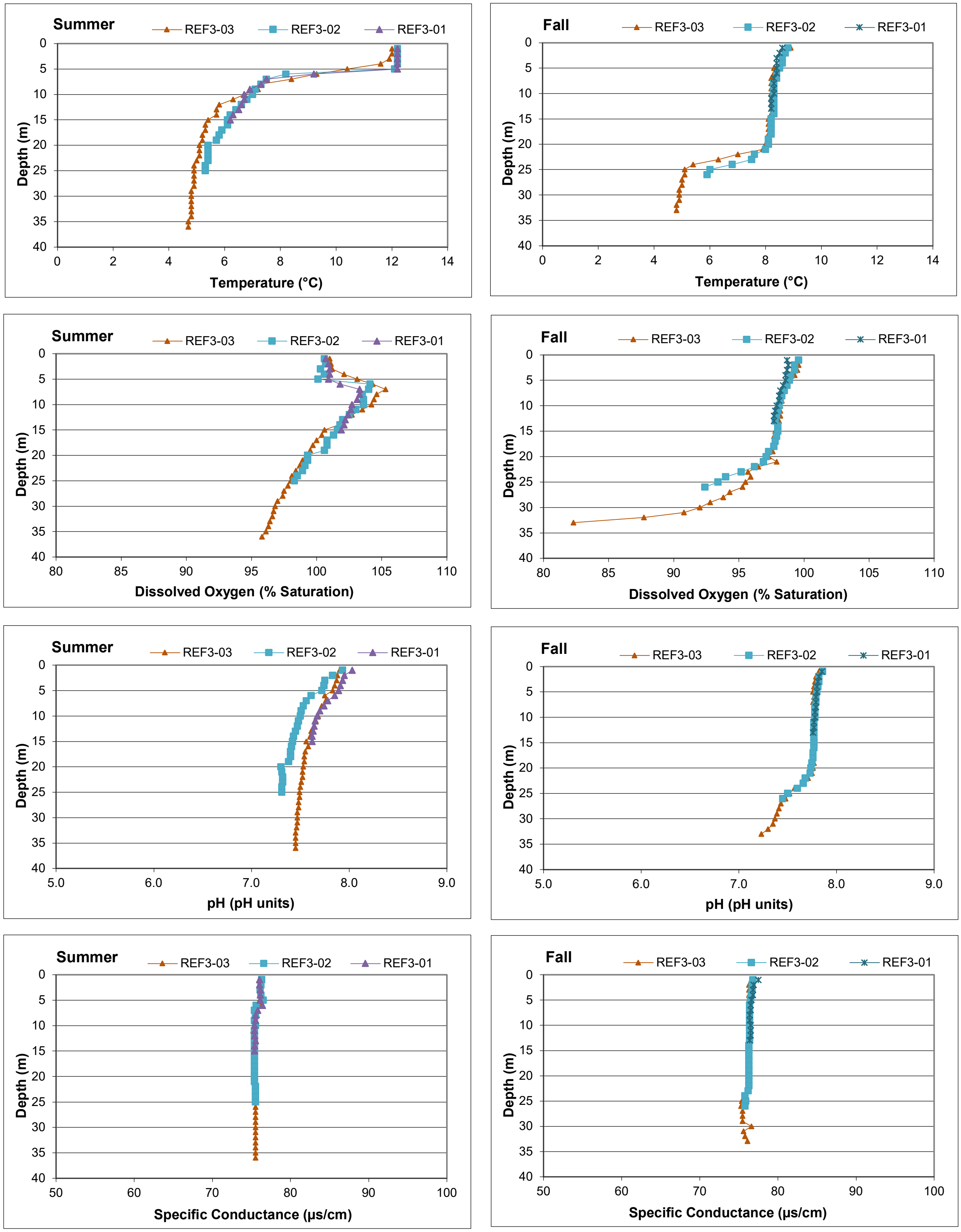


Figure B.3: ***In Situ*** **Water Quality with Depth from Surface at Reference Lake 3 during Summer and Fall Sampling Events, Mary River Project CREMP, 2020**

25 m, respectively (Appendix Figure B.3). No marked changes in dissolved oxygen concentrations occurred with increased depth at any of the Reference Lake 3 basins, and dissolved oxygen saturation remained high (i.e., ≥ 80%) throughout the entire water column in both the summer and fall profiles (Appendix Figure B.3). The 2020 water quality profiles also showed only minor changes in pH and specific conductance among stations and with depth during each of the summer and fall sampling events (Appendix Figure B.3). Overall, the i*n situ* water quality profiles suggested relatively thorough lateral mixing within Reference Lake 3 and despite the development of thermally stratification, no substantial changes in dissolved oxygen, pH, or conductivity occurred with depth through the water column.

The evaluation of water chemistry at Reference Lake 3 indicated that all monitored parameters were below WQG in summer and fall 2020 (Appendix Table B.4). No parameters were observed at concentrations above lentic AEMP benchmarks at Reference Lake 3 (Appendix Table B.4), suggesting that these water quality benchmarks were relevant for comparisons of water quality for the mine-exposed lakes. No substantial differences in water chemistry were observed between the summer and fall at Reference Lake 3 in 2020, which was similar to observations among winter, summer, and fall at local study area lakes during the mine baseline period and in summer and fall at Reference Lake 3 from 2015 to 2019 (KP 2014a; Minnow 2016a, 2017, 2018a, 2019, 20). Temporal comparisons also showed no substantial changes in water quality from 2015 to 2020 at Reference Lake 3 (Appendix Figure C.29).

Water chemistry data collected at Reference Lake 3 showed no consistent differences in parameter concentrations between the surface and the bottom of the water column at each individual station in 2020 (Appendix Figure B.4; Appendix Table B.4). The absence of any appreciable depth-related differences in parameter concentrations at each station was consistent with only minor differences in dissolved oxygen saturation, pH, and/or specific conductance with increased depth from the surface. Because anoxic conditions do not appear to develop in the summer or fall at Reference Lake 3, reducing conditions conducive to metal mobilization from sediment to the overlying water are less likely to occur near the lake bottom, resulting in relatively uniform water chemistry between surface and bottom waters of Reference Lake 3. Accordingly, metal concentrations can naturally be expected to be similar between surface and bottom of local study area lakes provided no substantial gradients in dissolved oxygen saturation, pH, and/or specific conductance occur within the water column.

Table B.4: Water Chemistry at Reference Lake 3, Mary River Project CREMP, 2020

Parameters		Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event						Fall Sampling Event					
					REF3-01	REF3-01	REF3-02	REF3-02	REF3-03	REF3-03	REF3-01	REF3-01	REF3-02	REF3-02	REF3-03	REF3-03
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					2-Aug-2020	2-Aug-2020	2-Aug-2020	2-Aug-2020	2-Aug-2020	2-Aug-2020	29-Aug-2020	29-Aug-2020	29-Aug-2020	29-Aug-2020	29-Aug-2020	29-Aug-2020
Conventionals[b]	Conductivity (lab)	umho/cm	-	-	78.8	78.8	78.5	79.0	78.4	78.9	79.0	79.6	78.4	79.2	77.7	79.3
	pH (lab)	pH	6.5 - 9.0	-	7.67	7.73	7.52	7.79	7.46	7.78	7.83	7.86	7.73	7.83	7.47	7.80
	Hardness (as $CaCO_3$)	mg/L	-	-	34.8	34.2	35.7	35.4	34.2	35	38.1	38.4	38.1	38.1	37.3	37.8
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	37	37	36	55	39	40	50	56	44	50	54	50
	Turbidity	NTU	-	-	0.15	0.14	0.18	0.14	0.13	0.15	0.12	0.14	0.20	0.16	0.12	0.13
	Alkalinity (as $CaCO_3$)	mg/L	-	-	43	45	52	45	43	47	34	35	34	35	33	35
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.031	0.014
	Nitrate	mg/L	3	3	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.16	0.16	0.17	<0.15	0.15	0.15
	Dissolved Organic Carbon	mg/L	-	-	3.44	3.40	3.18	3.27	3.32	3.38	3.39	3.42	3.52	3.62	3.25	3.50
	Total Organic Carbon	mg/L	-	-	4.72	4.68	4.42	4.29	4.70	4.92	3.76	3.96	3.72	3.71	3.63	3.75
	Total Phosphorus	mg/L	0.030[α]	-	<0.0030	<0.0030	0.0092	<0.0030	<0.0030	0.0035	<0.0030	<0.0030	<0.0030	0.0034	<0.0030	<0.0030
	Phenols	mg/L	0.004[α]	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	0.0011	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.48	1.35	1.34	1.36	1.34	1.34	1.36	1.38	1.37	1.37	1.38	1.37
	Sulphate (SO_4)	mg/L	218[β]	218	3.62	3.64	3.59	3.67	3.55	3.59	3.65	3.67	3.62	3.65	3.62	3.62
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	<0.0030	0.0034	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	0.0037
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00640	0.00653	0.00631	0.00657	0.00600	0.00633	0.00649	0.00941	0.00665	0.00650	0.00630	0.00639
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	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
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	7.18	7.31	6.98	7.23	7.09	7.23	7.23	7.35	7.37	7.15	7.07	7.25
	Chromium (Cr)	mg/L	0.0089	0.0089	<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 (Co)	mg/L	0.0009[α]	0.004	<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 (Cu)	mg/L	0.002	0.0022	0.00071	0.00073	0.00076	0.00075	0.00070	0.00072	0.00073	0.00079	0.00079	0.00073	0.00074	0.00074
	Iron (Fe)	mg/L	0.30	0.326	<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 (Pb)	mg/L	0.001	0.001	<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 (Li)	mg/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
	Magnesium (Mg)	mg/L	-	-	4.23	4.30	4.28	4.40	4.03	4.17	4.71	4.77	4.67	4.75	4.51	4.59
	Manganese (Mn)	mg/L	0.935[β]	-	0.000850	0.000789	0.000852	0.000764	0.000805	0.000740	0.000647	0.000730	0.000731	0.000639	0.000691	0.000650
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000137	0.000139	0.000130	0.000127	0.000123	0.000130	0.000151	0.000176	0.000152	0.000155	0.000137	0.000150
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.86	0.87	0.87	0.89	0.83	0.86	0.92	0.91	0.91	0.91	0.88	0.89
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.49	0.48	0.50	0.48	0.53	0.49	0.48	0.48	0.51	0.47	0.55	0.49
	Silver (Ag)	mg/L	0.00025	0.0001	<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 (Na)	mg/L	-	-	0.889	0.902	0.886	0.917	0.862	0.885	0.968	1.00	0.963	0.972	0.939	0.942
	Strontium (Sr)	mg/L	-	-	0.00882	0.00843	0.00811	0.00840	0.00796	0.00859	0.00830	0.00837	0.00826	0.00821	0.00804	0.00820
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.015	-	0.000315	0.000328	0.000299	0.000335	0.000293	0.000328	0.000340	0.000363	0.000319	0.000344	0.000294	0.000327
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Indicates parameter concentration above applicable Water Quality Guideline.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]) and β (British Columbia Water Quality Guideline [BCWQG]). See Table 2.2 for information regarding WQG.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using background water quality data. The values presented are specific to the Camp Lake system.

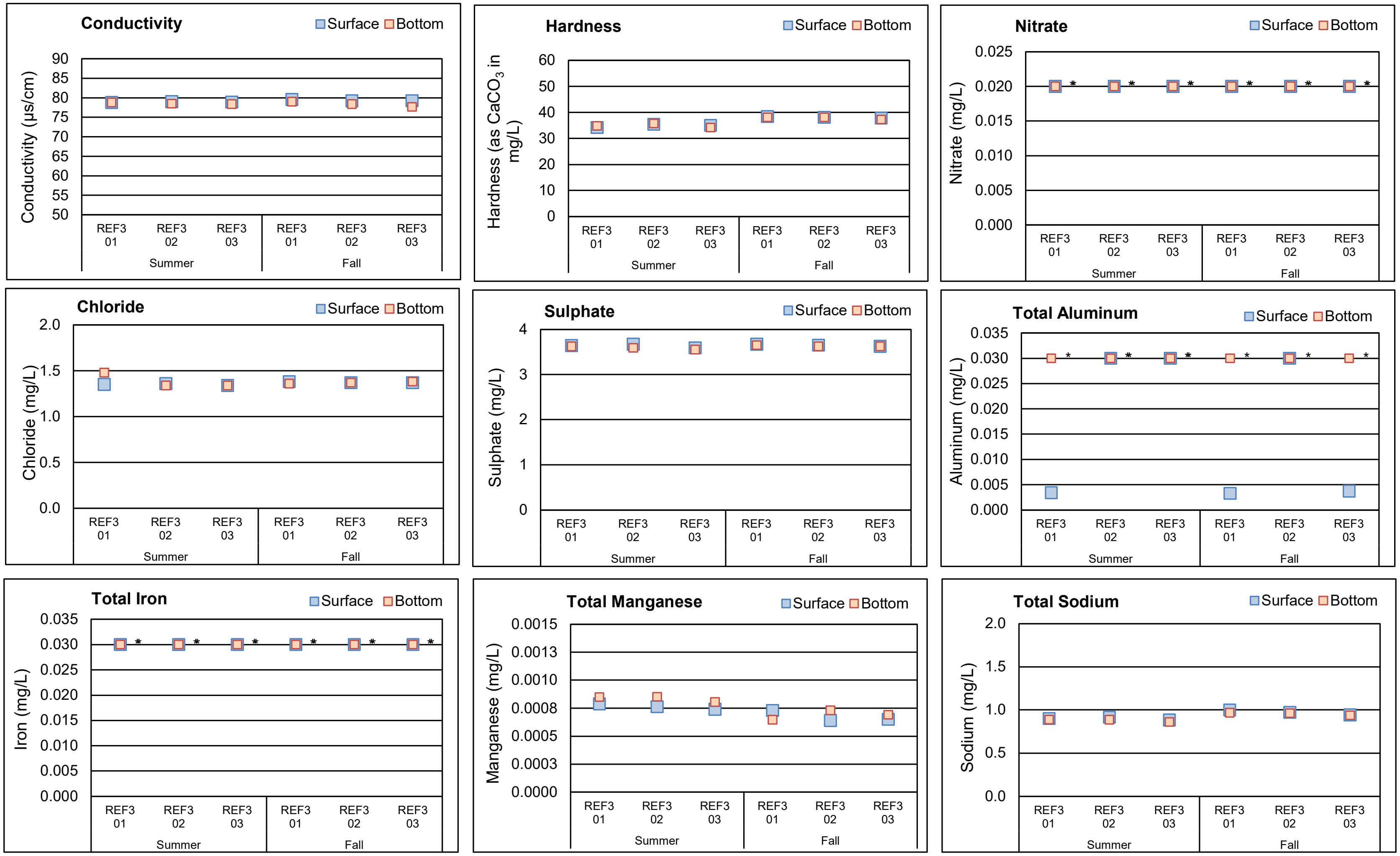


Figure B.4: Water Chemistry Comparison Between the Surface and the Bottom of the Water Column at Reference Lake 3 Routine Monitoring Stations during Summer and Fall, Mary River Project CREMP, 2020

Note: An asterisk (*) indicates that the parameter concentration was below the laboratory reportable detection limit.

B4 SEDIMENT QUALITY

B4.1 Creek/Tributary Environments

Deposited sediment at Unnamed Reference Creek (CLT-REF) was visually characterized as predominantly medium-sized sand by Minnow (2018a). In-stream substrate of the reference creek was described as mainly cobble and pebble material (i.e., substrate diameter 6 to 25 cm, and 2 to 6 cm, respectively), with sand constituting only a small amount (i.e., ~7%) of the material observed at the sediment surface (Minnow 2018a). Deposited sediment suitable for chemical characterization (i.e., sand and finer substrate sizes) was present primarily at shoreline/streambank areas, and not in the main channel. Sediment total organic carbon (TOC) content was very low (i.e., <0.1%) at the reference creek suggesting very limited deposition of fine organic materials (Minnow 2018a). Metal concentrations in deposited sediment at the reference creek were well below SQG during sampling conducted in 2017 (Minnow 2018a) and 2020 (Appendix Table D.2), and therefore the Unnamed Reference Creek data were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on chemistry of deposited sediment at the mine-exposed creeks.

B4.2 River Environments

Deposited sediment at the Mary River (G0-09) upstream reference area was visually characterized as predominantly coarse sand in 2017 (Minnow 2018a). In-stream substrate of the reference creek was composed mainly of boulder and cobble material (i.e., substrate diameter >25 cm, and 6 to 25 cm, respectively), with sand constituting only a minor amount (i.e., ~10%) of the material observed at the sediment surface. Deposited sediment suitable for chemical characterization (i.e., sand and finer substrate sizes) was collected in-stream from quiescent zones immediately downstream of large boulders in 2017 (Minnow 2018a) and 2020. Sediment total organic carbon (TOC) content was very low (i.e., <0.1%) at the G0-09 reference area, suggesting very limited deposition of fine organic materials. Metal concentrations in deposited sediment at the reference creek were shown to be well below SQG in 2017 (Minnow 2018a) and 2020 (Appendix Table D.34), and therefore the G0-09 data were deemed to provide a meaningful benchmark for the evaluation of potential mine-related influences on chemistry of deposited sediment at the Mary River mine-exposed study areas.

B4.3 Lake Environments (Reference Lake 3)

Sediment sampling was conducted at littoral and profundal (i.e., <12 m and >12 m depths, respectively) areas of Reference Lake 3 from 2015 to 2020 for the analysis of particle size, total organic carbon (TOC) content, and total metal concentrations (see Figure 2.3). Surficial sediment at Reference Lake 3 littoral and profundal areas was composed of silty to sandy loam material with moderate TOC content. Sediment moisture differed significantly between the Reference Lake 3 littoral and profundal habitats in 2020, with higher moisture content present at littoral stations compared to the profundal stations (Appendix Table F.17). No significant differences in substrate particle size or TOC content occurred between the littoral and profundal stations sampled at the reference lake in 2020 (Appendix Table F.17). A surficial and/or sub-surface layer of oxidized material (likely iron hydroxide or oxy-hydroxides), visible as an orange-brown floc or distinct layer, was occasionally observed in the surficial sediment of Reference Lake 3 (Appendix Tables D.3 and D.4). In addition, sub-surface sediment of Reference Lake 3 occasionally contained blackened/dark colouration, which suggested the occurrence of reducing (i.e., anoxic) sediment conditions (Appendix Tables D.3 and D.4). The physical properties of sediment observed at Reference Lake 3 in 2020 were consistent with those of the 2015 to 2019 studies (see Minnow 2016a, 2017, 2018a, 2019, 2020).

Metal concentrations in sediment at Reference Lake 3 were generally lower at the littoral stations than at the profundal stations, although less than a two-fold difference in concentrations was typically shown for most parameters between the littoral and profundal station depths (Appendix Table B.5; Appendix Figure B.5). The differences in sediment metal concentrations between the littoral and profundal station depths likely reflected a naturally (but not significantly) higher proportion of clay-sized particles at the latter, which is consistent with expected depositional patterns in lakes. Among metals with established SQG, mean concentrations of iron were elevated above SQG at littoral and profundal stations, and mean concentrations of manganese were elevated above SQG at profundal stations of Reference Lake 3 in 2020 (Appendix Table B.5). Therefore, compared to SQG, high concentrations of iron and manganese appear to occur naturally in sediments of Mary River Project local study area lakes. Mean copper and iron concentrations at littoral stations, and mean copper, iron, and manganese concentrations at profundal stations, were above the most stringent (i.e., lowest) AEMP sediment quality benchmarks at Reference Lake 3 (Appendix Table B.5). This suggested that the AEMP sediment benchmarks for these metals were conservative. No substantial changes in concentrations of metals were indicated from 2015 to 2020 at littoral or profundal stations of Reference Lake 3 (Appendix Figure B.5; Figure 3.7).

Table B.5: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Reference Lake 3 (REF-03) Sediment Stations, Mary River Project CREMP, August 2020

	Parameter	Units	Sediment Quality Guideline (SQG)[a]	Most Stringent AEMP Benchmark	Reference Lake 3 Station										Study Area Summary Statistics		
					REF-03-1 (littoral)	REF-03-6 (profundal)	REF-03-2 (littoral)	REF-03-7 (profundal)	REF-03-3 (littoral)	REF-03-8 (profundal)	REF-03-4 (littoral)	REF-03-9 (profundal)	REF-03-5 (littoral)	REF-03-10 (profundal)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	-	40.4	56.6	23.4	13.9	24.7	55.3	34.5	15.2	24.8	16.8	30.6	15.7	4.97
	Silt	%	-	-	53.4	36.9	68.4	71.9	61.9	38.4	59.3	71.8	68.2	68.1	59.8	13.05	4.13
	Clay	%	-	-	6.3	6.5	8.2	14.2	13.4	6.3	6.2	13.0	7.0	15.1	9.6	3.79	1.198
	Moisture	%	-	-	90.0	78.3	92.3	86.6	87.9	79.4	80.2	84.9	89.2	84.0	85.3	4.79	1.51
	Total Organic Carbon	%	10^{α}	-	6.95	2.20	6.54	4.30	3.71	2.36	2.26	4.52	4.54	3.71	4.11	1.66	0.525
Metals	Aluminum (Al)	mg/kg	-	-	15,400	19,000	18,200	24,700	19,300	20,400	16,200	22,300	15,300	22,600	19,340	3,204	1,013
	Antimony (Sb)	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	0
	Arsenic (As)	mg/kg	17	5.9	4.73	3.66	4.36	4.65	3.67	3.76	2.78	4.03	2.10	4.24	3.80	0.82	0.261
	Barium (Ba)	mg/kg	-	-	139	98.4	134	143	99.7	108	88.4	129	124	132	120	19.3	6.10
	Beryllium (Be)	mg/kg	-	-	0.59	0.68	0.74	0.93	0.69	0.77	0.65	0.80	0.56	0.84	0.73	0.11	0.036
	Bismuth (Bi)	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	0
	Boron (B)	mg/kg	-	-	11.6	11.9	13.1	16.8	13.2	14.5	11.7	15.1	11.5	15.0	13.4	1.84	0.580
	Cadmium (Cd)	mg/kg	3.5	1.5	0.246	0.128	0.184	0.175	0.120	0.144	0.163	0.142	0.150	0.150	0.160	0.0359	0.0114
	Calcium (Ca)	mg/kg	-	-	6,080	4,410	7,440	5,480	4,820	4,830	4,190	5,180	5,510	5,150	5,309	930	294
	Chromium (Cr)	mg/kg	90	79	54.9	57.1	57.4	73.0	59.4	59.3	48.6	68.5	51.3	67.3	59.7	7.75	2.45
	Cobalt (Co)	mg/kg	-	-	10.8	13.2	9.86	17.2	12.8	14.1	11.8	15.6	8.59	15.8	13.0	2.77	0.88
	Copper (Cu)	mg/kg	197	50	80.0	68.8	89.7	97.6	72.2	77.5	59.8	86.1	55.3	89.2	77.6	13.7	4.32
	Iron (Fe)	mg/kg	$40{,}000^{\alpha}$	34,400	83,200	39,600	68,900	51,100	41,400	42,100	38,000	45,700	21,500	46,900	47,840	17,136	5,419
	Lead (Pb)	mg/kg	91.3	35	13.7	14.2	14.3	19.1	14.8	15.8	12.9	17.2	13.1	17.1	15.2	2.03	0.64
	Lithium (Li)	mg/kg	-	-	23.2	29.3	26.3	38.8	29.6	30.6	26.8	34.4	24.1	35.5	29.9	5.09	1.61
	Magnesium (Mg)	mg/kg	-	-	11,600	12,500	11,800	16,000	12,500	13,000	10,400	14,800	10,900	14,600	12,810	1,811	573
	Manganese (Mn)	mg/kg	$1{,}100^{\alpha,\beta}$	657	578	909	413	1,250	790	1,010	866	1,820	246	1,160	904	451	143
	Mercury (Hg)	mg/kg	0.486	0.17	0.0730	0.0391	0.0594	0.0689	0.0396	0.0497	0.0269	0.0806	0.0511	0.0530	0.0541	0.0167	0.0053
	Molybdenum (Mo)	mg/kg	-	-	6.77	2.74	8.95	2.86	2.87	2.40	2.74	2.19	0.87	2.42	3.48	2.43	0.770
	Nickel (Ni)	mg/kg	$75^{\alpha,\beta}$	66	44.5	39.5	41.7	50.9	40.4	41.6	38.5	47.3	35.1	45.7	42.5	4.64	1.47
	Phosphorus (P)	mg/kg	$2{,}000^{\alpha}$	1,278	1,700	888	1,470	1,000	963	959	810	933	892	999	1,061	287	91
	Potassium (K)	mg/kg	-	-	3,560	4,660	4,280	6,030	4,760	4,940	4,040	5,590	3,860	5,470	4,719	805	255
	Selenium (Se)	mg/kg	-	-	1.02	0.40	1.09	0.68	0.58	0.55	0.42	0.89	0.53	0.55	0.67	0.24	0.077
	Silver (Ag)	mg/kg	-	-	0.17	0.12	0.21	0.26	0.12	0.18	<0.10	0.25	0.11	0.20	0.17	0.058	0.018
	Sodium (Na)	mg/kg	-	-	283	299	315	413	332	347	259	421	332	366	337	52	17
	Strontium (Sr)	mg/kg	-	-	11.7	10.5	14.3	13.8	11.3	11.8	9.64	12.9	11.0	12.6	12.0	1.46	0.461
	Sulphur (S)	mg/kg	-	-	1,700	<1,000	1,900	1,300	1,300	<1,000	<1,000	1,400	1,100	<1,000	1,270	320	101
	Thallium (Tl)	mg/kg	-	-	0.373	0.470	0.402	0.714	0.437	0.535	0.355	0.637	0.330	0.614	0.487	0.132	0.0418
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0	0
	Titanium (Ti)	mg/kg	-	-	936	1,070	866	1,190	1,030	1,100	1,050	1,170	1,150	1,150	1,071	105	33
	Uranium (U)	mg/kg	-	-	14.3	15.5	12.5	24.2	10.3	19.5	9.85	16.7	8.13	22.8	15.4	5.48	1.73
	Vanadium (V)	mg/kg	-	-	52.4	57.7	61.7	70.2	57.2	60.0	51.3	63.4	47.9	65.7	58.8	6.90	2.18
	Zinc (Zn)	mg/kg	315	123	71.3	73.7	85.7	96.4	74.8	79.3	67.9	82.9	65.8	86.7	78.5	9.56	3.02
	Zirconium (Zr)	mg/kg	-	-	4.4	3.9	4.9	4.2	3.3	3.5	3.9	3.8	6.0	4.3	4.2	0.78	0.25

Indicates parameter concentration above Sediment Quality Guideline (SQG).

Note: "-" indicates no SQG applicable.

[a] Canadian Sediment Quality Guideline for the protection of aquatic life, probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Objective [PSQO], severe effect level (SEL); OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level (PEL; BCMOE 2015)).

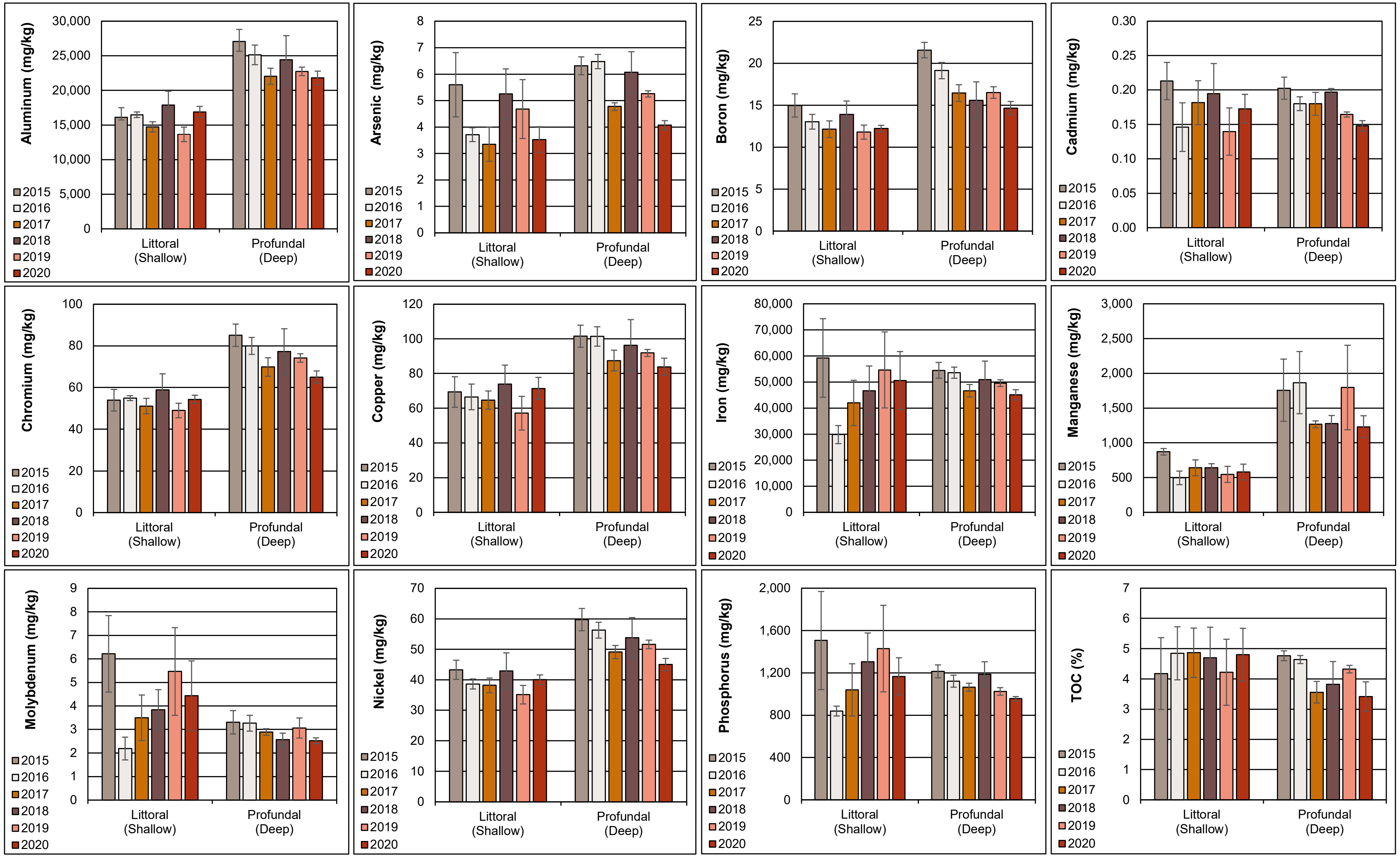


Figure B.5: Sediment Metal Concentrations (mean ± SE) at Littoral (<12m depth) and Profundal (>12m depth) Monitoring Stations of Reference Lake 3 (REF03), Mary River Project CREMP, 2015 to 2020

B5 PHYTOPLANKTON (CHLOROPHYLL-A)

B5.1 Lotic Environments

Chlorophyll-a concentrations, which were used as a surrogate for phytoplankton abundance, ranged from 0.24 to 0.93 µg/L at the reference creek and river stations among spring, summer, and fall sampling events in 2020 (Appendix Table B.6). Therefore, lotic reference station chlorophyll-a concentrations were consistently well below the AEMP benchmark of 3.7 µg/L, and reflected low (i.e., oligotrophic) phytoplankton productivity according to Dodds et al (1998) trophic status classification for stream environments. This trophic status classification was generally consistent with an ultra-oligotrophic to meso-eutrophic CWQG (CCME 2020) categorization for the stream and river reference stations based on mean aqueous total phosphorus concentrations generally ranging between 3 and 24 µg/L during each respective spring, summer, and fall sampling event in 2020 (Appendix Tables B.2 and B.3). Chlorophyll-a concentrations were significantly lower in the spring but highest in the summer at the reference creeks and at the at the Mary River G0-09 series reference stations, in 2020 (Appendix Tables B.6 and B.7).

Like-season chlorophyll-a concentrations from 2015 to 2020 showed no consistent significant differences among years over the spring, summer, and fall sampling events at either the reference creek or the Mary River reference area stations (Appendix Figure B.6). The variability in response shown among seasons and years at the lotic reference areas indicated that significant differences in chlorophyll-a concentrations occur naturally among years and seasons in watercourses within the Mary River Project mine local study area.

B5.2 Lentic Environments (Reference Lake 3)

Chlorophyll-a concentrations at Reference Lake 3 showed no consistent differences between the surface and the bottom of the water column at each individual station during both the summer and fall sampling events in 2020 (Appendix Figure B.7). Reference Lake 3 chlorophyll-a concentrations averaged 0.69 µg/L in summer and fall 2020, and were consistently well below the AEMP benchmark of 3.7 µg/L (Appendix Table E.3; Appendix Figure B.7). Similar to the lotic reference stations, mean chlorophyll-a concentrations observed at Reference Lake 3 in 2020 indicated low (i.e., oligotrophic) phytoplankton productivity based on the lake trophic status classification presented in Wetzel (2001). This trophic status classification was generally consistent with an ultra-oligotrophic CWQG (CCME 2020) categorization for Reference Lake 3 based on mean aqueous total phosphorus concentrations below 4 µg/L during the summer and fall sampling events in 2020 (Appendix Table B.4). Chlorophyll-a concentrations did not differ significantly

Table B.6: Phytoplankton Monitoring Data Collected at Lotic Reference Stations, Mary River Project CREMP, 2020

	Station	Reference Creek Stations				Mary River Reference Stations		
		CLT-REF3	CLT-REF4	MRY-REF2	MRY-REF3	G0-09-A	G0-09	G0-09-B
Sample Collection Date	Spring	4-Jul-20	4-Jul-20	4-Jul-20	4-Jul-20	4-Jul-20	4-Jul-20	4-Jul-20
	Summer	3-Aug-20	3-Aug-20	3-Aug-20	3-Aug-20	3-Aug-20	2-Aug-20	2-Aug-20
	Fall	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Chlorophyll-a (µg/L)	Spring	0.35	0.31	0.24	0.34	0.24	0.25	0.27
	Summer	0.62	0.90	0.92	0.52	0.66	0.71	0.93
	Fall	0.74	0.31	0.34	0.45	0.33	0.43	0.34
	Average	0.57	0.51	0.50	0.44	0.41	0.46	0.51
	Standard Deviation	0.20	0.34	0.37	0.09	0.22	0.23	0.36
	Standard Error	0.12	0.20	0.21	0.05	0.13	0.13	0.21
Phaeophytin-a (µg/L)	Spring	0.40	<0.10	0.37	0.45	0.35	0.66	0.43
	Summer	1.17	1.50	1.60	1.36	1.34	1.45	1.70
	Fall	0.78	0.46	0.57	0.58	0.85	0.84	0.99
	Average	0.78	0.69	0.85	0.80	0.85	0.98	1.04
	Standard Deviation	0.39	0.73	0.66	0.49	0.50	0.41	0.64
	Standard Error	0.22	0.42	0.38	0.28	0.29	0.24	0.37

Table B.7: Statistical Comparisons of Chlorophyll-a Concentrations among Winter, Spring, Summer, and/or Fall Sampling Events at Reference Lotic and Lentic Study Areas, Mary River Project CREMP, 2020

Study Lake	Overall 3-group Comparison			Pair-wise, *post hoc* comparisons[a]			
	Significant Difference Among Areas?	p-value	Statistical Test[b]	(I) Area	(J) Area	Significant Difference Between 2 Areas?	p-value
Stream Reference Stations	YES	0.036	K-W	Spring	Summer	YES	0.011
				Spring	Fall	NO	0.325
				Summer	Fall	NO	0.115
Mary River GO-09 Reference Stations	YES	0.027	K-W	Spring	Summer	YES	0.007
				Spring	Fall	NO	0.180
				Summer	Fall	NO	0.180
Reference Lake 3	-	-	-	Winter	Summer	not applicable	-
				Winter	Fall	not applicable	-
	YES	0.022	t-equal	Summer	Fall	YES	0.022

[a] *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

[b] Statistical tests include Kruskal Wallis H-test (K-W) and t-test with equal variances.

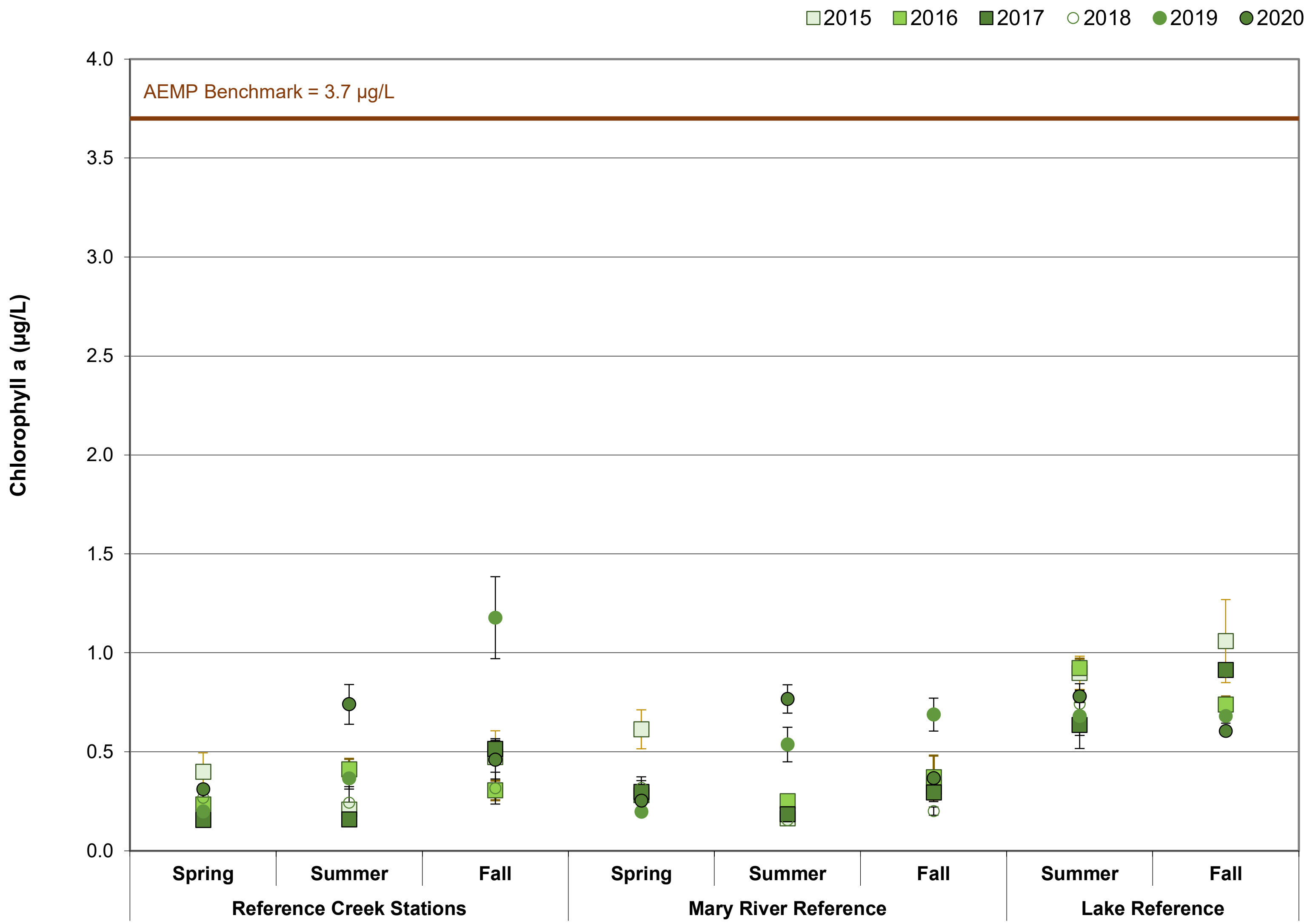


Figure B.6: Chlorophyll-a Concentration Seasonal Comparison from 2015 to 2020 at Creek, River, and Lake Reference Phytoplankton Monitoring Stations, Mary River Project CREMP

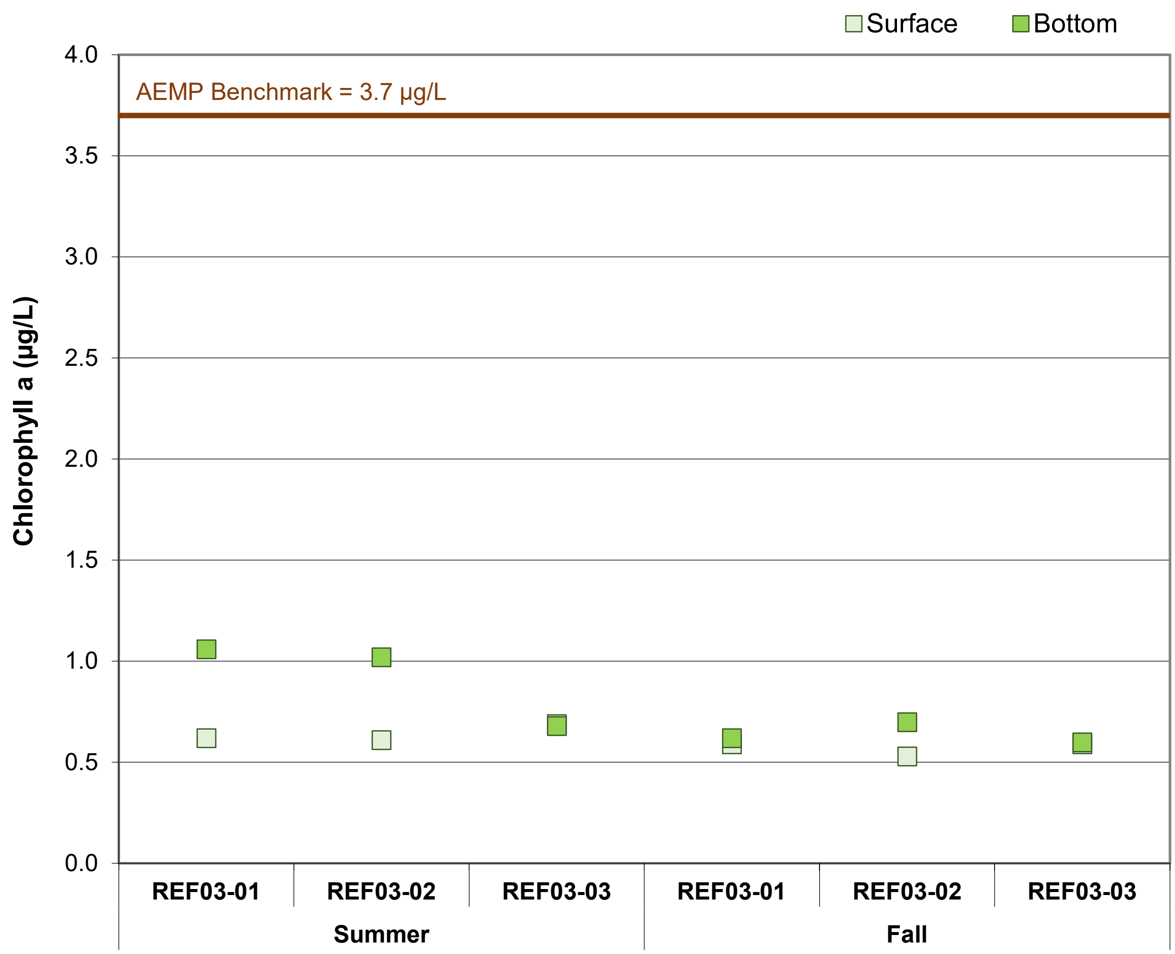


Figure B.7: Chlorophyll-a Concentrations at the Surface and Bottom of the Water Column at Reference Lake 3 Phytoplankton Monitoring Stations during Summer and Fall Sampling Events, Mary River Project CREMP, 2020

between the summer and fall at Reference Lake 3 in 2020 (Appendix Table B.7), which was similar to the 2015, but differed from the 2016 (significantly higher chlorophyll-a concentrations in summer compared to fall) and the 2017 and 2018 studies (significantly lower chlorophyll-a concentrations in summer compared to fall). Therefore, although chlorophyll-a concentrations were generally comparable from 2015 to 2020 for like-seasons at Reference Lake 3, the relative seasonal changes in chlorophyll-a concentrations among years suggested naturally variable temporal patterns in phytoplankton abundance can be expected at Mary River Project mine local study area lakes.

B6 BENTHIC INVERTEBRATE COMMUNITY

B6.1 Creek/Tributary Environments

The original Mary River Project CREMP design had not included/identified a reference creek from which to evaluate potential mine-related effects on benthic invertebrate communities of creek/tributary environments, instead relying solely on a before-after approach to identify potential mine influences on benthic invertebrates over time (see NSC 2014). Stemming from recommendations from the 2015 CREMP (Minnow 2016b), a reference creek was incorporated into the 2016 to 2020 CREMP benthic invertebrate community studies to provide a stronger basis for evaluating potential within-year mine-related effects to biota residing in mine-exposed tributaries of Camp and Sheardown lakes. The benthic invertebrate community (benthic) study area selected for the CREMP was located within at the same unnamed tributary to Angajurjualuk Lake that is used for reference water quality sampling (Stations CLT-REF4 and MRY-REF2; Table 2.5; Figure 2.4). Criteria used for the selection of this creek as a reference area for the CREMP, which is herein referred to as Unnamed Reference Creek, included a watercourse exhibiting similar habitat characteristics (e.g., width, water velocity, substrate size) as the mine-exposed tributaries that is not/has not been influenced by mining or adverse anthropogenic disturbances. The acceptance of Unnamed Reference Creek as a reference area for the evaluation of mine-related influences on tributary water chemistry under the original CREMP (KP 2014a) was also considered an important criterion in the selection of this watercourse as a suitable reference area for the benthic invertebrate community survey.

Benthic invertebrate density at Unnamed Reference Creek ranged from 258 to 1,032 individuals/m^2 in the 2020 study (mean of 713 individuals/m^2) , which is considered moderate for Arctic streams (Craig and McCart 1975). Unnamed Reference Creek showed relatively high richness and Simpson's Evenness in 2020, which was unlike the low production that can naturally be expected in Arctic streams as the result of constraints associated with low nutrients and seasonal temperatures, as well as food limitation (Huryn and Wallace 2000). The dominant taxonomic group observed at Unnamed Reference Creek benthic stations in 2020 was Chironomidae (non-biting midges), collectively accounting for approximately 86% of the community (Appendix Table B.8). Collector-gatherers were the dominant benthic invertebrate functional feeding group (FFG) present at Unnamed Reference Creek (Appendix Table B.8), suggesting greatest reliance upon deposited fine particulate organic matter as a food source for benthic invertebrates. Shredders constituted a low proportion of the Unnamed Reference Creek benthic invertebrate community (Appendix Table B.8), suggesting that live and/or decomposing leaf material was a less important food source. In terms of benthic invertebrate habit preference group (HPG), sprawlers were the dominant

Table B.8: Benthic Invertebrate Community Summary Statistics for Unnamed Reference Creek and Mary River (GO-09) Reference Areas, Mary River Project CREMP, August 2020

Metric	Area	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Density (no. organisms / m^2)	Unnamed Reference Creek	5	713	296	133	258	1,032
	Mary River GO-09 Reference	5	886	831	372	315	2,208
Richness (Number of Taxa)	Unnamed Reference Creek	5	16	4.4	2.0	9.0	20.0
	Mary River GO-09 Reference	5	15	2.0	0.9	12.0	17.0
Simpson's Evenness	Unnamed Reference Creek	5	0.84	0.04	0.02	0.77	0.88
	Mary River GO-09 Reference	5	0.83	0.15	0.07	0.56	0.92
Nemata (% of community)	Unnamed Reference Creek	5	0.7	1.3	0.6	0.0	3.0
	Mary River GO-09 Reference	5	0.5	0.6	0.3	0.0	1.2
Hydracarina (% of community)	Unnamed Reference Creek	5	4.5	3.7	1.7	2.1	11.1
	Mary River GO-09 Reference	5	1.1	1.3	0.6	0.0	3.2
Chironomidae (% of community)	Unnamed Reference Creek	5	48.3	12.9	5.8	36.7	67.3
	Mary River GO-09 Reference	5	89.6	5.1	2.3	83.2	96.2
Metal Sensitive Chironomidae (% of community)	Unnamed Reference Creek	5	0.8	1.2	0.6	0.0	3.0
	Mary River GO-09 Reference	5	32.0	23.7	10.6	10.8	68.7
Tipulidae (% of community)	Unnamed Reference Creek	5	1.5	2.3	1.0	0.0	5.6
	Mary River GO-09 Reference	5	1.2	0.5	0.2	0.9	2.0
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	5	80.7	8.8	3.9	70.0	91.1
	Mary River GO-09 Reference	5	80.2	4.1	1.8	74.9	85.5
Filterer FFG (% of community)	Unnamed Reference Creek	5	9.9	8.9	4.0	0.0	21.5
	Mary River GO-09 Reference	5	2.0	1.8	0.8	0.0	4.9
Shredder FFG (% of community)	Unnamed Reference Creek	5	2.8	2.7	1.2	0.0	7.0
	Mary River GO-09 Reference	5	11.3	7.1	3.2	4.7	20.1
Clinger HPG (% of community)	Unnamed Reference Creek	5	15.8	7.7	3.5	7.8	27.0
	Mary River GO-09 Reference	5	15.0	5.8	2.6	5.9	21.3
Sprawler HPG (% of community)	Unnamed Reference Creek	5	79.4	6.6	3.0	70.0	87.2
	Mary River GO-09 Reference	5	79.0	5.9	2.6	69.8	85.2
Burrower HPG (% of community)	Unnamed Reference Creek	5	4.8	3.3	1.5	1.4	8.3
	Mary River GO-09 Reference	5	6.0	10.2	4.6	1.1	24.3

group at Unnamed Reference Creek (Appendix Table B.8) suggesting that most invertebrates were associated with substrate surfaces and were not deeply embedded in the substrate (i.e., non-burrowers).

B6.2 River Environments

The area of Mary River located upstream of the mine lease property has been considered representative of reference conditions for the mine-exposed stations/study areas situated farther downstream on the Mary River under the CREMP (Baffinland 2015; KP 2014a,b, 2015; NSC 2014). As in previous CREMP studies, the G0-09 area of Mary River (including water quality stations G0-09A, G0-09, and G0-09B) was used as the benthic reference area for mine-exposed areas of Mary River as part of the 2020 CREMP (see Table 2.5; Figure 2.4).

Benthic invertebrate density at the Mary River reference area in the 2020 study ranged from 315 to 2,208 individuals/m^2, which is considered moderate for Arctic lotic systems (Craig and McCart 1975). Moderate richness and Simpson's Evenness also characterized the benthic invertebrate community of the Mary River reference area, and reflected naturally low Arctic stream environment productivity as a result of low ambient temperatures and nutrient levels (Huryn and Wallace 2000). Midges of the family Chironomidae were the dominant taxonomic group observed at the Mary River reference area, with the relative abundance of this group ranging from 83% to nearly 96% of individuals (mean of 97.2%) and chironomid taxa considered metal-sensitive constituting 11% to 69% of the community (Appendix Table B.8). Similar to the reference creek, collector-gatherers were the dominant FFG present at the Mary River reference area (Appendix Table B.8), suggesting that fine particulate organic matter was the predominant food source for benthic invertebrates at this area. Sprawlers composed the dominant HPG at the Mary River reference area (Appendix Table B.8), which suggested that most benthic invertebrates were associated with the surface of rocky substrates.

Comparison of the Mary River reference area benthic invertebrate communities among baseline (2006, 2007) and mine-operational (2015 to 2020) studies for key metrics indicated no consistent significant differences in density, richness, and relative abundance of metal-sensitive chironomids or the collector-gatherer FFG between the baseline and mine-operational periods (Appendix Figure F.14; Appendix Table F.47). Simpson's Evenness and collector-gatherer FFG relative abundance has routinely been significantly higher and lower, respectively during years of mine operation (2015 to 2018, 2020) compared to baseline (Appendix Figure F.14; Appendix Table F.47). However, the direction of these differences was not consistent with an adverse change but rather suggested more even distribution of invertebrate groups and FFG for the mine-operational period (Appendix Figure F.14).

The changes in benthic invertebrate community metrics between the mine operational and baseline studies at the Mary River reference area were thus attributable to natural variability in community traits among years and/or to artifacts associated with CREMP sampling among studies.

B6.3 Lentic Environments (Reference Lake 3)

The benthic invertebrate community of Reference Lake 3 differed dramatically between littoral (<12 m depth) and profundal (>12 m depth) stations in 2020. As in previous monitoring conducted from 2015 to 2019, significantly higher benthic invertebrate density and richness was observed at littoral stations compared to profundal stations in 2020, both at Critical Effect Sizes outside of ± 2 SD (Appendix Table B.9). In addition, differences in benthic invertebrate community structure occurred between sampling depths as indicated by significantly higher and lower relative abundance of Ostracoda (seed shrimp) and Chironomidae (non-biting midges), respectively, at littoral stations compared to profundal stations (Appendix Table B.9). No significant differences in the relative abundance of FFG or HPG were indicated between littoral and profundal habitats of Reference Lake 3 in 2020 with the exception of a higher relative abundance of the burrower HPG at littoral stations (Appendix Table B.9). The difference in benthic invertebrate community metrics and assemblage features between the littoral and profundal stations observed at Reference Lake 3 from 2015 to 2020 validated proposed changes to the CREMP benthic invertebrate community survey by Minnow (2016b). Specifically, benthic invertebrate community surveys can focus only on littoral habitat to reflect the fact that natural habitat factors that affect community assemblage at profundal areas limit the ability to interpret potential mine-related biological effects at profundal depths of the local study area lakes.

Littoral and profundal habitat benthic invertebrate communities at Reference Lake 3 in 2020 showed density, richness, Simpson's Evenness, and relative abundance of dominant taxonomic groups and FFGs al within the range of those observed from 2015 to 2019 (Appendix Figures F.5 and F.6). This suggested that the benthic invertebrate community at littoral and profundal habitat of Reference Lake 3 showed relatively minor changes from 2015 to 2020.

Table B.9: Benthic Invertebrate Community Statistical Comparison Results between Littoral and Profundal Stations at Reference Lake 3, Mary River Project CREMP, August 2020

Metric	Statistical Test Results					Summary Statistics						
	Statistical Test	Data Transform-ation	Significant Difference Between Areas?	p-value	Magnitude of Difference [a] (No. of SD)	Habitat	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (Individuals/m^2)	t-equal	log10	YES	< 0.001	-2.5	Lake Littoral	1,571	430	193	1,190	1,474	2,310
						Lake Profundal	479	142	63	336	491	681
Richness (Number of Taxa)	t-equal	log10	YES	< 0.001	-3.0	Lake Littoral	14.6	2.5	1.1	13.0	14.0	19.0
						Lake Profundal	7.0	1.9	0.8	5.0	8.0	9.0
Simpson's Evenness (E)	t-equal	none	NO	0.177	-0.7	Lake Littoral	0.810	0.110	0.049	0.630	0.847	0.923
						Lake Profundal	0.731	0.045	0.020	0.689	0.721	0.795
Shannon Diversity	t-equal	log10	YES	0.004	-1.7	Lake Littoral	2.710	0.526	0.235	2.080	2.730	3.510
						Lake Profundal	1.800	0.196	0.088	1.580	1.720	2.030
Hydracarina (%)	t-equal	log10(x+1)	NO	0.134	-0.9	Lake Littoral	5.3	2.6	1.2	3.5	4.4	9.9
						Lake Profundal	2.8	2.0	0.9	0.0	3.5	5.1
Ostracoda (%)	t-equal	log10	YES	< 0.001	-2.0	Lake Littoral	37.9	14.5	6.5	26.7	36.2	62.6
						Lake Profundal	8.6	4.1	1.8	3.5	7.7	14.5
Chironomidae (%)	t-equal	none	YES	0.001	2.3	Lake Littoral	52.6	15.6	7.0	26.9	59.0	66.4
						Lake Profundal	87.9	4.2	1.9	82.3	87.2	92.7
Metal-Sensitive Chironomidae (%)	t-equal	none	NO	0.773	0.3	Lake Littoral	28.8	9.5	4.3	15.6	32.5	38.7
						Lake Profundal	31.5	17.6	7.9	7.9	38.0	49.3
Collector-Gatherers (%)	t-equal	log10	NO	0.917	0.0	Lake Littoral	63.1	11.4	5.1	53.6	60.3	81.5
						Lake Profundal	62.9	15.0	6.7	45.4	56.1	79.0
Filterers (%)	t-equal	none	NO	0.701	0.4	Lake Littoral	27.1	9.8	4.4	14.4	29.2	38.0
						Lake Profundal	30.7	17.5	7.8	7.9	38.0	49.3
Shredders (%)	t-equal	none	NO	0.396	-0.5	Lake Littoral	3.9	3.3	1.5	0.6	3.2	7.4
						Lake Profundal	2.2	2.3	1.0	0.0	2.5	5.3
Clingers (%)	t-equal	none	NO	0.863	0.2	Lake Littoral	31.9	9.3	4.2	17.9	33.5	41.6
						Lake Profundal	33.5	16.9	7.6	13.1	41.5	52.8
Sprawlers (%)	t-equal	none	NO	0.466	0.6	Lake Littoral	57.9	12.1	5.4	41.0	57.2	73.8
						Lake Profundal	64.8	16.2	7.2	45.5	58.5	87.0
Burrowers (%)	t-equal	none	YES	0.011	-1.7	Lake Littoral	10.2	4.9	2.2	4.6	8.3	17.3
						Lake Profundal	1.7	2.9	1.3	0.0	0.0	6.7

Grey shading indicates statistically significant difference between habitat types based on p-value ≤ 0.10.

Blue shaded values indicate significant difference (p-value ≤ 0.10) that was also outside of a CES of ±2 SD, indicating that the difference was ecologically meaningful.

[a] Magnitude calculated by comparing the difference between the lake littoral and profundal area means divided by the littoral area standard deviation.

B7 FISH POPULATION

B7.1 Lotic Environments

Fish population sampling of lotic habitats is not required as part of the Mary River Project CREMP (see NSC 2014). In part, this reflects the fact that fish can only inhabit local study area creeks/rivers for a short period each year (i.e., July to September) as a result of complete freezing/desiccation of these lotic habitats over much of the year. In addition, sampling of juvenile arctic charr within a representative lotic habitat is conducted for the federal Environmental Effects Monitoring (EEM) program to meet Metal and Diamond Mining Effluent Regulation requirements (Baffinland 2015; Minnow 2018b, 2021).

B7.2 Lentic Environments (Reference Lake 3)

The Reference Lake 3 fish community has historically been composed of arctic charr and ninespine stickleback. The relative abundance of both species has been low at Reference Lake 3 based on low electrofishing and gill netting catches and catch-per-unit-effort (CPUE) for each species in all previous studies (Minnow 2018a, 2019, 2020), and predominantly arctic charr were captured at the reference lake in 2020 (Appendix Tables G.1 and G.2). Suitable numbers of arctic charr were captured at nearshore habitat of Reference Lake 3 (i.e., 100 individuals) to allow evaluation of mine-related effects on survival, growth, and condition of fish collected at the mine-exposed lake shorelines. For these fish, young-of-the-year (YOY) individuals were generally distinguishable from the 1+ to 5+ age classes at a fork length of 4.5 cm based on the evaluation of length-frequency distributions coupled with supporting age determinations (Appendix Figure B.8). In 2015 and 2019, YOY arctic charr captured at nearshore habitat were not able to be distinguished from older age classes at Reference Lake 3 (Appendix Figure B.8). However, population comparisons of nearshore arctic charr captured between the mine-exposed and reference lakes from 2016 to 2018 and 2020 were completed separately for YOY and non-YOY data sets. Temporal comparisons of the 2015 to 2020 nearshore arctic charr data indicated that fish sizes in 2020 were within range of those captured in previous years, with condition of fish within the critical effect size for growth endpoints of ±25% for 2020 compared to all years except 2018 for non-YOY (Appendix Table B.10). The data show that larger fish are likely to naturally exhibit lower condition than smaller sized fish (Appendix Table B.10; Appendix Figure B.9). Overall, the Reference Lake fish population data indicated that some year-to-year differences in fish population endpoints can be expected naturally at local study area lakes.

Low numbers of arctic charr were captured at littoral/profundal areas of Reference Lake 3 in 2020 (i.e., 69 individuals) despite application of similar fishing effort to that used at the

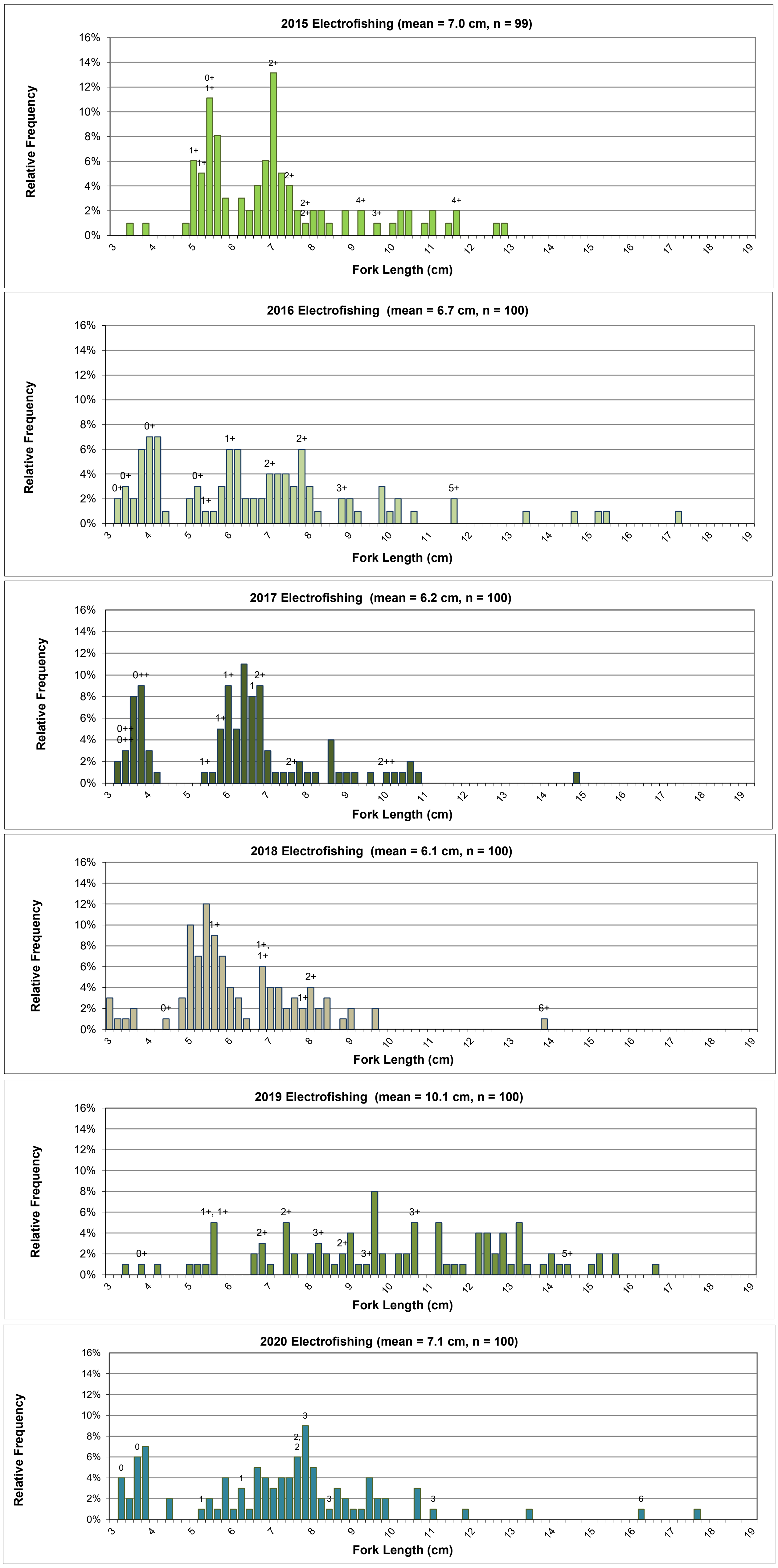


Figure B.8: Length-frequency Distributions for Arctic Charr Captured by Backpack Electrofishing and Gill Netting at Reference Lake 3 (REF3) in August 2015 to 2020, Mary River Project CREMP

Note: Fish ages are shown above the bars, where available.

Table B.10: Statistical Comparisons For Length, Weight, and Condition Endpoints For non-Young-of-the-Year Arctic Charr from Reference Lake 3, 2015 to 2020

Group	Indicator	Endpoint	Variables		Sample Size (n)						Test[a]	Area P-Value	Year 1	Year 2	Pairwise Comparisons[b]	
			Response	Covariate	2015	2016	2017	2018	2019	2020					P-value	Magnitude of Difference (%)[c]
Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	-	68	74	92	97	79	K-W	<0.001	2015	2016	0.023	5.8
														2017	0.781	-4.3
														2018	0.005	-16
														2019	<0.001	45
														2020	0.001	12
													2016	2017	0.058	-9.6
														2018	<0.001	-20
														2019	<0.001	37
														2020	0.416	5.5
													2017	2018	0.004	-12
														2019	<0.001	52
														2020	0.005	17
													2018	2019	<0.001	72
														2020	<0.001	72
													2019	2020	<0.001	-23
	Body Size	Body Weight	Body Weight (g)	-	-	68	74	92	97	79	K-W	<0.001	2015	2016	0.022	23
														2017	0.768	-8.4
														2018	0.069	-32
														2019	<0.001	211
														2020	0.004	31
													2016	2017	0.058	-26
														2018	<0.001	-45
														2019	<0.001	153
														2020	0.64	6.1
													2017	2018	0.045	-26
														2019	<0.001	240
														2020	0.014	43
													2018	2019	<0.001	362
														2020	<0.001	362
													2019	2020	<0.001	-58
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	-	68	74	92	97	79	ANCOVA	<0.001	2015	2016	0.827	1.7
														2017	1	0.046
														2018	<0.001	12
														2019	0.082	-3.7
														2020	0.067	-3.7
													2016	2017	0.87	-1.7
														2018	<0.001	9.9
														2019	0.003	-5.3
														2020	0.003	-5.3
													2017	2018	<0.001	12
														2019	0.105	-3.7
														2020	0.091	-3.7
													2018	2019	<0.001	-14
														2020	<0.001	-14
													2019	2020	1	0.0091
YOY[c]	Body Size	Fork Length	Fork Length (cm)	-	-	31	26	8	-	21	K-W	<0.001	2016	2017	0.006	-6.4
														2018	<0.001	-18
														2020	0.004	-7.7
													2017	2018	0.106	-12
														2020	0.768	-1.4
													2018	2020	0.173	12
	Body Size	Body Weight	log10[Body Weight (g)]	-	-	31	26	8	-	21	ANOVA	0.001	2016	2017	0.716	-8.8
														2018	0.004	-37
														2020	0.018	-24
													2017	2018	0.033	-31
														2020	0.217	-17
													2018	2020	0.542	20
	Energy Storage	Condition	log10[Body Weight (g)]	log10[Fork Length (cm)]	-	31	25[e]	8	-	21	ANCOVA	0.005	2016	2017	0.023	12
														2018	0.998	1.1
														2020	0.923	-2.6
													2017	2018	0.293	-9.9
														2020	0.006	-13
													2018	2020	0.924	-3.7

(grey) Area P-value < 0.1 or Interaction P-value < 0.05.
(blue) Magnitude of Difference greater than absolute Effect Size of 25% for length and weight endpoints, or 10% for condition endpoint.

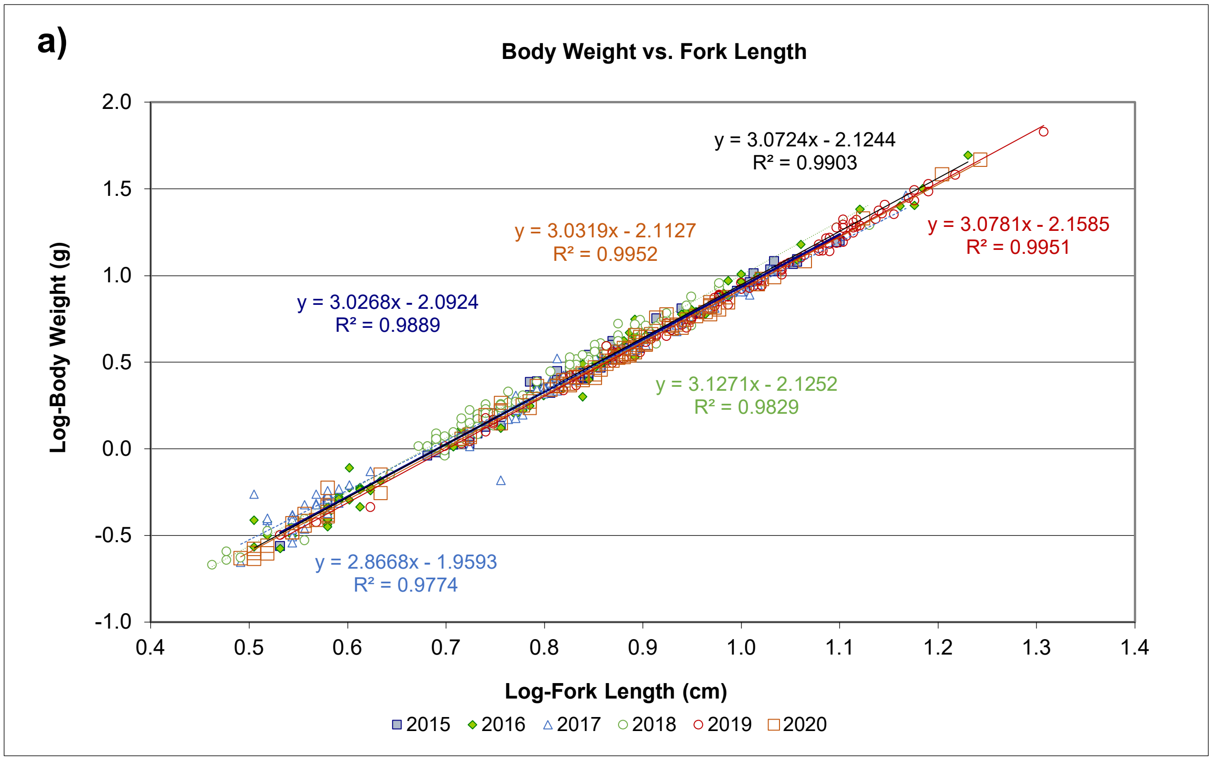
[a] Statistical tests included the Kruskal Wallis H-test (K-W), ANOVA, and ANCOVA.

[b] Calculated as the difference in measure of central tendency (MCT) between areas (mine-exposed minus reference), expressed as a percentage of the reference area MCT (except for the K-W test; see footnote b).

[c] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has a greater number of fish with length measures that are less than where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish with length measures that are less than where the maximum difference in CRFDs was observed.

[d] Could not be calculated for 2015, 2018, or 2019 data sets.

[e] One outlier (REF317-ACJ-25, Stdnt resid: 4.226) removed from analysis.



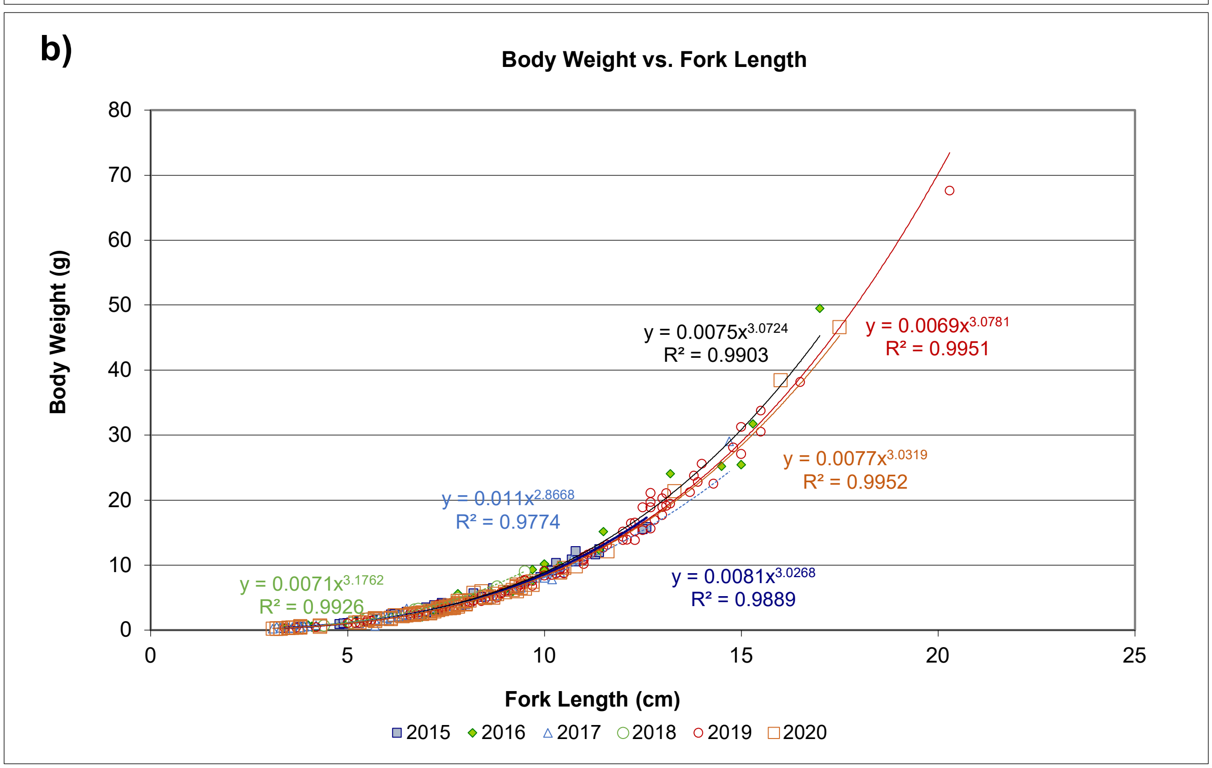


Figure B.9: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Reference Lake 3 in August from 2015 to 2020 using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

mine-exposed study lakes (Appendix Table G.2). However, unlike previous studies conducted from 2015 to 2018 that resulted in catches ranging from 1 to 27, the sample size in 2020 was sufficient as a basis for conducting meaningful statistical comparison with the mine-exposed lakes to evaluate mine-related effects on the population of reproductive-aged arctic charr. Notably, because arctic charr can show differential growth rates between the sexes (females grow faster; Jonsson et al. 1988; Skulason et al. 1996; Gulseth and Nilssen 2001), natural differences in sex ratios between study areas could potentially result in falsely attributing differences in growth and/or condition between mine-exposed and reference areas to mine-related influences. Thus, the inability to definitively determine arctic charr sex using external characteristics when applying a non-lethal sampling approach could confound data interpretation. To determine whether differences in sex ratios could potentially confound the interpretation of the CREMP arctic charr health assessment, growth and condition were compared between male and female Arctic charr collected at Camp, Sheardown and Mary lakes during the baseline period as part of the 2015 CREMP (Minnow 2016a). No significant differences in growth and condition were indicated between males and females based on this analysis, suggesting that a non-lethal study approach is unlikely to bias the evaluation of mine-related effects on fish health as part of the CREMP. Contrary to the published literature, the absence of differences in arctic charr growth and condition between males and females at Mary River Project local study area lakes may be explained by naturally slow growth rates and low spawning frequency (i.e., once every 2 to 4 years) at high Arctic areas, and also by low gonadosomatic index (GSI) at the time that sampling is normally conducted for the Mary River Project CREMP (i.e., August).

B8 CREMP IMPLICATIONS

This overview of reference conditions was included in the CREMP to provide context and perspective regarding key chemical, physical, and biological features of the CREMP reference study areas. Key implications of reference area features that could affect the ability of the CREMP to evaluate mine-related effects at mine-exposed waterbodies that were identified through the 2016 to 2020 reference area overviews include the following:

- **Federal Water Quality Guidelines (WQG) are not applicable for aqueous phenol concentrations**. Aqueous concentrations of phenols were routinely elevated above WQG at the CREMP creek, river and lake reference stations in 2015 and 2016. Correlation analysis indicated a significant, positive relationship between phenol and both nitrate and DOC concentrations in the 2015 and 2016 CREMP, suggesting that high phenol concentrations in waterbodies near the Mary River Project mine were associated with influences from natural organic composition. Therefore, phenol concentration comparisons against applicable WQG did not serve as a focus for discussion as part of the 2016 to 2020 CREMP.

- **Greater reliance on the use of dissolved metals concentrations for assessing mine-related influences on aqueous metal concentrations at waterbodies used for the CREMP**. Total aluminum concentrations were routinely elevated, and other metals including (total) iron periodically elevated, above WQG at creek, river, and/or lake reference areas used for the CREMP from 2015 to 2020, and historically in baseline studies. Significant positive correlations between total concentrations of these metals and turbidity were identified using the 2015 to 2020 data sets which suggested that these metals were likely bound to and/or composed the physical make-up of suspended particulate materials in water samples. This was supported by a low ratio of dissolved to total concentrations of metals such as aluminum, iron, and manganese in reference water samples from 2015 to 2020. Accordingly, greater emphasis should be placed on comparison of dissolved metal concentrations for assessing potential mine-related influences on water quality as part of the CREMP studies.

- **Use of fall sampling event water quality data to allow the most conservative evaluation of potential mine-related influences on water chemistry**. Water chemistry at lotic reference stations showed distinct seasonal changes in parameter concentrations during the baseline, and 2015 to 2020 studies. In general, conventional parameters, anions, and total metals were observed at lowest concentrations in spring, with intermediate concentrations in the summer, and highest concentrations observed during the fall in each year. Therefore, although water chemistry data from winter, spring, and summer sampling events were examined, the fall water chemistry data generally served as the focus for the evaluation of potential mine-related influences on water quality at the mine-exposed lakes in CREMP studies conducted from 2016 to 2020.

- **Use of average water chemistry and chlorophyll-a data for lake water quality/phytoplankton monitoring stations**. No consistent differences in water chemistry or chlorophyll-a concentrations were observed between the surface and bottom of the water column at Reference Lake 3 stations from 2015 to 2020. Therefore, the evaluation of water chemistry and phytoplankton productivity among stations and study areas for the 2016 to 2020 Mary River Project CREMP studies was based on average water chemistry and chlorophyll-a values from the water column surface and bottom for each lake station.

- **Consider updating of the AEMP sediment quality benchmarks**. Arsenic, chromium, copper, iron, manganese, and phosphorus have been observed at concentrations above the AEMP sediment quality benchmarks in sediment at Reference Lake 3 in CREMP studies conducted from 2015 to 2020. This suggested that the AEMP benchmarks for these metals may be overly conservative and therefore, to improve the applicability of the AEMP benchmarks for these metals, consideration should be given to incorporating reference lake data into derivation of updated sediment quality AEMP benchmarks.

- **Focus lake benthic invertebrate community survey on littoral zone**. Benthic invertebrate community data collected at Reference Lake 3 from 2015 to 2020 consistently indicated that, similar to most lakes, benthic invertebrate community features can be expected to naturally change with depth. In general, as depth increases, lower benthic invertebrate density and richness typically occurs. The occurrence of naturally low density and/or richness can, in turn, limit the ability to distinguish adverse effects associated with a project. Therefore, in order to maximize the confidence in the benthic invertebrate community analysis results, the littoral zone should serve as the focus for the lake benthic invertebrate community survey analysis for the CREMP.

- **Adopting of standard CES for benthic invertebrate community and fish population endpoints into the CREMP**. Year-to-year evaluation of reference creek and lake habitat used for the CREMP has indicated that benthic invertebrate and fish populations differences between years can be expected to vary within the CES set out for use under the federal EEM program (Munkittrick et al. 2009). Therefore, the use of established CES for defining effects appears to be applicable to the Mary River Project CREMP.

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APPENDIX C

WATER QUALITY DATA

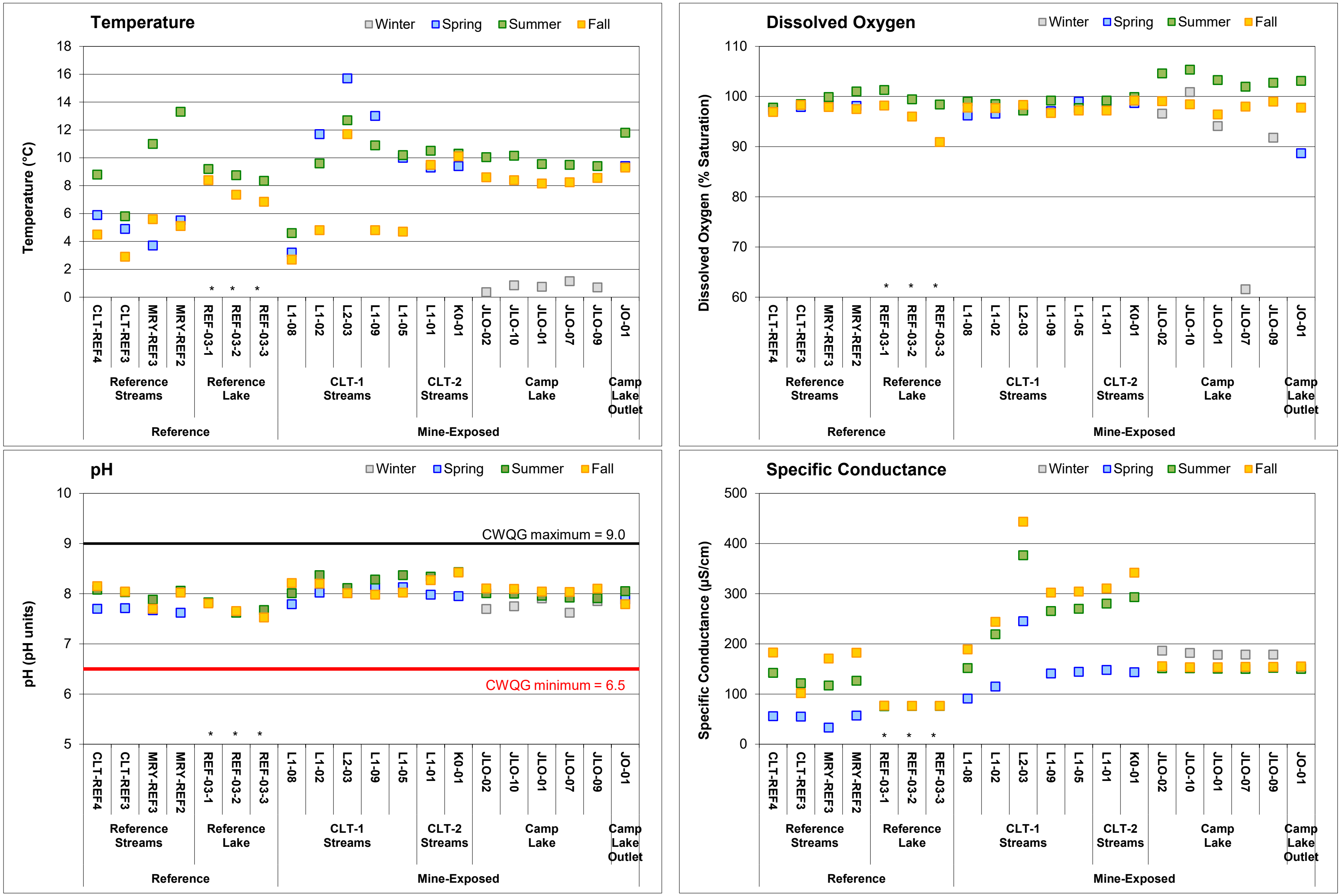


Figure C.1: Comparison of *In Situ* Water Quality Measured at Camp Lake System Water Quality Monitoring Stations in Winter, Spring, Summer, and Fall 2020, Mary River Project CREMP

Notes: Lake values represent mean of surface and bottom *in situ* water quality measurements. Streams were not sampled in winter. Lakes were not sampled in spring.
* Reference Lake 3 (REF-03) was not sampled in winter.

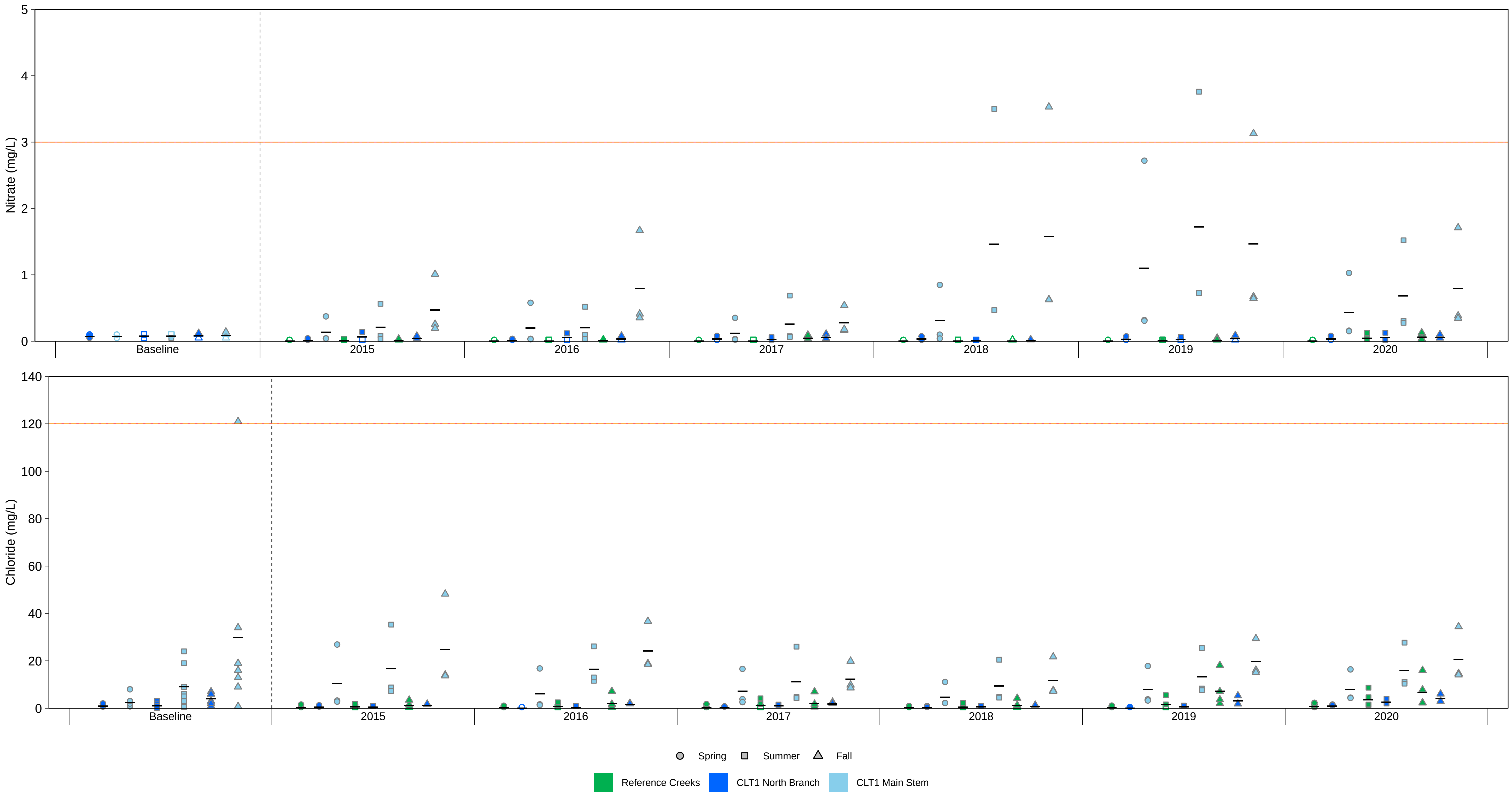
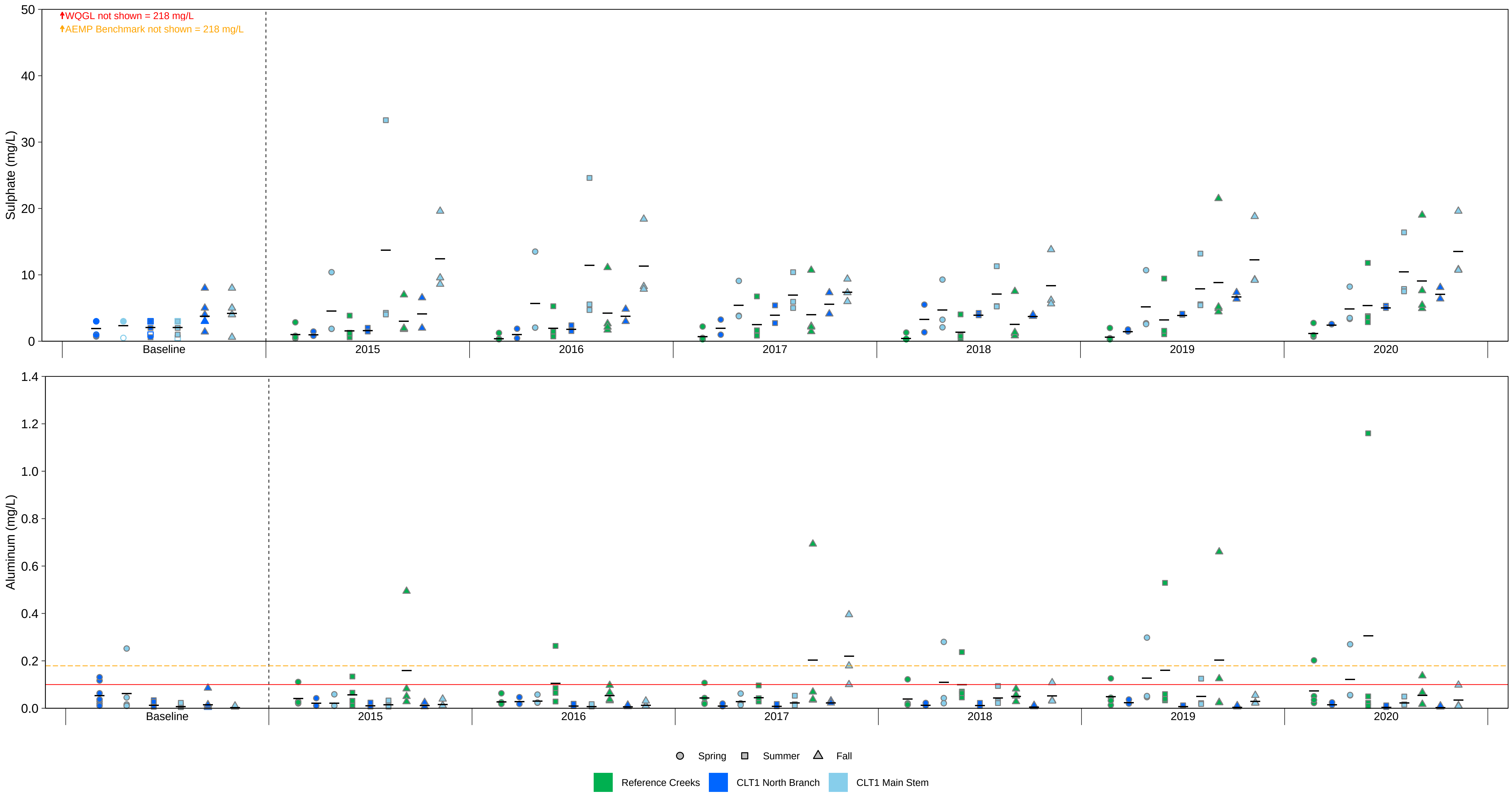


Figure C.2: Temporal Comparison of Water Chemistry at Camp Lake Tributary 1 (CLT1) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.



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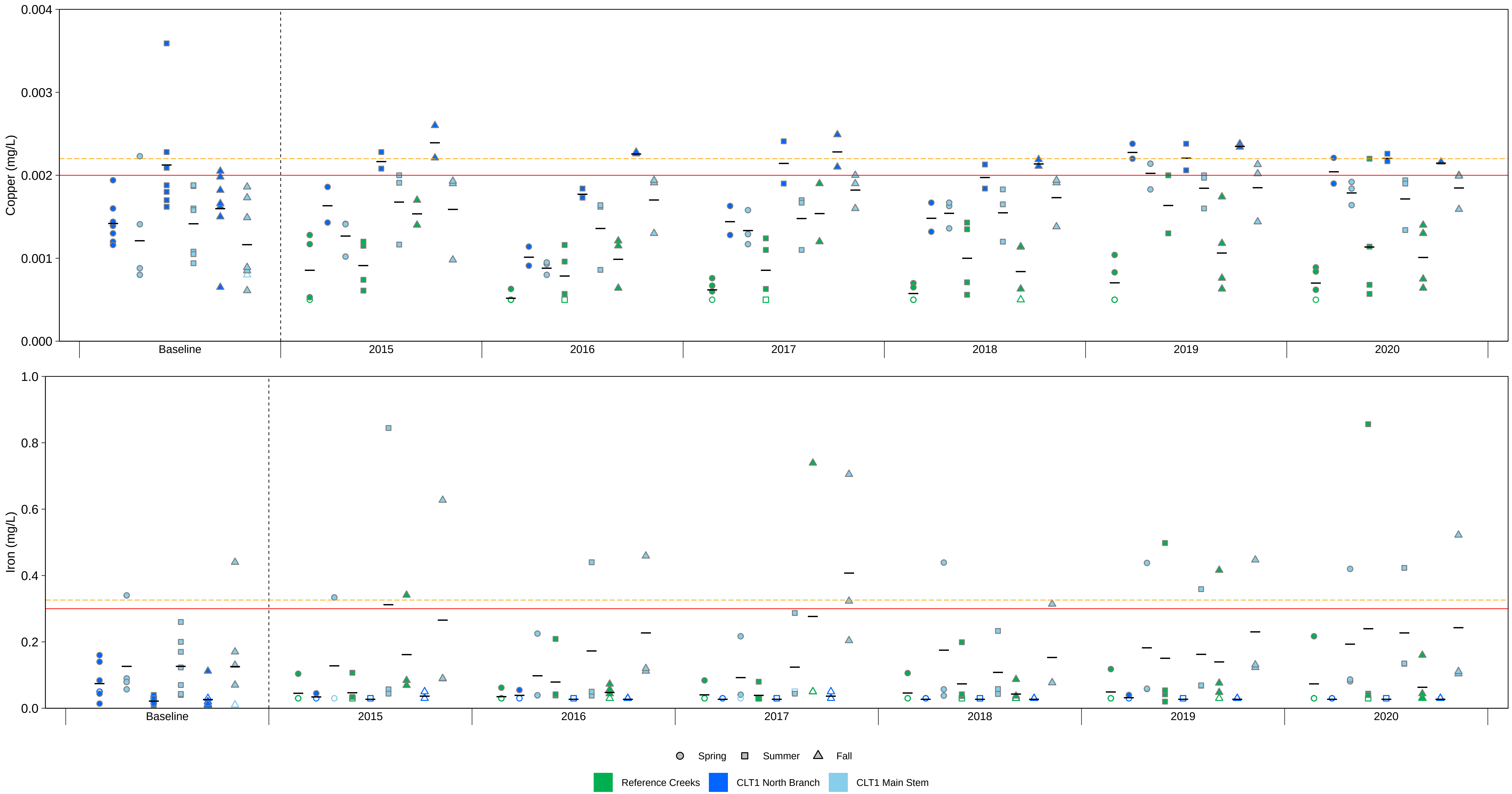

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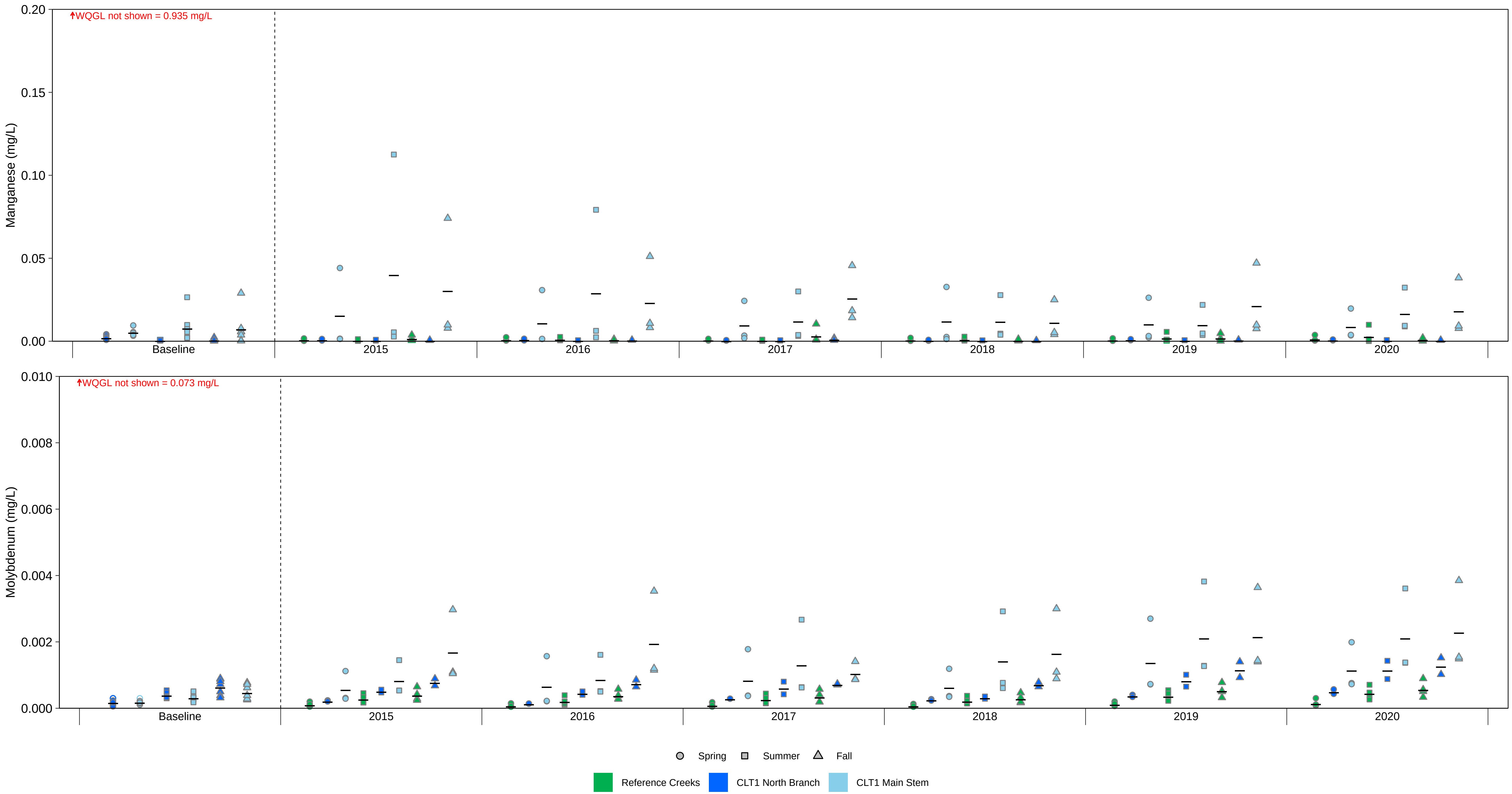

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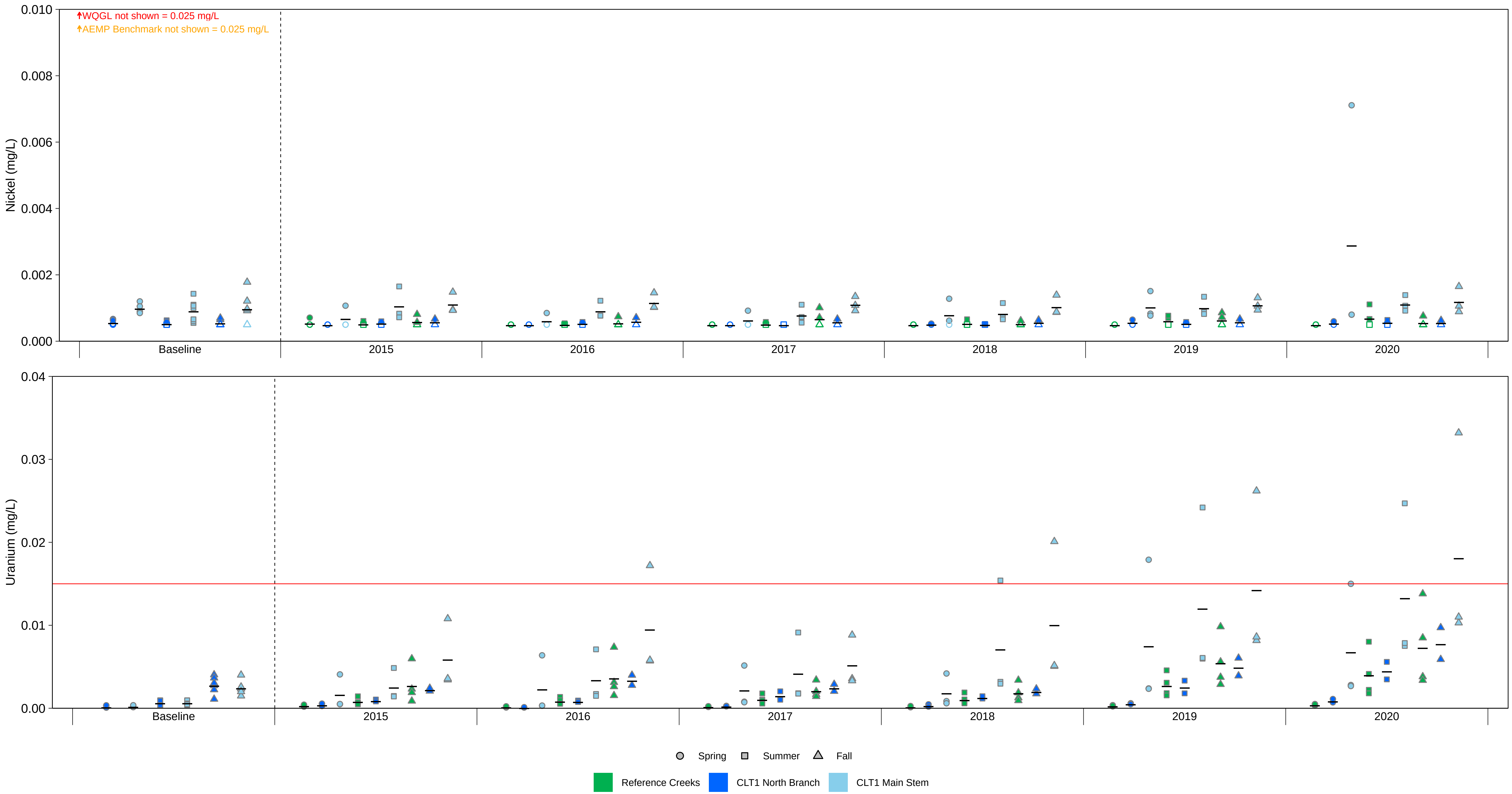

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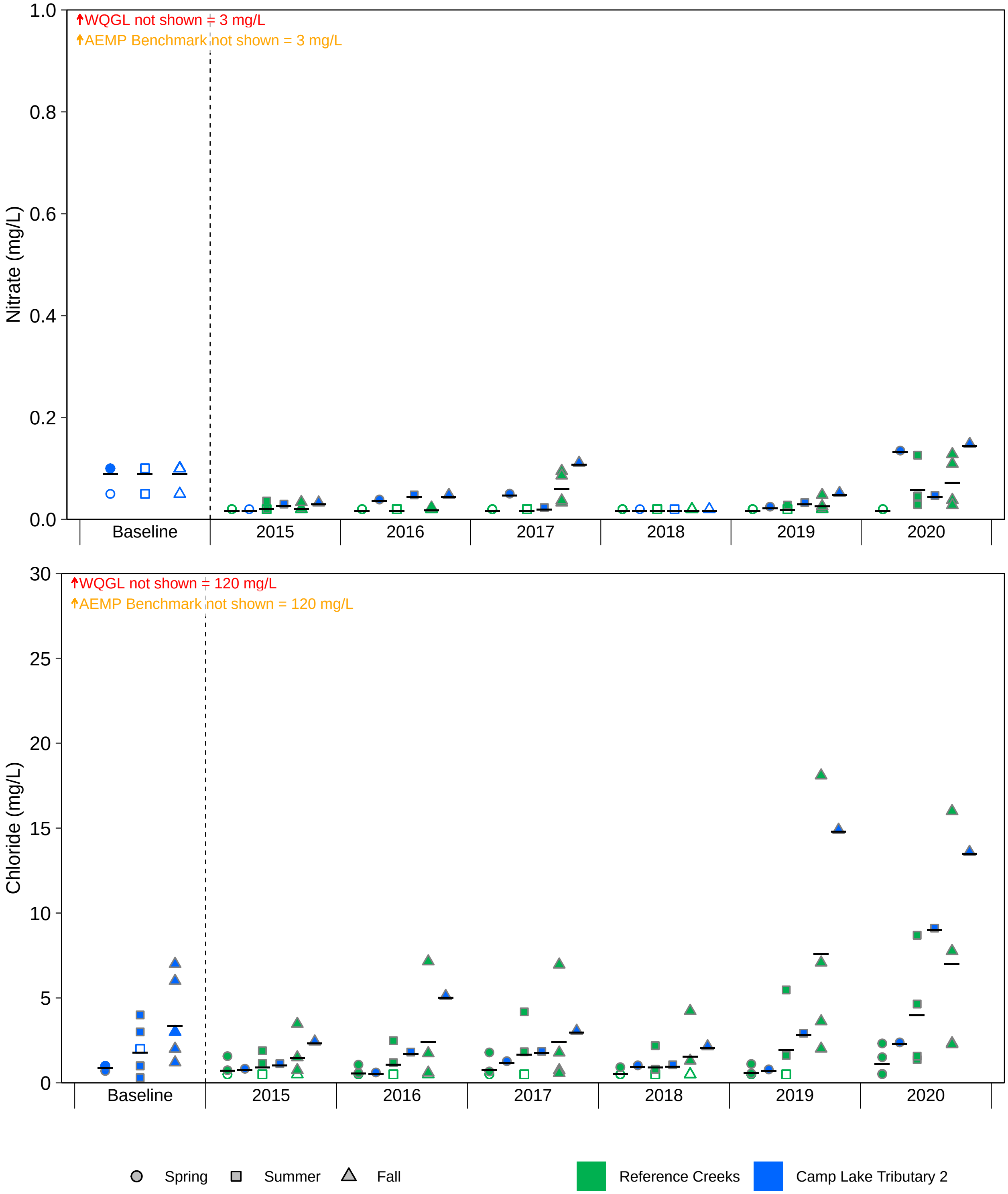

Figure C.3: Temporal Comparison of Water Chemistry at Camp Lake Tributary 2 (CLT2) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

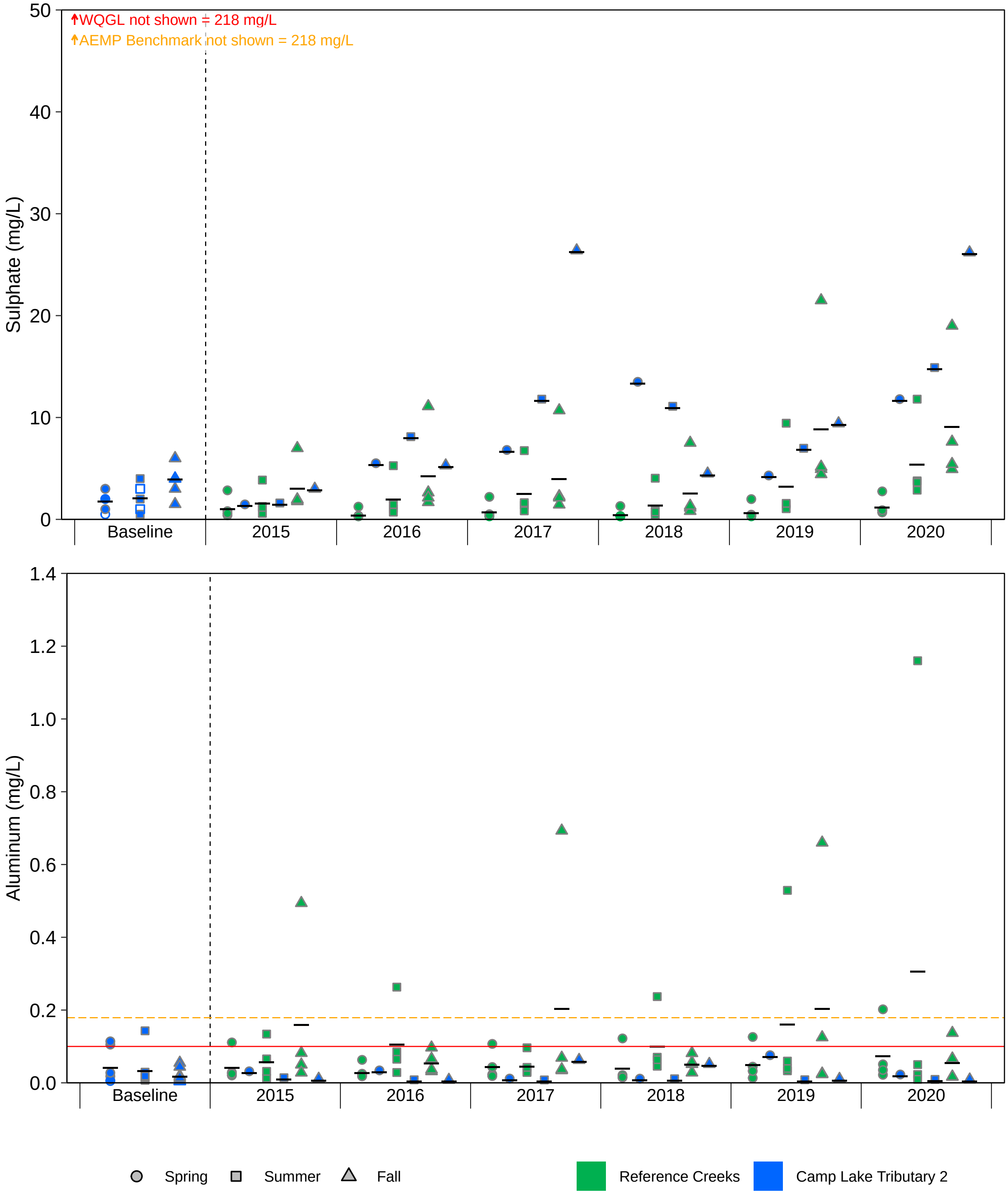

Figure C.3: Temporal Comparison of Water Chemistry at Camp Lake Tributary 2 (CLT2) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

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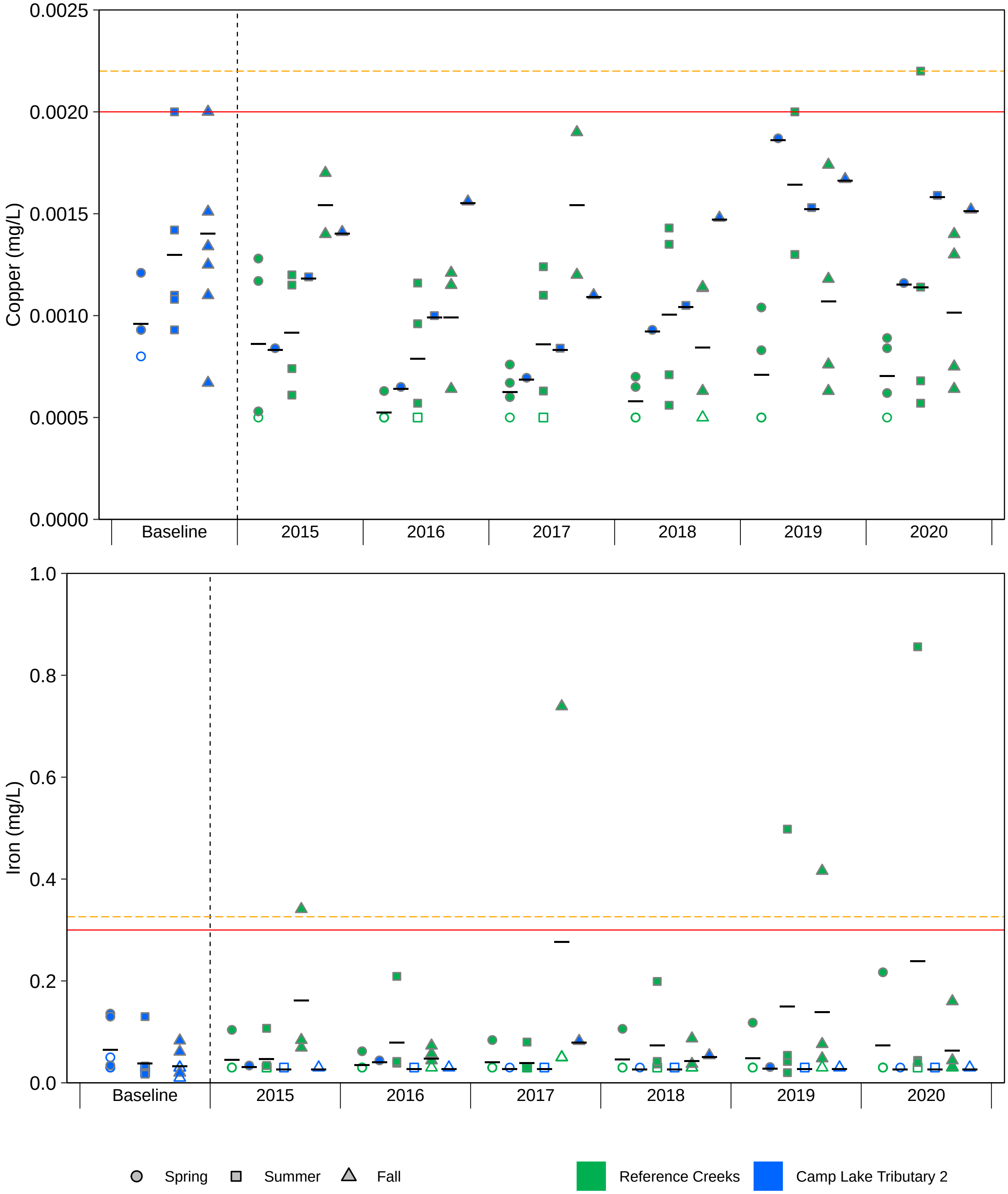

Figure C.3: Temporal Comparison of Water Chemistry at Camp Lake Tributary 2 (CLT2) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

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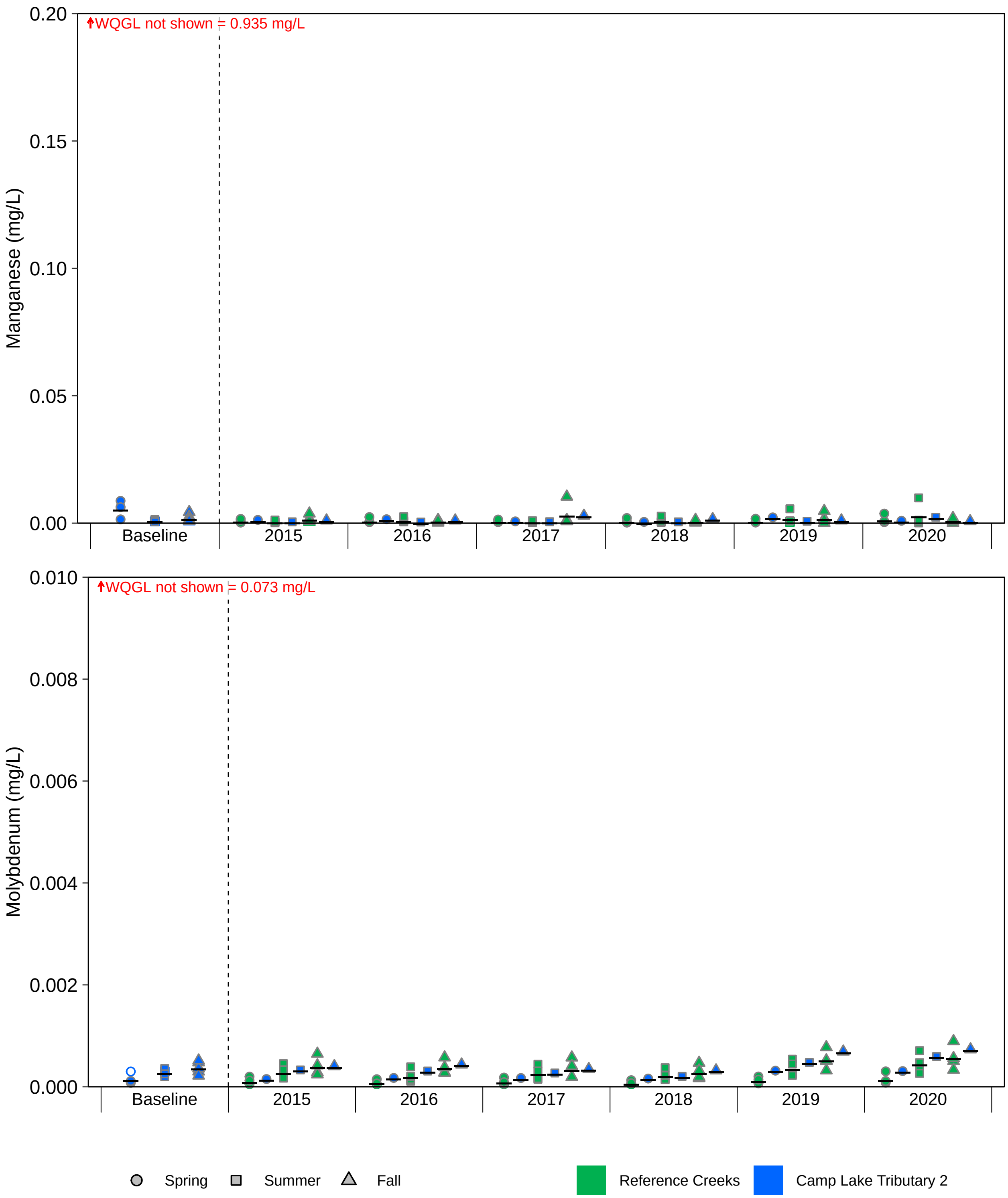

Figure C.3: Temporal Comparison of Water Chemistry at Camp Lake Tributary 2 (CLT2) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

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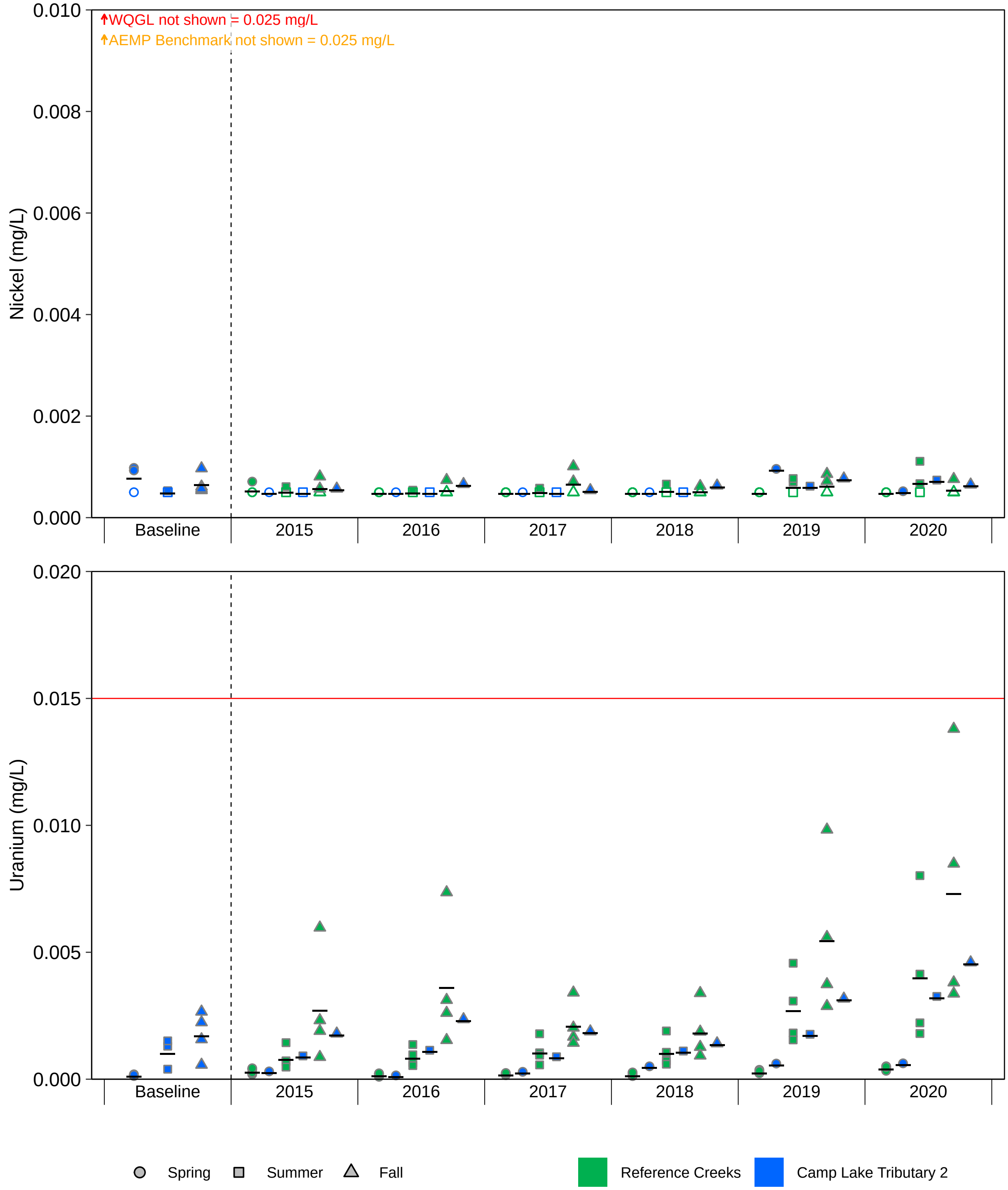

Figure C.3: Temporal Comparison of Water Chemistry at Camp Lake Tributary 2 (CLT2) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

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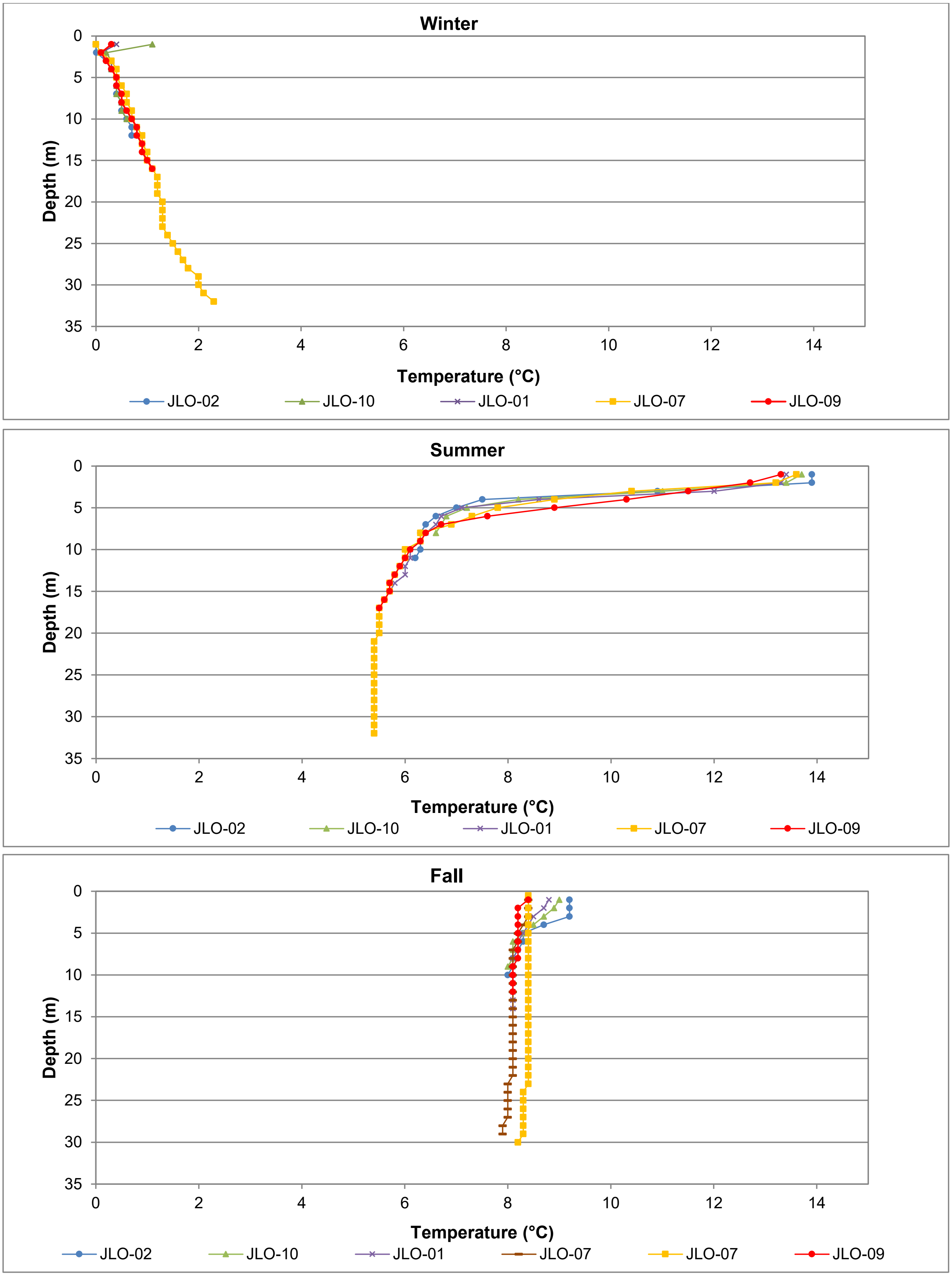


Figure C.4: Vertical Profiles of Temperature Measured at Camp Lake in Winter, Summer, and Fall, 2020

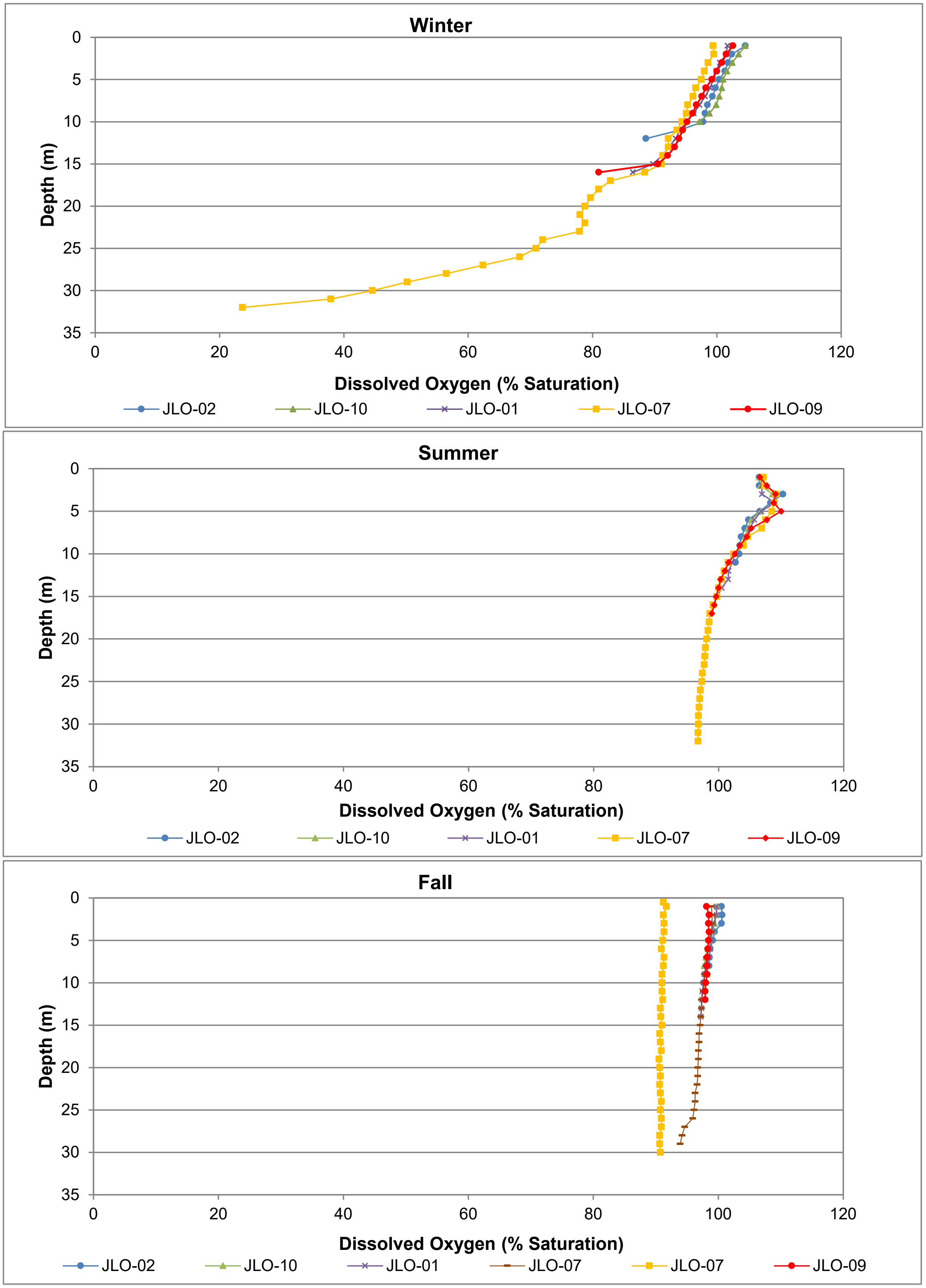


Figure C.5: Vertical Profiles of Dissolved Oxygen Measured at Camp Lake in Winter, Summer, and Fall, 2020

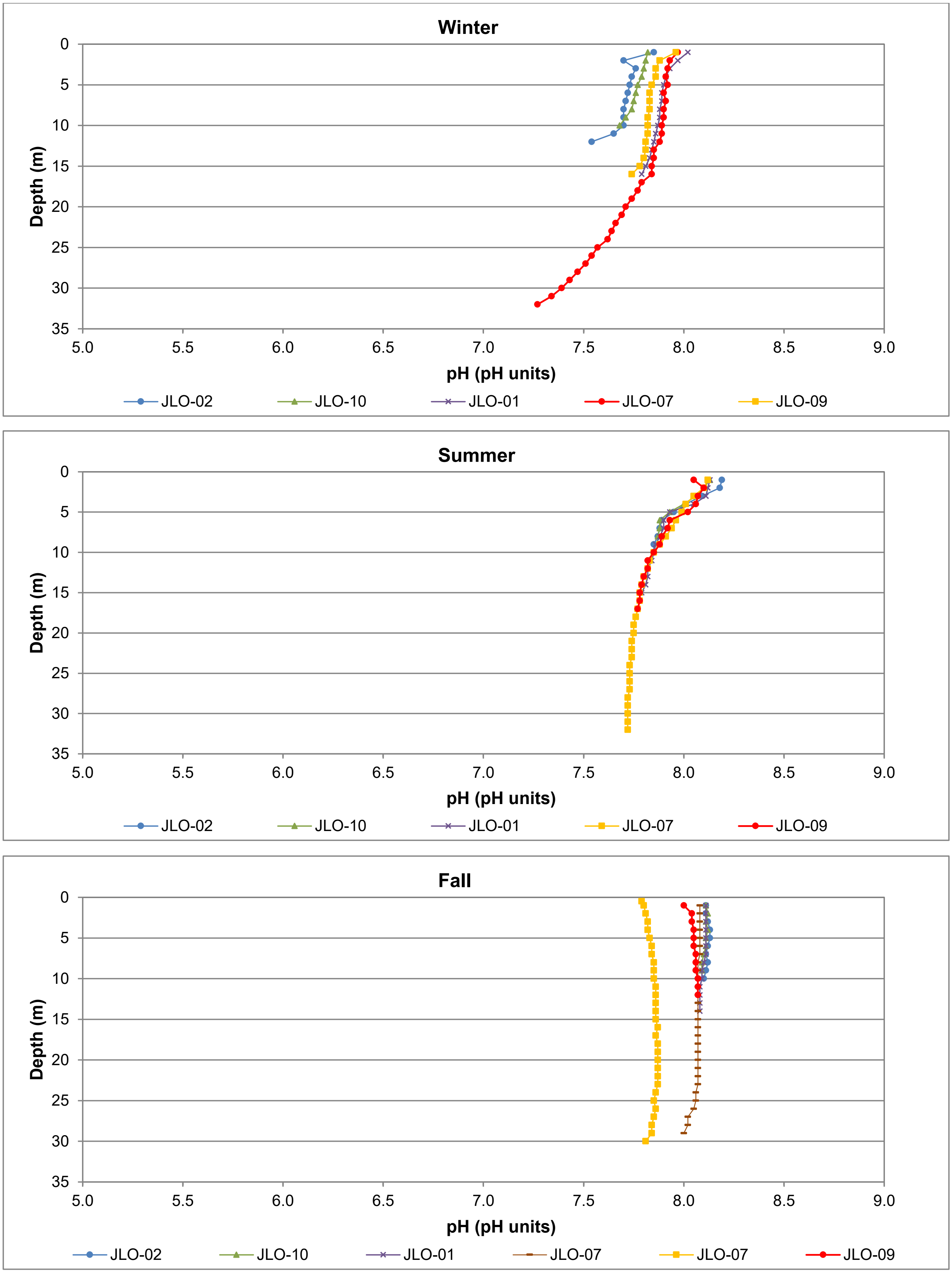


Figure C.6: Vertical Profiles of pH Measured at Camp Lake in Winter, Summer, and Fall, 2020

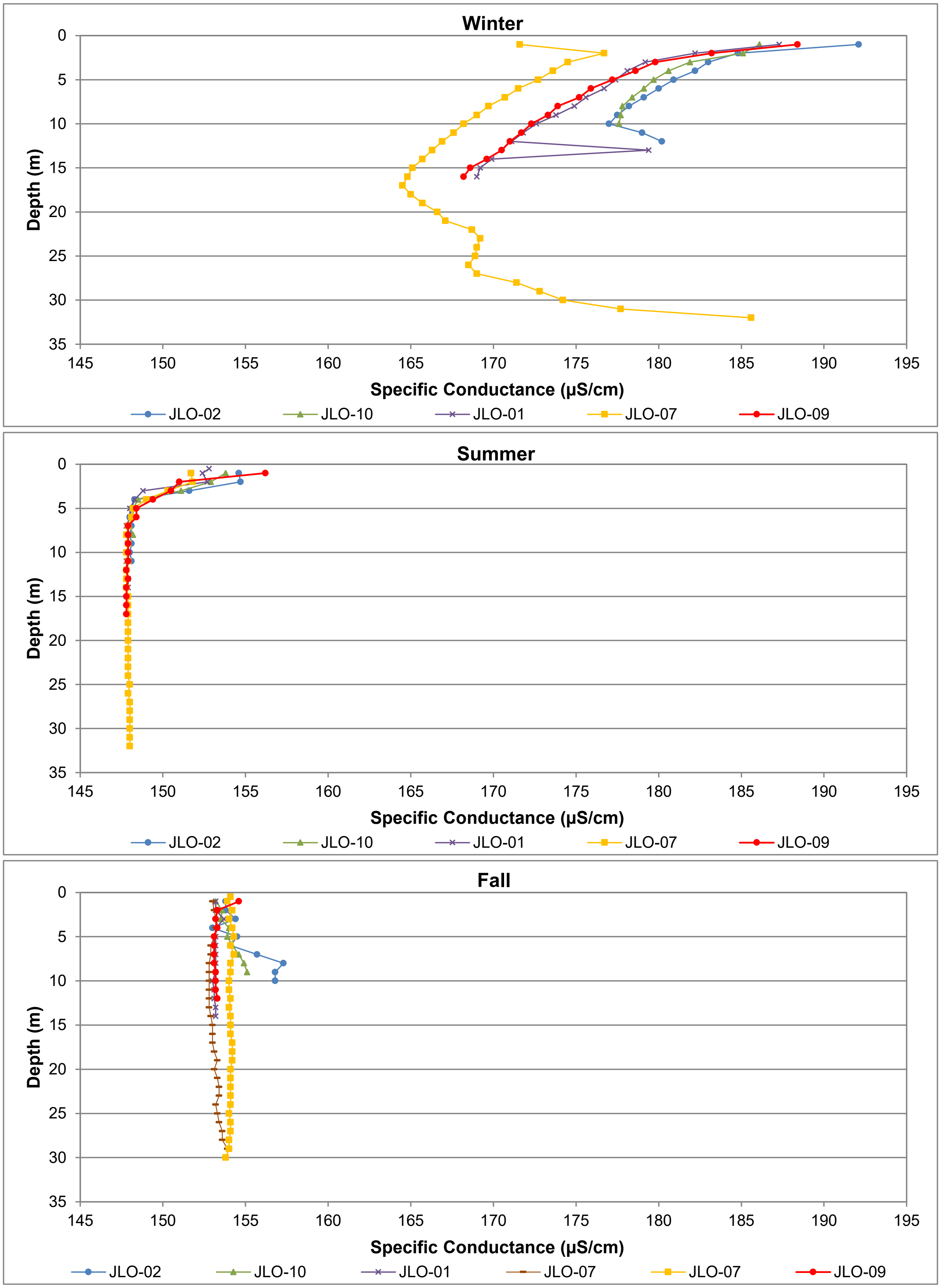


Figure C.7: Vertical Profiles of Specific Conductance Measured at Camp Lake in Winter, Summer, and Fall, 2020

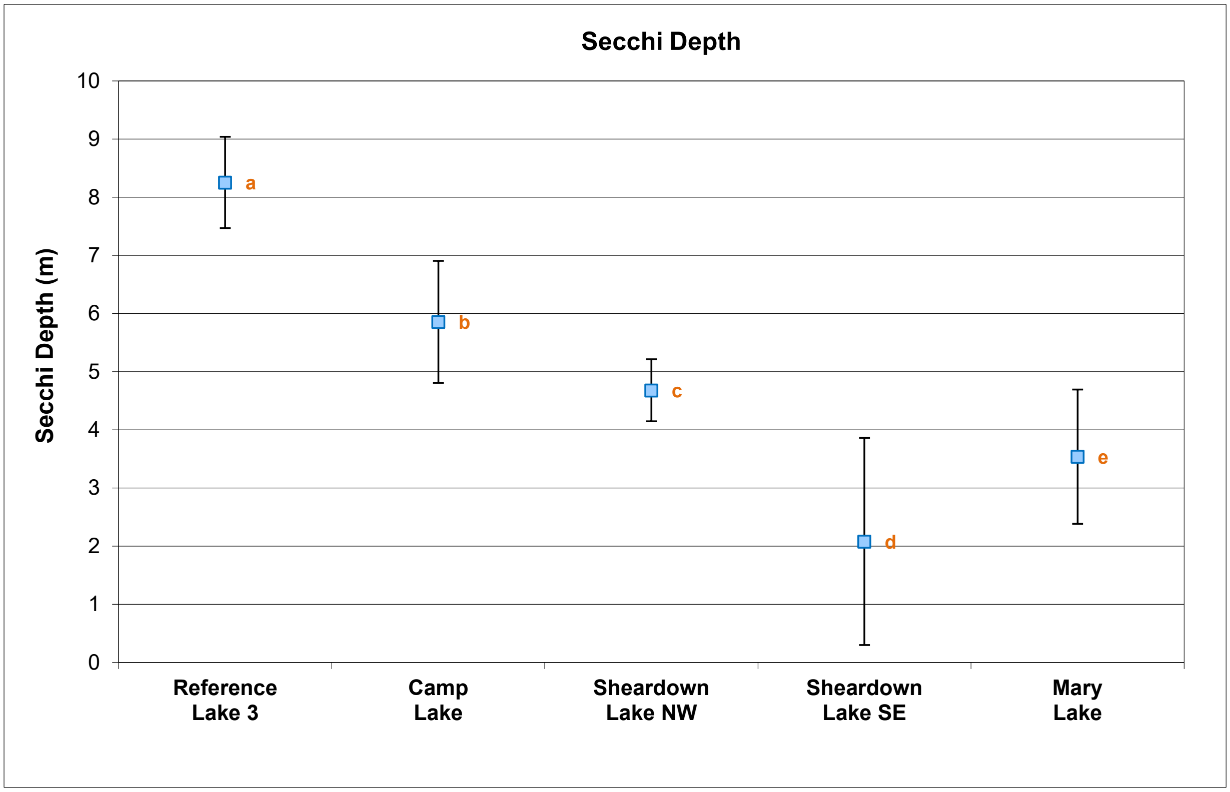


Figure C.8: Comparison of Secchi Depth (mean ± SD) Measured at the Mary River Project Lake Benthic Invertebrate Community Stations, August 2020

Notes: The same letter(s) next to study area data points indicate no significant difference between study areas. Sample size (n) was 10 for all lakes except Sheardown Lake NW, where n was 9.

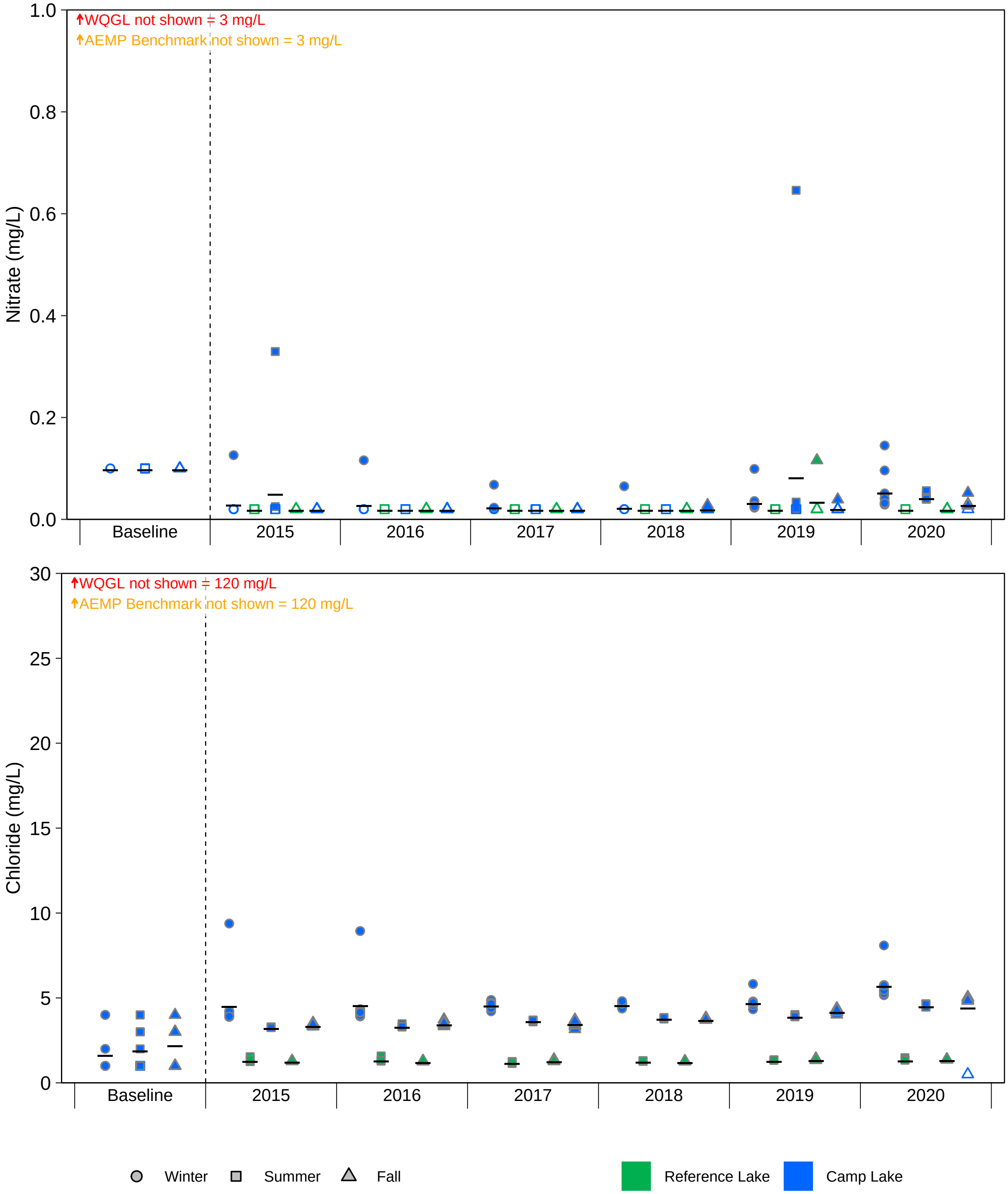


Figure C.9: Temporal Comparison of Water Chemistry at Camp Lake (JLO) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

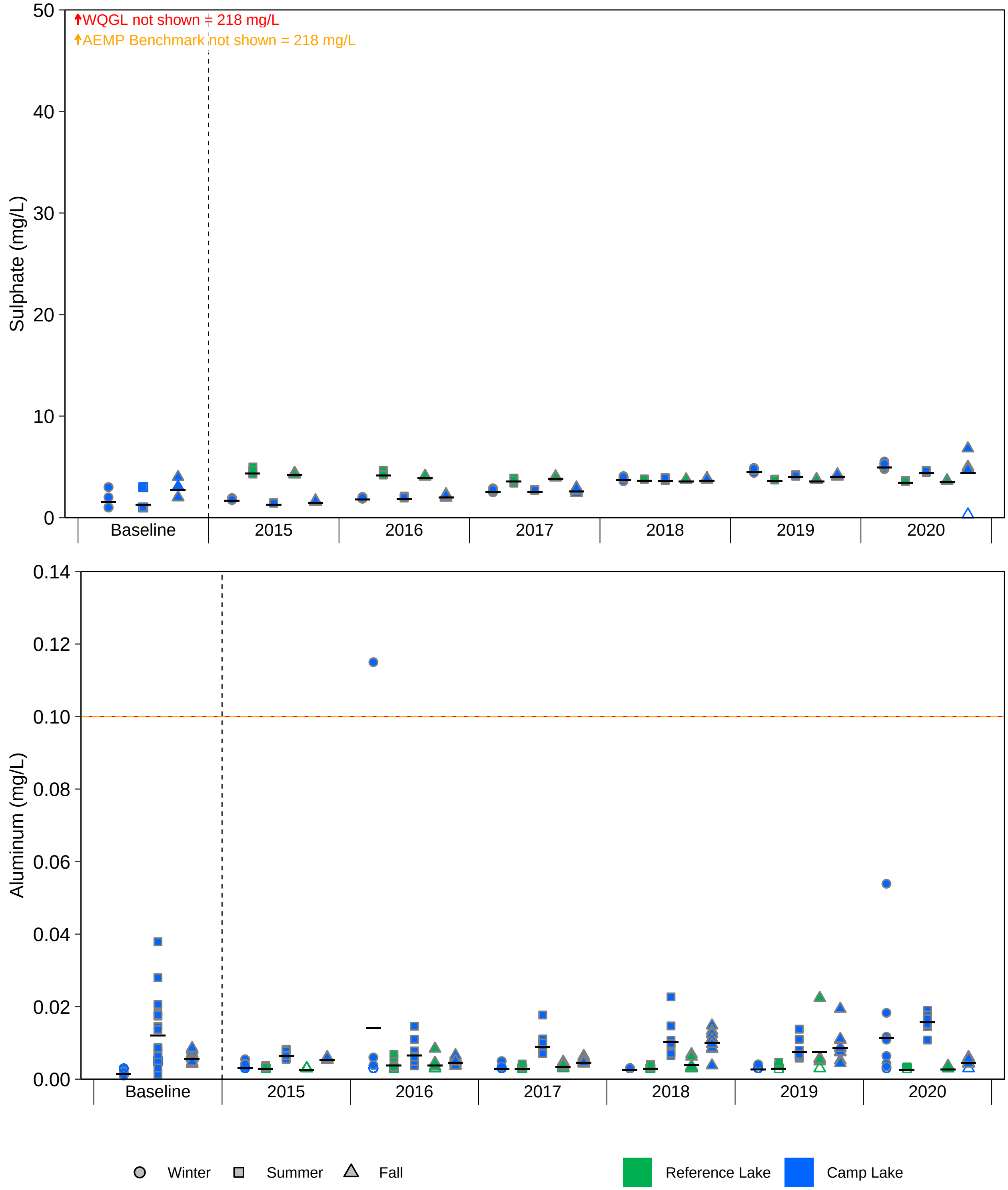


Figure C.9: Temporal Comparison of Water Chemistry at Camp Lake (JLO) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

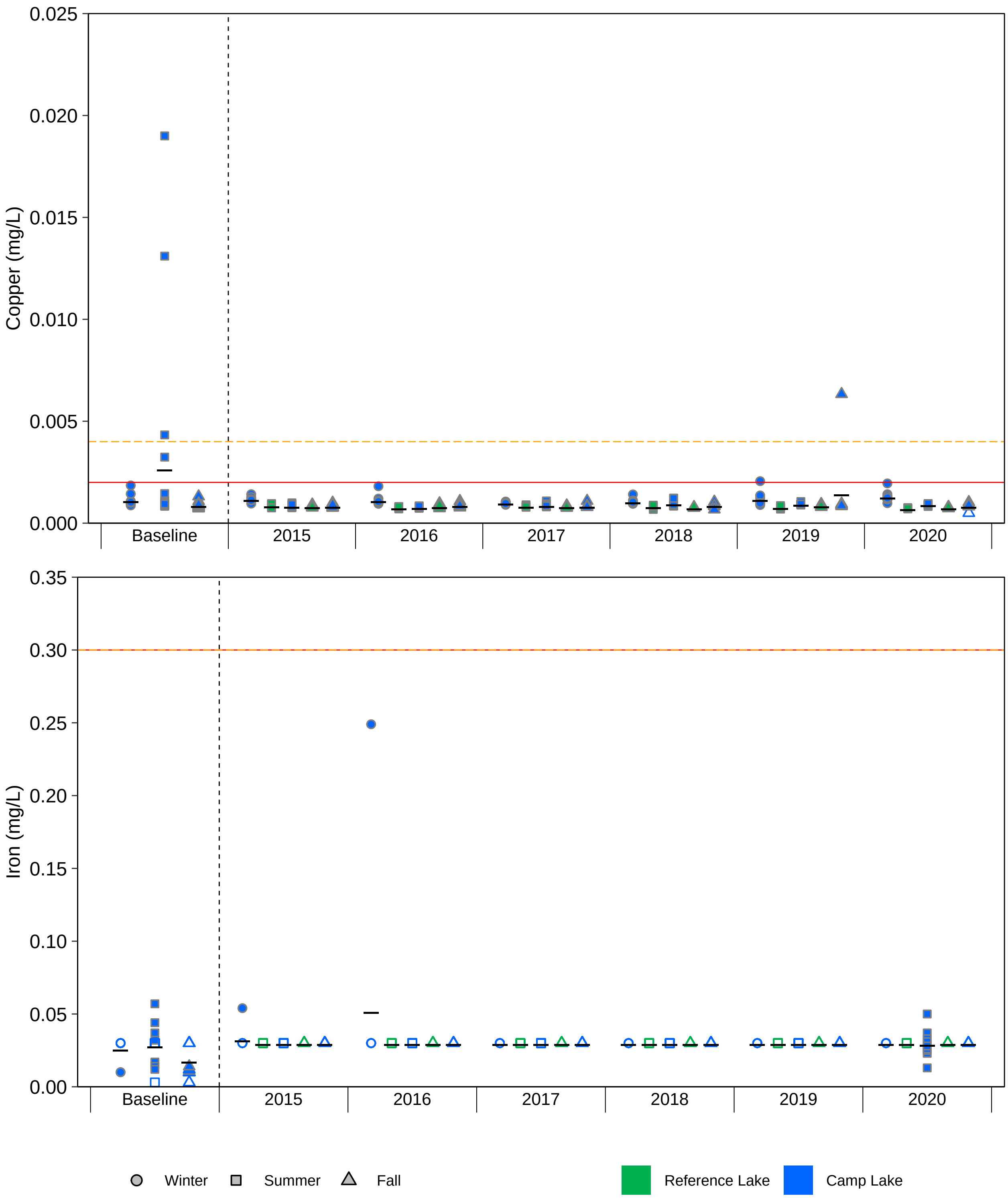


Figure C.9: Temporal Comparison of Water Chemistry at Camp Lake (JLO) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

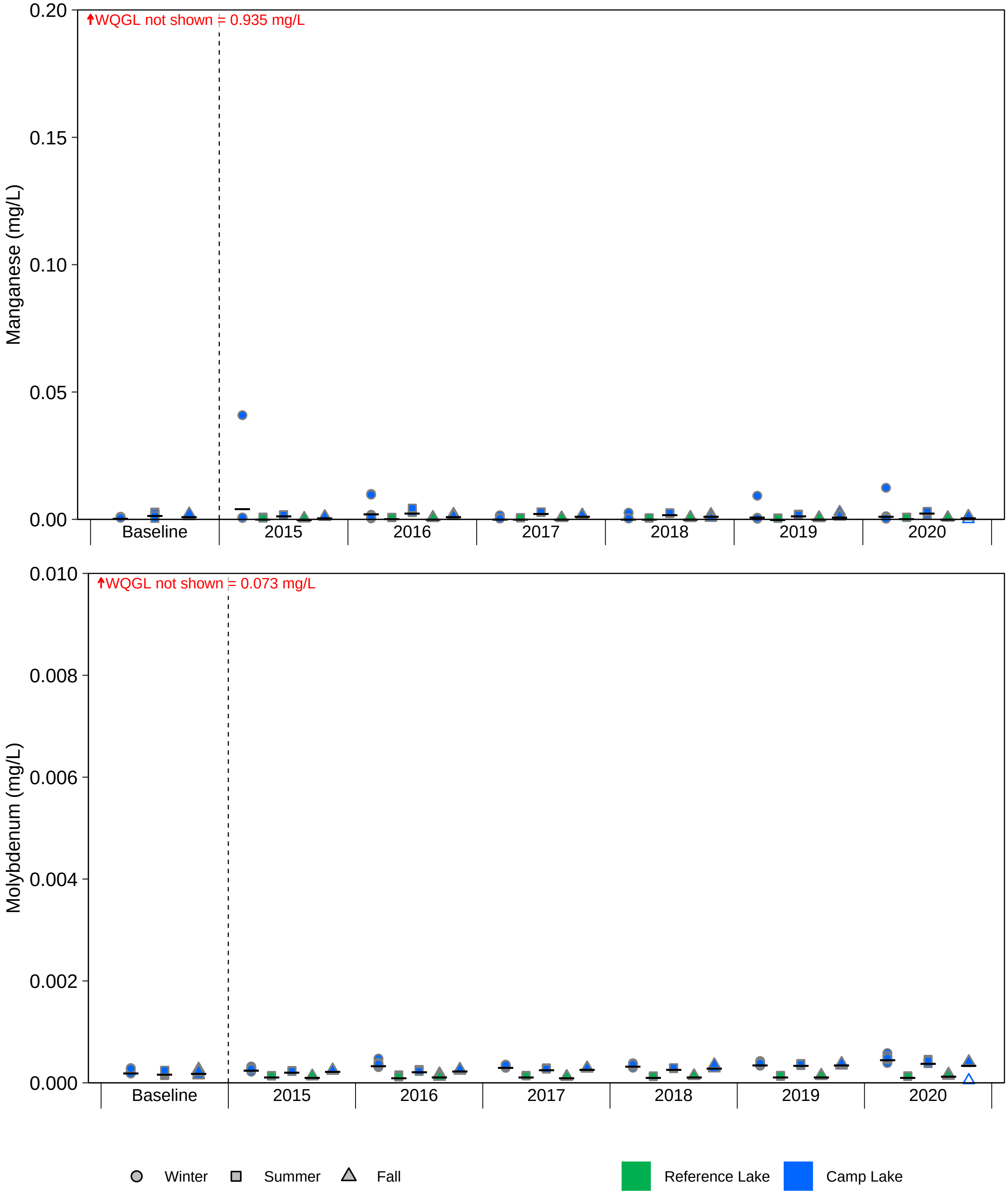


Figure C.9: Temporal Comparison of Water Chemistry at Camp Lake (JLO) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

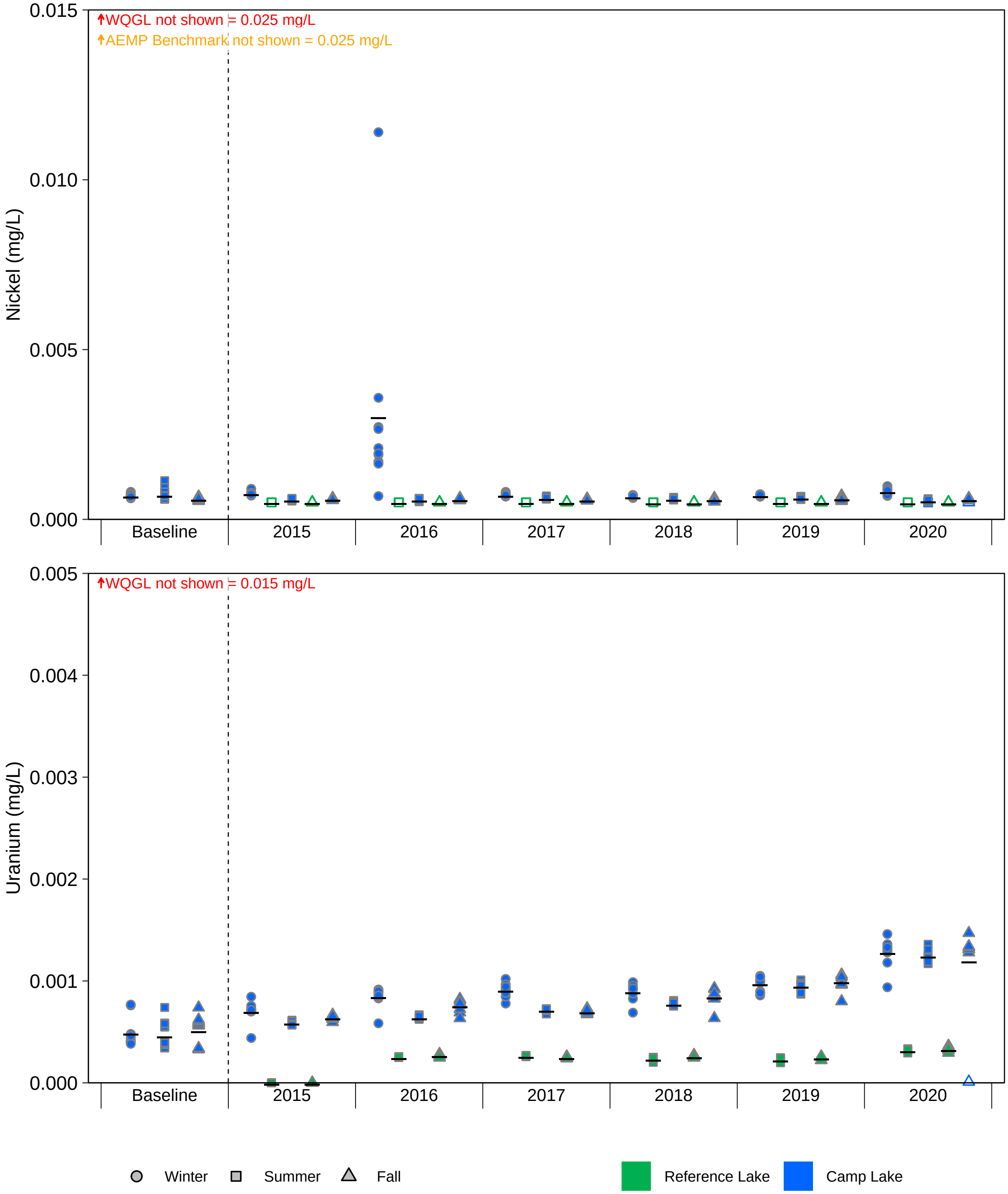


Figure C.9: Temporal Comparison of Water Chemistry at Camp Lake (JLO) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

Figure C.10: Comparison of *In Situ* Water Quality Variables Measured at Sheardown Lake System Water Quality Monitoring Stations in Winter, Spring, Summer, and Fall 2020, Mary River Project CREMP

Notes: Lake values represent mean of surface and bottom *in situ* water quality measurements. Streams were not sampled in winter. Lakes were not sampled in spring.

* Reference Lake 3 (REF-03) was not sampled in winter.

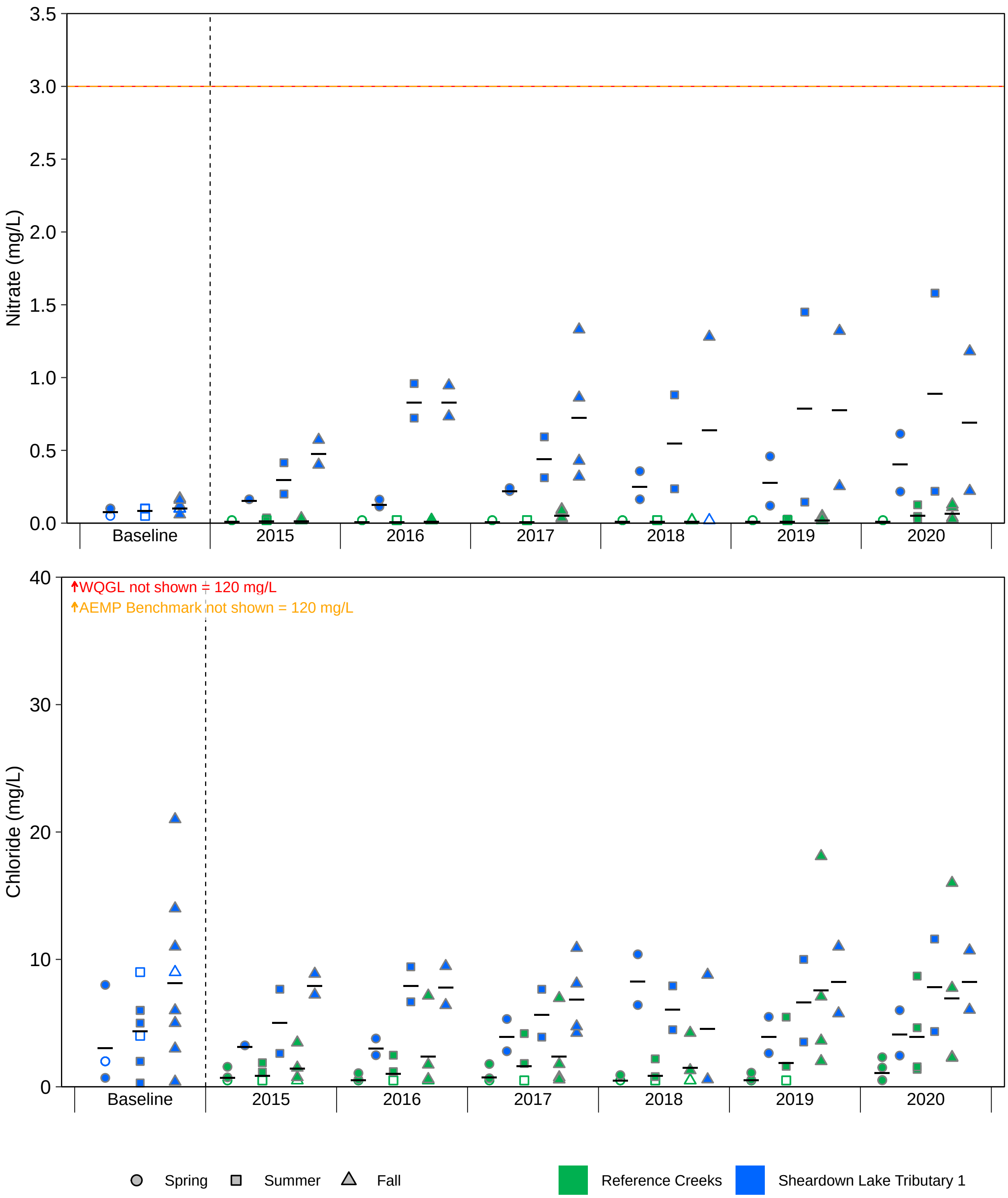


Figure C.11: Temporal Comparison of Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

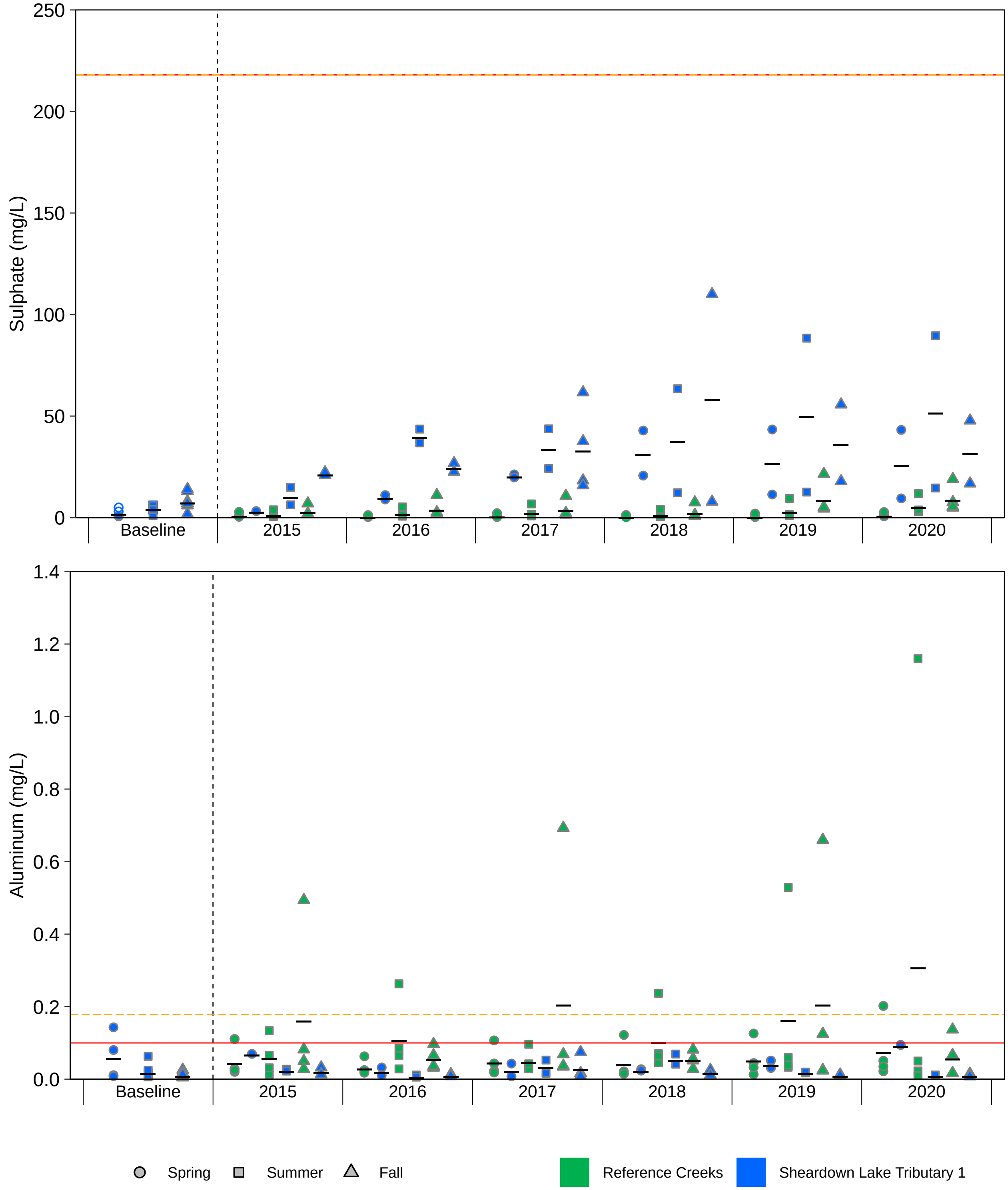


Figure C.11: Temporal Comparison of Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

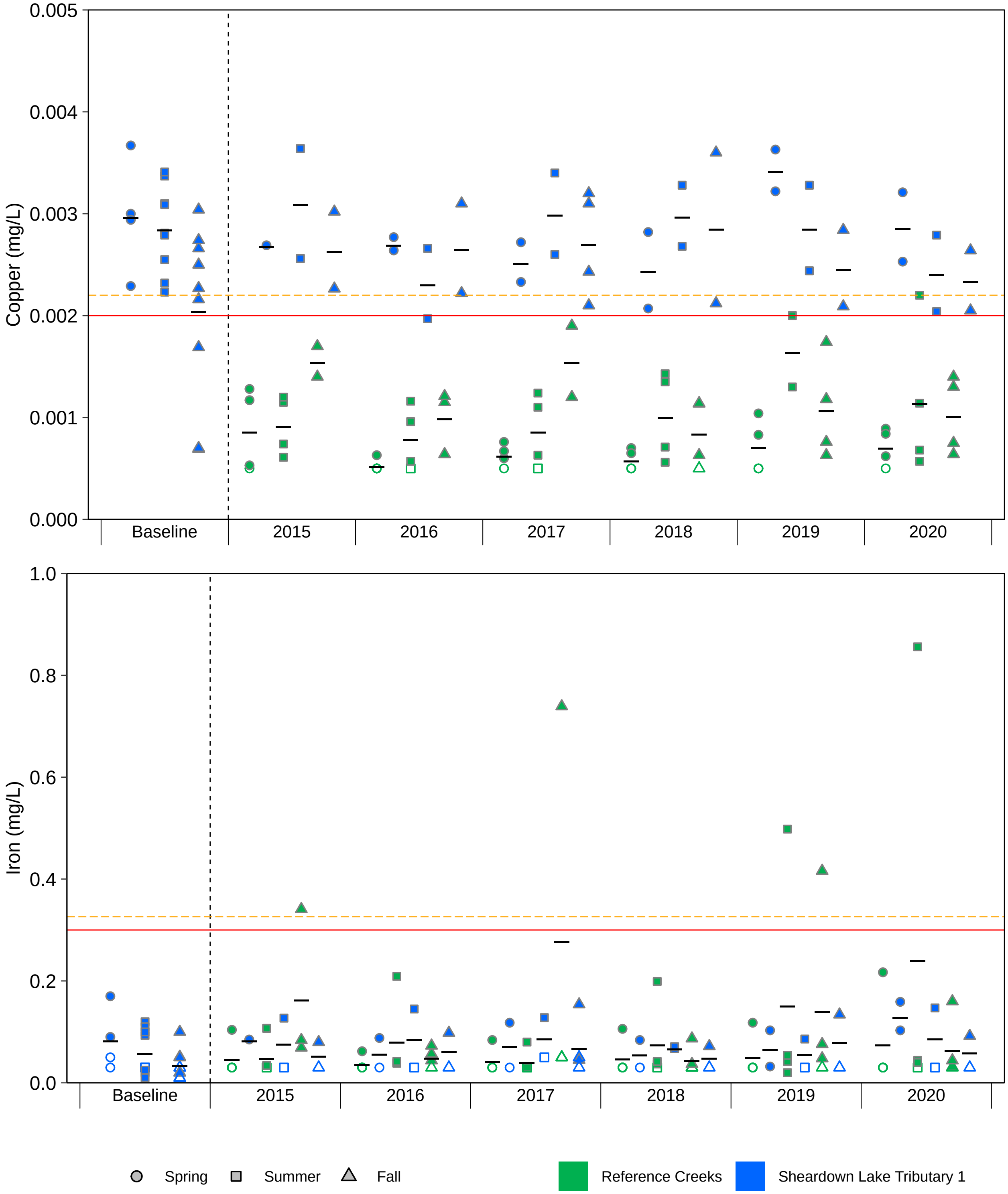


Figure C.11: Temporal Comparison of Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

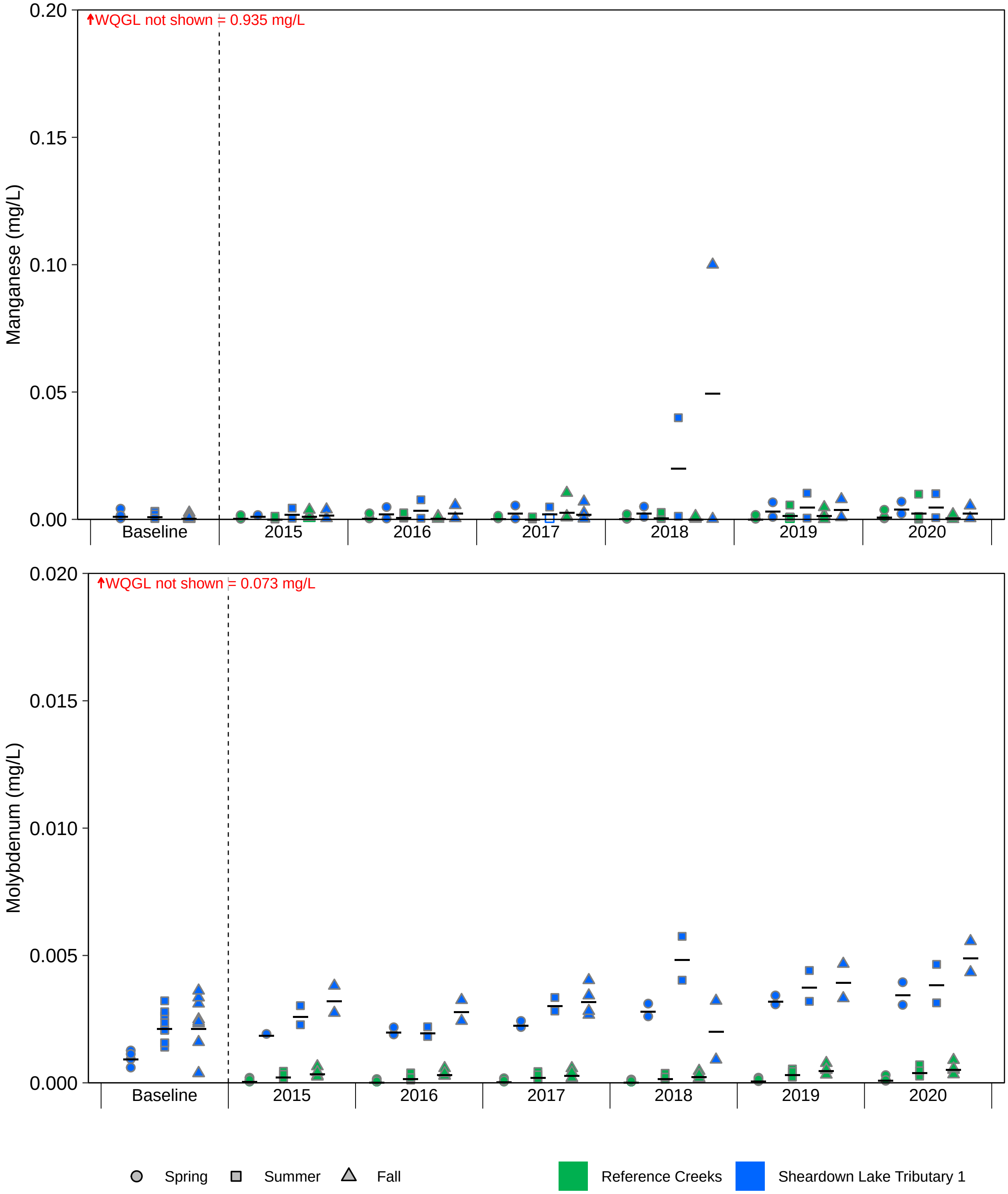


Figure C.11: Temporal Comparison of Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

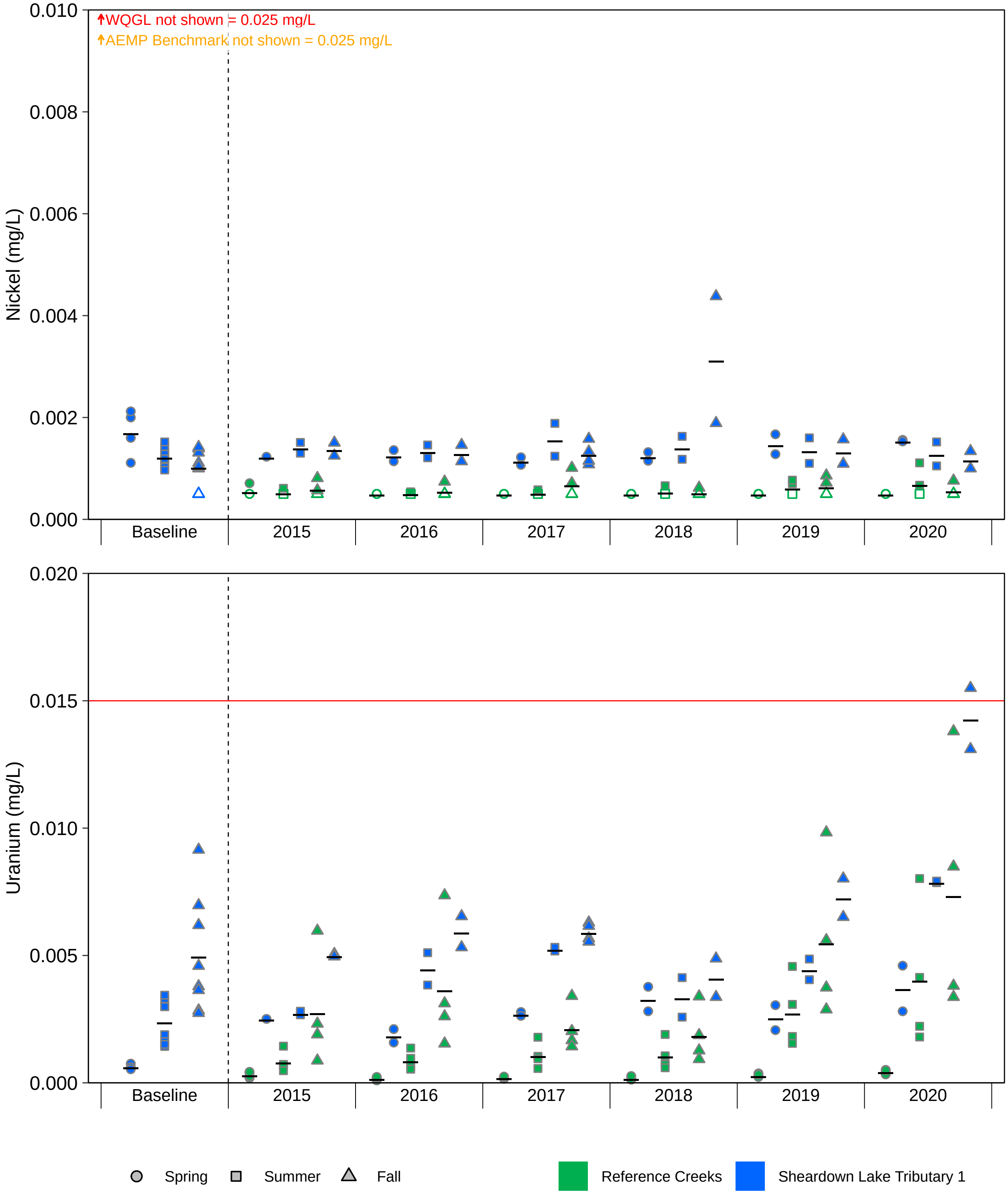


Figure C.11: Temporal Comparison of Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

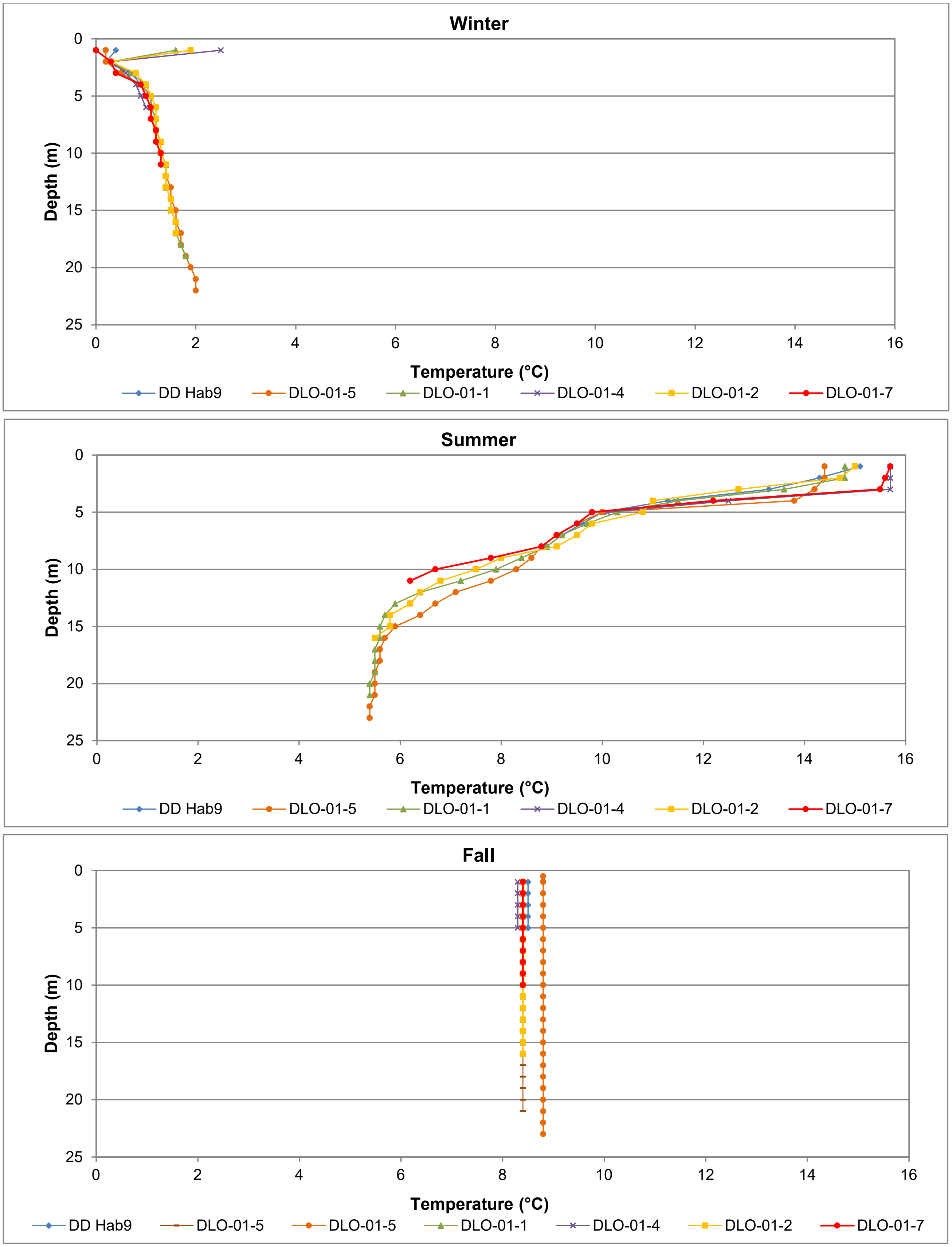


Figure C.12: Vertical Profiles of Temperature Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2020

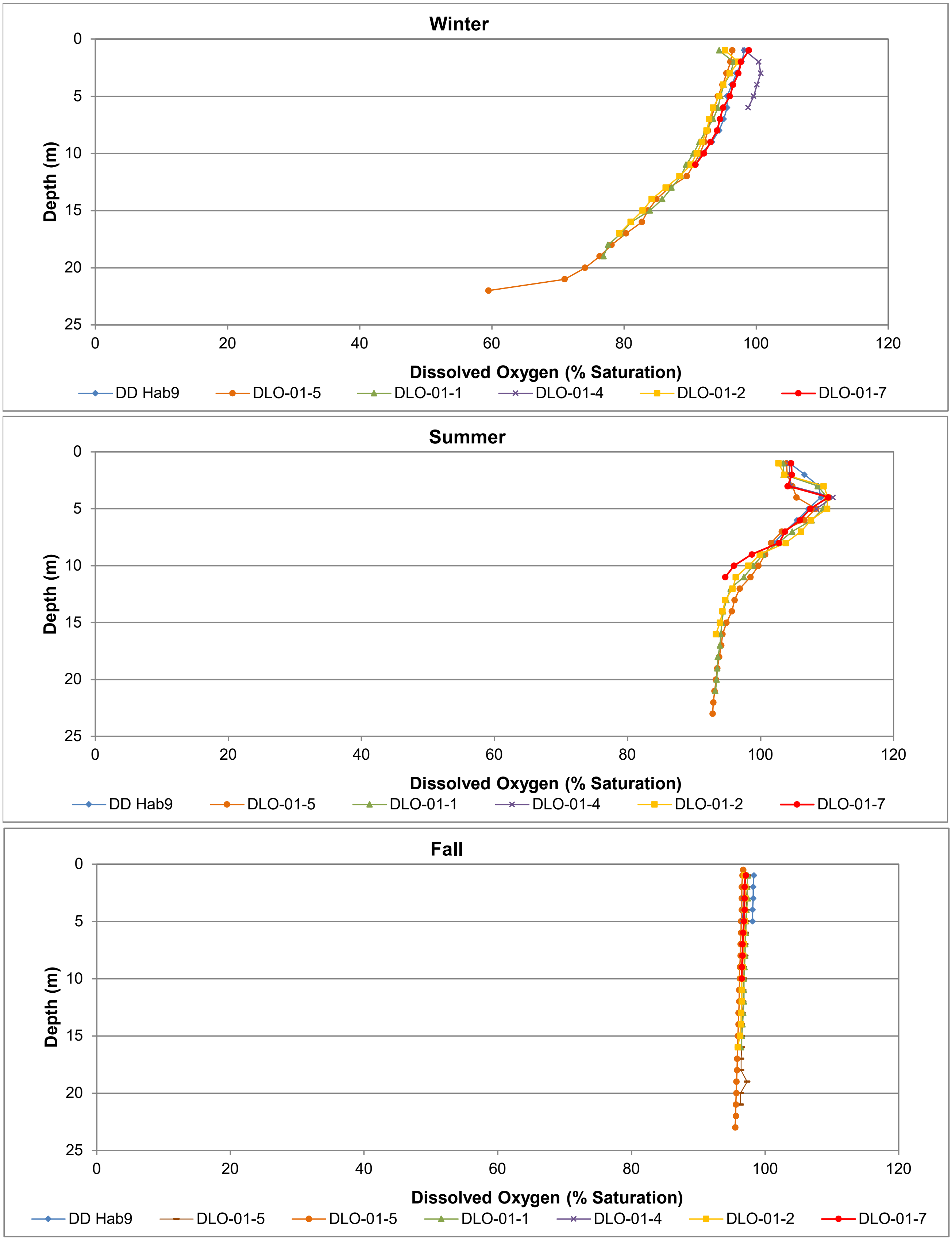


Figure C.13: Vertical Profiles of Dissolved Oxygen Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2020

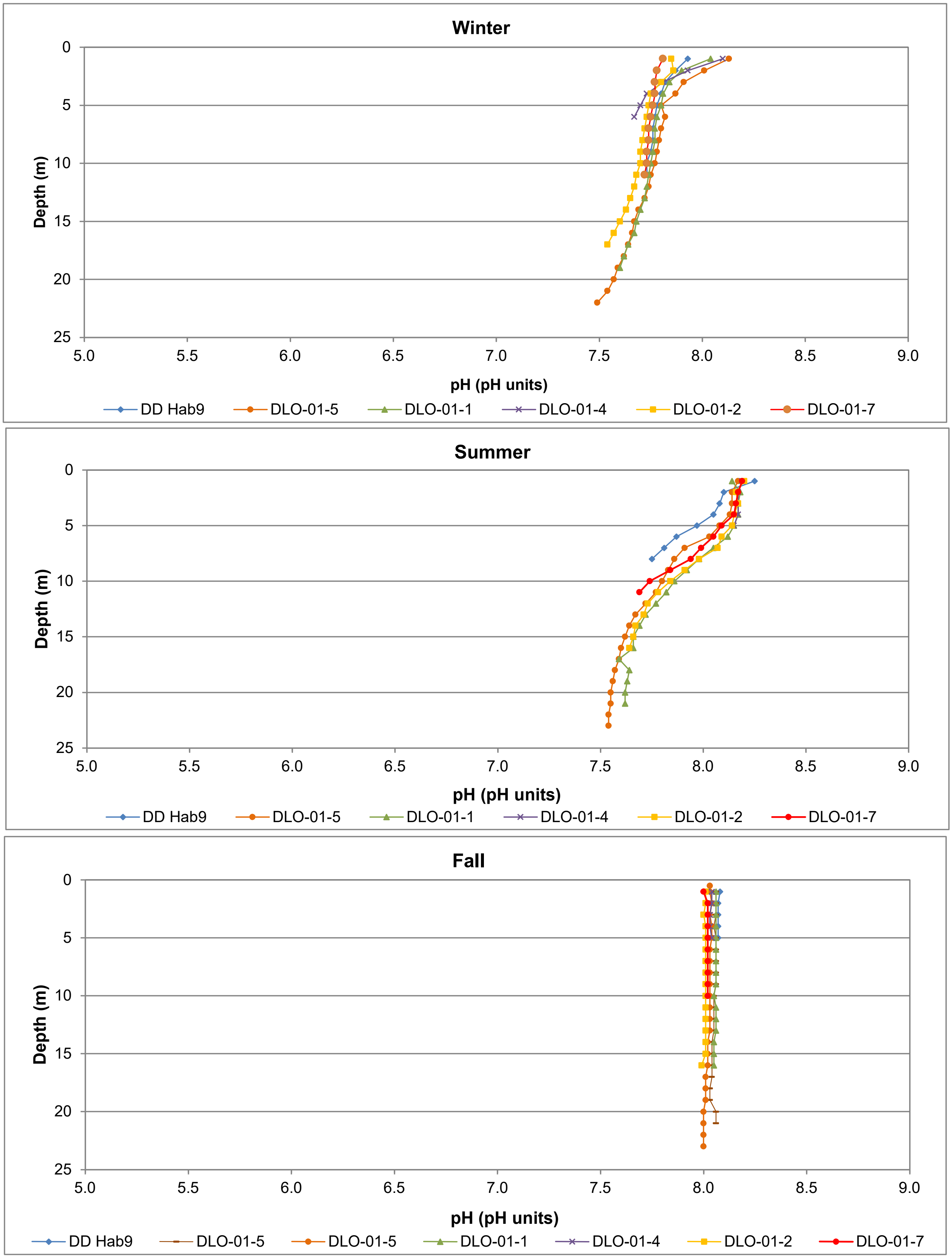


Figure C.14: Vertical Profiles of pH Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2020

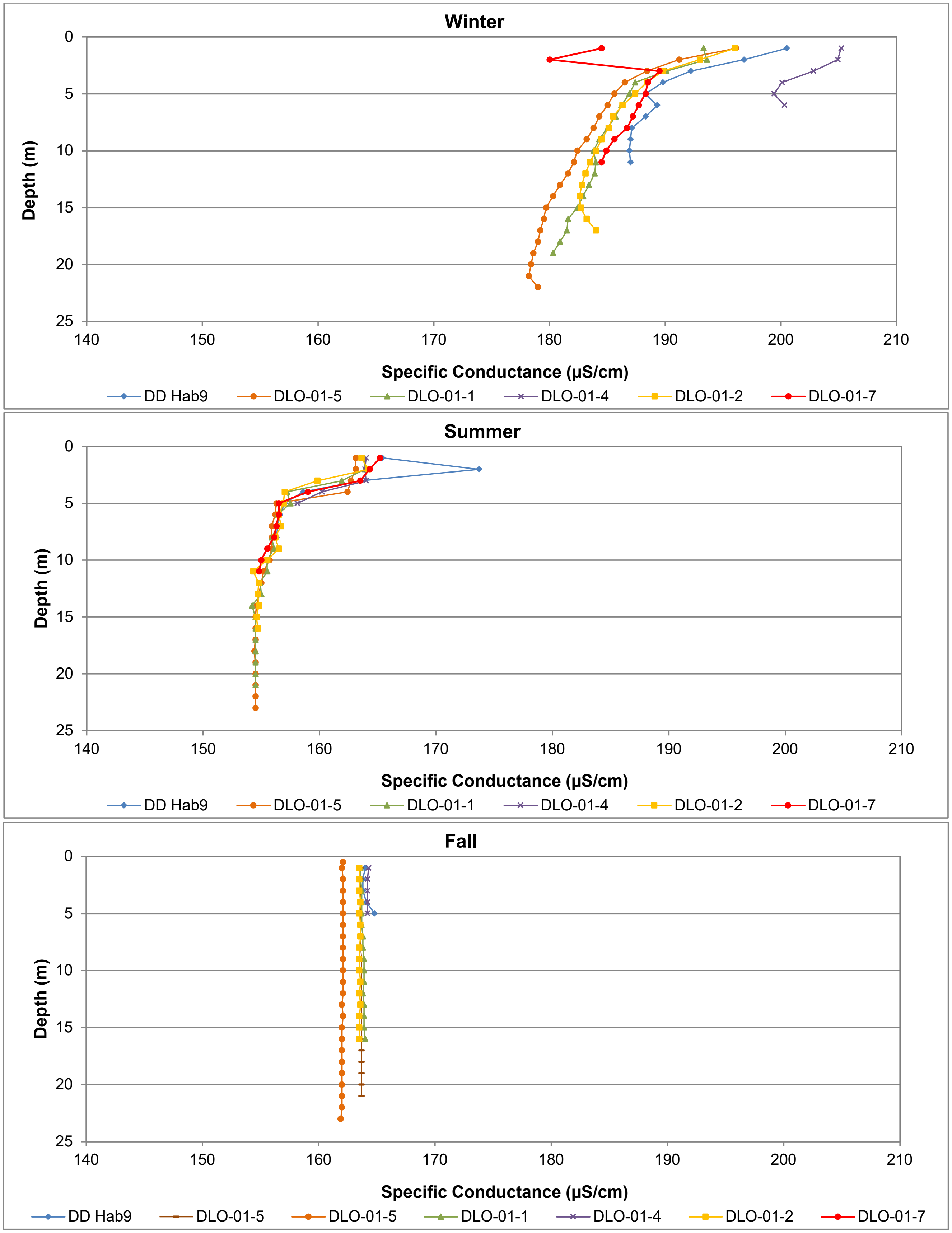


Figure C.15: Vertical Profiles of Specific Conductance Measured at Sheardown Lake NW in Winter, Summer, and Fall, 2020

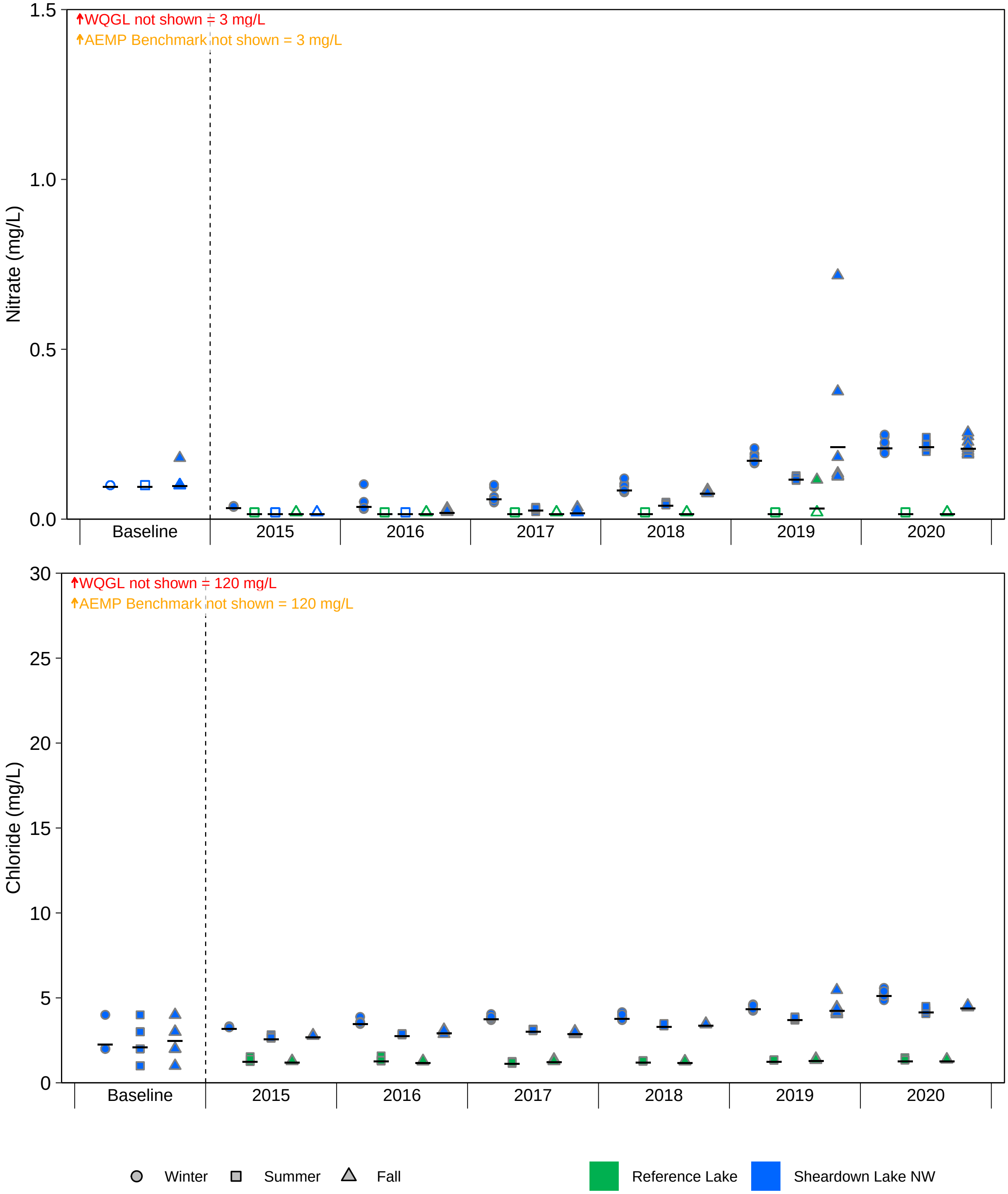


Figure C.16: Temporal Comparison of Water Chemistry at Sheardown Lake Northwest (DL0−01) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

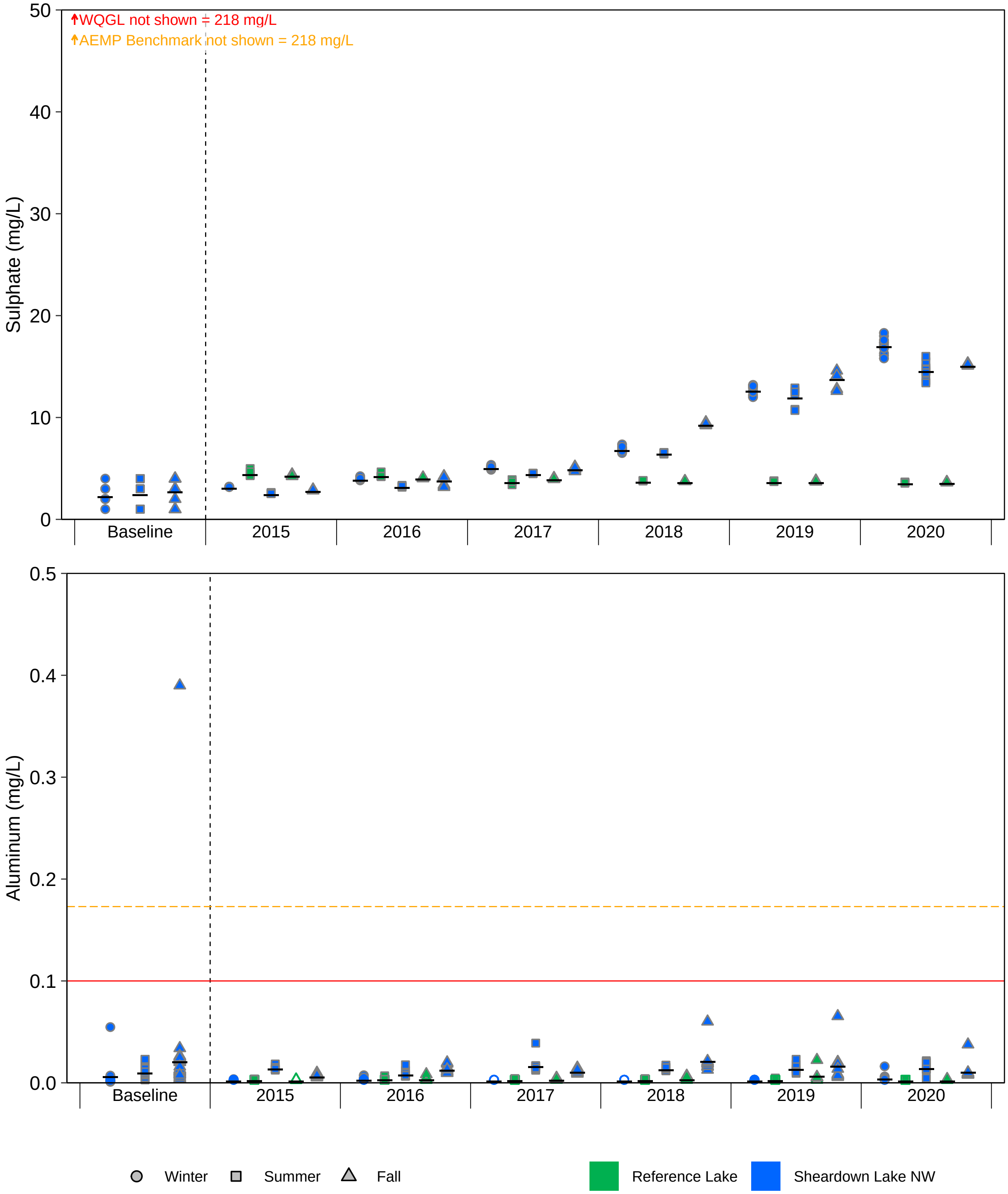
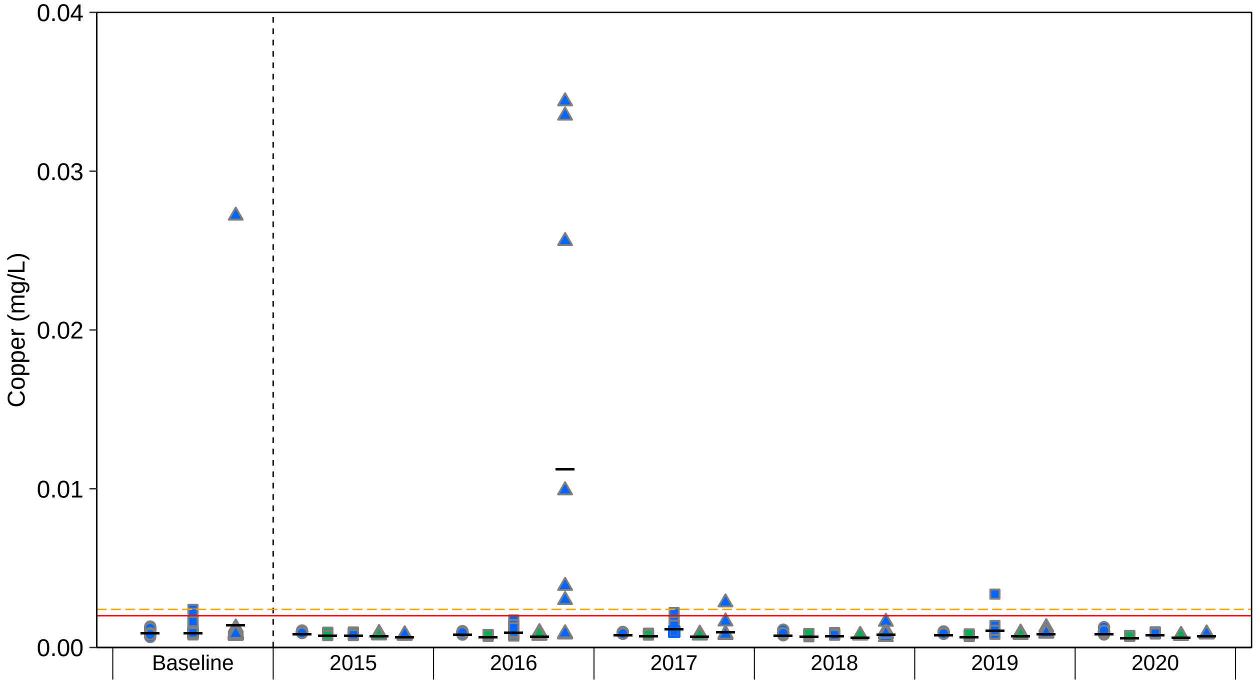


Figure C.16: Temporal Comparison of Water Chemistry at Sheardown Lake Northwest (DL0−01) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.



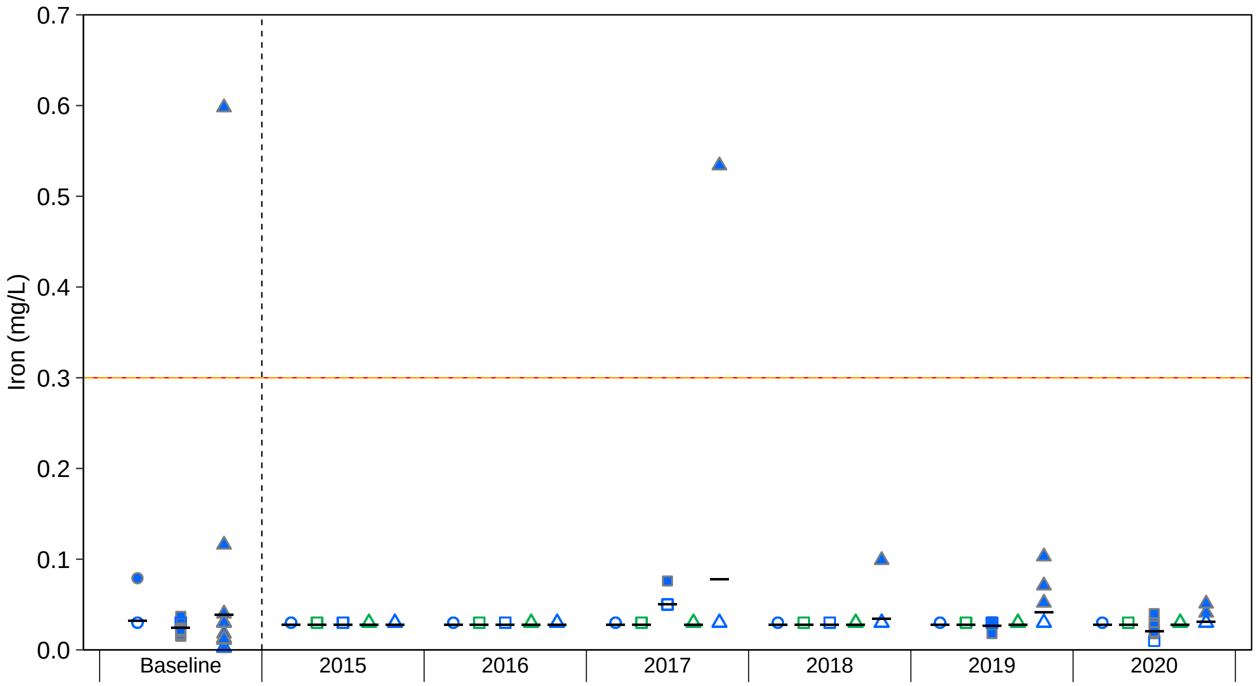


Figure C.16: Temporal Comparison of Water Chemistry at Sheardown Lake Northwest (DL0−01) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

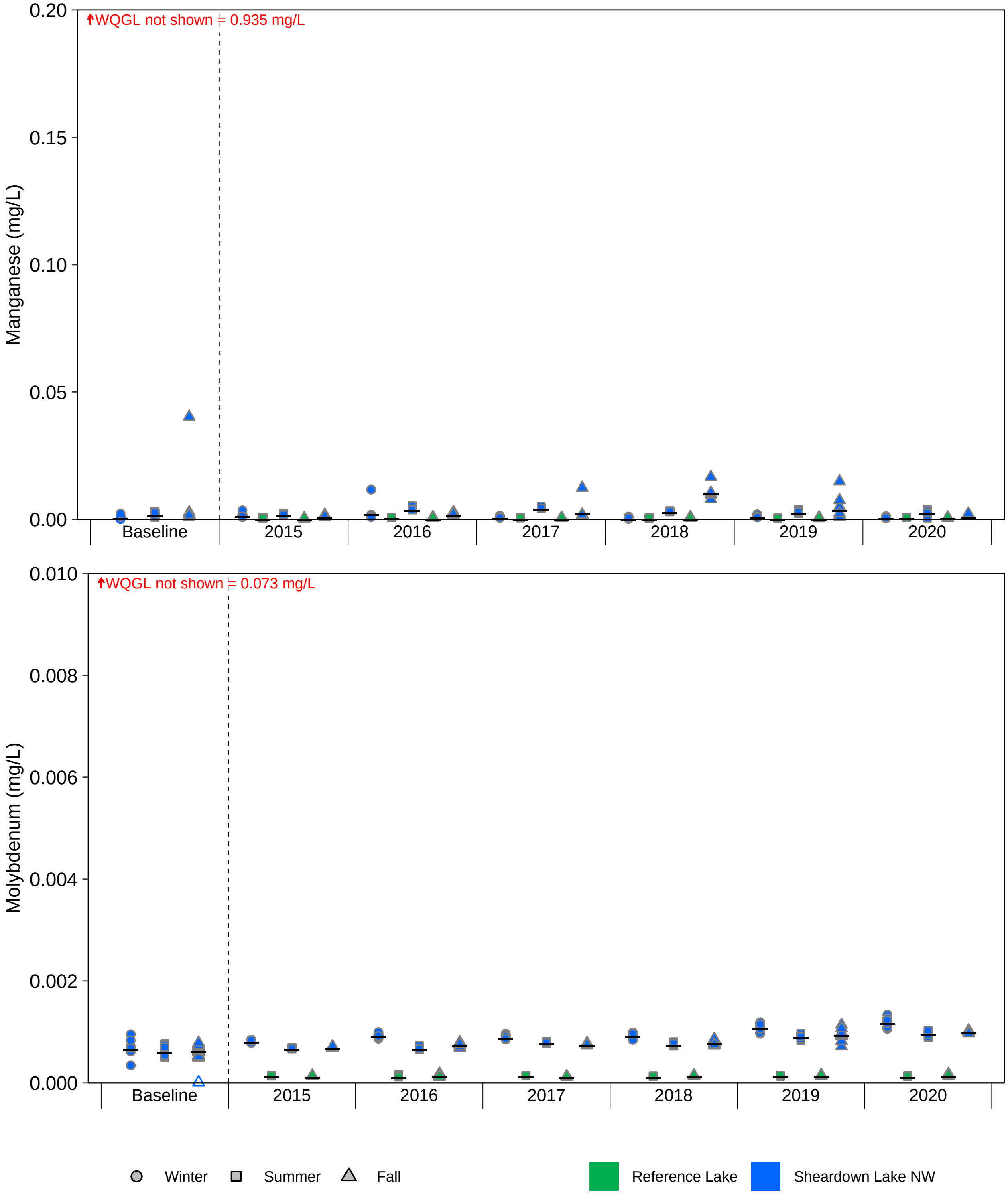


Figure C.16: Temporal Comparison of Water Chemistry at Sheardown Lake Northwest (DL0−01) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

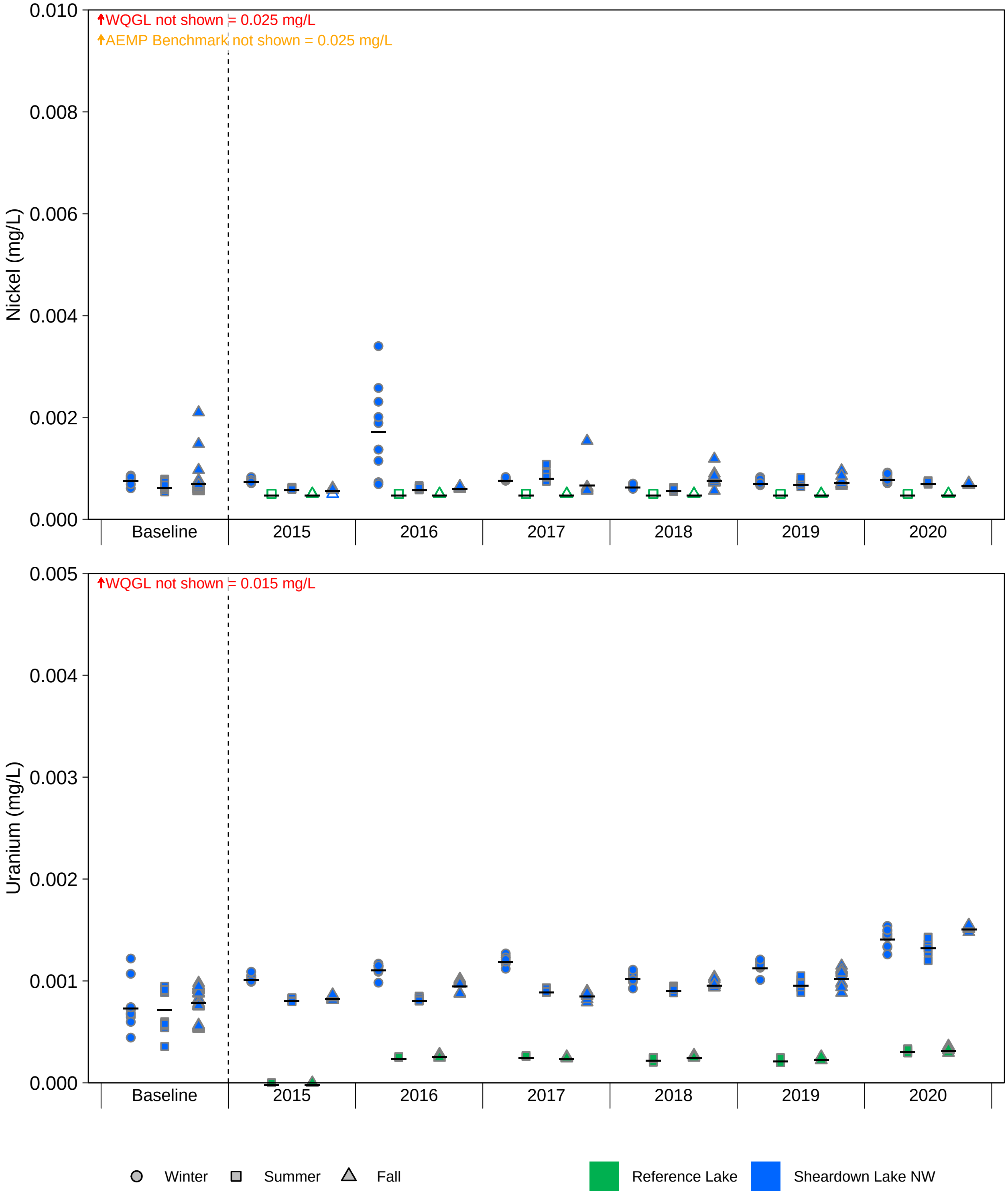


Figure C.16: Temporal Comparison of Water Chemistry at Sheardown Lake Northwest (DL0−01) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

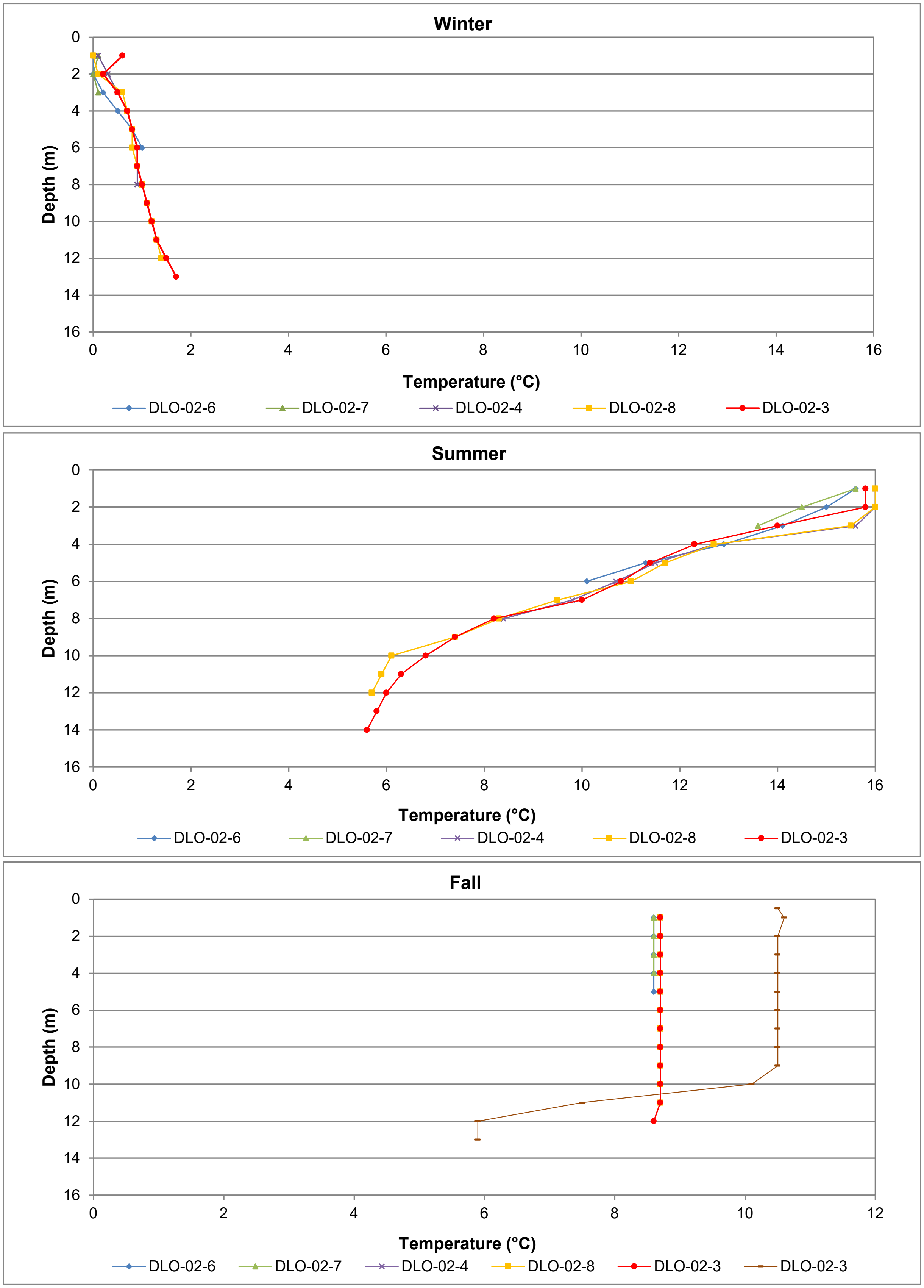
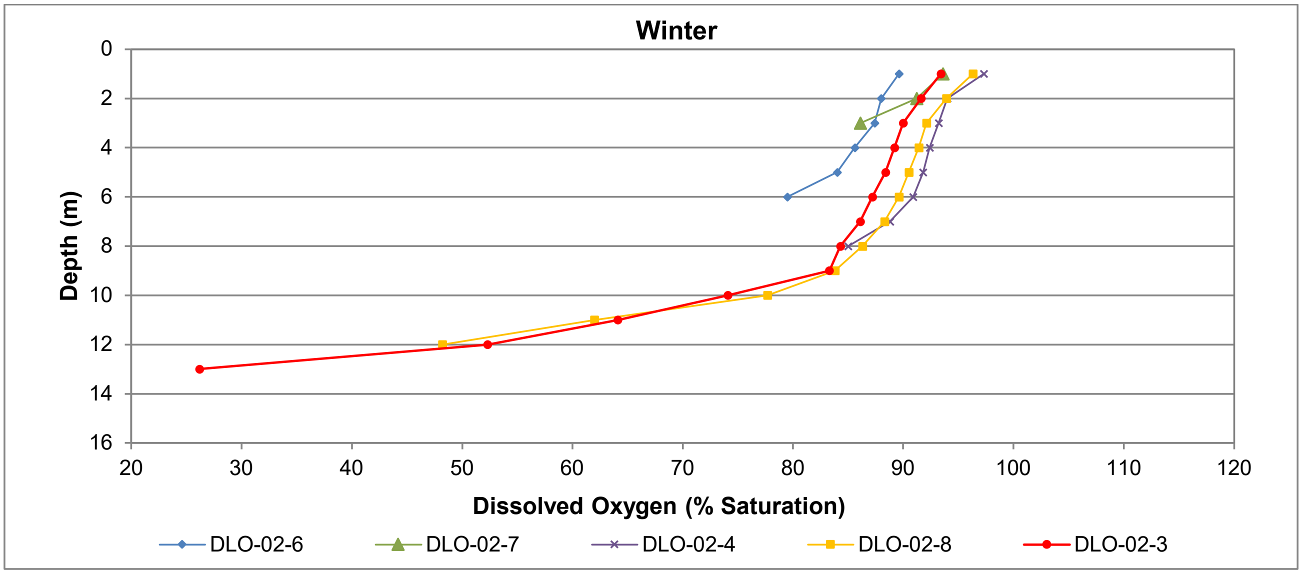
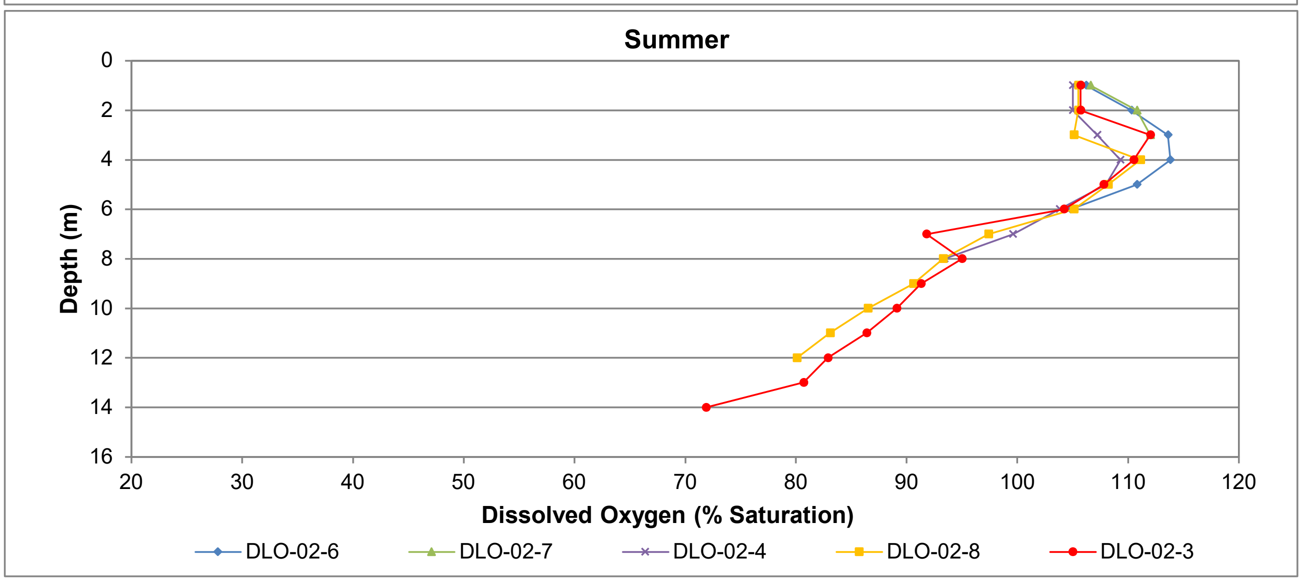


Figure C.17: Vertical Profiles of Temperature Measured at Sheardown Lake SE in Winter, Summer, and Fall, 2020





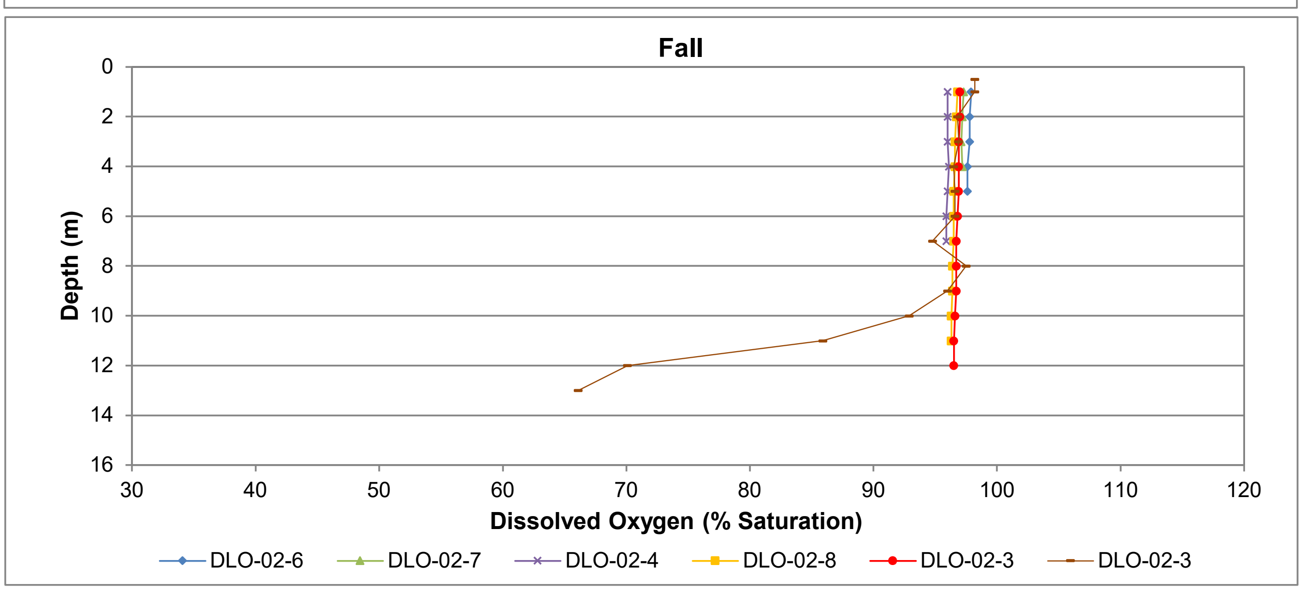


Figure C.18: Vertical Profiles of Dissolved Oxygen Measured at Sheardown Lake SE in Winter, Summer, and Fall, 2020

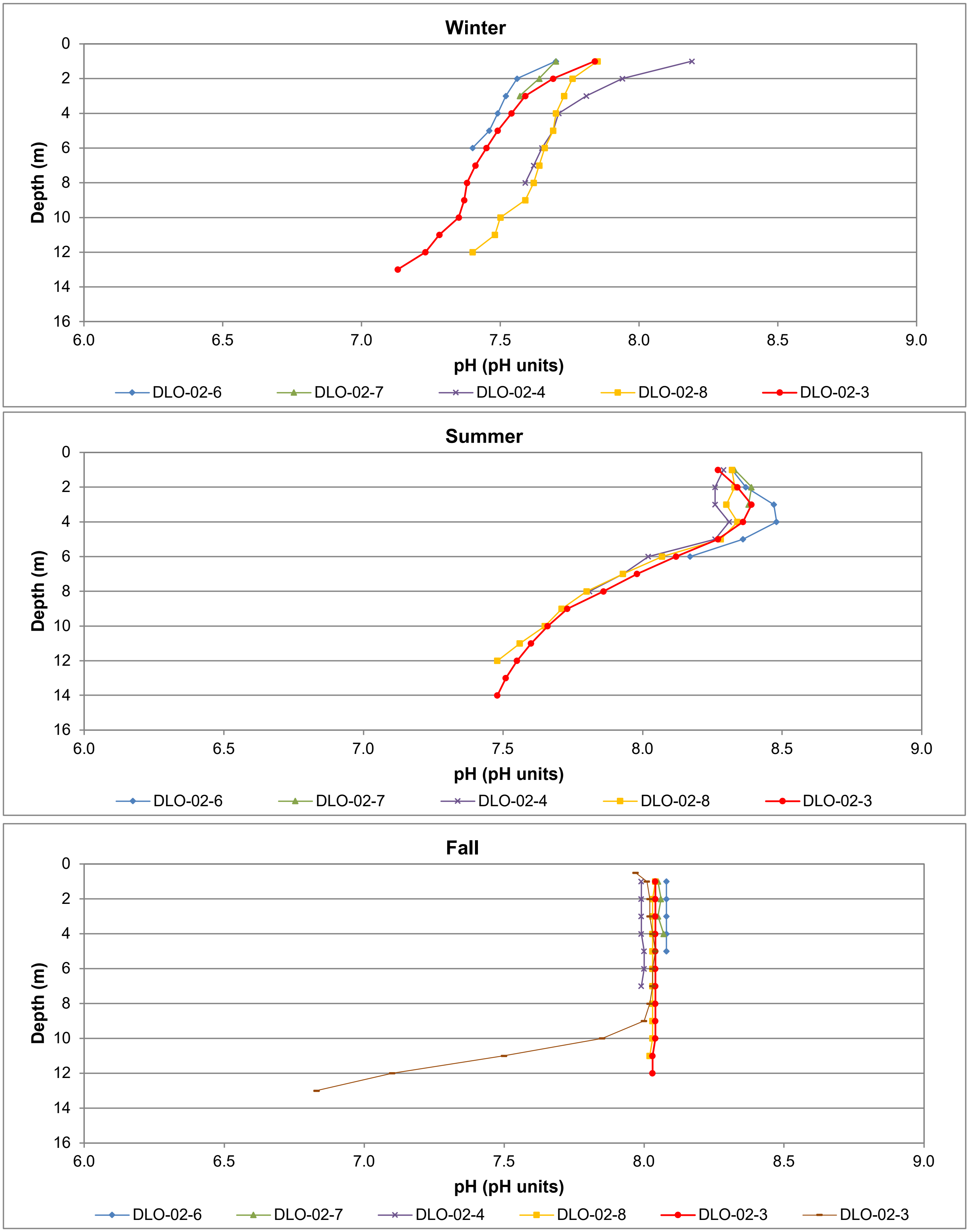


Figure C.19: Vertical Profiles of pH Measured at Sheardown Lake SE in Winter, Summer, and Fall, 2020

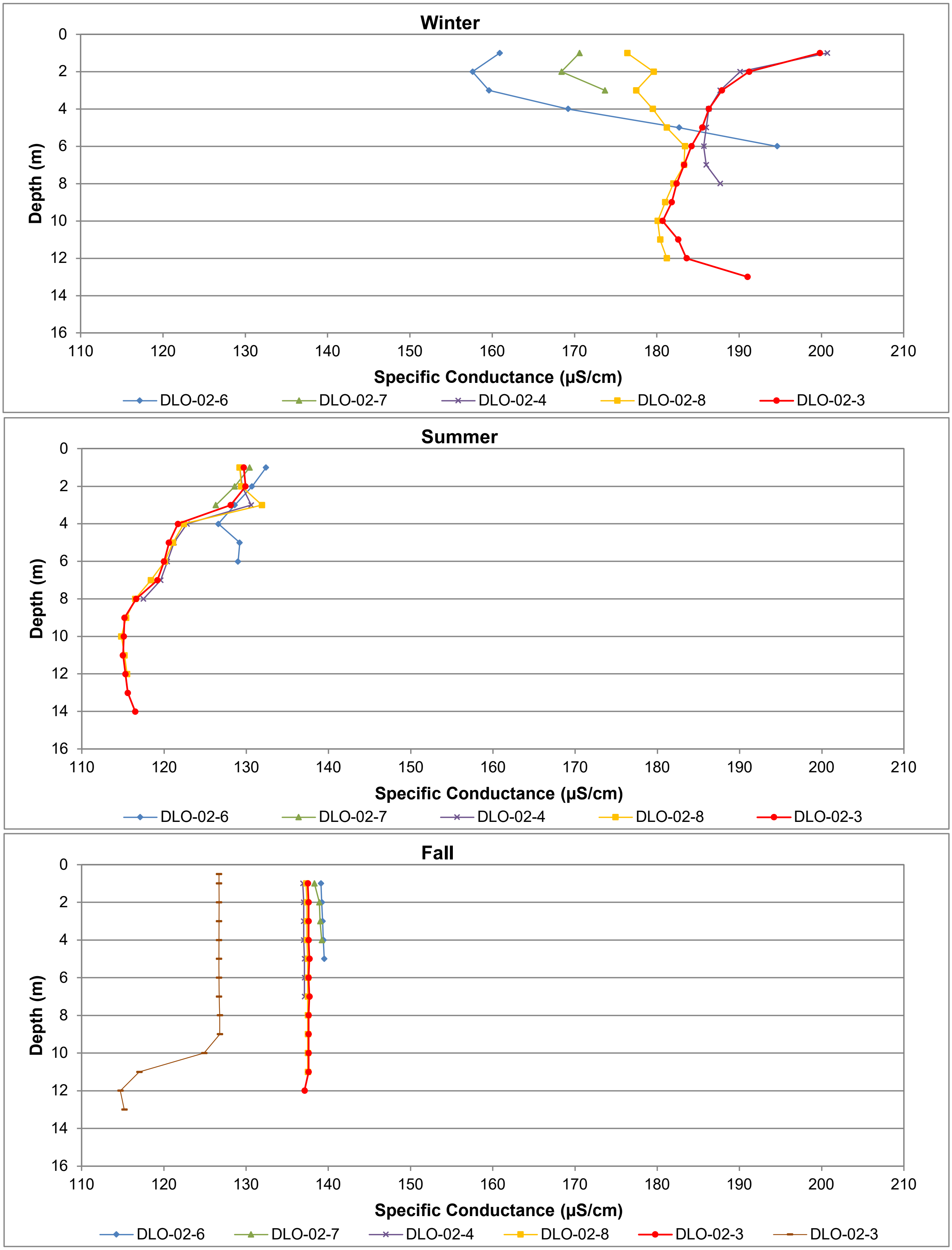


Figure C.20: Vertical Profiles of Conductivity Measured at Sheardown Lake SE in Winter, Summer, and Fall 2020

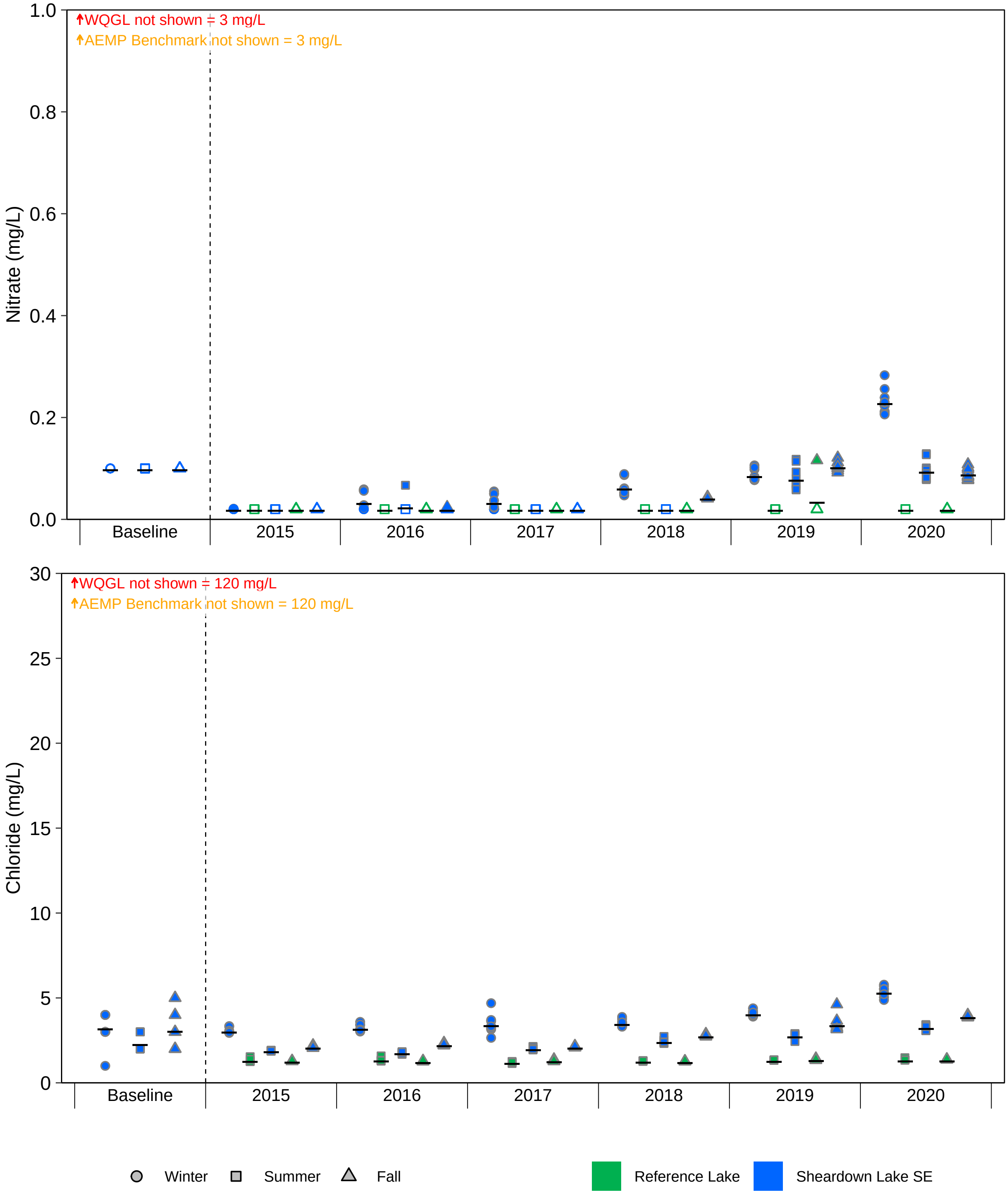


Figure C.21: Temporal Comparison of Water Chemistry at Sheardown Lake Southeast (DL0−02) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

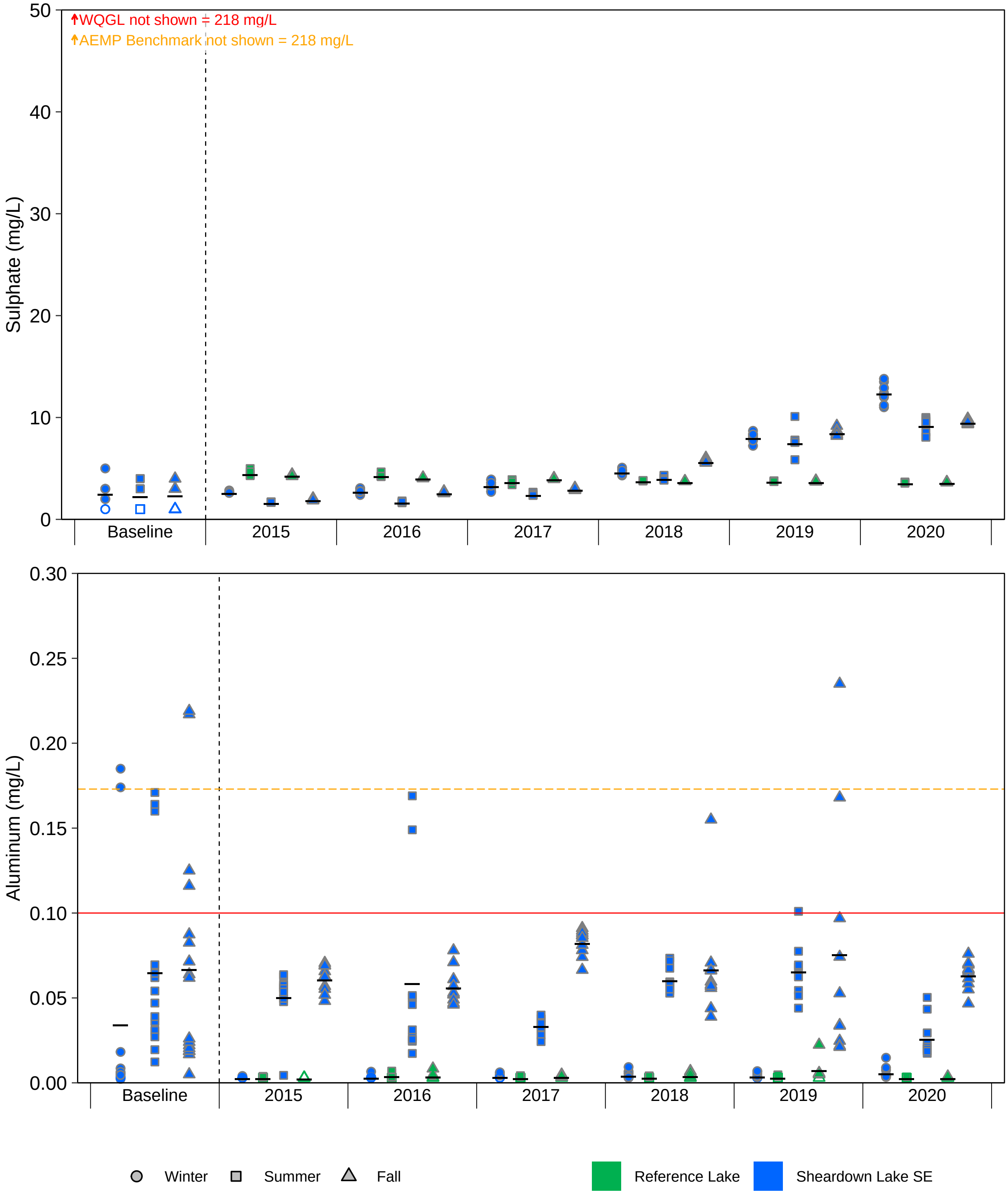


Figure C.21: Temporal Comparison of Water Chemistry at Sheardown Lake Southeast (DL0−02) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

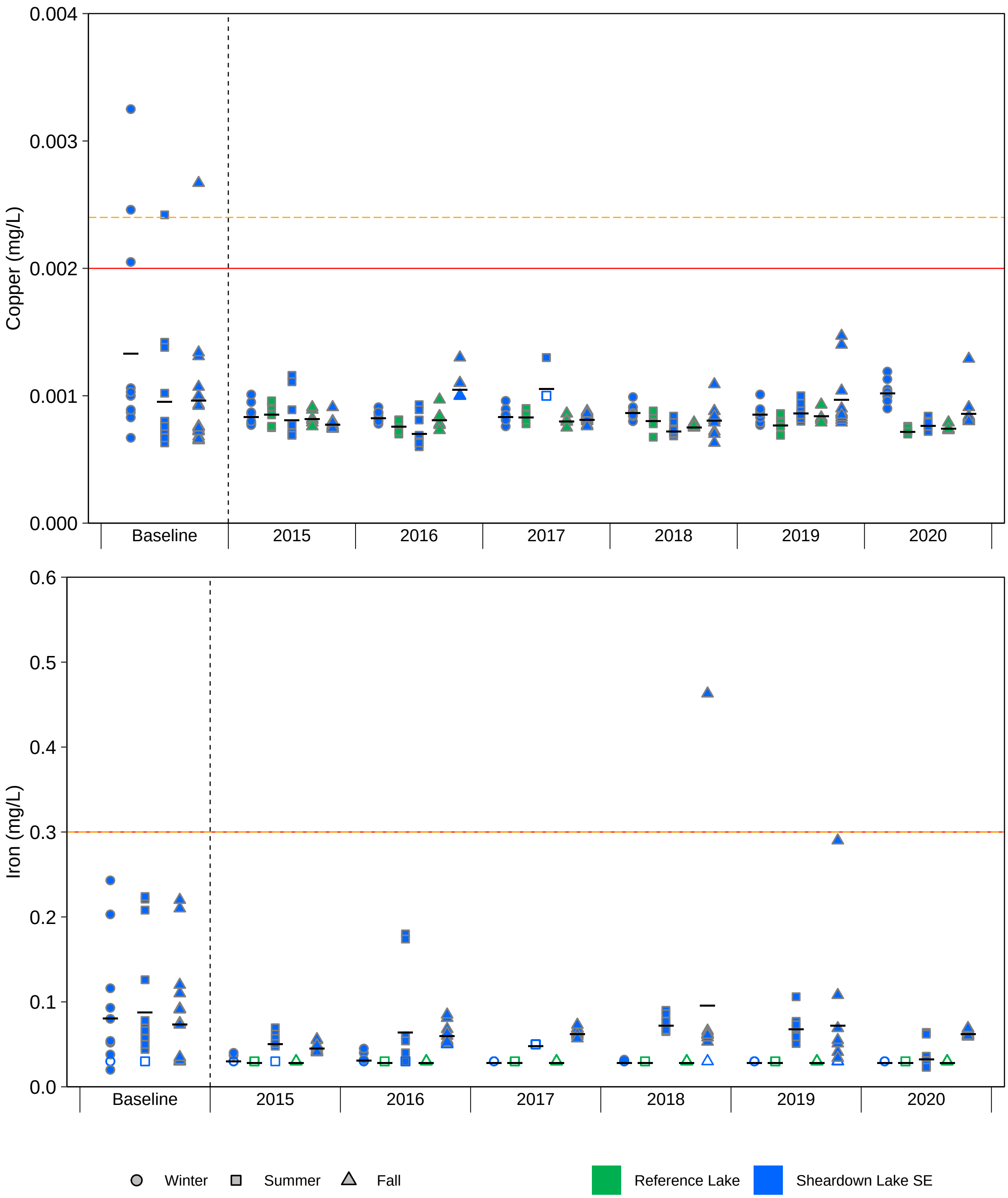


Figure C.21: Temporal Comparison of Water Chemistry at Sheardown Lake Southeast (DL0−02) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

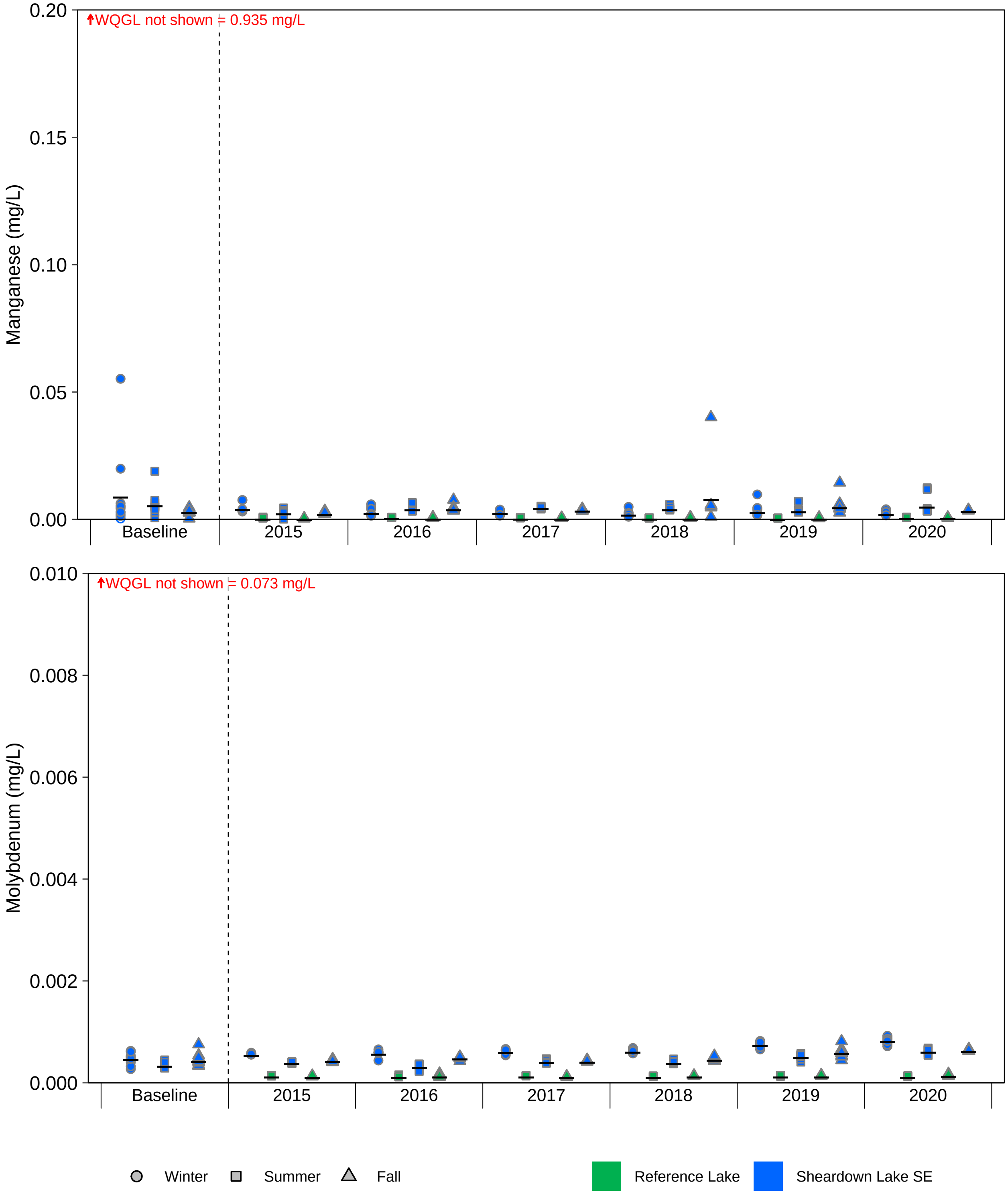


Figure C.21: Temporal Comparison of Water Chemistry at Sheardown Lake Southeast (DL0−02) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

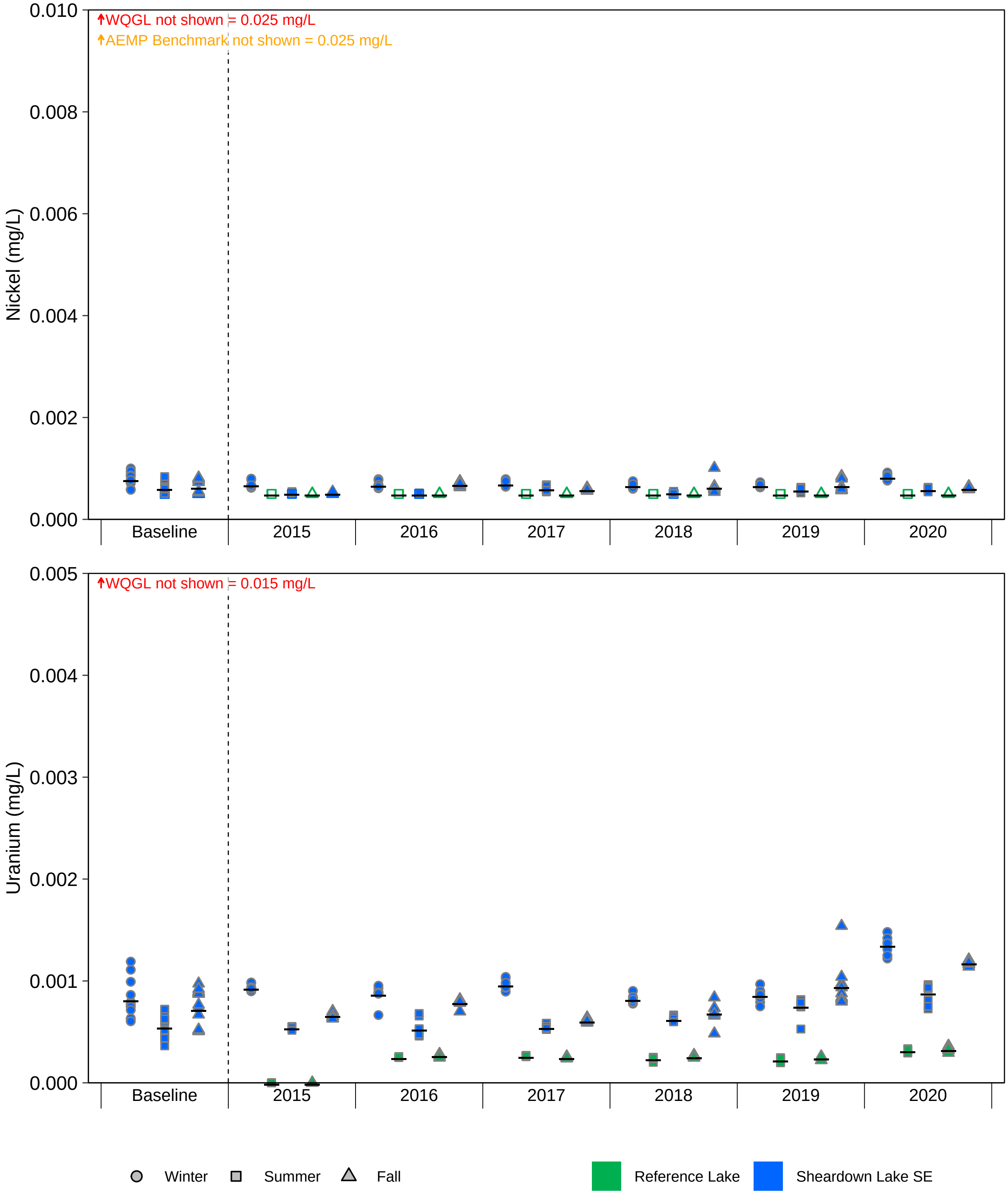


Figure C.21: Temporal Comparison of Water Chemistry at Sheardown Lake Southeast (DL0−02) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

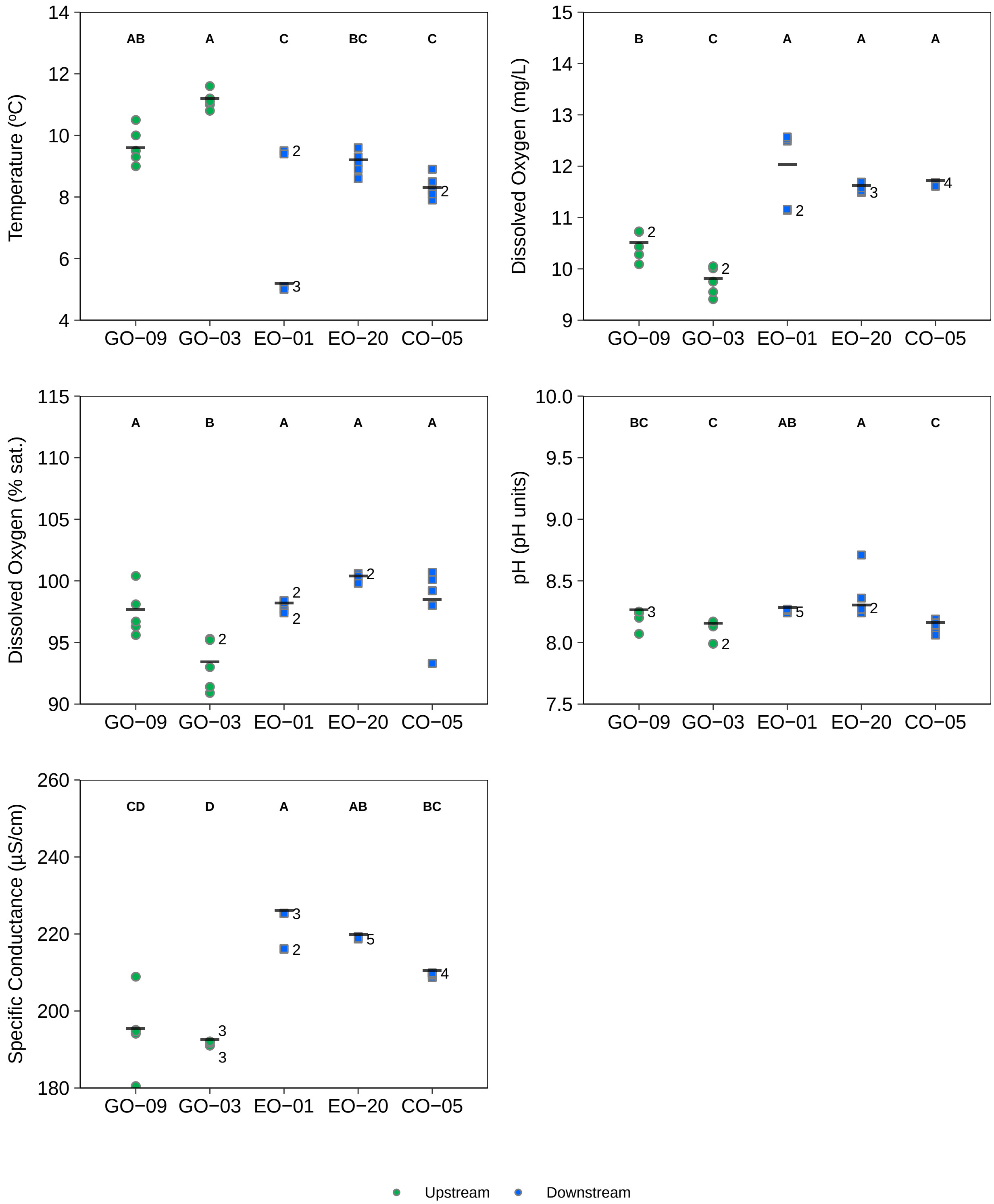


Figure C.22: In Situ Water Quality Measurements Collected at Mary River Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Notes: Study areas with the same letters do not differ significantly (alpha = 0.1).

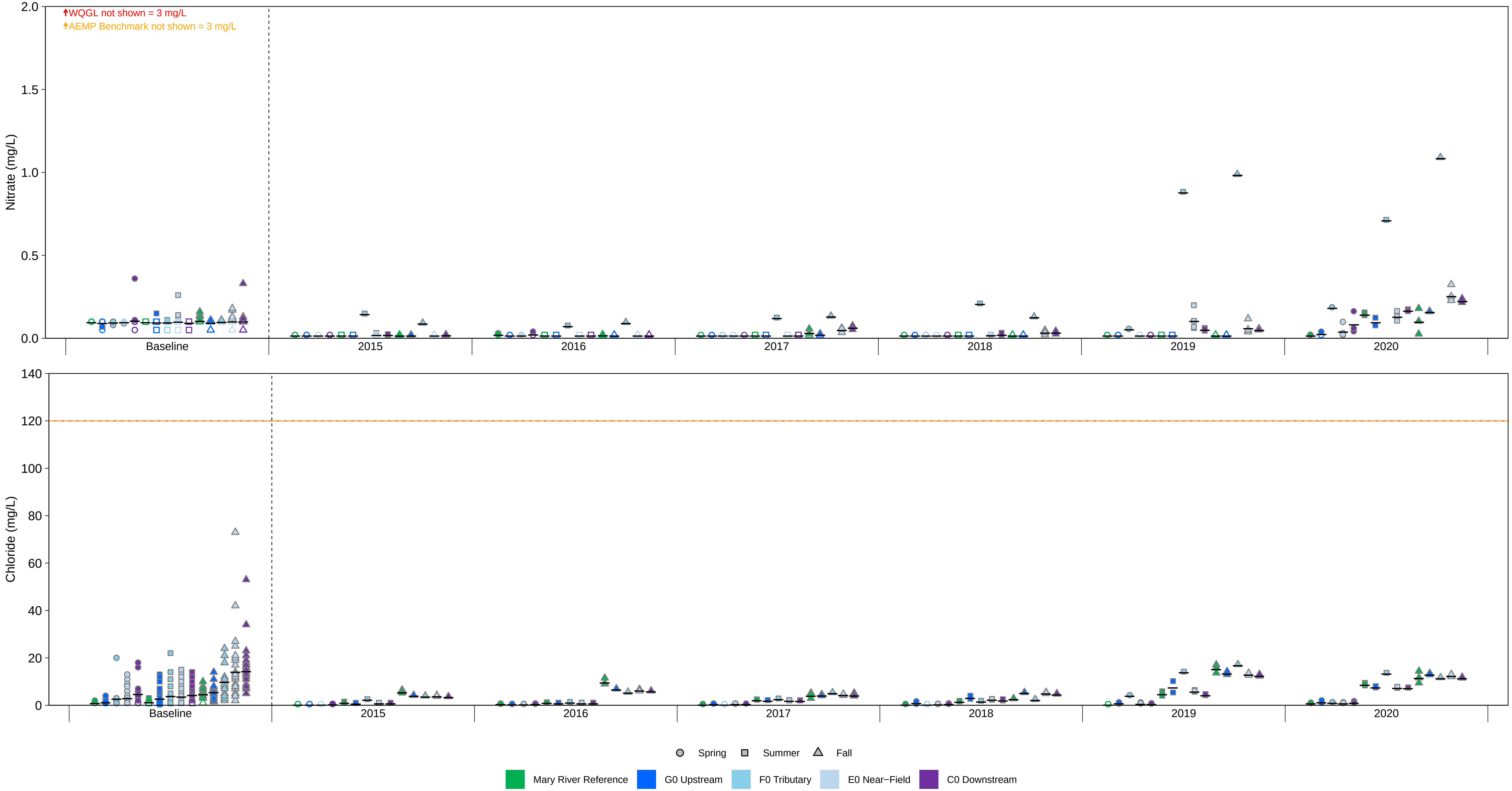


Figure C.23: Temporal Comparison of Water Chemistry at Mary River Stations Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

Figure C.23: Temporal Comparison of Water Chemistry at Mary River Stations Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

Figure C.23: Temporal Comparison of Water Chemistry at Mary River Stations Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

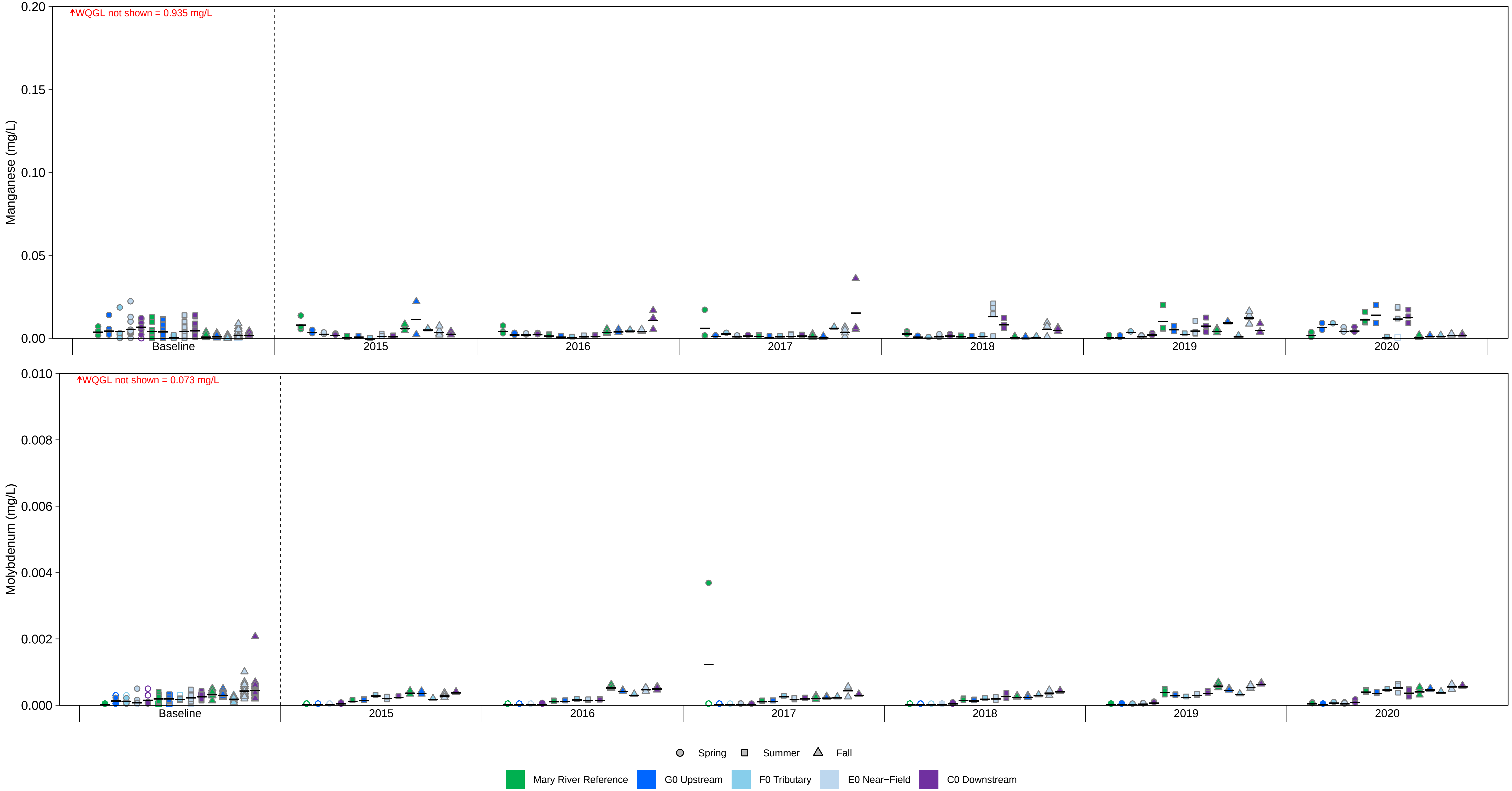


Figure C.23: Temporal Comparison of Water Chemistry at Mary River Stations Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

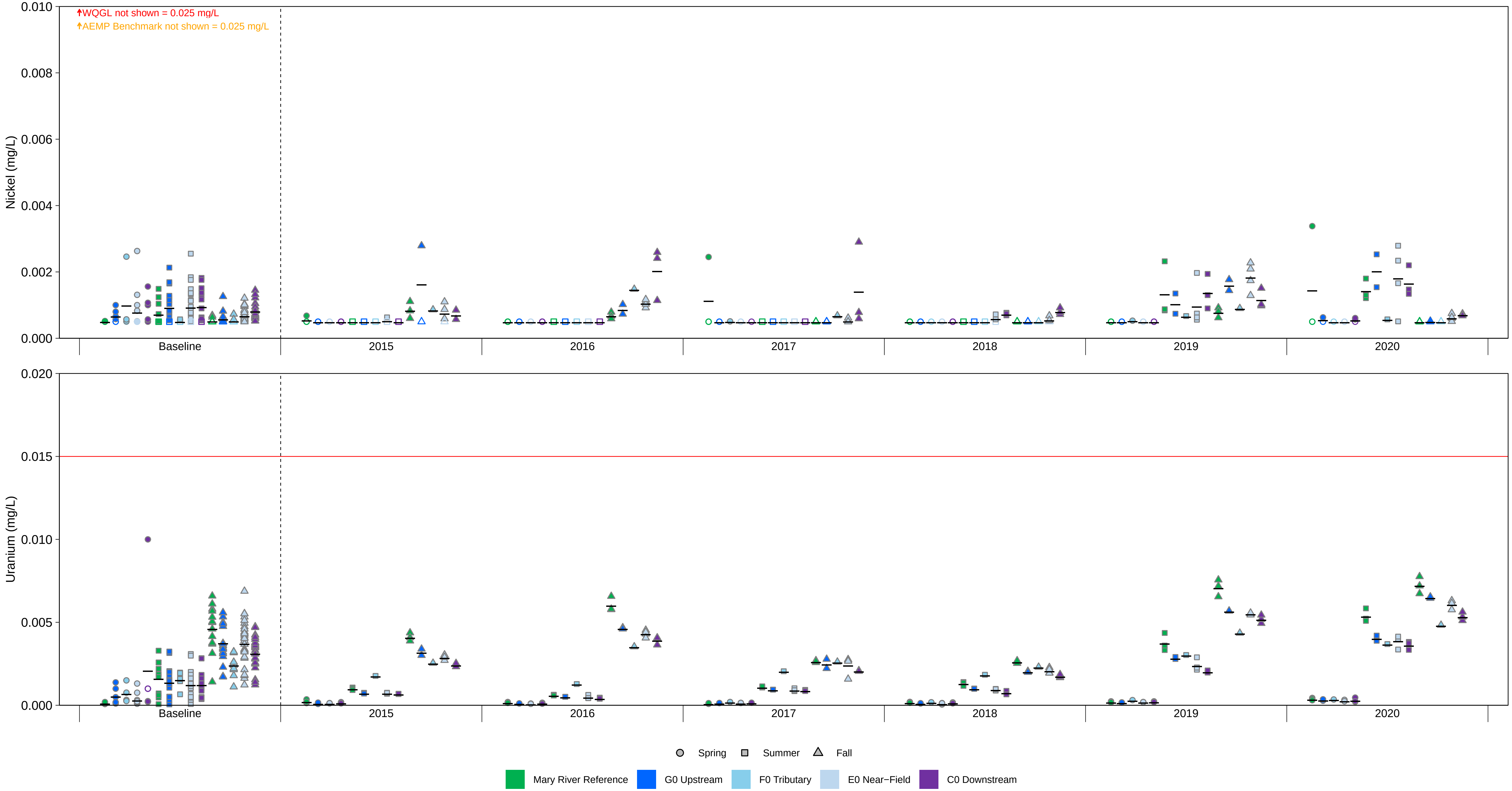


Figure C.23: Temporal Comparison of Water Chemistry at Mary River Stations Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

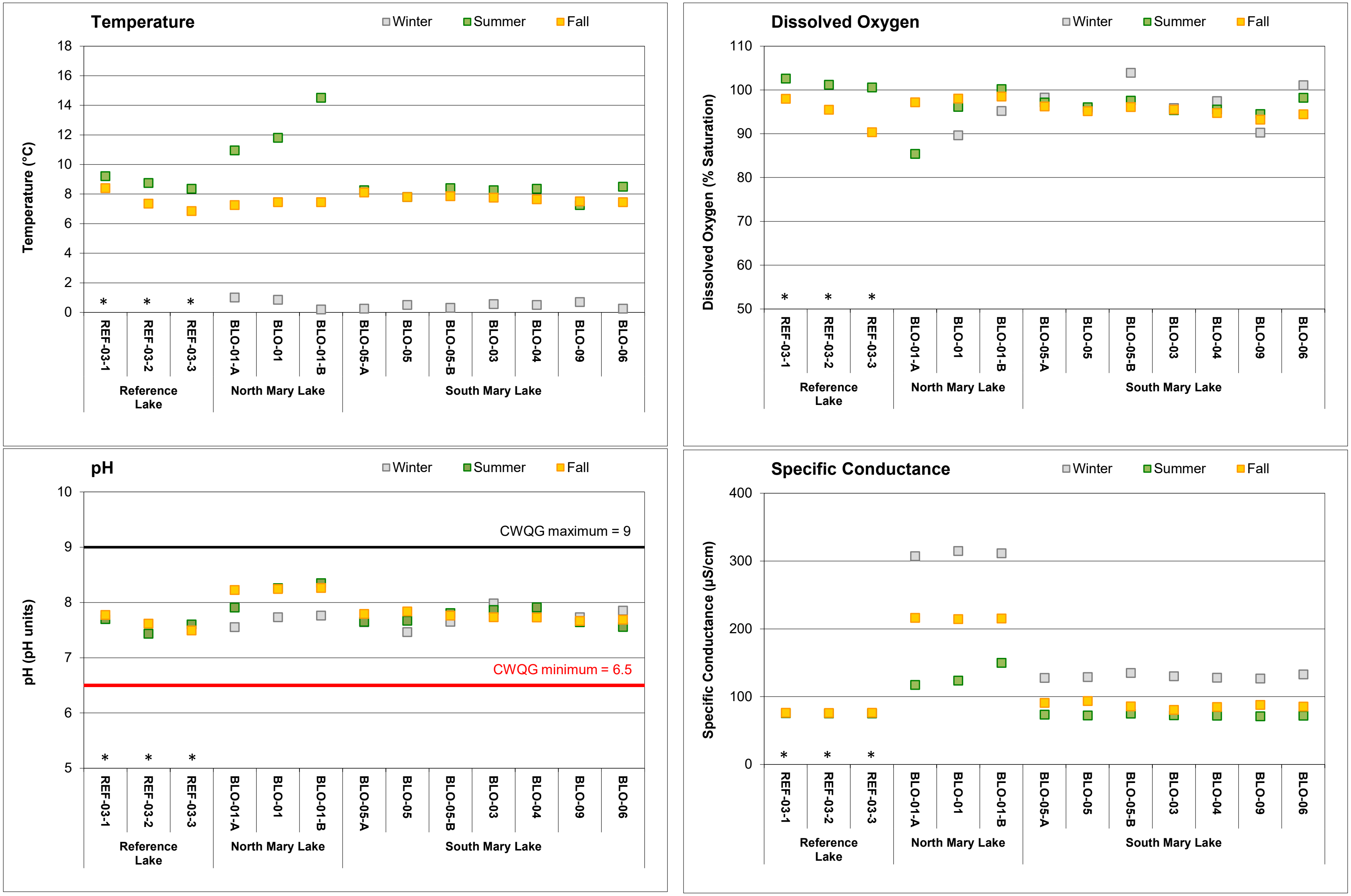


Figure C.24: Comparison of *In Situ* Water Quality Variables Measured at Mary Lake Water Quality Monitoring Stations in Winter, Summer, and Fall 2020, Mary River Project CREMP

Notes: Lake values represent mean of surface and bottom *in situ* water quality measurements. * Reference Lake 3 (REF-03) was not sampled in winter.

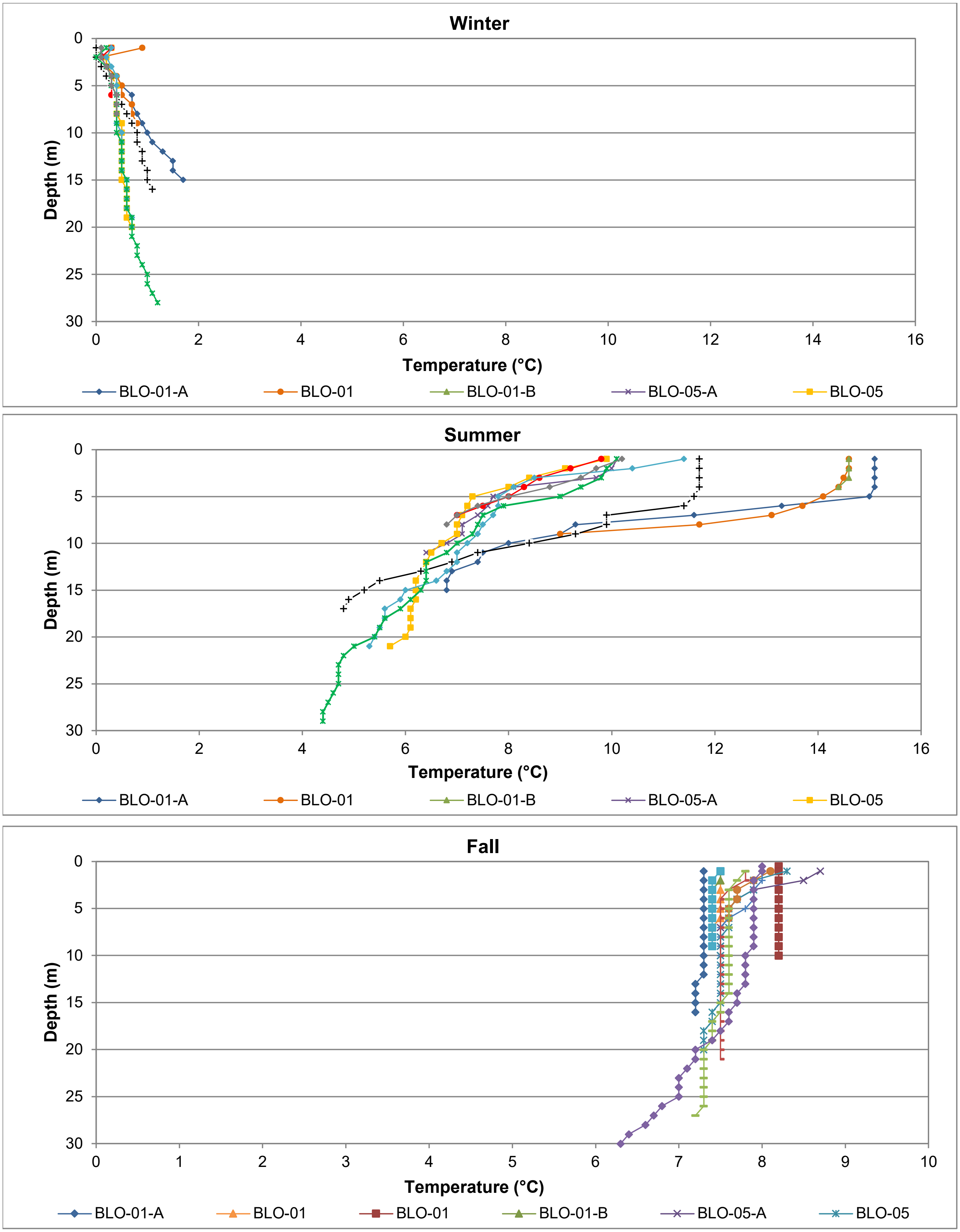
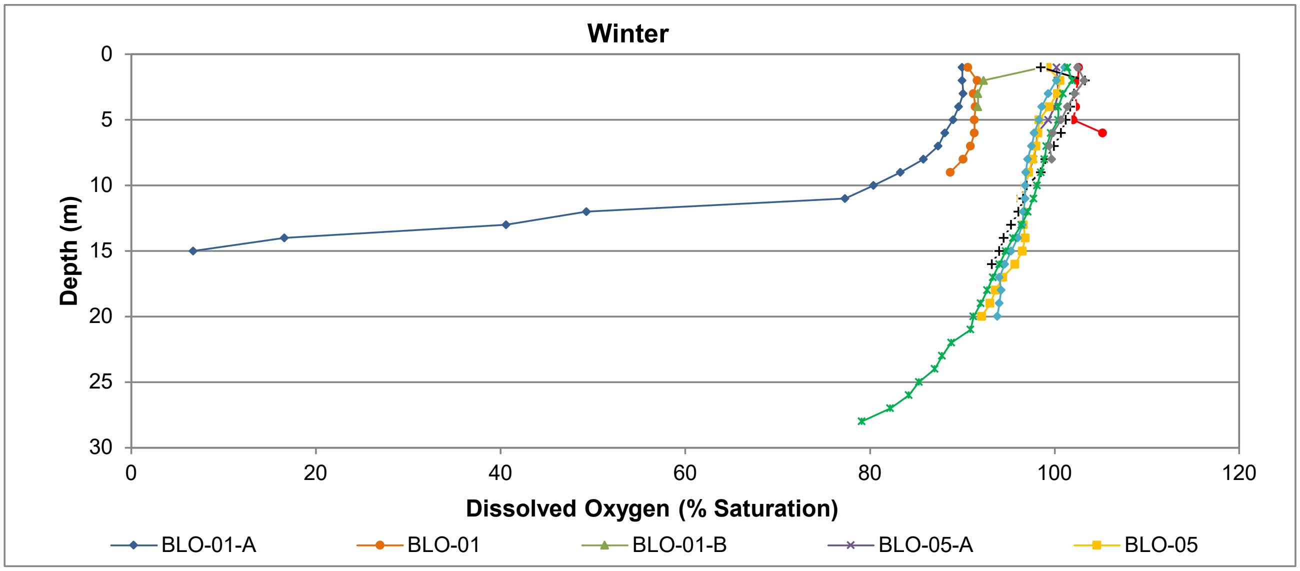
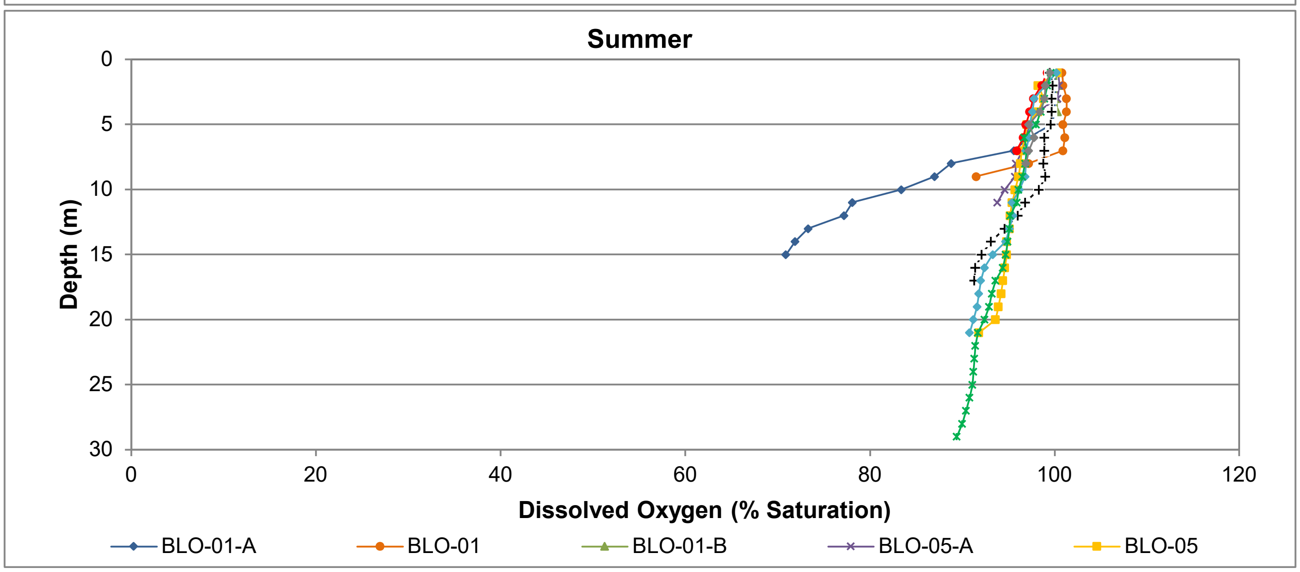


Figure C.25: Vertical Profiles of Temperature Measured at Mary Lake in Winter, Summer, and Fall, 2020





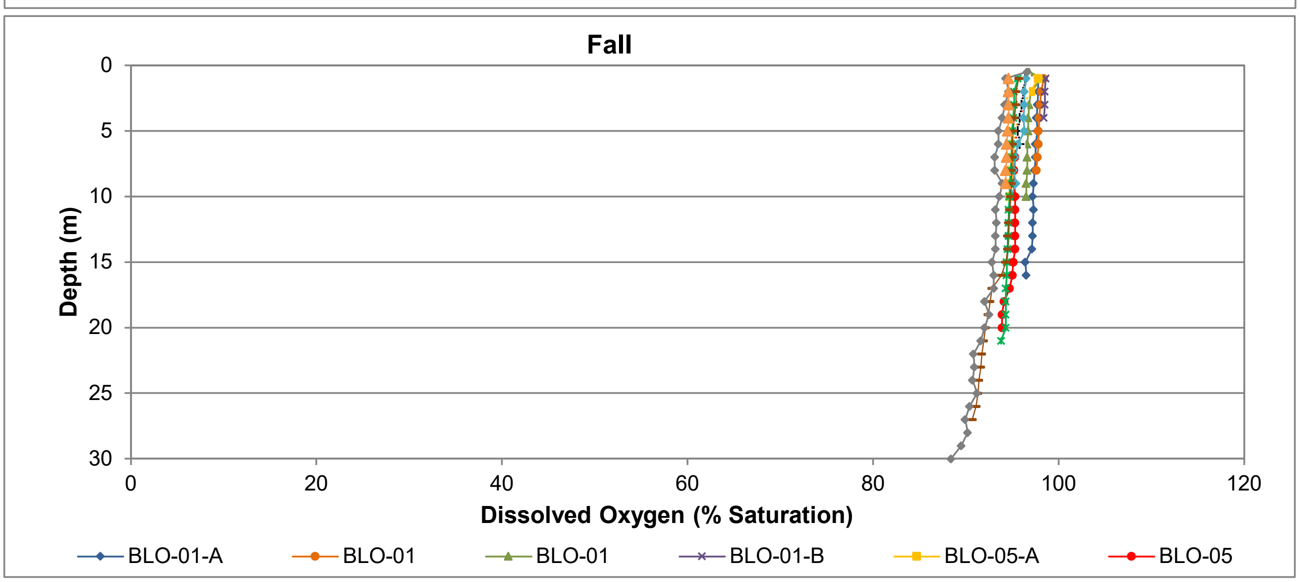


Figure C.26: Vertical Profiles of Dissolved Oxygen Measured at Mary Lake in Winter, Summer, and Fall, 2020

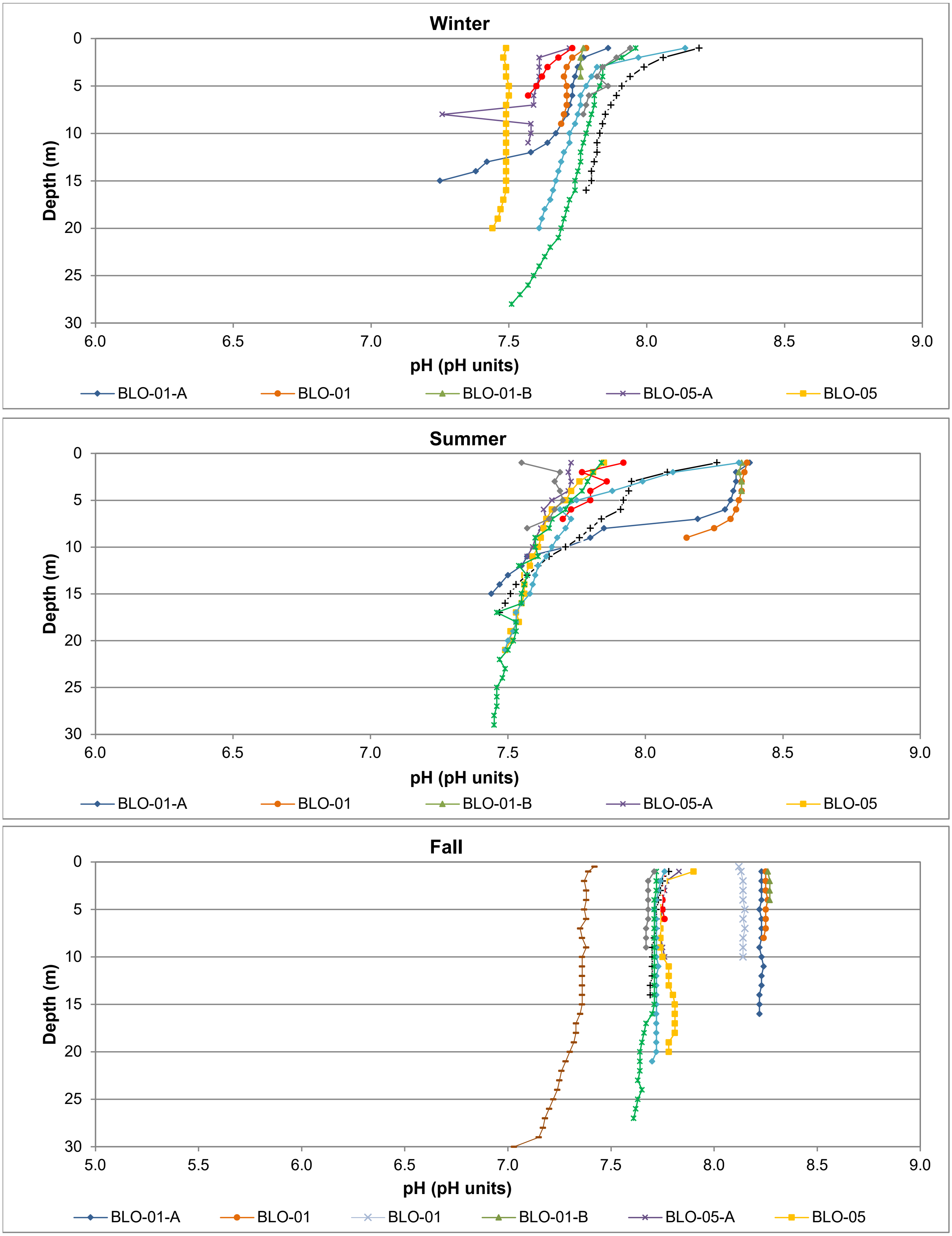


Figure C.27: Vertical Profiles of pH Measured at Mary Lake in Winter, Summer, and Fall, 2020

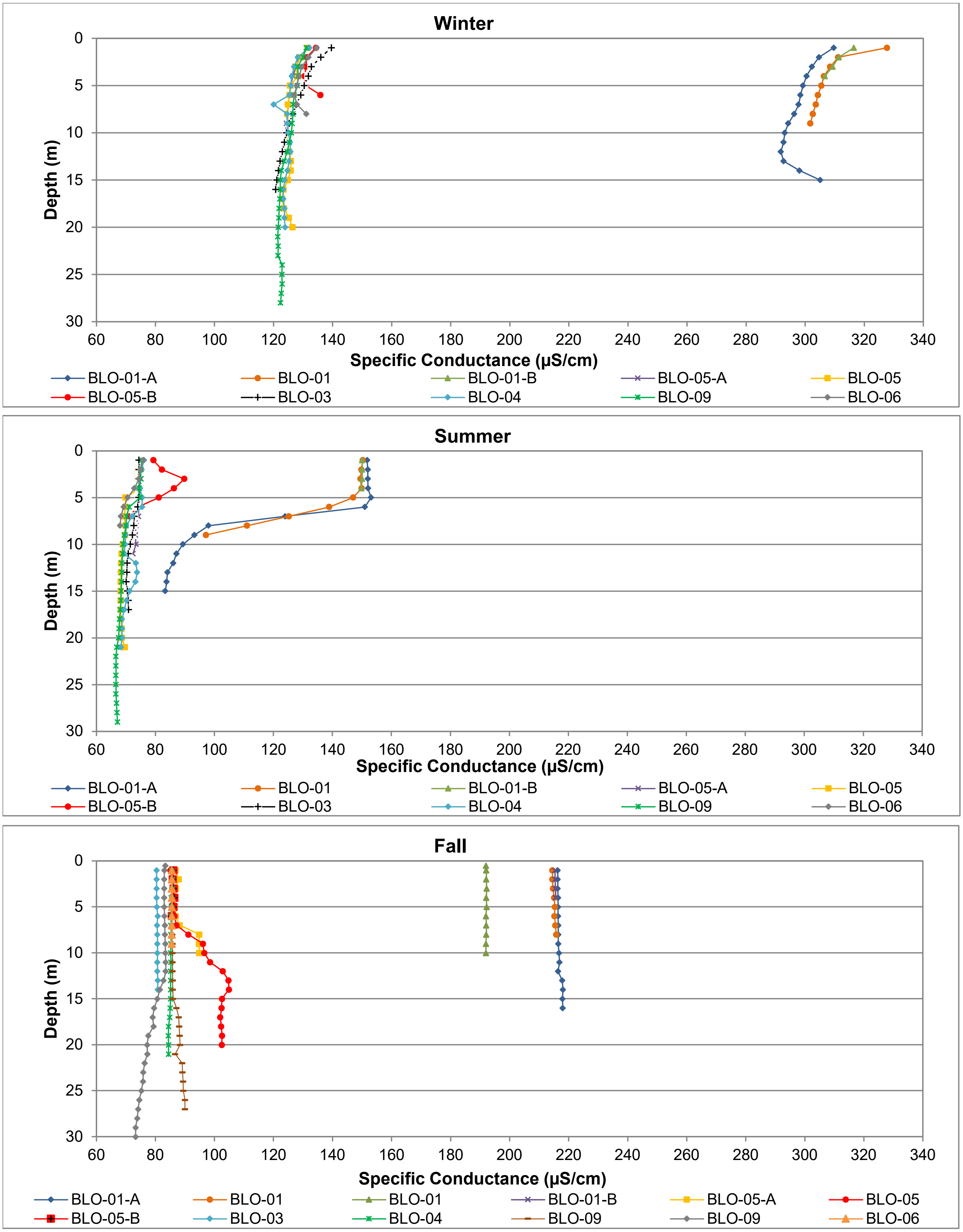


Figure C.28: Vertical Profiles of Specific Conductance Measured at Mary Lake in Winter, Summer, and Fall, 2020

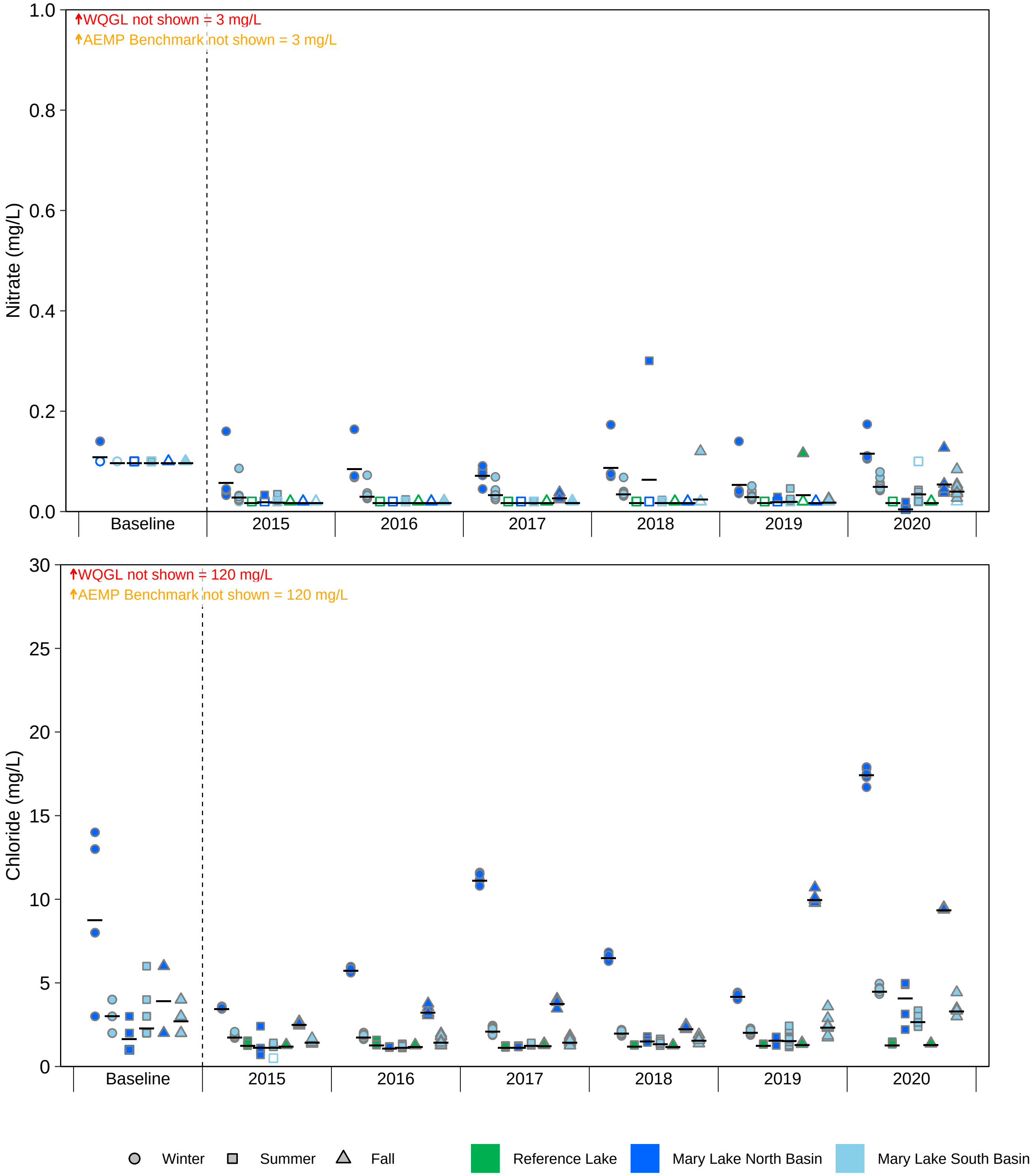


Figure C.29: Temporal Comparison of Water Chemistry at Mary Lake (BL0) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

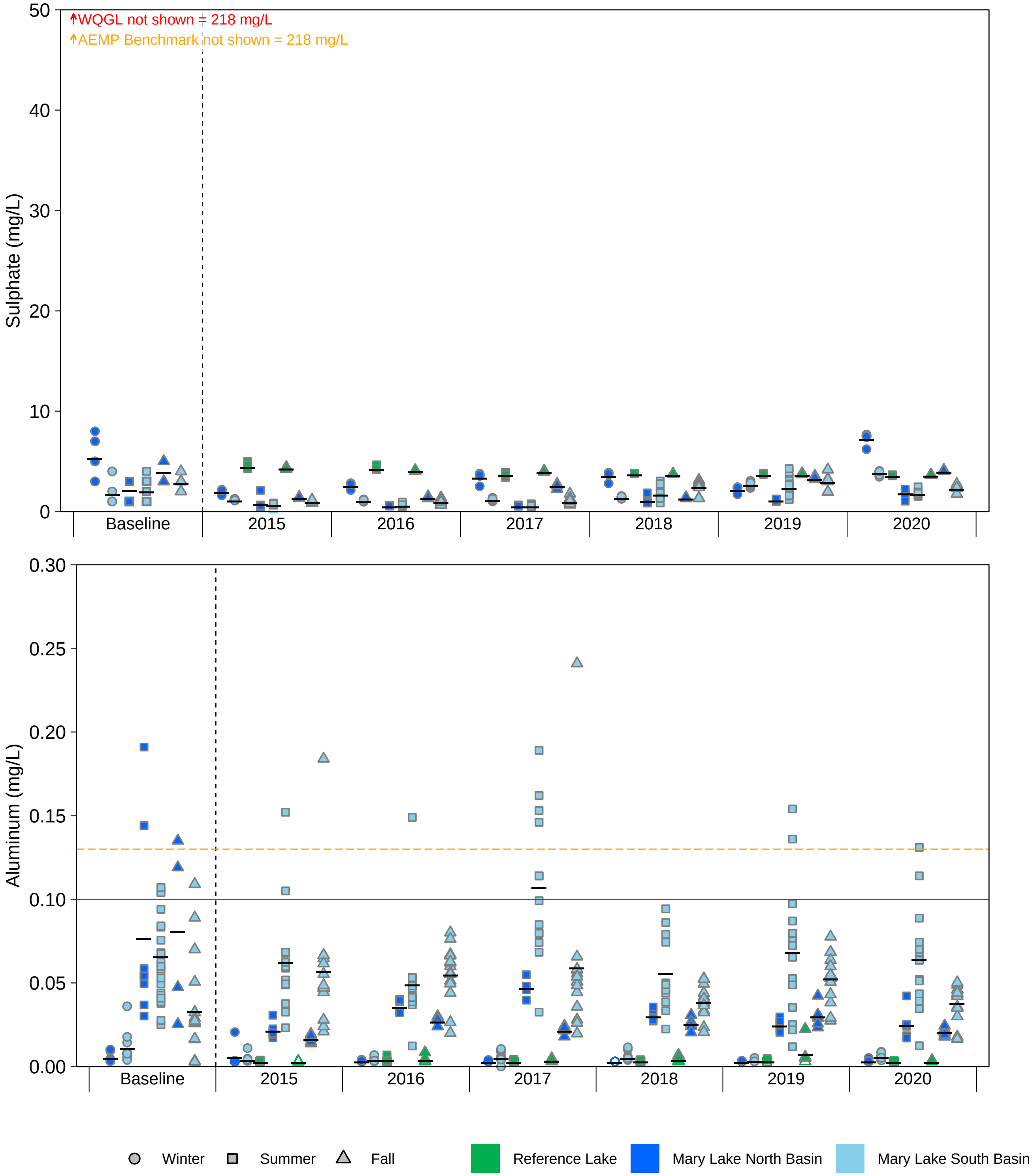


Figure C.29: Temporal Comparison of Water Chemistry at Mary Lake (BL0) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

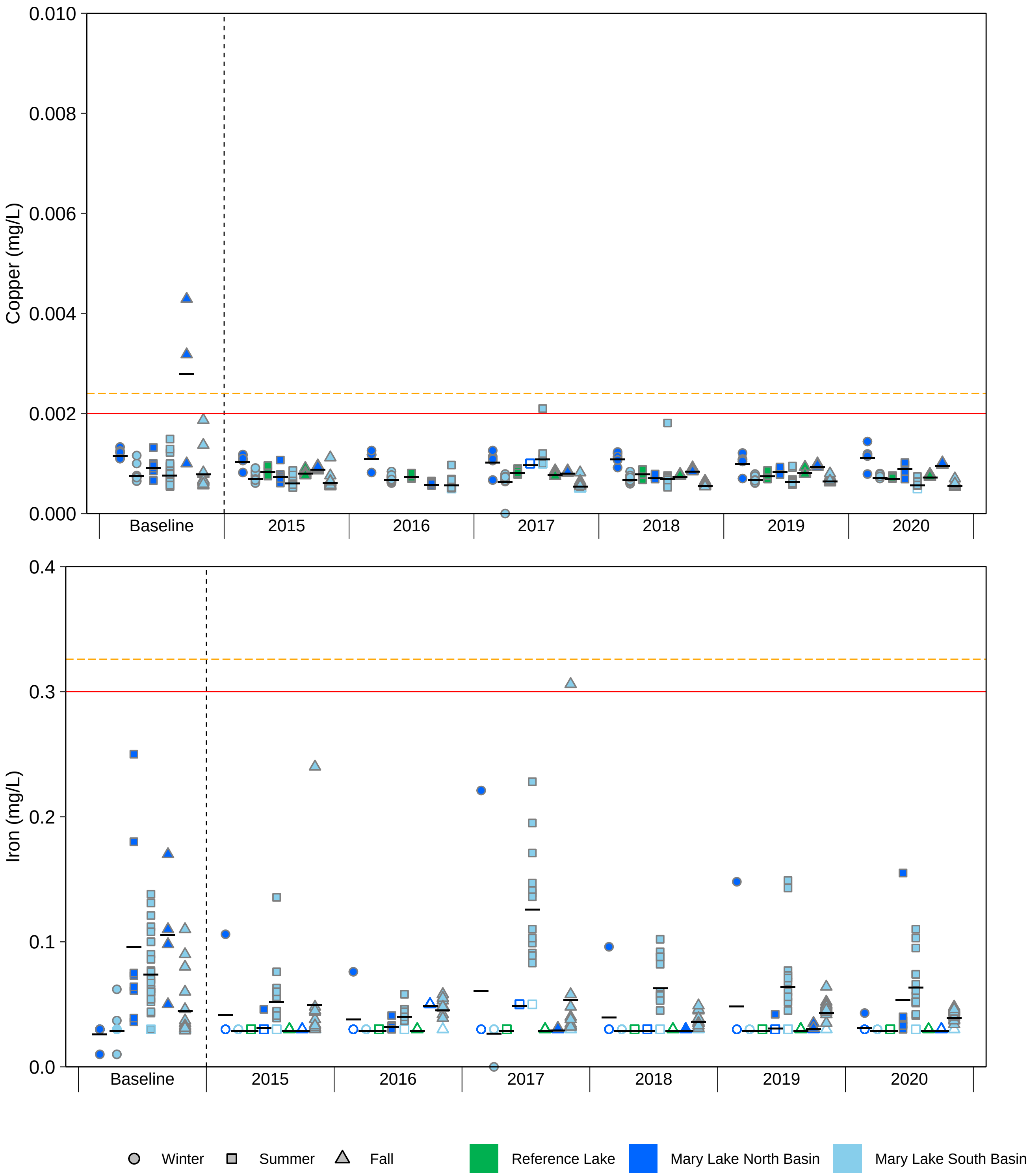


Figure C.29: Temporal Comparison of Water Chemistry at Mary Lake (BL0) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

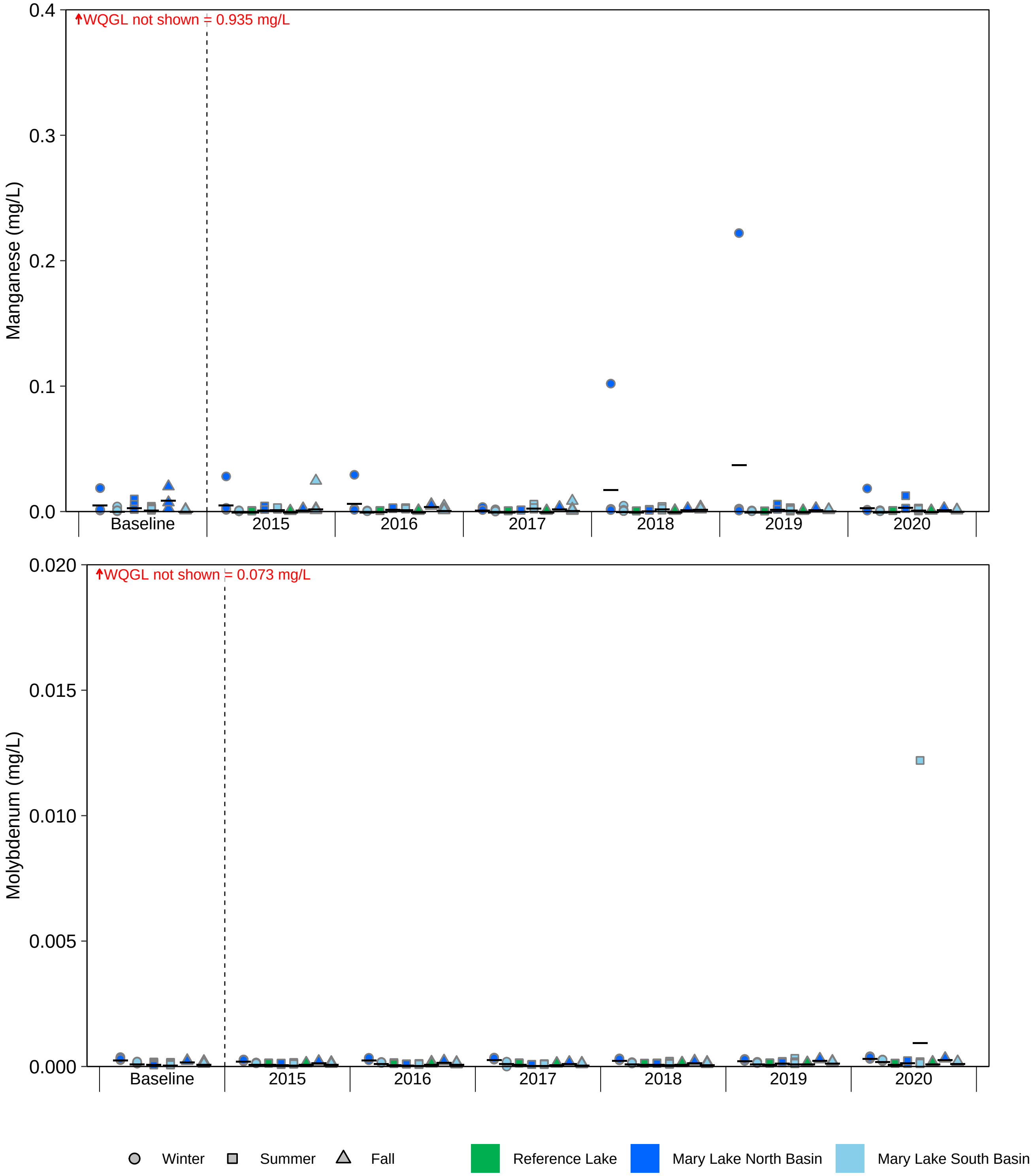


Figure C.29: Temporal Comparison of Water Chemistry at Mary Lake (BL0) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

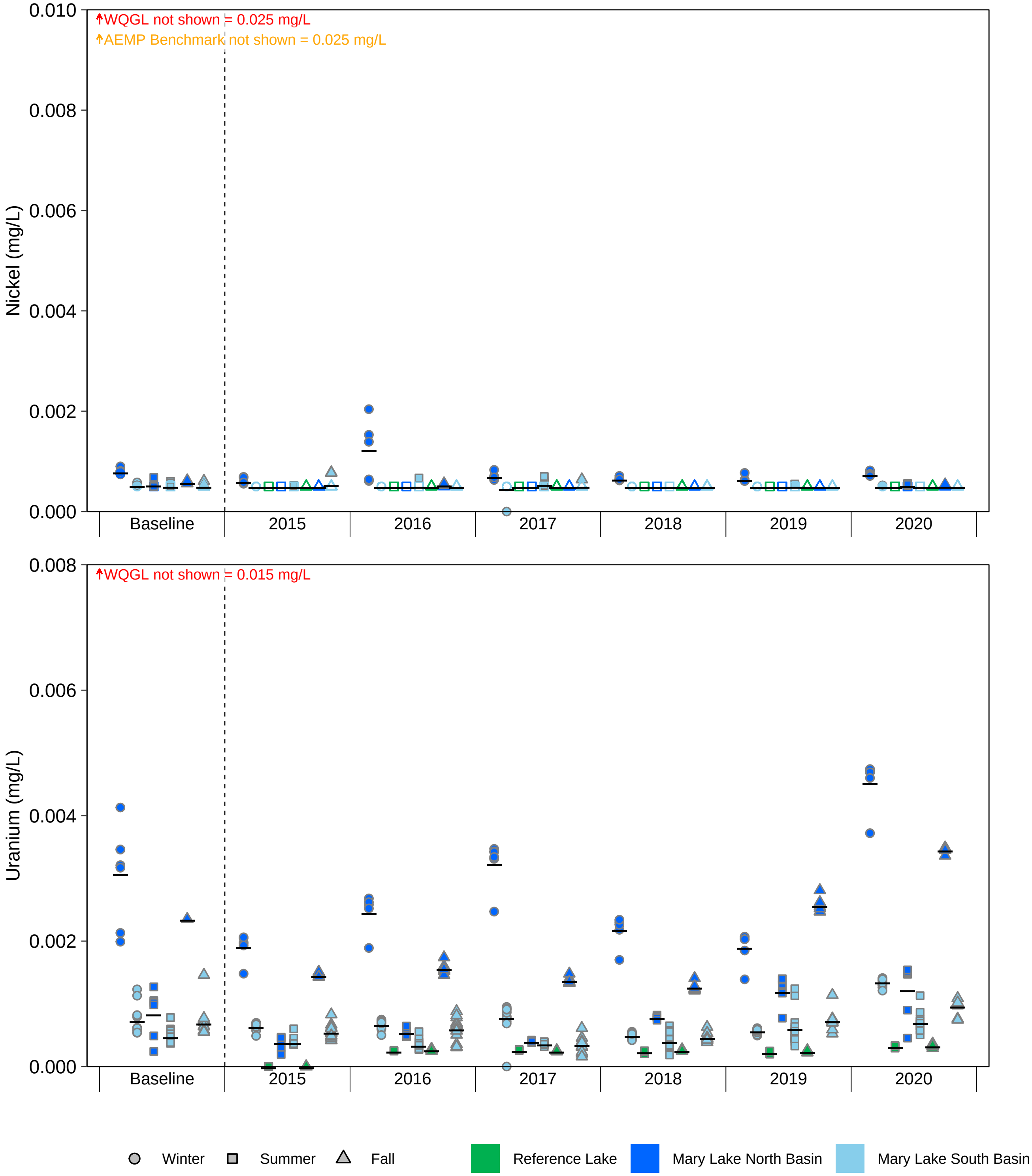


Figure C.29: Temporal Comparison of Water Chemistry at Mary Lake (BL0) Over Mine Baseline (2006 to 2013) and Operations (2015 to 2020) Periods

Notes: Concentrations below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL and the open symbol represents one or more values reported below the LRL. Red line indicates Water Quality Guidelines; orange dashed line indicates AEMP Benchmark.

Table C.1: *In Situ* Water Quality Data Collected from Lotic Environments for the Mary River Project CREMP, Spring 2020

Study Area		Station	Sampling Date	*In Situ* Water Quality Parameter					
				Temperature (°C)	Dissolved Oxygen		pH	Specific Conductance (µS/cm)	Turbidity (NTU)
					(% saturated)	(mg/L)			
Camp Lake System	Reference Creek Stations	CLT-REF4	4-Jul-20	5.9	97.3	12.1	7.70	55.8	-0.30
		CLT-REF3	4-Jul-20	4.9	97.9	12.6	7.71	54.9	-0.84
		MRY-REF3	4-Jul-20	3.7	98.3	13.0	7.67	33.1	5.30
		MRY-REF2	4-Jul-20	5.5	98.1	12.4	7.62	56.9	-0.50
	CLT-1	L1-08	4-Jul-20	3.2	96.2	12.9	7.79	90.7	0.35
		L1-02	2-Jul-20	11.7	96.6	10.5	8.02	114.8	0.28
		L2-03	2-Jul-20	15.7	97.7	9.7	8.01	244.9	15.90
		L1-09	2-Jul-20	13.0	97.1	10.2	8.12	141.0	1.97
		L1-05	3-Jul-20	10.0	99.0	11.2	8.13	144.0	1.13
		L0-01	3-Jul-20	9.3	98.9	11.4	7.98	147.8	0.61
	CLT-2	K0-01	3-Jul-20	9.4	98.7	11.3	7.95	143.2	-0.54
	Camp Lake	J0-01	4-Jul-20	3.3	95.8	12.9	7.88	151.8	-0.07
Sheardown Lake System	SDL Tribs	D1-05	2-Jul-20	8.4	94.8	11.3	8.00	142.7	5.03
		D1-00	2-Jul-20	14.3	96.8	9.9	8.05	264.0	3.26
Mary River/Lake System	Tom River	I0-01	4-Jul-20	7.1	99.6	12.1	7.73	61.9	1.16
	Mary River	G0-09-A	4-Jul-20	4.9	95.5	12.3	7.75	66.6	-0.12
		G0-09	4-Jul-20	4.6	95.5	12.3	7.68	63.0	1.50
		G0-09-B	4-Jul-20	3.8	96.1	12.7	7.71	40.9	9.20
		G0-03	3-Jul-20	10.8	96.9	10.8	7.63	45.4	10.76
		G0-01	3-Jul-20	9.9	100.6	11.4	7.73	40.6	6.43
		F0-01	3-Jul-20	11.0	98.7	10.9	7.90	94.3	5.25
		E0-10	3-Jul-20	10.6	100.0	11.1	7.74	73.5	5.20
		E0-03	3-Jul-20	8.6	100.2	11.7	7.90	44.3	6.71
		E0-20	3-Jul-20	7.3	100.0	12.0	7.68	41.7	6.52
		E0-21	3-Jul-20	7.7	98.6	11.8	8.01	41.5	6.85
		C0-10	3-Jul-20	7.0	101.3	12.3	7.68	40.5	7.01
		C0-05	3-Jul-20	6.4	101.8	12.6	7.90	65.8	6.94
		C0-01	3-Jul-20	6.2	101.8	12.6	7.65	50.2	9.42

Table C.2: *In Situ* Water Quality Data Collected from Lotic Environments for the Mary River Project CREMP, Summer 2020

Study Area		Station	Sampling Date	*In Situ* Water Quality Parameter					
				Temperature (°C)	Dissolved Oxygen		pH	Specific Conductance (µS/cm)	Turbidity (NTU)
					(% saturated)	(mg/L)			
Camp Lake System	Reference Creek Stations	CLT-REF4	2-Aug-20	8.8	97.8	11.4	8.08	141.9	-0.96
		CLT-REF3	2-Aug-20	5.8	98.5	12.4	8.03	121.6	-0.82
		MRY-REF3	2-Aug-20	11.0	99.9	11.0	7.88	117.0	20.67
		MRY-REF2	2-Aug-20	13.3	101.0	10.6	8.06	126.3	0.28
	CLT-1	L1-08	2-Aug-20	4.6	99.0	12.8	8.01	151.5	-0.87
		L1-02	1-Aug-20	9.6	98.5	11.2	8.37	218.8	-1.97
		L2-03	1-Aug-20	12.7	97.2	10.3	8.11	376.5	1.09
		L1-09	1-Aug-20	10.9	99.2	11.0	8.28	265.4	-1.19
		L1-05	1-Aug-20	10.2	97.7	11.0	8.37	269.9	-0.84
		L0-01	1-Aug-20	10.5	99.2	11.1	8.34	280.3	-1.25
	CLT-2	K0-01	1-Aug-20	10.3	99.9	11.2	8.43	293.2	-1.65
	Camp Lake	J0-01	2-Aug-20	11.8	103.1	11.2	8.05	149.8	-0.49
Sheardown Lake System	SDL Tribs	D1-05	2-Aug-20	6.6	92.5	11.3	7.83	216.5	-1.05
		D1-00	2-Aug-20	9.8	96.1	10.9	7.96	453.1	0.67
Mary River/Lake System	Tom River	I0-01	2-Aug-20	10.6	100.4	11.2	8.31	216.3	-1.28
	Mary River	G0-09-A	2-Aug-20	9.0	96.1	11.2	8.15	187.2	14.52
		G0-09	1-Aug-20	10.0	96.8	10.9	8.38	184.9	31.42
		G0-09-B	1-Aug-20	10.2	96.7	10.9	8.33	172.4	24.20
		G0-03	1-Aug-20	4.8	96.5	11.0	8.02	161.5	42.01
		G0-01	31-Jul-20	13.3	98.5	10.3	8.31	167.1	21.01
		F0-01	31-Jul-20	11.7	97.7	10.6	8.33	335.6	-1.17
		E0-10	31-Jul-20	13.1	98.4	10.3	8.23	171.2	30.25
		E0-03	31-Jul-20	12.1	99.0	10.6	8.16	172.7	42.19
		E0-20	31-Jul-20	12.0	100.3	10.8	8.21	172.1	41.64
		E0-21	31-Jul-20	11.7	99.2	10.8	8.23	172.3	43.72
		C0-10	30-Jul-20	11.1	98.1	10.8	8.15	168.4	21.33
		C0-05	30-Jul-20	11.7	99.3	10.7	8.24	166.6	29.80
		C0-01	30-Jul-20	12.0	98.4	10.6	8.26	168.0	34.42

Table C.3: ***In Situ*** **Water Quality Data Collected From Lotic Environments for the Mary River Project CREMP, Fall 2020**

Study Area		Station	Sampling Date	*In Situ* Water Quality Parameter					
				Temperature (^{o}C)	Dissolved Oxygen		pH	Specific Conductance (µS/cm)	Turbidity (NTU)
					(% saturated)	(mg/L)			
Camp Lake System	Reference Creek Stations	CLT-REF4	21-Aug-19	4.5	96.9	12.6	8.15	182.8	0.4
		CLT-REF3	21-Aug-19	2.9	98.3	13.3	8.04	101.6	0.5
		MRY-REF3	21-Aug-19	5.6	97.9	12.3	7.70	170.7	8.0
		MRY-REF2	21-Aug-19	5.1	97.5	12.5	8.02	182.4	0.6
	CLT-1	L1-08	18-Aug-19	2.7	97.8	13.3	8.21	188.9	0.3
		L1-02	19-Aug-19	4.8	97.7	12.6	8.20	243.9	0.2
		L2-03	19-Aug-19	11.7	98.3	10.7	8.01	443.3	2.3
		L1-09	19-Aug-19	4.8	96.7	12.4	7.98	301.9	0.6
		L1-05	19-Aug-19	4.7	97.2	12.5	8.02	304.0	0.6
		L0-01	19-Aug-19	9.5	97.2	11.1	8.27	310.4	0.7
	CLT-2	K0-01	19-Aug-19	10.1	99.2	11.2	8.42	341.7	0.2
	Camp Lake	J0-01	18-Aug-19	9.3	97.8	11.2	7.79	155.1	0.3
Sheardown Lake System	SDL Tribs	D1-05	19-Aug-19	5.3	94.9	12.0	7.98	243.3	0.2
		D1-00	19-Aug-19	10.3	98.6	11.1	8.16	365.2	2.3
Mary River/Lake System	Tom River	I0-01	19-Aug-19	6.3	99.4	12.3	8.25	263.5	0.2
	Mary River	G0-09-A	20-Aug-19	9.6	96.8	11.0	8.38	246.6	0.3
		G0-09	20-Aug-19	9.5	97.4	11.1	8.40	247.1	3.2
		G0-09-B	20-Aug-19	9.8	99.0	11.0	8.36	237.0	6.0
		G0-03	20-Aug-19	8.4	98.5	11.6	8.33	224.0	4.1
		G0-01	20-Aug-19	6.5	99.2	12.2	8.26	227.1	5.5
		F0-01	20-Aug-19	7.2	98.2	11.9	8.33	399.6	1.3
		E0-10	20-Aug-19	6.2	98.9	12.2	8.27	255.4	5.2
		E0-03	20-Aug-19	5.2	98.9	12.6	8.30	239.5	6.6
		E0-20	20-Aug-19	5.6	100.1	12.6	8.22	236.5	7.7
		E0-21	20-Aug-19	5.2	100.0	12.7	8.22	245.3	8.0
		C0-10	20-Aug-19	6.5	102.9	12.6	8.23	234.9	4.1
		C0-05	20-Aug-19	5.8	101.2	12.7	8.02	231.3	4.7
		C0-01	20-Aug-19	5.5	100.3	12.7	8.00	229.4	2.9

Table C.4: Dissolved Metal Concentrations at Reference Creek Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Spring Sampling Event				Summer Sampling Event				Fall Sampling Event			
			CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2
			04-Jul-20	04-Jul-20	04-Jul-20	04-Jul-20	03-Aug-20	03-Aug-20	03-Aug-20	03-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0200	0.0128	0.0289	0.0120	0.0055	0.0096	0.111	0.0173	0.0066	0.0083	0.0442	0.0152
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00275	0.00344	0.00330	0.00313	0.00588	0.00643	0.0106	0.00808	0.00709	0.00900	0.0142	0.0100
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	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
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	5.76	5.49	2.65	5.43	13.8	11.7	9.72	12.4	18.9	16.0	14.7	17.1
	Chromium (Cr)	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
	Cobalt (Co)	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
	Copper (Cu)	mg/L	<0.00050	0.00086	0.00053	<0.00050	0.00055	0.00110	0.00122	0.00065	0.00064	0.00119	0.00116	0.00071
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.054	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000077	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0013	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	3.27	3.32	1.39	3.21	7.73	6.92	4.87	7.01	11.3	10.7	7.48	10.4
	Manganese (Mn)	mg/L	0.000105	0.000293	0.000726	0.000422	<0.000070	0.000805	0.00067	0.000526	0.000073	0.000955	0.000360	0.000611
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000094	0.000305	0.000134	0.000089	0.000353	0.000745	0.000639	0.000247	0.000563	0.000887	0.000619	0.000329
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00065	<0.00050	<0.00050	<0.00050	0.00075	<0.00050	<0.00050
	Potassium (K)	mg/L	0.38	0.43	0.44	0.43	0.68	0.73	1.14	0.85	0.83	0.96	1.31	1.05
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.51	0.61	0.42	0.43	0.64	0.86	1.22	0.66	0.60	0.91	1.08	0.79
	Silver (Ag)	mg/L	<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 (Na)	mg/L	0.584	0.575	1.14	0.959	2.33	1.56	4.71	2.66	3.38	2.22	6.73	4.09
	Strontium (Sr)	mg/L	0.00462	0.00385	0.00591	0.00467	0.0117	0.00841	0.0236	0.0123	0.0155	0.0115	0.0320	0.0164
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.00354	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000517	0.000447	0.000260	0.000330	0.00824	0.00423	0.00154	0.00212	0.0136	0.00854	0.00326	0.00372
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0010	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Note: "-" indicates no data reported.

Table C.5: *In Situ* Water Quality Profile Data Collected at Reference Lake 3 Water Quality Monitoring Stations in Summer 2020, Mary River Project CREMP

Depth (m)	Temperature (°C)			Dissolved Oxygen (mg/L)			Dissolved Oxygen (% Saturation)			pH (pH units)			Specific Conductance (µS/cm)		
	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01
Date Collected	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20
1.0	12.0	12.2	12.2	10.89	10.78	10.80	101.0	100.6	100.7	7.90	7.93	8.03	76.0	76.3	76.0
2.0	12.0	12.2	12.2	10.91	10.84	10.83	101.1	100.7	100.9	7.88	7.83	7.95	76.1	76.2	76.0
3.0	11.9	12.2	12.2	10.94	10.77	10.83	101.2	100.3	101.0	7.87	7.75	7.93	76.1	76.1	76.1
4.0	11.6	12.2	12.2	11.17	10.80	10.83	102.1	100.6	101.0	7.85	7.74	7.91	76.1	76.2	76.1
5.0	10.4	12.1	12.2	11.53	10.79	10.83	103.1	100.1	100.9	7.83	7.72	7.89	76.0	76.5	76.1
6.0	9.3	8.2	9.2	11.99	12.33	11.86	104.3	104.1	101.8	7.75	7.61	7.85	76.1	75.6	76.4
7.0	8.4	7.5	7.5	12.35	12.48	12.41	105.3	104.0	103.3	7.76	7.56	7.78	75.6	75.4	75.8
8.0	7.3	7.3	7.3	12.60	12.51	12.52	104.6	103.5	103.3	7.72	7.53	7.74	75.7	75.5	75.5
9.0	7.2	7.1	6.9	12.64	12.56	12.54	104.4	103.6	103.1	7.70	7.51	7.70	75.4	75.4	75.5
10.0	6.7	7.0	6.7	12.74	12.56	12.57	104.2	103.6	102.7	7.68	7.50	7.67	75.5	75.5	75.4
11.0	6.3	6.8	6.7	12.77	12.56	12.57	103.5	103.0	102.6	7.66	7.48	7.65	75.2	75.4	75.4
12.0	5.8	6.6	6.6	12.84	12.57	12.57	102.7	102.5	102.4	7.64	7.47	7.64	75.5	75.4	75.4
13.0	5.7	6.4	6.5	12.81	12.60	12.61	102.2	102.0	102.2	7.61	7.45	7.63	75.4	75.4	75.5
14.0	5.7	6.2	6.3	12.79	12.60	12.61	101.7	101.8	102.1	7.60	7.43	7.62	75.4	75.4	75.4
15.0	5.4	6.1	6.2	12.71	12.60	12.63	100.6	101.6	101.9	7.56	7.42	7.62	75.4	75.4	75.4
16.0	5.3	6.1	-	12.71	12.60	-	100.4	101.3	-	7.58	7.41	-	75.4	75.4	-
17.0	5.3	5.9	-	12.58	12.59	-	100.0	100.8	-	7.55	7.40	-	75.4	75.4	-
18.0	5.2	5.8	-	12.67	12.61	-	99.7	100.8	-	7.54	7.40	-	75.4	75.4	-
19.0	5.2	5.7	-	12.65	12.61	-	99.5	100.6	-	7.54	7.38	-	75.4	75.4	-
20.0	5.1	5.4	-	12.63	12.54	-	99.2	99.3	-	7.53	7.30	-	75.4	75.4	-
21.0	5.1	5.4	-	12.61	12.54	-	98.9	99.3	-	7.52	7.31	-	75.4	75.4	-
22.0	5.1	5.4	-	12.60	12.53	-	98.7	99.1	-	7.52	7.32	-	75.5	75.5	-
23.0	5.0	5.4	-	12.57	12.51	-	98.4	98.9	-	7.51	7.32	-	75.5	75.5	-
24.0	4.9	5.3	-	12.55	12.48	-	98.1	98.5	-	7.50	7.31	-	75.5	75.5	-
25.0	4.9	5.3	-	12.54	12.46	-	98.0	98.3	-	7.49	7.31	-	75.5	75.5	-
26.0	4.9	-	-	12.52	-	-	97.8	-	-	7.49	-	-	75.5	-	-
27.0	4.9	-	-	12.49	-	-	97.5	-	-	7.48	-	-	75.5	-	-
28.0	4.9	-	-	12.48	-	-	97.4	-	-	7.48	-	-	75.5	-	-
29.0	4.8	-	-	12.44	-	-	97.0	-	-	7.47	-	-	75.5	-	-
30.0	4.8	-	-	12.42	-	-	96.8	-	-	7.47	-	-	75.5	-	-
31.0	4.8	-	-	12.42	-	-	96.7	-	-	7.47	-	-	75.5	-	-
32.0	4.8	-	-	12.41	-	-	96.6	-	-	7.46	-	-	75.5	-	-
33.0	4.8	-	-	12.39	-	-	96.4	-	-	7.45	-	-	75.5	-	-
34.0	4.8	-	-	12.37	-	-	96.3	-	-	7.45	-	-	75.5	-	-
35.0	4.7	-	-	12.35	-	-	96.1	-	-	7.45	-	-	75.5	-	-
36.0	4.7	-	-	12.31	-	-	95.8	-	-	7.45	-	-	75.5	-	-

Notes: "-" = no data / not applicable. Total depth at stations REF3-03, REF3-02, and REF3-01 was 36.7, 30.3, and 15.4 m, respectively, at the time of summer sampling.

Table C.6: *In Situ* Water Quality Profile Data Collected at Reference Lake 3 Water Quality Monitoring Stations in Fall 2020, Mary River Project CREMP

Depth (m)	Temperature (°C)			Dissolved Oxygen (mg/L)			Dissolved Oxygen (% Saturation)			pH (pH units)			Specific Conductance (µS/cm)		
	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01	REF3-03	REF3-02	REF3-01
Date Collected	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
1.0	8.9	8.8	8.6	11.56	11.58	11.51	99.5	99.6	98.7	7.82	7.86	7.85	76.6	76.8	77.5
2.0	8.7	8.7	8.5	11.60	11.57	11.56	99.6	99.3	98.8	7.79	7.82	7.82	76.3	76.7	76.9
3.0	8.6	8.6	8.4	11.60	11.58	11.56	99.5	99.3	98.7	7.78	7.82	7.81	76.3	76.7	76.8
4.0	8.6	8.6	8.4	11.61	11.56	11.56	99.3	99.0	98.6	7.77	7.81	7.80	76.3	76.6	76.8
5.0	8.3	8.5	8.4	11.61	11.58	11.56	98.8	98.9	98.6	7.76	7.80	7.80	76.3	76.5	76.6
6.0	8.3	8.4	8.4	11.60	11.57	11.54	98.6	98.7	98.4	7.77	7.79	7.79	76.3	76.4	76.5
7.0	8.2	8.4	8.3	11.59	11.56	11.53	98.4	98.5	98.2	7.76	7.79	7.79	76.3	76.4	76.5
8.0	8.2	8.3	8.3	11.58	11.54	11.53	98.3	98.3	98.1	7.78	7.78	7.79	76.3	76.4	76.4
9.0	8.2	8.3	8.3	11.58	11.54	11.53	98.3	98.2	98.1	7.77	7.78	7.78	76.3	76.4	76.4
10.0	8.2	8.3	8.3	11.58	11.53	11.52	98.2	98.1	97.9	7.77	7.78	7.78	76.3	76.4	76.5
11.0	8.2	8.3	8.2	11.57	11.52	11.52	98.2	98.0	97.8	7.77	7.77	7.77	76.3	76.4	76.5
12.0	8.2	8.3	8.2	11.57	11.52	11.51	98.2	97.9	97.7	7.77	7.77	7.77	76.3	76.4	76.5
13.0	8.2	8.3	8.2	11.56	11.51	11.50	98.1	97.8	97.7	7.77	7.77	7.76	76.3	76.4	76.4
14.0	8.2	8.3	-	11.55	11.53	-	98.0	98.0	-	7.78	7.77	-	76.3	76.3	-
15.0	8.1	8.2	-	11.54	11.53	-	97.8	98.0	-	7.77	7.77	-	76.3	76.3	-
16.0	8.1	8.2	-	11.54	11.53	-	97.7	97.9	-	7.77	7.77	-	76.3	76.3	-
17.0	8.1	8.2	-	11.54	11.52	-	97.7	97.8	-	7.76	7.76	-	76.3	76.3	-
18.0	8.1	8.2	-	11.53	11.51	-	97.7	97.7	-	7.76	7.76	-	76.3	76.3	-
19.0	8.1	8.1	-	11.52	11.49	-	97.6	97.3	-	7.77	7.75	-	76.3	76.3	-
20.0	8.0	8.1	-	11.51	11.47	-	97.3	97.1	-	7.76	7.74	-	76.3	76.3	-
21.0	7.9	8.0	-	11.52	11.49	-	97.9	96.9	-	7.75	7.73	-	76.3	76.3	-
22.0	7.0	7.6	-	11.64	11.49	-	96.5	96.2	-	7.71	7.68	-	76.3	76.3	-
23.0	6.3	7.5	-	11.88	11.47	-	95.7	95.2	-	7.65	7.66	-	76.2	76.2	-
24.0	5.4	6.8	-	12.11	11.57	-	95.9	94.0	-	7.57	7.60	-	75.7	75.8	-
25.0	5.1	6.0	-	12.16	11.62	-	95.5	93.4	-	7.52	7.50	-	75.4	75.9	-
26.0	5.1	5.9	-	12.14	11.53	-	95.3	92.4	-	7.48	7.45	-	75.3	75.8	-
27.0	5.0	-	-	12.04	-	-	94.3	-	-	7.43	-	-	75.5	-	-
28.0	5.0	-	-	11.98	-	-	93.8	-	-	7.41	-	-	75.5	-	-
29.0	4.9	-	-	11.86	-	-	92.8	-	-	7.39	-	-	75.5	-	-
30.0	4.9	-	-	11.76	-	-	92.0	-	-	7.37	-	-	76.6	-	-
31.0	4.9	-	-	11.62	-	-	90.8	-	-	7.35	-	-	75.6	-	-
32.0	4.8	-	-	11.24	-	-	87.7	-	-	7.30	-	-	75.8	-	-
33.0	4.8	-	-	10.57	-	-	82.3	-	-	7.23	-	-	76.1	-	-

Notes: "-" = no data / not applicable. Total depth at stations REF3-03, REF3-02, and REF3-01 was 36.7, 30.3, and 15.4 m, respectively, at the time of fall sampling.

Table C.7: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Reference Lake 3 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Replicate ID	Date Sampled	Station Depth (m)	Secchi Depth (m)	Colour/ Clarity	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (pH units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
REF 03-1	14-Aug-20	10.5	8.05	clear, colourless	surface	10.1	12.71	114.4	7.67	75.5
					bottom	9.7	11.94	108.2	7.12	76.8
REF 03-2	14-Aug-20	-	7.4	clear, colourless	surface	10.3	13.09	118.5	7.38	74.9
					bottom	9.2	11.83	104.6	6.94	82.1
REF 03-3	14-Aug-20	10.0	9.15	clear, colourless	surface	10.1	12.59	112.6	7.41	74.9
					bottom	9.4	13.00	115.0	7.56	75.2
REF 03-4	14-Aug-20	8.5	8.12	clear, colourless	surface	10.2	13.33	120.5	7.16	74.9
					bottom	9.4	13.03	115.0	7.13	74.8
REF 03-5	14-Aug-20	11.0	7.92	clear, colourless	surface	9.8	12.99	116.0	7.26	74.8
					bottom	8.9	13.34	116.7	7.20	74.5
REF 03-6	14-Aug-20	20.5	8.55	clear, colourless	surface	10.2	12.46	112.4	7.20	75.1
					bottom	6.1	13.73	112.0	6.94	78.1
REF 03-7	14-Aug-20	23.0	8.10	clear, colourless	surface	10.2	12.79	115.2	7.35	75.2
					bottom	5.8	12.82	103.5	6.27	76.0
REF 03-8	14-Aug-20	19.0	9.84	clear, colourless	surface	10.2	13.42	121.4	7.27	75.1
					bottom	5.7	15.78	127.9	6.95	75.2
REF 03-9	15-Aug-20	21.0	7.18	clear, colourless	surface	9.6	10.92	97.3	7.13	75.0
					bottom	5.6	12.93	104.2	6.53	74.0
REF 03-10	15-Aug-20	19.5	8.29	clear, colourless	surface	9.7	10.81	96.6	6.89	75.0
					bottom	5.9	12.91	105.2	6.82	74.3

Note: "-" indicates data not collected.

Table C.8: Statistical Comparison of Bottom *In Situ* Water Quality Between Littoral and Profundal Stations of Reference Lake 3, Mary River Project CREMP, August 2020

Parameter	Statistical Test Results				Summary Statistics						
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Station Type	n	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	tequal	none	NO	0.621	Littoral	5	8.1	0.6	0.3	7.4	9.2
					Profundal	5	8.4	1.0	0.4	7.2	9.8
Temperature (˚C)	tequal	none	YES	0.001	Littoral	5	9.3	0.3	0.1	8.9	9.7
					Profundal	5	5.8	0.2	0.1	5.6	6.1
Dissolved Oxygen (mg/L)	tequal	log10	NO	0.147	Littoral	5	12.6	0.7	0.3	11.8	13.3
					Profundal	5	13.6	1.3	0.6	12.8	15.8
Dissolved Oxygen (% saturation)	tequal	none	NO	0.801	Littoral	5	111.9	5.2	2.3	104.6	116.7
					Profundal	5	110.6	10.3	4.6	103.5	127.9
pH (units)	tequal	none	YES	0.019	Littoral	5	7.19	0.23	0.10	6.94	7.56
					Profundal	5	6.70	0.30	0.13	6.27	6.95
Specific Conductance (µS/cm)	M-W	rank	NO	0.600	Littoral	5	76.7	3.2	1.4	74.5	82.1
					Profundal	5	75.5	1.6	0.7	74.0	78.1

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.9: Dissolved Metal Concentrations at Reference Lake 3 Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Summer Sampling Event						Fall Sampling Event					
			REF3-01	REF3-01	REF3-02	REF3-02	REF3-03	REF3-03	REF3-01	REF3-01	REF3-02	REF3-02	REF3-03	REF3-03
			Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface	Bottom	Surface
			02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0614	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0108
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00643	0.00618	0.00626	0.00609	0.00618	0.00624	0.00649	0.00637	0.00644	0.00632	0.00633	0.00630
	Beryllium (Be)	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
	Bismuth (Bi)	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
	Boron (B)	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
	Cadmium (Cd)	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
	Calcium (Ca)	mg/L	6.83	6.75	7.19	7.26	6.69	7.00	7.20	7.33	7.21	7.26	7.11	7.23
	Chromium (Cr)	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
	Cobalt (Co)	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
	Copper (Cu)	mg/L	0.00072	0.00069	0.00070	0.00068	0.00068	0.00069	0.00074	0.00074	0.00070	0.00074	0.00071	0.00072
	Iron (Fe)	mg/L	<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 (Pb)	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
	Lithium (Li)	mg/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
	Magnesium (Mg)	mg/L	4.32	4.22	4.31	4.19	4.24	4.25	4.88	4.88	4.88	4.86	4.75	4.80
	Manganese (Mn)	mg/L	0.000211	0.000247	0.000140	0.000279	0.000225	0.000241	0.000143	0.000160	0.000079	0.000159	0.000117	0.000164
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000129	0.000119	0.000129	0.000133	0.000133	0.000136	0.000153	0.000180	0.000151	0.000152	0.000146	0.000148
	Nickel (Ni)	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
	Potassium (K)	mg/L	0.89	0.86	0.86	0.85	0.84	0.86	0.92	0.97	0.91	0.94	0.89	1.03
	Selenium (Se)	mg/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
	Silicon (Si)	mg/L	0.48	0.44	0.50	0.47	0.48	0.47	0.48	0.47	0.49	0.47	0.54	0.48
	Silver (Ag)	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
	Sodium (Na)	mg/L	0.980	0.889	0.906	0.879	0.868	0.896	1.00	1.02	1.01	1.00	0.993	1.13
	Strontium (Sr)	mg/L	0.00788	0.00799	0.00837	0.00839	0.00826	0.00834	0.00807	0.00811	0.00809	0.00813	0.00796	0.00828
	Thallium (Tl)	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
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.000293	0.000307	0.000306	0.000318	0.000292	0.000313	0.000345	0.000354	0.000322	0.000340	0.000296	0.000329
	Vanadium (V)	mg/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
	Zinc (Zn)	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

Table C.10: Average Relative Percent Difference (RPD) Values between Water Chemistry Samples Taken at the Top and Bottom of the Water Column at Lake Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Reference Lake		Camp Lake			Sheardown Lake Northwest			Sheardown Lake Southeast			Mary Lake North Basin			Mary Lake South Basin		
		Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall	Winter	Summer	Fall
Conventionals[b]	Conductivity (lab)	0.4	1.3	5.0	2.8	39	5	4	0	2.7	6.4	0.7	2.3	29	0.5	5.9	6.3	1.1
	pH (lab)	2.8	2.0	2.4	2.0	3.7	1.5	4.0	0.5	1.2	5.4	0.5	2.3	4.4	0.4	1.2	3.2	0.9
	Hardness (as $CaCO_3$)	1.6	0.7	6.5	2.5	41	5.1	3.3	1.5	2.1	8.4	0.9	3.4	27	0.6	4.0	8.1	1.2
	Total Suspended Solids (TSS)	0	0	0	1.0	0	0	21	0	0	0	6.0	0	0	0	0	15	6.6
	Total Dissolved Solids (TDS)	15	11	7.8	5.7	78	2.6	9.3	16	7.1	9.6	17	3.4	30	3.7	11	9.9	7.9
	Turbidity	15	15	26	9.5	29	20	24	5.8	54	39	4.0	52	36	10.0	14	31	5.6
	Alkalinity (as $CaCO_3$)	9.3	3.9	5.7	2.6	32	5.6	3.7	19	2.4	6.6	1.1	2.3	28	2.0	5.3	7.6	3.0
Nutrients and Organics	Total Ammonia	0	25	56	1.5	13	52	3.8	24	38	38	4.8	0	68	0	0	0	0
	Nitrate	0	0	70	13	19	13	10	12	7.4	27	13	17	46	46	18	22	33
	Nitrite	0	0	0	0	0	0	36	0	0	26	0	0	15	0	0	0	0
	Total Kjeldahl Nitrogen (TKN)	0	4.2	28	8.2	2.9	12	8.9	3.7	1.3	13	1.3	10.0	6.0	6.3	10	0	0
	Dissolved Organic Carbon	1.9	3.7	15	27	31	9.8	16	3.6	13	38	13	10	31	16	5.4	17	8.3
	Total Organic Carbon	2.8	2.9	8.9	5.4	17	5.6	11	5.2	5.0	8.4	3.1	6.4	9.5	51	6.5	11	6.8
	Total Phosphorus	39	4.2	39	36	34	84	22	38	24	27	23	20	42	30	1.4	30	45
	Phenols	0	9.2	34	53	23	14	10	43	1.9	36	0	28	0	0	8.0	0	16
Anions	Bromide (Br)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Chloride (Cl)	3.6	0.7	14	2.6	34	5.3	3.9	0.6	2.9	5.1	1.1	2.9	41	1.2	6.0	9.6	4.9
	Sulphate (SO_4)	1.3	0.5	7.0	2.9	44	5.4	7.5	0.1	4.9	9.9	0.7	7.6	38	1.1	6.4	7.3	4.4
Total Metals	Aluminum (Al)	4.2	10	102	16	20	50	41	41	42	48	10	17	40	16	25	40	14
	Antimony (Sb)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Arsenic (As)	0	0	1.9	0	0	0	0	1.6	1.9	0	0	6.1	29	0	0	0	1.4
	Barium (Ba)	3.8	13	4.9	5.0	42	5.3	3.2	2.1	2.9	2.3	3.5	4.1	25	2.4	4.7	9.9	3.0
	Boron (B)	0	0	0	0	0	5.8	23	2.6	3.4	0	0	0	0	0	0	0	0
	Cadmium (Cd)	0	0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Calcium (Ca)	2.4	2.4	7.2	3.3	41	5.7	4.3	1.3	2.8	6.8	1.5	2.5	27	0.6	3.4	6.0	0.8
	Chromium (Cr)	0	0	0	21	0	0	15	0	0	21	0	0	28	0	0	0	0
	Cobalt (Co)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Copper (Cu)	2.3	5.3	17	5.8	17	11	5.4	2.8	9.6	4.6	12	20	18	2.7	5.4	9.0	6.4
	Iron (Fe)	0	0	0	36	0	0	42	14	0	50	5.7	12	50	0	0	29	9.1
	Lead (Pb)	0	0	48	0	0	11	0	0	0	10	9.0	0	6.1	0	0	22	0
	Lithium (Li)	0	0	6.0	4.9	3.3	8.8	9.0	3.2	6.4	8.6	11	6.9	3.2	10	0	0	0
	Magnesium (Mg)	2.6	1.6	4.6	1.4	41	5.0	6.1	1.2	3.5	4.2	1.0	1.4	28	2.1	4.7	9.6	2.8
	Manganese (Mn)	8.9	11	58	12	43	39	44	38	37	54	2.2	79	47	2.9	45	35	13
	Mercury (Hg)	0	0	0	0	0	2.8	0	0	0	0	0	0	0	0	2.3	5.0	0
	Molybdenum (Mo)	3.1	8.8	16	8.9	35	9.0	4.5	2.2	7.6	10	2.3	9.8	35	0.4	6.3	39	6.4
	Nickel (Ni)	0	0	18	7.6	6.3	9.0	3.9	3.4	5.1	9.9	2.6	5.7	7.6	3.9	1.7	0	0
	Potassium (K)	2.3	0.7	8.1	2.8	30	6.3	4.0	1.3	4.3	2.6	0.5	2.4	23	0.6	5.4	8.3	1.8
	Selenium (Se)	0	0	0	0.7	0	0	7.1	0	0	0	0	0	0	0	0	0	0
	Silicon (Si)	4.7	6.6	26	2.2	25	15	4.8	2.4	16	19	4.1	16	7.5	2.3	6.8	9.8	4.7
	Silver (Ag)	0	0	0	0	0	0	44	0	0	0	0	0	0	0	0	0	0
	Sodium (Na)	2.5	1.5	12	3.6	40	6.0	6.1	1.0	3.4	4.4	1.3	2.6	41	1.4	4.4	11	2.1
	Strontium (Sr)	5.2	1.1	5.7	3.9	41	5.3	4.9	0.5	2.1	5.5	0.8	2.8	33	3.0	6.7	7.6	2.0
	Thallium (Tl)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Tin (Sn)	0	0	6.7	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Titanium (Ti)	0	0	0	27	0	0	44	0	0	62	0	0	66	0	0	0	0
	Uranium (U)	8.9	8.2	11	6.5	43	6.7	7.7	1.3	3.8	13	1.0	7.8	53	1.6	5.8	14	2.3
	Vanadium (V)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Zinc (Zn)	0	0	38	32	0	16	0	0	20	0	0	0	0	0	0	18	0

Note: Shaded values indicate RDP >30%.

Table C.11: ***In Situ*** **Water Quality Measurements Collected at Camp Lake Tributary 1 and Tributary 2 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020**

Study Area	Station	Sampling Date	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH (pH units)	Specific Conductance (µS/cm)
Unnamed Reference Creek	REF-CRK-B1	10-Aug-20	9.9	10.42	95.3	7.71	132.4
	REF-CRK-B2	10-Aug-20	9.0	10.61	94.6	7.58	132.8
	REF-CRK-B3	10-Aug-20	8.4	10.68	93.2	7.48	132.8
	REF-CRK-B4	10-Aug-20	8.0	11.09	96.5	7.50	130.8
	REF-CRK-B5	10-Aug-20	7.6	11.30	98.0	7.57	133.0
Camp Lake Tributary 1 Upstream	CLT-1-US-B1	17-Aug-20	7.9	10.51	92.0	8.22	240.0
	CLT-1-US B2	17-Aug-20	7.8	10.59	92.5	8.17	241.0
	CLT-1-US-B3	17-Aug-20	7.8	10.72	93.4	8.17	243.2
	CLT-1-US-B4	17-Aug-20	7.7	10.74	93.6	8.17	246.6
	CLT-1-US-B5	17-Aug-20	8.4	10.27	91.3	8.13	318.0
Camp Lake Tributary 1 Downstream	CLT-1-DS-B1	8-Aug-20	12.4	11.67	115.5	8.30	292.2
	CLT-1-DS-B2	8-Aug-20	12.3	11.23	107.3	7.91	299.0
	CLT-1-DS-B3	8-Aug-20	12.2	11.43	109.7	7.96	289.0
	CLT-1-DS-B4	8-Aug-20	11.9	11.55	110.7	8.18	289.3
	CLT-1-DS-B5	8-Aug-20	11.5	11.94	112.8	8.03	289.0
Camp Lake Tributary 2 Upstream	CLT-2-US-B1	9-Aug-20	11.1	10.90	103.4	8.26	307.4
	CLT-2-US-B2	9-Aug-20	11.0	11.22	103.4	8.09	307.7
	CLT-2-US-B3	9-Aug-20	10.4	11.61	106.9	8.18	307.4
	CLT-2-US-B4	9-Aug-20	10.2	11.69	107.0	8.13	287.5
	CLT-2-US-B5	9-Aug-20	9.5	11.66	105.8	8.20	308.1
Camp Lake Tributary 2 Downstream	CLT-2-DS-B1	9-Aug-20	8.7	12.63	111.5	8.33	311.5
	CLT-2-DS-B2	9-Aug-20	8.3	12.68	110.3	8.10	311.2
	CLT-2-DS-B3	9-Aug-20	7.8	12.91	111.5	8.08	309.7
	CLT-2-DS-B4	9-Aug-20	6.1	13.64	113.0	8.00	312.0
	CLT-2-DS-B5	9-Aug-20	5.9	13.85	115.0	8.03	310.0

Table C.12: *In Situ* Water Quality Summary Statistics for the Camp Lake Tributary Benthic Stations, Mary River Project CREMP, August 2020

Metric	Study Area	Sample Size	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Water Temperature (°C)	REF-CRK Unnamed Reference Creek	5	8.6	0.9	0.4	7.9	9.2	7.6	9.9
	CLT1-US North Branch	5	7.9	0.3	0.1	7.7	8.1	7.7	8.4
	CLT1-DS Lower Main Stem	5	12.1	0.4	0.2	11.8	12.3	11.5	12.4
	CLT2-US Upstream	5	10.4	0.7	0.3	10.0	10.9	9.5	11.1
	CLT2-DS Downstream	5	7.4	1.3	0.6	6.4	8.3	5.9	8.7
Dissolved Oxygen (mg/L)	REF-CRK Unnamed Reference Creek	5	10.82	0.36	0.16	10.55	11.09	10.42	11.30
	CLT1-US North Branch	5	10.57	0.19	0.09	10.43	10.71	10.27	10.74
	CLT1-DS Lower Main Stem	5	11.56	0.27	0.12	11.37	11.76	11.23	11.94
	CLT2-US Upstream	5	11.42	0.35	0.15	11.16	11.67	10.90	11.69
	CLT2-DS Downstream	5	13.14	0.57	0.25	12.73	13.56	12.63	13.85
Dissolved Oxygen (% Saturation)	REF-CRK Unnamed Reference Creek	5	95.5	1.8	0.8	94.2	96.9	93.2	98.0
	CLT1-US North Branch	5	92.6	1.0	0.4	91.9	93.3	91.3	93.6
	CLT1-DS Lower Main Stem	5	111.2	3.1	1.4	108.9	113.5	107.3	115.5
	CLT2-US Upstream	5	105.3	1.8	0.8	104.0	106.6	103.4	107.0
	CLT2-DS Downstream	5	112.3	1.8	0.8	110.9	113.6	110.3	115.0
pH (units)	REF-CRK Unnamed Reference Creek	5	7.57	0.09	0.04	7.50	7.63	7.48	7.71
	CLT1-US North Branch	5	8.17	0.03	0.01	8.15	8.20	8.13	8.22
	CLT1-DS Lower Main Stem	5	8.08	0.16	0.07	7.96	8.19	7.91	8.30
	CLT2-US Upstream	5	8.17	0.07	0.03	8.12	8.22	8.09	8.26
	CLT2-DS Downstream	5	8.11	0.13	0.06	8.01	8.20	8.00	8.33
Specific Conductance (µS/cm)	REF-CRK Unnamed Reference Creek	5	132	0.9	0.4	132	133	131	133
	CLT1-US North Branch	5	258	33.8	15.1	233	283	240	318
	CLT1-DS Lower Main Stem	5	292	4.3	1.9	289	295	289	299
	CLT2-US Upstream	5	304	9.0	4.0	297	310	288	308
	CLT2-DS Downstream	5	311	1.0	0.4	310	312	310	312

Table C.13: *In Situ* Water Quality Statistical Comparisons among Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 3-group Comparison				Pair-wise, *post hoc* comparisons[a]			
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	(I) Area	(J) Area	Significant Difference Between Areas?	P-value
Water Temperature (°C)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT1 North Branch	NO	0.215
					REF-CRK Unnamed Reference Creek	CLT1 Lower Main Stem	YES	<0.001
					CLT1 North Branch	CLT1 Lower Main Stem	YES	<0.001
Dissolved Oxygen (mg/L)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT1 North Branch	NO	0.360
					REF-CRK Unnamed Reference Creek	CLT1 Lower Main Stem	YES	0.003
					CLT1 North Branch	CLT1 Lower Main Stem	YES	<0.001
Dissolved Oxygen (% saturation)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT1 North Branch	NO	0.117
					REF-CRK Unnamed Reference Creek	CLT1 Lower Main Stem	YES	<0.001
					CLT1 North Branch	CLT1 Lower Main Stem	YES	<0.001
pH (units)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT1 North Branch	YES	<0.001
					REF-CRK Unnamed Reference Creek	CLT1 Lower Main Stem	YES	<0.001
					CLT1 North Branch	CLT1 Lower Main Stem	NO	0.371
Specific Conductance (µS/cm)	K-W	rank	YES	0.0050	REF-CRK Unnamed Reference Creek	CLT1 North Branch	YES	0.034
					REF-CRK Unnamed Reference Creek	CLT1 Lower Main Stem	YES	0.001
					CLT1 North Branch	CLT1 Lower Main Stem	NO	0.288

Highlighted values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Signficant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table C.14: Water Chemistry at Lotic Camp Lake Tributary (CLT) Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Spring Sampling Event						
					L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01
					04-Jul-20	02-Jul-20	02-Jul-20	02-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20
Conventionals	Conductivity (lab)	µS/cm	-	-	97.5	124	258	151	155	160	154
	pH (lab)	pH	6.5 - 9.0	-	7.93	8.14	8.16	8.23	8.15	8.20	8.18
	Hardness (as $CaCO_3$)	mg/L	-	-	44.5	59.9	103	68.7	69.3	71.2	70.4
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	2.7	9.9	2.6	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	92	80	158	109	118	104	120
	Turbidity	NTU	-	-	1.27	1.15	15.8	3.17	2.07	1.68	0.55
	Alkalinity (as $CaCO_3$)	mg/L	-	-	46	59	93	66	70	70	62
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	0.064	0.011	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.081	<0.020	1.03	0.151	0.159	0.137	0.135
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	0.0089	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.081	<0.021	1.0389	0.151	0.159	0.137	0.135
	Dissolved Organic Carbon	mg/L	-	-	2.27	3.03	4.79	3.32	3.50	3.41	2.81
	Total Organic Carbon	mg/L	-	-	2.62	4.38	5.87	4.78	4.57	4.68	3.86
	Total Phosphorus	mg/L	0.030[α]	-	0.0042	0.0032	0.0197	0.0033	0.0184	<0.0030	0.0075
	Phenols	mg/L	0.004[α]	-	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	1.26	1.57	16.4	4.33	4.47	4.41	2.38
	Sulphate (SO_4)	mg/L	218[β]	218	2.59	2.55	8.22	3.50	3.36	3.57	11.8
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0248	0.0139	***0.270***	0.0560	0.0546	0.0592	0.0229
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	0.00018	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00691	0.00825	0.0124	0.00884	0.00880	0.00903	0.00856
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	0.017	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	8.67	11.8	20.6	13.7	14.0	14.5	13.9
	Chromium (Cr)	mg/L	0.0089	0.000856	<0.00050	<0.00050	0.00059	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	0.00027	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	***0.00221***	0.00190	0.00164	0.00192	0.00184	0.00179	0.00116
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	***0.420***	0.087	0.081	0.073	<0.030
	Lead (Pb)	mg/L	0.001	0.001	0.000056	<0.000050	0.000987	0.000116	0.000100	0.000091	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	<0.0010	0.0033	0.0014	0.0015	0.0016	0.0012
	Magnesium (Mg)	mg/L	-	-	5.62	7.23	13.1	8.42	8.78	9.19	8.91
	Manganese (Mn)	mg/L	0.935[β]	-	0.00104	0.000528	0.0197	0.00381	0.00352	0.00280	0.000933
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000570	0.000435	0.00199	0.000727	0.000758	0.000710	0.000308
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00060	0.00711	0.00080	0.00080	0.00085	0.00052
	Potassium (K)	mg/L	-	-	1.47	1.39	2.85	1.67	1.67	1.66	1.20
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.66	0.67	1.23	0.78	0.79	0.82	0.67
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.470	0.897	9.30	2.34	2.47	2.48	1.85
	Strontium (Sr)	mg/L	-	-	0.00601	0.00658	0.0202	0.0103	0.0114	0.0113	0.00886
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00111	0.000707	0.0150	0.00268	0.00280	0.00247	0.000625
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	0.0034	<0.0030	<0.0030	<0.0030	<0.0030

[grey box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake Tributaries.

Table C.14: Water Chemistry at Lotic Camp Lake Tributary (CLT) Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event						
					L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01
					03-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20
Conventionals	Conductivity (lab)	µS/cm	-	-	157	227	393	274	283	289	300
	pH (lab)	pH	6.5 - 9.0	-	8.03	8.24	8.01	8.21	8.22	8.26	8.34
	Hardness (as $CaCO_3$)	mg/L	-	-	73	108	147	121	125	138	147
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	2.1	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	92	109	191	125	129	141	153
	Turbidity	NTU	-	-	0.24	0.14	2.38	0.81	0.84	0.71	0.20
	Alkalinity (as $CaCO_3$)	mg/L	-	-	78	110	138	120	120	125	134
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	0.024	<0.010	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.127	0.021	1.52	0.277	0.306	0.256	0.047
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	0.0099	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.32	0.18	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.64	3.37	6.01	5.27	4.35	4.67	3.88
	Total Organic Carbon	mg/L	-	-	3.60	4.10	7.48	5.01	5.83	5.69	4.36
	Total Phosphorus	mg/L	0.030^{α}	-	<0.0030	<0.0030	0.0093	<0.0030	0.0033	<0.0030	<0.0030
	Phenols	mg/L	0.004^{α}	-	<0.0010	0.0015	0.0012	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	2.02	3.99	27.7	10.4	11.2	12.1	9.11
	Sulphate (SO_4)	mg/L	218^{β}	218	5.00	5.34	16.4	7.51	7.87	8.54	14.9
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0122	0.0051	0.0495	0.0151	0.0164	0.0147	0.0094
	Antimony (Sb)	mg/L	0.020^{α}	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0105	0.0138	0.0151	0.0141	0.0144	0.0156	0.0155
	Beryllium (Be)	mg/L	0.011^{α}	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	0.025	0.012	0.012	0.011	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	14.7	20.9	29.4	24.6	24.8	26.5	27.6
	Chromium (Cr)	mg/L	0.0089	0.000856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009^{α}	0.004	<0.00010	<0.00010	0.00019	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	***0.00226***	0.00217	0.00134	0.00190	0.00194	0.00199	0.00159
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	***0.423***	0.135	0.134	0.100	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	0.000092	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	0.0015	0.0042	0.0025	0.0026	0.0027	0.0021
	Magnesium (Mg)	mg/L	-	-	9.05	13.4	19.1	15.2	15.3	16.5	16.6
	Manganese (Mn)	mg/L	0.935^{β}	-	0.000710	0.000556	0.0323	0.00933	0.00890	0.00715	0.00230
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.00143	0.000882	0.00361	0.00138	0.00137	0.00122	0.000594
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00064	0.00139	0.00092	0.00107	0.00125	0.00074
	Potassium (K)	mg/L	-	-	2.38	2.22	4.05	2.67	2.56	2.69	2.10
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.84	0.99	0.94	1.08	1.11	1.18	0.86
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.779	2.27	16.0	5.85	5.70	5.92	5.68
	Strontium (Sr)	mg/L	-	-	0.0111	0.0126	0.0311	0.0221	0.0233	0.0239	0.0195
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00559	0.00348	0.0247	0.00786	0.00751	0.00672	0.00326
	Vanadium (V)	mg/L	0.006^{α}	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

(shaded) Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake Tributaries.

Table C.14: Water Chemistry at Lotic Camp Lake Tributary (CLT) Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Fall Sampling Event						
					LI-08	L1-02	L2-03	L1-09	L0-05	L0-01	K0-01
					28-Aug-20	30-Aug-20	29-Aug-20	30-Aug-20	30-Aug-20	29-Aug-20	29-Aug-20
Conventionals	Conductivity (lab)	µS/cm	-	-	190	242	449	288	298	315	345
	pH (lab)	pH	6.5 - 9.0	-	8.08	8.20	8.11	8.17	8.18	8.33	8.43
	Hardness (as $CaCO_3$)	mg/L	-	-	100	125	191	145	149	153	167
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	97	<10	236	85	81	163	192
	Turbidity	NTU	-	-	0.24	0.12	2.62	1.40	0.63	0.62	0.23
	Alkalinity (as $CaCO_3$)	mg/L	-	-	88	113	156	134	135	130	136
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.022	<0.010	0.036	0.015	0.014	<0.010	<0.010
	Nitrate	mg/L	3	3	0.101	0.049	1.71	0.345	0.383	0.322	0.148
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	0.0124	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.54	0.16	0.21	0.16	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.49	2.52	8.00	3.54	3.54	4.28	3.08
	Total Organic Carbon	mg/L	-	-	2.70	3.02	6.86	3.94	4.07	4.22	3.50
	Total Phosphorus	mg/L	0.030[α]	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Phenols	mg/L	0.004[α]	-	<0.0010	<0.0010	0.0018	0.0017	0.0010	0.0012	0.0017
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.01	6.05	34.4	14.1	14.7	15.2	13.6
	Sulphate (SO_4)	mg/L	218[β]	218	6.38	8.11	19.6	10.7	10.8	11.9	26.2
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0104	0.0055	0.0979	0.0092	0.0117	0.0162	0.0089
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	0.00014	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0122	0.0151	0.0180	0.0160	0.0162	0.0164	0.0184
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<0.010	<0.010	0.023	0.012	0.012	0.012	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	19.3	24.3	35.7	28.0	27.7	28.6	31.8
	Chromium (Cr)	mg/L	0.0089	0.000856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	0.00024	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	0.00216	0.00216	0.00159	0.00199	0.00200	0.00189	0.00152
	Iron (Fe)	mg/L	0.30	0.326	<0.030	<0.030	***0.522***	0.111	0.104	0.084	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	0.000222	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	<0.0010	0.0015	0.0042	0.0024	0.0025	0.0028	0.0019
	Magnesium (Mg)	mg/L	-	-	12.1	15.7	24.2	18.0	18.2	18.4	20.3
	Manganese (Mn)	mg/L	0.935[β]	-	0.000673	0.000554	0.0382	0.00920	0.00774	0.00603	0.000767
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.00152	0.00102	0.00385	0.00154	0.00149	0.00141	0.000734
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00063	0.00165	0.00089	0.00106	0.00106	0.00065
	Potassium (K)	mg/L	-	-	2.60	2.52	4.40	2.81	2.79	2.79	2.45
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.93	0.98	1.08	1.05	1.11	1.16	0.72
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	0.885	2.80	19.0	6.93	6.98	7.09	7.36
	Strontium (Sr)	mg/L	-	-	0.0147	0.0146	0.0385	0.0268	0.0273	0.0271	0.0221
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00972	0.00589	0.0332	0.0110	0.0103	0.00935	0.00460
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake Tributaries.

Table C.15: Magnitude of Elevation in Seasonal Average Water Chemistry (Total Metal Concentration Data Provided) Between the Camp Lake Tributaries and Average Reference Creek Stations, Mary River Project CREMP, 2020

Parameter	Spring				Summer				Fall			
	CLT1			CLT2	CLT1			CLT2	CLT1			CLT2
	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01
Conductivity (lab)	2.0	4.7	2.8	2.8	1.4	2.9	2.1	2.2	1.2	2.6	1.7	2.0
Hardness (as $CaCO_3$)	2.2	4.4	3.0	3.0	1.6	2.6	2.2	2.6	1.4	2.3	1.8	2.0
Total Suspended Solids (TSS)	0.7	3.1	0.7	0.6	0.7	0.7	0.8	0.7	1.0	1.0	1.0	1.0
Total Dissolved Solids (TDS)	1.0	1.9	1.3	1.4	1.2	2.3	1.6	1.8	0.5	2.4	1.1	1.9
Turbidity	0.6	8.4	1.2	0.3	0.0	0.4	0.1	0.0	0.1	1.1	0.4	0.1
Alkalinity (as $CaCO_3$)	2.2	3.9	2.9	2.6	1.5	2.3	2.0	2.2	1.5	2.3	1.9	2.0
Total Ammonia	1.0	6.4	1.0	1.0	0.8	2.0	0.8	0.8	1.6	3.6	1.3	1.0
Nitrate	2.5	52	7.5	6.8	1.2	25	4.5	0.8	1.0	23	4.6	2.0
Nitrite	1.0	1.8	1.0	1.0	1.0	2.0	1.0	1.0	1.0	2.5	1.0	1.0
Total Kjeldahl Nitrogen (TKN)	2.4	49	7.1	6.4	1.0	2.1	1.1	1.0	1.0	3.6	1.2	1.0
Dissolved Organic Carbon	1.4	2.5	1.8	1.5	0.9	1.7	1.4	1.1	1.1	3.5	1.6	1.3
Total Organic Carbon	1.6	2.6	2.1	1.7	1.3	2.5	1.8	1.4	1.3	3.2	1.9	1.6
Total Phosphorus	0.8	4.4	1.8	1.7	0.5	1.4	0.5	0.5	0.8	0.8	0.8	0.8
Phenols	1.0	1.0	1.0	1.0	1.3	1.2	1.0	1.0	0.5	0.9	0.6	0.8
Bromide (Br)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride (Cl)	1.2	13	3.6	2.0	0.7	6.8	2.8	2.2	0.6	4.9	2.1	1.9
Sulphate (SO_4)	2.0	6.3	2.7	9.0	0.9	3.0	1.4	2.7	0.8	2.1	1.2	2.8
Aluminum (Al)	0.2	3.5	0.7	0.3	0.0	0.2	0.0	0.0	0.1	1.7	0.2	0.2
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.8	1.0	1.0	0.8	1.2	0.8	0.8	1.0	1.4	1.0	1.0
Barium (Ba)	2.1	3.4	2.5	2.4	1.3	1.6	1.6	1.6	1.3	1.7	1.6	1.8
Beryllium (Be)	1.0	1.0	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.7	1.0	1.0	1.0	2.5	1.2	1.0	1.0	2.3	1.2	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
Calcium (Ca)	2.1	4.2	2.9	2.9	1.5	2.5	2.1	2.3	1.3	2.2	1.7	1.9
Chromium (Cr)	1.0	1.2	1.0	1.0	0.6	0.6	0.6	0.6	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	2.7	1.0	1.0	0.6	1.2	0.6	0.6	1.0	2.4	1.0	1.0
Copper (Cu)	2.9	2.3	2.6	1.6	1.9	1.2	1.7	1.4	2.1	1.6	1.9	1.5
Iron (Fe)	0.4	5.5	1.0	0.4	0.1	1.7	0.5	0.1	0.5	7.9	1.5	0.5
Lead (Pb)	0.5	9.2	1.0	0.5	0.2	0.4	0.2	0.2	0.5	2.4	0.5	0.5
Lithium (Li)	1.0	3.3	1.5	1.2	1.2	3.9	2.4	2.0	1.3	4.2	2.6	1.9
Magnesium (Mg)	2.2	4.6	3.1	3.1	1.7	2.9	2.3	2.5	1.5	2.5	1.9	2.1
Manganese (Mn)	0.6	15	2.5	0.7	0.2	11	2.8	0.8	0.6	38	7.5	0.8
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	3.4	13	4.9	2.1	2.5	7.9	2.9	1.3	2.2	6.7	2.6	1.3
Nickel (Ni)	1.1	14	1.6	1.0	0.8	2.0	1.6	1.1	1.0	2.9	1.8	1.2
Potassium (K)	3.2	6.3	3.7	2.7	2.5	4.4	2.8	2.3	2.5	4.2	2.7	2.4
Selenium (Se)	1.0	1.0	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Silicon (Si)	1.1	2.0	1.3	1.1	0.7	0.8	0.9	0.7	1.1	1.2	1.3	0.8
Silver (Ag)	1.0	1.0	1.0	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0
Sodium (Na)	0.8	11	2.9	2.2	0.6	5.8	2.1	2.1	0.5	4.8	1.8	1.9
Strontium (Sr)	1.3	4.1	2.3	1.8	0.9	2.2	1.7	1.4	0.8	2.1	1.5	1.2
Thallium (Tl)	1.0	1.0	1.0	1.0	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	0.9	0.9	0.9	0.9	0.4	0.4	0.4	0.4	1.0	1.0	1.0	1.0
Uranium (U)	2.0	34	6.0	1.4	1.1	6.1	1.8	0.8	1.1	4.5	1.4	0.6
Vanadium (V)	1.0	1.0	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference value).

Denotes differences in method detection limit between the indicated study area and that of the reference creeks, precluding an evaluation of magnitude of elevation.

Table C.16: Dissolved Metal Concentrations at Camp Lake Tributary Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Spring Sampling Event							Summer Sampling Event							Fall Sampling Event						
			L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01	L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01	LI-08	L1-02	L2-03	L1-09	L0-05	L0-01	K0-01
			04-Jul-20	02-Jul-20	02-Jul-20	02-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	28-Aug-20	30-Aug-20	29-Aug-20	30-Aug-20	30-Aug-20	29-Aug-20	29-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0085	0.0086	0.0228	0.0115	0.0112	0.0088	0.0088	0.0067	0.0031	0.0121	0.0046	0.0049	0.0046	0.0036	0.0062	<0.0030	0.0081	0.0033	0.0033	0.0031	0.0296
	Antimony (Sb)	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
	Arsenic (As)	mg/L	<0.00010	<0.00010	0.00011	<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	0.00013	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00668	0.00807	0.0102	0.00852	0.00846	0.00853	0.00854	0.0102	0.0133	0.0144	0.0137	0.0140	0.0159	0.0174	0.0124	0.0153	0.0171	0.0159	0.0162	0.0166	0.0187
	Beryllium (Be)	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
	Bismuth (Bi)	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
	Boron (B)	mg/L	<0.010	<0.010	0.016	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.023	0.011	0.012	0.012	<0.010	<0.010	<0.010	0.022	0.011	0.011	0.012	<0.010
	Cadmium (Cd)	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
	Calcium (Ca)	mg/L	8.61	11.9	20.0	13.8	13.8	14.1	14.0	14.7	21.6	28.0	23.8	25.2	27.0	28.8	19.6	23.5	36.7	27.7	27.7	29.9	31.9
	Chromium (Cr)	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 (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00019	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00210	0.00187	0.00111	0.00176	0.00167	0.00168	0.00113	0.00217	0.00207	0.00117	0.00186	0.00186	0.00199	0.00166	0.00212	0.00213	0.00147	0.00194	0.00197	0.00186	0.00157
	Iron (Fe)	mg/L	<0.030	<0.030	0.059	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.229	0.084	0.086	0.064	<0.030	<0.030	<0.030	0.221	0.067	0.062	0.039	<0.030
	Lead (Pb)	mg/L	<0.000050	<0.000050	0.000109	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<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 (Li)	mg/L	<0.0010	<0.0010	0.0028	0.0013	0.0014	0.0013	0.0011	<0.0010	0.0015	0.0039	0.0023	0.0024	0.0030	0.0024	0.0010	0.0012	0.0043	0.0023	0.0022	0.0028	0.0022
	Magnesium (Mg)	mg/L	5.59	7.31	12.8	8.33	8.45	8.77	8.63	8.83	13.1	18.8	14.9	15.1	17.1	18.3	12.5	16.0	24.2	18.4	19.5	19.0	21.3
	Manganese (Mn)	mg/L	0.000513	0.000350	0.0130	0.00251	0.00217	0.00194	0.000488	0.000457	0.000467	0.0303	0.00852	0.00704	0.00597	0.00212	0.000438	0.000465	0.0329	0.00854	0.00704	0.00422	0.000630
	Mercury (Hg)	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	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.000592	0.000458	0.00252	0.000753	0.000786	0.000759	0.000307	0.00139	0.000911	0.00338	0.00139	0.00137	0.00141	0.000686	0.00154	0.00107	0.00386	0.00151	0.00147	0.00141	0.000734
	Nickel (Ni)	mg/L	<0.00050	0.00057	0.00106	0.00069	0.00069	0.00076	<0.00050	<0.00050	0.00064	0.00123	0.00091	0.00108	0.00127	0.00082	<0.00050	0.00061	0.00143	0.00086	0.00101	0.00104	0.00069
	Potassium (K)	mg/L	1.44	1.38	2.72	1.65	1.60	1.59	1.20	2.54	2.17	4.00	2.54	2.56	2.60	2.24	2.66	2.52	4.44	2.88	2.86	2.81	2.53
	Selenium (Se)	mg/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
	Silicon (Si)	mg/L	0.65	0.64	0.81	0.71	0.68	0.71	0.63	0.81	0.98	0.89	1.05	1.08	1.15	0.86	0.94	0.98	0.96	1.05	1.11	1.16	0.75
	Silver (Ag)	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
	Sodium (Na)	mg/L	0.467	0.918	9.07	2.39	2.36	2.43	1.83	0.751	2.24	15.7	5.75	5.70	5.90	6.16	0.952	2.90	19.7	7.31	7.25	7.38	8.00
	Strontium (Sr)	mg/L	0.00589	0.00660	0.0196	0.0103	0.0111	0.0113	0.00878	0.0111	0.0128	0.0290	0.0220	0.0235	0.0246	0.0201	0.0154	0.0146	0.0371	0.0262	0.0272	0.0273	0.0226
	Thallium (Tl)	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
	Tin (Sn)	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 (Ti)	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
	Uranium (U)	mg/L	0.00116	0.000751	0.0147	0.00284	0.00286	0.00253	0.000653	0.00556	0.00364	0.0229	0.00757	0.00754	0.00675	0.00336	0.0101	0.00579	0.0340	0.0108	0.0104	0.00972	0.00464
	Vanadium (V)	mg/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
	Zinc (Zn)	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

Table C.17: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between the Camp Lake Tributaries and Average Reference Creek Stations, Mary River Project CREMP, 2020

Parameter	Spring				Summer				Fall			
	CLT1			CLT2	CLT1			CLT2	CLT1			CLT2
	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01
Aluminum (Al)	0.5	0.6	0.5	0.5	0.1	0.3	0.1	0.1	0.2	0.4	0.2	1.6
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.1	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.3	1.0	1.0
Barium (Ba)	2.3	1.3	2.7	2.7	1.5	1.9	2.0	2.2	1.4	1.7	1.6	1.9
Beryllium (Be)	1.0	1.3	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Bismuth (Bi)	1.0	1.3	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.6	1.0	1.0	1.0	2.3	1.2	1.0	1.0	2.2	1.2	1.0
Cadmium (Cd)	1.0	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
Calcium (Ca)	2.1	1.7	2.9	2.9	1.5	2.4	2.2	2.4	1.3	2.2	1.7	1.9
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	1.0	1.6	1.0	1.0	1.0	1.9	1.0	1.0
Copper (Cu)	3.3	1.3	2.8	1.9	2.4	1.3	2.2	1.9	2.3	1.6	2.0	1.7
Iron (Fe)	1.0	1.6	1.0	1.0	0.8	6.4	2.0	0.8	1.0	7.4	1.6	1.0
Lead (Pb)	1.0	1.9	1.0	1.0	0.9	0.9	0.9	0.9	1.0	1.0	1.0	1.0
Lithium (Li)	1.0	2.6	1.3	1.1	1.2	3.6	2.6	2.2	1.1	4.3	2.6	2.2
Magnesium (Mg)	2.3	1.9	3.1	3.1	1.7	2.8	2.5	2.8	1.4	2.4	1.9	2.1
Manganese (Mn)	1.1	25	5.4	1.3	0.9	59	13	4.1	0.9	66	11	1.3
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	3.4	5.1	4.9	2.0	2.3	6.8	2.8	1.4	2.2	6.4	2.4	1.2
Nickel (Ni)	1.1	2.0	1.5	1.0	1.1	2.3	2.2	1.5	1.0	2.5	1.8	1.2
Potassium (K)	3.4	3.2	3.8	2.9	2.8	4.7	3.0	2.6	2.5	4.3	2.7	2.4
Selenium (Se)	1.0	1.3	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Silicon (Si)	1.3	1.0	1.4	1.3	1.1	1.1	1.3	1.0	1.1	1.1	1.3	0.9
Silver (Ag)	1.0	0.5	1.0	1.0	0.5	0.5	0.5	0.5	1.0	1.0	1.0	1.0
Sodium (Na)	0.9	3.2	3.0	2.2	0.5	5.6	2.1	2.2	0.5	4.8	1.8	1.9
Strontium (Sr)	1.3	1.4	2.3	1.8	0.9	2.1	1.7	1.4	0.8	2.0	1.4	1.2
Thallium (Tl)	1.0	1.3	1.0	1.0	1.3	1.3	1.3	1.3	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.2	1.0	1.0	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0
Uranium (U)	2.5	3.6	6.8	1.7	1.1	5.7	1.7	0.8	1.1	4.7	1.4	0.6
Vanadium (V)	1.0	1.1	1.0	1.0	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.2	1.0	1.0	1.2	1.2	1.2	1.2	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference value).
Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference value).
Denotes differences in method detection limit between the indicated study area and that of the reference creeks, precluding an evaluation of magnitude of elevation.

Table C.18: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations at the Camp Lake Tributaries between 2020 and Mine Baseline (2005 to 2013) Periods

Variable	Spring				Summer				Fall			
	CLT1			CLT2	CLT1			CLT2	CLT1			CLT2
	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01	North Branch	Upper Main Stem L2-03	Lower Main Stem	Station KO-01
Aluminum (Al)	1.2	7.2	1.4	1.6	1.0	1.7	1.1	0.7	1.2	3.0	1.2	8.4
Antimony (Sb)	0.5	1.0	1.0	0.6	0.7	1.0	1.0	0.6	0.7	1.0	1.0	0.6
Arsenic (As)	1.0	1.1	1.0	1.0	1.0	1.3	1.0	1.0	1.0	1.3	1.0	1.0
Barium (Ba)	2.4	2.3	2.2	1.6	1.7	1.6	1.7	2.1	1.4	1.0	1.1	1.8
Beryllium (Be)	0.3	5.0	5.0	0.4	0.5	2.1	2.1	0.4	0.5	2.1	2.1	0.4
Bismuth (Bi)	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.1	1.1	1.0	1.0	1.1
Boron (B)	0.5	1.6	1.0	0.6	0.6	2.3	1.2	1.0	1.0	2.2	1.1	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.9
Calcium (Ca)	2.4	1.7	2.0	1.9	1.8	1.3	1.8	2.1	1.3	0.8	1.0	1.5
Chromium (Cr)	-	-	-	-	-	-	-	0.5	-	-	-	-
Cobalt (Co)	0.6	1.0	1.0	0.6	0.8	1.5	1.0	0.6	0.8	1.8	1.0	0.6
Copper (Cu)	2.1	1.8	1.8	1.5	1.3	1.4	1.2	1.7	1.3	2.1	1.1	0.7
Iron (Fe)	1.2	1.7	1.2	1.1	1.6	1.2	2.6	1.4	1.8	2.1	1.3	1.4
Lead (Pb)	0.5	2.2	1.0	0.6	0.7	1.0	1.0	0.6	0.7	1.0	1.0	0.6
Lithium (Li)	0.7	2.8	2.5	0.5	0.5	1.2	1.1	1.0	0.5	0.7	0.7	0.7
Magnesium (Mg)	2.4	1.9	2.1	1.9	1.8	1.6	1.9	2.3	1.4	1.2	1.3	1.6
Manganese (Mn)	0.4	4.6	0.8	0.1	1.5	2.4	3.4	3.1	1.1	2.3	1.5	0.5
Mercury (Hg)	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0
Molybdenum (Mo)	2.9	17	5.2	2.1	2.9	16	3.2	2.4	1.9	15	2.4	1.7
Nickel (Ni)	0.8	1.4	1.0	0.2	1.0	1.2	1.9	0.4	0.9	1.1	1.1	0.4
Potassium (K)	2.3	3.4	2.3	2.0	1.9	4.1	2.0	2.3	1.5	3.0	1.6	1.9
Selenium (Se)	-	-	-	-	-	-	-	-	-	-	-	0.0
Silicon (Si)	1.7	1.4	1.7	1.4	1.6	1.0	1.7	1.4	1.3	0.7	1.1	1.2
Silver (Ag)	0.3	-	-	0.2	0.5	-	-	0.2	0.6	-	-	0.2
Sodium (Na)	2.0	8.9	4.0	4.8	2.4	8.8	5.2	5.6	1.9	5.9	3.2	4.4
Strontium (Sr)	2.8	1.5	1.9	2.5	2.3	0.9	1.8	2.6	1.8	0.3	0.5	1.9
Thallium (Tl)	1.3	-	-	1.3	1.4	2.5	2.4	1.2	1.6	2.5	2.5	0.2
Tin (Sn)	0.3	1.0	1.0	0.0	0.4	1.0	1.0	0.0	0.4	1.0	1.0	0.0
Titanium (Ti)	1.3	1.0	1.0	1.2	1.1	1.0	1.0	1.2	1.1	1.0	1.0	1.5
Uranium (U)	5.9	66	15	4.4	7.7	40	9.7	4.8	3.1	21	3.9	2.6
Vanadium (V)	1.0	1.0	1.0	1.0	0.8	1.0	1.0	0.9	0.9	1.0	1.0	0.6
Zinc (Zn)	2.1	2.1	1.5	1.9	2.2	1.7	1.2	1.2	2.2	1.6	2.1	2.4

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference value).

Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.19: *In Situ* Water Quality Statistical Comparisons among Camp Lake Tributary 2 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 3-group Comparison				Pair-wise, *post hoc* comparisons[a]			
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	(I) Area	(J) Area	Significant Difference Between Areas?	P-value
Water Temperature (°C)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT2 Upstream	YES	0.028
					REF-CRK Unnamed Reference Creek	CLT2 Downstream	NO	0.163
					CLT2 Upstream	CLT2 Downstream	YES	<0.001
Dissolved Oxygen (mg/L)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT2 Upstream	NO	0.119
					REF-CRK Unnamed Reference Creek	CLT2 Downstream	YES	<0.001
					CLT2 Upstream	CLT2 Downstream	YES	<0.001
Dissolved Oxygen (% saturation)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT2 Upstream	YES	<0.001
					REF-CRK Unnamed Reference Creek	CLT2 Downstream	YES	<0.001
					CLT2 Upstream	CLT2 Downstream	YES	<0.001
pH (units)	ANOVA	none	YES	< 0.001	REF-CRK Unnamed Reference Creek	CLT2 Upstream	YES	<0.001
					REF-CRK Unnamed Reference Creek	CLT2 Downstream	YES	<0.001
					CLT2 Upstream	CLT2 Downstream	NO	0.578
Specific Conductance (µS/cm)	K-W	rank	YES	0.0020	REF-CRK Unnamed Reference Creek	CLT2 Upstream	YES	0.077
					REF-CRK Unnamed Reference Creek	CLT2 Downstream	YES	<0.001
					CLT2 Upstream	CLT2 Downstream	YES	0.077

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Signficant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table C.20: ***In Situ*** **Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Winter, Mary River Project CREMP, April 2020**

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09
Date Collected	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20
1.0	0.0	1.1	0.4	0.0	0.3	15.30	14.77	14.66	14.51	14.51	104.6	104.6	101.7	99.4	102.6	7.85	7.82	8.02	7.97	7.96	192.1	186.1	187.3	171.6	188.4
2.0	0.0	0.2	0.1	0.1	0.1	14.92	15.03	14.77	14.46	14.75	102.4	103.5	101.5	99.5	101.5	7.70	7.81	7.97	7.93	7.88	184.8	185.1	182.2	176.7	183.2
3.0	0.2	0.3	0.3	0.3	0.2	14.78	14.86	14.56	14.27	14.60	101.8	102.5	100.5	98.6	100.8	7.76	7.80	7.93	7.92	7.86	183.0	181.9	179.2	174.5	179.8
4.0	0.3	0.3	0.3	0.4	0.3	14.68	14.71	14.45	14.16	14.46	101.3	101.6	99.9	98.0	100.0	7.74	7.79	7.91	7.91	7.86	182.2	180.6	178.1	173.6	178.6
5.0	0.4	0.4	0.4	0.4	0.4	14.52	14.62	14.38	14.06	14.33	100.4	101.0	99.4	97.5	99.2	7.73	7.77	7.90	7.92	7.84	180.9	179.7	177.4	172.7	177.2
6.0	0.4	0.4	0.4	0.5	0.4	14.42	14.56	14.28	13.92	14.17	99.8	100.8	98.9	96.6	98.2	7.72	7.76	7.89	7.90	7.83	180.0	179.1	176.7	171.5	175.9
7.0	0.4	0.4	0.5	0.6	0.5	14.34	14.49	14.13	13.83	14.05	99.3	100.4	98.1	96.2	97.6	7.71	7.75	7.89	7.91	7.83	179.1	178.4	175.6	170.7	175.2
8.0	0.5	0.5	0.5	0.6	0.5	14.20	14.40	14.00	13.68	13.90	98.5	99.9	97.2	95.3	96.7	7.70	7.74	7.88	7.90	7.83	178.2	177.8	174.9	169.7	173.9
9.0	0.5	0.5	0.6	0.7	0.6	14.12	14.21	13.83	13.52	13.80	98.1	98.8	96.3	95.1	96.1	7.70	7.71	7.88	7.90	7.82	177.5	177.7	173.8	169.0	173.3
10.0	0.6	0.6	0.7	0.7	0.7	14.04	13.95	13.63	13.51	13.65	97.8	97.2	95.1	94.4	95.2	7.70	7.68	7.87	7.89	7.82	177.0	177.6	172.6	168.2	172.3
11.0	0.7	-	0.8	0.8	0.8	13.45	-	13.45	13.38	13.52	94.0	-	94.1	93.6	94.5	7.65	-	7.86	7.89	7.82	179.0	-	171.8	167.6	171.7
12.0	0.7	-	0.8	0.9	0.8	12.68	-	13.33	13.25	13.40	88.6	-	93.4	92.2	93.9	7.54	-	7.85	7.88	7.81	180.2	-	171.1	166.9	171.0
13.0	-	-	0.9	0.9	0.9	-	-	13.15	13.09	13.28	-	-	92.3	92.2	93.2	-	-	7.84	7.85	7.81	-	-	179.4	166.3	170.5
14.0	-	-	1.0	1.0	0.9	-	-	12.97	12.97	13.09	-	-	91.2	91.3	92.1	-	-	7.83	7.85	7.80	-	-	169.9	165.7	169.6
15.0	-	-	1.0	1.0	1.0	-	-	12.73	12.91	12.84	-	-	89.7	91.1	90.5	-	-	7.81	7.84	7.78	-	-	169.2	165.1	168.6
16.0	-	-	1.1	1.1	1.1	-	-	12.25	12.51	12.6	-	-	86.5	88.4	81.0	-	-	7.79	7.84	7.74	-	-	169.0	164.8	168
17.0	-	-	-	1.2	-	-	-	-	11.70	-	-	-	-	82.9	-	-	-	-	7.79	-	-	-	-	164.5	-
18.0	-	-	-	1.2	-	-	-	-	11.43	-	-	-	-	81.0	-	-	-	-	7.77	-	-	-	-	165.0	-
19.0	-	-	-	1.2	-	-	-	-	11.25	-	-	-	-	79.7	-	-	-	-	7.74	-	-	-	-	165.7	-
20.0	-	-	-	1.3	-	-	-	-	11.11	-	-	-	-	78.8	-	-	-	-	7.71	-	-	-	-	166.6	-
21.0	-	-	-	1.3	-	-	-	-	10.99	-	-	-	-	78.0	-	-	-	-	7.69	-	-	-	-	167.1	-
22.0	-	-	-	1.3	-	-	-	-	11.11	-	-	-	-	78.8	-	-	-	-	7.66	-	-	-	-	168.7	-
23.0	-	-	-	1.3	-	-	-	-	10.96	-	-	-	-	77.9	-	-	-	-	7.64	-	-	-	-	169.2	-
24.0	-	-	-	1.4	-	-	-	-	10.14	-	-	-	-	72.0	-	-	-	-	7.62	-	-	-	-	169.0	-
25.0	-	-	-	1.5	-	-	-	-	9.91	-	-	-	-	70.9	-	-	-	-	7.57	-	-	-	-	168.9	-
26.0	-	-	-	1.6	-	-	-	-	9.40	-	-	-	-	68.3	-	-	-	-	7.54	-	-	-	-	168.5	-
27.0	-	-	-	1.7	-	-	-	-	8.50	-	-	-	-	62.4	-	-	-	-	7.51	-	-	-	-	169.0	-
28.0	-	-	-	1.8	-	-	-	-	7.82	-	-	-	-	56.5	-	-	-	-	7.47	-	-	-	-	171.4	-
29.0	-	-	-	2.0	-	-	-	-	6.90	-	-	-	-	50.2	-	-	-	-	7.43	-	-	-	-	172.8	-
30.0	-	-	-	2.0	-	-	-	-	6.14	-	-	-	-	44.6	-	-	-	-	7.39	-	-	-	-	174.2	-
31.0	-	-	-	2.1	-	-	-	-	5.19	-	-	-	-	37.9	-	-	-	-	7.34	-	-	-	-	177.7	-
32.0	-	-	-	2.3	-	-	-	-	3.22	-	-	-	-	23.7	-	-	-	-	7.27	-	-	-	-	185.6	-

Notes: "-" = data not available / data not applicable. Total depth at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 11.7, 10.2, 16.5, 31.0, and 15.2 m, respectively, at the time of winter sampling. Ice thickness at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 1.69, 1.25, 1.72, 1.63, and 1.53 m, respectively, at the time of winter sampling.

Table C.21: ***In Situ*** **Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Summer, Mary River Project CREMP, July 2020**

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-09
Date Collected	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20
1.0	13.9	13.7	13.4	13.6	13.3	11.00	11.05	11.14	15.16	11.15	106.5	106.5	106.8	107.2	106.6	8.19	8.13	8.13	8.12	8.05	154.6	153.8	152.8	151.7	156.2
2.0	13.9	13.4	13.3	13.2	12.7	11.01	11.14	11.19	11.27	11.43	106.5	106.7	106.9	107.4	107.7	8.18	8.10	8.12	8.10	8.10	154.7	152.9	152.4	151.8	151.0
3.0	10.9	11.0	12.0	10.4	11.5	12.20	11.99	11.53	12.17	11.90	110.3	108.6	106.9	109.2	109.1	8.09	8.06	8.11	8.05	8.07	151.6	151.1	152.7	150.3	150.5
4.0	7.5	8.2	8.6	8.9	10.3	13.01	12.85	12.72	12.62	12.20	108.3	109.0	109.0	108.9	108.8	8.01	8.00	8.05	8.01	8.06	148.3	148.5	148.8	149.0	149.4
5.0	7.0	7.2	7.1	7.8	8.9	12.93	12.88	12.92	12.90	12.74	106.6	106.7	106.8	108.5	110.0	7.95	7.93	7.93	7.99	8.02	148.1	148.2	148.3	148.2	148.4
6.0	6.6	6.8	6.7	7.3	7.6	12.85	12.84	12.93	12.96	12.86	104.8	105.2	105.7	107.5	107.7	7.89	7.88	7.90	7.96	7.93	148.0	148.2	148.0	148.1	148.4
7.0	6.4	6.7	6.6	6.9	6.7	12.83	12.79	12.87	13.01	12.87	104.2	104.7	105.0	106.9	105.2	7.88	7.88	7.90	7.94	7.92	148.1	148.0	148.0	147.9	147.9
8.0	6.3	6.6	6.4	6.3	6.4	12.78	12.80	12.86	12.91	12.88	103.6	104.2	104.4	104.7	104.5	7.87	7.87	7.88	7.91	7.89	148.0	148.2	147.8	147.8	147.9
9.0	6.3	-	6.3	6.3	6.3	12.76	-	12.81	12.85	12.80	103.4	-	103.7	104.0	103.4	7.85	-	7.86	7.88	7.88	148.1	-	147.9	147.9	147.9
10.0	6.3	-	6.1	6.0	6.1	12.75	-	12.72	12.72	12.73	103.3	-	102.6	102.4	102.6	7.85	-	7.85	7.85	7.85	148.0	-	147.9	147.8	147.9
11.0	6.2	-	6.1	6.0	6.0	12.70	-	12.68	12.65	12.66	102.7	-	102.2	101.5	101.6	7.83	-	7.84	7.83	7.82	148.1	-	147.9	147.9	147.9
12.0	-	-	6.0	5.9	5.9	-	-	12.64	12.59	12.60	-	-	101.6	100.9	101.0	-	-	7.82	7.82	7.82	-	-	147.8	147.8	147.8
13.0	-	-	6.0	5.8	5.8	-	-	12.63	12.57	12.55	-	-	101.5	100.5	100.3	-	-	7.82	7.80	7.80	-	-	147.8	147.8	147.9
14.0	-	-	5.8	5.7	5.7	-	-	12.55	12.53	12.52	-	-	100.5	100.0	100.0	-	-	7.81	7.79	7.79	-	-	147.9	147.8	147.8
15.0	-	-	5.7	5.7	5.7	-	-	12.51	12.50	12.50	-	-	99.8	99.7	99.6	-	-	7.79	7.78	7.78	-	-	147.9	147.9	147.8
16.0	-	-	-	5.6	5.6	-	-	-	12.46	12.48	-	-	-	99.1	99.3	-	-	-	7.78	7.78	-	-	-	147.9	147.8
17.0	-	-	-	5.5	5.5	-	-	-	12.42	12.46	-	-	-	98.6	98.9	-	-	-	7.77	7.77	-	-	-	147.9	147.8
18.0	-	-	-	5.5	-	-	-	-	12.40	-	-	-	-	98.5	-	-	-	-	7.76	-	-	-	-	147.9	-
19.0	-	-	-	5.5	-	-	-	-	12.39	-	-	-	-	98.3	-	-	-	-	7.75	-	-	-	-	147.9	-
20.0	-	-	-	5.5	-	-	-	-	12.37	-	-	-	-	98.1	-	-	-	-	7.75	-	-	-	-	147.9	-
21.0	-	-	-	5.4	-	-	-	-	12.35	-	-	-	-	97.9	-	-	-	-	7.74	-	-	-	-	147.9	-
22.0	-	-	-	5.4	-	-	-	-	12.34	-	-	-	-	97.8	-	-	-	-	7.74	-	-	-	-	147.9	-
23.0	-	-	-	5.4	-	-	-	-	12.33	-	-	-	-	97.7	-	-	-	-	7.74	-	-	-	-	147.9	-
24.0	-	-	-	5.4	-	-	-	-	12.31	-	-	-	-	97.4	-	-	-	-	7.73	-	-	-	-	147.9	-
25.0	-	-	-	5.4	-	-	-	-	12.29	-	-	-	-	97.3	-	-	-	-	7.73	-	-	-	-	148.0	-
26.0	-	-	-	5.4	-	-	-	-	12.28	-	-	-	-	97.1	-	-	-	-	7.73	-	-	-	-	147.9	-
27.0	-	-	-	5.4	-	-	-	-	12.26	-	-	-	-	97.0	-	-	-	-	7.73	-	-	-	-	148.0	-
28.0	-	-	-	5.4	-	-	-	-	12.25	-	-	-	-	96.9	-	-	-	-	7.72	-	-	-	-	148.0	-
29.0	-	-	-	5.4	-	-	-	-	12.24	-	-	-	-	96.8	-	-	-	-	7.72	-	-	-	-	148.0	-
30.0	-	-	-	5.4	-	-	-	-	12.23	-	-	-	-	96.8	-	-	-	-	7.72	-	-	-	-	148.0	-
31.0	-	-	-	5.4	-	-	-	-	12.23	-	-	-	-	96.7	-	-	-	-	7.72	-	-	-	-	148.0	-
32.0	-	-	-	5.4	-	-	-	-	12.22	-	-	-	-	96.7	-	-	-	-	7.72	-	-	-	-	148.0	-

Notes: "-" = no data / not applicable. Total depth at stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 11.4, 8.8, 15.5, 34.1, and 18.9 m, respectively, at the time of summer sampling.

Table C.22: ***In Situ*** **Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020**

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)					
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09
Date Collected	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	18-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	18-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	18-Aug-20	30-Aug-20
0.5	-	-	-	-	8.4	-	-	-	-	-	10.46	-	-	-	-	-	91.2	-
1.0	9.2	9.0	8.8	8.4	8.4	8.4	11.50	11.50	11.59	11.59	10.48	11.5	100.5	99.8	99.7	98.9	91.7	98.1
2.0	9.2	8.9	8.7	8.4	8.4	8.2	11.56	11.59	11.59	11.62	10.48	11.6	100.6	99.7	99.7	99.0	91.2	98.5
3.0	9.2	8.7	8.5	8.4	8.4	8.2	11.56	11.59	11.62	11.61	10.46	11.6	100.5	99.4	99.2	99.0	91.3	98.4
4.0	8.7	8.5	8.4	8.3	8.4	8.2	11.61	11.62	11.60	11.61	10.44	11.6	99.4	99.1	99.0	98.9	91.3	98.5
5.0	8.3	8.3	8.3	8.2	8.4	8.2	11.63	11.61	11.62	11.60	10.43	11.6	99.1	98.7	98.8	98.5	91.1	98.4
6.0	8.3	8.1	8.2	8.2	8.4	8.2	11.63	11.60	11.62	11.58	10.43	11.6	98.7	98.3	98.7	98.3	90.9	98.3
7.0	8.2	8.1	8.2	8.1	8.4	8.2	11.62	11.58	11.59	11.57	10.44	11.6	98.6	98.0	98.5	98.1	91.3	98.2
8.0	8.1	8.1	8.1	8.1	8.4	8.2	11.62	11.55	11.58	11.55	10.44	11.6	98.5	97.7	98.1	98.0	91.2	98.2
9.0	8.1	8.0	8.1	8.1	8.4	8.1	11.57	11.61	11.55	11.54	10.44	11.6	97.9	98.2	97.8	97.8	91.0	98.2
10.0	8.0	-	8.1	8.1	8.4	8.1	11.56	-	11.53	11.53	10.43	11.6	97.6	-	97.7	97.7	91.0	98.0
11.0	-	-	8.1	8.1	8.4	8.1	-	-	11.51	11.52	10.42	11.6	-	-	97.4	97.6	91.0	97.9
12.0	-	-	8.1	8.1	8.4	8.1	-	-	11.50	11.48	10.42	11.6	-	-	97.4	97.3	91.1	97.9
13.0	-	-	8.1	8.1	8.4	-	-	-	11.49	11.48	10.38	-	-	-	97.3	97.3	90.7	-
14.0	-	-	8.1	8.1	8.4	-	-	-	11.48	11.47	10.41	-	-	-	97.2	97.2	90.8	-
15.0	-	-	-	8.1	8.4	-	-	-	-	11.47	10.42	-	-	-	-	97.1	91.0	-
16.0	-	-	-	8.1	8.4	-	-	-	-	11.45	10.38	-	-	-	-	96.9	90.6	-
17.0	-	-	-	8.1	8.4	-	-	-	-	11.45	10.40	-	-	-	-	96.9	90.7	-
18.0	-	-	-	8.1	8.4	-	-	-	-	11.44	10.42	-	-	-	-	96.8	90.9	-
19.0	-	-	-	8.1	8.4	-	-	-	-	11.44	10.37	-	-	-	-	96.8	90.5	-
20.0	-	-	-	8.1	8.4	-	-	-	-	11.43	10.37	-	-	-	-	96.7	90.6	-
21.0	-	-	-	8.1	8.4	-	-	-	-	11.43	10.40	-	-	-	-	96.7	90.7	-
22.0	-	-	-	8.1	8.4	-	-	-	-	11.42	10.36	-	-	-	-	96.6	90.6	-
23.0	-	-	-	8.0	8.4	-	-	-	-	11.40	10.38	-	-	-	-	96.3	90.7	-
24.0	-	-	-	8.0	8.3	-	-	-	-	11.39	10.42	-	-	-	-	96.3	90.9	-
25.0	-	-	-	8.0	8.3	-	-	-	-	11.37	10.41	-	-	-	-	96.1	90.7	-
26.0	-	-	-	8.0	8.3	-	-	-	-	11.34	10.42	-	-	-	-	95.9	90.9	-
27.0	-	-	-	8.0	8.3	-	-	-	-	11.21	10.37	-	-	-	-	94.6	90.9	-
28.0	-	-	-	7.9	8.3	-	-	-	-	11.16	10.41	-	-	-	-	94.2	90.6	-
29.0	-	-	-	7.9	8.3	-	-	-	-	11.13	10.40	-	-	-	-	93.9	90.6	-
30.0					8.2						10.46						90.7	

Notes: "-" = no data / not applicable. August 18, 2020 sampling was conducted by Minnow. Camp Lake water profile sampling on all other dates was conducted by Baffinland. Total depth at Stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 11.4, 10.2, 15.8, 32.2, and 14.1 m, respectively, at the time of fall sampling.

Table C.22: *In Situ* Water Quality Profile Data Collected at Camp Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020

Depth (m)	pH (pH units)						Specific Conductance (µS/cm)					
	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09	JLO-02	JLO-10	JLO-01	JLO-07	JLO-07	JLO-09
Date Collected	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	18-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	18-Aug-20	30-Aug-20
0.5	-	-	-	-	7.79	-	-	-	-	-	154.1	-
1.0	8.11	8.11	8.11	8.08	7.80	8.00	153.8	153.2	153.2	153.0	153.9	154.6
2.0	8.11	8.12	8.11	8.08	7.81	8.04	153.8	153.6	153.2	153.1	154.2	153.3
3.0	8.12	8.11	8.11	8.08	7.82	8.04	154.4	153.5	153.7	153.2	154.0	153.2
4.0	8.13	8.12	8.11	8.08	7.82	8.05	162.7	154.0	153.2	153.2	154.2	153.3
5.0	8.13	8.11	8.11	8.08	7.83	8.05	154.5	153.9	153.2	153.1	154.3	153.1
6.0	8.12	8.11	8.11	8.08	7.84	8.05	154.1	154.2	153.2	152.9	154.1	153.1
7.0	8.11	8.10	8.11	8.08	7.84	8.06	155.7	154.6	153.2	152.9	154.3	153.1
8.0	8.12	8.09	8.10	8.07	7.85	8.06	157.3	154.9	153.2	152.8	154.1	153.1
9.0	8.11	8.09	8.09	8.07	7.85	8.06	156.8	155.1	153.2	152.8	154.1	153.2
10.0	8.10	-	8.09	8.07	7.85	8.07	156.8	-	153.0	152.8	154.0	153.2
11.0	-	-	8.08	8.07	7.86	8.07	-	-	153.1	152.8	154.0	153.2
12.0	-	-	8.08	8.07	7.86	8.07	-	-	153.1	152.8	154.1	153.3
13.0	-	-	8.08	8.07	7.86	-	-	-	153.2	152.8	154.0	-
14.0	-	-	8.08	8.07	7.86	-	-	-	153.2	152.9	154.1	-
15.0	-	-	-	8.07	7.86	-	-	-	-	153.0	154.1	-
16.0	-	-	-	8.07	7.87	-	-	-	-	153.0	154.1	-
17.0	-	-	-	8.07	7.86	-	-	-	-	153.0	154.2	-
18.0	-	-	-	8.07	7.87	-	-	-	-	153.1	154.2	-
19.0	-	-	-	8.07	7.87	-	-	-	-	153.3	154.2	-
20.0	-	-	-	8.07	7.87	-	-	-	-	153.1	154.1	-
21.0	-	-	-	8.07	7.87	-	-	-	-	153.3	154.1	-
22.0	-	-	-	8.07	7.87	-	-	-	-	153.4	154.1	-
23.0	-	-	-	8.07	7.87	-	-	-	-	153.4	154.1	-
24.0	-	-	-	8.06	7.86	-	-	-	-	153.2	154.1	-
25.0	-	-	-	8.06	7.85	-	-	-	-	153.3	154.0	-
26.0	-	-	-	8.05	7.86	-	-	-	-	153.4	154.1	-
27.0	-	-	-	8.02	7.85	-	-	-	-	153.6	154.1	-
28.0	-	-	-	8.02	7.84	-	-	-	-	153.6	154.0	-
29.0	-	-	-	8.00	7.84	-	-	-	-	153.9	154.0	-
30.0					7.81						153.8	

Notes: "-" = no data / not applicable. August 18, 2020 sampling was conducted by Minnow. Camp Lake water profile sampling on all other dates was conducted by Baffinland. Total depth at Stations JLO-02, JLO-10, JLO-01, JLO-07, and JLO-09 was 11.4, 10.2, 15.8, 32.2, and 14.1 m, respectively, at the time of fall sampling.

Table C.23: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Camp Lake Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Colour/ Clarity	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
								(mg/L)	(% sat.)		
Littoral (Shallow) Stations	JLO-02	18-Aug-20	11.0	4.29	clear, colourless	surface	8.3	10.58	92.1	7.78	154.6
						bottom	8.2	9.63	83.3	7.73	155.7
	JLO-21	18-Aug-20	10.0	4.72	clear, colourless	surface	8.3	10.71	92.9	7.60	155.6
						bottom	8.3	9.34	81.8	7.32	154.7
	JLO-20	18-Aug-20	7.0	5.15	clear, colourless	surface	8.3	10.65	92.7	7.65	154.2
						bottom	8.3	10.14	88.3	7.64	154.1
	JLO-19	11-Aug-20	7.5	6.23	clear, colourless	surface	10.8	10.58	98.6	8.13	148.1
						bottom	9.8	9.12	83.8	7.23	147.3
	JLO-18	11-Aug-20	12.0	7.10	clear, colourless	surface	10.9	10.33	95.9	8.13	150.1
						bottom	7.1	8.96	75.4	7.56	158.2
Profundal (Deep) Stations	JLO-01	18-Aug-20	18.0	5.08	clear, colourless	surface	8.4	10.89	95.7	7.70	154.4
						bottom	8.3	9.90	86.4	7.27	155.5
	JLO-07	11-Aug-20	33.0	6.40	clear, colourless	surface	10.4	10.40	95.7	8.70	147.4
						bottom	6.0	11.04	91.1	7.26	144.0
	JLO-16	11-Aug-20	16.0	6.44	clear, colourless	surface	10.3	10.42	95.8	8.05	148.2
						bottom	6.8	10.01	84.5	7.53	145.1
	JLO-11	11-Aug-20	28.5	7.50	clear, colourless	surface	10.0	10.57	96.7	7.94	147.4
						bottom	5.8	12.22	101.9	7.45	144.4
	JLO-12	11-Aug-20	17.0	5.71	clear, colourless	surface	9.8	10.59	95.6	7.72	147.3
						bottom	6.2	11.11	92.5	7.27	144.8

Table C.24: Statistical Comparison of Bottom *In Situ* Water Quality Between Camp Lake Littoral and Profundal Stations, Mary River Project CREMP, August 2020

Parameter	Statistical Test Results				Summary Statistics					
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Lake Zone	Mean (n = 5)	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	tequal	none	NO	0.298	Littoral	5.49	1.15	0.51	4.29	7.10
					Profundal	6.22	0.91	0.41	5.08	7.50
Temperature (˚C)	tequal	none	YES	0.025	Littoral	8.34	0.96	0.43	7.10	9.80
					Profundal	6.62	1.01	0.45	5.80	8.30
Dissolved Oxygen (mg/L)	tequal	none	YES	0.017	Littoral	9.4	0.5	0.2	9.0	10.1
					Profundal	10.9	0.9	0.4	9.9	12.2
Dissolved Oxygen (% saturation)	tequal	none	YES	0.045	Littoral	82.5	4.7	2.1	75.4	88.3
					Profundal	91.3	6.8	3.0	84.5	101.9
pH (units)	tequal	none	NO	0.241	Littoral	7.50	0.21	0.10	7.23	7.73
					Profundal	7.36	0.13	0.06	7.26	7.53
Specific Conductance (µS/cm)	tequal	none	YES	0.035	Littoral	154.0	4.1	1.8	147.3	158.2
					Profundal	146.8	4.9	2.2	144.0	155.5

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.25: Statistical Comparison of Bottom *In Situ* Water Quality Between Camp Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Parameter	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	**Station Depth (m)**	tequal	none	NO	0.690	Reference	4	10.00	1.08	0.54	8.50	11.00
						Camp	5	9.50	2.18	0.97	7.00	12.00
	Secchi Depth (m)	tequal	none	YES	0.002	Reference	5	8.12	0.64	0.29	7.38	9.15
						Camp	5	5.49	1.15	0.51	4.29	7.10
	Temperature (˚C)	tequal	none	YES	0.061	Reference	5	9.32	0.29	0.13	8.90	9.70
						Camp	5	8.34	0.96	0.43	7.10	9.80
	Dissolved Oxygen (mg/L)	tequal	none	YES	0.001	Reference	5	12.6	0.7	0.3	11.8	13.3
						Camp	5	9.4	0.5	0.2	9.0	10.1
	Dissolved Oxygen (% saturation)	tequal	none	YES	0.001	Reference	5	111.9	5.2	2.3	104.6	116.7
						Camp	5	82.5	4.7	2.1	75.4	88.3
	pH (units)	tequal	none	YES	0.060	Reference	5	7.19	0.23	0.10	6.94	7.56
						Camp	5	7.50	0.21	0.10	7.23	7.73
	Specific Conductance (µS/cm)	tequal	none	YES	0.001	Reference	5	76.7	3.2	1.4	74.5	82.1
						Camp	5	154.0	4.1	1.8	147.3	158.2
Profundal (Deep) Stations	**Station Depth (m)**	tequal	none	NO	0.605	Reference	5	20.60	1.56	0.70	19.00	23.00
						Camp	5	22.50	7.73	3.46	16.00	33.00
	Secchi Depth (m)	tequal	none	YES	0.006	Reference	5	8.39	0.96	0.43	7.18	9.84
						Camp	5	6.22	0.91	0.41	5.08	7.50
	Temperature (˚C)	tequal	none	NO	0.120	Reference	5	5.82	0.19	0.09	5.60	6.10
						Camp	5	6.62	1.01	0.45	5.80	8.30
	Dissolved Oxygen (mg/L)	tequal	log10	YES	0.003	Reference	5	13.6	1.3	0.6	12.8	15.8
						Camp	5	10.9	0.9	0.4	9.9	12.2
	Dissolved Oxygen (% saturation)	tequal	log10	YES	0.006	Reference	5	110.6	10.3	4.6	103.5	127.9
						Camp	5	91.3	6.8	3.0	84.5	101.9
	pH (units)	tequal	none	YES	0.002	Reference	5	6.70	0.30	0.13	6.27	6.95
						Camp	5	7.36	0.13	0.06	7.26	7.53
	Specific Conductance (µS/cm)	M-W	rank	YES	0.008	Reference	5	75.5	1.6	0.7	74.0	78.1
						Camp	5	146.8	4.9	2.2	144.0	155.5

Highlighted values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.26: Water Chemistry at Camp Lake (JLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Winter Sampling Event										Spring Sampling Event	Summer Sampling Event					
					JL0-02	JL0-02	JL0-10	JL0-10	JL0-01	JL0-01	JL0-07	JL0-07	JL0-09	JL0-09	J0-01	JL0-02	JL0-02	JL0-10	JL0-10	JL0-01	JL0-01
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	outlet	bottom	surface	bottom	surface	bottom	surface
					12-Apr-20	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	14-Apr-20	04-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20
Conventionals	Conductivity (lab)	µmho/cm	-	-	179	186	178	187	170	182	179	176	171	185	163	152	158	152	159	151	156
	pH (lab)	pH	6.5 - 9.0	-	7.84	7.90	7.79	7.79	7.66	7.81	7.19	7.82	7.69	7.77	7.83	7.89	8.14	7.90	8.13	8.06	8.12
	Hardness (as $CaCO_3$)	mg/L	-	-	96.3	102	97.4	99.4	90.2	101	91.1	96	90.5	98.2	76.4	70.7	72.3	68.2	70.7	73.5	72
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	100	93	118	132	112	114	130	128	119	100	132	80	86	79	93	82	86
	Turbidity	NTU	-	-	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	0.15	0.14	<0.10	0.28	1.03	0.81	0.87	0.85	0.73	0.81	0.75
	Alkalinity (as $CaCO_3$)	mg/L	-	-	79	84	80	84	76	83	76	79	79	83	69	65.1	68.7	66.3	67.4	65.0	67.5
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.018	0.042	0.019	0.020	<0.010	0.020	<0.010	0.020	<0.010	0.019	<0.010	<0.0050	<0.0050	<0.0050	0.0054	<0.0050	<0.0050
	Nitrate	mg/L	3	3	0.029	0.096	0.041	0.032	0.049	0.030	0.145	0.031	0.051	0.033	0.053	0.0410	0.0404	0.0433	0.0402	0.0491	0.0407
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.17	<0.15	0.40	<0.15	0.25	0.17	<0.15	<0.15	<0.15	0.109	0.126	0.126	0.114	0.105	0.115
	Dissolved Organic Carbon	mg/L	-	-	2.78	2.20	2.11	2.30	2.05	2.31	1.88	2.24	3.07	2.69	2.74	5.17	2.19	1.78	2.34	2.46	2.06
	Total Organic Carbon	mg/L	-	-	2.62	3.00	2.72	2.82	2.62	2.63	2.32	2.64	2.79	3.22	3.76	1.96	2.04	1.89	2.07	1.95	2.08
	Total Phosphorus	mg/L	0.020$^{\alpha}$	-	<0.0030	0.0092	<0.0030	<0.0030	0.0032	0.0083	0.0042	0.0043	<0.0030	<0.0030	0.0066	0.0034	0.0043	0.0038	0.0025	0.0027	0.0021
	Phenols	mg/L	0.004$^{\alpha}$	-	<0.0010	0.0115	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0028	0.0023	0.0016	0.0025	0.0036	0.0019
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl)	mg/L	120	120	5.43	5.73	5.45	5.73	5.16	5.60	8.09	5.39	5.27	5.76	4.73	4.48	4.66	4.46	4.63	4.46	4.61
	Sulphate (SO_4)	mg/L	218$^{\beta}$	218	5.05	5.53	5.07	5.31	4.79	5.19	4.79	5.01	4.87	5.32	4.46	4.48	4.66	4.48	4.64	4.47	4.62
Total Metals	Aluminum (Al)	mg/L	0.100	0.1	<0.0030	0.0183	0.0035	0.0109	<0.0030	0.0035	0.0064	0.0539	0.0043	0.0117	0.0219	0.0190	0.0162	0.0176	0.0167	0.0108	0.0178
	Antimony (Sb)	mg/L	0.020$^{\alpha}$	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00876	0.00918	0.00867	0.00885	0.00841	0.00901	0.00868	0.00904	0.00912	0.00976	0.00776	0.00711	0.00757	0.00725	0.00754	0.00686	0.00753
	Beryllium (Be)	mg/L	0.011$^{\alpha}$	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.0001	<0.000010	0.000017	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000016	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	-	-	18.3	19.7	18.5	19.1	17.5	19.3	17.7	19.1	17.6	19.1	15.0	13.4	14.2	13.7	14.1	14.3	13.9
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00011	0.00013	<0.00010	0.00011	<0.00010	0.00011
	Cobalt (Co)	mg/L	0.0009$^{\alpha}$	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<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 (Cu)	mg/L	0.002	0.004	0.00132	0.00142	0.00116	0.00124	0.00098	0.00116	0.00129	0.00195	0.00117	0.00133	0.00095	0.00092	0.00096	0.00088	0.00096	0.00082	0.00093
	Iron (Fe)	mg/L	0.30	0.300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.033	0.031	0.026	0.028	0.013	0.037
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	0.000108	<0.000050	0.000114	<0.000050	<0.000050	<0.000050	0.000091	<0.000050	0.000067	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0015	0.0016	0.0016	0.0016	0.0017	0.0017	0.0015	0.0019	0.0013	0.0013	0.0013	0.0011	0.0013	0.0012	0.0013	0.0012	0.0012
	Magnesium (Mg)	mg/L	-	-	12.0	12.4	12.0	12.0	11.6	12.3	11.4	11.8	11.1	12.3	9.42	8.40	8.55	8.45	8.44	8.69	8.65
	Manganese (Mn)	mg/L	0.935$^{\beta}$	-	0.000367	0.000479	0.000301	0.000311	0.000460	0.000322	0.0124	0.00123	0.000614	0.000328	0.00210	0.00302	0.00303	0.00296	0.00312	0.00182	0.00315
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000455	0.000505	0.000466	0.000484	0.000417	0.000476	0.000388	0.000584	0.000456	0.000527	0.000393	0.000384	0.000430	0.000386	0.000434	0.000462	0.000405
	Nickel (Ni)	mg/L	0.025	0.025	0.00075	0.00087	0.00072	0.00085	0.00069	0.00086	0.00082	0.00098	0.00077	0.00091	0.00084	0.00053	0.00057	0.00051	0.00057	0.00061	0.00060
	Potassium (K)	mg/L	-	-	1.50	1.61	1.50	1.56	1.46	1.59	1.41	1.57	1.55	1.72	1.33	1.29	1.33	1.25	1.32	1.35	1.33
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	0.000059	0.000057	<0.000050	<0.000050
	Silicon (Si)	mg/L	-	-	0.42	0.42	0.41	0.42	0.46	0.42	1.51	0.43	0.45	0.42	0.46	0.45	0.47	0.46	0.46	0.45	0.46
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<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 (Na)	mg/L	-	-	2.39	2.56	2.42	2.44	2.35	2.54	3.90	2.64	2.40	2.59	2.00	1.83	1.99	1.78	1.89	1.95	1.97
	Strontium (Sr)	mg/L	-	-	0.0147	0.0156	0.0147	0.0155	0.0140	0.0153	0.0155	0.0153	0.0149	0.0160	0.0121	0.0110	0.0115	0.0111	0.0115	0.0122	0.0114
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00014	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.00089	0.00066	0.00083	0.00093	0.00037	0.00091
	Uranium (U)	mg/L	0.015	-	0.00128	0.00134	0.00130	0.00133	0.00118	0.00130	0.000938	0.00132	0.00136	0.00146	0.00119	0.00117	0.00136	0.00119	0.00131	0.00120	0.00125
	Vanadium (V)	mg/L	0.006$^{\alpha}$	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	0.0032	<0.0030	0.0036	<0.0030	<0.0030	<0.0030	***0.0304***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

(shaded) Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake system.

Table C.26: Water Chemistry at Camp Lake (JLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event					Fall Sampling Event										
					JL0-07	JL0-07	JL0-09	JL0-09	J0-01	JL0-02	JL0-02	JL0-10	JL0-10	JL0-01	JL0-01	JL0-07	JL0-07	JL0-09	JL0-09	J0-01
					bottom	surface	bottom	surface	outlet	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	outlet
					29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	03-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	29-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	151	154	154	155	155	160	157	157	156	156	<3.0	158	157	158	157	158
	pH (lab)	pH	6.5 - 9.0	-	8.13	8.13	7.85	8.13	8.06	8.14	8.15	8.12	8.13	8.06	6.75	8.12	8.08	8.13	8.12	8.11
	Hardness (as $CaCO_3$)	mg/L	-	-	69.2	70.8	70.6	72.3	74.1	82	80	79.5	78.9	79.9	<0.50	78.6	79	76.3	78.5	80.4
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	89	89	84	84	85	83	<10	80	89	98	88	89	126	<10	167	84
	Turbidity	NTU	-	-	0.77	0.71	0.79	0.72	0.72	0.36	0.4	0.33	0.29	0.34	<0.10	0.35	0.33	0.33	0.31	0.27
	Alkalinity (as $CaCO_3$)	mg/L	-	-	65.7	67.2	67.4	67.4	75	72	70	71	70	69	<10	67	69	68	71	69
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.0050	<0.0050	<0.0050	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.02	<0.010	<0.010	<0.010	0.021
	Nitrate	mg/L	3	3	0.0563	0.0395	0.0398	0.0408	0.024	0.029	0.028	0.028	0.027	0.027	<0.020	0.052	0.03	0.028	0.027	0.027
	Nitrite	mg/L	0.06	0.06	<0.0010	<0.0010	<0.0010	<0.0010	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.113	0.108	0.114	0.111	<0.15	0.22	0.19	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.83	1.92	1.96	1.92	2.52	2.45	2.7	2.49	2.38	2.39	<0.50	2.58	2.37	2.46	2.39	2.79
	Total Organic Carbon	mg/L	-	-	1.99	1.94	2.02	1.92	3.66	3.1	2.85	3.17	3.02	2.96	1.43	2.98	2.99	3.05	2.94	2.54
	Total Phosphorus	mg/L	0.020[α]	-	0.0036	0.0026	0.0056	0.0030	0.0037	<0.0030	<0.0030	0.0072	<0.0030	<0.0030	<0.0030	0.0078	<0.0030	<0.0030	<0.0030	0.0046
	Phenols	mg/L	0.004[α]	-	<0.0010	0.0043	0.0038	0.0045	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0036	<0.0010	<0.0010	<0.0010	0.0045
Anions	Bromide (Br)	mg/L	-	-	<0.050	<0.050	<0.050	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	4.49	4.56	4.54	4.55	4.58	5.05	4.96	4.92	4.85	4.85	<0.50	5.02	4.83	4.83	4.86	4.81
	Sulphate (SO_4)	mg/L	218[β]	218	4.45	4.60	4.57	4.59	4.40	5.01	4.77	4.9	4.76	4.73	<0.30	6.82	4.75	4.73	4.76	4.70
Total Metals	Aluminum (Al)	mg/L	0.100	0.1	0.0166	0.0177	0.0145	0.0151	0.0106	0.0046	0.0057	0.0043	0.0056	0.0043	<0.0030	0.0052	0.0046	0.0057	0.0061	0.0048
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.0001	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00735	0.00743	0.00727	0.00759	0.00748	0.00787	0.00741	0.00744	0.00772	0.00725	<0.000050	0.0073	0.00757	0.00741	0.00755	0.00779
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.0001	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	14.2	14.0	13.9	14.4	14.0	15.4	15.3	15.3	15.5	15.3	<0.050	15	14.9	15.1	14.8	15.0
	Chromium (Cr)	mg/L	0.0089	0.0089	0.00021	0.00010	<0.00010	<0.00010	<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 (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<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 (Cu)	mg/L	0.002	0.004	0.00092	0.00091	0.00089	0.00091	0.00087	0.0009	0.00082	0.00087	0.00087	0.00082	<0.00050	0.00083	0.00103	0.00087	0.0009	0.00093
	Iron (Fe)	mg/L	0.30	0.300	0.050	0.027	0.023	0.025	0.068	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<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 (Li)	mg/L	-	-	0.0012	0.0012	0.0012	0.0012	0.0011	0.0012	0.0013	0.0011	0.0012	<0.0010	<0.0010	0.0011	0.0011	0.0011	0.0011	0.0011
	Magnesium (Mg)	mg/L	-	-	8.55	8.70	8.69	8.45	8.62	9.71	9.35	9.37	9.45	9.35	<0.050	9.26	9.44	9.52	9.6	9.69
	Manganese (Mn)	mg/L	0.935[β]	-	0.00296	0.00296	0.00297	0.00302	0.00354	0.00123	0.0011	0.00121	0.00119	0.00125	<0.000070	0.00108	0.00124	0.00119	0.00129	0.00182
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000376	0.000407	0.000387	0.000389	0.000357	0.000407	0.000415	0.00039	0.000416	0.000412	<0.000050	0.00042	0.000391	0.000389	0.000407	0.000398
	Nickel (Ni)	mg/L	0.025	0.025	0.00060	0.00052	0.00052	<0.00050	0.00066	0.00058	0.00061	0.0006	0.0006	0.00058	<0.00050	0.00063	0.00056	0.0006	0.0006	0.00066
	Potassium (K)	mg/L	-	-	1.31	1.29	1.28	1.31	1.23	1.35	1.31	1.33	1.32	1.29	<0.20	1.3	1.29	1.3	1.3	1.34
	Selenium (Se)	mg/L	0.001	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.48	0.46	0.45	0.45	0.40	0.37	0.34	0.33	0.35	0.33	<0.10	0.34	0.34	0.34	0.35	0.36
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<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 (Na)	mg/L	-	-	1.93	1.88	1.88	1.88	1.87	2.2	2.05	2.09	2.1	2.07	<0.050	2.06	2.09	2.11	2.1	2.13
	Strontium (Sr)	mg/L	-	-	0.0111	0.0113	0.0112	0.0109	0.0111	0.0116	0.0112	0.0113	0.0114	0.0112	<0.00010	0.0114	0.0111	0.0112	0.0112	0.0111
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	-	-	0.00075	0.00080	0.00073	0.00076	<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 (U)	mg/L	0.015	-	0.00124	0.00126	0.00126	0.00123	0.00120	0.00147	0.00131	0.00133	0.00134	0.00131	<0.000010	0.00128	0.00133	0.00131	0.00131	0.00131
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	0.0259	<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

[grey shading] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Camp Lake system.

Table C.27: Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between Camp Lake and Reference Lake 3 in 2020, and Between Camp Lake 2020 and Baseline (2005 to 2013) Data, Mary River Project CREMP

Parameter	Camp Lake vs Reference Lake 3 in 2020		Camp Lake 2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Conductivity (lab)	2.0	1.8	1.4	1.3	1.2
Hardness (as $CaCO_3$)	2.0	1.9	1.5	1.2	1.2
Total Suspended Solids (TSS)	1.0	1.0	1.0	1.0	1.0
Total Dissolved Solids (TDS)	2.1	1.7	1.4	1.1	1.1
Turbidity	5.3	2.2	0.7	1.5	1.0
Alkalinity (as $CaCO_3$)	1.5	1.9	1.2	1.2	1.1
Total Ammonia	0.5	0.8	0.3	0.1	0.4
Nitrate	2.2	1.5	0.5	0.4	0.3
Nitrite	0.2	1.0	1.9	0.0	1.0
Total Kjeldahl Nitrogen (TKN)	0.8	1.0	1.1	0.6	0.5
Dissolved Organic Carbon	0.7	0.7	1.2	1.3	1.3
Total Organic Carbon	0.4	0.8	1.4	1.0	1.5
Total Phosphorus	0.8	1.3	0.7	0.7	0.8
Phenols	2.8	1.2	2.1	2.1	1.3
Bromide (Br)	0.5	1.0	1.1	0.2	0.4
Chloride (Cl)	3.3	3.3	4.1	2.3	2.0
Sulphate (SO_4)	1.3	1.3	3.7	3.1	1.6
Aluminum (Al)	5.3	1.6	7.3	1.3	0.8
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	1.2	1.0	1.5	1.4	1.2
Beryllium (Be)	0.2	1.0	1.1	0.3	2.8
Cadmium (Cd)	0.5	1.0	0.7	0.4	0.9
Calcium (Ca)	2.0	1.9	1.5	1.2	1.2
Chromium (Cr)	0.2	1.0	-	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	1.2	1.1	1.2	0.3	1.0
Iron (Fe)	1.0	1.0	1.1	1.0	1.7
Lead (Pb)	1.0	1.0	0.9	0.6	1.0
Lithium (Li)	1.2	1.1	0.4	0.3	
Magnesium (Mg)	2.0	1.8	1.5	1.2	1.2
Manganese (Mn)	3.6	1.6	2.0	1.4	0.7
Mercury (Hg)	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	3.1	2.4	2.3	2.1	1.8
Nickel (Ni)	1.1	1.2	1.2	0.8	1.0
Potassium (K)	1.5	1.3	-	1.6	1.4
Selenium (Se)	0.1	1.0	-	0.6	-
Silicon (Si)	0.9	0.6	1.1	1.0	0.8
Silver (Ag)	1.0	1.0	1.1	1.6	2.7
Sodium (Na)	2.1	2.0	-	2.1	1.9
Strontium (Sr)	1.4	1.2	2.1	1.6	1.3
Thallium (Tl)	0.1	1.0	1.1	0.1	-
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	0.1	1.0	1.0	0.1	1.0
Uranium (U)	3.9	3.6	2.8	2.7	2.4
Vanadium (V)	0.5	1.0	1.0	0.5	1.0
Zinc (Zn)	1.8	1.0	4.6	2.2	1.3

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.28: Dissolved Metal Concentrations at Camp Lake Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Winter Sampling Event										Spring Sampling Event	Summer Sampling Event					
			JL0-02	JL0-02	JL0-10	JL0-10	JL0-01	JL0-01	JL0-07	JL0-07	JL0-09	JL0-09	J0-01	JL0-02	JL0-02	JL0-10	JL0-10	JL0-01	JL0-01
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	outlet	bottom	surface	bottom	surface	bottom	surface
			12-Apr-20	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	14-Apr-20	4-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	0.0033	<0.0030	<0.0030	<0.0030	0.0282	<0.0030	<0.0030	<0.0030	0.0171	0.0045	0.0059	0.0046	0.0037	0.0048	0.0028	0.0037
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.00011	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00882	0.00931	0.00883	0.00927	0.00814	0.0101	0.00854	0.00879	0.00910	0.0107	0.00820	0.00710	0.00809	0.00707	0.00732	0.00735	0.00761
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	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
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000029	<0.000010	<0.000010	<0.000010	0.000067	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	18.8	19.7	19.1	19.4	17.4	19.8	17.6	18.4	17.8	19.1	14.9	14.3	14.0	13.5	14.4	14.8	13.9
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00016	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)	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
	Copper (Cu)	mg/L	0.00126	0.00117	0.00099	0.00118	0.00092	0.00211	0.00098	0.00108	0.00109	0.00230	0.00087	0.00085	0.00095	0.00079	0.00081	0.00073	0.00088
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000188	<0.000050	<0.000050	<0.000050	0.000539	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0018	0.0018	0.0018	0.0018	0.0017	0.0019	0.0016	0.0019	0.0012	0.0014	0.0013	0.0011	0.0012	0.0011	0.0012	0.0011	0.0011
	Magnesium (Mg)	mg/L	12.0	12.8	12.1	12.4	11.4	12.4	11.5	12.1	11.2	12.3	9.53	8.49	9.05	8.36	8.41	8.85	9.07
	Manganese (Mn)	mg/L	0.000186	0.000222	0.000108	0.000189	0.000214	0.00163	0.00855	0.000143	0.000178	0.00137	0.000986	0.00063	0.00114	0.00052	0.00104	0.00027	0.00105
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000467	0.000478	0.000455	0.000503	0.000426	0.000642	0.000381	0.000474	0.000450	0.000605	0.000399	0.000394	0.000407	0.000383	0.000404	0.000378	0.000392
	Nickel (Ni)	mg/L	0.00074	0.00082	0.00072	0.00077	0.00068	0.00119	0.00076	0.00072	0.00077	0.00100	0.00068	0.00065	0.00065	0.00058	0.00065	0.00059	0.00069
	Potassium (K)	mg/L	1.54	1.65	1.54	1.62	1.42	1.65	1.42	1.54	1.53	1.73	1.34	1.30	1.35	1.22	1.29	1.28	1.37
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)	mg/L	0.41	0.43	0.41	0.44	0.47	0.46	1.58	0.42	0.44	0.45	0.42	0.386	0.421	0.408	0.419	0.427	0.414
	Silver (Ag)	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
	Sodium (Na)	mg/L	2.41	2.60	2.46	2.53	2.25	2.74	4.04	2.43	2.35	2.68	2.02	2.02	2.12	1.92	2.03	1.96	2.16
	Strontium (Sr)	mg/L	0.0151	0.0154	0.0151	0.0154	0.0140	0.0162	0.0156	0.0150	0.0150	0.0179	0.0121	0.0111	0.0108	0.0104	0.0110	0.0112	0.0109
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00018	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)	mg/L	0.00131	0.00140	0.00132	0.00135	0.00120	0.00140	0.000938	0.00130	0.00137	0.00154	0.00122	0.00120	0.00134	0.00119	0.00128	0.00125	0.00128
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0157	<0.0030	<0.0030	<0.0030	0.0141	<0.0030	0.0043	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

Table C.28: Dissolved Metal Concentrations at Camp Lake Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Summer Sampling Event					Fall Sampling Event										
			JL0-07	JL0-07	JL0-09	JL0-09	J0-01	JL0-02	JL0-02	JL0-10	JL0-10	JL0-01	JL0-01	JL0-07	JL0-07	JL0-09	JL0-09	J0-01
			bottom	surface	bottom	surface	outlet	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	outlet
			29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	3-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	29-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0039	0.0042	0.0037	0.0047	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0596	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00780	0.00759	0.00712	0.00735	0.00777	0.00751	0.00756	0.0075	0.00752	0.00754	0.000359	0.00745	0.00776	0.00746	0.00739	0.00743
	Beryllium (Be)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	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
	Cadmium (Cd)	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	13.7	14.0	14.1	14.4	14.3	16.1	15.6	15.4	15.3	15.9	<0.050	15.2	15.5	15.3	15.3	15.6
	Chromium (Cr)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<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 (Co)	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
	Copper (Cu)	mg/L	0.00086	0.00089	0.00088	0.00091	0.00091	0.0009	0.0009	0.00087	0.00089	0.00088	<0.00050	0.00088	0.00087	0.00088	0.00087	0.00086
	Iron (Fe)	mg/L	<0.010	<0.010	<0.010	<0.010	0.038	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	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
	Lithium (Li)	mg/L	0.0011	0.0011	0.0012	0.0012	0.0014	0.0013	0.0013	0.0013	0.0013	0.0015	<0.0010	0.0013	0.0013	0.001	0.0013	0.0014
	Magnesium (Mg)	mg/L	8.49	8.69	8.59	8.82	9.29	10.1	9.97	9.95	9.91	9.79	<0.050	9.86	9.76	9.23	9.8	10.0
	Manganese (Mn)	mg/L	0.00094	0.00093	0.00090	0.00097	0.00198	0.000177	0.000372	0.000203	0.000309	0.000107	<0.000070	0.000302	0.000088	0.000166	0.000178	0.00106
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000404	0.000392	0.000380	0.000402	0.000398	0.00041	0.000404	0.000402	0.00042	0.000399	<0.000050	0.000413	0.000416	0.000426	0.00039	0.000386
	Nickel (Ni)	mg/L	0.00062	0.00063	0.00064	0.00064	0.00071	0.00059	0.00061	0.00059	0.00059	0.00059	<0.00050	0.00059	0.0006	0.0006	0.00061	0.00062
	Potassium (K)	mg/L	1.24	1.49	1.29	1.33	1.28	1.35	1.36	1.33	1.4	1.34	<0.20	1.34	1.37	1.27	1.31	1.34
	Selenium (Se)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.424	0.412	0.413	0.422	0.39	0.37	0.34	0.35	0.35	0.36	<0.10	0.34	0.35	0.34	0.33	0.36
	Silver (Ag)	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
	Sodium (Na)	mg/L	2.01	2.22	1.99	2.04	2.02	2.43	2.3	2.28	2.19	2.27	<0.050	2.21	2.22	2.05	2.2	2.20
	Strontium (Sr)	mg/L	0.0109	0.0113	0.0108	0.0109	0.0110	0.0114	0.0112	0.0113	0.0113	0.0111	<0.00010	0.0112	0.0111	0.0117	0.011	0.0110
	Thallium (Tl)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<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 (U)	mg/L	0.00126	0.00123	0.00123	0.00126	0.00128	0.00147	0.00132	0.00132	0.00133	0.00131	<0.000010	0.00132	0.00133	0.00131	0.00129	0.00132
	Vanadium (V)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0010	0.0029	<0.0010	0.0010	<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 C.29: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Camp Lake and Reference Lake 3 in 2020, and Between Camp Lake 2020 and Baseline (2005 to 2013) Data, Mary River Project CREMP

Parameter	Camp Lake vs Reference Lake 3 in 2020		Camp Lake 2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	0.3	2.0	0.0	0.9	2.9
Antimony (Sb)	1.0	1.0	0.0	0.0	1.0
Arsenic (As)	1.0	1.0	1.0	0.8	1.0
Barium (Ba)	1.2	1.1	0.0	1.4	1.2
Beryllium (Be)	0.2	1.0	1.2	0.2	2.1
Bismuth (Bi)	0.1	1.0	1.0	0.0	1.0
Boron (B)	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	0.5	1.0	0.5	0.0	0.8
Calcium (Ca)	2.0	1.9	1.4	1.2	1.2
Chromium (Cr)	0.2	1.0	-	0.9	-
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	1.2	1.2	1.0	0.6	1.0
Iron (Fe)	0.3	1.0	1.2	0.4	1.7
Lead (Pb)	1.0	1.0	0.7	1.0	1.0
Lithium (Li)	1.1	1.3	0.4	0.0	0.5
Magnesium (Mg)	2.0	1.8	1.5	1.3	1.3
Manganese (Mn)	3.7	1.4	2.1	0.0	0.3
Mercury (Hg)	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	3.0	2.4	2.0	0.0	1.9
Nickel (Ni)	1.3	1.2	1.1	0.7	1.0
Potassium (K)	1.5	1.3	1.0	1.2	1.0
Selenium (Se)	0.1	1.0	-	0.5	-
Silicon (Si)	0.9	0.7	1.1	1.0	0.8
Silver (Ag)	1.0	1.0	1.2	1.8	2.7
Sodium (Na)	2.3	2.0	1.5	1.6	1.6
Strontium (Sr)	1.3	1.3	2.0	1.5	1.3
Thallium (Tl)	0.1	1.0	1.2	0.1	2.6
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	0.0	1.0	1.0	0.0	1.0
Uranium (U)	4.1	3.6	2.6	2.8	2.4
Vanadium (V)	0.5	1.0	1.0	0.5	1.0
Zinc (Zn)	0.6	1.0	2.2	0.6	1.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.30: *In Situ* Water Quality Measurements Collected at Sheardown Lake Tributary 1, Tributary 12, and Tributary 9 Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Study Area	Station	Sampling Date	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH (pH units)	Specific Conductance (µS/cm)
Unnamed Reference Creek	REF-CRK-B1	10-Aug-20	9.9	10.42	95.3	7.71	132.4
	REF-CRK-B2	10-Aug-20	9.0	10.61	94.6	7.58	132.8
	REF-CRK-B3	10-Aug-20	8.4	10.68	93.2	7.48	132.8
	REF-CRK-B4	10-Aug-20	8.0	11.09	96.5	7.50	130.8
	REF-CRK-B5	10-Aug-20	7.6	11.30	98.0	7.57	133.0
Sheardown Lake Tributary 1 Reach 1	SDLT-1-R1 B1	17-Aug-20	7.7	10.41	90.6	7.95	451.4
	SDLT-1-R1-B2	17-Aug-20	7.6	10.55	91.5	7.02	430.2
	SDLT-1-R1-B3	17-Aug-20	7.3	10.78	93.6	7.87	440.2
	SDLT-1-R1-B4	17-Aug-20	7.1	10.87	93.3	7.81	417.5
	SDLT-1-R1-B5	17-Aug-20	7.0	11.00	100.8	7.82	419.5
Sheardown Lake Tributary 12 Downstream	SDLT-12-DS-B1	13-Aug-20	4.4	9.22	77.5	7.79	376.2
	SDLT-12-DS-B2	13-Aug-20	4.1	9.49	76.9	7.83	370.0
	SDLT-12-DS-B3	13-Aug-20	4.2	9.71	74.5	7.82	361.7
Sheardown Lake Tributary 9 Upstream	SDLT-9-DS-B1	13-Aug-20	5.3	9.26	74.1	7.64	275.8
	SDLT-9-DS-B2	13-Aug-20	5.3	10.25	81.0	7.69	284.6
	SDLT-9-DS-B3	13-Aug-20	5.3	10.91	86.7	7.69	284.2
	SDLT-9-DS-B4	13-Aug-20	5.3	11.35	92.8	7.67	283.6
	SDLT-9-DS-B5	13-Aug-20	5.7	11.35	90.8	7.70	283.4

Table C.31: *In Situ* Water Quality Summary Statistics for the Sheardown Lake Tributary Benthic Stations, Mary River Project CREMP, August 2020

Metric	Study Area	Sample Size	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Water Temperature (°C)	Unnamed Reference Creek	5	8.6	0.9	0.4	7.9	9.2	7.6	9.9
	Sheardown Lake Tributary 1 (SDLT1)	5	7.3	0.3	0.1	7.1	7.6	7.0	7.7
	Sheardown Lake Tributary 12 (SDLT12)	3	4.2	0.2	0.1	4.1	4.4	4.1	4.4
	Sheardown Lake Tributary 9 (SDLT9)	5	5.4	0.2	0.1	5.2	5.5	5.3	5.7
Dissolved Oxygen (mg/L)	Unnamed Reference Creek	5	10.82	0.36	0.16	10.55	11.09	10.42	11.30
	Sheardown Lake Tributary 1 (SDLT1)	5	10.72	0.24	0.11	10.55	10.90	10.41	11.00
	Sheardown Lake Tributary 12 (SDLT12)	3	9.47	0.25	0.14	9.24	9.71	9.22	9.71
	Sheardown Lake Tributary 9 (SDLT9)	5	10.62	0.89	0.40	9.97	11.28	9.26	11.35
Dissolved Oxygen (% Saturation)	Unnamed Reference Creek	5	95.5	1.8	0.8	94.2	96.9	93.2	98.0
	Sheardown Lake Tributary 1 (SDLT1)	5	94.0	4.0	1.8	91.0	96.9	90.6	100.8
	Sheardown Lake Tributary 12 (SDLT12)	3	76.3	1.6	0.9	74.8	77.8	74.5	77.5
	Sheardown Lake Tributary 9 (SDLT9)	5	85.1	7.6	3.4	79.5	90.7	74.1	92.8
pH (units)	Unnamed Reference Creek	5	7.57	0.09	0.04	7.50	7.63	7.48	7.71
	Sheardown Lake Tributary 1 (SDLT1)	5	7.69	0.38	0.17	7.41	7.97	7.02	7.95
	Sheardown Lake Tributary 12 (SDLT12)	3	7.81	0.02	0.01	7.79	7.83	7.79	7.83
	Sheardown Lake Tributary 9 (SDLT9)	5	7.68	0.02	0.01	7.66	7.70	7.64	7.70
Specific Conductance (µS/cm)	Unnamed Reference Creek	5	132	0.9	0.4	131.7	133.0	130.8	133
	Sheardown Lake Tributary 1 (SDLT1)	4	432	14	6	421	442	418	451
	Sheardown Lake Tributary 12 (SDLT12)	3	369	7	4	362	376	362	376
	Sheardown Lake Tributary 9 (SDLT9)	5	282	4	2	280	285	276	285

Table C.32: *In Situ* Water Quality Statistical Comparisons Among the Sheardown Lake Tributaries and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 4-group Comparison				Pair-wise, *post hoc* comparisons[a]			
	Statistical Test[a]	Transformation	Significant Difference Between Areas?	P-value	(I) Area	(J) Area	Significant Difference Between Areas?	P-value
Water Temperature (°C)	ANOVA	none	YES	0.001	Unnamed Reference Creek	Sheardown Tributary 1	YES	<0.001
					Unnamed Reference Creek	Sheardown Tributary 12	YES	<0.001
					Unnamed Reference Creek	Sheardown Tributary 9	YES	<0.001
					Sheardown Tributary 1	Sheardown Tributary 12	YES	0.041
					Sheardown Tributary 1	Sheardown Tributary 9	YES	0.041
					Sheardown Tributary 12	Sheardown Tributary 9	YES	0.041
Dissolved Oxygen (mg/L)	ANOVA	none	YES	0.019	Unnamed Reference Creek	Sheardown Tributary 1	YES	0.018
					Unnamed Reference Creek	Sheardown Tributary 12	YES	0.018
					Unnamed Reference Creek	Sheardown Tributary 9	NO	0.937
					Sheardown Tributary 1	Sheardown Tributary 12	YES	0.047
					Sheardown Tributary 1	Sheardown Tributary 9	YES	0.047
					Sheardown Tributary 12	Sheardown Tributary 9	YES	0.047
Dissolved Oxygen (% saturation)	ANOVA	none	YES	0.001	Unnamed Reference Creek	Sheardown Tributary 1	YES	<0.001
					Unnamed Reference Creek	Sheardown Tributary 12	YES	<0.001
					Unnamed Reference Creek	Sheardown Tributary 9	YES	0.017
					Sheardown Tributary 1	Sheardown Tributary 12	YES	0.098
					Sheardown Tributary 1	Sheardown Tributary 9	YES	0.098
					Sheardown Tributary 12	Sheardown Tributary 9	YES	0.098
pH (units)	K-W	rank	YES	0.045	Unnamed Reference Creek	Sheardown Tributary 1	YES	0.019
					Unnamed Reference Creek	Sheardown Tributary 12	YES	0.019
					Unnamed Reference Creek	Sheardown Tributary 9	NO	0.374
					Sheardown Tributary 1	Sheardown Tributary 12	NO	0.113
					Sheardown Tributary 1	Sheardown Tributary 9	NO	0.113
					Sheardown Tributary 12	Sheardown Tributary 9	NO	0.113
Specific Conductance (µS/cm)	ANOVA	none	YES	0.001	Unnamed Reference Creek	Sheardown Tributary 1	YES	<0.001
					Unnamed Reference Creek	Sheardown Tributary 12	YES	<0.001
					Unnamed Reference Creek	Sheardown Tributary 9	YES	<0.001
					Sheardown Tributary 1	Sheardown Tributary 12	YES	<0.001
					Sheardown Tributary 1	Sheardown Tributary 9	YES	<0.001
					Sheardown Tributary 12	Sheardown Tributary 9	YES	<0.001

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Signficant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table C.33: Water Chemistry at Sheardown Lake Tributary 1 (SDLT1) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Spring Sampling Event		Summer Sampling Event		Fall Sampling Event	
					D1-05	D1-00	D1-05	D1-00	DI-05	DI-00
					02-Jul-20	02-Jul-20	03-Aug-20	03-Aug-20	29-Aug-20	29-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	154	280	217	458	248	369
	pH (lab)	pH	6.5 - 9.0	-	7.92	8.22	7.85	8.02	7.94	8.20
	Hardness (as $CaCO_3$)	mg/L	-	-	72.5	128	98.8	205	123	186
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	3.2	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	99	145	117	278	130	213
	Turbidity	NTU	-	-	6.52	4.22	0.32	0.82	0.22	0.17
	Alkalinity (as $CaCO_3$)	mg/L	-	-	64	84	98	125	99	123
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.217	0.614	0.219	1.58	0.221	1.18
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	0.21	<0.15	0.31
	Dissolved Organic Carbon	mg/L	-	-	3.27	3.43	3.20	4.33	2.96	3.24
	Total Organic Carbon	mg/L	-	-	4.82	4.86	4.41	5.46	3.25	3.58
	Total Phosphorus	mg/L	0.030$^{\alpha}$	-	0.0073	0.0043	<0.0030	0.0504	<0.0030	<0.0030
	Phenols	mg/L	0.004$^{\alpha}$	-	0.0025	<0.0010	<0.0010	<0.0010	0.0015	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	2.45	6.01	4.34	11.6	6.04	10.7
	Sulphate (SO_4)	mg/L	218$^{\beta}$	218	9.47	43.2	14.6	89.6	16.8	47.8
Total Metals	Aluminum (Al)	mg/L	0.100	0.179	0.0946	0.0946	0.0111	0.0115	0.0077	0.0149
	Antimony (Sb)	mg/L	0.020$^{\alpha}$	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00878	0.0126	0.0110	0.0191	0.0122	0.0171
	Beryllium (Be)	mg/L	0.011$^{\alpha}$	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	0.011	0.015	0.013	0.018	0.014	0.017
	Cadmium (Cd)	mg/L	0.00012	0.00008	0.000035	0.000016	0.000035	0.000015	0.000037	0.000013
	Calcium (Ca)	mg/L	-	-	13.1	21.8	18.3	35.8	22.1	32.8
	Chromium (Cr)	mg/L	0.0089	0.00856	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009$^{\alpha}$	0.004	<0.00010	0.00012	<0.00010	0.00012	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0022	***0.00321***	***0.00253***	***0.00279***	0.00204	***0.00264***	0.00205
	Iron (Fe)	mg/L	0.30	0.326	0.103	0.159	<0.030	0.147	<0.030	0.092
	Lead (Pb)	mg/L	0.001	0.001	0.000301	0.000167	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0014	0.0023	0.0013	0.0026	0.0014	0.0024
	Magnesium (Mg)	mg/L	-	-	8.90	17.1	13.3	28.0	16.3	24.4
	Manganese (Mn)	mg/L	0.935$^{\beta}$	-	0.00224	0.00699	0.000675	0.0101	0.000440	0.00541
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.00395	0.00306	0.00465	0.00314	0.00556	0.00434
	Nickel (Ni)	mg/L	0.025	0.025	0.00153	0.00156	0.00105	0.00152	0.00100	0.00134
	Potassium (K)	mg/L	-	-	2.25	2.63	2.61	3.06	2.77	3.35
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	1.35	1.42	1.35	1.49	1.37	1.48
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.49	3.42	2.32	5.48	2.90	5.50
	Strontium (Sr)	mg/L	-	-	0.0112	0.0171	0.0146	0.0254	0.0156	0.0218
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00281	0.00460	0.00792	0.00786	0.0131	0.0155
	Vanadium (V)	mg/L	0.006$^{\alpha}$	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	0.0033	0.0093	<0.0030	0.0083	<0.0030	0.0067

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data and adopted from the Camp Lake Tributaries.

Table C.34: Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between SDLT1 and Reference Creek Stations in 2020, and at SDLT1 Between 2020 and the Baseline Period

Parameter	2020 vs Reference Creek			2020 vs Baseline		
	Spring	Summer	Fall	Spring	Summer	Fall
Conductivity (lab)	4.0	2.5	1.8	2.8	1.9	1.3
Hardness (as $CaCO_3$)	4.2	2.7	1.9	2.6	1.7	1.4
Total Suspended Solids (TSS)	0.8	0.7	1.0	1.3	1.0	1.0
Total Dissolved Solids (TDS)	1.4	2.3	1.7	2.5	1.7	1.1
Turbidity	2.9	0.1	0.1	5.1	1.1	0.6
Alkalinity (as $CaCO_3$)	3.1	1.8	1.6	2.2	1.4	1.1
Total Ammonia	1.0	0.8	1.0	0.1	0.1	0.2
Nitrate	21	15	9.2	4.3	9.1	6.4
Nitrite	1.0	1.0	1.0	1.0		0.8
Total Kjeldahl Nitrogen (TKN)	7.1	1.2	1.5	0.9	1.2	1.9
Dissolved Organic Carbon	1.7	1.1	1.3	0.9	1.4	1.3
Total Organic Carbon	2.2	1.6	1.6	1.2	1.8	1.4
Total Phosphorus	1.3	4.1	0.8	0.5	5.8	0.7
Phenols	1.8	1.0	0.6			
Bromide (Br)	1.0	1.0	1.0	0.4		
Chloride (Cl)	3.5	2.0	1.2	0.6	1.9	1.0
Sulphate (SO_4)	20	9.4	3.5	49	9.7	3.6
Aluminum (Al)	1.2	0.0	0.2	1.8	0.6	1.0
Antimony (Sb)	1.0	1.0	1.0	0.8	0.8	0.9
Arsenic (As)	1.0	0.8	1.0	1.0	1.0	1.0
Barium (Ba)	3.0	1.6	1.4	2.2	1.6	1.3
Beryllium (Be)	1.0	1.3	1.0	-		
Bismuth (Bi)	1.0	1.3	1.0	1.0		
Boron (B)	1.3	1.6	1.6	1.2	0.9	1.1
Cadmium (Cd)	2.6	2.9	2.5	1.2	0.9	1.0
Calcium (Ca)	3.6	2.3	1.7	2.4	1.6	1.3
Chromium (Cr)	1.0	0.6	1.0	2.0	2.1	3.5
Cobalt (Co)	1.1	0.7	1.0	0.8	1.0	0.9
Copper (Cu)	4.0	2.1	2.3	1.0	0.9	1.1
Iron (Fe)	1.7	0.4	0.9	1.4	1.3	1.5
Lead (Pb)	2.2	0.2	0.5	0.8	0.7	0.8
Lithium (Li)	1.9	1.8	1.9	3.7	1.8	1.8
Magnesium (Mg)	4.5	3.1	2.1	2.6	1.8	1.5
Manganese (Mn)	3.4	1.8	2.9	2.1	2.4	2.2
Mercury (Hg)	1.0	1.0	1.0	0.5		
Molybdenum (Mo)	24	8.6	8.6	3.4	1.8	2.1
Nickel (Ni)	3.1	1.8	2.1	0.9	1.0	1.1
Potassium (K)	5.4	3.1	2.9	2.6	1.7	1.7
Selenium (Se)	1.0	1.3	1.0			
Silicon (Si)	2.2	1.1	1.6	1.4	1.1	1.1
Silver (Ag)	1.0	0.5	1.0	0.9		
Sodium (Na)	3.0	1.4	1.1	5.9	3.4	2.0
Strontium (Sr)	2.9	1.4	1.0	3.3	2.0	1.4
Thallium (Tl)	1.0	1.2	1.0	-	-	-
Tin (Sn)	1.0	1.0	1.0	1.0		
Titanium (Ti)	0.9	0.4	1.0	1.0		
Uranium (U)	8.3	2.0	1.9	5.9	3.1	2.7
Vanadium (V)	1.0	0.9	1.0	1.0		
Zinc (Zn)	2.1	1.9	1.6	5.9	1.5	1.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).
Denotes differences in method detection limit between the 2020 and reference area or baseline data, precluding an evaluation of magnitude of elevatior

Table C.35: Dissolved Metal Concentrations at Sheardown Lake Tributary Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Spring Sampling Event		Summer Sampling Event		Fall Sampling Event	
			D1-05	D1-00	D1-05	D1-00	D1-05	DI-00
			2-Jul-20	2-Jul-20	3-Aug-20	3-Aug-20	29-Aug-20	29-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0216	0.0181	0.0055	0.0047	0.0063	0.0039
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00808	0.0125	0.0111	0.0185	0.0119	0.0172
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	0.012	0.014	0.013	0.018	0.014	0.016
	Cadmium (Cd)	mg/L	0.000026	0.000013	0.000036	0.000014	0.000038	0.000015
	Calcium (Ca)	mg/L	14.2	22.9	17.8	36.3	22.2	33.1
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	0.00012	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00294	0.00236	0.00276	0.00199	0.00264	0.00204
	Iron (Fe)	mg/L	<0.030	0.052	<0.030	0.102	<0.030	0.055
	Lead (Pb)	mg/L	0.000064	0.000063	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0016	0.0022	0.0011	0.0026	0.0015	0.0023
	Magnesium (Mg)	mg/L	9.02	17.3	13.2	27.7	16.4	25.1
	Manganese (Mn)	mg/L	0.000521	0.00508	0.000585	0.00955	0.000421	0.00483
	Mercury (Hg)	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.00438	0.00314	0.00442	0.00314	0.00546	0.00430
	Nickel (Ni)	mg/L	0.00117	0.00142	0.00100	0.00148	0.00102	0.00131
	Potassium (K)	mg/L	2.19	2.62	2.53	3.13	2.73	3.32
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	1.26	1.29	1.31	1.55	1.39	1.44
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	1.48	3.45	2.33	5.42	3.02	5.76
	Strontium (Sr)	mg/L	0.0115	0.0173	0.0137	0.0243	0.0161	0.0227
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.00291	0.00459	0.00788	0.00788	0.0129	0.0163
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	0.0076	<0.0030	0.0075	<0.0030	0.0061

Table C.36: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Winter, Mary River Project CREMP, April 2020**

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)					
	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20
1.0	0.4	0.2	1.6	2.5	1.9	0.0	14.14	14.02	13.14	13.42	13.10	14.44	98.2	96.4	94.4	98.3	95.3	98.9
2.0	0.2	0.2	0.3	0.3	0.3	0.3	14.18	13.90	14.00	14.50	14.04	14.15	97.8	96.1	96.6	100.4	97.3	97.7
3.0	0.7	0.5	0.7	0.6	0.8	0.4	13.89	13.66	13.70	14.45	13.71	13.92	97.0	95.5	96.1	100.7	96.0	97.3
4.0	0.9	0.9	1.0	0.8	1.0	0.9	13.70	13.47	13.51	14.28	13.50	13.72	96.3	94.9	95.1	100.1	95.0	96.5
5.0	1.1	1.1	1.1	0.9	1.1	1.0	13.55	13.34	13.40	14.18	13.37	13.61	95.6	94.2	94.6	99.6	94.4	96.0
6.0	1.1	1.1	1.1	1.0	1.2	1.1	13.55	13.24	13.32	14.04	13.22	13.47	95.6	93.7	94.2	98.8	93.5	95.0
7.0	1.2	1.2	1.2	-	1.2	1.1	13.44	13.14	13.21	-	13.11	13.37	95.1	93.1	93.5	-	92.9	94.5
8.0	1.2	1.2	1.2	-	1.2	1.2	13.32	13.07	13.03	-	13.04	13.28	94.4	92.7	92.4	-	92.5	94.1
9.0	1.2	1.3	1.3	-	1.3	1.2	13.16	12.97	12.88	-	12.93	13.13	93.3	92.2	91.4	-	91.8	93.1
10.0	1.3	1.3	1.3	-	1.3	1.3	12.92	12.86	12.72	-	12.80	12.96	91.7	91.5	90.5	-	91.0	92.1
11.0	1.3	1.4	1.4	-	1.4	1.3	12.81	12.71	12.57	-	12.60	12.78	90.9	90.5	89.4	-	90.1	90.8
12.0	-	1.4	1.4	-	1.4	-	-	12.55	12.45	-	12.41	-	-	89.5	88.6	-	88.4	-
13.0	-	1.5	1.4	-	1.4	-	-	12.16	12.22	-	12.10	-	-	86.8	87.2	-	86.3	-
14.0	-	1.5	1.5	-	1.5	-	-	11.89	12.02	-	11.78	-	-	84.9	85.8	-	84.2	-
15.0	-	1.6	1.5	-	1.5	-	-	11.67	11.72	-	11.59	-	-	83.6	83.9	-	82.8	-
16.0	-	1.6	1.6	-	1.6	-	-	11.53	11.31	-	11.31	-	-	82.7	81.1	-	81.0	-
17.0	-	1.7	1.6	-	1.6	-	-	11.16	11.07	-	11.06	-	-	80.3	79.5	-	79.3	-
18.0	-	1.7	1.7	-	-	-	-	10.84	10.80	-	-	-	-	78.1	77.6	-	-	-
19.0	-	1.8	1.8	-	-	-	-	10.58	10.67	-	-	-	-	76.3	76.9	-	-	-
20.0	-	1.9	-	-	-	-	-	10.25	-	-	-	-	-	74.1	-	-	-	-
21.0	-	2.0	-	-	-	-	-	9.80	-	-	-	-	-	71.0	-	-	-	-
22.0	-	2.0	-	-	-	-	-	8.20	-	-	-	-	-	59.5	-	-	-	-
23.0	-	2.3	-	-	-	-	-	0.80	-	-	-	-	-	6.1	-	-	-	-

Notes: Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 9.5, 23.5, 19.7, 6.5, 17.4 and 11.7 m, respectively, at the time of winter sampling. Ice thickness at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 1.40, 1.58, 1.26, 1.43, 1.77, and 1.54 m, respectively, at the time of winter sampling.

Table C.36: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Winter, Mary River Project CREMP, April 2020**

Depth (m)	pH (pH units)						Specific Conductance (µS/cm)					
	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20
1.0	7.93	8.13	8.04	8.10	7.85	7.81	200.5	196.1	193.3	205.2	196.0	174.5
2.0	7.87	8.01	7.90	7.93	7.86	7.78	196.8	191.2	193.6	204.9	193.0	170.0
3.0	7.82	7.91	7.84	7.81	7.80	7.77	192.2	188.4	190.1	202.8	189.8	189.5
4.0	7.80	7.87	7.81	7.73	7.75	7.77	189.8	186.5	187.4	200.1	188.4	188.5
5.0	7.78	7.80	7.80	7.70	7.74	7.76	188.3	185.6	186.9	199.4	187.4	188.3
6.0	7.77	7.82	7.78	7.67	7.73	7.75	189.3	185.0	186.2	200.3	186.3	187.7
7.0	7.76	7.80	7.77	-	7.72	7.74	188.3	184.3	185.7	-	185.5	187.2
8.0	7.76	7.79	7.77	-	7.71	7.74	187.1	183.8	185.0	-	185.1	186.7
9.0	7.75	7.78	7.76	-	7.70	7.73	187.0	183.2	184.3	-	184.5	185.6
10.0	7.73	7.77	7.75	-	7.70	7.73	186.9	182.4	183.8	-	184.0	184.9
11.0	7.73	7.75	7.74	-	7.68	7.72	187.0	182.1	184.0	-	183.5	184.5
12.0	-	7.74	7.73	-	7.67	-	-	181.6	183.9	-	183.1	-
13.0	-	7.72	7.72	-	7.65	-	-	180.9	183.4	-	182.8	-
14.0	-	7.69	7.70	-	7.63	-	-	180.3	182.9	-	182.6	-
15.0	-	7.67	7.68	-	7.60	-	-	179.7	182.4	-	182.7	-
16.0	-	7.66	7.67	-	7.57	-	-	179.5	181.6	-	183.2	-
17.0	-	7.64	7.64	-	7.54	-	-	179.2	181.5	-	184	-
18.0	-	7.62	7.62	-	-	-	-	179.0	180.9	-	-	-
19.0	-	7.59	7.60	-	-	-	-	178.6	180.3	-	-	-
20.0	-	7.57	-	-	-	-	-	178.4	-	-	-	-
21.0	-	7.54	-	-	-	-	-	178.2	-	-	-	-
22.0	-	7.49	-	-	-	-	-	179.0	-	-	-	-
23.0	-	7.22	-	-	-	-	-	193.2	-	-	-	-

Notes: Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 9.5, 23.5, 19.7, 6.5, 17.4 and 11.7 m, respectively, at the time of winter sampling. Ice thickness at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 1.40, 1.58, 1.26, 1.43, 1.77, and 1.54 m, respectively, at the time of winter sampling.

Table C.37: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Summer, Mary River Project CREMP, July 2020**

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)					
	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20
1.0	15.1	14.4	14.8	15.7	15.0	15.7	10.50	10.62	10.46	10.35	10.36	10.39	104.4	103.9	103.4	104.3	102.7	104.6
2.0	14.3	14.4	14.8	15.7	14.7	15.6	10.91	10.63	10.49	10.36	10.53	10.39	106.6	104.0	103.5	104.4	103.6	104.7
3.0	13.3	14.2	13.6	15.7	12.7	15.5	11.39	10.76	11.07	10.37	11.62	10.39	108.7	104.8	108.6	104.5	109.5	104.1
4.0	11.3	13.8	11.5	12.5	11.0	12.2	12.00	10.91	11.96	11.86	12.14	11.91	109.1	105.4	110.0	110.9	110.1	110.2
5.0	10.0	10.0	10.3	10.1	10.8	9.8	12.09	12.21	12.25	12.23	12.02	12.17	107.2	108.3	109.4	108.4	110.0	107.5
6.0	9.6	9.5	9.7	-	9.8	9.5	12.00	12.15	12.23	-	12.19	12.08	105.5	106.6	107.7	-	107.6	105.9
7.0	9.2	9.1	9.2	-	9.5	9.1	11.91	11.89	12.04	-	12.11	11.95	103.7	103.2	104.8	-	106.1	103.7
8.0	8.9	8.8	8.9	-	9.1	8.8	11.79	11.79	11.90	-	11.95	11.86	102.0	101.6	102.7	-	103.8	102.8
9.0	-	8.6	8.4	-	8.0	7.8	-	11.75	11.78	-	11.82	11.75	-	100.7	100.4	-	99.9	98.7
10.0	-	8.3	7.9	-	7.5	6.7	-	11.72	11.74	-	11.76	11.75	-	99.7	98.9	-	98.2	96.0
11.0	-	7.8	7.2	-	6.8	6.2	-	11.72	11.77	-	11.75	11.74	-	98.5	97.5	-	96.3	94.7
12.0	-	7.1	6.4	-	6.4	-	-	11.74	11.77	-	11.79	-	-	96.9	95.5	-	95.8	-
13.0	-	6.7	5.9	-	6.2	-	-	11.75	11.85	-	11.77	-	-	96.1	94.9	-	94.7	-
14.0	-	6.4	5.7	-	5.8	-	-	11.78	11.82	-	11.78	-	-	95.7	94.4	-	94.3	-
15.0	-	5.9	5.6	-	5.8	-	-	11.83	11.84	-	11.76	-	-	94.9	94.2	-	93.9	-
16.0	-	5.7	5.6	-	5.5	-	-	11.83	11.83	-	11.76	-	-	94.3	94.0	-	93.3	-
17.0	-	5.6	5.5	-	-	-	-	11.82	11.83	-	-	-	-	94.1	93.9	-	-	-
18.0	-	5.6	5.5	-	-	-	-	11.79	11.81	-	-	-	-	93.8	93.6	-	-	-
19.0	-	5.5	5.5	-	-	-	-	11.78	11.80	-	-	-	-	93.5	93.5	-	-	-
20.0	-	5.5	5.4	-	-	-	-	11.77	11.79	-	-	-	-	93.3	93.4	-	-	-
21.0	-	5.5	5.4	-	-	-	-	11.75	11.78	-	-	-	-	93.1	93.2	-	-	-
22.0	-	5.4	-	-	-	-	-	11.74	-	-	-	-	-	92.9	-	-	-	-
23.0	-	5.4	-	-	-	-	-	11.72	-	-	-	-	-	92.8	-	-	-	-

Note: Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 8.8, 22.9, 22.1, 5.8, 15.8, and 11.3 m, respectively, at the time of summer sampling.

Table C.37: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Summer, Mary River Project CREMP, July 2020**

Depth (m)	pH (pH units)						Specific Conductance (µS/cm)					
	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20
1.0	8.25	8.17	8.14	8.19	8.20	8.19	165.4	163.1	163.8	164.0	163.6	165.2
2.0	8.10	8.14	8.18	8.17	8.16	8.17	173.7	163.1	163.9	163.9	164.2	164.3
3.0	8.08	8.14	8.17	8.17	8.17	8.16	163.5	162.7	161.9	164.0	159.8	163.5
4.0	8.05	8.13	8.17	8.17	8.15	8.15	158.6	162.4	157.2	160.2	157.0	159.0
5.0	7.97	8.08	8.15	8.15	8.14	8.09	157.0	156.3	157.5	158.1	156.9	156.5
6.0	7.87	8.03	8.12	-	8.09	8.05	156.6	156.2	156.4	-	156.5	156.5
7.0	7.81	7.91	8.05	-	8.07	7.99	156.4	155.9	156.4	-	156.7	156.3
8.0	7.75	7.86	7.98	-	7.98	7.94	156.3	155.9	155.9	-	156.2	156.1
9.0	-	7.83	7.92	-	7.91	7.84	-	155.9	156.1	-	156.5	155.5
10.0	-	7.80	7.86	-	7.84	7.74	-	155.7	155.5	-	155.5	155.0
11.0	-	7.77	7.82	-	7.78	7.69	-	155.2	155.5	-	154.3	154.8
12.0	-	7.72	7.77	-	7.73	-	-	155.0	154.9	-	154.8	-
13.0	-	7.67	7.72	-	7.71	-	-	154.8	155.0	-	154.7	-
14.0	-	7.64	7.69	-	7.67	-	-	154.6	154.2	-	154.8	-
15.0	-	7.62	7.66	-	7.66	-	-	154.5	154.5	-	154.6	-
16.0	-	7.60	7.66	-	7.64	-	-	154.5	154.5	-	154.7	-
17.0	-	7.59	7.59	-	-	-	-	154.5	154.5	-	-	-
18.0	-	7.57	7.64	-	-	-	-	154.4	154.5	-	-	-
19.0	-	7.56	7.63	-	-	-	-	154.5	154.5	-	-	-
20.0	-	7.55	7.62	-	-	-	-	154.5	154.5	-	-	-
21.0	-	7.55	7.62	-	-	-	-	154.5	154.5	-	-	-
22.0	-	7.54	-	-	-	-	-	154.5	-	-	-	-
23.0	-	7.54	-	-	-	-	-	154.5	-	-	-	-

Note: Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 8.8, 22.9, 22.1, 5.8, 15.8, and 11.3 m, respectively, at the time of summer sampling.

Table C.38: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020**

Depth (m)	Temperature (°C)							Dissolved Oxygen (mg/L)							Dissolved Oxygen (% Saturation)						
	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	26-Aug-20	27-Aug-20	18-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	26-Aug-20	27-Aug-20	18-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	26-Aug-20	27-Aug-20	18-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20
surface	-	-	8.8	-	-	-	-	-	-	11.21	-	-	-	-	-	-	96.7	-	-	-	-
1.0	8.5	8.4	8.8	8.4	8.3	8.4	8.4	11.49	11.42	11.20	11.41	11.40	11.35	11.38	98.3	97.4	96.6	97.4	97.0	96.9	97.1
2.0	8.5	8.4	8.8	8.4	8.3	8.4	8.4	11.48	11.41	11.20	11.40	11.39	11.36	11.36	98.2	97.3	96.5	97.3	96.9	97.0	96.9
3.0	8.5	8.4	8.8	8.4	8.3	8.4	8.4	11.48	11.40	11.19	11.41	11.38	11.36	11.36	98.2	97.2	96.5	97.4	96.8	97.0	96.9
4.0	8.5	8.4	8.8	8.4	8.3	8.4	8.4	11.48	11.39	11.19	11.39	11.37	11.35	11.35	98.1	97.2	96.5	97.2	96.7	96.9	96.9
5.0	8.5	8.4	8.8	8.4	8.3	8.4	8.4	11.47	11.40	11.18	11.38	11.36	11.35	11.34	98.1	97.2	96.4	97.1	96.6	96.9	96.8
6.0	-	8.4	8.8	8.4	-	8.4	8.4	-	11.38	11.18	11.38	-	11.34	11.33	-	97.1	96.4	97.1	-	96.8	96.7
7.0	-	8.4	8.8	8.4	-	8.4	8.4	-	11.38	11.17	11.37	-	11.33	11.32	-	97.0	96.3	97.0	-	96.8	96.6
8.0	-	8.4	8.8	8.4	-	8.4	8.4	-	11.37	11.17	11.37	-	11.33	11.32	-	97.0	96.3	97.0	-	96.7	96.6
9.0	-	8.4	8.8	8.4	-	8.4	8.4	-	11.36	11.16	11.36	-	11.32	11.31	-	96.8	96.2	96.9	-	96.6	96.5
10.0	-	8.4	8.8	8.4	-	8.4	8.4	-	11.35	11.16	11.35	-	11.31	11.30	-	96.8	96.2	96.8	-	96.5	96.5
11.0	-	8.4	8.8	8.4	-	8.4	-	-	11.34	11.15	11.34	-	11.31	-	-	96.7	96.1	96.8	-	96.5	-
12.0	-	8.4	8.8	8.4	-	8.4	-	-	11.34	11.15	11.34	-	11.31	-	-	96.7	96.1	96.8	-	96.5	-
13.0	-	8.4	8.8	8.4	-	8.4	-	-	11.33	11.14	11.34	-	11.30	-	-	96.6	96.0	96.7	-	96.4	-
14.0	-	8.4	8.8	8.4	-	8.4	-	-	11.33	11.14	11.33	-	11.30	-	-	96.5	96.0	96.6	-	96.4	-
15.0	-	8.4	8.8	8.4	-	8.4	-	-	11.32	11.13	11.32	-	11.28	-	-	96.5	95.9	96.5	-	96.2	-
16.0	-	8.4	8.8	8.4	-	8.4	-	-	11.31	11.13	11.31	-	11.23	-	-	96.5	95.9	96.4	-	95.9	-
17.0	-	8.4	8.8	-	-	-	-	-	11.30	11.12	-	-	-	-	-	96.4	95.8	-	-	-	-
18.0	-	8.4	8.8	-	-	-	-	-	11.30	11.12	-	-	-	-	-	96.4	95.8	-	-	-	-
19.0	-	8.4	8.8	-	-	-	-	-	11.29	11.11	-	-	-	-	-	97.3	95.7	-	-	-	-
20.0	-	8.4	8.8	-	-	-	-	-	11.30	11.11	-	-	-	-	-	96.3	95.7	-	-	-	-
21.0	-	8.4	8.8	-	-	-	-	-	11.29	11.10	-	-	-	-	-	96.3	95.6	-	-	-	-
22.0	-	-	8.8	-	-	-	-	-	-	11.10	-	-	-	-	-	-	95.6	-	-	-	-
23.0	-	-	8.8	-	-	-	-	-	-	11.09	-	-	-	-	-	-	95.5	-	-	-	-

Notes: 18-Aug-20 sampling was conducted by Minnow. Sheardown Lake NW water profile sampling on all other dates was conducted by Baffinland. Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 9.9, 22.2, 17.6, 6.7 , 18.2, and 11.4 m, respectively, at the time of fall sampling.

Table C.38: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake NW Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020**

Depth (m)	pH (pH units)							Specific Conductance (µS/cm)						
	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7	DD Hab9	DLO-01-5	DLO-01-5	DLO-01-1	DLO-01-4	DLO-01-2	DLO-01-7
Date Collected	26-Aug-20	27-Aug-20	18-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	26-Aug-20	27-Aug-20	18-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20
surface	-	-	8.03	-	-	-	-	-	-	162.1	-	-	-	-
1.0	8.08	8.06	8.03	8.06	8.04	8.01	8.00	164.0	163.6	162.0	163.6	164.3	163.5	163.4
2.0	8.07	8.06	8.04	8.06	8.04	8.01	8.02	163.8	163.6	162.1	163.6	164.2	163.5	163.4
3.0	8.07	8.06	8.03	8.06	8.03	8.00	8.02	163.8	163.6	162.1	163.7	164.2	163.5	163.4
4.0	8.07	8.05	8.04	8.06	8.03	8.01	8.02	164.1	163.6	162.1	163.7	164.2	163.6	163.5
5.0	8.07	8.06	8.04	8.06	8.04	8.01	8.02	164.8	163.6	162.1	163.7	164.2	163.5	163.4
6.0	-	8.06	8.03	8.06	-	8.01	8.02	-	163.6	162.1	163.7	-	163.6	163.4
7.0	-	8.06	8.03	8.06	-	8.01	8.02	-	163.6	162.1	163.8	-	163.6	163.4
8.0	-	8.06	8.03	8.06	-	8.01	8.02	-	163.6	162.1	163.8	-	163.5	163.4
9.0	-	8.06	8.03	8.06	-	8.01	8.02	-	163.7	162.1	163.9	-	163.5	163.4
10.0	-	8.05	8.03	8.05	-	8.01	8.02	-	163.7	162.1	163.9	-	163.5	163.4
11.0	-	8.05	8.03	8.06	-	8.01	-	-	163.7	162.1	163.9	-	163.6	-
12.0	-	8.05	8.03	8.06	-	8.01	-	-	163.7	162.1	163.8	-	163.5	-
13.0	-	8.05	8.03	8.06	-	8.01	-	-	163.7	162.0	163.9	-	163.6	-
14.0	-	8.04	8.02	8.05	-	8.01	-	-	163.7	162.1	163.9	-	163.5	-
15.0	-	8.04	8.02	8.05	-	8.01	-	-	163.7	162.0	163.9	-	163.5	-
16.0	-	8.04	8.02	8.05	-	7.99	-	-	163.7	162.0	164.0	-	163.5	-
17.0	-	8.04	8.01	-	-	-	-	-	163.7	162.0	-	-	-	-
18.0	-	8.03	8.01	-	-	-	-	-	163.7	162.0	-	-	-	-
19.0	-	8.03	8.01	-	-	-	-	-	163.7	162.0	-	-	-	-
20.0	-	8.06	8.00	-	-	-	-	-	163.7	162.0	-	-	-	-
21.0	-	8.06	8.00	-	-	-	-	-	163.7	162.0	-	-	-	-
22.0	-	-	8.00	-	-	-	-	-	-	162.0	-	-	-	-
23.0	-	-	8.00	-	-	-	-	-	-	161.9	-	-	-	-

Notes: 18-Aug-20 sampling was conducted by Minnow. Sheardown Lake NW water profile sampling on all other dates was conducted by Baffinland. Total depth at stations DD Hab9, DLO-01-5, DLO-01-1, DLO-01-4, DLO-01-2, and DLO-01-7 was 9.9, 22.2, 17.6, 6.7 , 18.2, and 11.4 m, respectively, at the time of fall sampling.

Table C.39: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Sheardown Lake NW Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	DLO-01-9	18-Aug-2020	7.6	4.53	surface	8.5	11.30	96.7	8.02	161.4
					bottom	8.6	11.26	96.4	8.00	161.7
	DLO-01-4	18-Aug-2020	7.5	4.53	surface	8.5	11.29	96.6	8.00	160.8
					bottom	8.5	11.25	96.3	7.99	160.7
	DLO-01-3	18-Aug-2020	8.2	3.88	surface	8.7	11.22	96.5	7.95	161.7
					bottom	8.7	11.19	96.2	7.93	161.8
	DLO-01-11	18-Aug-2020	8.2	5.28	surface	8.6	11.20	96.2	7.88	161.2
					bottom	8.6	11.10	95.9	7.88	160.9
	DLO-01-10	18-Aug-2020	7.9	4.10	surface	8.6	11.18	95.8	7.81	161.0
					bottom	8.6	11.15	95.6	7.77	160.9
Profundal (Deep) Stations	DLO-01-5	15-Aug-2020	23.3	4.37	surface	10.4	10.39	95.3	7.87	159.9
					bottom	5.5	10.94	89.1	7.31	151.4
	DLO-01-14	15-Aug-2020	22.0	5.14	surface	10.4	10.19	93.1	7.86	159.8
					bottom	5.5	10.82	88.2	7.27	151.3
	DLO-01-15	15-Aug-2020	21.7	4.91	surface	10.3	10.36	94.7	7.69	159.8
					bottom	5.7	10.78	88.2	7.18	151.5
	DLO-01-2	18-Aug-2020	17.5	-	surface	8.8	11.20	96.5	7.98	162.0
					bottom	8.7	11.10	95.5	7.96	161.8
	DLO-01-12	15-Aug-2020	14.0	5.41	surface	10.1	10.51	95.8	7.84	159.7
					bottom	6.5	11.23	94.0	7.47	152.1

Note: "-" indicates no available data.

Table C.40: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake NW Littoral and Profundal Stations, Mary River Project CREMP, August 2020

Parameter	Statistical Test Results				Summary Statistics						
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Lake Zone	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	tequal	none	NO	0.183	Littoral	5	4.46	0.54	0.24	3.88	5.28
					Profundal	4	4.96	0.44	0.22	4.37	5.41
Temperature (˚C)	M-W	rank	NO	0.110	Littoral	5	8.60	0.07	0.03	8.50	8.70
					Profundal	5	6.38	1.36	0.61	5.50	8.70
Dissolved Oxygen (mg/L)	tequal	none	YES	0.043	Littoral	5	11.2	0.1	0.0	11.1	11.3
					Profundal	5	11.0	0.2	0.1	10.8	11.2
Dissolved Oxygen (% saturation)	tequal	none	YES	0.012	Littoral	5	96.1	0.3	0.1	95.6	96.4
					Profundal	5	91.0	3.5	1.6	88.2	95.5
pH (units)	tequal	none	YES	0.011	Littoral	5	7.91	0.09	0.04	7.77	8.00
					Profundal	5	7.44	0.31	0.14	7.18	7.96
Specific Conductance (umho/cm)	M-W	rank	NO	0.115	Littoral	5	161.2	0.5	0.2	160.7	161.8
					Profundal	5	153.6	4.6	2.0	151.3	161.8

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.41: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake NW and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Parameter	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	tequal	none	YES	0.004	Reference	4	10.0	1.1	0.5	8.5	11.0
						Sheardown NW	5	7.9	0.3	0.1	7.5	8.2
	Secchi Depth (m)	tequal	none	YES	0.001	Reference	5	8.12	0.64	0.29	7.38	9.15
						Sheardown NW	5	4.46	0.54	0.24	3.88	5.28
	Temperature (˚C)	tequal	none	YES	0.001	Reference	5	9.32	0.29	0.13	8.90	9.70
						Sheardown NW	5	8.60	0.07	0.03	8.50	8.70
	Dissolved Oxygen (mg/L)	tequal	none	YES	0.002	Reference	5	12.6	0.7	0.3	11.8	13.3
						Sheardown NW	5	11.2	0.1	0.0	11.1	11.3
	Dissolved Oxygen (% saturation)	tequal	none	YES	0.001	Reference	5	111.9	5.2	2.3	104.6	116.7
						Sheardown NW	5	96.1	0.3	0.1	95.6	96.4
	pH (units)	tequal	none	YES	0.001	Reference	5	7.19	0.23	0.10	6.94	7.56
						Sheardown NW	5	7.91	0.09	0.04	7.77	8.00
	Specific Conductance (umho/cm)	M-W	rank	YES	0.012	Reference	5	76.7	3.2	1.4	74.5	82.1
						Sheardown NW	5	161.2	0.5	0.2	160.7	161.8
Profundal (Deep) Stations	Station Depth (m)	tequal	none	NO	0.642	Reference	5	20.6	1.6	0.7	19.0	23.0
						Sheardown NW	5	19.7	3.9	1.7	14.0	23.3
	Secchi Depth (m)	tequal	none	YES	0.001	Reference	5	8.39	0.96	0.43	7.18	9.84
						Sheardown NW	4	4.96	0.44	0.22	4.37	5.41
	Temperature (˚C)	M-W	rank	NO	0.916	Reference	5	5.82	0.19	0.09	5.60	6.10
						Sheardown NW	5	6.38	1.36	0.61	5.50	8.70
	Dissolved Oxygen (mg/L)	tequal	log10	YES	0.008	Reference	5	13.6	1.3	0.6	12.8	15.8
						Sheardown NW	5	11.0	0.2	0.1	10.8	11.2
	Dissolved Oxygen (% saturation)	tequal	log10	YES	0.002	Reference	5	110.6	10.3	4.6	103.5	127.9
						Sheardown NW	5	91.0	3.5	1.6	88.2	95.5
	pH (units)	tequal	none	YES	0.005	Reference	5	6.70	0.30	0.13	6.27	6.95
						Sheardown NW	5	7.44	0.31	0.14	7.18	7.96
	Specific Conductance (umho/cm)	M-W	rank	YES	0.008	Reference	5	75.5	1.6	0.7	74.0	78.1
						Sheardown NW	5	153.6	4.6	2.0	151.3	161.8

Highlighted values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.42: Water Chemistry at Sheardown Lake NW (DLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Winter Sampling Event											
					DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1	DL0-01-4	DL0-01-4	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					17-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	16-Apr-20	17-Apr-20	17-Apr-20	15-Apr-20	15-Apr-20
Conventionals	Conductivity (lab)	umho/cm	-	-	187	197	179	193	182	196	197	203	182	193	187	194
	pH (lab)	pH	6.5 - 9.0	-	7.69	7.70	7.49	7.71	7.50	7.72	7.67	7.70	7.54	7.70	7.66	7.70
	Hardness (as $CaCO_3$)	mg/L	-	-	96.3	105	92.4	97.7	91.3	97.5	102	102	90.9	94.9	96.5	102
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	115	118	107	107	112	112	130	124	107	100	139	141
	Turbidity	NTU	-	-	0.18	<0.10	<0.10	<0.10	0.12	0.17	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
	Alkalinity (as $CaCO_3$)	mg/L	-	-	75	78	71	75	70	78	81	83	73	78	71	74
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.028	0.031	<0.010	0.029	<0.010	0.028	0.036	0.031	0.012	0.028	0.028	0.032
	Nitrate	mg/L	3	3	0.196	0.201	0.249	0.196	0.243	0.197	0.202	0.209	0.223	0.194	0.194	0.226
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.19	0.23	<0.15	0.19	<0.15	<0.15	0.17	0.18	0.16	0.20	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.74	2.83	2.73	2.51	2.46	2.78	2.74	2.75	2.38	3.05	2.89	2.61
	Total Organic Carbon	mg/L	-	-	3.61	3.98	3.50	3.40	4.25	4.59	4.42	4.15	4.18	4.30	2.54	2.65
	Total Phosphorus	mg/L	0.020[α]	-	0.0113	<0.0030	0.0112	<0.0030	0.0249	<0.0030	0.0045	0.0079	<0.0030	0.0038	<0.0030	0.0043
	Phenols	mg/L	0.004[α]	-	<0.0010	<0.0010	<0.0010	<0.0010	0.0029	0.0029	0.0025	0.0020	0.0024	0.0013	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	5.09	5.39	4.86	5.22	4.93	5.29	5.54	5.59	4.98	5.27	5.11	5.39
	Sulphate (SO_4)	mg/L	218[β]	218	16.8	17.6	15.8	17.1	16.1	17.4	18.0	18.3	16.3	17.3	16.8	17.6
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[c]	<0.0030	0.0037	<0.0030	0.0035	0.0062	<0.0030	<0.0030	0.0046	<0.0030	0.0162	<0.0030	0.0035
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00890	0.00939	0.00853	0.00918	0.00865	0.00930	0.00943	0.00958	0.00865	0.00927	0.00955	0.00990
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	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
	Boron (B)	mg/L	1.5	-	0.012	0.012	0.011	0.012	0.011	0.012	0.011	0.012	0.011	0.011	0.011	0.012
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	19.0	19.3	17.7	19.0	17.0	19.6	19.0	20.4	18.1	18.9	18.3	18.3
	Chromium (Cr)	mg/L	0.0089	0.0089	<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 (Co)	mg/L	0.0009[α]	0.004	<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 (Cu)	mg/L	0.002	0.0024	0.00090	0.00093	0.00090	0.00093	0.00088	0.00091	0.00092	0.00096	0.00082	0.00128	0.00099	0.00105
	Iron (Fe)	mg/L	0.30	0.300	<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 (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000096	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0015	0.0016	0.0015	0.0016	0.0014	0.0016	0.0014	0.0016	0.0016	0.0015	0.0014	0.0015
	Magnesium (Mg)	mg/L	-	-	11.6	12.2	11.1	11.9	11.0	11.6	12.3	12.5	11.1	11.9	12.6	13.1
	Manganese (Mn)	mg/L	0.935[β]	-	0.000548	0.000542	0.00105	0.000428	0.00126	0.000476	0.000632	0.000543	0.000926	0.00119	0.000755	0.000626
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000059	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.00121	0.00124	0.00109	0.00121	0.00106	0.00123	0.00126	0.00127	0.00109	0.00134	0.00117	0.00123
	Nickel (Ni)	mg/L	0.025	0.025	0.00076	0.00079	0.00073	0.00077	0.00072	0.00080	0.00080	0.00086	0.00071	0.00092	0.00089	0.00090
	Potassium (K)	mg/L	-	-	1.61	1.70	1.51	1.66	1.52	1.66	1.71	1.74	1.51	1.65	1.67	1.73
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.56	0.57	0.81	0.55	0.75	0.56	0.57	0.59	0.65	0.56	0.63	0.60
	Silver (Ag)	mg/L	0.00025	0.0001	<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 (Na)	mg/L	-	-	2.20	2.32	2.05	2.27	2.08	2.24	2.32	2.38	2.07	2.25	2.39	2.45
	Strontium (Sr)	mg/L	-	-	0.0129	0.0138	0.0121	0.0131	0.0121	0.0133	0.0137	0.0138	0.0124	0.0128	0.0137	0.0142
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.015	-	0.00139	0.00146	0.00126	0.00146	0.00133	0.00144	0.00149	0.00154	0.00134	0.00143	0.00146	0.00150
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0088	<0.0030	<0.0030

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

[c] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

Table C.42: Water Chemistry at Sheardown Lake NW (DLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event											
					DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1	DL0-01-4	DL0-01-4	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	28-Jul-20
Conventionals	Conductivity (lab)	umho/cm	-	-	160	167	158	166	161	168	161	166	163	167	158	168
	pH (lab)	pH	6.5 - 9.0	-	7.95	8.10	7.69	8.14	7.67	8.18	8.14	8.15	7.68	8.17	7.85	8.17
	Hardness (as $CaCO_3$)	mg/L	-	-	71.9	73	74.7	77.3	74.3	75.3	75.9	78.6	76	77.3	74	80.3
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	8.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	80	100	91	93	99	104	87	107	93	93	80	85
	Turbidity	NTU	-	-	1.04	0.76	0.87	0.65	0.94	0.78	0.90	0.77	1.01	0.69	0.88	0.77
	Alkalinity (as $CaCO_3$)	mg/L	-	-	57.6	60.0	57.3	60.0	58.5	60.1	57.4	61.1	58.8	59.9	58.6	60.1
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.0050	<0.0050	0.0063	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Nitrate	mg/L	3	3	0.204	0.260	0.212	0.221	0.207	0.221	0.199	0.241	0.212	0.222	0.213	0.219
	Nitrite	mg/L	0.06	0.06	<0.0010	0.0020	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	0.0023	<0.0010	<0.0010	<0.0010	0.0023
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.122	0.127	0.105	0.116	0.120	0.130	0.127	0.122	0.120	0.148	0.115	0.108
	Dissolved Organic Carbon	mg/L	-	-	1.58	1.97	1.52	2.01	1.67	1.90	1.55	1.89	1.92	2.08	1.55	1.64
	Total Organic Carbon	mg/L	-	-	1.55	1.92	1.78	1.76	1.81	1.81	1.65	1.91	1.73	2.06	1.66	1.84
	Total Phosphorus	mg/L	0.020^{α}	-	0.0057	0.0054	0.0026	0.0022	0.0044	0.0042	0.0046	0.0094	0.0028	0.0028	0.0041	0.0060
	Phenols	mg/L	0.004^{α}	-	0.0025	0.0023	<0.0010	<0.0010	<0.0010	<0.0010	0.0021	0.0033	<0.0010	<0.0010	0.0024	0.0026
Anions	Bromide (Br)	mg/L	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl)	mg/L	120	120	4.21	4.37	4.07	4.21	4.08	4.25	4.24	4.40	4.18	4.25	4.21	4.50
	Sulphate (SO_4)	mg/L	218^{β}	218	14.5	15.7	13.4	14.7	13.6	14.9	14.6	15.5	14.5	14.8	14.4	16.0
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[c]	0.0195	0.0162	0.0204	0.0168	0.0159	0.0126	0.0217	0.0045	0.0155	0.0133	0.0199	0.0135
	Antimony (Sb)	mg/L	0.020^{α}	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00742	0.00752	0.00738	0.00805	0.00742	0.00758	0.00760	0.00743	0.00779	0.00790	0.00735	0.00759
	Beryllium (Be)	mg/L	0.011^{α}	-	<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 (Bi)	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
	Boron (B)	mg/L	1.5	-	0.012	0.014	0.010	0.012	0.010	0.013	0.011	0.013	0.011	0.013	0.011	0.017
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	-	-	14.0	14.7	13.8	14.3	13.4	14.3	14.0	14.5	13.9	14.2	13.6	14.3
	Chromium (Cr)	mg/L	0.0089	0.0089	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	0.00010	<0.00010	0.00011	<0.00010	0.00015	0.00011
	Cobalt (Co)	mg/L	0.0009^{α}	0.004	<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 (Cu)	mg/L	0.002	0.0024	0.00090	0.00093	0.00089	0.00095	0.00090	0.00093	0.00090	0.00085	0.00092	0.00095	0.00099	0.00089
	Iron (Fe)	mg/L	0.30	0.300	0.028	0.024	0.040	0.022	0.023	0.018	0.030	<0.010	0.023	0.018	0.027	0.020
	Lead (Pb)	mg/L	0.001	0.001	<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 (Li)	mg/L	-	-	0.0014	0.0014	0.0013	0.0014	0.0013	0.0014	0.0014	0.0018	0.0014	0.0014	0.0013	0.0015
	Magnesium (Mg)	mg/L	-	-	8.70	9.00	9.23	9.57	9.10	9.94	8.65	9.73	9.41	10.1	8.69	8.51
	Manganese (Mn)	mg/L	0.935^{β}	-	0.00334	0.00295	0.00404	0.00258	0.00320	0.00251	0.00351	0.00053	0.00273	0.00247	0.00347	0.00262
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000962	0.00104	0.000898	0.000947	0.000893	0.000981	0.000990	0.00101	0.000966	0.000972	0.00101	0.00103
	Nickel (Ni)	mg/L	0.025	0.025	0.00072	0.00069	0.00071	0.00075	0.00073	0.00073	0.00075	0.00069	0.00071	0.00072	0.00076	0.00073
	Potassium (K)	mg/L	-	-	1.30	1.35	1.29	1.35	1.30	1.37	1.31	1.37	1.32	1.38	1.30	1.28
	Selenium (Se)	mg/L	0.001	-	0.000064	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000060
	Silicon (Si)	mg/L	-	-	0.66	0.68	0.67	0.60	0.62	0.59	0.63	0.63	0.60	0.59	0.66	0.61
	Silver (Ag)	mg/L	0.00025	0.0001	<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 (Na)	mg/L	-	-	1.72	1.82	1.77	1.91	1.78	1.91	1.77	1.95	1.85	1.93	1.74	1.78
	Strontium (Sr)	mg/L	-	-	0.00977	0.0103	0.0102	0.0108	0.00986	0.0107	0.0102	0.0107	0.0104	0.0110	0.0102	0.0102
	Thallium (Tl)	mg/L	0.0008	0.0008	<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 (Sn)	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
	Titanium (Ti)	mg/L	-	-	0.00108	0.00073	0.00119	0.00070	0.00088	0.00057	0.00117	<0.00030	0.00075	0.00055	0.00099	0.00058
	Uranium (U)	mg/L	0.015	-	0.00131	0.00146	0.00120	0.00136	0.00128	0.00136	0.00134	0.00143	0.00132	0.00136	0.00132	0.00142
	Vanadium (V)	mg/L	0.006^{α}	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

[c] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

Table C.42: Water Chemistry at Sheardown Lake NW (DLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Fall Sampling Event											
					DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1	DL0-01-4	DL0-01-4	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					26-Aug-20	26-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	26-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	165	165	166	168	167	167	168	168	166	166	164	164
	pH (lab)	pH	6.5 - 9.0	-	8.05	8.03	7.98	7.99	8.07	7.99	8.05	8.03	7.97	8.03	8.00	8.03
	Hardness (as $CaCO_3$)	mg/L	-	-	81.2	79.1	78.5	79.3	79.4	82.2	80.7	81.2	80.3	79.7	79.8	80.1
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	84	92	87	110	88	83	76	80	98	101	78	127
	Turbidity	NTU	-	-	0.58	0.57	0.48	0.51	0.61	0.52	0.49	0.51	0.60	0.62	0.58	0.56
	Alkalinity (as $CaCO_3$)	mg/L	-	-	62	62	68	63	64	63	62	63	190	63	61	61
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	0.028	<0.010	<0.010	0.017	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.207	0.202	0.19	0.201	0.244	0.194	0.201	0.255	0.228	0.195	0.208	0.212
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	0.20	0.16	<0.15	0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.03	2.08	2.06	2.09	1.95	1.95	2.15	2.05	1.98	2.13	2.04	1.93
	Total Organic Carbon	mg/L	-	-	2.49	2.46	2.76	2.54	2.45	2.61	2.64	2.40	2.54	2.60	2.33	2.42
	Total Phosphorus	mg/L	0.020[α]	-	0.0083	0.0062	0.0102	0.004	0.0061	0.0094	0.0067	0.0079	0.0085	0.0059	0.0059	0.0071
	Phenols	mg/L	0.004[α]	-	<0.0010	<0.0010	0.0056	<0.0010	<0.0010	0.0031	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	4.56	4.52	4.44	4.45	4.49	4.45	4.48	4.5	4.45	4.44	4.52	4.56
	Sulphate (SO_4)	mg/L	218[β]	218	15.3	15.3	15.1	15.1	15.2	15.1	15.3	15.3	15.1	15.1	15.2	15.2
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[c]	0.0087	0.003	0.0097	0.0087	0.0079	0.0083	0.0082	0.0092	0.009	0.0084	0.0102	0.0376
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00813	0.00817	0.00817	0.0081	0.00814	0.00793	0.00838	0.00865	0.00785	0.00813	0.0082	0.00837
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	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
	Boron (B)	mg/L	1.5	-	0.014	0.014	0.013	0.013	0.013	0.013	0.015	0.015	0.014	0.013	0.013	0.012
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	15.8	15.7	15.6	15.4	15.4	15.2	15.3	15.8	15.4	15.6	15.3	15.3
	Chromium (Cr)	mg/L	0.0089	0.0089	<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 (Co)	mg/L	0.0009[α]	0.004	<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 (Cu)	mg/L	0.002	0.0024	0.00086	0.00081	0.00083	0.00085	0.00084	0.00083	0.00084	0.00084	0.00088	0.00086	0.00082	0.00086
	Iron (Fe)	mg/L	0.30	0.300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.041	<0.030	<0.030	<0.030	<0.030	0.051
	Lead (Pb)	mg/L	0.001	0.001	<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 (Li)	mg/L	-	-	0.0016	0.0017	0.0014	0.0014	0.0014	0.0014	0.0016	0.0016	0.0016	0.0016	0.0016	0.0014
	Magnesium (Mg)	mg/L	-	-	10.1	10.0	10.1	9.96	9.92	10.1	10.2	10.3	10.1	10.2	10.1	10.0
	Manganese (Mn)	mg/L	0.935[β]	-	0.00136	0.000124	0.00134	0.00134	0.00141	0.00129	0.00138	0.00137	0.00127	0.00131	0.00141	0.00228
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000999	0.00103	0.00102	0.00102	0.00101	0.001	0.000998	0.00101	0.00103	0.000986	0.00101	0.000973
	Nickel (Ni)	mg/L	0.025	0.025	0.00068	0.00065	0.0007	0.00072	0.00067	0.00069	0.00068	0.0007	0.0007	0.00068	0.00068	0.00071
	Potassium (K)	mg/L	-	-	1.39	1.36	1.36	1.37	1.37	1.36	1.41	1.40	1.38	1.36	1.36	1.39
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.56	0.55	0.54	0.56	0.54	0.55	0.57	0.57	0.55	0.56	0.56	0.59
	Silver (Ag)	mg/L	0.00025	0.0001	<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 (Na)	mg/L	-	-	1.96	1.94	1.95	1.96	1.94	1.96	1.98	1.95	1.98	1.98	1.93	1.97
	Strontium (Sr)	mg/L	-	-	0.0109	0.0109	0.0109	0.0108	0.0108	0.0108	0.011	0.011	0.0108	0.0107	0.0108	0.0107
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.015	-	0.00155	0.00156	0.00153	0.00152	0.00155	0.00153	0.00153	0.00151	0.00148	0.00151	0.00152	0.00155
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

[c] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

Table C.43: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between the Sheardown Lake Basins and Reference Lake 3 in 2020, and at the Sheardown Lake Basins Between 2020 and the Baseline Period

Variable	Sheardown Lake NW					Sheardown Lake SE				
	2020 vs Reference Lake 3		2020 vs Baseline			2020 vs Reference Lake 3		2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall	Summer	Fall	Winter	Summer	Fall
Conductivity (lab)	2.1	2.1	1.3	1.4	1.4	1.6	1.8	1.2	1.3	1.3
Hardness (as $CaCO_3$)	2.2	2.1	1.5	1.3	1.3	1.7	1.8	1.3	1.3	1.3
Total Suspended Solids (TSS)	1.3	1.0	1.0	0.6	0.8	1.0	1.1	0.9	0.8	0.9
Total Dissolved Solids (TDS)	2.3	1.8	1.3	1.2	1.2	1.7	1.5	1.3	1.1	1.1
Turbidity	5.7	3.8	0.5	1.1	1.0	6.3	16	0.5	0.6	1.3
Alkalinity (as $CaCO_3$)	1.3	2.1	1.1	1.0	1.3	1.1	1.6	1.0	1.0	1.1
Total Ammonia	0.5	0.9	0.2	0.1	0.3	0.7	0.9	0.2	0.3	0.4
Nitrate	11	11	2.1	2.2	2.1	4.8	4.5	2.3	1.0	0.9
Nitrite	0.3	1.0	1.3	0.0	1.1	0.3	1.0	1.4	0.1	1.1
Total Kjeldahl Nitrogen (TKN)	0.8	1.0	0.8	0.8	1.0	0.8	1.0	0.7	0.9	0.7
Dissolved Organic Carbon	0.5	0.6	1.5	1.0	1.2	0.6	0.6	1.4	1.3	1.4
Total Organic Carbon	0.4	0.7	2.1	1.0	1.4	0.4	0.6	1.4	1.1	1.5
Total Phosphorus	1.1	2.3	1.9	0.7	1.4	1.6	2.9	0.8	0.9	1.7
Phenols	1.8	1.5	1.7	1.8	1.6	2.6	1.0	1.0	2.6	1.0
Bromide (Br)	0.5	1.0	0.6	0.2	0.4	0.5	1.0	0.7	0.2	0.4
Chloride (Cl)	3.1	3.3	1.6	1.7	1.6	2.4	2.8	1.6	1.4	1.3
Sulphate (SO_4)	4.1	4.2	5.2	5.4	5.0	2.6	2.6	4.3	4.2	3.9
Aluminum (Al)	5.2	3.4	1.6	1.1	0.5	8.6	20	1.0	0.3	0.9
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	1.2	1.2	1.5	1.5	1.6	1.0	1.1	1.6	1.2	1.3
Beryllium (Be)	0.2	1.0	2.0	0.3	1.5	0.2	1.0	1.5	0.2	1.3
Bismuth (Bi)	0.1	1.0	1.0	0.1	1.0	0.1	1.0	1.0	0.1	1.0
Boron (B)	1.2	1.4	1.1	1.2	1.4	1.0	1.1	1.1	1.0	1.1
Cadmium (Cd)	0.5	1.0	0.8	0.4	0.9	0.5	1.0	0.8	0.4	0.8
Calcium (Ca)	2.0	2.1	1.3	1.2	1.3	1.6	1.8	1.2	1.2	1.2
Chromium (Cr)	0.2	1.0	-	0.9	-	0.3	1.0	-	1.1	-
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9	1.0	1.0	1.0	0.9	0.9
Copper (Cu)	1.3	1.1	1.0	0.9	0.6	1.1	1.2	1.0	0.6	0.9
Iron (Fe)	0.8	1.1	1.2	0.8	0.9	1.1	2.1	0.6	0.3	0.8
Lead (Pb)	1.0	1.0	1.0	0.9	0.1	1.1	1.2	0.5	0.5	0.7
Lithium (Li)	1.4	1.5	0.6	0.4	0.0	1.1	1.3	0.4	0.3	0.3
Magnesium (Mg)	2.2	2.2	1.4	1.3	1.4	1.6	1.8	1.4	1.3	1.3
Manganese (Mn)	3.5	1.9	1.2	1.6	0.6	6.6	5.3	0.2	0.9	1.1
Mercury (Hg)	1.0	1.0	0.5	0.4	0.1	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	7.4	6.6	1.5	1.5	1.5	4.8	4.2	1.6	1.8	1.5
Nickel (Ni)	1.4	1.4	1.0	1.1	1.0	1.2	1.2	1.1	0.9	1.0
Potassium (K)	1.5	1.5	1.6	1.7	1.6	1.2	1.3	1.6	1.6	1.5
Selenium (Se)	0.1	1.0	-	0.6	-	0.1	1.0	-	-	-
Silicon (Si)	1.3	1.1	0.8	1.0	0.9	1.1	1.0	0.8	0.8	0.7
Silver (Ag)	1.0	1.0	2.5	1.0	1.3	1.0	1.0	1.6	1.4	1.4
Sodium (Na)	2.1	2.0	1.5	1.7	1.7	1.5	1.8	1.9	2.1	1.9
Strontium (Sr)	1.2	1.3	1.4	1.4	1.4	1.0	1.2	1.3	1.1	1.1
Thallium (Tl)	0.1	1.0	2.3	0.2	0.4	0.1	1.0	1.6	0.1	1.3
Tin (Sn)	1.0	1.0	0.2	0.2	0.2	1.0	1.0	0.1	0.1	0.1
Titanium (Ti)	0.1	1.0	1.0	0.1	1.0	0.1	1.0	1.0	0.1	0.9
Uranium (U)	4.3	4.6	1.5	1.8	1.8	2.8	3.6	1.6	1.6	1.6
Vanadium (V)	0.5	1.0	1.0	0.5	1.0	0.5	1.0	1.0	0.5	1.0
Zinc (Zn)	1.0	1.0	1.4	1.5	1.2	1.0	1.0	1.2	1.8	1.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).

Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.44: Dissolved Metal Concentrations at Sheardown Lake NW Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Winter Sampling Event												Summer Sampling Event					
			DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1	DL0-01-4	DL0-01-4	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7	DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-5	DL0-01-5	DL0-01-1	DL0-01-1
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			17-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	16-Apr-20	17-Apr-20	17-Apr-20	15-Apr-20	15-Apr-20	28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	<0.0030	<0.0030	0.0032	0.0406	<0.0030	<0.0030	0.0052	0.0037	<0.0030	0.0065	<0.0030	0.0025	0.0035	0.0031	0.0036	0.0030	0.0226
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00880	0.0102	0.00861	0.00899	0.00877	0.00891	0.00936	0.00960	0.00847	0.00873	0.00951	0.0102	0.00663	0.00693	0.00755	0.00752	0.00736	0.00775
	Beryllium (Be)	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	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	mg/L	0.012	0.012	0.011	0.012	0.011	0.012	0.012	0.012	0.010	0.011	0.012	0.012	0.011	0.012	0.010	0.012	0.011	0.012
	Cadmium (Cd)	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	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	19.4	20.6	19.0	19.8	18.1	19.4	20.6	20.3	18.0	18.7	18.1	19.3	13.8	14.2	14.7	15.0	14.6	14.3
	Chromium (Cr)	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	<0.00010	<0.00010	0.00012	<0.00010	<0.00010	<0.00010
	Cobalt (Co)	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
	Copper (Cu)	mg/L	0.00095	0.00101	0.00095	0.00096	0.00096	0.00096	0.00093	0.00095	0.00089	0.00093	0.00110	0.00101	0.00070	0.00079	0.00081	0.00085	0.00080	0.00081
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Lead (Pb)	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
	Lithium (Li)	mg/L	0.0017	0.0017	0.0016	0.0016	0.0016	0.0017	0.0016	0.0017	0.0014	0.0015	0.0014	0.0017	0.0013	0.0013	0.0013	0.0014	0.0014	0.0015
	Magnesium (Mg)	mg/L	11.6	12.9	10.9	11.7	11.2	11.9	12.2	12.4	11.2	11.7	12.5	13.2	9.09	9.10	9.21	9.69	9.19	9.65
	Manganese (Mn)	mg/L	0.000171	0.000173	0.000174	0.000137	0.000296	0.000123	0.000133	0.000208	0.000200	0.000153	0.000215	0.000148	<0.00010	0.00038	0.00015	0.00041	<0.00010	0.00043
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.00119	0.00124	0.00108	0.00128	0.00109	0.00124	0.00133	0.00129	0.00113	0.00120	0.00115	0.00127	0.000906	0.000980	0.000920	0.00101	0.000927	0.000940
	Nickel (Ni)	mg/L	0.00076	0.00084	0.00072	0.00079	0.00075	0.00080	0.00077	0.00081	0.00081	0.00078	0.00087	0.00087	0.00060	0.00064	0.00066	0.00069	0.00067	0.00072
	Potassium (K)	mg/L	1.62	1.73	1.51	1.65	1.54	1.67	1.69	1.74	1.54	1.60	1.65	1.73	1.30	1.27	1.33	1.36	1.33	1.42
	Selenium (Se)	mg/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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)	mg/L	0.55	0.56	0.79	0.55	0.74	0.55	0.58	0.59	0.66	0.53	0.61	0.62	0.561	0.527	0.634	0.559	0.604	0.542
	Silver (Ag)	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
	Sodium (Na)	mg/L	2.21	2.43	2.11	2.24	2.15	2.31	2.32	2.41	2.13	2.21	2.35	2.44	1.77	1.81	1.82	1.93	1.84	2.10
	Strontium (Sr)	mg/L	0.0127	0.0136	0.0122	0.0135	0.0123	0.0136	0.0143	0.0136	0.0121	0.0130	0.0133	0.0146	0.00945	0.0101	0.0103	0.0108	0.0101	0.0108
	Thallium (Tl)	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	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)	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
	Titanium (Ti)	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	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
	Uranium (U)	mg/L	0.00142	0.00151	0.00128	0.00146	0.00136	0.00148	0.00159	0.00159	0.00136	0.00147	0.00148	0.00156	0.00127	0.00142	0.00121	0.00137	0.00127	0.00142
	Vanadium (V)	mg/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	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	0.0116	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0050	<0.0030	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010

Table C.44: Dissolved Metal Concentrations at Sheardown Lake NW Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Summer Sampling Event						Fall Sampling Event											
			DL0-01-04	DL0-01-04	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7	DD-HAB9-STN1	DD-HAB9-STN1	DL0-01-1	DL0-01-1	DL0-01-5	DL0-01-5	DL0-01-4	DL0-01-4	DL0-01-2	DL0-01-2	DL0-01-7	DL0-01-7
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			28-Jul-20	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	28-Jul-20	26-Aug-20	26-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	26-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0028	0.0149	0.0241	0.0038	0.0038	0.0039	<0.0030	0.0088	<0.0030	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00760	0.00792	0.00769	0.00788	0.00745	0.00786	0.0082	0.00799	0.00786	0.00774	0.00786	0.00808	0.00812	0.00797	0.00786	0.00795	0.00791	0.00802
	Beryllium (Be)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	0.012	0.013	0.011	0.013	0.011	0.019	0.014	0.014	0.013	0.013	0.014	0.014	0.015	0.015	0.014	0.013	0.013	0.013
	Cadmium (Cd)	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	15.2	14.9	14.7	15.0	13.6	15.2	15.8	15.3	15.2	15.4	15.1	15.9	15.4	15.9	15.5	15.3	15.5	15.5
	Chromium (Cr)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<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 (Co)	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
	Copper (Cu)	mg/L	0.00078	0.00087	0.00080	0.00086	0.00081	0.00085	0.00082	0.00082	0.00079	0.00079	0.00082	0.0008	0.00079	0.0008	0.00081	0.00082	0.0008	0.00082
	Iron (Fe)	mg/L	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	<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 (Pb)	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
	Lithium (Li)	mg/L	0.0015	0.0013	0.0014	0.0015	0.0012	0.0015	0.0017	0.0016	0.0014	0.0015	0.0017	0.0018	0.0017	0.0018	0.0015	0.0016	0.0015	0.0016
	Magnesium (Mg)	mg/L	9.24	10.1	9.58	9.67	9.70	10.3	10.1	9.92	9.85	9.95	10.1	10.3	10.3	10.1	10.1	10.1	9.98	10
	Manganese (Mn)	mg/L	0.00018	0.00267	0.00024	0.00043	<0.00010	0.00059	0.000158	0.00136	0.000092	0.000095	0.000108	0.000113	0.000138	0.000114	0.000104	0.000128	0.000091	0.0001
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000977	0.000989	0.000972	0.000988	0.000856	0.000946	0.00106	0.001	0.00103	0.00099	0.00101	0.00102	0.00101	0.00101	0.00101	0.00101	0.00102	0.00105
	Nickel (Ni)	mg/L	0.00064	0.00067	0.00068	0.00068	0.00062	0.00066	0.00068	0.0007	0.00064	0.00065	0.00075	0.00066	0.00066	0.00069	0.00066	0.00069	0.00067	0.00063
	Potassium (K)	mg/L	1.41	1.32	1.38	1.39	1.31	1.35	1.38	1.36	1.33	1.35	1.37	1.39	1.4	1.39	1.37	1.38	1.36	1.36
	Selenium (Se)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.583	0.572	0.570	0.561	0.532	0.560	0.57	0.55	0.53	0.55	0.55	0.58	0.55	0.55	0.55	0.57	0.54	0.55
	Silver (Ag)	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
	Sodium (Na)	mg/L	1.81	1.96	2.03	1.92	1.86	1.95	1.96	1.95	1.93	1.94	1.97	2.02	2.05	1.95	2	2	1.91	1.92
	Strontium (Sr)	mg/L	0.0103	0.0104	0.0108	0.0110	0.00987	0.0109	0.011	0.0108	0.011	0.0105	0.0109	0.0108	0.0109	0.0109	0.0109	0.0108	0.0107	0.0109
	Thallium (Tl)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	<0.00030	0.00057	<0.00030	<0.00030	<0.00030	<0.00030	<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 (U)	mg/L	0.00135	0.00139	0.00130	0.00134	0.00123	0.00136	0.00178	0.00157	0.00153	0.00152	0.00152	0.00154	0.00149	0.00152	0.00149	0.0015	0.00151	0.00152
	Vanadium (V)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0010	<0.0010	0.0012	<0.0010	<0.0010	0.0012	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0032	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.45: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Sheardown Lake Northwest and Reference Lake 3 in 2020, and at Sheardown Lake Northwest Between 2020 and the Baseline Period

Dissolved Metal	Sheardown Lake NW				
	2020 vs Reference Lake 3		2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	0.6	0.8	0.0	1.6	1.2
Antimony (Sb)	1.0	1.0	0.0	0.0	1.0
Arsenic (As)	1.0	1.0	1.0	0.8	1.0
Barium (Ba)	1.2	1.2	0.0	1.4	1.4
Beryllium (Be)	0.2	1.0	1.2	0.2	2.1
Bismuth (Bi)	0.1	1.0	1.0	0.0	1.0
Boron (B)	1.2	1.4	1.2	1.3	1.4
Cadmium (Cd)	0.5	1.0	0.4	0.0	0.8
Calcium (Ca)	2.1	2.1	1.5	1.3	1.3
Chromium (Cr)	0.2	1.0	-	0.9	-
Cobalt (Co)	1.0	1.0	1.0	1.0	0.9
Copper (Cu)	1.2	1.1	0.8	0.5	1.0
Iron (Fe)	0.4	1.0	1.2	0.4	1.7
Lead (Pb)	1.0	1.0	0.6	1.0	1.0
Lithium (Li)	1.4	1.6	0.4	0.0	0.7
Magnesium (Mg)	2.2	2.1	1.5	1.4	1.4
Manganese (Mn)	2.2	1.6	0.3	0.0	0.3
Mercury (Hg)	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	7.3	6.6	5.3	0.0	5.1
Nickel (Ni)	1.3	1.3	1.1	0.7	1.2
Potassium (K)	1.6	1.5	1.0	1.2	1.1
Selenium (Se)	0.1	1.0	-	0.5	-
Silicon (Si)	1.2	1.1	1.3	1.4	1.4
Silver (Ag)	1.0	1.0	1.2	1.8	2.7
Sodium (Na)	2.1	1.9	1.4	1.5	1.5
Strontium (Sr)	1.3	1.3	1.7	1.5	1.4
Thallium (Tl)	0.1	1.0	1.2	0.1	2.6
Tin (Sn)	1.0	1.0	0.1	0.2	0.1
Titanium (Ti)	0.0	1.0	1.0	0.0	1.0
Uranium (U)	4.4	4.7	3.0	2.9	3.1
Vanadium (V)	0.5	1.0	1.0	0.5	1.0
Zinc (Zn)	0.3	1.0	2.0	0.3	1.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).
Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.46: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Winter, Mary River Project CREMP, April 2020**

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3
Date Collected	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20
1.0	0.0	-0.1	0.1	0.0	0.6	13.10	13.71	14.17	14.03	13.39	89.6	93.6	97.3	96.3	93.4	7.70	7.70	8.19	7.85	7.84	160.9	170.6	200.7	176.4	199.8
2.0	0.0	0.0	0.3	0.1	0.2	12.82	13.33	13.63	13.63	13.28	88.0	91.2	94.0	93.9	91.6	7.56	7.64	7.94	7.76	7.69	157.6	168.4	190.1	179.6	191.2
3.0	0.2	0.1	0.5	0.6	0.5	12.67	12.54	13.39	13.24	12.92	87.4	86.1	93.2	92.1	90.0	7.52	7.57	7.81	7.73	7.59	159.6	173.7	187.7	177.5	187.9
4.0	0.5	-	0.7	0.7	0.7	12.31	-	13.20	13.09	12.74	85.6	-	92.4	91.4	89.2	7.49	-	7.71	7.70	7.54	169.2	-	186.3	179.5	186.3
5.0	0.8	-	0.8	0.8	0.8	12.00	-	13.11	12.93	12.61	84.0	-	91.8	90.5	88.4	7.46	-	7.69	7.69	7.49	182.7	-	186.0	181.2	185.5
6.0	1.0	-	0.9	0.8	0.9	11.28	-	12.96	12.77	12.42	79.5	-	90.9	89.6	87.2	7.40	-	7.65	7.66	7.45	194.6	-	185.7	183.4	184.2
7.0	-	-	0.9	0.9	0.9	-	-	12.64	12.57	12.25	-	-	88.8	88.3	86.1	-	-	7.62	7.64	7.41	-	-	186.0	183.3	183.3
8.0	-	-	0.9	1.0	1.0	-	-	12.06	12.23	11.98	-	-	85.0	86.3	84.3	-	-	7.59	7.62	7.38	-	-	187.7	182.0	182.4
9.0	-	-	-	1.1	1.1	-	-	-	11.85	11.78	-	-	-	83.8	83.3	-	-	-	7.59	7.37	-	-	-	181.0	181.8
10.0	-	-	-	1.2	1.2	-	-	-	10.97	10.46	-	-	-	77.7	74.1	-	-	-	7.50	7.35	-	-	-	180.1	180.7
11.0	-	-	-	1.3	1.3	-	-	-	8.72	9.00	-	-	-	62.0	64.1	-	-	-	7.48	7.28	-	-	-	180.4	182.6
12.0	-	-	-	1.4	1.5	-	-	-	6.74	7.31	-	-	-	48.2	52.3	-	-	-	7.40	7.23	-	-	-	181.2	183.6
13.0	-	-	-	-	1.7	-	-	-	-	3.66	-	-	-	-	26.2	-	-	-	-	7.13	-	-	-	-	191.0

Notes: Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 6.8, 4.2, 8.7, 12.9, and 14.1 m, respectively, at the time of winter sampling. Ice thickness at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 1.40, 1.62, 1.86, 1.96, and 1.62 m, respectively, at the time of winter sampling.

Table C.47: *In Situ* Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Summer, Mary River Project CREMP, July 2020

Depth (m)	Temperature (°C)					Dissolved Oxygen (mg/L)					Dissolved Oxygen (% Saturation)					pH (pH units)					Specific Conductance (µS/cm)				
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3
Date Collected	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20
1.0	15.6	15.6	16.0	16.0	15.8	10.56	10.62	10.35	10.41	10.47	106.2	106.6	105.0	105.5	105.7	8.32	8.33	8.29	8.32	8.27	132.4	130.4	129.2	129.2	129.7
2.0	15.0	14.5	16.0	16.0	15.8	11.16	11.31	10.35	10.43	10.49	110.3	110.8	105.0	105.5	105.7	8.37	8.39	8.26	8.33	8.34	130.7	128.6	129.5	129.4	129.9
3.0	14.1	13.6	15.6	15.5	14.0	11.70	11.64	10.73	10.49	11.55	113.6	112.0	107.2	105.1	112.0	8.47	8.38	8.26	8.30	8.39	128.6	126.3	130.6	131.9	128.1
4.0	12.9	-	12.7	12.7	12.3	12.03	-	11.64	11.82	11.83	113.8	-	109.3	111.1	110.5	8.48	-	8.31	8.34	8.36	126.6	-	122.8	122.4	121.7
5.0	11.3	-	11.5	11.7	11.4	12.15	-	11.75	11.74	11.77	110.8	-	108.0	108.2	107.8	8.36	-	8.26	8.28	8.27	129.2	-	121.2	121.1	120.6
6.0	10.1	-	10.7	11.0	10.8	11.78	-	11.52	11.58	11.53	104.8	-	103.8	105.1	104.2	8.17	-	8.02	8.07	8.12	129.0	-	120.4	120.1	120.0
7.0	-	-	9.8	9.5	10.0	-	-	11.28	11.12	11.26	-	-	99.6	97.4	91.8	-	-	7.93	7.93	7.98	-	-	119.6	118.4	119.2
8.0	-	-	8.4	8.3	8.2	-	-	10.94	10.97	11.16	-	-	93.4	93.3	95.0	-	-	7.81	7.80	7.86	-	-	117.5	116.5	116.6
9.0	-	-	-	7.4	7.4	-	-	-	10.89	10.98	-	-	-	90.6	91.3	-	-	-	7.71	7.73	-	-	-	115.4	115.2
10.0	-	-	-	6.1	6.8	-	-	-	10.70	10.86	-	-	-	86.5	89.1	-	-	-	7.65	7.66	-	-	-	114.8	115.1
11.0	-	-	-	5.9	6.3	-	-	-	10.31	10.68	-	-	-	83.1	86.4	-	-	-	7.56	7.60	-	-	-	115.2	115.0
12.0	-	-	-	5.7	6.0	-	-	-	10.03	10.33	-	-	-	80.1	82.9	-	-	-	7.48	7.55	-	-	-	115.5	115.3
13.0	-	-	-	-	5.8	-	-	-	-	10.06	-	-	-	-	80.7	-	-	-	-	7.51	-	-	-	-	115.6
14.0	-	-	-	-	5.6	-	-	-	-	9.05	-	-	-	-	71.9	-	-	-	-	7.48	-	-	-	-	116.5

Note: Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 6.5, 3.8, 8.4, 12.6, and 13.3 m, respectively, at the time of summer sampling.

Table C.48: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020**

Depth (m)	Temperature (°C)						Dissolved Oxygen (mg/L)						Dissolved Oxygen (% Saturation)					
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3
Date Collected	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	13-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	13-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	13-Aug-20
surface	-	-	-	-	-	10.5	-	-	-	-	-	10.67	-	-	-	-	-	98.2
1.0	8.6	8.6	8.7	8.7	8.7	10.6	11.42	11.34	11.17	11.26	11.30	10.69	97.9	97.3	96.0	96.8	97.0	98.2
2.0	8.6	8.6	8.7	8.7	8.7	10.5	11.41	11.34	11.17	11.25	11.28	10.50	97.8	97.2	96.0	96.7	97.0	96.8
3.0	8.6	8.6	8.7	8.7	8.7	10.5	11.41	11.34	11.17	11.24	11.27	10.54	97.8	97.1	96.0	96.6	96.9	96.9
4.0	8.6	8.6	8.7	8.7	8.7	10.5	11.39	11.36	11.18	11.23	11.27	10.51	97.6	97.2	96.1	96.6	96.9	96.5
5.0	8.6	-	8.7	8.7	8.7	10.5	11.39	-	11.17	11.23	11.27	10.50	97.6	-	96.0	96.5	96.9	96.6
6.0	-	-	8.7	8.7	8.7	10.5	-	-	11.16	11.23	11.26	10.51	-	-	95.9	96.5	96.8	96.6
7.0	-	-	8.7	8.7	8.7	10.5	-	-	11.16	11.22	11.26	10.30	-	-	95.9	96.5	96.7	94.8
8.0	-	-	-	8.7	8.7	10.5	-	-	-	11.22	11.25	10.62	-	-	-	96.4	96.7	97.5
9.0	-	-	-	8.7	8.7	10.5	-	-	-	11.21	11.25	10.47	-	-	-	96.4	96.7	96.0
10.0	-	-	-	8.7	8.7	10.1	-	-	-	11.21	11.24	10.23	-	-	-	96.3	96.6	92.9
11.0	-	-	-	8.7	8.7	7.5	-	-	-	11.20	11.23	10.03	-	-	-	96.3	96.5	85.9
12.0	-	-	-	-	8.6	5.9	-	-	-	-	11.22	8.53	-	-	-	-	96.5	70.1
13.0	-	-	-	-	-	5.9	-	-	-	-	-	8.07	-	-	-	-	-	66.1
14.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Notes: 13-Aug-20 sampling was conducted by Minnow. Sheardown Lake SE water profile sampling on all other dates was conducted by Baffinland. Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 6.5, 3.7, 8.2, 12.6, and 14.1 m, respectively, at the time of fall sampling.

Table C.48: ***In Situ*** **Water Quality Profile Data Collected at Sheardown Lake SE Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020**

Depth (m)	pH (pH units)						Specific Conductance (µS/cm)					
	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3	DLO-02-6	DLO-02-7	DLO-02-4	DLO-02-8	DLO-02-3	DLO-02-3
Date Collected	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	13-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	13-Aug-20
surface	-	-	-	-	-	7.97	-	-	-	-	-	126.7
1.0	8.08	8.05	7.99	8.04	8.04	8.01	139.1	138.3	136.9	137.3	137.5	126.7
2.0	8.08	8.06	7.99	8.03	8.04	8.02	139.2	138.9	137.0	137.4	137.6	126.7
3.0	8.08	8.05	7.99	8.03	8.04	8.02	139.3	139.0	137.0	137.4	137.6	126.7
4.0	8.08	8.07	7.99	8.03	8.04	8.03	139.4	139.2	137.0	137.4	137.6	126.7
5.0	8.08	-	8.00	8.03	8.04	8.04	139.5	-	137.1	137.5	137.7	126.7
6.0	-	-	8.00	8.03	8.04	8.03	-	-	137.1	137.5	137.6	126.7
7.0	-	-	7.99	8.03	8.04	8.03	-	-	137.1	137.5	137.7	126.7
8.0	-	-	-	8.03	8.04	8.02	-	-	-	137.5	137.6	126.8
9.0	-	-	-	8.03	8.04	8.00	-	-	-	137.5	137.6	126.8
10.0	-	-	-	8.03	8.04	7.85	-	-	-	137.5	137.6	124.9
11.0	-	-	-	8.02	8.03	7.50	-	-	-	137.5	137.6	117.0
12.0	-	-	-	-	8.03	7.10	-	-	-	-	137.1	114.7
13.0	-	-	-	-	-	6.83	-	-	-	-	-	115.2
14.0	-	-	-	-	-	-	-	-	-	-	-	-

Notes: 13-Aug-20 sampling was conducted by Minnow. Sheardown Lake SE water profile sampling on all other dates was conducted by Baffinland. Total depth at stations DLO-02-6, DLO-02-7, DLO-02-4, DLO-02-8, and DLO-02-3 was 6.5, 3.7, 8.2, 12.6, and 14.1 m, respectively, at the time of fall sampling.

Table C.49: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Sheardown Lake SE Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	DLO-02-1	13-Aug-20	12.1	5.53	surface	10.5	10.69	98.1	7.92	126.8
					bottom	10.4	10.45	96.0	7.90	128.1
	DLO-02-11	18-Aug-20	7.0	1.00	surface	9.4	9.88	88.7	7.97	135.7
					bottom	9.4	9.73	87.2	7.98	135.7
	DLO-02-10	18-Aug-20	7.0	1.07	surface	9.4	9.79	87.7	7.93	135.6
					bottom	9.4	9.80	87.6	7.95	135.8
	DLO-02-4	18-Aug-20	8.0	1.26	surface	9.4	9.86	88.4	7.87	135.5
					bottom	9.4	9.17	82.2	7.75	134.7
	DLO-02-9	19-Aug-20	8.5	1.19	surface	9.1	10.16	90.1	7.62	136.5
					bottom	9.1	10.03	89.3	7.55	136.5
Profundal (Deep) Stations	DLO-02-12	18-Aug-20	11.0	1.66	surface	9.3	11.06	96.5	8.11	132.8
					bottom	9.3	10.99	95.8	8.10	132.9
	DLO-02-8	19-Aug-20	13.0	1.10	surface	9.1	10.60	94.4	7.51	136.4
					bottom	9.0	10.75	95.6	7.41	136.9
	DLO-02-13	19-Aug-20	11.0	1.28	surface	9.1	10.66	94.6	7.55	136.1
					bottom	9.1	10.47	93.3	7.36	136.2
	DLO-02-2	19-Aug-20	15.0	1.40	surface	9.1	10.65	94.6	7.61	136.4
					bottom	9.0	10.56	93.8	7.61	136.8
	DLO-02-3	13-Aug-20	13.2	5.36	surface	10.5	10.56	97.9	7.89	126.6
					bottom	6.0	8.43	69.6	7.12	115.0

Table C.50: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake SE Littoral and Profundal Stations, Mary River Project CREMP, August 2020

Parameter	Statistical Test Results				Summary Statistics						
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Lake Zone	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	M-W	rank	NO	0.310	Littoral	5	2.01	1.97	0.88	1.00	5.53
					Profundal	5	2.16	1.80	0.80	1.10	5.36
Temperature (˚C)	M-W	rank	YES	0.025	Littoral	5	9.54	0.50	0.22	9.10	10.40
					Profundal	5	8.48	1.39	0.62	6.00	9.30
Dissolved Oxygen (mg/L)	M-W	rank	NO	0.151	Littoral	5	9.8	0.5	0.2	9.2	10.5
					Profundal	5	10.2	1.0	0.5	8.4	11.0
Dissolved Oxygen (% saturation)	M-W	rank	NO	0.548	Littoral	5	88.5	5.0	2.2	82.2	96.0
					Profundal	5	89.6	11.2	5.0	69.6	95.8
pH (units)	tequal	none	NO	0.133	Littoral	5	7.83	0.18	0.08	7.55	7.98
					Profundal	5	7.52	0.37	0.16	7.12	8.10
Specific Conductance (umho/cm)	M-W	rank	NO	0.690	Littoral	5	134.2	3.4	1.5	128.1	136.5
					Profundal	5	131.6	9.4	4.2	115.0	136.9

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.51: Statistical Comparison of Bottom *In Situ* Water Quality Between Sheardown Lake SE Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Habitat Variable	Statistical Test Results				Summary Statistics						
		Significant Difference Between Areas?	P-value	Statistical Analysis	Transformation	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	**Station Depth (m)**	NO	0.246	tequal	none	Reference	4	10.0	1.08	0.540	8.50	11.0
						Mary Lake	5	8.52	2.10	0.941	7.00	12.1
	Secchi Depth (m)	YES	0.008	M-W	rank	Reference	5	8.12	0.645	0.288	7.38	9.15
						Mary Lake	5	2.01	1.97	0.882	1.00	5.53
	Temperature (°C)	NO	0.420	tequal	none	Reference	5	9.32	0.295	0.132	8.90	9.70
						Mary Lake	5	9.54	0.498	0.223	9.10	10.4
	Dissolved Oxygen (mg/L)	YES	0.001	tequal	none	Reference	5	112	5.23	2.34	105	117
						Mary Lake	5	88.5	4.98	2.23	82.2	96.0
	Dissolved Oxygen (% saturation)	YES	0.001	tequal	none	Reference	5	112	5.23	2.34	105	117
						Mary Lake	5	88.5	4.98	2.23	82.2	96.0
	pH (units)	YES	0.001	tequal	none	Reference	5	7.19	0.228	0.102	6.94	7.56
						Mary Lake	5	7.83	0.178	0.0795	7.55	7.98
	Specific Conductance (umho/cm)	YES	0.001	tequal	none	Reference	5	76.7	3.16	1.41	74.5	82.1
						Mary Lake	5	134	3.45	1.54	128	137
Profundal (Deep) Stations	**Station Depth (m)**	YES	0.001	tequal	none	Reference	5	20.6	1.56	0.696	19.0	23.0
						Mary Lake	5	12.6	1.69	0.755	11.0	15.0
	Secchi Depth (m)	YES	0.008	M-W	rank	Reference	5	8.39	0.962	0.430	7.18	9.84
						Mary Lake	5	2.16	1.80	0.805	1.10	5.36
	Temperature (°C)	YES	0.021	M-W	rank	Reference	5	5.82	0.192	0.0860	5.60	6.10
						Mary Lake	5	8.48	1.39	0.622	6.00	9.30
	Dissolved Oxygen (mg/L)	YES	0.015	tequal	none	Reference	5	111	10.3	4.59	104	128
						Mary Lake	5	89.6	11.2	5.03	69.6	95.8
	Dissolved Oxygen (% saturation)	YES	0.015	tequal	none	Reference	5	111	10.3	4.59	104	128
						Mary Lake	5	89.6	11.2	5.03	69.6	95.8
	pH (units)	YES	0.005	tequal	none	Reference	5	6.70	0.295	0.132	6.27	6.95
						Mary Lake	5	7.52	0.368	0.165	7.12	8.10
	Specific Conductance (umho/cm)	YES	0.008	M-W	rank	Reference	5	75.5	1.64	0.734	74.0	78.1
						Mary Lake	5	132	9.40	4.20	115	137

Highlighted values indicate significant difference between study areas based on ANOVA p-value less than 0.10.

Notes: Analysis was completed on samples collected at the bottom of the water column. M-W = Mann-Whitney U-Test, tequal = T-test with equal variance, tunequal = T-test with unequal variance.

Table C.52: Water Chemistry at Sheardown Lake SE (DLO-02) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Winter Sampling Event									
					DL0-02-6	DL0-02-6	DL0-02-7	DL0-02-7	DL0-02-4	DL0-02-4	DL0-02-8	DL0-02-8	DL0-02-3	DL0-02-3
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					15-Apr-20	15-Apr-20	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	15-Apr-20
Conventionals	Conductivity (lab)	umho/cm	-	-	204	208	196	200	188	192	183	191	186	192
	pH (lab)	pH	6.5 - 9.0	-	7.37	7.42	7.47	7.45	7.48	7.50	7.37	7.51	7.28	7.50
	Hardness (as $CaCO_3$)	mg/L	-	-	108	108	105	105	96.7	98.5	94.6	99.5	97.6	101
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	155	147	134	148	117	118	131	117	114	105
	Turbidity	NTU	-	-	0.18	0.14	0.14	0.80	0.17	0.13	0.18	0.20	0.22	0.11
	Alkalinity (as $CaCO_3$)	mg/L	-	-	85	85	81	81	76	78	73	77	76	79
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	0.020	0.018	0.026	0.030	<0.010	0.024	<0.010	0.024
	Nitrate	mg/L	3	3	0.256	0.283	0.223	0.229	0.211	0.208	0.230	0.206	0.239	0.212
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	0.16	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	3.69	2.64	2.57	2.52	2.46	2.95	2.31	2.46	2.45	2.64
	Total Organic Carbon	mg/L	-	-	2.71	2.80	2.73	2.72	2.51	2.70	2.53	2.63	2.48	2.75
	Total Phosphorus	mg/L	0.020^{α}	-	0.0032	0.0052	0.0036	0.0039	<0.0030	0.0032	0.0035	0.0042	0.0046	0.0031
	Phenols	mg/L	0.004^{α}	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0011	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	5.70	5.78	5.53	5.52	5.25	5.28	4.88	5.22	5.03	5.32
	Sulphate (SO_4)	mg/L	218^{β}	218	13.5	13.8	12.9	12.9	12.0	12.3	11.2	12.1	11.0	12.4
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[c]	0.0039	0.0046	0.0048	0.0034	0.0042	0.0047	0.0037	0.0089	0.0075	0.0148
	Antimony (Sb)	mg/L	0.020^{α}	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010
	Barium (Ba)	mg/L	-	-	0.0119	0.0123	0.0117	0.0114	0.0105	0.0104	0.0104	0.0108	0.0105	0.0101
	Beryllium (Be)	mg/L	0.011^{α}	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	0.013	0.014	0.012	0.012	0.011	0.011	0.010	0.011	0.011	0.011
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	20.6	20.8	19.8	20.1	18.2	18.3	18.0	19.2	18.5	17.7
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009^{α}	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00105	0.00103	0.00100	0.00099	0.00090	0.00104	0.00096	0.00113	0.00103	0.00119
	Iron (Fe)	mg/L	0.30	0.300	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0015	0.0015	0.0014	0.0014	0.0012	0.0013	0.0011	0.0012	0.0014	0.0012
	Magnesium (Mg)	mg/L	-	-	13.8	14.2	13.5	13.2	12.5	12.6	12.1	12.7	12.5	11.7
	Manganese (Mn)	mg/L	0.935^{β}	-	0.00382	0.00287	0.00162	0.00176	0.00165	0.00159	0.00286	0.00160	0.00397	0.00158
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000882	0.000924	0.000862	0.000860	0.000780	0.000789	0.000752	0.000822	0.000718	0.000906
	Nickel (Ni)	mg/L	0.025	0.025	0.00088	0.00092	0.00087	0.00085	0.00078	0.00081	0.00077	0.00085	0.00076	0.00080
	Potassium (K)	mg/L	-	-	1.82	1.95	1.78	1.75	1.58	1.64	1.55	1.65	1.60	1.55
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.83	0.82	0.71	0.73	0.61	0.62	0.81	0.65	1.02	0.61
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	2.65	2.71	2.55	2.48	2.35	2.42	2.31	2.43	2.40	2.31
	Strontium (Sr)	mg/L	-	-	0.0170	0.0169	0.0165	0.0160	0.0150	0.0150	0.0148	0.0156	0.0148	0.0146
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00148	0.00148	0.00138	0.00142	0.00131	0.00137	0.00125	0.00137	0.00122	0.00125
	Vanadium (V)	mg/L	0.006^{α}	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0092

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

[c] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

Table C.52: Water Chemistry at Sheardown Lake SE (DLO-02) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event									
					DL0-02-6	DL0-02-6	DL0-02-7	DL0-02-7	DL0-02-4	DL0-02-4	DL0-02-8	DL0-02-8	DL0-02-3	DL0-02-3
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20
Conventionals	Conductivity (lab)	umho/cm	-	-	131	133	129	133	122	131	118	130	118	131
	pH (lab)	pH	6.5 - 9.0	-	8.13	8.25	8.30	8.25	7.83	8.13	7.41	8.24	7.43	8.24
	Hardness (as $CaCO_3$)	mg/L	-	-	61.7	63	62.9	66.4	53.4	58.4	53	61	56.3	63.1
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	68	70	74	74	70	67	55	77	64	69
	Turbidity	NTU	-	-	0.89	0.75	0.82	0.75	0.90	0.73	1.59	0.69	1.51	0.72
	Alkalinity (as $CaCO_3$)	mg/L	-	-	49.6	51.3	50.3	51.3	46.5	50.4	45.8	50.4	45.8	50.6
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0153	<0.0050	0.0132	<0.0050
	Nitrate	mg/L	3	3	0.0974	0.0809	0.0900	0.0791	0.101	0.0884	0.127	0.0818	0.129	0.0781
	Nitrite	mg/L	0.06	0.06	0.0013	0.0017	0.0016	0.0025	0.0013	0.0017	0.0019	0.0016	0.0016	0.0014
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	0.121	0.121	0.121	0.115	0.113	0.183	0.114	0.121	0.119	0.126
	Dissolved Organic Carbon	mg/L	-	-	1.80	1.58	6.23	1.41	1.52	1.69	1.12	1.37	1.30	1.56
	Total Organic Carbon	mg/L	-	-	1.65	1.71	1.71	1.89	1.58	1.76	1.53	1.66	1.63	1.79
	Total Phosphorus	mg/L	0.020[α]	-	0.0072	0.0060	0.0059	0.0044	0.0065	0.0066	0.0083	0.0052	0.0058	0.0085
	Phenols	mg/L	0.001[α]	-	0.0022	0.0025	0.0047	0.0029	0.0018	<0.0010	0.0027	0.0023	0.0035	0.0022
Anions	Bromide (Br)	mg/L	-	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Chloride (Cl)	mg/L	120	120	3.43	3.40	3.30	3.36	3.11	3.31	3.08	3.32	3.07	3.36
	Sulphate (SO_4)	mg/L	218[β]	218	10.0	9.86	9.44	9.70	8.55	9.51	8.06	9.55	8.08	9.66
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[c]	0.0234	0.0174	0.0211	0.0199	0.0294	0.0202	0.0434	0.0186	0.0503	0.0192
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00668	0.00649	0.00628	0.00649	0.00632	0.00640	0.00623	0.00634	0.00634	0.00650
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	mg/L	-	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	mg/L	1.5	-	0.010	0.010	<0.010	<0.010	<0.010	0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	-	-	11.4	11.8	11.3	11.7	10.6	11.7	10.3	11.4	10.9	11.7
	Chromium (Cr)	mg/L	0.0089	0.0089	0.00010	<0.00010	0.00017	0.00021	0.00014	<0.00010	0.00015	0.00010	0.00011	0.00012
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00078	0.00078	0.00077	0.00080	0.00084	0.00077	0.00076	0.00079	0.00072	0.00077
	Iron (Fe)	mg/L	0.30	0.300	0.031	0.024	0.027	0.026	0.036	0.025	0.062	0.023	0.064	0.023
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000069	<0.000050	0.000061	<0.000050
	Lithium (Li)	mg/L	-	-	0.0011	0.0011	0.0011	0.0011	<0.0010	0.0011	0.0010	0.0011	0.0014	0.0011
	Magnesium (Mg)	mg/L	-	-	6.87	7.31	6.87	6.98	6.74	6.90	6.22	6.88	7.08	7.04
	Manganese (Mn)	mg/L	0.935[β]	-	0.00389	0.00349	0.00343	0.00352	0.00427	0.00325	0.0118	0.00321	0.0124	0.00335
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000683	0.000672	0.000655	0.000645	0.000576	0.000637	0.000545	0.000644	0.000537	0.000662
	Nickel (Ni)	mg/L	0.025	0.025	0.00058	0.00060	0.00057	0.00062	0.00056	0.00062	0.00054	0.00062	0.00055	0.00063
	Potassium (K)	mg/L	-	-	1.05	1.05	1.03	1.05	1.01	1.06	0.969	1.03	1.04	1.04
	Selenium (Se)	mg/L	0.001	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)	mg/L	-	-	0.52	0.49	0.49	0.48	0.51	0.51	0.75	0.50	0.79	0.48
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.38	1.44	1.38	1.41	1.34	1.41	1.28	1.36	1.34	1.40
	Strontium (Sr)	mg/L	-	-	0.00892	0.00887	0.00876	0.00884	0.00816	0.00876	0.00799	0.00866	0.00806	0.00897
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	0.00137	0.00083	0.00105	0.00102	0.00163	0.00090	0.00267	0.00098	0.00276	0.00081
	Uranium (U)	mg/L	0.015	-	0.000947	0.000964	0.000924	0.000948	0.000812	0.000925	0.000751	0.000935	0.000726	0.000931
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

[grey box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

[c] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

Table C.52: Water Chemistry at Sheardown Lake SE (DLO-02) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Fall Sampling Event									
					DL0-02-6	DL0-02-6	DL0-02-7	DL0-02-7	DL0-02-4	DL0-02-4	DL0-02-8	DL0-02-8	DL0-02-3	DL0-02-3
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	142	146	141	140	145	145	139	139	139	139
	pH (lab)	pH	6.5 - 9.0	-	8.03	8.04	8	8.05	7.98	7.95	8.02	7.98	7.97	8.03
	Hardness (as $CaCO_3$)	mg/L	-	-	68.7	67.3	67.6	68.2	67.2	66.3	67.3	67.2	67.8	67.8
	Total Suspended Solids (TSS)	mg/L	-	-	2.6	2.5	<2.0	<2.0	<2.0	<2.0	2.6	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	75	83	71	89	74	89	81	72	60	76
	Turbidity	NTU	-	-	2.16	2.22	2.23	2.28	2.53	2.43	2.40	2.39	2.16	2.40
	Alkalinity (as $CaCO_3$)	mg/L	-	-	56	57	57	57	56	55	56	56	56	57
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	0.011	0.012	0.013	0.013	0.013	0.014	0.012	0.013	0.012	0.012
	Nitrate	mg/L	3	3	0.079	0.094	0.083	0.085	0.086	0.077	0.108	0.099	0.102	0.079
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	0.16	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.53	1.98	2.07	1.92	2.18	1.89	2.11	1.93	2.05	1.89
	Total Organic Carbon	mg/L	-	-	2.41	2.41	2.43	2.33	2.54	2.41	2.35	2.37	2.36	2.49
	Total Phosphorus	mg/L	0.020[α]	-	0.0079	0.0068	0.014	0.0095	0.0101	0.009	0.0117	0.0088	0.0053	0.0067
	Phenols	mg/L	0.001[α]	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.92	4.00	3.97	3.90	3.85	3.87	3.87	3.90	3.88	3.86
	Sulphate (SO_4)	mg/L	218[β]	218	9.76	9.78	9.88	9.65	9.33	9.35	9.44	9.52	9.44	9.43
Total Metals	Aluminum (Al)	mg/L	0.100	0.179, 0.173[c]	0.0585	0.0696	0.0615	0.0665	0.055	0.0467	0.0704	0.076	0.0671	0.0654
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00767	0.00782	0.00767	0.00823	0.00769	0.00754	0.00767	0.00818	0.00756	0.00757
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	0.012	0.012	0.012	0.012	0.011	0.011	0.011	0.011	0.011	0.011
	Cadmium (Cd)	mg/L	0.00012	0.00009	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	13.5	13.4	13.9	13.9	12.6	13.3	13.3	13.1	13.4	13.4
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00082	0.0008	0.00082	0.00084	0.00091	0.00081	0.0008	0.0008	0.00083	0.00129
	Iron (Fe)	mg/L	0.30	0.300	0.061	0.064	0.060	0.066	0.062	0.059	0.068	0.069	0.064	0.069
	Lead (Pb)	mg/L	0.001	0.001	0.000055	0.000052	0.000055	0.000061	0.000056	0.000053	0.000071	0.000058	0.000059	0.000057
	Lithium (Li)	mg/L	-	-	0.0014	0.0014	0.0013	0.0015	<0.0010	0.0012	0.0012	0.0013	0.0012	0.0014
	Magnesium (Mg)	mg/L	-	-	8.35	8.33	8.47	8.42	8.18	8.13	8.31	8.46	8.48	8.35
	Manganese (Mn)	mg/L	0.935[β]	-	0.00345	0.00361	0.00355	0.00354	0.00373	0.00376	0.00369	0.00353	0.00363	0.0036
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000645	0.000647	0.000666	0.000632	0.000658	0.000627	0.000629	0.000635	0.000622	0.000621
	Nickel (Ni)	mg/L	0.025	0.025	0.0006	0.00059	0.00061	0.00065	0.0006	0.00059	0.00063	0.00062	0.00061	0.00062
	Potassium (K)	mg/L	-	-	1.15	1.16	1.15	1.15	1.13	1.12	1.17	1.16	1.15	1.15
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	0.49	0.52	0.48	0.51	0.48	0.45	0.53	0.52	0.50	0.50
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	-	-	1.75	1.70	1.70	1.70	1.69	1.68	1.74	1.76	1.69	1.72
	Strontium (Sr)	mg/L	-	-	0.0101	0.0102	0.0104	0.0102	0.0102	0.0102	0.0102	0.0103	0.0101	0.0101
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00121	0.00120	0.00119	0.00119	0.00114	0.00117	0.00119	0.00118	0.00117	0.00116
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Sheardown Lake.

[c] Benchmark is 0.179 mg/L and 0.173 mg/L for shallow and deep stations, respectively.

Table C.53: Dissolved Metal Concentrations at Sheardown Lake SE Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Winter Sampling Event										Summer Sampling Event					
			DL0-02-6	DL0-02-6	DL0-02-7	DL0-02-7	DL0-02-4	DL0-02-4	DL0-02-8	DL0-02-8	DL0-02-3	DL0-02-3	DL0-02-6	DL0-02-6	DL0-02-7	DL0-02-7	DL0-02-4	DL0-02-4
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			15-Apr-20	15-Apr-20	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	15-Apr-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0046	<0.0030	0.0044	<0.0030	0.0044	<0.0030	0.0041	<0.0030	0.0047	<0.0030	0.0039	0.0089	0.0255	0.0066	0.0060	0.0053
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.0119	0.0119	0.0115	0.0113	0.0105	0.0106	0.0102	0.0108	0.0110	0.0109	0.00673	0.00678	0.00675	0.00702	0.00611	0.00633
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.00025	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	mg/L	0.013	0.013	0.013	0.012	0.011	0.011	0.011	0.011	0.011	0.012	0.011	<0.050	0.010	0.011	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.000025	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	20.6	20.3	20.4	20.1	18.5	18.7	17.8	19.1	18.6	19.3	11.9	12.6	11.9	12.5	10.2	11.4
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00119	0.00098	0.00104	0.00106	0.00097	0.00103	0.00098	0.00103	0.00090	0.00095	0.00067	<0.0010	0.00075	0.00081	0.00058	0.00062
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.010	<0.050	0.020	<0.010	<0.010	<0.010
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00025	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	0.0015	0.0015	0.0015	0.0016	0.0013	0.0012	0.0011	0.0011	0.0014	0.0014	0.0010	<0.0050	0.0010	0.0011	<0.0010	0.0010
	Magnesium (Mg)	mg/L	13.8	13.9	13.1	13.3	12.2	12.6	12.2	12.6	12.4	12.9	7.77	7.69	8.04	8.54	6.75	7.27
	Manganese (Mn)	mg/L	0.000497	0.000294	0.000263	0.000303	0.000189	0.000275	0.000296	0.000242	0.000312	0.000218	0.00016	0.00067	0.00064	0.00053	0.00012	0.00033
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000911	0.000883	0.000853	0.000864	0.000788	0.000807	0.000710	0.000816	0.000680	0.000856	0.000612	0.00061	0.000576	0.000625	0.000519	0.000588
	Nickel (Ni)	mg/L	0.00092	0.00088	0.00084	0.00093	0.00078	0.00081	0.00077	0.00083	0.00071	0.00080	<0.00050	<0.0025	0.00052	0.00054	<0.00050	0.00052
	Potassium (K)	mg/L	1.90	1.91	1.75	1.75	1.56	1.65	1.57	1.66	1.60	1.67	1.07	1.15	1.08	1.11	0.975	1.01
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.00025	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)	mg/L	0.81	0.82	0.72	0.74	0.62	0.62	0.80	0.63	0.98	0.65	0.411	0.42	0.417	0.407	0.435	0.422
	Silver (Ag)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010
	Sodium (Na)	mg/L	2.71	2.65	2.53	2.53	2.32	2.40	2.29	2.40	2.35	2.44	1.50	1.57	1.55	1.61	1.32	1.41
	Strontium (Sr)	mg/L	0.0176	0.0171	0.0169	0.0168	0.0154	0.0160	0.0152	0.0158	0.0148	0.0160	0.00872	0.0094	0.00849	0.00892	0.00771	0.00826
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	<0.000010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.00030	<0.0015	0.00126	<0.00030	<0.00030	<0.00030
	Uranium (U)	mg/L	0.00144	0.00147	0.00143	0.00146	0.00133	0.00139	0.00126	0.00137	0.00124	0.00139	0.000930	0.000939	0.000863	0.000934	0.000789	0.000920
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.0025	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0010	<0.0050	0.0019	<0.0010	<0.0010	<0.0010

Table C.53: Dissolved Metal Concentrations at Sheardown Lake SE Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Summer Sampling Event				Fall Sampling Event									
			DL0-02-8	DL0-02-8	DL0-02-3	DL0-02-3	DL0-02-6	DL0-02-6	DL0-02-7	DL0-02-7	DL0-02-4	DL0-02-4	DL0-02-8	DL0-02-8	DL0-02-3	DL0-02-3
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0110	0.0067	0.0154	0.0091	0.0132	0.0125	0.012	0.0079	0.0106	0.0108	0.0091	0.0137	0.009	0.0089
	Antimony (Sb)	mg/L	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.00616	0.00671	0.00632	0.00677	0.00727	0.00736	0.00769	0.00735	0.0074	0.00735	0.00722	0.00719	0.00722	0.00724
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00025	<0.00025	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	<0.050	<0.050	<0.010	0.010	0.012	0.012	0.012	0.011	0.011	0.010	0.011	0.011	0.011	0.011
	Cadmium (Cd)	mg/L	<0.000025	<0.000025	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	10.6	12.1	10.9	12.0	13.5	13.1	13.5	13.6	13.1	13.0	13.4	13.2	13.3	13.6
	Chromium (Cr)	mg/L	<0.00050	<0.00050	0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00050	<0.00050	<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 (Cu)	mg/L	<0.0010	<0.0010	0.00082	0.00072	0.00075	0.00071	0.00072	0.00072	0.00076	0.00072	0.0007	0.00072	0.0007	0.00072
	Iron (Fe)	mg/L	<0.050	<0.050	0.011	<0.010	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	<0.00025	<0.00025	<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 (Li)	mg/L	<0.0050	<0.0050	<0.0010	0.0010	0.0013	0.0012	0.0012	0.0013	0.0014	0.0012	0.0012	0.0012	0.0011	0.0013
	Magnesium (Mg)	mg/L	6.44	7.50	7.08	8.06	8.48	8.43	8.23	8.32	8.39	8.22	8.20	8.31	8.39	8.22
	Manganese (Mn)	mg/L	0.00226	<0.00050	0.00158	0.00056	0.000525	0.00058	0.000598	0.000451	0.000323	0.000353	0.000427	0.000399	0.000418	0.000437
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.00050	0.00065	0.000501	0.000593	0.000626	0.000665	0.000628	0.000624	0.000633	0.00062	0.000631	0.000646	0.000611	0.000651
	Nickel (Ni)	mg/L	<0.0025	<0.0025	<0.00050	0.00051	0.00052	0.00056	0.00054	0.00053	0.00052	0.00053	0.00054	0.00077	0.00053	0.00052
	Potassium (K)	mg/L	1.03	1.14	0.986	1.07	1.15	1.14	1.13	1.12	1.13	1.11	1.13	1.13	1.10	1.11
	Selenium (Se)	mg/L	<0.00025	<0.00025	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	0.64	0.40	0.592	0.407	0.41	0.40	0.40	0.40	0.41	0.41	0.39	0.40	0.40	0.40
	Silver (Ag)	mg/L	<0.000050	<0.000050	<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 (Na)	mg/L	1.37	1.50	1.40	1.55	1.76	1.7	1.72	1.75	1.75	1.71	1.68	1.72	1.72	1.68
	Strontium (Sr)	mg/L	0.0082	0.0093	0.00767	0.00850	0.0101	0.0101	0.01	0.00997	0.0102	0.01	0.0101	0.0101	0.01	0.00987
	Thallium (Tl)	mg/L	<0.000050	<0.000050	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	<0.00050	<0.00050	<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 (Ti)	mg/L	<0.0015	<0.0015	0.00038	<0.00030	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.000721	0.000923	0.000709	0.000904	0.00117	0.00118	0.00117	0.00116	0.00114	0.00115	0.00115	0.00114	0.00116	0.00116
	Vanadium (V)	mg/L	<0.0025	<0.0025	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0050	<0.0050	<0.0010	<0.0010	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.54: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Sheardown Lake Southeast and Reference Lake 3 in 2020, and at Sheardown Lake Southeast Between 2020 and the Baseline Period

Dissolved Metal	Sheardown Lake SE				
	2020 vs Reference Lake 3		2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	0.8	2.5	0.0	2.1	3.6
Antimony (Sb)	2.2	1.0	0.0	0.0	1.0
Arsenic (As)	2.2	1.0	1.0	1.9	1.0
Barium (Ba)	1.1	1.1	0.0	1.3	1.3
Beryllium (Be)	0.4	1.0	1.2	0.5	2.1
Bismuth (Bi)	0.2	1.0	1.0	0.1	1.0
Boron (B)	2.2	1.1	1.2	2.3	1.1
Cadmium (Cd)	1.1	1.0	0.4	0.0	0.8
Calcium (Ca)	1.7	1.8	1.5	1.0	1.1
Chromium (Cr)	0.4	1.0	-	2.0	-
Cobalt (Co)	2.2	1.0	1.0	2.2	0.9
Copper (Cu)	1.1	1.0	0.8	0.5	0.9
Iron (Fe)	0.8	1.0	1.2	1.0	1.7
Lead (Pb)	2.2	1.0	0.6	2.2	1.0
Lithium (Li)	2.2	1.2	0.3	0.1	0.5
Magnesium (Mg)	1.8	1.7	1.6	1.1	1.2
Manganese (Mn)	3.3	3.3	0.5	0.0	0.7
Mercury (Hg)	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	4.4	4.1	3.6	0.0	3.1
Nickel (Ni)	2.2	1.1	1.2	1.2	1.0
Potassium (K)	1.2	1.2	1.1	1.0	0.9
Selenium (Se)	0.1	1.0	-	1.1	-
Silicon (Si)	1.0	0.8	1.5	1.1	1.0
Silver (Ag)	2.2	1.0	1.2	-	2.7
Sodium (Na)	1.6	1.7	1.5	1.2	1.3
Strontium (Sr)	1.0	1.2	2.1	1.2	1.3
Thallium (Tl)	0.2	1.0	1.2	0.3	2.6
Tin (Sn)	2.2	1.0	0.1	0.4	0.1
Titanium (Ti)	0.1	1.0	1.0	0.1	1.0
Uranium (U)	2.8	3.5	2.8	1.9	2.3
Vanadium (V)	1.1	1.0	1.0	1.1	1.0
Zinc (Zn)	0.8	1.0	1.5	0.8	1.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.55: *In Situ* Water Quality Measurements Collected at Mary River Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Study Area	Station	Date Sampled	Temperature (°C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Saturation)	pH (pH units)	Specific Conductance (µS/cm)
Mary River Upstream (GO-09)	GO-09 B1	10-Aug-20	10.5	10.09	95.6	8.25	208.9
	GO-09 B2	10-Aug-20	10.0	10.28	96.3	8.24	195.1
	GO-09 B3	10-Aug-20	9.5	10.43	96.7	8.20	194.1
	GO-09 B4	10-Aug-20	9.3	10.72	100.4	8.25	194.7
	GO-09 B5	10-Aug-20	9.0	10.73	98.1	8.07	180.5
Mary River Upstream (GO-03)	GO-03 B1	10-Aug-20	11.6	9.41	90.9	8.15	191.0
	GO-03 B2	10-Aug-20	11.0	9.55	91.4	8.13	191.0
	GO-03 B3	10-Aug-20	11.2	9.75	93.0	7.99	191.7
	GO-03 B4	10-Aug-20	11.1	10.01	95.3	7.99	192.0
	GO-03 B5	10-Aug-20	10.8	10.05	95.2	8.17	192.1
Mary River Downstream (EO-01)	EO-01 B1	13-Aug-20	5.1	12.49	98.0	8.25	225.3
	EO-01 B2	13-Aug-20	5.1	12.53	98.4	8.26	225.4
	EO-01 B3	13-Aug-20	5.0	12.57	98.4	8.24	225.3
	EO-01 B4	11-Aug-20	9.5	11.14	97.6	8.26	216.0
	EO-01 B5	11-Aug-20	9.4	11.16	97.4	8.27	216.2
Mary River Downstream (EO-20)	EO-20 B1	11-Aug-20	9.6	11.49	100.6	8.36	218.7
	EO-20 B2	11-Aug-20	9.3	11.52	100.4	8.28	219.4
	EO-20 B3	11-Aug-20	9.1	11.52	99.9	8.24	219.1
	EO-20 B4	11-Aug-20	8.9	11.58	100.1	8.71	219.1
	EO-20 B5	11-Aug-20	8.6	11.69	99.8	8.27	218.9
Mary River Downstream (CO-05)	CO-05 B1	11-Aug-20	8.9	11.68	100.7	8.12	208.7
	CO-05 B2	11-Aug-20	8.5	11.68	100.1	8.19	209.3
	CO-05 B3	11-Aug-20	8.2	11.68	99.2	8.16	209.8
	CO-05 B4	11-Aug-20	7.9	11.66	98.0	8.14	209.9
	CO-05 B5	11-Aug-20	8.1	11.61	93.3	8.06	209.9

Table C.56: ***In Situ*** **Water Quality Summary for Mary River Benthic Invertebrate Community Study Areas, Mary River Project CREMP, August 2020**

Metric	Station	Sample Size	Mean	Standard Deviation	Standard Error	95% Confidence Interval		Minimum	Maximum
						Lower Bound	Upper Bound		
Temperature (˚C)	GO-09	5	9.66	0.59	0.27	9.22	10.10	9.00	10.50
	GO-03	5	11.14	0.30	0.13	10.92	11.36	10.80	11.60
	EO-01	5	6.82	2.40	1.07	5.05	8.59	5.00	9.50
	EO-20	5	9.10	0.38	0.17	8.82	9.38	8.60	9.60
	CO-05	5	8.32	0.39	0.17	8.03	8.61	7.90	8.90
Dissolved Oxygen (mg/L)	GO-09	5	10.5	0.3	0.1	10.2	10.7	10.1	10.7
	GO-03	5	9.8	0.3	0.1	9.5	10.0	9.4	10.1
	EO-01	5	12.0	0.8	0.3	11.4	12.5	11.1	12.6
	EO-20	5	11.6	0.1	0.0	11.5	11.6	11.5	11.7
	CO-05	5	11.7	0.0	0.0	11.6	11.7	11.6	11.7
Dissolved Oxygen (% saturation)	GO-09	5	97.4	1.9	0.8	96.0	98.8	95.6	100.4
	GO-03	5	93.2	2.1	0.9	91.6	94.7	90.9	95.3
	EO-01	5	98.0	0.5	0.2	97.6	98.3	97.4	98.4
	EO-20	5	100.2	0.3	0.2	99.9	100.4	99.8	100.6
	CO-05	5	98.3	3.0	1.3	96.1	100.4	93.3	100.7
pH (pH units)	GO-09	5	8.20	0.08	0.03	8.15	8.26	8.07	8.25
	GO-03	5	8.09	0.09	0.04	8.02	8.15	7.99	8.17
	EO-01	5	8.26	0.01	0.01	8.25	8.26	8.24	8.27
	EO-20	5	8.37	0.19	0.09	8.23	8.51	8.24	8.71
	CO-05	5	8.13	0.05	0.02	8.10	8.17	8.06	8.19
Specific Conductance (µS/cm)	GO-09	5	194.7	10.0	4.5	187.3	202.1	180.5	208.9
	GO-03	5	191.6	0.5	0.2	191.2	192.0	191.0	192.1
	EO-01	5	221.6	5.1	2.3	217.9	225.4	216.0	225.4
	EO-20	5	219.0	0.3	0.1	218.8	219.2	218.7	219.4
	CO-05	5	209.5	0.5	0.2	209.1	209.9	208.7	209.9

Table C.57: Statistical Comparison of *In Situ* Water Quality Variables Among Mary River Benthic Invertebrate Community Study Areas, Mary River Project CREMP, August 2020

In Situ Variable	Overall 5-group Comparison				Pair-wise, *post hoc* comparisons[a]			
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	(I) Area	(J) Area	Significant Difference Between Areas?	P-value
Temperature (˚C)	K-W	rank	YES	0.00200	GO-09	GO-03	NO	0.132
					GO-09	EO-01	YES	0.068
					GO-09	EO-20	NO	0.414
					GO-09	CO-05	YES	0.037
					GO-03	EO-01	YES	<0.001
					GO-03	EO-20	YES	0.02
					GO-03	CO-05	YES	<0.001
					EO-01	EO-20	NO	0.312
					EO-01	CO-05	NO	0.796
					EO-20	CO-05	NO	0.205
Dissolved Oxygen (mg/L)	ANOVA	none	YES	0.00100	GO-09	GO-03	YES	0.064
					GO-09	EO-01	YES	<0.001
					GO-09	EO-20	YES	0.002
					GO-09	CO-05	YES	<0.001
					GO-03	EO-01	YES	<0.001
					GO-03	EO-20	YES	<0.001
					GO-03	CO-05	YES	<0.001
					EO-01	EO-20	NO	0.443
					EO-01	CO-05	NO	0.693
					EO-20	CO-05	NO	0.993
Dissolved Oxygen (% Saturation)	ANOVA	none	YES	0.001	GO-09	GO-03	YES	0.012
					GO-09	EO-01	NO	0.99
					GO-09	EO-20	NO	0.168
					GO-09	CO-05	NO	0.949
					GO-03	EO-01	YES	0.004
					GO-03	EO-20	YES	<0.001
					GO-03	CO-05	YES	0.002
					EO-01	EO-20	NO	0.353
					EO-01	CO-05	NO	0.999
					EO-20	CO-05	NO	0.494
pH (pH units)	K-W	rank	YES	0.001	GO-09	GO-03	NO	0.111
					GO-09	EO-01	NO	0.236
					GO-09	EO-20	YES	0.061
					GO-09	CO-05	NO	0.212
					GO-03	EO-01	YES	0.005
					GO-03	EO-20	YES	<0.001
					GO-03	CO-05	NO	0.73
					EO-01	EO-20	NO	0.491
					EO-01	CO-05	YES	0.015
					EO-20	CO-05	YES	0.002
Specific Conductance (uS/cm)	K-W	rank	YES	0.001	GO-09	GO-03	NO	0.491
					GO-09	EO-01	YES	0.003
					GO-09	EO-20	YES	0.006
					GO-09	CO-05	NO	0.229
					GO-03	EO-01	YES	<0.001
					GO-03	EO-20	YES	<0.001
					GO-03	CO-05	YES	0.058
					EO-01	EO-20	NO	0.83
					EO-01	CO-05	YES	0.078
					EO-20	CO-05	NO	0.122

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table C.58: Water Chemistry at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Spring Sampling Event												
					G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01
					04-Jul-20	04-Jul-20	04-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20
Conventionals	Conductivity (lab)	umho/cm	-	-	72.0	67.2	44.4	47.7	43.2	108	78.5	45.4	42.7	43.4	46.8	70.9	54.7
	pH (lab)	pH	6.5 - 9.0	-	7.83	7.83	7.55	7.64	7.63	7.89	7.83	7.66	7.65	7.54	7.65	7.73	7.61
	Hardness (as $CaCO_3$)	mg/L	-	-	32.5	31.7	19	20.7	19.3	49.9	35.3	20.8	19.7	20.2	19.3	32.2	23.6
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	18.5	10.6	9.8	9.0	8.3	8.8	7.7	6.3	7.4	9.4
	Total Dissolved Solids (TDS)	mg/L	-	-	60	69	70	79	53	90	88	69	72	67	65	77	77
	Turbidity	NTU	-	-	1.17	2.60	9.05	7.76	6.81	2.19	4.37	6.91	7.11	6.79	7.72	7.43	10.2
	Alkalinity (as $CaCO_3$)	mg/L	-	-	35	32	21	22	20	39	47	21	20	21	19	29	24
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<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
	Nitrate	mg/L	3	3	<0.020	<0.020	0.022	0.040	<0.020	0.187	0.099	0.031	0.023	0.020	0.163	0.061	0.042
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	1.84	1.56	1.50	2.19	2.34	2.12	2.55	2.11	2.14	2.15	2.15	2.27	2.12
	Total Organic Carbon	mg/L	-	-	2.55	2.12	2.03	2.71	2.77	2.94	2.68	3.00	2.95	3.15	3.16	3.44	3.18
	Total Phosphorus	mg/L	0.030[α]	-	0.0205	0.0036	0.0122	0.0609	0.0504	0.0377	0.0681	0.0266	0.0676	0.0295	0.0189	0.0665	0.0240
	Phenols	mg/L	0.004[α]	-	0.0025	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	0.0012	<0.0010	0.0013	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<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
	Chloride (Cl)	mg/L	120	120	1.05	0.94	1.11	2.07	1.04	1.34	1.26	1.01	0.98	0.95	0.99	1.77	1.30
	Sulphate (SO_4)	mg/L	218[β]	218	0.67	0.73	0.65	0.63	0.53	11.8	6.67	2.00	1.58	1.36	2.36	3.44	1.97
Total Metals	Aluminum (Al)	mg/L	0.100	0.966	0.0551	0.112	0.197	0.241	0.219	0.170	0.234	0.196	0.221	0.213	0.212	0.155	0.244
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	0.00012	<0.00010	0.00013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00462	0.00530	0.00474	0.00567	0.00467	0.00544	0.00529	0.00465	0.00467	0.00458	0.00447	0.00556	0.00532
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	***0.000064***	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000011	<0.000010
	Calcium (Ca)	mg/L	-	-	6.95	7.30	4.21	5.47	4.10	9.35	6.90	4.24	3.94	3.98	3.94	6.62	4.90
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	0.00064	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	0.00022	0.00011	0.00016	0.00013	0.00011	0.00010	<0.00010	<0.00010	0.00011	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00056	***0.00670***	0.00092	0.00109	0.00079	0.00051	0.00065	0.00075	0.00073	0.00074	0.00072	0.00106	0.00065
	Iron (Fe)	mg/L	0.30	0.874	<0.030	0.102	0.181	0.363	0.199	0.202	0.232	0.192	0.180	0.198	0.181	0.179	0.184
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	0.000387	0.000260	0.000447	0.000236	0.000212	0.000184	0.000219	0.000214	0.000216	0.000214	0.000235	0.000159
	Magnesium (Mg)	mg/L	-	-	4.06	3.66	2.43	2.75	2.42	6.67	4.68	2.75	2.50	2.60	2.48	4.00	3.26
	Manganese (Mn)	mg/L	0.935[β]	-	0.000824	0.00299	0.00376	0.00922	0.00514	0.00905	0.00669	0.00477	0.00405	0.00410	0.00401	0.00686	0.00415
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000068	0.000087	0.000060	<0.000050	0.000053	0.000099	0.000088	0.000053	0.000070	0.000074	0.000076	0.000176	0.000091
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00338	<0.00050	0.00063	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00061	0.00057
	Potassium (K)	mg/L	-	-	0.53	0.76	0.53	0.52	0.50	0.65	0.58	0.49	0.49	0.49	0.49	0.66	0.62
	Selenium (Se)	mg/L	0.001	-	<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
	Silicon (Si)	mg/L	-	-	0.67	0.66	0.73	0.74	0.78	0.64	0.81	0.69	0.79	0.78	0.74	0.64	0.87
	Sodium (Na)	mg/L	-	-	0.783	1.02	0.818	0.601	0.657	0.439	0.543	0.580	0.569	0.580	0.597	0.902	0.789
	Strontium (Sr)	mg/L	-	-	0.00571	0.00584	0.00465	0.00505	0.00419	0.00994	0.00745	0.00456	0.00426	0.00409	0.00403	0.00565	0.00475
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	mg/L	-	-	<0.00010	0.00101	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	0.010	0.017	0.012	0.011	0.014	0.010	0.011	0.011	0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.000441	0.000389	0.000304	0.000358	0.000274	0.000349	0.000328	0.000265	0.000245	0.000241	0.000242	0.000462	0.000210
	Vanadium (V)	mg/L	0.006[α]	0.006	<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
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	***0.0320***	0.0033	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0041	<0.0030

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Mary River system.

Table C.58: Water Chemistry at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event												
					G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01
					03-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	31-Jul-20	31-Jul-20	31-Jul-20
Conventionals	Conductivity (lab)	umho/cm	-	-	189	190	180	169	173	345	177	179	179	178	178	174	176
	pH (lab)	pH	6.5 - 9.0	-	8.22	8.23	8.22	8.09	8.18	8.30	8.18	8.16	8.17	8.17	8.25	8.21	8.19
	Hardness (as $CaCO_3$)	mg/L	-	-	84.4	83.2	75.7	73	75.5	166	78.3	76.9	77.2	76.4	75	75.1	75.7
	Total Suspended Solids (TSS)	mg/L	-	-	6.8	21.2	9.8	13.6	6.9	<2.0	8.2	11.5	16.1	14.1	9.1	17.9	18.3
	Total Dissolved Solids (TDS)	mg/L	-	-	114	93	83	95	110	190	116	113	121	112	106	107	107
	Turbidity	NTU	-	-	16.3	37.2	25.5	45.6	23.3	0.41	30.4	40.6	43.2	40.0	21.8	33.2	33.5
	Alkalinity (as $CaCO_3$)	mg/L	-	-	84	80	76	72	84	122	86	87	82	78	84	81	82
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.139	0.156	0.145	0.124	0.078	0.714	0.106	0.129	0.133	0.165	0.164	0.173	0.175
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	0.16	<0.15	<0.15	<0.15	0.32	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	3.68	4.53	3.81	4.31	3.70	1.69	4.04	3.95	1.87	2.23	2.20	2.53	2.94
	Total Organic Carbon	mg/L	-	-	2.9	2.5	3.4	<2.5	3.02	2.74	3.12	3.35	3.17	3.32	3.06	3.32	3.41
	Total Phosphorus	mg/L	0.020[α]	-	0.0220	0.0243	0.0182	0.0316	0.0133	<0.0030	0.0180	0.0253	0.0275	0.0251	0.0203	0.0241	0.0246
	Phenols	mg/L	0.004[α]	-	<0.0010	0.0013	0.0012	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0010
Anions	Bromide (Br)	mg/L	-	-	<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
	Chloride (Cl)	mg/L	120	120	9.45	8.36	8.94	8.08	7.48	13.7	7.68	7.78	7.77	7.31	7.43	7.57	7.54
	Sulphate (SO_4)	mg/L	218[β]	218	5.69	5.19	5.63	4.76	4.95	36.0	5.95	6.45	6.97	6.38	6.28	6.14	5.93
Total Metals	Aluminum (Al)	mg/L	0.100	0.966	0.868	**1.27**	**1.00**	**1.77**	0.889	0.0337	**1.19**	**1.51**	**1.56**	0.0243	0.846	**1.21**	**1.55**
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	0.00018	0.00025	0.00020	0.00030	0.00019	<0.00010	0.00022	0.00028	0.00027	<0.00010	0.00019	0.00026	0.00024
	Barium (Ba)	mg/L	-	-	0.0155	0.0171	0.0152	0.0204	0.0151	0.0165	0.0161	0.0185	0.0191	0.0102	0.0145	0.0173	0.0151
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	0.0000063	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000121	0.0000096	<0.0000050	0.0000056	<0.0000050	0.0000060
	Calcium (Ca)	mg/L	-	-	16.4	16.7	15.0	14.9	14.1	29.4	15.0	15.4	15.6	15.5	14.4	15.7	15.5
	Chromium (Cr)	mg/L	0.0089	0.0089	0.00167	0.00256	0.00171	0.00356	0.00163	<0.00050	0.00218	0.00306	0.00325	<0.00050	0.00142	0.00270	0.00142
	Cobalt (Co)	mg/L	0.0009[α]	0.004	0.00034	0.00056	0.00036	0.00074	0.00034	<0.00010	0.00044	0.00064	0.00069	<0.00010	0.00031	0.00058	0.00034
	Copper (Cu)	mg/L	0.002	0.0024	0.0019	0.0024	0.0019	**0.0030**	0.0019	<0.0010	0.0022	**0.0029**	**0.0031**	<0.0010	0.0018	**0.0025**	0.0021
	Iron (Fe)	mg/L	0.30	0.874	0.748	**1.22**	0.855	**1.71**	0.719	0.028	**1.01**	**1.44**	**1.38**	0.013	0.660	**1.34**	0.759
	Lead (Pb)	mg/L	0.001	0.001	0.000587	0.000934	0.000661	**0.00125**	0.000532	<0.000050	0.000745	**0.00105**	**0.00117**	<0.000050	0.000497	0.000936	0.000798
	Magnesium (Mg)	mg/L	-	-	9.03	9.37	8.63	8.68	8.92	21.4	8.81	9.32	9.44	8.90	9.12	9.19	8.91
	Manganese (Mn)	mg/L	0.935[β]	-	0.00948	0.0160	0.0101	0.0201	0.00919	0.00103	0.0119	0.0180	0.0188	<0.00050	0.00914	0.0173	0.0132
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	0.0000051	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000458	0.000399	0.000434	0.000398	0.000360	0.000491	0.000382	0.000574	0.000597	0.000647	0.000453	0.000484	0.000263
	Nickel (Ni)	mg/L	0.025	0.025	0.00121	0.00180	0.00130	0.00253	0.00154	0.00057	0.00166	0.00234	0.00279	0.00051	0.00134	0.00220	0.00147
	Potassium (K)	mg/L	-	-	1.62	1.69	1.63	1.84	1.58	1.81	1.61	1.78	1.83	1.26	1.50	1.69	1.48
	Selenium (Se)	mg/L	0.001	-	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000070	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)	mg/L	-	-	1.93	2.72	2.11	3.56	1.85	1.00	2.35	3.09	3.00	0.74	1.86	3.51	1.73
	Sodium (Na)	mg/L	-	-	4.94	4.29	4.58	3.98	4.02	3.23	3.75	3.94	3.88	3.66	3.82	3.89	4.01
	Strontium (Sr)	mg/L	-	-	0.0225	0.0211	0.0207	0.0202	0.0173	0.0414	0.0189	0.0200	0.0206	0.0181	0.0178	0.0204	0.0193
	Thallium (Tl)	mg/L	0.0008	0.0008	0.000021	0.000030	0.000021	0.000041	0.000021	<0.000010	0.000025	0.000032	0.000037	<0.000010	0.000019	0.000034	0.000024
	Tin (Sn)	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
	Titanium (Ti)	mg/L	-	-	0.0518	0.0837	0.0593	0.112	0.0526	0.00167	0.0694	0.0932	0.0970	0.00070	0.0534	0.0756	0.0944
	Uranium (U)	mg/L	0.015	-	0.00584	0.00522	0.00509	0.00420	0.00389	0.00369	0.00400	0.00407	0.00414	0.00336	0.00334	0.00374	0.00382
	Vanadium (V)	mg/L	0.006[α]	0.006	0.00161	0.00240	0.00176	0.00327	0.00167	<0.00050	0.00202	0.00276	0.00294	<0.00050	0.00142	0.00242	0.00150
	Zinc (Zn)	mg/L	0.030	0.030	0.0197	0.0032	<0.0030	0.0044	<0.0030	<0.0030	<0.0030	0.0061	0.0043	<0.0030	<0.0030	0.0032	<0.0030

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.
BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Mary River system.

Table C.58: Water Chemistry at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Fall Sampling Event												
					G0-09-A	G0-09	G0-09-B	G0-03	GO-01	F0-01	E0-10	EO-03	EO-21	EO-20	C0-10	C0-05	CO-01
					28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	252	250	243	226	229	403	259	240	240	240	239	232	232
	pH (lab)	pH	6.5 - 9.0	-	8.34	8.37	8.29	8.75	8.20	8.32	8.22	8.13	8.20	8.20	8.21	8.14	8.16
	Hardness (as $CaCO_3$)	mg/L	-	-	126	123	110	104	108	211	127	114	114	114	112	113	110
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	2.4	3.6	2.0	<2.0	<2.0	3.2	<2.0	2.8	2.0	<2.0	2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	134	127	127	113	124	224	126	123	131	132	124	122	134
	Turbidity	NTU	-	-	0.36	3.06	4.96	4.16	5.21	0.61	4.61	6.18	6.97	6.89	4.26	3.05	2.70
	Alkalinity (as $CaCO_3$)	mg/L	-	-	111	105	94	89	92	132	100	95	93	93	95	94	93
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<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
	Nitrate	mg/L	3	3	0.026	0.103	0.180	0.161	0.164	1.09	0.324	0.230	0.228	0.252	0.240	0.216	0.230
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	0.16	0.15	<0.15	0.22	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.55	2.62	2.59	2.42	2.23	1.96	2.35	2.26	1.84	2.16	2.15	2.50	2.11
	Total Organic Carbon	mg/L	-	-	2.55	2.30	2.31	2.22	2.28	2.27	2.11	2.38	2.44	2.27	2.41	2.83	2.45
	Total Phosphorus	mg/L	0.020^{α}	-	<0.0030	0.0035	0.0036	<0.0030	0.0046	<0.0030	<0.0030	0.0035	0.0057	0.0063	0.0074	0.0045	0.0101
	Phenols	mg/L	0.004^{α}	-	<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
Anions	Bromide (Br)	mg/L	-	-	<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
	Chloride (Cl)	mg/L	120	120	9.45	11.6	14.4	13.5	12.9	11.7	12.7	13.0	13.0	12.1	11.9	11.6	11.5
	Sulphate (SO_4)	mg/L	218^{β}	218	4.96	7.03	7.99	6.90	7.08	60.7	16.4	10.7	10.7	10.5	10.3	10.1	10.7
Total Metals	Aluminum (Al)	mg/L	0.100	0.966	0.0116	0.107	0.143	0.154	0.141	0.0407	0.148	0.181	0.196	0.166	0.144	0.113	0.107
	Antimony (Sb)	mg/L	0.020^{α}	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0134	0.0140	0.0145	0.0144	0.0151	0.0179	0.0159	0.0155	0.0159	0.0157	0.0152	0.0143	0.0149
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	24.8	24.7	22.2	21.1	21.6	36.7	24.7	22.7	22.6	22.5	22.6	21.6	21.4
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<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 (Co)	mg/L	0.0009^{α}	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00017	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.002	0.0024	0.00085	0.00102	0.00123	0.00115	0.00121	0.00086	0.00117	0.00124	0.00130	0.00130	0.00112	0.00107	0.00107
	Iron (Fe)	mg/L	0.30	0.874	<0.030	0.084	0.127	0.118	0.132	0.050	0.133	0.178	0.200	0.191	0.132	0.104	0.097
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	0.000084	0.000130	0.000121	0.000147	<0.000050	0.000130	0.000172	0.000195	0.000190	0.000120	0.000087	0.000077
	Magnesium (Mg)	mg/L	-	-	13.9	13.4	12.5	12.4	12.4	27.8	15.2	13.1	13.5	13.4	13.2	13.2	13.0
	Manganese (Mn)	mg/L	0.935^{β}	-	0.000498	0.00133	0.00202	0.00169	0.00180	0.00182	0.00197	0.00232	0.00266	0.00275	0.00204	0.00266	0.00246
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000313	0.000447	0.000544	0.000508	0.000470	0.000408	0.000485	0.000625	0.000636	0.000607	0.000595	0.000581	0.000584
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	0.00051	0.00060	0.00063	0.00075	0.00068	0.00074	0.00072
	Potassium (K)	mg/L	-	-	1.30	1.44	1.61	1.51	1.49	1.69	1.53	1.53	1.59	1.53	1.51	1.45	1.46
	Selenium (Se)	mg/L	0.001	-	<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
	Silicon (Si)	mg/L	-	-	0.88	0.94	1.03	0.98	0.98	1.09	1.07	1.22	1.08	1.07	1.03	0.96	0.91
	Sodium (Na)	mg/L	-	-	4.77	5.77	6.95	5.87	5.74	3.39	5.46	5.63	5.77	5.41	5.38	5.15	5.10
	Strontium (Sr)	mg/L	-	-	0.0228	0.0259	0.0270	0.0246	0.0241	0.0373	0.0261	0.0259	0.0263	0.0244	0.0248	0.0228	0.0234
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	0.012	0.011	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00673	0.00720	0.00776	0.00654	0.00645	0.00483	0.00614	0.00631	0.00615	0.00576	0.00562	0.00532	0.00511
	Vanadium (V)	mg/L	0.006^{α}	0.006	<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
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	***0.0494***	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

[shaded] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to the Mary River system.

Table C.59: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between Mary River Mine-Exposed and Reference (GO-09) Stations in 2020

Variable	Spring										Summer									
	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01
Conductivity (lab)	0.8	0.7	1.8	1.3	0.7	0.7	0.7	0.8	1.2	0.9	0.9	0.9	1.9	0.9	1.0	1.0	1.0	1.0	0.9	0.9
Hardness (as $CaCO_3$)	0.7	0.7	1.8	1.3	0.8	0.7	0.7	0.7	1.2	0.9	0.9	0.9	2.0	1.0	0.9	1.0	0.9	0.9	0.9	0.9
Total Suspended Solids (TSS)	9.3	5.3	4.9	4.5	4.2	4.4	3.9	3.2	3.7	4.7	1.1	0.5	0.2	0.7	0.9	1.3	1.1	0.7	1.4	1.5
Total Dissolved Solids (TDS)	1.2	0.8	1.4	1.3	1.0	1.1	1.0	1.0	1.2	1.2	1.0	1.1	2.0	1.2	1.2	1.3	1.2	1.1	1.1	1.1
Turbidity	1.8	1.6	0.5	1.0	1.6	1.7	1.6	1.8	1.7	2.4	1.7	0.9	0.0	1.2	1.5	1.6	1.5	0.8	1.3	1.3
Alkalinity (as $CaCO_3$)	0.8	0.7	1.3	1.6	0.7	0.7	0.7	0.6	1.0	0.8	0.9	1.1	1.5	1.1	1.1	1.0	1.0	1.1	1.0	1.0
Total Ammonia	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Nitrate	1.9	1.0	9.0	4.8	1.5	1.1	1.0	7.9	3.0	2.0	0.8	0.5	4.9	0.7	0.9	0.9	1.1	1.1	1.2	1.2
Nitrite	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Kjeldahl Nitrogen (TKN)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Dissolved Organic Carbon	1.3	1.4	1.3	1.6	1.3	1.3	1.3	1.3	1.4	1.3	1.1	0.9	0.4	1.0	1.0	0.5	0.6	0.5	0.6	0.7
Total Organic Carbon	1.2	1.2	1.3	1.2	1.3	1.3	1.4	1.4	1.5	1.4	0.9	1.0	0.9	1.1	1.1	1.1	1.1	1.0	1.1	1.2
Total Phosphorus	5.0	4.2	3.1	5.6	2.2	5.6	2.4	1.6	5.5	2.0	1.5	0.6	0.1	0.8	1.2	1.3	1.2	0.9	1.1	1.1
Phenols	0.7	0.7	0.7	0.7	1.1	0.8	0.7	0.9	0.7	0.7	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Bromide (Br)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride (Cl)	2.0	1.0	1.3	1.2	1.0	0.9	0.9	1.0	1.7	1.3	0.9	0.8	1.5	0.9	0.9	0.9	0.8	0.8	0.8	0.8
Sulphate (SO_4)	0.9	0.8	17	9.8	2.9	2.3	2.0	3.5	5.0	2.9	0.9	0.9	6.5	1.1	1.2	1.3	1.2	1.1	1.1	1.1
Aluminum (Al)	2.0	1.8	1.4	1.9	1.6	1.8	1.8	1.7	1.3	2.0	1.7	0.8	0.0	1.1	1.4	1.5	0.0	0.8	1.2	1.5
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.2	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.4	0.9	0.5	1.0	1.3	1.3	0.5	0.9	1.2	1.1
Barium (Ba)	1.2	1.0	1.1	1.1	1.0	1.0	0.9	0.9	1.1	1.1	1.3	0.9	1.0	1.0	1.2	1.2	0.6	0.9	1.1	0.9
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.9	0.9	0.9	0.9	2.2	1.8	0.9	1.0	0.9	1.1
Calcium (Ca)	0.9	0.7	1.5	1.1	0.7	0.6	0.6	0.6	1.1	0.8	0.9	0.9	1.8	0.9	1.0	1.0	1.0	0.9	1.0	1.0
Chromium (Cr)	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.8	0.8	0.3	1.1	1.5	1.6	0.3	0.7	1.4	0.7
Cobalt (Co)	2.2	1.1	1.6	1.3	1.1	1.0	1.0	1.0	1.1	1.0	1.8	0.8	0.2	1.0	1.5	1.6	0.2	0.7	1.4	0.8
Copper (Cu)	0.4	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.2	1.5	0.9	0.5	1.1	1.4	1.5	0.5	0.9	1.2	1.0
Iron (Fe)	3.5	1.9	1.9	2.2	1.8	1.7	1.9	1.7	1.7	1.8	1.8	0.8	0.0	1.1	1.5	1.5	0.0	0.7	1.4	0.8
Lead (Pb)	1.9	1.0	0.9	0.8	0.9	0.9	0.9	0.9	1.0	0.7	1.7	0.7	0.1	1.0	1.4	1.6	0.1	0.7	1.3	1.1
Lithium (Li)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.6	0.8	1.3	1.0	1.4	1.4	0.5	0.8	1.4	0.9
Magnesium (Mg)	0.8	0.7	2.0	1.4	0.8	0.7	0.8	0.7	1.2	1.0	1.0	1.0	2.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Manganese (Mn)	3.7	2.0	3.6	2.6	1.9	1.6	1.6	1.6	2.7	1.6	1.7	0.8	0.1	1.0	1.5	1.6	0.0	0.8	1.5	1.1
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	0.7	0.7	1.4	1.2	0.7	1.0	1.0	1.1	2.5	1.3	0.9	0.8	1.1	0.9	1.3	1.4	1.5	1.1	1.1	0.6
Nickel (Ni)	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	1.8	1.1	0.4	1.2	1.6	1.9	0.4	0.9	1.5	1.0
Potassium (K)	0.9	0.8	1.1	1.0	0.8	0.8	0.8	0.8	1.1	1.0	1.1	1.0	1.1	1.0	1.1	1.1	0.8	0.9	1.0	0.9
Selenium (Se)	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	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	1.1	1.1	0.9	1.2	1.0	1.2	1.1	1.1	0.9	1.3	1.6	0.8	0.4	1.0	1.4	1.3	0.3	0.8	1.6	0.8
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	0.7	0.8	0.5	0.6	0.7	0.7	0.7	0.7	1.0	0.9	0.9	0.9	0.7	0.8	0.9	0.8	0.8	0.8	0.8	0.9
Strontium (Sr)	0.9	0.8	1.8	1.4	0.8	0.8	0.8	0.7	1.0	0.9	0.9	0.8	1.9	0.9	0.9	1.0	0.8	0.8	1.0	0.9
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7	0.9	0.4	1.0	1.3	1.5	0.4	0.8	1.4	1.0
Tin (Sn)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.7	1.2	1.1	1.4	1.0	1.1	1.1	1.0	1.0	1.0	1.7	0.8	0.0	1.1	1.4	1.5	0.0	0.8	1.2	1.5
Uranium (U)	0.9	0.7	0.9	0.9	0.7	0.6	0.6	0.6	1.2	0.6	0.8	0.7	0.7	0.7	0.8	0.8	0.6	0.6	0.7	0.7
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.7	0.9	0.3	1.1	1.4	1.5	0.3	0.7	1.3	0.8
Zinc (Zn)	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.5	0.3	0.3	0.3	0.7	0.5	0.3	0.3	0.4	0.3

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Table C.59: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Data Provided) Between Mary River Mine-Exposed and Reference (GO-09) Stations in 2020

Variable	Fall									
	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01
Conductivity (lab)	0.9	0.9	1.6	1.0	1.0	1.0	1.0	1.0	0.9	0.9
Hardness (as $CaCO_3$)	0.9	0.9	1.8	1.1	1.0	1.0	1.0	0.9	0.9	0.9
Total Suspended Solids (TSS)	1.7	0.9	0.9	0.9	1.5	0.9	1.3	0.9	0.9	0.9
Total Dissolved Solids (TDS)	0.9	1.0	1.7	1.0	1.0	1.0	1.0	1.0	0.9	1.0
Turbidity	1.5	1.9	0.2	1.7	2.2	2.5	2.5	1.5	1.1	1.0
Alkalinity (as $CaCO_3$)	0.9	0.9	1.3	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Total Ammonia	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	1.0
Nitrate	1.6	1.6	11	3.1	2.2	2.2	2.4	2.3	2.1	2.2
Nitrite	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Total Kjeldahl Nitrogen (TKN)	1.0	1.0	1.1	1.0	1.0	1.5	1.0	1.0	1.0	1.0
Dissolved Organic Carbon	0.9	0.9	0.8	0.9	0.9	0.7	0.8	0.8	1.0	0.8
Total Organic Carbon	0.9	1.0	1.0	0.9	1.0	1.0	1.0	1.0	1.2	1.0
Total Phosphorus	0.9	1.4	0.9	0.9	1.0	1.7	1.9	2.2	1.3	3.0
Phenols	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bromide (Br)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Chloride (Cl)	1.1	1.1	1.0	1.1	1.1	1.1	1.0	1.0	1.0	1.0
Sulphate (SO_4)	1.0	1.1	9.1	2.5	1.6	1.6	1.6	1.5	1.5	1.6
Aluminum (Al)	1.8	1.6	0.5	1.7	2.1	2.2	1.9	1.7	1.3	1.2
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	1.0	1.1	1.3	1.1	1.1	1.1	1.1	1.1	1.0	1.1
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium (Ca)	0.9	0.9	1.5	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.7	1.0	1.0	1.0	1.1	1.0	1.0	1.0
Copper (Cu)	1.1	1.2	0.8	1.1	1.2	1.3	1.3	1.1	1.0	1.0
Iron (Fe)	1.5	1.6	0.6	1.7	2.2	2.5	2.4	1.6	1.3	1.2
Lead (Pb)	1.4	1.7	0.6	1.5	2.0	2.2	2.2	1.4	1.0	0.9
Lithium (Li)	1.0	1.0	1.8	1.2	1.1	1.1	1.1	1.0	1.0	1.0
Magnesium (Mg)	0.9	0.9	2.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Manganese (Mn)	1.3	1.4	1.4	1.5	1.8	2.1	2.1	1.6	2.1	1.9
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	1.2	1.1	0.9	1.1	1.4	1.5	1.4	1.4	1.3	1.3
Nickel (Ni)	1.0	1.0	1.0	1.0	1.2	1.3	1.5	1.4	1.5	1.4
Potassium (K)	1.0	1.0	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	1.0	1.0	1.1	1.1	1.3	1.1	1.1	1.1	1.0	1.0
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	1.0	1.0	0.6	0.9	1.0	1.0	0.9	0.9	0.9	0.9
Strontium (Sr)	1.0	1.0	1.5	1.0	1.0	1.0	1.0	1.0	0.9	0.9
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.2	1.1	1.0	1.0	1.0
Uranium (U)	0.9	0.9	0.7	0.8	0.9	0.9	0.8	0.8	0.7	0.7
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	16	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).

Table C.60: Dissolved Metal Concentrations at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Spring Sampling Event													Summer Sampling Event					
			G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01	G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01
			04-Jul-20	04-Jul-20	04-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Jul-20	03-Aug-20	02-Aug-20	02-Aug-20	02-Aug-20	01-Aug-20	01-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0112	0.0172	0.0825	0.0512	0.0517	0.0099	0.0273	0.0440	0.0528	0.0456	0.0426	0.0282	0.0412	0.0291	0.0305	0.0271	0.0592	0.0325	0.0067
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00416	0.00366	0.00320	0.00334	0.00325	0.00405	0.00378	0.00314	0.00311	0.00316	0.00315	0.00418	0.00358	0.0117	0.0108	0.0105	0.0107	0.0105	0.0168
	Beryllium (Be)	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	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	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
	Cadmium (Cd)	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	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	6.75	6.76	3.86	4.26	3.98	9.23	6.55	4.11	3.92	3.98	3.90	6.22	4.69	17.3	17.6	15.6	15.2	15.6	30.8
	Chromium (Cr)	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
	Cobalt (Co)	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
	Copper (Cu)	mg/L	<0.00050	<0.00050	0.00051	0.00053	0.00058	<0.00050	<0.00050	<0.00050	0.00051	0.00054	<0.00050	0.00057	0.00063	0.00110	0.00099	0.00093	0.00090	0.00097	0.00100
	Iron (Fe)	mg/L	<0.030	<0.030	0.039	0.030	0.031	<0.030	<0.030	<0.030	<0.030	0.032	0.031	<0.030	0.031	0.015	0.013	0.011	0.034	0.013	<0.010
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000056	<0.000050	0.000055	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/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	0.0016	0.0017	0.0016	0.0016	0.0032
	Magnesium (Mg)	mg/L	3.80	3.59	2.29	2.45	2.27	6.51	4.60	2.56	2.41	2.49	2.32	4.05	2.89	9.99	9.54	8.94	8.51	8.86	21.6
	Manganese (Mn)	mg/L	0.000352	0.000291	0.000908	0.000994	0.00121	0.00240	0.00169	0.000980	0.000957	0.00123	0.00135	0.00315	0.00227	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Mercury (Hg)	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 (Mo)	mg/L	0.000078	0.000074	0.000092	0.000077	0.000077	0.000111	0.000102	0.000089	0.000103	0.000101	0.000104	0.000265	0.000161	0.000562	0.000503	0.000563	0.000487	0.000467	0.000561
	Nickel (Ni)	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	0.00054
	Potassium (K)	mg/L	0.49	0.46	0.44	0.44	0.46	0.57	0.52	0.43	0.43	0.43	0.40	0.63	0.50	1.43	1.32	1.39	1.28	1.36	1.83
	Selenium (Se)	mg/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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000082
	Silicon (Si)	mg/L	0.57	0.52	0.57	0.52	0.49	0.42	0.45	0.47	0.48	0.45	0.46	0.45	0.43	0.820	0.906	0.747	0.741	0.809	1.10
	Silver (Ag)	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	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)	mg/L	0.735	0.688	0.698	0.587	0.679	0.433	0.555	0.573	0.570	0.576	0.577	0.874	0.712	5.40	4.70	5.12	4.24	4.22	3.32
	Strontium (Sr)	mg/L	0.00571	0.00518	0.00433	0.00425	0.00402	0.00971	0.00717	0.00437	0.00419	0.00401	0.00384	0.00528	0.00444	0.0220	0.0209	0.0216	0.0194	0.0183	0.0430
	Thallium (Tl)	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	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	0.000010
	Tin (Sn)	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
	Titanium (Ti)	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	0.00092	0.00087	0.00073	0.00227	0.00086	<0.00030
	Uranium (U)	mg/L	0.000441	0.000345	0.000234	0.000224	0.000193	0.000309	0.000268	0.000193	0.000184	0.000184	0.000179	0.000381	0.000237	0.00533	0.00485	0.00491	0.00367	0.00381	0.00373
	Vanadium (V)	mg/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	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	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	0.0035	0.0021	<0.0010	0.0098	<0.0010	0.0018	<0.0010

Table C.60: Dissolved Metal Concentrations at Mary River Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Summer Sampling Event						
			E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01
			01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	31-Jul-20	31-Jul-20	31-Jul-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0276	0.0265	0.0247	0.720	0.0199	0.106	0.0308
	Antimony (Sb)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	<0.00010	<0.00010	<0.00010	0.00024	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	0.0105	0.0107	0.0109	0.0164	0.0106	0.0107	0.0106
	Beryllium (Be)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Bismuth (Bi)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Boron (B)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Cadmium (Cd)	mg/L	<0.0000050	<0.0000050	<0.0000050	0.0000081	<0.0000050	<0.0000050	<0.0000050
	Calcium (Ca)	mg/L	16.6	15.8	16.1	15.5	15.4	15.4	15.9
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	0.00173	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	0.00045	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00094	0.00090	0.00089	0.00231	0.00098	0.00115	0.00100
	Iron (Fe)	mg/L	0.013	0.013	0.012	1.03	0.011	0.084	0.020
	Lead (Pb)	mg/L	<0.000050	<0.000050	<0.000050	0.000921	<0.000050	0.000108	<0.000050
	Lithium (Li)	mg/L	0.0015	0.0012	0.0012	0.0023	0.0010	0.0014	<0.0010
	Magnesium (Mg)	mg/L	8.97	9.09	8.99	9.16	8.86	8.92	8.72
	Manganese (Mn)	mg/L	<0.00050	<0.00050	<0.00050	0.0127	<0.00050	0.00201	0.00230
	Mercury (Hg)	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.000486	0.000720	0.000781	0.000421	0.000617	0.000583	0.000585
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	0.00177	<0.00050	0.00088	0.00056
	Potassium (K)	mg/L	1.28	1.30	1.28	1.56	1.26	1.29	1.26
	Selenium (Se)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Silicon (Si)	mg/L	0.797	0.834	0.756	2.02	0.941	1.17	0.912
	Silver (Ag)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Sodium (Na)	mg/L	4.05	3.94	3.89	3.77	3.93	4.00	3.96
	Strontium (Sr)	mg/L	0.0198	0.0198	0.0202	0.0197	0.0194	0.0188	0.0193
	Thallium (Tl)	mg/L	<0.000010	<0.000010	<0.000010	0.000029	<0.000010	0.000011	<0.000010
	Tin (Sn)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Titanium (Ti)	mg/L	0.00076	0.00076	0.00081	0.0571	0.00058	0.00463	0.00107
	Uranium (U)	mg/L	0.00390	0.00373	0.00368	0.00370	0.00336	0.00331	0.00342
	Vanadium (V)	mg/L	<0.00050	<0.00050	<0.00050	0.00192	<0.00050	<0.00050	<0.00050
	Zinc (Zn)	mg/L	<0.0010	<0.0010	<0.0010	0.0030	<0.0010	0.0036	<0.0010

	Parameters	Units	Fall Sampling Event													
			G0-09-A	G0-09	G0-09-B	G0-03	GO-01	FO-01	EO-10	EO-03	EO-21	EO-20	C0-10	C0-05	CO-01
			28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0064	0.0112	0.0194	0.0199	0.0154	0.0055	0.0141	0.0223	0.0198	0.0091	0.0137	0.0650	0.0519
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.0135	0.0137	0.0141	0.0137	0.0140	0.0176	0.0148	0.0146	0.0147	0.0145	0.0140	0.0145	0.0140
	Beryllium (Be)	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
	Bismuth (Bi)	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
	Boron (B)	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
	Cadmium (Cd)	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
	Calcium (Ca)	mg/L	26.4	25.8	22.2	21.0	22.2	37.3	24.5	22.8	22.8	22.6	22.5	22.2	21.8
	Chromium (Cr)	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
	Cobalt (Co)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00015	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Copper (Cu)	mg/L	0.00102	0.00096	0.00108	0.00137	0.00106	0.00136	0.00099	0.00101	0.00105	0.00098	0.00098	0.00106	0.00100
	Iron (Fe)	mg/L	<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 (Pb)	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
	Lithium (Li)	mg/L	0.0010	0.0011	0.0011	<0.0010	0.0011	0.0022	0.0012	0.0010	0.0011	0.0011	0.0010	<0.0010	<0.0010
	Magnesium (Mg)	mg/L	14.6	14.1	13.4	12.6	12.7	28.5	15.9	13.9	13.8	13.9	13.5	14.1	13.6
	Manganese (Mn)	mg/L	0.000404	0.000268	0.000309	0.000265	0.000222	0.000634	0.000307	0.000356	0.000374	0.000477	0.000580	0.00189	0.00104
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000313	0.000481	0.000570	0.000504	0.000532	0.000415	0.000520	0.000664	0.000689	0.000673	0.000648	0.000616	0.000595
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00054	0.00052	0.00067	0.00065
	Potassium (K)	mg/L	1.36	1.49	1.61	1.48	1.49	1.69	1.53	1.54	1.55	1.50	1.48	1.52	1.44
	Selenium (Se)	mg/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
	Silicon (Si)	mg/L	0.92	0.79	0.85	0.79	0.79	1.07	0.84	0.79	0.81	0.81	0.80	0.80	0.76
	Silver (Ag)	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
	Sodium (Na)	mg/L	5.27	6.22	7.28	6.06	5.99	3.59	5.65	6.02	5.93	5.66	5.64	5.76	5.45
	Strontium (Sr)	mg/L	0.0241	0.0251	0.0275	0.0240	0.0240	0.0363	0.0275	0.0257	0.0261	0.0247	0.0247	0.0229	0.0236
	Thallium (Tl)	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
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.00662	0.00712	0.00761	0.00649	0.00625	0.00469	0.00590	0.00615	0.00604	0.00563	0.00558	0.00539	0.00514
	Vanadium (V)	mg/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
	Zinc (Zn)	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

Table C.61: Summary of the Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Mary River Mine-Exposed and Reference (GO-09) Stations in 2020

Variable	Spring										Summer										Fall									
	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01	G0-03	G0-01	FO-01	E0-10	E0-03	E0-21	E0-20	C0-10	CO-05	CO-01
Aluminum (Al)	1.4	1.4	0.3	0.7	1.2	1.4	1.2	1.2	0.8	1.1	2.0	1.1	0.2	1.0	0.9	0.9	25	0.7	3.7	1.1	1.6	1.2	0.4	1.1	1.8	1.6	0.7	1.1	5.3	4.2
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.4	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Barium (Ba)	0.9	0.9	1.1	1.0	0.9	0.8	0.9	0.9	1.1	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.3	1.1	1.1	1.1	1.1	1.0	1.1	1.0
Beryllium (Be)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Bismuth (Bi)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Calcium (Ca)	0.7	0.7	1.6	1.1	0.7	0.7	0.7	0.7	1.1	0.8	0.9	0.9	1.8	1.0	0.9	1.0	0.9	0.9	0.9	0.9	0.8	0.9	1.5	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Chromium (Cr)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cobalt (Co)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	4.5	1.0	1.0	1.0	1.0	1.0	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Copper (Cu)	1.1	1.2	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.3	0.9	1.0	1.0	0.9	0.9	0.9	2.3	1.0	1.1	1.0	1.3	1.0	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Iron (Fe)	0.9	0.9	0.9	0.9	0.9	0.9	1.0	0.9	0.9	0.9	2.6	1.0	0.8	1.0	1.0	0.9	79	0.8	6.5	1.5	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lead (Pb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	18	1.0	2.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Lithium (Li)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.9	0.9	0.7	0.7	1.4	0.6	0.8	0.6	0.9	1.0	2.1	1.1	0.9	1.0	1.0	0.9	0.9	0.9
Magnesium (Mg)	0.8	0.7	2.0	1.4	0.8	0.7	0.8	0.7	1.3	0.9	0.9	0.9	2.3	0.9	1.0	0.9	1.0	0.9	0.9	0.9	0.9	0.9	2.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0
Manganese (Mn)	1.9	2.3	4.6	3.3	1.9	1.9	2.4	2.6	6.1	4.4	1.0	1.0	1.0	1.0	1.0	1.0	25	1.0	4.0	4.6	0.8	0.7	1.9	0.9	1.1	1.1	1.5	1.8	5.8	3.2
Mercury (Hg)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Molybdenum (Mo)	0.9	0.9	1.4	1.3	1.1	1.3	1.2	1.3	3.3	2.0	0.9	0.9	1.0	0.9	1.3	1.4	0.8	1.1	1.1	1.1	1.1	1.2	0.9	1.1	1.5	1.5	1.5	1.4	1.4	1.3
Nickel (Ni)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	1.0	3.5	1.0	1.8	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.3	1.3
Potassium (K)	0.9	1.0	1.2	1.1	0.9	0.9	0.9	0.9	1.4	1.1	0.9	1.0	1.3	0.9	0.9	0.9	1.1	0.9	0.9	0.9	1.0	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Selenium (Se)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.6	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Silicon (Si)	0.9	0.9	0.8	0.8	0.8	0.9	0.8	0.8	0.8	0.8	0.9	1.0	1.3	1.0	1.0	0.9	2.5	1.1	1.4	1.1	0.9	0.9	1.3	1.0	0.9	0.9	0.9	0.9	0.9	0.9
Silver (Ag)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Sodium (Na)	0.8	1.0	0.6	0.8	0.8	0.8	0.8	0.8	1.2	1.0	0.8	0.8	0.7	0.8	0.8	0.8	0.7	0.8	0.8	0.8	1.0	1.0	0.6	0.9	1.0	0.9	0.9	0.9	0.9	0.9
Strontium (Sr)	0.8	0.8	1.9	1.4	0.9	0.8	0.8	0.8	1.0	0.9	0.9	0.9	2.0	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	1.4	1.1	1.0	1.0	1.0	1.0	0.9	0.9
Thallium (Tl)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.9	1.0	1.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Tin (Sn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Titanium (Ti)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	2.7	1.0	0.4	0.9	0.9	1.0	-	0.7	5.5	1.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	0.7	0.6	0.9	0.8	0.6	0.5	0.5	0.5	1.1	0.7	0.7	0.8	0.7	0.8	0.7	0.7	0.7	0.7	0.7	0.7	0.9	0.9	0.7	0.8	0.9	0.8	0.8	0.8	0.8	0.7
Vanadium (V)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	3.8	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.2	0.2	0.4	0.2	0.2	0.2	0.2	0.7	0.2	0.8	0.2	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).

Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).

Denotes highly elevated concentration (mean concentration≥ 10 times higher than respective mean reference or baseline period value).

Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.62: ***In Situ*** **Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Winter, Mary River Project CREMP, April 2020**

Depth (m)	Temperature (°C)										Dissolved Oxygen (mg/L)										Dissolved Oxygen (% Saturation)				
	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05
Date Collected	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20
1.0	0.3	0.9	0.1	0.0	0.3	0.3	0.0	0.3	0.2	0.1	13.11	12.93	13.52	14.67	14.40	14.77	14.57	14.63	14.78	14.95	90.0	90.6	98.7	100.2	99.2
2.0	0.1	0.1	0.0	0.2	0.2	0.1	0.0	0.2	0.0	0.1	13.09	13.32	13.44	14.58	14.66	14.93	15.09	14.55	14.87	15.02	90.0	91.6	92.3	100.3	100.6
3.0	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.3	0.2	0.2	13.03	13.24	13.32	14.58	14.55	14.86	14.82	14.40	14.66	14.81	90.1	91.2	91.7	100.4	100.3
4.0	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.4	0.3	0.3	12.89	13.20	13.23	14.48	14.38	14.82	14.74	14.25	14.57	14.68	89.6	91.4	91.7	100.0	99.4
5.0	0.5	0.5	-	0.4	0.4	0.3	0.3	0.4	0.3	0.3	12.79	13.15	-	14.36	14.21	14.78	14.65	14.21	14.53	14.56	89.0	91.3	-	99.3	98.3
6.0	0.7	0.5	-	0.4	0.4	0.3	0.4	0.4	0.4	0.4	12.62	13.11	-	14.17	14.18	15.23	14.53	14.14	14.39	14.42	88.1	91.3	-	98.1	98.2
7.0	0.7	0.7	-	0.4	0.4	-	0.5	0.4	0.4	0.4	12.48	13.01	-	14.15	14.14	-	14.37	14.08	14.32	14.37	87.4	90.9	-	98.0	98.0
8.0	0.8	0.7	-	0.4	0.4	-	0.6	0.4	0.4	0.4	12.19	12.86	-	14.10	14.08	-	14.22	14.02	14.28	14.42	85.8	90.1	-	97.7	97.6
9.0	0.9	0.8	-	0.5	0.5	-	0.7	0.4	0.4	-	11.79	12.62	-	14.01	14.02	-	14.08	13.99	14.20	-	83.3	88.7	-	97.2	97.2
10.0	1.0	-	-	0.5	0.5	-	0.8	0.5	0.4	-	11.33	-	-	13.94	13.94	-	13.86	13.96	14.15	-	80.4	-	-	96.8	96.8
11.0	1.1	-	-	0.5	0.5	-	0.8	0.5	0.5	-	10.81	-	-	13.87	13.89	-	13.78	13.95	14.08	-	77.3	-	-	96.3	96.4
12.0	1.3	-	-	-	0.5	-	0.9	0.5	0.5	-	6.90	-	-	-	13.90	-	13.70	13.92	13.99	-	49.3	-	-	-	96.5
13.0	1.5	-	-	-	0.5	-	0.9	0.5	0.5	-	5.58	-	-	-	13.92	-	13.55	13.89	13.88	-	40.6	-	-	-	96.6
14.0	1.5	-	-	-	0.5	-	1.0	0.5	0.5	-	2.30	-	-	-	13.93	-	13.42	13.82	13.74	-	16.6	-	-	-	96.8
15.0	1.7	-	-	-	0.5	-	1.0	0.6	0.6	-	0.93	-	-	-	13.88	-	13.34	13.70	13.61	-	6.7	-	-	-	96.5
16.0	-	-	-	-	0.6	-	1.1	0.6	0.6	-	-	-	-	-	13.73	-	13.20	13.59	13.50	-	-	-	-	-	95.7
17.0	-	-	-	-	0.6	-	-	0.6	0.6	-	-	-	-	-	13.54	-	-	13.50	13.39	-	-	-	-	-	94.4
18.0	-	-	-	-	0.6	-	-	0.6	0.6	-	-	-	-	-	13.42	-	-	13.52	13.29	-	-	-	-	-	93.6
19.0	-	-	-	-	0.6	-	-	0.7	0.7	-	-	-	-	-	13.35	-	-	13.48	13.20	-	-	-	-	-	93.0
20.0	-	-	-	-	0.7	-	-	0.7	0.7	-	-	-	-	-	13.25	-	-	13.43	13.07	-	-	-	-	-	92.1
21.0	-	-	-	-	-	-	-	-	0.7	-	-	-	-	-	-	-	-	-	13.00	-	-	-	-	-	-
22.0	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	12.66	-	-	-	-	-	-
23.0	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-	-	-	12.52	-	-	-	-	-	-
24.0	-	-	-	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-	12.40	-	-	-	-	-	-
25.0	-	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	12.14	-	-	-	-	-	-
26.0	-	-	-	-	-	-	-	-	1.0	-	-	-	-	-	-	-	-	-	11.94	-	-	-	-	-	-
27.0	-	-	-	-	-	-	-	-	1.1	-	-	-	-	-	-	-	-	-	11.35	-	-	-	-	-	-
28.0	-	-	-	-	-	-	-	-	1.2	-	-	-	-	-	-	-	-	-	11.18	-	-	-	-	-	-

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.8, 9.7, 5.0, 11.5, 20.7, 7.3, 16.9, 20.0, 27.0, and 8.5 m, respectively, at the time of winter sampling. Ice thickness at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 1.32, 1.75, 1.40, 1.39, 1.43, 1.52, 1.65, 1.50, 1.33, and 1.40 m, respectively, at the time of winter sampling.

Table C.62: ***In Situ*** **Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Winter, Mary River Project CREMP, April 2020**

Depth (m)	Dissolved Oxygen (% Saturation)					pH (pH units)										Specific Conductance (µS/cm)									
	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06
Date Collected	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20
1.0	102.6	98.5	101.1	101.4	102.5	7.86	7.78	7.77	7.72	7.49	7.73	8.19	8.14	7.96	7.94	309.7	327.7	316.5	131.7	131.5	134.4	139.6	132.1	131.1	134.6
2.0	102.5	103.3	100.2	101.9	103.2	7.77	7.73	7.76	7.61	7.48	7.68	8.06	7.97	7.91	7.89	304.7	311.2	311.4	128.6	129.3	131.2	136.0	128.2	130.0	131.8
3.0	102.3	102.1	99.3	100.9	102.2	7.75	7.71	7.76	7.61	7.49	7.64	7.99	7.82	7.84	7.84	302.3	308.5	309.3	127.7	127.4	131.0	132.8	127.0	128.2	129.6
4.0	102.3	101.7	98.6	100.4	101.4	7.74	7.70	7.76	7.61	7.49	7.62	7.94	7.80	7.84	7.82	300.5	306.4	306.7	126.6	128.3	130.5	131.8	126.2	128.3	128.7
5.0	102.0	101.2	98.3	100.4	100.7	7.73	7.71	-	7.60	7.50	7.60	7.91	7.78	7.83	7.86	299.3	305.5	-	125.9	125.6	130.9	130.4	125.9	128.1	127.9
6.0	105.2	100.7	97.8	99.6	99.8	7.73	7.71	-	7.59	7.50	7.57	7.89	7.76	7.81	7.79	298.4	304.3	-	125.3	125.4	135.9	129.2	125.4	127.0	127.0
7.0	-	99.9	97.5	99.1	99.4	7.72	7.71	-	7.59	7.49	-	7.87	7.76	7.81	7.78	297.8	303.6	-	125.0	124.9	-	127.7	120.0	126.6	127.9
8.0	-	99.0	97.1	98.9	99.7	7.71	7.70	-	7.26	7.49	-	7.85	7.75	7.80	7.77	296.3	302.6	-	124.7	124.6	-	126.5	124.6	126.6	131.1
9.0	-	98.5	96.9	98.5	-	7.69	7.69	-	7.58	7.49	-	7.84	7.74	7.79	-	294.3	301.8	-	124.4	125.2	-	125.3	124.7	126.3	-
10.0	-	97.0	96.8	98.1	-	7.67	-	-	7.58	7.49	-	7.83	7.72	7.78	-	293.1	-	-	123.9	124.4	-	124.4	125.0	126.0	-
11.0	-	96.6	96.8	97.7	-	7.64	-	-	7.57	7.49	-	7.82	7.72	7.77	-	292.7	-	-	123.9	124.7	-	123.7	125.6	125.3	-
12.0	-	96.1	96.6	97.1	-	7.58	-	-	-	7.49	-	7.82	7.70	7.76	-	291.8	-	-	-	125.3	-	123.0	125.7	124.6	-
13.0	-	95.3	96.5	96.4	-	7.42	-	-	-	7.49	-	7.81	7.69	7.76	-	292.7	-	-	-	125.9	-	122.2	125.3	123.6	-
14.0	-	94.5	96.0	95.5	-	7.38	-	-	-	7.49	-	7.80	7.68	7.75	-	298.1	-	-	-	125.8	-	121.7	124.7	122.7	-
15.0	-	94.0	95.3	94.7	-	7.25	-	-	-	7.49	-	7.80	7.67	7.74	-	305.1	-	-	-	124.9	-	121.1	123.8	122.3	-
16.0	-	93.2	94.6	94.0	-	-	-	-	-	7.49	-	7.78	7.66	7.74	-	-	-	-	-	123.4	-	120.7	123.3	122.3	-
17.0	-	-	94.0	93.3	-	-	-	-	-	7.48	-	-	7.65	7.72	-	-	-	-	-	122.9	-	-	123.3	122.1	-
18.0	-	-	94.2	92.7	-	-	-	-	-	7.47	-	-	7.63	7.71	-	-	-	-	-	123.5	-	-	123.7	121.9	-
19.0	-	-	94.0	92.0	-	-	-	-	-	7.46	-	-	7.62	7.70	-	-	-	-	-	125.2	-	-	123.7	121.8	-
20.0	-	-	93.8	91.2	-	-	-	-	-	7.44	-	-	7.61	7.69	-	-	-	-	-	126.4	-	-	123.9	121.6	-
21.0	-	-	-	90.9	-	-	-	-	-	-	-	-	-	7.68	-	-	-	-	-	-	-	-	-	121.4	-
22.0	-	-	-	88.8	-	-	-	-	-	-	-	-	-	7.65	-	-	-	-	-	-	-	-	-	121.6	-
23.0	-	-	-	87.8	-	-	-	-	-	-	-	-	-	7.63	-	-	-	-	-	-	-	-	-	121.5	-
24.0	-	-	-	87.0	-	-	-	-	-	-	-	-	-	7.61	-	-	-	-	-	-	-	-	-	122.9	-
25.0	-	-	-	85.3	-	-	-	-	-	-	-	-	-	7.59	-	-	-	-	-	-	-	-	-	122.8	-
26.0	-	-	-	84.2	-	-	-	-	-	-	-	-	-	7.57	-	-	-	-	-	-	-	-	-	122.9	-
27.0	-	-	-	82.2	-	-	-	-	-	-	-	-	-	7.54	-	-	-	-	-	-	-	-	-	122.6	-
28.0	-	-	-	79.1	-	-	-	-	-	-	-	-	-	7.51	-	-	-	-	-	-	-	-	-	122.4	-

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.8, 9.7, 5.0, 11.5, 20.7, 7.3, 16.9, 20.0, 27.0, and 8.5 m, respectively, at the time of winter sampling. Ice thickness at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 1.32, 1.75, 1.40, 1.39, 1.43, 1.52, 1.65, 1.50, 1.33, and 1.40 m, respectively, at the time of winter sampling.

Table C.63: ***In Situ*** **Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Summer, Mary River Project CREMP, July 2020**

Depth (m)	Temperature (°C)										Dissolved Oxygen (mg/L)										Dissolved Oxygen (% Saturation)				
	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05
Date Collected	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20
1.0	15.1	14.6	14.6	10.1	9.9	9.8	11.7	11.4	10.1	10.2	10.05	10.25	10.19	11.30	11.36	11.24	10.81	10.94	11.20	11.19	99.9	100.8	100.1	100.4	100.3
2.0	15.1	14.6	14.6	10.0	9.1	9.2	11.7	10.4	9.9	9.7	10.06	10.28	10.20	11.35	11.46	11.36	10.83	11.10	11.23	11.28	100.2	100.9	100.3	100.5	98.2
3.0	15.1	14.5	14.6	9.7	8.4	8.6	11.7	8.5	9.8	9.4	10.06	10.34	10.20	11.42	11.59	11.42	10.83	11.48	11.24	11.33	100.0	101.3	100.2	100.3	98.8
4.0	15.1	14.4	14.4	8.1	8.0	8.3	11.7	8.1	9.4	8.8	10.06	10.35	10.26	11.63	11.65	11.47	10.83	11.53	11.31	11.43	100.0	101.3	100.3	98.2	98.2
5.0	15.0	14.1	-	7.7	7.3	8.0	11.6	7.8	9.0	8.0	10.05	10.40	-	11.63	11.68	11.50	10.83	11.57	11.34	11.55	99.7	100.9	-	97.3	97.0
6.0	13.3	13.7	-	7.6	7.2	7.5	11.4	7.8	7.9	7.4	10.16	10.55	-	11.60	11.69	11.60	10.96	11.58	11.55	11.74	97.2	101.1	-	96.9	96.8
7.0	11.6	13.1	-	7.4	7.1	7.0	9.9	7.7	7.5	7.0	10.40	10.85	-	11.60	11.69	11.63	11.20	11.58	11.62	11.83	95.6	100.9	-	96.5	96.4
8.0	9.3	11.7	-	7.1	7.0	-	9.9	7.5	7.4	6.8	10.20	10.70	-	11.59	11.68	-	11.22	11.63	11.64	11.81	88.8	97.2	-	95.8	96.3
9.0	9.0	9.0	-	7.1	7.0	-	9.3	7.4	7.3	-	10.08	10.57	-	11.59	11.67	-	11.35	11.63	11.63	-	87.0	91.5	-	95.7	96.1
10.0	8.0	-	-	6.8	6.7	-	8.4	7.2	7.0	-	9.88	-	-	11.57	11.71	-	11.50	11.63	11.69	-	83.4	-	-	94.6	95.7
11.0	7.5	-	-	6.4	6.5	-	7.4	7.0	6.8	-	9.37	-	-	11.57	11.74	-	11.61	11.65	11.69	-	78.1	-	-	93.8	95.4
12.0	7.4	-	-	-	6.4	-	6.9	7.0	6.4	-	9.27	-	-	-	11.74	-	11.68	11.60	11.71	-	77.2	-	-	-	95.2
13.0	6.9	-	-	-	6.3	-	6.3	6.8	6.4	-	8.90	-	-	-	11.74	-	11.70	11.59	11.70	-	73.3	-	-	-	95.1
14.0	6.8	-	-	-	6.2	-	5.5	6.6	6.4	-	8.75	-	-	-	11.74	-	11.75	11.60	11.70	-	71.9	-	-	-	94.8
15.0	6.8	-	-	-	6.2	-	5.2	6.0	6.3	-	8.65	-	-	-	11.74	-	11.72	11.58	11.71	-	70.9	-	-	-	94.8
16.0	-	-	-	-	6.2	-	4.9	5.9	6.1	-	-	-	-	-	11.73	-	11.72	11.57	11.71	-	-	-	-	-	94.6
17.0	-	-	-	-	6.1	-	4.8	5.6	5.9	-	-	-	-	-	11.71	-	11.71	11.56	11.67	-	-	-	-	-	94.4
18.0	-	-	-	-	6.1	-	-	5.6	5.6	-	-	-	-	-	11.70	-	-	11.56	11.70	-	-	-	-	-	94.2
19.0	-	-	-	-	6.1	-	-	5.5	5.5	-	-	-	-	-	11.66	-	-	11.55	11.69	-	-	-	-	-	93.9
20.0	-	-	-	-	6.0	-	-	5.4	5.4	-	-	-	-	-	11.64	-	-	11.53	11.67	-	-	-	-	-	93.6
21.0	-	-	-	-	5.7	-	-	5.3	5.0	-	-	-	-	-	11.50	-	-	11.52	11.72	-	-	-	-	-	91.8
22.0	-	-	-	-	-	-	-	-	4.8	-	-	-	-	-	-	-	-	-	11.76	-	-	-	-	-	-
23.0	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	11.74	-	-	-	-	-	-
24.0	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	11.74	-	-	-	-	-	-
25.0	-	-	-	-	-	-	-	-	4.7	-	-	-	-	-	-	-	-	-	11.74	-	-	-	-	-	-
26.0	-	-	-	-	-	-	-	-	4.6	-	-	-	-	-	-	-	-	-	11.73	-	-	-	-	-	-
27.0	-	-	-	-	-	-	-	-	4.5	-	-	-	-	-	-	-	-	-	11.68	-	-	-	-	-	-
28.0	-	-	-	-	-	-	-	-	4.4	-	-	-	-	-	-	-	-	-	11.64	-	-	-	-	-	-
29.0	-	-	-	-	-	-	-	-	4.4	-	-	-	-	-	-	-	-	-	11.58	-	-	-	-	-	-

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.0, 10.3, 4.5, 11.7, 20.9, 7.5, 17.6, 21.2, 30.3, and 8.8 m, respectively, at the time of summer sampling.

Table C.63: ***In Situ*** **Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Summer, Mary River Project CREMP, July 2020**

Depth (m)	Dissolved Oxygen (% Saturation)					pH (pH units)										Specific Conductance (µS/cm)									
	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-06
Date Collected	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20
1.0	99.2	99.5	100.2	99.6	99.5	8.38	8.37	8.35	7.73	7.85	7.92	8.26	8.34	7.84	7.55	151.8	150.3	150.1	74.5	74.9	79.3	74.4	76.1	75.4	75.9
2.0	98.6	99.8	99.0	99.2	99.0	8.33	8.36	8.34	7.72	7.81	7.77	8.08	8.10	7.81	7.69	152.0	149.8	150.1	74.8	74.0	82.2	74.4	75.3	75.1	74.9
3.0	97.7	99.7	97.8	98.9	98.9	8.33	8.35	8.35	7.73	7.76	7.86	7.95	7.99	7.79	7.67	152.0	149.5	150.1	75.1	74.0	89.8	74.4	74.4	75.0	74.4
4.0	97.3	99.7	97.6	98.5	98.4	8.32	8.35	8.35	7.72	7.73	7.80	7.94	7.88	7.77	7.69	152.1	149.9	149.8	74.9	74.7	86.3	74.4	74.8	74.5	72.8
5.0	96.9	99.6	97.3	98.0	97.2	8.31	8.34	-	7.66	7.71	7.80	7.92	7.75	7.73	7.70	153.1	147.0	-	74.6	69.9	81.1	74.3	75.5	74.8	70.6
6.0	96.6	98.9	97.2	96.7	97.8	8.29	8.33	-	7.63	7.66	7.73	7.91	7.69	7.71	7.67	151.0	138.9	-	74.4	69.8	74.0	74.0	75.5	71.1	69.2
7.0	95.9	98.9	96.9	97.0	97.2	8.19	8.31	-	7.64	7.64	7.70	7.84	7.73	7.66	7.65	124.0	125.2	-	74.2	69.5	71.1	72.8	72.1	70.2	68.3
8.0	-	98.8	96.9	96.8	96.9	7.85	8.25	-	7.62	7.63	-	7.80	7.71	7.65	7.57	98.0	111.0	-	73.4	69.8	-	72.7	70.1	70.0	68.0
9.0	-	99.0	96.8	96.5	-	7.80	8.15	-	7.60	7.62	-	7.76	7.68	7.60	-	93.2	97.1	-	73.2	69.7	-	72.2	69.9	69.5	-
10.0	-	98.3	96.2	96.1	-	7.71	-	-	7.59	7.61	-	7.71	7.66	7.60	-	89.3	-	-	73.4	68.9	-	71.5	69.7	69.0	-
11.0	-	96.8	95.4	95.9	-	7.57	-	-	7.57	7.59	-	7.65	7.64	7.61	-	87.1	-	-	72.4	68.5	-	70.8	69.4	68.9	-
12.0	-	96.0	95.5	95.2	-	7.55	-	-	-	7.58	-	7.61	7.61	7.54	-	86.0	-	-	-	68.4	-	70.4	73.4	68.6	-
13.0	-	94.6	95.1	95.1	-	7.50	-	-	-	7.56	-	7.57	7.60	7.57	-	84.1	-	-	-	68.3	-	70.3	73.8	68.6	-
14.0	-	93.1	94.7	94.9	-	7.47	-	-	-	7.56	-	7.53	7.59	7.56	-	83.8	-	-	-	68.2	-	70.1	73.2	68.5	-
15.0	-	92.1	93.3	94.7	-	7.44	-	-	-	7.56	-	7.51	7.58	7.55	-	83.3	-	-	-	68.2	-	70.5	71.3	68.4	-
16.0	-	91.4	92.4	94.4	-	-	-	-	-	7.55	-	7.49	7.55	7.55	-	-	-	-	-	68.2	-	70.8	70.2	68.3	-
17.0	-	91.3	92.0	93.6	-	-	-	-	-	7.53	-	7.47	7.53	7.46	-	-	-	-	-	68.2	-	70.9	69.5	68.1	-
18.0	-	-	91.8	93.2	-	-	-	-	-	7.54	-	-	7.53	7.53	-	-	-	-	-	68.3	-	-	68.6	67.8	-
19.0	-	-	91.6	92.9	-	-	-	-	-	7.51	-	-	7.52	7.53	-	-	-	-	-	68.5	-	-	68.7	67.7	-
20.0	-	-	91.2	92.4	-	-	-	-	-	7.51	-	-	7.50	7.52	-	-	-	-	-	68.6	-	-	68.7	67.5	-
21.0	-	-	90.8	91.7	-	-	-	-	-	7.49	-	-	7.49	7.50	-	-	-	-	-	69.6	-	-	68.3	66.9	-
22.0	-	-	-	91.4	-	-	-	-	-	-	-	-	-	7.47	-	-	-	-	-	-	-	-	-	66.6	-
23.0	-	-	-	91.3	-	-	-	-	-	-	-	-	-	7.49	-	-	-	-	-	-	-	-	-	66.6	-
24.0	-	-	-	91.2	-	-	-	-	-	-	-	-	-	7.48	-	-	-	-	-	-	-	-	-	66.6	-
23.0	-	-	-	91.1	-	-	-	-	-	-	-	-	-	7.46	-	-	-	-	-	-	-	-	-	66.6	-
24.0	-	-	-	90.8	-	-	-	-	-	-	-	-	-	7.46	-	-	-	-	-	-	-	-	-	66.6	-
25.0	-	-	-	90.4	-	-	-	-	-	-	-	-	-	7.46	-	-	-	-	-	-	-	-	-	66.8	-
26.0	-	-	-	90.0	-	-	-	-	-	-	-	-	-	7.45	-	-	-	-	-	-	-	-	-	67.0	-
27.0	-	-	-	89.4	-	-	-	-	-	-	-	-	-	7.45	-	-	-	-	-	-	-	-	-	67.1	-

Notes: Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.0, 10.3, 4.5, 11.7, 20.9, 7.5, 17.6, 21.2, 30.3, and 8.8 m, respectively, at the time of summer sampling.

Table C.64: *In Situ* Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 202(

Depth (m)	Temperature (°C)												Dissolved Oxygen (mg/L)											
	BLO-01-A	BLO-01	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06
Date Collected	27-Aug-20	27-Aug-20	20-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	19-Aug-20	28-Aug-20	27-Aug-20	27-Aug-20	20-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	19-Aug-20	28-Aug-20
surface	-	-	8.2	-	-	-	-	-	-	-	8.00	-	-	-	11.40	-	-	-	-	-	-	-	11.19	-
1.0	7.3	7.5	8.2	7.5	8.7	8.3	8.1	8.0	7.8	7.8	8.0	7.5	11.76	11.79	11.55	11.83	11.38	11.34	11.39	11.42	11.36	11.40	10.95	11.34
2.0	7.3	7.5	8.2	7.5	8.5	7.9	7.9	8.0	7.8	7.7	7.9	7.4	11.76	11.75	11.42	11.82	11.42	11.42	11.42	11.42	11.38	11.39	11.04	11.35
3.0	7.3	7.5	8.2	7.4	7.9	7.9	7.7	7.9	7.6	7.6	7.9	7.4	11.75	11.75	11.40	11.82	11.44	11.42	11.45	11.43	11.39	11.41	10.98	11.36
4.0	7.3	7.5	8.2	7.4	7.7	7.7	7.7	7.9	7.5	7.6	7.9	7.4	11.74	11.74	11.40	11.81	11.43	11.43	11.44	11.43	11.39	11.38	10.93	11.36
5.0	7.3	7.5	8.2	-	7.6	7.6	7.6	7.8	7.5	7.6	7.9	7.4	11.75	11.74	11.39	-	11.40	11.42	11.44	11.45	11.38	11.38	10.89	11.35
6.0	7.3	7.5	8.2	-	7.6	7.6	7.6	7.6	7.5	7.6	7.9	7.4	11.73	11.73	11.38	-	11.38	11.41	11.47	11.44	11.37	11.37	10.90	11.34
7.0	7.3	7.4	8.2	-	7.5	7.6	-	7.5	7.5	7.6	7.9	7.4	11.73	11.73	11.38	-	11.39	11.40	-	11.41	11.36	11.37	10.85	11.33
8.0	7.3	7.4	8.2	-	7.5	7.5	-	7.5	7.5	7.6	7.9	7.4	11.72	11.71	11.38	-	11.38	11.41	-	11.40	11.35	11.36	10.86	11.33
9.0	7.3	-	8.2	-	7.5	7.5	-	7.5	7.5	7.6	7.9	7.4	11.71	-	11.37	-	11.37	11.42	-	11.38	11.35	11.35	10.95	11.31
10.0	7.3	-	8.2	-	7.5	7.5	-	7.5	7.5	7.6	7.8	-	11.70	-	11.37	-	11.36	11.42	-	11.37	11.35	11.35	10.90	-
11.0	7.3	-	-	-	-	7.5	-	7.5	7.5	7.6	7.8	-	11.72	-	-	-	-	11.42	-	11.35	11.34	11.33	10.89	-
12.0	7.3	-	-	-	-	7.5	-	7.5	7.5	7.6	7.8	-	11.71	-	-	-	-	11.42	-	11.35	11.34	11.32	10.88	-
13.0	7.2	-	-	-	-	7.5	-	7.5	7.5	7.6	7.8	-	11.72	-	-	-	-	11.43	-	11.34	11.33	11.32	10.87	-
14.0	7.2	-	-	-	-	7.5	-	7.5	7.5	7.6	7.7	-	11.72	-	-	-	-	11.42	-	11.34	11.32	11.31	10.89	-
15.0	7.2	-	-	-	-	7.5	-	-	7.5	7.5	7.7	-	11.64	-	-	-	-	11.41	-	-	11.32	11.30	10.89	-
16.0	7.2	-	-	-	-	7.4	-	-	7.5	7.5	7.6	-	11.65	-	-	-	-	11.41	-	-	11.31	11.24	10.89	-
17.0	-	-	-	-	-	7.4	-	-	7.5	7.4	7.6	-	-	-	-	-	-	11.49	-	-	11.31	11.15	10.90	-
18.0	-	-	-	-	-	7.3	-	-	7.5	7.4	7.5	-	-	-	-	-	-	11.33	-	-	11.31	11.13	10.82	-
19.0	-	-	-	-	-	7.3	-	-	7.5	7.4	7.4	-	-	-	-	-	-	11.31	-	-	11.30	11.11	10.95	-
20.0	-	-	-	-	-	7.3	-	-	7.5	7.3	7.2	-	-	-	-	-	-	11.31	-	-	11.30	11.08	10.92	-
21.0	-	-	-	-	-	-	-	-	7.5	7.3	7.2	-	-	-	-	-	-	-	-	-	11.22	11.06	10.86	-
22.0	-	-	-	-	-	-	-	-	-	7.3	7.1	-	-	-	-	-	-	-	-	-	-	11.04	10.78	-
23.0	-	-	-	-	-	-	-	-	-	7.3	7.0	-	-	-	-	-	-	-	-	-	-	11.03	10.82	-
24.0	-	-	-	-	-	-	-	-	-	7.3	7.0	-	-	-	-	-	-	-	-	-	-	11.01	10.80	-
25.0	-	-	-	-	-	-	-	-	-	7.3	7.0	-	-	-	-	-	-	-	-	-	-	11.01	10.86	-
26.0	-	-	-	-	-	-	-	-	-	7.3	6.8	-	-	-	-	-	-	-	-	-	-	10.99	10.82	-
27.0	-	-	-	-	-	-	-	-	-	7.2	6.7	-	-	-	-	-	-	-	-	-	-	10.94	10.87	-
28.0	-	-	-	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-	-	-	10.85	-
29.0	-	-	-	-	-	-	-	-	-	-	6.4	-	-	-	-	-	-	-	-	-	-	-	10.82	-
30.0	-	-	-	-	-	-	-	-	-	-	6.3	-	-	-	-	-	-	-	-	-	-	-	10.68	-

Notes: 19-Aug-20 and 20-Aug-20 sampling was conducted by Minnow. Mary Lake water profile sampling on all other dates was conducted by Baffinland. Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.1, 9.1, 5.0, 12.0, 20.6, 7.4, 15.3, 22.1, 29.7 and 9.5 m, respectively, at the time of fall sampling.

Table C.64: ***In Situ*** **Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 202(**

Depth (m)	Dissolved Oxygen (% Saturation)												pH (pH units)											
	BLO-01-A	BLO-01	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06	BLO-01-A	BLO-01	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06
Date Collected	27-Aug-20	27-Aug-20	20-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	19-Aug-20	28-Aug-20	27-Aug-20	27-Aug-20	20-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	19-Aug-20	28-Aug-20
surface	-	-	96.8	-	-	-	-	-	-	-	96.6	-	-	-	8.12	-	-	-	-	-	-	-	7.42	-
1.0	97.8	98.4	98.2	98.6	97.8	96.4	96.4	96.5	95.6	95.7	94.3	94.6	8.23	8.25	8.13	8.26	7.83	7.90	7.77	7.78	7.76	7.72	7.39	7.71
2.0	97.8	98.1	97.0	98.5	97.0	96.3	96.2	96.3	95.2	95.4	94.6	94.6	8.23	8.25	8.14	8.27	7.77	7.76	7.75	7.75	7.74	7.72	7.37	7.68
3.0	97.7	98.0	96.8	98.5	96.2	96.2	96.0	96.3	95.2	95.4	94.2	94.6	8.23	8.25	8.14	8.27	7.76	7.74	7.75	7.74	7.73	7.72	7.38	7.68
4.0	97.6	97.9	96.7	98.4	95.6	95.8	95.8	96.2	95.1	95.2	93.9	94.6	8.23	8.26	8.14	8.27	7.75	7.74	7.75	7.73	7.72	7.71	7.38	7.68
5.0	97.7	97.8	96.7	-	95.3	95.4	95.6	96.3	95.0	95.1	93.5	94.5	8.22	8.25	8.15	-	7.75	7.74	7.75	7.72	7.71	7.71	7.37	7.68
6.0	97.5	97.8	96.6	-	95.2	95.4	95.8	95.6	94.9	95.0	93.5	94.4	8.23	8.25	8.14	-	7.74	7.74	7.76	7.72	7.72	7.71	7.38	7.68
7.0	97.5	97.7	96.6	-	95.1	95.3	-	95.3	94.9	95.0	93.1	94.4	8.23	8.25	8.15	-	7.74	7.74	-	7.72	7.72	7.71	7.35	7.67
8.0	97.4	97.6	96.6	-	95.0	95.2	-	95.1	94.8	94.9	93.1	94.3	8.23	8.24	8.14	-	7.74	7.74	-	7.71	7.72	7.71	7.36	7.67
9.0	97.3	-	96.5	-	94.9	95.2	-	95.4	94.7	94.9	93.9	94.3	8.22	-	8.14	-	7.75	7.74	-	7.70	7.72	7.71	7.38	7.67
10.0	97.2	-	96.5	-	94.7	95.3	-	94.8	94.7	94.8	93.6	-	8.23	-	8.14	-	7.76	7.75	-	7.70	7.72	7.71	7.36	-
11.0	97.3	-	-	-	-	95.3	-	94.7	94.6	94.7	93.2	-	8.24	-	-	-	-	7.78	-	7.70	7.73	7.71	7.36	-
12.0	97.2	-	-	-	-	95.3	-	94.6	94.6	94.6	93.3	-	8.23	-	-	-	-	7.78	-	7.70	7.72	7.71	7.36	-
13.0	97.2	-	-	-	-	95.3	-	94.5	94.6	94.5	93.2	-	8.23	-	-	-	-	7.78	-	7.69	7.72	7.71	7.36	-
14.0	97.1	-	-	-	-	95.3	-	94.5	94.5	94.5	93.2	-	8.22	-	-	-	-	7.80	-	7.69	7.72	7.71	7.36	-
15.0	96.4	-	-	-	-	95.1	-	-	94.4	94.3	92.8	-	8.22	-	-	-	-	7.81	-	-	7.72	7.71	7.36	-
16.0	96.5	-	-	-	-	95.0	-	-	94.4	93.8	93.0	-	8.22	-	-	-	-	7.81	-	-	7.72	7.70	7.35	-
17.0	-	-	-	-	-	94.7	-	-	94.3	92.8	93.0	-	-	-	-	-	-	7.81	-	-	7.72	7.67	7.33	-
18.0	-	-	-	-	-	94.1	-	-	94.3	92.6	92.0	-	-	-	-	-	-	7.81	-	-	7.72	7.66	7.33	-
19.0	-	-	-	-	-	93.9	-	-	94.3	92.4	92.5	-	-	-	-	-	-	7.78	-	-	7.72	7.65	7.32	-
20.0	-	-	-	-	-	93.9	-	-	94.3	92.1	92.0	-	-	-	-	-	-	7.78	-	-	7.72	7.64	7.30	-
21.0	-	-	-	-	-	-	-	-	93.8	91.9	91.6	-	-	-	-	-	-	-	-	-	7.70	7.64	7.28	-
22.0	-	-	-	-	-	-	-	-	-	91.7	90.8	-	-	-	-	-	-	-	-	-	-	7.64	7.26	-
23.0	-	-	-	-	-	-	-	-	-	91.6	90.9	-	-	-	-	-	-	-	-	-	-	7.63	7.25	-
24.0	-	-	-	-	-	-	-	-	-	91.4	90.7	-	-	-	-	-	-	-	-	-	-	7.65	7.24	-
25.0	-	-	-	-	-	-	-	-	-	91.3	91.2	-	-	-	-	-	-	-	-	-	-	7.63	7.22	-
26.0	-	-	-	-	-	-	-	-	-	91.1	90.4	-	-	-	-	-	-	-	-	-	-	7.62	7.20	-
27.0	-	-	-	-	-	-	-	-	-	90.7	89.9	-	-	-	-	-	-	-	-	-	-	7.61	7.18	-
28.0	-	-	-	-	-	-	-	-	-	-	90.2	-	-	-	-	-	-	-	-	-	-	-	7.17	-
29.0	-	-	-	-	-	-	-	-	-	-	89.5	-	-	-	-	-	-	-	-	-	-	-	7.15	-
30.0	-	-	-	-	-	-	-	-	-	-	88.4	-	-	-	-	-	-	-	-	-	-	-	7.03	-

Notes: 19-Aug-20 and 20-Aug-20 sampling was conducted by Minnow. Mary Lake water profile sampling on all other dates was conducted by Baffinland. Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.1, 5.0, 9.5, 12.0, 20.6, 7.4, 15.3, 22.1, 29.7 and 9.5 m, respectively, at the time of fall sampling.

Table C.64: *In Situ* Water Quality Profile Data Collected at Mary Lake Water Quality Monitoring Stations in Fall, Mary River Project CREMP, August 2020

Depth (m)	Specific Conductance (µS/cm)											
	BLO-01-A	BLO-01	BLO-01	BLO-01-B	BLO-05-A	BLO-05	BLO-05-B	BLO-03	BLO-04	BLO-09	BLO-09	BLO-06
Date Collected	27-Aug-20	27-Aug-20	20-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	19-Aug-20	28-Aug-20
surface	-	-	192.0	-	-	-	-	-	-	-	83.4	-
1.0	216.3	214.5	192.1	215.4	86.9	85.1	86.1	80.4	85.5	85.8	83.1	85.6
2.0	216.3	214.5	192.1	215.4	87.9	85.9	85.9	80.4	85.8	85.7	83.0	85.6
3.0	216.3	214.7	192.2	215.5	87.0	86.3	86.2	80.4	85.8	85.7	83.0	85.6
4.0	216.4	215.1	192.1	215.6	86.7	86.1	86.4	80.4	85.4	85.8	83.0	85.6
5.0	216.4	215.3	192.2	-	86.6	86.3	86.1	80.5	85.4	85.7	83.0	85.6
6.0	216.4	215.2	192.0	-	86.9	86.5	85.6	80.8	85.3	85.7	83.1	85.6
7.0	216.5	215.5	192.1	-	88.2	87.1	-	80.6	85.3	85.7	83.2	85.6
8.0	216.5	215.8	192.1	-	94.9	91.2	-	80.7	85.3	85.7	83.2	85.6
9.0	216.5	-	192.0	-	94.8	96.1	-	80.7	85.3	85.8	83.4	85.6
10.0	216.7	-	192.0	-	94.9	96.6	-	80.7	85.2	85.8	83.4	-
11.0	216.9	-	-	-	-	98.5	-	80.7	85.3	85.8	83.5	-
12.0	216.4	-	-	-	-	102.8	-	80.7	85.2	85.8	83.5	-
13.0	217.8	-	-	-	-	104.8	-	80.8	85.2	85.9	82.8	-
14.0	218.1	-	-	-	-	104.9	-	80.8	85.2	85.9	81.5	-
15.0	217.9	-	-	-	-	102.6	-	-	85.2	86.0	80.7	-
16.0	218.0	-	-	-	-	102.4	-	-	85.0	87.1	79.6	-
17.0	-	-	-	-	-	102.0	-	-	84.9	87.9	79.1	-
18.0	-	-	-	-	-	102.3	-	-	84.5	88.1	79.4	-
19.0	-	-	-	-	-	102.6	-	-	84.4	88.2	77.6	-
20.0	-	-	-	-	-	102.5	-	-	84.5	88.4	77.2	-
21.0	-	-	-	-	-	-	-	-	84.5	86.7	77.3	-
22.0	-	-	-	-	-	-	-	-	-	89.1	76.4	-
23.0	-	-	-	-	-	-	-	-	-	89.2	75.9	-
24.0	-	-	-	-	-	-	-	-	-	89.4	75.8	-
25.0	-	-	-	-	-	-	-	-	-	89.5	75.3	-
26.0	-	-	-	-	-	-	-	-	-	90.0	74.6	-
27.0	-	-	-	-	-	-	-	-	-	90.0	74.2	-
28.0	-	-	-	-	-	-	-	-	-	-	73.9	-
29.0	-	-	-	-	-	-	-	-	-	-	73.3	-
30.0	-	-	-	-	-	-	-	-	-	-	73.3	-

Notes: 19-Aug-20 and 20-Aug-20 sampling was conducted by Minnow. Mary Lake water profile sampling on all other dates was conducted by Baffinland. Total depth at stations BLO-01-A, BLO-01, BLO-01-B, BLO-05-A, BLO-05, BLO-05-B, BLO-03, BLO-04, BLO-09, and BLO-06 was 15.1, 5.0, 9.5, 12.0, 20.6, 7.4, 15.3, 22.1, 29.7 and 9.5 m, respectively, at the time of fall sampling.

Table C.65: Sampling Depth, Water Clarity Measures, and Surface and Bottom *In Situ* Water Quality Measures Collected at Mary Lake Benthic Invertebrate Community Stations, Mary River Project CREMP, August 2020

Categorization & Replicate ID		Date Sampled	Station Depth (m)	Secchi Depth (m)	Depth sampled	Temperature (°C)	Dissolved Oxygen		pH (units)	Specific Conductance (µS/cm)
							(mg/L)	(% sat.)		
Littoral (Shallow) Stations	BLO-01	20-Aug-20	10.0	4.78	surface	8.2	11.40	96.8	8.12	192.0
					bottom	9.2	11.37	96.5	8.14	192.0
	BLO-11	16-Aug-20	9.3	3.33	surface	9.3	10.46	93.8	7.20	80.7
					bottom	9.4	10.35	92.9	7.26	84.2
	BLO-07	16-Aug-20	12.8	3.79	surface	8.9	10.99	97.5	7.01	76.0
					bottom	8.8	10.62	94.0	6.74	76.4
	BLO-06	16-Aug-20	6.7	4.38	surface	8.8	10.67	94.3	6.96	76.0
					bottom	8.5	10.59	92.9	6.93	76.0
Profundal (Deep) Stations	BLO-03	16-Aug-20	16.4	3.94	surface	9.2	10.62	94.8	7.19	74.8
					bottom	6.4	11.26	94.1	6.97	72.2
	BLO-15	16-Aug-20	29.1	3.16	surface	9.1	10.71	95.5	7.24	74.9
					bottom	4.6	10.75	85.5	6.89	72.3
	BLO-14	20-Aug-20	20.0	5.28	surface	7.8	11.46	96.3	7.90	76.9
					bottom	7.6	11.43	95.7	7.69	76.9
	BLO-05	16-Aug-20	21.5	3.18	surface	9.3	10.58	95.1	7.32	80.9
					bottom	5.8	10.25	84.5	7.13	69.5
	BLO-13	19-Aug-20	22.0	1.95	surface	7.8	11.11	95.2	7.46	82.8
					bottom	7.5	10.89	92.9	7.30	90.6
	BLO-04	19-Aug-20	22.0	1.63	surface	7.8	11.05	94.7	7.41	83.4
					bottom	7.6	10.68	91.7	7.28	84.7

Table C.66: Statistical Comparison of Bottom *In Situ* Water Quality Between Mary Lake Littoral and Profundal Stations, Mary River Project CREMP, August 2020

Parameter	Statistical Test Results				Summary Statistics						
	Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Lake Zone	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Secchi Depth (m)	tequal	none	NO	0.261	Littoral	4	4.07	0.64	0.32	3.33	4.78
					Profundal	6	3.19	1.34	0.55	1.63	5.28
Temperature (˚C)	tequal	none	YES	0.006	Littoral	4	8.98	0.40	0.20	8.50	9.40
					Profundal	6	6.58	1.22	0.50	4.60	7.60
Dissolved Oxygen (mg/L)	tequal	none	NO	0.618	Littoral	4	10.7	0.4	0.2	10.4	11.4
					Profundal	6	10.9	0.4	0.2	10.3	11.4
Dissolved Oxygen (% saturation)	tequal	none	NO	0.212	Littoral	4	94.1	1.7	0.8	92.9	96.5
					Profundal	6	90.7	4.6	1.9	84.5	95.7
pH (units)	tequal	none	NO	0.845	Littoral	4	7.27	0.62	0.31	6.74	8.14
					Profundal	6	7.21	0.29	0.12	6.89	7.69
Specific Conductance (umho/cm)	M-W	rank	NO	0.476	Littoral	4	107.2	56.7	28.3	76.0	192.0
					Profundal	6	77.7	8.3	3.4	69.5	90.6

Shaded values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.67: Statistical Comparison of Bottom *In Situ* Water Quality Between Mary Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Parameter	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	tequal	none	NO	0.833	Reference	4	10.0	1.1	0.5	8.5	11.0
						Mary Lake	4	9.7	2.5	1.3	6.7	12.8
	Secchi Depth (m)	tequal	none	YES	0.001	Reference	5	8.12	0.64	0.29	7.38	9.15
						Mary Lake	4	4.07	0.64	0.32	3.33	4.78
	Temperature (˚C)	tequal	none	NO	0.180	Reference	5	9.32	0.29	0.13	8.90	9.70
						Mary Lake	4	8.98	0.40	0.20	8.50	9.40
	Dissolved Oxygen (mg/L)	tequal	none	YES	0.002	Reference	5	12.6	0.7	0.3	11.8	13.3
						Mary Lake	4	10.7	0.4	0.2	10.4	11.4
	Dissolved Oxygen (% saturation)	tequal	none	YES	0.001	Reference	5	111.9	5.2	2.3	104.6	116.7
						Mary Lake	4	94.1	1.7	0.8	92.9	96.5
	pH (units)	tequal	none	NO	0.801	Reference	5	7.19	0.23	0.10	6.94	7.56
						Mary Lake	4	7.27	0.62	0.31	6.74	8.14
	Specific Conductance (umho/cm)	M-W	rank	NO	0.190	Reference	5	76.7	3.2	1.4	74.5	82.1
						Mary Lake	4	107.2	56.7	28.3	76.0	192.0
Profundal (Deep) Stations	Station Depth (m)	tequal	none	NO	0.547	Reference	5	20.6	1.6	0.7	19.0	23.0
						Mary Lake	6	21.8	4.1	1.7	16.4	29.1
	Secchi Depth (m)	tequal	none	YES	0.001	Reference	5	8.39	0.96	0.43	7.18	9.84
						Mary Lake	6	3.19	1.34	0.55	1.63	5.28
	Temperature (˚C)	tunequal	none	NO	0.189	Reference	5	5.82	0.19	0.09	5.60	6.10
						Mary Lake	6	6.58	1.22	0.50	4.60	7.60
	Dissolved Oxygen (mg/L)	tequal	log10	YES	0.001	Reference	5	13.6	1.3	0.6	12.8	15.8
						Mary Lake	6	10.9	0.4	0.2	10.3	11.4
	Dissolved Oxygen (% saturation)	tequal	log10	YES	0.001	Reference	5	110.6	10.3	4.6	103.5	127.9
						Mary Lake	6	90.7	4.6	1.9	84.5	95.7
	pH (units)	tequal	none	YES	0.018	Reference	5	6.70	0.30	0.13	6.27	6.95
						Mary Lake	6	7.21	0.29	0.12	6.89	7.69
	Specific Conductance (umho/cm)	tequal	none	NO	0.580	Reference	5	75.5	1.6	0.7	74.0	78.1
						Mary Lake	6	77.7	8.3	3.4	69.5	90.6

Highlighted values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Student's t-test assuming equal variance (tequal), Student's t-test assuming unequal variance (tunequal), or Mann-Whitney U-test (M-W).

Table C.68: Water Chemistry at Mary Lake North Basin (BLO-01) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameter		Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Winter Sampling Event						Summer Sampling Event						Fall Sampling Event					
					BL0-01-A	BL0-01-A	BL0-01	BL0-01	BL0-01-B	BL0-01-B	BL0-01-A	BL0-01-A	BL0-01	BL0-01	BL0-01-B	BL0-01-B	BLO-01-A	BLO-01-A	BLO-01	BLO-01	BLO-01-B	BLO-01-B
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					19-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	30-Jul-20	30-Jul-20	30-Jul-20	30-Jul-20	30-Jul-20	30-Jul-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	292	303	299	307	306	308	85.8	155	113	153	154	153	220	219	226	226	219	217
	pH (lab)	pH	6.5 - 9.0	-	7.26	7.77	7.73	7.72	7.72	7.73	7.40	8.22	8.12	8.31	8.32	8.30	8.2	8.23	8.21	8.23	8.23	8.18
	Hardness (as $CaCO_3$)	mg/L	-	-	151	155	153	161	156	160	39.3	71.1	56.4	71.3	69.2	69.6	108	106	106	106	106	106
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	170	178	180	183	176	183	63	122	67	87	81	80	118	113	122	123	137	129
	Turbidity	NTU	-	-	0.32	<0.10	<0.10	0.17	<0.10	<0.10	2.06	0.71	0.74	0.67	0.69	0.68	0.77	0.70	0.65	0.53	0.67	0.67
	Alkalinity (as $CaCO_3$)	mg/L	-	-	128	133	130	132	132	134	38.9	69.1	50.8	68.0	69.0	68.9	104	99	97	96	96	96
Nutrients and Organics	Total Ammonia	mg/L	-	0.855	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.0316	<0.0050	<0.0050	0.0092	<0.0050	<0.0050	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Nitrate	mg/L	3	3	0.174	0.109	0.106	0.111	0.107	0.105	0.0189	0.0051	0.0063	<0.0050	<0.0050	<0.0050	0.127	0.045	0.041	0.04	0.055	0.037
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	0.0016	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	0.16	0.15	<0.15	<0.15	0.19	0.117	0.114	0.095	0.109	0.111	0.113	0.16	0.15	<0.15	<0.15	<0.15	0.17
	Dissolved Organic Carbon	mg/L	-	-	3.12	3.96	3.28	3.34	3.62	3.83	1.57	1.67	1.74	2.20	4.29	2.26	2.36	2.35	2.36	2.54	3.55	2.35
	Total Organic Carbon	mg/L	-	-	5.02	5.03	4.95	5.04	4.19	4.98	1.59	1.63	1.50	1.74	1.76	1.97	2.88	2.77	2.68	2.79	3.88	24.8
	Total Phosphorus	mg/L	0.020[α]	-	<0.0030	<0.0030	0.0055	<0.0030	<0.0030	<0.0030	0.0106	0.0046	0.0036	0.0030	0.0037	0.0028	0.0044	0.0041	0.0065	0.0121	0.0052	0.0066
	Phenols	mg/L	0.004[α]	-	0.0024	0.0026	0.0030	0.0025	<0.0010	0.0018	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	16.7	17.5	17.3	17.9	17.8	17.9	2.21	4.98	3.14	4.89	4.96	4.89	9.51	9.40	9.46	9.38	9.37	9.51
	Sulphate (SO_4)	mg/L	218[β]	218	6.21	7.48	7.41	7.68	7.53	7.59	1.04	2.23	1.44	2.17	2.15	2.15	4.14	4.04	4.04	4.02	4.03	4.02
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	<0.0030	0.0033	0.0051	0.0034	<0.0030	<0.0030	0.0422	0.0171	0.0252	0.0241	0.0184	0.0251	0.019	0.0244	0.0222	0.0207	0.0212	0.0178
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	0.00012	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00011	<0.00010	0.00023	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.0137	0.0144	0.0145	0.0151	0.0145	0.0150	0.00480	0.00788	0.00612	0.00795	0.00783	0.00781	0.0108	0.0111	0.0111	0.0107	0.0108	0.0107
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	-	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	30.3	30.8	30.0	31.5	32.0	31.7	8.28	14.2	10.8	14.1	14.6	14.4	21.5	21.5	21.1	21.2	21.5	21.2
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00013	0.00012	0.00010	0.00020	<0.00010	0.00011	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<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 (Cu)	mg/L	0.002	0.0024	0.00079	0.00115	0.00144	0.00119	0.00115	0.00119	0.00069	0.00102	0.00084	0.00097	0.00100	0.00098	0.00099	0.00101	0.00102	0.00097	0.00098	0.00097
	Iron (Fe)	mg/L	0.30	0.326	0.043	<0.030	<0.030	<0.030	<0.030	<0.030	0.155	0.033	0.037	0.040	0.030	0.034	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000060	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/L	-	-	0.0013	0.0013	0.0016	0.0013	0.0015	0.0015	<0.0010	0.0010	<0.0010	0.0010	0.0010	0.0011	0.0013	0.0011	0.0013	0.0014	0.0014	0.0013
	Magnesium (Mg)	mg/L	-	-	18.5	18.9	19.4	19.6	19.5	19.7	4.92	8.94	6.68	8.57	8.60	8.75	12.9	12.6	12.7	12.9	12.8	12.5
	Manganese (Mn)	mg/L	0.935[β]	-	0.0184	0.000776	0.00146	0.000978	0.00103	0.000898	0.0126	0.00264	0.00257	0.00236	0.00252	0.00255	0.00236	0.00241	0.00245	0.00236	0.00245	0.00238
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000303	0.000370	0.000409	0.000388	0.000397	0.000381	0.000118	0.000234	0.000157	0.000228	0.000223	0.000230	0.000319	0.000318	0.000324	0.000325	0.000315	0.000317
	Nickel (Ni)	mg/L	0.025	0.025	0.00074	0.00071	0.00082	0.00073	0.00074	0.00075	<0.00050	0.00054	<0.00050	0.00056	0.00051	0.00053	0.00051	<0.00050	0.00054	<0.00050	0.00051	<0.00050
	Potassium (K)	mg/L	-	-	1.32	1.37	1.43	1.44	1.42	1.46	0.603	0.970	0.763	0.957	0.969	0.966	1.17	1.17	1.16	1.17	1.16	1.15
	Selenium (Se)	mg/L	0.001	-	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	-	-	2.13	1.35	1.39	1.39	1.38	1.43	0.75	0.67	0.59	0.66	0.66	0.66	0.73	0.74	0.71	0.74	0.73	0.74
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<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 (Na)	mg/L	-	-	6.49	6.74	6.88	7.13	6.99	7.03	1.18	2.88	1.88	2.74	2.82	2.78	4.39	4.47	4.34	4.29	4.32	4.38
	Strontium (Sr)	mg/L	-	-	0.0219	0.0220	0.0218	0.0230	0.0226	0.0232	0.00575	0.0110	0.00810	0.0115	0.0113	0.0112	0.0165	0.0162	0.0169	0.0162	0.0161	0.0166
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.00174	0.00063	0.00118	0.00068	0.00053	0.00089	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.015	-	0.00372	0.00460	0.00469	0.00474	0.00474	0.00469	0.000453	0.00154	0.000899	0.00147	0.00149	0.00151	0.00349	0.00345	0.00347	0.00336	0.00349	0.00348
	Vanadium (V)	mg/L	0.006[α]	0.006	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	0.030	0.030	<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

(shaded box) Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Mary Lake.

Table C.69: Summary of the Magnitude of Elevation in Seasonal Average Parameter Concentrations (Total Metal Concentration Provided) Between Mary Lake and Reference Lake 3 in 2020, and at Mary Lake Between 2020 and the Baseline Period

Parameter	Mary Lake North Basin					Mary Lake South Basin				
	2020 vs Reference Lake 3		2020 vs Baseline			2020 vs Reference Lake 3		2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall	Summer	Fall	Winter	Summer	Fall
Conductivity (lab)	1.7	2.8	1.2	1.3	1.3	1.0	1.1	1.3	1.2	1.1
Hardness (as $CaCO_3$)	1.8	2.8	1.3	1.2	1.2	1.0	1.1	1.5	1.1	1.1
Total Suspended Solids (TSS)	1.0	1.0	1.0	1.0	1.0	1.1	1.0	1.0	0.6	1.0
Total Dissolved Solids (TDS)	2.0	2.4	1.1	1.2	1.1	1.2	1.0	1.4	1.1	1.0
Turbidity	6.2	4.6	0.7	0.3	0.8	13	9.7	0.2	1.1	1.2
Alkalinity (as $CaCO_3$)	1.3	2.9	1.1	1.1	1.2	0.9	1.1	1.3	1.3	1.0
Total Ammonia	1.0	0.7	0.1	0.1	0.1	1.0	0.7	0.1	0.1	0.1
Nitrate	0.4	2.9	1.1	0.1	0.6	1.9	2.2	0.5	0.4	0.4
Nitrite	0.2	1.0	1.2	0.3	0.8	1.6	1.0	1.6	0.4	1.1
Total Kjeldahl Nitrogen (TKN)	0.7	1.0	0.8	0.3	0.6	1.0	1.0	1.1	0.9	0.9
Dissolved Organic Carbon	0.7	0.7	1.7	1.6	1.5	0.7	0.5	2.0	1.6	1.4
Total Organic Carbon	0.4	1.8	2.3	1.0	3.8	0.6	0.6	2.4	1.9	1.5
Total Phosphorus	1.1	2.1	0.5	0.6	0.9	1.1	1.7	0.9	0.8	0.8
Phenols	1.0	1.0	2.2	1.0	1.0	1.0	1.1	1.6	1.0	1.1
Bromide (Br)	0.5	1.0	0.5	0.3	0.7	1.6	1.0	0.9	0.7	0.4
Chloride (Cl)	3.1	6.9	2.0	2.4	2.4	2.0	2.5	1.5	1.2	1.2
Sulphate (SO_4)	0.5	1.1	1.3	0.8	1.0	0.5	0.6	2.1	0.9	0.8
Aluminum (Al)	8.3	6.6	0.6	0.3	0.3	21	12	0.5	1.0	1.1
Antimony (Sb)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Arsenic (As)	1.2	1.0	1.0	1.2	0.5	1.0	1.0	1.0	1.0	0.9
Barium (Ba)	1.1	1.6	1.2	1.1	1.2	0.7	0.7	1.4	1.0	1.0
Beryllium (Be)	0.2	1.0	1.5	0.3	1.0	1.0	1.0	1.1	1.5	2.0
Bismuth (Bi)	0.1	1.0	1.0	0.1	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	0.5	1.0	0.8	0.4	0.7	1.0	1.0	0.2	0.9	0.8
Calcium (Ca)	1.8	2.9	1.3	1.1	1.2	1.0	1.1	1.4	1.0	1.0
Chromium (Cr)	0.3	1.0	1.4	0.2	0.7	1.0	1.0	1.2	1.1	1.1
Cobalt (Co)	1.0	1.0	1.0	0.8	0.7	1.0	1.0	1.0	0.9	0.9
Copper (Cu)	1.3	1.3	1.0	1.0	0.4	0.8	0.8	1.0	0.7	0.7
Iron (Fe)	1.8	1.0	1.2	0.6	0.3	2.2	1.3	1.0	0.9	0.9
Lead (Pb)	1.0	1.0	0.9	0.7	0.7	1.4	1.0	0.9	0.9	0.9
Lithium (Li)	1.0	1.3	0.5	0.3	0.3	1.0	1.0	0.2	0.3	0.4
Magnesium (Mg)	1.8	2.7	1.3	1.2	1.3	1.0	1.1	1.5	1.1	1.1
Manganese (Mn)	5.3	3.5	0.6	1.1	0.2	2.5	1.7	0.5	0.9	1.0
Mercury (Hg)	1.0	1.0	0.5	0.5	0.5	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	1.5	2.1	1.2	1.5	1.4	7.6	1.1	1.6	9.3	1.2
Nickel (Ni)	1.0	1.0	0.9	1.0	0.9	1.0	1.0	1.0	1.0	1.0
Potassium (K)	1.0	1.3	1.1	1.5	1.5	0.7	0.7	1.2	1.2	1.2
Selenium (Se)	0.1	1.0	2.8	0.1	1.8	1.0	1.0	1.2	1.4	1.9
Silicon (Si)	1.3	1.5	1.2	1.0	0.8	1.1	1.0	1.2	1.0	1.1
Silver (Ag)	1.0	1.0	1.6	1.8	1.8	1.0	1.0	1.2	1.9	2.3
Sodium (Na)	2.7	4.5	1.6	2.9	2.1	1.4	1.7	1.5	1.6	1.6
Strontium (Sr)	1.2	2.0	1.4	1.4	1.4	0.7	0.9	1.2	1.0	0.9
Thallium (Tl)	0.1	1.0	1.6	0.1	1.0	1.0	1.0	1.1	1.5	2.1
Tin (Sn)	1.0	1.0	0.1	0.0	0.0	1.0	1.0	0.2	0.1	0.1
Titanium (Ti)	0.1	1.0	1.0	0.1	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	3.9	10	1.5	1.5	1.5	2.2	2.9	1.8	1.5	1.4
Vanadium (V)	0.5	1.0	1.0	0.5	0.5	1.0	1.0	1.0	1.0	1.0
Zinc (Zn)	1.0	1.0	1.6	1.6	-	1.3	1.0	1.7	1.8	1.4

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
Denotes highly elevated concentration (mean concentration greater than 10 times higher than respective mean reference or baseline period value).
Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.70: **Dissolved Metal Concentrations at Mary Lake North Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2020**

	Parameters	Units	Winter Sampling Event						Summer Sampling Event						Fall Sampling Event					
			BL0-01-A	BL0-01-A	BL0-01	BL0-01	BL0-01-B	BL0-01-B	BL0-01-A	BL0-01-A	BL0-01	BL0-01	BL0-01-B	BL0-01-B	BL0-01-A	BL0-01-A	BL0-01	BL0-01	BL0-01-B	BL0-01-B
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			19-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	19-Apr-20	30-Jul-20	30-Jul-20	30-Jul-20	30-Jul-20	30-Jul-20	30-Jul-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	<0.0030	0.0041	0.0060	0.0058	0.0067	<0.0030	0.0097	0.0085	0.0070	0.0078	0.0580	0.0078	0.0063	0.0047	0.0045	0.0049	0.005	0.0045
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.0136	0.0145	0.0144	0.0154	0.0144	0.0150	0.00454	0.00809	0.00617	0.00816	0.00800	0.00807	0.011	0.011	0.0106	0.0107	0.0105	0.0108
	Beryllium (Be)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Boron (B)	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
	Cadmium (Cd)	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	30.1	30.4	30.0	31.1	30.6	31.8	8.11	14.8	11.7	14.8	14.3	14.3	22.2	21.5	21.1	21.2	21.4	21.8
	Chromium (Cr)	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Cobalt (Co)	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
	Copper (Cu)	mg/L	0.00078	0.00126	0.00124	0.00124	0.00125	0.00119	0.00055	0.00091	0.00071	0.00088	0.00089	0.00087	0.00102	0.00096	0.00098	0.00097	0.00095	0.00096
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.049	0.013	0.010	0.014	0.011	0.012	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	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
	Lithium (Li)	mg/L	0.0013	0.0014	0.0014	0.0013	0.0014	0.0016	<0.0010	0.0010	<0.0010	0.0010	0.0010	<0.0010	0.0013	0.0013	0.0013	0.0013	0.0013	0.0013
	Magnesium (Mg)	mg/L	18.3	19.3	18.9	20.2	19.4	19.5	4.61	8.29	6.62	8.34	8.13	8.21	12.7	12.7	12.9	12.8	12.9	12.5
	Manganese (Mn)	mg/L	0.00187	0.000444	0.000494	0.000395	0.000501	0.000403	0.00207	0.00074	0.00030	0.00065	0.00080	0.00073	0.000548	0.000448	0.000423	0.000364	0.000464	0.000479
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000307	0.000393	0.000383	0.000396	0.000397	0.000393	0.000126	0.000236	0.000180	0.000232	0.000238	0.000233	0.00031	0.000323	0.000311	0.000318	0.000313	0.000306
	Nickel (Ni)	mg/L	0.00074	0.00077	0.00075	0.00079	0.00075	0.00073	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050
	Potassium (K)	mg/L	1.32	1.40	1.38	1.47	1.41	1.45	0.585	0.941	0.777	0.959	0.941	0.953	1.17	1.13	1.16	1.16	1.18	1.14
	Selenium (Se)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Silicon (Si)	mg/L	2.16	1.37	1.39	1.41	1.39	1.39	0.633	0.635	0.553	0.615	0.615	0.633	0.700	0.710	0.720	0.700	0.700	0.700
	Silver (Ag)	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
	Sodium (Na)	mg/L	6.55	6.90	6.78	7.19	6.85	6.97	1.15	2.87	1.98	2.80	2.74	2.75	4.43	4.38	4.46	4.40	4.39	4.38
	Strontium (Sr)	mg/L	0.0218	0.0225	0.0231	0.0231	0.0226	0.0230	0.00580	0.0117	0.00855	0.0118	0.0115	0.0115	0.0165	0.0165	0.0161	0.0163	0.0163	0.0161
	Thallium (Tl)	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
	Uranium (U)	mg/L	0.00366	0.00480	0.00462	0.00482	0.00470	0.00482	0.000428	0.00147	0.000947	0.00146	0.00145	0.00147	0.00343	0.00343	0.00338	0.00339	0.00346	0.00341
	Vanadium (V)	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	0.0082	<0.0030	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

Table C.71: Magnitude of Elevation in Seasonal Average Dissolved Metal Concentrations Between Mary Lake and Reference Lake 3 in 2020, and at Mary Lake Between 2020 and the Baseline Period

Dissolved Metal	Mary Lake North Basin					Mary Lake South Basin				
	2020 vs Reference Lake 3		2020 vs Baseline			2020 vs Reference Lake 3		2020 vs Baseline		
	Summer	Fall	Winter	Summer	Fall	Summer	Fall	Winter	Summer	Fall
Aluminum (Al)	1.3	1.2	0.4	1.4	1.0	1.2	3.1	0.5	1.3	2.8
Antimony (Sb)	1.0	1.0	0.8	0.8	1.0	1.0	1.0	0.8	0.8	1.0
Arsenic (As)	1.0	1.0	0.8	0.9	1.0	1.0	1.0	0.8	0.9	1.0
Barium (Ba)	1.2	1.7	1.6	0.8	2.4	0.7	0.8	0.8	0.5	1.1
Beryllium (Be)	0.2	1.0	1.0	0.3	2.1	1.0	1.0	1.0	1.4	2.1
Bismuth (Bi)	0.1	1.0	1.0	0.1	1.0	1.0	1.0	1.0	1.0	1.0
Boron (B)	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Cadmium (Cd)	0.5	1.0	0.8	0.3	1.0	1.0	1.0	0.8	0.5	1.0
Calcium (Ca)	1.9	3.0	1.8	0.7	1.4	1.0	1.1	0.8	0.4	0.5
Chromium (Cr)	0.2	1.0	1.3	0.3	2.1	1.0	1.0	1.3	1.7	2.1
Cobalt (Co)	1.0	1.0	0.8	0.8	1.0	1.0	1.0	0.8	0.8	1.0
Copper (Cu)	1.2	1.3	0.8	0.6	1.3	0.8	0.8	0.6	0.4	0.7
Iron (Fe)	0.6	1.0	0.9	0.6	1.8	1.0	1.0	0.9	1.1	1.8
Lead (Pb)	1.0	1.0	1.0	0.8	1.0	1.0	1.0	1.0	0.8	1.0
Lithium (Li)	1.0	1.3	0.3	0.3	0.6	1.0	1.0	0.2	0.3	0.4
Magnesium (Mg)	1.7	2.6	1.9	0.7	1.4	1.0	1.0	0.8	0.4	0.6
Manganese (Mn)	3.9	3.3	0.5	0.6	0.1	2.8	1.8	0.3	0.4	0.1
Mercury (Hg)	1.0	1.0	0.5	0.5	0.5	1.0	1.0	0.5	0.5	0.5
Molybdenum (Mo)	1.6	2.0	1.6	0.8	1.8	1.0	1.1	1.0	0.5	1.0
Nickel (Ni)	1.0	1.0	1.2	0.7	0.9	1.0	1.0	0.8	0.7	0.9
Potassium (K)	1.0	1.2	1.7	1.0	1.5	0.6	0.7	1.0	0.6	0.9
Selenium (Se)	0.1	1.0	-	0.5	-	1.0	1.0	-	-	-
Silicon (Si)	1.3	1.4	1.7	0.7	0.8	0.9	0.9	0.7	0.5	0.5
Silver (Ag)	1.0	1.0	0.2	1.8	2.5	1.0	1.0	0.2	1.8	2.5
Sodium (Na)	2.6	4.3	4.0	1.1	2.1	1.4	1.6	1.3	0.6	0.8
Strontium (Sr)	1.2	2.0	2.1	0.9	1.7	0.7	0.9	1.1	0.5	0.7
Thallium (Tl)	0.1	1.0	1.0	0.1	2.5	1.0	1.0	1.0	1.4	2.5
Tin (Sn)	1.0	1.0	0.0	0.2	0.4	1.0	1.0	0.0	0.2	0.4
Titanium (Ti)	0.0	1.0	1.0	0.0	1.0	1.0	1.0	1.0	1.0	1.0
Uranium (U)	4.0	10	2.3	0.6	2.3	2.2	2.8	0.7	0.3	0.6
Vanadium (V)	0.5	1.0	0.8	0.5	1.0	1.0	1.0	0.8	0.9	1.0
Zinc (Zn)	0.4	1.0	2.1	0.5	1.2	1.0	1.1	1.9	1.3	1.3

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference or baseline period value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference or baseline period value).
Denotes highly elevated concentration (mean concentration ≥ 10 times higher than respective mean reference or baseline period value).
Denotes differences in method detection limit between the 2020 and baseline data, precluding an evaluation of magnitude of elevation.

Table C.72: Water Chemistry at Mary Lake South Basin (BLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Winter Sampling Event													
					BL0-05-A	BL0-05-A	BL0-05	BL0-05	BL0-05-B	BL0-05-B	BL0-03	BL0-03	BL0-04	BL0-04	BL0-09	BL0-09	BL0-06	BL0-06
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					21-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20
Conventionals	Conductivity (lab)	umho/cm	-	-	123	131	125	130	130	133	124	138	123	131	122	132	128	133
	pH (lab)	pH	6.5 - 9.0	-	7.70	7.73	7.56	7.67	7.68	7.68	7.65	7.71	7.61	7.72	7.42	7.66	7.60	7.68
	Hardness (as $CaCO_3$)	mg/L	-	-	65.4	68.1	65.5	68.2	69.5	69.4	65.2	71	63.5	66.2	62.4	63.9	64.9	67.8
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	82	95	91	102	91	89	83	96	66	79	73	78	77	82
	Turbidity	NTU	-	-	<0.10	<0.10	0.14	<0.10	0.12	0.12	<0.10	0.10	0.13	0.12	0.18	<0.10	<0.10	0.10
	Alkalinity (as $CaCO_3$)	mg/L	-	-	57	59	59	60	60	61	56	62	58	62	56	62	59	61
Nutrients and Organics	Total Ammonia	mg/L	variable[c]	0.855	<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
	Nitrate	mg/L	3	3	0.044	0.049	0.051	0.048	0.042	0.050	0.043	0.052	0.057	0.068	0.079	0.046	0.050	0.051
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	0.20	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.23
	Dissolved Organic Carbon	mg/L	-	-	3.00	3.14	3.18	3.20	3.19	2.84	3.51	3.36	3.02	3.11	2.63	2.96	2.99	3.05
	Total Organic Carbon	mg/L	-	-	3.86	4.16	3.84	4.21	3.87	4.04	3.34	3.36	3.24	3.46	3.22	3.39	3.22	3.63
	Total Phosphorus	mg/L	0.020[α]	-	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0033	<0.0030	<0.0030
	Phenols	mg/L	0.004[α]	-	0.0023	0.0026	0.0022	0.0025	0.0026	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<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
	Chloride (Cl)	mg/L	120	120	4.33	4.63	4.36	4.60	4.64	4.70	4.35	4.96	4.34	4.67	4.47	4.63	4.48	4.69
	Sulphate (SO_4)	mg/L	218[β]	218	3.73	3.95	3.74	3.97	4.01	4.03	3.47	3.94	3.72	3.99	3.66	3.99	3.88	4.04
Total Metals	Aluminum (Al)	mg/L	0.100	0.130	0.0057	0.0052	0.0064	0.0058	0.0053	0.0088	0.0049	0.0037	0.0060	0.0055	0.0085	0.0053	0.0063	0.0081
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00671	0.00739	0.00675	0.00699	0.00694	0.00706	0.00662	0.00698	0.00663	0.00710	0.00706	0.00720	0.00702	0.00731
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	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
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	12.7	13.0	13.0	13.1	13.6	13.3	12.4	13.6	12.4	12.7	12.3	12.6	13.0	13.6
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<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 (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<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 (Cu)	mg/L	0.002	0.0024	0.00072	0.00080	0.00071	0.00074	0.00073	0.00077	0.00078	0.00075	0.00071	0.00074	0.00070	0.00074	0.00075	0.00078
	Iron (Fe)	mg/L	0.30	0.326	<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 (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<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 (Li)	mg/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
	Magnesium (Mg)	mg/L	-	-	7.73	8.46	7.64	7.84	7.91	8.16	7.97	8.26	7.10	7.65	7.34	7.56	7.50	7.81
	Manganese (Mn)	mg/L	0.935[β]	-	0.000413	0.000394	0.000822	0.000322	0.000364	0.000416	0.000521	0.00103	0.000514	0.000318	0.000913	0.000351	0.000398	0.000428
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000061	0.0000052	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000223	0.000230	0.000217	0.000235	0.000243	0.000241	0.000215	0.000228	0.000254	0.000276	0.000230	0.000264	0.000263	0.000275
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	0.00052	<0.00050	<0.00050	<0.00050	<0.00050	0.00052	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050	0.00051
	Potassium (K)	mg/L	-	-	0.79	0.87	0.79	0.82	0.82	0.82	0.79	0.86	0.83	0.88	0.84	0.89	0.88	0.92
	Selenium (Se)	mg/L	0.001	-	<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
	Silicon (Si)	mg/L	-	-	0.58	0.60	0.60	0.59	0.56	0.59	0.58	0.61	0.58	0.60	0.79	0.60	0.59	0.60
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<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 (Na)	mg/L	-	-	1.99	2.19	1.98	2.08	2.12	2.11	2.11	2.22	2.00	2.12	2.09	2.11	2.13	2.21
	Strontium (Sr)	mg/L	-	-	0.0111	0.0117	0.0112	0.0113	0.0118	0.0120	0.0109	0.0121	0.0106	0.0119	0.0102	0.0116	0.0117	0.0122
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.015	-	0.00133	0.00140	0.00129	0.00137	0.00139	0.00141	0.00126	0.00138	0.00131	0.00137	0.00121	0.00139	0.00139	0.00140
	Vanadium (V)	mg/L	0.006[α]	0.006	<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
	Zinc (Zn)	mg/L	0.030	0.030	<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

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Mary Lake.

Table C.72: Water Chemistry at Mary Lake South Basin (BLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Summer Sampling Event													
					BL0-05-A	BL0-05-A	BL0-05	BL0-05	BL0-05-B	BL0-05-B	BL0-03	BL0-03	BL0-04	BL0-04	BL0-09	BL0-09	BL0-06	BL0-06
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	31-Jul-20	31-Jul-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20	01-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	76.5	76.1	76.2	77.1	79.4	93.3	73.2	78.0	73.1	79.9	70.1	78.4	78.9	79.0
	pH (lab)	pH	6.5 - 9.0	-	7.54	7.72	7.52	7.72	7.63	7.82	7.55	7.89	7.45	7.81	7.44	7.75	7.61	7.72
	Hardness (as $CaCO_3$)	mg/L	-	-	32.9	34.6	33.8	34.3	35	41.6	31.5	35.3	31.1	34.1	29.9	33.7	33.8	33.6
	Total Suspended Solids (TSS)	mg/L	-	-	2.1	<2.0	2.1	<2.0	2.1	2.5	2.1	<2.0	2.5	<2.0	2.2	<2.0	3.0	<2.0
	Total Dissolved Solids (TDS)	mg/L	-	-	47	52	43	48	53	63	38	46	53	53	49	51	47	51
	Turbidity	NTU	-	-	3.12	1.73	1.83	1.75	3.33	4.09	1.47	1.13	1.96	1.03	1.80	1.38	1.83	1.50
	Alkalinity (as $CaCO_3$)	mg/L	-	-	40	40	44	44	41	55	42	44	39	38	40	45	43	41
Nutrients and Organics	Total Ammonia	mg/L	variable[c]	0.855	<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
	Nitrate	mg/L	3	3	0.039	0.021	0.024	0.021	0.039	0.043	0.025	<0.020	<0.10	<0.10	0.030	0.020	<0.020	0.022
	Nitrite	mg/L	0.06	0.06	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.025	<0.025	<0.0050	<0.0050	<0.0050	<0.0050
	Total Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15
	Dissolved Organic Carbon	mg/L	-	-	2.09	1.95	2.24	2.11	1.39	2.28	2.06	2.36	2.68	1.90	2.50	2.65	2.46	2.57
	Total Organic Carbon	mg/L	-	-	2.91	3.06	2.81	3.07	3.13	3.21	2.94	2.02	2.84	3.10	2.94	3.12	3.20	3.03
	Total Phosphorus	mg/L	0.020[α]	-	0.0042	0.0035	0.0051	<0.0030	0.0072	0.0047	0.0043	0.0032	0.0072	0.0043	0.0047	0.0049	0.0050	0.0045
	Phenols	mg/L	0.004[α]	-	<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
Anions	Bromide (Br)	mg/L	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.50	<0.50	<0.10	<0.10	<0.10	<0.10
	Chloride (Cl)	mg/L	120	120	3.01	2.63	2.66	2.67	2.79	3.34	2.57	2.59	2.6	3.3	2.38	2.64	2.63	2.64
	Sulphate (SO_4)	mg/L	218[β]	218	1.94	1.86	1.84	1.81	2.00	2.46	1.51	1.60	1.7	1.9	1.68	1.81	1.83	1.84
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	0.0887	0.0635	0.0639	0.0700	0.114	**0.131**	0.0124	0.0391	0.0684	0.0346	0.0743	0.0435	0.0520	0.0512
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Barium (Ba)	mg/L	-	-	0.00489	0.00453	0.00429	0.00474	0.00507	0.00602	0.00384	0.00465	0.00416	0.00444	0.00449	0.00444	0.00446	0.00482
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	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
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	7.21	7.22	6.48	6.80	7.67	8.22	6.38	7.01	6.54	6.94	6.16	6.69	7.45	6.99
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<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 (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<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 (Cu)	mg/L	0.002	0.0024	0.00064	0.00057	0.00057	0.00060	0.00064	0.00074	<0.00050	0.00060	0.00057	0.00056	0.00063	0.00057	0.00056	0.00057
	Iron (Fe)	mg/L	0.30	0.326	0.103	0.061	0.057	0.066	0.095	0.110	<0.030	0.041	0.074	0.042	0.074	0.052	0.051	0.052
	Lead (Pb)	mg/L	0.001	0.001	0.000101	0.000061	0.000066	0.000059	0.000107	0.000109	<0.000050	<0.000050	0.000084	<0.000050	0.000080	0.000060	0.000061	0.000053
	Lithium (Li)	mg/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
	Magnesium (Mg)	mg/L	-	-	4.03	4.08	3.83	4.19	4.15	4.94	4.08	4.40	3.48	4.11	3.69	4.12	3.99	4.17
	Manganese (Mn)	mg/L	0.935[β]	-	0.00269	0.00177	0.00223	0.00197	0.00246	0.00249	0.000527	0.00184	0.00240	0.00175	0.00274	0.00178	0.00171	0.00177
	Mercury (Hg)	mg/L	0.000026	-	<0.0000050	0.0000051	0.0000053	<0.0000050	0.0000063	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	0.0000052	<0.0000050
	Molybdenum (Mo)	mg/L	0.073	-	0.000130	0.000143	0.000114	0.000135	0.000148	0.000193	0.0122	0.000114	0.000121	0.000125	0.000113	0.000132	0.000139	0.000131
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.59	0.57	0.54	0.58	0.60	0.72	0.53	0.58	0.50	0.55	0.54	0.56	0.54	0.58
	Selenium (Se)	mg/L	0.001	-	<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
	Silicon (Si)	mg/L	-	-	0.57	0.53	0.52	0.59	0.64	0.71	0.45	0.45	0.55	0.44	0.53	0.49	0.50	0.46
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<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 (Na)	mg/L	-	-	1.26	1.27	1.17	1.35	1.38	1.74	1.28	1.34	1.06	1.24	1.13	1.27	1.20	1.30
	Strontium (Sr)	mg/L	-	-	0.00635	0.00644	0.00556	0.00614	0.00708	0.00813	0.00530	0.00584	0.00591	0.00591	0.00555	0.00618	0.00658	0.00609
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.015	-	0.000755	0.000721	0.000583	0.000681	0.000864	0.00113	0.000505	0.000642	0.000639	0.000648	0.000574	0.000689	0.000728	0.000686
	Vanadium (V)	mg/L	0.006[α]	0.006	<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
	Zinc (Zn)	mg/L	0.030	0.030	<0.0030	<0.0030	0.0136	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030

[shaded box] Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Mary Lake.

Table C.72: Water Chemistry at Mary Lake South Basin (BLO) Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Water Quality Guideline (WQG)[a]	AEMP Benchmark[b]	Fall Sampling Event													
					BL0-05-A	BL0-05-A	BL0-05	BL0-05	BL0-05-B	BL0-05-B	BL0-03	BL0-03	BL0-04	BL0-04	BL0-09	BL0-09	BL0-06	BL0-06
					bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
					28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Conventionals	Conductivity (lab)	umho/cm	-	-	89.2	88.9	87.8	87.4	88.4	88	83.3	84.1	89.1	88.2	91.1	87.8	87.9	88.4
	pH (lab)	pH	6.5 - 9.0	-	7.76	7.78	7.81	7.75	7.78	7.79	7.73	7.75	7.76	7.76	7.7	7.75	7.73	7.39
	Hardness (as $CaCO_3$)	mg/L	-	-	42.2	41.5	41.9	41.5	42.6	42.3	39.5	38.9	40.1	41.0	41.3	41.0	40.6	40.8
	Total Suspended Solids (TSS)	mg/L	-	-	<2.0	2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2.0	<2.0	<2.0	2.0	3.2
	Total Dissolved Solids (TDS)	mg/L	-	-	49	52	57	57	52	45	46	58	58	56	48	50	52	50
	Turbidity	NTU	-	-	1.45	1.44	1.56	1.56	1.49	1.59	0.63	0.63	1.41	1.60	1.69	1.45	1.67	1.60
	Alkalinity (as $CaCO_3$)	mg/L	-	-	40	38	38	39	38	38	36	37	37	38	39	38	38	40
Nutrients and Organics	Total Ammonia	mg/L	variable[c]	0.855	<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
	Nitrate	mg/L	3	3	0.038	0.037	0.036	0.051	0.041	0.054	<0.020	0.027	0.054	0.039	0.084	0.036	0.05	0.038
	Nitrite	mg/L	0.06	0.06	<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 Kjeldahl Nitrogen (TKN)	mg/L	-	-	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	<0.15	0.15
	Dissolved Organic Carbon	mg/L	-	-	1.75	1.83	1.72	1.69	1.88	1.82	1.89	2.03	2.18	1.86	1.84	2.18	1.81	1.66
	Total Organic Carbon	mg/L	-	-	2.21	2.16	2.19	2.09	2.41	2.31	2.23	2.61	2.17	2.20	2.23	2.40	2.33	2.07
	Total Phosphorus	mg/L	0.020[α]	-	<0.0030	<0.0030	0.0032	<0.0030	0.0041	0.0061	0.0093	<0.0030	0.0067	0.0049	0.0031	0.0049	0.0045	0.0124
	Phenols	mg/L	0.004[α]	-	0.0014	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0016	<0.0010	<0.0010	0.0012	0.0013	0.0013	<0.0010
Anions	Bromide (Br)	mg/L	-	-	<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
	Chloride (Cl)	mg/L	120	120	3.40	3.39	3.33	3.37	3.37	3.39	2.99	3.00	3.35	3.47	4.43	3.35	3.38	3.37
	Sulphate (SO_4)	mg/L	218[β]	218	2.40	2.41	2.34	2.39	2.41	2.64	1.77	1.76	2.35	2.44	2.74	2.37	2.37	2.38
Total Metals	Aluminum (Al)	mg/L	0.100	0.13	0.0459	0.0459	0.03	0.0432	0.0489	0.035	0.0178	0.0165	0.0357	0.0356	0.044	0.0502	0.0421	0.0459
	Antimony (Sb)	mg/L	0.020[α]	-	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Arsenic (As)	mg/L	0.005	0.005	<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
	Barium (Ba)	mg/L	-	-	0.00523	0.0053	0.00507	0.0052	0.00522	0.00507	0.00441	0.00445	0.00515	0.00529	0.00543	0.00509	0.00504	0.00527
	Beryllium (Be)	mg/L	0.011[α]	-	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Bismuth (Bi)	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
	Boron (B)	mg/L	1.5	-	<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
	Cadmium (Cd)	mg/L	0.00012	0.00006	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
	Calcium (Ca)	mg/L	-	-	7.97	8.07	7.95	7.93	8.08	8.00	7.51	7.52	7.98	7.95	8.27	8.08	7.93	7.91
	Chromium (Cr)	mg/L	0.0089	0.0089	<0.00050	<0.00050	<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 (Co)	mg/L	0.0009[α]	0.004	<0.00010	<0.00010	<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 (Cu)	mg/L	0.002	0.0024	0.00061	0.0006	0.00057	0.0006	0.00059	0.00055	0.00057	0.00053	0.00058	0.00059	0.0007	0.0006	0.00058	0.00062
	Iron (Fe)	mg/L	0.30	0.326	0.044	0.04	0.034	0.038	0.045	0.037	<0.030	<0.030	0.042	0.037	0.048	0.046	0.044	0.047
	Lead (Pb)	mg/L	0.001	0.001	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.00005	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/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
	Magnesium (Mg)	mg/L	-	-	4.91	5.03	4.93	5.08	4.97	5.01	4.64	4.72	5.03	4.92	5.23	4.96	4.81	5.02
	Manganese (Mn)	mg/L	0.935[β]	-	0.00124	0.00113	0.00105	0.00108	0.00127	0.00106	0.0011	0.000787	0.00118	0.00112	0.00148	0.00116	0.00126	0.00125
	Mercury (Hg)	mg/L	0.000026	-	<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 (Mo)	mg/L	0.073	-	0.000171	0.000182	0.00017	0.000179	0.000184	0.000164	0.000144	0.000152	0.000173	0.000177	0.000194	0.000185	0.000166	0.000183
	Nickel (Ni)	mg/L	0.025	0.025	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	-	-	0.63	0.65	0.63	0.65	0.65	0.63	0.57	0.57	0.64	0.64	0.64	0.64	0.62	0.64
	Selenium (Se)	mg/L	0.001	-	<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
	Silicon (Si)	mg/L	-	-	0.51	0.50	0.47	0.53	0.49	0.48	0.43	0.46	0.48	0.48	0.53	0.51	0.47	0.50
	Silver (Ag)	mg/L	0.00025	0.0001	<0.000010	<0.000010	<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 (Na)	mg/L	-	-	1.63	1.62	1.60	1.65	1.57	1.61	1.49	1.46	1.65	1.59	1.64	1.63	1.59	1.63
	Strontium (Sr)	mg/L	-	-	0.00709	0.00725	0.00711	0.00709	0.00727	0.00711	0.00626	0.00621	0.00714	0.00713	0.0075	0.00707	0.00698	0.00713
	Thallium (Tl)	mg/L	0.0008	0.0008	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.015	-	0.00101	0.00102	0.000984	0.000981	0.00101	0.000974	0.000762	0.000744	0.000994	0.000983	0.00109	0.00102	0.000973	0.000984
	Vanadium (V)	mg/L	0.006[α]	0.006	<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
	Zinc (Zn)	mg/L	0.030	0.030	<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

Indicates parameter concentration above applicable Water Quality Guideline.

BOLD Indicates parameter concentration above the AEMP benchmark.

Note: "-" indicates no WQG benchmark applicable.

[a] Canadian Water Quality Guideline for the protection of aquatic life (CCME 1987, 1999) except those indicated by α (Ontario Provincial Water Quality Objective [PWQO]; OMOE 1994) and β (British Columbia Water Quality Guideline [BCWQG]; BCMOE 2013). See Table 2.2 for information regarding WQG criteria.

[b] AEMP Water Quality Benchmarks developed by Intrinsik (2013) using baseline water quality data specific to Mary Lake.

Table C.73: Dissolved Metal Concentrations at Mary Lake South Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Winter Sampling Event													
			BL0-05-A	**BL0-05-A**	**BL0-05**	**BL0-05**	**BL0-05-B**	**BL0-05-B**	**BL0-03**	**BL0-03**	**BL0-04**	**BL0-04**	**BL0-09**	**BL0-09**	**BL0-06**	**BL0-06**
			bottom	**surface**	**bottom**	**surface**	**bottom**	**surface**	**bottom**	**surface**	**bottom**	**surface**	**bottom**	**surface**	**bottom**	**surface**
			21-Apr-20	**21-Apr-20**	**21-Apr-20**	**21-Apr-20**	**21-Apr-20**	**21-Apr-20**	**19-Apr-20**	**19-Apr-20**	**20-Apr-20**	**20-Apr-20**	**20-Apr-20**	**20-Apr-20**	**20-Apr-20**	**20-Apr-20**
Dissolved Metals	Aluminum (Al)	mg/L	0.0081	0.0048	0.0046	0.0051	0.0076	0.0041	0.0037	0.0031	0.0045	0.0038	0.0097	0.0091	0.0060	0.0045
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00706	0.00726	0.00711	0.00742	0.00750	0.00744	0.00665	0.00762	0.00679	0.00709	0.00708	0.00730	0.00699	0.00721
	Beryllium (Be)	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
	Bismuth (Bi)	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
	Boron (B)	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
	Cadmium (Cd)	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
	Calcium (Ca)	mg/L	13.1	13.8	12.9	13.5	13.9	13.8	13.1	14.1	13.2	14.1	13.0	13.2	13.7	14.2
	Chromium (Cr)	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
	Cobalt (Co)	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
	Copper (Cu)	mg/L	0.00079	0.00082	0.00076	0.00081	0.00084	0.00081	0.00074	0.00080	0.00073	0.00157	0.00081	0.00080	0.00076	0.00076
	Iron (Fe)	mg/L	<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 (Pb)	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	0.000102	0.000055	<0.000050	<0.000050	<0.000050
	Lithium (Li)	mg/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
	Magnesium (Mg)	mg/L	7.93	8.21	8.05	8.37	8.44	8.48	7.89	8.68	7.42	7.53	7.30	7.54	7.48	7.85
	Manganese (Mn)	mg/L	0.000436	0.000302	0.000541	0.000298	0.000328	0.000281	0.000300	0.000847	0.000348	0.000239	0.000696	0.000386	0.000310	0.000306
	Mercury (Hg)	mg/L	<0.0000050	<0.0000050	0.0000051	<0.0000050	<0.0000050	<0.0000050	0.0000054	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
	Molybdenum (Mo)	mg/L	0.000223	0.000234	0.000229	0.000254	0.000247	0.000252	0.000204	0.000242	0.000253	0.000257	0.000256	0.000258	0.000266	0.000268
	Nickel (Ni)	mg/L	<0.00050	<0.00050	<0.00050	0.00053	0.00054	0.00051	<0.00050	<0.00050	<0.00050	<0.00050	0.00051	<0.00050	<0.00050	<0.00050
	Potassium (K)	mg/L	0.81	0.84	0.81	0.87	0.87	0.87	0.78	0.88	0.84	0.87	0.85	0.91	0.87	0.91
	Selenium (Se)	mg/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
	Silicon (Si)	mg/L	0.57	0.59	0.60	0.61	0.60	0.60	0.57	0.63	0.58	0.59	0.78	0.62	0.58	0.59
	Silver (Ag)	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
	Sodium (Na)	mg/L	2.07	2.18	2.08	2.20	2.17	2.20	2.03	2.27	2.10	2.14	2.10	2.18	2.08	2.22
	Strontium (Sr)	mg/L	0.0114	0.0118	0.0115	0.0120	0.0121	0.0119	0.0110	0.0119	0.0103	0.0116	0.0104	0.0119	0.0116	0.0120
	Thallium (Tl)	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
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.00138	0.00143	0.00132	0.00144	0.00145	0.00145	0.00130	0.00146	0.00135	0.00144	0.00127	0.00148	0.00142	0.00147
	Vanadium (V)	mg/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
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0107	<0.0030	<0.0030

Table C.73: Dissolved Metal Concentrations at Mary Lake South Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2020

	Parameters	Units	Summer Sampling Event													
			BL0-05-A bottom 01-Aug-20	BL0-05-A surface 01-Aug-20	BL0-05 bottom 01-Aug-20	BL0-05 surface 01-Aug-20	BL0-05-B bottom 01-Aug-20	BL0-05-B surface 01-Aug-20	BL0-03 bottom 31-Jul-20	BL0-03 surface 31-Jul-20	BL0-04 bottom 01-Aug-20	BL0-04 surface 01-Aug-20	BL0-09 bottom 01-Aug-20	BL0-09 surface 01-Aug-20	BL0-06 bottom 01-Aug-20	BL0-06 surface 01-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0143	0.0132	0.0155	0.0163	0.0126	0.0196	0.0357	0.0111	0.0137	0.0103	0.0141	0.0097	0.0127	0.0119
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00423	0.00407	0.00414	0.00417	0.00446	0.00545	0.00398	0.00444	0.00394	0.00409	0.00385	0.00406	0.00416	0.00415
	Beryllium (Be)	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
	Bismuth (Bi)	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
	Boron (B)	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
	Cadmium (Cd)	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
	Calcium (Ca)	mg/L	6.41	7.03	6.85	6.96	7.14	8.54	6.39	6.71	6.30	6.94	6.00	6.94	6.90	6.72
	Chromium (Cr)	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
	Cobalt (Co)	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
	Copper (Cu)	mg/L	<0.00050	0.00050	0.00051	0.00051	0.00057	0.00111	0.00051	0.00058	<0.00050	0.00051	<0.00050	0.00051	0.00052	0.00052
	Iron (Fe)	mg/L	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.044	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Lead (Pb)	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
	Lithium (Li)	mg/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
	Magnesium (Mg)	mg/L	4.09	4.14	4.05	4.11	4.18	4.92	3.77	4.51	3.73	4.08	3.63	3.98	4.04	4.09
	Manganese (Mn)	mg/L	0.000621	0.000492	0.000469	0.000469	0.000545	0.000601	0.00239	0.000416	0.000634	0.000362	0.000595	0.000410	0.000422	0.000409
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000128	0.000145	0.000134	0.000133	0.000148	0.000206	0.000093	0.000109	0.000126	0.000128	0.000110	0.000131	0.000130	0.000132
	Nickel (Ni)	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
	Potassium (K)	mg/L	0.55	0.54	0.54	0.55	0.58	0.68	0.49	0.63	0.51	0.53	0.50	0.54	0.55	0.56
	Selenium (Se)	mg/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
	Silicon (Si)	mg/L	0.44	0.42	0.42	0.43	0.45	0.49	0.45	0.39	0.43	0.39	0.43	0.40	0.42	0.41
	Silver (Ag)	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
	Sodium (Na)	mg/L	1.28	1.27	1.23	1.27	1.40	1.71	1.14	1.36	1.13	1.26	1.07	1.26	1.32	1.27
	Strontium (Sr)	mg/L	0.00581	0.00604	0.00600	0.00599	0.00657	0.00817	0.00538	0.00562	0.00569	0.00609	0.00549	0.00609	0.00599	0.00578
	Thallium (Tl)	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
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.000642	0.000688	0.000687	0.000682	0.000804	0.00113	0.000596	0.000583	0.000582	0.000661	0.000551	0.000682	0.000658	0.000630
	Vanadium (V)	mg/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
	Zinc (Zn)	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

Table C.73: Dissolved Metal Concentrations at Mary Lake South Basin Water Quality Monitoring Stations, Mary River Project CREMP, 2020

Parameters		Units	Fall Sampling Event													
			BL0-05-A	BL0-05-A	BL0-05	BL0-05	BL0-05-B	BL0-05-B	BL0-03	BL0-03	BL0-04	BL0-04	BL0-09	BL0-09	BL0-06	BL0-06
			bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface	bottom	surface
			28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Dissolved Metals	Aluminum (Al)	mg/L	0.0141	0.0169	0.0105	0.0142	0.0144	0.012	0.0063	0.0065	0.0142	0.0175	0.0148	0.016	0.0118	0.0161
	Antimony (Sb)	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
	Arsenic (As)	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
	Barium (Ba)	mg/L	0.00508	0.00508	0.00507	0.00488	0.00489	0.00509	0.00442	0.00434	0.00486	0.00499	0.0051	0.00478	0.00505	0.00481
	Beryllium (Be)	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
	Bismuth (Bi)	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
	Boron (B)	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
	Cadmium (Cd)	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
	Calcium (Ca)	mg/L	8.11	8.19	8.16	8.04	8.51	8.25	7.74	7.57	7.93	8.14	7.99	8.20	8.06	8.15
	Chromium (Cr)	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
	Cobalt (Co)	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
	Copper (Cu)	mg/L	0.00054	0.00056	0.0006	0.00057	0.00056	0.00054	0.0005	0.00052	0.00054	0.00057	0.00058	0.00055	0.00056	0.00057
	Iron (Fe)	mg/L	<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 (Pb)	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
	Lithium (Li)	mg/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
	Magnesium (Mg)	mg/L	5.33	5.12	5.23	5.20	5.19	5.26	4.91	4.86	4.92	5.02	5.17	4.98	4.97	4.96
	Manganese (Mn)	mg/L	0.000321	0.000327	0.000225	0.000298	0.000193	0.000246	0.000141	0.000182	0.000245	0.000248	0.000205	0.000227	0.00034	0.000208
	Mercury (Hg)	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
	Molybdenum (Mo)	mg/L	0.000178	0.000183	0.000179	0.00019	0.000178	0.000183	0.000143	0.000139	0.000181	0.000181	0.000188	0.00018	0.000185	0.000175
	Nickel (Ni)	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
	Potassium (K)	mg/L	0.66	0.73	0.66	0.73	0.67	0.73	0.58	0.62	0.63	0.73	0.65	0.74	0.66	0.74
	Selenium (Se)	mg/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
	Silicon (Si)	mg/L	0.46	0.47	0.45	0.46	0.45	0.47	0.43	0.42	0.44	0.43	0.46	0.44	0.45	0.47
	Silver (Ag)	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
	Sodium (Na)	mg/L	1.74	1.73	1.71	1.73	1.77	1.71	1.54	1.56	1.65	1.67	1.76	1.63	1.67	1.62
	Strontium (Sr)	mg/L	0.00724	0.00727	0.00715	0.00721	0.00727	0.00709	0.00623	0.00619	0.00707	0.00712	0.00729	0.00711	0.00719	0.00719
	Thallium (Tl)	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
	Tin (Sn)	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
	Titanium (Ti)	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
	Uranium (U)	mg/L	0.00099	0.000976	0.000962	0.000972	0.000986	0.000955	0.000743	0.000739	0.000949	0.000963	0.00103	0.000973	0.000932	0.000945
	Vanadium (V)	mg/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
	Zinc (Zn)	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030	0.0072	<0.0030	<0.0030	<0.0030	<0.0030

APPENDIX D

SEDIMENT QUALITY DATA

Table D.1: Deposited Sediment Field Observations and Collection Details at Unnamed Reference Creek[a], Mary River Project CREMP, August 2020

Station	Visually Assessed Texture Observations	Presence of Silt Precipitate
REF-CRK-1	medium (sized) course sand	none observed
REF-CRK-3	medium (sized) course sand	none observed
REF-CRK-5	medium (sized) course sand	none observed

[a] Deposited sediment samples were collected using a stainless steel spoon.

Table D.2: Deposited Sediment Total Organic Carbon and Metal Concentrations at Unnamed Reference Creek (REF-CRK), Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Unnamed Reference Creek Station			Study Area Summary Statistics		
			REF-CRK-B1	REF-CRK-B3	REF-CRK-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	<0.10	<0.10	0.16	0.12	0.035	0.020
Aluminum (Al)	µg/g	-	482	473	797	584	185	107
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.13	0.18	0.34	0.22	0.11	0.06
Barium (Ba)	µg/g	-	2.18	2.44	3.54	2.72	0.722	0.417
Beryllium (Be)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	<5.0	<5.0	0	0
Cadmium (Cd)	µg/g	3.5	<0.020	<0.020	<0.020	<0.020	0	0
Calcium (Ca)	µg/g	-	342	358	781	494	249	144
Chromium (Cr)	µg/g	90	1.82	9.25	12.3	7.79	5.39	3.11
Cobalt (Co)	µg/g	-	0.350	1.06	1.45	0.953	0.558	0.322
Copper (Cu)	µg/g	197	0.570	0.830	2.24	1.21	0.899	0.519
Iron (Fe)	µg/g	40,000[α]	1,880	14,700	20,900	12,493	9,700	5,600
Lead (Pb)	µg/g	91.3	0.870	1.70	1.90	1.49	0.546	0.315
Lithium (Li)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Magnesium (Mg)	µg/g	-	377	322	632	444	165	95
Manganese (Mn)	µg/g	1,100[α,β]	12.3	28.5	41.4	27.4	14.6	8.42
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Nickel (Ni)	µg/g	75[α,β]	0.820	1.79	2.66	1.76	0.920	0.531
Phosphorus (P)	µg/g	2,000[α]	109	111	280	167	98	57
Potassium (K)	µg/g	-	120	100	180	133	42	24
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	<50	<50	<50	<50	0	0
Strontium (Sr)	µg/g	-	1.59	1.80	2.62	2.00	0.544	0.314
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	<0.050	<0.050	<0.050	<0.050	0	0
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	35.3	84.6	130	83.3	47.4	27.3
Uranium (U)	µg/g	-	0.195	0.600	0.643	0.5	0.25	0.14
Vanadium (V)	µg/g	-	2.44	21.0	27.1	16.8	12.8	7.4
Zinc (Zn)	µg/g	315	<2.0	2.7	4.4	3.0	1.2	0.71
Zirconium (Zr)	µg/g	-	1.1	2.5	2.8	2.1	0.91	0.52

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.3: Field Observations of Sediment Properties at Reference Lake 3 (REF-03) Benthic Stations[a], Mary River Project CREMP, August 2020

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia[b]	Plant or Algal Presence
REF-03-1	10.5	brown silt on top of grey silt	presence of hydrogen sulphide odour	none observed
REF-03-2	10.6	grey silt sand	presence of hydrogen sulphide odour	sparse macrophytes, sparse algae
REF-03-3	10.0	brown grey silt and clay, some sandy material	none detected	none observed
REF-03-4	8.5	brown silt on grey silt	presence of hydrogen sulphide odour	sparse algae
REF-03-5	11.0	brown silt	none detected	sparse algae
REF-03-6	20.5	brown silt	none detected	none observed
REF-03-7	23.0	brown silt	none detected	none observed
REF-03-8	19.0	light brown and orange brown silt	none detected	none observed
REF-03-9	21.0	brown silt, slightly clay-like	none detected	none observed
REF-03-10	19.5	brown silt/clay, some red brown silt	none detected	none observed

[a] Sediment particle size and benthic invertebrate community samples were collected using a petite Ponar.

[b] Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.4: Observations from Sediment Cores Collected at Reference Lake 3 (REF-03), Mary River Project CREMP, August 2020

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
REF-03-1	9.0	Littoral	1	30.0	dark brown unconsolidated silt over dark grey fine sand.
			2	31.0	
			3	27.5	
			4	34.0	
REF-03-6	20.0	Profundal	1	20.5	light brown silt and fine sand over dark brown/grey coarse silt and sand.
			2	22.0	
			3	11.0	
			4	15.0	
REF-03-2	9.0	Littoral	1	37.0	light brown silt over dark grey fine sand.
			2	38.0	
			3	35.0	
			4	33.0	
REF-03-7	23.0	Profundal	1	12.0	light brown mixture of fine sand and silt with orange brown floc present, overlying unconsolidated light brown silt.
			2	17.0	
			3	19.0	
			4	21.0	
REF-03-3	10.0	Littoral	1	25.0	brown unconsolidated silt-sand fines overlying dark grey fine sand.
			2	26.0	
			3	20.0	
			4	19.0	
REF-03-8	18.5	Profundal	1	8.0	brown silt/fine sand (brown) upper layer on top of consolidated light grey sand overlying brown silt/sand.
			2	19.5	
			3	18.5	
			4	20.0	
REF-03-4	8.0	Littoral	1	23.0	light brown silt on top of consolidated dark grey fine sand underlain by light brown silt/sand.
			2	8.0	
			3	16.0	
			4	27.5	
REF-03-9	21.0	Profundal	1	10.5	brown silt, unconsolidated, or red/brown silt with some minor black streaking overlying consolidated grey silt.
			2	9.0	
			3	10.0	
			4	12.0	
REF-03-5	11.0	Littoral	1	30.5	brown unconsolidated silt overlying fine grey sand or dark grey silt/sand unconsolidated floc overlying dark grey silt/sand.
			2	33.5	
			3	26.0	
			4	27.0	
REF-03-10	20.0	Profundal	1	9.0	loose light brown silt overlying consolidated light grey silt.
			2	11.0	
			3	14.0	
			4	16.0	

Table D.5: Statistical Comparison of Substrate Physical Properties between Littoral and Profundal Sediment Stations of Individual Study Lakes, Mary River Project CREMP, August 2020

Lake	Habitat Variable	Statistical Test Results				Summary Statistics						
		Statistical Analysis[a]	Transform-ation	Significant Difference Between Areas?	P-value	Station Type	N	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Camp Lake	Sand (% by weight)	tequal	none	NO	0.109	Littoral	5	65.4	20.1	9.0	41.1	85.0
						Profundal	9	41.5	26.8	8.9	17.3	86.8
	Silt (% by weight)	tequal	none	NO	0.156	Littoral	5	32.1	18.2	8.2	14.2	55.1
						Profundal	9	50.6	23.6	7.9	11.8	79.2
	Clay (% by weight)	M-W	rank	YES	0.045	Littoral	5	2.6	2.0	0.9	1.0	5.5
						Profundal	9	7.9	4.7	1.6	1.4	14.7
	TOC (%)	tequal	none	NO	0.888	Littoral	5	1.4	1.2	0.5	0.3	3.4
						Profundal	9	1.5	0.9	0.3	0.3	3.1
Sheardown Lake NW	Sand (% by weight)	tequal	log10	YES	0.009	Littoral	7	40.5	24.6	9.3	20.1	93.0
						Profundal	7	17.2	9.3	3.5	8.5	35.3
	Silt (% by weight)	M-W	rank	YES	0.038	Littoral	7	48.6	20.5	7.7	6.4	67.1
						Profundal	7	68.2	9.8	3.7	49.3	78.9
	Clay (% by weight)	M-W	rank	YES	0.073	Littoral	7	10.9	4.7	1.8	1.0	14.8
						Profundal	7	14.6	3.3	1.2	8.8	17.2
	TOC (%)	tequal	none	YES	0.077	Littoral	7	2.5	1.4	0.5	0.2	4.3
						Profundal	7	1.4	0.5	0.2	0.4	2.0
Sheardown Lake SE	Sand (% by weight)	tequal	none	NO	0.330	Littoral	5	11.1	6.7	3.0	5.2	21.6
						Profundal	5	15.1	5.3	2.4	8.3	20.7
	Silt (% by weight)	tequal	none	NO	0.383	Littoral	5	75.0	5.5	2.5	68.9	81.5
						Profundal	5	72.2	4.0	1.8	67.5	76.6
	Clay (% by weight)	tequal	none	NO	0.590	Littoral	5	13.9	3.7	1.7	9.4	17.5
						Profundal	5	12.7	2.8	1.2	9.5	15.6
	TOC (%)	tequal	none	NO	0.428	Littoral	5	1.4	0.8	0.4	0.4	2.3
						Profundal	5	1.1	0.6	0.2	0.2	1.6
Mary Lake	Sand (% by weight)	tequal	log10	NO	0.839	Littoral	4	28.1	34.5	17.2	5.2	78.6
						Profundal	11	21.6	24.7	7.4	2.3	91.9
	Silt (% by weight)	M-W	rank	NO	0.851	Littoral	4	53.6	24.0	12.0	18.0	69.9
						Profundal	11	54.9	18.6	5.6	6.0	73.4
	Clay (% by weight)	tequal	none	NO	0.458	Littoral	4	18.3	14.5	7.2	3.4	32.0
						Profundal	11	23.5	10.6	3.2	2.1	33.2
	TOC (%)	tequal	none	NO	0.796	Littoral	4	0.8	0.5	0.2	0.2	1.3
						Profundal	11	0.7	0.3	0.1	0.2	1.5

Highlighted values indicate significant difference between study areas based on statistical test p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table D.6: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Reference Lake 3 (REF-03) Sediment Stations, Mary River Project CREMP, August 2020

Parameter		Units	Sediment Quality Guideline (SQG)[a]	Reference Lake 3 Station										Study Area Summary Statistics		
				REF-03-1 (littoral)	REF-03-6 (profundal)	REF-03-2 (littoral)	REF-03-7 (profundal)	REF-03-3 (littoral)	REF-03-8 (profundal)	REF-03-4 (littoral)	REF-03-9 (profundal)	REF-03-5 (littoral)	REF-03-10 (profundal)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	40.4	56.6	23.4	13.9	24.7	55.3	34.5	15.2	24.8	16.8	30.6	15.7	4.97
	Silt	%	-	53.4	36.9	68.4	71.9	61.9	38.4	59.3	71.8	68.2	68.1	59.8	13.05	4.13
	Clay	%	-	6.3	6.5	8.2	14.2	13.4	6.3	6.2	13.0	7.0	15.1	9.6	3.79	1.198
	Moisture	%	-	90.0	78.3	92.3	86.6	87.9	79.4	80.2	84.9	89.2	84.0	85.3	4.79	1.51
	Total Organic Carbon	%	10^{α}	6.95	2.20	6.54	4.30	3.71	2.36	2.26	4.52	4.54	3.71	4.11	1.66	0.525
Metals	Aluminum (Al)	mg/kg	-	15,400	19,000	18,200	24,700	19,300	20,400	16,200	22,300	15,300	22,600	19,340	3,204	1,013
	Antimony (Sb)	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	0
	Arsenic (As)	mg/kg	17	4.73	3.66	4.36	4.65	3.67	3.76	2.78	4.03	2.10	4.24	3.80	0.82	0.261
	Barium (Ba)	mg/kg	-	139	98.4	134	143	99.7	108	88.4	129	124	132	120	19.3	6.10
	Beryllium (Be)	mg/kg	-	0.59	0.68	0.74	0.93	0.69	0.77	0.65	0.80	0.56	0.84	0.73	0.11	0.036
	Bismuth (Bi)	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	0
	Boron (B)	mg/kg	-	11.6	11.9	13.1	16.8	13.2	14.5	11.7	15.1	11.5	15.0	13.4	1.84	0.580
	Cadmium (Cd)	mg/kg	3.5	0.246	0.128	0.184	0.175	0.120	0.144	0.163	0.142	0.150	0.150	0.160	0.0359	0.0114
	Calcium (Ca)	mg/kg	-	6,080	4,410	7,440	5,480	4,820	4,830	4,190	5,180	5,510	5,150	5,309	930	294
	Chromium (Cr)	mg/kg	90	54.9	57.1	57.4	73.0	59.4	59.3	48.6	68.5	51.3	67.3	59.7	7.75	2.45
	Cobalt (Co)	mg/kg	-	10.8	13.2	9.86	17.2	12.8	14.1	11.8	15.6	8.59	15.8	13.0	2.77	0.88
	Copper (Cu)	mg/kg	197	80.0	68.8	89.7	97.6	72.2	77.5	59.8	86.1	55.3	89.2	77.6	13.7	4.32
	Iron (Fe)	mg/kg	$40,000^{\alpha}$	83,200	39,600	68,900	51,100	41,400	42,100	38,000	45,700	21,500	46,900	47,840	17,136	5,419
	Lead (Pb)	mg/kg	91.3	13.7	14.2	14.3	19.1	14.8	15.8	12.9	17.2	13.1	17.1	15.2	2.03	0.64
	Lithium (Li)	mg/kg	-	23.2	29.3	26.3	38.8	29.6	30.6	26.8	34.4	24.1	35.5	29.9	5.09	1.61
	Magnesium (Mg)	mg/kg	-	11,600	12,500	11,800	16,000	12,500	13,000	10,400	14,800	10,900	14,600	12,810	1,811	573
	Manganese (Mn)	mg/kg	$1,100^{\alpha,\beta}$	578	909	413	1,250	790	1,010	866	1,820	246	1,160	904	451	143
	Mercury (Hg)	mg/kg	0.486	0.0730	0.0391	0.0594	0.0689	0.0396	0.0497	0.0269	0.0806	0.0511	0.0530	0.0541	0.0167	0.0053
	Molybdenum (Mo)	mg/kg	-	6.77	2.74	8.95	2.86	2.87	2.40	2.74	2.19	0.87	2.42	3.48	2.43	0.770
	Nickel (Ni)	mg/kg	$75^{\alpha,\beta}$	44.5	39.5	41.7	50.9	40.4	41.6	38.5	47.3	35.1	45.7	42.5	4.64	1.47
	Phosphorus (P)	mg/kg	$2,000^{\alpha}$	1,700	888	1,470	1,000	963	959	810	933	892	999	1,061	287	91
	Potassium (K)	mg/kg	-	3,560	4,660	4,280	6,030	4,760	4,940	4,040	5,590	3,860	5,470	4,719	805	255
	Selenium (Se)	mg/kg	-	1.02	0.40	1.09	0.68	0.58	0.55	0.42	0.89	0.53	0.55	0.67	0.24	0.077
	Silver (Ag)	mg/kg	-	0.17	0.12	0.21	0.26	0.12	0.18	<0.10	0.25	0.11	0.20	0.17	0.058	0.018
	Sodium (Na)	mg/kg	-	283	299	315	413	332	347	259	421	332	366	337	52	17
	Strontium (Sr)	mg/kg	-	11.7	10.5	14.3	13.8	11.3	11.8	9.64	12.9	11.0	12.6	12.0	1.46	0.461
	Sulphur (S)	mg/kg	-	1,700	<1,000	1,900	1,300	1,300	<1,000	<1,000	1,400	1,100	<1,000	1,270	320	101
	Thallium (Tl)	mg/kg	-	0.373	0.470	0.402	0.714	0.437	0.535	0.355	0.637	0.330	0.614	0.487	0.132	0.0418
	Tin (Sn)	mg/kg	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0	0
	Titanium (Ti)	mg/kg	-	936	1,070	866	1,190	1,030	1,100	1,050	1,170	1,150	1,150	1,071	105	33
	Uranium (U)	mg/kg	-	14.3	15.5	12.5	24.2	10.3	19.5	9.85	16.7	8.13	22.8	15.4	5.48	1.73
	Vanadium (V)	mg/kg	-	52.4	57.7	61.7	70.2	57.2	60.0	51.3	63.4	47.9	65.7	58.8	6.90	2.18
	Zinc (Zn)	mg/kg	315	71.3	73.7	85.7	96.4	74.8	79.3	67.9	82.9	65.8	86.7	78.5	9.56	3.02
	Zirconium (Zr)	mg/kg	-	4.4	3.9	4.9	4.2	3.3	3.5	3.9	3.8	6.0	4.3	4.2	0.78	0.25

Indicates parameter concentration above Sediment Quality Guideline (SQG).

Note: "-" indicates no SQG applicable.

[a] Canadian Sediment Quality Guideline for the protection of aquatic life probable effects level (PEL; CCME 2015) except α (Ontario Provincial Sediment Quality Guideline [PSQO] severe effect level [SEL]; OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG], probable effects level [PEL; BCMOE 2015]).

Table D.7: Deposited Sediment Field Sampling Observations from Camp Lake Tributary 1 and Camp Lake Tributary 2[a], Mary River Project CREMP, August 2020

Study Area	Station	Texture of Collected Sediment	Silt Presence[b]
Camp Lake Tributary 1 Upstream (North Branch; CLT1 US)	CLT1 US-1	medium (sized) coarse sand	none observed
	CLT1 US-3	medium (sized) sand	none observed
	CLT1 US-5	medium (sized) sand	none observed
Camp Lake Tributary 1 Downstream (Lower Main Stem; CLT1 DS)	CLT1 DS-1	medium (sized) coarse sand	precipitate and deposits (<1 mm)
	CLT1 DS-3	medium (sized) coarse sand	precipitate and deposits (<1 mm)
	CLT1 DS-5	medium (sized) coarse sand	precipitate and deposits (<1 mm)
Camp Lake Tributary 2 Upstream (CLT2 US)	CLT2 US-1	medium (sized) coarse sand	none observed
	CLT2 US-3	medium (sized) coarse sand	none observed
	CLT2 US-5	medium (sized) coarse sand	precipitate and deposits (<1 mm)
Camp Lake Tributary 2 Downstream (CLT2 DS)	CLT2 DS-1	medium (sized) coarse sand	none observed
	CLT2 DS-3	medium (sized) coarse sand	none observed
	CLT2 DS-5	medium (sized) coarse sand	precipitate and deposits (<1 mm)

[a] Sediment samples collected using a stainless steel scoop directly from the streambed or shoreline, as available.

[b] Evidence of silt precipitate included fine material present on the surface of in-stream substrate and/or as interstitial deposits not otherwise expected to occur at such habitat.

Table D.8: Deposited Sediment Total Organic Carbon and Metal Concentrations at Camp Lake Tributary 1 Upstream (CLT1-US) Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Camp Lake Tributary 1 Upstream Station			Study Area Summary Statistics		
			CLT1-US-1	CLT1-US-3	CLT1-US-5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	1.05	0.94	0.66	0.88	0.20	0.12
Aluminum (Al)	µg/g	-	8,010	7,080	7,080	7,390	537	310
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.82	0.58	0.67	0.69	0.12	0.07
Barium (Ba)	µg/g	-	21.2	17.4	14.8	17.8	3.2	1.9
Beryllium (Be)	µg/g	-	0.32	0.27	0.26	0.28	0.03	0.02
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	10.2	9.2	8.5	9.3	0.9	0.5
Cadmium (Cd)	µg/g	3.5	0.056	0.043	0.042	0.047	0.008	0.005
Calcium (Ca)	µg/g	-	2,890	2,430	2,660	2,660	230	133
Chromium (Cr)	µg/g	90	29.4	25.7	24.9	26.7	2.4	1.4
Cobalt (Co)	µg/g	-	7.36	6.14	5.69	6.40	0.86	0.50
Copper (Cu)	µg/g	197	35.8	22.1	13.8	23.9	11.1	6.41
Iron (Fe)	µg/g	40,000[α]	29,300	18,200	21,000	22,833	5,773	3,333
Lead (Pb)	µg/g	91.3	4.88	3.86	3.66	4.13	0.65	0.38
Lithium (Li)	µg/g	-	11.5	11.5	10.7	11.2	0.46	0.27
Magnesium (Mg)	µg/g	-	8,610	8,180	8,100	8,297	274	158
Manganese (Mn)	µg/g	1,100[α,β]	199	171	132	167	34	19
Mercury (Hg)	µg/g	0.486	0.0053	<0.0050	<0.0050	0.0051	0.0002	0.0001
Molybdenum (Mo)	µg/g	-	0.37	0.30	0.21	0.29	0.08	0.05
Nickel (Ni)	µg/g	75[α,β]	20.2	19.4	17.2	18.9	1.6	0.9
Phosphorus (P)	µg/g	2,000[α]	291	236	256	261	28	16
Potassium (K)	µg/g	-	1,380	1,260	1,140	1,260	120	69
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	84	71	78	78	7	4
Strontium (Sr)	µg/g	-	3.04	2.65	2.86	2.85	0.195	0.113
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.120	0.093	0.079	0.097	0.021	0.012
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	508	397	422	442	58	34
Uranium (U)	µg/g	-	0.984	0.914	0.795	0.898	0.096	0.055
Vanadium (V)	µg/g	-	27.2	22.7	22.9	24.3	2.5	1.5
Zinc (Zn)	µg/g	315	21.5	17.6	17.7	18.9	2.2	1.3
Zirconium (Zr)	µg/g	-	2.8	2.6	2.7	2.7	0.1	0.1

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.9: Deposited Sediment Total Organic Carbon and Metal Concentrations at Camp Lake Tributary 1 Downstream (CLT1-DS) Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Camp Lake Tributary 1 Downstream Station			Study Area Summary Statistics		
			CLT1-DS-1	CLT1-DS-3	CLT1-DS-5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10^{α}	0.46	0.70	3.55	1.57	1.72	0.992
Aluminum (Al)	µg/g	-	7,160	4,690	5,690	5,847	1,242	717
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.73	0.47	0.80	0.67	0.17	0.10
Barium (Ba)	µg/g	-	32.9	24.1	21.5	26.2	5.97	3.45
Beryllium (Be)	µg/g	-	0.28	0.19	0.23	0.23	0.045	0.026
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	6.4	5.5	0.81	0.47
Cadmium (Cd)	µg/g	3.5	0.052	0.044	0.050	0.049	0.0042	0.0024
Calcium (Ca)	µg/g	-	4,200	2,610	4,300	3,703	948	547
Chromium (Cr)	µg/g	90	23.7	13.9	25.9	21.2	6.39	3.69
Cobalt (Co)	µg/g	-	6.45	3.69	5.66	5.27	1.42	0.82
Copper (Cu)	µg/g	197	10.6	7.27	17.0	11.6	4.95	2.86
Iron (Fe)	µg/g	$40,000^{\alpha}$	24,700	18,300	36,600	26,533	9,287	5,362
Lead (Pb)	µg/g	91.3	5.24	3.62	8.33	5.73	2.39	1.38
Lithium (Li)	µg/g	-	9.1	6.4	7.8	7.8	1.4	0.8
Magnesium (Mg)	µg/g	-	8,910	5,460	6,360	6,910	1,790	1,033
Manganese (Mn)	µg/g	$1,100^{\alpha,\beta}$	327	183	230	247	73	42
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	0.0076	0.0059	0.0015	0.00087
Molybdenum (Mo)	µg/g	-	1.18	1.44	0.59	1.07	0.44	0.25
Nickel (Ni)	µg/g	$75^{\alpha,\beta}$	26.0	13.1	31.1	23.4	9.3	5.4
Phosphorus (P)	µg/g	$2,000^{\alpha}$	197	176	332	235	85	49
Potassium (K)	µg/g	-	2,900	2,050	1,430	2,127	738	426
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	100	63	62	75	22	13
Strontium (Sr)	µg/g	-	3.96	2.86	5.11	3.98	1.13	0.65
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.159	0.102	0.105	0.122	0.032	0.019
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	462	342	396	400	60	35
Uranium (U)	µg/g	-	1.52	1.01	2.03	1.52	0.51	0.29
Vanadium (V)	µg/g	-	16.0	10.8	20.7	15.8	5.0	2.9
Zinc (Zn)	µg/g	315	33.7	23.2	22.1	26.3	6.4	3.7
Zirconium (Zr)	µg/g	-	6.1	4.2	3.7	4.7	1.3	0.73

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.10: Magnitude of Elevation in Deposited Sediment Metal Concentrations between Camp Lake Tributary Study Areas and Average Lotic Reference Area Data, Mary River Project CREMP, August 2020

Parameter	Units	Reference Area Data		Camp Lake Tributary 1		Camp Lake Tributary 2	
		Reference Creek (REF-CRK)	Mary River Reference (GO-09)	CLT1-US Magnitude of Elevation	CLT1-DS Magnitude of Elevation	CLT2-US Magnitude of Elevation	CLT2-DS Magnitude of Elevation
Total Organic Carbon	%	0.12	0.11	7.6	13.5	2.9	2.2
Aluminum (Al)	µg/g	584	2,757	7.7	6.1	4.7	3.2
Antimony (Sb)	µg/g	<0.10	<0.10	1.0	1.0	1.0	1.0
Arsenic (As)	µg/g	0.22	0.38	2.5	2.4	2.7	1.7
Barium (Ba)	µg/g	2.72	12.6	4.0	5.9	3.5	2.2
Beryllium (Be)	µg/g	<0.10	0.14	2.5	2.0	1.6	1.4
Bismuth (Bi)	µg/g	<0.20	<0.20	1.0	1.0	1.0	1.0
Boron (B)	µg/g	<5.0	5.4	1.8	1.0	1.0	1.0
Cadmium (Cd)	µg/g	<0.020	<0.020	2.4	2.4	1.5	1.3
Calcium (Ca)	µg/g	494	2,750	3.2	4.4	6.3	2.6
Chromium (Cr)	µg/g	7.79	13.6	2.7	2.1	2.2	1.5
Cobalt (Co)	µg/g	0.953	2.40	4.7	3.9	3.3	2.0
Copper (Cu)	µg/g	1.21	4.45	12.5	6.1	6.2	3.9
Iron (Fe)	µg/g	12,493	11,063	1.9	2.3	1.5	1.2
Lead (Pb)	µg/g	1.49	3.07	2.1	2.9	1.7	1.5
Lithium (Li)	µg/g	<2.0	5.0	3.9	2.7	2.3	1.4
Magnesium (Mg)	µg/g	444	2,810	10.8	9.0	9.2	5.3
Manganese (Mn)	µg/g	27.4	75.7	4.2	6.1	3.6	2.5
Mercury (Hg)	µg/g	<0.0050	<0.0050	1.0	1.2	1.0	1.0
Molybdenum (Mo)	µg/g	<0.10	0.11	2.8	10.1	3.2	4.5
Nickel (Ni)	µg/g	1.76	6.11	6.9	8.6	5.6	3.7
Phosphorus (P)	µg/g	167	350	1.2	1.0	1.1	0.8
Potassium (K)	µg/g	133	750	5.6	9.4	5.8	4.8
Selenium (Se)	µg/g	<0.20	<0.20	1.0	1.0	1.0	1.0
Silver (Ag)	µg/g	<0.10	<0.10	1.0	1.0	1.0	1.0
Sodium (Na)	µg/g	<50	68	1.3	1.3	1.1	1.0
Strontium (Sr)	µg/g	2.00	4.72	1.0	1.4	1.4	0.9
Sulphur (S)	µg/g	<1,000	<1,000	1.0	1.0	1.0	1.0
Thallium (Tl)	µg/g	<0.050	0.068	1.7	2.1	1.4	1.2
Tin (Sn)	µg/g	<2.0	<2.0	1.0	1.0	1.0	1.0
Titanium (Ti)	µg/g	83.3	353	3.3	3.0	2.5	1.8
Uranium (U)	µg/g	0.479	0.922	1.4	2.4	1.2	1.7
Vanadium (V)	µg/g	16.8	19.5	1.3	0.9	0.9	0.7
Zinc (Zn)	µg/g	3.03	10.3	4.0	5.6	3.0	3.8
Zirconium (Zr)	µg/g	2.1	5.8	0.9	1.5	1.2	1.1

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference creek value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference creek value).
Denotes highly elevated (mean concentration greater than 10 times higher than respective mean reference creek value).

Table D.11: Deposited Sediment Total Organic Carbon and Metal Concentrations at Camp Lake Tributary 2 Upstream (CLT2-US) Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Camp Lake Tributary 2 Upstream Station			Study Area Summary Statistics		
			CLT2-US-B1	CLT2-US-B3	CLT2-US-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.24	0.31	0.45	0.33	0.11	0.015
Aluminum (Al)	µg/g	-	3,210	3,230	7,010	4,483	2,188	301
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.55	0.61	1.06	0.74	0.28	0.038
Barium (Ba)	µg/g	-	12.0	12.0	23.6	15.9	6.70	0.920
Beryllium (Be)	µg/g	-	0.14	0.15	0.27	0.19	0.072	0.0099
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	5.9	5.3	0.52	0.071
Cadmium (Cd)	µg/g	3.5	0.029	0.024	0.038	0.030	0.0071	0.0010
Calcium (Ca)	µg/g	-	4,770	3,670	7,390	5,277	1,911	263
Chromium (Cr)	µg/g	90	19.0	16.3	29.6	21.6	7.03	0.97
Cobalt (Co)	µg/g	-	3.61	3.37	6.38	4.45	1.67	0.230
Copper (Cu)	µg/g	197	7.11	13.8	14.7	11.9	4.15	0.570
Iron (Fe)	µg/g	40,000[α]	13,600	12,700	27,900	18,067	8,528	1,171
Lead (Pb)	µg/g	91.3	2.68	2.55	5.23	3.49	1.51	0.208
Lithium (Li)	µg/g	-	5.1	5.0	9.6	6.6	2.6	0.36
Magnesium (Mg)	µg/g	-	5,640	5,200	10,300	7,047	2,826	388
Manganese (Mn)	µg/g	1,100[α,β]	119	122	189	143	40	5.4
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	0.16	0.35	0.51	0.34	0.18	0.024
Nickel (Ni)	µg/g	75[α,β]	11.9	10.5	23.5	15.3	7.14	0.980
Phosphorus (P)	µg/g	2,000[α]	219	214	328	254	64	8.8
Potassium (K)	µg/g	-	830	780	2,330	1,313	881	121
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	51	<50	87	63	21	2.9
Strontium (Sr)	µg/g	-	3.37	3.18	5.03	3.86	1.018	0.140
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.060	0.055	0.132	0.082	0.043	0.0059
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	261	242	506	336	147	20
Uranium (U)	µg/g	-	0.480	0.460	1.29	0.743	0.474	0.0650
Vanadium (V)	µg/g	-	15.9	12.8	20.8	16.5	4.03	0.55
Zinc (Zn)	µg/g	315	9.40	9.70	22.5	13.9	7.48	1.03
Zirconium (Zr)	µg/g	-	3.3	2.6	5.2	3.7	1.3	0.18

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.12: Deposited Sediment Total Organic Carbon and Metal Concentrations at Camp Lake Tributary 2 Downstream (CLT2-DS) Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Camp Lake Tributary 2 Downstream Station			Study Area Summary Statistics		
			CLT2-DS-1	CLT2-DS-3	CLT2-DS-5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10^{α}	0.48	0.17	0.13	0.26	0.19	0.026
Aluminum (Al)	µg/g	-	3,720	4,210	1,240	3,057	1,592	219
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.62	0.47	0.31	0.47	0.16	0.021
Barium (Ba)	µg/g	-	12.0	12.3	4.61	9.64	4.36	0.598
Beryllium (Be)	µg/g	-	0.17	0.21	<0.10	0.16	0.056	0.0076
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	<5.0	<5.0	0	0
Cadmium (Cd)	µg/g	3.5	0.024	0.033	<0.020	0.026	0.0067	0.0009
Calcium (Ca)	µg/g	-	2,810	2,540	1,220	2,190	851	117
Chromium (Cr)	µg/g	90	25.7	12.8	7.19	15.2	9.49	1.30
Cobalt (Co)	µg/g	-	3.90	3.06	1.15	2.70	1.41	0.194
Copper (Cu)	µg/g	197	7.45	8.40	6.54	7.46	0.930	0.128
Iron (Fe)	µg/g	$40{,}000^{\alpha}$	20,800	15,400	4,570	13,590	8,265	1,135
Lead (Pb)	µg/g	91.3	3.31	3.77	2.07	3.05	0.879	0.121
Lithium (Li)	µg/g	-	5.1	5.3	<2.0	4.1	1.9	0.25
Magnesium (Mg)	µg/g	-	5,060	5,460	1,700	4,073	2,065	284
Manganese (Mn)	µg/g	$1{,}100^{\alpha,\beta}$	131	131	43	102	50.8	6.98
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	0.38	0.92	0.12	0.47	0.41	0.056
Nickel (Ni)	µg/g	$75^{\alpha,\beta}$	14.4	11.1	4.96	10.2	4.79	0.658
Phosphorus (P)	µg/g	$2{,}000^{\alpha}$	232	198	101	177	68.0	9.34
Potassium (K)	µg/g	-	1,020	1,780	430	1,077	677	93
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	80	<50	<50	60	17	2.4
Strontium (Sr)	µg/g	-	3.08	2.63	1.83	2.51	0.633	0.087
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.070	0.091	<0.050	0.070	0.021	0.0028
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	308	317	120	248	111	15
Uranium (U)	µg/g	-	1.25	1.31	0.708	1.09	0.332	0.0455
Vanadium (V)	µg/g	-	22.4	10.1	5.60	12.7	8.70	1.19
Zinc (Zn)	µg/g	315	22.9	22.0	8.10	17.7	8.30	1.140
Zirconium (Zr)	µg/g	-	3.4	5.0	1.8	3.4	1.6	0.22

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.13: Field Observations of Sediment Properties at Camp Lake (JLO) Benthic Stations[a], Mary River Project CREMP, August 2020

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia[b]	Plant or Algal Presence
JLO-02	11.0	dark grey silt, red brown silt on top, contains organics	none detected	sparse algae
JLO-01	18.0	light brown silt	none detected	sparse algae
JLO-21	10.0	dark brown silt	none detected	sparse algae
JLO-20	7.0	grey-brown silt-sand mixture	none detected	sparse algae
JLO-19	7.5	thick brown silt layer over dark grey fine silt-sand mixture	none detected	sparse algae
JLO-07	33.0	thin layer of silt overlying grey, very fine sand	none detected	sparse algae
JLO-18	12.0	dark grey organics (roots) mixed in with silt and sand	some hydrogen sulphide odour	sparse algae
JLO-16	16.0	thin layer of silt overlying grey fine sand	none detected	sparse algae
JLO-11	28.5	grey-brown fine sand mixed with some silt overlying degraded organics	some hydrogen sulphide odour	sparse algae
JLO-12	17.0	brown sand overlying grey sand; some black streaking between brown and grey layers	some blackened substrate	none observed

[a] Sediment particle size and benthic invertebrate community samples were collected using a petite-Ponar.

[b] Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.14: Observations from Sediment Cores Collected at Camp Lake (JLO), Mary River Project CREMP, August 2020

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
JLO-02	11.0	Littoral	1	19.5	light floc of light reddish brown silt overlying grey sandy material; no black streaking
			2	19.5	
			3	17.0	
			4	16.5	
JLO-01	17.7	Profundal	1	15.5	black-brown silt floc (some speckling in second core) over light brown slightly consolidated silt and consolidated brown silt
			2	11.5	
			3	11.5	
			4	12.0	
JLO-14	26.5	Profundal	1	6.0	light brown silt floc over consolidated brown silt and grey sandy material (core 3 and 4 had black streaking between brown and grey layer)
			2	20.0	
			3	14.0	
			4	10.0	
JLO-17	15.6	Profundal	1	14.5	unconsolidated light brown silt over consolidated grey fine sand; no dark streaking
			2	13.0	
			3	13.5	
			4	17.0	
JLO-07	33.1	Profundal	1	11.5	light brown unconsolidated silt floc overlying consolidated dark grey sand (some dark brown sand mixed) and variegated unconsolidated brown silt or consolidated grey sand
			2	16.0	
			3	17.0	
			4	14.0	
JLO-16	16.2	Profundal	1	4.5	light brown silt floc over consolidated grey sand with some light brown silt
			2	6.5	
			3	5.0	
			4	4.5	
JLO-15	17.0	Profundal	1	11.0	unconsolidated brown silt overlying consolidated brown silt mixed with fine grey sand; black streaking associated with brown silt layer
			2	12.0	
			3	10.5	
			4	11.5	
JLO-11	29.0	Profundal	1	8.5	unconsolidated fine light brown silt over consolidated grey sand; some black streaking
			2	14.0	
			3	11.0	
			4	14.5	
JLO-13	17.0	Profundal	1	13.5	unconsolidated light brown fine silt over consolidated light brown fine silt
			2	7.0	
			3	15.0	
			4	10.0	
JLO-12	17.0	Profundal	1	5.0	thin (<1 mm) layer of brown silt overlying consolidated light brown coarse sand, or consolidated light grey coarse sand; some black streaking present
			2	5.5	
			3	5.5	
			4	4.5	

Table D.15: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Camp Lake (JLO) Sediment Stations, Mary River Project CREMP, August 2020

	Parameter	Units	Sediment Quality Guideline (SQG)[a]	AEMP Benchmark[b]	Camp Lake Stations										Summary Statistics	
					JLO-02 (littoral)	JLO-01 (profundal)	JLO-14 (profundal)	JLO-17 (profundal)	JLO-07 (profundal)	JLO-16 (profundal)	JLO-15 (profundal)	JLO-11 (profundal)	JLO-13 (profundal)	JLO-12 (profundal)	Mean	Standard Deviation
Non-metals	Sand	%	-	-	46.5	27.6	20.8	17.3	18.3	86.8	42.2	47.8	29.3	83.4	42.0	25.3
	Silt	%	-	-	48.0	62.9	64.5	79.2	69.4	11.8	49.5	42.9	60.4	14.9	50.4	22.3
	Clay	%	-	-	5.5	9.6	14.7	3.4	12.3	1.4	8.3	9.3	10.3	1.7	7.65	4.50
	Moisture	%	-	-	81.7	73.6	75.4	70.3	74.4	26.4	59.2	63.8	71.9	38.8	63.6	17.7
	Total Organic Carbon	%	10^{α}	-	3.39	1.83	1.99	2.03	3.13	0.26	1.18	1.33	1.52	0.33	1.70	1.03
Metals	Aluminum (Al)	mg/kg	-	-	15,500	19,800	19,400	15,200	19,300	5,070	16,100	17,900	18,700	6,260	15,323	5,359
	Antimony (Sb)	mg/kg	-	-	0.11	0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	0.0032
	Arsenic (As)	mg/kg	17	5.9	***9.03***	5.61	***6.82***	***16.6***	3.49	1.00	3.90	4.99	5.22	2.21	5.89	4.40
	Barium (Ba)	mg/kg	-	-	122	80.3	83.1	222	73.6	20.6	57.9	96.5	71.2	39.5	86.7	55.3
	Beryllium (Be)	mg/kg	-	-	0.78	1.06	1.10	0.90	1.07	0.26	0.82	0.91	1.08	0.31	0.83	0.31
	Bismuth (Bi)	mg/kg	-	-	0.29	0.31	0.34	0.28	0.35	<0.20	0.23	0.25	0.27	<0.20	0.27	0.053
	Boron (B)	mg/kg	-	-	17.8	34.2	34.6	22.6	30.9	7.6	19.9	28.5	32.7	9.3	23.8	10.0
	Cadmium (Cd)	mg/kg	3.5	1.5	0.269	0.206	0.204	0.183	0.268	0.041	0.151	0.166	0.167	0.045	0.17	0.078
	Calcium (Ca)	mg/kg	-	-	5,650	5,010	5,120	5,290	5,860	10,600	3,770	4,120	4,500	1,830	5,175	2,234
	Chromium (Cr)	mg/kg	90	98	66.2	81.3	82.9	66.9	79.9	33.3	65.9	70.7	72.5	28.4	64.8	19.0
	Cobalt (Co)	mg/kg	-	-	18.4	19.2	20.8	22.0	17.9	6.05	16.2	18.3	18.5	7.63	16.5	5.34
	Copper (Cu)	mg/kg	197	50	49.9	49.7	***51.5***	42.2	***61.6***	12.6	38.7	43.8	44.4	12.1	40.7	16.2
	Iron (Fe)	mg/kg	$40{,}000^{\alpha}$	52,400	***61,000***	39,300	***52,500***	***63,100***	34,900	13,200	31,900	40,100	35,800	20,700	39,250	16,075
	Lead (Pb)	mg/kg	91.3	35	18.9	22.7	24.0	20.3	24.5	4.98	17.5	19.3	22.6	5.80	18.1	7.05
	Lithium (Li)	mg/kg	-	-	22.4	33.2	34.0	27.3	33.6	8.7	29.7	32.1	36.2	10.9	26.8	9.80
	Magnesium (Mg)	mg/kg	-	-	13,400	14,300	14,000	12,100	14,800	11,200	13,300	13,700	13,500	5,380	12,568	2,732
	Manganese (Mn)	mg/kg	$1{,}100^{\alpha,\beta}$	4,370	1,410	1,320	1,850	***7,790***	300	150	958	2,820	1,510	1,870	1,998	2,178
	Mercury (Hg)	mg/kg	0.486	0.17	0.0530	0.0508	0.0637	0.0473	0.0761	0.0059	0.0325	0.0407	0.0399	0.0069	0.0417	0.0223
	Molybdenum (Mo)	mg/kg	-	-	2.45	1.37	1.54	5.67	1.08	0.32	0.72	1.33	1.18	0.50	1.62	1.55
	Nickel (Ni)	mg/kg	$75^{\alpha,\beta}$	72	***72.5***	***77.2***	***74.6***	***72.1***	71.4	33.2	60.8	66.3	67.4	26.1	62.2	17.8
	Phosphorus (P)	mg/kg	$2{,}000^{\alpha}$	1,580	1,310	963	1,370	***2,220***	808	494	827	1,030	995	625	1,064	488
	Potassium (K)	mg/kg	-	-	4,100	5,730	5,640	4,190	5,540	1,290	3,960	4,650	5,160	1,380	4,164	1,626
	Selenium (Se)	mg/kg	-	-	0.49	0.44	0.53	0.46	0.56	<0.20	0.28	0.33	0.31	<0.20	0.38	0.13
	Silver (Ag)	mg/kg	-	-	0.12	0.14	0.15	0.10	0.23	<0.10	<0.10	0.11	0.13	<0.10	0.13	0.040
	Sodium (Na)	mg/kg	-	-	203	265	284	212	495	78	182	235	223	70	225	118
	Strontium (Sr)	mg/kg	-	-	9.87	12.8	15.2	12.0	25.6	7.58	9.27	10.8	13.6	4.55	12.1	5.64
	Sulphur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	8,100	<1,000	<1,000	<1,000	<1,000	<1,000	1,710	2,245
	Thallium (Tl)	mg/kg	-	-	0.467	0.597	0.541	0.592	0.545	0.112	0.416	0.445	0.519	0.148	0.438	0.173
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0
	Titanium (Ti)	mg/kg	-	-	833	1,040	1,020	697	948	379	880	989	979	413	818	244
	Uranium (U)	mg/kg	-	-	7.39	6.45	8.07	5.66	7.67	0.990	4.39	5.44	5.45	1.22	5.27	2.48
	Vanadium (V)	mg/kg	-	-	54.3	68.4	69.2	54.7	58.4	20.1	56.6	59.7	63.4	21.9	52.7	17.5
	Zinc (Zn)	mg/kg	315	135	59.4	67.6	64.3	52.3	70.4	17.9	50.4	55.1	54.3	19.5	51.1	18.3
	Zirconium (Zr)	mg/kg	-	-	7.8	4.6	5.2	3.7	14.4	4.2	5.1	4.4	4.9	1.7	5.6	3.4

(Shaded) Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD Indicates parameter concentration above the AEMP Benchmark.

Note: "-" indicates no SQG applicable.

[a] Canadian Sediment Quality Guideline for the protection of aquatic life probable effects level (PEL; CCME 2015) except those indicated by α (Ontario Provincial Sediment Quality Guideline [PSQG] severe effect level [SEL]; OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG] probable effects level [PEL; BCMOE 2015]).

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Camp Lake.

Table D.16: Statistical Comparison of Sediment Physical Properties Between Camp Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Analysis[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	**Sand-Sized Material (%)**	tequal	none	YES	0.006	Reference	5	29.6	7.5	3.4	23.4	40.4
						Camp	5	65.4	20.1	9.0	41.1	85.0
	Silt-Sized Material (%)	tequal	none	YES	0.008	Reference	5	62.2	6.3	2.8	53.4	68.4
						Camp	5	32.1	18.2	8.2	14.2	55.1
	Clay-Sized Material (%)	M-W	rank	YES	0.012	Reference	5	8.2	3.0	1.3	6.2	13.4
						Camp	5	2.6	2.0	0.9	1.0	5.5
	Moisture (%)	tequal	none	YES	0.006	Reference	5	87.9	4.6	2.1	80.2	92.3
						Camp	5	57.3	17.9	8.0	37.7	81.7
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.011	Reference	5	4.8	2.0	0.9	2.3	7.0
						Camp	5	1.4	1.2	0.5	0.3	3.4
Profundal (Deep) Stations	**Sand-Sized Material (%)**	M-W	rank	NO	0.298	Reference	5	31.6	22.3	10.0	13.9	56.6
						Camp	9	41.5	26.8	8.9	17.3	86.8
	Silt-Sized Material (%)	tequal	none	NO	0.588	Reference	5	57.4	18.1	8.1	36.9	71.9
						Camp	9	50.6	23.6	7.9	11.8	79.2
	Clay-Sized Material (%)	tequal	none	NO	0.243	Reference	5	11.0	4.3	1.9	6.3	15.1
						Camp	9	7.9	4.7	1.6	1.4	14.7
	Moisture (%)	M-W	rank	YES	0.001	Reference	5	82.6	3.6	1.6	78.3	86.6
						Camp	9	61.5	17.5	5.8	26.4	75.4
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.004	Reference	5	3.4	1.1	0.5	2.2	4.5
						Camp	9	1.5	0.9	0.3	0.3	3.1

(grey box) Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table D.17: Magnitude of Elevation in Sediment Metal Concentrations between Camp Lake and Reference Lake 3 2020 Data, and between Camp Lake 2020 and Baseline Data, Mary River Project CREMP, 2020

Parameter	Camp Lake 2020 versus Reference Lake 3 2020				Camp Lake 2020 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Camp Lake Baseline Concentration (mg/kg)	Magnitude of Elevation	Camp Lake Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	16,880	0.9	21,800	0.7	18,267	0.8	15,175	1.0
Antimony (Sb)	<0.10	1.1	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	3.53	2.6	4.07	1.4	2.80	3.2	3.47	1.6
Barium (Ba)	117	1.0	122	0.7	105	1.2	68	1.2
Beryllium (Be)	0.65	1.2	0.80	1.0	1.0	0.8	1.0	0.8
Bismuth (Bi)	<0.20	1.5	<0.20	1.4	-	-	-	-
Boron (B)	12.2	1.5	14.7	1.7	0.733	24.3	1.83	13.4
Cadmium (Cd)	0.173	1.6	0.148	1.1	0.500	0.5	0.50	0.3
Calcium (Ca)	5,608	1.0	5,010	1.0	3,130	1.8	2,857	1.8
Chromium (Cr)	54.3	1.2	65.0	1.0	81.0	0.8	71.0	0.9
Cobalt (Co)	10.8	1.7	15.2	1.1	18.3	1.0	16.5	1.0
Copper (Cu)	71.4	0.7	83.8	0.5	45.0	1.1	39.5	1.0
Iron (Fe)	50,600	1.2	45,080	0.8	36,133	1.7	33,206	1.1
Lead (Pb)	13.8	1.4	16.7	1.1	18.0	1.1	18.7	1.0
Lithium (Li)	26.0	0.9	33.7	0.8	-	-	-	-
Magnesium (Mg)	11,440	1.2	14,180	0.9	13,967	1.0	10,113	1.2
Manganese (Mn)	579	2.4	1,230	1.7	699	2.0	942	2.2
Mercury (Hg)	0.0500	1.1	0.0583	0.7	0.100	0.5	0.100	0.4
Molybdenum (Mo	4.44	0.6	2.52	0.6	1.00	2.5	1.00	1.5
Nickel (Ni)	40.0	1.8	45.0	1.4	67.0	1.1	62.5	1.0
Phosphorus (P)	1,167	1.1	956	1.1	800	1.6	1,125	0.9
Potassium (K)	4,100	1.0	5,338	0.8	3,450	1.2	3,771	1.1
Selenium (Se)	0.73	0.7	0.61	0.6	1.0	0.5	1.0	0.4
Silver (Ag)	0.14	0.8	0.20	0.6	0.27	0.4	0.35	0.4
Sodium (Na)	304	0.7	369	0.6	279	0.7	254	0.9
Strontium (Sr)	11.6	0.9	12.3	1.0	9.33	1.1	12.0	1.0
Sulphur (S)	1,400	0.7	1,140	1.6	-	-	-	-
Thallium (Tl)	0.379	1.2	0.594	0.7	1.0	0.5	1.0	0.4
Tin (Sn)	<2.0	1.0	<2.0	1.0	-	-	-	-
Titanium (Ti)	1,006	0.8	1,136	0.7	-	-	-	-
Uranium (U)	11.0	0.7	19.7	0.3	-	-	-	-
Vanadium (V)	54.1	1.0	63.4	0.8	69.0	0.8	56.8	0.9
Zinc (Zn)	73.1	0.8	83.8	0.6	67.0	0.9	56.8	0.9
Zirconium (Zr)	4.5	1.7	3.9	1.4	-	-	-	-

Denotes slight elevation (concentration 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
Denotes moderate elevation (concentration 5 to 10 times higher than mean reference area value or baseline period value, as applicable).
Denotes high elevation (concentration is ≥ 10 times higher than mean reference area value or baseline period value, as applicable).
Note: ' - ' indicates baseline data not available.

Table D.18: Deposited Sediment Field Sampling Observations at Sheardown Lake Tributaries 1, 12, and 9[a], Mary River Project CREMP, August 2020

Study Area	Station	Texture of Collected Sediment	Silt Presence[b]
Sheardown Lake Tributary 1 (SDLT1)	SDLT1-1	red-brown silt	precipitate and deposits (>1 mm)
	SDLT1-3	red-brown silt	precipitate and deposits (>1 mm)
	SDLT1-5	red-brown silt	precipitate and deposits (>1 mm)
Sheardown Lake Tributary 12 (SDLT12)	SDLT12-1	coarse sand	precipitate and deposits (<1 mm)
	SDLT12-2	coarse sand and gravel	precipitate and deposits (<1 mm)
	SDLT12-3	coarse sand and gravel	precipitate and deposits (<1 mm)
Sheardown Lake Tributary 9 (SDLT9)	SDLT9-1	medium (sized) coarse sand	none observed
	SDLT9-3	medium (sized) coarse sand	precipitate and deposits (<1 mm)
	SDLT9-5	medium (sized) coarse sand	none observed

[a] Sediment samples collected using a stainless steel scoop directly from the streambed or shoreline, as available.

[b] Evidence of silt precipitate included fine material present on the surface of in-stream substrate and/or as interstitial deposits not otherwise expected to occur at such habitat.

Table D.19: Deposited Sediment Total Organic Carbon and Metal Concentrations at Sheardown Lake Tributary 1 (SDLT1) Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Sheardown Lake Tributary 1 Station			Study Area Summary Statistics		
			SDLT1-1	SDLT1-3	SDLT1-5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.71	0.97	0.61	0.76	0.19	0.107
Aluminum (Al)	µg/g	-	17,600	15,900	14,400	15,967	1,601	924
Antimony (Sb)	µg/g	-	0.12	0.23	0.15	0.17	0.057	0.033
Arsenic (As)	µg/g	17	2.26	4.50	3.11	3.29	1.13	0.65
Barium (Ba)	µg/g	-	78.0	51.9	61.0	63.6	13.2	7.65
Beryllium (Be)	µg/g	-	0.68	0.66	0.60	0.65	0.042	0.024
Bismuth (Bi)	µg/g	-	0.61	0.31	0.53	0.48	0.16	0.090
Boron (B)	µg/g	-	7.3	7.6	5.6	6.8	1.1	0.62
Cadmium (Cd)	µg/g	3.5	0.156	0.113	0.160	0.143	0.0261	0.0150
Calcium (Ca)	µg/g	-	4,850	2,730	3,790	3,790	1,060	612
Chromium (Cr)	µg/g	90	34.5	35.5	31.2	33.7	2.25	1.30
Cobalt (Co)	µg/g	-	12.4	14.9	12.7	13.3	1.37	0.788
Copper (Cu)	µg/g	197	25.5	21.5	24.9	24.0	2.16	1.25
Iron (Fe)	µg/g	40,000[α]	114,000	174,000	170,000	152,667	33,546	19,368
Lead (Pb)	µg/g	91.3	13.0	12.6	11.7	12.4	0.666	0.384
Lithium (Li)	µg/g	-	19.0	17.8	16.6	17.8	1.20	0.693
Magnesium (Mg)	µg/g	-	16,500	12,800	12,700	14,000	2,166	1,250
Manganese (Mn)	µg/g	1,100[α,β]	646	657	740	681	51.4	29.7
Mercury (Hg)	µg/g	0.486	0.0059	0.0072	0.0063	0.0065	0.00067	0.00038
Molybdenum (Mo)	µg/g	-	5.41	7.19	4.59	5.73	1.33	0.767
Nickel (Ni)	µg/g	75[α,β]	32.8	34.4	32.2	33.1	1.14	0.657
Phosphorus (P)	µg/g	2,000[α]	368	287	378	344	49.9	28.8
Potassium (K)	µg/g	-	6,590	5,870	4,990	5,817	801	463
Selenium (Se)	µg/g	-	<0.20	0.22	0.22	0.21	0.012	0.0067
Silver (Ag)	µg/g	-	0.14	0.10	0.13	0.12	0.021	0.012
Sodium (Na)	µg/g	-	158	118	101	126	29	17
Strontium (Sr)	µg/g	-	4.43	3.52	3.67	3.87	0.488	0.282
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.296	0.276	0.241	0.271	0.0278	0.0161
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	971	714	777	821	134	77
Uranium (U)	µg/g	-	3.85	5.94	3.26	4.35	1.41	0.813
Vanadium (V)	µg/g	-	31.9	25.4	25.8	27.7	3.64	2.10
Zinc (Zn)	µg/g	315	79.4	65.7	82.4	75.8	8.90	5.14
Zirconium (Zr)	µg/g	-	9.5	10.6	6.9	9.0	1.9	1.1

(grey shading) Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.20: Magnitude of Elevation in Deposited Sediment Metal Concentrations at the Sheardown Lake Tributaries Compared to Average Lotic Reference Area Data, Mary River Project CREMP, August 2020

Parameter	Units	Reference Area Data		Sheardown Lake Tributary 1 (SDLT1) Magnitude of Elevation	Sheardown Lake Tributary 12 (SDLT12) Magnitude of Elevation	Sheardown Lake Tributary 9 (SDLT9) Magnitude of Elevation
		Reference Creek (REF-CRK)	Mary River Reference (GO-09)			
Total Organic Carbon	%	0.12	0.11	6.5	6.4	17.4
Aluminum (Al)	µg/g	584	2,757	16.6	8.5	7.3
Antimony (Sb)	µg/g	<0.10	<0.10	1.7	2.2	1.1
Arsenic (As)	µg/g	0.22	0.38	11.9	21.1	6.0
Barium (Ba)	µg/g	2.72	12.6	14.2	3.8	7.2
Beryllium (Be)	µg/g	<0.10	0.14	5.6	5.9	2.8
Bismuth (Bi)	µg/g	<0.20	<0.20	2.4	1.3	1.1
Boron (B)	µg/g	<5.0	5.4	1.3	1.1	1.6
Cadmium (Cd)	µg/g	<0.020	<0.020	7.2	2.5	3.2
Calcium (Ca)	µg/g	494	2,750	4.5	1.5	3.5
Chromium (Cr)	µg/g	7.79	13.6	3.4	3.1	2.3
Cobalt (Co)	µg/g	0.953	2.40	9.8	10.7	4.6
Copper (Cu)	µg/g	1.21	4.45	12.6	10.2	8.2
Iron (Fe)	µg/g	12,493	11,063	13.0	29.4	5.1
Lead (Pb)	µg/g	1.49	3.07	6.2	2.7	2.7
Lithium (Li)	µg/g	<2.0	5.0	6.2	2.9	2.7
Magnesium (Mg)	µg/g	444	2,810	18.3	7.6	7.9
Manganese (Mn)	µg/g	27.4	75.7	16.9	20.1	7.3
Mercury (Hg)	µg/g	<0.0050	<0.0050	1.3	1.0	2.4
Molybdenum (Mo)	µg/g	<0.10	0.11	53.9	36.0	17.1
Nickel (Ni)	µg/g	1.76	6.11	12.1	13.4	9.0
Phosphorus (P)	µg/g	167	350	1.5	1.1	1.9
Potassium (K)	µg/g	133	750	25.7	3.5	7.1
Selenium (Se)	µg/g	<0.20	<0.20	1.1	1.3	1.4
Silver (Ag)	µg/g	<0.10	<0.10	1.2	1.0	1.0
Sodium (Na)	µg/g	<50	68	2.2	0.9	1.1
Strontium (Sr)	µg/g	2.00	4.72	1.4	0.7	1.4
Sulphur (S)	µg/g	<1,000	<1,000	1.0	1.0	1.0
Thallium (Tl)	µg/g	<0.050	0.068	4.7	1.2	2.7
Tin (Sn)	µg/g	<2.0	<2.0	1.0	1.0	1.0
Titanium (Ti)	µg/g	83.3	353	6.1	1.6	3.6
Uranium (U)	µg/g	0.479	0.922	6.9	3.7	2.0
Vanadium (V)	µg/g	16.8	19.5	1.5	0.9	1.0
Zinc (Zn)	µg/g	3.03	10.3	16.2	5.4	4.9
Zirconium (Zr)	µg/g	2.1	5.8	2.9	1.1	0.9

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference creek value).
Denotes moderate elevation (mean concentration 5 to 10 times higher than respective mean reference creek value).
Denotes highly elevated (mean concentration ≥10 times higher than respective mean reference creek value).

Table D.21: Deposited Sediment Total Organic Carbon and Metal Concentrations at Sheardown Lake Tributary 12 (SDLT12) Stations, Mary River Project CREMP, August 2020

Parameter	Units	SQG[a]	Sheardown Lake Tributary 12 Station			Study Area Summary Statistics		
			SDLT12-1	SDLT12-2	SDLT12-3	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.91	0.54	0.80	0.75	0.19	0.11
Aluminum (Al)	µg/g	-	9,070	7,840	7,550	8,153	807	466
Antimony (Sb)	µg/g	-	0.21	0.21	0.25	0.22	0.02	0.01
Arsenic (As)	µg/g	17	5.04	6.95	5.50	5.83	1.00	0.576
Barium (Ba)	µg/g	-	23.0	10.8	17.5	17.1	6.11	3.53
Beryllium (Be)	µg/g	-	0.68	0.70	0.66	0.68	0.020	0.012
Bismuth (Bi)	µg/g	-	0.29	0.21	0.26	0.25	0.040	0.023
Boron (B)	µg/g	-	6.3	<5.0	5.3	5.5	0.68	0.39
Cadmium (Cd)	µg/g	3.5	0.050	0.040	0.062	0.051	0.011	0.0064
Calcium (Ca)	µg/g	-	1,830	549	1,290	1,223	643	371
Chromium (Cr)	µg/g	90	30.1	31.3	30.3	30.6	0.643	0.371
Cobalt (Co)	µg/g	-	14.6	15.3	13.8	14.6	0.751	0.433
Copper (Cu)	µg/g	197	20.1	18.8	19.3	19.4	0.656	0.379
Iron (Fe)	µg/g	40,000[α]	283,000	378,000	374,000	345,000	53,731	31,021
Lead (Pb)	µg/g	91.3	6.24	4.28	5.91	5.48	1.05	0.606
Lithium (Li)	µg/g	-	10.1	7.0	7.4	8.2	1.7	0.97
Magnesium (Mg)	µg/g	-	6,890	5,150	5,330	5,790	957	552
Manganese (Mn)	µg/g	1,100[α,β]	699	905	825	810	104	60
Mercury (Hg)	µg/g	0.486	0.0055	<0.0050	<0.0050	0.0052	0.00029	0.00017
Molybdenum (Mo)	µg/g	-	4.10	3.63	3.73	3.82	0.248	0.143
Nickel (Ni)	µg/g	75[α,β]	36.3	38.2	34.8	36.4	1.70	0.984
Phosphorus (P)	µg/g	2,000[α]	300	198	259	252	51.3	29.6
Potassium (K)	µg/g	-	1,180	410	810	800	385	222
Selenium (Se)	µg/g	-	<0.20	0.28	0.32	0.27	0.061	0.035
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	0.10	0	0
Sodium (Na)	µg/g	-	<50	<50	<50	<50	0	0
Strontium (Sr)	µg/g	-	2.62	1.50	2.13	2.08	0.561	0.324
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.084	<0.050	0.071	0.068	0.017	0.010
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	283	146	226	218	69	40
Uranium (U)	µg/g	-	2.63	1.88	2.47	2.33	0.395	0.228
Vanadium (V)	µg/g	-	16.3	14.3	16.3	15.6	1.15	0.667
Zinc (Zn)	µg/g	315	31.1	19.8	24.7	25.2	5.67	3.27
Zirconium (Zr)	µg/g	-	3.7	3.1	3.8	3.5	0.38	0.22

(grey shading) Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.22: Deposited Sediment Total Organic Carbon and Metal Concentrations at Sheardown Lake Tributary 9 (SDLT9) Stations, Mary River Project CREMP, August 2020

Analyte	Units	SQG[a]	Sheardown Lake Tributary 9 Station			Study Area Summary Statistics		
			SDLT9-1	SDLT9-3	SDLT9-5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.81	1.31	3.96	2.03	1.69	0.977
Aluminum (Al)	µg/g	-	4,310	5,880	10,800	6,997	3,386	1,955
Antimony (Sb)	µg/g	-	<0.10	<0.10	0.12	<0.10	0	0
Arsenic (As)	µg/g	17	0.86	1.13	2.97	1.65	1.15	0.66
Barium (Ba)	µg/g	-	17.6	24.8	54.3	32.2	19.4	11.2
Beryllium (Be)	µg/g	-	0.17	0.24	0.55	0.32	0.20	0.12
Bismuth (Bi)	µg/g	-	<0.20	<0.20	0.26	0.22	0.035	0.020
Boron (B)	µg/g	-	<5.0	<5.0	15.5	8.50	6.06	3.50
Cadmium (Cd)	µg/g	3.5	0.037	0.044	0.110	0.064	0.040	0.023
Calcium (Ca)	µg/g	-	1,610	1,960	5,190	2,920	1,974	1,139
Chromium (Cr)	µg/g	90	15.1	18.6	34.5	22.7	10.3	5.97
Cobalt (Co)	µg/g	-	3.86	5.16	9.71	6.24	3.07	1.77
Copper (Cu)	µg/g	197	7.17	11.3	28.5	15.7	11.3	6.53
Iron (Fe)	µg/g	40,000[α]	31,300	42,100	107,000	60,133	40,945	23,640
Lead (Pb)	µg/g	91.3	3.25	4.27	8.92	5.48	3.02	1.75
Lithium (Li)	µg/g	-	4.90	6.50	11.6	7.67	3.50	2.02
Magnesium (Mg)	µg/g	-	3,630	4,990	9,430	6,017	3,033	1,751
Manganese (Mn)	µg/g	1,100[α,β]	164	225	493	294	175	101
Mercury (Hg)	µg/g	0.486	0.0061	0.0103	0.0196	0.0120	0.0069	0.0040
Molybdenum (Mo)	µg/g	-	0.960	1.22	3.27	1.82	1.27	0.731
Nickel (Ni)	µg/g	75[α,β]	13.6	18.6	41.3	24.5	14.8	8.52
Phosphorus (P)	µg/g	2,000[α]	330	347	606	428	155	89
Potassium (K)	µg/g	-	900	1,380	2,510	1,597	827	477
Selenium (Se)	µg/g	-	<0.20	<0.20	0.41	0.27	0.12	0.070
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	<50	<50	88	63	22	13
Strontium (Sr)	µg/g	-	3.13	2.99	6.05	4.06	1.73	1.00
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.088	0.130	0.240	0.153	0.078	0.045
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	379	433	642	485	139	80
Uranium (U)	µg/g	-	0.672	0.800	2.37	1.28	0.946	0.546
Vanadium (V)	µg/g	-	11.6	15.3	27.1	18.0	8.10	4.67
Zinc (Zn)	µg/g	315	13.5	18.7	37.2	23.1	12.5	7.19
Zirconium (Zr)	µg/g	-	1.4	1.9	5.3	2.9	2.1	1.2

[grey box] Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.23: Field Observations of Sediment Properties at Sheardown Lake Northwest (DLO-01) Benthic Stations[a], Mary River Project CREMP, August 2020

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia[b]	Plant or Algal Presence
DLO-01-9	7.6	thin oxidized layer over brown-coloured silt and sand	none detected	sparse macrophytes, sparse algae
DLO-01-4	7.5	brown-coloured silt	none detected	sparse macrophytes, sparse algae
DLO-01-3	8.2	brown-coloured silt	none detected	sparse macrophytes
DLO-01-11	8.2	thin layer of red-brown silt floc over grey-brown silt	slight hydrogen sulphide odour	none observed
DLO-01-10	7.9	reddish-brown coloured silt over grey-brown sandy silt	none detected	none observed
DLO-01-5	23.3	brown-coloured silt	slight hydrogen sulphide odour	none observed
DLO-01-14	22.0	reddish-brown coloured silt over grey-brown sandy silt	slight hydrogen sulphide odour	none observed
DLO-01-15	21.7	brown-coloured silt	none detected	none observed
DLO-01-2	17.5	brown-coloured silt	none detected	none observed
DLO-01-12	14.0	reddish-brown coloured silt	none detected	none observed

[a] Sediment particle size and benthic invertebrate community samples were collected using a petite-Ponar.

[b] Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.24: Observations from Sediment Cores Collected at Sheardown Lake NW (DLO-01), Mary River Project CREMP, August 2020

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
DLO-01-05	23.1	Profundal	1	14.0	dark brown silt floc over consolidated dark grey silt/clay
			2	12.0	
			3	13.0	
			4	12.5	
DD-HAB 9-STN2	10.8	Littoral	1	22.0	unconsolidated red brown silt overlying grey silt (some sand intermixed) and dark grey silty-clay
			2	17.5	
			3	19.0	
			4	18.0	
DLO-01-08	11.5	Littoral	1	19.0	red-brown silt floc overlying brown silt and grey silty-clay layers containing some fine sand
			2	19.0	
			3	19.5	
			4	18.0	
DLO-01	20.8	Profundal	1	5.5	brown silt floc overlying consolidated brown silt containing some fine sand
			2	11.5	
			3	12.0	
			4	5.0	
DLO-01-13	18.4	Profundal	1	19.0	red-brown silt floc overlying consolidated brown silt containing some fine sand
			2	21.0	
			3	19.0	
			4	16.0	
DLO-01-2	18.6	Profundal	1	16.0	red-brown silt floc overlying brown silt-clay and grey silt-clay layers containing some fine sand; black streaking in upper layers
			2	8.0	
			3	19.5	
			4	18.5	
DLO-01-9	7.8	Littoral	1	16.0	red-brown silt floc overlying grey silt; some black streaking in third core
			2	20.0	
			3	21.0	
			4	20.0	
DLO-01-10	7.6	Littoral	1	14.0	red-brown silt floc overlying grey silty clay and brown silty clay layers, each containing some sand
			2	10.0	
			3	14.0	
			4	15.0	

Table D.25: Sediment Particle Size, Total Organic Carbon, Metal Concentrations at Sheardown Lake Northwest (DLO-01) Sediment Stations, Mary River Project CREMP, August 2020

Parameter		Units	Sediment Quality Guideline (SQG)[a]	AEMP Benchmark[b]	Sheardown Lake Northwest Stations								Summary Statistics	
					DLO-01-5 (profundal)	DD-HAB 9-STN2 (littoral)	DLO-01-8 (littoral)	DLO-01 (profundal)	DLO-01-13 (profundal)	DLO-01-2 (profundal)	DLO-01-9 (littoral)	DLO-01-10 (littoral)	Mean	Standard Deviation
Non-metals	Sand	%	-	-	8.5	38.0	20.1	35.3	18.9	9.9	45.0	93.0	33.6	27.4
	Silt	%	-	-	74.3	47.2	65.8	49.3	64.7	78.9	44.6	6.40	53.9	23.0
	Clay	%	-	-	17.2	14.8	14.1	15.3	16.3	11.1	10.4	<1.0	12.5	5.22
	Moisture	%	-	-	64.3	75.2	76.2	49.9	65.7	70.9	84.3	27.4	64.2	18.0
	Total Organic Carbon	%	10[α]	-	1.76	3.15	1.60	0.38	1.24	1.30	3.47	0.17	1.63	1.18
Metals	Aluminum (Al)	mg/kg	-	-	23,100	19,300	20,800	15,000	23,700	20,900	19,800	2,640	18,155	6,808
	Antimony (Sb)	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0
	Arsenic (As)	mg/kg	17	6.2	4.40	***7.13***	5.43	2.87	4.03	3.57	3.03	0.62	3.89	1.92
	Barium (Ba)	mg/kg	-	-	144	149	80.9	61.5	90.4	143	106	11.1	98.2	47.9
	Beryllium (Be)	mg/kg	-	-	1.05	1.09	1.17	0.72	1.12	1.01	1.08	0.16	0.925	0.338
	Bismuth (Bi)	mg/kg	-	-	0.29	0.25	0.23	<0.20	0.23	0.22	0.25	<0.20	0.23	0.030
	Boron (B)	mg/kg	-	-	33.8	30.7	36.6	21.6	33.9	30.3	30.7	<5.0	27.8	10.2
	Cadmium (Cd)	mg/kg	3.5	1.5	0.270	0.447	0.225	0.186	0.263	0.292	0.309	0.025	0.252	0.119
	Calcium (Ca)	mg/kg	-	-	4,540	5,200	4,290	3,390	4,470	4,680	5,280	1,320	4,146	1,283
	Chromium (Cr)	mg/kg	90	97	77.3	74.2	77.1	54.5	79.4	73.9	75.4	13.8	65.7	22.4
	Cobalt (Co)	mg/kg	-	-	19.0	16.2	15.0	11.2	17.0	16.2	12.7	2.18	13.7	5.25
	Copper (Cu)	mg/kg	197	58	47.9	53.0	43.4	33.8	47.2	41.1	49.7	5.82	40.2	15.1
	Iron (Fe)	mg/kg	40,000[α]	52,200	***60,300***	***62,200***	48,300	28,800	42,200	42,100	42,900	11,400	42,275	16,447
	Lead (Pb)	mg/kg	91.3	35	22.8	21.5	20.2	14.2	22.3	19.6	20.6	3.70	18.1	6.40
	Lithium (Li)	mg/kg	-	-	36.7	36.4	39.1	23.9	38.8	33.5	37.6	5.1	31.4	11.7
	Magnesium (Mg)	mg/kg	-	-	14,800	12,700	12,300	9,520	14,900	13,200	12,700	2,020	11,518	4,186
	Manganese (Mn)	mg/kg	1,100[α,β]	4,530	***5,580***	974	649	843	1,140	***13,600***	404	77.0	2,908	4,659
	Mercury (Hg)	mg/kg	0.486	0.17	0.0521	0.0517	0.0269	0.0187	0.0329	0.0290	0.0388	<0.0050	0.0319	0.0159
	Molybdenum (Mo)	mg/kg	-	-	6.69	5.20	3.43	1.18	1.80	11.2	3.15	0.52	4.15	3.51
	Nickel (Ni)	mg/kg	75[α,β]	77	68.8	***80.4***	67.4	46.9	65.4	64.3	66.1	10.4	58.7	21.6
	Phosphorus (P)	mg/kg	2,000[α]	1,958	1,040	1,130	1,140	860	870	831	707	351	866	258
	Potassium (K)	mg/kg	-	-	5,970	5,240	5,600	3,800	6,050	5,330	5,150	680	4,728	1,777
	Selenium (Se)	mg/kg	-	-	0.47	0.57	0.32	<0.20	0.30	0.30	0.38	<0.20	0.34	0.13
	Silver (Ag)	mg/kg	-	-	0.18	0.20	0.15	0.13	0.18	0.15	0.17	<0.10	0.16	0.032
	Sodium (Na)	mg/kg	-	-	320	308	277	212	317	282	294	<50	258	91
	Strontium (Sr)	mg/kg	-	-	12.2	11.4	11.5	9.20	12.5	11.7	11.0	3.88	10.4	2.82
	Sulphur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	0
	Thallium (Tl)	mg/kg	-	-	0.598	0.606	0.487	0.332	0.558	0.568	0.518	0.064	0.466	0.185
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0
	Titanium (Ti)	mg/kg	-	-	1,310	1,150	1,200	884	1,340	1,240	1,160	227	1,064	366
	Uranium (U)	mg/kg	-	-	7.61	9.91	5.74	4.92	7.08	5.86	7.75	1.27	6.27	2.54
	Vanadium (V)	mg/kg	-	-	62.0	57.1	57.6	42.3	64.5	58.0	57.7	10.7	51.2	17.6
	Zinc (Zn)	mg/kg	315	123	72.6	69.6	66.4	46.4	70.0	64.1	67.9	10.0	58.4	21.2
	Zirconium (Zr)	mg/kg	-	-	7.2	15.1	7.8	5.0	9.1	6.8	15.4	2.0	8.6	4.6

[shaded] Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD5 Indicates parameter concentration above the AEMP Benchmark.

Note: "-" indicates no SQG applicable.

[a] Canadian Sediment Quality Guideline for the protection of aquatic life probable effects level (PEL; CCME 2015) except α (Ontario Provincial Sediment Quality Guideline [PSQG] severe effect level [SEL]; OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG] probable effects

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Sheardown Lake Northwest.

Table D.26: Statistical Comparison of Sediment Physical Properties Between Sheardown Lake NW and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Analysis[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	tequal	log10	NO	0.397	Reference	5	29.6	7.5	3.4	23.4	40.4
						Sheardown NW	7	40.5	24.6	9.3	20.1	93.0
	Silt-Sized Material (%)	M-W	rank	NO	0.149	Reference	5	62.2	6.3	2.8	53.4	68.4
						Sheardown NW	7	48.6	20.5	7.7	6.4	67.1
	Clay-Sized Material (%)	M-W	rank	NO	0.149	Reference	5	8.2	3.0	1.3	6.2	13.4
						Sheardown NW	7	10.9	4.7	1.8	1.0	14.8
	Moisture (%)	M-W	rank	YES	0.015	Reference	5	87.9	4.6	2.1	80.2	92.3
						Sheardown NW	7	70.0	19.3	7.3	27.4	84.3
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.035	Reference	5	4.8	2.0	0.9	2.3	7.0
						Sheardown NW	7	2.5	1.4	0.5	0.2	4.3
Profundal (Deep) Stations	Sand-Sized Material (%)	tequal	none	NO	0.154	Reference	5	31.6	22.3	10.0	13.9	56.6
						Sheardown NW	7	17.2	9.3	3.5	8.5	35.3
	Silt-Sized Material (%)	tequal	none	NO	0.211	Reference	5	57.4	18.1	8.1	36.9	71.9
						Sheardown NW	7	68.2	9.8	3.7	49.3	78.9
	Clay-Sized Material (%)	M-W	rank	YES	0.073	Reference	5	11.0	4.3	1.9	6.3	15.1
						Sheardown NW	7	14.6	3.3	1.2	8.8	17.2
	Moisture (%)	M-W	rank	YES	0.003	Reference	5	82.6	3.6	1.6	78.3	86.6
						Sheardown NW	7	65.6	7.3	2.8	49.9	70.9
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.001	Reference	5	3.4	1.1	0.5	2.2	4.5
						Sheardown NW	7	1.4	0.5	0.2	0.4	2.0

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table D.27: Magnitude of Elevation in Sediment Metal Concentrations between Sheardown Lake NW and Reference Lake 3 2020 Data, and between Sheardown Lake NW 2020 and Baseline Data, Mary River Project CREMP, 2020

Parameter	Sheardown Lake NW versus Reference Lake 3 in 2020				Sheardown Lake NW 2020 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Sheardown Lake NW Baseline Concentration (mg/kg)	Magnitude of Elevation	Sheardown Lake NW Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	16,880	0.9	21,800	0.9	11,792	1.3	17,745	1.2
Antimony (Sb)	<0.10	1.0	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	3.53	1.1	4.07	0.9	2.95	1.4	3.20	1.2
Barium (Ba)	117	0.7	122	0.9	78.1	1.1	93.2	1.2
Beryllium (Be)	0.65	1.4	0.80	1.2	1.0	0.9	1.0	1.0
Bismuth (Bi)	<0.20	1.2	<0.20	1.2	-	-	-	-
Boron (B)	12.2	2.1	14.7	2.0	2.86	9.0	3.11	9.6
Cadmium (Cd)	0.173	1.5	0.148	1.7	0.500	0.5	0.500	0.5
Calcium (Ca)	5,608	0.7	5,010	0.9	2,697	1.5	3,558	1.2
Chromium (Cr)	54.3	1.1	65.0	1.1	52.8	1.1	81.0	0.9
Cobalt (Co)	10.8	1.1	15.2	1.0	10.4	1.1	15.5	1.0
Copper (Cu)	71.4	0.5	83.8	0.5	32.6	1.2	48.3	0.9
Iron (Fe)	50,600	0.8	45,080	1.0	28,120	1.5	40,382	1.1
Lead (Pb)	13.8	1.2	16.7	1.2	12.7	1.3	20.1	1.0
Lithium (Li)	26.0	1.1	33.7	1.0	-	-	-	-
Magnesium (Mg)	11,440	0.9	14,180	0.9	7,448	1.3	11,498	1.1
Manganese (Mn)	579	0.9	1,230	4.3	756	0.7	2,164	2.4
Mercury (Hg)	0.0500	0.6	0.0583	0.6	0.100	0.3	0.100	0.3
Molybdenum (Mo)	4.44	0.7	2.52	2.1	3.40	0.9	3.55	1.5
Nickel (Ni)	40.0	1.4	45.0	1.4	49.3	1.1	68.9	0.9
Phosphorus (P)	1,167	0.7	956	0.9	863	1.0	1,400	0.6
Potassium (K)	4,100	1.0	5,338	1.0	2,681	1.6	4,612	1.1
Selenium (Se)	0.73	0.5	0.61	0.5	1.0	0.4	1.0	0.3
Silver (Ag)	0.14	1.1	0.20	0.8	0.27	0.6	0.30	0.5
Sodium (Na)	304	0.8	369	0.8	249	0.9	342	0.8
Strontium (Sr)	11.6	0.8	12.3	0.9	7.20	1.3	11.4	1.0
Sulphur (S)	1,400	0.7	1,140	0.9	-	-	-	-
Thallium (Tl)	0.379	1.1	0.594	0.9	1.0	0.4	1.0	0.5
Tin (Sn)	<2.0	1.0	<2.0	1.0	-	-	-	-
Titanium (Ti)	1,006	0.9	1,136	1.1	-	-	-	-
Uranium (U)	11.0	0.6	19.7	0.3	-	-	-	-
Vanadium (V)	54.1	0.8	63.4	0.9	37.4	1.2	57.9	1.0
Zinc (Zn)	73.1	0.7	83.8	0.8	51.1	1.0	76.0	0.8
Zirconium (Zr)	4.5	2.2	3.9	1.8	-	-	-	-

Denotes slight elevation (concentration 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
Denotes moderate elevation (concentration 5 to 10 times higher than mean reference area value or baseline period value, as applicable).
Denotes high elevation (concentration is ≥ 10 times higher than mean reference area value or baseline period value, as applicable).
Note: ' - ' indicates baseline data not available.

Table D.28: Field Observations of Sediment Properties at Sheardown Lake Southeast (DLO-02) Benthic Stations[a], Mary River Project CREMP, August 2020

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia[b]	Plant or Algal Presence
DLO-02-11	7.0	brown silt overlying dark grey silt-clay; some organics present	none detected	none observed
DLO-02-10	7.0	brown silt overlying dark grey silt-clay; some organics present	none detected	none observed
DLO-02-4	8.0	brown silt overlying dark grey silt-clay	none detected	none observed
DLO-02-9	8.5	light brown silt overlying grey silt-clay	none detected	none observed
DLO-02-1	12.1	reddish brown thin layer at surface; medium brown compact silt with some fine sand intermixed	none detected	sparse algae (mare's eggs)
DLO-02-12	11.0	brown silt overlying dark grey silt-clay	none detected	none observed
DLO-02-8	13.0	brown silt overlying grey silt-clay	none detected	sparse algae
DLO-02-13	11.0	brown silt overlying grey silt-clay	none detected	sparse algae
DLO-02-2	15.0	brown silt overlying dark grey silt-clay; some organics present	none detected	sparse algae
DLO-02-3	13.2	reddish brown thin layer over medium brown to grey-brown compact silt	none detected	sparse macrophytes (bryophytes)

[a] Sediment particle size and benthic invertebrate community samples were collected using a petite-Ponar.

[b] Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.29: Observations from Sediment Cores Collected at Sheardown Lake Southeast (DLO-02), Mary River Project CREMP, August 2020

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
DLO-02-1	11.5	Littoral	1	7.5	reddish oxidized silt overlying grey brown silt; some black streaking
			2	11.0	
			3	11.0	
			4	11.0	
DLO-02-11	7.0	Littoral	1	18.5	brown silt floc overlying compact grey silt containing some clay
			2	15.0	
			3	15.5	
			4	11.5	
DLO-02-4	8.8	Littoral	1	13.0	brown silt floc overlying compact grey silt containing some clay
			2	13.5	
			3	19.5	
			4	12.0	
DLO-02-2	15.4	Profundal	1	7.0	brown silt floc overlying compact grey silt containing some clay
			2	12.5	
			3	8.0	
			4	9.0	
DLO-02-3	13.0	Profundal	1	14.0	red-brown silt overlying grey-brown to dark grey-brown silt
			2	15.0	
			3	20.0	
			4	18.0	

Table D.30: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Sheardown Lake Southeast (DLO-02) Sediment Stations, Mary River Project CREMP, August 2020

Parameter		Units	Sediment Quality Guideline (SQG)[a]	AEMP Benchmark[b]	Sheardown Lake Southeast Basin Station					Summary Statistics		
					DLO-02-1 (littoral)	DLO-02-11 (littoral)	DLO-02-4 (littoral)	DLO-02-2 (profundal)	DLO-02-3 (profundal)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	-	21.6	5.2	6.7	20.7	20.3	14.9	8.20	3.67
	Silt	%	-	-	68.9	77.4	77.8	69.8	67.5	72.3	4.93	2.20
	Clay	%	-	-	9.4	17.5	15.5	9.5	12.2	12.8	3.61	1.62
	Moisture	%	-	-	48.9	62.6	63.7	49.0	41.9	53.2	9.52	4.26
	Total Organic Carbon	%	10^{α}	-	1.89	0.39	0.74	1.39	0.92	1.07	0.585	0.262
Metals	Aluminum (Al)	mg/kg	-	-	16,200	17,600	18,400	16,200	18,900	17,460	1,240	555
	Antimony (Sb)	mg/kg	-	-	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0	0
	Arsenic (As)	mg/kg	17	5.9	3.48	3.49	4.05	3.11	2.94	3.41	0.428	0.191
	Barium (Ba)	mg/kg	-	-	74.2	94.6	106	68.2	79.8	84.6	15.5	6.92
	Beryllium (Be)	mg/kg	-	-	0.81	0.84	0.96	0.78	0.89	0.86	0.071	0.032
	Bismuth (Bi)	mg/kg	-	-	0.21	0.27	0.25	<0.20	0.23	0.23	0.029	0.013
	Boron (B)	mg/kg	-	-	20.4	20.4	26.2	22.3	19.3	21.7	2.73	1.22
	Cadmium (Cd)	mg/kg	3.5	1.5	0.091	0.112	0.104	0.079	0.101	0.097	0.013	0.0057
	Calcium (Ca)	mg/kg	-	-	6,540	9,250	7,200	5,870	6,110	6,994	1,359	607.6
	Chromium (Cr)	mg/kg	90	79	69.3	***86.5***	***83.2***	74.0	70.5	76.7	7.73	3.46
	Cobalt (Co)	mg/kg	-	-	13.4	13.9	13.9	12.6	14.0	13.6	0.586	0.262
	Copper (Cu)	mg/kg	110	56	25.6	29.7	29.3	24.2	27.9	27.3	2.38	1.06
	Iron (Fe)	mg/kg	$40,000^{\alpha}$	34,400	***49,500***	***36,900***	***41,800***	***37,000***	***46,900***	***42,420***	5,710	2,554
	Lead (Pb)	mg/kg	91.3	35	15.2	18.0	18.9	14.5	16.3	16.6	1.85	0.828
	Lithium (Li)	mg/kg	-	-	30.6	33.0	34.3	30.5	33.9	32.5	1.81	0.808
	Magnesium (Mg)	mg/kg	-	-	13,600	17,700	14,900	12,800	14,800	14,760	1,861	832
	Manganese (Mn)	mg/kg	$1,100^{\alpha,\beta}$	657	***698***	***978***	***1,100***	645	559	***796***	231	103
	Mercury (Hg)	mg/kg	0.486	0.17	0.0217	0.0218	0.0210	0.0162	0.0245	0.0210	0.00302	0.00135
	Molybdenum (Mo)	mg/kg	-	-	1.78	1.22	1.49	1.27	1.53	1.46	0.225	0.100
	Nickel (Ni)	mg/kg	$75^{\alpha,\beta}$	66	52.0	***69.0***	63.0	56.4	51.9	58.5	7.43	3.32
	Phosphorus (P)	mg/kg	$2,000^{\alpha}$	1,278	1,020	942	1,050	946	912	974	58	26
	Potassium (K)	mg/kg	-	-	4,060	4,250	4,720	4,050	5,080	4,432	453	203
	Selenium (Se)	mg/kg	-	-	0.21	<0.20	<0.20	<0.20	0.21	0.20	0.0055	0.0024
	Silver (Ag)	mg/kg	-	-	0.11	0.12	0.12	0.11	0.13	0.12	0.0084	0.0037
	Sodium (Na)	mg/kg	-	-	247	282	308	270	251	272	24.8	11.1
	Strontium (Sr)	mg/kg	-	-	10.3	12.0	12.8	11.2	10.1	11.3	1.14	0.509
	Sulphur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	0	0
	Thallium (Tl)	mg/kg	-	-	0.349	0.432	0.465	0.338	0.389	0.395	0.0540	0.0242
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0	0
	Titanium (Ti)	mg/kg	-	-	1,220	1,300	1,390	1,290	1,290	1,298	60.6	27.1
	Uranium (U)	mg/kg	-	-	5.22	4.54	5.34	4.39	5.32	4.96	0.459	0.205
	Vanadium (V)	mg/kg	-	-	46.6	52.1	54.3	47.1	49.4	49.9	3.29	1.47
	Zinc (Zn)	mg/kg	315	135	56.1	56.3	59.4	50.2	59.3	56.3	3.74	1.67
	Zirconium (Zr)	mg/kg	-	-	15.7	18.0	19.2	16.6	19.1	17.7	1.54	0.689

(shaded) Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD Indicates parameter concentration above the AEMP Benchmark.

Note: "-" indicates no SGQ applicable.

[a] Canadian Sediment Quality Guideline for the protection of aquatic life probable effects level (PEL; CCME 2015) except α (Ontario Provincial Sediment Quality Guideline [PSQG] severe effect level [SEL]; OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG] probable effects level [PEL; BCMOE 2015]).

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Sheardown Lake Southeast.

Table D.31: Statistical Comparison of Sediment Physical Properties Between Sheardown Lake SE and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Analysis[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	tequal	log10	YES	0.004	Reference	5	29.6	7.5	3.4	23.4	40.4
						Sheardown SE	5	11.1	6.7	3.0	5.2	21.6
	Silt-Sized Material (%)	tequal	none	YES	0.009	Reference	5	62.2	6.3	2.8	53.4	68.4
						Sheardown SE	5	75.0	5.5	2.5	68.9	81.5
	Clay-Sized Material (%)	tequal	none	YES	0.029	Reference	5	8.2	3.0	1.3	6.2	13.4
						Sheardown SE	5	13.9	3.7	1.7	9.4	17.5
	Moisture (%)	tequal	none	YES	0.001	Reference	5	87.9	4.6	2.1	80.2	92.3
						Sheardown SE	5	60.9	7.3	3.3	48.9	68.6
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.008	Reference	5	4.8	2.0	0.9	2.3	7.0
						Sheardown SE	5	1.4	0.8	0.4	0.4	2.3
Profundal (Deep) Stations	Sand-Sized Material (%)	tequal	none	NO	0.146	Reference	5	31.6	22.3	10.0	13.9	56.6
						Sheardown SE	5	15.1	5.3	2.4	8.3	20.7
	Silt-Sized Material (%)	tequal	none	NO	0.112	Reference	5	57.4	18.1	8.1	36.9	71.9
						Sheardown SE	5	72.2	4.0	1.8	67.5	76.6
	Clay-Sized Material (%)	tequal	none	NO	0.477	Reference	5	11.0	4.3	1.9	6.3	15.1
						Sheardown SE	5	12.7	2.8	1.2	9.5	15.6
	Moisture (%)	tequal	none	YES	0.001	Reference	5	82.6	3.6	1.6	78.3	86.6
						Sheardown SE	5	55.8	11.8	5.3	41.9	70.7
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.002	Reference	5	3.4	1.1	0.5	2.2	4.5
						Sheardown SE	5	1.1	0.6	0.2	0.2	1.6

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table D.32: Magnitude of Elevation in Sediment Metal Concentrations between Sheardown Lake SE and Reference Lake 3 2020 Data, and between Sheardown Lake SE 2020 and Baseline Data, Mary River Project CREMP, 2020

Parameter	Sheardown Lake SE versus Reference Lake 3 in 2020				Sheardown Lake SE 2020 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Sheardown Lake SE Baseline Concentration (mg/kg)	Magnitude of Elevation	Sheardown Lake SE Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	16,880	1.0	21,800	0.8	14,950	1.2	13,133	1.3
Antimony (Sb)	<0.10	1.0	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	3.53	1.0	4.07	0.7	1.85	2.0	1.53	2.0
Barium (Ba)	117	0.8	122	0.6	80.5	1.1	64.3	1.2
Beryllium (Be)	0.65	1.3	0.80	1.0	1.0	0.9	1.0	0.8
Bismuth (Bi)	<0.20	1.2	<0.20	1.1	-	-	-	-
Boron (B)	12.2	1.8	14.7	1.4	2.50	8.9	1.35	15.4
Cadmium (Cd)	0.173	0.6	0.148	0.6	0.500	0.2	0.625	0.1
Calcium (Ca)	5,608	1.4	5,010	1.2	6,310	1.2	8,925	0.7
Chromium (Cr)	54.3	1.5	65.0	1.1	78.0	1.0	72.3	1.0
Cobalt (Co)	10.8	1.3	15.2	0.9	12.5	1.1	12.0	1.1
Copper (Cu)	71.4	0.4	83.8	0.3	29.5	1.0	24.5	1.1
Iron (Fe)	50,600	0.8	45,080	0.9	32,284	1.3	29,117	1.4
Lead (Pb)	13.8	1.3	16.7	0.9	17.0	1.0	13.8	1.1
Lithium (Li)	26.0	1.3	33.7	1.0	-	-	-	-
Magnesium (Mg)	11,440	1.3	14,180	1.0	12,634	1.2	13,742	1.0
Manganese (Mn)	579	1.6	1,230	0.5	462	2.0	410	1.5
Mercury (Hg)	0.0500	0.4	0.0583	0.3	0.100	0.2	0.100	0.2
Molybdenum (Mo	4.44	0.3	2.52	0.6	1.5	1.0	1.0	1.4
Nickel (Ni)	40.0	1.5	45.0	1.2	61.5	1.0	62.0	0.9
Phosphorus (P)	1,167	0.9	956	1.0	1,150	0.9	950	1.0
Potassium (K)	4,100	1.1	5,338	0.9	3,947	1.1	3,317	1.4
Selenium (Se)	0.73	0.3	0.61	0.3	1.0	0.2	1.0	0.2
Silver (Ag)	0.14	0.8	0.20	0.6	0.42	0.3	0.31	0.4
Sodium (Na)	304	0.9	369	0.7	353	0.8	330	0.8
Strontium (Sr)	11.6	1.0	12.3	0.9	16.0	0.7	11.0	1.0
Sulphur (S)	1,400	0.7	1,140	0.9	-	-	-	-
Thallium (Tl)	0.379	1.1	0.594	0.6	1.0	0.4	1.0	0.4
Tin (Sn)	<2.0	1.0	<2.0	1.0	-	-	-	-
Titanium (Ti)	1,006	1.3	1,136	1.1	-	-	-	-
Uranium (U)	11.0	0.5	19.7	0.2	-	-	-	-
Vanadium (V)	54.1	0.9	63.4	0.8	52.0	1.0	44.3	1.1
Zinc (Zn)	73.1	0.8	83.8	0.7	51.0	1.1	50.8	1.1
Zirconium (Zr)	4.5	3.9	3.9	4.5	-	-	-	-

Denotes slight elevation (concentration 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
Denotes moderate elevation (concentration 5 to 10 times higher than mean reference area value or baseline period value, as applicable).
Denotes high elevation (concentration is ≥ 10 times higher than mean reference area value or baseline period value, as applicable).
Note: ' - ' indicates baseline data not available.

Table D.33: Deposited Sediment Field Sampling Observations at Mary River Study Areas[a], Mary River Project CREMP, August 2020

Study Area	Station	Texture of Collected Sediment	Silt Presence[b]
GO-09 Upstream Reference	GO-09-1	medium (sized) coarse sand and gravel	precipitate and deposits (<1 mm)
	GO-09-3	medium (sized) coarse sand and gravel	precipitate and deposits (<1 mm)
	GO-09-5	medium (sized) coarse sand and gravel	precipitate and deposits (<1 mm)
GO-03 Upstream	GO-03-1	medium (sized) coarse sand and gravel	none observed
	GO-03-3	coarse sand and gravel	none observed
	GO-03-5	coarse sand and gravel	none observed
EO-01 Upper Mine-Exposed	EO-01-1	gravel	none observed
	EO-01-3	gravel and coarse sand	none observed
	EO-01-5	medium (sized) coarse sand	none observed
EO-20 Middle Mine-Exposed	EO-20-1	medium (sized) coarse sand	precipitate and deposits (<1 mm complex with periphyton)
	EO-20-3	medium (sized) coarse sand	none observed
	EO-20-5	medium (sized) coarse sand	none observed
CO-05 Lower Mine-Exposed	CO-05-1	medium (sized) coarse sand	none observed
	CO-05-3	medium (sized) coarse sand	none observed
	CO-05-5	medium (sized) coarse sand	none observed

[a] Sediment samples collected using a stainless steel scoop directly from the streambed or shoreline, as available.

[b] Silt observations described as fine material present on the surface of in-stream substrate and/or as interstitial deposits, occurring unusually.

Table D.34: Deposited Sediment Total Organic Carbon and Metal Concentrations at Mary River GO-09 Reference Stations, Mary River Project CREMP, August 2020

Analyte	Units	SQG[a]	Mary River GO-09 Reference Station			Study Area Summary Statistics		
			GO-09-B1	GO-09-B3	GO-09-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.12	<0.10	0.12	0.11	0.012	0.0067
Aluminum (Al)	µg/g	-	3,930	1,650	2,690	2,757	1,141	659
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.45	0.26	0.43	0.38	0.10	0.060
Barium (Ba)	µg/g	-	17.7	7.61	12.4	12.6	5.05	2.91
Beryllium (Be)	µg/g	-	0.18	<0.10	0.13	0.14	0.040	0.023
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	6.3	<5.0	<5.0	5.4	0.75	0.43
Cadmium (Cd)	µg/g	3.5	<0.020	<0.020	<0.020	<0.020	0	0
Calcium (Ca)	µg/g	-	3,540	1,780	2,930	2,750	894	516
Chromium (Cr)	µg/g	90	16.8	8.68	15.4	13.6	4.34	2.51
Cobalt (Co)	µg/g	-	3.09	1.59	2.53	2.40	0.758	0.438
Copper (Cu)	µg/g	197	7.18	2.28	3.90	4.45	2.50	1.44
Iron (Fe)	µg/g	40,000[α]	11,400	8,490	13,300	11,063	2,423	1,399
Lead (Pb)	µg/g	91.3	3.96	2.25	3.01	3.07	0.857	0.495
Lithium (Li)	µg/g	-	7.4	2.9	4.8	5.0	2.3	1.3
Magnesium (Mg)	µg/g	-	4,060	1,640	2,730	2,810	1,212	700
Manganese (Mn)	µg/g	1,100[α,β]	104	45.4	77.8	75.7	29.4	16.9
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	0.14	<0.10	<0.10	0.11	0.023	0.013
Nickel (Ni)	µg/g	75[α,β]	8.04	4.06	6.22	6.11	1.99	1.15
Phosphorus (P)	µg/g	2,000[α]	371	223	456	350	118	68
Potassium (K)	µg/g	-	1,080	440	730	750	320	185
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	91	<50	64	68	21	12
Strontium (Sr)	µg/g	-	5.61	3.62	4.92	4.72	1.01	0.583
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.093	<0.050	0.060	0.068	0.023	0.013
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	472	226	362	353	123	71
Uranium (U)	µg/g	-	1.22	0.625	0.922	0.922	0.298	0.172
Vanadium (V)	µg/g	-	20.4	14.0	24.0	19.5	5.06	2.92
Zinc (Zn)	µg/g	315	14.5	5.90	10.6	10.3	4.31	2.49
Zirconium (Zr)	µg/g	-	7.8	3.9	5.6	5.8	2.0	1.1

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQF) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.35: Deposited Sediment Total Organic Carbon and Metal Concentrations at Mary River GO-03 Upstream Stations, Mary River Project CREMP, August 2020

Analyte	Units	SQG[a]	Mary River GO-03 Upstream Station			Study Area Summary Statistics		
			GO-03-B1	GO-03-B3	GO-03-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	<0.10	0.12	<0.10	0.11	0.012	0.0067
Aluminum (Al)	µg/g	-	1,480	2,780	1,740	2,000	688	397
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.400	0.470	2.42	1.10	1.15	0.662
Barium (Ba)	µg/g	-	7.35	12.9	7.92	9.4	3.05	1.76
Beryllium (Be)	µg/g	-	<0.10	0.14	<0.10	<0.10	0	0
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	<5.0	<5.0	0	0
Cadmium (Cd)	µg/g	3.5	<0.020	<0.020	<0.020	<0.020	0	0
Calcium (Ca)	µg/g	-	2,350	2,030	1,860	2,080	249	144
Chromium (Cr)	µg/g	90	13.1	17.5	10.6	13.7	3.49	2.02
Cobalt (Co)	µg/g	-	1.67	2.50	1.71	1.96	0.468	0.270
Copper (Cu)	µg/g	197	2.07	3.93	2.34	2.78	1.01	0.580
Iron (Fe)	µg/g	40,000[α]	13,000	17,000	10,900	13,633	3,099	1,789
Lead (Pb)	µg/g	91.3	2.37	3.39	2.45	2.74	0.567	0.327
Lithium (Li)	µg/g	-	2.7	4.8	2.9	<2.0	1.2	0.67
Magnesium (Mg)	µg/g	-	1,610	2,240	1,530	1,793	389	225
Manganese (Mn)	µg/g	1,100[α,β]	47.7	74.8	53.3	58.6	14.3	8.26
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	0.0051	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Nickel (Ni)	µg/g	75[α,β]	4.22	6.12	4.15	4.83	1.12	0.645
Phosphorus (P)	µg/g	2,000[α]	458	369	372	400	51	29
Potassium (K)	µg/g	-	360	720	440	507	189	109
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	<50	65	50	55	8.7	5.0
Strontium (Sr)	µg/g	-	3.78	4.13	4.05	3.99	0.183	0.106
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	<0.050	0.060	<0.050	<0.050	0	0
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	241	320	228	263	50	29
Uranium (U)	µg/g	-	0.732	1.05	0.684	0.822	0.199	0.115
Vanadium (V)	µg/g	-	22.8	29.2	19.5	23.8	4.93	2.85
Zinc (Zn)	µg/g	315	6.1	10.4	6.8	7.8	2.3	1.3
Zirconium (Zr)	µg/g	-	3.4	6.0	3.7	4.4	1.4	0.82

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.36: Magnitude of Elevation in Deposited Sediment Metal Concentrations at Mary River Upper and Mine-Exposed Study Areas Compared to Reference Area Data, Mary River Project CREMP, August 2020

Parameter	Units	Mary River Reference (GO-09)	Upstream (GO-03)	Upper Mine-Exposed (EO-01)	Middle Mine-Exposed (EO-20)	Lower Mine-Exposed (CO-05)
Total Organic Carbon	%	0.11	0.9	1.0	1.6	1.0
Aluminum (Al)	µg/g	2,757	0.7	0.9	1.5	0.9
Antimony (Sb)	µg/g	<0.10	1.0	1.0	1.0	1.0
Arsenic (As)	µg/g	0.38	2.9	1.1	1.6	1.0
Barium (Ba)	µg/g	12.6	0.7	0.9	1.6	0.8
Beryllium (Be)	µg/g	0.14	0.8	0.8	1.7	1.0
Bismuth (Bi)	µg/g	<0.20	1.0	1.2	1.5	1.0
Boron (B)	µg/g	5.4	0.9	0.9	1.2	0.9
Cadmium (Cd)	µg/g	<0.020	1.0	1.3	1.9	1.0
Calcium (Ca)	µg/g	2,750	0.8	0.9	1.0	0.7
Chromium (Cr)	µg/g	13.6	1.0	1.4	1.9	1.0
Cobalt (Co)	µg/g	2.40	0.8	1.1	1.6	1.0
Copper (Cu)	µg/g	4.45	0.6	0.9	1.7	0.7
Iron (Fe)	µg/g	11,063	1.2	1.5	1.7	0.6
Lead (Pb)	µg/g	3.07	0.9	0.9	1.4	0.7
Lithium (Li)	µg/g	5.0	0.7	0.7	1.3	1.0
Magnesium (Mg)	µg/g	2,810	0.6	0.9	1.6	1.2
Manganese (Mn)	µg/g	75.7	0.8	1.1	1.8	1.0
Mercury (Hg)	µg/g	<0.0050	1.0	1.0	1.0	1.0
Molybdenum (Mo)	µg/g	0.11	0.9	1.8	3.2	1.1
Nickel (Ni)	µg/g	6.11	0.8	1.4	2.7	2.3
Phosphorus (P)	µg/g	350	1.1	1.1	1.1	0.8
Potassium (K)	µg/g	750	0.7	0.8	1.6	0.7
Selenium (Se)	µg/g	<0.20	1.0	1.0	1.0	1.0
Silver (Ag)	µg/g	<0.10	1.0	1.0	1.3	1.0
Sodium (Na)	µg/g	68	0.8	0.7	1.0	0.8
Strontium (Sr)	µg/g	4.72	0.8	0.8	1.0	0.7
Sulphur (S)	µg/g	<1,000	1.0	1.0	1.0	1.0
Thallium (Tl)	µg/g	0.068	0.8	0.7	1.3	0.8
Tin (Sn)	µg/g	<2.0	1.0	1.0	1.0	1.0
Titanium (Ti)	µg/g	353	0.7	0.8	1.1	0.7
Uranium (U)	µg/g	0.922	0.9	0.9	1.2	0.8
Vanadium (V)	µg/g	19.5	1.2	1.2	1.3	0.5
Zinc (Zn)	µg/g	10.3	0.8	1.0	1.6	0.9
Zirconium (Zr)	µg/g	5.8	0.8	0.7	1.0	0.5

Denotes slight elevation (mean concentration 3 to 5 times higher than respective mean reference area value).
Denotes moderate elevation (concentration 5 to 10 times higher than respective mean reference area value).
Denotes highly elevated (mean concentration ≥10 times higher than respective mean reference area value).

Table D.37: Deposited Sediment Total Organic Carbon and Metal Concentrations at Mary River EO-01 Mine-Exposed Stations, Mary River Project CREMP, August 2020

Analyte	Units	SQG[a]	Mary River Mine-Exposed Area Station			Study Area Summary Statistics		
			EO-01-B1	EO-01-B3	EO-01-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.11	0.12	0.10	0.11	0.010	0.0058
Aluminum (Al)	µg/g	-	2,500	1,930	2,790	2,407	438	253
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.48	0.39	0.37	0.41	0.059	0.034
Barium (Ba)	µg/g	-	12.1	9.12	12.7	11.3	1.92	1.11
Beryllium (Be)	µg/g	-	0.12	<0.10	0.11	0.11	0.010	0.006
Bismuth (Bi)	µg/g	-	<0.20	0.33	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	<5.0	<5.0	0	0
Cadmium (Cd)	µg/g	3.5	<0.020	0.030	0.028	<0.020	0	0
Calcium (Ca)	µg/g	-	2,250	2,850	1,960	2,353	454	262
Chromium (Cr)	µg/g	90	31.1	11.0	14.1	18.7	10.8	6.25
Cobalt (Co)	µg/g	-	3.49	1.81	2.43	2.58	0.850	0.490
Copper (Cu)	µg/g	197	3.88	3.97	4.29	4.05	0.215	0.124
Iron (Fe)	µg/g	40,000[α]	33,000	7,880	9,970	16,950	13,939	8,048
Lead (Pb)	µg/g	91.3	3.30	2.36	2.69	2.78	0.477	0.275
Lithium (Li)	µg/g	-	3.6	2.8	3.9	3.4	0.57	0.33
Magnesium (Mg)	µg/g	-	2,650	2,370	2,870	2,630	251	145
Manganese (Mn)	µg/g	1,100[α,β]	113	62.9	80.2	85.4	25.4	14.7
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	0.29	0.12	0.20	0.20	0.085	0.049
Nickel (Ni)	µg/g	75[α,β]	10.3	6.24	8.28	8.27	2.03	1.17
Phosphorus (P)	µg/g	2,000[α]	336	537	277	383	136	79
Potassium (K)	µg/g	-	670	470	710	617	129	74
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	<50	<50	<50	<50	0	0
Strontium (Sr)	µg/g	-	3.83	4.08	3.34	3.75	0.376	0.217
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	<0.050	<0.050	<0.050	0.050	0	0
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	317	276	290	294	21	12
Uranium (U)	µg/g	-	0.999	0.638	0.719	0.785	0.189	0.109
Vanadium (V)	µg/g	-	43.8	10.9	13.3	22.7	18.3	10.6
Zinc (Zn)	µg/g	315	11.1	9.10	10.6	10.3	1.04	0.601
Zirconium (Zr)	µg/g	-	4.1	3.2	4.0	3.8	0.49	0.28

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.38: Deposited Sediment Total Organic Carbon and Metal Concentrations at Mary River EO-20 Mine-Exposed Stations, Mary River Project CREMP, August 2020

Analyte	Units	SQG[a]	Mary River Mine-Exposed Area Station			Study Area Summary Statistics		
			EO-20-B1	EO-20-B3	EO-20-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.30	<0.10	0.16	0.19	0.10	0.059
Aluminum (Al)	µg/g	-	6,940	2,170	3,540	4,217	2,456	1,418
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.75	0.58	0.52	0.62	0.12	0.069
Barium (Ba)	µg/g	-	30.5	11.1	20.4	20.7	9.70	5.60
Beryllium (Be)	µg/g	-	0.46	0.11	0.14	0.24	0.19	0.11
Bismuth (Bi)	µg/g	-	0.51	<0.20	<0.20	0.30	0.18	0.10
Boron (B)	µg/g	-	10.0	<5.0	<5.0	6.67	2.89	1.67
Cadmium (Cd)	µg/g	3.5	0.061	0.030	0.023	0.038	0.020	0.012
Calcium (Ca)	µg/g	-	4,210	2,270	2,180	2,887	1,147	662
Chromium (Cr)	µg/g	90	27.6	30.5	20.1	26.1	5.37	3.10
Cobalt (Co)	µg/g	-	5.26	3.04	3.33	3.88	1.21	0.697
Copper (Cu)	µg/g	197	9.65	7.44	5.11	7.40	2.27	1.31
Iron (Fe)	µg/g	40,000[α]	12,900	25,700	19,100	19,233	6,401	3,696
Lead (Pb)	µg/g	91.3	5.89	2.98	3.94	4.27	1.48	0.856
Lithium (Li)	µg/g	-	11.4	3.10	4.50	6.33	4.44	2.57
Magnesium (Mg)	µg/g	-	7,380	2,170	3,770	4,440	2,669	1,541
Manganese (Mn)	µg/g	1,100[α,β]	180	105	125	137	39	22
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	0.54	0.15	0.39	0.36	0.20	0.11
Nickel (Ni)	µg/g	75[α,β]	23.9	12.2	14.0	16.7	6.30	3.64
Phosphorus (P)	µg/g	2,000[α]	376	452	300	376	76	44
Potassium (K)	µg/g	-	1,820	520	1,160	1,167	650	375
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	0.18	<0.10	<0.10	0.13	0.046	0.027
Sodium (Na)	µg/g	-	100	<50	<50	67	29	17
Strontium (Sr)	µg/g	-	6.54	4.31	3.22	4.69	1.69	0.98
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.140	<0.050	0.068	0.086	0.048	0.027
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	549	309	330	396	133	77
Uranium (U)	µg/g	-	1.45	0.805	1.02	1.09	0.328	0.190
Vanadium (V)	µg/g	-	18.7	37.1	21.9	25.9	9.83	5.68
Zinc (Zn)	µg/g	315	25.4	9.70	15.9	17.0	7.91	4.57
Zirconium (Zr)	µg/g	-	9.2	4.9	3.1	5.7	3.1	1.8

Indicates parameter concentration above SQG.

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.39: Deposited Sediment Total Organic Carbon and Metal Concentrations at Mary River Downstream (CO-05) Stations, Mary River Project CREMP, August 2020

Analyte	Units	SQG[a]	Mary River Downstream Mine-Exposed Area Station			Study Area Summary Statistics		
			CO-05-B1	CO-05-B3	CO-05-B5	Mean	Standard Deviation	Standard Error
Total Organic Carbon	%	10[α]	0.12	<0.10	0.13	<0.10	0	0
Aluminum (Al)	µg/g	-	2,810	964	3,630	2,468	1,366	788
Antimony (Sb)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Arsenic (As)	µg/g	17	0.33	0.12	0.66	0.37	0.27	0.16
Barium (Ba)	µg/g	-	12.9	3.90	13.9	10.2	5.51	3.18
Beryllium (Be)	µg/g	-	0.11	<0.10	0.18	0.13	0.044	0.025
Bismuth (Bi)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Boron (B)	µg/g	-	<5.0	<5.0	<5.0	<5.0	0	0
Cadmium (Cd)	µg/g	3.5	<0.020	<0.020	<0.020	<0.020	0	0
Calcium (Ca)	µg/g	-	2,340	539	3,260	2,046	1,384	799
Chromium (Cr)	µg/g	90	12.0	4.41	25.9	14.1	10.9	6.29
Cobalt (Co)	µg/g	-	2.44	0.81	3.70	2.32	1.45	0.84
Copper (Cu)	µg/g	197	3.27	1.24	4.91	3.14	1.84	1.06
Iron (Fe)	µg/g	40,000[α]	7,270	1,960	10,100	6,443	4,132	2,386
Lead (Pb)	µg/g	91.3	2.45	1.23	3.21	2.30	1.00	0.577
Lithium (Li)	µg/g	-	4.7	<2.0	7.7	4.80	2.85	1.65
Magnesium (Mg)	µg/g	-	3,380	1,010	5,750	3,380	2,370	1,368
Manganese (Mn)	µg/g	1,100[α,β]	83.5	27.1	107	72.5	41.1	23.7
Mercury (Hg)	µg/g	0.486	<0.0050	<0.0050	<0.0050	<0.0050	0	0
Molybdenum (Mo)	µg/g	-	0.12	<0.10	0.15	<0.10	0	0
Nickel (Ni)	µg/g	75[α,β]	9.68	4.22	28.7	14.2	12.9	7.42
Phosphorus (P)	µg/g	2,000[α]	271	103	436	270	167	96
Potassium (K)	µg/g	-	630	180	740	517	297	171
Selenium (Se)	µg/g	-	<0.20	<0.20	<0.20	<0.20	0	0
Silver (Ag)	µg/g	-	<0.10	<0.10	<0.10	<0.10	0	0
Sodium (Na)	µg/g	-	<50	<50	71	<50	12	7
Strontium (Sr)	µg/g	-	3.36	1.94	4.54	3.28	1.30	0.752
Sulphur (S)	µg/g	-	<1,000	<1,000	<1,000	<1,000	0	0
Thallium (Tl)	µg/g	-	0.054	<0.050	0.062	0.055	0.0061	0.0035
Tin (Sn)	µg/g	-	<2.0	<2.0	<2.0	<2.0	0	0
Titanium (Ti)	µg/g	-	321	93.2	350	255	141	81.2
Uranium (U)	µg/g	-	0.577	0.227	1.37	0.725	0.586	0.338
Vanadium (V)	µg/g	-	10.5	3.19	14.1	9.26	5.56	3.21
Zinc (Zn)	µg/g	315	10.1	3.30	14.1	9.17	5.46	3.15
Zirconium (Zr)	µg/g	-	3.2	1.5	4.5	3.1	1.5	0.87

Indicates parameter concentration above SQG).

Notes: SQG = Sediment Quality Guidelines. "-" = no applicable SQG.

[a] Canadian SQG for the protection of aquatic life probable effects level (PEL; CCME 2020) except α = Ontario Provincial Sediment Quality Guideline (PSQG) severe effect level (SEL; OMOE 1993) and β = British Columbia Working SQG PEL (BC ENV 2020).

Table D.40: Field Observations of Sediment Properties at Mary Lake (BLO) Benthic Stations[a], Mary River Project CREMP, August 2020

Station	Station Depth (m)	Colour and Texture Observations	Evidence of Anoxia[b]	Plant or Algal Presence
BLO-01	10.0	brown silt on top of grey silt, some sand intermixed	none detected	none observed
BLO-11	9.3	grey-brown silt with sand intermixed	none detected	none observed
BLO-7	12.8	brown silt	none detected	none observed
BLO-6	6.7	brown silt	none detected	none observed
BLO-3	16.4	red-brown oxidized surface layer over grey-brown silty-sand	none detected	none observed
BLO-15	29.1	red-brown oxidized surface layer over grey-brown silt	none detected	none observed
BLO-14	20.0	brown silt, some sand intermixed	none detected	none observed
BLO-13	22.0	brown silt	none detected	none observed
BLO-4	22.0	brown silt	none detected	none observed
BLO-5	21.5	brown silt	none detected	none observed

[a] Sediment particle size and benthic invertebrate community samples were collected using a petite-Ponar.

[b] Evidence of anoxic sediments assessed visually as the presence of blackened substrate, and by smell based on presence/strength of hydrogen sulphide odour.

Table D.41: Observations from Sediment Cores Collected at Mary Lake (BLO), Mary River Project CREMP, August 2020

Sample Station	Station Depth (m)	Station Type	Core Number	Core Length (cm)	Surficial Substrate Texture Description
BLO-01	10.0	Littoral	1	7.0	brown silt floc overlying grey silt intermixed with sand; black streaking in upper layer
			2	12.0	
			3	9.5	
			4	11.5	
BLO-16	30.5	Profundal	1	31.0	reddish oxidized silt overlying medium brown silt that becomes more consolidated with depth; no black streaking
			2	36.0	
			3	25.0	
			4	33.0	
BLO-03	16.0	Profundal	1	16.0	reddish brown silty sand overlying medium brown sandy silt; possible redox boundary between layers but no black streaking
			2	19.0	
			3	21.0	
			4	20.5	
BLO-14	20.0	Profundal	1	26.0	reddish brown silt overlying medium brown silt with fine sand intermixed; black streaking present
			2	22.0	
			3	23.0	
			4	19.0	
BLO-12	20.0	Profundal	1	14.0	reddish brown silt overlying medium brown silt, possibly reduced between layers; some black streaking present
			2	10.0	
			3	22.0	
			4	11.5	
BLO-04	19.5	Profundal	1	15.0	reddish brown silt overlying grey-brown silt that becomes more consolidated with depth; some black streaking present
			2	23.5	
			3	18.5	
			4	7.0	
BLO-10	19.0	Profundal	1	11.0	light brown silt floc overlying grey-brown silt
			2	11.0	
			3	12.0	
			4	11.5	
BLO-09	29.0	Profundal	1	11.0	red-brown silt floc overlying grey-brown silt; black streaking in upper layer
			2	6.5	
			3	10.0	
			4	16.5	
BLO-08	26.0	Profundal	1	10.5	light brown silt floc overlying consolidated grey-brown silt.
			2	12.5	
			3	11.5	
			4	9.0	
BLO-06	6.0	Littoral	1	10.0	light brown silt
			2	9.5	
			3	7.5	
			4	10.5	

Table D.42: Sediment Particle Size, Total Organic Carbon, and Metal Concentrations at Mary Lake (BLO) Sediment Stations, Mary River Project CREMP, August 2020

	Analyte	Units	Sediment Quality Guideline (SQG)[a]	AEMP Benchmark[b]	Mary Lake Stations										Summary Statistics		
					BLO-01 (littoral)	BLO-16 (profundal)	BLO-03 (profundal)	BLO-14 (profundal)	BLO-12 (profundal)	BLO-04 (profundal)	BLO-10 (profundal)	BLO-09 (profundal)	BLO-08 (profundal)	BLO-06 (littoral)	Mean	Standard Deviation	Standard Error
Non-metals	Sand	%	-	-	21.6	22.2	91.9	21.2	24.3	23.6	4.5	5.6	2.3	6.8	22.4	26.0	8.22
	Silt	%	-	-	69.9	46.7	6.0	45.5	61.7	55.5	62.7	65.1	64.8	63.8	54.2	18.7	5.92
	Clay	%	-	-	8.5	31.1	2.1	33.2	14.0	20.9	32.8	29.4	32.9	29.4	23.4	11.43	3.62
	Moisture	%	-	-	40.9	57.5	16.6	66.8	37.8	51.3	43.5	51.1	53.5	67.3	48.6	15.0	4.74
	Total Organic Carbon	%	10[α]	-	1.31	1.49	0.22	0.93	0.68	0.54	0.46	0.38	0.65	0.68	0.73	0.40	0.13
Metals	Aluminum (Al)	mg/kg	-	-	15,000	24,200	9,230	30,100	20,700	20,600	25,500	22,600	28,000	29,600	22,553	6,578	2,080
	Antimony (Sb)	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	0
	Arsenic (As)	mg/kg	17	5.9	4.82	4.01	1.47	4.04	2.33	2.63	3.18	3.67	3.42	3.47	3.30	0.960	0.304
	Barium (Ba)	mg/kg	-	-	79.2	99.9	36.7	110	74.8	74.5	96.4	102	96.3	104	87.4	21.8	6.90
	Beryllium (Be)	mg/kg	-	-	0.72	1.17	0.42	1.38	0.91	0.86	1.14	1.03	1.25	1.33	1.02	0.299	0.0945
	Bismuth (Bi)	mg/kg	-	-	<0.20	0.25	<0.20	0.25	0.26	0.21	0.23	0.23	0.26	0.23	0.23	0.023	0.0073
	Boron (B)	mg/kg	-	-	18.9	31.8	15.5	45.2	24.2	25.7	31.0	25.6	42.0	43.9	30.4	10.4	3.29
	Cadmium (Cd)	mg/kg	3.5	1.5	0.108	0.156	0.066	0.186	0.128	0.109	0.151	0.144	0.162	0.145	0.136	0.0340	0.0108
	Calcium (Ca)	mg/kg	-	-	7,720	3,950	1,890	4,810	4,460	4,350	4,710	4,490	5,040	5,310	4,673	1,426	451
	Chromium (Cr)	mg/kg	90	98	60.6	83.4	31.1	93.0	75.5	82.1	86.3	87.8	97.7	94.1	79.2	19.9	6.31
	Cobalt (Co)	mg/kg	-	-	14.0	16.1	6.93	19.9	14.8	14.7	17.4	17.7	18.7	18.7	15.9	3.71	1.17
	Copper (Cu)	mg/kg	110	50	27.8	37.4	11.8	39.2	28.2	28.7	35.0	32.7	37.0	36.0	31.4	8.02	2.54
	Iron (Fe)	mg/kg	40,000[α]	52,400	34,500	41,000	18,800	47,000	40,000	35,200	42,300	43,400	44,400	46,600	39,320	8,352	2,641
	Lead (Pb)	mg/kg	91.3	35	14.5	23.8	8.25	26.5	17.1	18.7	24.6	21.6	24.2	25.5	20.5	5.82	1.84
	Lithium (Li)	mg/kg	-	-	29.2	45.8	15.8	51.5	33.6	35.5	46.8	39.8	47.0	50.7	39.6	11.2	3.55
	Magnesium (Mg)	mg/kg	-	-	14,500	16,500	5,870	18,800	15,400	14,900	17,200	16,200	18,500	18,700	15,657	3,777	1,194
	Manganese (Mn)	mg/kg	1,100[α,β]	4,370	1,350	407	1,490	955	835	617	2,490	***4,980***	1,770	778	1,567	1,349	427
	Mercury (Hg)	mg/kg	0.486	0.17	0.0293	0.0823	0.0264	0.0814	0.0344	0.0393	0.0539	0.0430	0.0612	0.0541	0.0505	0.0199	0.00630
	Molybdenum (Mo)	mg/kg	-	-	0.52	0.70	0.51	0.80	1.31	0.73	1.37	1.29	1.12	0.92	0.927	0.326	0.103
	Nickel (Ni)	mg/kg	75[α,β]	72	51.7	63.4	23.8	66.3	54.8	58.8	60.0	66.4	69.0	62.0	57.6	13.03	4.12
	Phosphorus (P)	mg/kg	2,000[α]	1,580	1,100	1,050	449	917	876	857	791	1,020	876	849	879	181	57
	Potassium (K)	mg/kg	-	-	3,470	6,180	2,150	7,780	5,020	5,120	6,410	5,590	7,230	7,650	5,660	1,813	573
	Selenium (Se)	mg/kg	-	-	<0.20	0.26	<0.20	0.34	<0.20	<0.20	0.21	0.23	0.24	0.26	0.23	0.045	0.014
	Silver (Ag)	mg/kg	-	-	<0.10	0.17	<0.10	0.17	0.14	0.14	0.16	0.15	0.17	0.16	0.15	0.027	0.008
	Sodium (Na)	mg/kg	-	-	238	393	147	434	290	335	405	383	448	453	353	100	32
	Strontium (Sr)	mg/kg	-	-	11.1	16.5	6.70	17.1	11.2	12.4	14.3	13.4	16.4	16.7	13.6	3.33	1.052
	Sulphur (S)	mg/kg	-	-	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	<1,000	0	0
	Thallium (Tl)	mg/kg	-	-	0.298	0.484	0.194	0.609	0.392	0.417	0.571	0.484	0.539	0.603	0.459	0.136	0.0429
	Tin (Sn)	mg/kg	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	0	0
	Titanium (Ti)	mg/kg	-	-	978	1,340	608	1,760	1,470	1,470	1,710	1,500	1,870	1,970	1,468	416	131
	Uranium (U)	mg/kg	-	-	3.35	7.96	3.43	9.89	6.22	6.29	8.49	6.55	8.19	8.48	6.89	2.17	0.686
	Vanadium (V)	mg/kg	-	-	48.0	68.0	26.0	80.0	55.0	57.1	69.6	63.5	74.4	78.6	62.0	16.4	5.18
	Zinc (Zn)	mg/kg	315	135	48.1	73.1	27.6	85.4	63.8	62.0	78.6	69.1	79.9	86.2	67.4	18.2	5.77
	Zirconium (Zr)	mg/kg	-	-	10.4	23.5	6.4	23.0	16.9	22.1	25.1	20.4	25.5	25.9	19.9	6.70	2.12

[shaded box] Indicates parameter concentration above Sediment Quality Guideline (SQG).

BOLD Indicates parameter concentration above the AEMP Benchmark.

Note: "-" indicates no SQG applicable.

[a] Canadian Sediment Quality Guideline for the protection of aquatic life probable effects level (PEL; CCME 2015) except α (Ontario Provincial Sediment Quality Guideline [PSQG] severe effect level [SEL]; OMOE 1993) and β (British Columbia Working Sediment Quality Guideline [BCSQG] probable effects level [PEL; BCMOE 2015]).

[b] AEMP Sediment Quality Benchmarks developed by Intrinsik (2013) using sediment quality guidelines, background sediment quality data, and method detection limits. The indicated values are specific to Mary Lake.

Table D.43: Statistical Comparison of Sediment Physical Properties Between Mary Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Analysis[a]	Transform-ation	Significant Difference Between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	tequal	log10	NO	0.310	Reference	5	29.6	7.5	3.4	23.4	40.4
						Mary	4	28.1	34.5	17.2	5.2	78.6
	Silt-Sized Material (%)	tequal	none	NO	0.459	Reference	5	62.2	6.3	2.8	53.4	68.4
						Mary	4	53.6	24.0	12.0	18.0	69.9
	Clay-Sized Material (%)	tunequal	none	NO	0.258	Reference	5	8.2	3.0	1.3	6.2	13.4
						Mary	4	18.3	14.5	7.2	3.4	32.0
	Moisture (%)	tunequal	none	YES	0.031	Reference	5	87.9	4.6	2.1	80.2	92.3
						Mary	4	50.7	19.9	10.0	27.3	67.3
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.005	Reference	5	4.8	2.0	0.9	2.3	7.0
						Mary	4	0.8	0.5	0.2	0.2	1.3
Profundal (Deep) Stations	Sand-Sized Material (%)	tequal	log10	NO	0.239	Reference	5	31.6	22.3	10.0	13.9	56.6
						Mary	11	21.6	24.7	7.4	2.3	91.9
	Silt-Sized Material (%)	M-W	rank	NO	0.743	Reference	5	57.4	18.1	8.1	36.9	71.9
						Mary	11	54.9	18.6	5.6	6.0	73.4
	Clay-Sized Material (%)	tequal	none	YES	0.025	Reference	5	11.0	4.3	1.9	6.3	15.1
						Mary	11	23.5	10.6	3.2	2.1	33.2
	Moisture (%)	tequal	none	YES	0.001	Reference	5	82.6	3.6	1.6	78.3	86.6
						Mary	11	49.2	14.3	4.3	16.6	68.4
	Total Organic Carbon (TOC) Content (%)	tunequal	none	YES	0.004	Reference	5	3.4	1.1	0.5	2.2	4.5
						Mary	11	0.7	0.3	0.1	0.2	1.5

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table D.44: Magnitude of Elevation in Sediment Metal Concentrations between Mary Lake and Reference Lake 3 2020 Data, and between Mary Lake 2020 and Baseline Data, Mary River Project CREMP, 2020

Parameter	Mary Lake versus Reference Lake 3 in 2020				Mary Lake 2020 versus Baseline Period			
	Littoral Stations		Profundal Stations		Littoral Stations		Profundal Stations	
	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Reference Lake Concentration (µg/g)	Magnitude of Elevation	Mary Lake Baseline Concentration (mg/kg)	Magnitude of Elevation	Mary Lake Baseline Concentration (mg/kg)	Magnitude of Elevation
Aluminum (Al)	16,880	1.3	21,800	1.0	18,267	1.2	17,000	1.3
Antimony (Sb)	<0.10	1.0	<0.10	1.0	1.0	0.1	1.0	0.1
Arsenic (As)	3.53	1.2	4.07	0.8	2.80	1.5	3.70	0.8
Barium (Ba)	117	0.8	122	0.7	105	0.9	75.9	1.1
Beryllium (Be)	0.65	1.6	0.80	1.3	1.0	1.0	1.0	1.0
Bismuth (Bi)	<0.20	1.1	<0.20	1.2	-	-	-	-
Boron (B)	12.2	2.6	14.7	2.1	0.733	42.8	2.09	14.4
Cadmium (Cd)	0.173	0.7	0.148	0.9	0.500	0.3	0.500	0.3
Calcium (Ca)	5,608	1.2	5,010	0.8	3,130	2.1	2,934	1.4
Chromium (Cr)	54.3	1.4	65.0	1.2	81.0	1.0	76.3	1.0
Cobalt (Co)	10.8	1.5	15.2	1.0	18.3	0.9	17.8	0.9
Copper (Cu)	71.4	0.4	83.8	0.4	45.0	0.7	43.9	0.7
Iron (Fe)	50,600	0.8	45,080	0.9	36,133	1.1	35,654	1.1
Lead (Pb)	13.8	1.5	16.7	1.2	18.0	1.1	21.3	1.0
Lithium (Li)	26.0	1.5	33.7	1.2	-	-	-	-
Magnesium (Mg)	11,440	1.5	14,180	1.1	13,967	1.2	10,903	1.4
Manganese (Mn)	579	1.8	1,230	1.4	699	1.5	991	1.7
Mercury (Hg)	0.0500	0.8	0.0583	0.9	0.100	0.4	0.100	0.5
Molybdenum (Mo	4.44	0.2	2.52	0.4	1.0	0.7	1.0	1.0
Nickel (Ni)	40.0	1.4	45.0	1.3	67.0	0.8	65.4	0.9
Phosphorus (P)	1,167	0.8	956	0.9	800	1.2	1,325	0.6
Potassium (K)	4,100	1.4	5,338	1.1	3,450	1.6	4,287	1.3
Selenium (Se)	0.728	0.3	0.614	0.4	1.0	0.2	1.0	0.2
Silver (Ag)	0.142	0.9	0.202	0.7	0.273	0.5	0.365	0.4
Sodium (Na)	304	1.1	369	1.0	279	1.2	284	1.2
Strontium (Sr)	11.6	1.2	12.3	1.1	9.3	1.5	13.3	1.0
Sulphur (S)	1,400	0.7	1,140	0.9	-	-	-	-
Thallium (Tl)	0.379	1.2	0.594	0.8	1.0	0.5	1.0	0.5
Tin (Sn)	<2.0	1.0	<2.0	1.0	-	-	-	-
Titanium (Ti)	1,006	1.5	1,136	1.3	-	-	-	-
Uranium (U)	11.0	0.5	19.7	0.4	-	-	-	-
Vanadium (V)	54.1	1.2	63.4	1.0	69.0	0.9	63.3	1.0
Zinc (Zn)	73.1	0.9	83.8	0.8	67.0	1.0	63.6	1.1
Zirconium (Zr)	4.5	4.0	3.9	5.2	-	-	-	-

Denotes slight elevation (concentration 3 to 5 times higher than respective mean reference lake value or baseline period, as applicable).
Denotes moderate elevation (concentration 5 to 10 times higher than mean reference area value or baseline period value, as applicable).
Denotes high elevation (concentration is ≥ 10 times higher than mean reference area value or baseline period value, as applicable).
Note: ' - ' indicates baseline data not available.

Mary River Project 2020
Core Receiving Environment Monitoring Program Report

Part 3 of 3
(Appendices E to G)

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APPENDIX E
PHYTOPLANKTON DATA

Table E.1: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Lotic Reference Stations, Camp Lake Tributaries, Sheardown Lake Tributary 1, and Tom River, Mary River Project 2020 CREMP

Station		Reference Creek Stations				Camp Lake Tributary 1 (CLT1)						Camp Lake Tributary 2	Camp Lake Outlet	Sheardown Lake Tributary 1 (SDLT1)		Tom River
						North Branch		Main Stem								
		CLT-REF4	CLT-REF3	MRY-REF3	MRY-REF2	L1-08	L1-02	L2-03	L1-09	L1-05	L0-01	K0-01	J0-01	D1-05	D1-00	I0-01
Sample Collection Date	Spring	4-Jul-20	4-Jul-20	4-Jul-20	4-Jul-20	4-Jul-20	2-Jul-20	2-Jul-20	2-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	4-Jul-20	2-Jul-20	2-Jul-20	4-Jul-20
	Summer	3-Aug-20	3-Aug-20	3-Aug-20	3-Aug-20	3-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	3-Aug-20	3-Aug-20	3-Aug-20	3-Aug-20
	Fall	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	28-Aug-20	30-Aug-20	29-Aug-20	30-Aug-20	30-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20	29-Aug-20
Chlorophyll-a (µg/L)	Spring	0.35	0.31	0.24	0.34	0.21	0.27	0.66	0.35	0.36	0.32	<0.10	0.79	0.22	0.24	0.24
	Summer	0.62	0.90	0.92	0.52	0.43	0.67	0.83	0.56	0.77	0.64	0.67	2.04	0.41	0.47	0.43
	Fall	0.74	0.31	0.34	0.45	0.21	0.33	0.64	0.39	0.40	0.49	0.66	1.20	0.19	0.32	0.44
	Average	0.57	0.51	0.50	0.44	0.28	0.42	0.71	0.43	0.51	0.48	0.48	1.34	0.27	0.34	0.37
	Standard Deviation	0.20	0.34	0.37	0.09	0.13	0.22	0.10	0.11	0.23	0.16	0.33	0.64	0.12	0.12	0.11
	Standard Error	0.12	0.20	0.21	0.05	0.07	0.12	0.06	0.06	0.13	0.09	0.19	0.37	0.07	0.07	0.07
Phaeophytin-a (µg/L)	Spring	0.40	<0.10	0.37	0.45	0.39	0.51	0.52	0.42	0.42	0.37	0.37	0.57	0.35	0.37	0.32
	Summer	1.17	1.50	1.60	1.36	1.16	1.24	1.37	1.01	1.48	1.17	1.05	1.75	1.23	1.10	0.97
	Fall	0.78	0.46	0.57	0.58	0.69	0.51	0.61	0.54	0.54	0.57	0.63	0.82	0.40	0.43	0.52
	Average	0.78	0.69	0.85	0.80	0.75	0.75	0.83	0.66	0.81	0.70	0.68	1.05	0.66	0.63	0.60
	Standard Deviation	0.39	0.73	0.66	0.49	0.39	0.42	0.47	0.31	0.58	0.42	0.34	0.62	0.49	0.41	0.33
	Standard Error	0.22	0.42	0.38	0.28	0.22	0.24	0.27	0.18	0.34	0.24	0.20	0.36	0.29	0.23	0.19

Table E.2: Chlorophyll-a Concentration (µg/L) Data Summary and Statistical Comparison Results between Camp Lake Tributary 1 Main Stem Stations and Lotic Reference Creek Stations for Spring, Summer and Fall Sampling Events in 2020

Season	Two-Area Comparison			Study Area	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
	Significant Difference between Areas?	P-value	Statistical Test[a]							
Spring	NO	0.226	tequal	Reference	4	0.310	0.050	0.025	0.240	0.350
				CLT1 Main Stem	4	0.422	0.159	0.080	0.320	0.660
Summer	NO	0.745	tequal	Reference	4	0.740	0.201	0.100	0.520	0.920
				CLT1 Main Stem	4	0.700	0.122	0.061	0.560	0.830
Fall	NO	0.866	tequal	Reference	4	0.460	0.196	0.098	0.310	0.740
				CLT1 Main Stem	4	0.480	0.116	0.058	0.390	0.640

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical test was T-test (tequal) for comparisons between Lotic Reference Creek and Camp Lake Tributary 1 Main Stem Stations within a season.

\ Data analysis included: α - data untransformed, single factor ANOVA test conducted; β - data log-transformed, single factor ANOVA test conducted; γ - data untransformed, Mann-Whitney U-test conducted; ζ - data untransformed, t-test assuming unequal variance conducted; η - data log-transformed, t-test assuming unequal variance conducted.

Table E.3: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Reference Lake 3 (REF-03), Mary River Project 2020 CREMP

	Analyte	Chlorophyll-a (µg/L)						Phaeophytin-a (µg/L)					
	Station	**REF3-01**	**REF3-02**	**REF3-03**	**Average**	**Standard Deviation**	**Standard Error**	**REF3-01**	**REF3-02**	**REF3-03**	**Average**	**Standard Deviation**	**Standard Error**
Sample Collection Date	Summer	2-Aug-20			-	-	-	2-Aug-20			-	-	-
	Fall	29-Aug-20			-	-	-	29-Aug-20			-	-	-
Summer	Surface	0.62	0.61	0.69	0.64	0.04	0.03	1.29	1.22	1.35	1.29	0.07	0.04
	Bottom	1.06	1.02	0.68	0.92	0.21	0.12	1.65	1.47	1.38	1.50	0.14	0.08
	Average	0.84	0.82	0.69	0.78	0.08	0.05	1.47	1.35	1.37	1.39	0.07	0.04
Fall	Surface	0.59	0.53	0.59	0.57	0.03	0.02	0.56	0.57	0.54	0.56	0.02	0.01
	Bottom	0.62	0.70	0.60	0.64	0.05	0.03	0.58	0.68	0.59	0.62	0.06	0.03
	Average	0.61	0.62	0.60	0.61	0.01	0.01	0.57	0.63	0.57	0.59	0.03	0.02

Table E.4: Statistical Comparisons of Chlorophyll-a Concentrations Among Years at Reference Lake 3, Mary River Project CREMP, 2020

Season	Data Transform-ation	Overall 5-group Comparison			Summary				Pairwise Comparison[b]
		Significant Difference Among Years?	P-value	Statistical Treatment[a]	Year	Sample Size (n)	Mean Concentration (mg/L)	Standard Deviation (mg/L)	
Summer	rank	YES	0.047	K-W	2015	3	0.899	0.146	AB
					2016	3	0.922	0.0845	A
					2017	3	0.634	0.0899	C
					2018	3	0.742	0.0660	BC
					2019	3	0.680	0.213	BC
					2020	6	0.780	0.0744	ABC
Fall	rank	YES	0.003	K-W	2015	3	1.06	0.363	AB
					2016	3	0.738	0.0708	ABC
					2017	3	0.913	0.0189	A
					2018	3	0.907	0.0388	A
					2019	3	0.680	0.0695	BC
					2020	6	0.605	0.00894	C

(Grey shading) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] The statistical test was A Kruskal Wallis H-test (KW H-test) for differences among 5 years.

[b] Annual data sets sharing the same letter do not differ significantly.

Table E.5: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Camp Lake (JLO), Mary River Project CREMP, 2020

	Analyte	Chlorophyll-a (µg/L)							
	Station	JL0-02	JL0-10	JL0-01	JL0-07	JL0-09	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	-	-	-
	Summer	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	-	-	-
	Fall	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	-	-	-
Winter	Surface	1.37	0.41	0.99	0.59	0.31	0.73	0.44	0.20
	Bottom	0.31	0.24	0.14	0.14	0.18	0.20	0.07	0.03
	Average	0.84	0.33	0.57	0.37	0.25	0.47	0.24	0.11
Summer	Surface	1.31	1.39	1.07	0.94	0.77	1.10	0.26	0.11
	Bottom	1.62	2.02	0.96	1.05	0.78	1.29	0.52	0.23
	Average	1.47	1.71	1.02	1.00	0.78	1.19	0.38	0.17
Fall	Surface	0.87	0.99	<0.10	1.34	1.16	0.89	0.48	0.21
	Bottom	1.31	1.46	1.31	0.90	1.13	1.22	0.21	0.10
	Average	1.09	1.23	0.71	1.12	1.15	1.06	0.20	0.09

	Analyte	Phaeophytin-a (µg/L)							
	Station	JL0-02	JL0-10	JL0-01	JL0-07	JL0-09	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	12-Apr-20	13-Apr-20	13-Apr-20	13-Apr-20	14-Apr-20	-	-	-
	Summer	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	29-Jul-20	-	-	-
	Fall	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	30-Aug-20	-	-	-
Winter	Surface	0.68	0.42	0.60	0.54	0.41	0.53	0.12	0.05
	Bottom	0.38	0.35	0.32	0.34	0.41	0.36	0.04	0.02
	Average	0.53	0.39	0.46	0.44	0.41	0.45	0.06	0.02
Summer	Surface	1.11	1.03	0.99	1.00	0.88	1.00	0.08	0.04
	Bottom	1.29	1.47	0.68	0.92	0.78	1.03	0.34	0.15
	Average	1.20	1.25	0.84	0.96	0.83	1.02	0.20	0.09
Fall	Surface	0.65	0.73	0.25	0.99	1.02	0.73	0.31	0.14
	Bottom	0.87	0.90	0.92	0.77	0.81	0.85	0.06	0.03
	Average	0.76	0.82	0.59	0.88	0.92	0.79	0.13	0.06

Table E.6: Statistical Comparisons of Chlorophyll-a Concentrations Among Winter, Spring, Summer and/or Fall Sampling Events at Mine-Exposed and Reference Creek and Lake Study Areas, Mary River Project CREMP, 2020

Study Area	Overall 3-group Comparison			Pair-wise, *post hoc* comparisons[a]			
	Significant Difference Among Seasons?	P-value	Statistical Test[b]	(I) Season	(J) Season	Significant Difference Between 3 Seasons?	P-value
Reference Creek Stations	YES	0.036	K-W	Spring	Summer	YES	0.011
				Spring	Fall	NO	0.325
				Summer	Fall	NO	0.115
Mary River GO-09 Reference Stations	YES	0.027	K-W	Spring	Summer	YES	0.007
				Spring	Fall	NO	0.180
				Summer	Fall	NO	0.180
Reference Lake 3	YES	0.022	tequal	Winter	Summer	YES	0.022
				Winter	Fall	YES	0.022
				Summer	Fall	YES	0.022
Camp Lake	YES	0.004	ANOVA	Winter	Summer	YES	0.004
				Winter	Fall	YES	0.004
				Summer	Fall	NO	0.743
Sheardown Lake NW	YES	0.003	K-W	Winter	Summer	YES	0.027
				Winter	Fall	YES	<0.001
				Summer	Fall	NO	0.279
Sheardown Lake SE	YES	0.002	K-W	Winter	Summer	YES	<0.001
				Winter	Fall	YES	0.066
				Summer	Fall	NO	0.104
Mary Lake North Basin	YES	0.002	ANOVA	Winter	Summer	YES	0.002
				Winter	Fall	YES	0.033
				Summer	Fall	YES	0.061
Mary Lake South Basin	YES	0.003	K-W	Winter	Summer	YES	0.001
				Winter	Fall	NO	0.477
				Summer	Fall	YES	0.012

[a] *Post hoc* analysis of 1-way ANOVA among all areas protected for multiple comparisons.

[b] Statistical tests include Analysis of Variance (ANOVA), Kruskal Wallis H-test (KW H-test) for differences among three seasons within each station and T-test (tequal) for Reference Lake 3 when only two seasons were sampled.

Table E.7: Summary Data and Statistical Results for Chlorophyll-a Concentration (mg/L) Comparisons between Individual Mine-Exposed Lakes and Reference Lake 3 for Summer Sampling, Mary River Project CREMP, 2020

Study Lake	Two-Group Comparison to Reference				Number of Stations (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
	Significant Difference between Areas?	P-value	Statistical Test[a]	Magnitude of Difference[b]						
Reference Lake 03	-	-	-	-	3	0.780	0.0832	0.0480	0.685	0.840
Camp Lake	NO	0.143	M-W	5.4	5	1.19	0.381	0.171	0.775	1.71
Sheardown Lake NW	YES	0.048	M-W	16	6	2.45	2.92	1.19	0.835	8.36
Sheardown Lake SE	YES	0.036	M-W	33	5	1.92	0.306	0.137	1.43	2.19
Mary Lake North	NO	0.100	M-W	29	3	1.67	0.475	0.275	1.12	2.00
Mary Lake South	YES	0.017	M-W	4.0	7	1.01	0.134	0.0506	0.860	1.22

(grey shading) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical Test was Mann-Whitney (M-W) U-test between indvidual mine-exposed lakes and Reference Lake 3.

[b] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Table E.8: Summary Data and Statistical Results for Chlorophyll-a Concentration (mg/L) Comparisons between Individual Mine-Exposed Lakes and Reference Lake 3 for Fall Sampling, Mary River Project CREMP, 2020

Study Lake	Two-Group Comparison to Reference				Number of Stations (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
	Significant Difference between Areas?	P-value	Statistical Test[a]	Magnitude of Difference[b]						
Reference Lake (	-	-	-	-	3	0.605	0.0100	0.00577	0.595	0.615
Camp Lake	YES	0.036	M-W	35	5	1.06	0.203	0.0908	0.705	1.23
Sheardown Lake NW	YES	<0.001	tequal	66	6	1.79	0.129	0.0527	1.67	1.97
Sheardown Lake SE	YES	<0.001	tequal	48	5	1.35	0.0767	0.0343	1.27	1.46
Mary Lake North	NO	0.100	M-W	28	3	1.01	0.0275	0.0159	0.975	1.02
Mary Lake South	NO	0.295	tequal	4.2	7	0.651	0.0690	0.0261	0.580	0.780

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical Test were Mann-Whitney U-test (M-W) or T-test (tequal) between indvidual mine-exposed lakes and Reference Lake 3.

[b] Magnitude calculated by comparing the difference between the reference area and mine-exposed area means divided by the reference area standard deviation.

Table E.9: Statistical Comparison of Chlorophyll-a Concentrations at Camp Lake Among Years of Mine Operation (2015 to 2020)

Season	Data Transform-ation	Statistical Test[a]	Overall 7-Year Comparison		Pair-wise, post-hoc comparisons[b]				
			Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Pairwise Comparison[c]
Winter	log10	ANOVA	YES	<0.001	2014	4	0.275	0.150	C
					2015	5	0.742	0.152	A
					2016	5	0.645	0.120	AB
					2017	5	0.316	0.108	C
					2018	5	0.384	0.0414	BC
					2019	5	0.474	0.123	ABC
					2020	10	0.468	0.225	BC
Summer	rank	K-W	YES	0.004	2014	2	1.05	1.20	BC
					2015	5	1.26	0.163	B
					2016	5	1.50	0.319	AB
					2017	5	1.24	0.154	BC
					2018	5	2.00	0.0351	A
					2019	5	0.875	0.288	C
					2020	10	1.19	0.360	BC
Fall	log10	ANOVA	YES	<0.001	2014	5	1.59	0.726	B
					2015	5	0.650	0.0696	D
					2016	5	1.06	0.214	BCD
					2017	5	1.19	0.149	BCD
					2018	5	2.15	0.0354	A
					2019	5	1.28	0.252	BC
					2020	10	1.06	0.191	CD
Annual	rank	K-W	NO	0.224	2014	11	1.01	0.864	A
					2015	15	0.884	0.305	A
					2016	15	1.07	0.421	A
					2017	15	0.915	0.458	A
					2018	15	1.51	0.828	A
					2019	15	0.875	0.402	A
					2020	30	0.905	0.411	A

(grey shading) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical tests include Analysis of Variance (ANOVA) or Kruskal Wallis H-test (KW) for differences among seven years.

[b] *Post hoc* analysis of 1-way ANOVA or Kruskall Waliis H-test (KW) among all years protected for multiple comparisons.

[c] Similar letter indicates no significant differences.

Table E.10: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Sheardown Lake Northwest (DLO-01), Mary River Project CREMP, 2020

	Analyte	Chlorophyll-a (µg/L)								
	Station	DD-HAB 9-STN1	DL0-01-5	DL0-01-1	DL0-01-4	DL0-01-2	DL0-01-7	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20	-	-	-
	Summer	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20	-	-	-
	Fall	26-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	-	-	-
Winter	Surface	0.38	0.84	0.30	0.35	1.83	0.69	0.73	0.58	0.24
	Bottom	0.30	0.17	0.18	0.52	0.19	0.19	0.26	0.14	0.06
	Average	0.34	0.51	0.24	0.44	1.01	0.44	0.50	0.27	0.11
Summer	Surface	0.91	1.02	0.98	15.0	0.87	1.47	3.38	5.70	2.33
	Bottom	0.98	0.65	2.08	1.72	1.70	2.04	1.53	0.58	0.24
	Average	0.95	0.84	1.53	8.36	1.29	1.76	2.45	2.92	1.19
Fall	Surface	1.80	1.75	1.81	1.55	2.08	1.73	1.79	0.17	0.07
	Bottom	1.53	2.14	1.73	1.87	1.85	1.69	1.80	0.21	0.08
	Average	1.67	1.95	1.77	1.71	1.97	1.71	1.79	0.13	0.05

	Analyte	Phaeophytin-a (µg/L)								
	Station	DD-HAB 9-STN1	DL0-01-5	DL0-01-1	DL0-01-4	DL0-01-2	DL0-01-7	Average	Standard Deviation	Standard Error
Sample Collection Date	Winter	17-Apr-20	17-Apr-20	17-Apr-20	16-Apr-20	17-Apr-20	15-Apr-20	-	-	-
	Summer	28-Jul-20	29-Jul-20	29-Jul-20	28-Jul-20	29-Jul-20	28-Jul-20	-	-	-
	Fall	26-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	27-Aug-20	26-Aug-20	-	-	-
Winter	Surface	0.37	0.47	0.36	0.39	0.83	0.56	0.50	0.18	0.07
	Bottom	0.40	0.33	0.34	0.46	0.34	0.33	0.37	0.05	0.02
	Average	0.39	0.40	0.35	0.43	0.59	0.45	0.43	0.08	0.03
Summer	Surface	0.70	1.04	0.92	7.96	0.96	1.52	2.18	2.84	1.16
	Bottom	0.67	0.77	1.54	1.12	1.45	2.00	1.26	0.50	0.21
	Average	0.69	0.91	1.23	4.54	1.21	1.76	1.72	1.43	0.58
Fall	Surface	0.99	1.06	1.18	1.02	1.21	1.20	1.11	0.10	0.04
	Bottom	0.76	1.26	0.94	1.07	1.26	0.96	1.04	0.20	0.08
	Average	0.88	1.16	1.06	1.05	1.24	1.08	1.08	0.12	0.05

Table E.11: Statistical Comparison of Chlorophyll-a Concentrations at Sheardown Lake NW Among Years of Mine Operation (2015 to 2020)

Season	Data Transform-ation	Statistical Test[a]	Overall 7-Year Comparison		Pair-wise, post-hoc comparisons[b]				
			Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Pairwise Comparison[c]
Winter	rank	K-W	YES	<0.001	2014	6	2.55	1.34	A
					2015	6	1.10	0.0469	AB
					2016	6	0.874	0.316	B
					2017	6	0.790	0.268	BC
					2018	6	1.03	0.495	AB
					2019	6	0.463	0.235	C
					2020	12	0.495	0.256	C
Summer	rank	K-W	YES	0.003	2014	6	2.42	0.821	A
					2015	6	1.51	0.244	BC
					2016	6	2.13	0.387	A
					2017	6	1.22	0.126	C
					2018	6	2.01	0.183	A
					2019	6	1.81	0.246	AB
					2020	12	2.45	2.78	BC
Fall	rank	K-W	YES	<0.001	2014	6	0.800	0.379	D
					2015	6	1.61	0.44	BC
					2016	6	1.53	0.183	BC
					2017	6	1.56	0.222	BC
					2018	6	1.75	0.136	AB
					2019	6	1.19	0.309	CD
					2020	12	1.79	0.123	A
Annual	rank	K-W	YES	0.071	2014	18	1.93	1.20	A
					2015	18	1.41	0.355	AB
					2016	18	1.51	0.602	AB
					2017	18	1.19	0.381	B
					2018	18	1.60	0.519	A
					2019	18	1.15	0.618	B
					2020	36	1.58	1.77	B

(grey box) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical tests include Analysis of Variance (ANOVA) or Kruskal Wallis H-test (KW) for differences among seven years.

[b] *Post hoc* analysis of 1-way ANOVA or Kruskall Waliis H-test (KW) among all years protected for multiple comparisons.

[c] Similar letter indicates no significant differences.

Table E.12: **Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Sheardown Lake SE (DLO-02), Mary River Project CREMP, 2020**

	Analyte	Chlorophyll-a (µg/L)							
	Station	**DL0-02-06**	**DL0-02-07**	**DL0-02-4**	**DL0-02-8**	**DL0-02-03**	**Average**	**Standard Deviation**	**Standard Error**
Sample Collection Date	Winter	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	-	-	-
	Summer	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	-	-	-
	Fall	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	-	-	-
Winter	Surface	0.98	0.95	1.11	1.42	1.81	1.25	0.36	0.16
	Bottom	0.21	0.96	0.64	0.28	0.23	0.46	0.33	0.15
	Average	0.60	0.96	0.88	0.85	1.02	0.86	0.16	0.07
Summer	Surface	0.22	1.45	2.16	3.05	1.60	1.70	1.04	0.46
	Bottom	2.64	2.93	1.91	1.18	2.03	2.14	0.68	0.31
	Average	1.43	2.19	2.04	2.12	1.82	1.92	0.31	0.14
Fall	Surface	1.40	1.39	1.38	1.25	1.41	1.37	0.07	0.03
	Bottom	1.14	1.35	1.36	1.32	1.51	1.34	0.13	0.06
	Average	1.27	1.37	1.37	1.29	1.46	1.35	0.08	0.03

	Analyte	Phaeophytin-a (µg/L)							
	Station	**DL0-02-06**	**DL0-02-07**	**DL0-02-4**	**DL0-02-8**	**DL0-02-03**	**Average**	**Standard Deviation**	**Standard Error**
Sample Collection Date	Winter	15-Apr-20	15-Apr-20	14-Apr-20	14-Apr-20	15-Apr-20	-	-	-
	Summer	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	28-Jul-20	-	-	-
	Fall	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	26-Aug-20	-	-	-
Winter	Surface	0.63	0.69	1.05	1.00	1.01	0.88	0.20	0.09
	Bottom	0.39	0.71	0.68	0.44	0.39	0.52	0.16	0.07
	Average	0.51	0.70	0.87	0.72	0.70	0.70	0.13	0.06
Summer	Surface	0.84	1.89	1.97	2.21	1.93	1.77	0.53	0.24
	Bottom	2.30	3.14	1.77	1.90	1.90	2.20	0.56	0.25
	Average	1.57	2.52	1.87	2.06	1.92	1.99	0.35	0.15
Fall	Surface	0.88	0.81	0.77	0.91	0.86	0.85	0.06	0.03
	Bottom	0.68	0.90	0.89	0.83	0.93	0.85	0.10	0.04
	Average	0.78	0.86	0.83	0.87	0.90	0.85	0.04	0.02

Table E.13: Statistical Comparison of Chlorophyll-a Concentrations at Sheardown Lake SE Among Years of Mine Operation (2015 to 2020)

Season	Data Transform-ation	Statistical Test[a]	Overall 7-Year Comparison		Pair-wise, post-hoc comparisons[b]				
			Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Pairwise Comparison[c]
Winter	log10	ANOVA	YES	<0.001	2014	5	2.67	1.01	A
					2015	5	1.58	0.525	BC
					2016	5	1.90	0.648	AB
					2017	5	1.36	0.412	BC
					2018	5	2.23	0.851	AB
					2019	5	1.88	0.386	AB
					2020	10	0.859	0.153	C
Summer	rank	K-W	YES	<0.001	2014	5	0.203	0.00437	D
					2015	5	0.913	0.0705	CD
					2016	5	1.51	0.208	BC
					2017	5	1.37	0.156	C
					2018	5	2.12	0.0728	A
					2019	5	2.16	0.242	A
					2020	10	1.92	0.289	AB
Fall	rank	K-W	YES	<0.001	2014	5	1.54	1.63	CD
					2015	5	0.992	0.103	D
					2016	5	2.87	0.737	A
					2017	5	1.50	0.0757	BC
					2018	5	2.03	0.115	AB
					2019	5	2.00	0.446	AB
					2020	10	1.35	0.0723	CD
Annual	rank	K-W	YES	<0.001	2014	15	1.47	1.46	B
					2015	15	1.16	0.420	B
					2016	15	2.09	0.798	A
					2017	15	1.41	0.248	B
					2018	15	2.13	0.468	A
					2019	15	2.01	0.362	A
					2020	30	1.38	0.478	B

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical tests include Analysis of Variance (ANOVA) or Kruskal Wallis H-test (KW) for differences among seven years.

[b] *Post hoc* analysis of 1-way ANOVA or Kruskall Waliis H-test (KW) among all years protected for multiple comparisons.

[c] Similar letter indicates no significant differences.

Table E.14: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at the Mary River, Mary River Project CREMP, 2020

	Station	Upstream Reference			Upstream Mine-Exposed							Downstream Mine-Exposed		
		G0-09-A	G0-09	G0-09-B	G0-03	G0-01	F0-01	E0-10	E0-03	E0-21	E0-20	C0-10	C0-05	C0-01
Sample Collection Date	Spring	4-Jul-20	4-Jul-20	4-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20	3-Jul-20
	Summer	3-Aug-20	2-Aug-20	2-Aug-20	2-Aug-20	1-Aug-20	1-Aug-20	1-Aug-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	31-Jul-20	31-Jul-20
	Fall	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20
Chlorophyll-a (µg/L)	Spring	0.24	0.25	0.27	0.51	0.42	0.29	0.28	0.26	0.23	<0.10	0.25	0.54	0.48
	Summer	0.66	0.71	0.93	0.79	0.52	0.41	0.60	0.60	0.56	0.68	0.53	0.69	0.64
	Fall	0.33	0.43	0.34	0.73	0.27	0.33	0.28	0.30	0.34	0.32	0.35	0.38	0.33
	Average	0.41	0.46	0.51	0.68	0.40	0.34	0.39	0.39	0.38	0.37	0.38	0.54	0.48
	Standard Deviation	0.22	0.23	0.36	0.15	0.13	0.06	0.18	0.19	0.17	0.29	0.14	0.16	0.16
	Standard Error	0.13	0.13	0.21	0.09	0.073	0.04	0.11	0.11	0.10	0.17	0.08	0.09	0.09
Phaeophytin-a (µg/L)	Spring	0.35	0.66	0.43	0.44	0.43	0.34	0.39	0.37	0.35	0.39	0.36	0.48	0.48
	Summer	1.34	1.45	1.70	1.70	1.46	1.02	1.59	1.58	1.75	1.69	0.88	1.26	1.03
	Fall	0.85	0.84	0.99	1.01	0.68	0.75	0.71	0.76	0.78	0.78	0.73	0.74	0.66
	Average	0.85	0.98	1.04	1.05	0.86	0.70	0.90	0.90	0.96	0.95	0.66	0.83	0.72
	Standard Deviation	0.50	0.41	0.64	0.63	0.54	0.34	0.62	0.62	0.72	0.67	0.27	0.40	0.28
	Standard Error	0.29	0.24	0.37	0.36	0.31	0.20	0.36	0.357	0.41	0.39	0.15	0.23	0.16

Table E.15: Phytoplankton Monitoring Data (i.e., chlorophyll-a and phaeophytin-a concentrations) Collected at Mary Lake (north and south basins; BLO), Mary River Project CREMP, 2020

	Analyte	Chlorophyll-a (µg/L)												
	Station	Mary Lake North			Mary Lake South							Average	Standard Deviation	Standard Error
		BL0-01A	BL0-01	BL0-01B	BL0-05-A	BL0-05	BL0-05-B	BL0-03	BL0-04	BL0-09	BL0-06			
Sample Collection Date	Winter	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	-	-	-
	Summer	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	-	-	-
	Fall	27-Aug-20	27-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	-	-	-
Winter	Surface	0.22	0.48	0.25	0.90	0.80	1.27	0.52	0.89	1.54	0.70	0.76	0.42	0.13
	Bottom	<0.10	<0.10	0.26	0.13	0.17	0.72	0.12	0.14	0.18	0.21	0.21	0.19	0.06
	Average	0.16	0.29	0.26	0.52	0.49	1.00	0.32	0.52	0.86	0.46	0.49	0.26	0.08
Summer	Surface	1.46	1.69	1.83	0.93	0.86	1.00	1.69	1.40	1.40	1.25	1.35	0.34	0.11
	Bottom	0.78	2.30	1.93	0.83	0.86	1.08	0.74	0.53	0.48	1.04	1.06	0.59	0.19
	Average	1.12	2.00	1.88	0.88	0.86	1.04	1.22	0.97	0.94	1.15	1.20	0.40	0.13
Fall	Surface	0.99	1.12	1.02	0.49	0.57	0.50	0.72	0.61	0.57	0.69	0.73	0.23	0.07
	Bottom	0.96	0.93	1.02	0.76	0.59	0.83	0.84	0.63	0.62	0.70	0.79	0.15	0.05
	Average	0.98	1.03	1.02	0.63	0.58	0.67	0.78	0.62	0.60	0.70	0.76	0.18	0.06

	Analyte	Phaeophytin-a (µg/L)												
	Station	Mary Lake North			Mary Lake South							Average	Standard Deviation	Standard Error
		BL0-01-A	BL0-01	BL0-01-B	BL0-05-A	BL0-05	BL0-05-B	BL0-03	BL0-04	BL0-09	BL0-06			
Sample Collection Date	Winter	19-Apr-20	19-Apr-20	19-Apr-20	21-Apr-20	21-Apr-20	21-Apr-20	19-Apr-20	20-Apr-20	20-Apr-20	20-Apr-20	-	-	-
	Summer	30-Jul-20	30-Jul-20	30-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	31-Jul-20	1-Aug-20	1-Aug-20	1-Aug-20	-	-	-
	Fall	27-Aug-20	27-Aug-20	27-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	28-Aug-20	-	-	-
Winter	Surface	0.29	0.43	0.30	0.61	0.55	0.75	0.38	0.58	0.77	0.60	0.53	0.17	0.05
	Bottom	0.29	0.27	0.34	0.35	0.39	0.62	0.29	0.32	0.35	0.41	0.36	0.10	0.03
	Average	0.29	0.35	0.32	0.48	0.47	0.69	0.34	0.45	0.56	0.51	0.44	0.12	0.04
Summer	Surface	1.15	1.09	1.32	1.40	1.31	1.57	1.48	1.65	1.67	1.42	1.41	0.20	0.06
	Bottom	1.14	1.70	2.00	1.24	1.33	1.47	0.89	1.23	1.10	1.64	1.37	0.33	0.10
	Average	1.15	1.40	1.66	1.32	1.32	1.52	1.19	1.44	1.39	1.53	1.39	0.16	0.05
Fall	Surface	0.76	0.79	0.82	0.80	0.96	0.76	0.87	0.93	0.82	0.92	0.84	0.07	0.02
	Bottom	0.85	0.73	0.84	1.05	0.92	0.99	1.30	0.90	0.99	0.87	0.94	0.15	0.05
	Average	0.81	0.76	0.83	0.93	0.94	0.88	1.09	0.92	0.91	0.90	0.89	0.09	0.03

Table E.16: Statistical Comparison of Chlorophyll-a Concentrations at the Mary Lake North Basin Among Years of Mine Operation (2015 to 2020)

Season	Data Transform-ation	Statistical Test[a]	Overall 7-Year Comparison		Pair-wise, post-hoc comparisons[b]				
			Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Pairwise Comparison[c]
Winter	rank	K-W	NO	0.216	2014	3	0.585	0.663	A
					2015	3	0.652	0.684	A
					2016	2	0.182	0.0247	A
					2017	3	0.178	0.0553	A
					2018	3	0.197	0.0425	A
					2019	3	0.498	0.422	A
					2020	6	0.235	0.0602	A
Summer	rank	K-W	YES	0.010	2014	3	0.917	0.725	BC
					2015	3	0.827	0.246	BC
					2016	3	1.16	0.0961	AB
					2017	3	0.266	0.0166	C
					2018	3	0.504	0.187	C
					2019	3	0.737	0.118	BC
					2020	6	1.67	0.425	A
Fall	rank	K-W	YES	0.008	2014	3	0.517	0.252	B
					2015	3	0.623	0.0718	B
					2016	3	0.997	0.0909	A
					2017	3	0.905	0.136	A
					2018	3	0.860	0.0661	AB
					2019	3	0.850	0.0757	AB
					2020	6	1.01	0.0246	A
Annual	rank	K-W	NO	0.147	2014	9	0.673	0.54	A
					2015	9	0.701	0.378	A
					2016	8	0.854	0.427	A
					2017	9	0.450	0.351	A
					2018	9	0.520	0.305	A
					2019	9	0.695	0.271	A
					2020	18	0.969	0.645	A

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical tests include Analysis of Variance (ANOVA) or Kruskal Wallis H-test (KW) for differences among seven years.

[b] *Post hoc* analysis of 1-way ANOVA or Kruskall Waliis H-test (KW) among all years protected for multiple comparisons.

[c] Similar letter indicates no significant differences.

Table E.17: Statistical Comparison of Chlorophyll-a Concentrations at the Mary Lake South Basin Among Years of Mine Operation (2015 to 2020)

Season	Data Transform-ation	Statistical Test[a]	Overall 7-Year Comparison		Pair-wise, post-hoc comparisons[b]				
			Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Pairwise Comparison[c]
Winter	rank	K-W	YES	0.061	2014	7	0.879	1.46	BC
					2015	7	0.646	0.340	A
					2016	7	0.306	0.197	C
					2017	7	0.351	0.209	BC
					2018	7	0.532	0.337	ABC
					2019	7	0.482	0.168	AB
					2020	14	0.592	0.232	A
Summer	rank	K-W	YES	<0.001	2014	7	0.864	0.594	AB
					2015	7	0.789	0.116	B
					2016	7	1.08	0.172	A
					2017	7	0.802	0.0827	B
					2018	7	0.848	0.218	AB
					2019	7	0.521	0.0254	C
					2020	14	1.01	0.129	A
Fall	rank	K-W	YES	<0.001	2014	7	0.75	0.294	A
					2015	7	0.895	0.120	AB
					2016	7	0.752	0.231	A
					2017	7	0.75	0.0773	AC
					2018	7	0.904	0.0252	AB
					2019	7	0.934	0.0415	B
					2020	14	0.651	0.0663	C
Annual	rank	K-W	NO	0.515	2014	21	0.831	0.878	A
					2015	21	0.777	0.232	A
					2016	21	0.711	0.376	A
					2017	21	0.634	0.244	A
					2018	21	0.762	0.277	A
					2019	21	0.645	0.230	A
					2020	42	0.75	0.241	A

[shaded box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[a] Statistical tests include Analysis of Variance (ANOVA) or Kruskal Wallis H-test (KW) for differences among seven years.

[b] *Post hoc* analysis of 1-way ANOVA or Kruskall Waliis H-test (KW) among all years protected for multiple comparisons.

[c] Similar letter indicates no significant differences.

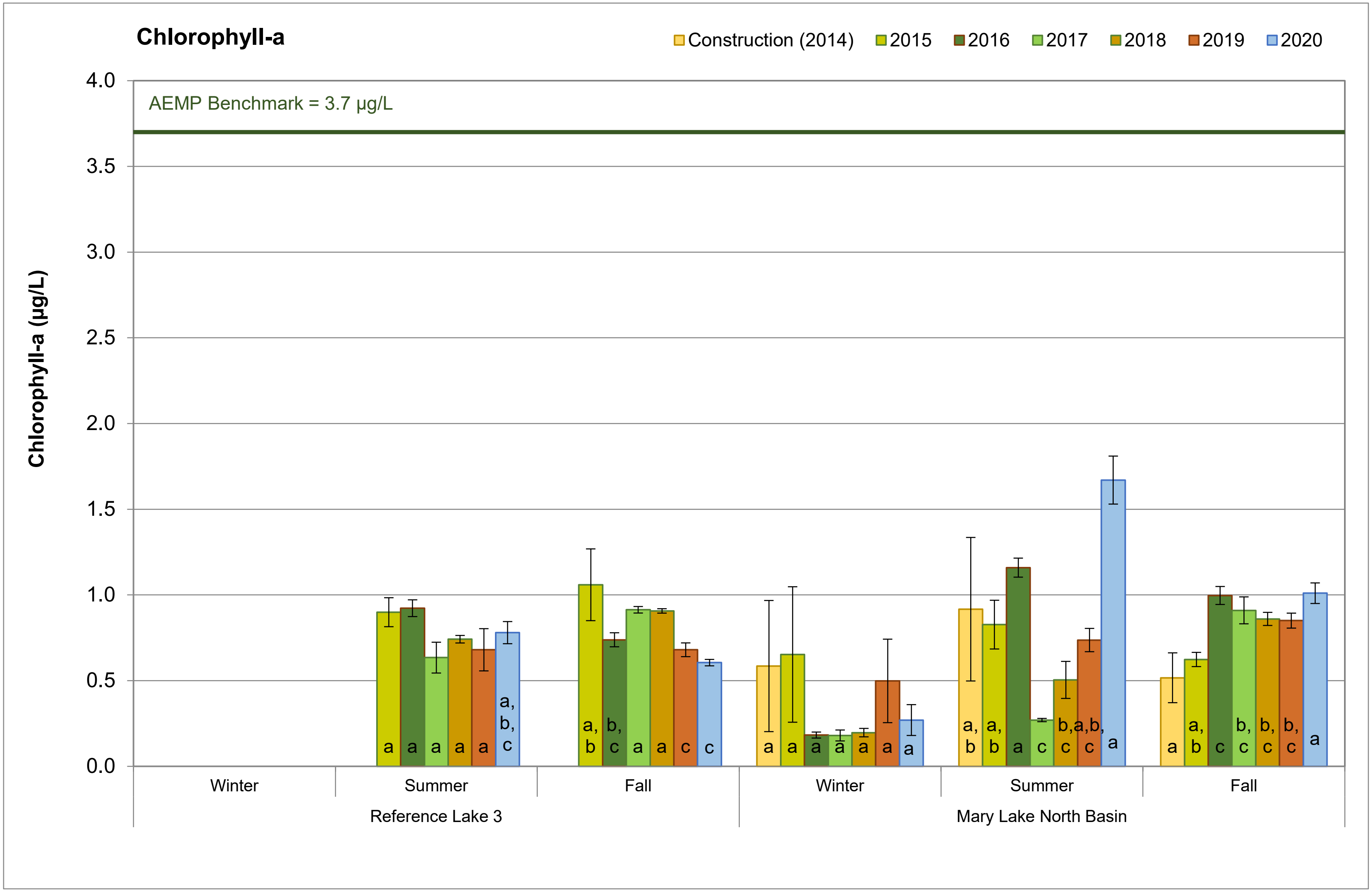


Figure E.1: Temporal Comparison of Chlorophyll-a Concentrations Among Seasons between the Mary Lake North Basin and Reference Lake 3 for Mine Construction (2014) and Operational (2015 to 2020) Periods (mean ± SE)

Note: Bars with the same letter at the base do not differ significantly between years for the applicable season.

APPENDIX F

BENTHIC INVERTEBRATE COMMUNITY DATA

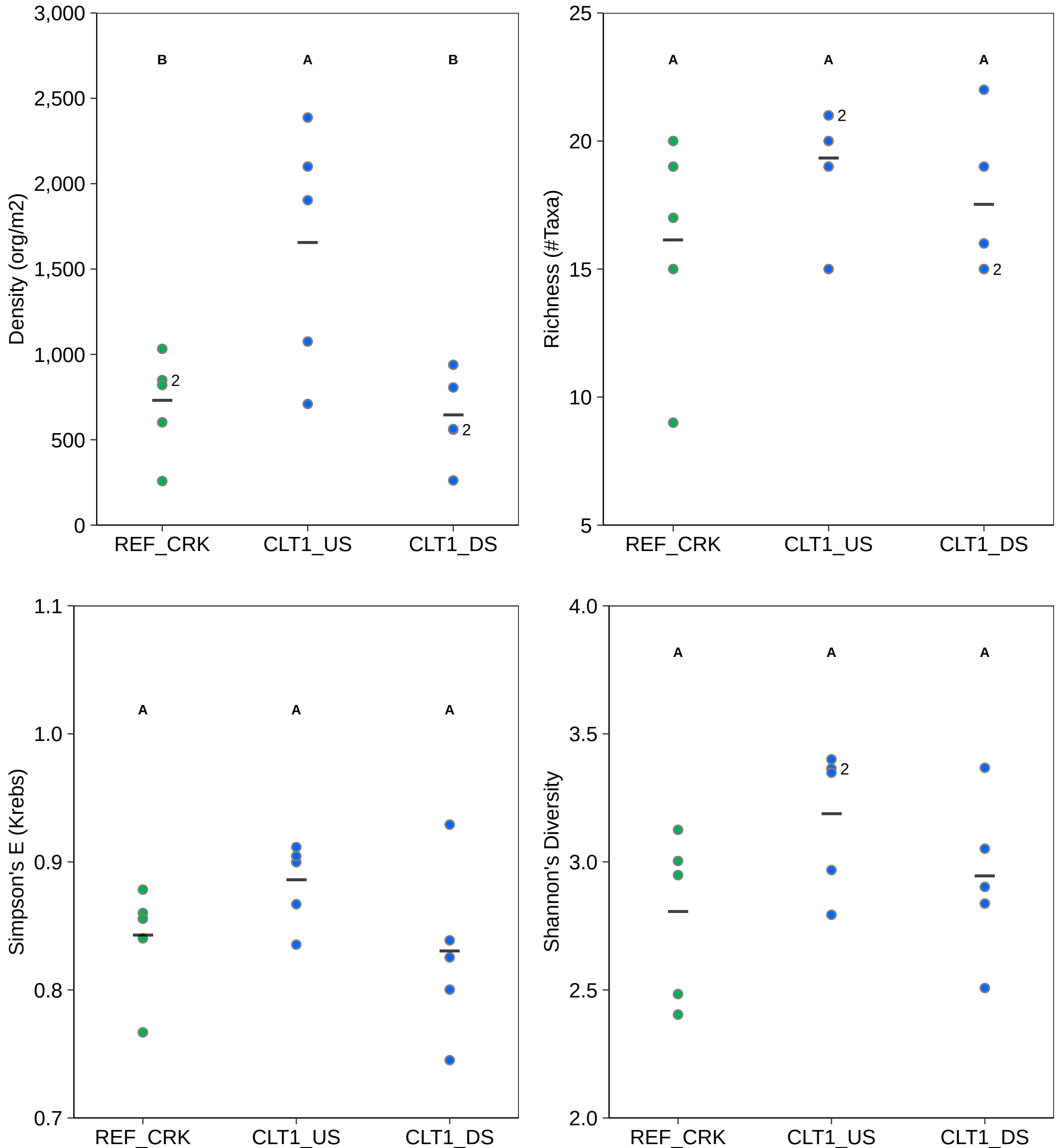
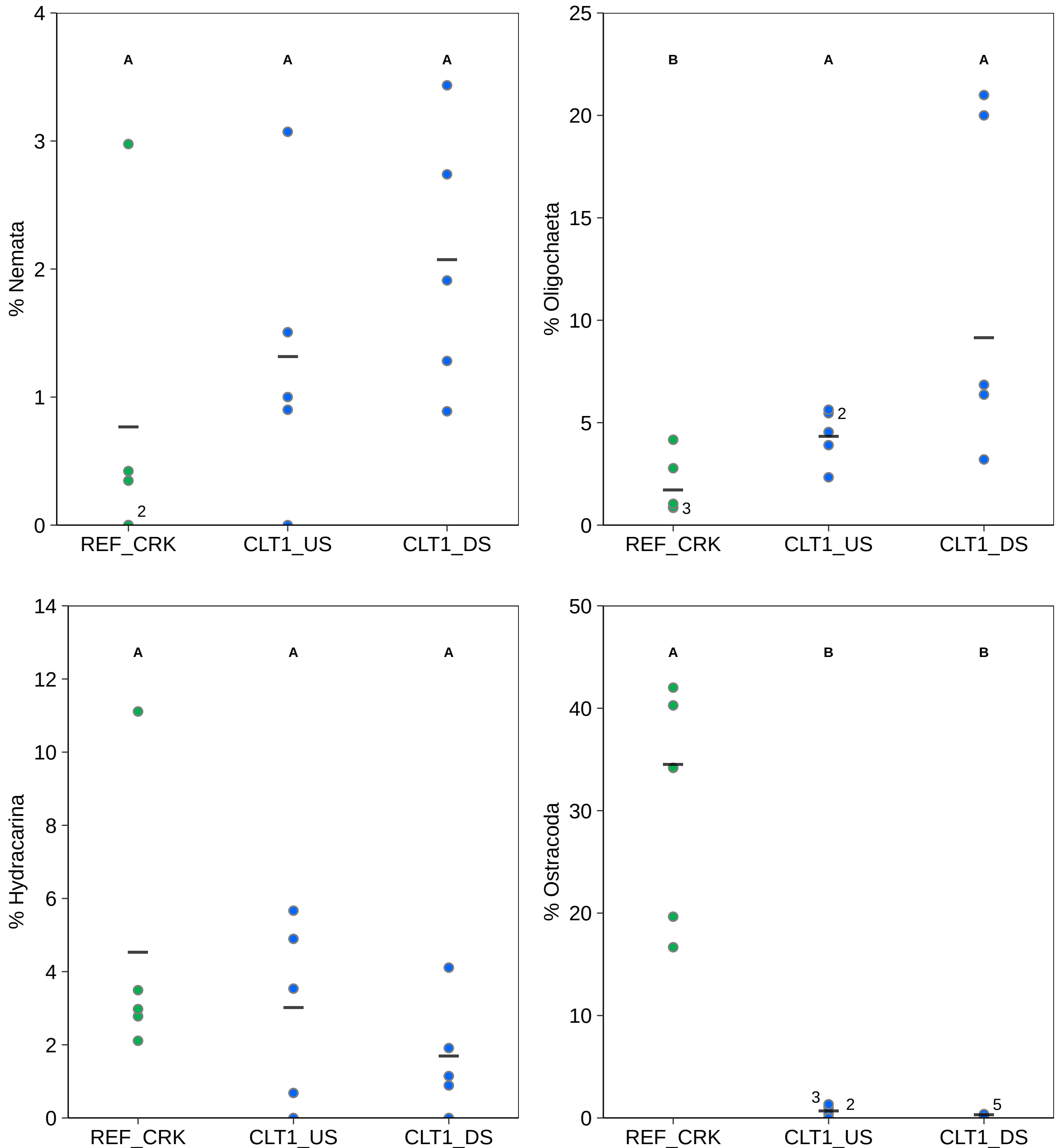


Figure F.1: Benthic Invertebrate Community Endpoint Comparisons for Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Notes: Areas that share a letter are not significant (P−value=0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.



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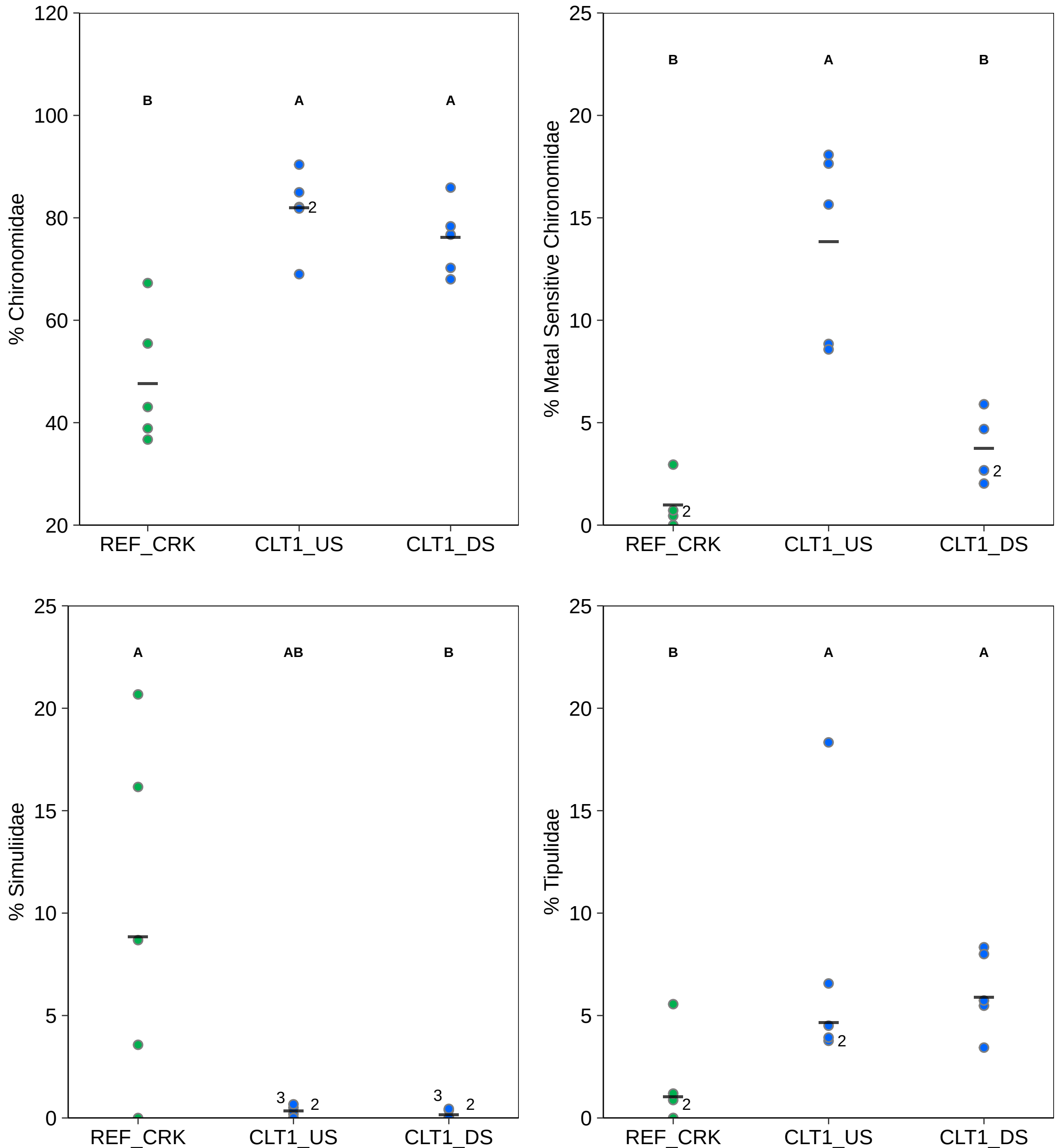

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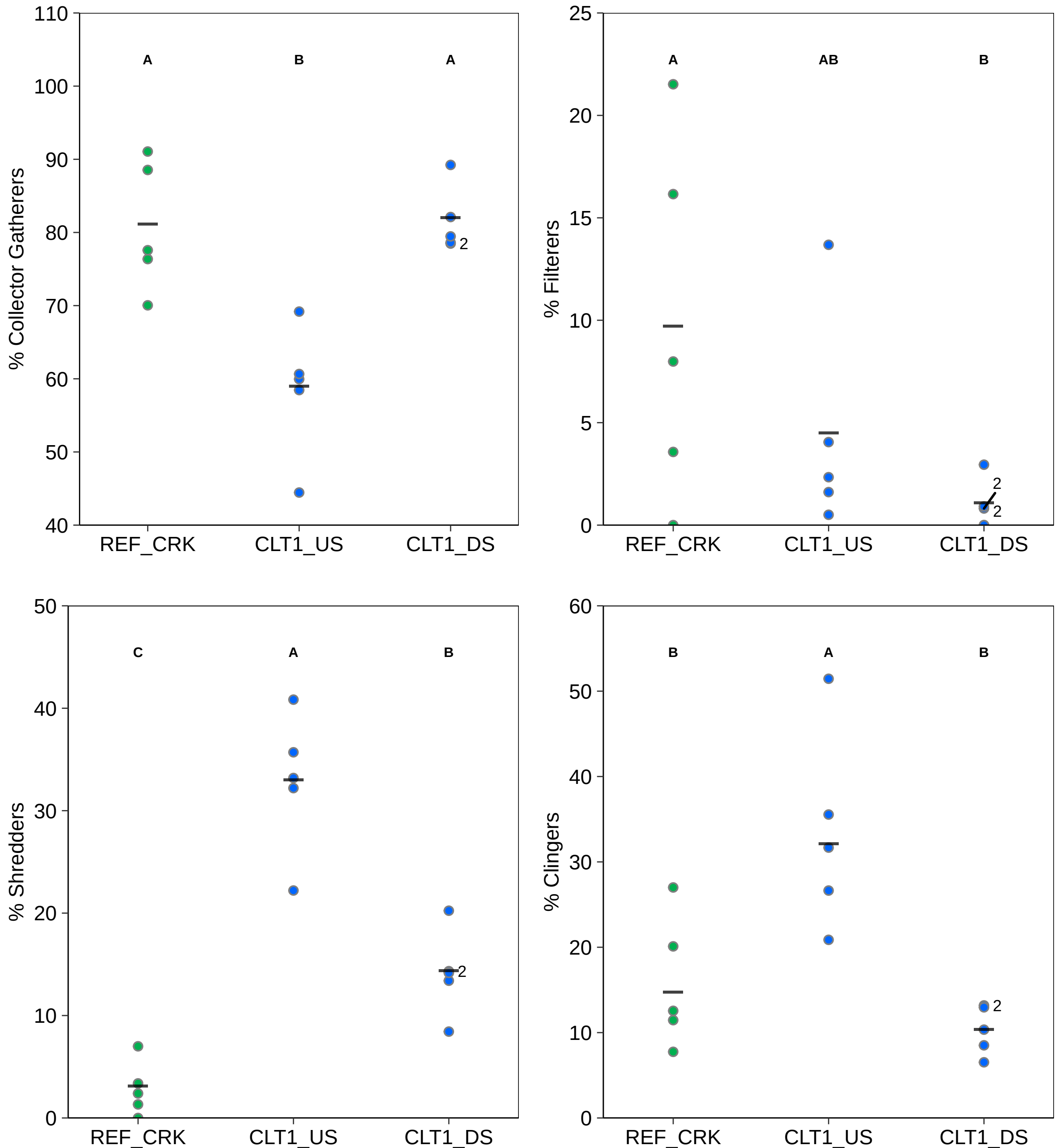

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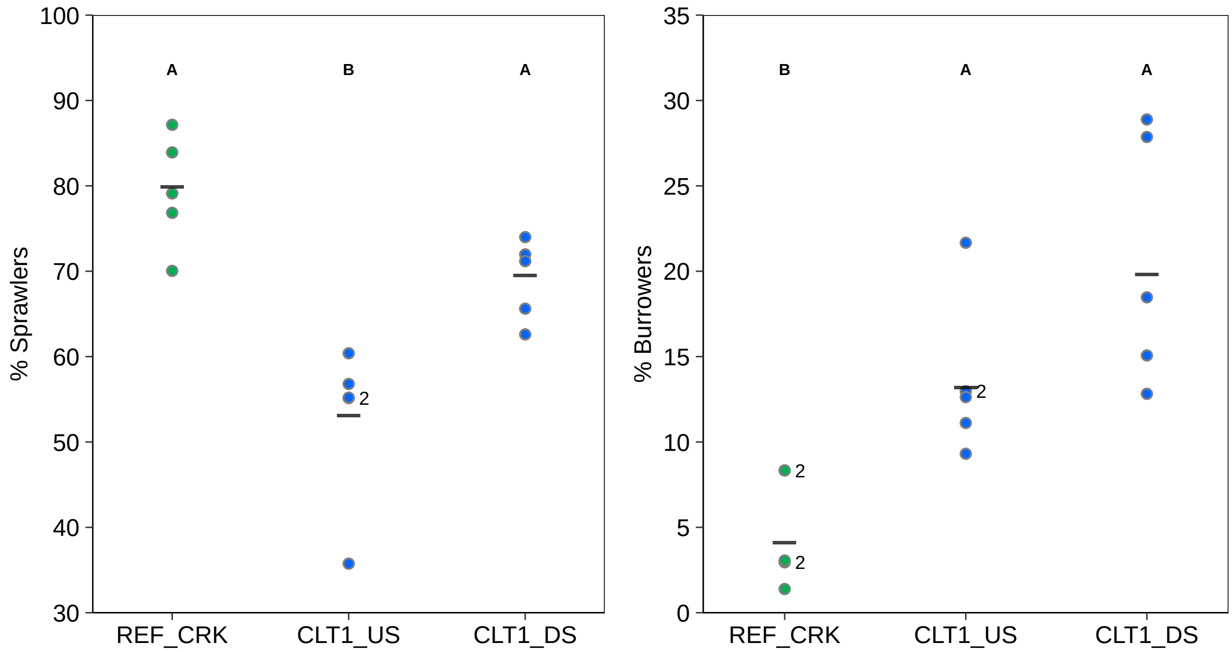


Figure F.1: Benthic Invertebrate Community Endpoint Comparisons for Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Notes: Areas that share a letter are not significant (P−value=0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.

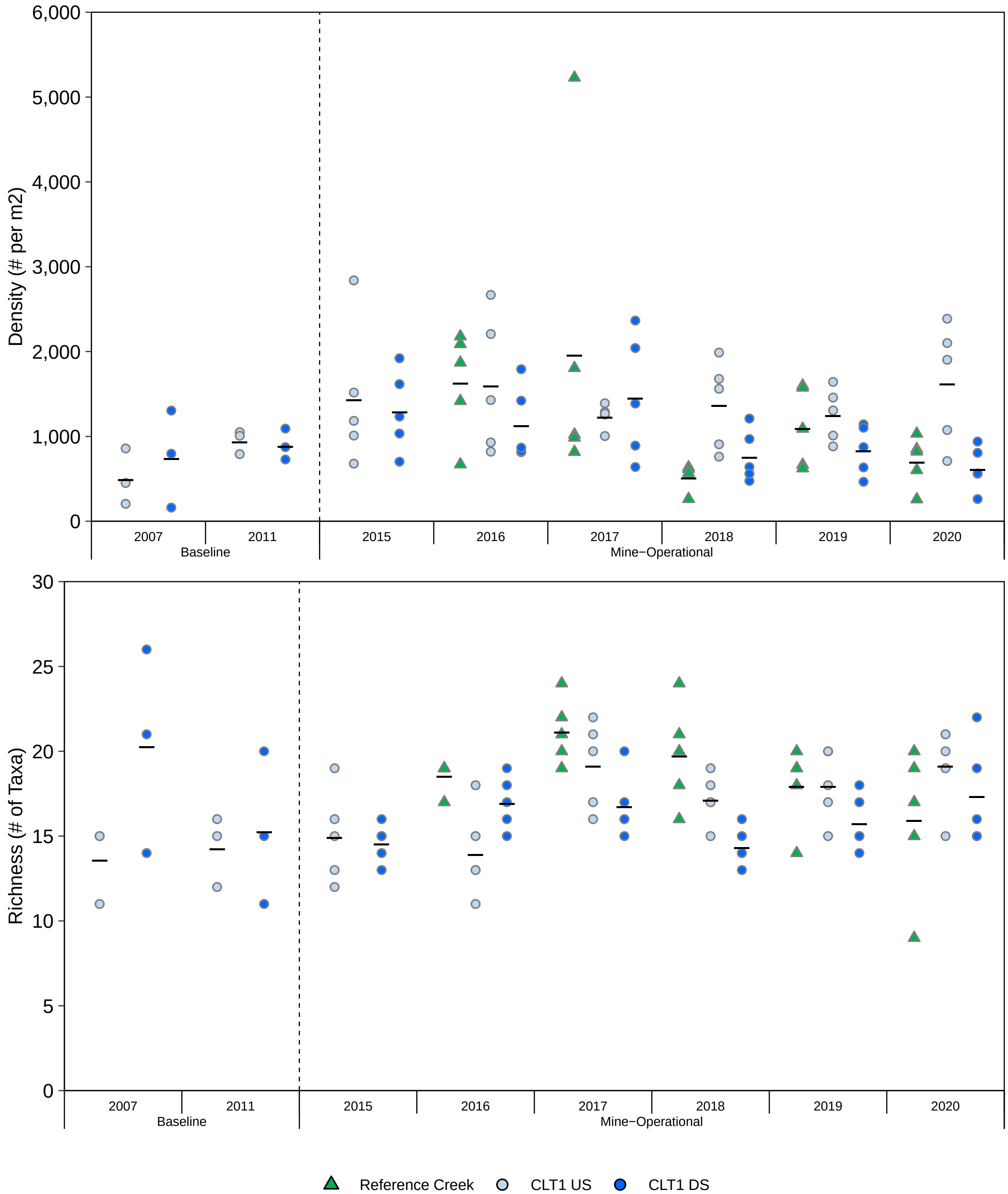
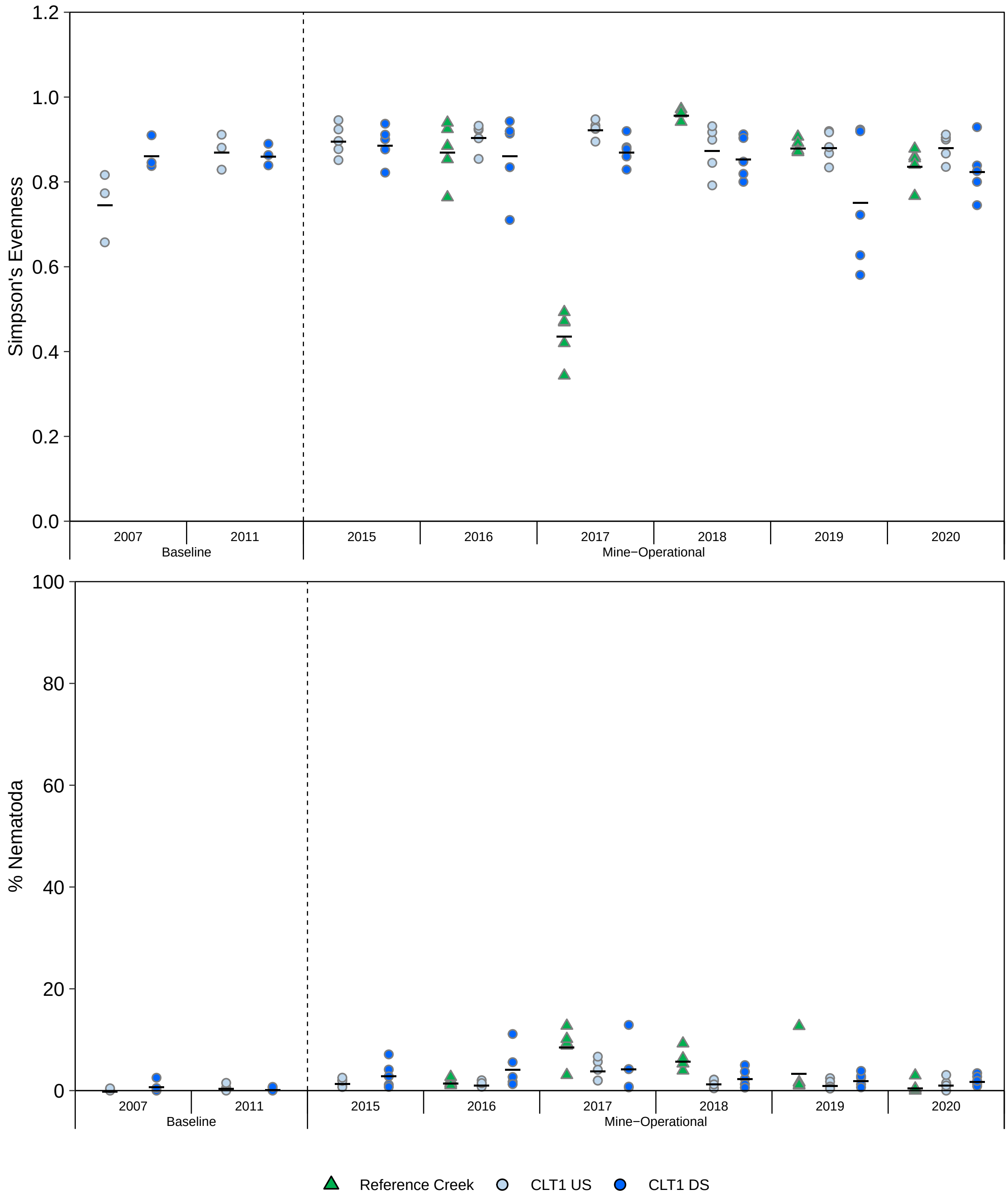


Figure F.2: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake Tributary 1 Upstream (CLT1 US) and Downstream (CLT1 DS) Stations among Mine Baseline (2007 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.



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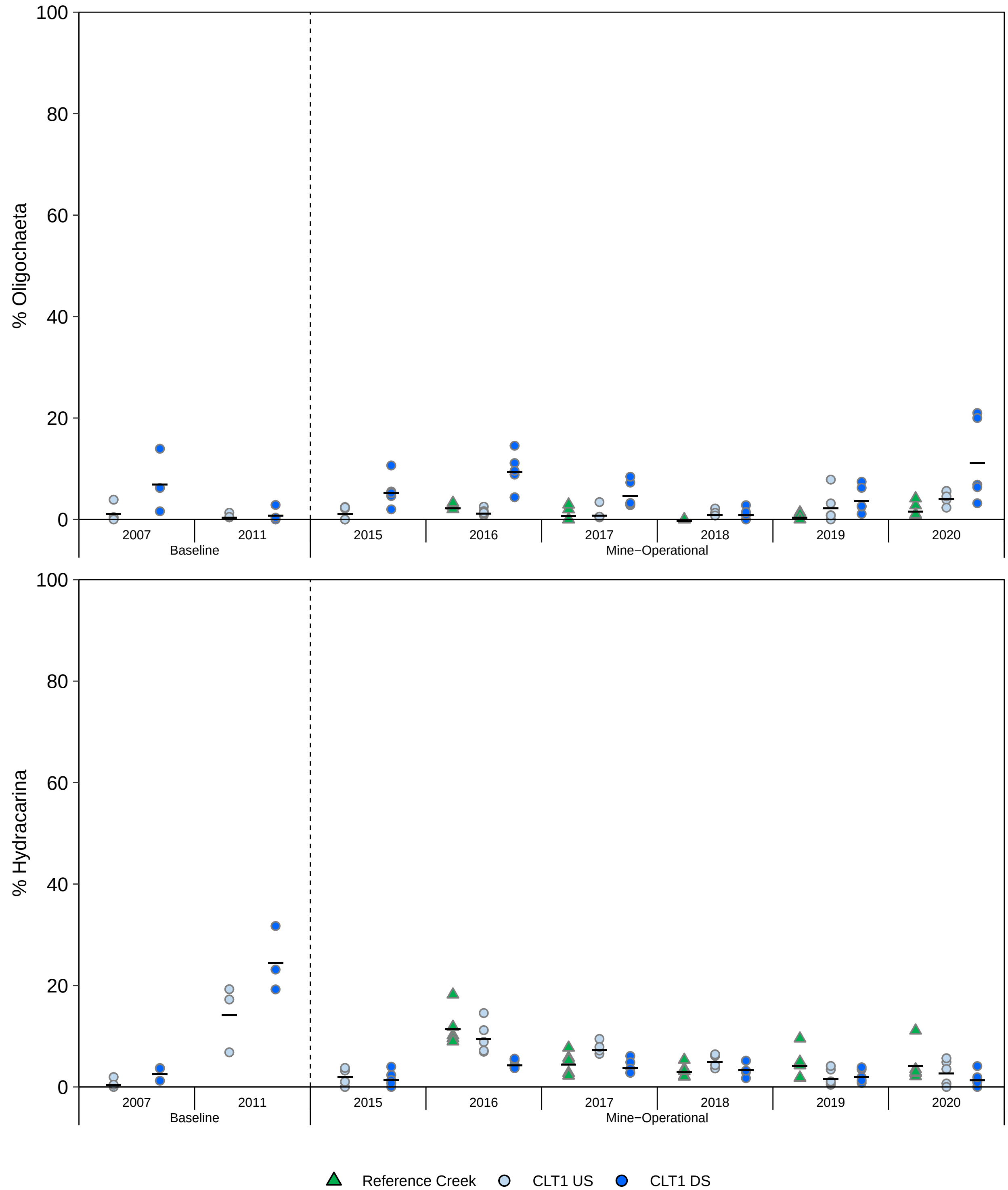

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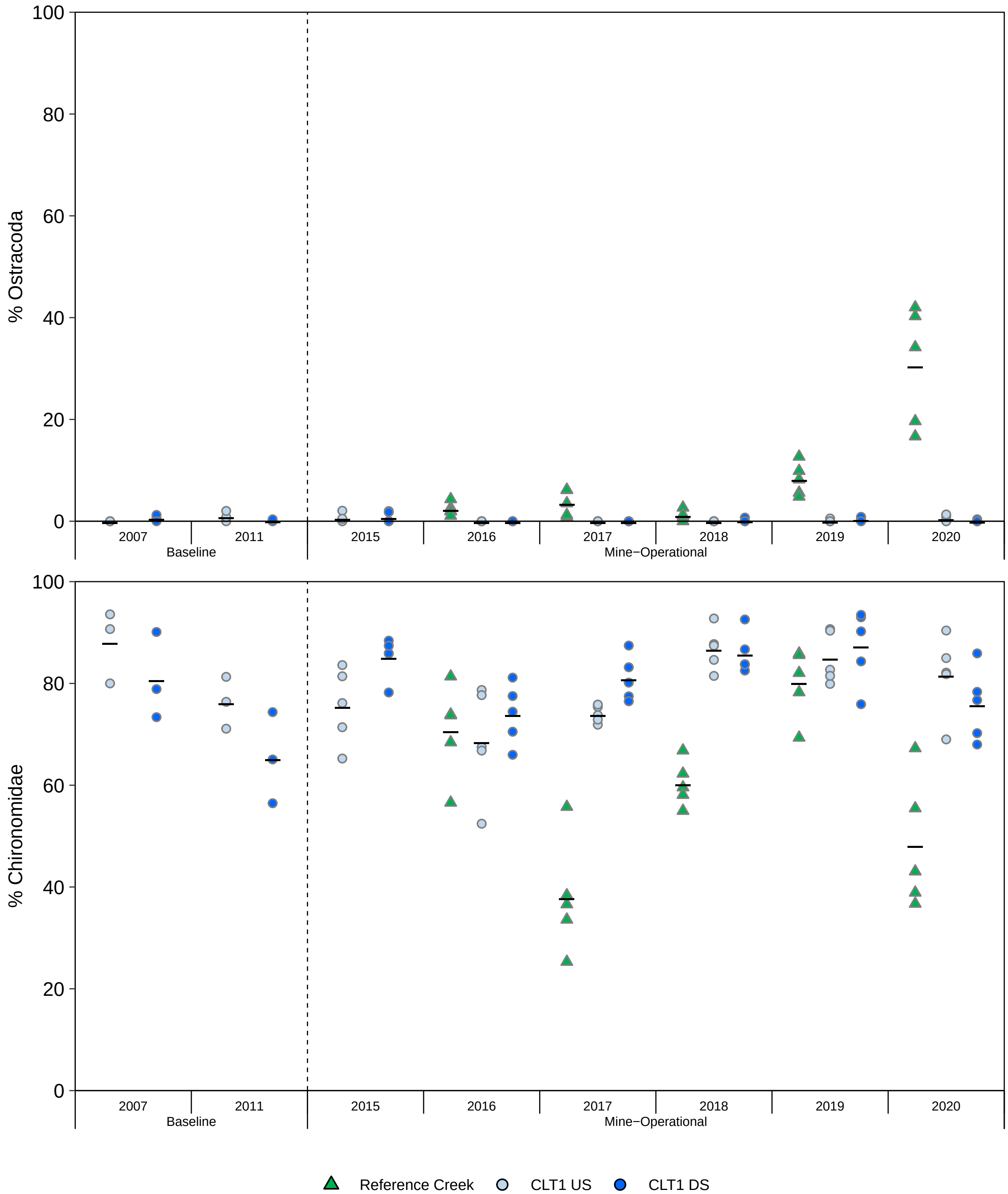

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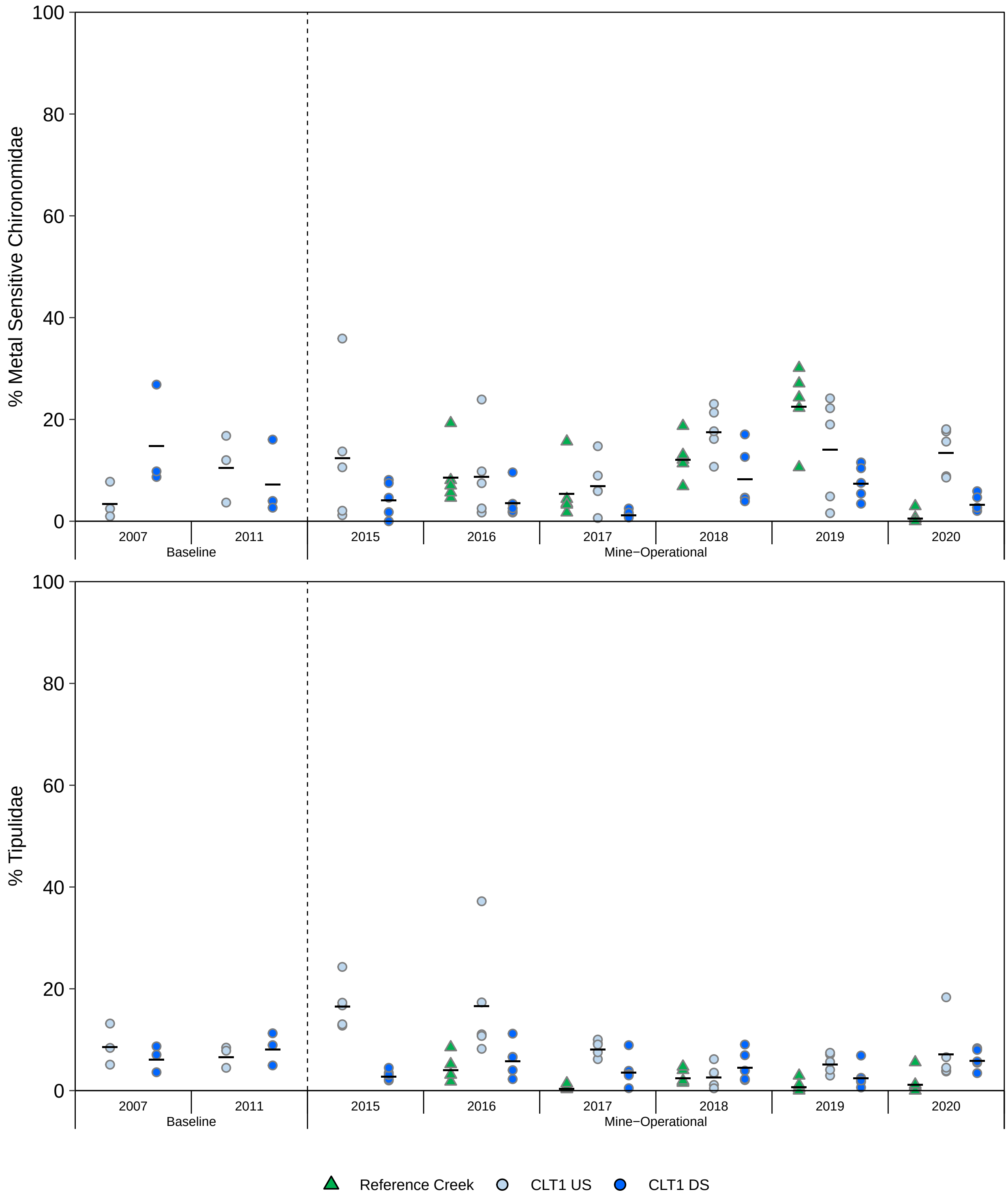

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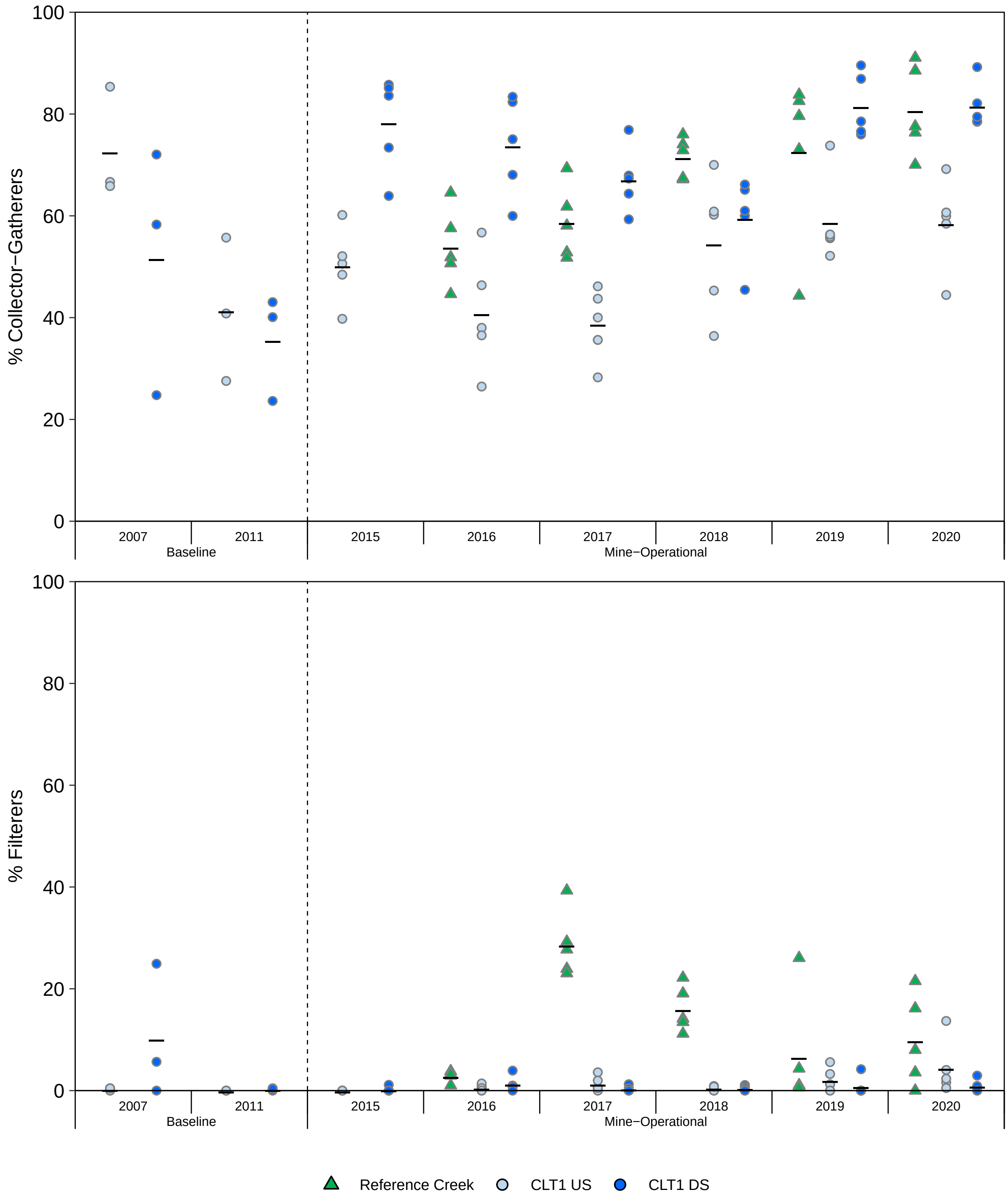

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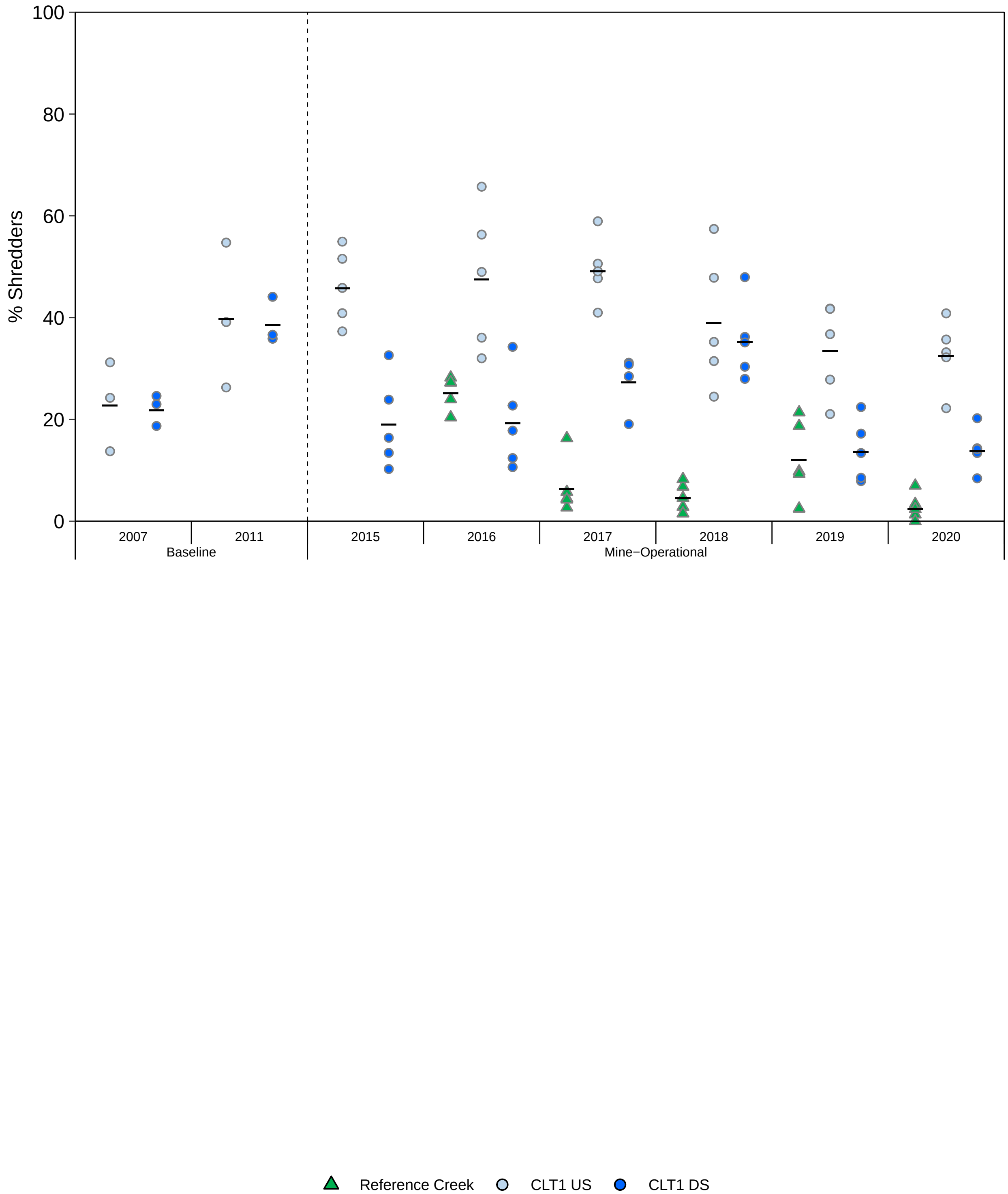

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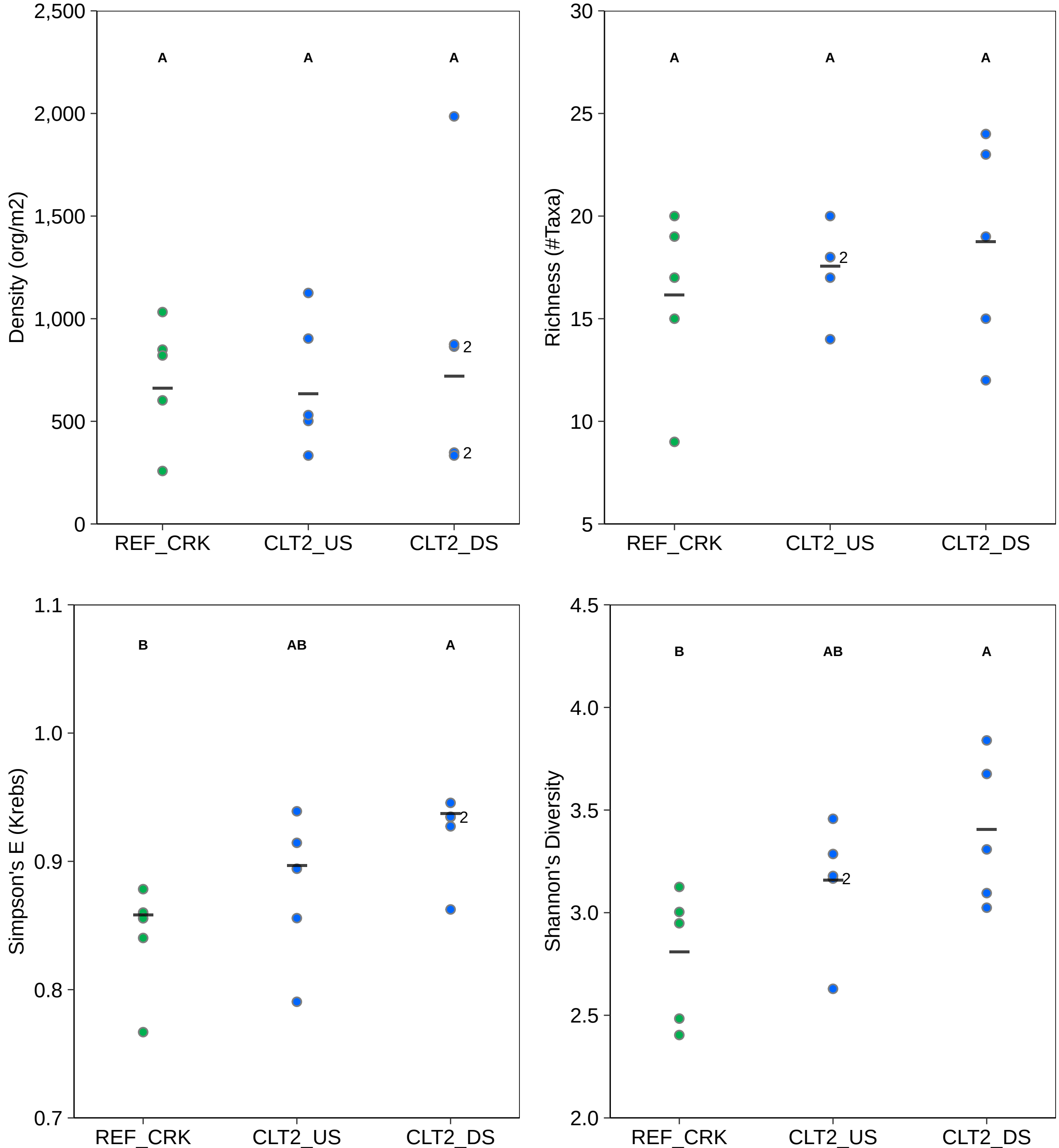
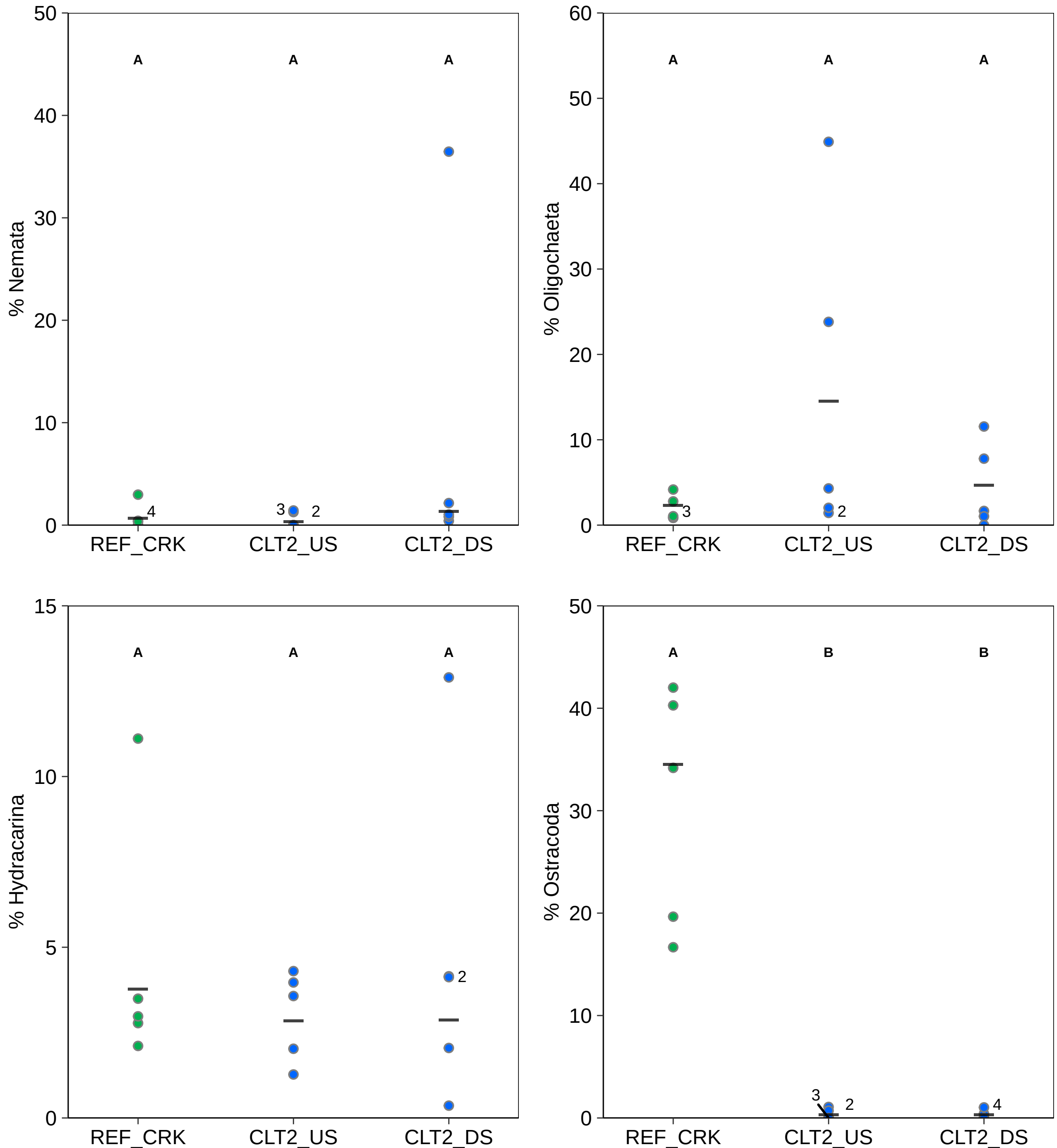


Figure F.3: Benthic Invertebrate Community Endpoint Comparisons for Camp Lake Tributary 2 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Notes: Areas that share a letter are not significant (P−value=0.1). Bars indicate measures of central tendency. Numbers indicate the number of overlapping points.



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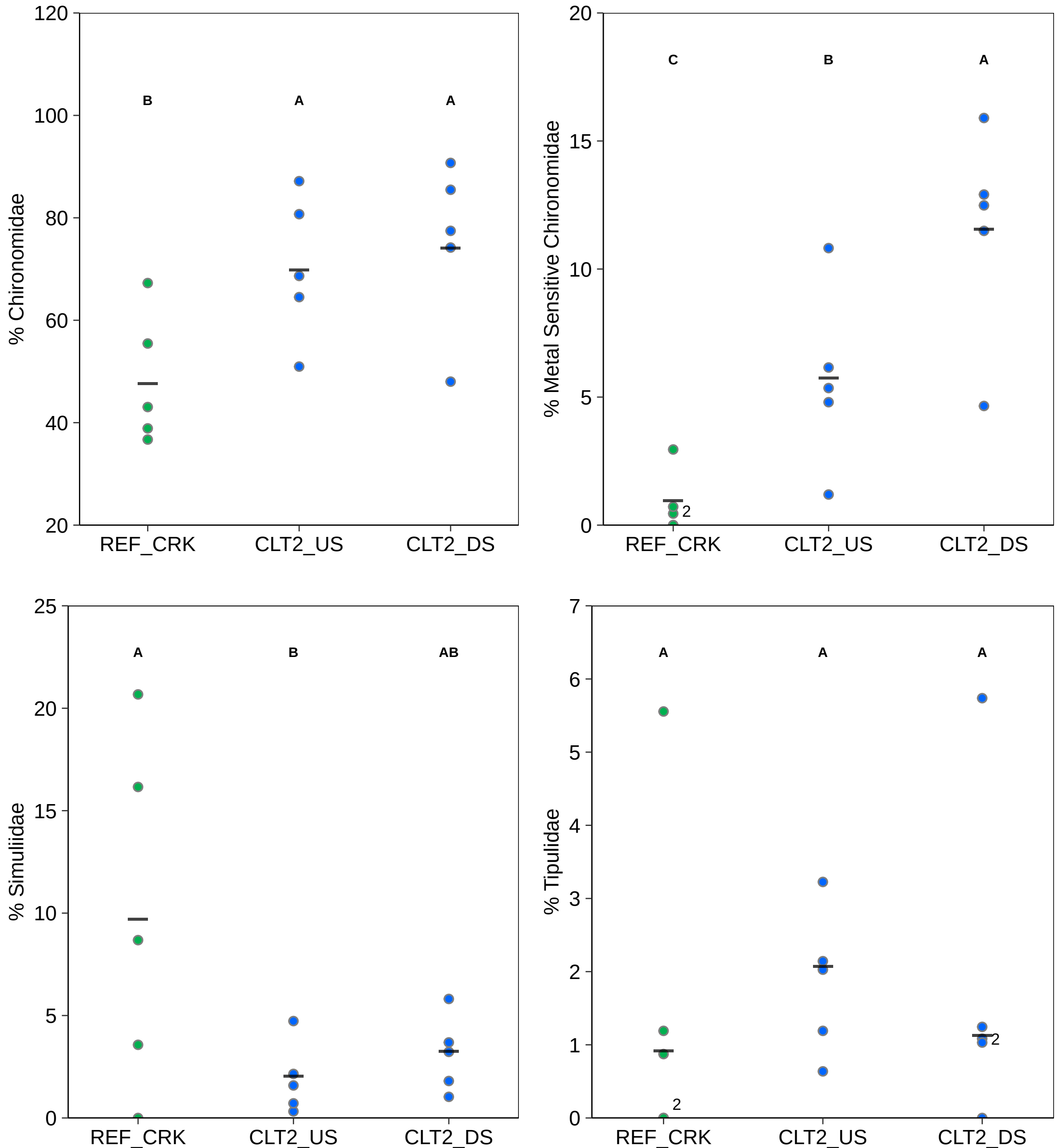

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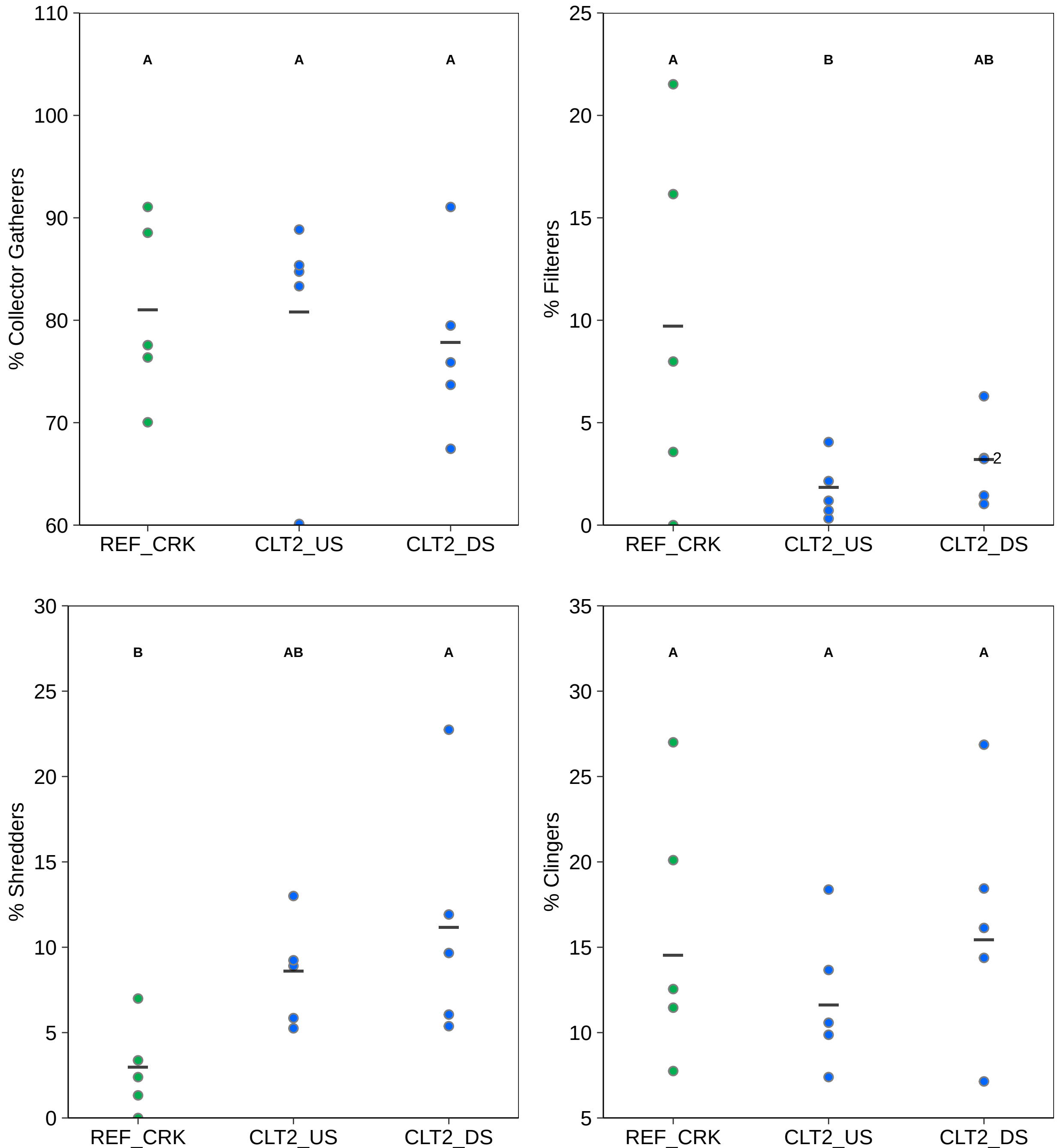

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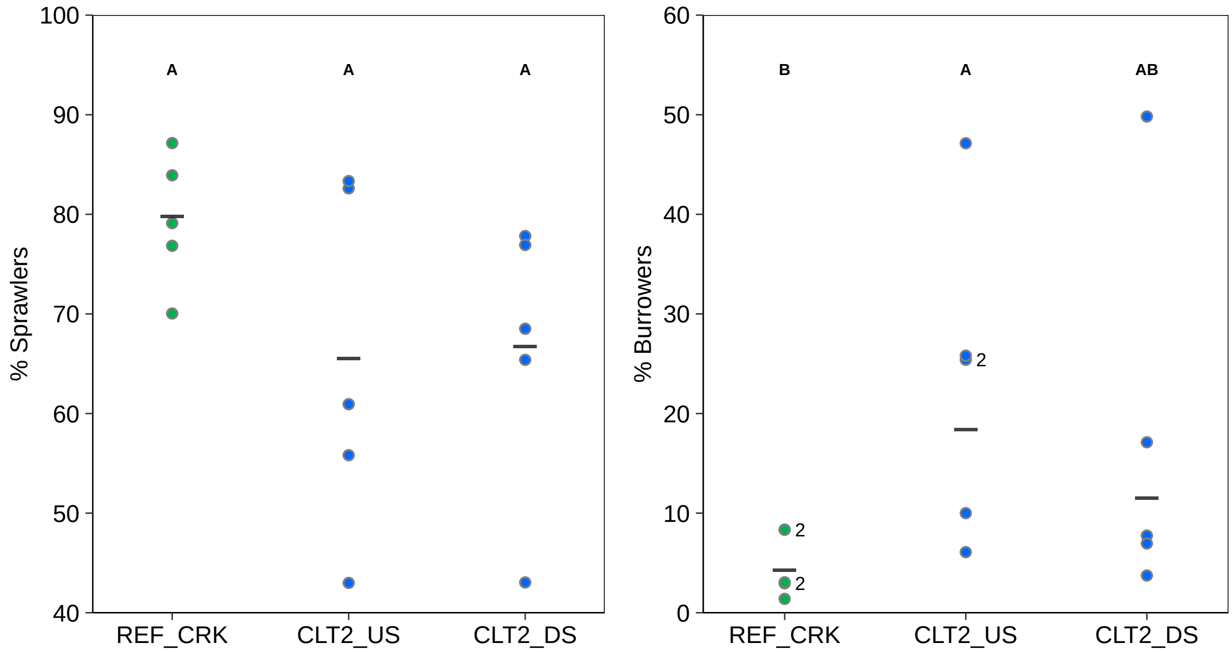

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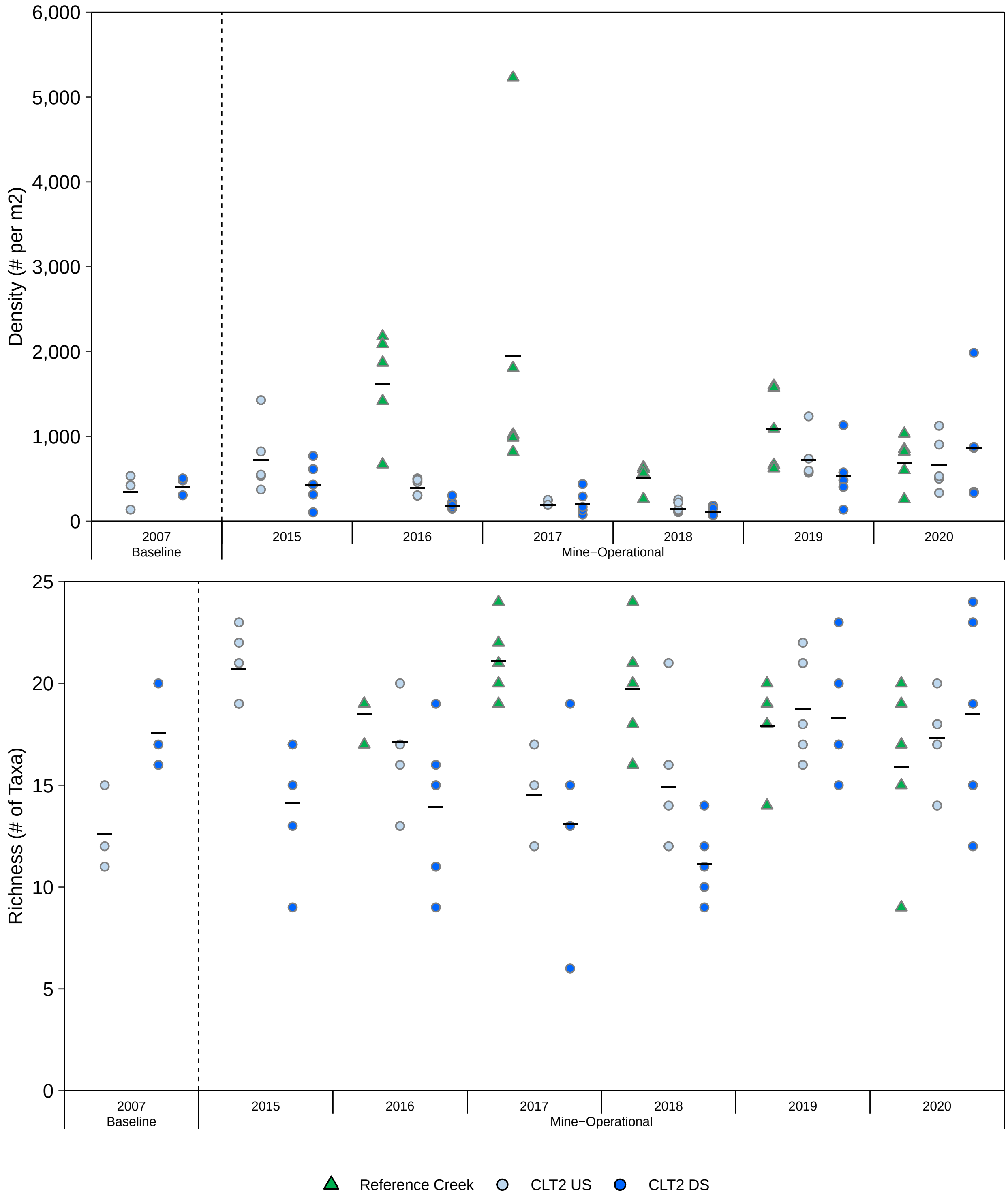
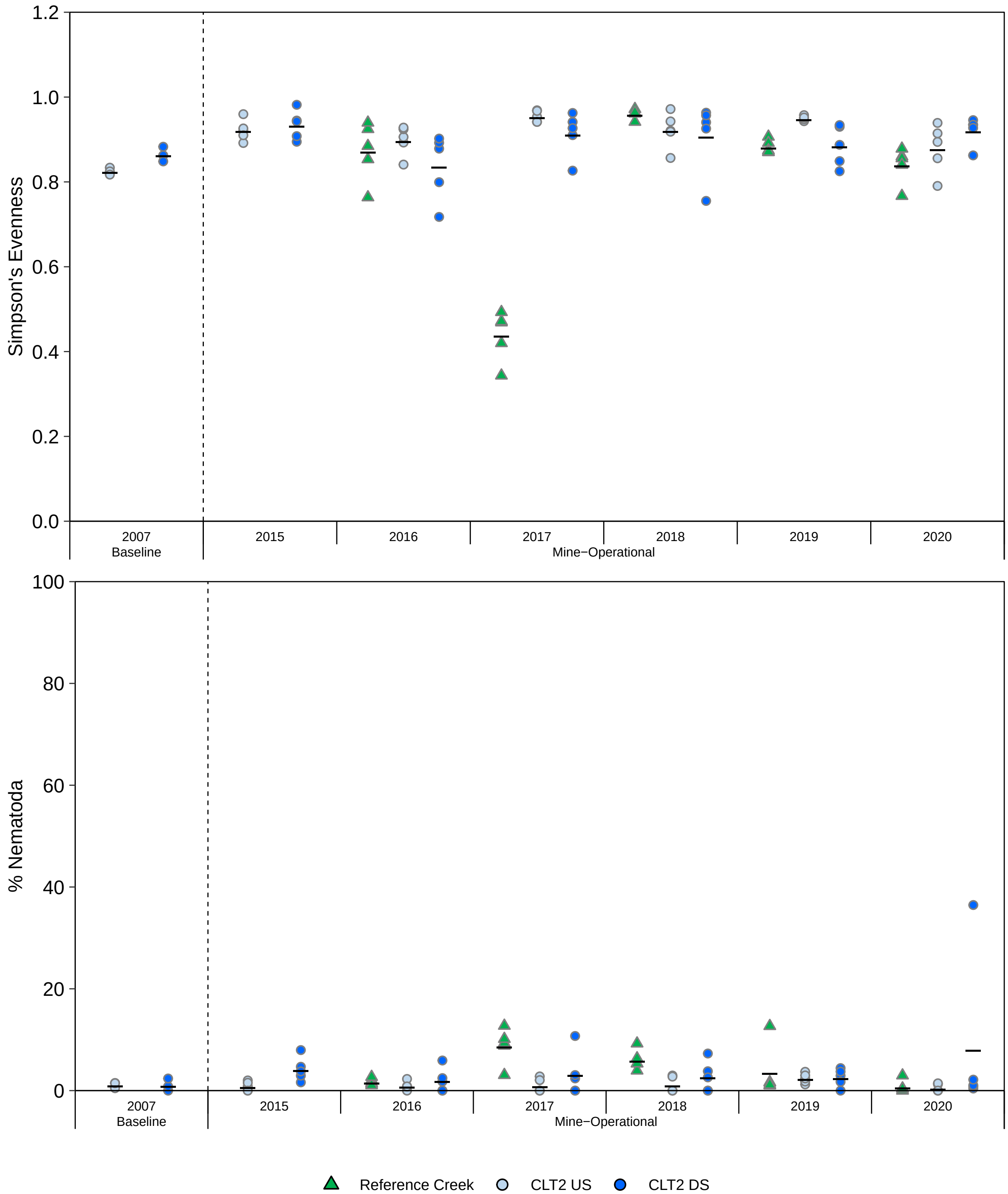


Figure F.4: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) and Downstream (CLT2 DS) Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.



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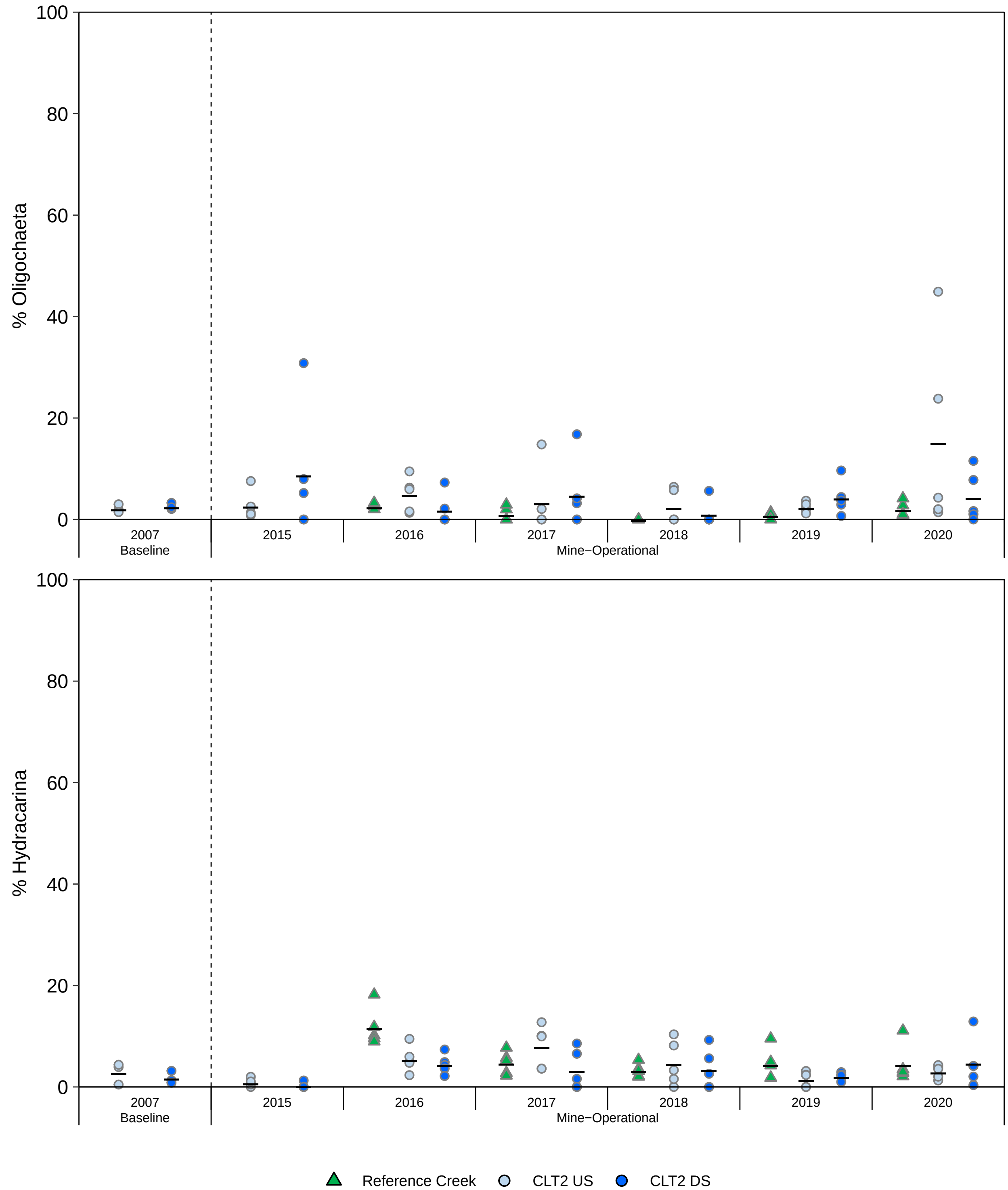

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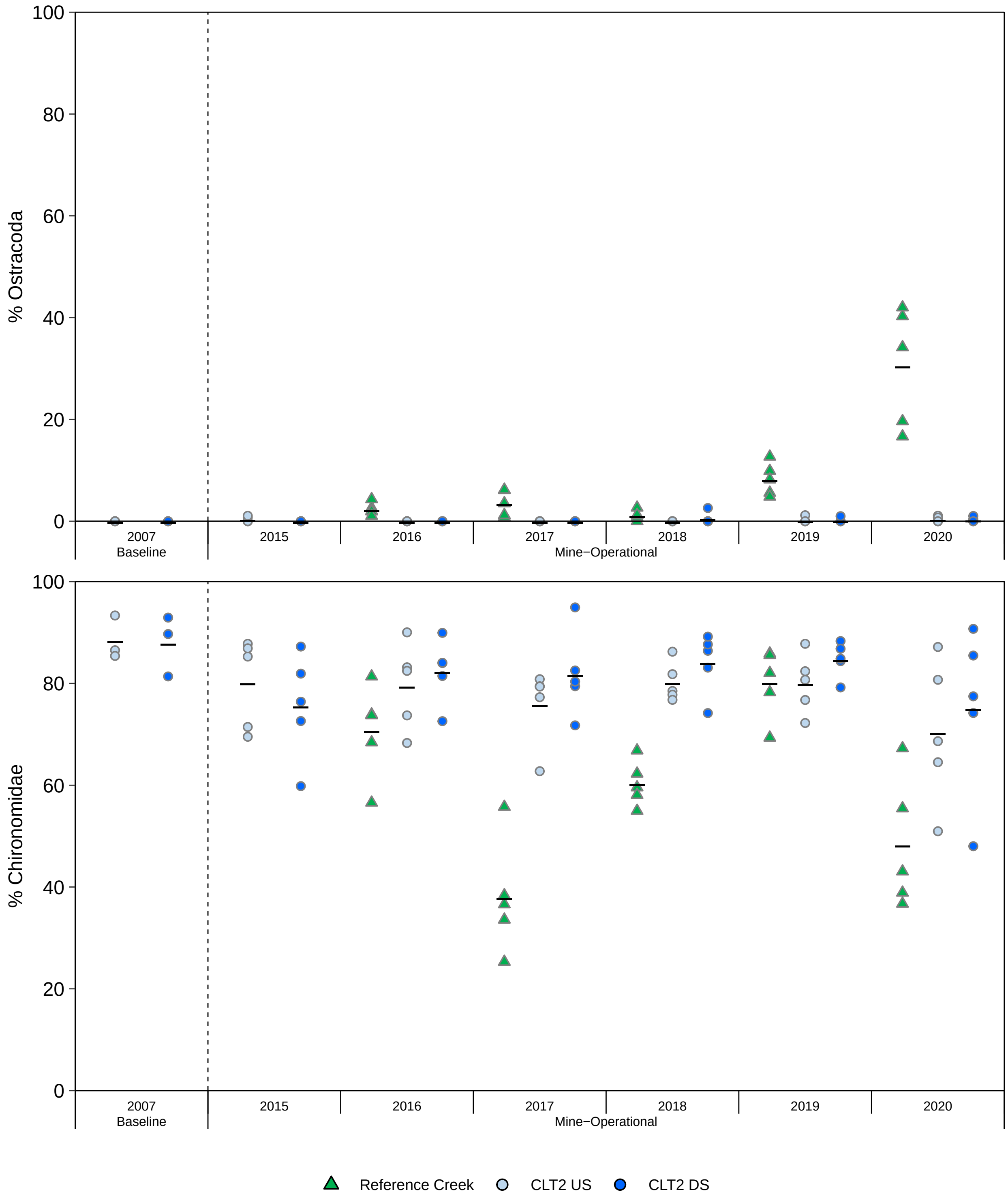

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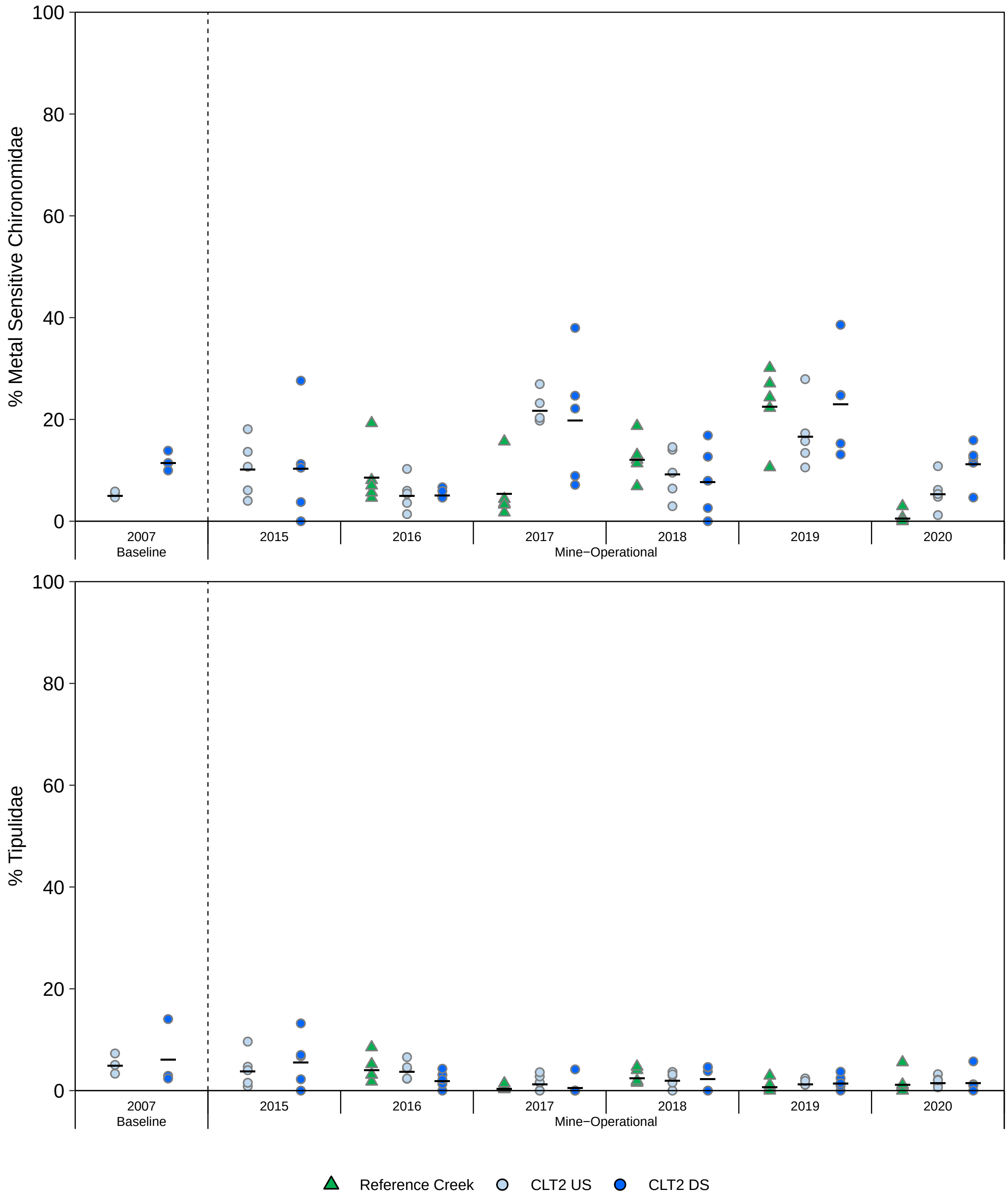


Figure F.4: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) and Downstream (CLT2 DS) Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

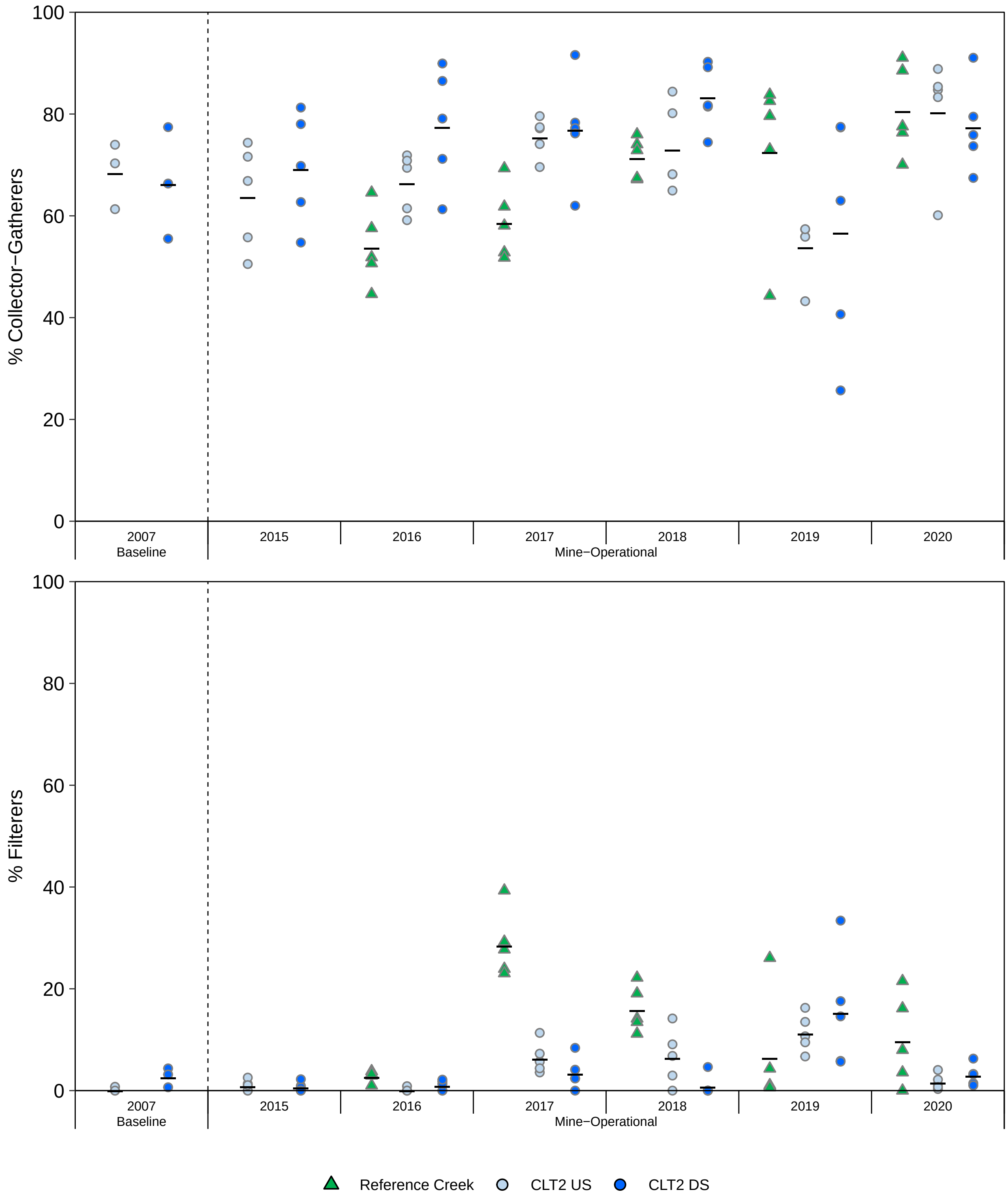


Figure F.4: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) and Downstream (CLT2 DS) Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

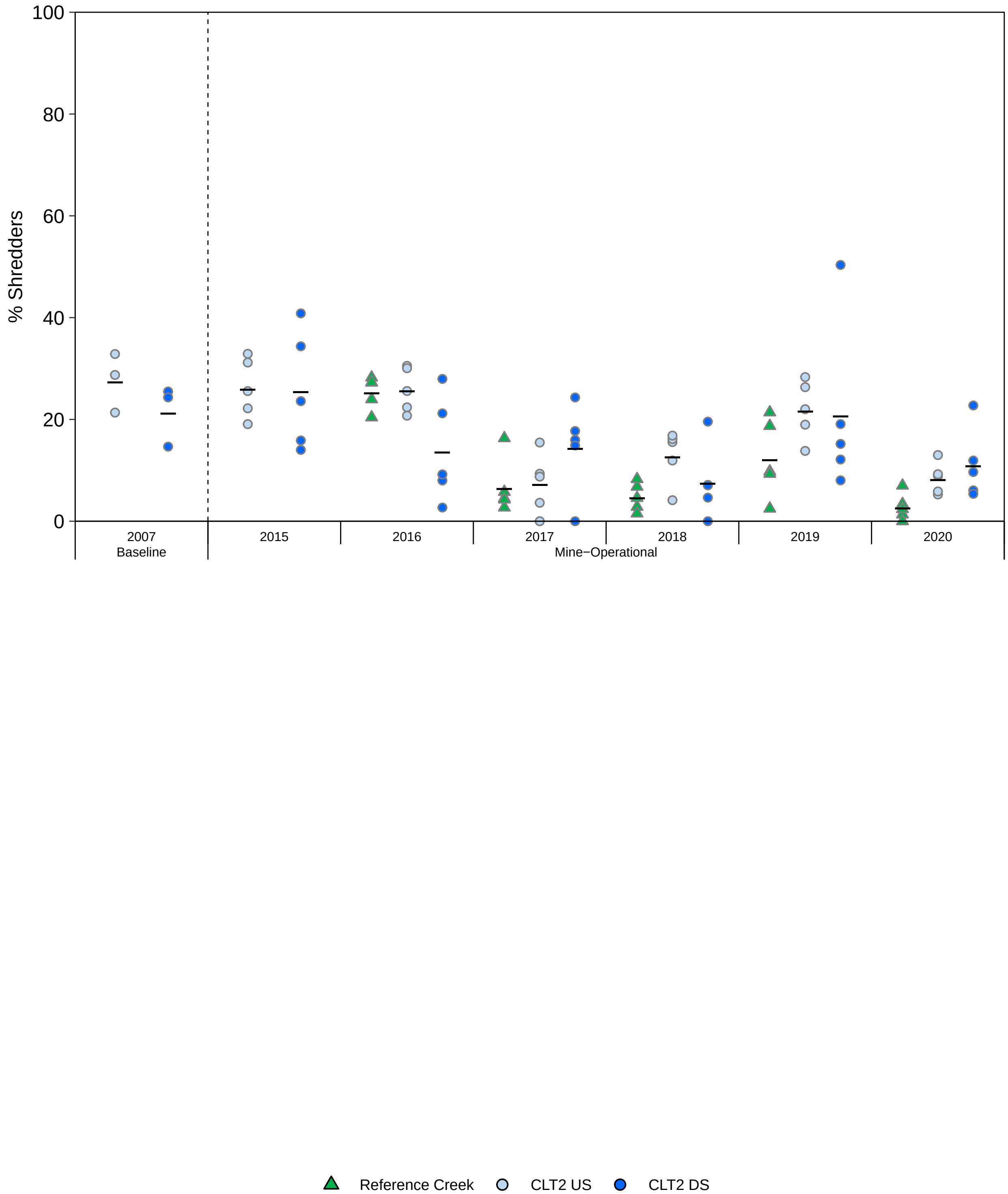


Figure F.4: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) and Downstream (CLT2 DS) Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

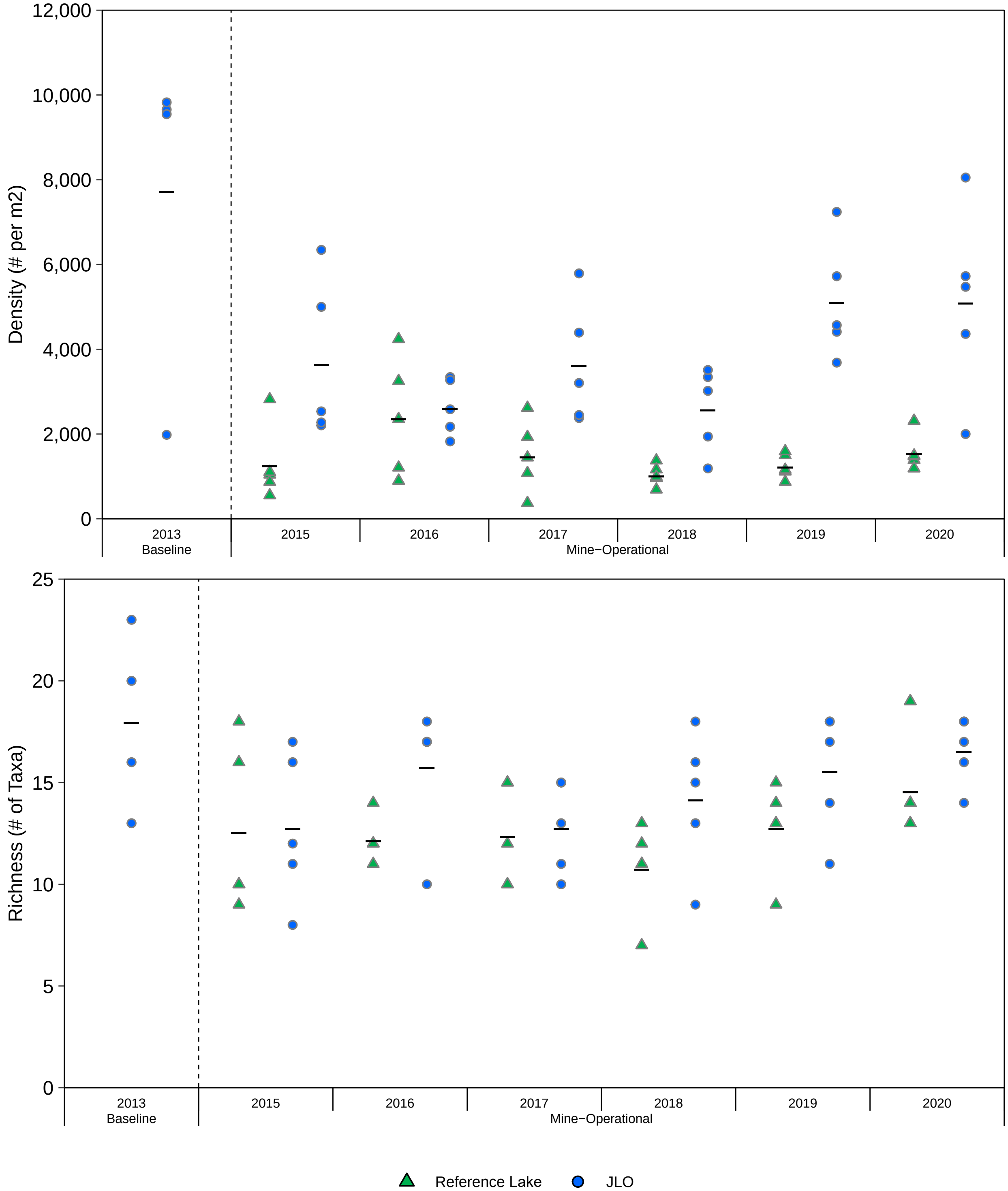


Figure F.5: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

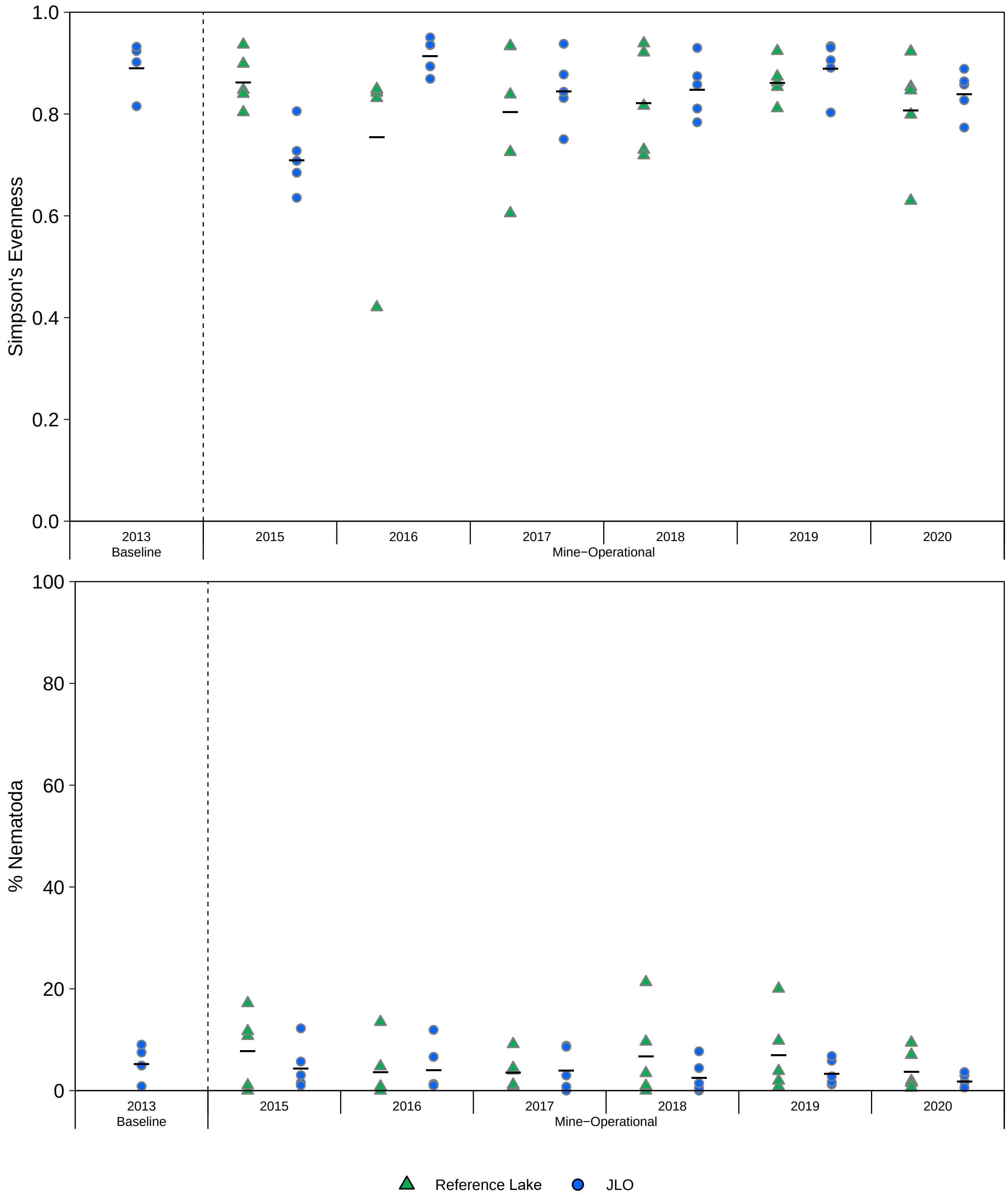


Figure F.5: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

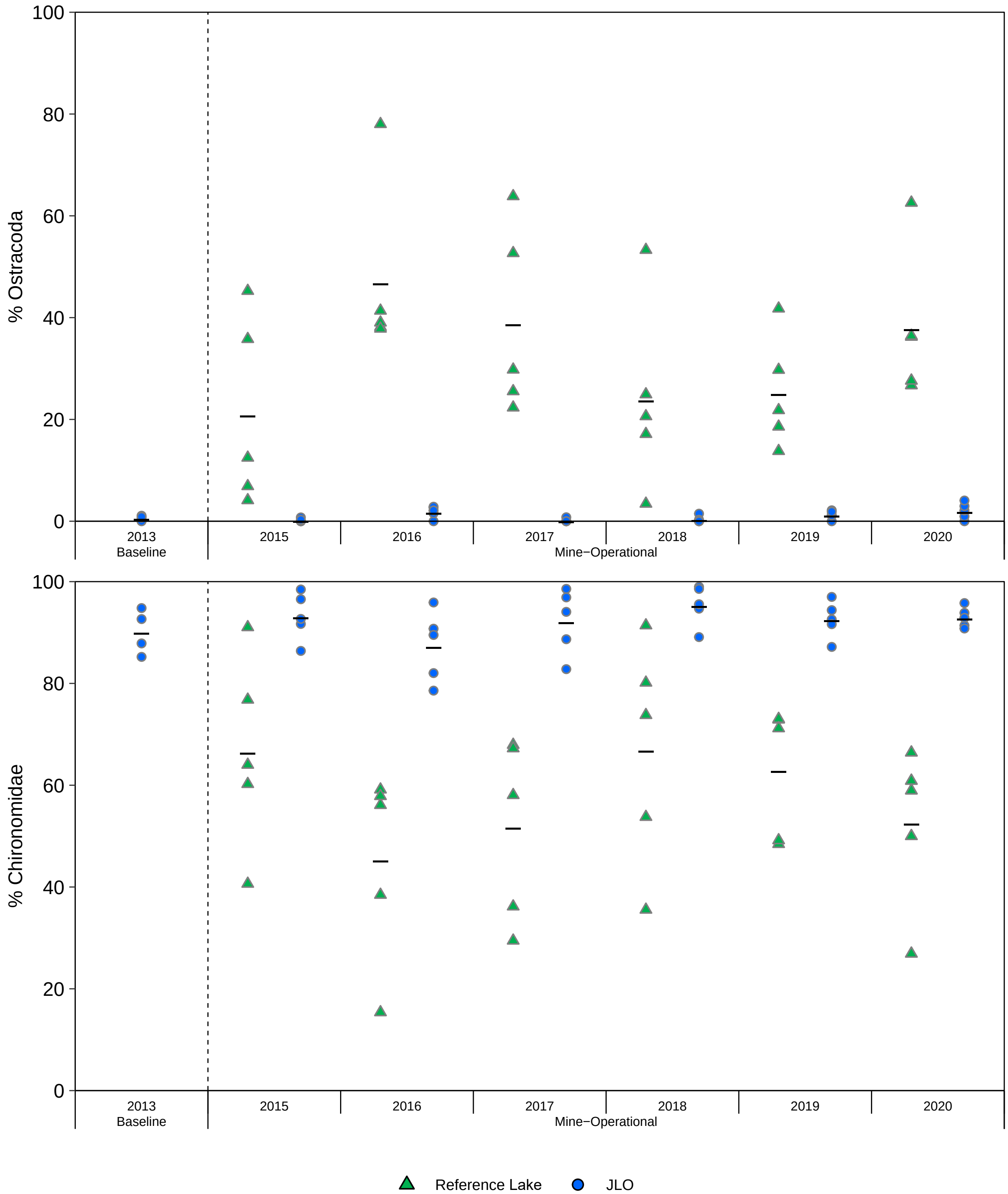


Figure F.5: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

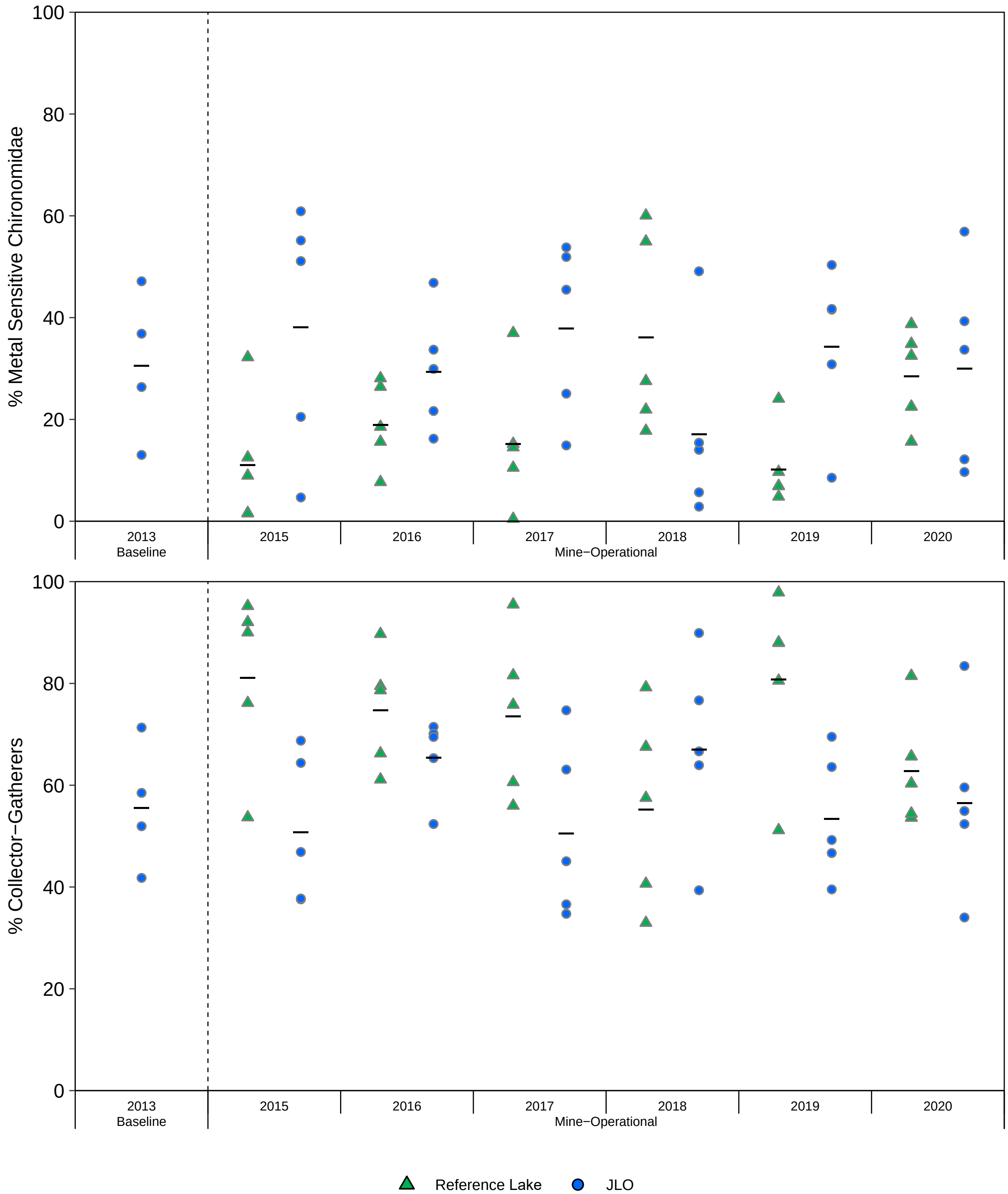


Figure F.5: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

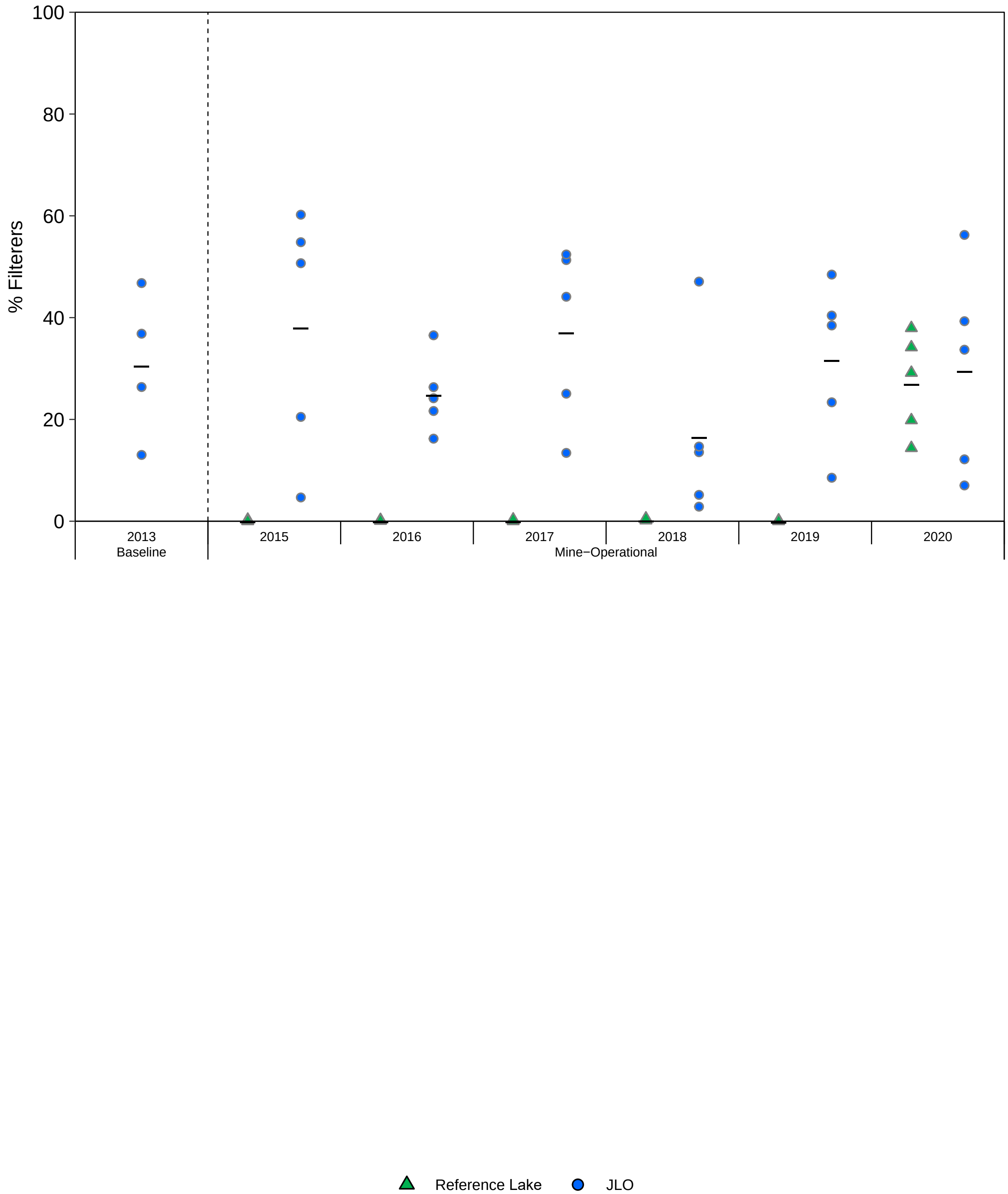


Figure F.5: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

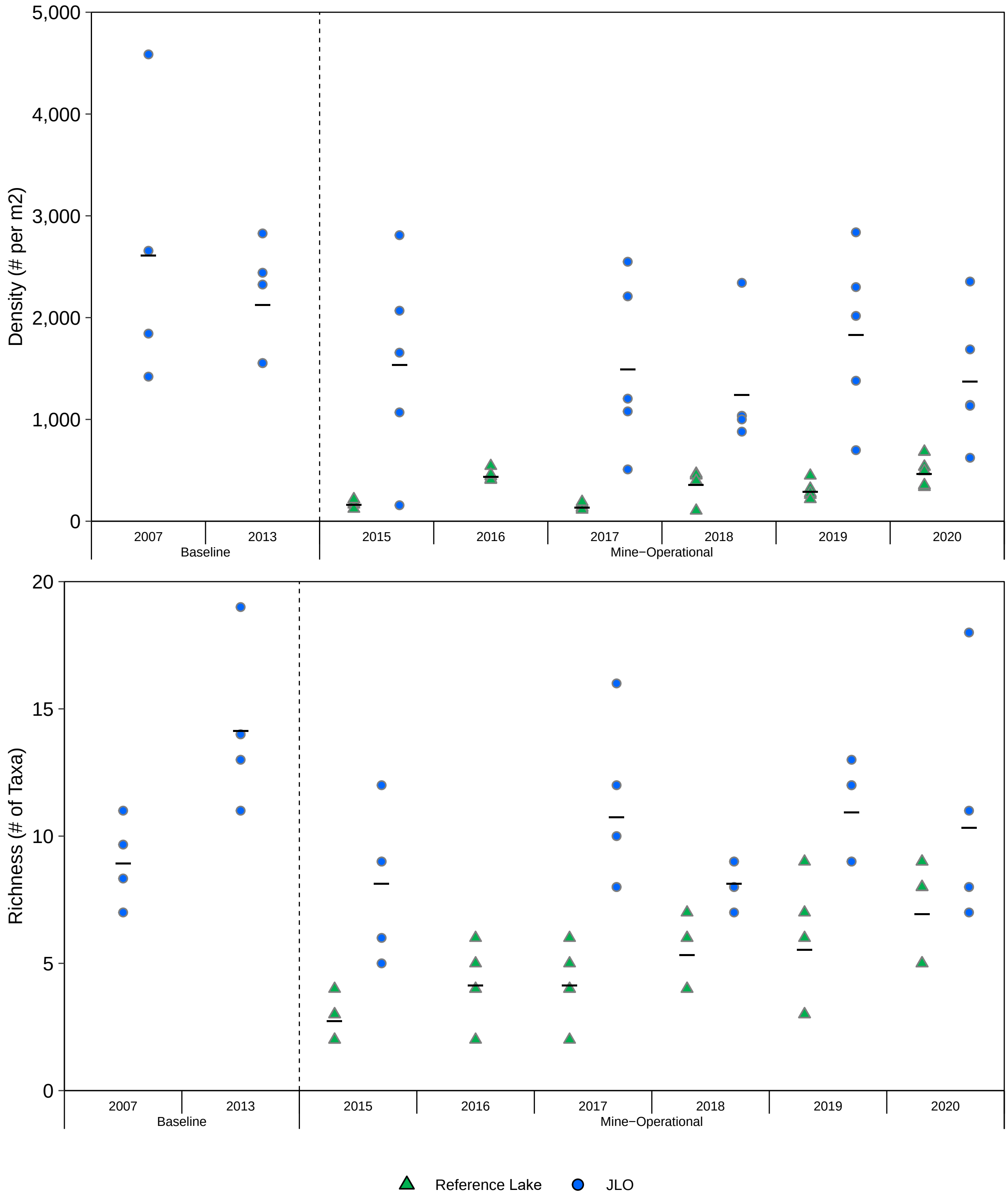


Figure F.6: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

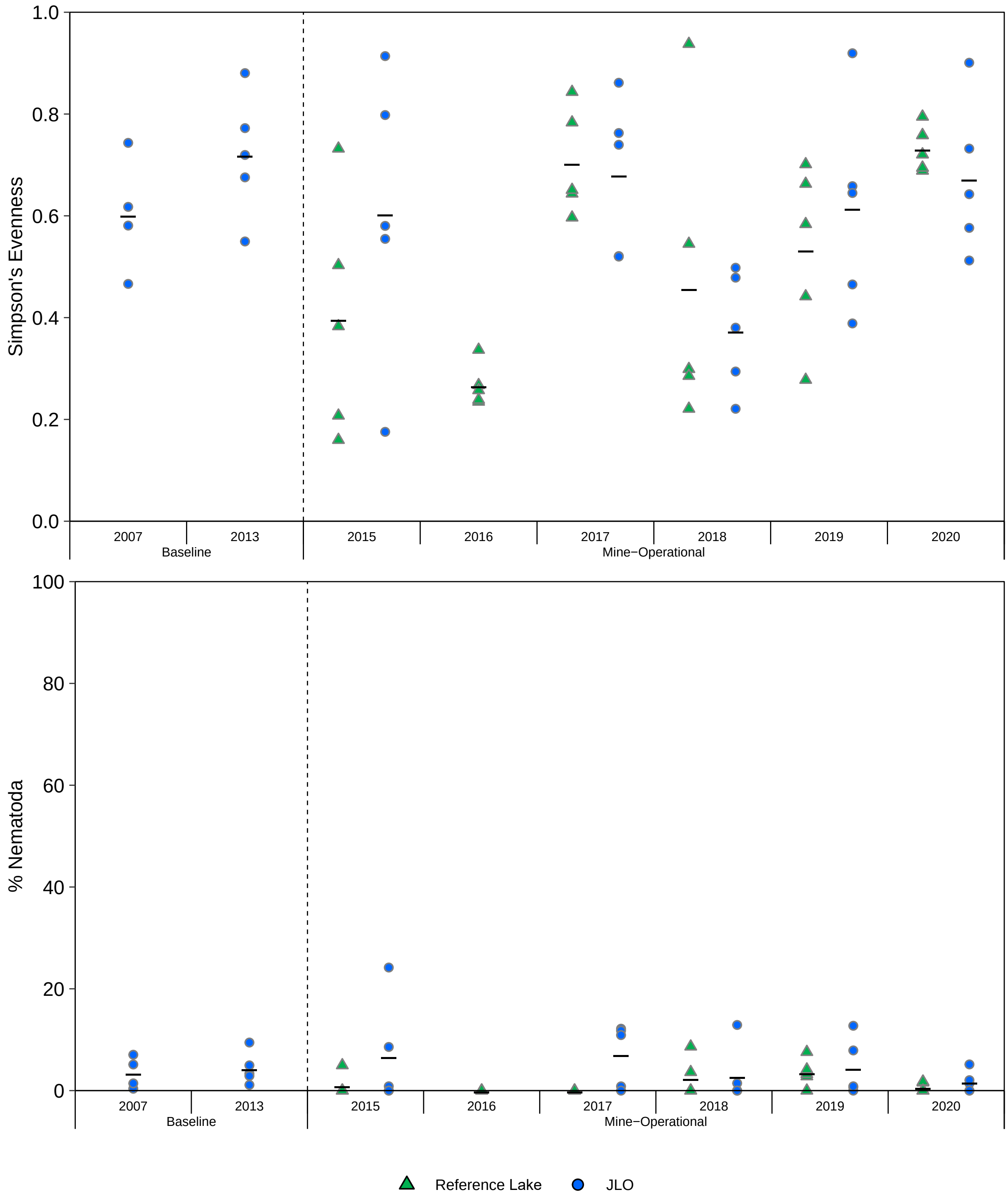


Figure F.6: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

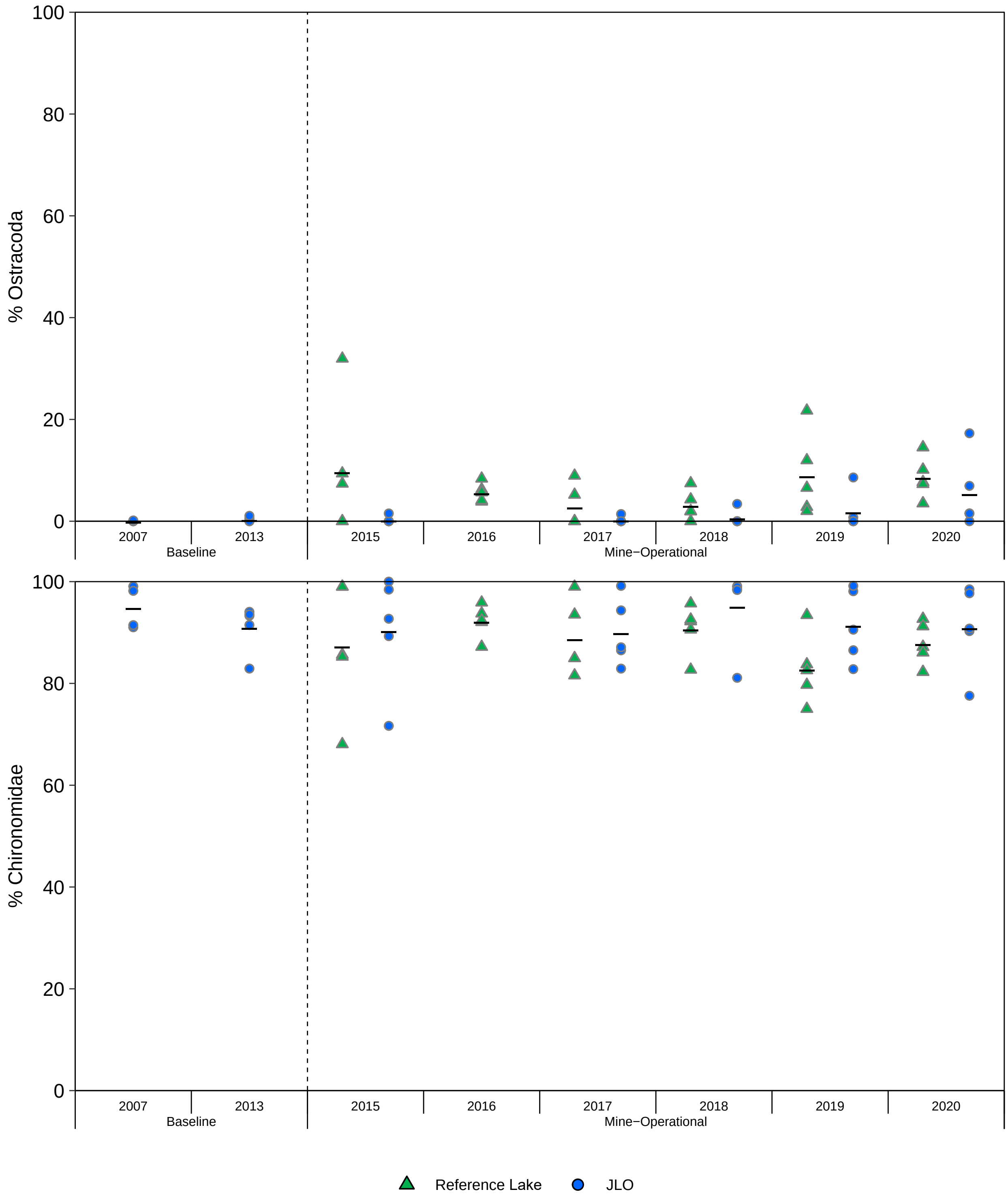


Figure F.6: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

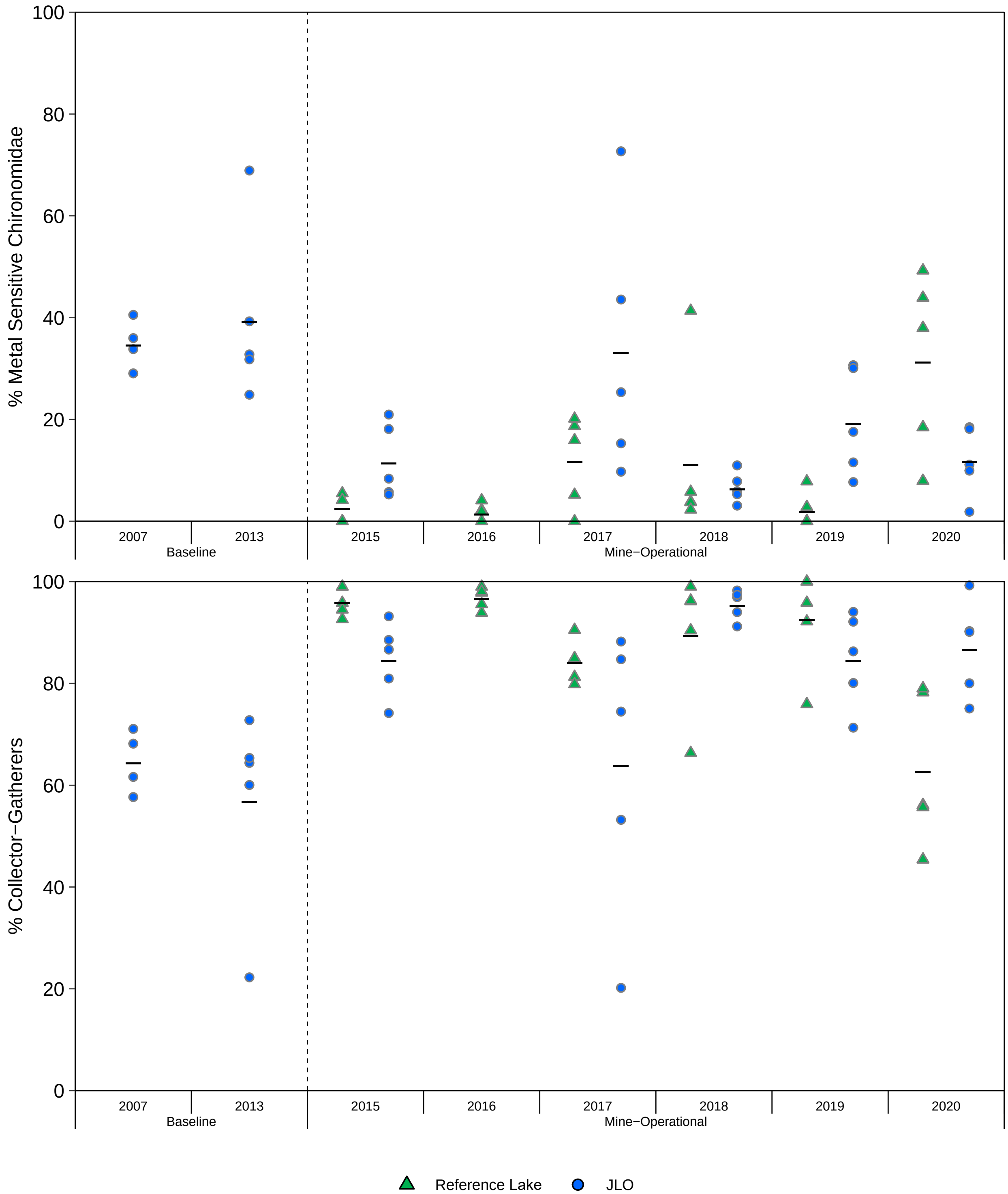


Figure F.6: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

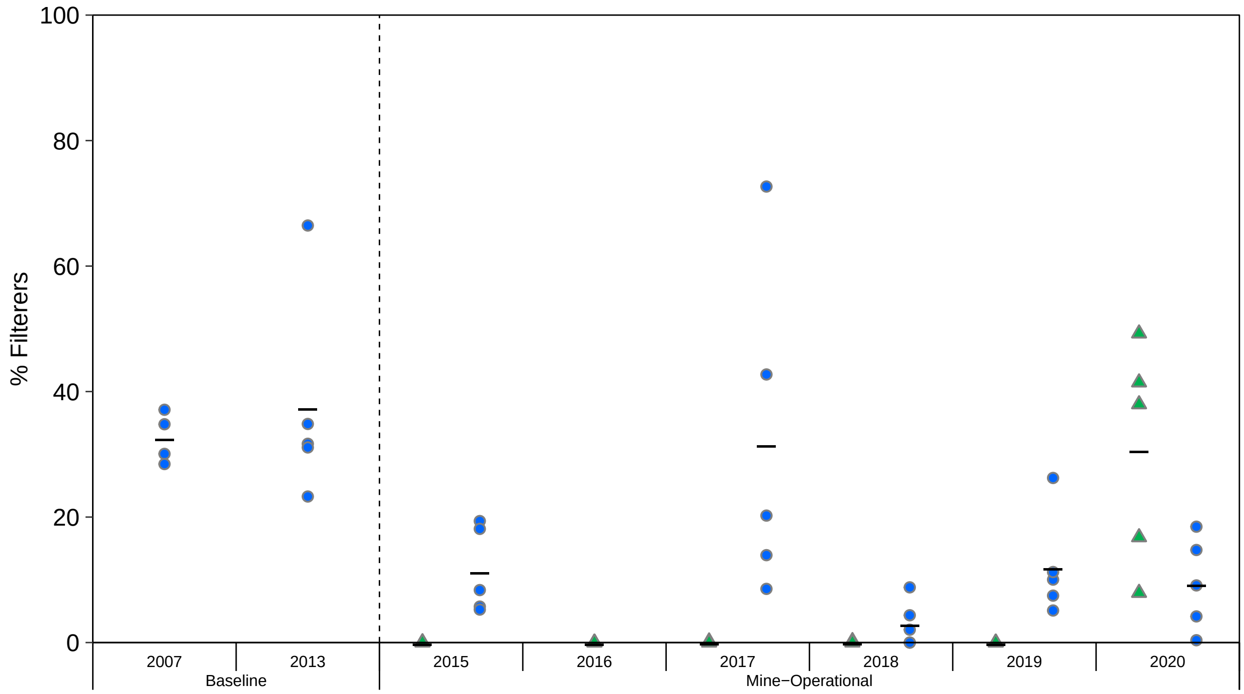


Figure F.6: Comparison of Key Benthic Invertebrate Community Metrics at Camp Lake (JL0) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

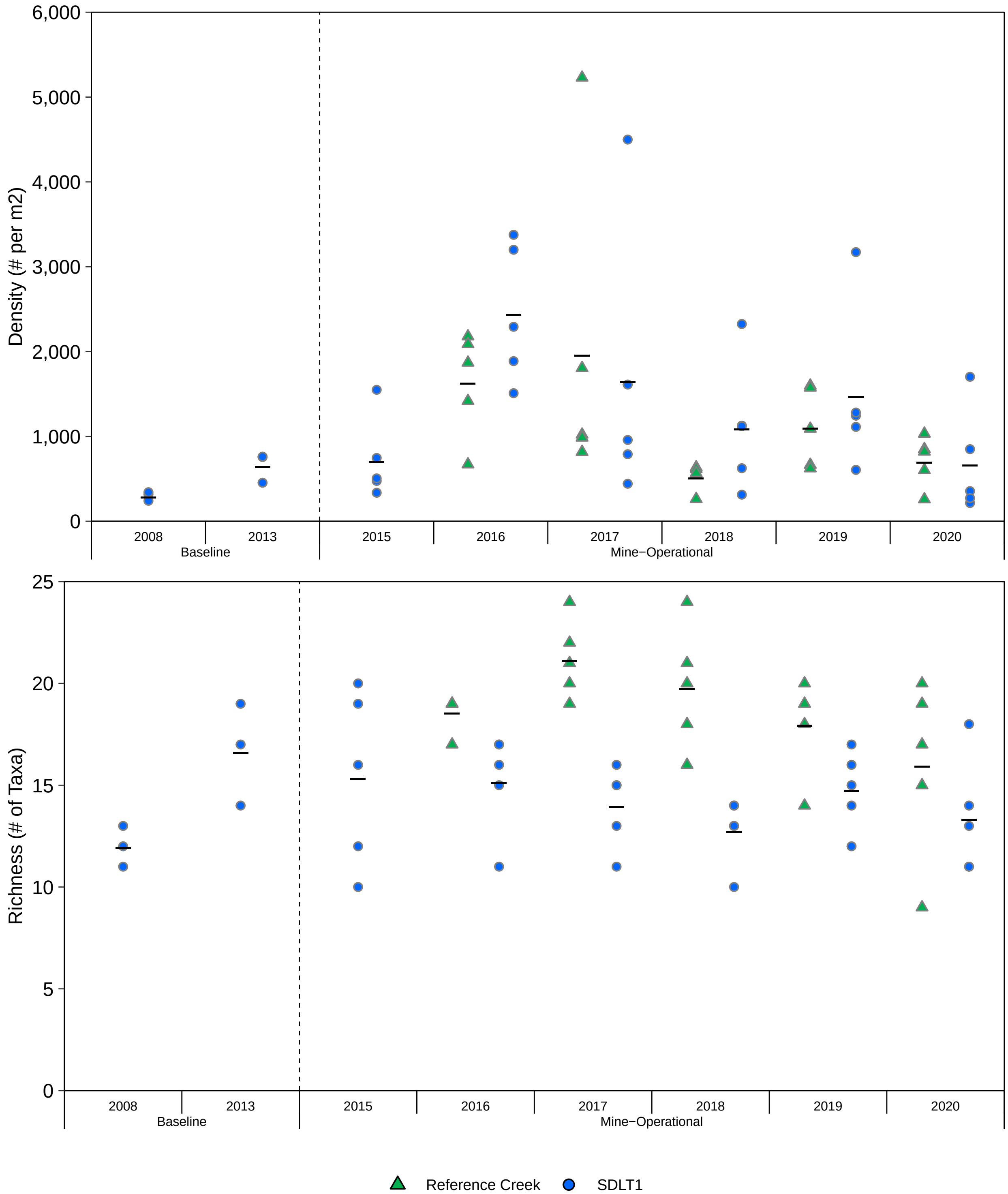


Figure F.7: Temporal Comparison of Benthic Endpoints at SDLT1 Over Mine Baseline (2008 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

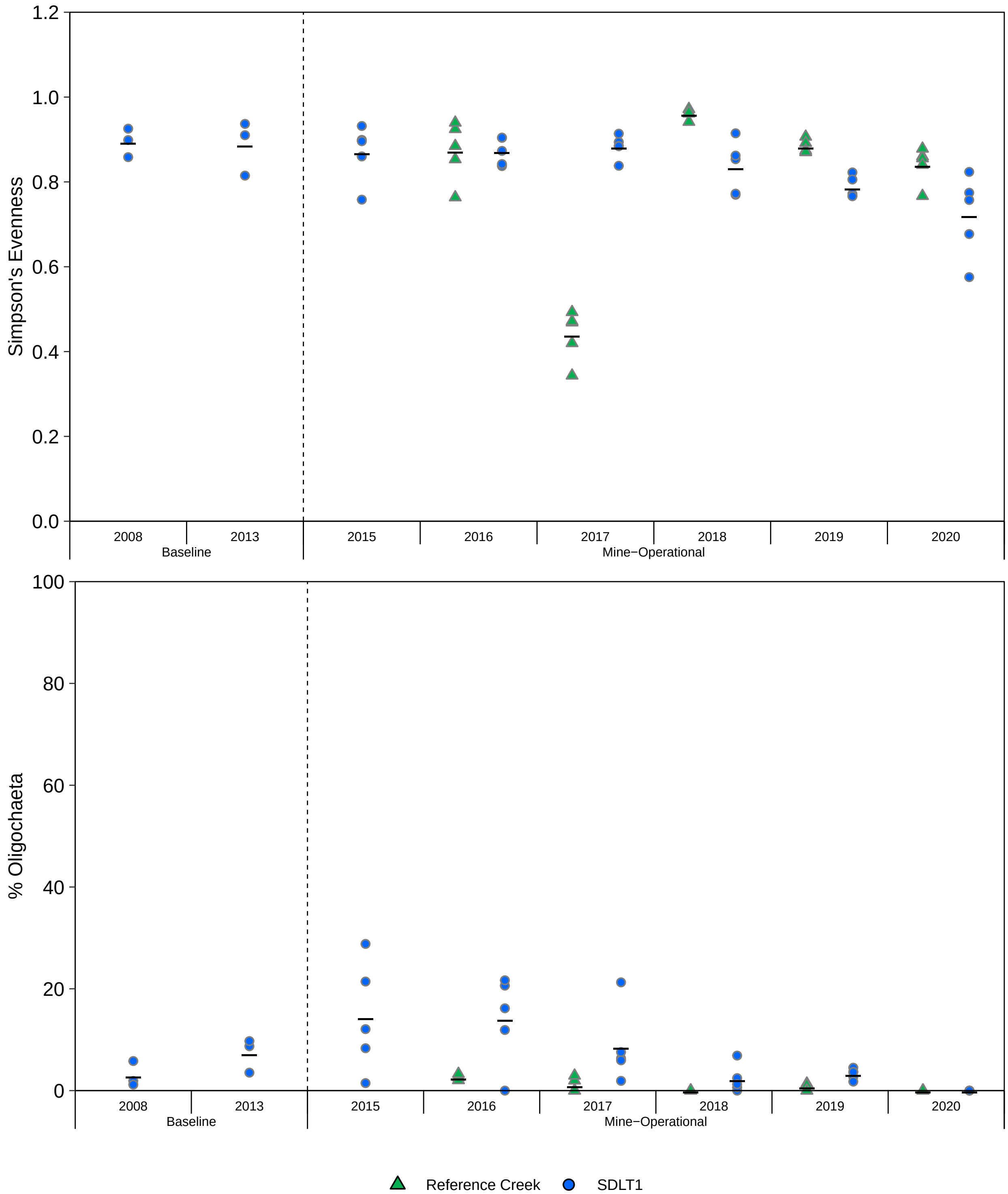


Figure F.7: Temporal Comparison of Benthic Endpoints at SDLT1 Over Mine Baseline (2008 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

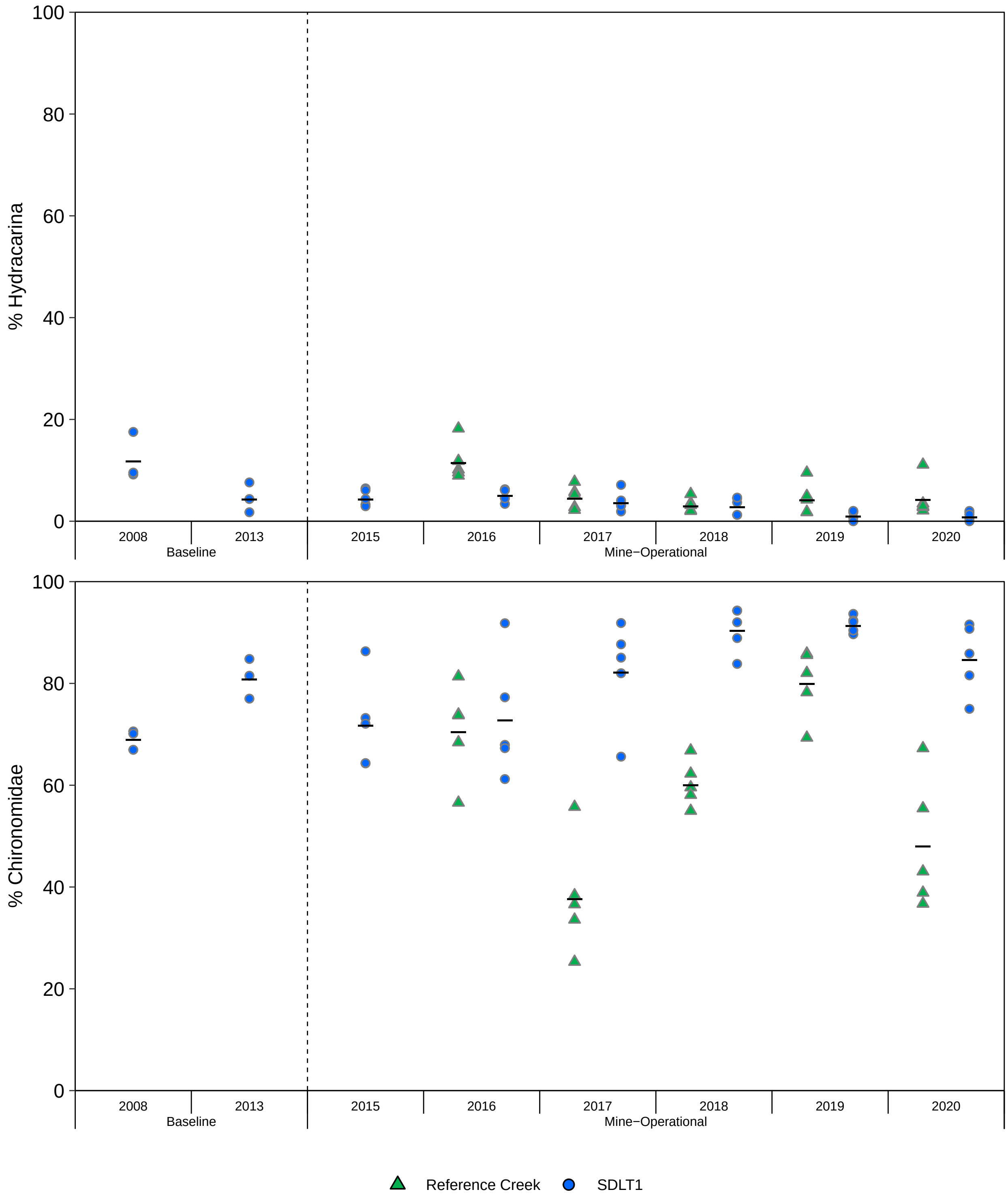


Figure F.7: Temporal Comparison of Benthic Endpoints at SDLT1 Over Mine Baseline (2008 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

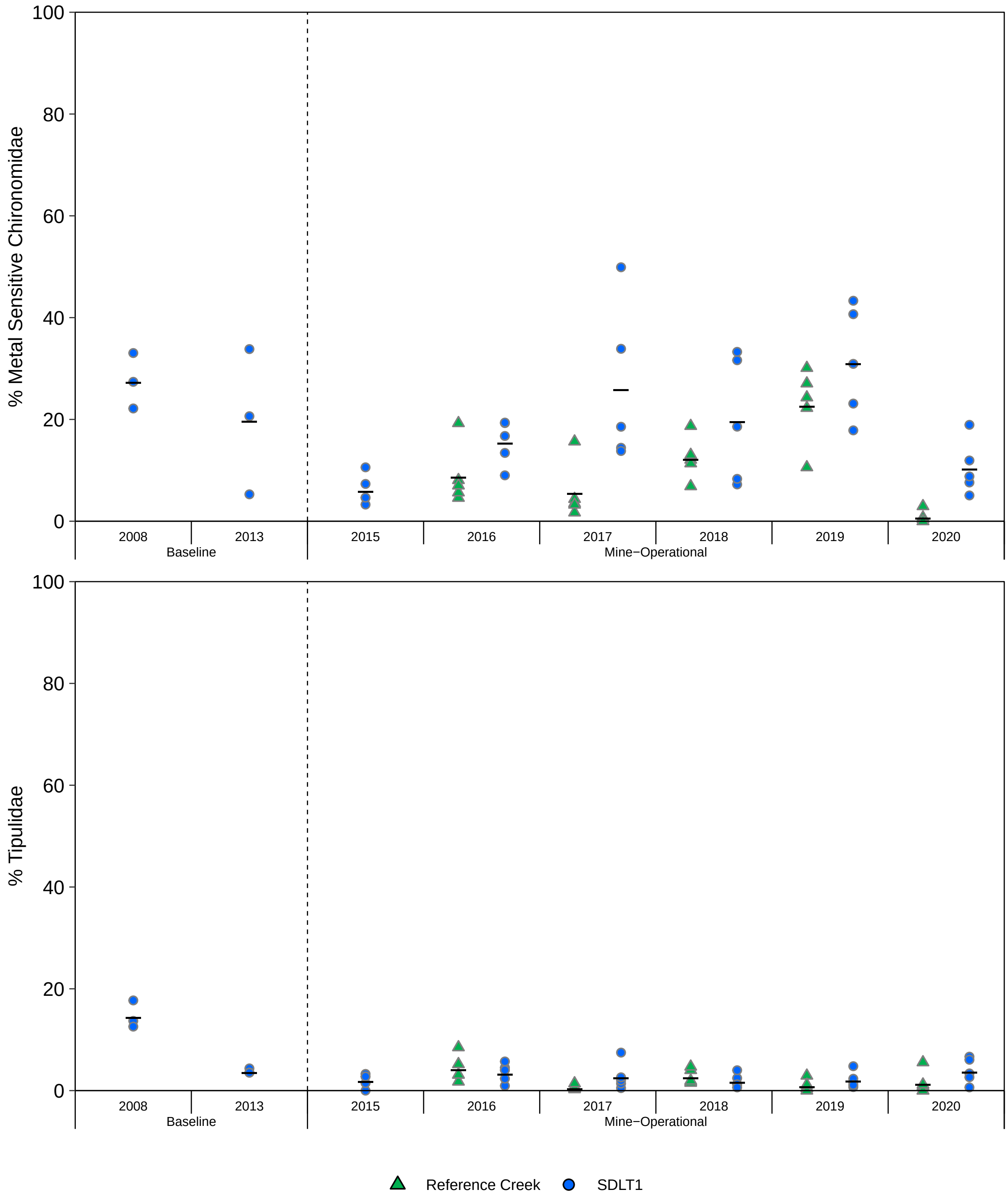


Figure F.7: Temporal Comparison of Benthic Endpoints at SDLT1 Over Mine Baseline (2008 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

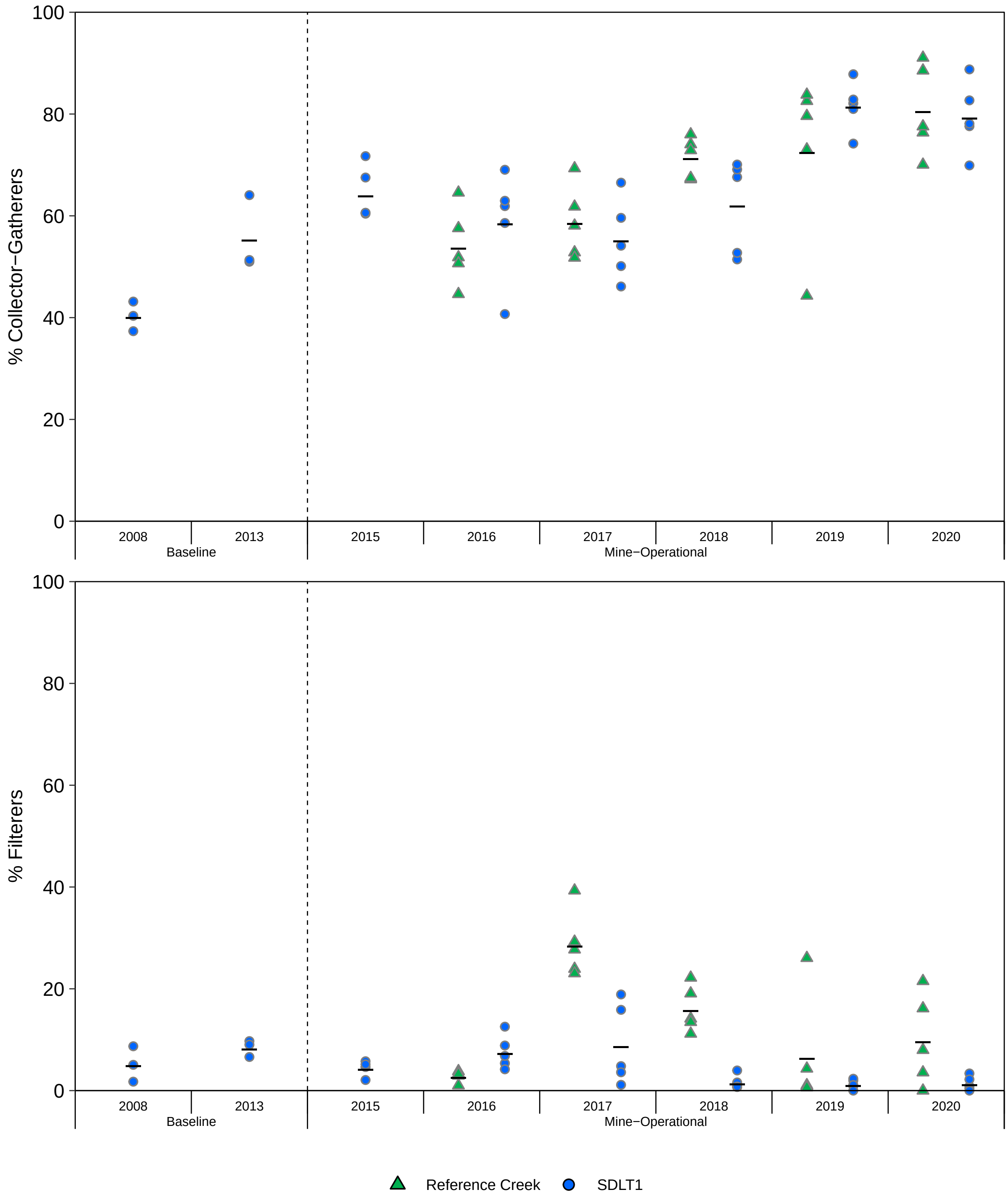


Figure F.7: Temporal Comparison of Benthic Endpoints at SDLT1 Over Mine Baseline (2008 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

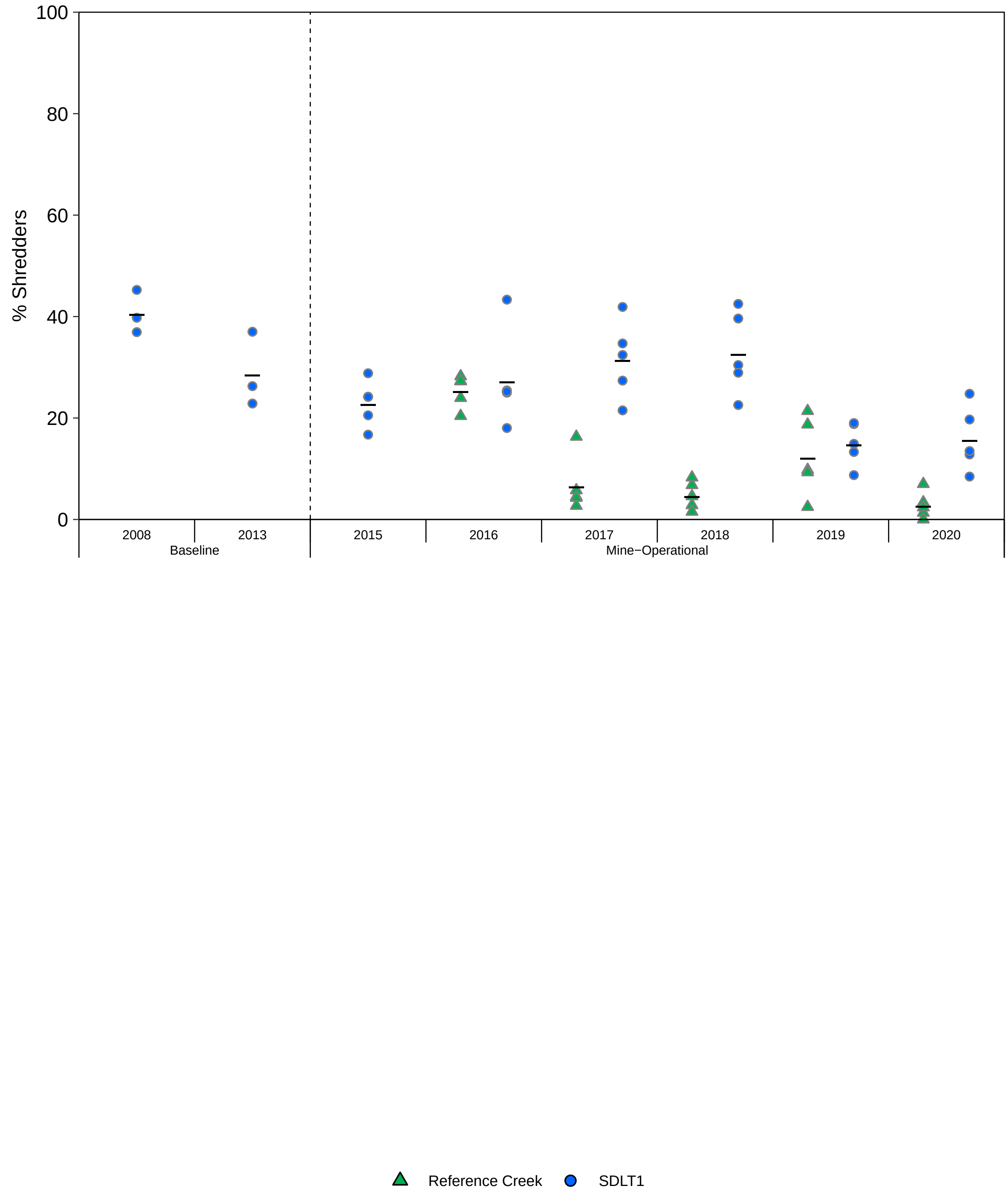


Figure F.7: Temporal Comparison of Benthic Endpoints at SDLT1 Over Mine Baseline (2008 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

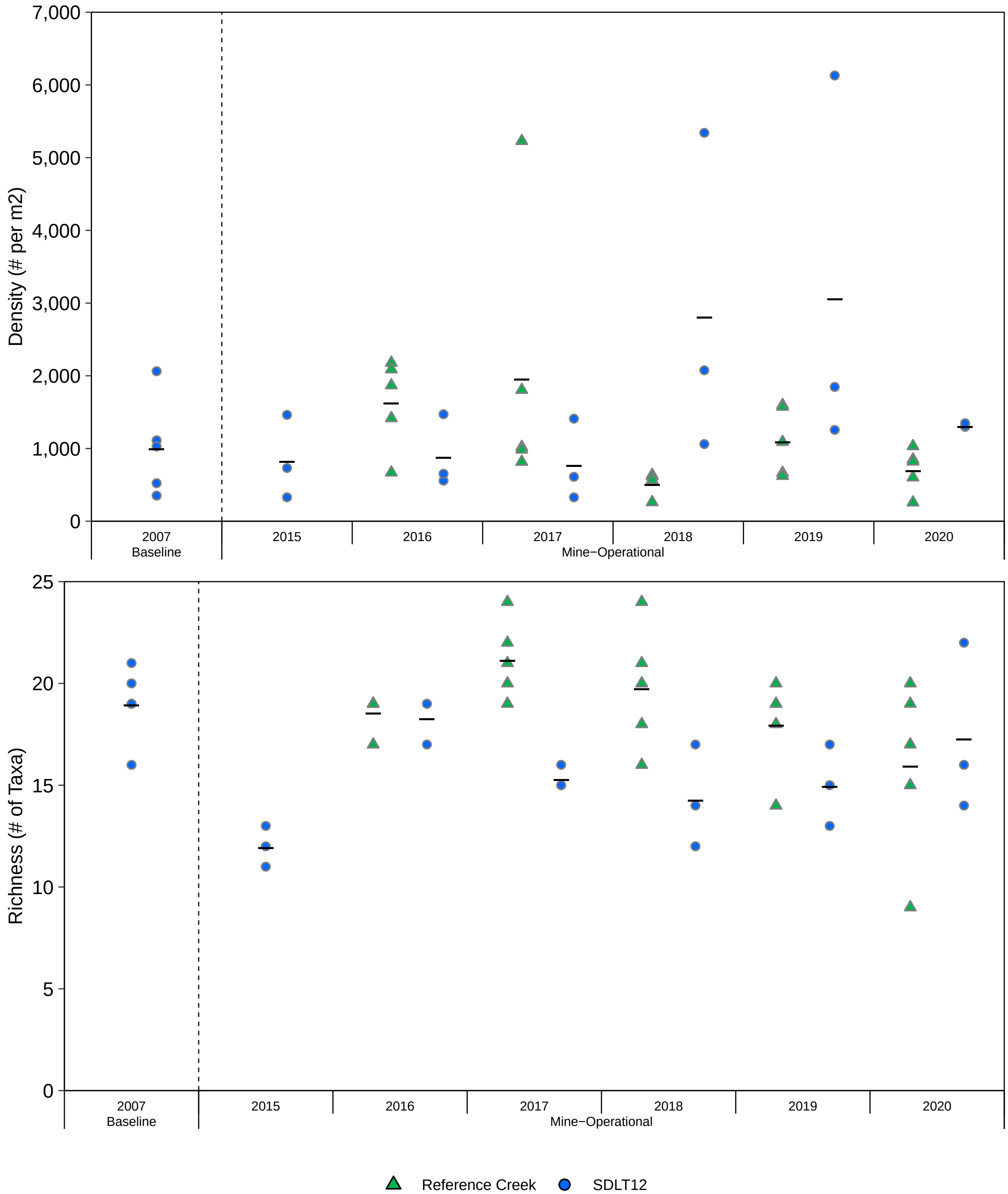


Figure F.8: Temporal Comparison of Benthic Endpoints at SDLT12 Over Mine Baseline (2007) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

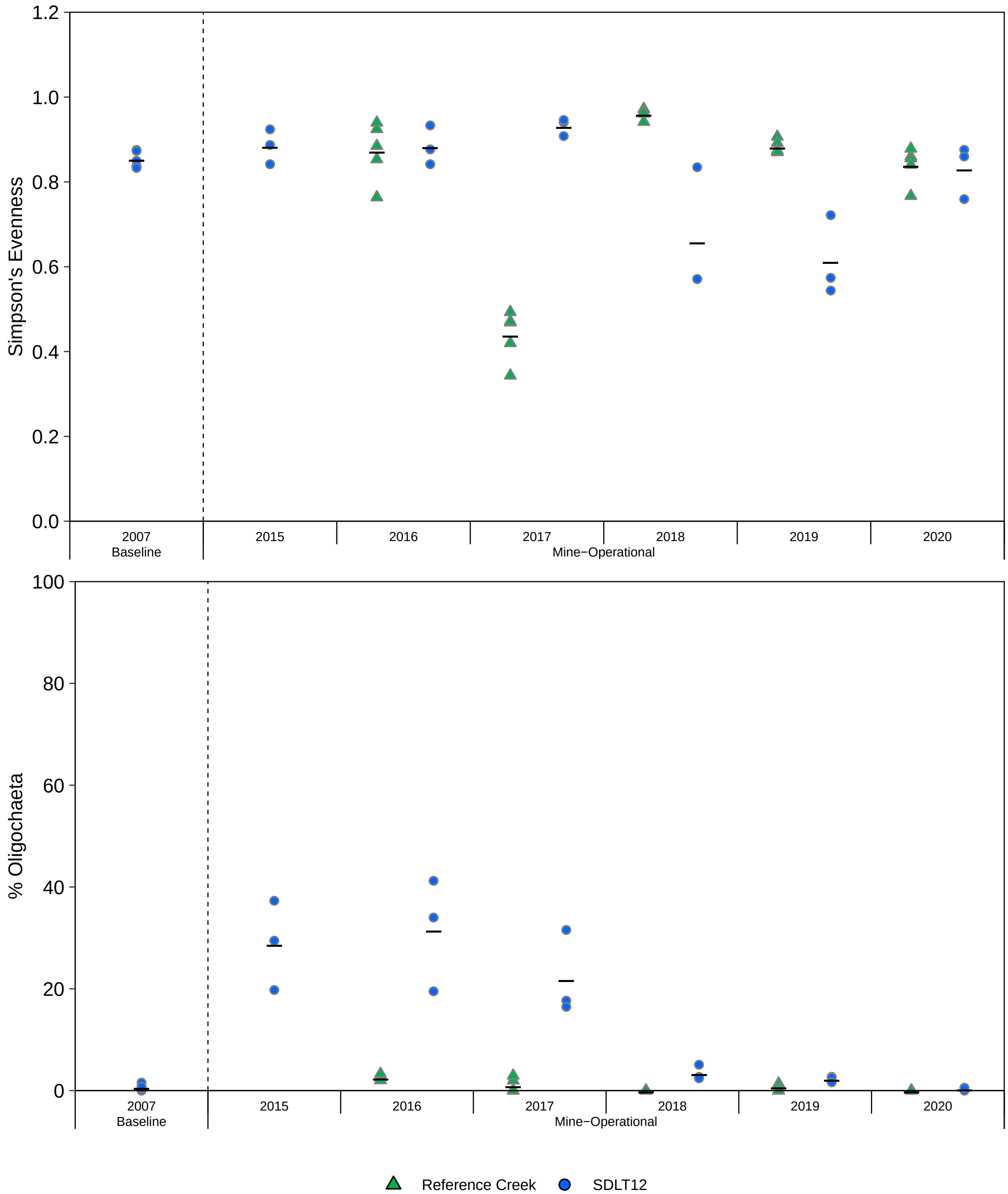


Figure F.8: Temporal Comparison of Benthic Endpoints at SDLT12 Over Mine Baseline (2007) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

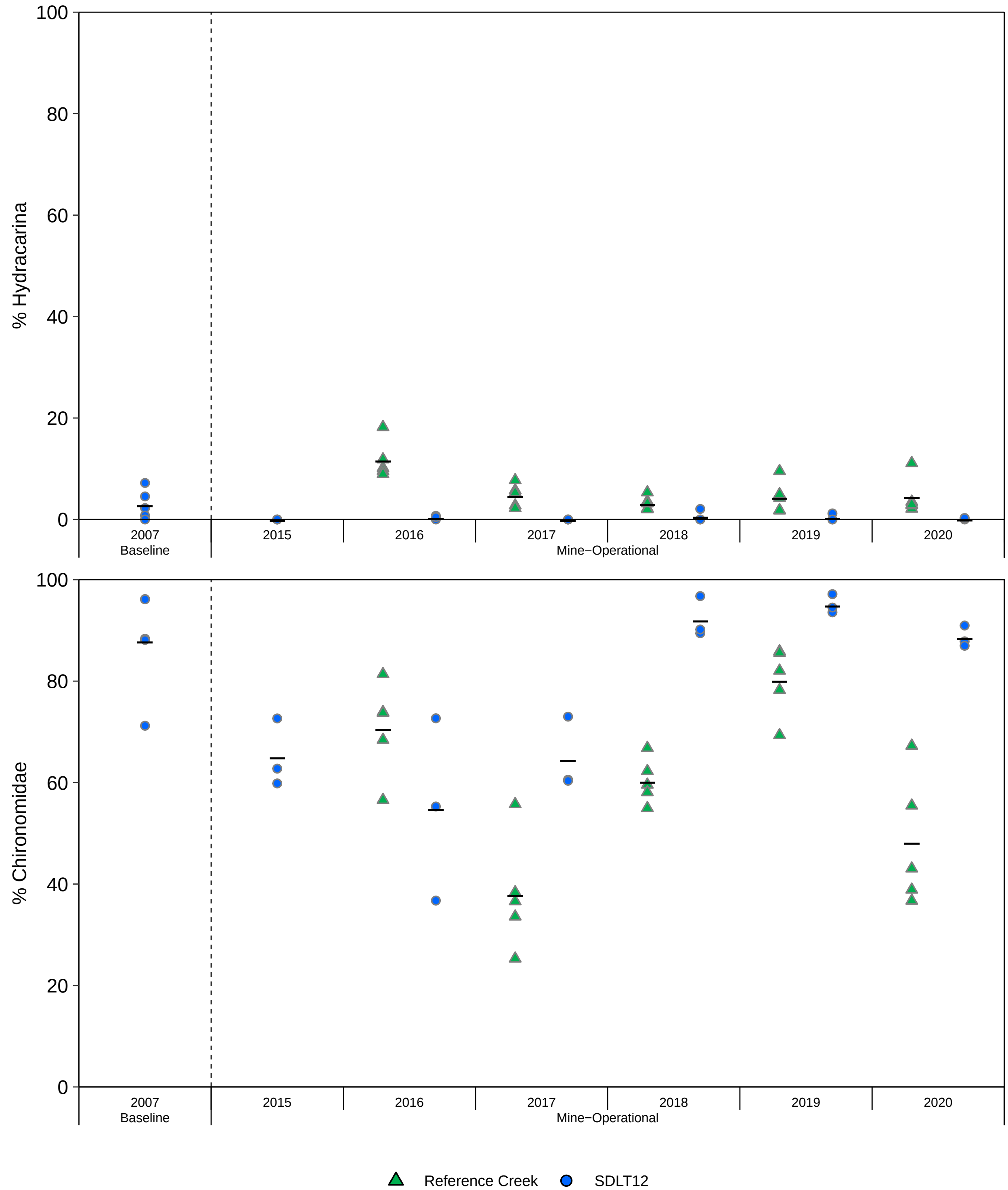


Figure F.8: Temporal Comparison of Benthic Endpoints at SDLT12 Over Mine Baseline (2007) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

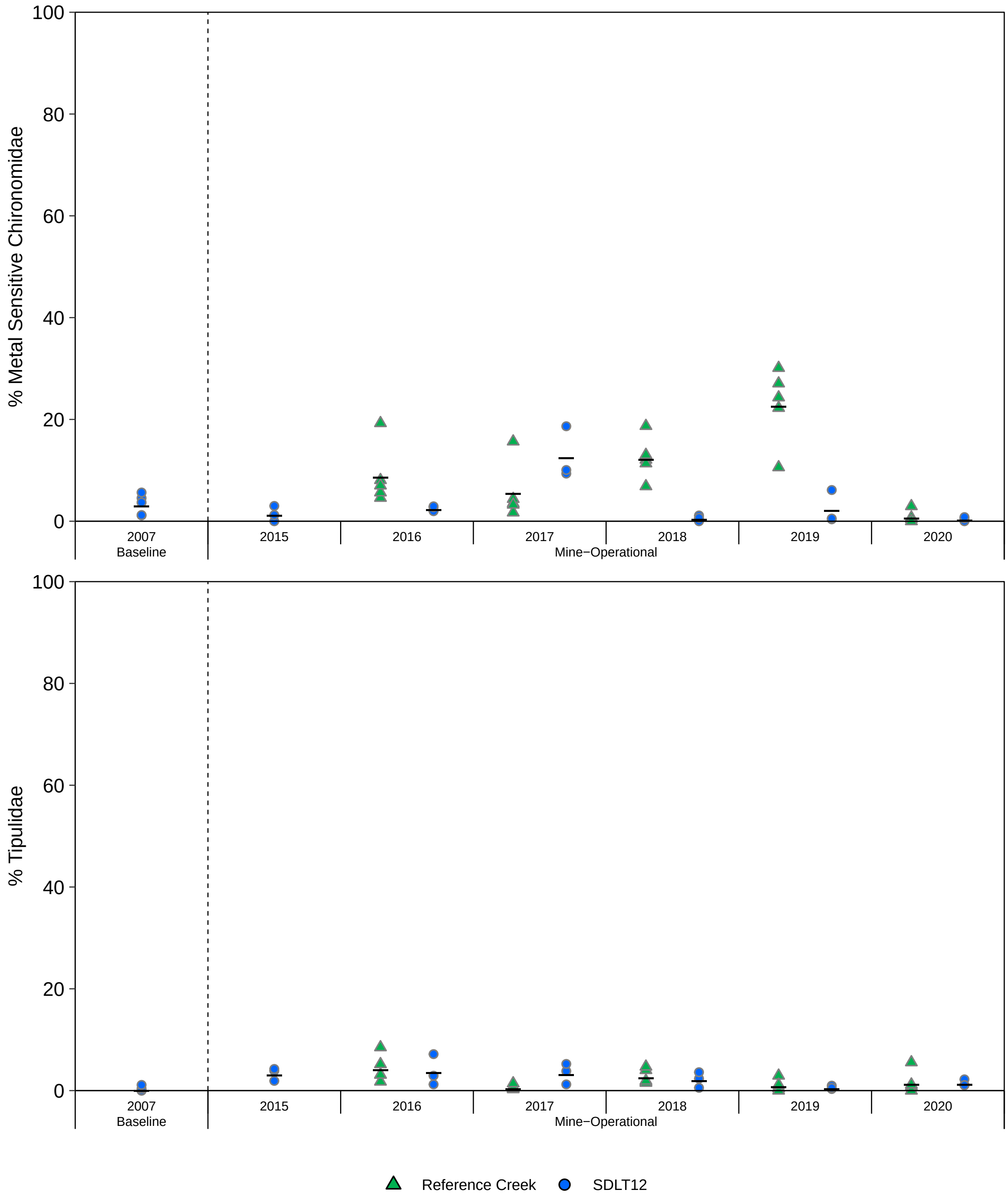


Figure F.8: Temporal Comparison of Benthic Endpoints at SDLT12 Over Mine Baseline (2007) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

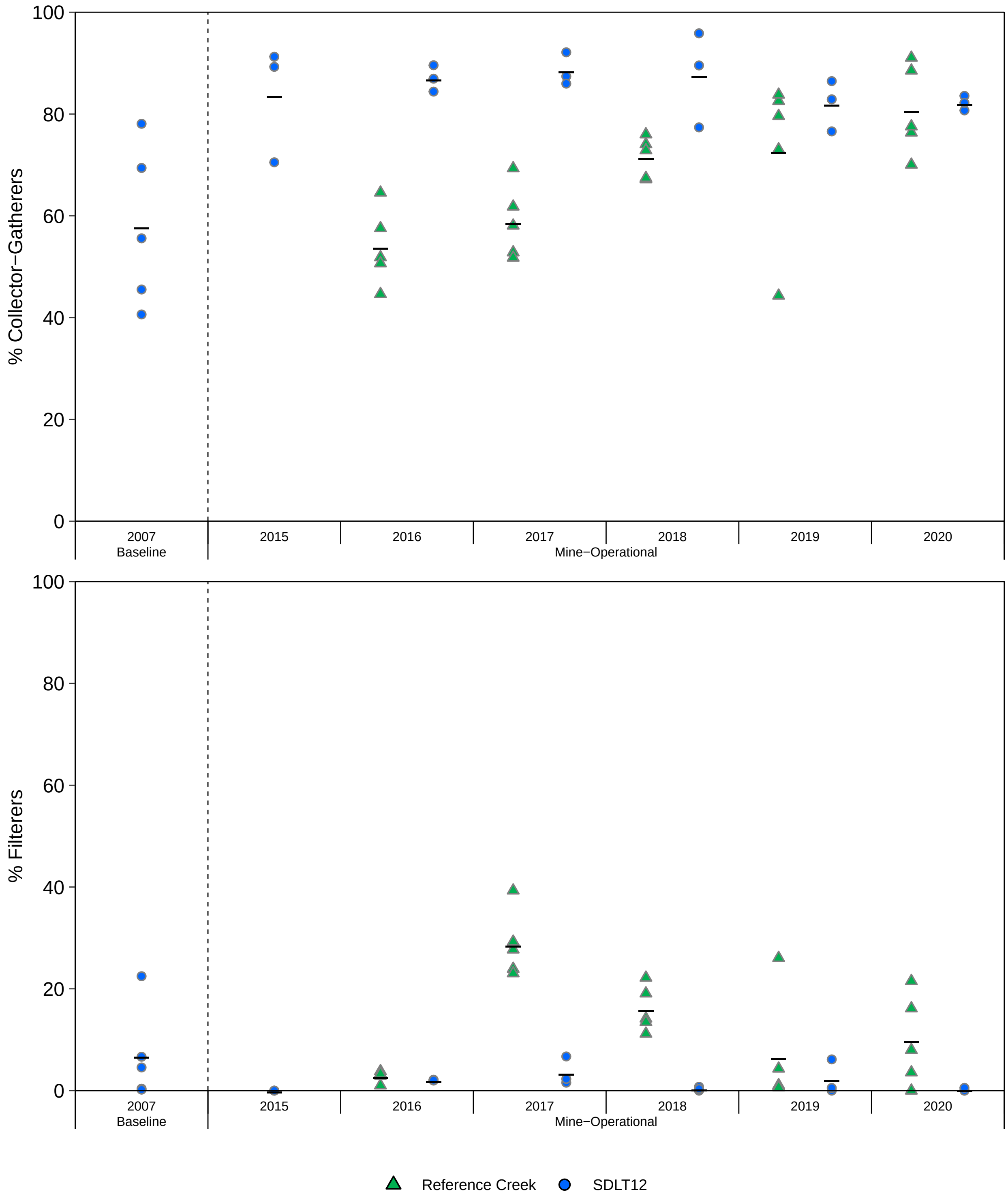


Figure F.8: Temporal Comparison of Benthic Endpoints at SDLT12 Over Mine Baseline (2007) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

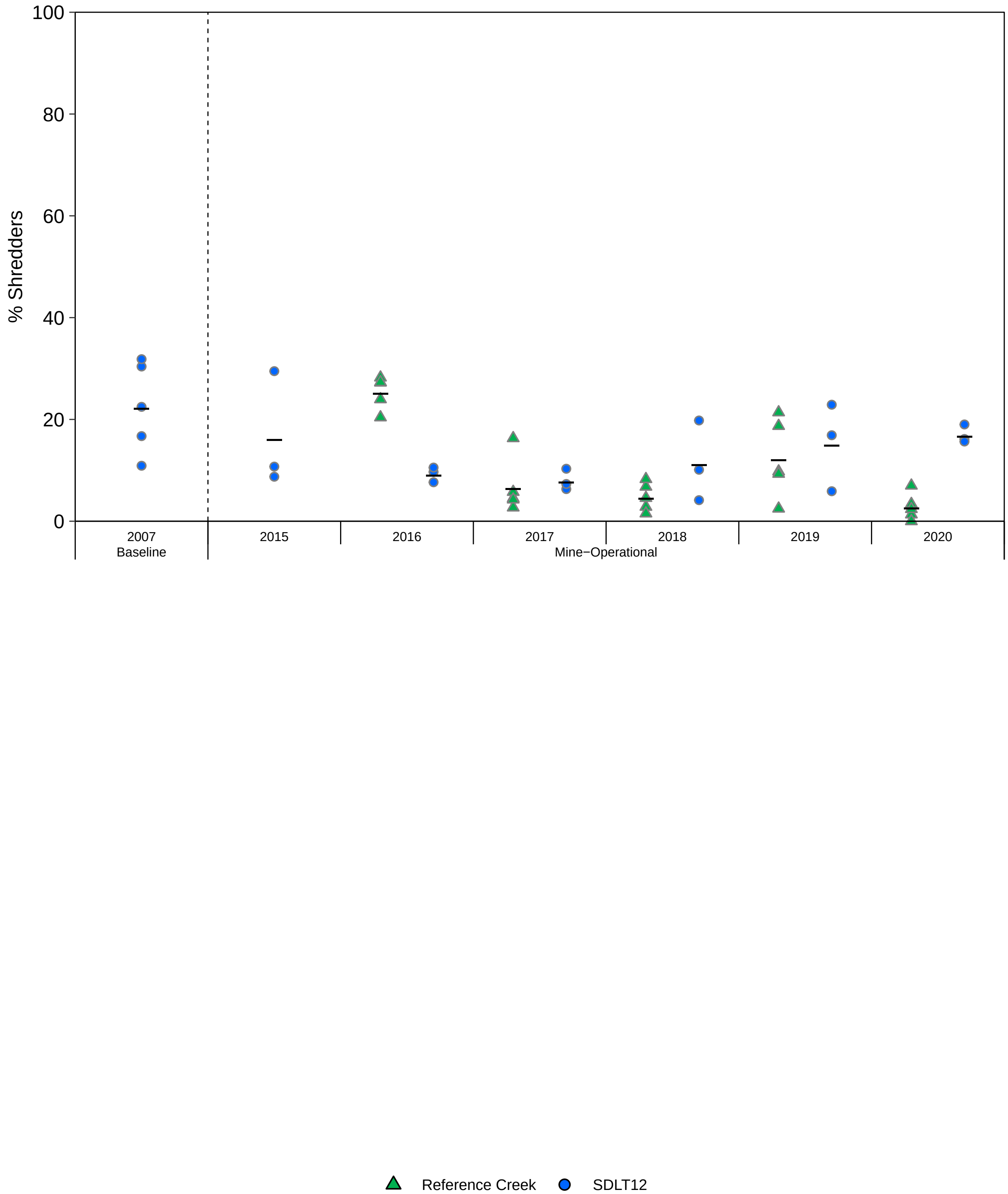


Figure F.8: Temporal Comparison of Benthic Endpoints at SDLT12 Over Mine Baseline (2007) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

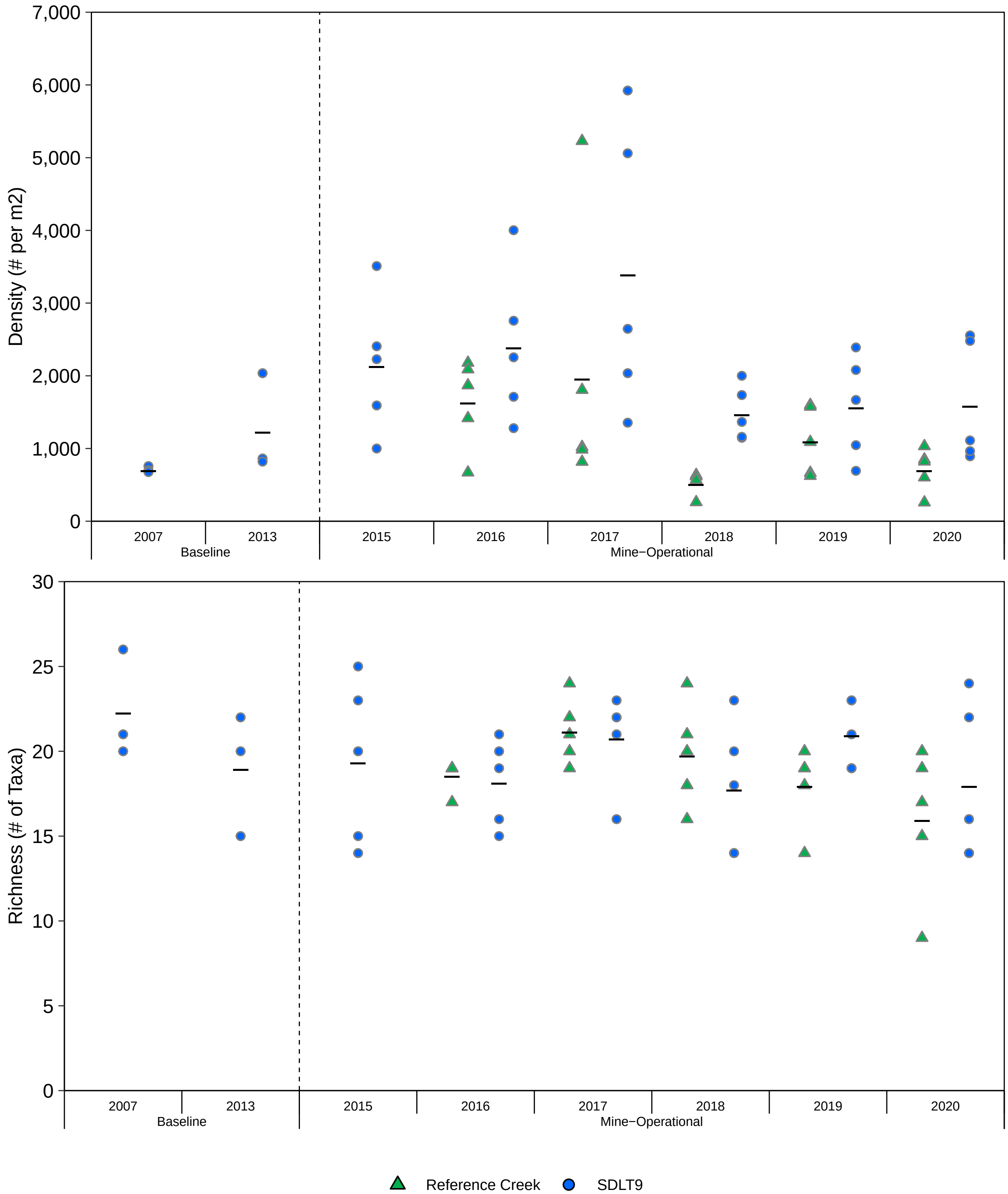


Figure F.9: Temporal Comparison of Benthic Endpoints at SDLT9 Over Mine Baseline (2007 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

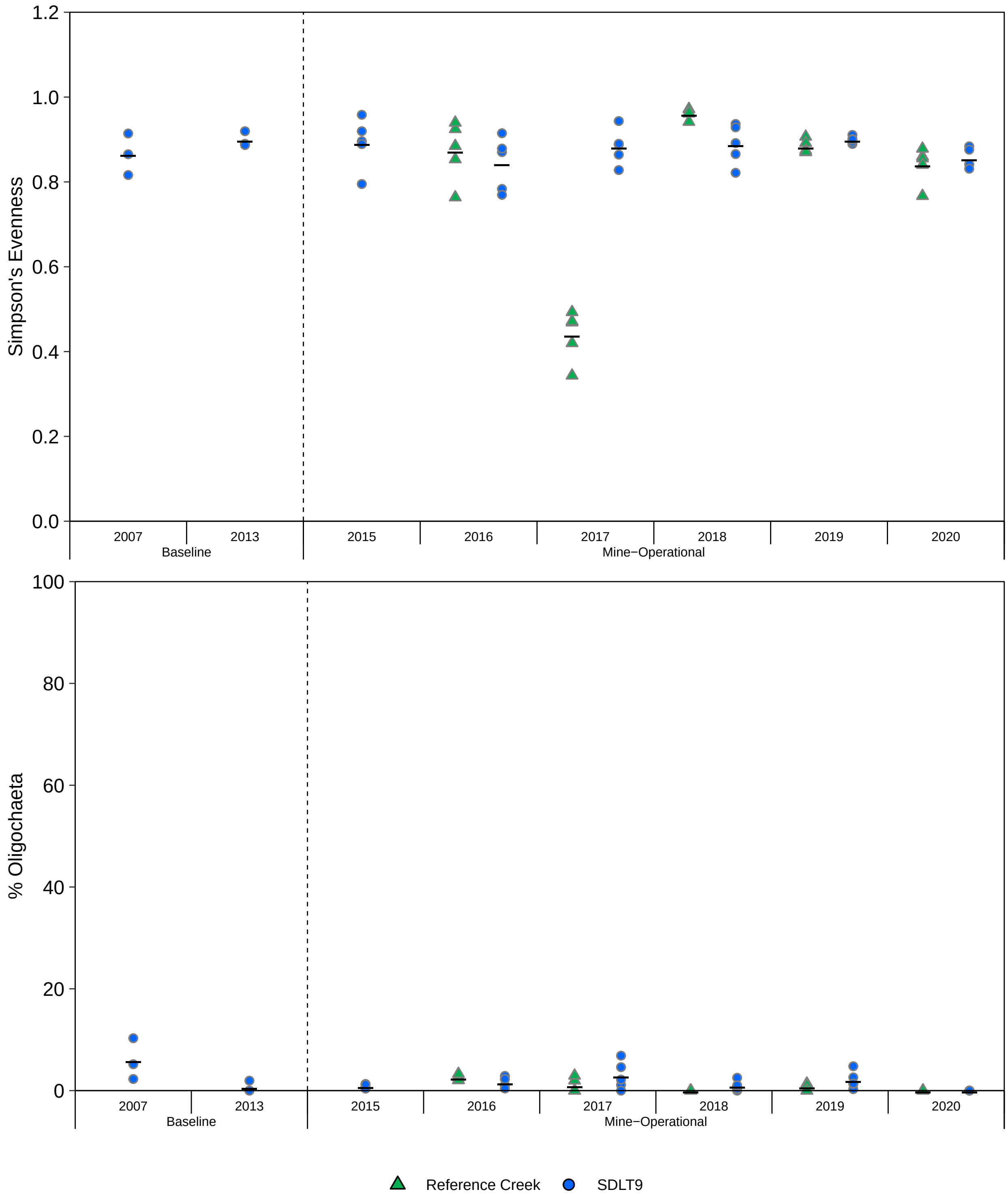


Figure F.9: Temporal Comparison of Benthic Endpoints at SDLT9 Over Mine Baseline (2007 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

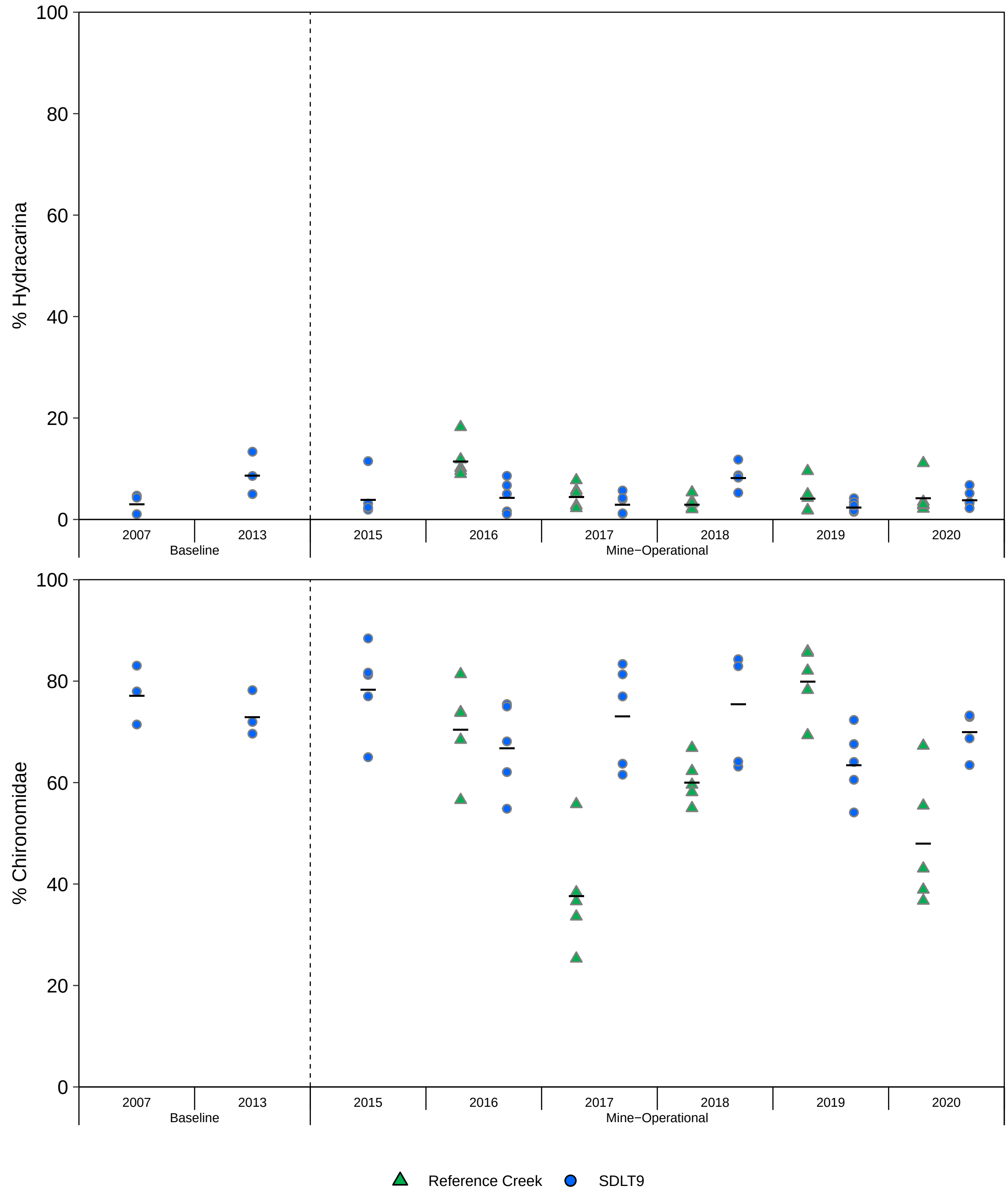


Figure F.9: Temporal Comparison of Benthic Endpoints at SDLT9 Over Mine Baseline (2007 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

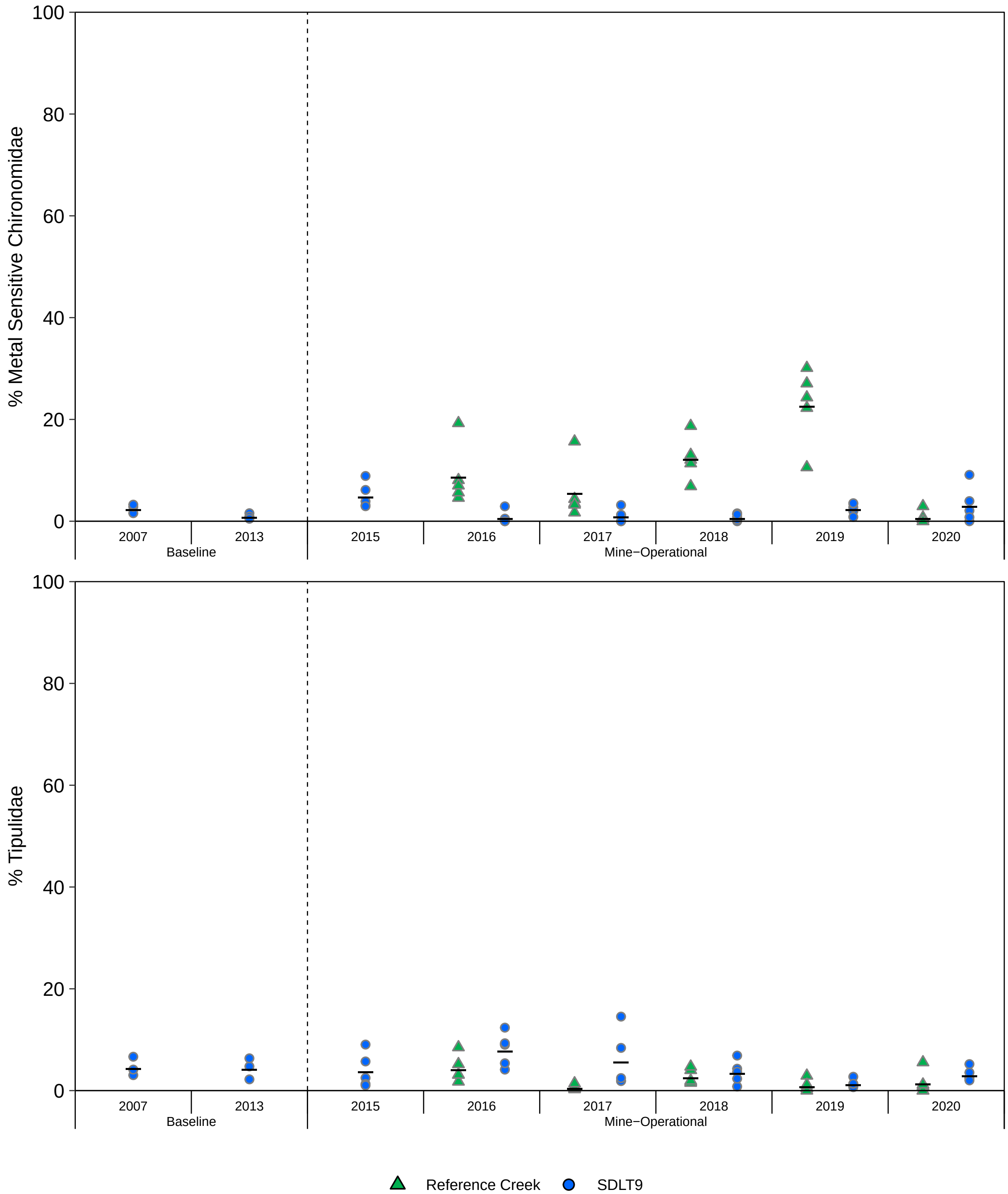


Figure F.9: Temporal Comparison of Benthic Endpoints at SDLT9 Over Mine Baseline (2007 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

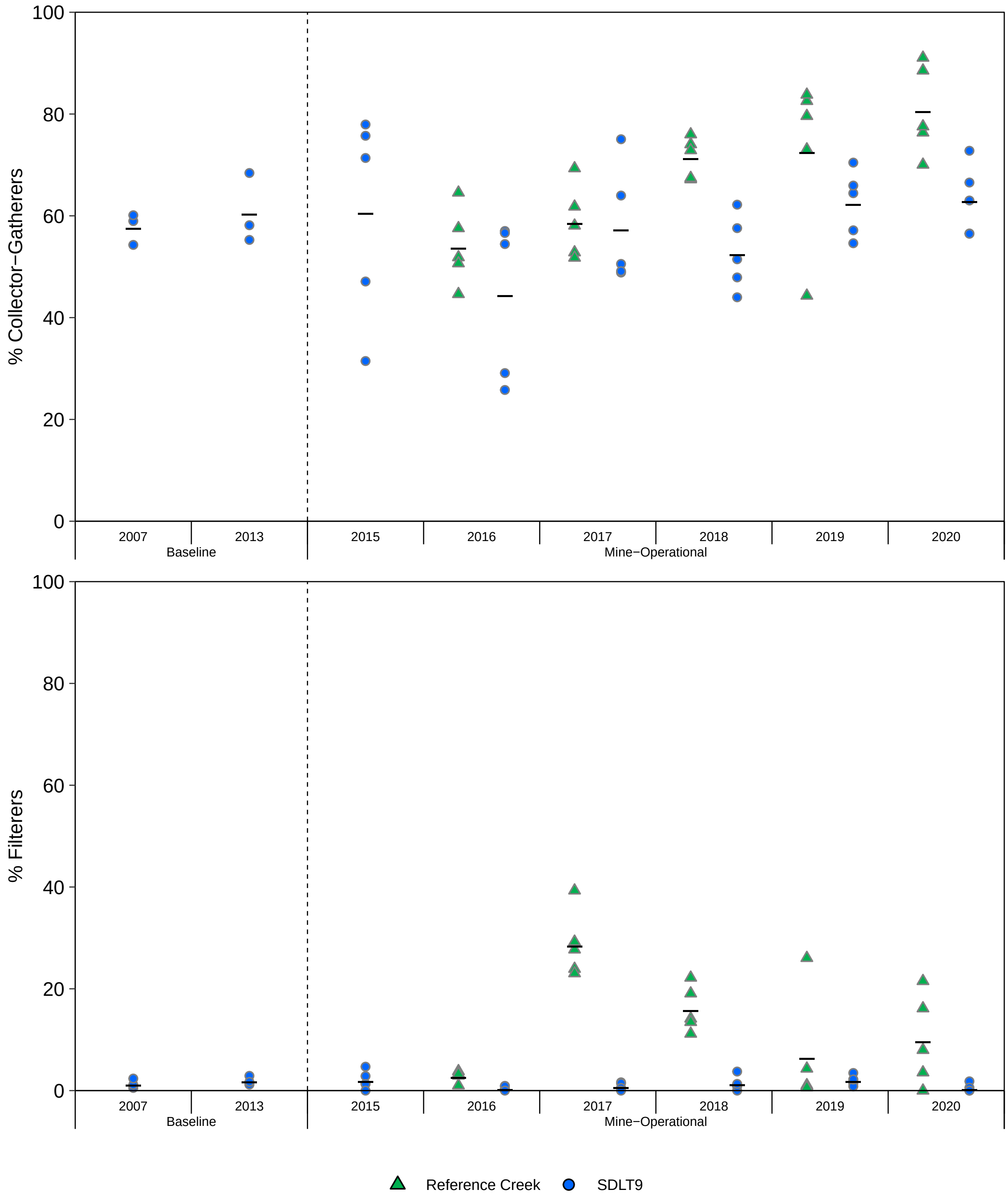


Figure F.9: **Temporal Comparison of Benthic Endpoints at SDLT9 Over Mine Baseline (2007 to 2013) and Operations (2015 to 2020) Periods**

Note: Black bars indicate average of replicates.

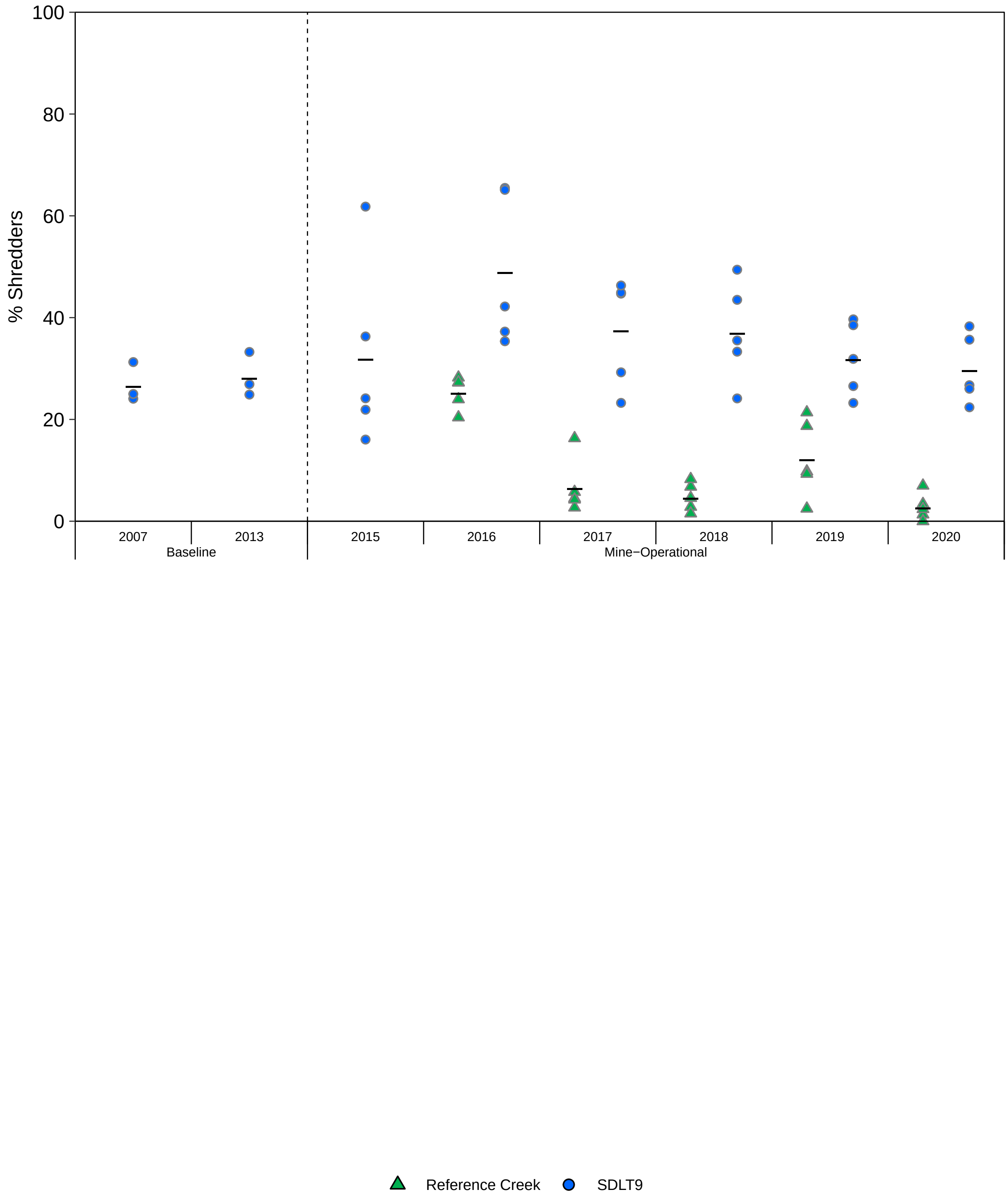


Figure F.9: Temporal Comparison of Benthic Endpoints at SDLT9 Over Mine Baseline (2007 to 2013) and Operations (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

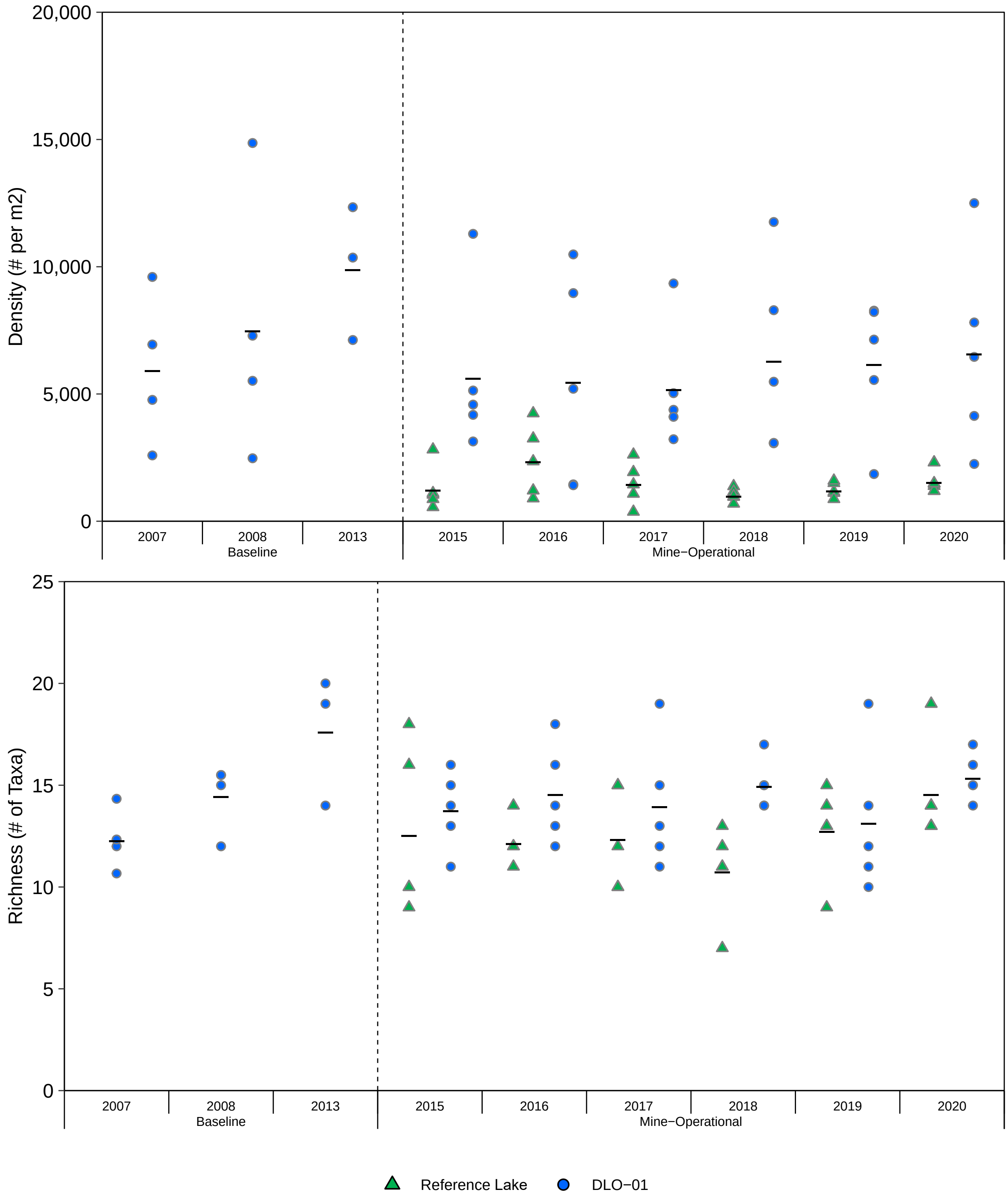


Figure F.10: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Littoral Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

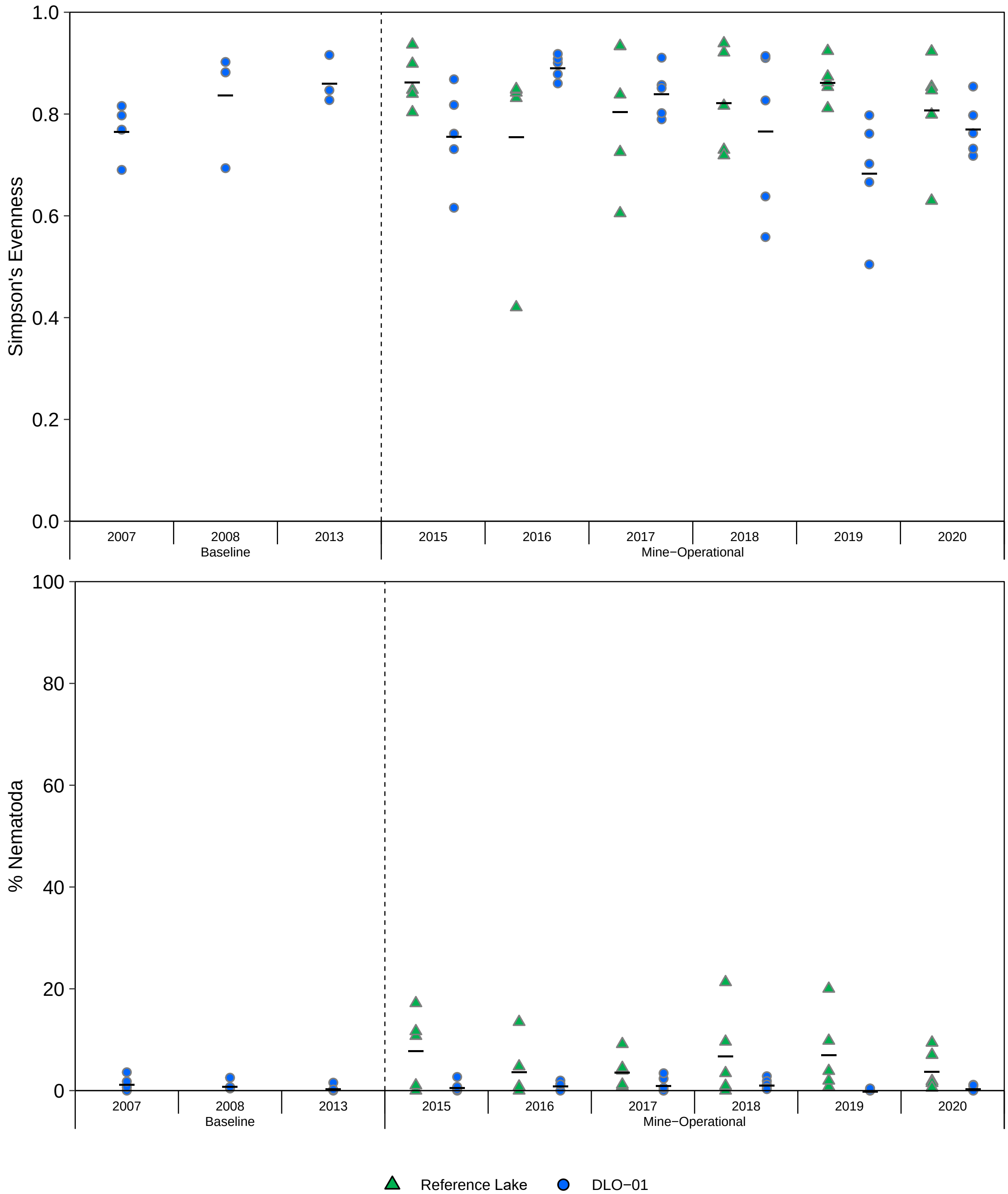


Figure F.10: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Littoral Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

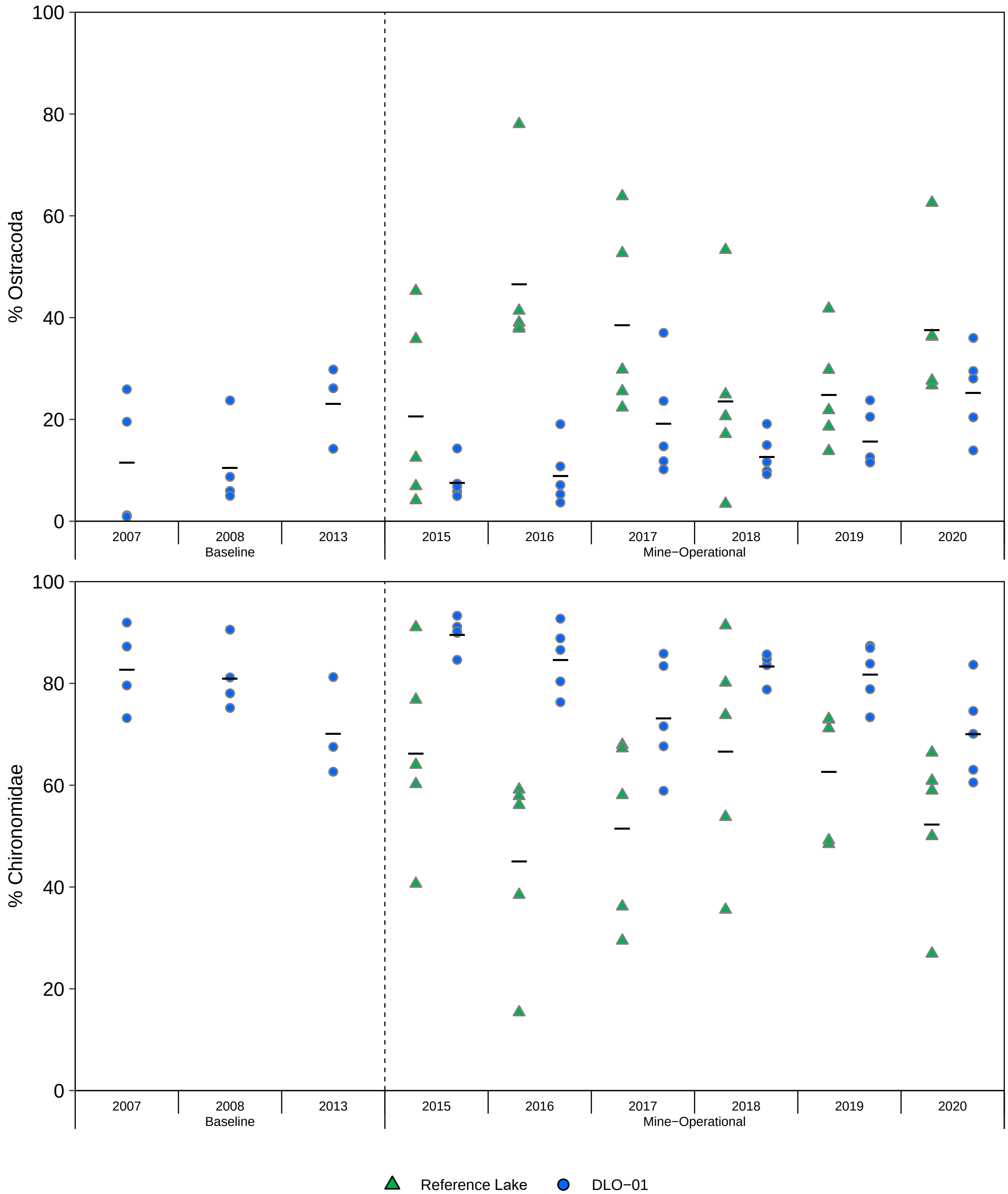


Figure F.10: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Littoral Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

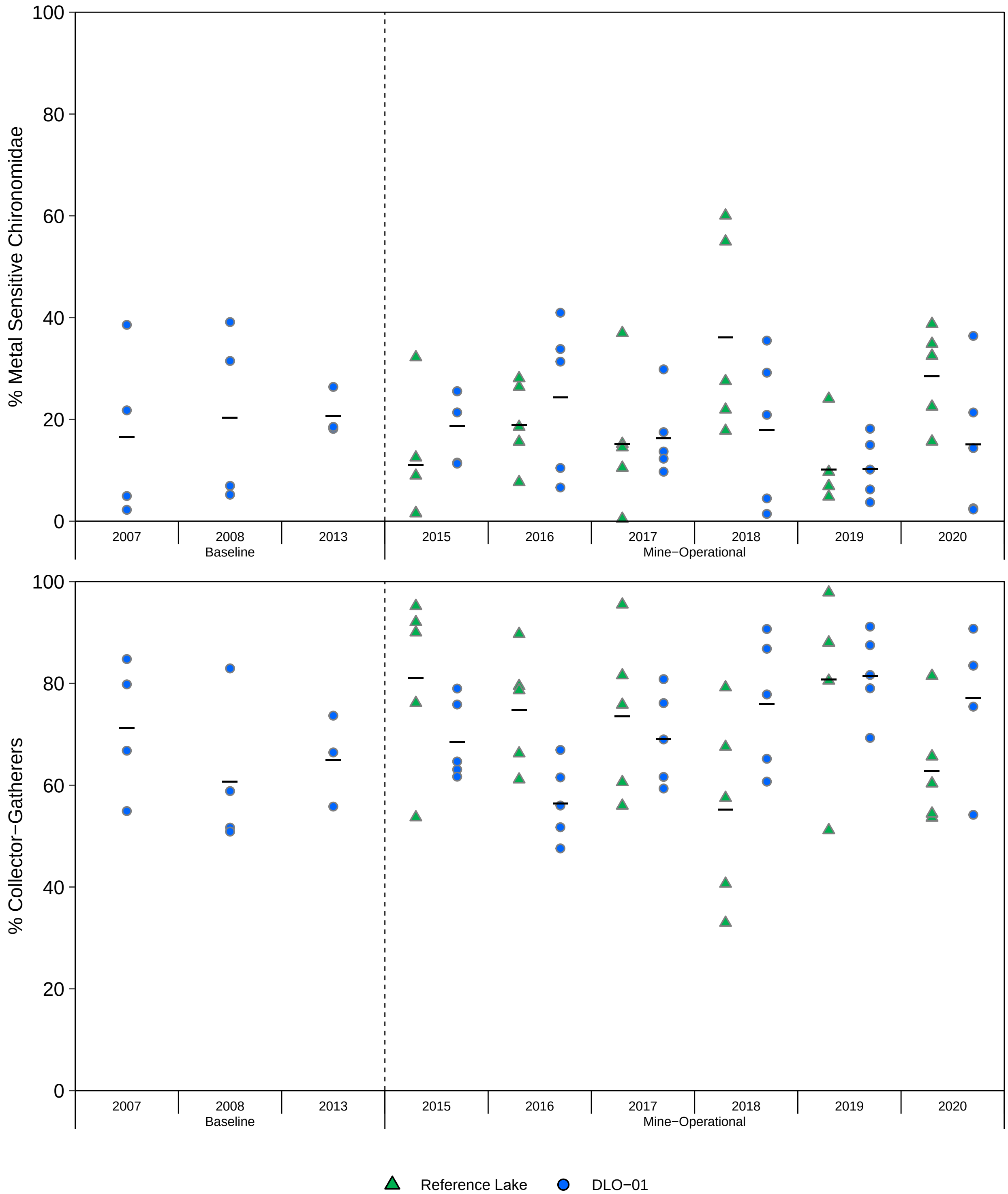


Figure F.10: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Littoral Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

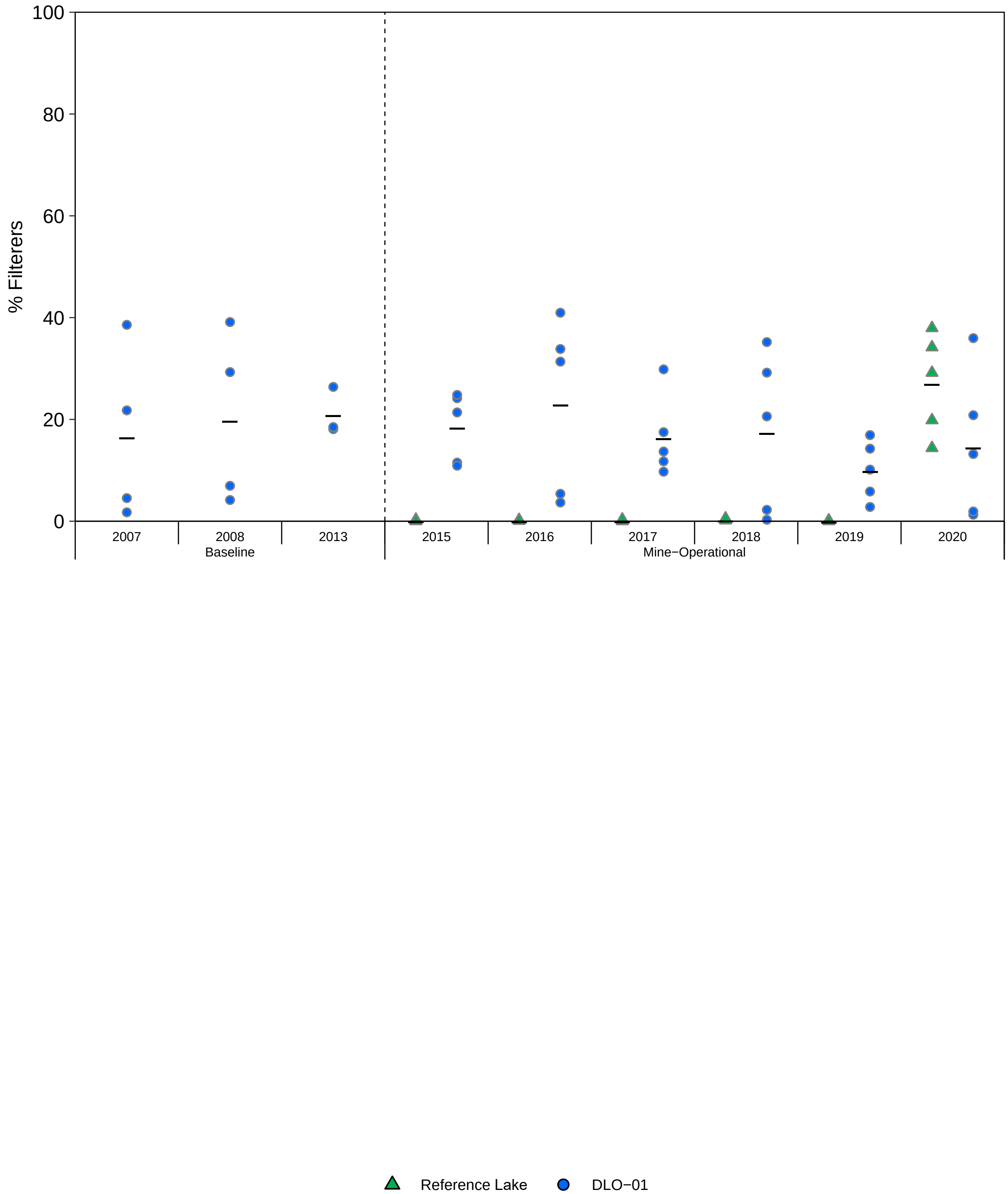


Figure F.10: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Littoral Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

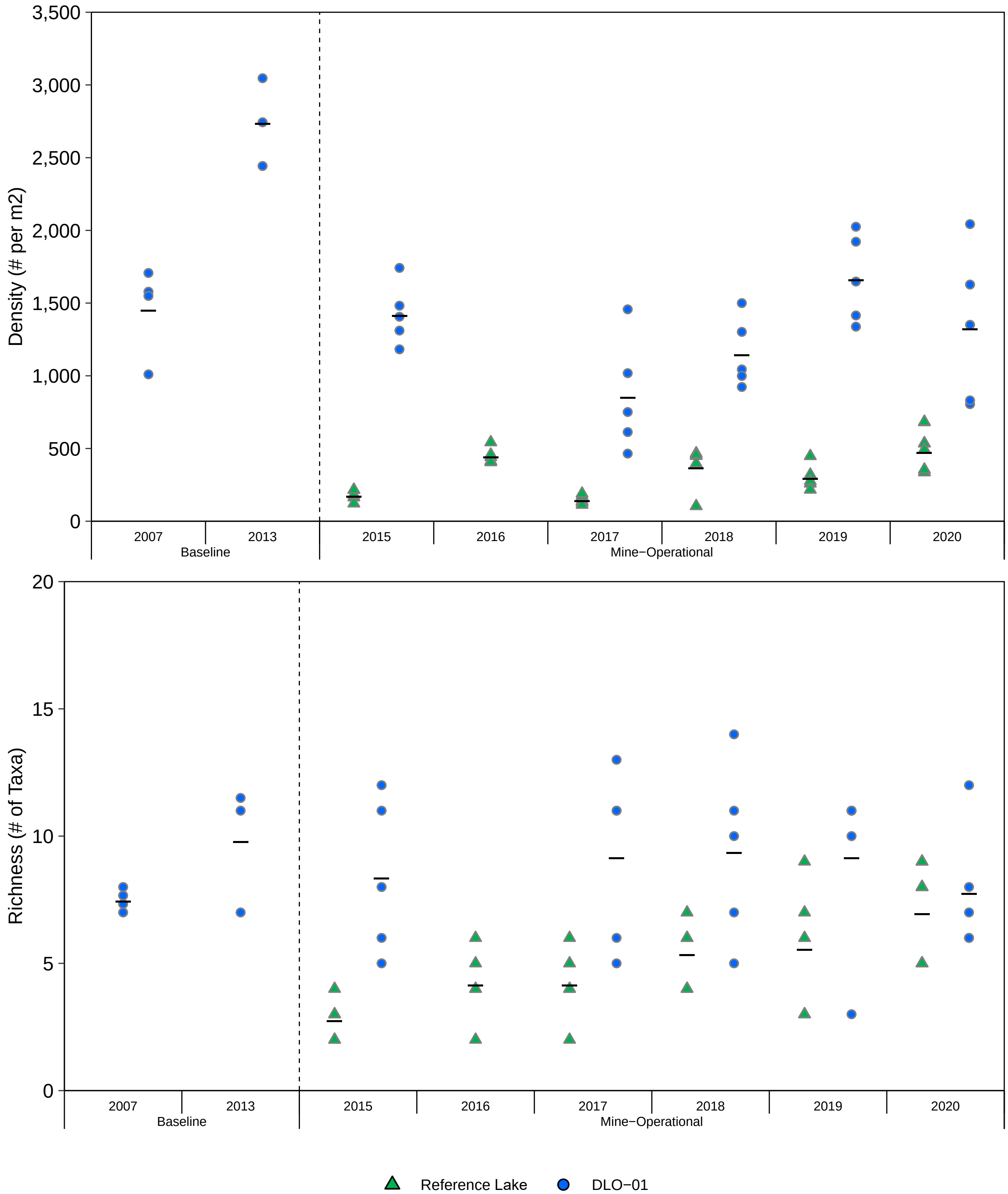


Figure F.11: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

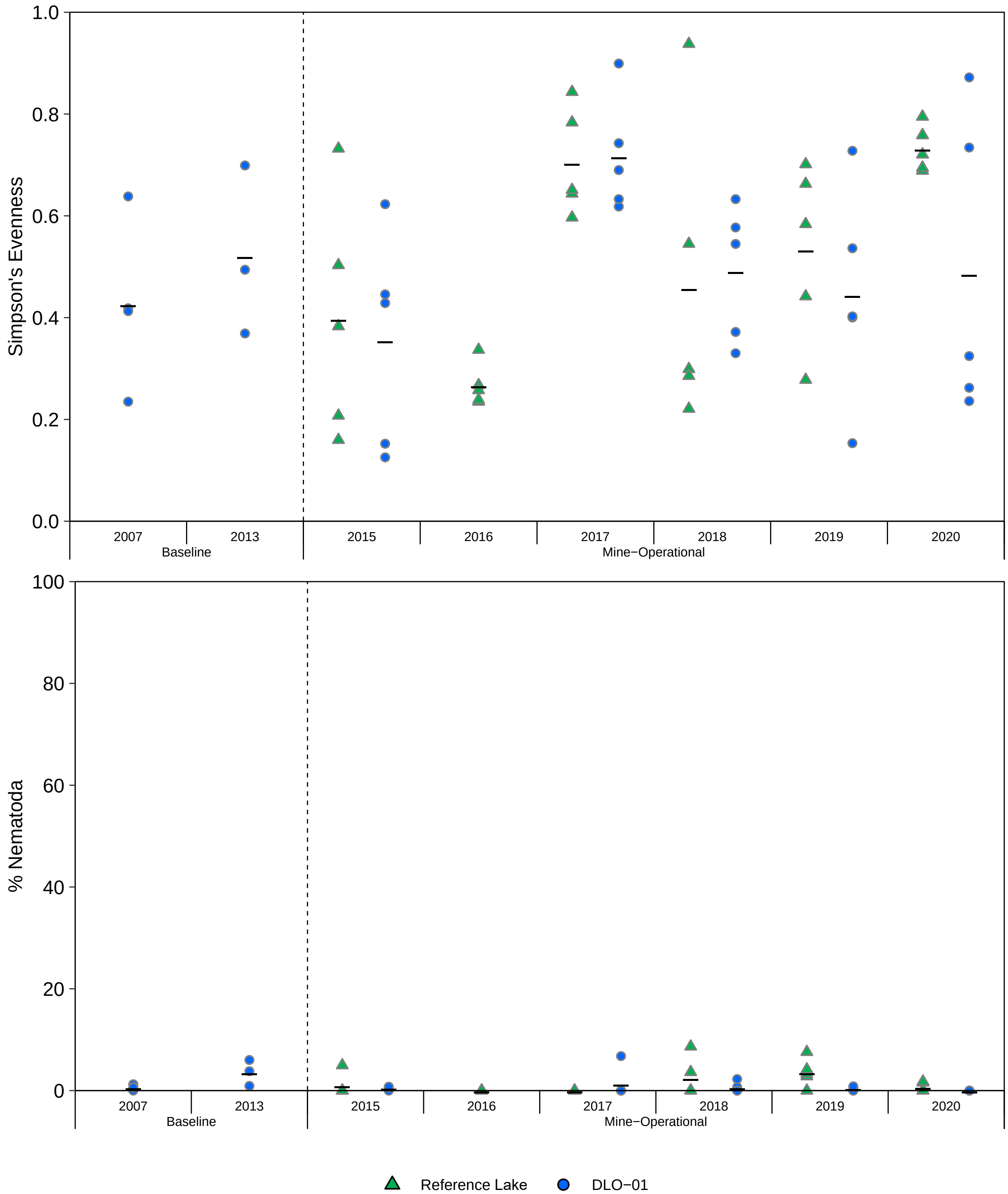


Figure F.11: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

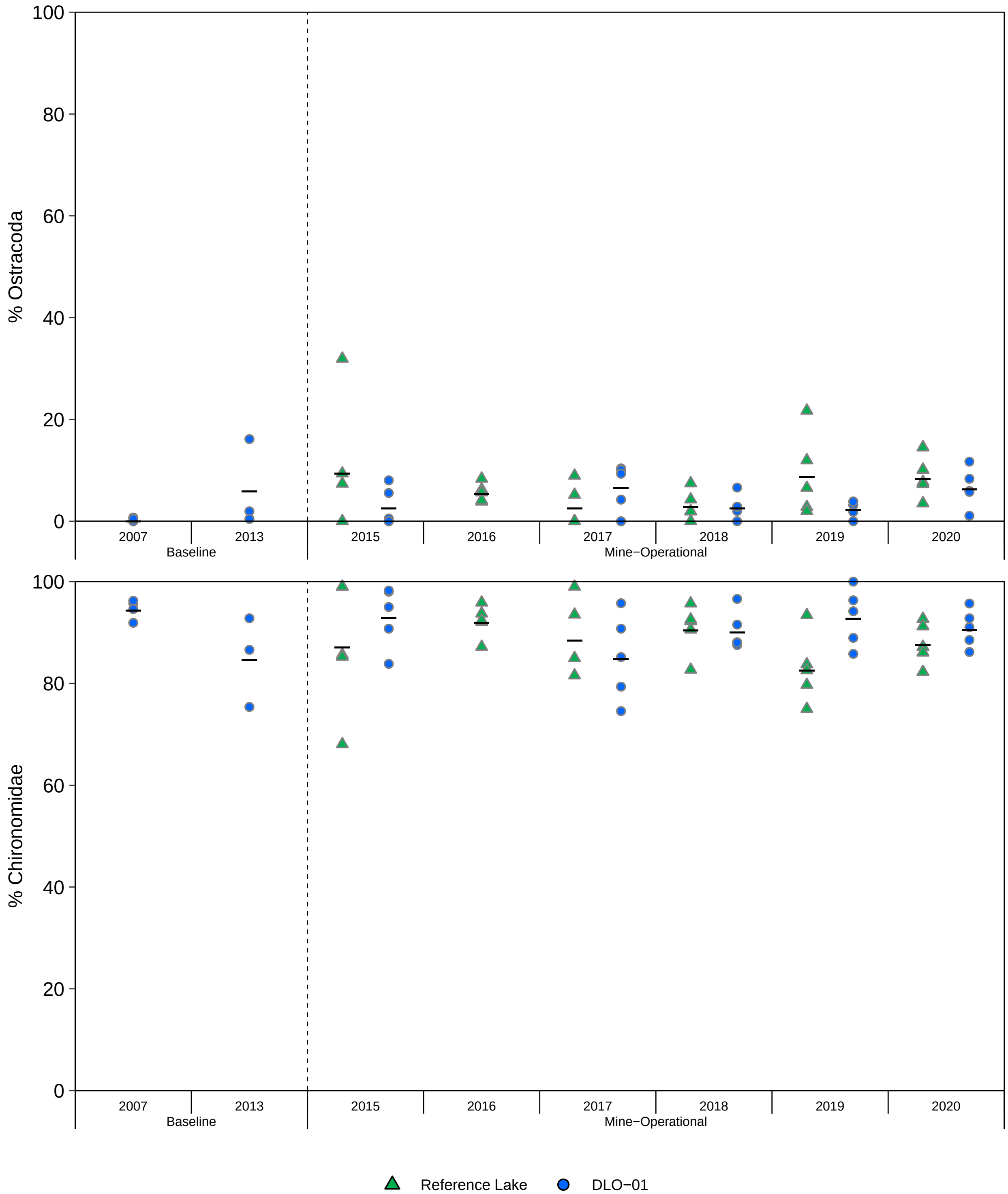


Figure F.11: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

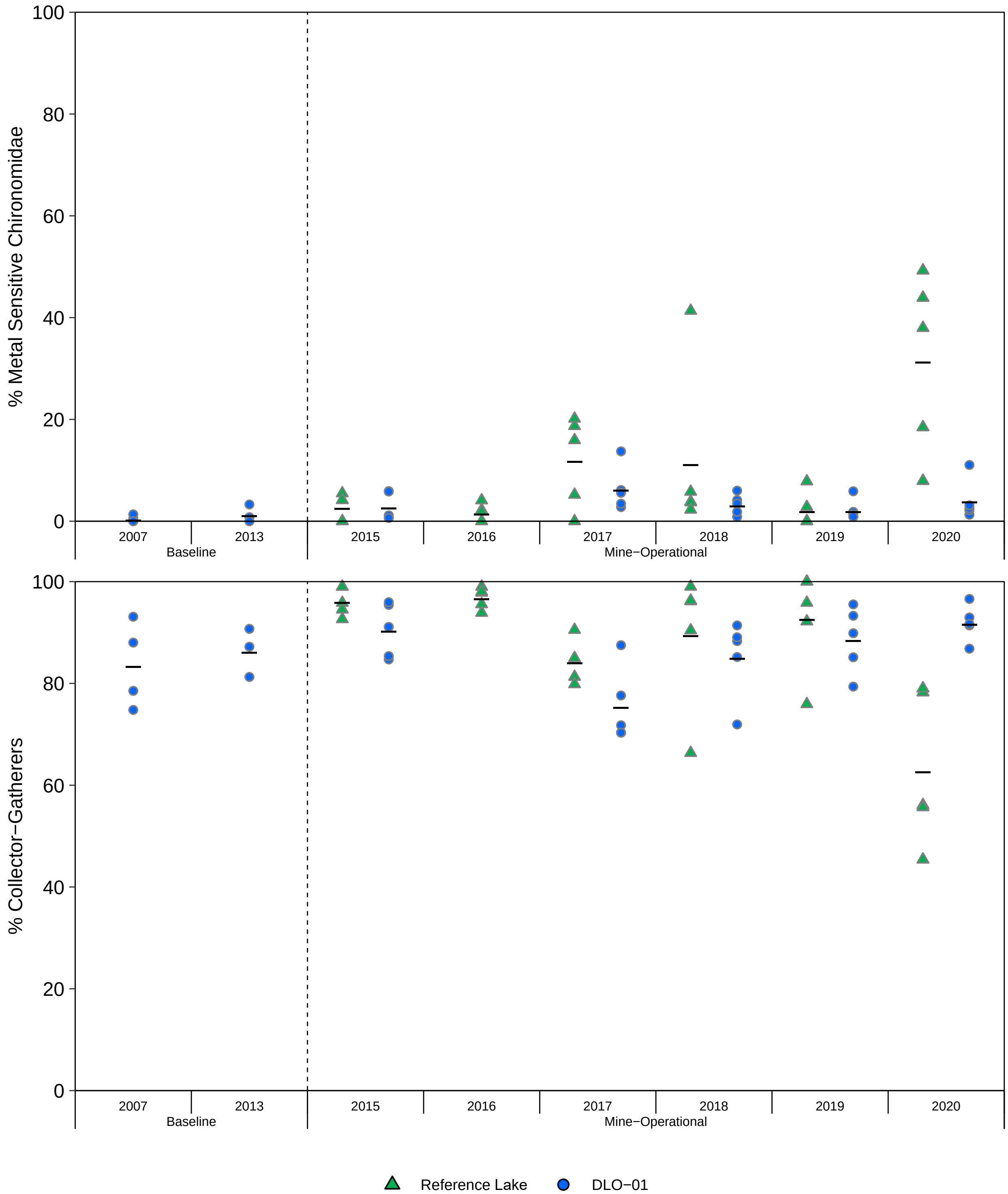


Figure F.11: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

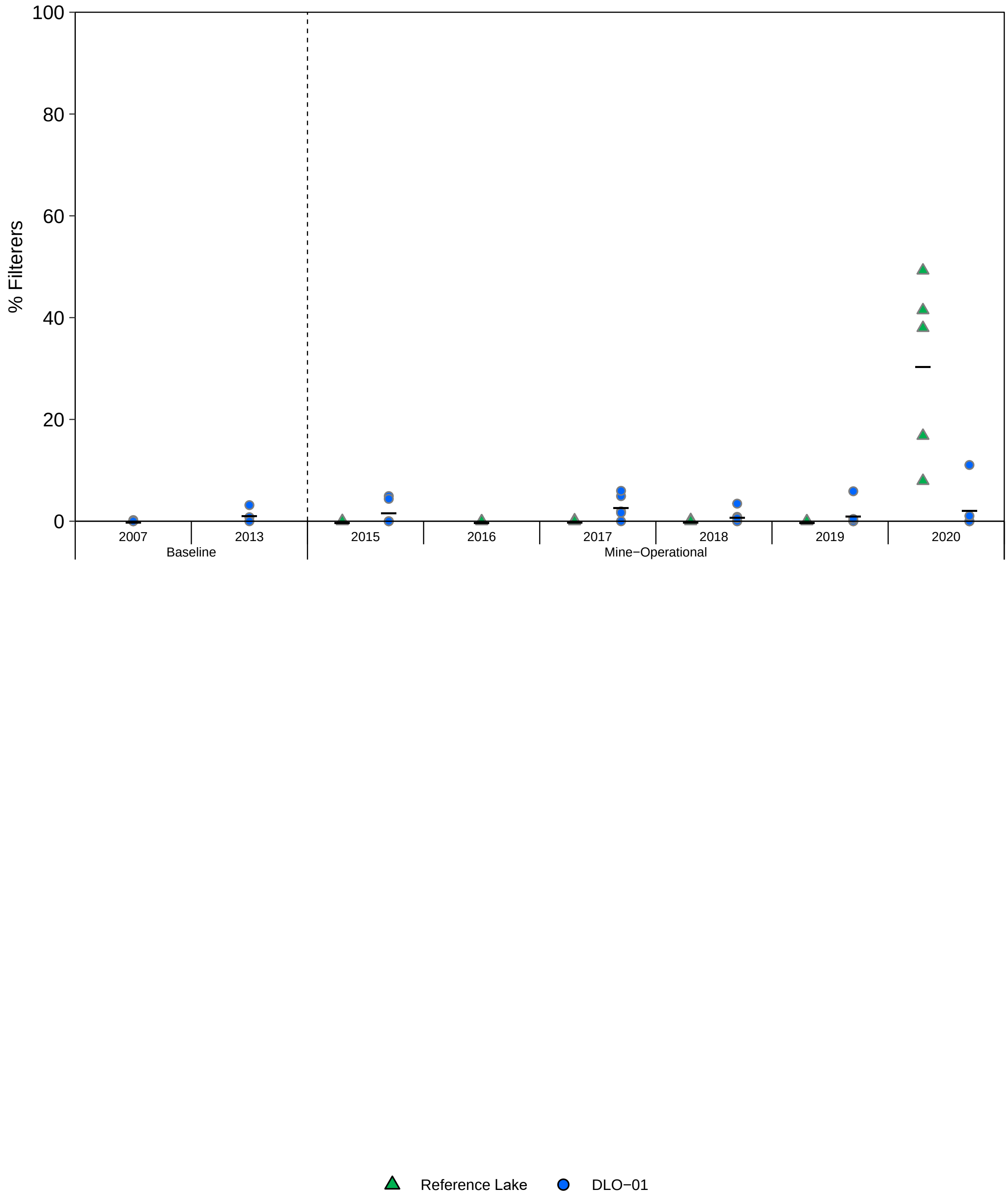


Figure F.11: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake NW (DL0−1) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

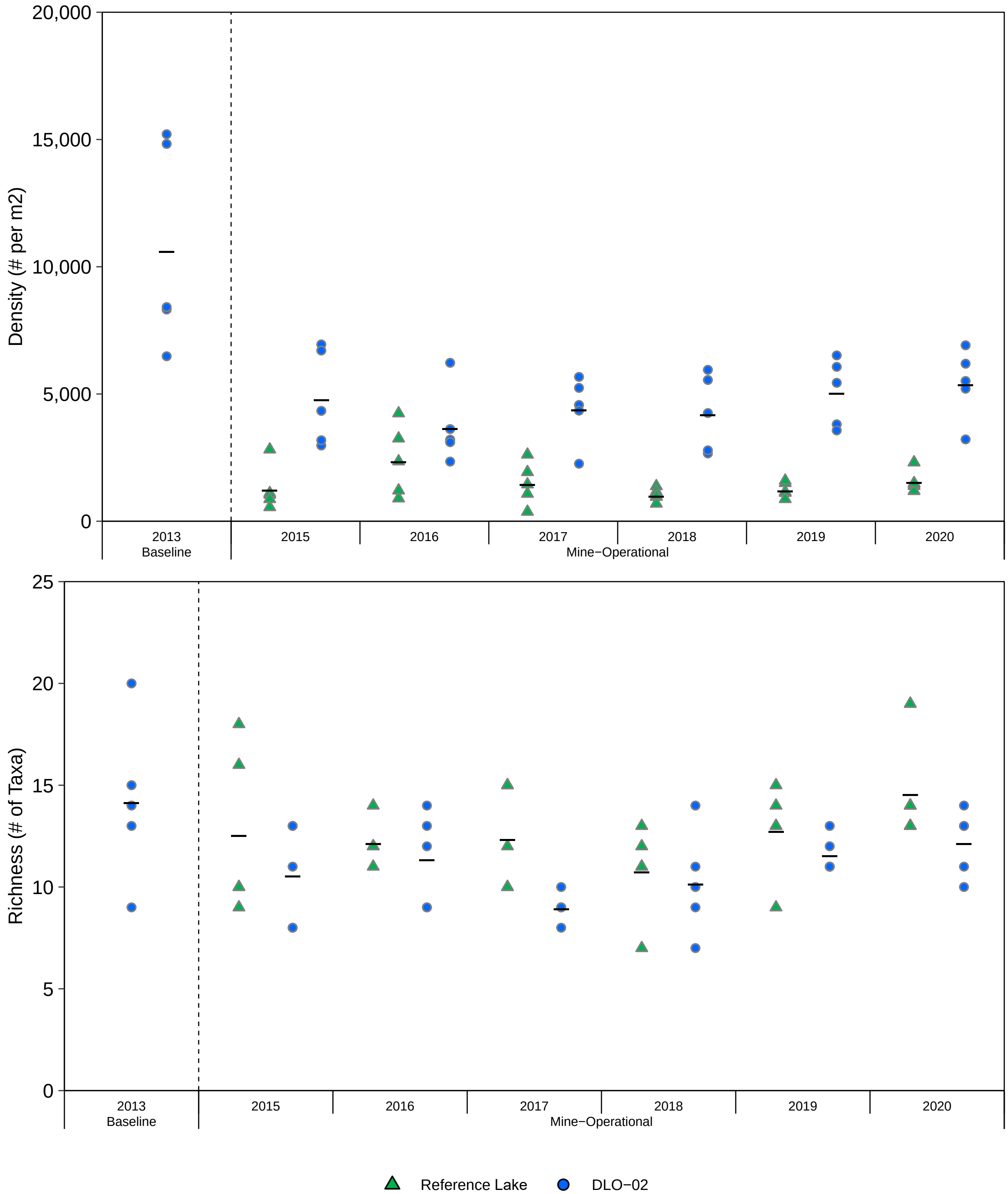


Figure F.12: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

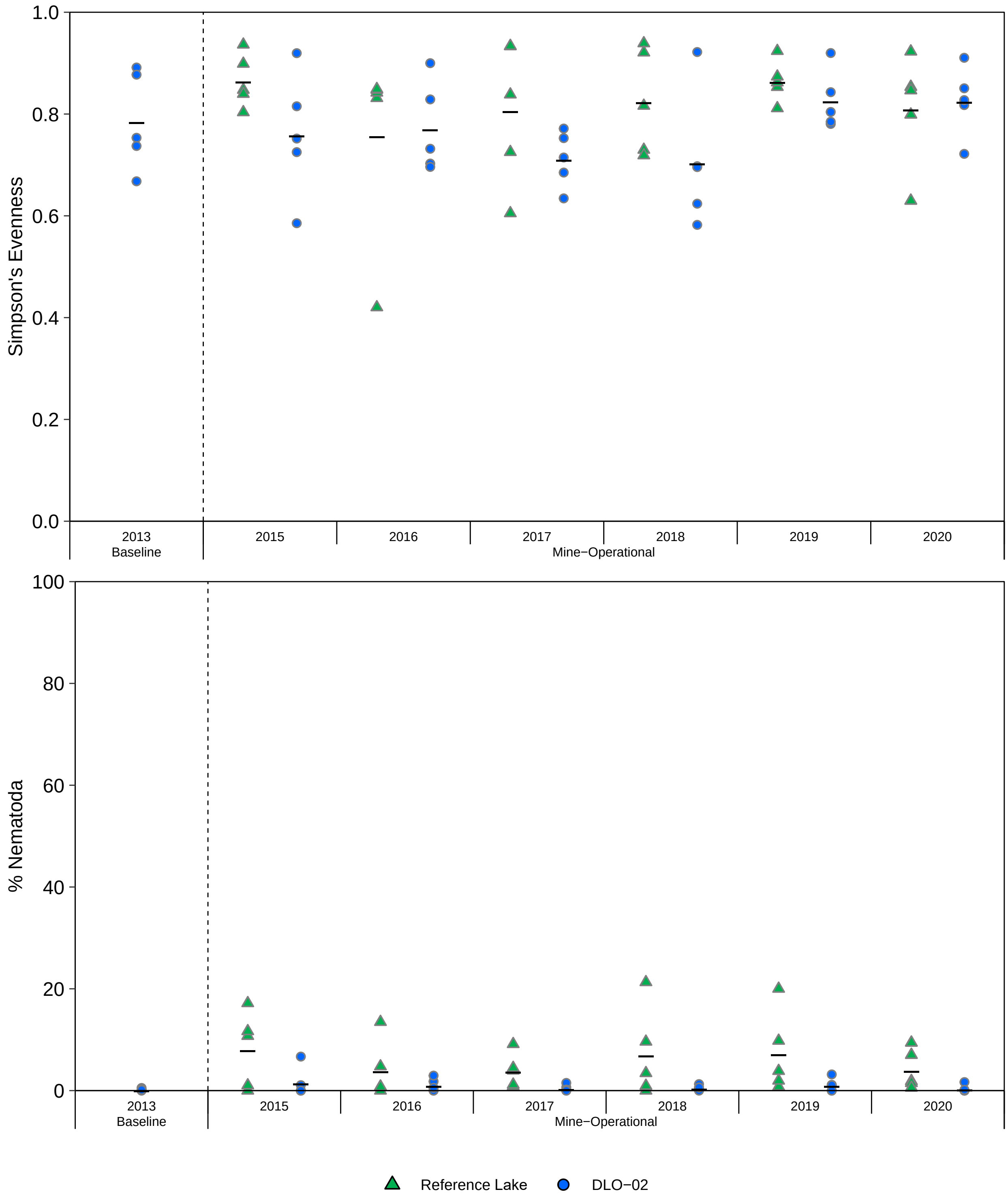


Figure F.12: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

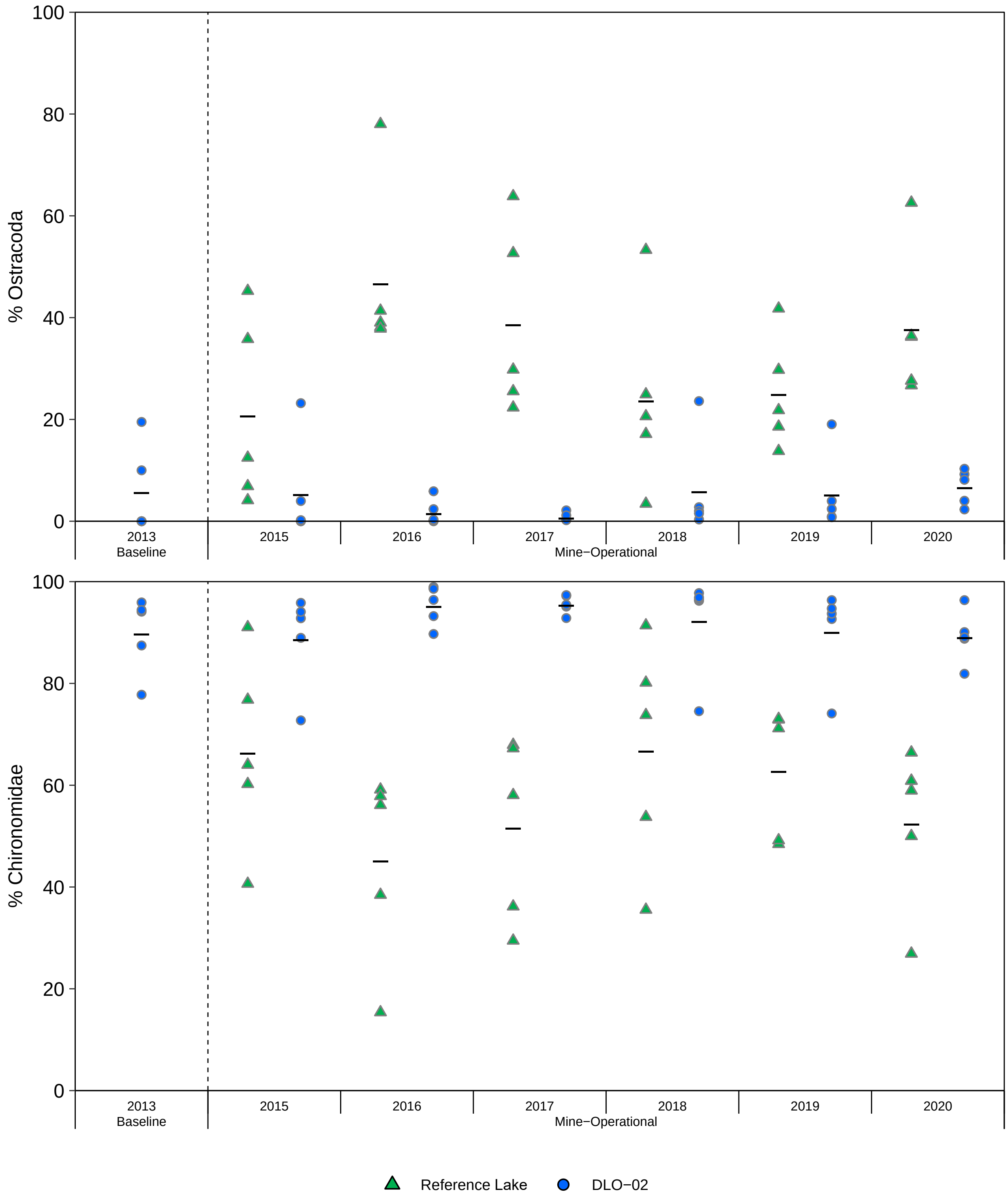


Figure F.12: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

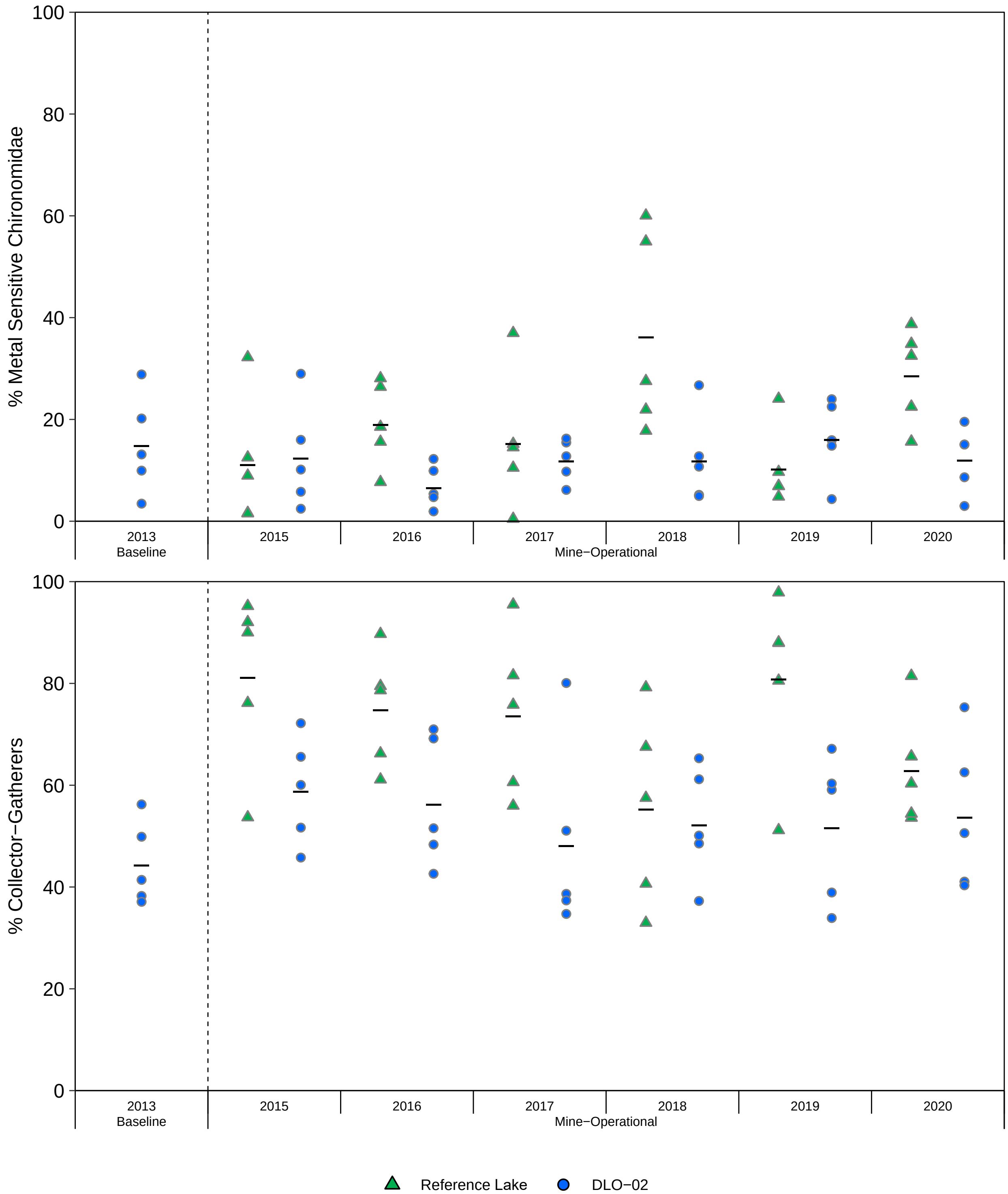


Figure F.12: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

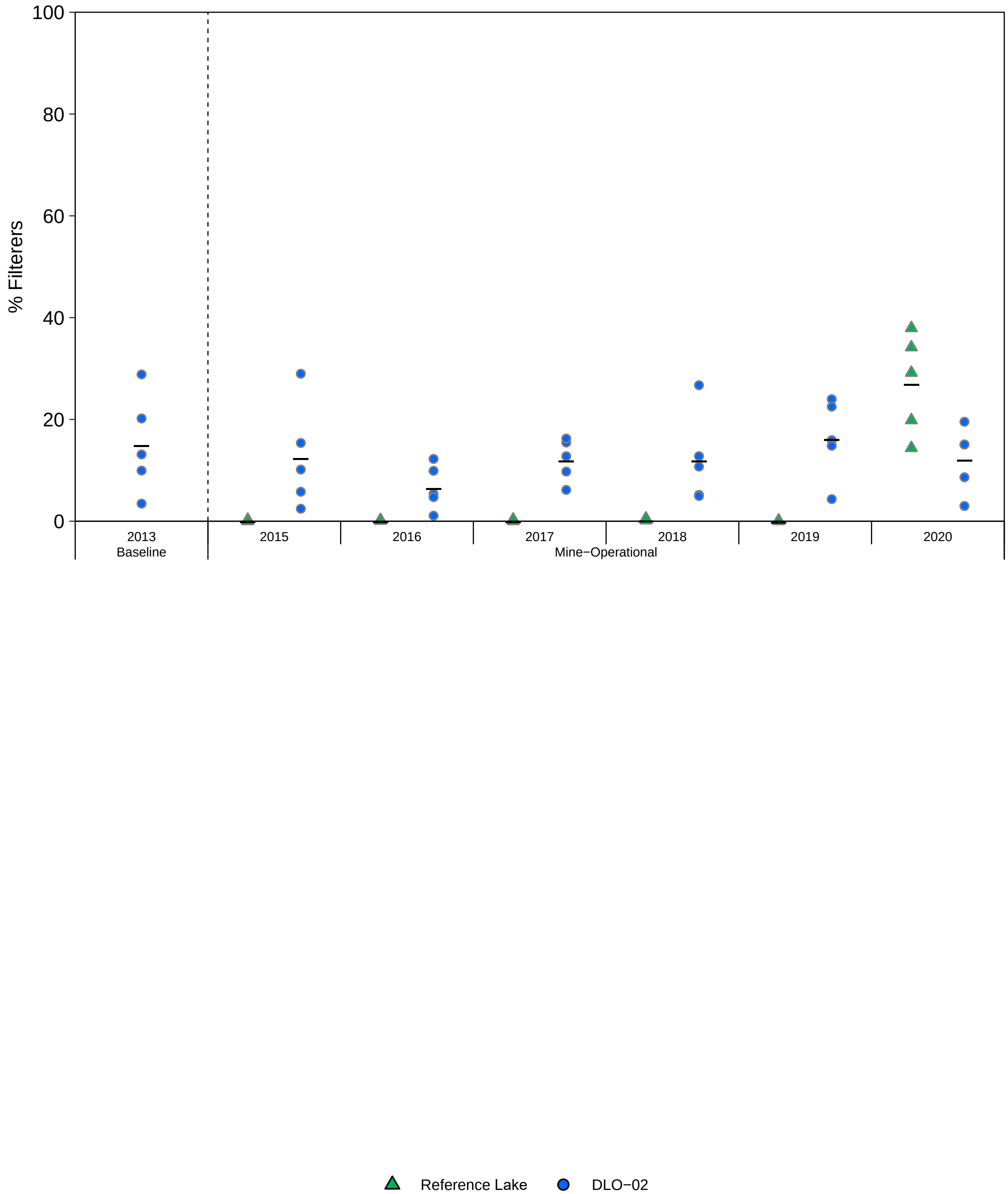


Figure F.12: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Littoral Habitat Stations among Mine Baseline (2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

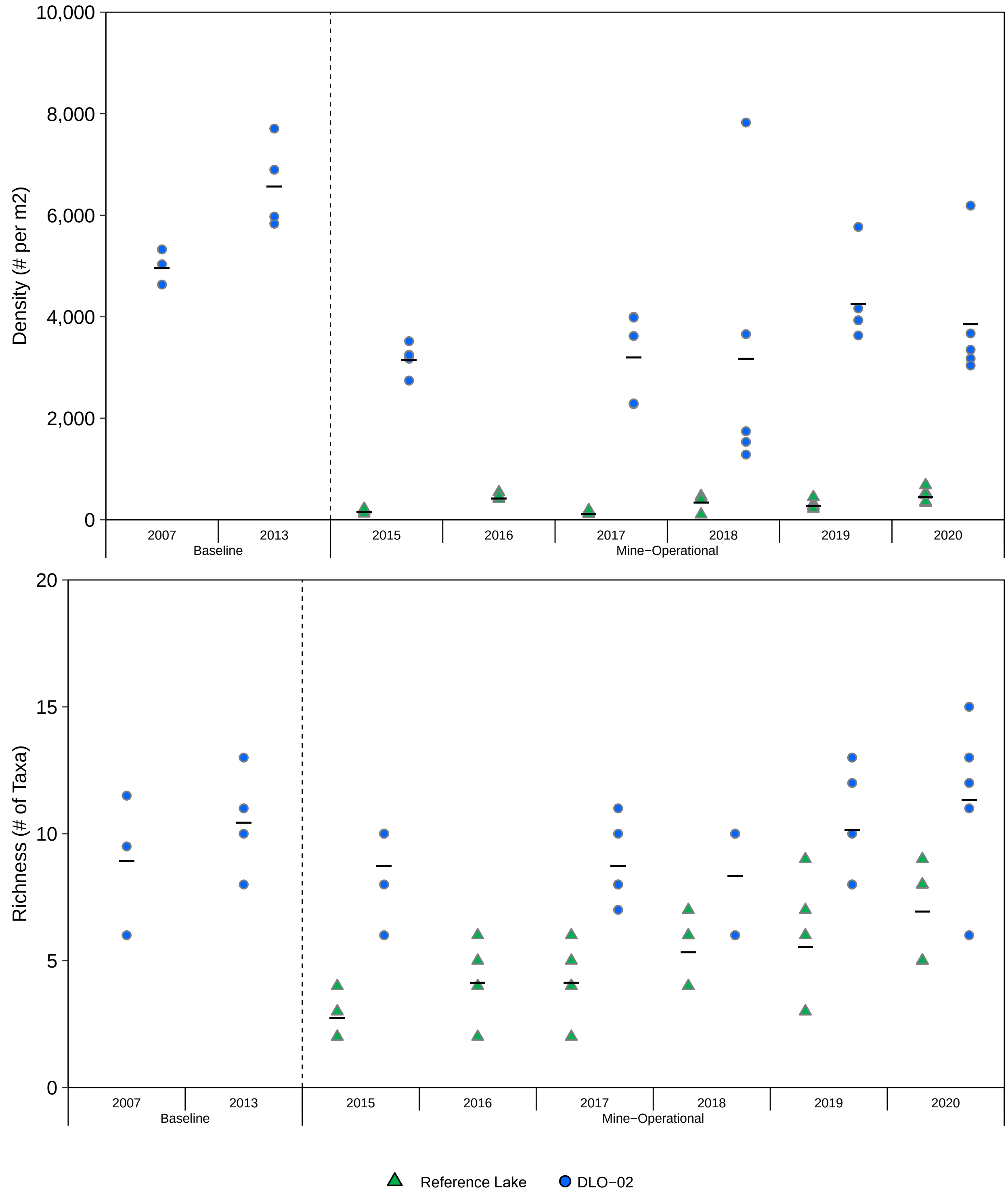


Figure F.13: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

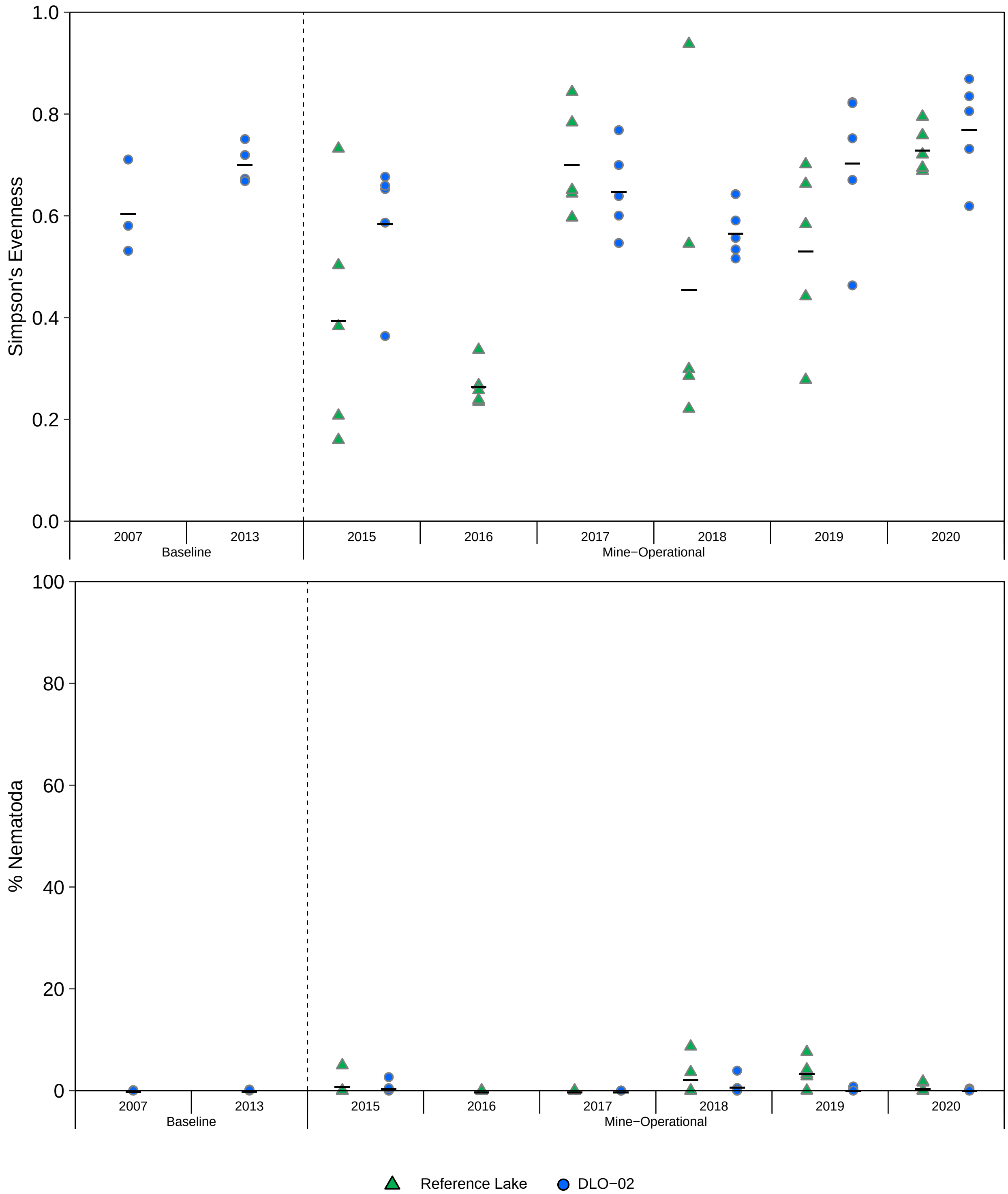


Figure F.13: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

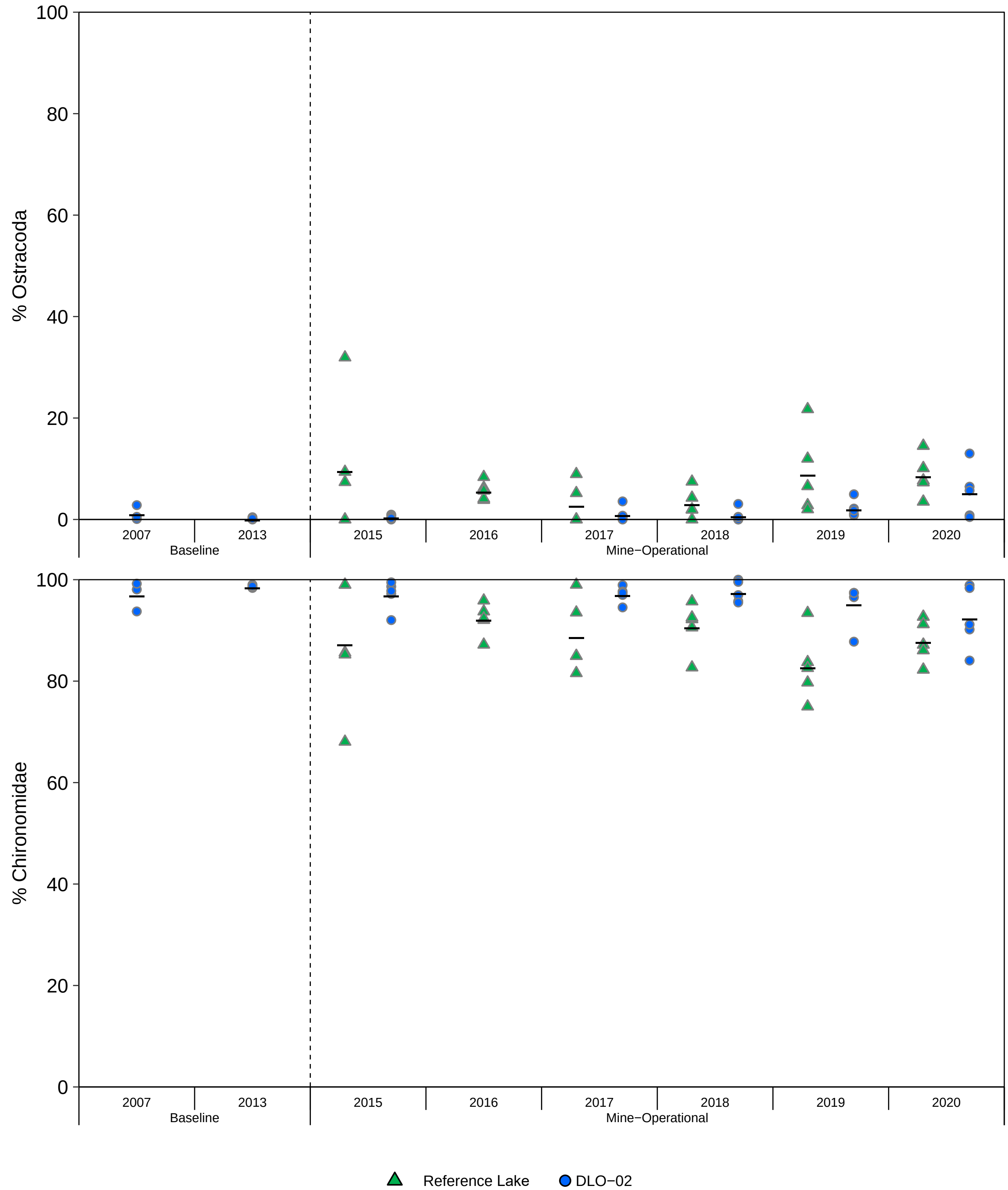


Figure F.13: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

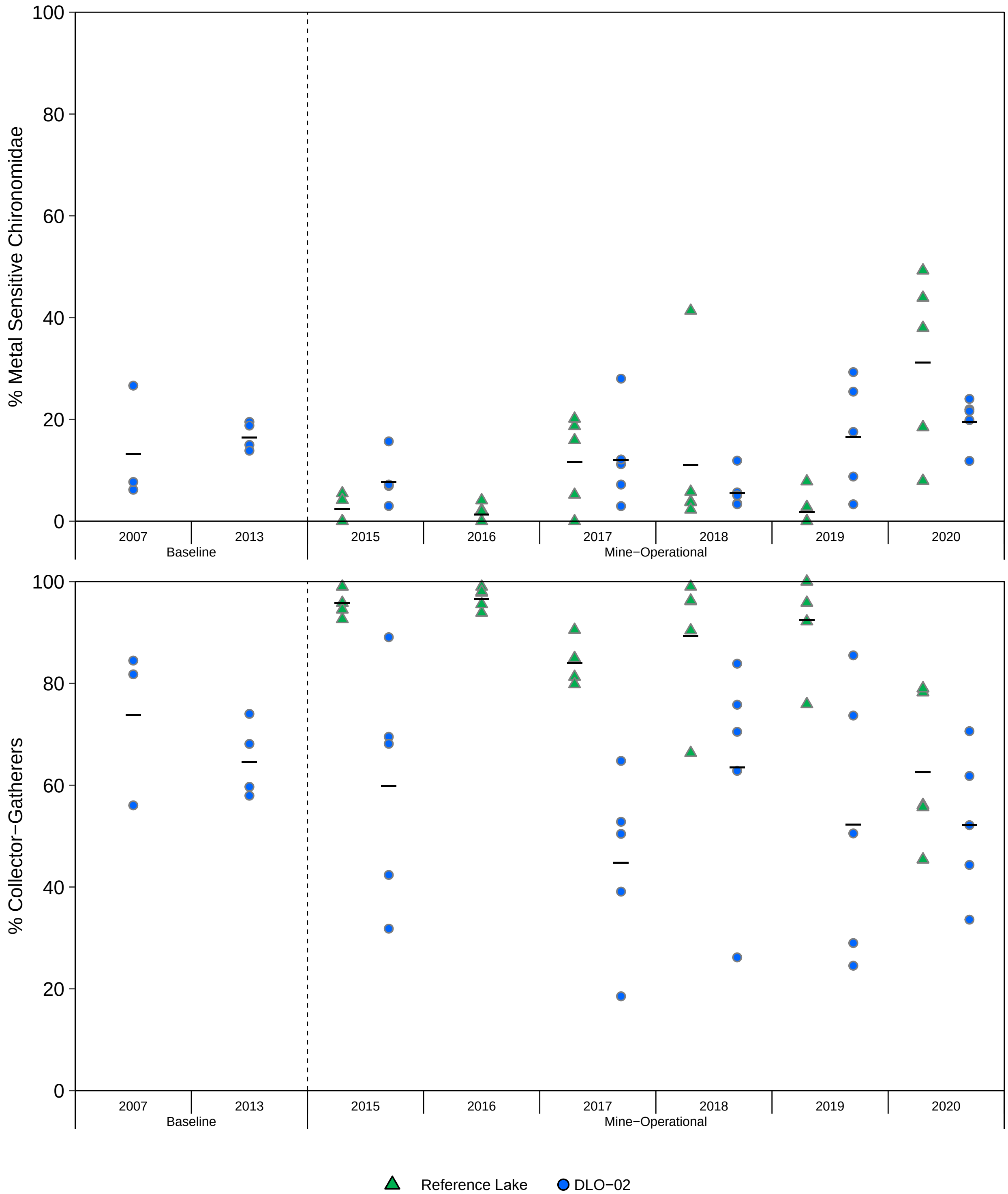


Figure F.13: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

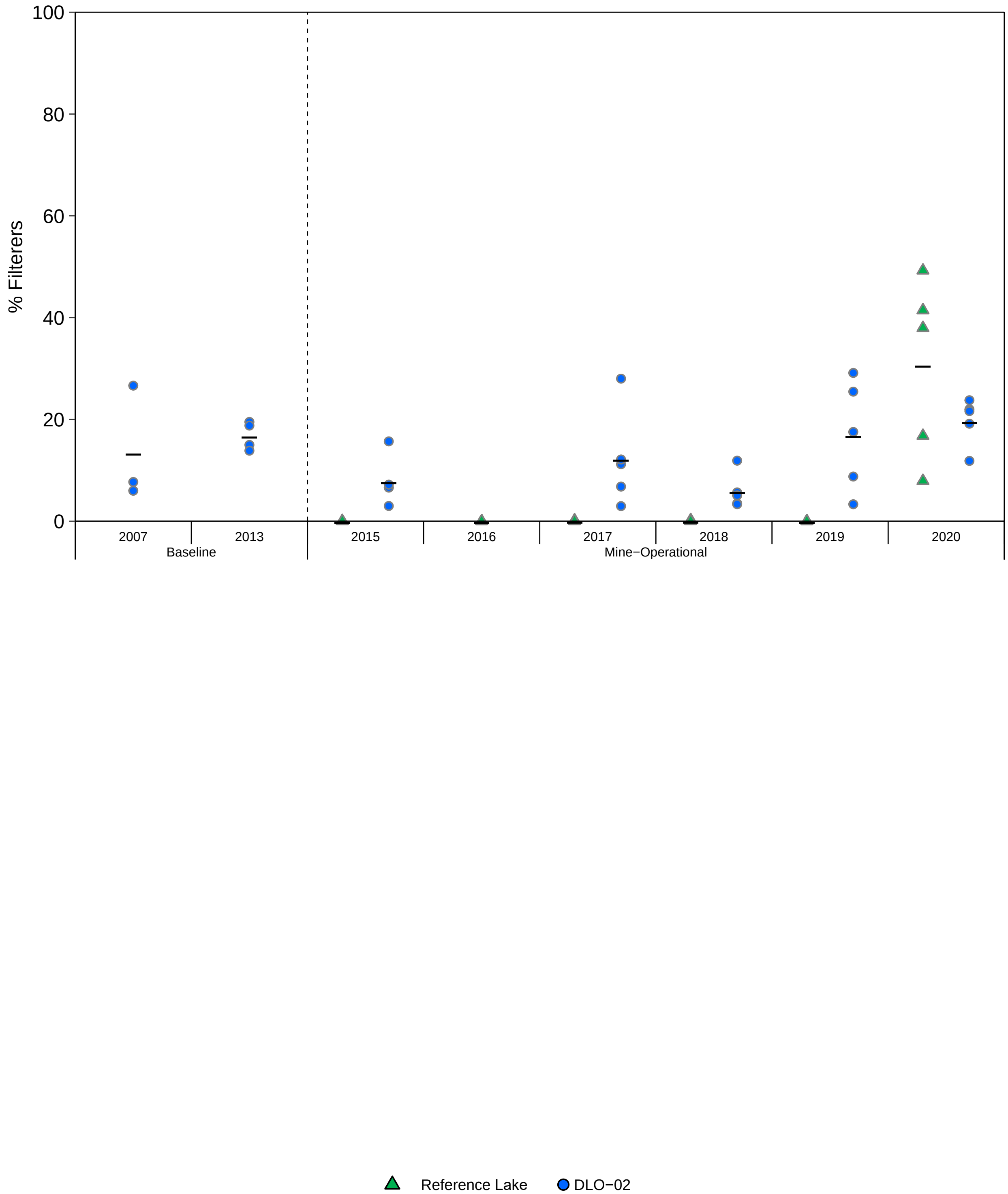


Figure F.13: Comparison of Key Benthic Invertebrate Community Metrics at Sheardown Lake SE (DL0−2) Profundal Habitat Stations among Mine Baseline (2007 to 2013) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

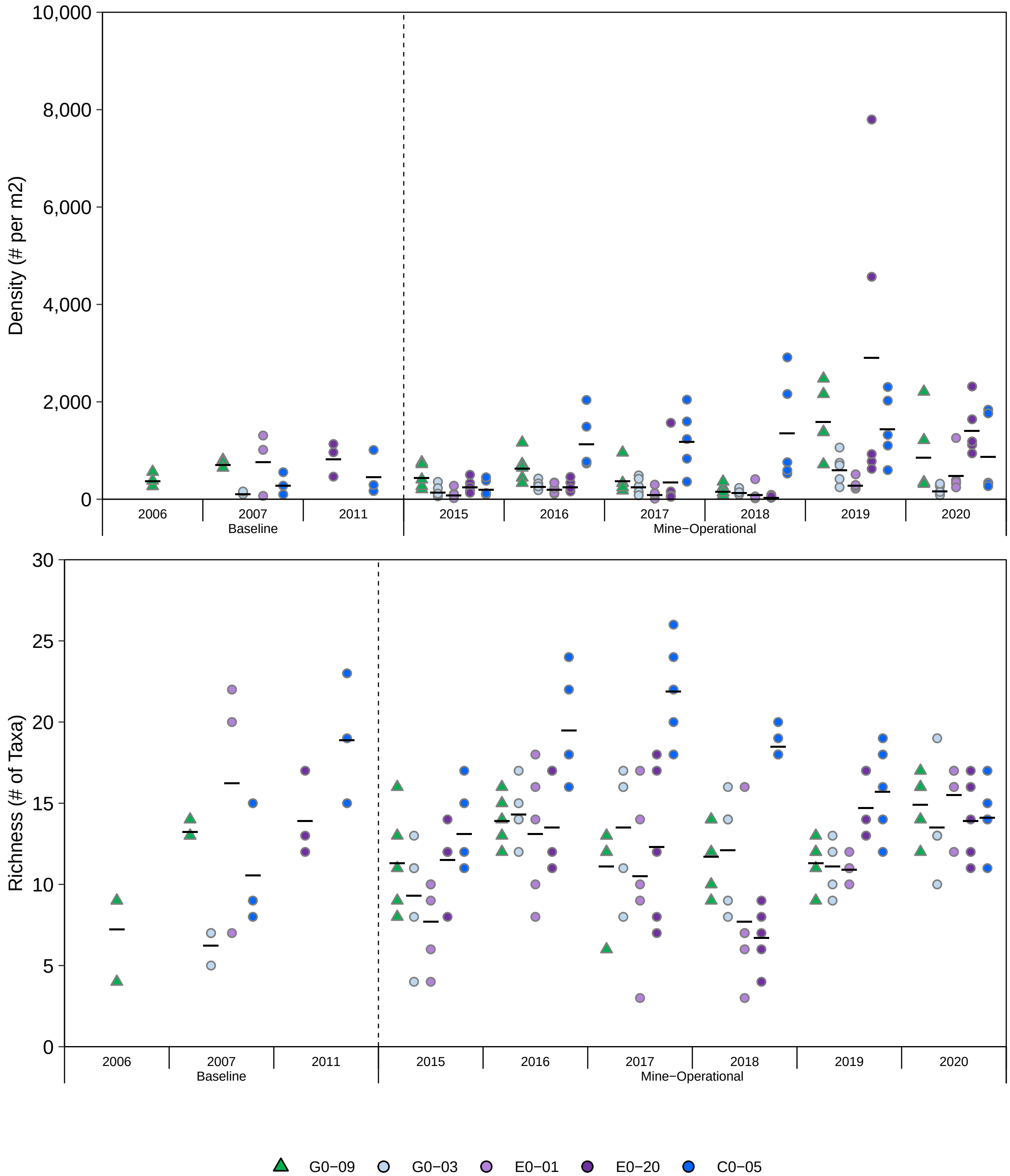


Figure F.14: Comparison of Key Benthic Invertebrate Community Metrics at Mary River Upstream (G0−09) and Downstream (G0−03, E0−01, E0−20, C0−05) Stations among Mine Baseline (2006 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

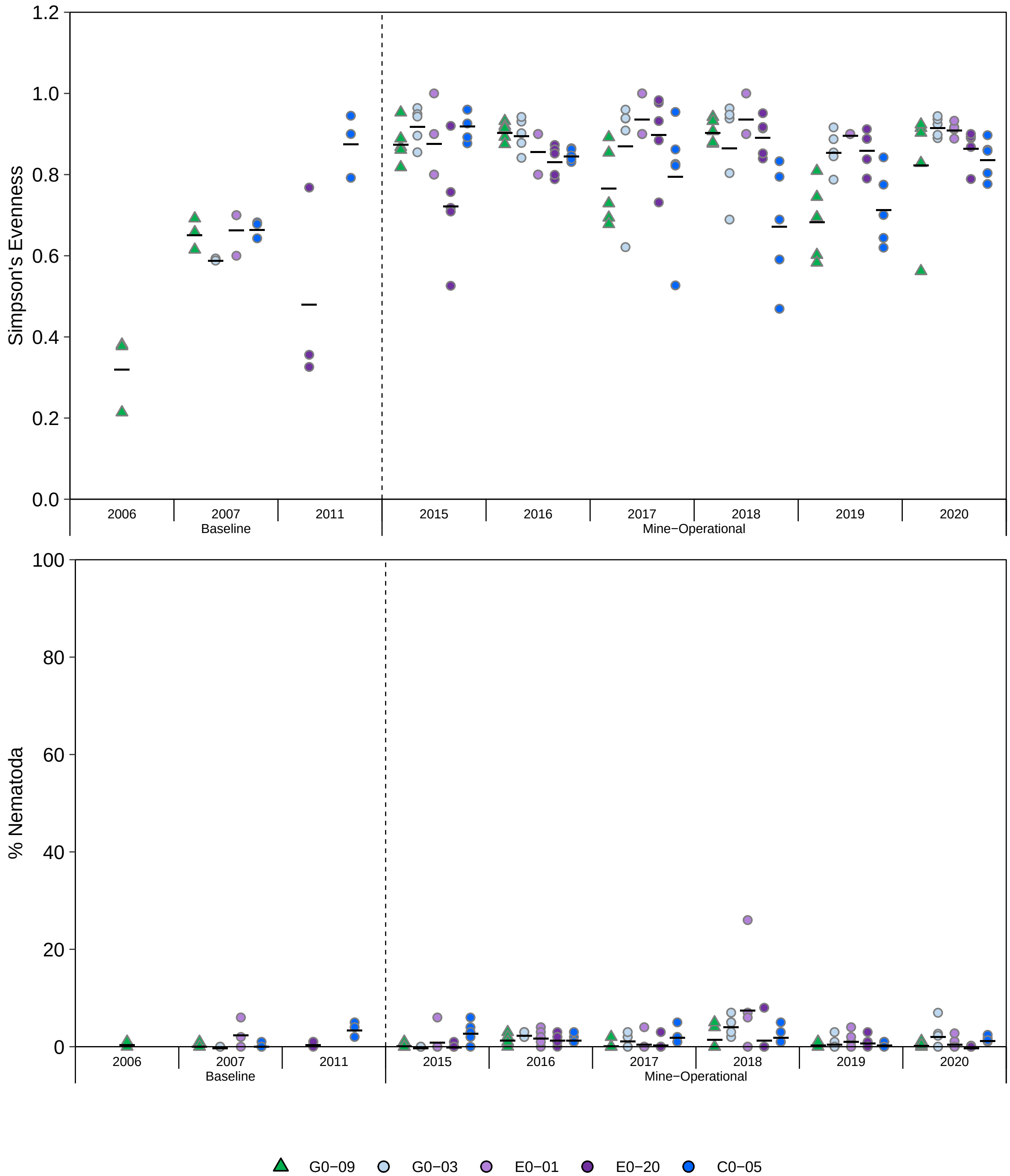


Figure F.14: Comparison of Key Benthic Invertebrate Community Metrics at Mary River Upstream (G0−09) and Downstream (G0−03, E0−01, E0−20, C0−05) Stations among Mine Baseline (2006 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

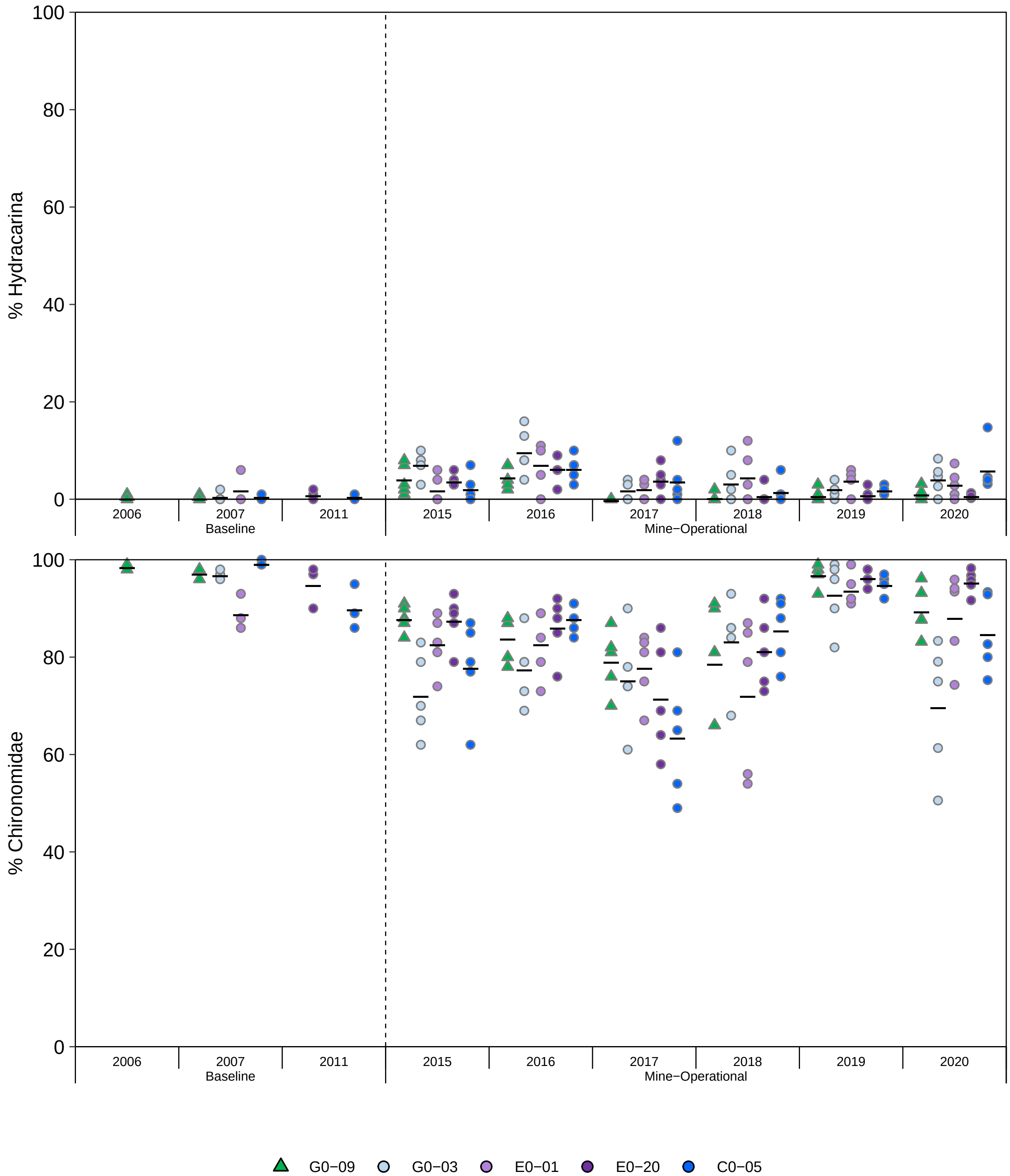


Figure F.14: Comparison of Key Benthic Invertebrate Community Metrics at Mary River Upstream (G0−09) and Downstream (G0−03, E0−01, E0−20, C0−05) Stations among Mine Baseline (2006 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

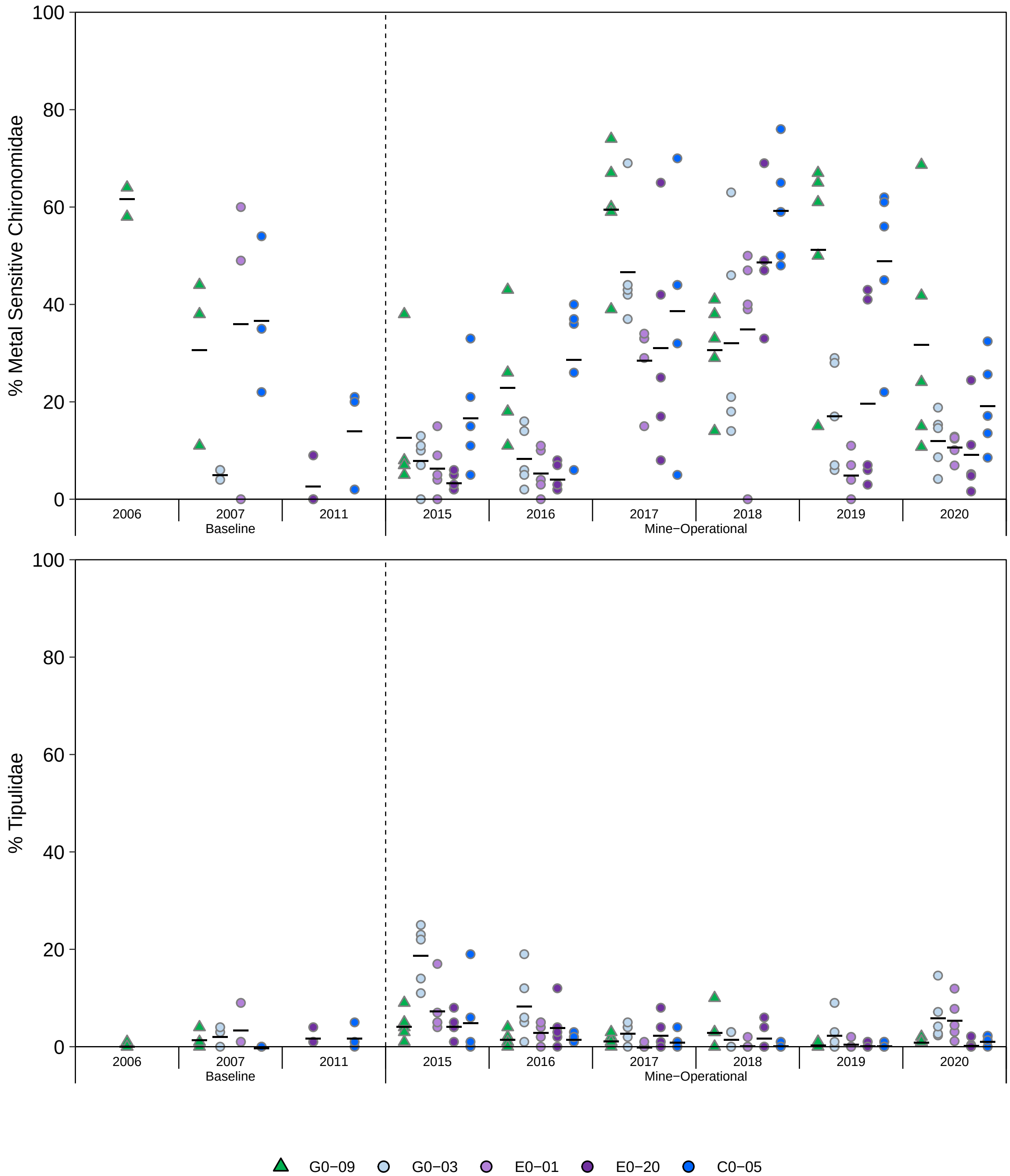


Figure F.14: Comparison of Key Benthic Invertebrate Community Metrics at Mary River Upstream (G0−09) and Downstream (G0−03, E0−01, E0−20, C0−05) Stations among Mine Baseline (2006 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

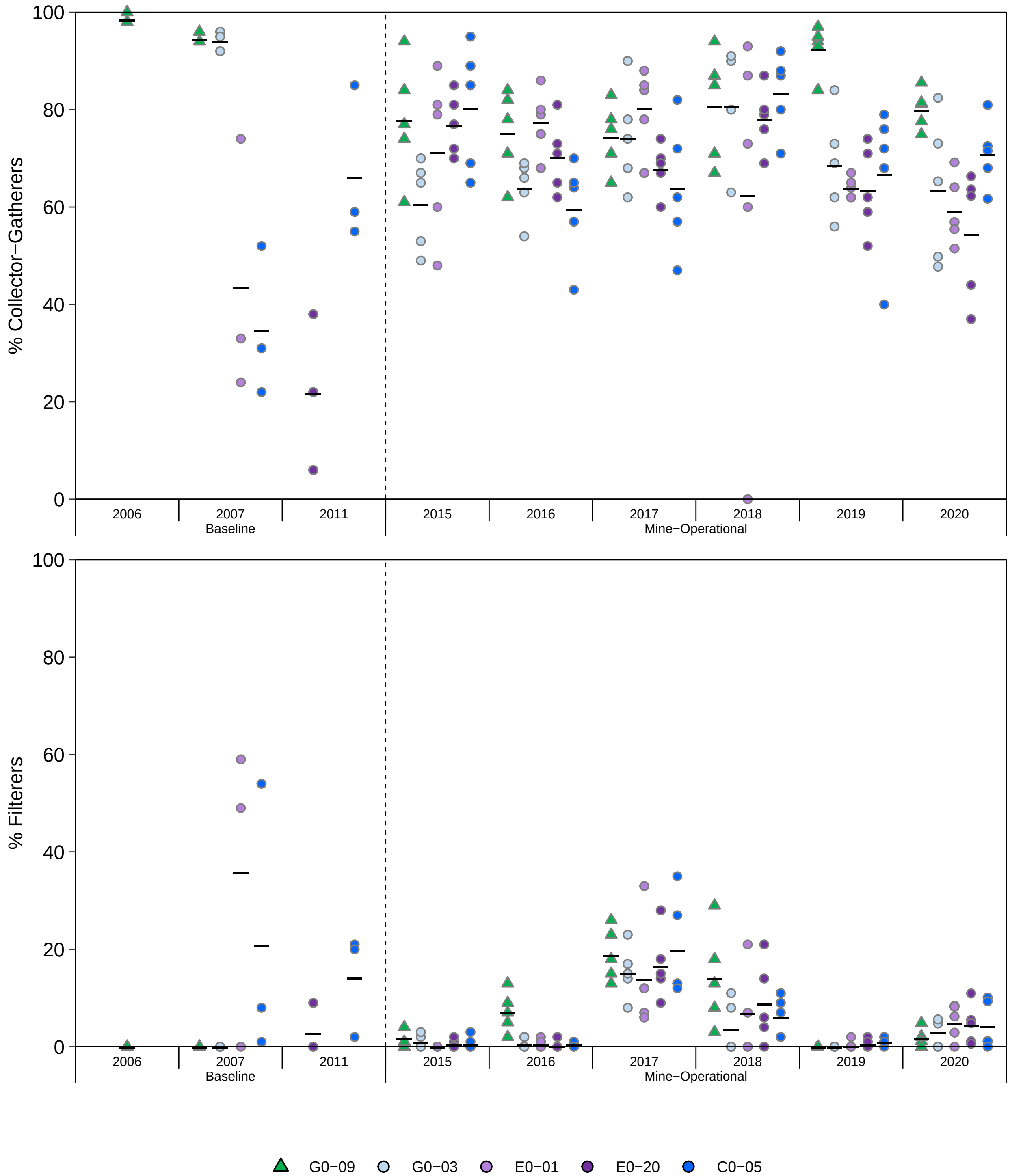


Figure F.14: Comparison of Key Benthic Invertebrate Community Metrics at Mary River Upstream (G0−09) and Downstream (G0−03, E0−01, E0−20, C0−05) Stations among Mine Baseline (2006 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

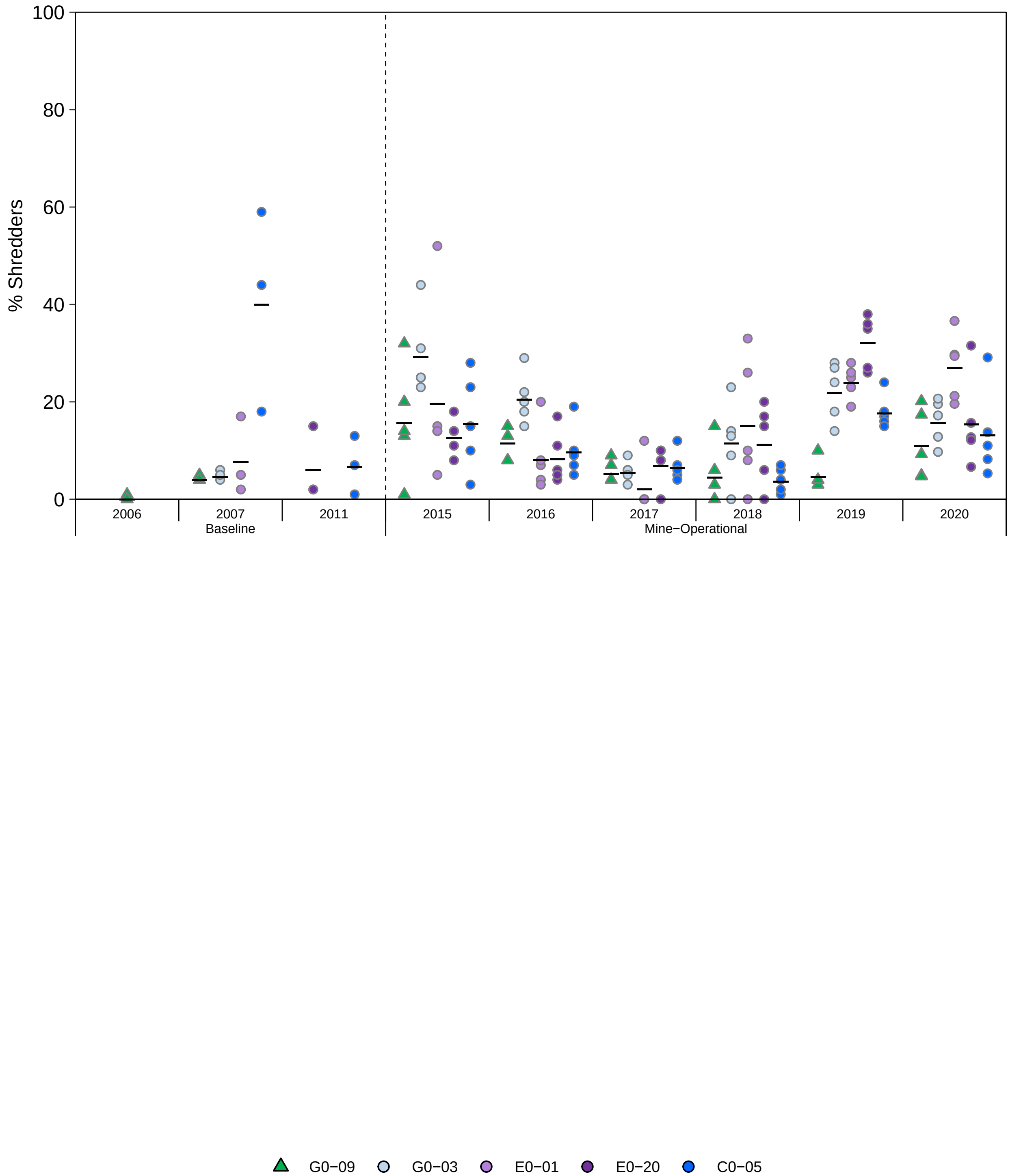


Figure F.14: Comparison of Key Benthic Invertebrate Community Metrics at Mary River Upstream (G0−09) and Downstream (G0−03, E0−01, E0−20, C0−05) Stations among Mine Baseline (2006 to 2011) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

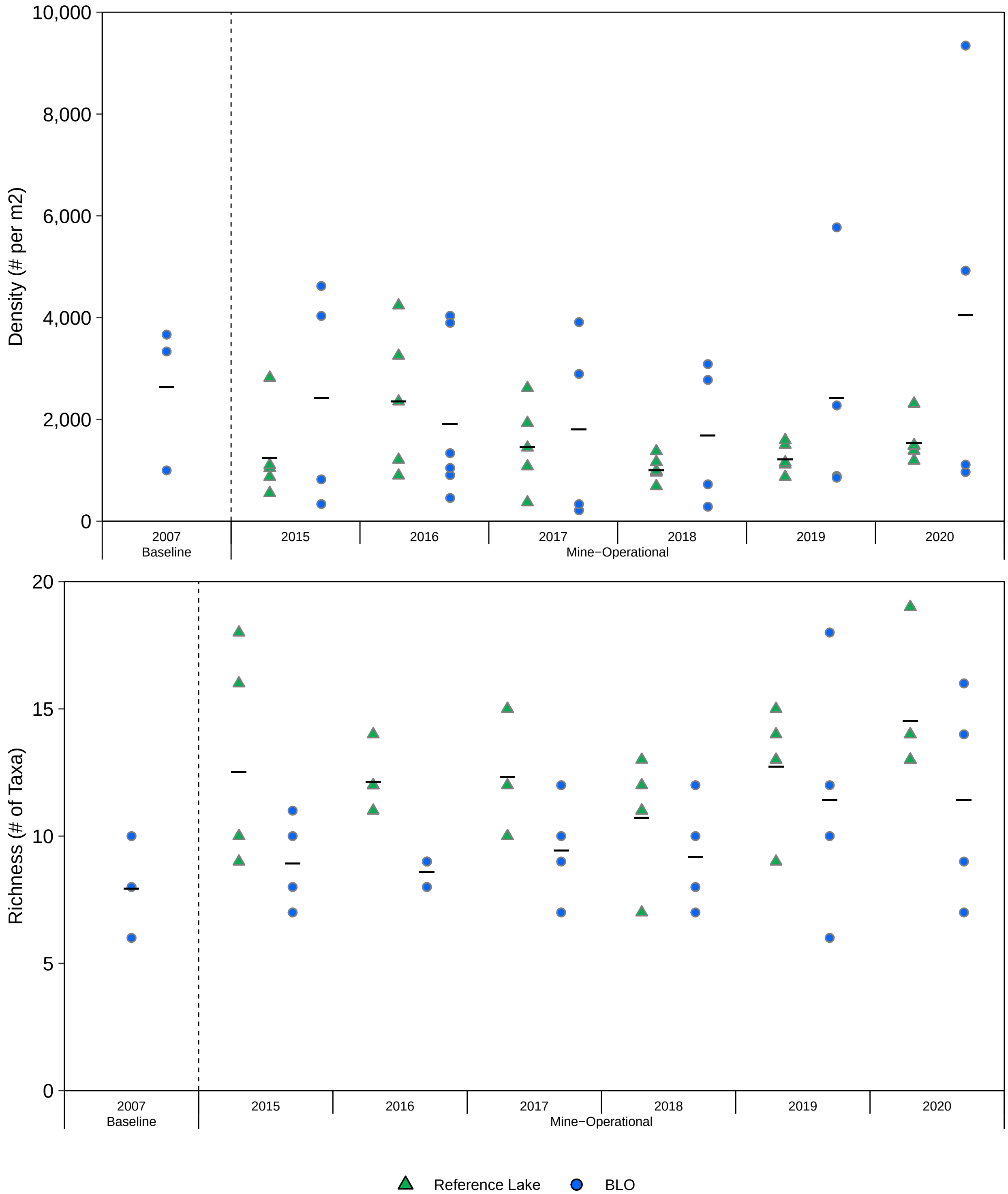


Figure F.15: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Littoral Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

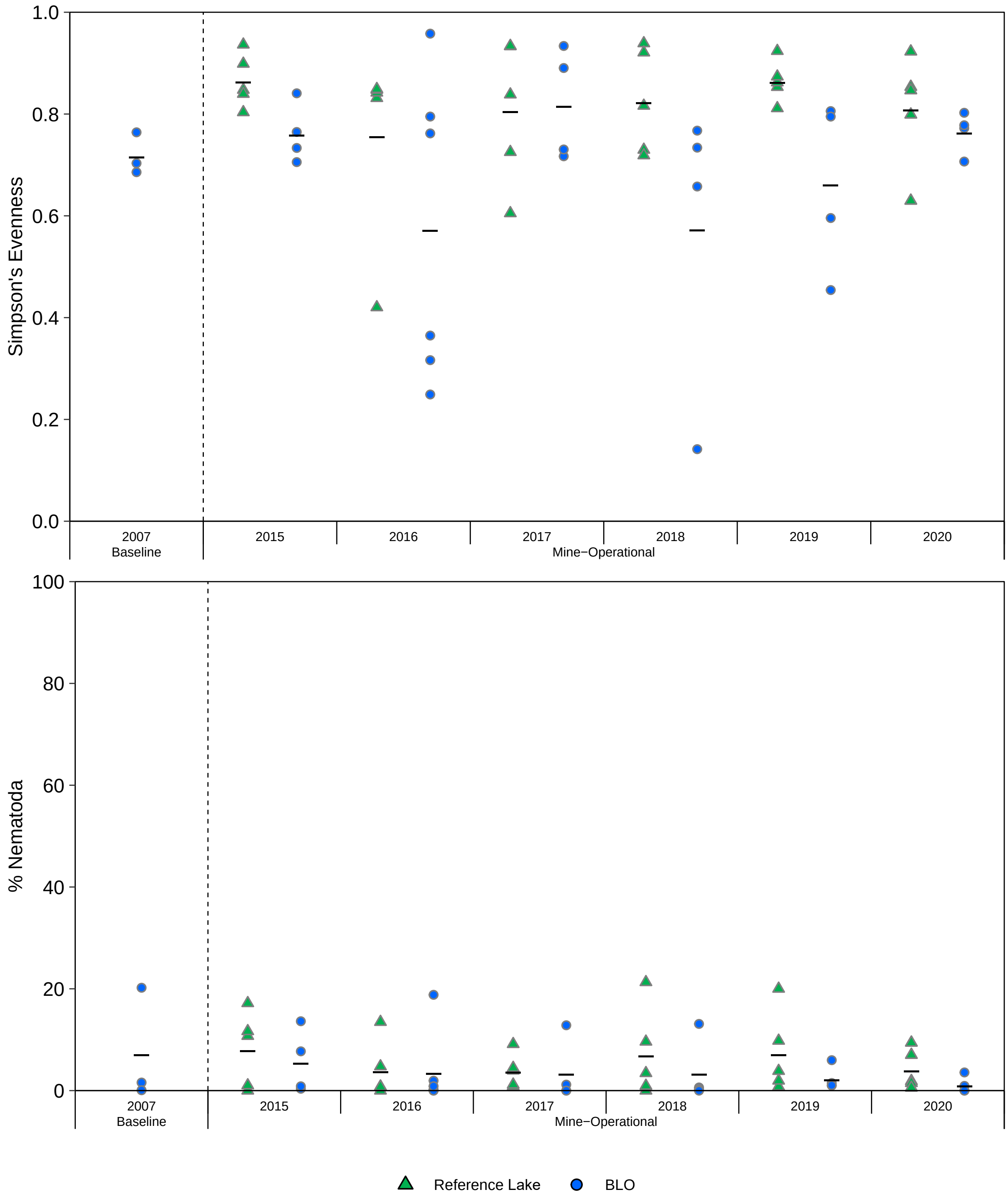


Figure F.15: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Littoral Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

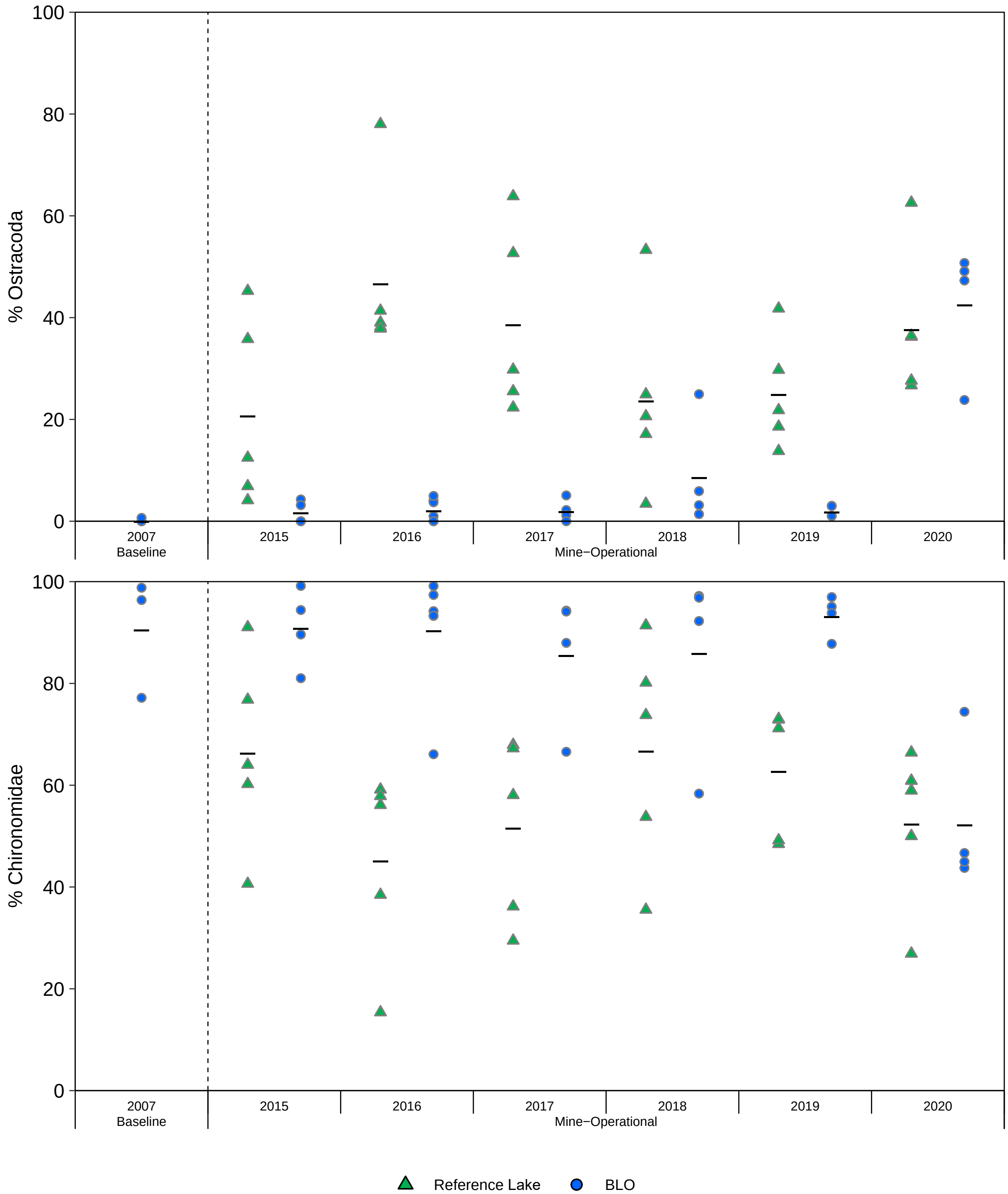


Figure F.15: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Littoral Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

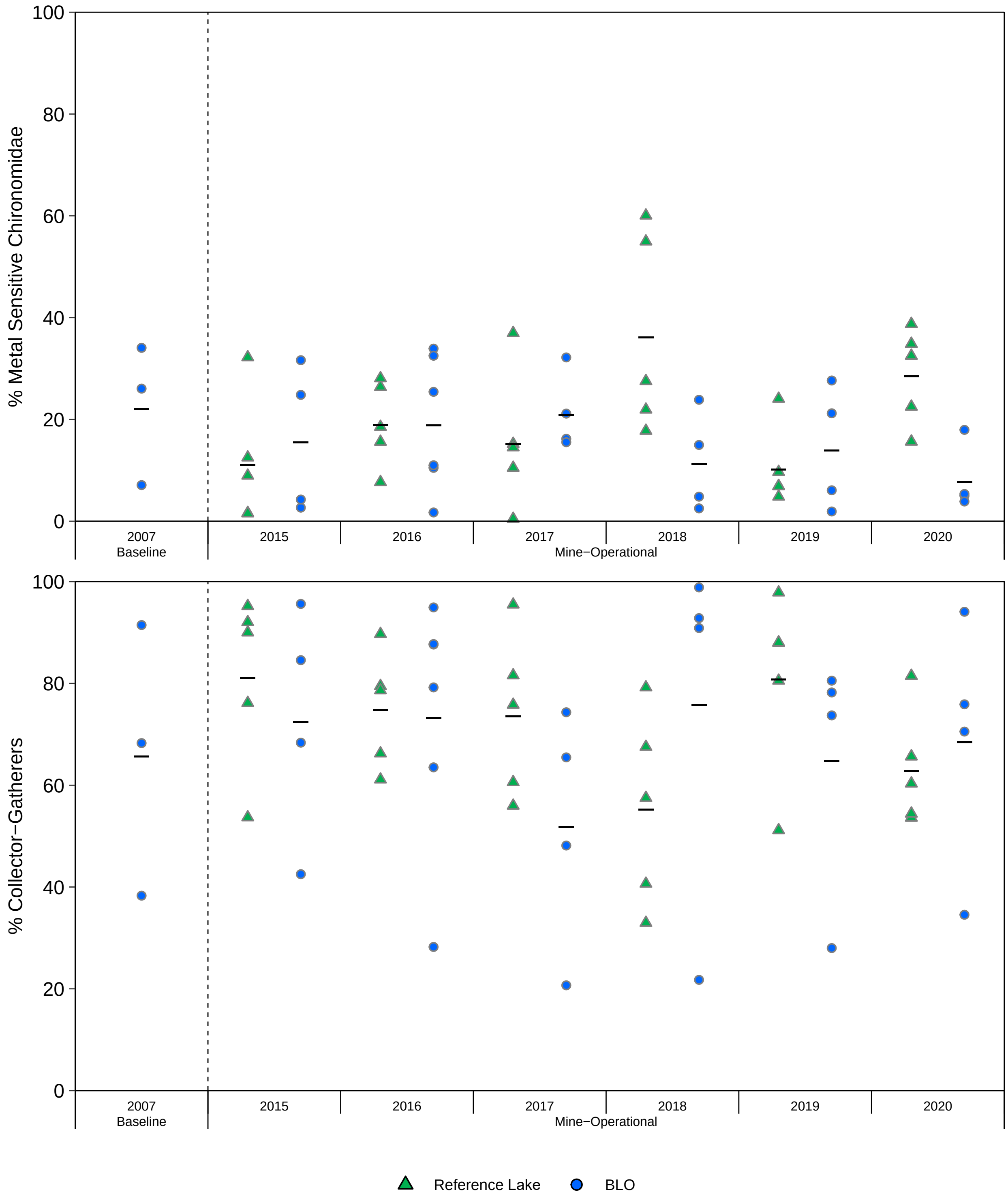


Figure F.15: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Littoral Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

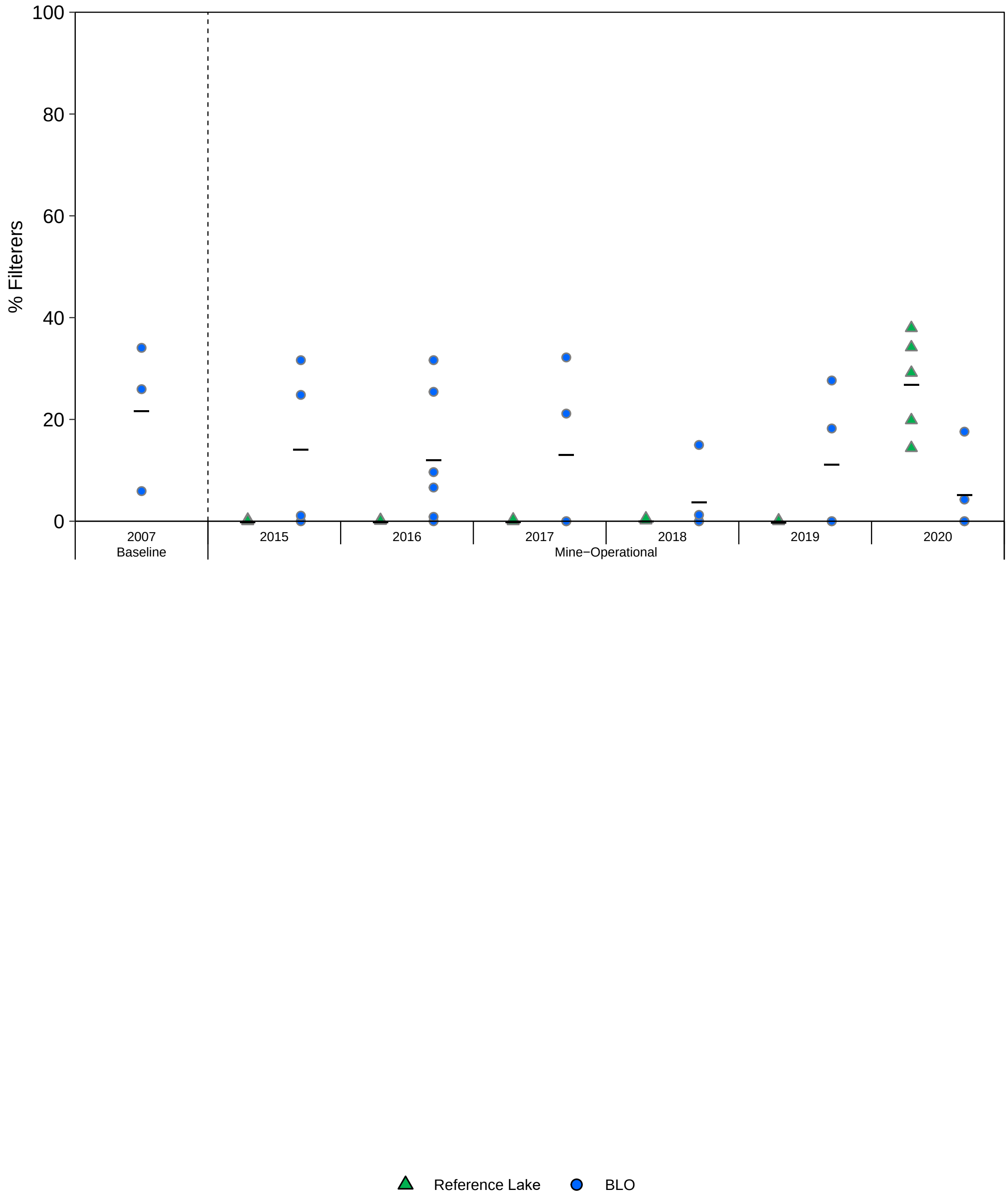


Figure F.15: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Littoral Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

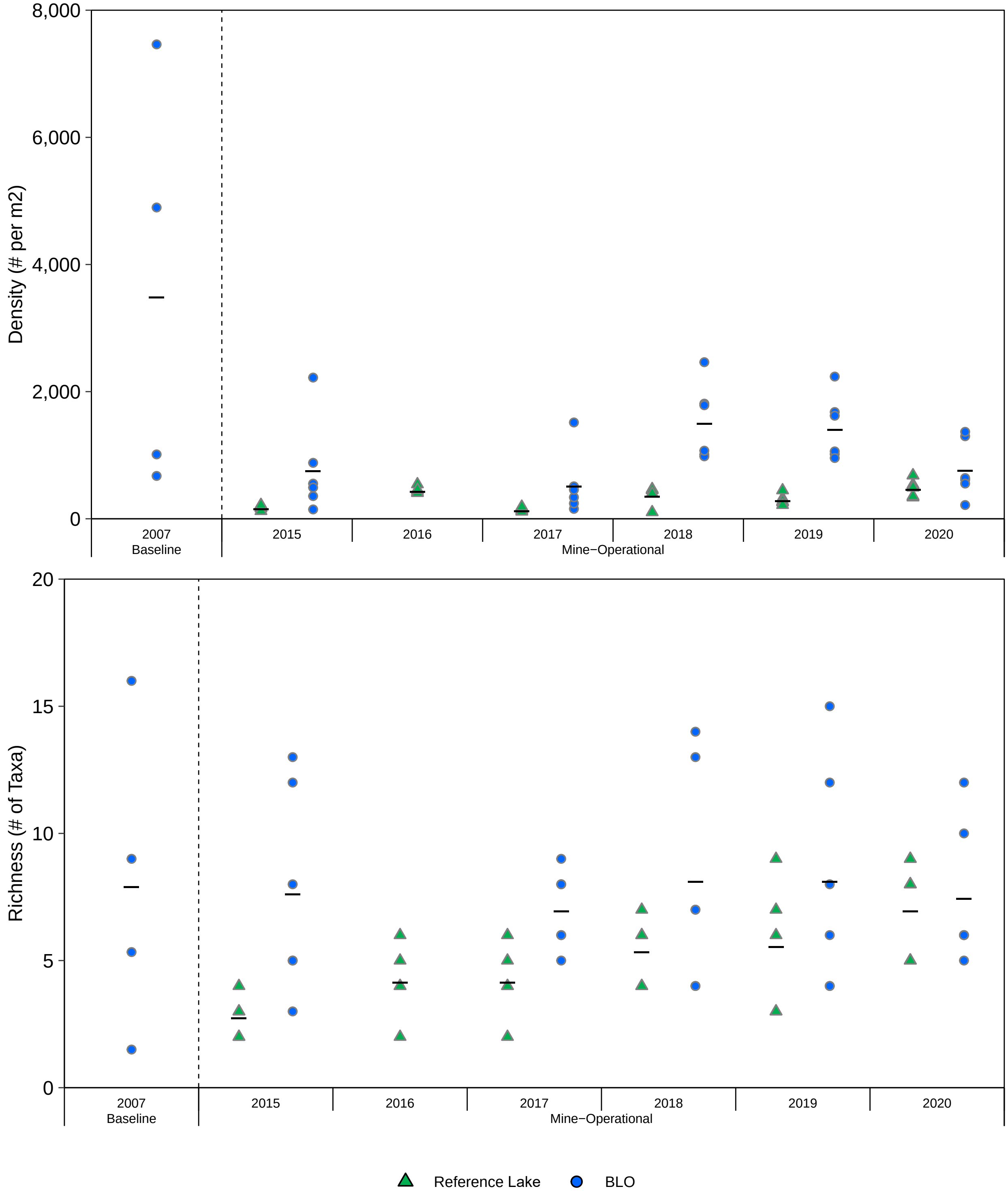


Figure F.16: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Profundal Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

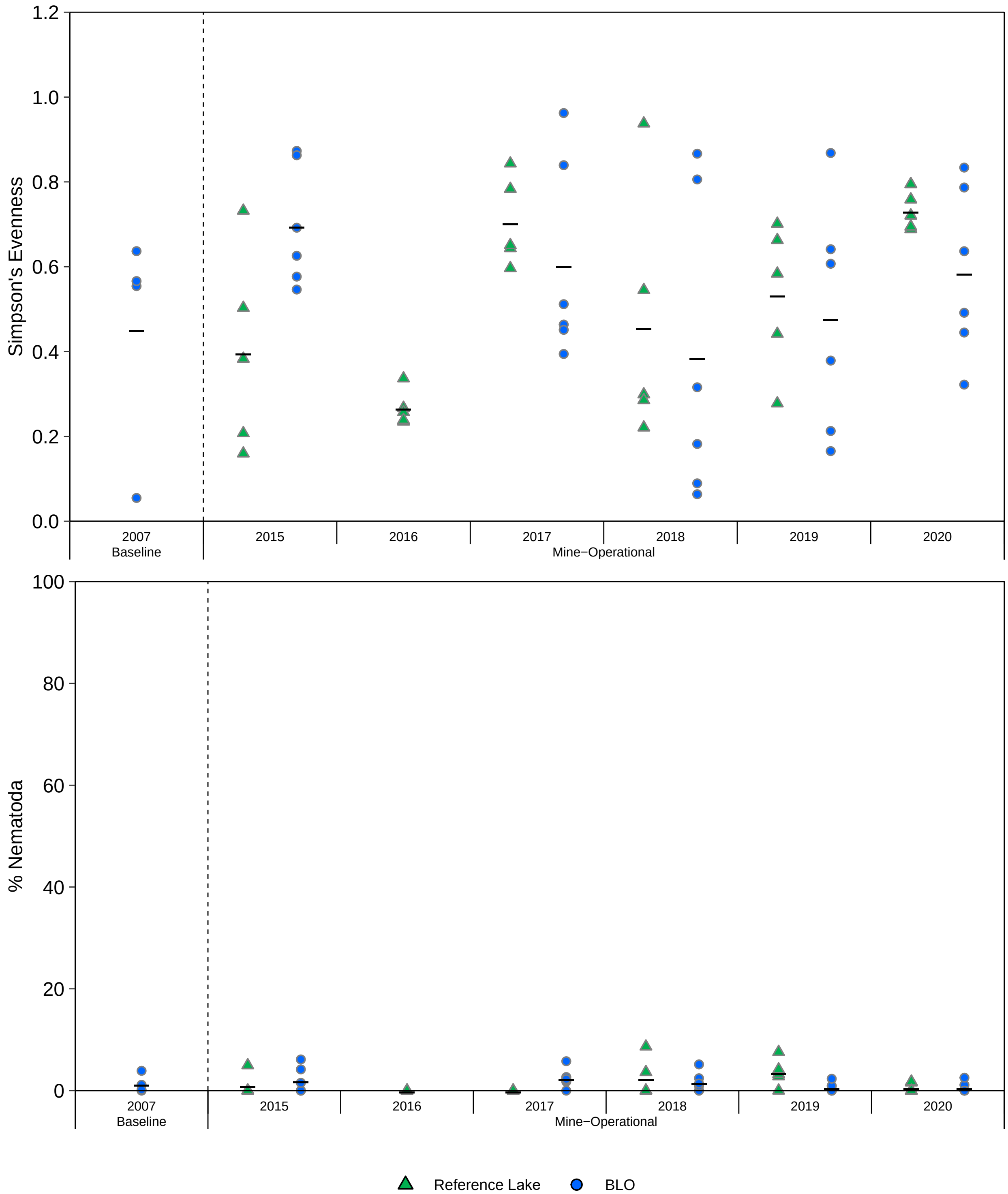


Figure F.16: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Profundal Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

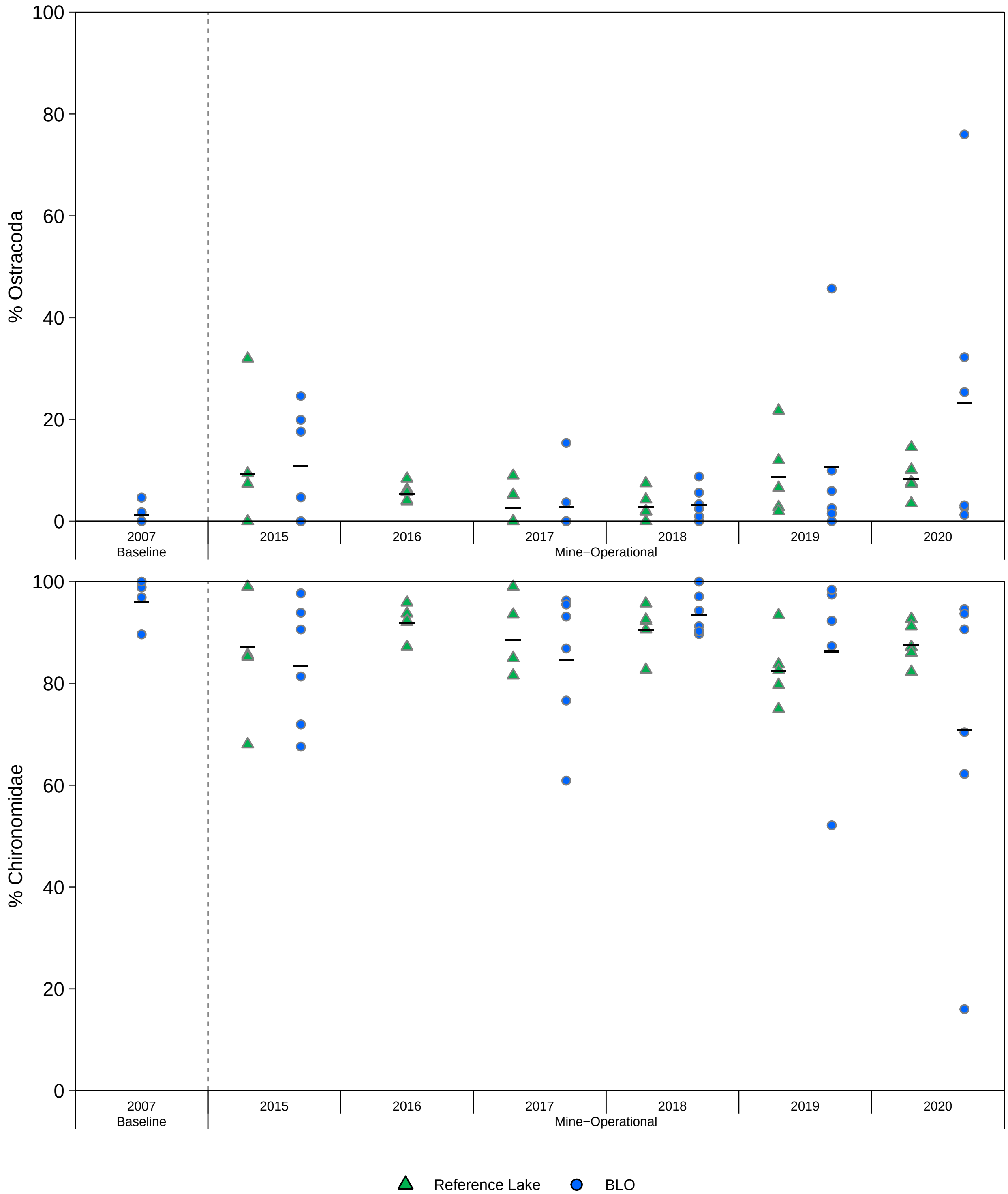


Figure F.16: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Profundal Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

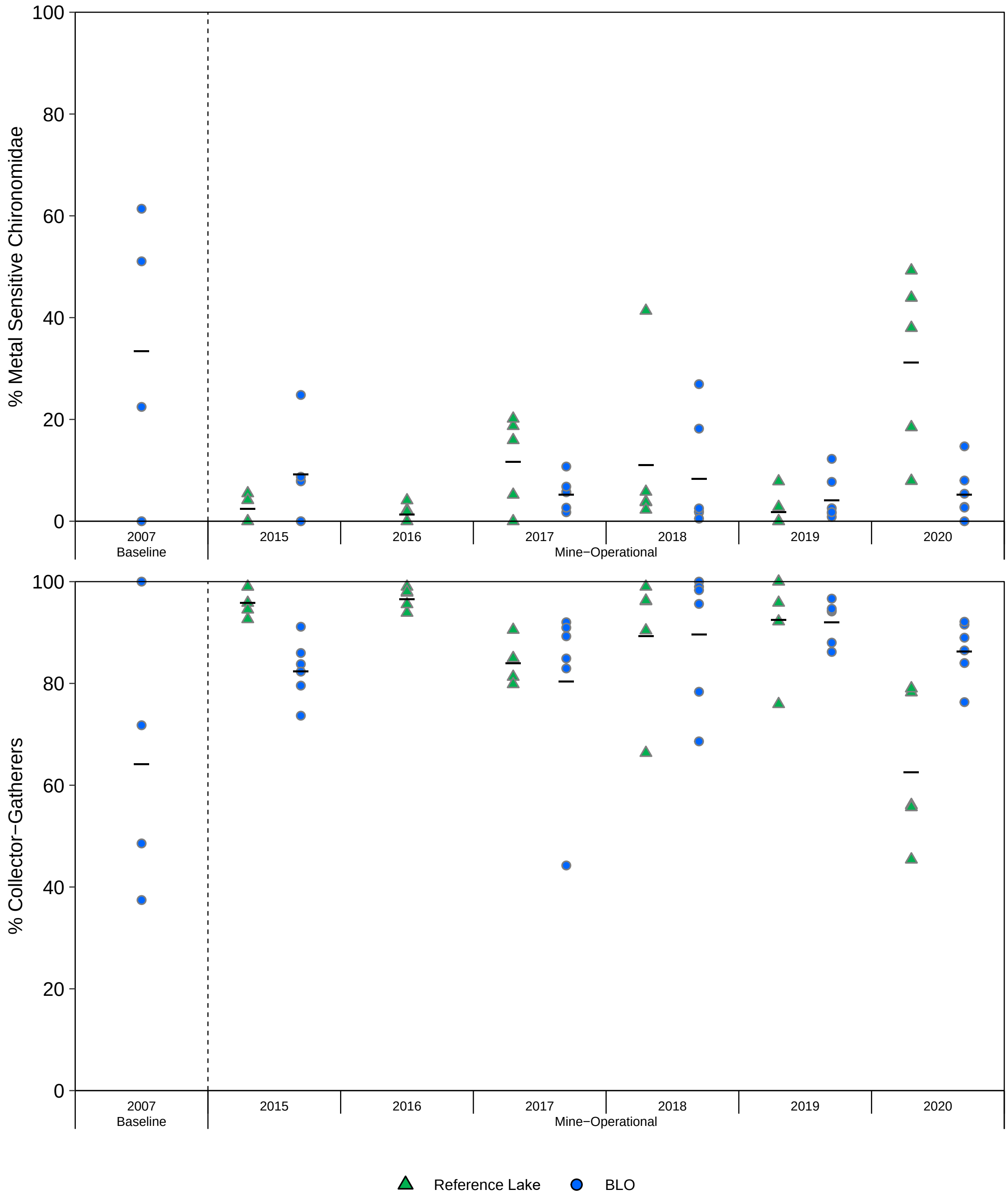


Figure F.16: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Profundal Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

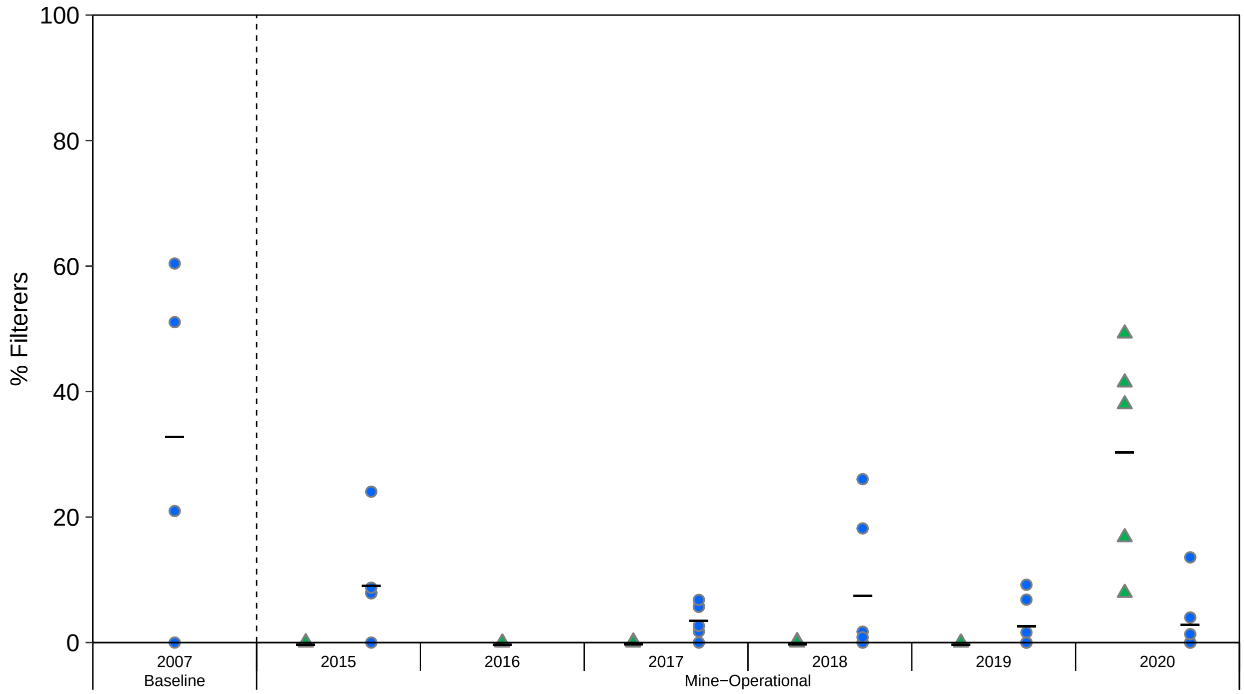


Figure F.16: Comparison of Key Benthic Invertebrate Community Metrics at Mary Lake (BL0) Profundal Habitat Stations among Mine Baseline (2007) and Operational (2015 to 2020) Periods

Note: Black bars indicate average of replicates.

Table F.1: Replicate Grab Data for Benthic Invertebrate Community Samples Collected at the Unnamed Reference Creek and Camp Lake Tributaries, Mary River Project CREMP, August 2020

Study Area	Station	Water Depth (cm)			Water Velocity (m/s)			Embeddedness			In-Stream Vegetation			Algae Presence		
		Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3
Unnamed Reference Creek	REF-CRK-B1	6.0	10	8.0	0.35	0.50	0.33	25%	50%	25%	sparse	none	none	sparse	sparse	sparse
	REF-CRK-B2	6.0	8.0	10	0.31	0.37	0.48	25%	25%	25%	none	none	none	sparse	sparse	sparse
	REF-CRK-B3	16	8.0	7.0	0.33	0.37	0.31	50%	50%	50%	none	none	none	sparse	sparse	common
	REF-CRK-B4	10	12	8.0	0.50	0.51	0.42	50%	50%	25%	none	none	none	sparse	sparse	sparse
	REF-CRK-B5	10	8.0	9.0	0.37	0.35	0.38	50%	50%	25%	none	none	none	sparse	sparse	sparse
Camp Lake Tributary 1 Upstream	CLT-1-US-B1	12	10	12	0.46	0.34	0.45	75%	50%	75%	none	common	none	sparse	sparse	common
	CLT-1-US-B2	9.0	15	13	0.41	0.34	0.32	50%	25%	75%	none	none	none	common	common	common
	CLT-1-US-B3	10	20	8.0	0.38	0.45	0.31	50%	50%	-	sparse	sparse	-	common	common	-
	CLT-1-US-B4	9.0	18	20	0.33	0.38	0.42	25%	50%	50%	sparse	sparse	sparse	sparse	sparse	common
	CLT-1-US-B5	14	5.0	10	0.38	0.35	0.31	0%	25%	25%	sparse	sparse	sparse	sparse	sparse	sparse
Camp Lake Tributary 1 Downstream	CLT-1-DS-B1	6.0	6.0	12	0.38	0.44	0.31	25%	25%	25%	none	none	none	sparse	sparse	common
	CLT-1-DS-B2	8.0	10	12	0.45	0.31	0.36	25%	50%	25%	none	none	sparse	sparse	sparse	sparse
	CLT-1-DS-B3	8.0	10	12	0.36	0.32	0.42	25%	25%	25%	sparse	common	sparse	sparse	sparse	sparse
	CLT-1-DS-B4	12	6.0	6.0	0.54	0.42	0.35	25%	25%	25%	common	sparse	common	sparse	common	sparse
	CLT-1-DS-B5	6.0	7.0	10	0.35	0.32	0.41	25%	25%	50%	sparse	common	sparse	sparse	sparse	sparse
Camp Lake Tributary 2 Upstream	CLT-2-US-B1	12	8.0	14	0.56	0.34	0.51	50%	25%	50%	sparse	sparse	sparse	common	sparse	common
	CLT-2-US-B2	12	10	14	0.36	0.51	0.38	25%	25%	50%	sparse	sparse	none	sparse	sparse	sparse
	CLT-2-US-B3	11	12	8.0	0.47	0.55	0.37	25%	50%	50%	sparse	sparse	sparse	sparse	sparse	sparse
	CLT-2-US-B4	12	10	6.0	0.55	0.44	0.31	50%	50%	50%	none	none	none	sparse	sparse	sparse
	CLT-2-US-B5	6.0	10	8.0	0.46	0.31	0.51	25%	50%	50%	none	none	none	sparse	common	sparse
Camp Lake Tributary 2 Downstream	CLT-2-DS-B1	6.0	10	8.0	0.49	0.31	0.34	25%	50%	25%	none	none	none	sparse	sparse	sparse
	CLT-2-DS-B2	12	12	6.0	0.45	0.35	0.31	25%	25%	50%	none	none	none	sparse	sparse	sparse
	CLT-2-DS-B3	12	10	6.0	0.42	0.55	0.35	25%	25%	25%	none	none	none	sparse	sparse	sparse
	CLT-2-DS-B4	8.0	10	12	0.48	0.36	0.31	25%	25%	50%	none	none	none	sparse	sparse	sparse
	CLT-2-DS-B5	10	8.0	12	0.42	0.51	0.33	25%	25%	25%	none	none	none	sparse	sparse	sparse

Note: "-" indicates no data available.

Table F.2: Replicate Station Habitat Feature Summary Statistics for the Camp Lake Tributary Benthic Stations, Mary River Project CREMP, August 2020

Metric	Study Area	Sample Size	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Water Depth (m)	Unnamed Reference Creek	5	9.1	1.09	0.49	8.00	10.3
	CLT1-US North Branch	5	12.3	2.20	0.98	9.67	15.7
	CLT1-DS Lower Main Stem	5	8.7	1.16	0.52	7.67	10.0
	CLT2-US Upstream	5	10.2	1.59	0.71	8.00	12.0
	CLT2-DS Downstream	5	9.5	0.869	0.39	8.00	10.0
Water Velocity (m/s)	Unnamed Reference Creek	5	0.39	0.052	0.023	0.34	0.48
	CLT1-US North Branch	5	0.38	0.027	0.012	0.35	0.42
	CLT1-DS Lower Main Stem	5	0.38	0.031	0.014	0.36	0.44
	CLT2-US Upstream	5	0.44	0.023	0.010	0.42	0.47
	CLT2-DS Downstream	5	0.40	0.030	0.013	0.37	0.44
Substrate Embeddedness (%)	Unnamed Reference Creek	5	0.38	0.095	0.042	0.25	0.50
	CLT1-US North Branch	5	0.45	0.183	0.082	0.17	0.67
	CLT1-DS Lower Main Stem	5	0.28	0.046	0.020	0.25	0.33
	CLT2-US Upstream	5	0.42	0.059	0.026	0.33	0.50
	CLT2-DS Downstream	5	0.30	0.046	0.020	0.25	0.33

Note: Five stations were sampled at each study area.

Table F.3: Benthic Station Habitat Feature Statistical Comparisons among Camp Lake Tributary 1 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 3-group Comparison				Pair-wise, post-hoc comparisons			
	Statistical Test [a]	Transform-ation	Significant Difference between Areas?	p-value	(I) Area	(J) Area	Significant Difference Between Areas?	P-value
Water Depth (cm)	ANOVA	none	YES	0.006	Unnamed Reference Creek	CLT1 Upstream	YES	0.019
					Unnamed Reference Creek	CLT1 Downstream	NO	0.651
					CLT1 Upstream	CLT1 Downstream	YES	0.026
Water Velocity (cm/s)	ANOVA	none	NO	0.792	Unnamed Reference Creek	CLT1 Upstream	NO	0.539
					Unnamed Reference Creek	CLT1 Downstream	NO	0.456
					CLT1 Upstream	CLT1 Downstream	NO	0.683
Substrate Embeddedness (%)	ANOVA	none	NO	0.135	Unnamed Reference Creek	CLT1 Upstream	NO	0.554
					Unnamed Reference Creek	CLT1 Downstream	NO	0.145
					CLT1 Upstream	CLT1 Downstream	NO	0.154

Highlighted values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.4: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Unnamed Reference Creek Study Area, August 2020

Taxa	Study Area	Unnamed Reference Creek				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		4	-	-	4	18
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		7	7	7	11	25
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Lebertiidae						
Lebertia		-	4	-	-	-
F. Sperchonidae						
Sperchon		18	25	29	29	18
SEED SHRIMPS						
Cl. Ostracoda		290	161	104	434	100
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		29	18	4	22	7
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		14	11	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		-	**14**	**4**	**14**	**4**
S.F. Chironominae						
Micropsectra		-	-	-	-	-
Paratanytarsus		-	-	-	-	-
Rheotanytarsus		7	-	-	-	-
S.F. Diamesinae						
Diamesa		7	-	-	4	-
Pseudokiefferiella		11	4	-	4	-
S.F. Orthocladiinae						
Cardiocladius		-	-	-	-	-
Chaetocladius		-	4	-	-	-
Corynoneura		11	-	-	4	-
Cricotopus		29	4	4	-	7
Cricotopus/Orthocladius		-	-	-	-	-
Eukiefferiella		25	36	-	29	57

Table F.4: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Unnamed Reference Creek Study Area, August 2020

Taxa — Study Area / Replicate Station	Unnamed Reference Creek B1	B2	B3	B4	B5
Hydrobaenus	-	-	-	-	-
Hydrosmittia	14	-	-	-	-
Krenosmittia	4	4	-	-	-
Limnophyes	7	7	-	4	4
Metriocnemus	-	-	-	-	-
Orthocladius (Euorthocladius)	-	18	-	47	29
Parakiefferiella	-	-	-	-	-
Paraphaenocladius	-	-	-	4	4
Psectrocladius	-	-	-	-	-
Thienemanniella	-	-	-	-	-
Tokunagaia	47	79	18	32	111
Tvetenia	140	276	65	305	190
indeterminate	-	-	-	-	-
S.F. Podonominae					
Trichotanypus	-	-	-	-	-
S.F. Tanypodinae					
Thienemannimyia complex	11	11	11	-	-
F. Empididae					
Clinocera	-	-	-	-	-
F. Muscidae	-	-	-	-	-
F. Simuliidae					
Gymnopais	-	-	-	7	-
Metacnephia	29	36	-	36	4
Prosimulium	122	97	-	43	18
pupae	**25**	-	-	**4**	-
F. Tipulidae					
Dicranota	-	-	-	-	-
Tipula	-	7	14	-	7
Number of Organisms (No. organisms per m^2)	849	821	258	1,032	602
Richness (total number of taxa)[a]	20	19	9	17	15
Simpson's Evenness (E)	0.860	0.856	0.840	0.767	0.878
Shannon-Wiener Diversity	3.13	3.00	2.40	2.48	2.95
Percent Composition					
% Nemata	0.4	0.0	0.0	0.3	3.0
% Oligochaeta	0.8	0.9	2.8	1.0	4.2
% Hydracarina	2.1	3.5	11.1	2.8	3.0
% Ostracods	34.2	19.7	40.3	42.0	16.7
% Ephemeroptera	3.4	2.2	1.4	2.1	1.2
% Chironomids	36.7	55.5	38.9	43.1	67.3
% Metal Sensitive Chironmids	3.0	0.5	0.0	0.7	0.0
% Simuliidae	20.7	16.2	0.0	8.7	3.6
% Tipulidae	0.0	0.9	5.6	0.0	1.2
Functional Feeding Group Composition					
% Collector - Gatherers	70.0	76.4	77.6	88.5	91.1
% Filterers	21.5	16.2	0.0	8.0	3.6
% Shredders	3.4	1.3	7.0	0.0	2.4
Habitat Preference Group Composition					
% Clingers	27.0	20.1	12.6	11.5	7.7
% Sprawlers	70.0	76.8	79.1	87.2	83.9
% Burrowers	3.0	3.1	8.3	1.4	8.3

[a] Bold entries excluded from taxa count

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2020

Taxa / Study Area	North Branch Upstream (CLT1-US)				
Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS					
P. Nemata	29	65	22	-	11
ANNELIDS					
P. Annelida					
WORMS					
Cl. Oligochaeta					
F. Enchytraeidae	104	118	93	32	25
ARTHROPODS					
P. Arthropoda					
MITES					
Cl. Arachnida					
O. Acarina					
F. Lebertiidae					
Lebertia	-	-	-	-	-
F. Sperchonidae					
Sperchon	93	14	-	25	61
SEED SHRIMPS					
Cl. Ostracoda	7	22	-	-	14
SPRINGTAILS					
Cl. Entognatha					
O. Collembola	-	4	-	14	7
INSECTS					
Cl. Insecta					
MAYFLIES					
O. Ephemeroptera					
F. Baetidae					
Acentrella feropagus	-	-	-	-	4
STONEFLIES					
O. Plecoptera					
F. Capniidae					
immature	-	4	-	-	-
TRUE FLIES					
O. Diptera					
BITING-MIDGE					
F. Ceratopogonidae					
Culicoides	-	-	-	-	-
MIDGES					
F. Chironomidae					
chironomid pupae	**115**	**93**	**79**	**50**	**108**
S.F. Chironominae					
Micropsectra	25	272	93	-	-
Paratanytarsus	-	-	-	-	22
Rheotanytarsus	-	-	-	-	-
S.F. Diamesinae					
Diamesa	7	7	-	-	-
Pseudokiefferiella	244	72	323	57	57
S.F. Orthocladiinae					
Cardiocladius	-	-	-	-	-
Chaetocladius	14	-	-	-	-
Corynoneura	7	29	22	7	11
Cricotopus	179	495	523	151	82
Cricotopus/Orthocladius	362	244	330	39	125
Eukiefferiella	-	-	-	29	-

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2020

Taxa	Study Area	North Branch Upstream (CLT1-US)				
	Replicate Station	B1	B2	B3	B4	B5
Hydrobaenus		-	29	7	7	-
Hydrosmittia		61	409	330	25	32
Krenosmittia		14	36	7	11	14
Limnophyes		47	29	14	4	11
Metriocnemus		39	-	-	-	-
Orthocladius (Euorthocladius)		265	14	366	118	147
Parakiefferiella		-	-	36	-	-
Paraphaenocladius		-	-	-	-	-
Psectrocladius		-	-	-	4	-
Thienemanniella		-	-	-	-	11
Tokunagaia		115	29	-	57	43
Tvetenia		61	22	22	14	79
indeterminate		-	-	**7**	-	-
S.F. Podonominae						
Trichotanypus		-	7	-	-	-
S.F. Tanypodinae						
Thienemannimyia complex		7	-	-	7	-
F. Empididae						
Clinocera		32	7	7	7	7
F. Muscidae		-	-	-	-	-
F. Simuliidae						
Gymnopais		-	-	-	-	7
Metacnephia		-	-	-	-	-
Prosimulium		4	-	-	4	-
pupae		-	-	-	-	-
F. Tipulidae						
Dicranota		-	-	-	-	-
Tipula		72	82	108	47	197
Number of Organisms (No. organisms per m^2)		1,903	2,100	2,387	710	1,075
Richness (total number of taxa)[a]		21	21	15	19	20
Simpson's Evenness (E)		0.900	0.835	0.867	0.905	0.912
Shannon-Wiener Diversity		3.364	2.968	2.793	3.348	3.400
Percent Composition						
% Nemata		1.5	3.1	0.9	0.0	1.0
% Oligochaeta		5.5	5.6	3.9	4.5	2.3
% Hydracarina		4.9	0.7	0.0	3.5	5.7
% Ostracods		0.4	1.0	0.0	0.0	1.3
% Ephemeroptera		0.0	0.0	0.0	0.0	0.3
% Chironomids		82.1	85.0	90.4	81.8	69.0
% Metal Sensitive Chironmids		15.6	17.6	18.1	8.8	8.6
% Simuliidae		0.2	0.0	0.0	0.5	0.7
% Tipulidae		3.8	3.9	4.5	6.6	18.3
Functional Feeding Group Composition						
% Collector - Gatherers		69.2	44.5	59.9	60.7	58.5
% Filterers		1.6	13.7	4.1	0.5	2.3
% Shredders		22.2	40.8	35.7	33.2	32.2
Habitat Preference Group Composition						
% Clingers		26.6	51.5	35.5	31.7	20.9
% Sprawlers		60.4	35.7	55.1	55.2	56.8
% Burrowers		13.0	12.6	9.3	11.1	21.7

[a] Bold entries excluded from taxa count

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2020

Taxa	Study Area	Lower Main Stem (CLT1-DS)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		32	7	7	7	11
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		197	18	18	161	36
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Lebertiidae						
Lebertia		-	-	-	-	-
F. Sperchonidae						
Sperchon		11	-	11	7	11
SEED SHRIMPS						
Cl. Ostracoda		4	-	-	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	11	-	7
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	4	25
MIDGES						
F. Chironomidae						
chironomid pupae		**39**	**18**	**14**	**29**	**22**
S.F. Chironominae						
Micropsectra		-	-	-	-	-
Paratanytarsus		7	-	7	4	-
Rheotanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	4	7	11	-
Pseudokiefferiella		11	11	-	22	14
S.F. Orthocladiinae						
Cardiocladius		-	-	-	-	-
Chaetocladius		-	-	-	-	-
Corynoneura		4	4	-	-	-
Cricotopus		36	47	14	32	22
Cricotopus/Orthocladius		11	22	11	18	39
Eukiefferiella		-	-	-	7	-

Table F.5: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 1 Study Areas, August 2020

Taxa (Study Area / Replicate Station)	Lower Main Stem (CLT1-DS) B1	B2	B3	B4	B5
Hydrobaenus	11	7	4	14	4
Hydrosmittia	380	276	57	283	237
Krenosmittia	25	4	14	11	4
Limnophyes	7	7	4	-	11
Metriocnemus	-	-	-	-	-
Orthocladius (Euorthocladius)	11	11	7	14	14
Parakiefferiella	29	4	-	4	-
Paraphaenocladius	7	-	-	4	-
Psectrocladius	-	-	-	-	-
Thienemanniella	-	4	-	-	-
Tokunagaia	25	-	7	18	18
Tvetenia	32	65	54	75	57
indeterminate	**25**	-	-	-	-
S.F. Podonominae					
Trichotanypus	-	-	-	-	-
S.F. Tanypodinae					
Thienemannimyia complex	-	-	-	4	-
F. Empididae					
Clinocera	-	7	-	11	-
F. Muscidae	-	-	-	-	-
F. Simuliidae					
Gymnopais	4	-	-	-	-
Metacnephia	-	-	-	4	-
Prosimulium	-	-	-	-	-
pupae	-	-	-	-	-
F. Tipulidae					
Dicranota	-	-	-	4	-
Tipula	32	47	14	61	32
Number of Organisms (No. organisms per m^2)	939	559	262	806	563
Richness (total number of taxa)[a]	19	16	15	22	15
Simpson's Evenness (E)	0.800	0.745	0.929	0.839	0.825
Shannon-Wiener Diversity	2.837	2.507	3.367	3.051	2.902
Percent Composition					
% Nemata	3.4	1.3	2.7	0.9	1.9
% Oligochaeta	21.0	3.2	6.8	20.0	6.4
% Hydracarina	1.1	0.0	4.1	0.9	1.9
% Ostracods	0.4	0.0	0.0	0.0	0.0
% Ephemeroptera	0.0	0.0	4.1	0.0	1.3
% Chironomids	70.2	85.9	76.7	68.0	78.3
% Metal Sensitive Chironmids	2.0	2.7	5.9	4.7	2.7
% Simuliidae	0.4	0.0	0.0	0.4	0.0
% Tipulidae	3.4	8.3	5.5	8.0	5.7
Functional Feeding Group Composition					
% Collector - Gatherers	89.2	78.5	78.6	82.1	79.5
% Filterers	0.8	0.0	3.0	0.9	0.0
% Shredders	8.4	20.2	14.3	13.4	14.2
Habitat Preference Group Composition					
% Clingers	6.5	13.2	13.0	8.5	10.3
% Sprawlers	65.6	74.0	72.0	62.6	71.2
% Burrowers	27.9	12.8	15.1	28.9	18.5

[a] Bold entries excluded from taxa count

Table F.6: Benthic Invertebrate Community Summary Statistics for Camp Lake Tributary 1 Study Areas, Mary River Project CREMP, August 2020

Metric	Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (no. organisms / m^2)	Unnamed Reference Creek	713	296	133	258	821	1,032
	CLT1 Upstream	1,635	711	318	710	1,903	2,387
	CLT1 Downstream	626	261	117	262	563	939
Richness (Number of Taxa)	Unnamed Reference Creek	16.0	4.36	1.95	9	17	20
	CLT1 Upstream	19.2	2.49	1.11	15	20	21
	CLT1 Downstream	17.4	3.05	1.36	15	16	22
Simpson's Evenness	Unnamed Reference Creek	0.840	0.0432	0.0193	0.767	0.856	0.878
	CLT1 Upstream	0.884	0.0319	0.0143	0.835	0.9	0.912
	CLT1 Downstream	0.828	0.0671	0.03	0.745	0.825	0.929
Nemata (% of community)	Unnamed Reference Creek	0.7%	1.3%	0.6%	0.0%	0.3%	3.0%
	CLT1 Upstream	1.3%	1.1%	0.5%	0.0%	1.0%	3.1%
	CLT1 Downstream	2.1%	1.0%	0.5%	0.9%	1.9%	3.4%
Oligochaeta (% of community)	Unnamed Reference Creek	1.9%	1.5%	0.7%	0.8%	1.0%	4.2%
	CLT1 Upstream	4.4%	1.3%	0.6%	2.3%	4.6%	5.6%
	CLT1 Downstream	11.5%	8.4%	3.7%	3.2%	6.9%	21.0%
Hydracarina (% of community)	Unnamed Reference Creek	4.5%	3.7%	1.7%	2.1%	3.0%	11.1%
	CLT1 Upstream	3.0%	2.5%	1.1%	0.0%	3.5%	5.7%
	CLT1 Downstream	1.6%	1.6%	0.7%	0.0%	1.2%	4.1%
Ostracoda (% of community)	Unnamed Reference Creek	30.6%	11.7%	5.3%	16.7%	34.2%	42.0%
	CLT1 Upstream	0.5%	0.6%	0.3%	0.0%	0.4%	1.3%
	CLT1 Downstream	0.1%	0.2%	0.1%	0.0%	0.0%	0.4%
Chironomidae (% of community)	Unnamed Reference Creek	48.3%	12.9%	5.8%	36.7%	43.1%	67.3%
	CLT1 Upstream	81.7%	7.9%	3.5%	69.0%	82.1%	90.4%
	CLT1 Downstream	75.8%	7.1%	3.2%	68.0%	76.7%	85.9%
Metal-Sensitive Chironomidae (% of community)	Unnamed Reference Creek	22.9%	7.5%	3.3%	10.6%	10.6%	30.1%
	CLT1 Upstream	14.4%	10.4%	4.6%	1.6%	1.6%	24.1%
	CLT1 Downstream	7.7%	3.4%	1.5%	3.4%	3.4%	11.6%
Simuliidae (% of community)	Unnamed Reference Creek	0.3%	0.5%	0.2%	0.0%	0.0%	1.0%
	CLT1 Upstream	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	CLT1 Downstream	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Tipulidae (% of community)	Unnamed Reference Creek	1.0%	1.1%	0.5%	0.0%	0.0%	2.9%
	CLT1 Upstream	5.4%	1.9%	0.9%	2.9%	2.9%	7.4%
	CLT1 Downstream	2.7%	2.4%	1.1%	0.6%	0.6%	6.9%
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	72.7%	16.4%	7.3%	44.3%	44.3%	83.8%
	CLT1 Upstream	58.8%	8.6%	3.8%	52.1%	52.1%	73.8%
	CLT1 Downstream	81.5%	6.3%	2.8%	76.0%	76.0%	89.6%
Filterer FFG (% of community)	Unnamed Reference Creek	6.6%	11.0%	4.9%	0.6%	0.6%	26.1%
	CLT1 Upstream	2.0%	2.4%	1.1%	0.0%	0.0%	5.6%
	CLT1 Downstream	0.8%	1.9%	0.8%	0.0%	0.0%	4.2%
Shredder FFG (% of community)	Unnamed Reference Creek	12.3%	7.7%	3.4%	2.5%	2.5%	21.4%
	CLT1 Upstream	33.8%	9.1%	4.1%	21.1%	21.1%	41.8%
	CLT1 Downstream	13.9%	6.1%	2.7%	7.9%	7.9%	22.4%
Clinger HPG (% of community)	Unnamed Reference Creek	21.8%	18.3%	8.2%	7.3%	7.3%	52.0%
	CLT1 Upstream	34.1%	7.6%	3.4%	21.7%	21.7%	40.2%
	CLT1 Downstream	14.9%	5.9%	2.7%	7.8%	7.8%	21.5%
Sprawler HPG (% of community)	Unnamed Reference Creek	69.4%	16.1%	7.2%	42.8%	42.8%	83.1%
	CLT1 Upstream	55.8%	11.0%	4.9%	46.0%	46.0%	74.3%
	CLT1 Downstream	75.0%	9.4%	4.2%	65.2%	65.2%	86.3%
Burrower HPG (% of community)	Unnamed Reference Creek	5.7%	4.6%	2.1%	2.7%	2.7%	13.8%
	CLT1 Upstream	9.3%	5.1%	2.3%	3.9%	3.9%	17.1%
	CLT1 Downstream	9.0%	5.5%	2.5%	4.4%	4.4%	17.0%

Note: Sample size equals five for all study areas.

Table F.7: Statistical Comparison of Bray-Curtis Index for Camp Lake Tributary 1 and 2 Compared to Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Mine-Exposed Area	Comparison	n		Betadisper P-Value	Mantel Test			dbRDA			
		Reference	Mine-Exposed		r	R^2	P-Value	F-Value	R^2	R^2_{adj}	P-Value
Camp Lake Tributary 1	CLT1-US vs REF-CRK	5	5	0.661	0.822	0.676	0.008	11.17	0.583	0.530	0.006
	CLT1-DS vs REF-CRK	5	5	0.435	0.835	0.697	0.008	10.34	0.564	0.509	0.007
Camp Lake Tributary 2	CLT2-US vs REF-CRK	5	5	0.435	0.741	0.549	0.008	8.69	0.521	0.461	0.008
	CLT2-DS vs REF-CRK	5	5	0.846	0.570	0.324	0.008	5.31	0.399	0.324	0.007

Highlighted values indicate significant difference between study areas based on statistical test p-value less than 0.10.

Table F.8: Statistical Comparison of Primary and Percent Compositional Benthic Metrics at Camp Lake Tributary 1 North Branch (CLT1 US) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2011	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	0.023	2007	3	505	330	-	-3.2	a
					2011	3	949	139	1.3	-	a,b
					2015	5	1,446	836	2.9	3.6	b
					2016	5	1,610	806	3.3	4.8	b
					2017	5	1,242	143	2.2	2.1	b
					2018	5	1,379	524	2.6	3.1	b
					2019	5	1,260	313	2.3	2.2	b
					2020	5	1,635	711	3.4	4.9	b
Richness (No. of Taxa)	ANOVA	none	YES	0.002	2007	3	13.7	2.3	-	-0.3	a
					2011	3	14.3	2.1	0.3	-	a,b
					2015	5	15.0	2.7	0.6	0.3	a,b
					2016	5	14.0	2.7	0.1	-0.1	a
					2017	5	19.2	2.6	2.4	2.4	b
					2018	5	17.2	1.5	1.5	1.4	a,b
					2019	5	18.0	2.1	1.9	1.8	a,b
					2020	5	19.2	2.5	2.4	2.4	b
Simpson's Evenness	ANOVA	none	YES	<0.001	2007	3	0.749	0.082	-	-3.0	a
					2011	3	0.874	0.042	1.5	-	b
					2015	5	0.899	0.037	1.8	0.6	b
					2016	5	0.908	0.032	1.9	0.8	b
					2017	5	0.925	0.019	2.1	1.2	b
					2018	5	0.877	0.058	1.6	0.1	b
					2019	5	0.884	0.036	1.6	0.2	b
					2020	5	0.884	0.032	1.6	0.2	b
Nemata (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	0.1	0.3	-	-0.7	a
					2011	3	0.7	0.8	2.1	-	a
					2015	5	1.7	0.7	6.0	1.3	a
					2016	5	1.3	0.5	4.5	0.8	a
					2017	5	4.1	2.1	15.4	4.4	b
					2018	5	1.6	0.7	5.5	1.1	a
					2019	5	1.3	0.8	4.4	0.7	a
					2020	5	1.3	1.1	4.5	0.8	a
Hydracarina (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	0.8	1.0	-	-2.0	a
					2011	3	14.4	6.7	13.3	-	b
					2015	5	2.3	1.7	1.5	-1.8	a
					2016	5	9.8	3.2	8.8	-0.7	b,c
					2017	5	7.7	1.1	6.7	-1.0	c,d
					2018	5	5.3	1.3	4.5	-1.4	a,c,d
					2019	5	2.0	1.7	1.1	-1.9	a
					2020	5	3.0	2.5	2.1	-1.7	a,d
Chironomidae (% of community)	ANOVA	none	YES	<0.001	2007	3	88.1	7.2	-	2.3	a
					2011	3	76.3	5.1	-1.7	-	a,b,c
					2015	5	75.6	7.5	-1.7	-0.1	a,b,c
					2016	5	68.6	10.6	-2.7	-1.5	c
					2017	5	74.0	1.7	-2.0	-0.5	a,c
					2018	5	86.8	4.2	-0.2	2.1	c
					2019	5	85.0	5.1	-0.4	1.7	b,c
					2020	5	81.7	7.9	-0.9	1.1	a,b
Metal Sensitive Taxa (% of community)	ANOVA	log10	NO	0.255	2007	3	3.7	3.6	-	-1.1	a
					2011	3	10.8	6.6	2.0	-	a
					2015	5	12.7	14.1	2.5	0.3	a
					2016	5	9.1	9.0	1.5	-0.3	a
					2017	5	7.2	5.2	1.0	-0.5	a
					2018	5	17.8	4.8	3.9	1.1	a
					2019	5	14.4	10.4	3.0	0.5	a
					2020	5	13.8	4.7	2.8	0.5	a
Tipulidae (% of community)	ANOVA	log10	YES	<0.001	2007	3	8.9	4.1	-	0.9	a,b
					2011	3	6.9	2.1	-0.5	-	a,b,c
					2015	5	16.8	4.7	1.9	4.6	a
					2016	5	16.9	11.8	2.0	4.7	a,b
					2017	5	8.4	1.5	-0.1	0.7	a,b
					2018	5	2.9	2.3	-1.5	-1.9	c
					2019	5	5.5	1.9	-0.8	-0.7	b,c
					2020	5	7.4	6.2	-0.4	0.2	a,b

(Grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(Blue) Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.9: Statistical Comparison of Functional Feeding Group (FFG) Benthic Metrics at Camp Lake Tributary 1 North Branch (CLT1 US) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2011	Pairwise Comparison
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.001	2007	3	72.6	11.0	-	2.2	a
					2011	3	41.4	14.1	-2.8	-	b,c
					2015	5	50.2	7.3	-2.0	0.6	b,c
					2016	5	40.8	11.3	-2.9	0.0	b,c
					2017	5	38.8	7.1	-3.1	-0.2	b
					2018	5	54.6	13.5	-1.6	0.9	a,b,c
					2019	5	58.8	8.6	-1.3	1.2	a,c
					2020	5	58.5	8.9	-1.3	1.2	a,c
Filterer FFG (% of community)	K-W	rank	YES	0.020	2007	3	0.3	0.3	-	not calculable	a,b
					2011	3	0.0	0.0	-1.2	-	b
					2015	5	0.0	0.0	-1.2	not calculable	b
					2016	5	0.5	0.6	0.9	not calculable	a,b
					2017	5	1.3	1.5	3.9	not calculable	a,c
					2018	5	0.5	0.5	0.8	not calculable	b,c
					2019	5	2.0	2.4	6.5	not calculable	a,c
					2020	5	4.4	5.3	15.7	not calculable	c
Shredder FFG (% of community)	ANOVA	none	YES	0.016	2007	3	23.1	8.8	-	-1.2	a
					2011	3	40.0	14.2	1.9	-	a,b
					2015	5	46.1	7.3	2.6	0.4	b
					2016	5	47.8	14.0	2.8	0.5	b
					2017	5	49.5	6.4	3.0	0.7	b
					2018	5	39.3	13.2	1.8	0.0	a,b
					2019	5	33.8	9.1	1.2	-0.4	a,b
					2020	5	32.8	6.8	1.1	-0.5	a,b

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint values between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.10: Statistical Comparison of Primary and Percent Compositional Benthic Metrics at Camp Lake Tributary 1 Lower Main Stem (CLT1 DS) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2011	Pairwise Comparison
Density (No. per m^2)	ANOVA	none	YES	0.077	2007	3	754	573	-	-0.8	a,b
					2011	3	898	183	0.3	-	a,b
					2015	5	1,301	479	1.0	2.2	a,b
					2016	5	1,143	443	0.7	1.3	a,b
					2017	5	1,465	735	1.2	3.1	a
					2018	5	771	309	0.0	-0.7	a,b
					2019	5	843	293	0.2	-0.3	a,b
					2020	5	626	261	-0.2	-1.5	b
Richness (No. of Taxa)	ANOVA	log10	NO	0.125	2007	3	20.3	6.0	-	1.1	a
					2011	3	15.3	4.5	-0.8	-	a
					2015	5	14.6	1.1	-0.9	-0.2	a
					2016	5	17.0	1.6	-0.5	0.4	a
					2017	5	16.8	1.9	-0.6	0.3	a
					2018	5	14.4	1.1	-1.0	-0.2	a
					2019	5	15.8	1.6	-0.7	0.1	a
					2020	5	17.4	3.1	-0.5	0.5	a
Simpson's Evenness	ANOVA	none	NO	0.276	2007	3	0.864	0.040	-	0.0	a
					2011	3	0.864	0.025	0.0	-	a
					2015	5	0.889	0.044	0.6	1.0	a
					2016	5	0.864	0.095	0.0	0.0	a
					2017	5	0.874	0.033	0.3	0.4	a
					2018	5	0.857	0.050	-0.2	-0.3	a
					2019	5	0.755	0.161	-2.7	-4.3	a
					2020	5	0.828	0.067	-0.9	-1.4	a
Nemata (% of community)	K-W	rank	NO	0.162	2007	3	1.0	1.3	-	1.5	a
					2011	3	0.4	0.4	-0.4	-	a
					2015	5	3.2	2.6	1.6	7.2	a
					2016	5	4.5	4.1	2.6	10.6	a
					2017	5	4.6	5.0	2.6	10.8	a
					2018	5	2.6	1.8	1.2	5.6	a
					2019	5	2.2	1.3	0.9	4.7	a
					2020	5	2.1	1.0	0.8	4.3	a
Oligochaeta (% of community)	ANOVA	log10(x+1)	YES	0.008	2007	3	7.3	6.2	-	4.0	a,b,c
					2011	3	1.1	1.6	-1.0	-	a,c
					2015	5	5.6	3.1	-0.3	2.9	a,b,c
					2016	5	9.7	3.7	0.4	5.5	a,b
					2017	5	5.0	2.7	-0.4	2.5	a,b,c
					2018	5	1.2	1.0	-1.0	0.1	c
					2019	5	4.0	2.7	-0.5	1.9	a,b,c
					2020	5	11.5	8.4	0.7	6.7	b
Hydracarina (% of community)	K-W	rank	YES	0.007	2007	3	2.9	1.4	-	-3.4	a,c,d
					2011	3	24.7	6.4	15.4	-	b
					2015	5	1.7	1.6	-0.8	-3.6	d
					2016	5	4.6	0.8	1.2	-3.1	a,b
					2017	5	4.0	1.4	0.8	-3.2	a,c
					2018	5	3.6	1.5	0.5	-3.3	a,c,d
					2019	5	2.3	1.4	-0.4	-3.5	c,d
					2020	5	1.6	1.6	-0.9	-3.6	d
Chironomidae (% of community)	ANOVA	log10	YES	<0.001	2007	3	80.8	8.5	-	1.7	a,b
					2011	3	65.3	9.0	-1.8	-	c
					2015	5	85.2	4.0	0.5	2.2	a,b
					2016	5	73.9	5.9	-0.8	1.0	b,c
					2017	5	80.9	4.5	0.0	1.7	a,b
					2018	5	85.9	4.1	0.6	2.3	a
					2019	5	87.4	7.4	0.8	2.5	a
					2020	5	75.8	7.1	-0.6	1.2	a,b,c
Metal Sensitive Taxa (% of community)	K-W	rank	YES	0.009	2007	3	15.1	10.2	-	1.0	a
					2011	3	7.6	7.4	-0.7	-	a,b,c
					2015	5	4.4	3.5	-1.0	-0.4	b,c
					2016	5	3.9	3.3	-1.1	-0.5	c,d
					2017	5	1.5	0.7	-1.3	-0.8	d
					2018	5	8.6	6.0	-0.6	0.1	a,b
					2019	5	7.7	3.4	-0.7	0.0	a,b
					2020	5	3.6	1.6	-1.1	-0.5	b,c
Tipulidae (% of community)	ANOVA	log10	YES	0.082	2007	3	6.5	2.6	-	-0.6	a
					2011	3	8.4	3.2	0.7	-	a
					2015	5	3.1	1.0	-1.3	-1.7	a
					2016	5	6.1	3.4	-0.1	-0.7	a
					2017	5	3.9	3.1	-1.0	-1.4	a
					2018	5	4.9	3.1	-0.6	-1.1	a
					2019	5	2.8	2.4	-1.4	-1.8	a
					2020	5	6.2	2.0	-0.1	-0.7	a

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.11: Statistical Comparison of Functional Feeding Group (FFG) Benthic Metrics at Camp Lake Tributary 1 Lower Main Stem (CLT1 DS) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size: vs. Baseline Year 2007	Effect Size: vs. Baseline Year 2011	Pairwise Comparison
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	<0.0010	2007	3	51.7	24.3	-	1.5	a.b
					2011	3	35.6	10.5	-0.7	-	b
					2015	5	78.4	9.5	1.1	4.1	c
					2016	5	73.8	9.9	0.9	3.6	c,d
					2017	5	67.2	6.4	0.6	3.0	a,c,d
					2018	5	59.5	8.3	0.3	2.3	a,d
					2019	5	81.5	6.3	1.2	4.4	c
					2020	5	81.6	4.5	1.2	4.4	c
Filterer FFG (% of community)	K-W	rank	NO	0.488	2007	3	10.2	13.1	-	41.0	a
					2011	3	0.3	0.2	-0.8	-	a
					2015	5	0.2	0.5	-0.8	-0.2	a
					2016	5	1.3	1.5	-0.7	4.3	a
					2017	5	0.3	0.5	-0.8	0.3	a
					2018	5	0.4	0.5	-0.7	0.6	a
					2019	5	0.8	1.9	-0.7	2.3	a
					2020	5	0.9	1.2	-0.7	2.7	a
Shredder FFG (% of community)	ANOVA	log10	YES	<0.0010	2007	3	22.1	3.1	-	-3.7	a,b,c
					2011	3	38.9	4.6	5.5	-	a
					2015	5	19.3	9.0	-0.9	-4.3	b,c
					2016	5	19.6	9.5	-0.8	-4.2	b,c
					2017	5	27.6	4.9	1.8	-2.5	a,b
					2018	5	35.5	7.7	4.4	-0.7	a
					2019	5	13.9	6.1	-2.7	-5.5	c
					2020	5	14.1	4.2	-2.6	-5.5	c

[Grey] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[Blue] Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint values between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2020

Taxa	Study Area	Upstream (CLT2-US)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	-	14	7	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		215	14	505	7	11
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Lebertiidae						
Lebertia		-	-	-	-	-
F. Sperchonidae						
Sperchon		36	14	14	18	11
SEED SHRIMPS						
Cl. Ostracoda		-	4	-	4	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	4	11	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		4	61	4	25	11
MIDGES						
F. Chironomidae						
chironomid pupae		**100**	**22**	**79**	**57**	**54**
S.F. Chironominae						
Micropsectra		-	-	-	-	-
Paratanytarsus		-	-	-	-	-
Rheotanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		11	-	11	32	14
Pseudokiefferiella		36	4	36	14	11
S.F. Orthocladiinae						
Cardiocladius		-	-	-	-	-
Chaetocladius		11	-	4	4	11
Corynoneura		4	-	4	4	4
Cricotopus		50	22	68	4	18
Cricotopus/Orthocladius		36	14	39	14	-
Eukiefferiella		61	65	-	22	18

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2020

Taxa	Study Area / Replicate Station	Upstream (CLT2-US) B1	B2	B3	B4	B5
Hydrobaenus		4	-	-	-	-
Hydrosmittia		18	22	72	-	22
Krenosmittia		43	7	32	82	50
Limnophyes		-	-	7	7	14
Metriocnemus		-	-	-	-	-
Orthocladius (Euorthocladius)		168	18	151	86	183
Parakiefferiella		-	-	-	-	-
Paraphaenocladius		-	-	-	-	-
Psectrocladius		-	-	-	-	-
Thienemanniella		-	-	-	-	-
Tokunagaia		-	-	-	11	4
Tvetenia		75	43	72	65	57
indeterminate		**4**	-	-	**4**	**4**
S.F. Podonominae						
Trichotanypus		-	-	-	-	-
S.F. Tanypodinae						
Thienemannimyia complex		-	-	-	-	-
F. Empididae						
Clinocera		4	7	-	11	-
F. Muscidae		-	-	-	-	-
F. Simuliidae						
Gymnopais		4	-	-	-	4
Metacnephia		-	-	-	-	-
Prosimulium		11	7	4	4	22
pupae		-	-	-	-	-
F. Tipulidae						
Dicranota		-	-	-	-	-
Tipula		11	11	7	11	11
Number of Organisms (No. organisms per m^2)		903	333	1,125	502	530
Richness (total number of taxa)[a]		18	14	17	20	18
Simpson's Evenness (E)		0.894	0.939	0.791	0.914	0.856
Shannon-Wiener Diversity		3.166	3.286	2.629	3.457	3.179
Percent Composition						
% Nemata		0.0	0.0	1.3	1.4	0.0
% Oligochaeta		23.8	4.3	44.9	1.4	2.0
% Hydracarina		4.0	4.3	1.3	3.6	2.0
% Ostracods		0.0	1.1	0.0	0.7	0.0
% Ephemeroptera		0.0	0.0	0.0	0.0	0.0
% Chironomids		68.7	64.5	51.0	80.7	87.2
% Metal Sensitive Chironmids		6.2	1.2	4.8	10.8	5.4
% Simuliidae		1.6	2.2	0.3	0.7	4.7
% Tipulidae		1.2	3.2	0.6	2.1	2.0
Functional Feeding Group Composition						
% Collector - Gatherers		84.7	60.1	88.9	83.3	85.4
% Filterers		1.2	2.2	0.3	0.7	4.1
% Shredders		8.9	13.0	9.2	5.3	5.8
Habitat Preference Group Composition						
% Clingers		13.7	18.4	9.9	7.4	10.6
% Sprawlers		60.9	55.8	43.0	82.6	83.3
% Burrowers		25.4	25.8	47.1	10.0	6.1

[a] Bold entries excluded from taxa count

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2020

Taxa	Study Area / Replicate Station	Downstream (CLT2-DS) B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		724	4	7	4	7
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		229	14	68	4	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Lebertiidae						
Lebertia		-	-	-	-	-
F. Sperchonidae						
Sperchon		7	36	18	14	43
SEED SHRIMPS						
Cl. Ostracoda		-	4	-	4	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	4	-	-	18
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		14	-	11	-	7
MIDGES						
F. Chironomidae						
chironomid pupae		**115**	**100**	**75**	**36**	**47**
S.F. Chironominae						
Micropsectra		-	-	-	-	-
Paratanytarsus		-	-	-	-	-
Rheotanytarsus		-	4	-	-	-
S.F. Diamesinae						
Diamesa		93	82	75	14	39
Pseudokiefferiella		108	7	25	-	4
S.F. Orthocladiinae						
Cardiocladius		-	-	22	14	7
Chaetocladius		50	14	14	18	4
Corynoneura		7	4	-	-	-
Cricotopus		72	57	54	57	-
Cricotopus/Orthocladius		50	7	11	18	11
Eukiefferiella		36	22	22	14	-

Table F.12: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake Tributary 2 Study Areas, August 2020

Taxa — Study Area / Replicate Station	Downstream (CLT2-DS) B1	B2	B3	B4	B5
Hydrobaenus	-	11	-	-	-
Hydrosmittia	14	7	7	-	-
Krenosmittia	14	65	75	22	-
Limnophyes	-	18	14	-	-
Metriocnemus	-	-	-	-	-
Orthocladius (Euorthocladius)	165	115	97	50	32
Parakiefferiella	-	-	7	-	-
Paraphaenocladius	-	4	-	-	-
Psectrocladius	-	-	-	-	-
Thienemanniella	-	-	-	-	-
Tokunagaia	36	90	25	32	36
Tvetenia	194	133	154	39	68
indeterminate	-	-	-	-	-
S.F. Podonominae					
Trichotanypus	-	-	-	-	-
S.F. Tanypodinae					
Thienemannimyia complex	-	-	-	-	-
F. Empididae					
Clinocera	-	-	11	-	-
F. Muscidae	-	4	-	-	-
F. Simuliidae					
Gymnopais	7	-	4	-	-
Metacnephia	14	11	7	4	-
Prosimulium	14	32	22	-	11
pupae	-	**7**	-	-	-
F. Tipulidae					
Dicranota	-	-	11	-	-
Tipula	22	11	39	4	-
Number of Organisms (No. organisms per m^2)	1,986	864	875	348	333
Richness (total number of taxa)[a]	19	24	23	15	12
Simpson's Evenness (E)	0.863	0.935	0.946	0.935	0.927
Shannon-Wiener Diversity	3.095	3.676	3.839	3.308	3.024
Percent Composition					
% Nemata	36.5	0.4	0.8	1.0	2.2
% Oligochaeta	11.6	1.7	7.8	1.0	0.0
% Hydracarina	0.4	4.1	2.0	4.1	12.9
% Ostracods	0.0	0.4	0.0	1.0	0.0
% Ephemeroptera	0.0	0.0	0.0	0.0	0.0
% Chironomids	48.0	85.5	77.5	90.7	74.2
% Metal Sensitive Chironmids	11.5	12.5	12.9	4.7	15.9
% Simuliidae	1.8	5.8	3.7	1.0	3.2
% Tipulidae	1.1	1.2	5.7	1.0	0.0
Functional Feeding Group Composition					
% Collector - Gatherers	91.1	79.5	75.9	67.5	73.7
% Filterers	1.4	6.3	3.3	1.0	3.2
% Shredders	6.1	9.7	11.9	22.7	5.4
Habitat Preference Group Composition					
% Clingers	7.1	18.4	14.4	26.9	16.1
% Sprawlers	43.0	77.8	68.5	65.4	76.9
% Burrowers	49.8	3.7	17.1	7.7	7.0

[a] Bold entries excluded from taxa count

Table F.13: Benthic Station Habitat Feature Statistical Comparisons among Camp Lake Tributary 2 and Unnamed Reference Creek Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 3-group Comparison				Pair-wise, post-hoc comparisons			
	Statistical Test [a]	Transformation	Significant Difference between Areas?	p-value	(I) Area	(J) Area	Significant Difference Between Areas?	P-value
Water Depth (cm)	ANOVA	none	NO	0.362	Unnamed Reference Creek	CLT2 Upstream	NO	0.342
					Unnamed Reference Creek	CLT2 Downstream	NO	0.477
					CLT2 Upstream	CLT2 Downstream	NO	0.481
Water Velocity (cm/s)	ANOVA	none	NO	0.111	Unnamed Reference Creek	CLT2 Upstream	NO	0.150
					Unnamed Reference Creek	CLT2 Downstream	NO	0.852
					CLT2 Upstream	CLT2 Downstream	NO	0.372
Substrate Embeddedness (%)	ANOVA	none	YES	0.056	Unnamed Reference Creek	CLT2 Upstream	NO	0.374
					Unnamed Reference Creek	CLT2 Downstream	NO	0.230
					CLT2 Upstream	CLT2 Downstream	YES	0.025

Highlighted values indicate significant difference between study areas based on test p-value less than 0.10.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Signficant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.14: Benthic Invertebrate Community Summary Statistics for Camp Lake Tributary 2 Study Areas, Mary River Project CREMP, August 2020

Metric	Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (no. organisms / m^2)	Unnamed Reference Creek	713	296	133	258	821	1,032
	CLT2 Upstream	679	325	145	333	530	1,125
	CLT2 Downstream	881	672	300	333	864	1,986
Richness (Number of Taxa)	Unnamed Reference Creek	16.0	4.4	2.0	9.0	17.0	20.0
	CLT2 Upstream	17.4	2.2	1.0	14.0	18.0	20.0
	CLT2 Downstream	18.6	5.1	2.3	12.0	19.0	24.0
Simpson's Evenness	Unnamed Reference Creek	0.840	0.043	0.019	0.767	0.856	0.878
	CLT2 Upstream	0.879	0.058	0.026	0.791	0.894	0.939
	CLT2 Downstream	0.921	0.033	0.015	0.863	0.935	0.946
Nemata (% of community)	Unnamed Reference Creek	0.7%	1.3%	0.6%	0.0%	0.3%	3.0%
	CLT2 Upstream	0.5%	0.7%	0.3%	0.0%	0.0%	1.4%
	CLT2 Downstream	8.2%	15.8%	7.1%	0.4%	1.0%	36.5%
Oligochaeta (% of community)	Unnamed Reference Creek	1.9%	1.5%	0.7%	0.8%	1.0%	4.2%
	CLT2 Upstream	15.3%	19.0%	8.5%	1.4%	4.3%	44.9%
	CLT2 Downstream	4.4%	5.0%	2.3%	0.0%	1.7%	11.6%
Hydracarina (% of community)	Unnamed Reference Creek	4.5%	3.7%	1.7%	2.1%	3.0%	11.1%
	CLT2 Upstream	3.0%	1.3%	0.6%	1.3%	3.6%	4.3%
	CLT2 Downstream	4.7%	4.8%	2.2%	0.4%	4.1%	12.9%
Ostracoda (% of community)	Unnamed Reference Creek	30.6%	11.7%	5.3%	16.7%	34.2%	42.0%
	CLT2 Upstream	0.4%	0.5%	0.2%	0.0%	0.0%	1.1%
	CLT2 Downstream	0.3%	0.5%	0.2%	0.0%	0.0%	1.0%
Chironomidae (% of community)	Unnamed Reference Creek	48.3%	12.9%	5.8%	36.7%	43.1%	67.3%
	CLT2 Upstream	70.4%	14.2%	6.3%	51.0%	68.7%	87.2%
	CLT2 Downstream	75.2%	16.5%	7.4%	48.0%	77.5%	90.7%
Metal-Sensitive Chironomidae (% of community)	Unnamed Reference Creek	0.8%	1.2%	0.6%	0.0%	0.5%	3.0%
	CLT2 Upstream	5.7%	3.5%	1.5%	1.2%	5.4%	10.8%
	CLT2 Downstream	11.5%	4.2%	1.9%	4.7%	12.5%	15.9%
Simuliidae (% of community)	Unnamed Reference Creek	9.8%	8.6%	3.8%	0.0%	8.7%	20.7%
	CLT2 Upstream	1.9%	1.7%	0.8%	0.3%	1.6%	4.7%
	CLT2 Downstream	3.1%	1.9%	0.8%	1.0%	3.2%	5.8%
Tipulidae (% of community)	Unnamed Reference Creek	1.5%	2.3%	1.0%	0.0%	0.9%	5.6%
	CLT2 Upstream	1.8%	1.0%	0.4%	0.6%	2.0%	3.2%
	CLT2 Downstream	1.8%	2.2%	1.0%	0.0%	1.1%	5.7%
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	80.7%	8.8%	3.9%	70.0%	77.6%	91.1%
	CLT2 Upstream	80.5%	11.6%	5.2%	60.1%	84.8%	88.8%
	CLT2 Downstream	77.5%	8.7%	3.9%	67.5%	75.9%	91.0%
Filterer FFG (% of community)	Unnamed Reference Creek	9.9%	8.9%	4.0%	0.0%	8.0%	21.5%
	CLT2 Upstream	1.7%	1.5%	0.7%	0.3%	1.2%	4.1%
	CLT2 Downstream	3.1%	2.1%	0.9%	1.0%	3.2%	6.3%
Shredder FFG (% of community)	Unnamed Reference Creek	2.8%	2.7%	1.2%	0.0%	2.4%	7.0%
	CLT2 Upstream	8.5%	3.1%	1.4%	5.3%	8.9%	13.0%
	CLT2 Downstream	11.2%	7.0%	3.1%	5.4%	9.7%	22.7%
Clinger HPG (% of community)	Unnamed Reference Creek	15.8%	7.7%	3.5%	7.8%	12.6%	27.0%
	CLT2 Upstream	12.0%	4.2%	1.9%	7.4%	10.6%	18.4%
	CLT2 Downstream	16.6%	7.1%	3.2%	7.1%	16.1%	26.9%
Sprawler HPG (% of community)	Unnamed Reference Creek	79.4%	6.6%	3.0%	70.0%	79.1%	87.2%
	CLT2 Upstream	65.1%	17.6%	7.9%	43.0%	60.9%	83.3%
	CLT2 Downstream	66.3%	14.1%	6.3%	43.0%	68.5%	77.8%
Burrower HPG (% of community)	Unnamed Reference Creek	4.8%	3.3%	1.5%	1.4%	3.1%	8.3%
	CLT2 Upstream	22.9%	16.2%	7.3%	6.1%	25.4%	47.1%
	CLT2 Downstream	17.1%	19.0%	8.5%	3.7%	7.8%	49.8%

Note: Sample size equals five for all study areas.

Table F.15: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	<0.001	2007	3	364	205	-	a,b,c
					2015	5	741	416	1.8	a
					2016	5	412	100	0.2	a,b,c
					2017	5	216	30	-0.7	b,c
					2018	5	168	65	-1.0	c
					2019	5	745	282	1.9	a
					2020	5	679	325	1.5	a
Richness (No. of Taxa)	ANOVA	log10	YES	0.003	2007	3	12.7	2.1	-	a
					2015	5	20.8	1.8	3.9	b
					2016	5	17.2	3.0	2.2	a,b,c
					2017	5	14.6	2.5	0.9	a,c
					2018	5	15.0	3.7	1.1	a,c
					2019	5	18.8	2.6	2.9	b,c
					2020	5	17.4	2.2	2.3	a,b,c
Simpson's Evenness	K-W	rank	YES	0.003	2007	3	0.825	0.008	-	a
					2015	5	0.922	0.025	11.9	b,c
					2016	5	0.898	0.035	8.9	a,c
					2017	5	0.955	0.013	15.9	b
					2018	5	0.922	0.043	11.9	b,c
					2019	5	0.949	0.005	15.2	b
					2020	5	0.879	0.058	6.6	a,c
Nemata (% of community)	K-W	rank	NO	0.255	2007	3	1.1	0.6	-	a
					2015	5	0.9	0.9	-0.5	a
					2016	5	1.0	0.8	-0.3	a
					2017	5	1.0	1.4	-0.3	a
					2018	5	1.1	1.6	0.0	a
					2019	5	2.4	1.0	2.2	a
					2020	5	0.5	0.7	-1.0	a
Oligochaeta (% of community)	K-W	rank	NO	0.406	2007	3	2.1	0.8	-	a
					2015	5	2.7	2.8	0.7	a
					2016	5	4.9	3.5	3.5	a
					2017	5	3.4	6.5	1.6	a
					2018	5	2.4	3.4	0.4	a
					2019	5	2.4	1.0	0.4	a
					2020	5	15.3	19.0	16.7	a
Hydracarina (% of community)	ANOVA	log10(x+1)	YES	0.007	2007	3	2.9	2.1	-	a,b
					2015	5	0.9	0.7	-1.0	b
					2016	5	5.5	2.6	1.2	a,b
					2017	5	8.0	4.2	2.4	a
					2018	5	4.7	4.4	0.8	a,b
					2019	5	1.6	1.5	-0.6	b
					2020	5	3.0	1.3	0.0	a,b
Chironomidae (% of community)	ANOVA	none	NO	0.181	2007	3	88.4	4.3	-	a
					2015	5	80.2	8.9	-1.9	a
					2016	5	79.5	8.6	-2.1	a
					2017	5	75.9	7.5	-2.9	a
					2018	5	80.2	3.9	-1.9	a
					2019	5	80.0	5.9	-2.0	a
					2020	5	70.4	14.2	-4.2	a

Table F.15: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Upstream (CLT2 US) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Metal Sensitive Taxa (% of community)	ANOVA	none	YES	<0.001	2007	3	5.3	0.6	-	a
					2015	5	10.5	5.7	8.7	a,b
					2016	5	5.3	3.3	0.0	a
					2017	5	22.0	3.1	28.2	c
					2018	5	9.5	5.0	7.1	a,b
					2019	5	17.0	6.6	19.7	b,c
					2020	5	5.7	3.5	0.6	a
Tipulidae (% of community)	ANOVA	log10(x+1)	YES	0.042	2007	3	5.2	2.0	-	a
					2015	5	4.1	3.5	-0.5	a
					2016	5	4.0	1.8	-0.6	a
					2017	5	1.6	1.6	-1.8	a
					2018	5	2.3	1.5	-1.5	a
					2019	5	1.6	0.6	-1.8	a
					2020	5	1.8	1.0	-1.7	a
Collector-Gatherer FFG (% of community)	K-W	rank	YES	0.008	2007	3	68.5	6.5	-	a,b,c
					2015	5	63.8	10.3	-0.7	c,d
					2016	5	66.6	5.8	-0.3	b,c
					2017	5	75.6	3.9	1.1	a,b
					2018	5	73.2	8.6	0.7	a,b,c
					2019	5	54.0	6.0	-2.2	d
					2020	5	80.5	11.6	1.8	a
Filterer FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	0.3	0.4	-	a
					2015	5	1.0	1.1	1.7	a
					2016	5	0.2	0.4	-0.2	a
					2017	5	6.5	3.1	14.4	b,c
					2018	5	6.6	5.5	14.7	b,c
					2019	5	11.3	3.7	25.6	b
					2020	5	1.7	1.5	3.3	a,c
Shredder FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	27.6	5.8	-	a
					2015	5	26.2	5.9	-0.2	a
					2016	5	25.9	4.4	-0.3	a
					2017	5	7.4	5.9	-3.5	b
					2018	5	12.9	5.3	-2.5	b,c
					2019	5	21.9	5.8	-1.0	a,c
					2020	5	8.5	3.1	-3.3	b

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.16: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Downstream (CLT2 DS) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	0.002	2007	3	431	109	-	a,b,c
					2015	5	447	258	0.1	a,b
					2016	5	205	61	-2.1	b,c
					2017	5	222	144	-1.9	b,c
					2018	5	127	51	-2.8	c
					2019	5	546	366	1.1	a,b
					2020	5	881	672	4.1	a
Richness (No. of Taxa)	ANOVA	none	YES	0.029	2007	3	17.7	2.1	-	a,b
					2015	5	14.2	3.4	-1.7	a,b
					2016	5	14.0	4.0	-1.8	a,b
					2017	5	13.2	4.7	-2.2	a,b
					2018	5	11.2	1.9	-3.1	b
					2019	5	18.4	3.1	0.3	a
					2020	5	18.6	5.1	0.4	a
Simpson's Evenness	K-W	rank	YES	0.075	2007	3	0.865	0.017	-	a,b
					2015	5	0.934	0.034	4.0	c
					2016	5	0.838	0.079	-1.6	b
					2017	5	0.913	0.052	2.8	a,c,d
					2018	5	0.908	0.087	2.5	c,d
					2019	5	0.885	0.048	1.1	a,b,c
					2020	5	0.921	0.033	3.2	c,d
Nemata (% of community)	K-W	rank	NO	0.643	2007	3	1.1	1.2	-	a
					2015	5	4.2	2.4	2.6	a
					2016	5	2.0	2.4	0.8	a
					2017	5	3.2	4.4	1.8	a
					2018	5	2.7	3.0	1.4	a
					2019	5	2.6	1.8	1.2	a
					2020	5	8.2	15.8	5.9	a
Oligochaeta (% of community)	K-W	rank	NO	0.486	2007	3	2.6	0.6	-	a
					2015	5	8.8	12.8	10.1	a
					2016	5	1.9	3.2	-1.1	a
					2017	5	4.8	6.9	3.7	a
					2018	5	1.1	2.5	-2.3	a
					2019	5	4.3	3.3	2.8	a
					2020	5	4.4	5.0	3.0	a
Hydracarina (% of community)	K-W	rank	YES	0.091	2007	3	1.8	1.2	-	a,b
					2015	5	0.3	0.6	-1.2	b
					2016	5	4.5	1.9	2.2	a
					2017	5	3.3	4.0	1.3	a
					2018	5	3.5	4.0	1.4	a
					2019	5	2.1	0.7	0.3	b
					2020	5	4.7	4.8	2.4	a
Chironomidae (% of community)	K-W	rank	NO	0.469	2007	3	88.0	6.0	-	a
					2015	5	75.6	10.4	-2.1	a
					2016	5	82.4	6.3	-0.9	a
					2017	5	81.8	8.4	-1.0	a
					2018	5	84.1	6.0	-0.7	a
					2019	5	84.7	3.5	-0.6	a
					2020	5	75.2	16.5	-2.1	a

Table F.16: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Tributary 2 Downstream (CLT2 DS) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Metal Sensitive Taxa (% of community)	K-W	rank	YES	0.032	2007	3	11.8	2.0	-	a,b,c
					2015	5	10.6	10.6	-0.6	b,c
					2016	5	5.4	0.9	-3.3	c
					2017	5	20.2	12.6	4.3	a,b
					2018	5	8.0	7.0	-1.9	b,c
					2019	5	23.3	10.1	5.9	a
					2020	5	11.5	4.2	-0.2	a,b,c
Tipulidae (% of community)	ANOVA	log10(x+1)	NO	0.116	2007	3	6.5	6.6	-	a
					2015	5	5.8	5.1	-0.1	a
					2016	5	2.2	1.6	-0.6	a
					2017	5	0.8	1.9	-0.9	a
					2018	5	2.6	2.4	-0.6	a
					2019	5	1.7	1.4	-0.7	a
					2020	5	1.8	2.2	-0.7	a
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.059	2007	3	66.4	11.0	-	a,b
					2015	5	69.3	10.9	0.3	a,b
					2016	5	77.6	11.6	1.0	a,b
					2017	5	77.1	10.5	1.0	a,b
					2018	5	83.4	6.5	1.5	a
					2019	5	56.8	23.0	-0.9	b
					2020	5	77.5	8.7	1.0	a,b
Filterer FFG (% of community)	K-W	rank	YES	0.005	2007	3	2.7	1.9	-	a,b,c,d
					2015	5	0.8	0.9	-1.0	c,d
					2016	5	1.1	1.0	-0.9	b,c,d
					2017	5	3.5	3.1	0.4	b,d
					2018	5	0.9	2.1	-1.0	c
					2019	5	15.4	11.3	6.7	a
					2020	5	3.1	2.1	0.2	a,b
Shredder FFG (% of community)	ANOVA	log10(x+1)	NO	0.130	2007	3	21.5	6.0	-	a
					2015	5	25.7	11.6	0.7	a
					2016	5	13.8	10.4	-1.3	a
					2017	5	14.6	8.9	-1.2	a
					2018	5	7.7	7.3	-2.3	a
					2019	5	21.0	16.9	-0.1	a
					2020	5	11.2	7.0	-1.7	a

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

Note: "-" indicates no data applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.17: Statistical Comparison of Physical Sediment Quality Between Littoral and Profundal Stations of Reference Lake 3, Mary River Project CREMP, August 2020

Habitat Variable	Statistical Test Results				Summary Statistics						
	Statistical Analysis[a]	Transformation	Significant Difference Between Areas?	P-value	Station Type	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Sand-Sized Particles (% by weight)	tequal	none	NO	0.854	Littoral	5	29.6	7.5	3.4	23.4	40.4
					Profundal	5	31.6	22.3	10.0	13.9	56.6
Silt-Sized Particles (% by weight)	tequal	none	NO	0.590	Littoral	5	62.2	6.3	2.8	53.4	68.4
					Profundal	5	57.4	18.1	8.1	36.9	71.9
Clay-Sized Particles (% by weight)	tequal	none	NO	0.266	Littoral	5	8.2	3.0	1.3	6.2	13.4
					Profundal	5	11.0	4.3	1.9	6.3	15.1
Moisture (% by weight)	tequal	none	YES	0.078	Littoral	5	87.9	4.6	2.1	80.2	92.3
					Profundal	5	82.6	3.6	1.6	78.3	86.6
Total Organic Carbon (%)	tequal	none	NO	0.205	Littoral	5	4.8	2.0	0.9	2.3	7.0
					Profundal	5	3.4	1.1	0.5	2.2	4.5

Highlighted values indicate significant difference between study areas based on statistical test p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table F.18: Statistical Comparison of Sediment Physical Properties Between Camp Lake and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Data Transformation	Significant Difference between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Station Depth (m)	tequal	log10	NO	0.310	Reference	5	9.4	1.4	0.6	7.3	10.6
						Camp	5	8.3	1.9	0.8	7.0	11.3
	Sand-Sized Material (%)	tequal	none	YES	0.006	Reference	5	29.6	7.5	3.4	23.4	40.4
						Camp	5	65.4	20.1	9.0	41.1	85.0
	Silt-Sized Material (%)	tequal	none	YES	0.008	Reference	5	62.2	6.3	2.8	53.4	68.4
						Camp	5	32.1	18.2	8.2	14.2	55.1
	Clay-Sized Material (%)	tequal	none	YES	0.008	Reference	5	8.2	3.0	1.3	6.2	13.4
						Camp	5	2.6	2.0	0.9	1.0	5.5
	Moisture (%)	tequal	none	YES	0.006	Reference	5	87.9	4.6	2.1	80.2	92.3
						Camp	5	57.3	17.9	8.0	37.7	81.7
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.011	Reference	5	4.8	2.0	0.9	2.3	7.0
						Camp	5	1.4	1.2	0.5	0.3	3.4
Profundal (Deep) Stations	Station Depth (m)	tequal	none	YES	0.009	Reference	5	19.3	2.5	1.1	16.0	21.9
						Camp	5	26.6	4.1	1.8	21.2	31.0
	Sand-Sized Material (%)	tequal	none	NO	0.253	Reference	5	31.6	22.3	10.0	13.9	56.6
						Camp	5	52.8	31.4	14.0	18.3	86.8
	Silt-Sized Material (%)	tequal	none	NO	0.270	Reference	5	57.4	18.1	8.1	36.9	71.9
						Camp	5	40.4	26.6	11.9	11.8	69.4
	Clay-Sized Material (%)	tequal	none	NO	0.195	Reference	5	11.0	4.3	1.9	6.3	15.1
						Camp	5	6.9	5.0	2.2	1.4	12.3
	Moisture (%)	tequal	none	YES	0.024	Reference	5	82.6	3.6	1.6	78.3	86.6
						Camp	5	55.4	21.7	9.7	26.4	74.4
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.022	Reference	5	3.4	1.1	0.5	2.2	4.5
						Camp	5	1.4	1.2	0.5	0.3	3.1

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table F.19: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2020

Taxa	Study Area	Reference Lake 03 - Littoral Stations				
	Replicate Station	REF-01	REF-02	REF-03	REF-04	REF-05
ROUNDWORMS						
P. Nemata		26	34	112	103	9
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Acalyptonotidae						
Acalyptonotus		26	17	-	-	17
F. Hygrobatidae						
Hygrobates		60	86	17	9	9
F. Lebertiidae						
Lebertia		52	-	34	43	34
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		371	638	431	922	543
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	-	-	-	-
F. Limnephilidae						
Grensia praeterita		9	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		**52**	**86**	**78**	**26**	**121**
S.F. Chironominae						
Chironomus		-	-	-	-	-
Micropsectra		147	690	267	164	440

Table F.19: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2020

Taxa	Study Area / Replicate Station	Reference Lake 03 - Littoral Stations				
		REF-01	REF-02	REF-03	REF-04	REF-05
Paratanytarsus		17	17	-	-	-
Sergentia		-	-	-	-	-
Stictochironomus		52	328	9	9	43
Tanytarsus		95	121	34	34	-
S.F. Diamesinae						
Diamesa		-	-	-	-	-
Protanypus		26	17	26	9	9
Pseudodiamesa		9	-	9	9	-
S.F. Orthocladiinae						
Abiskomyia		181	86	69	52	60
Heterotrissocladius		26	69	52	34	69
Hydrobaenus		-	-	-	-	-
Mesocricotopus		-	-	-	-	-
Paracladius		95	-	43	43	-
Parakiefferiella		9	-	-	-	9
Psectrocladius		17	34	-	9	34
Zalutschia		86	69	9	9	95
Orthocladiinae indeterminate		-	-	-	-	-
S.F. Tanypodinae						
Arctopelopia		-	17	-	-	-
Procladius		34	-	-	-	-
Density (No. organisms per m^2)		1,388	2,310	1,190	1,474	1,491
Richness (total number of taxa)[a]		19	14	13	14	13
Simpson's Evenness (E)		0.923	0.853	0.847	0.630	0.799
Shannon-Wiener Diversity		3.510	2.760	2.730	2.079	2.457
Dominant Taxonomic Group Composition						
% Nemata		1.9	1.5	9.4	7.0	0.6
% Hydracarina		9.9	4.5	4.3	3.5	4.0
% Ostracods		26.7	27.6	36.2	62.6	36.4
% Chironomids		60.9	66.4	50.0	26.9	59.0
% Metal Sensitive Chironmids		22.5	38.7	32.5	15.6	34.8
Functional Feeding Group Composition						
% Collector - Gatherers		60.3	53.6	65.7	81.5	54.4
% Filterers		19.8	38.0	29.2	14.4	34.2
% Shredders		7.2	3.2	0.8	0.6	7.4
Habitat Preference Group Composition						
% Clingers		28.5	41.6	33.5	17.9	38.2
% Sprawlers		63.7	41.1	53.7	73.8	57.2
% Burrowers		7.8	17.3	12.8	8.3	4.6

[a] Bold entries excluded from taxa count

Table F.19: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2020

Taxa	Study Area	Reference Lake 03 - Profundal Stations				
	Replicate Station	REF-06	REF-07	REF-08	REF-09	REF-10
ROUNDWORMS						
P. Nemata		-	-	9	-	9
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Acalyptonotidae						
Acalyptonotus		9	-	9	-	-
F. Hygrobatidae						
Hygrobates		-	-	-	-	-
F. Lebertiidae						
Lebertia		9	-	9	26	9
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		26	26	17	69	78
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	-	-	-	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		**9**	-	**17**	-	**17**
S.F. Chironominae						
Chironomus		-	-	-	-	-
Micropsectra		26	147	233	259	86

Table F.19: **Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Reference Lake 3, August 2020**

Taxa — Study Area / Replicate Station	Reference Lake 03 - Profundal Stations				
	REF-06	REF-07	REF-08	REF-09	REF-10
Paratanytarsus	-	-	-	-	-
Sergentia	-	-	-	-	-
Stictochironomus	-	-	-	-	17
Tanytarsus	-	-	-	-	-
S.F. Diamesinae					
Diamesa	-	-	-	-	-
Protanypus	-	-	-	-	9
Pseudodiamesa	-	9	-	-	-
S.F. Orthocladiinae					
Abiskomyia	34	-	9	-	9
Heterotrissocladius	198	164	181	310	284
Hydrobaenus	-	-	-	-	-
Mesocricotopus	-	-	-	-	-
Paracladius	-	-	-	-	-
Parakiefferiella	-	-	-	-	-
Psectrocladius	-	-	-	-	-
Zalutschia	17	-	-	17	17
Orthocladiinae indeterminate	-	-	-	-	-
S.F. Tanypodinae					
Arctopelopia	-	-	-	-	-
Procladius	9	9	9	-	-
Density (No. organisms per m^2)	338	355	493	684	537
Richness (total number of taxa)[a]	8	5	8	5	9
Simpson's Evenness (E)	0.689	0.758	0.694	0.795	0.721
Shannon-Wiener Diversity	1.988	1.578	1.721	1.695	2.027
Dominant Taxonomic Group Compos					
% Nemata	0.0	0.0	1.8	0.0	1.6
% Hydracarina	5.1	0.0	3.5	3.8	1.6
% Ostracods	7.7	7.3	3.5	10.1	14.5
% Chironomids	87.2	92.7	91.2	86.1	82.3
% Metal Sensitive Chironmids	7.9	43.9	49.3	38.0	18.5
Functional Feeding Group Compositi					
% Collector - Gatherers	79.0	56.1	45.4	55.7	78.2
% Filterers	7.9	41.5	49.3	38.0	16.8
% Shredders	5.3	0.0	0.0	2.5	3.4
Habitat Preference Group Compositic					
% Clingers	13.1	41.5	52.8	41.8	18.4
% Sprawlers	86.9	58.5	45.5	58.2	75.0
% Burrowers	0.0	0.0	1.8	0.0	6.6

[a] Bold entries excluded from taxa count

Table F.20: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2020

Taxa	Study Area	Camp Lake - Littoral Stations				
	Replicate Station	JLO-02	JLO-21	JLO-20	JLO-19	JLO-18
ROUNDWORMS						
P. Nemata		34	293	129	86	34
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		17	17	-	9	17
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Acalyptonotidae						
Acalyptonotus		17	-	26	103	17
F. Hygrobatidae						
Hygrobates		-	34	9	9	103
F. Lebertiidae						
Lebertia		-	17	9	9	-
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		121	328	129	52	-
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		52	52	9	69	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		**52**	**17**	**17**	**103**	**34**
S.F. Chironominae						
Chironomus		-	-	-	-	17
Micropsectra		52	379	267	1,259	86

Table F.20: **Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2020**

Taxa / Study Area / Replicate Station	Camp Lake - Littoral Stations JLO-02	JLO-21	JLO-20	JLO-19	JLO-18
Paratanytarsus	517	759	86	190	17
Sergentia	17	-	-	-	121
Stictochironomus	1,672	2,190	1,388	1,043	966
Tanytarsus	121	1,569	1,353	1,569	34
S.F. Diamesinae					
Diamesa	-	-	-	-	-
Protanypus	-	-	-	34	52
Pseudodiamesa	-	-	-	-	-
S.F. Orthocladiinae					
Abiskomyia	241	103	103	112	121
Heterotrissocladius	1,276	1,431	440	457	259
Hydrobaenus	-	-	-	-	-
Mesocricotopus	-	-	-	-	17
Paracladius	-	17	17	-	-
Parakiefferiella	-	34	52	-	34
Psectrocladius	-	-	17	34	-
Zalutschia	-	17	34	86	-
Orthocladiinae indeterminate	-	-	-	-	-
S.F. Tanypodinae					
Arctopelopia	1,207	414	207	147	-
Procladius	328	379	69	103	69
Density (No. organisms per m^2)	5,724	8,052	4,362	5,474	2,000
Richness (total number of taxa)[a]	14	17	18	18	16
Simpson's Evenness (E)	0.864	0.889	0.827	0.858	0.773
Shannon-Wiener Diversity	2.705	3.006	2.770	2.889	2.715
Dominant Taxonomic Group Composition					
% Nemata	0.6	3.6	3.0	1.6	1.7
% Hydracarina	0.3	0.6	1.0	2.2	6.0
% Ostracods	2.1	4.1	3.0	0.9	0.0
% Chironomids	95.8	90.8	92.9	93.9	91.4
% Metal Sensitive Chironmids	12.2	33.7	39.3	56.9	9.7
Functional Feeding Group Composition					
% Collector - Gatherers	59.6	54.9	52.4	34.0	83.4
% Filterers	12.2	33.7	39.3	56.3	7.0
% Shredders	0.0	0.2	0.8	1.6	0.0
Habitat Preference Group Composition					
% Clingers	4.5	25.5	38.5	56.2	18.3
% Sprawlers	65.1	43.3	26.6	22.0	26.4
% Burrowers	30.4	31.1	34.9	21.8	55.3

[a] Bold entries excluded from taxa count

Table F.20: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2020

Taxa	Study Area / Replicate Station	Camp Lake - Profundal Stations JLO-16	JLO-01	JLO-07	JLO-11	JLO-12
ROUNDWORMS						
P. Nemata		34	9	-	-	121
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Acalyptonotidae						
Acalyptonotus		9	9	9	17	-
F. Hygrobatidae						
Hygrobates		34	-	-	-	-
F. Lebertiidae						
Lebertia		52	-	-	-	-
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		26	43	17	-	405
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	-	-	-	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		**147**	-	**86**	**17**	**17**
S.F. Chironominae						
Chironomus		43	-	586	776	-
Micropsectra		26	9	-	-	9

Table F.20: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Camp Lake, August 2020

Taxa	Study Area: Camp Lake - Profundal Stations				
Replicate Station	JLO-16	JLO-01	JLO-07	JLO-11	JLO-12
Paratanytarsus	-	17	-	52	-
Sergentia	78	-	86	-	-
Stictochironomus	414	-	121	34	-
Tanytarsus	198	-	95	155	-
S.F. Diamesinae					
Diamesa	-	-	-	-	-
Protanypus	34	26	9	-	34
Pseudodiamesa	17	17	-	-	-
S.F. Orthocladiinae					
Abiskomyia	155	78	121	69	34
Heterotrissocladius	302	388	-	17	1,672
Hydrobaenus	-	-	-	-	-
Mesocricotopus	-	-	-	-	-
Paracladius	34	-	-	-	43
Parakiefferiella	9	-	-	-	-
Psectrocladius	-	-	-	-	-
Zalutschia	17	-	-	-	-
Orthocladiinae indeterminate	-	-	-	-	-
S.F. Tanypodinae					
Arctopelopia	-	9	-	-	9
Procladius	52	17	-	-	-
Density (No. organisms per m^2)	623	1,134	1,688	1,143	2,355
Richness (total number of taxa)[a]	11	8	18	7	8
Simpson's Evenness (E)	0.643	0.732	0.901	0.576	0.512
Shannon-Wiener Diversity	2.031	2.003	3.278	1.553	1.346
Dominant Taxonomic Group Compo					
% Nemata	1.4	0.0	2.1	0.0	5.1
% Hydracarina	1.4	0.8	5.6	1.5	0.0
% Ostracods	6.9	1.5	1.5	0.0	17.3
% Chironomids	90.3	97.7	90.8	98.5	77.6
% Metal Sensitive Chironmids	11.1	9.9	18.2	18.5	1.9
Functional Feeding Group Compos					
% Collector - Gatherers	90.3	90.1	75.1	80.0	99.3
% Filterers	4.2	9.1	14.8	18.5	0.4
% Shredders	0.0	0.0	1.1	0.0	0.0
Habitat Preference Group Composi					
% Clingers	2.8	18.2	25.5	15.4	0.4
% Sprawlers	91.7	13.1	40.1	12.3	93.0
% Burrowers	5.6	68.7	34.4	72.3	6.6

[a] Bold entries excluded from taxa cour

Table F.21: Statistical Comparison of Bray-Curtis Index between the Mine-Exposed Lakes and Reference Lake 3, Mary River Project CREMP, August 2020

Waterbody	Comparison	n		Betadisper P-Value	Mantel Test			dbRDA			
		Reference	Mine-Exposed		r	R^2	P-Value	F-Value	R^2	R^2_{adj}	P-Value
Reference Lake 3	Littoral vs Profundal	5	5	0.277	0.789	0.622	0.008	12.32	0.606	0.557	0.006
Camp Lake (JL0)	Littoral Habitat, vs Reference Lake 3	5	5	0.855	0.649	0.421	0.008	8.12	0.504	0.442	0.008
	Profundal Habitat, vs Reference Lake 3	5	5	0.011	0.487	0.237	0.008	5.67	0.415	0.342	0.008
Sheardown Lake NW (DL0-1)	Littoral Habitat, vs Reference Lake 3	5	5	0.229	0.518	0.268	0.008	5.10	0.389	0.313	0.013
	Profundal Habitat, vs Reference Lake 3	5	5	0.554	0.479	0.230	0.008	5.44	0.405	0.330	0.008
Sheardown Lake SE (DL0-2)	Littoral Habitat, vs Reference Lake 3	5	5	0.350	0.809	0.654	0.008	11.81	0.596	0.546	0.008
	Profundal Habitat, vs Reference Lake 3	5	5	0.590	0.676	0.457	0.007	9.80	0.550	0.494	0.008
Mary Lake (BL0)	Littoral Habitat, vs Reference Lake 3	5	4	0.044	0.406	0.165	0.008	2.89	0.292	0.191	0.021
	Profundal Habitat, vs Reference Lake 3	5	6	0.243	0.240	0.058	0.030	3.18	0.261	0.179	0.010

Highlighted values indicate significant difference between study areas based on statistical test p-value less than 0.10.

Table F.22: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2013) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	<0.031	2013	4	7,752	3,849	-	a
					2015	5	3,671	1,891	-1.1	a,b
					2016	5	2,639	668	-1.3	b
					2017	5	3,642	1,449	-1.1	a,b
					2018	5	2,600	998	-1.3	b
					2019	5	5,126	1,390	-0.7	a,b
					2020	5	5,122	2,202	-0.7	a,b
Richness (No. of Taxa)	ANOVA	none	NO	0.149	2013	4	18.0	4.4	-	a
					2015	5	12.8	3.7	-1.2	a
					2016	5	15.8	3.3	-0.5	a
					2017	5	12.8	2.3	-1.2	a
					2018	5	14.2	3.4	-0.9	a
					2019	5	15.6	3.0	-0.5	a
					2020	5	16.6	1.7	-0.3	a
Simpson's Evenness	ANOVA	none	YES	<0.001	2013	4	0.893	0.054	-	a
					2015	5	0.712	0.063	-3.4	b
					2016	5	0.917	0.034	0.4	a
					2017	5	0.848	0.068	-0.8	a
					2018	5	0.851	0.057	-0.8	a
					2019	5	0.893	0.053	0.0	a
					2020	5	0.842	0.044	-1.0	a
Nemata (% of community)	ANOVA	log10(x+1)	NO	0.818	2013	4	5.6%	3.6%	-	a
					2015	5	4.7%	4.6%	-0.2	a
					2016	5	4.4%	4.8%	-0.3	a
					2017	5	4.2%	4.2%	-0.4	a
					2018	5	2.8%	3.2%	-0.8	a
					2019	5	3.7%	2.5%	-0.5	a
					2020	5	4.1%	3.9%	-0.4	a
Ostracoda (% of community)	ANOVA	log10(x+1)	YES	0.007	2013	4	0.7%	0.5%	-	a,b,c
					2015	5	0.2%	0.3%	-1.0	b
					2016	5	1.8%	1.1%	2.5	a,c
					2017	5	0.2%	0.3%	-1.1	b
					2018	5	0.4%	0.6%	-0.7	b,c
					2019	5	1.3%	0.8%	1.3	a,b,c
					2020	5	2.0%	1.6%	2.9	a
Chironomidae (% of community)	ANOVA	none	NO	0.270	2013	4	90.1%	4.4%	-	a
					2015	5	93.1%	4.7%	0.7	a
					2016	5	87.4%	7.0%	-0.6	a
					2017	5	92.2%	6.5%	0.5	a
					2018	5	95.4%	4.0%	1.2	a
					2019	5	92.6%	3.6%	0.6	a
					2020	5	92.9%	2.0%	0.6	a

Table F.22: Statistical Comparison of Benthic Invertebrate Community Metrics at Camp Lake Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2013) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Metal Sensitive Taxa (% of community)	ANOVA	none	NO	0.588	2013	4	30.8%	14.6%	-	a
					2015	5	38.5%	24.5%	0.5	a
					2016	5	29.7%	11.8%	-0.1	a
					2017	5	38.2%	17.3%	0.5	a
					2018	5	17.4%	18.5%	-0.9	a
					2019	5	34.6%	16.1%	0.3	a
					2020	5	30.3%	19.7%	0.0	a
Collector-Gatherer FFG (% of community)	ANOVA	none	NO	0.451	2013	4	55.9%	12.4%	-	a
					2015	5	51.1%	14.7%	-0.4	a
					2016	5	65.7%	7.8%	0.8	a
					2017	5	50.8%	17.4%	-0.4	a
					2018	5	67.3%	18.6%	0.9	a
					2019	5	53.7%	12.4%	-0.2	a
					2020	5	56.9%	17.7%	0.1	a
Filterer FFG (% of community)	ANOVA	none	NO	0.520	2013	4	30.8%	14.5%	-	a
					2015	5	38.2%	24.3%	0.5	a
					2016	5	25.0%	7.5%	-0.4	a
					2017	5	37.3%	17.3%	0.4	a
					2018	5	16.7%	17.8%	-1.0	a
					2019	5	31.8%	15.9%	0.1	a
					2020	5	29.7%	20.2%	-0.1	a

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.23: Statistical Comparison of Benthic Metrics at Camp Lake Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size: vs. Baseline Year 2007	Effect Size: vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	ANOVA	none	NO	0.251	2007	4	2,627	1,403	-	0.9	a
					2013	5	2,140	567	-0.3	-	a
					2015	5	1,552	1,005	-0.8	-1.0	a
					2017	5	1,510	844	-0.8	-1.1	a
					2018	5	1,258	609	-1.0	-1.6	a
					2019	5	1,847	830	-0.6	-0.5	a
					2020	5	1,383	656	-0.9	-1.3	a
Richness (No. of Taxa)	ANOVA	log10	YES	0.029	2007	4	9.0	1.7	-	-1.8	a,b
					2013	5	14.2	2.9	3.0	-	a
					2015	5	8.2	2.8	-0.5	-2.0	b
					2017	5	10.8	3.3	1.0	-1.2	a,b
					2018	5	8.2	0.8	-0.5	-2.0	b
					2019	5	11.0	1.9	1.2	-1.1	a,b
					2020	5	10.4	4.5	0.8	-1.3	a,b
Simpson's Evenness	ANOVA	none	YES	0.089	2007	4	0.602	0.114	-	-1.0	a,b
					2013	5	0.720	0.122	1.0	-	a
					2015	5	0.604	0.283	0.0	-0.9	a,b
					2017	5	0.681	0.154	0.7	-0.3	a,b
					2018	5	0.374	0.118	-2.0	-2.8	b
					2019	5	0.615	0.206	0.1	-0.9	a,b
					2020	5	0.673	0.151	0.6	-0.4	a,b
Nemata (% of community)	K-W	rank	NO	0.780	2007	4	3.5	3.1	-	-0.3	a
					2013	5	4.4	3.2	0.3	-	a
					2015	5	6.7	10.4	1.0	0.7	a
					2017	5	7.1	6.2	1.2	0.9	a
					2018	5	2.9	5.6	-0.2	-0.5	a
					2019	5	4.4	5.7	0.3	0.0	a
					2020	5	1.7	2.1	-0.6	-0.8	a
Ostracoda (% of community)	K-W	rank	NO	0.200	2007	4	0.0	0.1	-	-0.8	a
					2013	5	0.4	0.4	4.9	-	a
					2015	5	0.3	0.7	3.6	-0.2	a
					2017	5	0.3	0.6	3.3	-0.3	a
					2018	5	0.7	1.5	8.6	0.6	a
					2019	5	1.9	3.8	24.4	3.3	a
					2020	5	5.5	7.1	72.4	11.3	a
Chironomidae (% of community)	K-W	rank	NO	0.811	2007	4	94.9	4.3	-	0.8	a
					2013	5	91.1	4.7	-0.9	-	a
					2015	5	90.4	11.3	-1.1	-0.1	a
					2017	5	90.0	6.6	-1.1	-0.2	a
					2018	5	95.2	7.9	0.1	0.9	a
					2019	5	91.4	7.1	-0.8	0.1	a
					2020	5	91.0	8.4	-0.9	0.0	a
Metal Sensitive Taxa (% of community)	ANOVA	log10	YES	<0.001	2007	4	34.8	4.8	-	-0.3	a
					2013	5	39.5	17.2	1.0	-	a
					2015	5	11.7	7.3	-4.9	-1.6	b,c
					2017	5	33.3	25.5	-0.3	-0.4	a,b
					2018	5	6.6	3.0	-5.9	-1.9	c
					2019	5	19.5	10.5	-3.2	-1.2	a,b,c
					2020	5	11.9	6.9	-4.8	-1.6	b,c
Collector-Gatherer FFG (% of community)	K-W	rank	YES	<0.001	2007	4	64.6	6.1	-	0.4	a
					2013	5	57.0	19.9	-1.3	-	a
					2015	5	84.7	7.3	3.3	1.4	b,c
					2017	5	64.2	28.1	-0.1	0.4	a,b
					2018	5	95.6	2.9	5.1	1.9	c
					2019	5	84.8	9.3	3.3	1.4	b,c
					2020	5	87.0	9.5	3.7	1.5	c
Filterer FFG (% of community)	K-W	rank	YES	<0.001	2007	4	32.6	4.0	-	-0.3	a
					2013	5	37.5	16.8	1.2	-	a
					2015	5	11.4	6.8	-5.3	-1.6	b,c
					2017	5	31.6	26.4	-0.2	-0.3	a,b
					2018	5	3.0	3.7	-7.3	-2.1	c
					2019	5	12.0	8.3	-5.1	-1.5	b,c
					2020	5	9.4	7.4	-5.8	-1.7	c

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.24: Replicate Grab Habitat Data for Benthic Invertebrate Community Samples Collected at the Sheardown Lake Tributaries, Mary River Project CREMP, August 2020

Study Area	Station	Water Depth (cm)			Water Velocity (m/s)			Embeddedness			In-Stream Vegetation			Algae Presence		
		Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3
Unnamed Reference Creek	REF-CRK-B1	6	10	8	0.35	0.50	0.33	25%	50%	25%	sparse	none	none	sparse	sparse	sparse
	REF-CRK-B2	6	8	10	0.31	0.37	0.48	25%	25%	25%	none	none	none	sparse	sparse	sparse
	REF-CRK-B3	16	8	7	0.33	0.37	0.31	50%	50%	50%	none	none	none	sparse	sparse	common
	REF-CRK-B4	10	12	8	0.50	0.51	0.42	50%	50%	25%	none	none	none	sparse	sparse	sparse
	REF-CRK-B5	10	8	9	0.37	0.35	0.38	50%	50%	25%	none	none	none	sparse	sparse	sparse
Sheardown Lake Tributary 1	SDLT1 - B1	8	12	13	0.30	0.41	0.38	0%	50%	50%	sparse	sparse	sparse	common	sparse	sparse
	SDLT1 - B2	8	10	11	0.32	0.46	0.37	50%	50%	75%	common	sparse	sparse	sparse	sparse	sparse
	SDLT1 - B3	7	10	12	0.31	0.30	0.40	25%	25%	0%	common	common	sparse	sparse	sparse	sparse
	SDLT1 - B4	10	8	8	0.44	0.44	0.31	25%	25%	25%	common	common	sparse	sparse	sparse	sparse
	SDLT1 - B5	4	5	7	0.30	0.45	0.32	25%	50%	50%	common	common	common	sparse	sparse	sparse
Sheardown Lake Tributary 9	SDLT9 - B1	5	8	6	0.35	0.38	0.30	50%	25%	25%	sparse	none	none	common	sparse	common
	SDLT9 - B2	8	4	6	0.31	0.30	0.31	25%	50%	25%	sparse	sparse	sparse	common	common	sparse
	SDLT9 - B3	8	8	6	0.31	0.35	0.30	50%	50%	25%	none	none	sparse	sparse	common	common
	SDLT9 - B4	5	6	8	0.32	0.31	0.32	25%	50%	50%	none	sparse	sparse	sparse	common	sparse
	SDLT9 - B5	4	8	7	0.34	0.41	0.32	50%	50%	50%	sparse	sparse	sparse	common	common	sparse
Sheardown Lake Tributary 12	SDLT12 - B1	14	16	9	0.05	0.02	0.07	25%	0%	25%	sparse	none	common	sparse	common	common
	SDLT12 - B2	4	8	8	0.02	0.02	0.07	25%	25%	25%	common	sparse	common	common	sparse	sparse
	SDLT12 - B3	4	4	5	0.08	0.17	0.07	50%	25%	25%	sparse	sparse	common	common	common	common

Table F.25: Replicate Station Habitat Feature Summary Statistics for the Sheardown Lake Tributary Benthic Stations, Mary River Project CREMP, August 2020

Metric	Study Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Water Depth (cm)	Unnamed Reference Creek	9.1	1.1	0.49	8.0	9.0	10
	Sheardown Tributary 1 (SDLT1)	8.9	2.1	1.0	5.3	9.7	11
	Sheardown Tributary 12 (SDLT12)	8.0	4.48	2.59	4.3	6.7	13.0
	Sheardown Tributary 9 (SDLT9)	6.5	0.5	0.2	6.0	6.3	7
Water Velocity (m/s)	Unnamed Reference Creek	0.39	0.052	0.023	0.34	0.39	0.48
	Sheardown Tributary 1 (SDLT1)	0.37	0.023	0.010	0.34	0.36	0.40
	Sheardown Tributary 12 (SDLT12)	0.06	0.038	0.0219	0.04	0.05	0.11
	Sheardown Tributary 9 (SDLT9)	0.33	0.02	0.01	0.31	0.32	0.36
Substrate Embeddedness (%)	Unnamed Reference Creek	38%	10%	4%	25%	42%	50%
	Sheardown Tributary 1 (SDLT1)	35%	16%	7%	17%	33%	58%
	Sheardown Tributary 12 (SDLT12)	25%	8%	5%	17%	25%	33%
	Sheardown Tributary 9 (SDLT9)	40%	7%	3%	33%	42%	50%

Note: Five stations were sampled at Unnamed Reference Creek, SDLT1, and SDLT9, and three stations were sampled at SDLT12.

Table F.26: Benthic Station Habitat Feature Statistical Comparisons Between Individual Sheardown Lake Tributaries and Unnamed Reference Creek, Mary River Project CREMP, August 2020

Metric	Pair-wise comparisons[a]					
	Area 1	Area 2	Statistical Test[a]	Data Transformation	Significant Difference between Areas?	P-value
Water Depth (cm)	Unnamed Reference Creek	SDLT1	tequal	none	NO	0.857
	Unnamed Reference Creek	SDLT12	tequal	none	NO	0.613
	Unnamed Reference Creek	SDLT9	tequal	none	YES	<0.001
Water Velocity (m/s)	Unnamed Reference Creek	SDLT1	tequal	none	NO	0.363
	Unnamed Reference Creek	SDLT12	tequal	none	YES	0.001
	Unnamed Reference Creek	SDLT9	tequal	none	YES	0.036
Substrate Embeddedness (%)	Unnamed Reference Creek	SDLT1	tequal	none	NO	0.700
	Unnamed Reference Creek	SDLT12	tequal	none	YES	0.092
	Unnamed Reference Creek	SDLT9	tequal	none	NO	0.760

Shaded values indicate significant difference between study areas based on statistical test p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table F.27: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 1, August 2020

Taxa	Study Area	Sheardown Lake Tributary 1 (SDLT1)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		54	36	25	14	22
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		39	7	4	-	18
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		4	-	-	-	-
F. Lebertiidae						
Lebertia		4	-	-	-	-
F. Sperchonidae						
Sperchon		22	4	-	7	4
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		4	-	-	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	7	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	-	-
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		4	-	-	-	-
F. Limnephilidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		**50**	**65**	**4**	**25**	**22**
S.F. Chironominae						
Micropsectra		7	-	4	-	-
Paratanytarsus		-	4	-	-	-
Rheotanytarsus		-	-	-	7	-
Tanytarsus		7	-	-	-	-
S.F. Diamesinae						
Diamesa		-	-	-	-	-
Pseudokiefferiella		111	36	22	22	47
S.F. Orthocladiinae						
Chaetocladius		-	-	-	-	-
Corynoneura		-	-	-	-	-
Cricotopus		147	100	14	50	14

Table F.27: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 1, August 2020

Taxa — Study Area / Replicate Station	Sheardown Lake Tributary 1 (SDLT1) B1	B2	B3	B4	B5
Cricotopus/Orthocladius	54	29	-	11	-
Diplocladius	-	-	-	-	4
Doncricotopus	7	-	-	-	-
Eukiefferiella	-	-	4	-	-
Hydrobaenus	7	-	-	-	-
Hydrosmittia	1,086	452	93	161	125
Krenosmittia	-	-	-	-	-
Limnophyes	-	-	-	-	-
Metriocnemus	-	-	-	-	-
Orthocladius (Euorthocladius)	-	7	-	-	-
Parakiefferiella	32	7	4	4	-
Paraphaenocladius	-	-	-	-	-
Tokunagaia	-	-	4	-	4
Tvetenia	-	61	7	22	4
indeterminate	**25**	-	**4**	-	-
S.F. Podonominae					
Trichotanypus	-	-	-	-	-
S.F. Tanypodinae					
Procladius	-	-	4	-	-
Thienemannimyia complex	25	11	-	4	4
F. Dixidae					
pupae	-	-	4	-	-
F. Empididae					
Clinocera	-	-	7	-	-
F. Ephydridae	-	-	-	-	-
F. Muscidae	4	4	-	-	-
F. Simuliidae					
Gymnopais	-	-	-	-	-
Metacnephia	-	-	-	-	-
Prosimulium	-	-	-	-	-
pupae	-	-	-	-	-
F. Tipulidae					
Dicranota	-	-	-	-	-
Ormosia	-	-	-	-	-
Tipula	11	29	14	22	7
Density (No. organisms per m^2)	1,703	849	215	355	272
Richness (total number of taxa)[a]	18	13	14	11	11
Simpson's Evenness (E)	0.575	0.677	0.824	0.774	0.757
Shannon-Wiener Diversity	1.955	2.116	2.823	2.396	2.312
Dominant Group Composition					
% Nemata	3.2	4.2	11.7	4.0	7.9
% Oligochaeta	0.0	0.0	0.0	0.0	0.0
% Hydracarina	1.7	0.4	0.0	2.0	1.3
% Ostracods	0.2	0.0	0.0	0.0	0.0
% Ephemeroptera	0.0	0.0	0.0	0.0	0.0
% Chironomids	91.6	90.7	75.0	85.9	81.6
% Metal Sensitive Chironmids	7.6	5.1	11.9	8.8	18.9
% Simuliidae	0.0	0.0	0.0	0.0	0.0
% Tipulidae	0.6	3.4	6.7	6.1	2.6
Functional Feeding Group Composition					
% Collector - Gatherers	82.7	77.6	78.1	69.9	88.8
% Filterers	0.9	0.5	3.4	2.2	0.0
% Shredders	12.8	19.7	13.5	24.8	8.5
Habitat Preference Group Composition					
% Clingers	14.9	16.8	13.5	22.9	7.1
% Sprawlers	78.7	74.4	66.5	64.9	75.8
% Burrowers	6.3	8.9	20.0	10.1	17.1

[a] Bold entries excluded from taxa count

Table F.28: Benthic Invertebrate Community Summary Statistics for the Sheardown Lake Tributaries, Mary River Project CREMP, August 2020

Metric	Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (no. organisms/m^2)	Unnamed Reference Creek	713	296	133	258	821	1,032
	Sheardown Tributary 1 (SDLT1)	679	625	279	215	355	1,703
	Sheardown Tributary 12 (SDLT12)	1,318	26	15	1,297	1,308	1,348
	Sheardown Tributary 9 (SDLT9)	1,601	841	376	892	1,111	2,556
Richness (Number of Taxa)	Unnamed Reference Creek	16.0	4.4	2.0	9.0	17.0	20.0
	Sheardown Tributary 1 (SDLT1)	13.4	2.9	1.3	11.0	13.0	18.0
	Sheardown Tributary 12 (SDLT12)	17.3	4.2	2.4	14.0	16.0	22.0
	Sheardown Tributary 9 (SDLT9)	18.0	4.7	2.1	14.0	16.0	24.0
Simpson's Evenness	Unnamed Reference Creek	0.840	0.043	0.019	0.767	0.856	0.878
	Sheardown Tributary 1 (SDLT1)	0.722	0.097	0.044	0.575	0.757	0.824
	Sheardown Tributary 12 (SDLT12)	0.832	0.063	0.036	0.759	0.860	0.876
	Sheardown Tributary 9 (SDLT9)	0.855	0.024	0.011	0.831	0.841	0.884
Nemata (% of community)	Unnamed Reference Creek	0.7	1.3	0.6	0.0	0.3	3.0
	Sheardown Tributary 1 (SDLT1)	6.2	3.6	1.6	3.2	4.2	11.7
	Sheardown Tributary 12 (SDLT12)	5.4	1.7	1.0	3.6	5.8	6.9
	Sheardown Tributary 9 (SDLT9)	3.1	2.3	1.0	0.6	2.6	6.4
Oligochaeta (% of community)	Unnamed Reference Creek	0.0	0.0	0.0	0.0	0.0	0.0
	Sheardown Tributary 1 (SDLT1)	0.0	0.0	0.0	0.0	0.0	0.0
	Sheardown Tributary 12 (SDLT12)	0.4	0.3	0.2	0.0	0.5	0.6
	Sheardown Tributary 9 (SDLT9)	0.0	0.0	0.0	0.0	0.0	0.0
Hydracarina (% of community)	Unnamed Reference Creek	4.5	3.7	1.7	2.1	3.0	11.1
	Sheardown Tributary 1 (SDLT1)	1.1	0.9	0.4	0.0	1.3	2.0
	Sheardown Tributary 12 (SDLT12)	0.2	0.2	0.1	0.0	0.3	0.3
	Sheardown Tributary 9 (SDLT9)	4.2	1.8	0.8	2.2	3.4	6.8
Ostracoda (% of community)	Unnamed Reference Creek	30.6	11.7	5.3	16.7	34.2	42.0
	Sheardown Tributary 1 (SDLT1)	0.0	0.1	0.0	0.0	0.0	0.2
	Sheardown Tributary 12 (SDLT12)	0.6	0.1	0.1	0.5	0.6	0.8
	Sheardown Tributary 9 (SDLT9)	8.2	2.6	1.1	4.9	9.0	11.0
Chironomidae (% of community)	Unnamed Reference Creek	48.3	12.9	5.8	36.7	43.1	67.3
	Sheardown Tributary 1 (SDLT1)	85.0	6.9	3.1	75.0	85.9	91.6
	Sheardown Tributary 12 (SDLT12)	88.6	2.1	1.2	87.0	87.8	91.0
	Sheardown Tributary 9 (SDLT9)	70.3	4.3	1.9	63.5	72.9	73.2
Metal-Sensitive Chironomidae (% of community)	Unnamed Reference Creek	0.8	1.2	0.6	0.0	0.5	3.0
	Sheardown Tributary 1 (SDLT1)	10.5	5.3	2.4	5.1	8.8	18.9
	Sheardown Tributary 12 (SDLT12)	0.5	0.4	0.2	0.0	0.6	0.8
	Sheardown Tributary 9 (SDLT9)	3.2	3.6	1.6	0.0	2.1	9.1
Simuliidae (% of community)	Unnamed Reference Creek	9.8	8.6	3.8	0.0	8.7	20.7
	Sheardown Tributary 1 (SDLT1)	0.0	0.0	0.0	0.0	0.0	0.0
	Sheardown Tributary 12 (SDLT12)	0.0	0.0	0.0	0.0	0.0	0.0
	Sheardown Tributary 9 (SDLT9)	0.5	0.9	0.4	0.0	0.0	2.1
Tipulidae (% of community)	Unnamed Reference Creek	1.5	2.3	1.0	0.0	0.9	5.6
	Sheardown Tributary 1 (SDLT1)	3.9	2.5	1.1	0.6	3.4	6.7
	Sheardown Tributary 12 (SDLT12)	1.5	0.7	0.4	1.1	1.1	2.2
	Sheardown Tributary 9 (SDLT9)	3.1	1.3	0.6	2.0	2.5	5.2

Table F.28: Benthic Invertebrate Community Summary Statistics for the Sheardown Lake Tributaries, Mary River Project CREMP, August 2020

Metric	Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Collector-Gatherer FFG (% of community)	Unnamed Reference Creek	80.7	8.8	3.9	70.0	77.6	91.1
	Sheardown Tributary 1 (SDLT1)	79.4	7.0	3.1	69.9	78.1	88.8
	Sheardown Tributary 12 (SDLT12)	82.2	1.4	0.8	80.7	82.2	83.6
	Sheardown Tributary 9 (SDLT9)	63.1	6.9	3.1	56.5	63.0	72.8
Filterer FFG (% of community)	Unnamed Reference Creek	9.9	8.9	4.0	0.0	8.0	21.5
	Sheardown Tributary 1 (SDLT1)	1.4	1.4	0.6	0.0	0.9	3.4
	Sheardown Tributary 12 (SDLT12)	0.2	0.3	0.2	0.0	0.0	0.5
	Sheardown Tributary 9 (SDLT9)	0.5	0.8	0.4	0.0	0.0	1.8
Shredder FFG (% of community)	Unnamed Reference Creek	2.8	2.7	1.2	0.0	2.4	7.0
	Sheardown Tributary 1 (SDLT1)	15.8	6.4	2.9	8.5	13.5	24.8
	Sheardown Tributary 12 (SDLT12)	16.9	1.8	1.0	15.7	16.2	19.0
	Sheardown Tributary 9 (SDLT9)	29.8	6.8	3.0	22.4	26.7	38.3
Clinger HPG (% of community)	Unnamed Reference Creek	15.8	7.7	3.5	7.8	12.6	27.0
	Sheardown Tributary 1 (SDLT1)	15.1	5.7	2.6	7.1	14.9	22.9
	Sheardown Tributary 12 (SDLT12)	16.3	1.9	1.1	14.5	16.2	18.2
	Sheardown Tributary 9 (SDLT9)	33.4	8.1	3.6	22.0	32.5	41.2
Sprawler HPG (% of community)	Unnamed Reference Creek	79.4	6.6	3.0	70.0	79.1	87.2
	Sheardown Tributary 1 (SDLT1)	72.1	6.0	2.7	64.9	74.4	78.7
	Sheardown Tributary 12 (SDLT12)	73.8	0.3	0.2	73.6	73.7	74.2
	Sheardown Tributary 9 (SDLT9)	53.0	9.9	4.4	37.6	57.2	63.1
Burrower HPG (% of community)	Unnamed Reference Creek	4.8	3.3	1.5	1.4	3.1	8.3
	Sheardown Tributary 1 (SDLT1)	12.5	5.8	2.6	6.3	10.1	20.0
	Sheardown Tributary 12 (SDLT12)	9.9	1.6	0.9	8.2	10.1	11.3
	Sheardown Tributary 9 (SDLT9)	8.1	2.8	1.3	4.9	10.0	10.5

Note: Sample size equals five for Unnamed Reference Creek, SDLT1, and SDLT9, and three for SDLT12.

Table F.29: Statistical Comparison of Bray-Curtis Index for the Sheardown Lake Tributaries Compared to Unnamed Reference Creek, Mary River Project CREMP, August 2020

Comparison	Betadisper P-Value	Mantel Test			dbRDA			
		r	R^2	P-Value	F-Value	R^2	R^2_{adj}	P-Value
SDLT1 vs Reference Creek	0.661	0.822	0.676	0.008	11.17	0.583	0.530	0.006
SDLT12 vs Reference Creek	0.435	0.835	0.697	0.008	10.34	0.564	0.509	0.007
SDLT9 vs Reference Creek	0.846	0.570	0.324	0.008	5.31	0.399	0.324	0.007

Highlighted values indicate significant difference between study areas based on statistical test p-value less than 0.10.

Note: Sample size was five for all study areas except SDLT9, at which the sample size was three.

Table F.30: Statistical Comparison of Benthic Metrics at Sheardown Lake Tributary 1 (SDLT1) Among Years of Mine Operation (2015 to 2020) and Baseline (2008, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2008	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	0.003	2008	3	300	52	-	-2.0	a
					2013	3	657	176	6.8	-	a,b,c
					2015	5	722	485	8.1	0.4	a,b
					2016	5	2,453	814	41.1	10.2	c
					2017	5	1,660	1,643	26.0	5.7	a,b,c
					2018	5	1,102	766	15.3	2.5	a,b,c
					2019	5	1,483	982	22.6	4.7	b,c
					2020	5	679	625	7.2	0.1	a,c
Richness (No. of Taxa)	ANOVA	none	NO	0.305	2008	3	12.0	1.0	-	-1.9	a
					2013	3	16.7	2.5	4.7	-	a
					2015	5	15.4	4.3	3.4	-0.5	a
					2016	5	15.2	2.5	3.2	-0.6	a
					2017	5	14.0	2.0	2.0	-1.1	a
					2018	5	12.8	1.6	0.8	-1.5	a
					2019	5	14.8	1.9	2.8	-0.8	a
					2020	5	13.4	2.9	1.4	-1.3	a
Simpson's Evenness	ANOVA	none	YES	<0.001	2008	3	0.894	0.034	-	0.1	a
					2013	3	0.887	0.064	-0.2	-	a
					2015	5	0.869	0.067	-0.7	-0.3	a
					2016	5	0.872	0.032	-0.7	-0.2	a
					2017	5	0.883	0.028	-0.3	-0.1	a
					2018	5	0.834	0.063	-1.8	-0.8	a
					2019	5	0.787	0.026	-3.2	-1.6	a,b
					2020	5	0.722	0.097	-5.1	-2.6	b
Oligochaeta (% of community)	K-W	rank	YES	0.005	2008	3	3.0	2.5	-	-1.3	a,c,d
					2013	3	7.3	3.3	1.8	-	a,b,c
					2015	5	14.4	10.8	4.6	2.1	b
					2016	5	14.1	8.8	4.5	2.0	a,b
					2017	5	8.6	7.4	2.3	0.4	a,b
					2018	5	2.2	2.8	-0.3	-1.5	c,d
					2019	5	3.3	1.0	0.1	-1.2	a,b,c
					2020	5	0.0	0.0	-1.2	-2.2	d
Hydracarina (% of community)	ANOVA	log10(x+1)	YES	<0.001	2008	3	12.1	4.7	-	2.6	a
					2013	3	4.6	2.9	-1.6	-	b,c
					2015	5	4.6	1.6	-1.6	0.0	b,c
					2016	5	5.3	1.3	-1.4	0.2	b
					2017	5	3.9	2.0	-1.7	-0.2	b,c
					2018	5	3.1	1.7	-1.9	-0.5	b,c
					2019	5	1.3	0.9	-2.3	-1.1	c
					2020	5	1.1	0.9	-2.3	-1.2	c
Chironomidae (% of community)	ANOVA	none	YES	<0.001	2008	3	69.2	2.0	-	-3.0	a
					2013	3	81.1	3.9	6.0	-	a,b
					2015	5	72.0	9.0	1.4	-2.3	a
					2016	5	73.1	11.9	2.0	-2.0	a
					2017	5	82.4	10.1	6.7	0.3	a,b
					2018	5	90.7	4.4	10.9	2.5	b
					2019	5	91.6	1.6	11.4	2.7	b
					2020	5	85.0	6.9	8.0	1.0	a,b
Metal Sensitive Taxa (% of community)	ANOVA	log10	YES	<0.001	2008	3	27.5	5.5	-	0.5	a,b
					2013	3	19.9	14.3	-1.4	-	a,b,c
					2015	5	6.1	2.9	-3.9	-1.0	c
					2016	5	15.6	4.4	-2.2	-0.3	a,b,c
					2017	5	26.1	15.6	-0.3	0.4	a,b
					2018	5	19.8	12.4	-1.4	0.0	a,b
					2019	5	31.2	11.0	0.7	0.8	a
					2020	5	10.5	5.3	-3.1	-0.7	b,c
Tipulidae (% of community)	ANOVA	log10(x+1)	YES	<0.001	2008	3	14.7	2.7	-	22.9	a
					2013	3	3.8	0.5	-4.0	-	b
					2015	5	2.1	1.3	-4.7	-3.7	b
					2016	5	3.5	1.9	-4.1	-0.6	b
					2017	5	2.8	2.7	-4.4	-2.1	b
					2018	5	1.9	1.3	-4.7	-4.0	b
					2019	5	2.1	1.6	-4.6	-3.6	b
					2020	5	3.9	2.5	-4.0	0.1	b

Table F.30: Statistical Comparison of Benthic Metrics at Sheardown Lake Tributary 1 (SDLT1) Among Years of Mine Operation (2015 to 2020) and Baseline (2008, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2008	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	<0.001	2008	3	40.3	2.9	-	-2.0	a
					2013	3	55.5	7.5	5.2	-	a,b
					2015	5	64.2	5.2	8.2	1.2	b
					2016	5	58.6	10.7	6.3	0.4	b
					2017	5	55.3	8.0	5.2	0.0	a,b
					2018	5	62.2	9.3	7.5	0.9	b
					2019	5	81.6	4.9	14.2	3.5	c
					2020	5	79.4	7.0	13.4	3.2	c
Filterer FFG (% of community)	K-W	rank	YES	0.002	2008	3	5.2	3.5	-	-2.0	a,b
					2013	3	8.5	1.6	0.9	-	a
					2015	5	4.5	1.4	-0.2	-2.4	a
					2016	5	7.6	3.3	0.7	-0.5	a
					2017	5	8.9	8.0	1.1	0.3	a
					2018	5	1.6	1.4	-1.0	-4.2	c
					2019	5	1.3	0.9	-1.1	-4.4	b,c
					2020	5	1.4	1.4	-1.1	-4.3	c
Shredder FFG (% of community)	ANOVA	log10	YES	<0.001	2008	3	40.6	4.2	-	1.6	a
					2013	3	28.7	7.4	-2.8	-	a
					2015	5	22.9	4.5	-4.2	-0.8	a,b
					2016	5	27.4	9.4	-3.1	-0.2	a
					2017	5	31.6	7.7	-2.1	0.4	a
					2018	5	32.8	8.2	-1.8	0.6	a
					2019	5	15.0	4.3	-6.1	-1.9	b
					2020	5	15.8	6.4	-5.9	-1.7	b

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Signficant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.31: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 12, August 2020

Taxa	Study Area / Replicate Station	Sheardown Tributary 12 (SDLT12)		
		B1	B2	B3
ROUNDWORMS				
P. Nemata		75	47	93
ANNELIDS				
P. Annelida				
WORMS				
Cl. Oligochaeta				
F. Enchytraeidae		36	47	36
F. Lumbriculidae				
Lumbriculus		7	-	7
ARTHROPODS				
P. Arthropoda				
MITES				
Cl. Arachnida				
O. Acarina				
immature		-	-	-
F. Lebertiidae				
Lebertia		-	-	-
F. Sperchonidae				
Sperchon		4	-	4
HARPACTICOIDS				
O. Harpacticoida		-	-	4
SEED SHRIMPS				
Cl. Ostracoda		7	7	11
SPRINGTAILS				
Cl. Entognatha				
O. Collembola		-	-	-
INSECTS				
Cl. Insecta				
MAYFLIES				
O. Ephemeroptera				
F. Baetidae				
Acentrella feropagus		-	-	-
CADDISFLIES				
O. Trichoptera				
F. Apataniidae				
Apatania		-	-	-
F. Limnephilidae				
immature		-	-	4
TRUE FLIES				
O. Diptera				
BITING-MIDGE				
F. Ceratopogonidae				
Culicoides		-	-	-
MIDGES				
F. Chironomidae				
chironomid pupae		**11**	**7**	**18**
S.F. Chironominae				
Micropsectra		-	-	-
Paratanytarsus		-	-	7
Rheotanytarsus		-	-	-
Tanytarsus		-	-	-
S.F. Diamesinae				
Diamesa		-	7	4
Pseudokiefferiella		-	-	-
S.F. Orthocladiinae				
Chaetocladius		68	97	68
Corynoneura		-	-	-
Cricotopus		115	129	22

Table F.31: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 12, August 2020

Taxa — Study Area / Replicate Station	Sheardown Tributary 12 (SDLT12) B1	B2	B3
Cricotopus/Orthocladius	68	104	183
Diplocladius	631	423	315
Doncricotopus	-	-	-
Eukiefferiella	-	-	-
Hydrobaenus	22	-	-
Hydrosmittia	-	-	68
Krenosmittia	-	-	7
Limnophyes	7	29	7
Metriocnemus	-	29	22
Orthocladius (Euorthocladius)	-	-	-
Parakiefferiella	-	-	-
Paraphaenocladius	7	22	14
Tokunagaia	29	233	39
Tvetenia	-	7	22
indeterminate	**176**	**104**	**369**
S.F. Podonominae			
Trichotanypus	7	-	7
S.F. Tanypodinae			
Procladius	-	-	-
Thienemannimyia complex	-	-	-
F. Dixidae			
pupae	-	-	-
F. Empididae			
Clinocera	-	4	4
F. Ephydridae	-	-	-
F. Muscidae	-	-	-
F. Simuliidae			
Gymnopais	-	-	-
Metacnephia	-	-	-
Prosimulium	-	-	-
pupae	-	-	-
F. Tipulidae			
Dicranota	-	-	14
Ormosia	4	-	-
Tipula	25	14	-
Density (No. organisms per m^2)	1,297	1,308	1,348
Richness (total number of taxa)[a]	16	14	22
Simpson's Evenness (E)	0.759	0.876	0.860
Shannon-Wiener Diversity	2.489	2.859	3.033
Dominant Group Composition			
% Nemata	5.8	3.6	6.9
% Oligochaeta	0.6	0.0	0.5
% Hydracarina	0.3	0.0	0.3
% Ostracods	0.6	0.5	0.8
% Ephemeroptera	0.0	0.0	0.0
% Chironomids	87.8	91.0	87.0
% Metal Sensitive Chironmids	0.0	0.6	0.8
% Simuliidae	0.0	0.0	0.0
% Tipulidae	2.2	1.1	1.1
Functional Feeding Group Composition			
% Collector - Gatherers	83.6	80.7	82.2
% Filterers	0.0	0.0	0.5
% Shredders	16.2	19.0	15.7
Habitat Preference Group Composition			
% Clingers	14.5	18.2	16.2
% Sprawlers	74.2	73.6	73.7
% Burrowers	11.3	8.2	10.1

[a] Bold entries excluded from taxa count

Table F.32: Statistical Comparison of Benthic Invertebrate Community Metrics at Sheardown Lake Tributary 12 Upstream (SDLT12) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m²)	ANOVA	log10	NO	0.122	2007	5	1,016	669	-	a
					2015	3	841	575	-0.3	a
					2016	3	894	502	-0.2	a
					2017	3	783	561	-0.3	a
					2018	3	2,826	2,237	2.7	a
					2019	3	3,078	2,660	3.1	a
					2020	3	1,318	26	0.5	a
Richness (No. of Taxa)	ANOVA	log10	YES	0.004	2007	5	19.0	1.9	-	a
					2015	3	12.0	1.0	-3.7	b
					2016	3	18.3	1.2	-0.4	ac
					2017	3	15.3	0.6	-2.0	a,b,c
					2018	3	14.3	2.5	-2.5	b,c
					2019	3	15.0	2.0	-2.1	a,b,c
					2020	3	17.3	4.2	-0.9	a,c
Simpson's Evenness	ANOVA	none	YES	<0.001	2007	5	0.854	0.020	-	a
					2015	3	0.884	0.041	1.5	a
					2016	3	0.884	0.046	1.5	a
					2017	3	0.931	0.021	3.9	a
					2018	3	0.659	0.152	-9.8	b,c
					2019	3	0.613	0.095	-12.2	c
					2020	3	0.832	0.063	-1.1	a,b
Oligochaeta (% of community)	K-W	rank	YES	0.003	2007	5	0.7	0.6	-	a
					2015	3	28.8	8.8	48.7	b,c
					2016	3	31.6	11.1	53.6	c
					2017	3	21.9	8.4	36.8	b,c
					2018	3	3.4	1.5	4.7	a,b,c
					2019	3	2.3	0.6	2.8	a,b
					2020	3	0.4	0.3	-0.6	a
Hydracarina (% of community)	K-W	rank	NO	0.156	2007	5	3.0	2.9	-	a
					2015	3	0.0	0.0	-1.0	a
					2016	3	0.4	0.4	-0.9	a
					2017	3	0.0	0.0	-1.0	a
					2018	3	0.7	1.2	-0.8	a
					2019	3	0.4	0.7	-0.9	a
					2020	3	0.2	0.2	-0.9	a
Chironomidae (% of community)	ANOVA	none	YES	<0.001	2007	5	88.0	10.2	-	a
					2015	3	65.1	6.7	-2.2	b
					2016	3	54.9	18.0	-3.2	b
					2017	3	64.6	7.2	-2.3	b
					2018	3	92.1	4.0	0.4	a
					2019	3	95.1	1.9	0.7	a
					2020	3	88.6	2.1	0.1	a
Metal Sensitive Taxa (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	5	3.3	2.0	-	a
					2015	3	1.4	1.5	-0.9	a
					2016	3	2.6	0.5	-0.3	a
					2017	3	12.7	5.2	4.7	b
					2018	3	0.6	0.6	-1.3	a
					2019	3	2.3	3.3	-0.5	a
					2020	3	0.5	0.4	-1.4	a

Table F.32: Statistical Comparison of Benthic Invertebrate Community Metrics at Sheardown Lake Tributary 12 Upstream (SDLT12) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Tipulidae (% of community)	ANOVA	log10(x+1)	YES	0.033	2007	5	0.3	0.5	-	a
					2015	3	3.4	1.3	6.3	a,b
					2016	3	3.8	3.1	7.2	b
					2017	3	3.4	2.0	6.5	a,b
					2018	3	2.2	1.5	3.9	a,b
					2019	3	0.6	0.3	0.6	a,b
					2020	3	1.5	0.7	2.4	a,b
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.003	2007	5	57.8	15.8	-	a
					2015	3	83.7	11.4	1.6	b
					2016	3	87.0	2.6	1.8	b
					2017	3	88.5	3.2	1.9	b
					2018	3	87.6	9.4	1.9	b
					2019	3	82.0	5.0	1.5	b
					2020	3	82.2	1.4	1.5	b
Filterer FFG (% of community)	K-W	rank	YES	0.053	2007	5	6.9	9.2	-	a,b
					2015	3	0.0	0.0	-0.7	c
					2016	3	2.1	0.1	-0.5	a,b
					2017	3	3.5	2.8	-0.4	a
					2018	3	0.4	0.4	-0.7	b,c
					2019	3	2.2	3.4	-0.5	a,b,c
					2020	3	0.2	0.3	-0.7	c
Shredder FFG (% of community)	ANOVA	log10	NO	0.158	2007	5	22.5	8.9	-	a
					2015	3	16.3	11.4	-0.7	a
					2016	3	9.3	1.5	-1.5	a
					2017	3	8.0	2.1	-1.6	a
					2018	3	11.3	7.9	-1.3	a
					2019	3	15.2	8.6	-0.8	a
					2020	3	16.9	1.8	-0.6	a

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.33: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 9, August 2020

Taxa	Study Area / Replicate Station	Sheardown Lake Tributary 9 (SDLT9)				
		B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		108	36	57	25	7
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		79	29	11	25	25
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		4	-	-	-	-
F. Lebertiidae						
Lebertia		4	7	-	-	-
F. Sperchonidae						
Sperchon		79	161	29	22	57
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		125	222	90	61	122
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		36	111	100	47	57
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		108	11	-	4	-
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	-	-	-	-
F. Limnephilidae						
immature		-	7	-	4	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
Culicoides		7	-	-	-	11
MIDGES						
F. Chironomidae						
chironomid pupae		**287**	**423**	**129**	**125**	**136**
S.F. Chironominae						
Micropsectra		-	-	-	-	-
Paratanytarsus		-	-	-	-	-
Rheotanytarsus		-	-	-	-	-
Tanytarsus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		190	75	14	-	7
Pseudokiefferiella		7	-	-	-	-
S.F. Orthocladiinae						
Chaetocladius		-	-	-	-	-
Corynoneura		-	-	-	4	-

Table F.33: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Tributary 9, August 2020

Taxa — Study Area	Sheardown Lake Tributary 9 (SDLT9)				
Replicate Station	B1	B2	B3	B4	B5
Cricotopus	376	566	151	86	151
Cricotopus/Orthocladius	147	65	97	50	75
Diplocladius	-	-	4	-	-
Doncricotopus	-	-	-	-	-
Eukiefferiella	14	-	-	-	-
Hydrobaenus	-	-	-	11	-
Hydrosmittia	14	115	50	25	39
Krenosmittia	43	32	54	79	68
Limnophyes	-	-	-	-	-
Metriocnemus	14	7	-	-	-
Orthocladius (Euorthocladius)	-	18	-	-	-
Parakiefferiella	-	7	-	-	-
Paraphaenocladius	-	-	-	-	-
Tokunagaia	14	7	-	-	-
Tvetenia	742	434	47	287	262
indeterminate	-	**57**	**22**	**39**	**25**
S.F. Podonominae					
Trichotanypus	14	7	-	-	-
S.F. Tanypodinae					
Procladius	-	-	-	-	-
Thienemannimyia complex	-	-	-	-	-
F. Dixidae					
pupae	-	-	-	-	-
F. Empididae					
Clinocera	14	11	18	22	29
F. Ephydridae	-	-	4	-	-
F. Muscidae	11	-	-	-	-
F. Simuliidae					
Gymnopais	7	-	-	-	-
Metacnephia	22	7	-	-	-
Prosimulium	-	-	-	-	-
pupae	25	7	-	-	-
F. Tipulidae					
Dicranota	-	-	-	4	25
Ormosia	-	-	-	-	-
Tipula	65	57	18	47	14
Density (No. organisms per m^2)	2,556	2,480	892	964	1,111
Richness (total number of taxa)[a]	24	22	14	16	14
Simpson's Evenness (E)	0.841	0.841	0.884	0.831	0.876
Shannon-Wiener Diversity	3.106	2.974	3.015	2.855	2.920
Dominant Group Composition					
% Nemata	4.2	1.4	6.4	2.6	0.6
% Oligochaeta	0.0	0.0	0.0	0.0	0.0
% Hydracarina	3.4	6.8	3.2	2.2	5.2
% Ostracods	4.9	9.0	10.0	6.3	11.0
% Chironomids	72.9	73.1	63.5	73.2	68.7
% Metal Sensitive Chironmids	9.1	4.0	2.1	0.0	0.8
% Simuliidae	2.1	0.6	0.0	0.0	0.0
% Tipulidae	2.5	2.3	2.0	5.2	3.5
Functional Feeding Group Composition					
% Collector - Gatherers	66.5	56.5	56.5	72.8	63.0
% Filterers	1.8	0.6	0.0	0.0	0.0
% Shredders	26.7	35.7	38.3	22.4	26.0
Habitat Preference Group Composition					
% Clingers	30.2	41.2	41.1	22.0	32.5
% Sprawlers	57.8	49.5	37.6	63.1	57.2
% Burrowers	10.5	4.9	10.0	10.0	5.2

[a] Bold entries excluded from taxa count

Table F.34: Statistical Comparison of Benthic Metrics at Sheardown Lake Tributary 9 (SDLT9) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	ANOVA	none	YES	0.029	2007	3	712	42	-	-0.8	a
					2013	3	1,240	690	12.6	-	a,b
					2015	5	2,147	942	34.2	1.3	a,b
					2016	5	2,401	1,054	40.3	1.7	a,b
					2017	5	3,404	1,983	64.2	3.1	b
					2018	5	1,482	375	18.4	0.4	a,b
					2019	5	1,575	705	20.6	0.5	a,b
					2020	5	1,601	841	21.2	0.5	a,b
Richness (No. of Taxa)	ANOVA	none	NO	0.543	2007	3	22.3	3.2	-	0.9	a
					2013	3	19.0	3.6	-1.0	-	a
					2015	5	19.4	4.8	-0.9	0.1	a
					2016	5	18.2	2.6	-1.3	-0.2	a
					2017	5	20.8	2.8	-0.5	0.5	a
					2018	5	17.8	3.9	-1.4	-0.3	a
					2019	5	21.0	2.0	-0.4	0.6	a
					2020	5	18.0	4.7	-1.3	-0.3	a
Simpson's Evenness	ANOVA	none	NO	0.421	2007	3	0.865	0.049	-	-1.9	a
					2013	3	0.899	0.018	0.7	-	a
					2015	5	0.892	0.060	0.6	-0.4	a
					2016	5	0.843	0.064	-0.4	-3.1	a
					2017	5	0.883	0.042	0.4	-0.9	a
					2018	5	0.889	0.047	0.5	-0.6	a
					2019	5	0.899	0.008	0.7	0.0	a
					2020	5	0.855	0.024	-0.2	-2.4	a
Oligochaeta (% of community)	K-W	rank	YES	0.009	2007	3	5.9	4.1	-	4.7	a
					2013	3	0.7	1.1	-1.3	-	b,c
					2015	5	0.8	0.4	-1.3	0.2	b
					2016	5	1.5	1.0	-1.1	0.8	a,b
					2017	5	3.0	2.8	-0.7	2.0	a,b
					2018	5	0.9	1.0	-1.2	0.3	b,c
					2019	5	2.1	1.7	-0.9	1.3	a,b
					2020	5	0.0	0.0	-1.5	-0.6	c
Hydracarina (% of community)	ANOVA	log10	YES	0.052	2007	3	3.4	2.0	-	-1.3	a
					2013	3	9.0	4.2	2.8	-	a
					2015	5	4.2	4.1	0.4	-1.1	a
					2016	5	4.6	3.2	0.6	-1.0	a
					2017	5	3.3	2.0	-0.1	-1.4	a
					2018	5	8.5	2.3	2.6	-0.1	a
					2019	5	2.7	1.1	-0.3	-1.5	a
					2020	5	4.2	1.8	0.4	-1.2	a
Chironomidae (% of community)	K-W	rank	NO	0.154	2007	3	77.5	5.8	-	0.9	a
					2013	3	73.3	4.4	-0.7	-	a
					2015	5	78.7	8.7	0.2	1.2	a
					2016	5	67.1	8.8	-1.8	-1.4	a
					2017	5	73.4	10.1	-0.7	0.0	a
					2018	5	75.8	11.1	-0.3	0.6	a
					2019	5	63.7	6.9	-2.4	-2.2	a
					2020	5	70.3	4.3	-1.2	-0.7	a
Metal Sensitive Taxa (% of community)	K-W	rank	YES	0.022	2007	3	2.6	0.9	-	2.9	a,b
					2013	3	1.0	0.5	-1.8	-	b,c,d
					2015	5	5.0	2.5	2.8	7.4	a
					2016	5	0.8	1.2	-2.1	-0.4	d
					2017	5	1.1	1.3	-1.7	0.2	b,c,d
					2018	5	0.8	0.6	-2.0	-0.3	c,d
					2019	5	2.5	1.1	-0.1	2.8	a,b
					2020	5	3.2	3.6	0.7	4.0	a,b,c
Tipulidae (% of community)	ANOVA	log10	YES	0.029	2007	3	4.6	1.9	-	0.1	a,b
					2013	3	4.4	2.1	-0.1	-	a,b
					2015	5	3.9	3.4	-0.4	-0.2	a,b
					2016	5	8.0	3.3	1.8	1.7	a
					2017	5	5.8	5.6	0.7	0.7	a,b
					2018	5	3.6	2.3	-0.5	-0.4	a,b
					2019	5	1.4	0.8	-1.7	-1.5	b
					2020	5	3.1	1.3	-0.8	-0.6	a,b

Table F.34: Statistical Comparison of Benthic Metrics at Sheardown Lake Tributary 9 (SDLT9) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison
									vs. Baseline Year 2007	vs. Baseline Year 2013	
Collector-Gatherer FFG (% of community)	ANOVA	none	NO	0.267	2007	3	57.8	3.1	-	-0.4	a
					2013	3	60.6	6.9	0.9	-	a
					2015	5	60.7	20.5	0.9	0.0	a
					2016	5	44.6	15.7	-4.3	-2.3	a
					2017	5	57.5	11.6	-0.1	-0.4	a
					2018	5	52.6	7.3	-1.7	-1.2	a
					2019	5	62.5	6.5	1.5	0.3	a
					2020	5	63.1	6.9	1.7	0.4	a
Filterer FFG (% of community)	ANOVA	log10(x+1)	NO	0.140	2007	3	1.3	0.9	-	-0.7	a
					2013	3	1.9	0.9	0.6	-	a
					2015	5	2.0	1.8	0.7	0.1	a
					2016	5	0.5	0.4	-0.9	-1.6	a
					2017	5	0.8	0.7	-0.6	-1.3	a
					2018	5	1.4	1.4	0.1	-0.6	a
					2019	5	2.0	1.0	0.7	0.1	a
					2020	5	0.5	0.8	-0.9	-1.6	a
Shredder FFG (% of community)	ANOVA	log10	NO	0.143	2007	3	26.8	3.9	-	-0.4	a
					2013	3	28.4	4.4	0.4	-	a
					2015	5	32.0	18.2	1.3	0.8	a
					2016	5	49.1	15.0	5.7	4.7	a
					2017	5	37.7	10.7	2.8	2.1	a
					2018	5	37.2	9.7	2.7	2.0	a
					2019	5	32.0	7.2	1.3	0.8	a
					2020	5	29.8	6.8	0.8	0.3	a

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.35: Statistical Comparison of Sediment Physical Properties Between Sheardown Lake NW (DL0-1) and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Data Transformation	Significant Difference between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	tequal	none	NO	0.264	Reference	5	29.6	7.5	3.4	23.4	40.4
						Sheardown NW	5	45.1	27.9	12.5	22.9	93.0
	Silt-Sized Material (%)	tequal	none	NO	0.159	Reference	5	62.2	6.3	2.8	53.4	68.4
						Sheardown NW	5	45.5	23.3	10.4	6.4	67.1
	Clay-Sized Material (%)	tequal	none	NO	0.640	Reference	5	8.2	3.0	1.3	6.2	13.4
						Sheardown NW	5	9.5	5.0	2.2	1.0	13.6
	Moisture (%)	tequal	none	YES	0.092	Reference	5	87.9	4.6	2.1	80.2	92.3
						Sheardown NW	5	67.7	23.2	10.4	27.4	84.3
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.076	Reference	5	4.8	2.0	0.9	2.3	7.0
						Sheardown NW	5	2.5	1.6	0.7	0.2	4.3
Profundal (Deep) Stations	Sand-Sized Material (%)	tequal	none	NO	0.113	Reference	5	31.6	22.3	10.0	13.9	56.6
						Sheardown NW	5	13.3	5.3	2.4	8.5	19.5
	Silt-Sized Material (%)	tequal	none	NO	0.109	Reference	5	57.4	18.1	8.1	36.9	71.9
						Sheardown NW	5	72.6	5.2	2.3	64.4	78.9
	Clay-Sized Material (%)	tequal	none	NO	0.272	Reference	5	11.0	4.3	1.9	6.3	15.1
						Sheardown NW	5	14.1	3.9	1.7	8.8	17.2
	Moisture (%)	tequal	none	YES	<0.001	Reference	5	82.6	3.6	1.6	78.3	86.6
						Sheardown NW	5	68.7	2.7	1.2	64.3	70.9
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.006	Reference	5	3.4	1.1	0.5	2.2	4.5
						Sheardown NW	5	1.6	0.3	0.1	1.3	2.0

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table F.36: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Northwest, August 2020

Taxa	Study Area	Sheardown Lake NW - Littoral Stations				
	Replicate Station	DLO-1-9	DLO-1-4	DLO-1-3	DLO-1-11	DLO-1-10
ROUNDWORMS						
P. Nemata		69	-	-	26	34
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	17	-	-
F. Lumbriculidae						
Lumbriculus		-	34	17	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		**-**	**-**	**-**	**-**	**-**
F. Acalyptonotidae						
Acalyptonotus		-	17	17	86	52
F. Hygrobatidae						
Hygrobates		17	17	-	69	103
F. Lebertiidae						
Lebertia		-	-	-	26	17
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	17	17	-	-
SEED SHRIMPS						
Cl. Ostracoda		1,810	4,500	1,086	664	845
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		34	34	121	17	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	**17**	**17**	-	**52**
S.F. Chironominae						
Chironomus		-	-	34	-	-
Micropsectra		224	181	448	17	17

Table F.36: **Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Northwest, August 2020**

Taxa	Study Area	Sheardown Lake NW - Littoral Stations				
	Replicate Station	DLO-1-9	DLO-1-4	DLO-1-3	DLO-1-11	DLO-1-10
Paratanytarsus		784	1,284	1,966	26	-
Sergentia		112	34	-	-	-
Stictochironomus		2,586	4,655	2,422	1,060	2,138
Tanytarsus		336	181	388	-	34
S.F. Diamesinae						
Diamesa		-	-	-	-	-
Protanypus		34	147	34	9	34
Pseudodiamesa		-	-	-	-	17
S.F. Orthocladiinae						
Abiskomyia		112	224	34	-	34
Heterotrissocladius		147	810	560	95	328
Hydrobaenus		-	-	-	-	-
Mesocricotopus		-	-	-	-	-
Paracladius		-	-	-	17	224
Parakiefferiella		-	-	-	9	52
Psectrocladius		-	-	-	-	-
Zalutschia		-	-	-	9	-
Orthocladiinae indeterminate		-	-	**34**	-	-
S.F. Tanypodinae						
Arctopelopia		112	328	560	-	-
Procladius		78	17	34	121	155
Density (No. organisms per m^2)		6,457	12,500	7,810	2,250	4,138
Richness (total number of taxa)[a]		14	16	17	15	15
Simpson's Evenness (E)		0.798	0.762	0.854	0.732	0.718
Shannon-Wiener Diversity		2.481	2.273	2.764	2.260	2.283
Dominant Taxonomic Group Composition						
% Nemata		1.1	0.0	0.0	1.1	0.8
% Hydracarina		0.3	0.3	0.2	8.0	4.2
% Ostracods		28.0	36.0	13.9	29.5	20.4
% Chironomids		70.1	63.0	83.7	60.5	74.6
% Metal Sensitive Chironmids		21.4	14.4	36.4	2.3	2.5
Functional Feeding Group Composition						
% Collector - Gatherers		75.4	83.5	54.2	83.5	90.7
% Filterers		20.8	13.2	36.0	1.9	1.3
% Shredders		0.0	0.0	0.4	0.4	0.0
Habitat Preference Group Composition						
% Clingers		11.2	3.7	12.5	9.6	5.4
% Sprawlers		47.1	57.5	55.1	41.8	40.3
% Burrowers		41.7	38.8	32.4	48.7	54.2

[a] Bold entries excluded from taxa count

Table F.36: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Northwest, August 2020

Taxa	Study Area	Sheardown Lake NW - Profundal Stations				
	Replicate Station	DLO-1-5	DLO-1-14	DLO-1-15	DLO-1-2	DLO-1-12
ROUNDWORMS						
P. Nemata		-	-	-	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		**-**	**-**	**-**	**-**	**-**
F. Acalyptonotidae						
Acalyptonotus		9	17	17	9	9
F. Hygrobatidae						
Hygrobates		9	17	9	26	-
F. Lebertiidae						
Lebertia		9	-	-	9	17
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		69	190	9	78	121
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	-	-	-	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	**52**	-	-	**9**
S.F. Chironominae						
Chironomus		112	862	-	-	-
Micropsectra		9	-	-	-	-

Table F.36: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Northwest, August 2020

Taxa	Study Area / Replicate Station	Sheardown Lake NW - Profundal Stations				
		DLO-1-5	DLO-1-14	DLO-1-15	DLO-1-2	DLO-1-12
Paratanytarsus		-	17	-	-	-
Sergentia		17	-	-	-	-
Stictochironomus		259	259	-	-	-
Tanytarsus		-	155	-	-	-
S.F. Diamesinae						
Diamesa		-	-	-	-	-
Protanypus		17	-	17	34	26
Pseudodiamesa		-	-	-	-	-
S.F. Orthocladiinae						
Abiskomyia		69	52	-	-	-
Heterotrissocladius		216	-	707	1,138	1,810
Hydrobaenus		-	-	-	-	-
Mesocricotopus		-	-	-	-	-
Paracladius		-	-	-	-	-
Parakiefferiella		-	-	-	-	-
Psectrocladius		-	-	-	-	-
Zalutschia		-	-	-	-	-
Orthocladiinae indeterminate		-	-	-	-	-
S.F. Tanypodinae						
Arctopelopia		-	-	-	-	-
Procladius		34	-	43	52	43
Density (No. organisms per m^2)		831	1,627	805	1,350	2,043
Richness (total number of taxa)[a]		12	8	6	7	6
Simpson's Evenness (E)		0.872	0.734	0.262	0.324	0.236
Shannon-Wiener Diversity		2.716	1.970	0.766	0.961	0.677
Dominant Taxonomic Group Composi						
% Nemata		0.0	0.0	0.0	0.0	0.0
% Hydracarina		3.1	2.1	3.2	3.2	1.3
% Ostracods		8.3	11.7	1.1	5.8	5.9
% Chironomids		88.5	86.2	95.7	91.0	92.8
% Metal Sensitive Chironmids		3.1	11.0	2.2	2.6	1.3
Functional Feeding Group Compositio						
% Collector - Gatherers		91.7	86.8	91.4	92.9	96.6
% Filterers		1.0	11.0	0.0	0.0	0.0
% Shredders		0.0	0.0	0.0	0.0	0.0
Habitat Preference Group Compositio						
% Clingers		6.3	12.1	3.2	3.2	1.3
% Sprawlers		46.9	16.1	94.6	94.2	97.5
% Burrowers		46.9	71.8	2.2	2.6	1.3

[a] Bold entries excluded from taxa count

Table F.37: Statistical Comparison of Benthic Metrics at Sheardown Lake NW Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2008, 2013) for the Mary River Project CREMP

Metric	Overall 9-Year Comparison				Pair-wise, post-hoc comparisons[a]							
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Effect Size vs. Baseline Year 2008	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	NO	0.835	2007	4	5,974	3,000	-	-0.3	-1.5	a
					2008	4	7,536	5,273	0.5	-	-0.9	a
					2013	3	9,940	2,634	1.3	0.5	-	a
					2015	5	5,665	3,230	-0.1	-0.4	-1.6	a
					2016	5	5,503	4,184	-0.2	-0.4	-1.7	a
					2017	5	5,216	2,398	-0.3	-0.4	-1.8	a
					2018	5	6,334	3,717	0.1	-0.2	-1.4	a
					2019	5	6,207	2,673	0.1	-0.3	-1.4	a
					2020	5	6,631	3,914	0.2	-0.2	-1.3	a
Richness (No. of Taxa)	ANOVA	log10	NO	0.181	2007	4	12.3	1.5	-	-1.3	-1.7	a
					2008	4	14.5	1.7	1.4	-	-1.0	a
					2013	3	17.7	3.2	3.5	1.9	-	a
					2015	5	13.8	1.9	1.0	-0.4	-1.2	a
					2016	5	14.6	2.4	1.5	0.1	-1.0	a
					2017	5	14.0	3.2	1.1	-0.3	-1.1	a
					2018	5	15.0	1.2	1.8	0.3	-0.8	a
					2019	5	13.2	3.6	0.6	-0.8	-1.4	a
					2020	5	15.4	1.1	2.0	0.5	-0.7	a
Simpson's Evenness	ANOVA	log10	YES	0.038	2007	4	0.768	0.055	-	-0.7	-2.0	ab
					2008	4	0.840	0.098	1.3	-	-0.5	ab
					2013	3	0.863	0.047	1.7	0.2	-	ab
					2015	5	0.759	0.096	-0.2	-0.8	-2.2	ab
					2016	5	0.893	0.024	2.3	0.5	0.6	a
					2017	5	0.842	0.048	1.3	0.0	-0.5	ab
					2018	5	0.769	0.163	0.0	-0.7	-2.0	ab
					2019	5	0.686	0.114	-1.5	-1.6	-3.8	b
					2020	5	0.773	0.055	0.1	-0.7	-1.9	a
Nemata (% of community)	ANOVA	log10(x+1)	NO	0.592	2007	4	1.5	1.6	-	0.4	1.1	a
					2008	4	1.1	1.0	-0.3	-	0.6	a
					2013	3	0.6	0.8	-0.6	-0.5	-	a
					2015	5	0.9	1.1	-0.4	-0.2	0.3	a
					2016	5	1.1	0.7	-0.2	0.1	0.6	a
					2017	5	1.3	1.5	-0.2	0.2	0.8	a
					2018	5	1.3	1.0	-0.1	0.3	0.9	a
					2019	5	0.2	0.2	-0.9	-0.9	-0.5	a
					2020	5	0.6	0.6	-0.6	-0.5	0.0	a
Ostracoda (% of community)	ANOVA	none	YES	0.018	2007	4	11.9	12.8	-	0.1	-1.4	ab
					2008	4	10.8	8.7	-0.1	-	-1.5	ab
					2013	3	23.4	8.1	0.9	1.4	-	ab
					2015	5	7.8	3.7	-0.3	-0.3	-1.9	b
					2016	5	9.2	6.1	-0.2	-0.2	-1.7	b
					2017	5	19.5	11.1	0.6	1.0	-0.5	ab
					2018	5	13.0	4.1	0.1	0.2	-1.3	ab
					2019	5	16.0	5.7	0.3	0.6	-0.9	ab
					2020	5	25.6	8.6	1.1	1.7	0.3	a

Table F.37: Statistical Comparison of Benthic Metrics at Sheardown Lake NW Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2008, 2013) for the Mary River Project CREMP

Metric	Overall 9-Year Comparison				Pair-wise, post-hoc comparisons[a]							
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size			Pairwise Comparison
									vs. Baseline Year 2007	vs. Baseline Year 2008	vs. Baseline Year 2013	
Chironomidae (% of community)	ANOVA	log10	YES	0.003	2007	4	83.0	8.3	-	0.3	1.3	abc
					2008	4	81.2	6.7	-0.2	-	1.1	abc
					2013	3	70.5	9.6	-1.5	-1.6	-	bc
					2015	5	89.8	3.2	0.8	1.3	2.0	a
					2016	5	85.0	6.6	0.2	0.6	1.5	ab
					2017	5	73.5	11.2	-1.1	-1.2	0.3	bc
					2018	5	83.7	2.9	0.1	0.4	1.4	abc
					2019	5	82.1	5.9	-0.1	0.1	1.2	abc
					2020	5	70.4	9.3	-1.5	-1.6	0.0	c
Metal Sensitive Taxa (% of community)	ANOVA	log10	NO	0.804	2007	4	16.9	16.8	-	-0.2	-0.9	a
					2008	4	20.7	17.2	0.2	-	-0.1	a
					2013	3	21.0	4.6	0.2	0.0	-	a
					2015	5	19.1	7.2	0.1	-0.1	-0.4	a
					2016	5	24.6	15.2	0.5	0.2	0.8	a
					2017	5	16.6	7.9	0.0	-0.2	-0.9	a
					2018	5	18.3	15.0	0.1	-0.1	-0.6	a
					2019	5	10.7	6.0	-0.4	-0.6	-2.2	a
					2020	5	15.4	14.3	-0.1	-0.3	-1.2	a
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.034	2007	4	71.6	13.5	-	0.7	0.7	ab
					2008	4	61.1	15.0	-0.8	-	-0.5	ab
					2013	3	65.3	9.0	-0.5	0.3	-	ab
					2015	5	68.9	8.0	-0.2	0.5	0.4	ab
					2016	5	56.8	7.7	-1.1	-0.3	-1.0	a
					2017	5	69.4	9.2	-0.2	0.6	0.5	ab
					2018	5	76.2	13.1	0.3	1.0	1.2	ab
					2019	5	81.7	8.4	0.8	1.4	1.8	b
					2020	5	77.5	14.1	0.4	1.1	1.4	ab
Filterer FFG (% of community)	ANOVA	none	NO	0.908	2007	4	16.7	17.1	-	-0.2	-0.9	a
					2008	4	19.9	17.1	0.2	-	-0.2	a
					2013	3	21.0	4.7	0.3	0.1	-	a
					2015	5	18.6	6.8	0.1	-0.1	-0.5	a
					2016	5	23.0	17.3	0.4	0.2	0.4	a
					2017	5	16.5	8.0	0.0	-0.2	-1.0	a
					2018	5	17.5	15.7	0.0	-0.1	-0.7	a
					2019	5	10.0	5.8	-0.4	-0.6	-2.4	a
					2020	5	14.6	14.5	-0.1	-0.3	-1.4	a

(grey) Indicates a significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.38: Statistical Comparison of Benthic Metrics at Sheardown Lake NW Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison
									vs. Baseline Year 2007	vs. Baseline Year 2013	
Density (No. per m^2)	ANOVA	log10	YES	0.001	2007	4	1,461	308	-	-4.3	a
					2013	5	2,744	302	4.2	-	b
					2015	5	1,425	210	-0.1	-4.4	a
					2017	5	861	391	-1.9	-6.2	c
					2018	5	1,154	240	-1.0	-5.3	a,c
					2019	5	1,670	302	0.7	-3.6	a,b
					2020	5	1,326	527	-0.4	-4.7	a,c
Richness (No. of Taxa)	ANOVA	none	NO	0.898	2007	4	7.5	0.4	-	-0.9	a
					2013	5	9.8	2.5	5.4	-	a
					2015	5	8.4	3.0	2.1	-0.6	a
					2017	5	9.2	3.5	4.0	-0.3	a
					2018	5	9.4	3.5	4.4	-0.2	a
					2019	5	9.2	3.5	4.0	-0.3	a
					2020	5	7.8	2.5	0.7	-0.8	a
Simpson's Evenness	ANOVA	none	NO	0.228	2007	4	0.426	0.165	-	-0.6	a
					2013	5	0.521	0.167	0.6	-	a
					2015	5	0.355	0.212	-0.4	-1.0	a
					2017	5	0.717	0.113	1.8	1.2	a
					2018	5	0.491	0.133	0.4	-0.2	a
					2019	5	0.444	0.210	0.1	-0.5	a
					2020	5	0.486	0.295	0.4	-0.2	a
Nemata (% of community)	K-W	rank	YES	0.058	2007	4	0.6	0.5	-	-1.2	a,b
					2013	5	3.6	2.6	5.8	-	a
					2015	5	0.5	0.3	-0.2	-1.2	b
					2017	5	1.4	3.0	1.4	-0.9	b,c
					2018	5	0.6	1.0	-0.1	-1.2	b,c
					2019	5	0.4	0.4	-0.4	-1.2	b,c
					2020	5	0.0	0.0	-1.2	-1.4	c
Ostracoda (% of community)	ANOVA	log10(x+1)	NO	0.137	2007	4	0.3	0.4	-	-0.7	a
					2013	5	6.2	8.7	16.4	-	a
					2015	5	2.8	3.7	7.0	-0.4	a
					2017	5	6.8	4.6	18.2	0.1	a
					2018	5	2.9	2.4	7.1	-0.4	a
					2019	5	2.5	1.6	6.3	-0.4	a
					2020	5	6.6	3.9	17.5	0.0	a
Chironomidae (% of community)	ANOVA	log10	NO	0.124	2007	4	94.6	1.9	-	1.1	a
					2013	5	84.9	8.8	-5.0	-	a
					2015	5	93.2	6.0	-0.7	0.9	a
					2017	5	85.1	8.5	-4.9	0.0	a
					2018	5	90.4	3.8	-2.2	0.6	a
					2019	5	93.0	5.7	-0.8	0.9	a
					2020	5	90.8	3.7	-2.0	0.7	a
Metal Sensitive Taxa (% of community)	K-W	rank	YES	0.041	2007	4	0.5	0.6	-	-0.5	a
					2013	5	1.4	1.7	1.4	-	a,b
					2015	5	2.8	2.8	3.7	0.9	a,b
					2017	5	6.3	4.4	9.2	2.9	c
					2018	5	3.3	2.0	4.4	1.1	b,c
					2019	5	2.2	2.1	2.7	0.5	a,b
					2020	5	4.0	4.0	5.6	1.6	b,c
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.011	2007	4	83.6	8.4	-	-0.6	a,b
					2013	5	86.4	4.8	0.3	-	a,b
					2015	5	90.5	5.3	0.8	0.9	a
					2017	5	75.5	7.3	-1.0	-2.3	b
					2018	5	85.2	7.7	0.2	-0.3	a,b
					2019	5	88.6	6.5	0.6	0.5	a
					2020	5	91.9	3.5	1.0	1.2	a
Filterer FFG (% of community)	K-W	rank	NO	0.575	2007	4	0.1	0.1	-	-0.8	a
					2013	5	1.3	1.6	11.6	-	a
					2015	5	1.9	2.6	16.7	0.3	a
					2017	5	2.9	2.5	26.2	1.0	a
					2018	5	1.0	1.4	8.5	-0.2	a
					2019	5	1.3	2.6	11.1	0.0	a
					2020	5	2.4	4.9	21.8	0.7	a

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.39: Statistical Comparison of Sediment Physical Properties Between Sheardown Lake SE (DL0-2) and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Data Transformation	Significant Difference between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	tequal	none	YES	0.003	Reference	5	29.6	7.5	3.4	23.4	40.4
						Sheardown SE	5	11.1	6.7	3.0	5.2	21.6
	Silt-Sized Material (%)	tequal	none	YES	0.009	Reference	5	62.2	6.3	2.8	53.4	68.4
						Sheardown SE	5	75.0	5.5	2.5	68.9	81.5
	Clay-Sized Material (%)	tequal	none	YES	0.029	Reference	5	8.2	3.0	1.3	6.2	13.4
						Sheardown SE	5	13.9	3.7	1.7	9.4	17.5
	Moisture (%)	tequal	none	YES	0.000	Reference	5	87.9	4.6	2.1	80.2	92.3
						Sheardown SE	5	60.9	7.3	3.3	48.9	68.6
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.008	Reference	5	4.8	2.0	0.9	2.3	7.0
						Sheardown SE	5	1.4	0.8	0.4	0.4	2.3
Profundal (Deep) Stations	Station Depth (m)	tequal	log10	YES	0.001	Reference	5	20.6	2.2	1.0	18.5	24.2
						Sheardown SE	5	12.4	1.2	0.5	10.5	13.5
	Sand-Sized Material (%)	tequal	none	NO	0.146	Reference	5	31.6	22.3	10.0	13.9	56.6
						Sheardown SE	5	15.1	5.3	2.4	8.3	20.7
	Silt-Sized Material (%)	tequal	none	NO	0.112	Reference	5	57.4	18.1	8.1	36.9	71.9
						Sheardown SE	5	72.2	4.0	1.8	67.5	76.6
	Clay-Sized Material (%)	tequal	none	NO	0.477	Reference	5	11.0	4.3	1.9	6.3	15.1
						Sheardown SE	5	12.7	2.8	1.2	9.5	15.6
	Moisture (%)	tequal	none	YES	0.001	Reference	5	82.6	3.6	1.6	78.3	86.6
						Sheardown SE	5	55.8	11.8	5.3	41.9	70.7
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.002	Reference	5	3.4	1.1	0.5	2.2	4.5
						Sheardown SE	5	1.1	0.6	0.2	0.2	1.6

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table F.40: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Southeast, August 2020

Taxa	Study Area	Sheardown Lake SE - Littoral Stations				
	Replicate Station	DLO-2-11	DLO-2-10	DLO-2-4	DLO-2-9	DLO-2-1
ROUNDWORMS						
P. Nemata		-	-	103	9	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Acalyptonotidae						
Acalyptonotus		34	34	34	43	17
F. Hygrobatidae						
Hygrobates		34	17	259	69	129
F. Lebertiidae						
Lebertia		-	17	69	34	43
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		121	638	638	448	129
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	69	17	-	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	-	-	**17**	**112**
S.F. Chironominae						
Chironomus		-	-	-	-	543
Micropsectra		293	86	86	310	-

Table F.40: **Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Southeast, August 2020**

Taxa / Study Area / Replicate Station	Sheardown Lake SE - Littoral Stations DLO-2-11	DLO-2-10	DLO-2-4	DLO-2-9	DLO-2-1
Paratanytarsus	-	17	-	-	60
Sergentia	-	-	-	17	-
Stictochironomus	1,603	3,655	2,293	905	543
Tanytarsus	724	103	448	517	405
S.F. Diamesinae					
Diamesa	-	-	-	-	-
Protanypus	-	-	-	-	-
Pseudodiamesa	-	-	-	-	-
S.F. Orthocladiinae					
Abiskomyia	121	534	655	664	276
Heterotrissocladius	293	362	181	172	78
Hydrobaenus	-	-	-	-	-
Mesocricotopus	-	-	-	-	-
Paracladius	-	-	-	-	-
Parakiefferiella	-	-	-	-	-
Psectrocladius	-	17	-	-	-
Zalutschia	-	-	-	-	-
Orthocladiinae indeterminate	-	-	-	-	-
S.F. Tanypodinae					
Arctopelopia	17	121	60	9	-
Procladius	1,966	1,241	1,345	2,293	879
Density (No. organisms per m^2)	3,216	5,207	6,914	6,190	5,509
Richness (total number of taxa)[a]	11	10	14	13	13
Simpson's Evenness (E)	0.911	0.818	0.722	0.851	0.827
Shannon-Wiener Diversity	2.834	2.292	2.219	2.692	2.565
Dominant Taxonomic Group Composition					
% Nemata	0.0	0.0	0.0	1.7	0.2
% Hydracarina	5.9	1.3	1.0	5.8	2.7
% Ostracods	4.0	2.3	9.2	10.3	8.1
% Chironomids	90.1	96.4	88.8	81.9	89.0
% Metal Sensitive Chironmids	15.1	19.5	3.0	8.6	15.1
Functional Feeding Group Composition					
% Collector - Gatherers	50.6	41.1	75.3	62.5	40.3
% Filterers	15.1	19.5	3.0	8.6	15.1
% Shredders	0.0	0.0	0.0	0.0	0.0
Habit Preference Group Composition					
% Clingers	19.0	20.9	4.7	14.8	18.1
% Sprawlers	45.9	48.3	42.4	46.5	65.3
% Burrowers	35.1	30.8	52.9	38.7	16.6

[a] Bold entries excluded from taxa count

Table F.40: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Southeast, August 2020

Taxa	Study Area	Sheardown Lake SE - Profundal Stations				
	Replicate Station	DLO-2-12	DLO-2-8	DLO-2-13	DLO-2-2	DLO-2-3
ROUNDWORMS						
P. Nemata		-	-	-	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	-	-	-
F. Lumbriculidae						
Lumbriculus		-	-	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
immature		-	-	-	-	-
F. Acalyptonotidae						
Acalyptonotus		9	17	17	9	9
F. Hygrobatidae						
Hygrobates		9	17	9	26	-
F. Lebertiidae						
Lebertia		9	-	-	9	17
F. Sperchontidae						
Sperchon		-	-	-	-	-
HARPACTICOIDS						
O. Harpacticoida		-	-	-	-	-
SEED SHRIMPS						
Cl. Ostracoda		69	190	9	78	121
INSECTS						
Cl. Insecta						
CADDISFLIES						
O. Trichoptera						
F. Apataniidae						
Apatania		-	-	-	-	-
F. Limnephilidae						
Grensia praeterita		-	-	-	-	-
TRUE FLIES						
O. Diptera						
MIDGES						
F. Chironomidae						
chironomid pupae		-	**52**	-	-	**9**
S.F. Chironominae						
Chironomus		112	862	-	-	-
Micropsectra		9	-	-	-	-

Table F.40: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Sheardown Lake Southeast, August 2020

Taxa	Study Area / Replicate Station	Sheardown Lake SE - Profundal Stations				
		DLO-2-12	DLO-2-8	DLO-2-13	DLO-2-2	DLO-2-3
Paratanytarsus		-	17	-	-	-
Sergentia		17	-	-	-	-
Stictochironomus		259	259	-	-	-
Tanytarsus		-	155	-	-	-
S.F. Diamesinae						
Diamesa		-	-	-	-	-
Protanypus		17	-	17	34	26
Pseudodiamesa		-	-	-	-	-
S.F. Orthocladiinae						
Abiskomyia		69	52	-	-	-
Heterotrissocladius		216	-	707	1,138	1,810
Hydrobaenus		-	-	-	-	-
Mesocricotopus		-	-	-	-	-
Paracladius		-	-	-	-	-
Parakiefferiella		-	-	-	-	-
Psectrocladius		-	-	-	-	-
Zalutschia		-	-	-	-	-
Orthocladiinae indeterminate		-	-	-	-	-
S.F. Tanypodinae						
Arctopelopia		-	-	-	-	-
Procladius		34	-	43	52	43
Density (No. organisms per m^2)		3,350	3,038	6,189	3,177	3,670
Richness (total number of taxa)[a]		13	15	12	6	11
Simpson's Evenness (E)		0.835	0.806	0.869	0.732	0.619
Shannon-Wiener Diversity		2.566	2.596	2.670	1.665	1.736
Dominant Taxonomic Group Composi						
% Nemata		0.3	0.0	0.4	0.0	0.2
% Hydracarina		3.1	2.8	2.5	0.3	0.9
% Ostracods		6.5	5.7	13.0	0.8	0.5
% Chironomids		90.2	91.2	84.1	98.9	98.3
% Metal Sensitive Chironmids		24.0	21.6	19.9	22.0	11.8
Functional Feeding Group Compositi						
% Collector - Gatherers		33.6	52.1	44.3	61.8	70.6
% Filterers		23.8	21.6	19.2	22.0	11.8
% Shredders		0.3	0.6	0.0	0.0	0.0
Habit Preference Group Composition						
% Clingers		26.9	19.6	21.7	22.3	12.3
% Sprawlers		53.7	37.4	55.1	16.8	21.3
% Burrowers		19.4	43.0	23.2	61.0	66.4

[a] Bold entries excluded from taxa count

Table F.41: Statistical Comparison of Benthic Invertebrate Community Metrics at Sheardown Lake SE Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2013) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	ANOVA	none	YES	<0.001	2013	4	10,649	4,062	-	a
					2015	5	4,829	1,898	-1.4	b
					2016	5	3,700	1,485	-1.7	b
					2017	5	4,417	1,317	-1.5	b
					2018	5	4,240	1,520	-1.6	b
					2019	5	5,080	1,329	-1.4	b
					2020	5	5,407	1,391	-1.3	b
Richness (No. of Taxa)	ANOVA	log10	YES	0.052	2013	4	14.2	4.0	-	a
					2015	5	10.6	2.5	-0.9	a,b
					2016	5	11.4	2.3	-0.7	a,b
					2017	5	9.0	0.7	-1.3	b
					2018	5	10.2	2.6	-1.0	a,b
					2019	5	11.6	0.9	-0.7	a,b
					2020	5	12.2	1.6	-0.5	a,b
Simpson's Evenness	ANOVA	log10	NO	0.219	2013	4	0.785	0.096	-	a
					2015	5	0.759	0.123	-0.3	a
					2016	5	0.772	0.089	-0.1	a
					2017	5	0.712	0.055	-0.8	a
					2018	5	0.704	0.131	-0.8	a
					2019	5	0.826	0.058	0.4	a
					2020	5	0.826	0.068	0.4	a
Nemata (% of community)	K-W	rank	NO	0.905	2013	4	0.2	0.2	-	a
					2015	5	1.5	2.9	7.0	a
					2016	5	1.1	1.3	4.4	a
					2017	5	0.5	0.6	1.4	a
					2018	5	0.6	0.5	1.8	a
					2019	5	1.1	1.3	4.5	a
					2020	5	0.4	0.7	0.8	a
Ostracoda (% of community)	K-W	rank	NO	0.274	2013	4	5.9	8.8	-	a
					2015	5	5.5	10.0	0.0	a
					2016	5	1.7	2.5	-0.5	a
					2017	5	0.8	0.8	-0.6	a
					2018	5	6.1	9.9	0.0	a
					2019	5	5.4	7.7	-0.1	a
					2020	5	6.8	3.5	0.1	a
Chironomidae (% of community)	K-W	rank	NO	0.132	2013	4	89.9	7.5	-	a
					2015	5	88.9	9.4	-0.1	a
					2016	5	95.4	3.9	0.7	a
					2017	5	95.6	1.8	0.8	a
					2018	5	92.4	10.0	0.3	a
					2019	5	90.3	9.2	0.0	a
					2020	5	89.2	5.1	-0.1	a
Metal Sensitive Taxa (% of community)	ANOVA	none	NO	0.615	2013	4	15.1	9.8	-	a
					2015	5	12.7	10.4	-0.2	a
					2016	5	6.8	4.2	-0.8	a
					2017	5	12.1	4.2	-0.3	a
					2018	5	12.1	8.9	-0.3	a
					2019	5	16.3	7.8	0.1	a
					2020	5	12.3	6.5	-0.3	a

Table F.41: Statistical Comparison of Benthic Invertebrate Community Metrics at Sheardown Lake SE Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2013) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2013	Pairwise Comparison
Collector-Gatherer FFG (% of community)	ANOVA	log10	NO	0.605	2013	4	44.6	8.2	-	a
					2015	5	59.1	10.6	1.8	a
					2016	5	56.5	12.8	1.5	a
					2017	5	48.4	18.8	0.5	a
					2018	5	52.5	11.1	1.0	a
					2019	5	51.9	14.6	0.9	a
					2020	5	54.0	14.9	1.1	a
Filterer FFG (% of community)	ANOVA	none	NO	0.598	2013	4	15.1	9.8	-	a
					2015	5	12.5	10.4	-0.3	a
					2016	5	6.7	4.4	-0.9	a
					2017	5	12.1	4.2	-0.3	a
					2018	5	12.1	8.9	-0.3	a
					2019	5	16.3	7.8	0.1	a
					2020	5	12.3	6.5	-0.3	a

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.42: Statistical Comparison of Benthic Metrics at Sheardown Lake SE Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2013) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size: vs. Baseline Year 2007	Effect Size: vs. Baseline Year 2013	Pairwise Comparison
Density (No. per m^2)	K-W	rank	YES	0.020	2007	3	4,998	348	-	-1.8	a,b
					2013	4	6,602	874	4.6	-	a
					2015	5	3,185	281	-5.2	-3.9	c
					2017	5	3,234	880	-5.1	-3.9	b,c,d
					2018	5	3,209	2,747	-5.1	-3.9	c,d
					2019	5	4,284	851	-2.1	-2.7	a,b,d
					2020	5	3,869	1,304	-3.2	-3.1	b,c,d
Richness (No. of Taxa)	ANOVA	none	NO	0.395	2007	3	9.0	2.8	-	-0.7	a
					2013	4	10.5	2.1	0.5	-	a
					2015	5	8.8	1.8	-0.1	-0.8	a
					2017	5	8.8	1.6	-0.1	-0.8	a
					2018	5	8.4	2.2	-0.2	-1.0	a
					2019	5	10.2	2.3	0.4	-0.1	a
					2020	5	11.4	3.4	0.9	0.4	a
Simpson's Evenness	K-W	rank	YES	0.045	2007	3	0.607	0.093	-	-2.4	a,b
					2013	4	0.703	0.039	1.0	-	a,c
					2015	5	0.588	0.130	-0.2	-2.9	a,b
					2017	5	0.651	0.086	0.5	-1.3	a,b
					2018	5	0.568	0.050	-0.4	-3.4	b
					2019	5	0.706	0.149	1.1	0.1	a,c
					2020	5	0.772	0.099	1.8	1.8	c
Nemata (% of community)	K-W	rank	NO	0.509	2007	3	0.0	0.1	-	-0.9	a
					2013	4	0.1	0.1	1.6	-	a
					2015	5	0.6	1.1	11.4	5.4	a
					2017	5	0.0	0.0	-0.6	-1.2	a
					2018	5	0.9	1.7	16.4	8.2	a
					2019	5	0.3	0.3	4.8	1.8	a
					2020	5	0.2	0.2	2.9	0.7	a
Ostracoda (% of community)	K-W	rank	YES	0.033	2007	3	1.1	1.5	-	5.1	a,b
					2013	4	0.2	0.2	-0.7	-	b
					2015	5	0.5	0.4	-0.4	1.8	b
					2017	5	1.0	1.4	-0.1	4.5	b
					2018	5	0.8	1.3	-0.2	3.3	b
					2019	5	2.2	1.7	0.7	10.4	a
					2020	5	5.3	5.1	2.8	26.7	a
Chironomidae (% of community)	K-W	rank	NO	0.364	2007	3	97.0	2.9	-	-5.6	a
					2013	4	98.6	0.3	0.6	-	a
					2015	5	97.0	2.9	0.0	-5.5	a
					2017	5	97.1	1.6	0.0	-5.3	a
					2018	5	97.6	2.1	0.2	-3.7	a
					2019	5	95.3	4.2	-0.6	-11.5	a
					2020	5	92.5	6.2	-1.6	-21.1	a
Metal Sensitive Taxa (% of community)	ANOVA	none	YES	0.065	2007	3	13.5	11.4	-	-1.2	a,b
					2013	4	16.8	2.8	0.3	-	a,b
					2015	5	8.0	4.7	-0.5	-3.2	a,b
					2017	5	12.3	9.5	-0.1	-1.6	a,b
					2018	5	5.9	3.5	-0.7	-3.9	b
					2019	5	16.9	10.9	0.3	0.0	a,b
					2020	5	19.9	4.7	0.6	1.1	a
Collector-Gatherer FFG (% of community)	ANOVA	none	NO	0.459	2007	3	74.1	15.7	-	1.2	a
					2013	4	64.9	7.5	-0.6	-	a
					2015	5	60.2	23.0	-0.9	-0.6	a
					2017	5	45.1	17.4	-1.8	-2.6	a
					2018	5	63.8	22.4	-0.7	-0.1	a
					2019	5	52.7	26.8	-1.4	-1.6	a
					2020	5	52.5	14.5	-1.4	-1.7	a
Filterer FFG (% of community)	ANOVA	log10	YES	0.042	2007	3	13.4	11.5	-	-1.2	a,b
					2013	4	16.8	2.8	0.3	-	a,b
					2015	5	7.8	4.7	-0.5	-3.2	a,b
					2017	5	12.2	9.6	-0.1	-1.6	a,b
					2018	5	5.9	3.5	-0.7	-3.9	b
					2019	5	16.8	10.9	0.3	0.0	a,b
					2020	5	19.7	4.7	0.5	1.0	a

(Grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(Blue) Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.43: Replicate Grab Data for Benthic Invertebrate Community Samples Collected at the Mary River, Mary River Project CREMP, August 2020

Study Area	Station	Water Depth (cm)			Water Velocity (m/s)			Embeddedness			In-Stream Vegetation			Algae Presence		
		Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3	Replicate Grab 1	Replicate Grab 2	Replicate Grab 3
Mary River Upstream Reference (GO-09) (Reference)	GO-09 B1	8	11	16	0.31	0.32	0.47	50%	50%	50%	none	none	none	common	common	common
	GO-09 B2	11	15	6	0.33	0.45	0.31	50%	50%	25%	none	none	none	sparse	common	common
	GO-09 B3	17	9	7	0.32	0.34	0.31	50%	50%	50%	common	sparse	none	common	common	common
	GO-09 B4	11	10	6	0.31	0.32	0.35	25%	50%	50%	common	common	common	common	common	common
	GO-09 B5	15	16	8	0.31	0.36	0.45	25%	25%	25%	common	common	common	common	common	common
Mary River Upstream (GO-03)	GO-03 B1	12	6	8	0.31	0.38	0.30	25%	75%	50%	none	none	none	common	common	common
	GO-03 B2	8	6	7	0.33	0.45	0.37	50%	50%	50%	sparse	sparse	none	common	common	common
	GO-03 B3	12	8	6	0.46	0.32	0.32	50%	50%	50%	none	none	none	sparse	sparse	sparse
	GO-03 B4	8	10	12	0.39	0.55	0.32	50%	50%	50%	none	sparse	none	common	common	common
	GO-03 B5	12	16	15	0.45	0.31	0.52	25%	25%	25%	none	none	none	sparse	sparse	sparse
Mary River Upper Mine-Exposed (EO-01)	EO-01 B1	12	8	8	0.47	0.40	0.32	25%	25%	25%	none	none	none	sparse	common	sparse
	EO-01 B2	12	11	6	0.36	0.46	0.36	25%	25%	25%	sparse	sparse	none	sparse	sparse	sparse
	EO-01 B3	10	12	20	0.53	0.33	0.42	0%	25%	0%	none	none	none	sparse	sparse	common
	EO-01 B4	17	18	6	0.32	0.32	0.30	50%	50%	25%	none	none	none	sparse	common	sparse
	EO-01 B5	20	10	10	0.51	0.32	0.32	75%	50%	50%	none	none	none	sparse	sparse	sparse
Mary River Middle Mine-Exposed (EO-20)	EO-20 B1	12	14	8	0.32	0.34	0.36	25%	25%	25%	none	none	none	sparse	common	common
	EO-20 B2	16	10	18	0.30	0.51	0.31	25%	25%	25%	none	none	none	common	sparse	common
	EO-20 B3	14	20	16	0.39	0.42	0.37	50%	50%	50%	none	none	none	sparse	common	common
	EO-20 B4	8	11	16	0.42	0.31	0.48	25%	25%	50%	sparse	sparse	none	sparse	sparse	sparse
	EO-20 B5	12	12	6	0.30	0.42	0.42	25%	25%	50%	sparse	none	none	sparse	sparse	sparse
Mary River Lower Mine-Exposed (CO-05)	CO-05 B1	6	10	8	0.30	0.37	0.47	50%	50%	50%	sparse	none	sparse	sparse	sparse	sparse
	CO-05 B2	9	12	16	0.31	0.47	0.51	25%	25%	50%	sparse	none	none	sparse	sparse	sparse
	CO-05 B3	6	6	7	0.31	0.30	0.34	0%	25%	50%	sparse	none	common	sparse	sparse	sparse
	CO-05 B4	8	15	8	0.32	0.31	0.31	25%	25%	50%	sparse	sparse	sparse	sparse	sparse	sparse
	CO-05 B5	6	7	11	0.34	0.31	0.42	0%	25%	25%	sparse	none	sparse	sparse	sparse	sparse

Table F.44: Replicate Station Habitat Feature Summary Statistics for Mary River Benthic Stations, Mary River Project CREMP, August 2020

Metric	Study Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Water Depth (cm)	GO-09 Reference Area	11	1.5	0.7	9.0	11	13
	GO-03 Upstream Area	9.7	2.8	1.2	7.0	8.7	14
	EO-01 Upper Mine-Exposed Area	12	2.3	1.0	9.3	13	14
	EO-20 Middle Mine-Exposed Area	13	2.7	1.2	10	12	17
	CO-05 Lower Mine-Exposed Area	9.0	2.3	1.0	6.3	8.0	12
Water Velocity (m/s)	GO-09 Reference Area	0.35	0.024	0.011	0.32	0.36	0.37
	GO-03 Upstream Area	0.39	0.040	0.018	0.33	0.38	0.43
	EO-01 Upper Mine-Exposed Area	0.38	0.042	0.019	0.31	0.39	0.43
	EO-20 Middle Mine-Exposed Area	0.38	0.024	0.011	0.34	0.38	0.40
	CO-05 Lower Mine-Exposed Area	0.36	0.048	0.022	0.31	0.36	0.43
Substrate Embeddedness (%)	GO-09 Reference Area	0.42	0.10	0.046	0.25	0.42	0.50
	GO-03 Upstream Area	0.45	0.11	0.050	0.25	0.50	0.50
	EO-01 Upper Mine-Exposed Area	0.32	0.19	0.085	0.08	0.25	0.58
	EO-20 Middle Mine-Exposed Area	0.33	0.10	0.046	0.25	0.33	0.50
	CO-05 Lower Mine-Exposed Area	0.32	0.12	0.055	0.17	0.33	0.50

Note: Five stations were sampled at each study area.

Table F.45: Benthic Station Habitat Feature Statistical Comparisons Among Mary River Reference and Mine-Exposed Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 5-Area Comparison				Pair-wise, post hoc comparisons			
	Statistical Test [a]	Transformation	Significant Difference between Areas?	p-value	Study Area	Mean	Standard Deviation	Pairwise Comparison
Water Depth (cm)	ANOVA	log10	YES	0.079	G0-09	11.1	1.46	a,b
					G0-03	9.73	2.78	a,b
					E0-01	12.0	2.30	a,b
					E0-20	12.9	2.72	a
					C0-05	9.00	2.35	b
Water Velocity (m/s)	ANOVA	none	NO	0.505	G0-09	0.351	0.0237	a
					G0-03	0.385	0.0398	a
					E0-01	0.383	0.0420	a
					E0-20	0.378	0.0242	a
					C0-05	0.359	0.0484	a
Substrate Embeddedness (%)	ANOVA	none	NO	0.363	G0-09	41.7	10.2	a
					G0-03	45.0	11.2	a
					E0-01	31.7	19.0	a
					E0-20	33.3	10.2	a
					C0-05	31.7	12.4	a

Indicates a significant difference for respective comparison (p-value≤ 0.1).

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.46: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upstream Reference (GO-09) Study Area, August 2020

Taxa	Study Area	GO-09 (Upstream Reference)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	4	-	14	7
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	14	-	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		11	-	-	11	32
SEED SHRIMPS						
Cl. Ostracoda		-	-	-	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		25	7	11	7	29
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
indeterminate		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		**11**	**14**	**14**	**14**	**18**
S.F. Chironominae						
Micropsectra		-	-	-	-	-
Stictochironomus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		36	25	4	18	14
Pseudokiefferiella		43	25	29	484	1,487
S.F. Orthocladiinae						
Cardiocladius		-	57	-	-	-
Chaetocladius		-	-	-	39	-
Corynoneura		-	-	-	-	-
Cricotopus		11	7	54	165	68
Cricotopus/Orthocladius		22	22	7	50	29
Diplocladius		-	-	-	4	-
Eukiefferiella		-	-	-	-	50

Table F.46: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upstream Reference (GO-09) Study Area, August 2020

Taxa	Study Area	GO-09 (Upstream Reference)				
	Replicate Station	B1	B2	B3	B4	B5
Hydrobaenus		4	-	4	43	7
Hydrosmittia		-	-	-	22	-
Krenosmittia		-	4	29	18	7
Limnophyes		4	7	-	25	-
Metriocnemus		-	-	-	-	-
Orthocladius (Euorthocladius)		4	57	65	86	75
Synorthocladius		-	-	-	-	-
Tokunagaia		90	79	39	39	47
Tvetenia		14	11	50	118	82
indeterminate		**43**	-	-	**43**	**50**
S.F. Tanypodinae						
Thienemannimyia complex		4	-	-	-	-
F. Empididae						
Clinocera		-	-	-	-	-
F. Simuliidae						
Gymnopais		11	4	4	4	75
Metacnephia		7	4	-	-	39
Prosimulium		-	4	4	-	68
F. Tipulidae						
Dicranota		-	-	-	-	-
Ormosia		-	-	-	-	-
Tipula		4	7	4	11	22
Density (No. organisms per m^2)		341	351	315	1,215	2,208
Richness (total number of taxa)[a]		14	16	12	17	16
Simpson's Evenness (E)		0.915	0.903	0.923	0.829	0.562
Shannon-Wiener Diversity		3.120	3.160	2.940	2.840	2.020
Dominant Group Composition						
% Nemata		0.0	1.0	0.0	1.2	0.3
% Oligochaeta		0.0	4.1	0.0	0.0	0.0
% Hydracarina		3.2	0.0	0.0	0.9	1.5
% Ephemeroptera		7.4	2.0	3.4	0.6	1.3
% Ostracods		0.0	0.0	0.0	0.0	0.0
% Chironomids		83.2	87.8	93.2	96.2	87.7
% Metal Sensitive Chironmids		24.1	15.0	10.8	41.8	68.7
% Simuliidae		5.3	3.1	2.3	0.3	8.3
% Tipulidae		1.1	2.0	1.1	0.9	1.0
Functional Feeding Group Composition						
% Collector - Gatherers		81.2	74.9	77.6	81.5	85.5
% Filterers		2.1	2.0	1.1	0.0	4.9
% Shredders		9.3	4.9	20.1	17.4	4.7
Habitat Preference Group Composition						
% Clingers		16.6	5.9	21.3	17.7	13.5
% Sprawlers		82.3	69.8	77.6	80.3	85.2
% Burrowers		1.1	24.3	1.1	2.1	1.3

[a] Bold entries excluded from taxa count

Table F.47: Statistical Comparison of Benthic Metrics at the Mary River Reference Area (G0-09) Among Years of Mine Operation (2015 to 2020) and Baseline (2006, 2007) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2006	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m²)	ANOVA	log10	YES	<0.001	2006	3	404	149	-	-4.0	a,b
					2007	3	739	84	2.3	-	a,c
					2015	5	472	255	0.5	-3.2	a,b
					2016	5	662	320	1.7	-0.9	a,c
					2017	5	410	313	0.0	-3.9	a,b
					2018	5	194	112	-1.4	-6.5	b
					2019	5	1,623	700	8.2	10.5	c
					2020	5	886	831	3.2	1.8	a,c
Richness (No. of Taxa)	ANOVA	none	YES	0.005	2006	3	7.3	2.9	-	-10.4	a
					2007	3	13.3	0.6	2.1	-	b
					2015	5	11.4	3.2	1.4	-3.3	a,b
					2016	5	14.0	1.6	2.3	1.2	b
					2017	5	11.2	2.9	1.3	-3.7	a,b
					2018	5	11.8	2.3	1.5	-2.7	a,b
					2019	5	11.4	1.5	1.4	-3.3	a,b
					2020	5	15.0	2.0	2.7	2.9	b
Simpson's Evenness	K-W	rank	YES	0.001	2006	3	0.324	0.095	-	-8.6	a
					2007	3	0.655	0.039	3.5	-	a,b
					2015	5	0.878	0.049	5.8	5.8	c,d
					2016	5	0.907	0.023	6.1	6.5	c
					2017	5	0.770	0.097	4.7	3.0	b,d
					2018	5	0.907	0.030	6.1	6.5	c
					2019	5	0.687	0.095	3.8	0.8	a,b
					2020	5	0.826	0.153	5.3	4.4	c,d
Nemata (% of community)	K-W	rank	NO	0.6	2006	3	0.7	0.6	-	0.6	a
					2007	3	0.3	0.6	-0.6	-	a
					2015	5	0.4	0.5	-0.5	0.1	a
					2016	5	1.6	1.1	1.6	2.2	a
					2017	5	0.4	0.9	-0.5	0.1	a
					2018	5	1.8	2.5	2.0	2.5	a
					2019	5	0.6	0.5	-0.1	0.5	a
					2020	5	0.5	0.6	-0.3	0.3	a
Hydracarina (% of community)	K-W	rank	YES	0.003	2006	3	0.3	0.6	-	0.0	a
					2007	3	0.3	0.6	0.0	-	a
					2015	5	4.2	3.1	6.7	6.7	b
					2016	5	4.6	2.3	7.4	7.4	b
					2017	5	0.0	0.0	-0.6	-0.6	a
					2018	5	0.4	0.9	0.1	0.1	a
					2019	5	0.8	1.3	0.8	0.8	a
					2020	5	1.1	1.3	1.3	1.3	a
Chironomidae (% of community)	ANOVA	none	YES	<0.001	2006	3	98.7	0.6	-	1.2	a
					2007	3	97.3	1.2	-2.4	-	a
					2015	5	88.0	2.7	-18.5	-8.1	a,b
					2016	5	84.0	4.6	-25.5	-11.6	b
					2017	5	79.2	6.5	-33.8	-15.7	b
					2018	5	78.8	12.3	-34.5	-16.1	b
					2019	5	97.0	2.4	-2.9	-0.3	a
					2020	5	89.6	5.1	-15.8	-6.7	a,b
Metal Sensitive Taxa (% of community)	ANOVA	none	YES	<0.001	2006	3	62.0	3.5	-	1.8	a
					2007	3	31.0	17.6	-9.0	-	a,b,c
					2015	5	13.0	14.0	-14.2	-1.0	c
					2016	5	23.2	12.3	-11.2	-0.4	b,c
					2017	5	59.8	13.1	-0.6	1.6	a
					2018	5	31.0	10.6	-9.0	0.0	a,b,c
					2019	5	51.6	21.5	-3.0	1.2	a,b
					2020	5	32.0	23.7	-8.7	0.1	a,b,c
Tipulidae (% of community)	K-W	rank	NO	0.16	2006	3	0.3	0.6	-	-0.6	a
					2007	3	1.7	2.1	2.3	-	a
					2015	5	4.4	3.0	7.0	1.3	a
					2016	5	1.8	1.5	2.5	0.1	a
					2017	5	1.4	1.1	1.8	-0.1	a
					2018	5	3.2	4.1	5.0	0.7	a
					2019	5	0.6	0.5	0.5	-0.5	a
					2020	5	1.2	0.5	1.5	-0.2	a

Table F.47: Statistical Comparison of Benthic Metrics at the Mary River Reference Area (G0-09) Among Years of Mine Operation (2015 to 2020) and Baseline (2006, 2007) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transform-ation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2006	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	<0.001	2006	3	98.7	1.2	-	3.5	a
					2007	3	94.7	1.2	-3.5	-	a,b
					2015	5	78.0	12.2	-18.0	-14.5	b,c
					2016	5	75.4	9.0	-20.3	-16.8	c
					2017	5	74.6	6.9	-21.0	-17.5	c
					2018	5	80.8	11.4	-15.6	-12.1	b,c
					2019	5	92.6	5.0	-5.3	-1.8	a,b
					2020	5	80.2	4.1	-16.1	-12.6	b,c
Filterer FFG (% of community)	K-W	rank	YES	<0.001	2006	3	0.0	0.0	-	not calculable	a
					2007	3	0.0	0.0	not calculable	-	a
					2015	5	2.0	1.9	not calculable	not calculable	a,b
					2016	5	7.2	4.2	not calculable	not calculable	b,c
					2017	5	19.0	5.4	not calculable	not calculable	c
					2018	5	14.2	10.0	not calculable	not calculable	c
					2019	5	0.0	0.0	not calculable	not calculable	a
					2020	5	2.0	1.8	not calculable	not calculable	a,b
Shredder FFG (% of community)	K-W	rank	YES	0.014	2006	3	0.3	0.6	-	-6.9	a
					2007	3	4.3	0.6	6.9	-	a,b,c
					2015	5	16.0	11.3	27.2	20.2	b
					2016	5	11.8	3.6	19.9	12.9	b
					2017	5	5.6	2.3	9.1	2.2	b,c
					2018	5	4.8	6.2	7.7	0.8	a,c
					2019	5	5.0	2.8	8.1	1.2	a,c
					2020	5	11.3	7.1	19.0	12.1	b

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.48: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upstream of the Mine (GO-03) Study Area, August 2020

Taxa	Study Area / Replicate Station	GO-03 (Upstream of Mine) B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		11	7	-	-	7
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		11	-	-	7	7
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		7	7	7	-	18
SEED SHRIMPS						
Cl. Ostracoda		-	-	-	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	4	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	4	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
indeterminate		-	75	11	-	57
MIDGES						
F. Chironomidae						
chironomid pupae		**11**	**14**	**-**	**14**	**14**
S.F. Chironominae						
Micropsectra		7	-	-	-	-
Stictochironomus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		-	-	-	-	4
Pseudokiefferiella		14	36	4	25	22
S.F. Orthocladiinae						
Cardiocladius		-	-	4	-	4
Chaetocladius		-	-	-	-	4
Corynoneura		-	-	-	-	4
Cricotopus		18	32	4	11	11
Cricotopus/Orthocladius		4	7	4	-	25
Diplocladius		4	-	-	-	-
Eukiefferiella		-	-	-	4	-

Table F.48: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upstream of the Mine (GO-03) Study Area, August 2020

Taxa — Study Area	GO-03 (Upstream of Mine)				
Replicate Station	B1	B2	B3	B4	B5
Hydrobaenus	-	7	-	-	4
Hydrosmittia	4	7	-	11	-
Krenosmittia	4	4	7	18	25
Limnophyes	-	-	-	-	-
Metriocnemus	-	-	-	-	-
Orthocladius (Euorthocladius)	4	7	7	4	29
Synorthocladius	-	-	-	-	-
Tokunagaia	4	-	7	7	4
Tvetenia	43	50	29	32	14
indeterminate	**7**	-	-	-	-
S.F. Tanypodinae					
Thienemannimyia complex	-	-	-	-	-
F. Empididae					
Clinocera	-	-	-	-	4
F. Simuliidae					
Gymnopais	-	-	-	-	-
Metacnephia	-	-	-	4	11
Prosimulium	-	-	-	4	7
F. Tipulidae					
Dicranota	-	-	-	-	-
Ormosia	-	-	-	4	-
Tipula	4	7	4	7	47
Density (No. organisms per m^2)	154	269	86	151	319
Richness (total number of taxa)[a]	13	13	10	13	19
Simpson's Evenness (E)	0.890	0.898	0.924	0.936	0.944
Shannon-Wiener Diversity	3.05	2.94	2.96	3.23	3.63
Dominant Group Composition					
% Nemata	7.0	2.7	0.0	0.0	2.3
% Oligochaeta	7.0	0.0	0.0	4.8	2.3
% Hydracarina	4.7	2.7	8.3	0.0	5.6
% Ephemeroptera	0.0	1.3	0.0	0.0	0.0
% Ostracods	0.0	0.0	0.0	0.0	0.0
% Chironomids	79.1	61.3	75.0	83.3	50.6
% Metal Sensitive Chironmids	15.3	14.6	4.2	18.8	8.6
% Simuliidae	0.0	0.0	0.0	4.8	5.6
% Tipulidae	2.3	2.7	4.2	7.1	14.6
Functional Feeding Group Composition					
% Collector - Gatherers	73.0	49.8	65.3	82.4	47.8
% Filterers	5.1	0.0	0.0	4.8	5.6
% Shredders	17.2	19.5	9.7	12.8	20.7
Habitat Preference Group Composition					
% Clingers	24.6	18.2	13.9	12.8	18.4
% Sprawlers	59.1	48.5	65.3	75.3	43.3
% Burrowers	16.3	33.3	20.8	11.9	38.3

[a] Bold entries excluded from taxa count

Table F.49: Benthic Invertebrate Community Summary Statistics for Mary River, Mary River Project CREMP, August 2020

Metric	Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Density (no. organisms / m^2)	GO-09 Reference Area	886	831	372	315	351	2,208
	GO-03 Upstream Area	196	95.3	42.6	86	154	319
	EO-01 Upper Mine-Exposed Area	513	420	188	244	351	1,258
	EO-20 Middle Mine-Exposed Area	1,441	553	247	943	1,186	2,315
	CO-05 Lower Mine-Exposed Area	906	818	366	269	341	1,839
Richness (Number of Taxa)	GO-09 Reference Area	15.0	2.0	0.9	12.0	16.0	17.0
	GO-03 Upstream Area	13.6	3.3	1.5	10.0	13.0	19.0
	EO-01 Upper Mine-Exposed Area	15.6	2.1	0.9	12.0	16.0	17.0
	EO-20 Middle Mine-Exposed Area	14.0	2.6	1.1	11.0	14.0	17.0
	CO-05 Lower Mine-Exposed Area	14.2	2.2	1.0	11.0	14.0	17.0
Simpson's Evenness	GO-09 Reference Area	0.826	0.153	0.068	0.562	0.903	0.923
	GO-03 Upstream Area	0.918	0.024	0.011	0.890	0.924	0.944
	EO-01 Upper Mine-Exposed Area	0.913	0.016	0.007	0.889	0.916	0.933
	EO-20 Middle Mine-Exposed Area	0.868	0.046	0.021	0.789	0.890	0.900
	CO-05 Lower Mine-Exposed Area	0.839	0.048	0.022	0.777	0.859	0.897
Nemata (% of community)	GO-09 Reference Area	0.5	0.6	0.3	0.0	0.3	1.2
	GO-03 Upstream Area	2.4	2.9	1.3	0.0	2.3	7.0
	EO-01 Upper Mine-Exposed Area	0.8	1.2	0.5	0.0	0.0	2.8
	EO-20 Middle Mine-Exposed Area	0.0	0.1	0.0	0.0	0.0	0.2
	CO-05 Lower Mine-Exposed Area	1.5	0.6	0.3	1.1	1.3	2.4
Hydracarina (% of community)	GO-09 Reference Area	1.1	1.3	0.6	0.0	0.9	3.2
	GO-03 Upstream Area	4.3	3.1	1.4	0.0	4.7	8.3
	EO-01 Upper Mine-Exposed Area	3.1	2.9	1.3	0.0	2.9	7.3
	EO-20 Middle Mine-Exposed Area	0.8	0.4	0.2	0.2	0.8	1.3
	CO-05 Lower Mine-Exposed Area	6.0	4.9	2.2	3.1	4.0	14.7
Chironomidae (% of community)	GO-09 Reference Area	89.6	5.1	2.3	83.2	87.8	96.2
	GO-03 Upstream Area	69.9	13.6	6.1	50.6	75.0	83.3
	EO-01 Upper Mine-Exposed Area	88.2	9.2	4.1	74.3	93.5	95.9
	EO-20 Middle Mine-Exposed Area	95.5	2.5	1.1	91.7	95.8	98.2
	CO-05 Lower Mine-Exposed Area	84.8	8.0	3.6	75.3	82.7	93.4
Metal-Sensitive Chironomidae (% of community)	GO-09 Reference Area	32.0	23.7	10.6	10.8	24.1	68.7
	GO-03 Upstream Area	12.3	5.8	2.6	4.2	14.6	18.8
	EO-01 Upper Mine-Exposed Area	11.0	2.5	1.1	6.9	12.4	12.9
	EO-20 Middle Mine-Exposed Area	9.4	9.1	4.1	1.6	5.2	24.4
	CO-05 Lower Mine-Exposed Area	19.4	9.6	4.3	8.5	17.1	32.4
Tipulidae (% of community)	GO-09 Reference Area	1.2	0.5	0.2	0.9	1.1	2.0
	GO-03 Upstream Area	6.2	5.1	2.3	2.3	4.2	14.6
	EO-01 Upper Mine-Exposed Area	5.7	4.3	1.9	1.1	4.4	11.9
	EO-20 Middle Mine-Exposed Area	0.6	0.9	0.4	0.0	0.3	2.1
	CO-05 Lower Mine-Exposed Area	1.4	0.9	0.4	0.0	1.3	2.3
Collector-Gatherer FFG (% of community)	GO-09 Reference Area	80.2	4.1	1.8	74.9	81.2	85.5
	GO-03 Upstream Area	63.7	14.9	6.7	47.8	65.3	82.4
	EO-01 Upper Mine-Exposed Area	59.4	7.1	3.2	51.5	56.9	69.2
	EO-20 Middle Mine-Exposed Area	54.6	13.2	5.9	37.0	62.3	66.3
	CO-05 Lower Mine-Exposed Area	71.0	7.0	3.1	61.7	71.6	81.0

Table F.49: Benthic Invertebrate Community Summary Statistics for Mary River, Mary River Project CREMP, August 2020

Metric	Area	Mean	Standard Deviation	Standard Error	Minimum	Median	Maximum
Filterer FFG (% of community)	GO-09 Reference Area	2.0	1.8	0.8	0.0	2.0	4.9
	GO-03 Upstream Area	3.1	2.8	1.3	0.0	4.8	5.6
	EO-01 Upper Mine-Exposed Area	5.2	3.6	1.6	0.0	6.2	8.4
	EO-20 Middle Mine-Exposed Area	4.6	4.2	1.9	0.6	4.8	10.9
	CO-05 Lower Mine-Exposed Area	4.3	5.0	2.2	0.0	1.2	10.1
Shredder FFG (% of community)	GO-09 Reference Area	11.3	7.1	3.2	4.7	9.3	20.1
	GO-03 Upstream Area	16.0	4.6	2.1	9.7	17.2	20.7
	EO-01 Upper Mine-Exposed Area	27.3	7.0	3.1	19.6	29.4	36.6
	EO-20 Middle Mine-Exposed Area	15.8	9.4	4.2	6.7	12.7	31.5
	CO-05 Lower Mine-Exposed Area	13.5	9.3	4.2	5.3	11.0	29.1
Clinger HPG (% of community)	GO-09 Reference Area	15.0	5.8	2.6	5.9	16.6	21.3
	GO-03 Upstream Area	17.6	4.7	2.1	12.8	18.2	24.6
	EO-01 Upper Mine-Exposed Area	29.9	8.6	3.9	17.9	31.4	39.5
	EO-20 Middle Mine-Exposed Area	20.9	12.7	5.7	11.6	17.6	43.0
	CO-05 Lower Mine-Exposed Area	22.5	6.2	2.8	17.1	20.6	33.0
Sprawler HPG (% of community)	GO-09 Reference Area	79.0	5.9	2.6	69.8	80.3	85.2
	GO-03 Upstream Area	58.3	12.8	5.7	43.3	59.1	75.3
	EO-01 Upper Mine-Exposed Area	57.0	5.5	2.5	49.3	56.9	64.6
	EO-20 Middle Mine-Exposed Area	54.2	13.0	5.8	36.6	62.3	64.8
	CO-05 Lower Mine-Exposed Area	71.0	5.8	2.6	63.1	70.3	79.0
Burrower HPG (% of community)	GO-09 Reference Area	6.0	10.2	4.6	1.1	1.3	24.3
	GO-03 Upstream Area	24.1	11.3	5.0	11.9	20.8	38.3
	EO-01 Upper Mine-Exposed Area	13.1	5.2	2.3	7.3	11.2	19.5
	EO-20 Middle Mine-Exposed Area	24.9	12.5	5.6	13.0	23.6	45.8
	CO-05 Lower Mine-Exposed Area	6.4	2.7	1.2	3.9	6.7	10.2

Table F.50: Benthic Invertebrate Community Metric Statistical Comparison Results among Mary River Reference (GO-09), Upstream (GO-03) and Mine-Exposed (EO-01, EO-20, CO-05) Study Areas, Mary River Project CREMP, August 2020

Metric	Overall 5-Area Comparison				Pair-wise, post-hoc comparisons				
	Statistical Test[a]	Data Transformation	Significant Difference Among Areas?	P-value	Area	Mean	Standard Deviation (SD)	Magnitude of Difference (GO-09 Reference SD)	Pairwise Comparison
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.006	GO-09 Ref	80.2	4.1	-	a
					G0-03	63.7	14.9	-4.1	a,b
					E0-01	59.4	7.1	-5.1	b
					E0-20	54.6	13.2	-6.3	b
					C0-05	71.0	7.0	-2.3	a,b
Filterer FFG (% of community)	ANOVA	none	NO	0.667	GO-09 Ref	2.0	1.8	-	a
					G0-03	3.1	2.8	0.6	a
					E0-01	5.2	3.6	1.7	a
					E0-20	4.6	4.2	1.4	a
					C0-05	4.3	5.0	1.3	a
Shredder FFG (% of community)	ANOVA	log10	YES	0.051	GO-09 Ref	11.3	7.1	-	b
					G0-03	16.0	4.6	0.7	a,b
					E0-01	27.3	7.0	2.2	a
					E0-20	15.8	9.4	0.6	a,b
					C0-05	13.5	9.3	0.3	a,b
Clinger HPG (% of community)	ANOVA	log10	YES	0.068	GO-09 Ref	15.0	5.8	-	a
					G0-03	17.6	4.7	0.4	b,a
					E0-01	29.9	8.6	2.6	b
					E0-20	20.9	12.7	1.0	b,a
					C0-05	22.5	6.2	1.3	b,a
Sprawler HPG (% of community)	ANOVA	log10	YES	0.005	GO-09 Ref	79.0	5.9	-	a
					G0-03	58.3	12.8	-3.5	b,c
					E0-01	57.0	5.5	-3.7	b,c
					E0-20	54.2	13.0	-4.2	c
					C0-05	71.0	5.8	-1.4	a,b
Burrower HPG (% of community)	K-W	rank	YES	0.009	GO-09 Ref	6.0	10.2	-	b
					G0-03	24.1	11.3	1.8	a
					E0-01	13.1	5.2	0.7	a,b
					E0-20	24.9	12.5	1.9	a
					C0-05	6.4	2.7	0.0	b

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Blue shaded values indicate significant difference (ANOVA p-value ≤ 0.10) that was also outside of a Critical Effect Size of ±2 SD_{REF}, indicating that the difference between the mine-exposed area and reference area was ecologically meaningful.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.51: Statistical Comparison of Bray-Curtis Index for the Mary River Mine-exposed Areas Compared to the Upstream Reference Area, Mary River Project CREMP, August 2020

Comparison	Betadisper P-Value	Mantel Test			dbRDA			
		r	R^2	P-Value	F-Value	R^2	R^2_{adj}	P-Value
G0-03 vs G0-09	0.041	0.679	0.461	0.008	4.16	0.342	0.260	0.007
E0-01 vs G0-09	0.820	0.554	0.307	0.008	3.46	0.302	0.214	0.005
E0-20 vs G0-09	0.056	0.743	0.552	0.008	5.35	0.401	0.326	0.005
C0-05 vs G0-09	0.379	0.629	0.396	0.008	5.37	0.402	0.327	0.007

Highlighted values indicate significant difference between study areas based on statistical test p-value less than 0.10.

Note: Sample size was five for all study areas..

Table F.52: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary River Upstream of the Mine (G0-03) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	0.005	2007	3	136	29	-	a
					2015	5	169	122	1.1	a
					2016	5	287	92	5.1	a,b
					2017	5	282	172	5.0	a,b
					2018	5	165	54	1.0	a
					2019	5	634	315	17.0	b
					2020	5	196	95.3	2.0	a
Richness (No. of Taxa)	ANOVA	none	YES	0.011	2007	3	6.3	1.2	-	a
					2015	5	9.4	3.5	2.7	a,b
					2016	5	14.4	1.8	7.0	b
					2017	5	13.6	3.9	6.3	b
					2018	5	12.2	3.5	5.1	a,b
					2019	5	11.2	1.6	4.2	a,b
					2020	5	13.6	3.3	6.3	b
Simpson's Evenness	K-W	rank	YES	0.055	2007	3	0.591	0.003	-	a
					2015	5	0.921	0.045	114.3	b
					2016	5	0.899	0.041	106.5	b,c
					2017	5	0.873	0.142	97.7	b,c
					2018	5	0.868	0.119	96.0	b,c
					2019	5	0.858	0.048	92.4	a,c
					2020	5	0.918	0.0238	113.2	b,c
Nemata (% of community)	K-W	rank	YES	0.005	2007	3	0.0	1.2	-	a,b
					2015	5	0.0	0.0	0.0	b
					2016	5	2.2	1.3	1.9	c,d
					2017	5	1.3	1.2	1.1	a,b,d
					2018	5	4.4	2.2	3.7	c
					2019	5	0.7	1.2	0.6	a,b
					2020	5	2.38	2.85	2.0	a,c,d
Hydracarina (% of community)	ANOVA	log10(x+1)	YES	0.002	2007	3	0.0	3.4	-	a
					2015	5	8.0	4.5	2.4	b,c
					2016	5	10.3	4.4	3.1	b
					2017	5	1.9	1.9	0.6	a,c
					2018	5	3.3	4.1	1.0	a,c
					2019	5	2.4	1.9	0.7	a,c
					2020	5	4.3	3.1	1.3	a,b,c
Chironomidae (% of community)	ANOVA	none	YES	0.001	2007	3	100.0	8.6	-	a
					2015	5	71.9	8.2	-3.3	b
					2016	5	77.9	8.0	-2.6	b,c
					2017	5	75.3	10.3	-2.9	b
					2018	5	83.2	9.2	-2.0	a,b,c
					2019	5	92.9	7.2	-0.8	a,c
					2020	5	69.9	13.6	-3.5	b
Metal Sensitive Taxa (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	6.6	3.0	-	a
					2015	5	7.9	4.9	0.4	a
					2016	5	8.8	5.9	0.7	a
					2017	5	46.9	12.6	13.3	b
					2018	5	32.5	21.5	8.5	b,c
					2019	5	17.4	11.2	3.5	a,c
					2020	5	12.3	5.8	1.9	a

Table F.52: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary River Upstream of the Mine (G0-03) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Tipulidae (% of community)	ANOVA	none	YES	<0.001	2007	3	0.0	4.6	-	a
					2015	5	18.0	8.4	3.9	b
					2016	5	8.3	7.3	1.8	a
					2017	5	2.9	2.0	0.6	a
					2018	5	1.8	1.7	0.4	a
					2019	5	2.5	3.6	0.5	a
					2020	5	6.2	5.1	1.3	a
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	0.002	2007	3	93.3	5.8	-	a
					2015	5	62.1	11.0	-5.4	b
					2016	5	63.5	6.4	-5.2	b,c
					2017	5	74.2	10.6	-3.3	a,b,c
					2018	5	80.7	11.4	-2.2	a,c
					2019	5	68.9	10.8	-4.2	b,c
					2020	5	63.7	14.9	-5.1	b,c
Filterer FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	0.0	2.2	-	a
					2015	5	0.0	0.0	0.0	a
					2016	5	0.3	0.7	0.1	a
					2017	5	15.2	5.4	6.8	b
					2018	5	3.7	5.1	1.6	a
					2019	5	0.0	0.0	0.0	a
					2020	5	3.1	2.8	1.4	a
Shredder FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	6.7	5.8	-	a,b
					2015	5	30.0	7.1	4.0	c
					2016	5	20.7	5.5	2.4	c,d
					2017	5	5.7	2.2	-0.2	b
					2018	5	11.7	8.2	0.9	a,b,d
					2019	5	22.2	5.6	2.7	c,d
					2020	5	16.0	4.6	1.6	a,d

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.53: **Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upper Mine-Exposed (EO-01) Study Area, August 2020**

Taxa	Study Area	EO-01 (Upper Mine-Exposed)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	4	11	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		25	4	7	-	-
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		36	14	29	4	-
SEED SHRIMPS						
Cl. Ostracoda		-	4	-	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		4	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	4	4	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
indeterminate		4	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		**108**	**29**	**22**	**11**	**29**
S.F. Chironominae						
Micropsectra		-	18	7	29	14
Stictochironomus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		18	-	-	11	7
Pseudokiefferiella		129	18	18	4	-
S.F. Orthocladiinae						
Cardiocladius		36	4	4	14	32
Chaetocladius		-	-	-	4	-
Corynoneura		7	-	4	14	4
Cricotopus		151	61	14	54	22
Cricotopus/Orthocladius		251	29	50	57	22
Diplocladius		-	-	-	-	-
Eukiefferiella		-	-	-	-	-

Table F.53: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Upper Mine-Exposed (EO-01) Study Area, August 2020

Taxa	Study Area	EO-01 (Upper Mine-Exposed)				
	Replicate Station	B1	B2	B3	B4	B5
Hydrobaenus		22	7	-	4	4
Hydrosmittia		11	11	11	4	-
Krenosmittia		-	11	14	14	7
Limnophyes		7	4	-	4	-
Metriocnemus		36	-	-	-	-
Orthocladius (Euorthocladius)		65	18	39	32	11
Synorthocladius		-	-	-	-	-
Tokunagaia		100	11	18	29	25
Tvetenia		158	50	39	39	54
indeterminate		**79**	-	**50**	**14**	-
S.F. Tanypodinae						
Thienemannimyia complex		-	-	-	-	-
F. Empididae						
Clinocera		-	-	-	-	-
F. Simuliidae						
Gymnopais		-	-	-	-	-
Metacnephia		-	-	4	-	-
Prosimulium		-	-	-	-	4
F. Tipulidae						
Dicranota		-	-	-	-	-
Ormosia		-	-	-	-	-
Tipula		14	25	47	11	11
Density (No. organisms per m^2)		1,258	323	391	351	244
Richness (total number of taxa)[a]		17	17	16	16	12
Simpson's Evenness (E)		0.889	0.912	0.917	0.916	0.933
Shannon-Wiener Diversity		3.070	3.350	3.280	3.250	3.090
Dominant Group Composition						
% Nemata		0.0	1.1	2.8	0.0	0.0
% Oligochaeta		2.0	1.1	1.8	0.0	0.0
% Hydracarina		2.9	4.4	7.3	1.0	0.0
% Ephemeroptera		0.0	1.1	0.9	0.0	0.0
% Ostracods		0.0	1.1	0.0	0.0	0.0
% Chironomids		93.5	83.3	74.3	95.9	94.1
% Metal Sensitive Chironmids		12.9	12.4	6.9	12.6	10.1
% Simuliidae		0.0	0.0	0.9	0.0	1.5
% Tipulidae		1.1	7.8	11.9	3.1	4.4
Functional Feeding Group Composition						
% Collector - Gatherers		64.0	51.5	69.2	56.9	55.5
% Filterers		0.0	6.2	2.9	8.4	8.2
% Shredders		29.7	36.6	19.6	29.4	21.2
Habitat Preference Group Composition						
% Clingers		31.4	39.5	17.9	35.8	25.0
% Sprawlers		58.6	49.3	64.6	56.9	55.5
% Burrowers		9.7	11.2	17.5	7.3	19.5

[a] Bold entries excluded from taxa count

Table F.54: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Upper Mine-Exposed Area (E0-01) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	0.011	2007	3	797	648	-	a,b
					2015	5	116	97	-1.1	a,b
					2016	5	230	109	-0.9	a,b
					2017	5	126	106	-1.0	a,b
					2018	5	119	164	-1.0	a
					2019	5	312	115	-0.7	a,b
					2020	5	513	420	-0.4	b
Richness (No. of Taxa)	ANOVA	none	YES	0.025	2007	3	16.3	8.1	-	a,b
					2015	5	7.8	2.7	-1.0	a
					2016	5	13.2	4.1	-0.4	a,b
					2017	5	10.6	5.3	-0.7	a,b
					2018	5	7.8	4.9	-1.0	a
					2019	5	11.0	0.7	-0.7	a,b
					2020	5	15.6	2.07	-0.1	b
Simpson's Evenness	ANOVA	log10	YES	<0.001	2007	3	0.698	0.059	-	a
					2015	5	0.873	0.095	3.0	b
					2016	5	0.865	0.037	2.8	b
					2017	5	0.940	0.053	4.1	b
					2018	5	0.926	0.037	3.9	b
					2019	5	0.898	0.028	3.4	b
					2020	5	0.913	0.0159	3.7	b
Nemata (% of community)	K-W	rank	NO	0.467	2007	3	2.1	3.6	-	a
					2015	5	2.0	4.5	0.0	a
					2016	5	1.3	1.3	-0.2	a
					2017	5	0.8	1.8	-0.4	a
					2018	5	7.8	10.7	1.6	a
					2019	5	1.3	1.6	-0.2	a
					2020	5	0.8	1.2	-0.4	a
Hydracarina (% of community)	ANOVA	none	NO	0.271	2007	3	3.3	5.8	-	a
					2015	5	2.0	4.5	-0.2	a
					2016	5	7.2	4.6	0.7	a
					2017	5	2.2	2.1	-0.2	a
					2018	5	4.4	5.2	0.2	a
					2019	5	4.1	2.5	0.1	a
					2020	5	3.1	2.9	0.0	a
Chironomidae (% of community)	ANOVA	none	YES	0.013	2007	3	90.0	0.1	-	a,b,c
					2015	5	82.5	8.3	-74.8	a,b,c
					2016	5	82.9	7.3	-70.9	a,b,c
					2017	5	78.1	7.2	-118.7	b,c
					2018	5	72.0	16.0	-179.8	c
					2019	5	93.7	3.4	36.8	a
					2020	5	88.2	9.2	-18.0	a,b
Metal Sensitive Taxa (% of community)	K-W	rank	YES	0.031	2007	3	36.4	32.0	-	a,b
					2015	5	7.4	7.7	-0.9	a,c
					2016	5	5.7	4.7	-1.0	c
					2017	5	29.0	8.2	-0.2	b
					2018	5	35.2	20.2	0.0	b
					2019	5	5.1	4.0	-1.0	c
					2020	5	11.0	2.5	-0.8	a,b,c

Table F.54: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Upper Mine-Exposed Area (E0-01) Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Tipulidae (% of community)	K-W	rank	YES	0.002	2007	3	3.3	5.8	-	a,b,c
					2015	5	10.0	7.1	1.2	a
					2016	5	2.5	2.6	-0.2	a,b
					2017	5	0.3	0.6	-0.5	d
					2018	5	0.3	0.8	-0.5	c,d
					2019	5	0.7	0.9	-0.5	b,c,d
					2020	5	5.7	4.3	0.4	a
Collector-Gatherer FFG (% of community)	K-W	rank	YES	0.069	2007	3	40.0	26.5	-	a
					2015	5	72.2	16.5	1.2	a,b
					2016	5	77.9	6.9	1.4	b
					2017	5	80.3	8.5	1.5	b
					2018	5	62.4	37.2	0.8	a,b
					2019	5	64.0	2.1	0.9	a
					2020	5	59.4	7.1	0.7	a
Filterer FFG (% of community)	K-W	rank	YES	0.011	2007	3	36.7	32.1	-	a,b
					2015	5	0.0	0.0	-1.1	c
					2016	5	0.9	0.8	-1.1	a,c,d
					2017	5	14.0	11.2	-0.7	b
					2018	5	7.0	8.6	-0.9	a,b,d
					2019	5	0.4	0.8	-1.1	c,d
					2020	5	5.2	3.6	-1.0	a,b
Shredder FFG (% of community)	K-W	rank	YES	0.006	2007	3	6.7	11.5	-	a,b
					2015	5	18.0	17.9	1.0	a,c
					2016	5	7.4	7.6	0.1	a,b
					2017	5	2.5	5.5	-0.4	b
					2018	5	15.6	13.5	0.8	a,c
					2019	5	24.3	3.4	1.5	c
					2020	5	27.3	7.0	1.8	c

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.55: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Middle Mine-Exposed (EO-20) Study Area, August 2020

Taxa	Study Area	EO-20 (Middle Mine-Exposed)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		-	4	-	-	-
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	4	-	22
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		18	4	11	14	7
SEED SHRIMPS						
Cl. Ostracoda		-	-	4	-	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	4	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	-	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
indeterminate		22	7	7	14	-
MIDGES						
F. Chironomidae						
chironomid pupae		**240**	**161**	**50**	**72**	**140**
S.F. Chironominae						
Micropsectra		201	72	-	-	-
Stictochironomus		-	-	-	-	-
S.F. Diamesinae						
Diamesa		61	36	7	50	50
Pseudokiefferiella		244	57	7	4	-
S.F. Orthocladiinae						
Cardiocladius		244	258	394	237	208
Chaetocladius		29	-	-	-	-
Corynoneura		4	-	-	-	-
Cricotopus		272	86	79	54	65
Cricotopus/Orthocladius		530	272	115	36	93
Diplocladius		-	-	-	-	-
Eukiefferiella		-	-	-	-	-

Table F.55: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Middle Mine-Exposed (EO-20) Study Area, August 2020

Taxa	Study Area / Replicate Station	EO-20 (Middle Mine-Exposed)				
		B1	B2	B3	B4	B5
Hydrobaenus		14	-	7	-	-
Hydrosmittia		-	-	-	-	-
Krenosmittia		14	-	22	-	-
Limnophyes		-	-	-	-	-
Metriocnemus		-	-	-	-	-
Orthocladius (Euorthocladius)		115	143	79	72	75
Synorthocladius		-	-	-	-	-
Tokunagaia		158	369	36	355	247
Tvetenia		115	43	79	147	237
indeterminate		-	**115**	**29**	-	**11**
S.F. Tanypodinae						
Thienemannimyia complex		-	-	-	-	-
F. Empididae						
Clinocera		-	-	-	-	-
F. Simuliidae						
Gymnopais		-	-	-	11	-
Metacnephia		25	7	4	22	7
Prosimulium		4	4	7	32	-
F. Tipulidae						
Dicranota		-	-	-	-	4
Ormosia		-	-	-	-	-
Tipula		7	-	4	-	22
Density (No. organisms per m^2)		2,315	1,642	943	1,118	1,186
Richness (total number of taxa)[a]		17	14	16	12	11
Simpson's Evenness (E)		0.890	0.894	0.789	0.868	0.900
Shannon-Wiener Diversity		3.060	2.810	2.500	2.710	2.690
Dominant Group Composition						
% Nemata		0.0	0.2	0.0	0.0	0.0
% Oligochaeta		0.0	0.0	0.4	0.0	1.8
% Hydracarina		0.8	0.2	1.1	1.3	0.6
% Ephemeroptera		0.0	0.0	0.0	0.0	0.0
% Ostracods		0.0	0.0	0.4	0.0	0.0
% Chironomids		96.8	98.2	95.8	91.7	94.9
% Metal Sensitive Chironmids		24.4	11.2	1.6	5.2	4.8
% Simuliidae		1.2	0.7	1.1	5.8	0.6
% Tipulidae		0.3	0.0	0.4	0.0	2.1
Functional Feeding Group Composition						
% Collector - Gatherers		44.0	63.6	37.0	62.3	66.3
% Filterers		10.9	5.5	1.1	4.8	0.6
% Shredders		31.5	12.7	15.7	6.7	12.2
Habitat Preference Group Composition						
% Clingers		43.0	18.5	17.6	13.7	11.6
% Sprawlers		44.0	63.2	36.6	62.3	64.8
% Burrowers		13.0	18.1	45.8	24.0	23.6

[a] Bold entries excluded from taxa count

Table F.56: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Middle Mine-Exposed Area (E0-20) Among Years of Mine Operation (2015 to 2020) and Baseline (2011) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2011	Pairwise Comparison
Density (No. per m^2)	K-W	rank	YES	<0.001	2007	3	854	348	-	a,b
					2015	5	278	146	-1.7	b,c
					2016	5	283	118	-1.6	b,c
					2017	5	382	665	-1.4	c
					2018	5	61	23	-2.3	c
					2019	5	2,939	3,175	6.0	a
					2020	5	1,441	553	1.7	a
Richness (No. of Taxa)	ANOVA	none	YES	0.005	2007	3	14.0	2.6	-	a
					2015	5	11.6	2.2	-0.9	a,b
					2016	5	13.6	3.1	-0.2	a
					2017	5	12.4	5.0	-0.6	a
					2018	5	6.8	1.9	-2.7	b
					2019	5	14.8	2.0	0.3	a
					2020	5	14	2.55	0.0	a
Simpson's Evenness	K-W	rank	YES	0.025	2007	3	0.483	0.247	-	a
					2015	5	0.726	0.140	1.0	a,b
					2016	5	0.835	0.038	1.4	a,b,c
					2017	5	0.902	0.103	1.7	c
					2018	5	0.895	0.047	1.7	c
					2019	5	0.863	0.049	1.5	b,c
					2020	5	0.868	0.046	1.6	c
Nemata (% of community)	K-W	rank	NO	0.237	2007	3	0.0	0.0	-	a
					2015	5	0.0	0.0	not calculable	a
					2016	5	1.4	0.9	not calculable	a
					2017	5	0.6	1.4	not calculable	a
					2018	5	1.5	3.4	not calculable	a
					2019	5	1.1	1.4	not calculable	a
					2020	5	0.0	0.1	not calculable	a
Hydracarina (% of community)	K-W	rank	YES	0.006	2007	3	0.2	0.4	-	a,b
					2015	5	2.0	4.5	4.3	c
					2016	5	7.2	3.3	17.1	c
					2017	5	4.1	2.8	9.6	a,c
					2018	5	0.9	2.0	1.6	b
					2019	5	0.9	1.1	1.7	b
					2020	5	0.8	0.4	1.4	a,b
Chironomidae (% of community)	ANOVA	none	YES	<0.001	2007	3	96.7	5.8	-	a,b
					2015	5	88.6	5.0	-1.4	a,b
					2016	5	86.1	6.3	-1.8	a,b
					2017	5	71.4	11.7	-4.4	c
					2018	5	81.3	8.0	-2.7	a,c
					2019	5	96.5	1.5	0.0	b
					2020	5	95.5	2.5	-0.2	b
Metal Sensitive Taxa (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	3.1	5.4	-	a
					2015	5	4.2	4.0	0.2	a
					2016	5	4.3	2.9	0.2	a
					2017	5	31.4	22.5	5.2	b,c
					2018	5	49.0	12.9	8.4	b
					2019	5	19.7	20.0	3.0	a,c
					2020	5	9.4	9.1	1.2	a,c

Table F.56: Statistical Comparison of Benthic Invertebrate Community Metrics at the Mary River Middle Mine-Exposed Area (E0-20) Among Years of Mine Operation (2015 to 2020) and Baseline (2011) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2011	Pairwise Comparison
Tipulidae (% of community)	K-W	rank	NO	0.127	2007	3	0.0	0.0	-	a
					2015	5	4.0	5.5	not calculable	a
					2016	5	3.9	5.1	not calculable	a
					2017	5	2.7	3.3	not calculable	a
					2018	5	2.2	3.1	not calculable	a
					2019	5	0.3	0.4	not calculable	a
					2020	5	0.6	0.9	not calculable	a
Collector-Gatherer FFG (% of community)	ANOVA	none	YES	<0.001	2007	3	23.3	15.3	-	a
					2015	5	78.3	8.5	3.6	b
					2016	5	70.2	7.5	3.1	b,c
					2017	5	68.2	5.1	2.9	b,c
					2018	5	78.2	6.6	3.6	b
					2019	5	63.4	8.7	2.6	b,c
					2020	5	54.6	13.2	2.0	c
Filterer FFG (% of community)	K-W	rank	YES	0.004	2007	3	3.3	5.8	-	a,b,c
					2015	5	0.0	0.0	-0.6	b,c
					2016	5	0.4	0.8	-0.5	c
					2017	5	17.0	7.1	2.4	d
					2018	5	9.2	8.5	1.0	a,d
					2019	5	0.7	0.8	-0.5	b,c
					2020	5	4.6	4.2	0.2	a,b,d
Shredder FFG (% of community)	ANOVA	log10(x+1)	YES	<0.001	2007	3	6.7	11.5	-	a
					2015	5	12.0	4.5	0.5	a
					2016	5	7.7	6.3	0.1	a
					2017	5	7.0	4.1	0.0	a
					2018	5	11.7	8.2	0.4	a
					2019	5	32.4	5.5	2.2	b
					2020	5	15.8	9.4	0.8	a

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.57: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Lower Mine-Exposed (CO-05) Study Area, August 2020

Taxa	Study Area	CO-05 (Lower Mine-Exposed)				
	Replicate Station	B1	B2	B3	B4	B5
ROUNDWORMS						
P. Nemata		4	4	32	43	4
ANNELIDS						
P. Annelida						
WORMS						
Cl. Oligochaeta						
F. Enchytraeidae		-	-	4	11	4
ARTHROPODS						
P. Arthropoda						
MITES						
Cl. Arachnida						
O. Acarina						
F. Sperchonidae						
Sperchon		50	14	57	68	11
SEED SHRIMPS						
Cl. Ostracoda		4	7	-	4	-
SPRINGTAILS						
Cl. Entognatha						
O. Collembola		-	-	-	-	-
INSECTS						
Cl. Insecta						
MAYFLIES						
O. Ephemeroptera						
F. Baetidae						
Acentrella feropagus		-	14	-	-	-
STONEFLIES						
O. Plecoptera						
F. Capniidae						
immature		-	-	-	-	-
TRUE FLIES						
O. Diptera						
BITING-MIDGE						
F. Ceratopogonidae						
indeterminate		-	-	-	-	-
MIDGES						
F. Chironomidae						
chironomid pupae		**4**	**4**	**4**	**14**	**4**
S.F. Chironominae						
Micropsectra		-	-	14	-	-
Stictochironomus		-	-	4	-	-
S.F. Diamesinae						
Diamesa		-	-	-	-	-
Pseudokiefferiella		29	54	581	448	36
S.F. Orthocladiinae						
Cardiocladius		14	22	14	14	7
Chaetocladius		-	-	-	-	-
Corynoneura		-	-	-	-	-
Cricotopus		7	11	143	341	18
Cricotopus/Orthocladius		4	11	100	168	11
Diplocladius		-	-	-	-	-
Eukiefferiella		-	-	-	-	4

Table F.57: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for the Mary River Lower Mine-Exposed (CO-05) Study Area, August 2020

Taxa	Study Area	CO-05 (Lower Mine-Exposed)				
	Replicate Station	B1	B2	B3	B4	B5
Hydrobaenus		11	7	-	-	-
Hydrosmittia		7	-	190	61	14
Krenosmittia		18	-	-	-	25
Limnophyes		-	-	-	-	4
Metriocnemus		-	-	-	-	-
Orthocladius (Euorthocladius)		-	4	14	-	7
Synorthocladius		-	-	-	79	-
Tokunagaia		7	-	14	-	4
Tvetenia		165	122	638	434	86
indeterminate		-	-	-	-	-
S.F. Tanypodinae						
Thienemannimyia complex		7	7	-	79	4
F. Empididae						
Clinocera		-	-	-	-	-
F. Simuliidae						
Gymnopais		-	-	-	-	-
Metacnephia		4	11	-	-	7
Prosimulium		-	22	7	-	18
F. Tipulidae						
Dicranota		-	-	4	-	-
Ormosia		-	-	-	-	-
Tipula		7	7	18	-	4
Density (No. organisms per m^2)		341	319	1,839	1,763	269
Richness (total number of taxa)[a]		14	14	15	11	17
Simpson's Evenness (E)		0.777	0.861	0.804	0.859	0.897
Shannon-Wiener Diversity		2.630	2.980	2.430	2.520	3.290
Dominant Group Composition						
% Nemata		1.1	1.1	1.8	2.4	1.3
% Oligochaeta		0.0	0.0	0.2	0.6	1.3
% Hydracarina		14.7	4.5	3.1	3.9	4.0
% Ephemeroptera		0.0	4.5	0.0	0.0	0.0
% Ostracods		1.1	2.3	0.0	0.2	0.0
% Chironomids		80.0	75.3	93.4	92.9	82.7
% Metal Sensitive Chironmids		8.5	17.1	32.4	25.6	13.6
% Simuliidae		1.1	10.1	0.4	0.0	9.3
% Tipulidae		2.1	2.3	1.2	0.0	1.3
Functional Feeding Group Composition						
% Collector - Gatherers		72.5	68.0	81.0	61.7	71.6
% Filterers		1.1	10.1	1.2	0.0	9.3
% Shredders		5.3	8.2	13.8	29.1	11.0
Habitat Preference Group Composition						
% Clingers		19.0	20.6	17.1	33.0	23.0
% Sprawlers		73.6	69.2	79.0	63.1	70.3
% Burrowers		7.4	10.2	3.9	3.9	6.7

[a] Bold entries excluded from taxa count

Table F.58: Statistical Comparison of Benthic Metrics at the Mary River Lower Mine-Exposed Area (C0-05) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison
									vs. Baseline Year 2007	vs. Baseline Year 2011	
Density (No. per m^2)	ANOVA	none	YES	0.059	2006	3	311	230	-	-0.4	a
					2007	3	491	455	0.8	-	a
					2015	5	234	168	-0.3	-0.6	a
					2016	5	1,161	584	3.7	1.5	a
					2017	5	1,214	654	3.9	1.6	a
					2018	5	1,391	1,083	4.7	2.0	a
					2019	5	1,470	693	5.0	2.2	a
					2020	5	906	818	2.6	0.9	a
Richness (No. of Taxa)	ANOVA	log10	YES	<0.001	2006	3	10.7	3.8	-	-2.1	a
					2007	3	19.0	4.0	2.2	-	b,c,d
					2015	5	13.2	2.7	0.7	-1.5	ac
					2016	5	19.6	3.3	2.4	0.2	b,d
					2017	5	22.0	3.2	3.0	0.8	b
					2018	5	18.6	0.9	2.1	-0.1	b,d
					2019	5	15.8	2.9	1.4	-0.8	b,c,d
					2020	5	14.2	2.2	0.9	-1.2	a,c,d
Simpson's Evenness	K-W	rank	YES	0.003	2006	3	0.668	0.022	-	-2.7	a
					2007	3	0.879	0.079	9.8	-	b,c
					2015	5	0.923	0.038	11.8	0.6	b
					2016	5	0.849	0.015	8.4	-0.4	b,c
					2017	5	0.798	0.161	6.0	-1.0	a,c,d
					2018	5	0.675	0.149	0.4	-2.6	a
					2019	5	0.716	0.092	2.3	-2.1	a,d
					2020	5	0.839	0.048	7.9	-0.5	c,d
Nemata (% of community)	ANOVA	log10(x+1)	YES	0.043	2006	3	0.2	0.4	-	-0.5	a,b
					2007	3	1.6	2.7	3.2	-	a
					2015	5	2.0	4.5	4.3	0.2	a,b
					2016	5	1.0	1.0	1.9	-0.2	a,b
					2017	5	2.1	1.6	4.5	0.2	a,b
					2018	5	2.1	1.9	4.6	0.2	a,b
					2019	5	0.6	0.3	0.9	-0.4	b
					2020	5	1.5	0.6	3.1	0.0	a,b
Hydracarina (% of community)	K-W	rank	YES	0.02	2006	3	0.5	0.4	-	3.6	a
					2007	3	0.1	0.1	-1.0	-	a
					2015	5	2.0	4.5	3.7	16.9	a
					2016	5	5.5	3.9	12.2	47.8	b
					2017	5	3.9	4.7	8.2	33.2	a,b,c
					2018	5	1.5	2.3	2.4	12.3	a
					2019	5	2.0	1.1	3.6	16.9	a,c
					2020	5	6.0	4.9	13.4	52.3	b,c
Chironomidae (% of community)	ANOVA	none	YES	<0.001	2006	3	99.0	0.8	-	90.4	a
					2007	3	90.0	0.1	-10.9	-	a,b
					2015	5	80.4	11.4	-22.4	-95.8	b
					2016	5	87.8	3.0	-13.5	-21.7	a,b
					2017	5	63.8	12.6	-42.5	-262.1	c
					2018	5	85.6	7.0	-16.2	-44.2	a,b
					2019	5	95.1	1.8	-4.8	50.7	a
					2020	5	84.8	8.0	-17.2	-52.0	a,b
Metal Sensitive Taxa (% of community)	ANOVA	none	YES	<0.001	2006	3	37.2	16.0	-	2.2	a,b,c
					2007	3	14.4	10.4	-1.4	-	c
					2015	5	15.9	11.5	-1.3	0.1	c
					2016	5	29.2	13.6	-0.5	1.4	b,c
					2017	5	39.0	23.3	0.1	2.4	a,b,c
					2018	5	59.6	11.3	1.4	4.3	a
					2019	5	49.3	16.6	0.8	3.4	a,b
					2020	5	19.4	9.6	-1.1	0.5	c
Tipulidae (% of community)	K-W	rank	NO	0.121	2006	3	0.0	0.1	-	0.0	a
					2007	3	0.0	0.1	0.0	-	a
					2015	5	6.0	8.9	60.0	60.0	a
					2016	5	1.7	1.2	17.1	17.1	a
					2017	5	1.1	1.6	11.0	11.0	a
					2018	5	0.6	0.5	6.1	6.1	a
					2019	5	0.5	0.5	5.3	5.3	a
					2020	5	1.4	0.9	13.7	13.7	a

Table F.58: Statistical Comparison of Benthic Metrics at the Mary River Lower Mine-Exposed Area (C0-05) Among Years of Mine Operation (2015 to 2020) and Baseline (2007, 2011) for the Mary River Project CREMP

Metric	Overall 8-Year Comparison				Pair-wise, post-hoc comparisons						
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size		Pairwise Comparison
									vs. Baseline Year 2007	vs. Baseline Year 2011	
Collector-Gatherer FFG (% of community)	ANOVA	log10	YES	<0.001	2006	3	35.0	15.3	-	-2.7	a
					2007	3	66.7	11.5	2.1	-	b
					2015	5	82.9	13.0	3.1	1.4	b
					2016	5	59.0	10.2	1.6	-0.7	b
					2017	5	63.9	13.5	1.9	-0.2	b
					2018	5	83.7	8.2	3.2	1.5	b
					2019	5	67.0	15.7	2.1	0.0	b
					2020	5	71.0	7.0	2.4	0.4	b
Filterer FFG (% of community)	K-W	rank	YES	0.002	2006	3	21.0	28.3	-	0.7	a,b,c
					2007	3	13.3	11.5	-0.3	-	a,b
					2015	5	0.0	0.0	-0.7	-1.2	d
					2016	5	0.6	0.7	-0.7	-1.1	d
					2017	5	19.9	10.4	0.0	0.6	a
					2018	5	6.1	4.2	-0.5	-0.6	a,b
					2019	5	0.9	0.7	-0.7	-1.1	c,d
					2020	5	4.3	5.0	-0.6	-0.8	b,c,d
Shredder FFG (% of community)	ANOVA	log10	YES	0.001	2006	3	40.2	20.9	-	5.8	a
					2007	3	6.7	5.8	-1.6	-	b,c
					2015	5	16.0	11.4	-1.2	1.6	a,b
					2016	5	8.9	6.8	-1.5	0.4	a,b,c
					2017	5	6.7	3.1	-1.6	0.01	b,c
					2018	5	4.2	2.5	-1.7	-0.4	c
					2019	5	18.0	3.5	-1.1	2.0	a,b
					2020	5	13.5	9.3	-1.3	1.2	a,b,c

[grey box] Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

[blue box] Indicates magnitude of difference outside of a ± 2 SD effect size of respective baseline year mean indicating an ecologically meaningful difference between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.59: Statistical Comparison of Sediment Physical Properties Between Mary Lake (BL0) and Reference Lake 3 Stations Collected at Littoral and Profundal Depths, Mary River Project CREMP, August 2020

Lake Zone	Sediment Variable	Statistical Test Results				Summary Statistics						
		Statistical Test[a]	Data Transformation	Significant Difference between Areas?	P-value	Study Lake	Sample Size (n)	Mean	Standard Deviation	Standard Error	Minimum	Maximum
Littoral (Shallow) Stations	Sand-Sized Material (%)	tequal	none	NO	0.926	Reference	5	29.6	7.52	3.36	23.4	40.4
						Mary	4	28.1	34.5	15.4	5.20	78.6
	Silt-Sized Material (%)	tequal	none	NO	0.459	Reference	5	62.2	6.33	2.83	53.4	68.4
						Mary	4	53.6	24.0	10.7	18.0	69.9
	Clay-Sized Material (%)	tequal	none	NO	0.166	Reference	5	8.22	3.00	1.34	6.20	13.4
						Mary	4	18.3	14.5	6.48	3.40	32.0
	Moisture (%)	tequal	none	YES	0.005	Reference	5	87.9	4.60	2.06	80.2	92.3
						Mary	4	50.7	19.9	8.91	27.3	67.3
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	0.005	Reference	5	4.80	1.96	0.876	2.26	6.95
						Mary	4	0.765	0.450	0.201	0.220	1.31
Profundal (Deep) Stations	Sand-Sized Material (%)	tequal	none	NO	0.920	Reference	5	31.6	22.3	10.0	13.9	56.6
						Mary	6	29.9	30.9	13.8	7.70	91.9
	Silt-Sized Material (%)	tequal	none	NO	0.608	Reference	5	57.4	18.1	8.10	36.9	71.9
						Mary	6	50.4	24.4	10.9	6.00	73.4
	Clay-Sized Material (%)	tequal	none	NO	0.149	Reference	5	11.0	4.28	1.92	6.30	15.1
						Mary	6	19.7	11.6	5.19	2.10	33.2
	Moisture (%)	tequal	none	YES	0.004	Reference	5	82.6	3.60	1.61	78.3	86.6
						Mary	6	49.7	18.9	8.46	16.6	68.4
	Total Organic Carbon (TOC) Content (%)	tequal	none	YES	<0.001	Reference	5	3.42	1.08	0.484	2.20	4.52
						Mary	6	0.688	0.275	0.123	0.220	0.930

Highlighted values indicate significant difference between study areas based on statistical p-value less than 0.10.

[a] Statistical tests included tequal (t-test assuming equal variance), tunequal (t-test assuming unequal variance), and M-W (Mann-Whitney U-test).

Table F.60: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary Lake, August 2020

Taxa — Study Area	Mary Lake - Littoral Stations				Mary Lake - Profundal Stations					
Replicate Station	BLO-1	BLO-11	BLO-7	BLO-6	BLO-3	BLO-15	BLO-14	BLO-13	BLO-4	BLO-5
ROUNDWORMS										
P. Nemata	-	86	-	34	14	-	-	-	-	34
ANNELIDS										
P. Annelida										
WORMS										
Cl. Oligochaeta										
F. Enchytraeidae	-	-	-	-	-	-	-	-	-	-
F. Lumbriculidae										
Lumbriculus	-	-	-	-	-	-	-	-	-	-
ARTHROPODS										
P. Arthropoda										
MITES										
Cl. Arachnida										
O. Acarina										
immature	-	17	-	-	-	-	-	-	-	-
F. Acalyptonotidae										
Acalyptonotus	60	34	86	34	-	17	17	17	17	17
F. Hygrobatidae										
Hygrobates	17	52	-	-	14	-	-	-	-	17
F. Lebertiidae										
Lebertia	9	34	-	-	43	-	-	9	17	-
F. Sperchontidae										
Sperchon	-	17	-	-	-	-	-	-	-	-
HARPACTICOIDS										
O. Harpacticoida	-	-	-	-	-	-	-	-	-	-
SEED SHRIMPS										
Cl. Ostracoda	1,172	4,741	526	474	417	164	17	155	17	17
INSECTS										
Cl. Insecta										
CADDISFLIES										
O. Trichoptera										
F. Apataniidae										
Apatania	-	-	-	-	-	-	-	-	-	-
F. Limnephilidae										
Grensia praeterita	-	-	-	-	-	-	-	-	-	-
TRUE FLIES										
O. Diptera										
MIDGES										
F. Chironomidae										
chironomid pupae	**17**	**17**	-	-	**14**	-	-	-	**9**	**69**
S.F. Chironominae										
Chironomus	-	86	-	-	-	-	-	-	-	397
Micropsectra	422	241	-	-	172	9	-	-	-	17
Paratanytarsus	86	34	-	-	-	-	-	-	-	-
Sergentia	-	34	-	-	-	-	-	-	-	362
Stictochironomus	250	2,414	-	-	-	-	-	-	-	310
Tanytarsus	353	121	-	-	-	-	-	-	-	-
S.F. Diamesinae										
Diamesa	17	-	-	-	-	-	-	-	-	-
Protanypus	-	69	26	26	14	9	26	17	-	17
Pseudodiamesa	-	-	17	26	-	-	9	-	-	-
S.F. Orthocladiinae										
Abiskomyia	138	948	9	26	14	9	-	-	-	34
Heterotrissocladius	103	328	207	138	517	-	500	388	466	-
Hydrobaenus	-	-	-	-	-	-	-	-	-	17
Mesocricotopus	-	-	-	-	-	-	-	-	-	-
Paracladius	17	69	-	9	-	-	-	-	-	-
Parakiefferiella	-	-	-	-	-	-	-	-	-	-
Psectrocladius	-	-	-	-	-	-	-	-	-	-
Zalutschia	17	-	-	-	57	-	-	-	-	-
Orthocladiinae indeterminate	-	-	-	-	-	-	-	-	-	-
S.F. Tanypodinae										
Arctopelopia	-	-	-	-	-	-	-	-	-	-
Procladius	2,241	-	241	198	14	9	69	26	26	52

[a] Bold entries excluded from taxa count

Table F.60: Benthic Invertebrate Community Data, Expressed in Number of Organisms per Square Metre, for Mary Lake, August 2020

Taxa	Study Area	Mary Lake - Littoral Stations				Mary Lake - Profundal Stations					
	Replicate Station	BLO-1	BLO-11	BLO-7	BLO-6	BLO-3	BLO-15	BLO-14	BLO-13	BLO-4	BLO-5
Density (No. organisms per m^2)		4,922	9,345	1,112	966	1,298	216	641	1,368	615	554
Richness (total number of taxa)[a]		14	16	7	9	10	6	6	12	6	5
Simpson's Evenness (E)		0.772	0.707	0.802	0.778	0.787	0.492	0.445	0.834	0.637	0.322
Shannon-Wiener Diversity		2.38	2.14	2.00	2.20	2.17	1.34	1.18	2.48	1.49	0.867
Dominant Taxonomic Group Composition											
% Nemata		0	0.923	0	3.57	1.11	0	0	2.53	0	0
% Hydracarina		1.75	1.66	7.75	3.57	4.44	8.00	2.70	2.53	4.23	6.25
% Ostracods		23.8	50.7	47.3	49.1	32.2	76.0	2.70	1.27	25.4	3.13
% Chironomids		74.4	46.7	45.0	43.8	62.2	16.0	94.6	93.7	70.4	90.6
% Metal Sensitive Chironmids		17.9	5.00	3.88	5.36	14.7	8.00	5.41	2.68	2.82	0
% Tipulidae											
Functional Feeding Group Composition											
% Collector - Gatherers		34.6	94.1	70.5	75.9	76.3	84.0	86.5	92.1	91.5	89.0
% Filterers		17.6	4.26	0	0	13.6	4.00	0	1.34	0	0
% Shredders		0.352	0	0	0	4.53	0	0	0	0	0
Habitat Preference Group Composition											
% Clingers		17.6	5.92	7.75	3.57	18.0	12.0	2.70	32.0	4.23	6.25
% Sprawlers		77.3	65.6	89.9	90.2	79.7	84.0	93.2	9.29	93.0	93.8
% Burrowers		5.10	28.5	2.33	6.25	2.24	4.00	4.05	58.7	2.82	0

[a] Bold entries excluded from taxa count.

Table F.61: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary Lake Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m^2)	ANOVA	none	NO	0.780	2007	3	2,667	1,454	-	a
					2015	4	2,453	2,186	-0.1	a
					2016	6	1,947	1,591	-0.5	a
					2017	4	1,839	1,853	-0.6	a
					2018	4	1,718	1,418	-0.7	a
					2019	4	2,448	2,313	-0.2	a
					2020	4	4,086	3,955	1.0	a
Richness (No. of Taxa)	ANOVA	log10	NO	0.668	2007	3	8.0	2.0	-	a
					2015	4	9.0	1.8	0.5	a
					2016	6	8.7	0.5	0.3	a
					2017	4	9.5	2.1	0.8	a
					2018	4	9.3	2.2	0.6	a
					2019	4	11.5	5.0	1.8	a
					2020	4	11.5	4.2	1.8	a
Simpson's Evenness	ANOVA	none	NO	0.411	2007	3	0.718	0.041	-	a
					2015	4	0.761	0.058	1.1	a
					2016	6	0.574	0.299	-3.5	a
					2017	4	0.818	0.110	2.4	a
					2018	4	0.575	0.293	-3.5	a
					2019	4	0.663	0.169	-1.3	a
					2020	4	0.765	0.041	1.2	a
Nemata (% of community)	K-W	rank	NO	0.708	2007	3	7.3	11.2	-	a
					2015	4	5.6	6.3	-0.1	a
					2016	6	3.6	7.5	-0.3	a
					2017	4	3.5	6.2	-0.3	a
					2018	4	3.5	6.4	-0.3	a
					2019	4	2.4	2.4	-0.4	a
					2020	4	1.1	1.7	-0.6	a
Ostracoda (% of community)	K-W	rank	YES	0.020	2007	3	0.2	0.4	-	a
					2015	4	1.9	2.2	4.3	ab
					2016	6	2.3	2.2	5.5	ab
					2017	4	2.1	2.2	5.0	ab
					2018	4	8.9	10.9	22.8	bc
					2019	4	2.0	1.1	4.8	ab
					2020	4	42.7	12.7	112.4	c
Chironomidae (% of community)	K-W	rank	YES	0.013	2007	3	90.8	11.8	-	a
					2015	4	91.1	7.7	0.0	a
					2016	6	90.6	12.2	0.0	a
					2017	4	85.7	13.1	-0.4	a
					2018	4	86.2	18.7	-0.4	a
					2019	4	93.4	4.0	0.2	a
					2020	4	52.5	14.7	-3.2	b
Metal Sensitive Taxa (% of community)	ANOVA	log10	NO	0.654	2007	3	22.4	13.8	-	a
					2015	4	15.8	14.6	-0.5	a
					2016	6	19.2	13.3	-0.2	a
					2017	4	21.3	7.7	-0.1	a
					2018	4	11.6	9.8	-0.8	a
					2019	4	14.2	12.2	-0.6	a
					2020	4	8.1	6.6	-1.0	a
Collector-Gatherer FFG (% of community)	K-W	rank	NO	0.641	2007	3	66.0	26.7	-	a
					2015	4	72.8	23.1	0.3	a
					2016	6	73.5	24.7	0.3	a
					2017	4	52.2	23.6	-0.5	a
					2018	4	76.1	36.4	0.4	a
					2019	4	65.1	24.9	0.0	a
					2020	4	68.8	24.9	0.1	a

Table F.61: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary Lake Littoral (Shallow) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 7-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Filterer FFG (% of community)	K-W	rank	NO	0.544	2007	3	22.0	14.5	-	a
					2015	4	14.4	16.2	-0.5	a
					2016	6	12.4	13.2	-0.7	a
					2017	4	13.3	16.0	-0.6	a
					2018	4	4.1	7.3	-1.2	a
					2019	4	11.5	13.8	-0.7	a
					2020	4	5.5	8.3	-1.1	a

Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

Table F.62: Statistical Comparison of Benthic Invertebrate Community Metrics at Mary Lake Profundal (Deep) Stations Among Years of Mine Operation (2015 to 2020) and Baseline (2007) for the Mary River Project CREMP

Metric	Overall 6-Year Comparison				Pair-wise, post-hoc comparisons[a]					
	Statistical Test[a]	Data Transformation	Significant Difference Among Years?	P-value	Year	Sample Size (n)	Mean	Standard Deviation	Effect Size vs. Baseline Year 2007	Pairwise Comparison
Density (No. per m^2)	ANOVA	log10	YES	0.005	2007	4	3,512	3,257	-	a
					2015	6	775	748	-0.8	bc
					2017	6	536	497	-0.9	c
					2018	6	1,521	599	-0.6	ab
					2019	6	1,428	506	-0.6	ab
					2020	6	779	452	-0.8	abc
Richness (No. of Taxa)	ANOVA	log10	NO	0.992	2007	4	8.0	6.2	-	a
					2015	6	7.7	4.1	0.0	a
					2017	6	7.0	1.5	-0.2	a
					2018	6	8.2	4.4	0.0	a
					2019	6	8.2	4.5	0.0	a
					2020	6	7.5	2.8	-0.1	a
Simpson's Evenness	ANOVA	log10	NO	0.161	2007	4	0.453	0.268	-	a
					2015	6	0.696	0.142	0.9	a
					2017	6	0.604	0.236	0.6	a
					2018	6	0.387	0.359	-0.2	a
					2019	6	0.479	0.273	0.1	a
					2020	6	0.586	0.201	0.5	a
Nemata (% of community)	K-W	rank	NO	0.417	2007	4	1.3	1.8	-	a
					2015	6	2.0	2.6	0.4	a
					2017	6	2.4	1.9	0.6	a
					2018	6	1.7	1.9	0.2	a
					2019	6	0.7	0.9	-0.3	a
					2020	6	0.6	1.0	-0.4	a
Ostracoda (% of community)	K-W	rank	NO	0.215	2007	4	1.6	2.2	-	a
					2015	6	11.1	10.9	4.4	a
					2017	6	3.2	6.2	0.7	a
					2018	6	3.5	3.2	0.9	a
					2019	6	10.9	17.4	4.3	a
					2020	6	23.4	28.9	10.0	a
Chironomidae (% of community)	K-W	rank	NO	0.254	2007	4	96.4	4.7	-	a
					2015	6	83.8	12.2	-2.7	a
					2017	6	84.9	13.8	-2.5	a
					2018	6	93.8	4.1	-0.6	a
					2019	6	86.6	17.4	-2.1	a
					2020	6	71.3	30.2	-5.4	a
Metal Sensitive Taxa (% of community)	K-W	rank	NO	0.522	2007	4	33.7	27.9	-	a
					2015	6	9.5	8.2	-0.9	a
					2017	6	5.6	3.2	-1.0	a
					2018	6	8.6	11.2	-0.9	a
					2019	6	4.5	4.5	-1.1	a
					2020	6	5.6	5.2	-1.0	a
Collector-Gatherer FFG (% of community)	K-W	rank	NO	0.142	2007	4	64.4	27.7	-	a
					2015	6	82.7	5.9	0.7	a
					2017	6	80.7	18.2	0.6	a
					2018	6	90.0	13.2	0.9	a
					2019	6	92.3	4.2	1.0	a
					2020	6	86.6	5.9	0.8	a
Filterer FFG (% of community)	K-W	rank	NO	0.230	2007	4	33.1	27.8	-	a
					2015	6	9.4	7.9	-0.9	a
					2017	6	3.8	2.7	-1.1	a
					2018	6	7.8	11.4	-0.9	a
					2019	6	2.9	4.1	-1.1	a
					2020	6	3.2	5.3	-1.1	a

(grey) Indicates a statistically significant difference for respective comparison (p-value ≤ 0.1).

(blue) Indicates magnitude of difference outside of the Critical Effect Size of ± 2 SD of respective baseline year mean, suggesting an ecologically meaningful difference in endpoint value between study years.

Note: "-" indicates not applicable.

[a] Statistical tests include Analysis of Variance (ANOVA) followed by Tukey's Honestly Significant Difference (HSD) post hoc tests, or Kruskal-Wallis H-test (K-W) followed by Mann-Whitney U-test (M-W).

APPENDIX G

FISH POPULATION SURVEY DATA

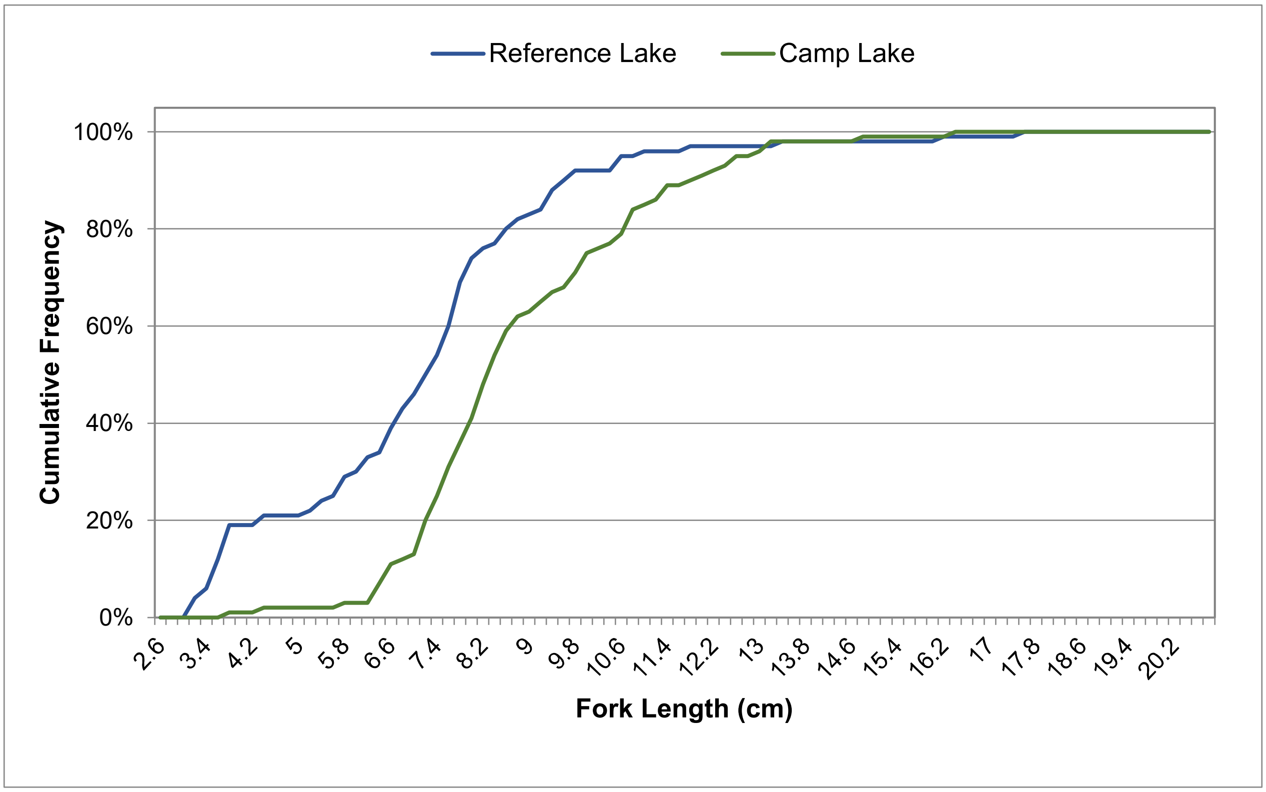


Figure G.1: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Camp Lake and Reference Lake 3, Mary River Project CREMP, August 2020

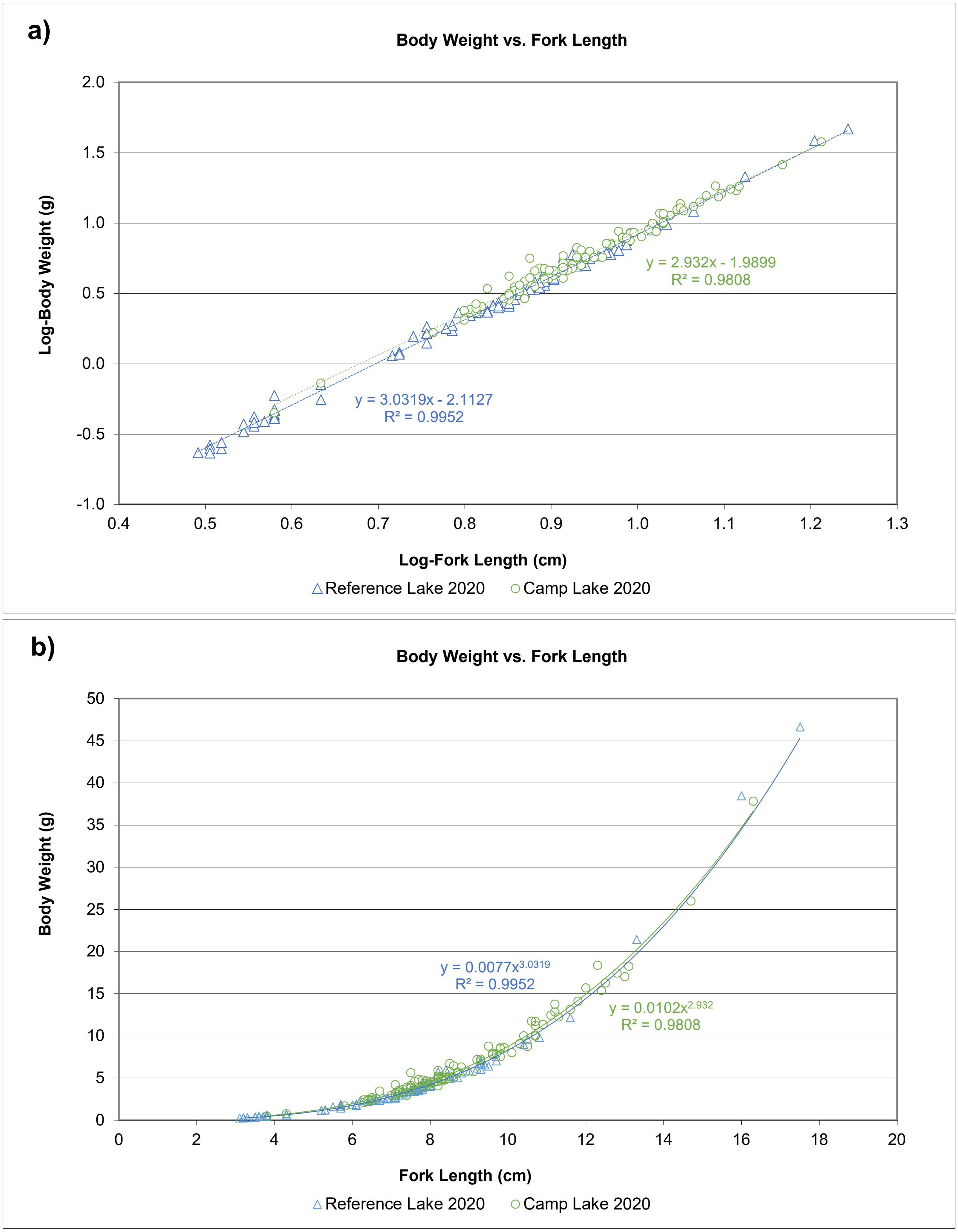
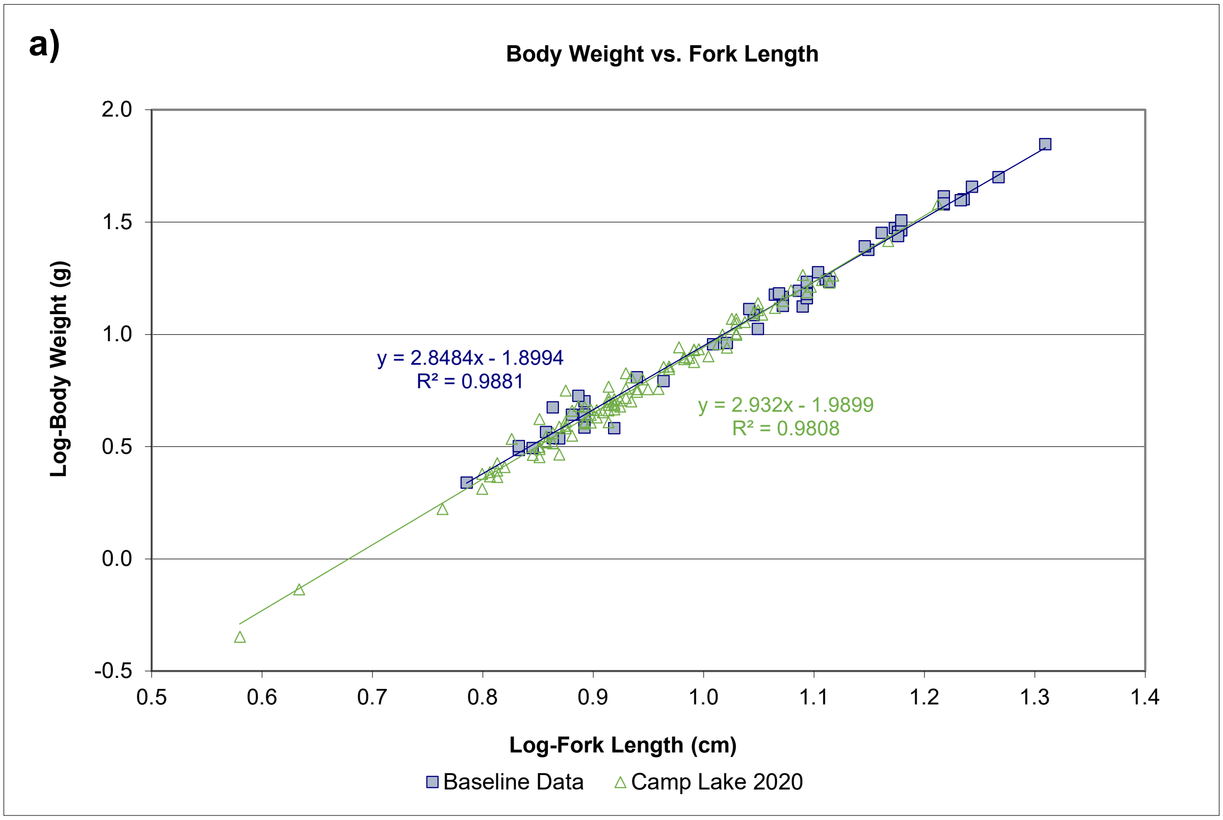


Figure G.2: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Camp Lake and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data



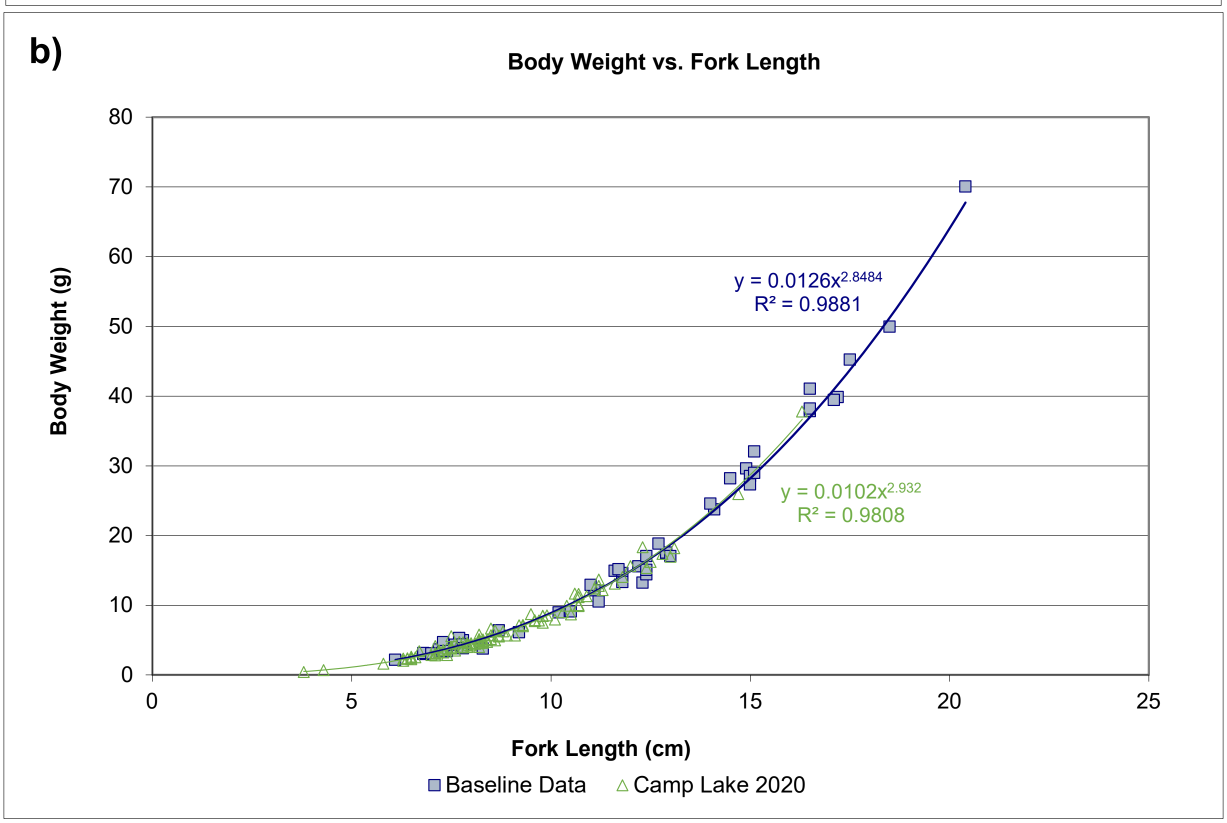


Figure G.3: Comparison of Condition (Weight-at-fork length Relationship) for Arctic Charr Collected in Fall (August-September) at Camp Lake Nearshore Areas in 2019 and during the Mine Baseline Period (2013) using Log-transformed (a) and Untransformed (b) Data

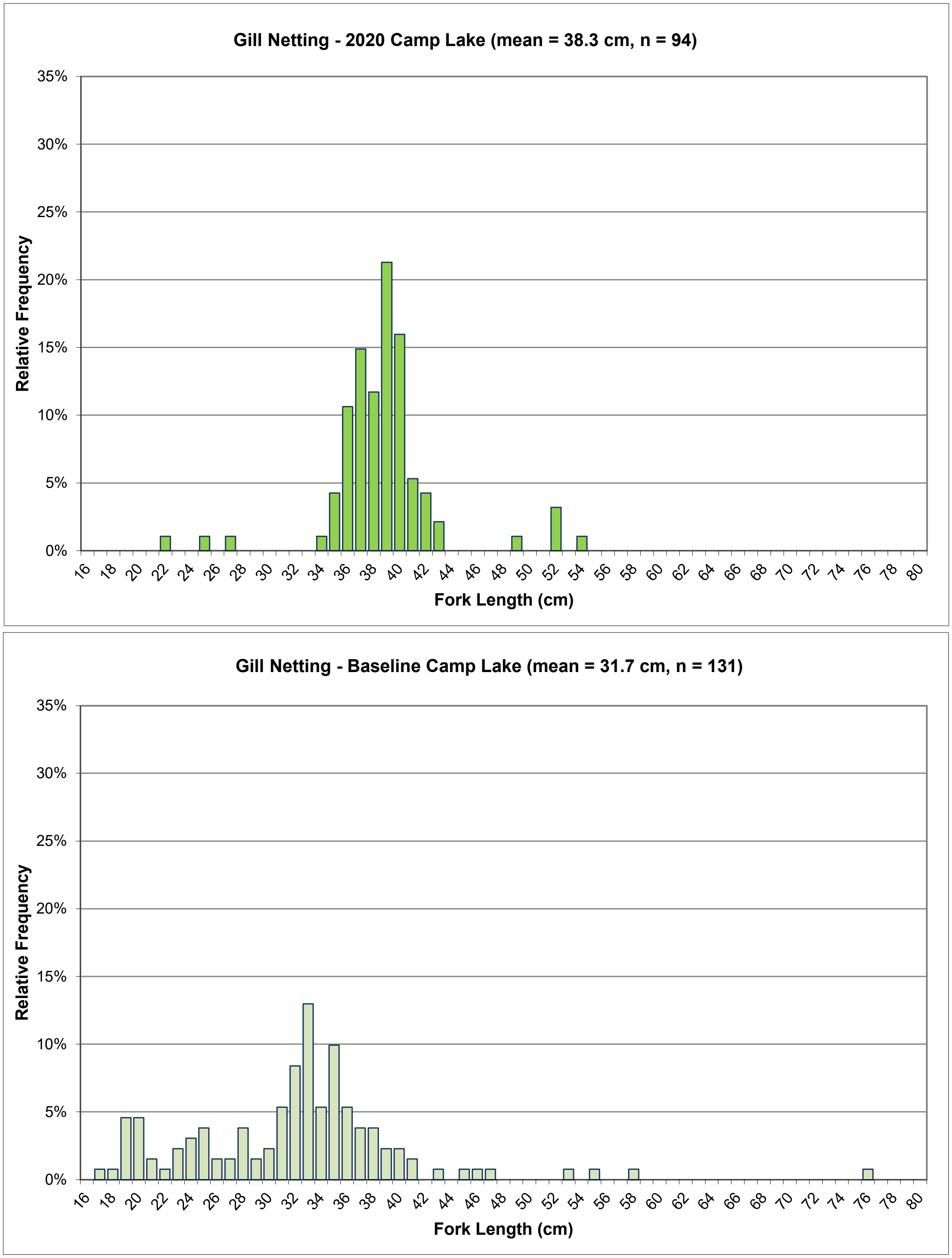


Figure G.4: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Camp Lake (JLO) in 2020 and Baseline Studies Conducted in Fall, Mary River Project CREMP

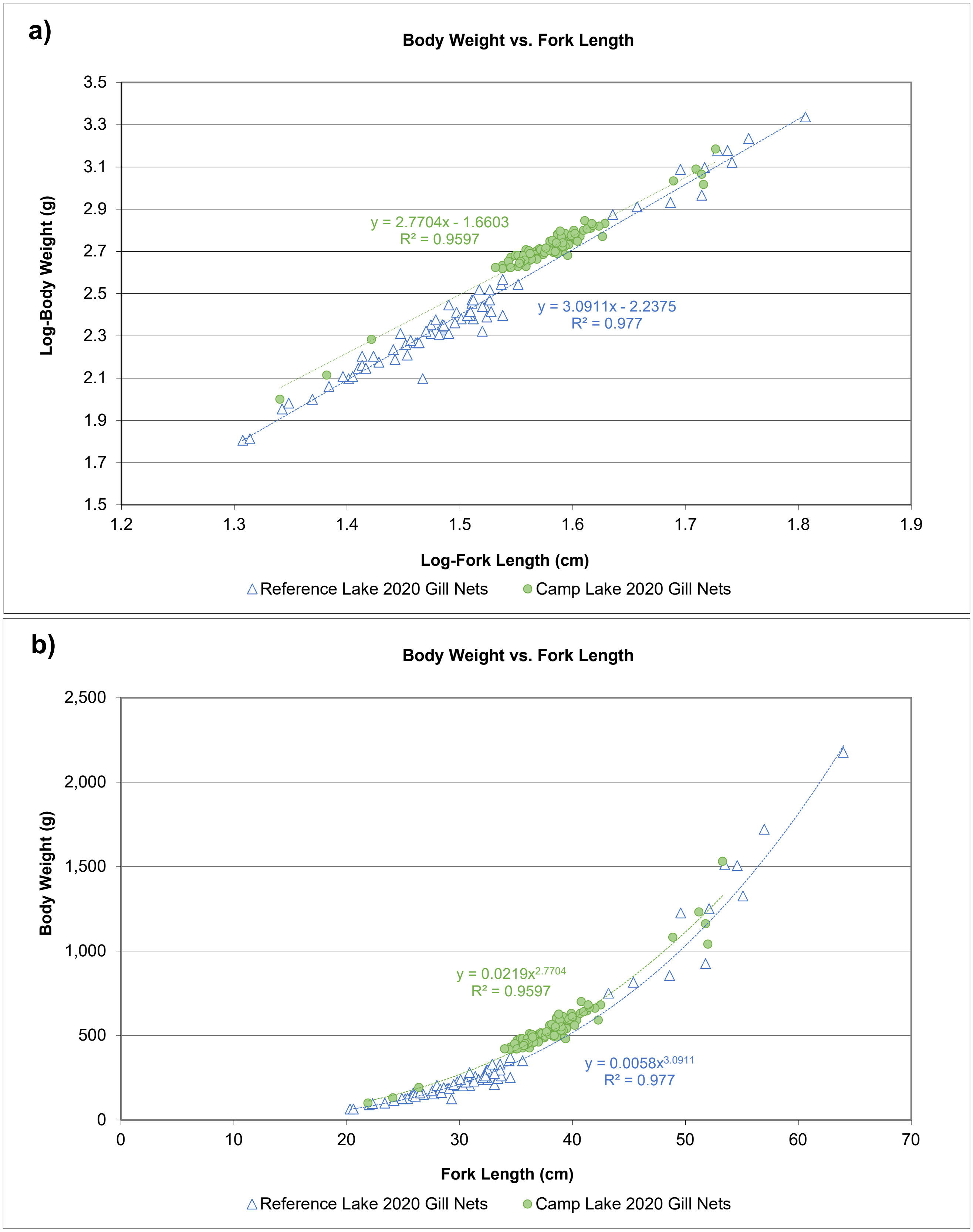
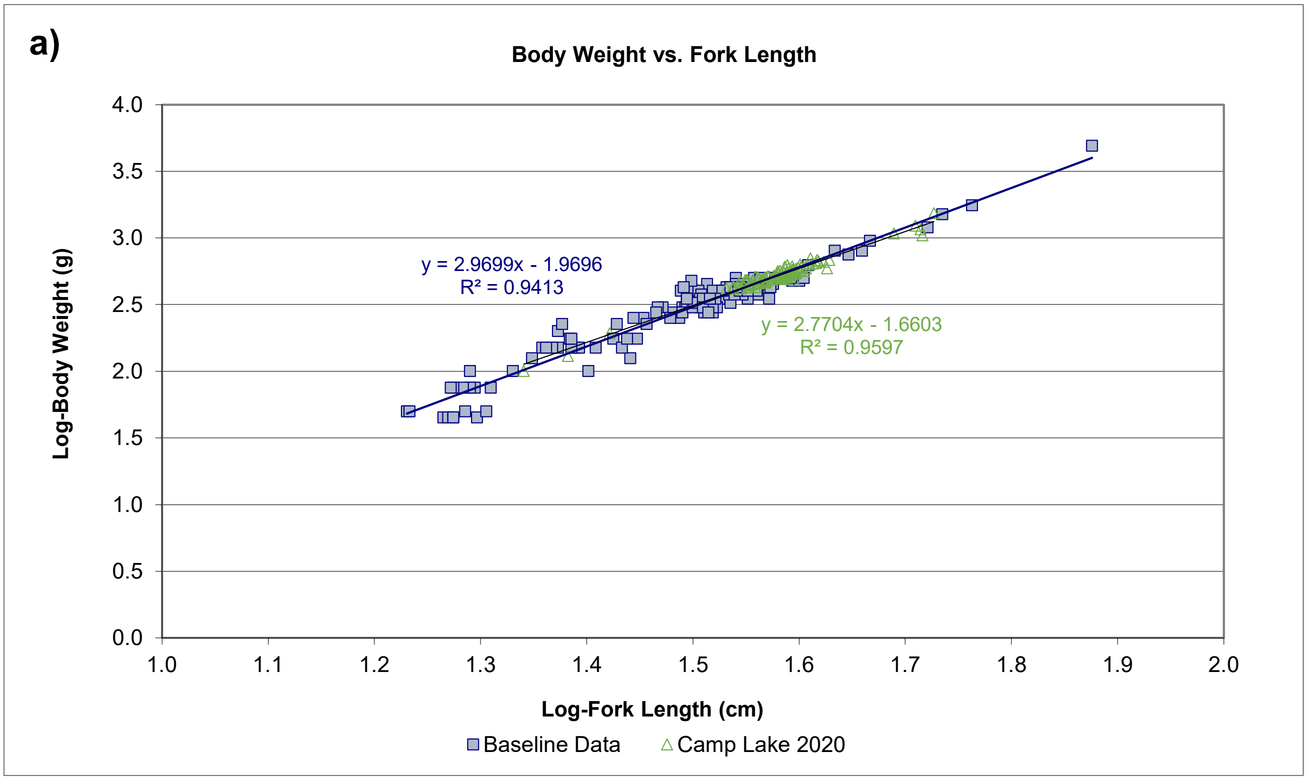


Figure G.5: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Camp Lake and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data



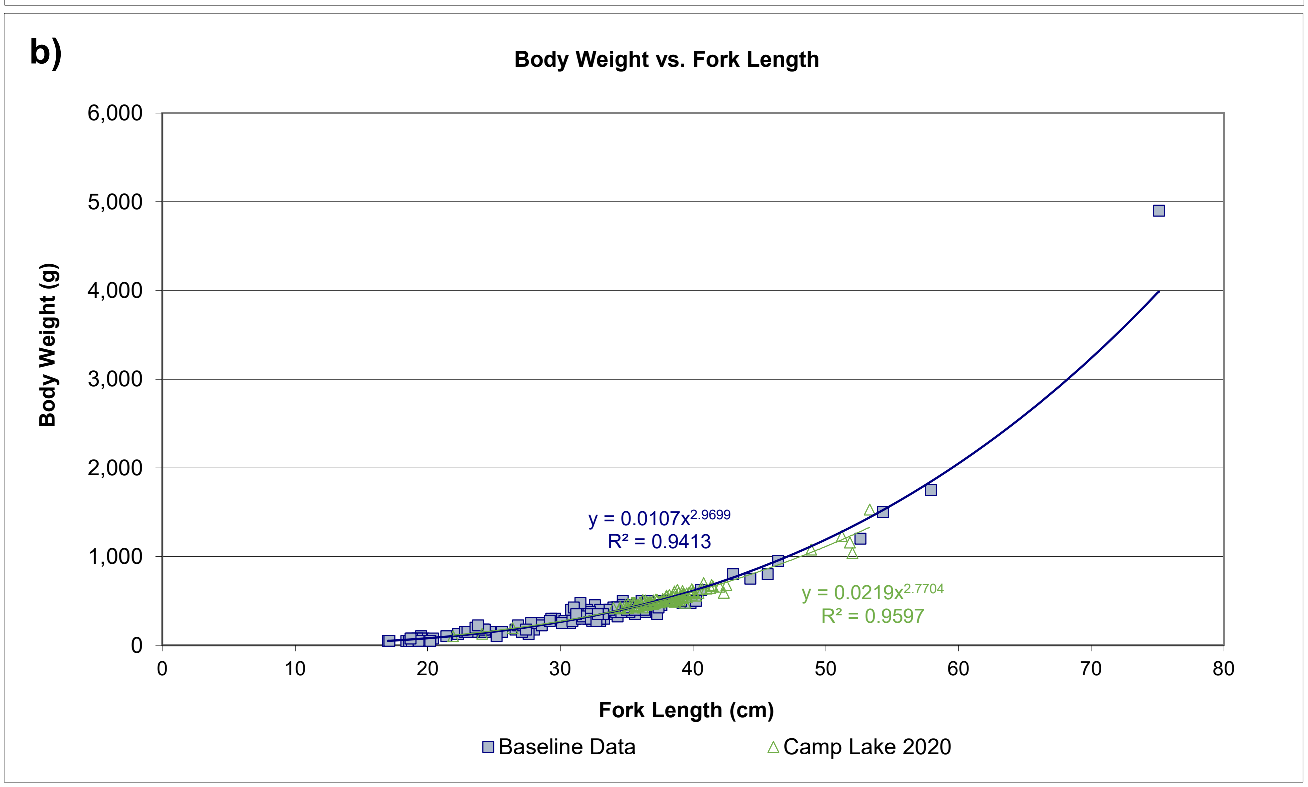


Figure G.6: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Camp Lake Littoral/Profundal Areas in 2020 and during the Mine Baseline Period (2006, 2007, 2008, 2013) using Log-transformed (a) and Untransformed (b) Data

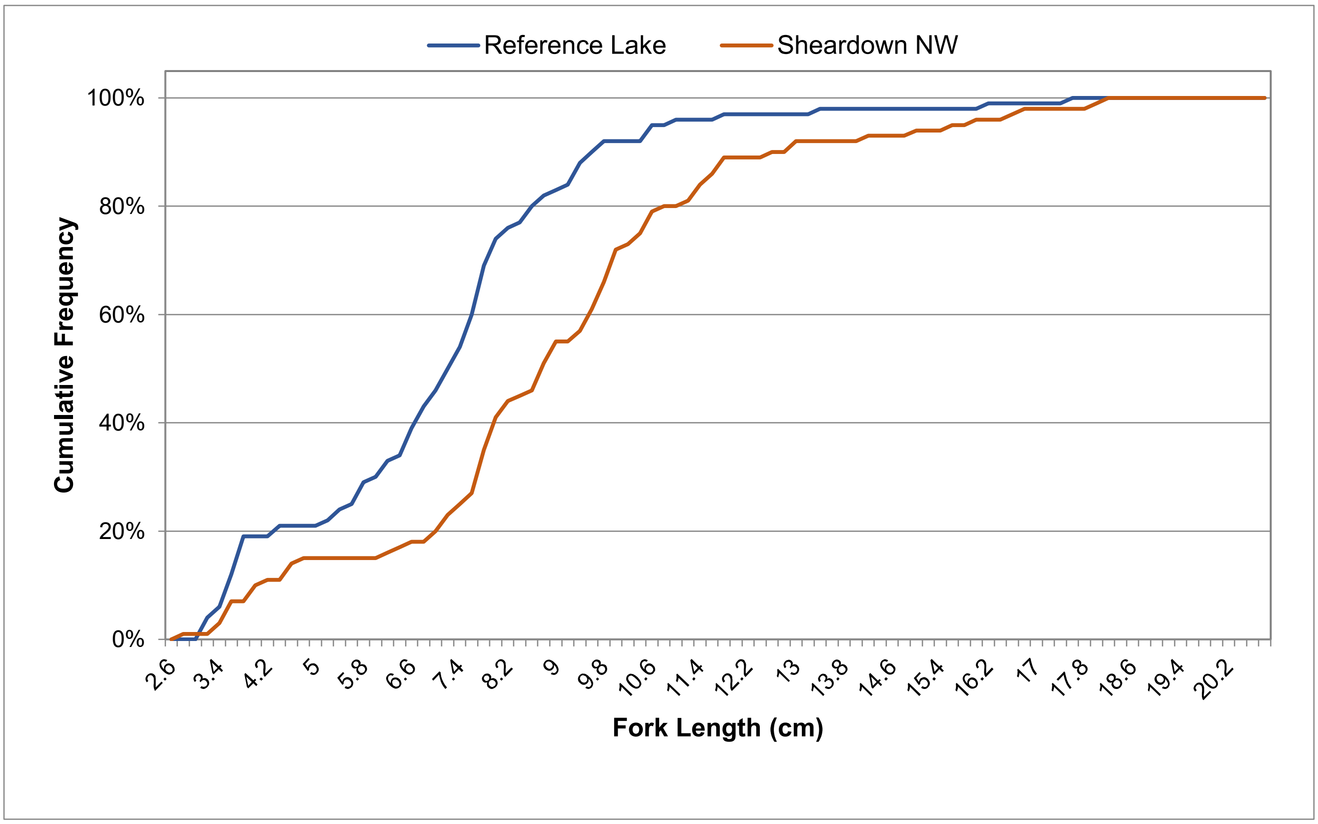
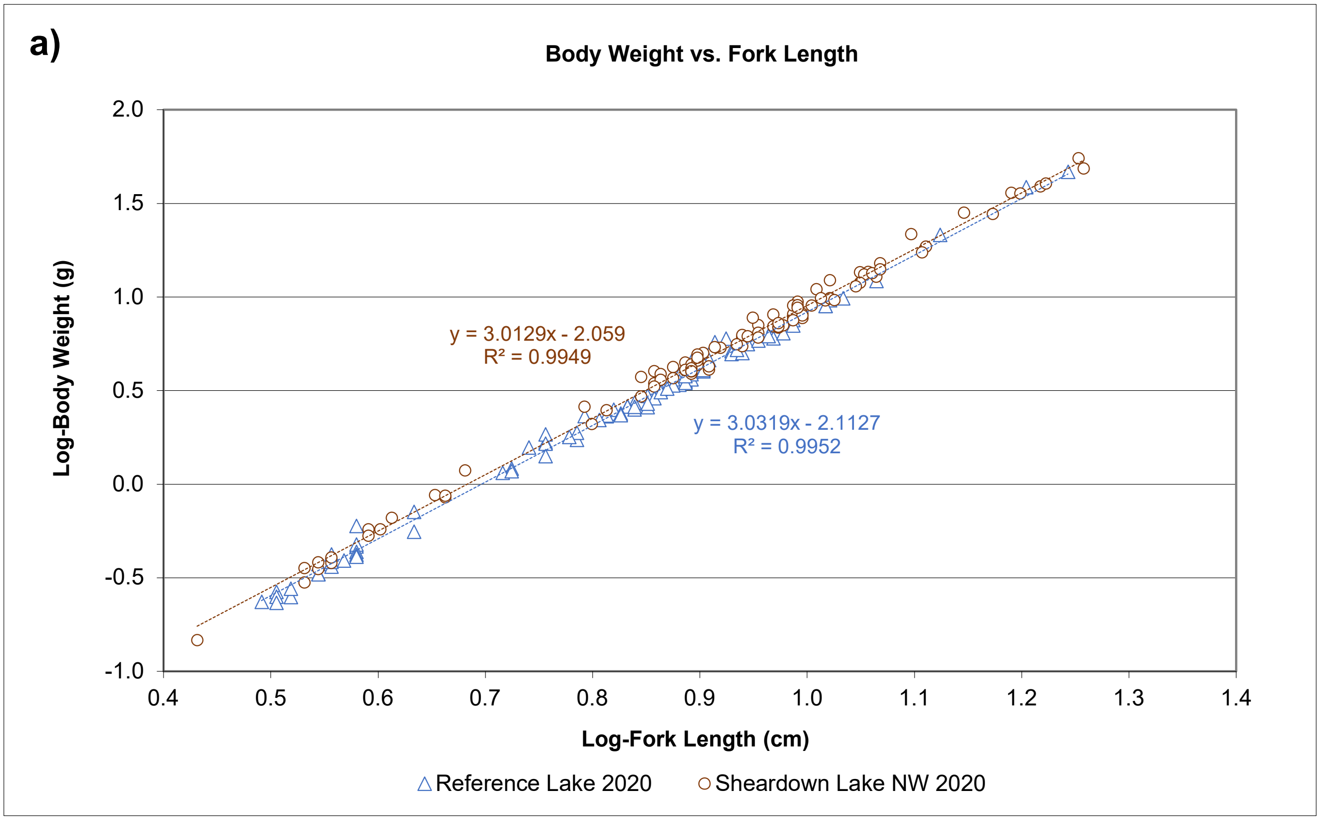


Figure G.7: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Sheardown Lake NW and Reference Lake 3, Mary River Project CREMP, August 2020



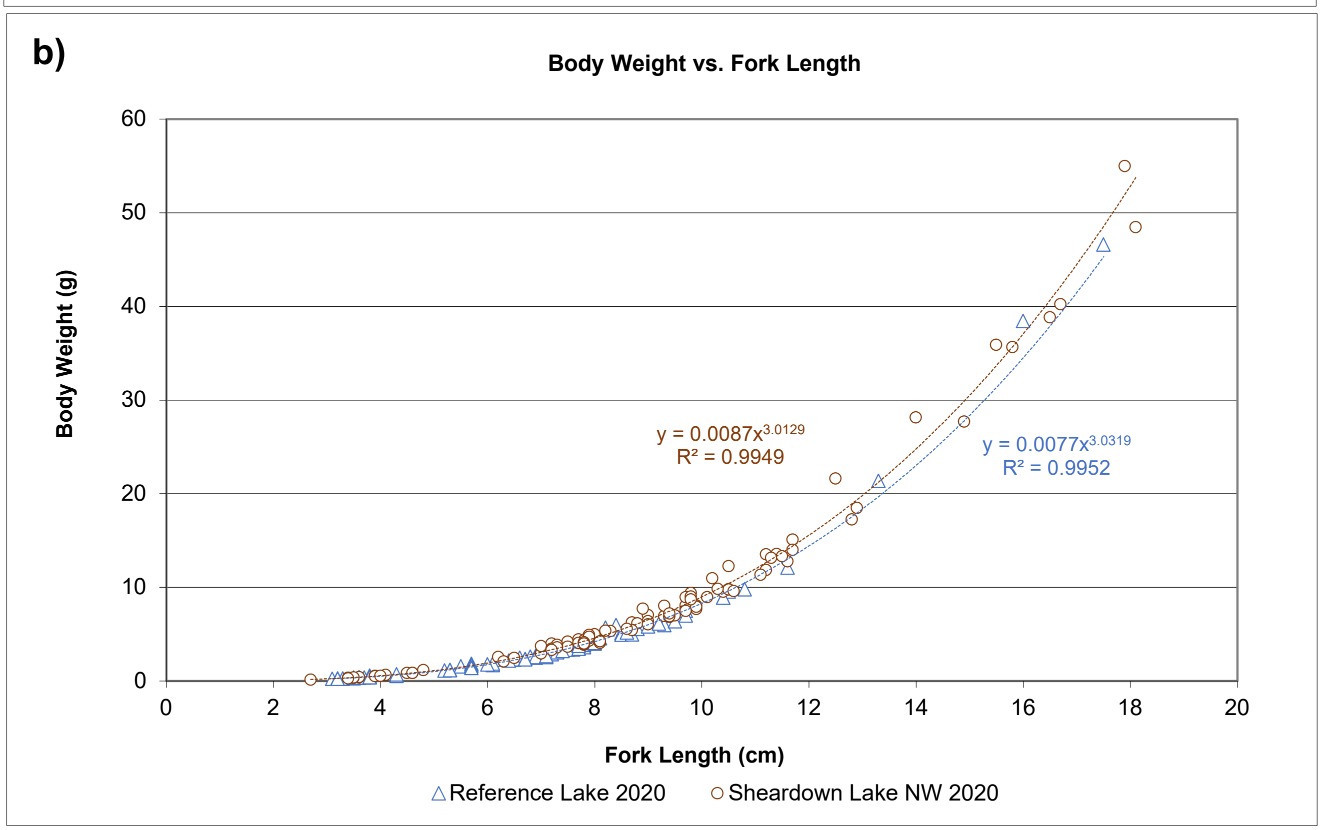
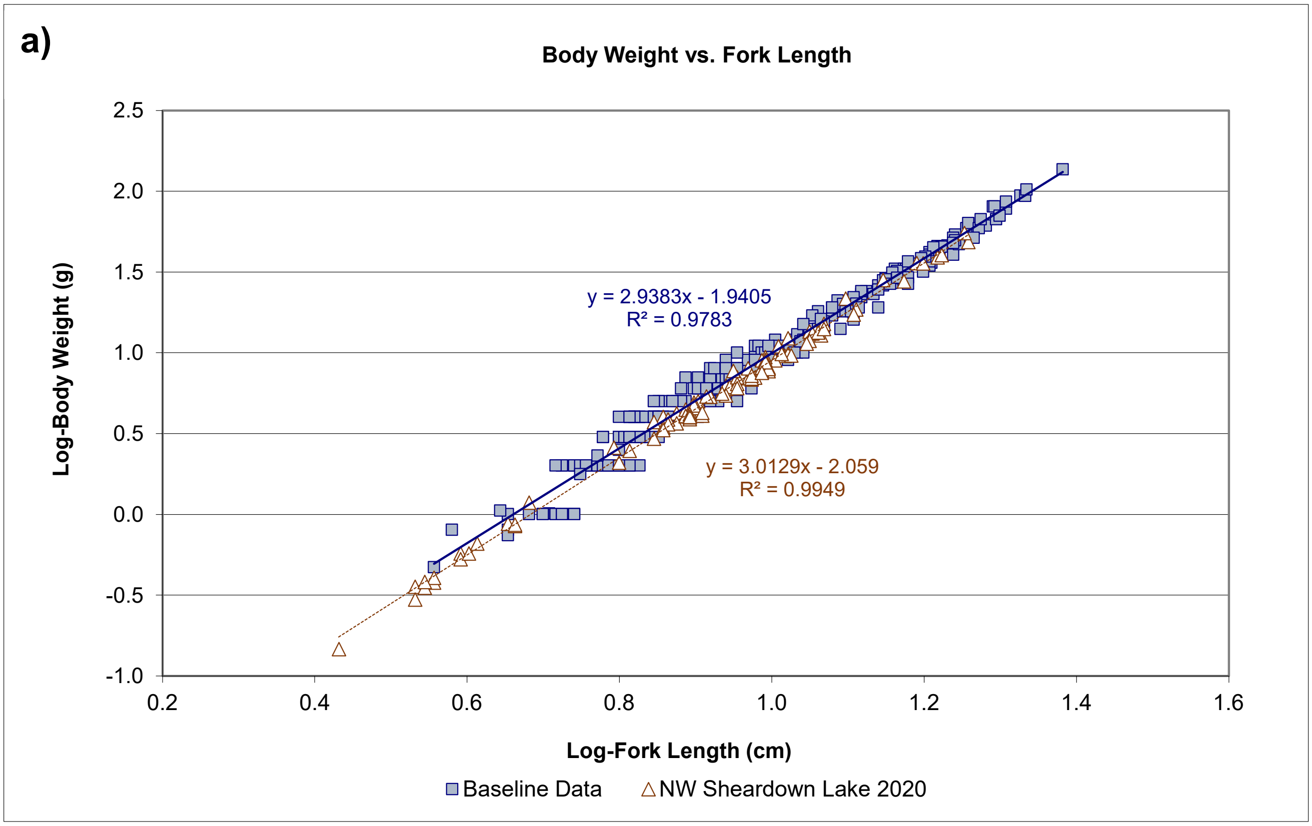


Figure G.8: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at the Nearshore Area of Sheardown Lake NW and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data



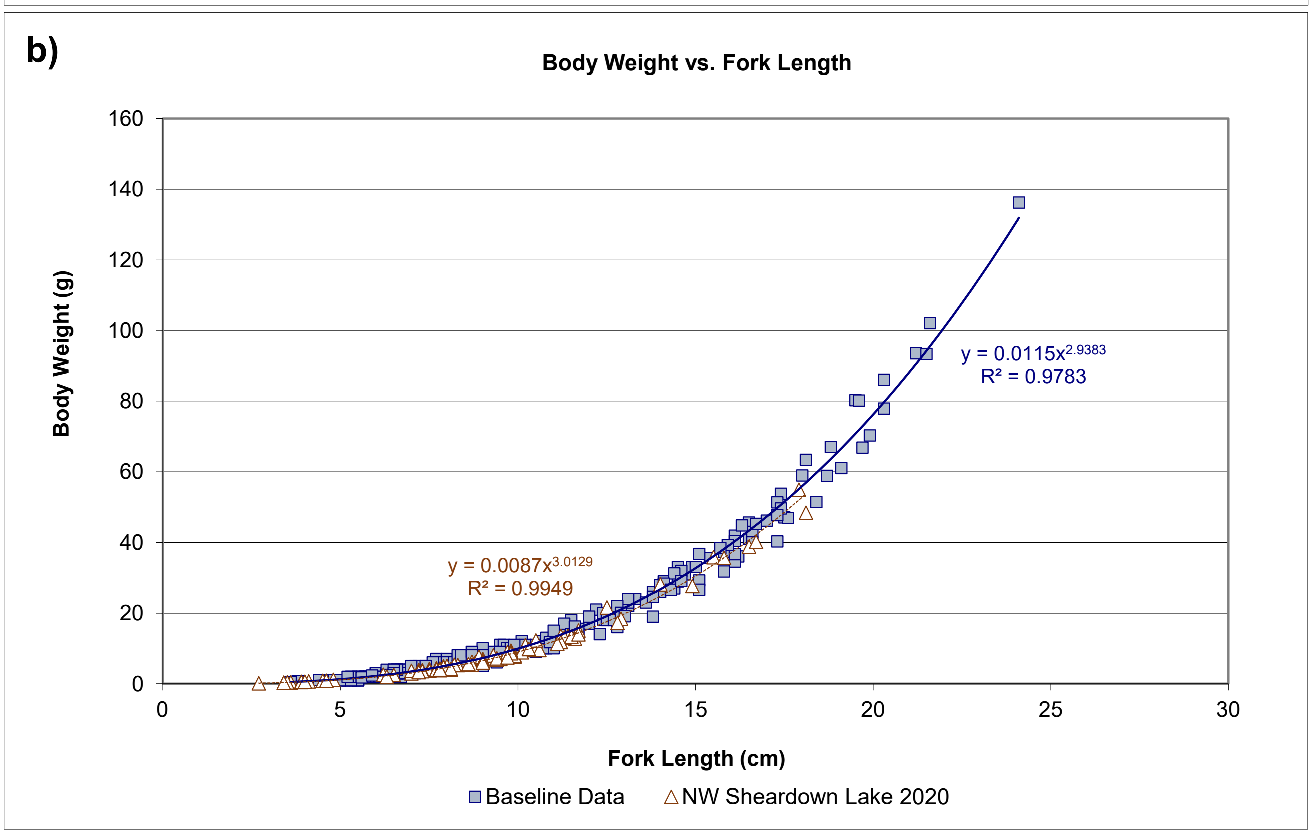
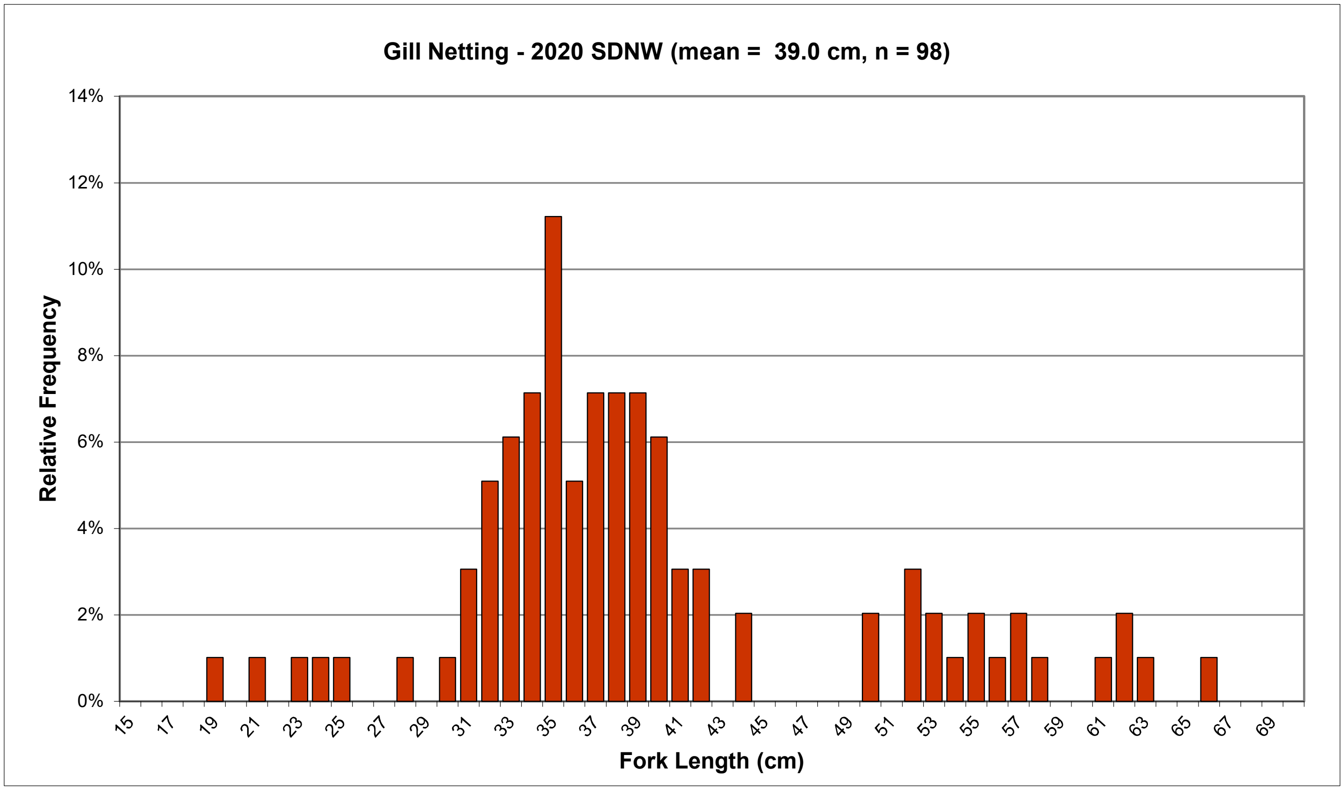


Figure G.9: Comparison of Condition (Weight-at-fork length Relationship) for Arctic Charr Collected in Fall (August-September) at Sheardown Lake NW Nearshore Areas in 2020 and During the Mine Baseline Period (2007, 2008, 2013) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP



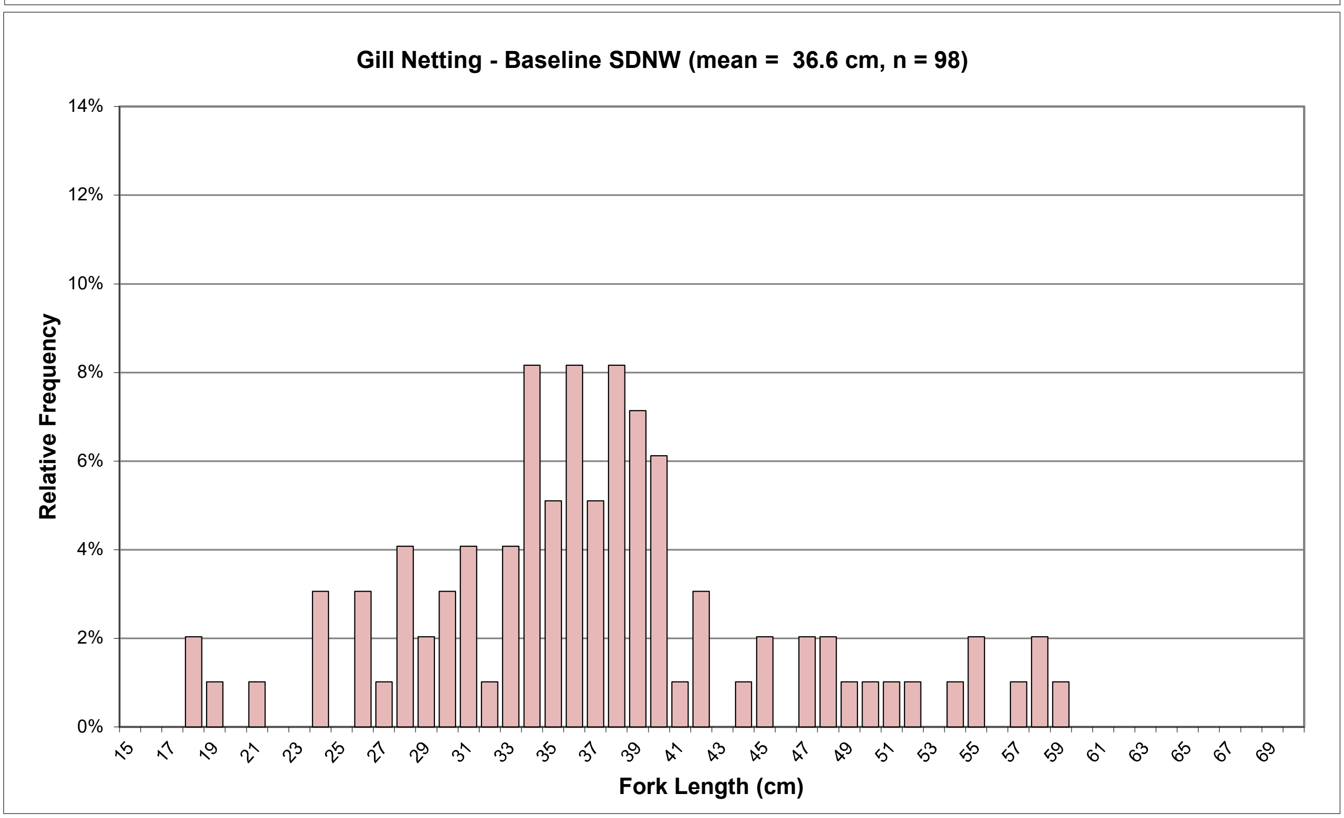


Figure G.10: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Sheardown Lake NW (DLO-01) in 2019 and Baseline Studies Conducted in Fall, Mary River Project CREMP

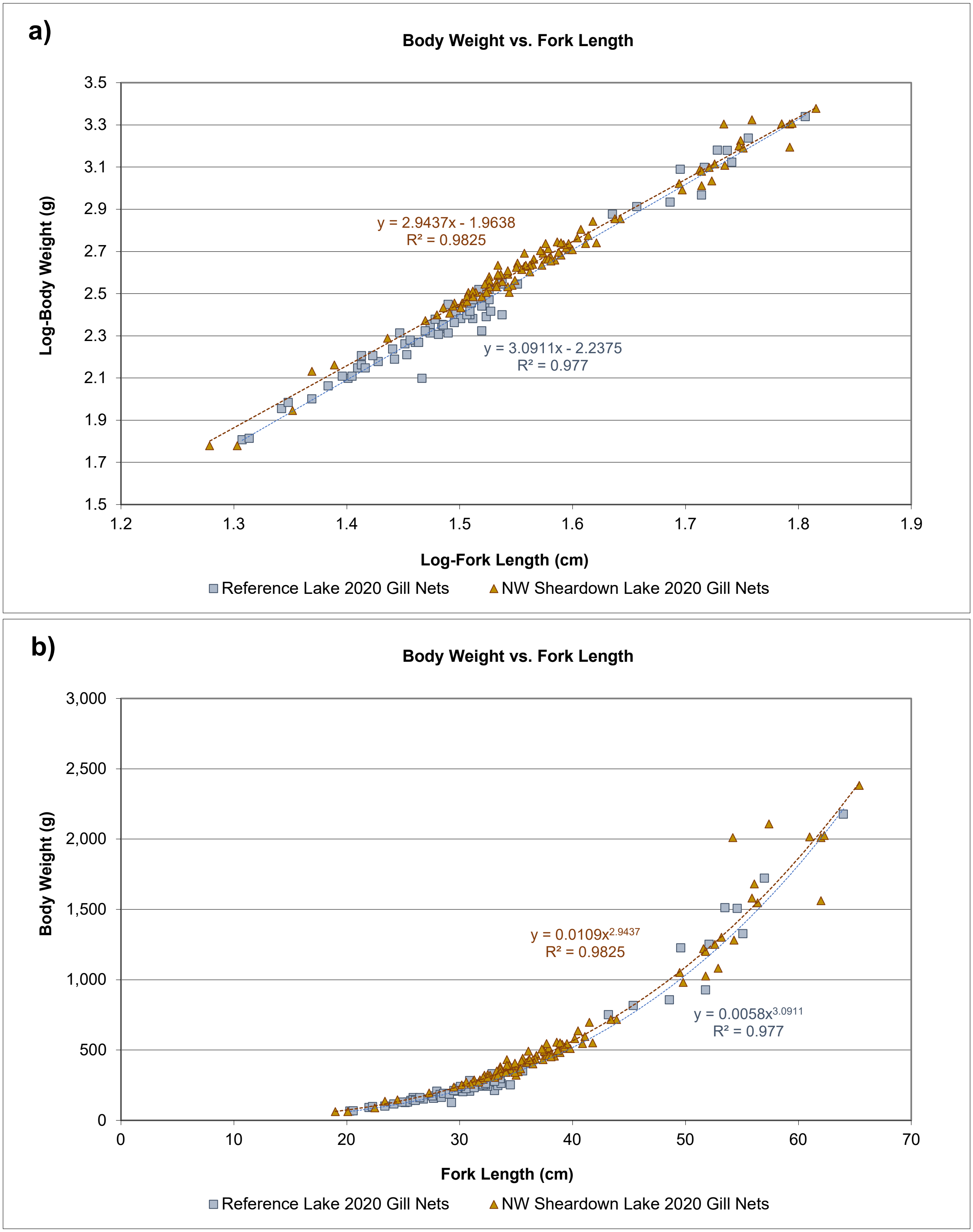
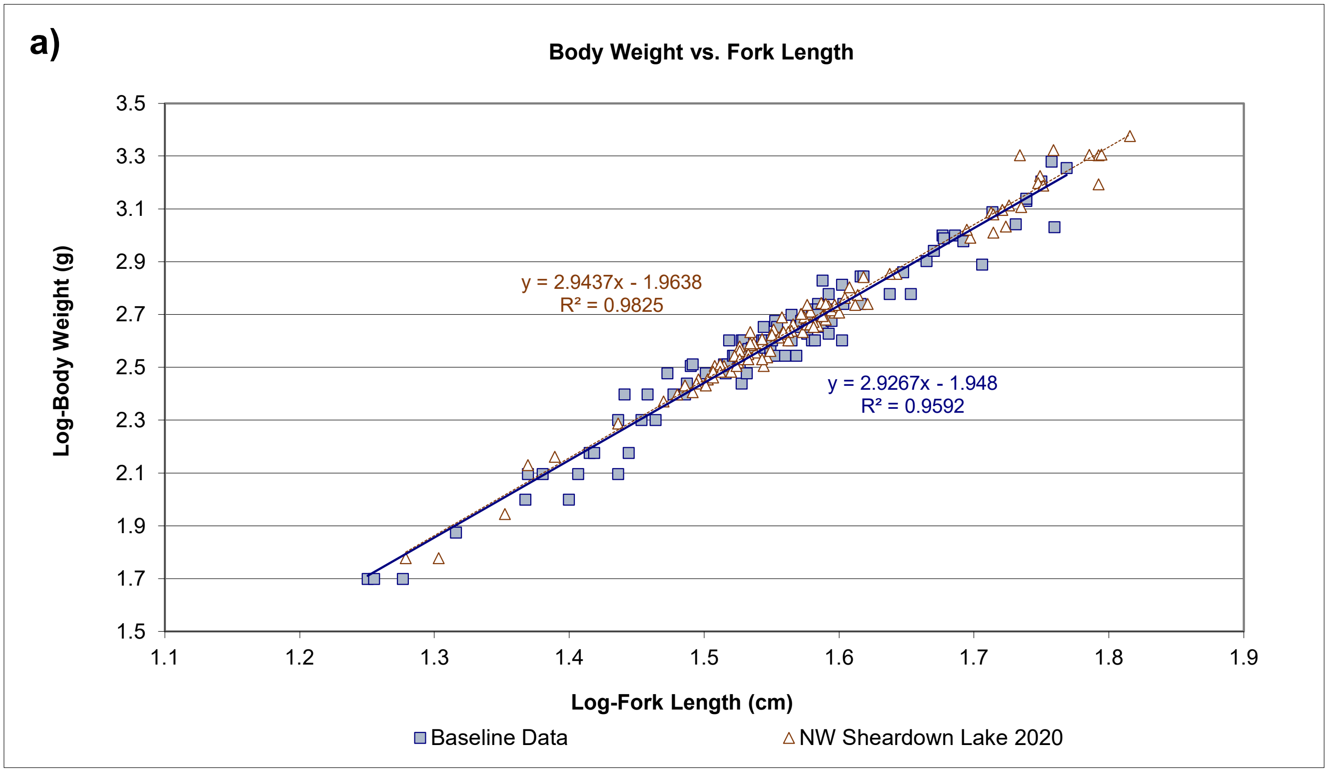


Figure G.11: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Sheardown Lake NW and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data



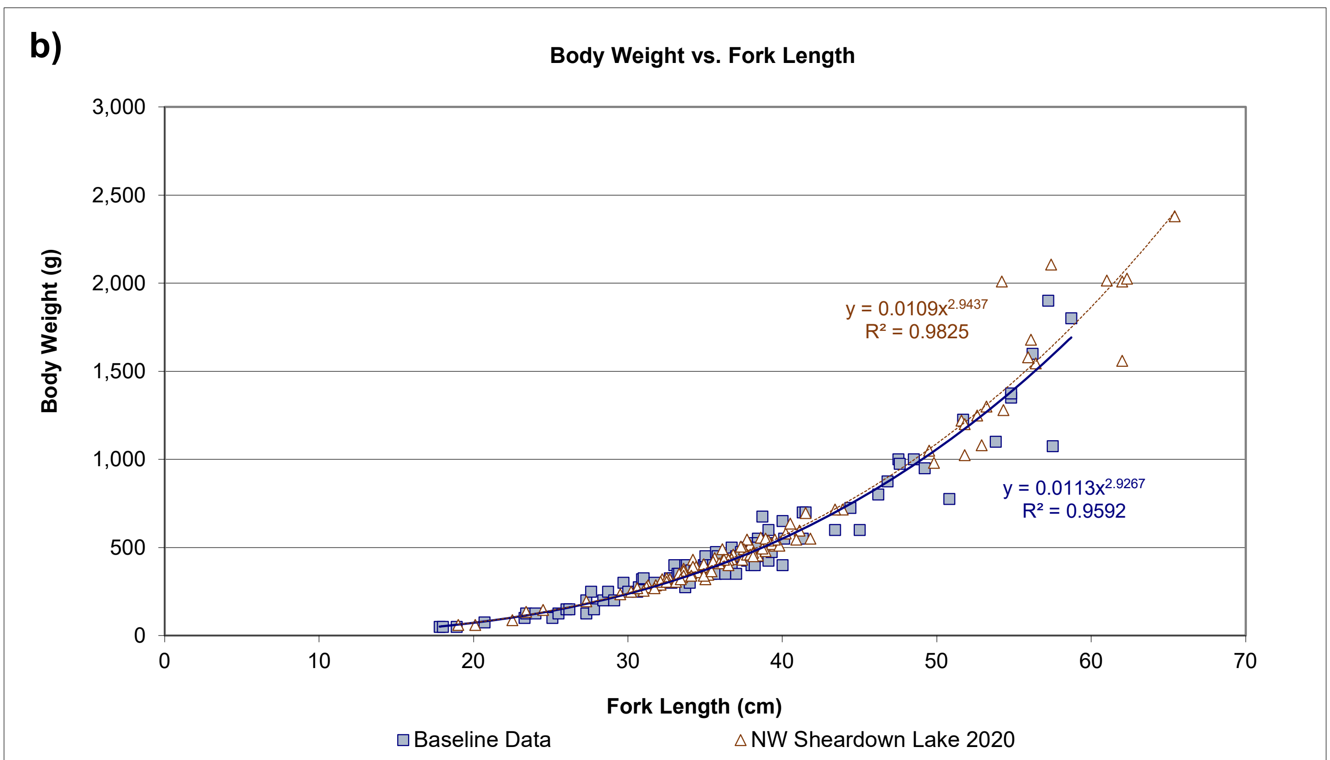


Figure G.12: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Sheardown Lake NW Nearshore Areas in 2020 and during the Mine Baseline Period (2006, 2007, 2008, 2013) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

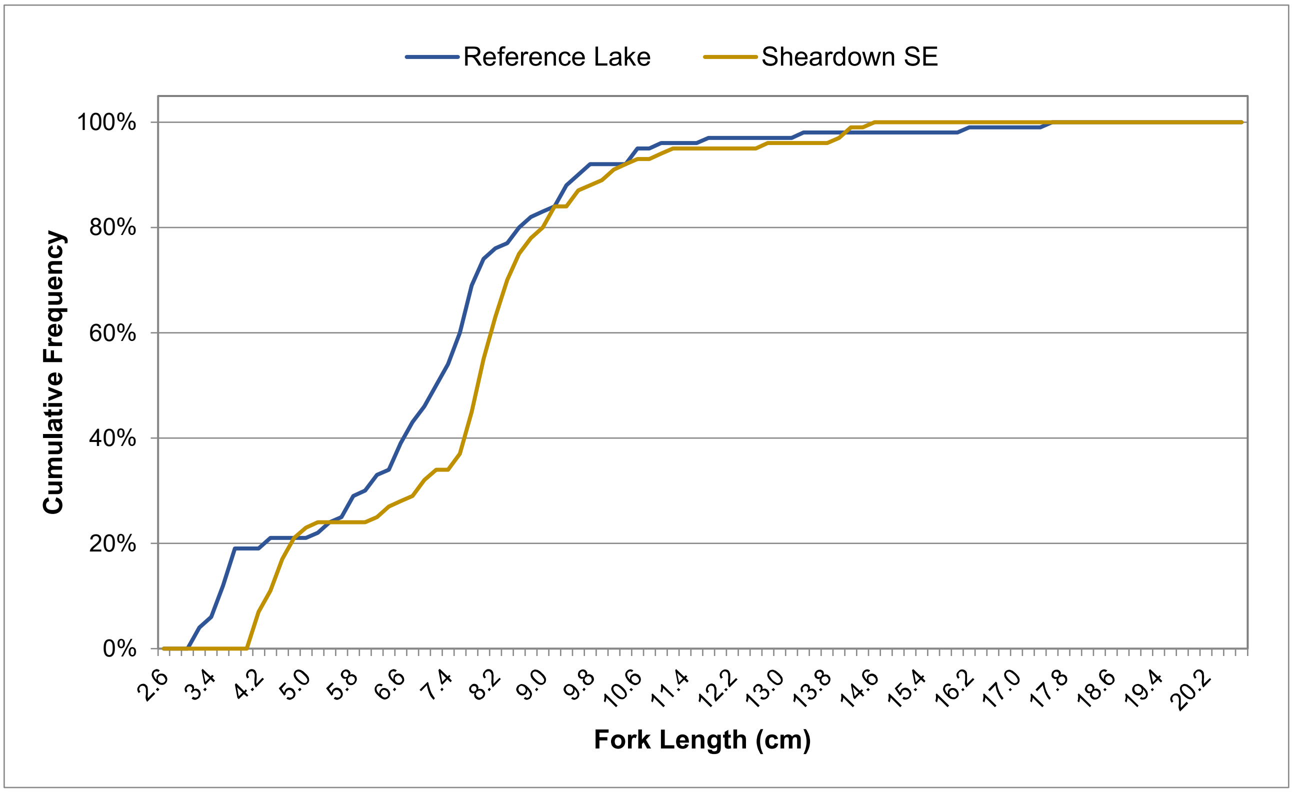


Figure G.13: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Sheardown Lake SE and Reference Lake 3, Mary River Project CREMP, August 2020

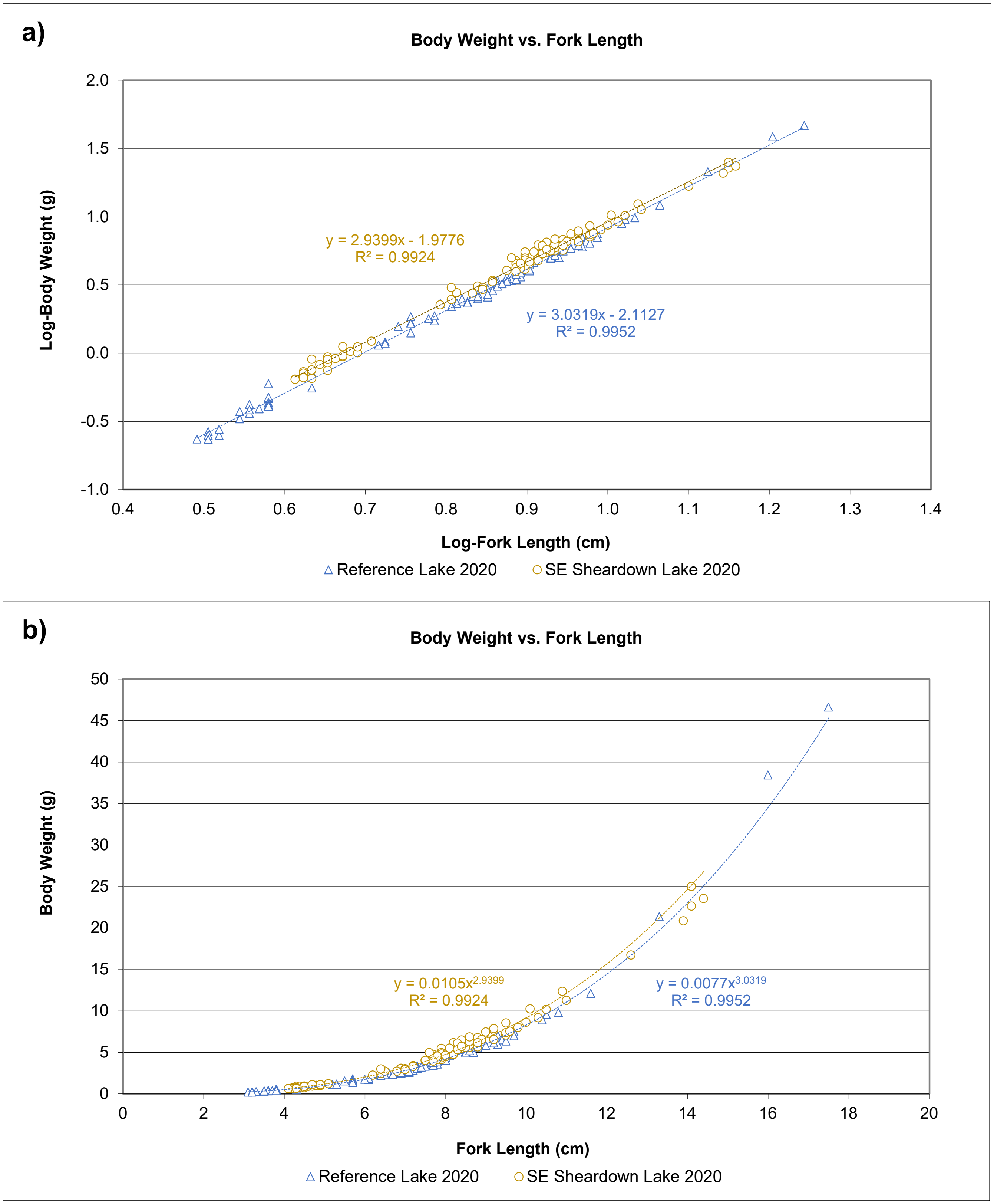


Figure G.14: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected at the Nearshore Area of Sheardown Lake SE and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data

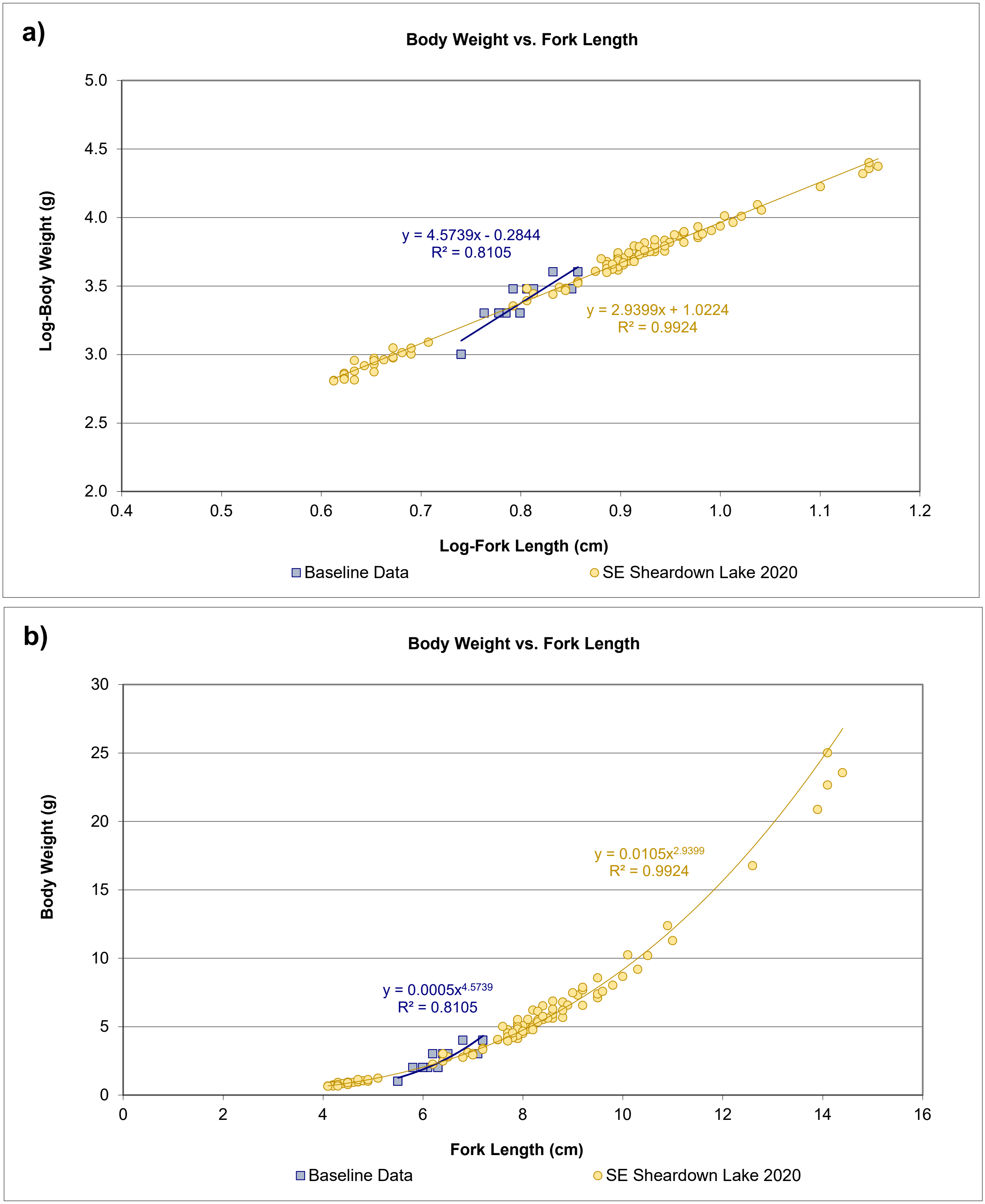


Figure G.15: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Sheardown Lake SE Nearshore Areas in 2020 and During the Mine Baseline Period (2007) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

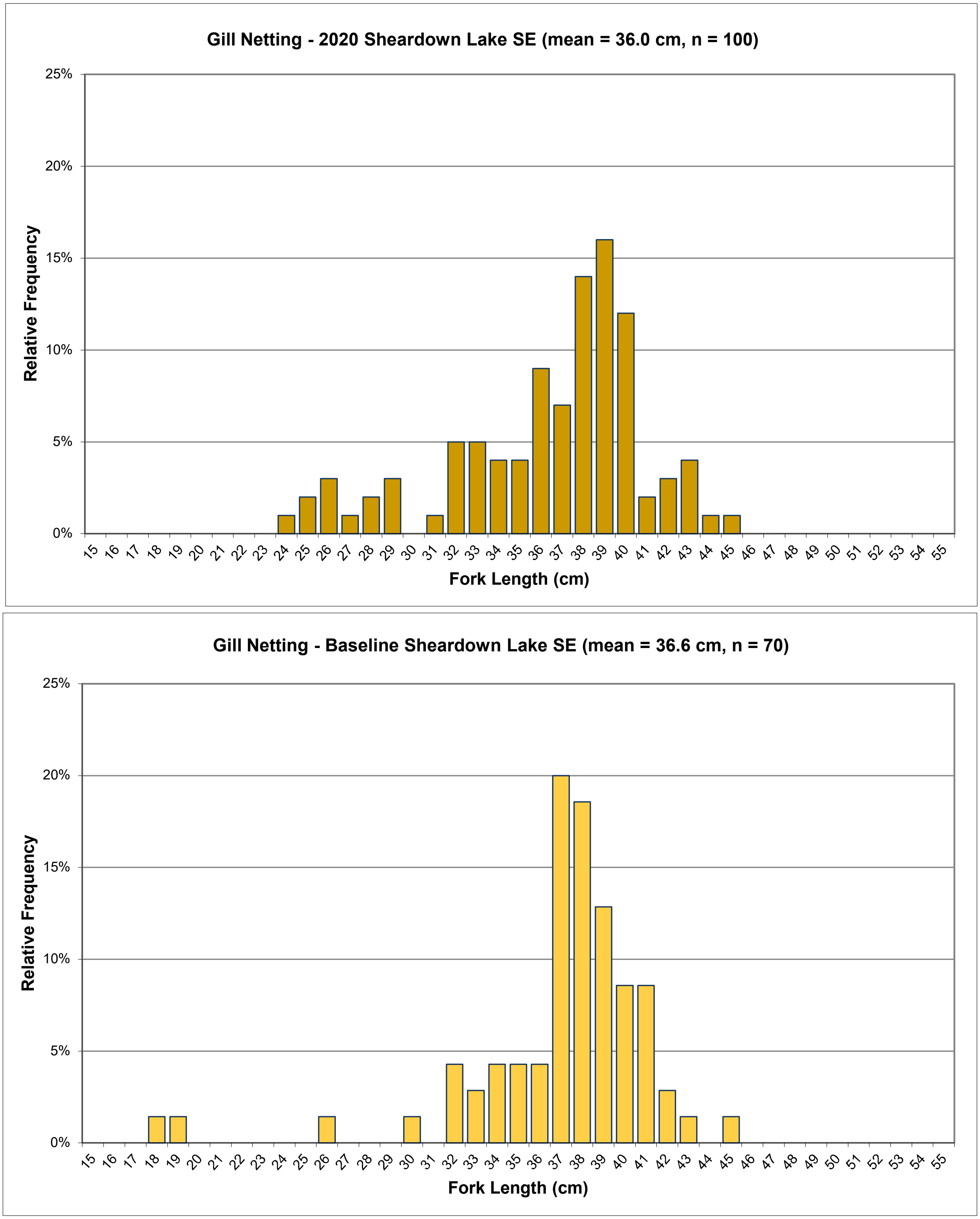
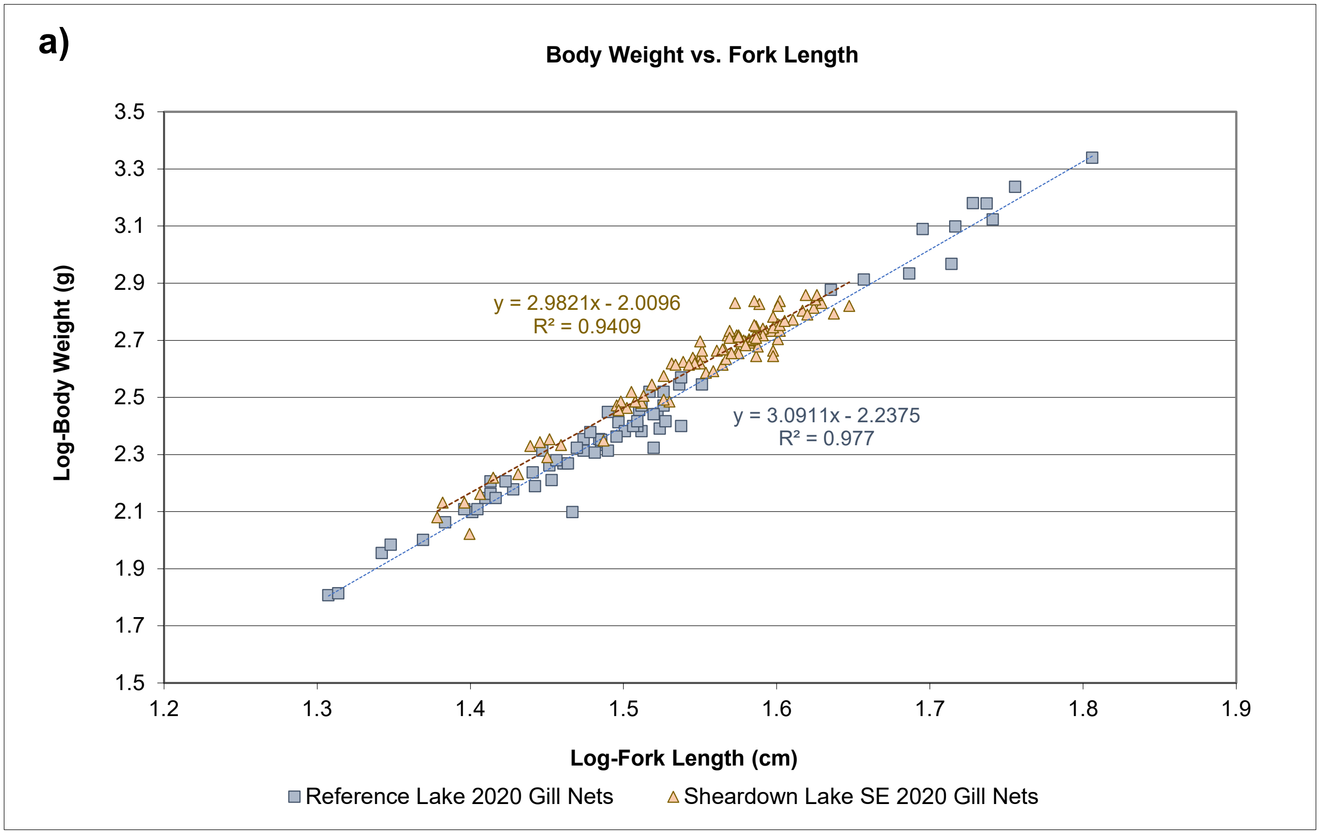


Figure G.16: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Sheardown Lake SE (DLO-02) in 2020 and Baseline Studies Conducted in Fall, Mary River Project CREMP



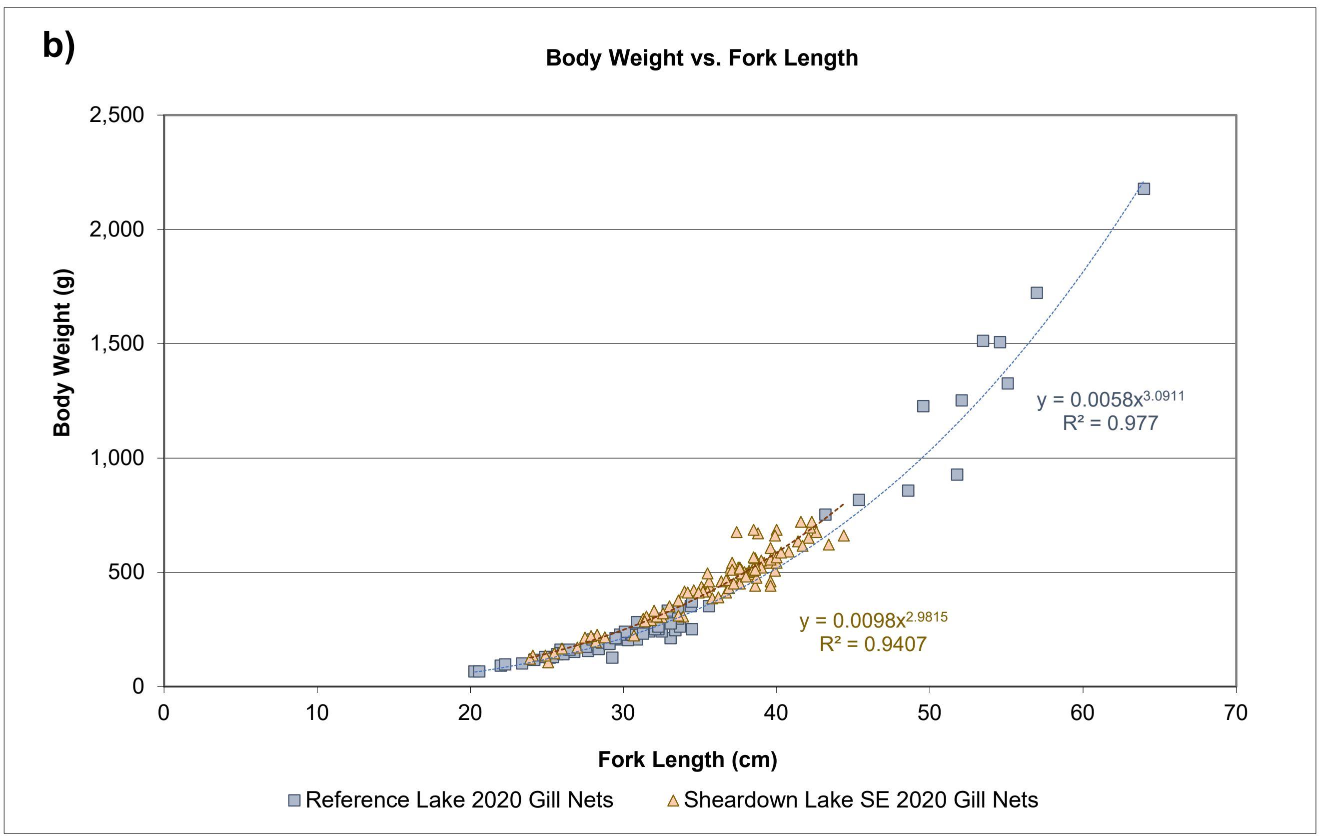


Figure G.17: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Sheardown Lake SE and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data

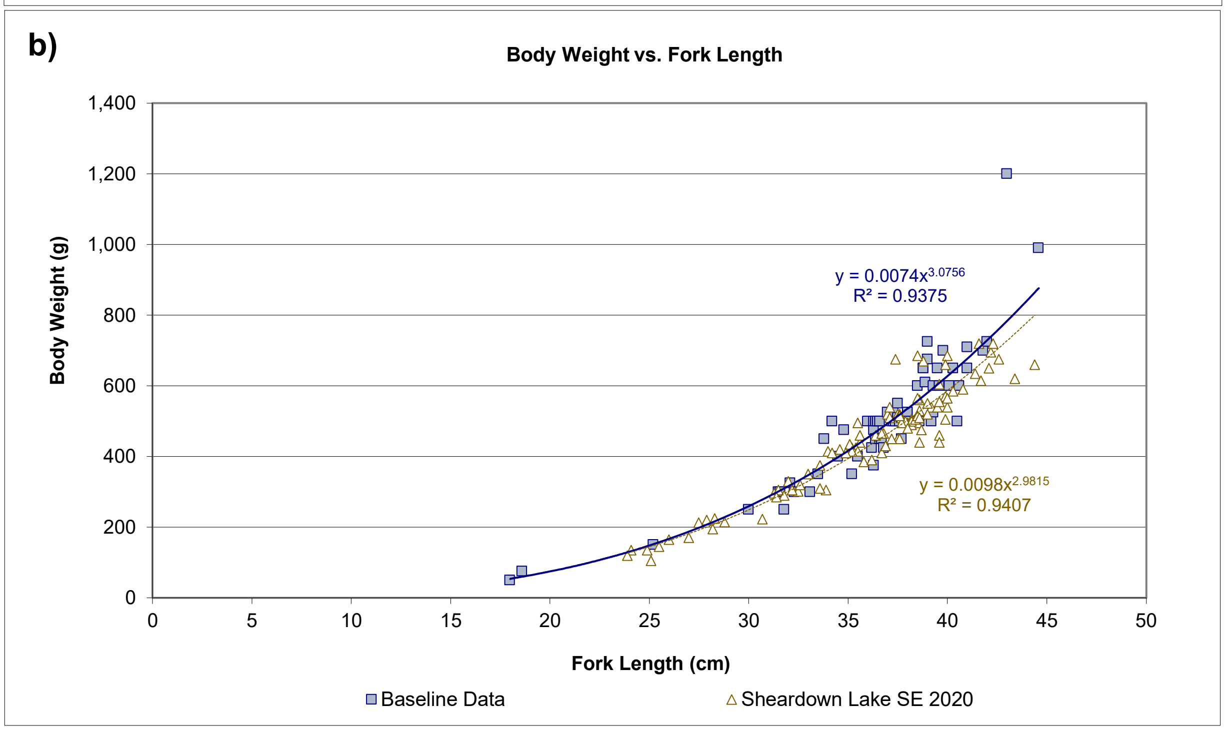


Figure G.18: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr collected in Fall (August-September) at Sheardown Lake SE Nearshore Areas in 2020 and During the Mine Baseline Period (2007, 2008) using Log-transformed (a) and Untransformed (b) Data, Mary River Project CREMP

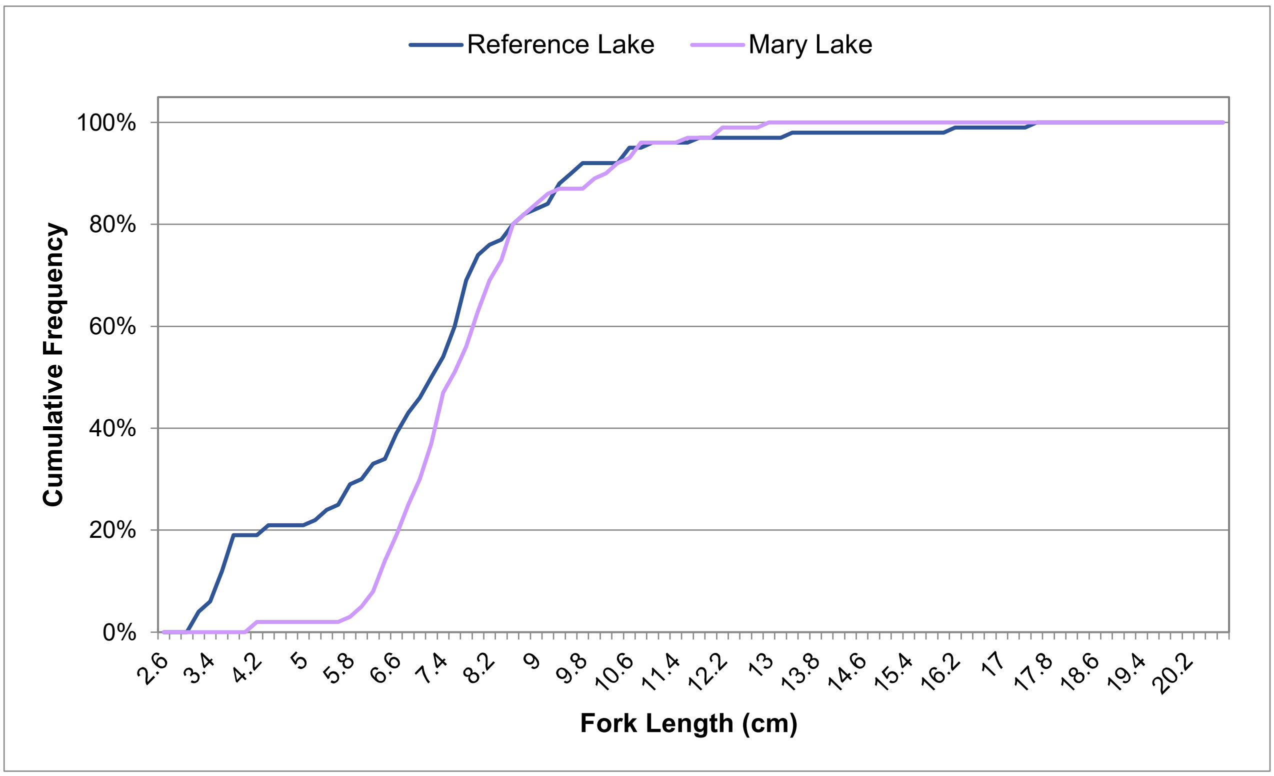


Figure G.19: Cumulative Length-frequency Distributions for Juvenile Arctic Charr Captured by Electrofishing at Nearshore Areas of Mary Lake and Reference Lake 3, Mary River Project CREMP, August 2020

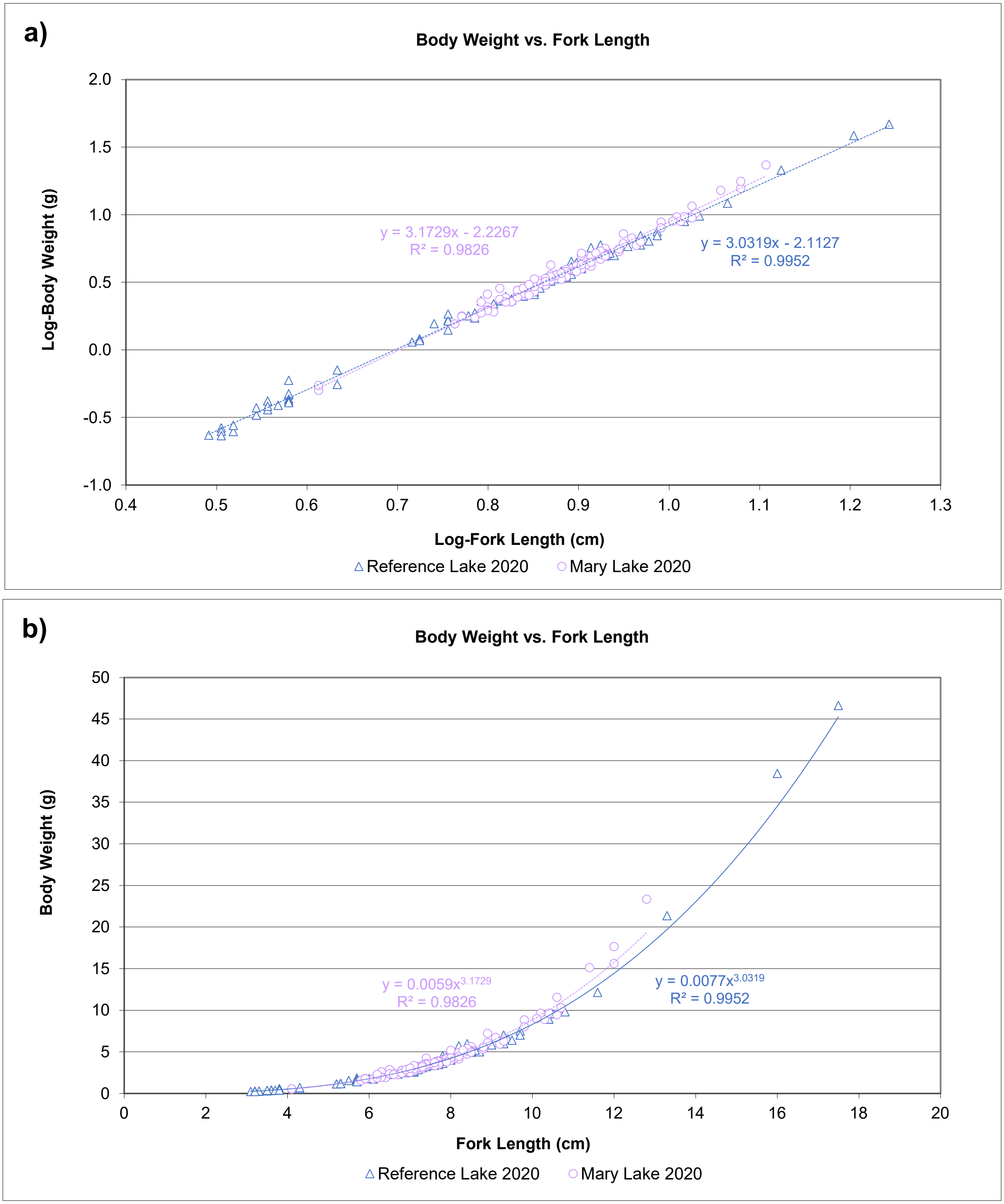
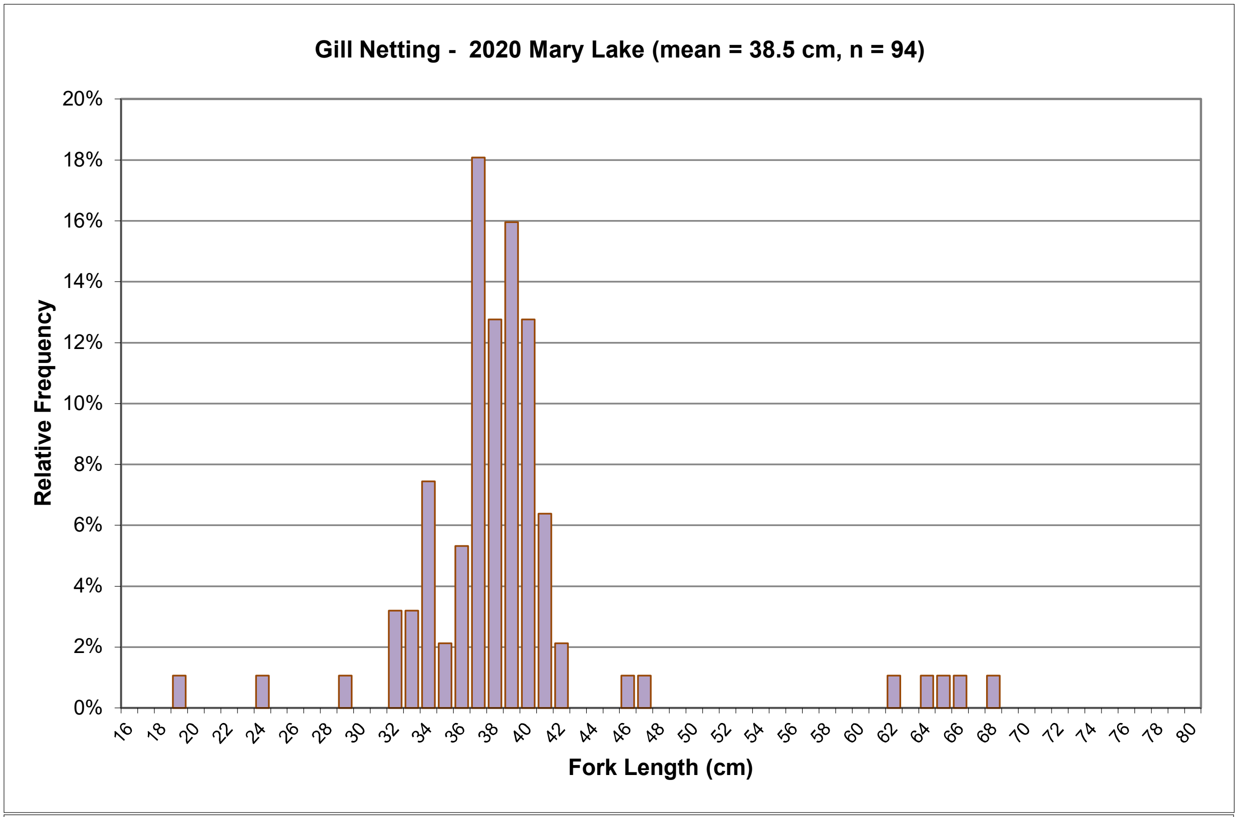


Figure G.20: Comparison of Condition (Weight-at-fork-Length Relationship) for Arctic Charr Collected at the Nearshore Area of Mary Lake and Reference Lake 3 in August 2019 using Log-Transformed (a) and Untransformed (b) Data, Mary River Project 2020 CREMP



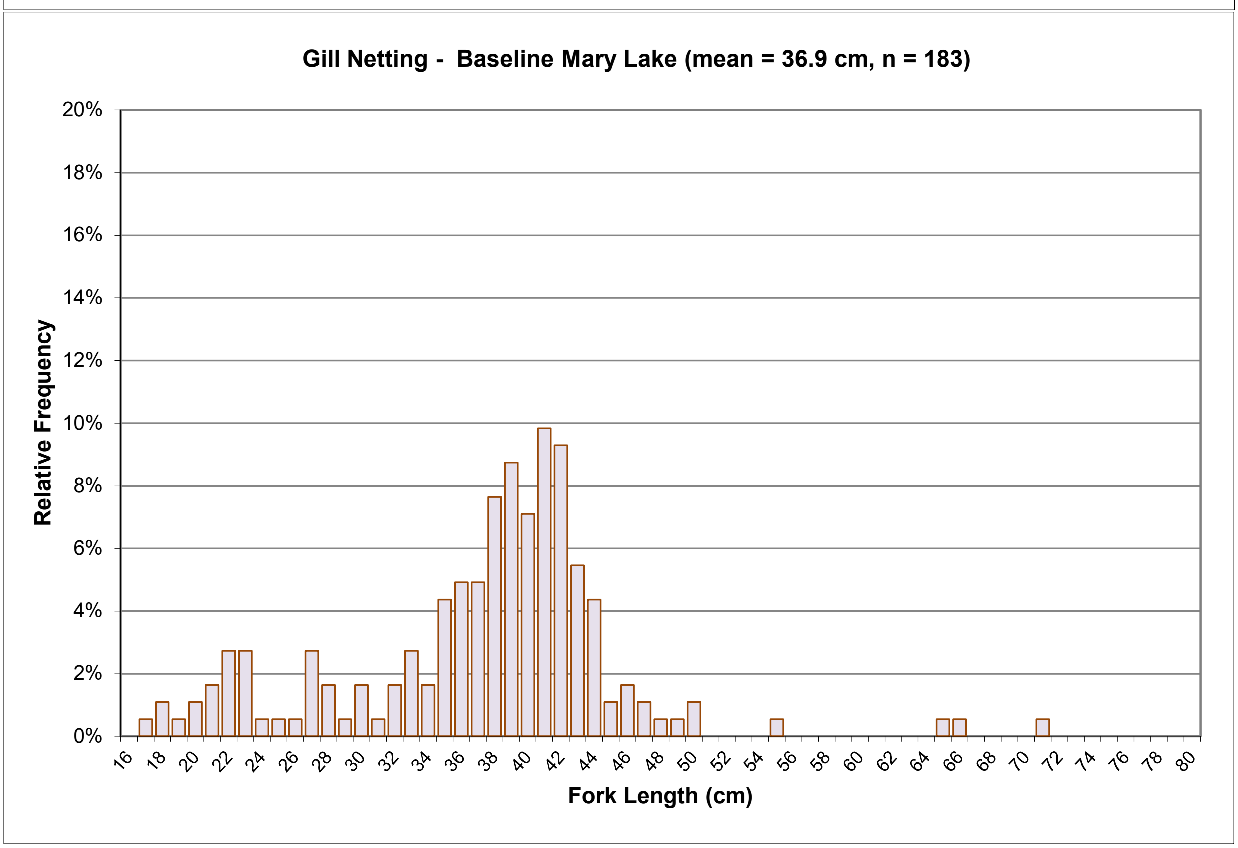
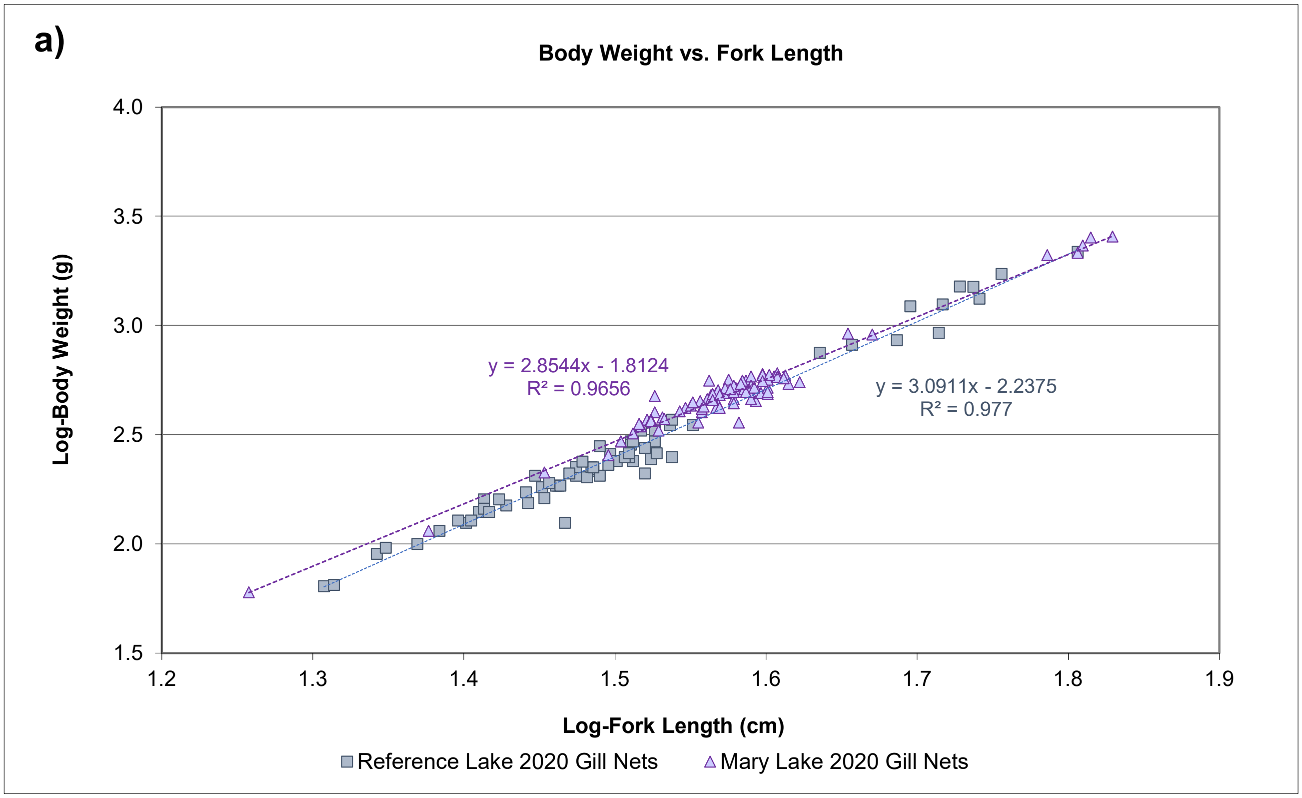


Figure G.21: Length-Frequency Distributions for Arctic Charr Captured by Gill Netting at Mary Lake (BLO) in 2020 and Baseline Studies Conducted in Fall



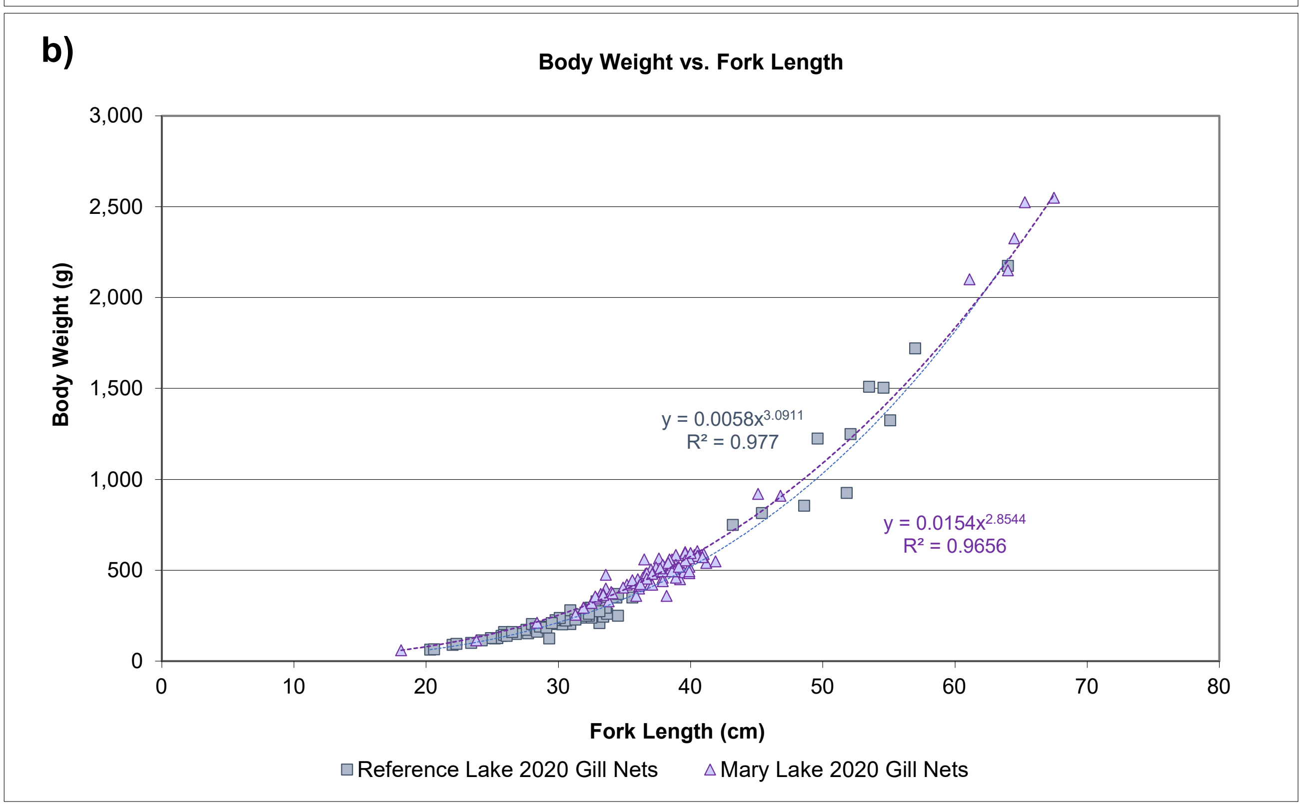


Figure G.22: Comparison of Condition (Weight-at-fork-length Relationship) for Arctic Charr Collected at Littoral/Profundal Areas of Mary Lake and Reference Lake 3 in August 2020 using Log-transformed (a) and Untransformed (b) Data

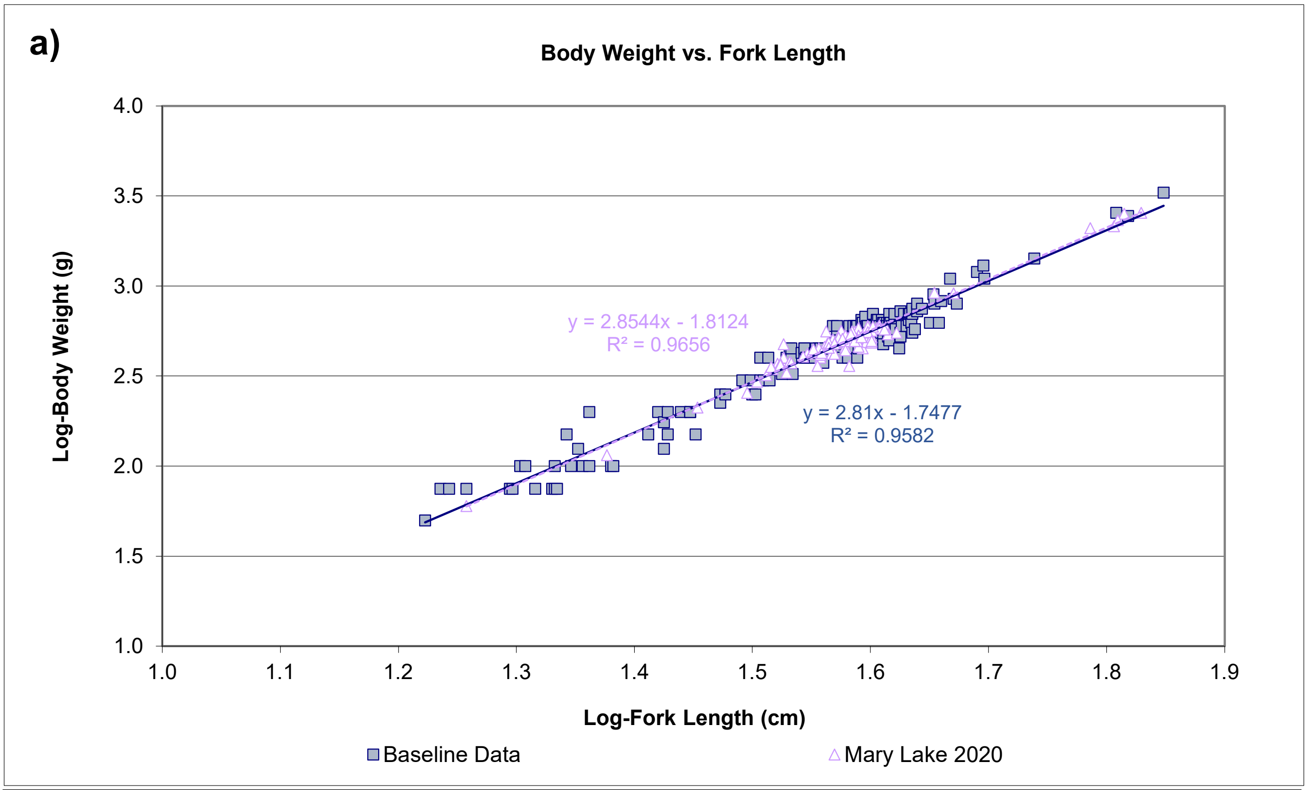


Figure G.23: Comparison of Condition (Weight-at-fork Length Relationship) for Arctic Charr Collected in Fall (August-September) at Mary Lake Nearshore Areas in 2020 and During the Mine Baseline Period (2006, 2007) using Log-transformed (a) and Untransformed (b) Data

Table G.1: Electrofishing Catch Records, Mary River Project CREMP, August 2020

Waterbody	Sample Station Identifier	Location (NAD83, UTM Zone 17W)				Fishing Date	Electrofisher Settings			No. of Passes	Effort (seconds)	Fish Species						Total (all species)	
		Start		Finish								Arctic Charr			Nine-spine Stickleback				
		Easting	Northing	Easting	Northing		Output Voltage (volts)	Cycle Freq. (Hz)	Duty Cycle (%)			No. Captured	No. Mortalities / Retained	CPUE	No. Captured	No. Mortalities / Retained	CPUE	Total Catch	CPUE
Reference Lake 3	REF3-20-EF-1	574891	7853038	575033	7853053	14-Aug-20	500	30	12	1	3,845	134	11	2.09	1	0	0.02	135	2.11
Camp Lake	JLO-20-EF-1	557802	7914653	557805	7914617	10-Aug-20	500	30	12	2	1,326	109	10	4.93	18	0	0.81	127	5.75
Sheardown Lake NW	DL01-20-EF-1	560206	7913484	560309	7913475	10-Aug-20	500	30	12	1	1,588	118	10	4.46	6	0	0.23	124	4.69
Sheardown Lake SE	DL02-20-EF-1	560709	7912330	560725	7912310	11-Aug-20	500	30	12	1	1,611	115	10	4.28	63	0	2.35	178	6.63
Mary Lake	BLO-20-EF-1	555410	7905139	555481	7905040	11-Aug-20	500	30	12	1	2,091	105	10	3.01	26	0	0.75	131	3.76

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per electrofishing minute.

Table G.2: Gill Netting Catch Records for Reference Lake 3, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
REF3-20-GN-1A	574556	7853020	91.4	12-Aug-20	12-Aug-20	10:30	12:21	1.85	1.69	0	4	0	4	2.36
REF3-20-GN-1B	574556	7853020	91.4	12-Aug-20	12-Aug-20	12:37	14:16	1.65	1.51	0	2	0	2	1.33
REF3-20-GN-1C	574556	7853020	91.4	12-Aug-20	12-Aug-20	14:27	15:41	1.23	1.13	0	2	1	3	2.66
REF3-20-GN-1D	574556	7853020	91.4	12-Aug-20	12-Aug-20	15:57	17:46	1.82	1.66	1	3	1	5	3.01
REF3-20-GN-2A	574524	7853031	91.4	12-Aug-20	12-Aug-20	10:36	12:39	2.05	1.87	0	3	0	3	1.60
REF3-20-GN-2B	574524	7853031	91.4	12-Aug-20	12-Aug-20	12:51	14:07	1.27	1.16	1	0	0	1	0.863
REF3-20-GN-2C	574524	7853031	91.4	12-Aug-20	12-Aug-20	14:31	15:59	1.47	1.34	0	0	0	0	0
REF3-20-GN-2D	574524	7853031	91.4	12-Aug-20	12-Aug-20	16:07	18:01	1.90	1.74	0	2	1	3	1.73
REF3-20-GN-3A	573853	7852739	91.4	12-Aug-20	12-Aug-20	10:42	12:56	2.23	2.04	0	5	0	5	2.45
REF3-20-GN-3B	573853	7852739	91.4	12-Aug-20	12-Aug-20	13:12	14:37	1.42	1.30	1	0	0	1	0.772
REF3-20-GN-3C	573853	7852739	91.4	12-Aug-20	12-Aug-20	14:47	16:12	1.42	1.30	1	0	0	1	0.772
REF3-20-GN-3D	573853	7852739	91.4	12-Aug-20	12-Aug-20	16:23	17:32	1.15	1.05	0	0	0	0	0
REF3-20-GN-4A	574320	7853695	61.0	12-Aug-20	12-Aug-20	10:51	13:20	2.48	1.51	1	-	0	1	0.661
REF3-20-GN-4B	574320	7853695	61.0	12-Aug-20	12-Aug-20	13:25	15:00	1.58	0.965	0	-	0	0	0
REF3-20-GN-4C	574320	7853695	61.0	12-Aug-20	12-Aug-20	15:07	16:28	1.35	0.823	0	-	0	0	0
REF3-20-GN-4D	574320	7853695	61.0	12-Aug-20	12-Aug-20	16:33	17:05	0.53	0.325	0	-	0	0	0
REF3-20-GN-5A	574259	7853606	91.4	12-Aug-20	12-Aug-20	10:56	13:28	2.53	2.32	3	4	0	7	3.02
REF3-20-GN-5B	574259	7853606	91.4	12-Aug-20	12-Aug-20	13:47	15:08	1.35	1.23	0	0	0	0	0

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.2: Gill Netting Catch Records for Reference Lake 3, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
REF3-20-GN-5C	574259	7853606	91.4	12-Aug-20	12-Aug-20	15:21	16:52	1.52	1.39	1	1	0	2	1.44
REF3-20-GN-6A	573984	7853562	91.4	12-Aug-20	12-Aug-20	11:05	13:57	2.87	2.62	0	0	1	1	0.381
REF3-20-GN-6B	573984	7853562	91.4	12-Aug-20	12-Aug-20	13:59	15:25	1.43	1.31	0	1	0	1	0.763
REF3-20-GN-6C	573984	7853562	91.4	12-Aug-20	12-Aug-20	15:35	17:05	1.50	1.37	1	2	0	3	2.19
REF3-20-GN-7A	574568	7853018	91.4	14-Aug-20	14-Aug-20	10:31	11:41	1.17	1.07	1	1	0	2	1.87
REF3-20-GN-7B	574568	7853018	91.4	14-Aug-20	14-Aug-20	11:51	13:09	1.30	1.19	0	0	1	1	0.841
REF3-20-GN-7C	574568	7853018	91.4	14-Aug-20	14-Aug-20	13:20	15:00	1.67	1.52	0	0	0	0	0
REF3-20-GN-7D	574568	7853018	91.4	14-Aug-20	14-Aug-20	15:09	16:43	1.57	1.43	0	2	0	2	1.40
REF3-20-GN-7E	574568	7853018	91.4	14-Aug-20	14-Aug-20	16:55	17:55	1.00	0.914	0	0	0	0	0
REF3-20-GN-8A	574532	7853048	61.0	14-Aug-20	14-Aug-20	10:35	11:53	1.30	0.792	0	-	0	0	0
REF3-20-GN-8B	574532	7853048	61.0	14-Aug-20	14-Aug-20	12:01	13:24	1.38	0.843	0	-	0	0	0
REF3-20-GN-8C	574532	7853048	91.4	14-Aug-20	14-Aug-20	14:56	16:56	2.00	1.83	0	0	0	0	0
REF3-20-GN-8D	574532	7853048	91.4	14-Aug-20	14-Aug-20	17:08	18:02	0.90	0.823	0	0	0	0	0
REF3-20-GN-9A	573788	7852693	91.4	14-Aug-20	14-Aug-20	10:43	12:07	1.40	1.28	0	0	0	0	0
REF3-20-GN-9B	573788	7852693	91.4	14-Aug-20	14-Aug-20	12:15	13:40	1.42	1.30	0	4	1	5	3.86
REF3-20-GN-9C	573788	7852693	91.4	14-Aug-20	14-Aug-20	13:57	15:25	1.47	1.34	0	1	0	1	0.746
REF3-20-GN-9D	573788	7852693	91.4	14-Aug-20	14-Aug-20	15:33	17:14	1.68	1.54	0	2	0	2	1.30
REF3-20-GN-10A	574293	7853675	91.4	14-Aug-20	14-Aug-20	10:52	12:19	1.45	1.33	0	0	0	0	0
REF3-20-GN-10B	574293	7853675	91.4	14-Aug-20	14-Aug-20	12:28	14:04	1.60	1.46	0	0	0	0	0

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.2: Gill Netting Catch Records for Reference Lake 3, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
REF3-20-GN-10C	574293	7853675	61.0	14-Aug-20	14-Aug-20	14:10	15:52	1.70	1.04	0	-	0	0	0
REF3-20-GN-10D	574293	7853675	61.0	14-Aug-20	14-Aug-20	16:03	17:27	1.40	0.853	0	-	0	0	0
REF3-20-GN-11A	574205	7853558	91.4	14-Aug-20	14-Aug-20	11:00	12:31	1.52	1.39	0	0	0	0	0
REF3-20-GN-11B	574205	7853558	91.4	14-Aug-20	14-Aug-20	12:38	14:12	1.57	1.43	0	3	1	4	2.79
REF3-20-GN-11C	574205	7853558	91.4	14-Aug-20	14-Aug-20	14:32	16:05	1.55	1.42	0	3	0	3	2.12
REF3-20-GN-11D	574205	7853558	91.4	14-Aug-20	14-Aug-20	16:23	17:33	1.17	1.07	0	0	0	0	0
REF3-20-GN-12A	574050	7853557	91.4	14-Aug-20	14-Aug-20	11:05	12:50	1.75	1.60	0	0	1	1	0.625
REF3-20-GN-12B	574050	7853557	91.4	14-Aug-20	14-Aug-20	13:02	14:36	1.57	1.43	0	2	0	2	1.40
REF3-20-GN-12C	574050	7853557	91.4	14-Aug-20	14-Aug-20	14:46	16:26	1.67	1.52	1	2	0	3	1.97
REF3-20-GN-12D	574050	7853557	91.4	14-Aug-20	14-Aug-20	16:39	17:40	1.02	0.930	0	0	0	0	0
								Total	**63.0**	**12**	**49**	**8**	**69**	**0.956**

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.3: Summary of Arctic Charr Gill Net Catches by Mesh Size, Mary River Project CREMP, August 2020

Waterbody	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE	Mortalities
		1½"	2"	3"			
Reference Lake 3	63.0	12	49	8	69	0.956	16
Camp Lake	6.35	13	35	46	94	14.8	18
Sheardown Lake NW	30.4	17	56	25	98	3.34	21
Sheardown Lake SE	28.3	20	42	45	107	3.81	27
Mary Lake	21.4	14	41	39	94	4.60	18
Total	**149.5**	**76**	**223**	**163**	**462**	**5.50**	**100**

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.4: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
REF3-20-ACJ-01	6.6	7.1	2.374	-	0.826
REF3-20-ACJ-02	6.9	7.3	2.497	-	0.760
REF3-20-ACJ-03	7.7	8.2	3.548	-	0.777
REF3-20-ACJ-04	7.7	8.2	3.514	-	0.770
REF3-20-ACJ-05	3.8	3.9	0.464	-	0.846
REF3-20-ACJ-06	3.8	3.9	0.474	-	0.864
REF3-20-ACJ-07	3.5	3.6	0.330	-	0.770
REF3-20-ACJ-08	3.8	3.9	0.433	-	0.789
REF3-20-ACJ-09	5.3	5.5	1.207	-	0.811
REF3-20-ACJ-10	3.1	3.2	0.234	-	0.785
REF3-20-ACJ-11	7.3	7.8	3.401	-	0.874
REF3-20-ACJ-12	7.5	8.1	3.411	-	0.809
REF3-20-ACJ-13	9.3	10.0	6.643	-	0.826
REF3-20-ACJ-14	9.3	10.1	6.740	-	0.838
REF3-20-ACJ-15	3.6	3.7	0.361	-	0.774
REF3-20-ACJ-16	6.2	6.6	2.306	-	0.968
REF3-20-ACJ-17	8.5	9.3	5.120	-	0.834
REF3-20-ACJ-18	8.5	9.1	4.955	-	0.807
REF3-20-ACJ-19	9.3	10.0	7.018	-	0.872
REF3-20-ACJ-20	7.8	8.4	3.618	-	0.762
REF3-20-ACJ-21	3.5	3.6	0.329	-	0.767
REF3-20-ACJ-22	5.5	5.8	1.566	-	0.941
REF3-20-ACJ-23	8.1	8.8	4.593	-	0.864
REF3-20-ACJ-24	8.7	9.3	5.003	-	0.760
REF3-20-ACJ-25	7.6	8.2	3.825	-	0.871
REF3-20-ACJ-26	7.3	7.9	3.225	-	0.829
REF3-20-ACJ-27	3.6	3.7	0.420	0	0.900
REF3-20-ACJ-28	3.2	3.3	0.265	0	0.809
REF3-20-ACJ-29	5.2	5.4	1.146	1	0.815
REF3-20-ACJ-30	6.1	6.5	1.722	1	0.759
REF3-20-ACJ-31	7.6	8.1	3.387	2	0.772
REF3-20-ACJ-32	7.8	8.4	4.526	3	0.954
REF3-20-ACJ-33	7.6	8.1	3.534	2	0.805
REF3-20-ACJ-34	8.4	9.0	5.972	3	1.008
REF3-20-ACJ-35	10.8	11.7	9.803	3	0.778
REF3-20-ACJ-36	16.0	17.3	38.457	6	0.939
REF3-20-ACJ-37	3.3	3.4	0.249	-	0.693
REF3-20-ACJ-38	7.9	8.6	4.419	-	0.896
REF3-20-ACJ-39	7.8	8.3	3.971	-	0.837
REF3-20-ACJ-40	17.5	19.0	46.623	-	0.870
REF3-20-ACJ-41	6.8	7.3	2.607	-	0.829
REF3-20-ACJ-42	6.5	7.0	2.305	-	0.839
REF3-20-ACJ-43	3.6	3.7	0.383	-	0.821
REF3-20-ACJ-44	7.1	7.6	2.950	-	0.824
REF3-20-ACJ-45	4.3	4.4	0.555	-	0.698
REF3-20-ACJ-46	5.7	6.0	1.667	-	0.900
REF3-20-ACJ-47	8.8	9.5	5.587	-	0.820
REF3-20-ACJ-48	6.5	7.0	2.306	-	0.840
REF3-20-ACJ-49	7.5	8.0	3.624	-	0.859

Note: "-" indicates measurement not taken or no comment.

Table G.4: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
REF3-20-ACJ-50	9.7	10.4	7.506	-	0.822
REF3-20-ACJ-51	6.9	7.4	2.715	-	0.826
REF3-20-ACJ-52	6.1	6.4	1.876	-	0.827
REF3-20-ACJ-53	6.8	7.3	2.589	-	0.823
REF3-20-ACJ-54	3.2	3.3	0.250	-	0.763
REF3-20-ACJ-55	3.8	4.0	0.596	-	1.086
REF3-20-ACJ-56	3.3	3.4	0.276	-	0.768
REF3-20-ACJ-57	7.8	8.3	4.133	-	0.871
REF3-20-ACJ-58	5.3	5.6	1.171	-	0.787
REF3-20-ACJ-59	8.2	8.8	5.716	-	1.037
REF3-20-ACJ-60	6.0	6.4	1.785	-	0.826
REF3-20-ACJ-61	8.0	8.6	4.441	-	0.867
REF3-20-ACJ-62	3.8	3.9	0.418	-	0.762
REF3-20-ACJ-63	6.6	7.0	2.491	-	0.866
REF3-20-ACJ-64	4.3	4.5	0.710	-	0.893
REF3-20-ACJ-65	9.0	9.7	5.839	-	0.801
REF3-20-ACJ-66	10.4	11.2	8.930	-	0.794
REF3-20-ACJ-67	6.5	6.9	2.319	-	0.844
REF3-20-ACJ-68	5.7	6.1	1.842	-	0.995
REF3-20-ACJ-69	7.2	7.7	2.869	-	0.769
REF3-20-ACJ-70	9.4	10.1	6.535	-	0.787
REF3-20-ACJ-71	7.5	8.2	3.360	-	0.796
REF3-20-ACJ-72	13.3	14.2	21.380	-	0.909
REF3-20-ACJ-73	3.7	3.8	0.389	-	0.768
REF3-20-ACJ-74	6.9	7.4	2.580	-	0.785
REF3-20-ACJ-75	6.7	7.2	2.377	-	0.790
REF3-20-ACJ-76	7.8	8.3	3.865	-	0.814
REF3-20-ACJ-77	7.1	7.5	2.568	-	0.717
REF3-20-ACJ-78	8.6	9.1	5.214	-	0.820
REF3-20-ACJ-79	8.0	8.6	4.073	-	0.796
REF3-20-ACJ-80	9.3	9.9	5.988	-	0.744
REF3-20-ACJ-81	9.2	9.9	6.163	-	0.791
REF3-20-ACJ-82	7.3	7.8	3.094	-	0.795
REF3-20-ACJ-83	7.7	8.2	3.463	-	0.759
REF3-20-ACJ-84	3.8	3.9	0.408	-	0.744
REF3-20-ACJ-85	5.7	6.0	1.641	-	0.886
REF3-20-ACJ-86	7.4	7.9	3.226	-	0.796
REF3-20-ACJ-87	10.5	11.3	9.575	-	0.827
REF3-20-ACJ-88	7.7	8.2	3.765	-	0.825
REF3-20-ACJ-89	8.0	8.6	3.992	-	0.780
REF3-20-ACJ-90	7.1	7.6	2.688	-	0.751
REF3-20-ACJ-91	6.7	7.1	2.332	-	0.775
REF3-20-ACJ-92	6.4	6.8	2.195	-	0.837
REF3-20-ACJ-93	10.4	11.2	8.924	-	0.793
REF3-20-ACJ-94	11.6	12.5	12.139	-	0.778
REF3-20-ACJ-95	9.7	10.4	7.013	-	0.768
REF3-20-ACJ-96	9.5	10.2	6.383	-	0.744
REF3-20-ACJ-97	8.0	8.5	4.064	-	0.794
REF3-20-ACJ-98	3.2	3.3	0.232	-	0.708
REF3-20-ACJ-99	3.5	3.6	0.373	-	0.870
REF3-20-ACJ-100	5.7	6.0	1.405	1	0.759

Note: "-" indicates measurement not taken or no comment.

Table G.4: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
Overall Catch Summary	Sample Size (N)	100	100	100	11	100
	Average	7.1	7.5	4.235	2.0	0.822
	Median	7.3	7.8	3.022	2.0	0.813
	Standard Deviation	2.6	2.8	6.318	1.7	0.069
	Standard Error	0.26	0.28	0.632	0.52	0.007
	Minimum	3.1	3.2	0.232	0	0.693
	Maximum	17.5	19.0	46.623	6	1.086
Young-of-the-Year Catch Summary	proportion of YOY	**21%**				
	Sample Size (N)	21	21	21	2	21
	Average	3.6	3.7	0.388	0	0.804
	Median	3.6	3.7	0.383	0	0.774
	Standard Deviation	0.3	0.3	0.125	-	0.088
	Standard Error	0.1	0.1	0.027	-	0.019
	Minimum	3.1	3.2	0.232	0	0.693
	Maximum	4.3	4.5	0.710	0	1.086

Note: "-" indicates measurement not taken or no comment.

Table G.5: Arctic Charr Measurements from Fish Captured at Camp Lake by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
JLO-20-ACJ-01	9.3	10.1	7.186	-	0.893
JLO-20-ACJ-02	4.3	4.5	0.729	-	0.917
JLO-20-ACJ-03	11.2	12.2	13.732	-	0.977
JLO-20-ACJ-04	13.0	14.0	16.986	-	0.773
JLO-20-ACJ-05	7.1	7.6	4.186	-	1.170
JLO-20-ACJ-06	8.5	9.2	5.197	-	0.846
JLO-20-ACJ-07	9.3	10.1	6.998	-	0.870
JLO-20-ACJ-08	9.8	10.5	8.531	-	0.906
JLO-20-ACJ-09	7.2	7.6	3.510	-	0.940
JLO-20-ACJ-10	7.8	8.3	4.064	-	0.856
JLO-20-ACJ-11	8.5	9.2	6.695	-	1.090
JLO-20-ACJ-12	8.3	8.8	4.908	-	0.858
JLO-20-ACJ-13	8.2	8.9	5.841	-	1.059
JLO-20-ACJ-14	11.1	12.0	12.446	-	0.910
JLO-20-ACJ-15	7.1	7.5	2.833	-	0.792
JLO-20-ACJ-16	7.9	8.4	4.044	-	0.820
JLO-20-ACJ-17	9.8	10.5	7.502	-	0.797
JLO-20-ACJ-18	7.5	8.1	3.902	-	0.925
JLO-20-ACJ-19	9.5	10.3	8.743	-	1.020
JLO-20-ACJ-20	12.8	13.9	17.405	-	0.830
JLO-20-ACJ-21	9.6	10.3	7.735	-	0.874
JLO-20-ACJ-22	9.8	10.5	8.475	-	0.900
JLO-20-ACJ-23	8.0	8.5	4.253	-	0.831
JLO-20-ACJ-24	10.3	11.1	9.037	2	0.827
JLO-20-ACJ-25	10.9	11.8	11.322	2	0.874
JLO-20-ACJ-26	9.1	9.7	5.705	-	0.757
JLO-20-ACJ-27	9.9	10.7	8.577	-	0.884
JLO-20-ACJ-28	7.7	8.2	4.786	-	1.048
JLO-20-ACJ-29	7.8	8.3	4.034	-	0.850
JLO-20-ACJ-30	10.1	10.8	7.973	-	0.774
JLO-20-ACJ-31	7.0	7.4	2.895	-	0.844
JLO-20-ACJ-32	8.5	9.2	5.711	-	0.930
JLO-20-ACJ-33	10.7	11.5	9.929	-	0.811
JLO-20-ACJ-34	7.2	7.7	3.296	-	0.883
JLO-20-ACJ-35	7.2	7.6	3.315	-	0.888
JLO-20-ACJ-36	10.6	11.5	11.713	-	0.983
JLO-20-ACJ-37	7.5	8.1	3.810	-	0.903
JLO-20-ACJ-38	7.4	7.8	2.906	-	0.717
JLO-20-ACJ-39	8.1	8.6	4.490	-	0.845
JLO-20-ACJ-40	5.8	6.1	1.664	-	0.853
JLO-20-ACJ-41	7.4	7.9	3.868	-	0.955
JLO-20-ACJ-42	7.6	8.2	3.534	-	0.805
JLO-20-ACJ-43	7.8	8.4	4.740	-	0.999
JLO-20-ACJ-44	8.8	9.4	6.283	-	0.922
JLO-20-ACJ-45	10.4	11.2	9.964	-	0.886
JLO-20-ACJ-46	6.7	7.2	3.416	-	1.136
JLO-20-ACJ-47	6.4	6.7	2.324	-	0.887
JLO-20-ACJ-48	11.8	12.7	14.093	-	0.858

Note: "-" indicates measurement not taken or no comment.

Table G.5: Arctic Charr Measurements from Fish Captured at Camp Lake by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
JLO-20-ACJ-49	9.2	9.8	7.143	-	0.917
JLO-20-ACJ-50	8.6	9.2	6.426	-	1.010
JLO-20-ACJ-51	6.3	6.6	2.045	1	0.818
JLO-20-ACJ-52	16.3	18.2	37.810	4	0.873
JLO-20-ACJ-53	8.9	9.5	5.688	-	0.807
JLO-20-ACJ-54	8.3	8.9	4.819	-	0.843
JLO-20-ACJ-55	8.6	9.1	5.014	-	0.788
JLO-20-ACJ-56	9.6	10.3	7.905	-	0.893
JLO-20-ACJ-57	6.6	7.0	2.557	-	0.889
JLO-20-ACJ-58	3.8	4.0	0.448	-	0.816
JLO-20-ACJ-59	7.3	7.7	3.275	-	0.842
JLO-20-ACJ-60	10.7	11.5	11.206	-	0.915
JLO-20-ACJ-61	8.3	8.8	5.126	-	0.896
JLO-20-ACJ-62	6.4	6.8	2.429	-	0.927
JLO-20-ACJ-63	8.2	8.6	4.046	-	0.734
JLO-20-ACJ-64	14.7	15.9	25.966	-	0.817
JLO-20-ACJ-65	12.5	13.6	16.247	-	0.832
JLO-20-ACJ-66	8.4	8.9	5.073	-	0.856
JLO-20-ACJ-67	7.5	8.0	5.612	-	1.33
JLO-20-ACJ-68	8.2	8.7	4.992	-	0.905
JLO-20-ACJ-69	8.4	9.0	4.766	-	0.804
JLO-20-ACJ-70	7.5	8.0	4.079	-	0.967
JLO-20-ACJ-71	6.5	7.0	2.307	-	0.840
JLO-20-ACJ-72	7.9	8.4	4.366	-	0.886
JLO-20-ACJ-73	11.2	12.1	12.801	-	0.911
JLO-20-ACJ-74	12.3	13.3	18.347	3	0.986
JLO-20-ACJ-75	6.5	6.9	2.467	1	0.898
JLO-20-ACJ-76	8.0	8.5	4.587	1	0.896
JLO-20-ACJ-77	7.6	8.2	4.553	1	1.037
JLO-20-ACJ-78	10.5	11.3	8.709	3	0.752
JLO-20-ACJ-79	10.7	11.5	10.053	2	0.821
JLO-20-ACJ-80	6.5	6.8	2.660	-	0.969
JLO-20-ACJ-81	6.3	6.6	2.387	-	0.955
JLO-20-ACJ-82	8.3	8.8	4.620	-	0.808
JLO-20-ACJ-83	7.1	7.4	3.145	-	0.879
JLO-20-ACJ-84	13.1	14.2	18.222	-	0.811
JLO-20-ACJ-85	10.7	11.7	11.668	-	0.952
JLO-20-ACJ-86	7.3	7.8	3.259	-	0.838
JLO-20-ACJ-87	7.1	7.5	3.077	-	0.860
JLO-20-ACJ-88	8.2	8.8	5.174	-	0.938
JLO-20-ACJ-89	7.8	8.4	4.002	-	0.843
JLO-20-ACJ-90	8.7	9.3	5.544	-	0.842
JLO-20-ACJ-91	9.7	10.3	7.831	-	0.858
JLO-20-ACJ-92	7.9	8.5	4.623	-	0.938
JLO-20-ACJ-93	12.0	12.9	15.662	-	0.906
JLO-20-ACJ-94	8.7	9.3	5.680	-	0.863
JLO-20-ACJ-95	11.3	12.2	12.209	-	0.846
JLO-20-ACJ-96	8.2	8.7	4.572	-	0.829
JLO-20-ACJ-97	8.2	8.7	4.841	-	0.878
JLO-20-ACJ-98	11.6	12.6	13.096	-	0.839
JLO-20-ACJ-99	7.3	7.8	3.620	-	0.931
JLO-20-ACJ-100	12.4	13.2	15.353	-	0.805

Note: "-" indicates measurement not taken or no comment.

Table G.5: Arctic Charr Measurements from Fish Captured at Camp Lake by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
Overall Catch Summary	Sample Size (N)	100	100	100	10	100
	Average	8.8	9.5	7.074	2.0	0.889
	Median	8.3	8.9	5.044	2.0	0.876
	Standard Deviation	2.1	2.3	5.524	1.1	0.092
	Standard Error	0.21	0.23	0.552	0.33	0.009
	Minimum	3.8	4.0	0.448	1.0	0.717
	Maximum	16.3	18.2	37.810	4.0	1.330
Young-of-the-Year Catch Summary	proportion of YOY			**2%**		
	Sample Size (N)	2	2	2	0	2
	Average	0.0	0.0	0.000	0	0.000
	Median	0.0	0.0	0.000	0	0.000
	Standard Deviation	0.0	0.0	0.000	-	0.000
	Standard Error	0.0	0.0	0.000	-	0.000
	Minimum	3.8	4.0	0.448	0	0.816
	Maximum	4.3	4.5	0.729	0	0.917

Note: "-" indicates measurement not taken or no comment.

Table G.6: Results of Nearshore Arctic Charr Non-Young-of-the-Year (YOY) Health Endpoint Statistical Comparisons between Camp Lake (JLO) and Reference Lake 3 (REF), Mary River Project CREMP, August 2020

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	MOD (%)[c,d]
			Response	Covariate	REF	JLO		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF	JLO		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	100	K-S	-	-	-	-	-	-	<0.001	-
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	79	98	K-S	-	-	-	-	-	-	0.003	-
	Body Size	Fork Length	Fork Length (cm)	-	79	98	M-W	-	-	-	Median	7.70	8.30	<0.001	7.8
		Body Weight	Body Weight (g)	-	79	98	M-W	-	-	-	Median	3.55	5.10	<0.001	44
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	79	98	ANCOVA	0.110	<0.001	8.28	Adjusted Mean	4.66	5.03	<0.001	7.9
		Condition	log[Body Weight (g)]	log[Fork Length (cm)]	79	97[e]	ANCOVA	0.147	<0.001	8.28	Adjusted Mean	4.67	5.02	<0.001	7.4

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

Notes: YOY = young-of-year. MOD = magnitude of difference.

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the

[b] The median, mean (geometric mean for $\log_{10}$-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CFRDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

[e] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9884 and R^2 of parallel slope model = 0.9882; a difference < 0.02) following Environment Canada (2012).

[f] One outlier (JLO-20-ACJ-67, Stdnt resid: 4.474) removed from analysis.

[g] ANCOVA proceeded under the assumption that the slopes are practically parallel (R^2 of interaction model = 0.9894 and R^2 of parallel slope model = 0.9892; a difference < 0.02) following Environment Canada (2012).

Table G.7: Results of Nearshore Arctic Charr Non-Young-of-the-Year (Non-YOY) Health Endpoint Statistical Comparisons between Samples Collected in 2020 and the Baseline Period at Individual Mine-Exposed Lakes, Mary River Project 2020 CREMP

Lake	Group	Indicator	Endpoint	Variables: Response	Variables: Covariate	Sample Size: Baseline	Sample Size: 2020	Test	ANCOVA Model Statistics: Interaction Model – Interaction P-value	ANCOVA Model Statistics: Parallel Slope Model – Covariate P-value	ANCOVA Model Statistics: Covariate Value for Comparisons[a]	Summary Statistics[b]: Statistic	Summary Statistics[b]: Baseline	Summary Statistics[b]: 2020	Test P-value	Magnitude of Difference (%)[c,d]
Camp (JLO)	Non-YOY	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	51	98	K-S	-	-	-	-	-	-	<0.001	-
		Body Size	Fork Length	Fork Length (cm)	-	51	98	tunequal	-	-	-	Geometric Mean	11.2	8.72	<0.001	-22
			Body Weight	Body Weight(g)	-	51	98	tunequal	-	-	-	Geometric Mean	12.3	5.87	<0.001	-52
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	51	98	ANCOVA	0.39	<0.001	9.5	Adjusted Mean	7.66	7.51	0.302	-
			Condition	log[Body Weight (g)]	log[Fork Length (cm)]	51	97[e]	ANCOVA	0.254	<0.001	9.52	Adjusted Mean	7.69	7.52	0.220	-
Sheardown NW (DLO-01)	Non-YOY	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	244	85	K-S	-	-	-	-	-	-	<0.001	-
		Body Size	Fork Length	Fork Length (cm)	-	244	85	M-W	-	-	-	Median	8.30	9.40	0.074	13
			Body Weight	Body Weight (g)	-	244	85	M-W	-	-	-	Median	6.00	7.05	0.316	-
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	244	85	ANCOVA	0.921	<0.001	9.29	Adjusted Mean	7.91	7.23	<0.001	-8.6
Sheardown SE (DLO-02) [g]	Non-YOY	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	16	76	K-S	-	-	-	-	-	-	<0.001	-87
		Body Size	Fork Length	log[Fork Length (cm)]	-	16	76	M-W	-	-	-	Median	6.30	8.20	<0.001	30
			Body Weight	Body Weight(g)	-	16	76	M-W	-	-	-	Median	2.50	5.43	<0.001	117
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	16	76	ANCOVA	<0.001[f]	<0.001	8.09	Adjusted Mean	4.84	4.98	0.496	-
			Condition	log[Body Weight (g)]	log[Fork Length (cm)]	14[g]	76	ANCOVA	<0.001[h]	<0.001	8.16	Adjusted Mean	5.23	5.12	0.519	-

(Grey box) Area P-value < 0.1 or Interaction P-value < 0.05.

(Blue box) Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint).

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for log_{10}-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(2018 mean - baseline mean) / baseline area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(2018 predicted mean - baseline predicted mean) / baseline predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between groups. A negative difference implies that 2018 has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that 2017 has fewer fish less than the length where the maximum difference in CFRDs was observed.

[e] One outlier (JLO-20-ACJ-67, Stdnt resid: 4.277) removed from analysis.

[f] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9687 and R2 of parallel slope model = 0.9583; a difference < 0.02) following Environment Canada (2012).

[g] One outlier (SLSE-07-1 Stdnt resid:-4.398; SLSE-07-2 Stdnt resid: -4.398) removed from analysis.

[h] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9687 and R2 of parallel slope model = 0.9583; a difference < 0.02) following Environment Canada (2012).

Table G.8: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Camp Lake Using 2020 Data Relative to Reference Lake 3 Data (2020) or Camp Lake Baseline Data (2006 to 2013) with α=β=0.1, Mary River Project 2020 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test [a]	S[b]	COV (%)[c]	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1									
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%
									Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2020 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0941	25.4	Response	393	105	29	20	16	13	10	7	4
			Body Weight	Body Weight (g)	-	M-W	0.28	116	Response	3,469	910	250	167	122	101	75	53	19
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0378	-	log(Response)	57	17	6	5	4	4	4	4	3
			Condition[d]	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0355	-	log(Response)	50	15	6	5	4	4	4	3	3
Nearshore Arctic Charr (Electrofishing) 2020 versus Baseline	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	tunequal	0.110	-	Response	463	122	34	23	17	15	11	8	4
			Body Weight	Body Weight (g)	-	tunequal	0.319	-	Response	3,886	1,019	279	187	136	113	83	57	20
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0425	-	log(Response)	71	20	7	6	5	5	4	4	3
			Condition[d]	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0403	-	log(Response)	64	18	7	5	5	4	4	4	3
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2020 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0804	20.9	Response	288	77	22	16	12	10	7	5	4
			Body Weight	Body Weight (g)	-	M-W	0.246	83.1	Response	2,671	701	193	129	94	79	58	41	16
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0417	-	log(Response)	69	20	7	6	5	4	4	4	3
			Condition[d]	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0386	-	log(Response)	59	17	6	5	4	4	4	4	3
Littoral/Profundal Arctic Charr (Gill Netting) 2020 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0915	21.9	Response	371	98	26	17	12	11	7	6	4
			Body Weight	Body Weight (g)	-	M-W	0.277	99.1	Response	3,396	892	245	164	120	100	73	51	19
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0664	-	log(Response)	170	46	14	10	8	7	6	5	4

[a] Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log_{10}-transformed scales and the lowest sample size is reported.

[b] Pooled standard deviation of the regression residuals

[c] Coefficient of variation (pooled standard deviation/reference mean)×100%

[d] Outliers removed from analysis.

Table G.9: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
REF3-20-AC-01	REF3-GN-1A	2	33.1	35.1	210	-	0.579
REF3-20-AC-02	REF3-GN-1A	2	32.4	35.0	295	Mortality	0.867
REF3-20-AC-03	REF3-GN-1A	2	29.3	31.5	125	-	0.497
REF3-20-AC-04	REF3-GN-1A	2	33.4	36.4	245	-	0.658
REF3-20-AC-05	REF3-GN-2A	2	25.7	28.1	140	-	0.825
REF3-20-AC-06	REF3-GN-2A	2	29.0	31.2	185	-	0.759
REF3-20-AC-07	REF3-GN-2A	2	33.3	35.6	275	Mortality	0.745
REF3-20-AC-08	REF3-GN-3A	2	29.8	32.3	205	-	0.775
REF3-20-AC-09	REF3-GN-3A	2	30.6	33.0	215	Mortality	0.750
REF3-20-AC-10	REF3-GN-3A	2	25.2	27.4	125	Mortality	0.781
REF3-20-AC-11	REF3-GN-3A	2	30.6	33.3	220	-	0.768
REF3-20-AC-12	REF3-GN-3A	2	32.4	34.8	285	-	0.838
REF3-20-AC-13	REF3-GN-4A	1½	22.0	23.8	90	Mortality	0.845
REF3-20-AC-14	REF3-GN-5A	2	27.7	30.1	154	-	0.725
REF3-20-AC-15	REF3-GN-5A	2	27.6	30.0	172	-	0.818
REF3-20-AC-16	REF3-GN-5A	2	30.9	33.1	205	-	0.695
REF3-20-AC-17	REF3-GN-5A	2	30.3	32.6	202	Mortality	0.726
REF3-20-AC-18	REF3-GN-5A	1½	26.8	29.0	150	-	0.779
REF3-20-AC-19	REF3-GN-5A	1½	25.9	28.6	160	-	0.921
REF3-20-AC-20	REF3-GN-5A	1½	25.4	27.7	128	-	0.781
REF3-20-AC-21	REF3-GN-6A	3	57.0	60.5	1,720	Mortality	0.929
REF3-20-AC-22	REF3-GN-2B	1½	22.3	24.2	96	-	0.866
REF3-20-AC-23	REF3-GN-1B	2	28.0	30.4	205	-	0.934
REF3-20-AC-24	REF3-GN-1B	2	29.8	32.5	225	-	0.850
REF3-20-AC-25	REF3-GN-3B	1½	32.5	35.5	295	Mortality	0.859
REF3-20-AC-26	REF3-GN-6B	2	24.9	27.1	128	-	0.829
REF3-20-AC-27	REF3-GN-1C	3	43.2	46.5	750	Gill parasite	0.930
REF3-20-AC-28	REF3-GN-1C	2	33.7	36.3	260	-	0.679
REF3-20-AC-29	REF3-GN-1C	2	30.5	33.0	225	-	0.793
REF3-20-AC-30	REF3-GN-3C	1½	20.3	22.0	64	-	0.765
REF3-20-AC-31	REF3-GN-5C	2	34.5	39.4	250	-	0.609
REF3-20-AC-32	REF3-GN-5C	1½	28.9	30.4	185	-	0.766
REF3-20-AC-33	REF3-GN-6C	1½	45.4	48.5	815	-	0.871
REF3-20-AC-34	REF3-GN-6C	2	28.3	31.4	182	-	0.803
REF3-20-AC-35	REF3-GN-6C	2	28.4	30.7	162	Mortality	0.707
REF3-20-AC-36	REF3-GN-1D	3	53.5	57.5	1,510	-	0.986
REF3-20-AC-37	REF3-GN-1D	2	31.4	34.1	258	-	0.833
REF3-20-AC-38	REF3-GN-1D	2	28.6	31.2	190	-	0.812
REF3-20-AC-39	REF3-GN-1D	2	30.6	32.9	224	-	0.782
REF3-20-AC-40	REF3-GN-1D	1½	23.4	25.9	100	-	0.780
REF3-20-AC-41	REF3-GN-2D	3	48.6	51.5	855	-	0.745
REF3-20-AC-42	REF3-GN-2D	2	32.5	35.2	240	-	0.699
REF3-20-AC-43	REF3-GN-2D	2	33.6	36.1	330	Mortality	0.870
REF3-20-AC-44	REF3-GN-7A	2	35.6	38.5	350	-	0.776
REF3-20-AC-45	REF3-GN-7A	1½	52.1	55.2	1,250	-	0.884
REF3-20-AC-46	REF3-GN-12A	3	54.6	58.1	1,505	Mortality	0.925
REF3-20-AC-47	REF3-GN-7B	3	49.6	52.7	1,225	-	1.004

Note: "-" indicates measurement not taken or no comment.

Table G.9: Arctic Charr Measurements from Fish Captured at Reference Lake 3 by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
REF3-20-AC-48	REF3-GN-9B	2	32.9	35.7	330	-	0.927
REF3-20-AC-49	REF3-GN-9B	3	51.8	55.2	925	Mortality	0.666
REF3-20-AC-50	REF3-GN-9B	2	25.9	28.0	145	-	0.835
REF3-20-AC-51	REF3-GN-9B	2	33.6	36.2	295	-	0.778
REF3-20-AC-52	REF3-GN-9B	2	31.7	34.2	240	Mortality	0.753
REF3-20-AC-53	REF3-GN-11B	3	55.1	58.5	1,325	-	0.792
REF3-20-AC-54	REF3-GN-11B	2	64.0	68.4	2,175	-	0.830
REF3-20-AC-55	REF3-GN-11B	2	33.1	25.6	275	-	0.758
REF3-20-AC-56	REF3-GN-11B	2	34.4	37.1	350	Mortality	0.860
REF3-20-AC-57	REF3-GN-12B	2	30.9	33.2	280	-	0.949
REF3-20-AC-58	REF3-GN-12B	2	26.1	28.3	140	Mortality	0.787
REF3-20-AC-59	REF3-GN-9C	2	32.3	35.0	250	-	0.742
REF3-20-AC-60	REF3-GN-11C	2	32.1	34.9	250	-	0.756
REF3-20-AC-61	REF3-GN-11C	2	32.3	34.8	260	Caudal fin split at fork	0.772
REF3-20-AC-62	REF3-GN-11C	2	29.1	31.9	185	-	0.751
REF3-20-AC-63	REF3-GN-12C	2	26.5	28.7	160	-	0.860
REF3-20-AC-64	REF3-GN-12C	2	24.2	26.2	115	-	0.811
REF3-20-AC-65	REF3-GN-12C	1½	20.6	22.4	65	-	0.744
REF3-20-AC-66	REF3-GN-7D	2	34.5	38.7	370	Mortality	0.901
REF3-20-AC-67	REF3-GN-7D	2	30.1	32.6	238	-	0.873
REF3-20-AC-68	REF3-GN-9D	2	29.5	31.8	210	-	0.818
REF3-20-AC-69	REF3-GN-9D	2	31.3	33.8	230	-	0.750
Overall Catch Summary	**Sample Size (N)**		**69**	**69**	**69**	**-**	**69**
	Average		**33.1**	**35.6**	**380**	**-**	**0.799**
	Median		**30.9**	**33.1**	**225**	**-**	**0.787**
	Standard Deviation		**9.3**	**9.8**	**433**	**-**	**0.091**
	Standard Error		**1.1**	**1.2**	**52**	**-**	**0.011**
	Minimum		**20.3**	**22.0**	**64**	**-**	**0.497**
	Maximum		**64.0**	**68.4**	**2,175**	**-**	**1.004**

Note: "-" indicates measurement not taken or no comment.

Table G.10: Gill Netting Catch Records for Camp Lake, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
JLO-20-GN-01	557514	7914792	91.4	8-Aug-20	8-Aug-20	15:30	16:30	1.00	0.914	2	6	5	13	14.2
JLO-20-GN-02	557694	7914771	91.4	8-Aug-20	8-Aug-20	15:35	17:04	1.48	1.36	2	9	10	21	15.5
JLO-20-GN-03	557766	7914552	91.4	8-Aug-20	8-Aug-20	15:41	17:54	2.22	2.03	3	16	26	45	22.2
JLO-20-GN-04	557656	7914433	91.4	8-Aug-20	8-Aug-20	15:45	18:00	2.25	2.06	6	4	5	15	7.29
								Total	**6.35**	**13**	**35**	**46**	**94**	**14.8**

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.11: Arctic Charr Measurements from Fish Captured at Camp Lake by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
JLO-20-AC-01	JLO-GN-1	3	51.2	54.7	1,230	-	0.916
JLO-20-AC-02	JLO-GN-1	3	42.3	45.8	590	-	0.780
JLO-20-AC-03	JLO-GN-1	3	36.7	39.4	485	-	0.981
JLO-20-AC-04	JLO-GN-1	3	38.0	43.5	540	-	0.984
JLO-20-AC-05	JLO-GN-1	3	38.6	41.9	505	-	0.878
JLO-20-AC-06	JLO-GN-1	2	39.4	42.6	480	-	0.785
JLO-20-AC-07	JLO-GN-1	2	40.4	43.8	590	-	0.895
JLO-20-AC-08	JLO-GN-1	2	39.9	43.0	570	-	0.897
JLO-20-AC-09	JLO-GN-1	2	35.5	38.5	480	-	1.073
JLO-20-AC-10	JLO-GN-1	2	40.7	43.9	630	-	0.934
JLO-20-AC-11	JLO-GN-1	2	39.2	42.8	575	-	0.955
JLO-20-AC-12	JLO-GN-1	1½	38.4	41.7	500	-	0.883
JLO-20-AC-13	JLO-GN-1	1½	21.9	23.6	100	-	0.952
JLO-20-AC-14	JLO-GN-2	1½	39.0	43.2	505	-	0.851
JLO-20-AC-15	JLO-GN-2	1½	38.8	42.4	520	-	0.890
JLO-20-AC-16	JLO-GN-2	2	35.0	37.7	420	-	0.980
JLO-20-AC-17	JLO-GN-2	2	39.2	42.2	550	-	0.913
JLO-20-AC-18	JLO-GN-2	2	37.8	41.2	515	-	0.954
JLO-20-AC-19	JLO-GN-2	2	35.6	38.2	425	-	0.942
JLO-20-AC-20	JLO-GN-2	2	37.1	40.5	475	-	0.930
JLO-20-AC-21	JLO-GN-2	2	38.4	42.2	510	-	0.901
JLO-20-AC-22	JLO-GN-2	2	34.5	37.5	430	-	1.047
JLO-20-AC-23	JLO-GN-2	2	41.3	45.3	645	-	0.916
JLO-20-AC-24	JLO-GN-2	2	39.3	42.7	580	-	0.956
JLO-20-AC-25	JLO-GN-2	3	38.3	42.2	495	-	0.881
JLO-20-AC-26	JLO-GN-2	3	38.6	41.8	605	-	1.052
JLO-20-AC-27	JLO-GN-2	3	40.0	43.4	600	-	0.938
JLO-20-AC-28	JLO-GN-2	3	39.9	43.3	630	Tagged green NSC103986	0.992
JLO-20-AC-29	JLO-GN-2	3	35.1	38.4	470	-	1.087
JLO-20-AC-30	JLO-GN-2	3	39.5	43.1	550	-	0.892
JLO-20-AC-31	JLO-GN-2	3	39.5	43.1	585	-	0.949
JLO-20-AC-32	JLO-GN-2	3	36.8	40.5	480	-	0.963
JLO-20-AC-33	JLO-GN-2	3	38.0	41.4	560	-	1.021
JLO-20-AC-34	JLO-GN-2	3	39.2	42.9	550	-	0.913
JLO-20-AC-35	JLO-GN-3	1½	34.5	37.2	415	-	1.011
JLO-20-AC-36	JLO-GN-3	1½	26.4	28.7	192	-	1.043
JLO-20-AC-37	JLO-GN-3	1½	38.6	42.9	600	-	1.043
JLO-20-AC-38	JLO-GN-3	2	37.0	40.5	505	-	0.997
JLO-20-AC-39	JLO-GN-3	2	51.8	55.0	1,160	-	0.835
JLO-20-AC-40	JLO-GN-3	2	41.0	44.8	640	-	0.929
JLO-20-AC-41	JLO-GN-3	2	35.4	38.6	480	-	1.082
JLO-20-AC-42	JLO-GN-3	2	36.2	39.3	425	-	0.896
JLO-20-AC-43	JLO-GN-3	2	37.2	41.1	515	-	1.000
JLO-20-AC-44	JLO-GN-3	2	36.2	39.3	510	-	1.075
JLO-20-AC-45	JLO-GN-3	2	36.8	40.2	485	-	0.973
JLO-20-AC-46	JLO-GN-3	2	35.9	38.7	445	-	0.962
JLO-20-AC-47	JLO-GN-3	2	37.5	40.6	490	-	0.929
JLO-20-AC-48	JLO-GN-3	2	35.6	38.9	480	-	1.064
JLO-20-AC-49	JLO-GN-3	2	36.8	40.0	465	-	0.933
JLO-20-AC-50	JLO-GN-3	2	36.0	39.3	480	-	1.029
JLO-20-AC-51	JLO-GN-3	2	37.5	40.4	485	-	0.920
JLO-20-AC-52	JLO-GN-3	2	37.0	40.3	465	-	0.918

Note: "-" indicates measurement not taken or no comment.

Table G.11: Arctic Charr Measurements from Fish Captured at Camp Lake by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
JLO-20-AC-53	JLO-GN-3	2	36.5	40.1	455	-	0.936
JLO-20-AC-54	JLO-GN-3	3	42.5	46.2	680	-	0.886
JLO-20-AC-55	JLO-GN-3	3	40.8	44.3	700	-	1.031
JLO-20-AC-56	JLO-GN-3	3	38.2	41.7	515	-	0.924
JLO-20-AC-57	JLO-GN-3	3	37.0	39.8	460	-	0.908
JLO-20-AC-58	JLO-GN-3	3	38.7	42.4	545	-	0.940
JLO-20-AC-59	JLO-GN-3	3	37.3	40.4	510	-	0.983
JLO-20-AC-60	JLO-GN-3	3	34.0	37.1	420	-	1.069
JLO-20-AC-61	JLO-GN-3	3	39.2	42.6	610	-	1.013
JLO-20-AC-62	JLO-GN-3	3	39.5	42.6	540	-	0.876
JLO-20-AC-63	JLO-GN-3	3	38.7	42.8	525	-	0.906
JLO-20-AC-64	JLO-GN-3	3	52.0	59.6	1,040	-	0.740
JLO-20-AC-65	JLO-GN-3	3	38.5	42.0	545	-	0.955
JLO-20-AC-66	JLO-GN-3	3	39.2	43.0	530	-	0.880
JLO-20-AC-67	JLO-GN-3	3	36.6	40.0	460	-	0.938
JLO-20-AC-68	JLO-GN-3	3	38.2	41.4	565	-	1.014
JLO-20-AC-69	JLO-GN-3	3	36.1	39.2	455	-	0.967
JLO-20-AC-70	JLO-GN-3	3	35.8	38.9	450	Jaw broken	0.981
JLO-20-AC-71	JLO-GN-3	3	37.6	40.7	495	-	0.931
JLO-20-AC-72	JLO-GN-3	3	38.9	42.6	590	-	1.002
JLO-20-AC-73	JLO-GN-3	3	34.9	37.9	450	-	1.059
JLO-20-AC-74	JLO-GN-3	3	40.2	43.5	560	-	0.862
JLO-20-AC-75	JLO-GN-3	3	48.9	53.2	1,080	-	0.924
JLO-20-AC-76	JLO-GN-3	3	39.0	42.3	530	-	0.893
JLO-20-AC-77	JLO-GN-3	3	36.4	39.6	505	-	1.047
JLO-20-AC-78	JLO-GN-3	3	39.7	43.4	595	-	0.951
JLO-20-AC-79	JLO-GN-3	3	39.0	42.5	550	-	0.927
JLO-20-AC-80	JLO-GN-4	3	38.6	43.5	490	-	0.852
JLO-20-AC-81	JLO-GN-4	3	53.3	57.3	1,530	-	1.010
JLO-20-AC-82	JLO-GN-4	3	38.0	40.9	505	-	0.920
JLO-20-AC-83	JLO-GN-4	3	42.0	45.0	660	-	0.891
JLO-20-AC-84	JLO-GN-4	3	40.0	43.1	610	-	0.953
JLO-20-AC-85	JLO-GN-4	2	37.7	40.9	520	-	0.970
JLO-20-AC-86	JLO-GN-4	2	35.1	38.0	420	-	0.971
JLO-20-AC-87	JLO-GN-4	2	38.8	43.3	625	-	1.070
JLO-20-AC-88	JLO-GN-4	1½	41.5	45.3	665	-	0.930
JLO-20-AC-89	JLO-GN-4	2	36.5	39.7	490	-	1.008
JLO-20-AC-90	JLO-GN-4	1½	24.1	26.3	130	-	0.929
JLO-20-AC-91	JLO-GN-4	1½	38.4	42.6	500	-	0.883
JLO-20-AC-92	JLO-GN-4	1½	41.4	44.5	680	-	0.958
JLO-20-AC-93	JLO-GN-4	1½	38.5	42.4	550	-	0.964
JLO-20-AC-94	JLO-GN-4	1½	35.7	38.6	440	-	0.967
Overall Catch Summary	**Sample Size (N)**		**94**	**94**	**94**	**-**	**94**
	Average		**38.3**	**41.8**	**551**	**-**	**0.950**
	Median		**38.4**	**42.0**	**515**	**-**	**0.946**
	Standard Deviation		**4.4**	**4.8**	**188**	**-**	**0.068**
	Standard Error		**0.45**	**0.50**	**19**	**-**	**0.007**
	Minimum		**21.9**	**23.6**	**100**	**-**	**0.740**
	Maximum		**53.3**	**59.6**	**1,530**	**-**	**1.087**

Note: "-" indicates measurement not taken or no comment.

Table G.12: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2020 Camp Lake (JLO) and 2020 Reference Lake 3 (REF) Data, and for Camp Lake between 2020 and the Mine Baseline Period (2005 to 2013), Mary River Project 2020 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF 2020 or JLO Base	JLO 2020		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF 2020 or JLO Base	JLO 2020		
Camp Lake versus Reference Lake 3, 2020	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	69	94	K-S	-	-	-	-	-	-	<0.001	-
	Body Size	Fork Length	Fork Length (cm)	-	69	94	M-W	-	-	-	Median	30.9	38.4	<0.001	24
		Body Weight	Body Weight (g)	-	69	94	M-W	-	-	-	Median	225	515	<0.001	129
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	69	94	ANCOVA	<0.001[e]	<0.001	35.4	Adjusted Mean	352	420	<0.001	19
		Condition	log[Body Weight (g)]	log[Fork Length (cm)]	68[f]	94	ANCOVA	<0.001[g]	<0.001	35.4	Adjusted Mean	356	422	<0.001	18
Camp Lake 2020 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	131	94	K-S	-	-	-	-	-	-	<0.001	-
	Body Size	Fork Length	Fork Length (cm)	-	131	94	M-W	-	-	-	Median	32.3	38.4	<0.001	19
		Body Weight	Body Weight (g)	-	131	94	M-W	-	-	-	Median	350	515	<0.001	47
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	131	94	ANCOVA	0.163	<0.001	33.6	Adjusted Mean	364	361	0.725	-

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for log_{10}-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

[e] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9806 and R2 of parallel slope model = 0.9792; a difference < 0.02) following Environment Canada (2012).

[f] One outlier (REF3-20-AC-03 Stdnt resid: -5.42) was removed from the analysis.

[g] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9834 and R2 of parallel slope model = 0.982; a difference < 0.02) following Environment Canada (2012).

Table G.13: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO1-20-ACJ-01	4.6	4.8	0.846	-	0.869
DLO1-20-ACJ-02	8.7	9.4	6.086	-	0.924
DLO1-20-ACJ-03	3.6	3.9	0.378	-	0.810
DLO1-20-ACJ-04	9.3	10.1	6.937	-	0.862
DLO1-20-ACJ-05	3.6	3.8	0.404	-	0.866
DLO1-20-ACJ-06	8.0	8.6	5.002	-	0.977
DLO1-20-ACJ-07	11.7	12.6	15.090	-	0.942
DLO1-20-ACJ-08	10.4	11.2	9.541	-	0.848
DLO1-20-ACJ-09	7.5	7.9	4.201	-	0.996
DLO1-20-ACJ-10	3.4	3.6	0.355	-	0.903
DLO1-20-ACJ-11	8.7	9.3	5.961	-	0.905
DLO1-20-ACJ-12	7.8	8.3	3.871	-	0.816
DLO1-20-ACJ-13	7.7	8.2	4.450	-	0.975
DLO1-20-ACJ-14	4.5	4.7	0.872	-	0.957
DLO1-20-ACJ-15	11.6	12.5	12.792	-	0.820
DLO1-20-ACJ-16	3.5	3.6	0.351	-	0.819
DLO1-20-ACJ-17	8.7	9.3	6.246	-	0.949
DLO1-20-ACJ-18	3.5	3.6	0.380	-	0.886
DLO1-20-ACJ-19	7.9	8.5	4.402	-	0.893
DLO1-20-ACJ-20	11.4	12.3	13.568	-	0.916
DLO1-20-ACJ-21	7.9	8.4	4.313	-	0.875
DLO1-20-ACJ-22	8.8	9.3	6.146	-	0.902
DLO1-20-ACJ-23	8.1	8.6	4.077	-	0.767
DLO1-20-ACJ-24	9.7	10.4	7.574	-	0.830
DLO1-20-ACJ-25	9.9	10.7	8.083	-	0.833
DLO1-20-ACJ-26	7.2	7.6	4.003	-	1.072
DLO1-20-ACJ-27	6.2	6.6	2.580	-	1.083
DLO1-20-ACJ-28	9.4	10.0	6.832	-	0.823
DLO1-20-ACJ-29	9.3	9.9	8.018	-	0.997
DLO1-20-ACJ-30	3.9	4.1	0.570	-	0.961
DLO1-20-ACJ-31	4.1	4.3	0.659	-	0.956
DLO1-20-ACJ-32	9.5	10.1	7.012	-	0.818
DLO1-20-ACJ-33	9.0	9.7	7.049	-	0.967
DLO1-20-ACJ-34	7.8	8.4	4.345	-	0.916
DLO1-20-ACJ-35	8.9	9.7	7.711	-	1.094
DLO1-20-ACJ-36	11.2	12.0	13.525	-	0.963
DLO1-20-ACJ-37	10.5	11.2	9.821	-	0.848
DLO1-20-ACJ-38	3.4	3.5	0.297	-	0.756
DLO1-20-ACJ-39	3.9	4.1	0.527	-	0.888

Note: "-" indicates measurement not taken or no comment.

Table G.13: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO1-20-ACJ-40	11.3	12.1	13.146	-	0.911
DLO1-20-ACJ-41	7.5	8.2	3.661	-	0.868
DLO1-20-ACJ-42	8.3	8.8	5.322	-	0.931
DLO1-20-ACJ-43	4.8	5.0	1.181	-	1.068
DLO1-20-ACJ-44	6.5	6.8	2.470	-	0.899
DLO1-20-ACJ-45	4.6	4.8	0.862	-	0.886
DLO1-20-ACJ-46	7.9	8.5	4.548	-	0.922
DLO1-20-ACJ-47	9.0	9.7	6.408	-	0.879
DLO1-20-ACJ-48	9.4	10.0	6.905	-	0.831
DLO1-20-ACJ-49	10.5	11.2	9.789	-	0.846
DLO1-20-ACJ-50	8.2	8.7	5.365	-	0.973
DLO1-20-ACJ-51	7.9	8.4	4.912	1	0.996
DLO1-20-ACJ-52	7.3	7.9	3.852	1	0.990
DLO1-20-ACJ-53	7.0	7.4	2.932	1	0.855
DLO1-20-ACJ-54	9.9	10.7	7.688	2	0.792
DLO1-20-ACJ-55	10.2	11.2	10.960	2	1.033
DLO1-20-ACJ-56	12.9	14.0	18.496	4	0.862
DLO1-20-ACJ-57	11.5	12.3	13.339	4	0.877
DLO1-20-ACJ-58	11.7	12.6	14.005	3	0.874
DLO1-20-ACJ-59	15.5	16.7	35.893	4	0.964
DLO1-20-ACJ-60	18.1	19.5	48.450	7	0.817
DLO1-20-ACJ-61	9.7	10.3	7.779	-	0.852
DLO1-20-ACJ-62	7.7	8.2	4.041	-	0.885
DLO1-20-ACJ-63	7.0	7.5	3.726	-	1.086
DLO1-20-ACJ-64	7.9	8.4	4.725	-	0.958
DLO1-20-ACJ-65	9.7	10.4	8.076	-	0.885
DLO1-20-ACJ-66	10.6	11.4	9.587	-	0.805
DLO1-20-ACJ-67	14.0	15.3	28.142	-	1.026
DLO1-20-ACJ-68	16.5	17.7	38.846	-	0.865
DLO1-20-ACJ-69	9.9	10.6	7.934	-	0.818
DLO1-20-ACJ-70	11.2	12.1	11.861	-	0.844
DLO1-20-ACJ-71	2.7	2.8	0.146	-	0.742
DLO1-20-ACJ-72	7.2	7.7	3.448	-	0.924
DLO1-20-ACJ-73	7.7	8.2	4.062	-	0.890
DLO1-20-ACJ-74	16.7	18.0	40.241	-	0.864
DLO1-20-ACJ-75	10.1	10.9	8.970	-	0.871
DLO1-20-ACJ-76	8.1	8.6	4.241	-	0.798
DLO1-20-ACJ-77	12.8	13.8	17.240	-	0.822
DLO1-20-ACJ-78	9.8	10.5	9.389	-	0.998

Note: "-" indicates measurement not taken or no comment.

Table G.13: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO1-20-ACJ-79		9.7	10.5	8.959	-	0.982
DLO1-20-ACJ-80		4.0	4.2	0.570	-	0.891
DLO1-20-ACJ-81		7.3	7.8	3.598	-	0.925
DLO1-20-ACJ-82		7.8	8.3	4.148	-	0.874
DLO1-20-ACJ-83		14.9	16.3	27.709	-	0.838
DLO1-20-ACJ-84		7.8	8.3	3.976	-	0.838
DLO1-20-ACJ-85		8.7	9.3	5.436	-	0.826
DLO1-20-ACJ-86		9.8	10.4	9.015	-	0.958
DLO1-20-ACJ-87		15.8	17.2	35.652	-	0.904
DLO1-20-ACJ-88		9.4	10.1	7.207	-	0.868
DLO1-20-ACJ-89		12.5	13.6	21.609	-	1.106
DLO1-20-ACJ-90		7.8	8.3	4.004	-	0.844
DLO1-20-ACJ-91		17.9	19.6	54.993	-	0.959
DLO1-20-ACJ-92		7.2	7.6	3.313	-	0.888
DLO1-20-ACJ-93		6.3	6.7	2.087	-	0.835
DLO1-20-ACJ-94		10.5	11.5	12.259	-	1.059
DLO1-20-ACJ-95		9.0	9.6	6.038	-	0.828
DLO1-20-ACJ-96		9.8	10.6	8.714	-	0.926
DLO1-20-ACJ-97		11.1	12.0	11.346	-	0.830
DLO1-20-ACJ-98		8.6	9.3	5.571	-	0.876
DLO1-20-ACJ-99		10.3	11.1	9.832	-	0.900
DLO1-20-ACJ-100		9.7	10.3	7.492	-	0.821
Overall Catch Summary	Sample Size (N)	100	100	100	10	100
	Average	8.9	10	8.910	2.9	0.901
	Median	8.8	9.4	6.116	2.5	0.886
	Standard Deviation	3.2	3.5	10.121	1.9	0.079
	Standard Error	0.32	0.35	1.012	0.6	0.008
	Minimum	2.7	2.8	0.146	1.0	0.742
	Maximum	18.1	19.6	54.993	7.0	1.106
Young-of-the-Year Catch Summary	proportion of YOY			**15%**		
	Sample Size (N)	15	15	15	0	15
	Average	3.9	4.1	0.6	-	0.9
	Median	3.9	4.1	0.5	-	0.9
	Standard Deviation	0.6	0.6	0.3	-	0.1
	Standard Error	0.1	0.2	0.1	-	0.0
	Minimum	2.7	2.8	0.1	0.0	0.7
	Maximum	4.8	5.0	1.2	0.0	1.1

Note: "-" indicates measurement not taken or no comment.

Table G.14: Results of Nearshore Arctic Charr Non-Young-of-the-Year (YOY) Health Endpoint Statistical Comparisons between Sheardown Lake NW (DLO1) and Reference Lake 3 (REF), Mary River Project CREMP, August 2020

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF	DLO1		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF	DLO1		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	100	K-S	-	-	-	-	-	-	<0.001	-
YOY	Body Size	Fork Length	Fork Length (cm)	-	21	15	tunequal	-	-	-	Mean	3.60	3.87	0.119	-
YOY	Body Size	Body Weight	Body Weight (g)	-	21	15	tunequal	-	-	-	Mean	0.388	0.560	0.038	44
YOY	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	21	15	ANCOVA	0.534	<0.001	3.69	Adjusted Mean	0.406	0.435	0.030	7.2
YOY	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	20[e]	15	ANCOVA	0.217	<0.001	3.69	Adjusted Mean	0.399	0.435	0.002	9.0
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	79	85	K-S	-	-	-	-	-	-	<0.001	-
Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	79	85	M-W	-	-	-	Median	7.70	9.40	<0.001	22
Non-YOY	Body Size	Body Weight	Body Weight (g)	-	79	85	M-W	-	-	-	Median	3.55	7.05	<0.001	99
Non-YOY	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	79	85	ANCOVA	0.400	<0.001	8.62	Adjusted Mean	5.27	5.78	<0.001	9.7

(grey) Area P-value < 0.1 or Interaction P-value < 0.05.

(blue) Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint).

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for $\log_{10}$-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

[e] One outlier (REF3-20-ACJ-55, Stdnt resid: 4.179) removed from analysis.

Table G.15: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Sheardown Lake NW (DLO1) Using 2020 Data Relative to Reference Lake 3 Data (2020) or Sheardown Lake NW Baseline Data (2006 to 2013) with α=β=0.1, Mary River Project 2020 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test [a]	S[b]	COV (%)[c]	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1									
				Response	Covariate				log(Response)	5% / -5%	10% / -9%	20% / -17%	25% / -20%	30% / -23%	33% / -25%	40% / -29%	50% / -33%	100% / -50%
									Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2020 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.101	29.5	Response	452	120	34	24	18	14	11	9	4
			Body Weight	Body Weight (g)	-	M-W	0.302	167	Response	4,035	1,058	291	195	142	117	86	61	21
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0343	-	log(Response)	47	14	6	5	4	4	4	3	3
Nearshore Arctic Charr (Electrofishing) 2020 versus Baseline	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.164	40.2	Response	1,185	312	82	54	38	31	22	14	5
			Body Weight	Body Weight (g)	-	M-W	0.487	118	Response	10,483	2,748	690	443	307	249	174	112	29
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0675	-	log(Response)	176	48	15	11	8	7	6	5	4
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2020 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.105	28.6	Response	489	129	36	25	19	16	12	9	4
			Body Weight	Body Weight (g)	-	M-W	0.319	126	Response	4,497	1,180	323	217	158	131	97	66	24
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.046	-	log(Response)	83	23	8	6	5	5	4	4	3
			Condition[d]	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0416	-	log(Response)	68	20	7	6	5	4	4	4	3
Littoral/Profundal Arctic Charr (Gill Netting) 2020 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.105	25.0	Response	484	125	33	21	16	13	10	7	4
			Body Weight	Body Weight (g)	-	M-W	0.312	88.6	Response	4,286	1,124	308	207	150	125	92	64	18
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0537	-	log(Response)	112	31	10	8	6	6	5	4	3

[a] Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log $_{10}$-transformed scales and the lowest sample size is reported.

[b] Pooled standard deviation of the regression residuals

[c] Coefficient of variation (pooled standard deviation/reference mean)×100%

[d] Two outliers (DLO1-20-AC-67 Stdnt resid: 4.045 and REF3-20-AC-03 Stdnt resid: -4.707) were removed from the analysis.

Table G.16: Gill Netting Catch Records for Sheardown Lake NW, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
DLO1-20-GN-1A	559838	791360	91.4	9-Aug-20	9-Aug-20	12:17	13:35	1.30	1.19	0	2	0	2	1.68
DLO1-20-GN-1B	559838	791360	91.4	9-Aug-20	9-Aug-20	13:50	15:05	1.25	1.14	2	0	1	3	2.63
DLO1-20-GN-2A	559731	7913629	91.4	9-Aug-20	9-Aug-20	12:21	13:52	1.52	1.39	2	6	2	10	7.21
DLO1-20-GN-2B	559731	7913629	91.4	9-Aug-20	9-Aug-20	14:20	15:23	1.05	0.960	0	3	2	5	5.21
DLO1-20-GN-2C	559731	7913629	91.4	9-Aug-20	9-Aug-20	15:50	17:23	1.55	1.42	0	4	0	4	2.82
DLO1-20-GN-3A	559686	7913536	91.4	9-Aug-20	9-Aug-20	12:25	14:22	1.95	1.78	0	5	4	9	5.05
DLO1-20-GN-3B	559686	7913536	91.4	9-Aug-20	9-Aug-20	14:47	16:33	1.77	1.61	2	2	2	6	3.72
DLO1-20-GN-4	559794	7913269	91.4	9-Aug-20	9-Aug-20	12:36	14:50	2.23	2.04	0	2	0	2	0.980
DLO1-20-GN-5	559686	7913374	91.4	9-Aug-20	9-Aug-20	15:00	16:54	1.90	1.74	1	2	0	3	1.73
DLO1-20-GN-6	559735	7913671	91.4	9-Aug-20	9-Aug-20	15:21	17:08	1.78	1.63	0	5	1	6	3.68
DLO1-20-GN-7A	559830	7913679	91.4	11-Aug-20	11-Aug-20	9:28	10:33	1.08	0.991	1	2	0	3	3.03
DLO1-20-GN-7B	559830	7913679	91.4	11-Aug-20	11-Aug-20	10:46	12:26	1.67	1.52	2	0	0	2	1.31
DLO1-20-GN-8A	559776	7913622	91.4	11-Aug-20	11-Aug-20	9:37	10:49	1.20	1.10	2	5	6	13	11.9
DLO1-20-GN-8B	559776	7913622	91.4	11-Aug-20	11-Aug-20	11:40	12:57	1.28	1.17	1	1	1	3	2.56
DLO1-20-GN-8C	559776	7913622	91.4	11-Aug-20	11-Aug-20	13:10	14:38	1.47	1.34	0	3	0	3	2.24
DLO1-20-GN-8D	559776	7913622	91.4	11-Aug-20	11-Aug-20	14:50	15:38	0.80	0.731	0	1	0	1	1.37
DLO1-20-GN-9A	559755	7913540	91.4	11-Aug-20	11-Aug-20	9:49	11:40	1.85	1.69	0	3	1	4	2.37
DLO1-20-GN-9B	559755	7913540	91.4	11-Aug-20	11-Aug-20	11:52	13:11	1.32	1.20	0	2	0	2	1.66
DLO1-20-GN-9C	559755	7913540	91.4	11-Aug-20	11-Aug-20	13:20	14:53	1.55	1.42	0	2	1	3	2.12
DLO1-20-GN-10A	559676	7913367	91.4	11-Aug-20	11-Aug-20	9:54	11:55	2.02	1.84	0	3	2	5	2.71
DLO1-20-GN-10B	559676	7913367	91.4	11-Aug-20	11-Aug-20	12:13	13:24	1.18	1.08	4	0	1	5	4.62
DLO1-20-GN-10C	559676	7913367	91.4	11-Aug-20	11-Aug-20	13:42	15:12	1.50	1.37	0	3	1	4	2.92
								Total	**30.4**	**17**	**56**	**25**	**98**	**3.34**

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.17: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
DLO1-20-AC-01	DLO1-GN-1A	2	31.3	34.2	285	-	0.929
DLO1-20-AC-02	DLO1-GN-1A	2	31.8	34.4	285	Mortality	0.886
DLO1-20-AC-03	DLO1-GN-2A	3	54.3	58.5	1,280	-	0.799
DLO1-20-AC-04	DLO1-GN-2A	3	38.4	41.7	455	Very orange	0.804
DLO1-20-AC-05	DLO1-GN-2A	2	51.6	55.3	1,220	Gill parasites	0.888
DLO1-20-AC-06	DLO1-GN-2A	2	32.7	35.6	320	Mortality - upper caudal deformed	0.915
DLO1-20-AC-07	DLO1-GN-2A	2	36.1	39.0	425	-	0.903
DLO1-20-AC-08	DLO1-GN-2A	2	33.6	36.4	380	Mortality	1.002
DLO1-20-AC-09	DLO1-GN-2A	2	34.5	37.4	360	-	0.877
DLO1-20-AC-10	DLO1-GN-2A	2	56.1	60.1	1,680	-	0.952
DLO1-20-AC-11	DLO1-GN-2A	1½	31.8	34.9	285	-	0.886
DLO1-20-AC-12	DLO1-GN-2A	1½	19.0	20.7	60	-	0.875
DLO1-20-AC-13	DLO1-GN-3A	2	35.6	38.4	440	-	0.975
DLO1-20-AC-14	DLO1-GN-3A	2	49.8	53.4	980	-	0.793
DLO1-20-AC-15	DLO1-GN-3A	2	37.9	40.8	515	-	0.946
DLO1-20-AC-16	DLO1-GN-3A	2	33.5	36.4	330	-	0.878
DLO1-20-AC-17	DLO1-GN-3A	2	51.8	55.8	1,200	-	0.863
DLO1-20-AC-18	DLO1-GN-3A	3	62.0	66.4	1,560	-	0.655
DLO1-20-AC-19	DLO1-GN-3A	3	39.6	43.0	520	-	0.837
DLO1-20-AC-20	DLO1-GN-3A	3	39.5	43.2	510	-	0.828
DLO1-20-AC-21	DLO1-GN-3A	3	36.8	40.3	460	-	0.923
DLO1-20-AC-22	DLO1-GN-4	2	35.0	37.9	320	-	0.746
DLO1-20-AC-23	DLO1-GN-4	2	34.2	37.1	385	Mortality	0.962
DLO1-20-AC-24	DLO1-GN-1B	3	39.3	42.6	520	-	0.857
DLO1-20-AC-25	DLO1-GN-1B	1½	34.2	36.7	430	-	1.075
DLO1-20-AC-26	DLO1-GN-1B	1½	32.2	35.2	320	-	0.958
DLO1-20-AC-27	DLO1-GN-2B	3	52.9	56.3	1,080	-	0.730
DLO1-20-AC-28	DLO1-GN-2B	2	32.1	35.0	290	-	0.877
DLO1-20-AC-29	DLO1-GN-2B	3	39.8	43.0	510	-	0.809
DLO1-20-AC-30	DLO1-GN-2B	2	36.7	39.6	435	-	0.880
DLO1-20-AC-31	DLO1-GN-2B	2	38.6	42.1	555	-	0.965
DLO1-20-AC-32	DLO1-GN-3B	3	40.2	43.4	580	-	0.893
DLO1-20-AC-33	DLO1-GN-3B	3	34.9	37.9	390	-	0.917
DLO1-20-AC-34	DLO1-GN-3B	2	55.9	59.6	1,580	-	0.905
DLO1-20-AC-35	DLO1-GN-3B	2	34.4	37.5	390	Mortality	0.958
DLO1-20-AC-36	DLO1-GN-3B	1½	22.5	24.4	88	-	0.773
DLO1-20-AC-37	DLO1-GN-3B	1½	65.4	69.9	2,380	-	0.851
DLO1-20-AC-38	DLO1-GN-5	2	35.2	38.1	345	Mortality	0.791
DLO1-20-AC-39	DLO1-GN-5	2	34.9	37.6	340	Mortality	0.800
DLO1-20-AC-40	DLO1-GN-5	1½	35.9	38.6	410	-	0.886
DLO1-20-AC-41	DLO1-GN-6	3	32.5	35.6	325	-	0.947
DLO1-20-AC-42	DLO1-GN-6	2	29.5	32.3	235	-	0.915
DLO1-20-AC-43	DLO1-GN-6	2	39.5	42.9	545	-	0.884

Note: "-" indicates measurement not taken or no comment.

Table G.17: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
DLO1-20-AC-44	DLO1-GN-6	2	35.4	38.2	365	Mortality	0.823
DLO1-20-AC-45	DLO1-GN-6	2	35.5	38.6	420	Mortality	0.939
DLO1-20-AC-46	DLO1-GN-6	2	37.4	40.7	430	Mortality	0.822
DLO1-20-AC-47	DLO1-GN-2C	2	49.5	54.0	1,050	-	0.866
DLO1-20-AC-48	DLO1-GN-2C	2	36.5	39.5	430	-	0.884
DLO1-20-AC-49	DLO1-GN-2C	2	27.3	29.7	194	-	0.953
DLO1-20-AC-50	DLO1-GN-2C	2	33.6	36.8	365	-	0.962
DLO1-20-AC-51	DLO1-GN-7A	2	30.2	32.6	250	Top caudal fin damaged	0.908
DLO1-20-AC-52	DLO1-GN-7A	2	31.2	34.3	275	Mortality	0.905
DLO1-20-AC-53	DLO1-GN-7A	1½	23.4	25.5	135	-	1.054
DLO1-20-AC-54	DLO1-GN-8A	3	38.9	42.0	480	-	0.815
DLO1-20-AC-55	DLO1-GN-8A	3	36.1	38.9	490	-	1.042
DLO1-20-AC-56	DLO1-GN-8A	3	31.7	34.6	270	-	0.848
DLO1-20-AC-57	DLO1-GN-8A	3	62.0	66.0	2,010	-	0.843
DLO1-20-AC-58	DLO1-GN-8A	3	41.1	45.7	595	-	0.857
DLO1-20-AC-59	DLO1-GN-8A	3	56.4	60.7	1,545	-	0.861
DLO1-20-AC-60	DLO1-GN-8A	2	51.8	56.0	1,025	Mortality	0.737
DLO1-20-AC-61	DLO1-GN-8A	2	32.1	35.0	305	-	0.922
DLO1-20-AC-62	DLO1-GN-8A	2	40.5	44.4	636	Mortality	0.957
DLO1-20-AC-63	DLO1-GN-8A	2	31.0	34.0	255	-	0.856
DLO1-20-AC-64	DLO1-GN-8A	2	41.8	44.8	550	-	0.753
DLO1-20-AC-65	DLO1-GN-8A	1½	61.0	64.7	2,015	-	0.888
DLO1-20-AC-66	DLO1-GN-8A	1½	32.5	35.5	305	-	0.888
DLO1-20-AC-67	DLO1-GN-9A	2	54.2	68.3	2,010	-	1.262
DLO1-20-AC-68	DLO1-GN-9A	2	34.1	37.0	355	Mortality	0.895
DLO1-20-AC-69	DLO1-GN-9A	2	37.7	41.1	460	Lateral sides scratched	0.858
DLO1-20-AC-70	DLO1-GN-9A	3	40.9	45.1	545	-	0.797
DLO1-20-AC-71	DLO1-GN-10A	3	38.1	41.4	470	-	0.850
DLO1-20-AC-72	DLO1-GN-10A	3	37.9	41.1	460	-	0.845
DLO1-20-AC-73	DLO1-GN-10A	2	34.9	38.2	405	-	0.953
DLO1-20-AC-74	DLO1-GN-10A	2	33.1	35.9	305	Mortality, lateral sides scratched	0.841
DLO1-20-AC-75	DLO1-GN-10A	2	33.3	36.0	350	Mortality	0.948
DLO1-20-AC-76	DLO1-GN-7B	1½	41.5	44.5	695	-	0.972
DLO1-20-AC-77	DLO1-GN-7B	1½	36.5	39.5	400	-	0.823
DLO1-20-AC-78	DLO1-GN-8B	3	62.3	69.9	2,025	-	0.837
DLO1-20-AC-79	DLO1-GN-8B	2	36.2	39.4	430	Mortality	0.906
DLO1-20-AC-80	DLO1-GN-8B	1½	34.2	37.0	390	-	0.975
DLO1-20-AC-81	DLO1-GN-9B	2	39.1	42.1	540	-	0.903
DLO1-20-AC-82	DLO1-GN-9B	2	52.6	56.7	1,250	-	0.859
DLO1-20-AC-83	DLO1-GN-10B	1½	20.1	21.7	60	-	0.739
DLO1-20-AC-84	DLO1-GN-10B	1½	24.5	26.6	145	-	0.986
DLO1-20-AC-85	DLO1-GN-10B	1½	38.7	41.7	495	-	0.854
DLO1-20-AC-86	DLO1-GN-10B	1½	30.6	33.1	270	Mortality	0.942

Note: "-" indicates measurement not taken or no comment.

Table G.17: Arctic Charr Measurements from Fish Captured at Sheardown Lake NW by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
DLO1-20-AC-87	DLO1-GN-10B	3	43.9	47.9	715	-	0.845
DLO1-20-AC-88	DLO1-GN-8C	2	43.4	46.5	715	Lesion on left jaw	0.875
DLO1-20-AC-89	DLO1-GN-8C	2	57.4	60.0	2,106	-	1.114
DLO1-20-AC-90	DLO1-GN-8C	2	37.7	40.8	545	Mortality	1.017
DLO1-20-AC-91	DLO1-GN-9C	3	38.9	42.1	550	-	0.934
DLO1-20-AC-92	DLO1-GN-9C	2	33.6	36.6	340	Mortality	0.896
DLO1-20-AC-93	DLO1-GN-9C	2	53.2	56.7	1,300	-	0.863
DLO1-20-AC-94	DLO1-GN-10C	3	37.5	40.5	490	-	0.929
DLO1-20-AC-95	DLO1-GN-10C	2	38.1	41.0	450	-	0.814
DLO1-20-AC-96	DLO1-GN-10C	2	33.4	36.0	320	-	0.859
DLO1-20-AC-97	DLO1-GN-10C	2	37.3	40.2	505	Mortality	0.973
DLO1-20-AC-98	DLO1-GN-8D	2	34.1	37.1	340	-	0.857
Overall Catch Summary	**Sample Size (N)**		**98**	**98**	**98**	**-**	**98**
	Average		**39.0**	**42.3**	**621**	**-**	**0.890**
	Median		**36.6**	**39.6**	**438**	**-**	**0.885**
	Standard Deviation		**9.56**	**10.4**	**506**	**-**	**0.085**
	Standard Error		**0.965**	**1.05**	**51**	**-**	**0.009**
	Minimum		**19.0**	**20.7**	**60**	**-**	**0.655**
	Maximum		**65.4**	**69.9**	**2,380**	**-**	**1.262**

Note: "-" indicates measurement not taken or no comment.

Table G.18: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2020 Sheardown Lake NW (DLO1) and 2020 Reference Lake 3 (REF) Data, and for Sheardown Lake NW between 2020 and the Mine Baseline Period (2006 to 2013), Mary River Project 2020 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF 2020 or DLO1 Base	DLO1 2020		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF 2020 or DLO1 Base	DLO1 2020		
Sheardown Lake NW versus Reference Lake 3, 2020	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	69	98	K-S	-	-	-	-	-	-	<0.001	-
	Body Size	Fork Length	Fork Length (cm)	-	69	98	M-W	-	-	-	Median	30.9	36.6	<0.001	18
		Body Weight	Body Weight (g)	-	69	98	M-W	-	-	-	Median	225	438	<0.001	94
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	69	98	ANCOVA	0.032[e]	<0.001	35.4	Adjusted Mean	351	391	<0.001	12
		Condition	log[Body Weight (g)]	log[Fork Length (cm)]	68[f]	97[g]	ANCOVA	0.009[h]	<0.001	35.3	Adjusted Mean	351	389	<0.001	11
Sheardown Lake NW 2020 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	98	98	K-S	-	-	-	-	-	-	0.270	-
	Body Size	Fork Length	Fork Length (cm)	-	98	98	M-W	-	-	-	Median	35.8	36.6	0.174	-
		Body Weight	Body Weight (g)	-	98	98	M-W	-	-	-	Median	400	438	0.131	-
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	98	98	ANCOVA	0.818	<0.001	36.7	Adjusted Mean	428	439	0.160	-

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for $\log_{10}$-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CFRDs was observed.

[e] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9829 and R2 of parallel slope model = 0.9824; a difference < 0.02) following Environment Canada (2012).

[f] One outlier (REF3-20-AC-03 Stdnt resid: -4.707) was removed from the analysis.

[g] One outlier (DLO1-20-AC-67 Stdnt resid: 4.045) was removed from the analysis.

[h] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9829 and R2 of parallel slope model = 0.9824; a difference < 0.02) following Environment Canada (2012).

Table G.19: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO2-20-ACJ-01	4.2	4.4	0.685	-	0.925
DLO2-20-ACJ-02	4.3	4.5	0.901	-	1.133
DLO2-20-ACJ-03	7.7	8.2	4.064	-	0.890
DLO2-20-ACJ-04	4.7	4.9	0.942	-	0.907
DLO2-20-ACJ-05	7.2	7.6	3.403	-	0.912
DLO2-20-ACJ-06	14.1	15.4	22.644	5	0.808
DLO2-20-ACJ-07	9.1	9.9	7.282	-	0.966
DLO2-20-ACJ-08	8.6	9.2	5.606	-	0.881
DLO2-20-ACJ-09	8.1	8.7	4.791	-	0.902
DLO2-20-ACJ-10	7.9	8.4	4.118	-	0.835
DLO2-20-ACJ-11	9.0	9.7	7.466	-	1.024
DLO2-20-ACJ-12	7.9	8.5	5.209	-	1.057
DLO2-20-ACJ-13	8.2	8.9	5.031	-	0.912
DLO2-20-ACJ-14	8.1	8.7	5.241	-	0.986
DLO2-20-ACJ-15	8.4	8.9	5.496	-	0.927
DLO2-20-ACJ-16	8.0	8.5	4.501	-	0.879
DLO2-20-ACJ-17	8.6	9.2	5.900	-	0.928
DLO2-20-ACJ-18	7.5	7.9	4.037	-	0.957
DLO2-20-ACJ-19	8.2	8.8	5.069	-	0.919
DLO2-20-ACJ-20	4.2	4.3	0.727	-	0.981
DLO2-20-ACJ-21	4.4	4.5	0.826	-	0.970
DLO2-20-ACJ-22	8.0	8.5	4.777	-	0.933
DLO2-20-ACJ-23	4.6	4.8	0.911	-	0.936
DLO2-20-ACJ-24	4.7	4.9	0.953	-	0.918
DLO2-20-ACJ-25	4.1	4.2	0.644	-	0.934
DLO2-20-ACJ-26	8.0	8.6	5.042	-	0.985
DLO2-20-ACJ-27	4.2	4.3	0.712	-	0.961
DLO2-20-ACJ-28	7.2	7.6	3.324	-	0.891
DLO2-20-ACJ-29	8.5	9.1	5.606	-	0.913
DLO2-20-ACJ-30	4.5	4.7	0.845	-	0.927
DLO2-20-ACJ-31	12.6	13.6	16.742	-	0.837
DLO2-20-ACJ-32	4.2	4.3	0.665	-	0.898
DLO2-20-ACJ-33	7.7	8.2	4.755	-	1.042
DLO2-20-ACJ-34	4.2	4.3	0.658	-	0.888
DLO2-20-ACJ-35	10.9	11.8	12.369	-	0.955
DLO2-20-ACJ-36	6.4	6.8	2.462	-	0.939
DLO2-20-ACJ-37	8.3	8.9	5.388	-	0.942
DLO2-20-ACJ-38	7.9	8.4	5.500	-	1.116
DLO2-20-ACJ-39	9.2	9.9	6.549	-	0.841
DLO2-20-ACJ-40	4.1	4.2	0.641	-	0.930
DLO2-20-ACJ-41	7.7	8.2	4.508	-	0.987
DLO2-20-ACJ-42	7.8	8.3	4.182	-	0.881
DLO2-20-ACJ-43	4.5	4.7	0.927	-	1.017
DLO2-20-ACJ-44	8.2	8.7	4.926	1	0.893
DLO2-20-ACJ-45	4.8	5.0	1.029	0	0.930
DLO2-20-ACJ-46	7.9	8.5	4.966	1	1.007
DLO2-20-ACJ-47	8.3	8.8	5.463	1	0.955
DLO2-20-ACJ-48	9.8	10.5	8.005	2	0.851
DLO2-20-ACJ-49	5.1	5.3	1.223	0	0.922
DLO2-20-ACJ-50	6.2	6.5	2.250	1	0.944
DLO2-20-ACJ-51	10.0	10.7	8.649	2	0.865
DLO2-20-ACJ-52	14.4	15.6	23.546	4	0.789
DLO2-20-ACJ-53	4.3	4.5	0.753	-	0.947
DLO2-20-ACJ-54	14.1	15.3	24.999	-	0.892
DLO2-20-ACJ-55	11.0	11.8	11.279	-	0.847
DLO2-20-ACJ-56	6.5	6.9	2.760	-	1.005
DLO2-20-ACJ-57	4.5	4.7	0.934	-	1.025

Note: "-" indicates measurement not taken or no comment.

Table G.19: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID		Fork Length (cm)	Total Length (cm)	Body Weight (g)	Age (years)	Fulton's Condition Factor (K)
DLO2-20-ACJ-58		10.3	11.1	9.169	-	0.839
DLO2-20-ACJ-59		8.2	8.7	6.186	-	1.122
DLO2-20-ACJ-60		9.5	10.2	7.100	-	0.828
DLO2-20-ACJ-61		8.8	9.4	5.665	-	0.831
DLO2-20-ACJ-62		7.6	8.1	4.990	-	1.137
DLO2-20-ACJ-63		8.8	9.3	6.787	-	0.996
DLO2-20-ACJ-64		9.5	10.1	8.550	-	0.997
DLO2-20-ACJ-65		7.9	8.4	4.357	-	0.884
DLO2-20-ACJ-66		9.2	9.8	7.659	-	0.984
DLO2-20-ACJ-67		13.9	15.0	20.854	-	0.777
DLO2-20-ACJ-68		9.5	10.1	7.368	-	0.859
DLO2-20-ACJ-69		4.9	5.1	1.002	-	0.852
DLO2-20-ACJ-70		7.9	8.4	4.807	-	0.975
DLO2-20-ACJ-71		6.9	7.3	3.089	-	0.940
DLO2-20-ACJ-72		8.9	9.4	6.559	-	0.930
DLO2-20-ACJ-73		7.5	8.0	4.038	-	0.957
DLO2-20-ACJ-74		7.8	8.3	4.184	-	0.882
DLO2-20-ACJ-75		10.5	11.3	10.180	-	0.879
DLO2-20-ACJ-76		8.2	8.7	4.756	-	0.863
DLO2-20-ACJ-77		7.7	8.2	4.234	-	0.927
DLO2-20-ACJ-78		4.7	4.9	1.114	-	1.073
DLO2-20-ACJ-79		6.4	6.9	3.014	-	1.150
DLO2-20-ACJ-80		4.3	4.4	0.650	-	0.818
DLO2-20-ACJ-81		8.1	8.6	5.512	-	1.037
DLO2-20-ACJ-82		8.6	9.2	6.263	-	0.985
DLO2-20-ACJ-83		4.9	5.1	1.111	-	0.944
DLO2-20-ACJ-84		7.0	7.4	3.030	-	0.883
DLO2-20-ACJ-85		10.1	10.9	10.236	-	0.993
DLO2-20-ACJ-86		7.8	8.3	4.538	-	0.956
DLO2-20-ACJ-87		9.2	9.9	7.853	-	1.008
DLO2-20-ACJ-88		8.4	9.0	6.501	-	1.097
DLO2-20-ACJ-89		8.3	8.9	6.113	-	1.069
DLO2-20-ACJ-90		7.7	8.1	3.950	-	0.865
DLO2-20-ACJ-91		7.0	7.5	2.922	-	0.852
DLO2-20-ACJ-92		4.5	4.7	0.746	-	0.819
DLO2-20-ACJ-93		6.8	7.2	2.742	-	0.872
DLO2-20-ACJ-94		8.3	8.8	5.335	-	0.933
DLO2-18-ACJ-95		8.0	8.5	4.659	-	0.910
DLO2-18-ACJ-96		8.8	9.4	6.169	-	0.905
DLO2-18-ACJ-97		8.6	9.2	6.852	-	1.077
DLO2-18-ACJ-98		4.5	4.7	0.898	-	0.985
DLO2-18-ACJ-99		9.6	10.3	7.566	-	0.855
DLO2-18-ACJ-100		8.4	9.0	5.726	-	0.966
Overall Catch Summary	Sample Size (N)	100	100	100	10	100
	Average	7.7	8.2	5.279	1.7	0.938
	Median	7.9	8.5	4.784	1.0	0.930
	Standard Deviation	2.3	2.6	4.681	1.6	0.080
	Standard Error	0.23	0.26	0.468	0.52	0.008
	Minimum	4.1	4.2	0.641	0.0	0.777
	Maximum	14.4	15.6	24.999	5.0	1.150
Young-of-the-Year Catch Summary	proportion of YOY	**24%**				
	Sample Size (N)	24	24	24	2	24
	Average	4.5	4.6	0.854	0	0.943
	Median	4.5	4.7	0.872	0	0.932
	Standard Deviation	0.3	0.3	0.168	0	0.072
	Standard Error	0.1	0.1	0.034	0	0.015
	Minimum	4.1	4.2	0.641	0	0.818
	Maximum	5.1	5.3	1.223	0	1.133

Note: "-" indicates measurement not taken or no comment.

Table G.20: Results of Nearshore Arctic Charr Non-Young-of-the-Year (YOY) Health Endpoint Statistical Comparisons between Sheardown Lake SE (DLO-02) and Reference Lake 3 (REF), Mary River Project CREMP, August 2020

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF	DLO-02		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF	DLO-02		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	100	K-S	-	-	-	-	-	-	0.006	-
YOY	Body Size	Fork Length	Fork Length (cm)	-	21	24	tequal	-	-	-	Mean	3.60	4.47	<0.001	24
YOY	Body Size	Body Weight	Body Weight (g)	-	21	24	tequal	-	-	-	Mean	0.388	0.854	<0.001	120
YOY	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	21	24	ANCOVA	0.339	<0.001	4.03	Adjusted Mean	0.535	0.607	0.01	13
YOY	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	20[e]	24	ANCOVA	0.437	<0.001	4.04	Adjusted Mean	0.525	0.614	<0.001	17
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	79	76	K-S	-	-	-	-	-	-	<0.001	-
Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	79	76	M-W	-	-	-	Median	7.70	8.20	<0.001	6.5
Non-YOY	Body Size	Body Weight	Body Weight (g)	-	79	76	M-W	-	-	-	Median	3.55	5.43	<0.001	53
Non-YOY	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	79	76	ANCOVA	<0.001[f]	<0.001	8.13	Adjusted Mean	4.41	5.03	<0.001	14

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for $\log_{10}$-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CRFDs was observed.

[e] One outlier (REF3-20-ACJ-55, Stdnt resid: 4.035) removed from analysis.

[f] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9856 and R2 of parallel slope model = 0.9845; a difference < 0.02) following Environment Canada (2012).

Table G.21: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Sheardown Lake SE (DLO-02) Using 2020 Data Relative to Reference Lake 3 Data (2020) or Sheardown Lake SE Baseline Data (2006 to 2013) with α=β=0.1, Mary River Project 2020 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test [a]	S[b]	COV (%)[c]	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1									
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%
									Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2020 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0879	23.8	Response	343	91	26	18	13	12	9	6	4
			Body Weight	Body Weight (g)	-	M-W	0.259	110	Response	2,966	778	215	144	105	87	64	44	17
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0342	-	log(Response)	47	14	6	5	4	4	4	3	3
Nearshore Arctic Charr (Electrofishing) 2020 versus Baseline	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0709	24.8	Response	224	60	18	12	10	9	6	5	4
			Body Weight	Body Weight (g)	-	M-W	0.210	163	Response	1,947	512	142	95	69	58	43	31	12
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0528	-	log(Response)	108	30	10	7	6	5	5	4	3
			Condition[d]	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0417	-	log(Response)	69	20	7	6	5	4	4	4	3
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2020 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0828	20.9	Response	305	82	24	16	12	10	7	5	4
			Body Weight	Body Weight (g)	-	M-W	0.258	78.8	Response	2,933	770	212	142	104	86	63	44	14
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0478	-	log(Response)	90	25	9	7	5	5	4	4	3
			Condition[e]	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0453	-	log(Response)	81	23	8	6	5	5	4	4	3
Littoral/Profundal Arctic Charr (Gill Netting) 2020 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0617	12.4	Response	123	32	10	7	5	5	4	4	3
			Body Weight	Body Weight (g)	-	M-W	0.193	31.9	Response	806	203	53	34	25	20	14	10	4
		Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0477	-	log(Response)	89	25	9	7	5	5	4	4	3
			Condition[f]	log[Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0455	-	log(Response)	81	23	8	6	5	5	4	4	3

[a] Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and $\log_{10}$-transformed scales and the lowest sample size is reported.

[b] Pooled standard deviation of the regression residuals

[c] Coefficient of variation (pooled standard deviation/reference mean)×100%

[d] One outlier (SLSE-07-1 Stdnt resid:-4.398; SLSE-07-2 Stdnt resid: -4.398) removed from analysis.

[e] One outlier (REF3-20-AC-03, Stdnt resid: -4.445) was removed from the analysis.

[f] One outlier (SLSE-08-AC-11, Stdnt resid: 4.136) was removed from the analysis.

Table G.22: Gill Netting Catch Records for Sheardown Lake SE, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch Per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
DLO2-20-GN-1A	560768	7912286	91.4	10-Aug-20	10-Aug-20	9:18	10:22	1.07	0.975	1	0	1	2	2.05
DLO2-20-GN-1B	560768	7912286	91.4	10-Aug-20	10-Aug-20	10:36	12:23	1.78	1.63	2	3	1	6	3.68
DLO2-20-GN-1C	560768	7912286	91.4	10-Aug-20	10-Aug-20	12:45	13:57	1.20	1.10	0	2	2	4	3.65
DLO2-20-GN-1D	560768	7912286	91.4	10-Aug-20	10-Aug-20	14:19	16:04	1.75	1.60	1	1	0	2	1.25
DLO2-20-GN-2A	561155	7911991	91.4	10-Aug-20	10-Aug-20	9:30	10:44	1.23	1.13	1	3	5	9	7.98
DLO2-20-GN-2B	561155	7911991	91.4	10-Aug-20	10-Aug-20	11:26	12:55	1.48	1.36	1	0	2	3	2.21
DLO2-20-GN-2C	561155	7911991	91.4	10-Aug-20	10-Aug-20	13:10	14:54	1.73	1.58	3	6	1	10	6.31
DLO2-20-GN-2D	561155	7911991	91.4	10-Aug-20	10-Aug-20	15:24	16:50	1.43	1.31	2	1	1	4	3.05
DLO2-20-GN-2E	561155	7911991	91.4	10-Aug-20	10-Aug-20	17:07	17:44	0.617	0.564	0	0	0	0	0
DLO2-20-GN-3A	561545	7911868	91.4	10-Aug-20	10-Aug-20	9:41	11:32	1.85	1.69	0	6	3	9	5.32
DLO2-20-GN-3B	561545	7911868	91.4	10-Aug-20	10-Aug-20	12:10	13:34	1.40	1.28	0	1	1	2	1.56
DLO2-20-GN-3C	561545	7911868	91.4	10-Aug-20	10-Aug-20	13:45	15:28	1.72	1.57	0	2	3	5	3.19
DLO2-20-GN-4A	560963	7912119	91.4	10-Aug-20	10-Aug-20	12:51	14:22	1.52	1.39	2	1	4	7	5.05
DLO2-20-GN-4B	560963	7912119	91.4	10-Aug-20	10-Aug-20	14:50	16:15	1.42	1.30	1	0	1	2	1.54
DLO2-20-GN-4C	560963	7912119	91.4	10-Aug-20	10-Aug-20	16:25	17:31	1.10	1.01	0	1	1	2	1.99
DLO2-20-GN-5	561051	7912067	91.4	10-Aug-20	10-Aug-20	17:14	18:05	0.850	0.777	3	0	1	4	5.15
DLO2-20-GN-6	560833	7912227	91.4	11-Aug-20	11-Aug-20	15:58	16:52	0.900	0.823	0	2	1	3	3.65
DLO2-20-GN-7	560987	7912107	91.4	11-Aug-20	11-Aug-20	16:04	17:07	1.05	0.960	0	0	0	0	0
DLO2-20-GN-8	561199	7912003	91.4	11-Aug-20	11-Aug-20	16:09	17:13	1.07	0.975	1	3	7	11	11.3
DLO2-20-GN-9A	561200	7911958	91.4	13-Aug-20	13-Aug-20	10:15	11:05	0.833	0.762	0	1	2	3	3.94
DLO2-20-GN-9B	561200	7911958	91.4	13-Aug-20	13-Aug-20	11:19	12:11	0.867	0.792	1	2	4	7	8.84
DLO2-20-GN-10A	561420	7911938	91.4	13-Aug-20	13-Aug-20	10:22	11:21	0.983	0.899	0	5	1	6	6.68
DLO2-20-GN-10B	561420	7911938	91.4	13-Aug-20	13-Aug-20	11:40	12:34	0.900	0.823	0	1	2	3	3.65
DLO2-20-GN-11A	561479	7911775	91.4	13-Aug-20	13-Aug-20	10:30	11:43	1.22	1.11	0	1	0	1	0.899
DLO2-20-GN-11B	561479	7911775	91.4	13-Aug-20	13-Aug-20	11:50	12:48	0.967	0.884	1	0	1	2	2.26
								Total	**28.3**	**20**	**42**	**45**	**107**	**3.81**

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.23: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
DLO2-20-AC-01	DLO2-GN-1A	1½	36.7	39.4	410	-	0.829
DLO2-20-AC-02	DLO2-GN-1A	3	39.2	42.4	540	-	0.896
DLO2-20-AC-03	DLO2-GN-2A	3	33.9	36.9	305	Bottom caudal fin ripped	0.783
DLO2-20-AC-04	DLO2-GN-2A	3	36.4	39.5	460	-	0.954
DLO2-20-AC-05	DLO2-GN-2A	3	39.6	43.0	605	-	0.974
DLO2-20-AC-06	DLO2-GN-2A	3	38.0	41.3	495	-	0.902
DLO2-20-AC-07	DLO2-GN-2A	3	39.9	43.2	570	-	0.897
DLO2-20-AC-08	DLO2-GN-2A	2	35.6	38.7	440	-	0.975
DLO2-20-AC-09	DLO2-GN-2A	2	35.4	37.9	425	Mortality	0.958
DLO2-20-AC-10	DLO2-GN-2A	2	39.5	42.8	540	-	0.876
DLO2-20-AC-11	DLO2-GN-2A	1½	31.3	33.5	296	Mortality	0.965
DLO2-20-AC-12	DLO2-GN-3A	3	38.5	41.6	495	-	0.867
DLO2-20-AC-13	DLO2-GN-3A	3	37.0	40.0	520	-	1.027
DLO2-20-AC-14	DLO2-GN-3A	3	40.8	44.3	590	-	0.869
DLO2-20-AC-15	DLO2-GN-3A	2	33.0	35.5	350	Mortality	0.974
DLO2-20-AC-16	DLO2-GN-3A	2	39.9	42.7	505	-	0.795
DLO2-20-AC-17	DLO2-GN-3A	2	35.2	38.0	425	Mortality	0.974
DLO2-20-AC-18	DLO2-GN-3A	2	34.0	38.0	415	Mortality	1.056
DLO2-20-AC-19	DLO2-GN-3A	2	28.2	30.2	195	-	0.870
DLO2-20-AC-20	DLO2-GN-3A	2	32.2	35.3	305	-	0.914
DLO2-20-AC-21	DLO2-GN-9A	3	42.1	45.9	650	-	0.871
DLO2-20-AC-22	DLO2-GN-9A	3	38.2	41.5	490	-	0.879
DLO2-20-AC-23	DLO2-GN-9A	2	37.5	40.3	450	-	0.853
DLO2-20-AC-24	DLO2-GN-10A	3	36.8	40.0	465	-	0.933
DLO2-20-AC-25	DLO2-GN-10A	2	39.0	42.4	550	-	0.927
DLO2-20-AC-26	DLO2-GN-10A	2	44.4	48.0	660	-	0.754
DLO2-20-AC-27	DLO2-GN-10A	2	38.6	41.9	440	-	0.765
DLO2-20-AC-28	DLO2-GN-10A	2	31.8	34.5	290	-	0.902
DLO2-20-AC-29	DLO2-GN-10A	2	35.6	38.7	460	-	1.020
DLO2-20-AC-30	DLO2-GN-11A	2	37.5	40.5	520	-	0.986
DLO2-20-AC-31	DLO2-GN-9B	3	41.4	44.8	635	-	0.895
DLO2-20-AC-32	DLO2-GN-9B	3	41.6	45.6	720	-	1.000
DLO2-20-AC-33	DLO2-GN-9B	3	35.1	38.1	435	-	1.006
DLO2-20-AC-34	DLO2-GN-9B	3	40.0	44.1	540	-	0.844
DLO2-20-AC-35	DLO2-GN-9B	2	34.6	37.5	420	-	1.014
DLO2-20-AC-36	DLO2-GN-9B	2	34.9	38.2	410	Mortality	0.965
DLO2-20-AC-37	DLO2-GN-9B	1½	39.6	43.1	555	-	0.894
DLO2-20-AC-38	DLO2-GN-10B	3	38.2	41.3	505	-	0.906
DLO2-20-AC-39	DLO2-GN-10B	3	38.2	41.5	500	-	0.897
DLO2-20-AC-40	DLO2-GN-10B	2	35.5	30.3	415	-	0.928
DLO2-20-AC-41	DLO2-GN-1B	3	37.6	40.9	450	-	0.847
DLO2-20-AC-42	DLO2-GN-1B	2	38.7	42.1	475	-	0.820
DLO2-20-AC-43	DLO2-GN-1B	2	28.3	30.2	225	-	0.993
DLO2-20-AC-44	DLO2-GN-1B	2	36.9	40.0	430	Mortality	0.856
DLO2-20-AC-45	DLO2-GN-1B	1½	25.1	27.3	105	-	0.664
DLO2-20-AC-46	DLO2-GN-1B	1½	39.0	42.3	520	-	0.877
DLO2-20-AC-47	DLO2-GN-2B	1½	38.8	42.1	670	-	1.147
DLO2-20-AC-48	DLO2-GN-2B	3	36.7	39.8	465	-	0.941
DLO2-20-AC-49	DLO2-GN-2B	3	37.1	40.1	540	-	1.057
DLO2-20-AC-50	DLO2-GN-3B	3	39.6	38.4	460	-	0.741
DLO2-20-AC-51	DLO2-GN-3B	2	32.5	35.3	302	Mortality	0.880
DLO2-20-AC-52	DLO2-GN-1C	2	35.8	38.7	385	Mortality	0.839
DLO2-20-AC-53	DLO2-GN-1C	2	33.6	36.3	310	Mortality	0.817

Note: "-" indicates measurement not taken or no comment.

Table G.23: Arctic Charr Measurements from Fish Captured at Sheardown Lake SE by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
DLO2-20-AC-54	DLO2-GN-1C	3	37.2	39.9	450	-	0.874
DLO2-20-AC-55	DLO2-GN-1C	3	35.2	37.6	415	-	0.952
DLO2-20-AC-56	DLO2-GN-4A	3	35.5	40.0	495	Lesions on left lateral line	1.106
DLO2-20-AC-57	DLO2-GN-4A	3	33.6	36.3	375	-	0.989
DLO2-20-AC-58	DLO2-GN-4A	3	27.5	29.6	213	Mortality	1.024
DLO2-20-AC-59	DLO2-GN-4A	3	39.6	43.1	440	Mortality	0.709
DLO2-20-AC-60	DLO2-GN-4A	2	37.7	40.9	510	-	0.952
DLO2-20-AC-61	DLO2-GN-4A	1½	38.5	41.4	685	-	1.200
DLO2-20-AC-62	DLO2-GN-4A	1½	42.6	45.0	675	-	0.873
DLO2-20-AC-63	DLO2-GN-2C	1½	38.6	41.5	530	Mortality	0.922
DLO2-20-AC-64	DLO2-GN-2C	1½	24.9	26.8	135	Mortality	0.874
DLO2-20-AC-65	DLO2-GN-2C	1½	31.5	34.1	305	Mortality	0.976
DLO2-20-AC-66	DLO2-GN-2C	2	37.9	41.1	500	-	0.918
DLO2-20-AC-67	DLO2-GN-2C	2	34.2	36.9	410	Mortality	1.025
DLO2-20-AC-68	DLO2-GN-2C	2	38.4	41.4	505	Mortality	0.892
DLO2-20-AC-69	DLO2-GN-2C	2	37.1	40.5	510	Mortality	0.999
DLO2-20-AC-70	DLO2-GN-2C	2	38.6	41.9	560	Mortality	0.974
DLO2-20-AC-71	DLO2-GN-2C	2	37.6	40.5	520	Mortality	0.978
DLO2-20-AC-72	DLO2-GN-2C	3	40.0	43.4	685	-	1.070
DLO2-20-AC-73	DLO2-GN-3C	2	41.7	45.1	615	-	0.848
DLO2-20-AC-74	DLO2-GN-3C	2	27.0	29.6	170	-	0.864
DLO2-20-AC-75	DLO2-GN-3C	3	37.7	40.8	495	-	0.924
DLO2-20-AC-76	DLO2-GN-3C	3	39.9	42.6	660	Mortality	1.039
DLO2-20-AC-77	DLO2-GN-3C	3	37.6	41.5	515	-	0.969
DLO2-20-AC-78	DLO2-GN-1D	1½	25.5	27.6	145	-	0.874
DLO2-20-AC-79	DLO2-GN-1D	2	38.5	42.6	565	Mortality	0.990
DLO2-20-AC-80	DLO2-GN-4B	1½	30.7	33.3	223	-	0.771
DLO2-20-AC-81	DLO2-GN-4B	3	38.5	41.6	515	-	0.902
DLO2-20-AC-82	DLO2-GN-2D	1½	32.2	35.1	305	-	0.914
DLO2-20-AC-83	DLO2-GN-2D	1½	42.2	46.0	695	-	0.925
DLO2-20-AC-84	DLO2-GN-2D	2	38.0	41.4	480	Mortality	0.875
DLO2-20-AC-85	DLO2-GN-2D	3	42.3	44.5	720	-	0.951
DLO2-20-AC-86	DLO2-GN-4C	3	40.0	40.6	565	-	0.883
DLO2-20-AC-87	DLO2-GN-4C	2	36.2	38.9	390	-	0.822
DLO2-20-AC-88	DLO2-GN-5	3	37.4	40.7	675	Mortality	1.290
DLO2-20-AC-89	DLO2-GN-5	1½	26.0	28.2	165	-	0.939
DLO2-20-AC-90	DLO2-GN-5	1½	24.1	26.1	135	-	0.964
DLO2-20-AC-91	DLO2-GN-5	1½	31.4	34.1	285	-	0.921
DLO2-20-AC-92	DLO2-GN-6	2	27.9	30.1	220	-	1.013
DLO2-20-AC-93	DLO2-GN-6	2	23.9	25.7	120	-	0.879
DLO2-20-AC-94	DLO2-GN-6	3	40.3	43.2	585	-	0.894
DLO2-20-AC-95	DLO2-GN-8	1½	28.8	31.4	215	-	0.900
DLO2-20-AC-96	DLO2-GN-8	2	32.0	34.5	330	Mortality	1.007
DLO2-20-AC-97	DLO2-GN-8	2	32.6	35.6	320	Mortality	0.924
DLO2-20-AC-98	DLO2-GN-8	2	43.4	46.6	620	-	0.758
DLO2-20-AC-99	DLO2-GN-8	3	34.9	38.0	410	-	0.965
DLO2-20-AC-100	DLO2-GN-8	3	38.6	42.2	510	-	0.887
Overall Catch Summary	**Sample Size (N)**		**100**	**100**	**100**	**-**	**100**
	Average		**36.0**	**38.9**	**449**	**-**	**0.923**
	Median		**37.3**	**40.2**	**465**	**-**	**0.916**
	Standard Deviation		**4.6**	**5.0**	**149**	**-**	**0.096**
	Standard Error		**0.46**	**0.50**	**14.9**	**-**	**0.010**
	Minimum		**23.9**	**25.7**	**105**	**-**	**0.664**
	Maximum		**44.4**	**48.0**	**720**	**-**	**1.290**

Note: "-" indicates measurement not taken or no comment.

Table G.24: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2020 Sheardown Lake SE (DLO-02) and 2020 Reference Lake 3 (REF) Data, and for Sheardown Lake SE between 2020 and the Mine Baseline Period (2006 to 2013), Mary River Project 2020 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF 2020 or DLO-02 Baseline	DLO-02 2020		Interaction Model / Interaction P-value	Parallel Slope Model / Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF 2020 or DLO-02 Baseline	DLO-02 2020		
Sheardown Lake SE versus Reference Lake 3, 2020	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	69	100	K-S	-	-	-	-	-	-	<0.001	-
	Body Size	Fork Length	Fork Length (cm)	-	69	100	M-W	-	-	-	Median	30.9	37.3	<0.001	21
		Body Weight	Body Weight (g)	-	69	100	M-W	-	-	-	Median	225	465	<0.001	107
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	69	100	ANCOVA	0.258	<0.001	34.1	Adjusted Mean	317	365	<0.001	15
					68[e]	100	ANCOVA	0.278	<0.001	34.2	Adjusted Mean	320	366	<0.001	14
Sheardown Lake SE 2020 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	70	100	K-S	-	-	-	-	-	-	0.261	-
	Body Size	Fork Length	Fork Length (cm)	-	70	100	M-W	-	-	-	Median	37.4	37.3	0.499	-
		Body Weight	Body Weight (g)	-	70	100	M-W	-	-	-	Median	500	465	0.070	-7.0
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	70	100	ANCOVA	0.434	<0.001	35.9	Adjusted Mean	450	425	0.001	-5.6
					69[f]	100	ANCOVA	0.702	<0.001	35.9	Adjusted Mean	446	424	0.002	-5.0

[Grey] Area P-value < 0.1 or Interaction P-value < 0.05.

[Blue] Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint).

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for log_{10}-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CRFDs was observed.

[e] One outlier (REF3-20-AC-03, Stdnt resid: -4.445) was removed from the analysis.

[f] One outlier (SLSE-08-AC-11, Stdnt resid: 4.136) was removed from the analysis.

Table G.25: Arctic Charr Measurements from Fish Captured at Mary Lake by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Total Weight (g)	Age (years)	Fulton's Condition Factor (K)
BLO-20-ACJ-01	8.1	8.6	4.703	-	0.885
BLO-20-ACJ-02	7.8	8.2	3.991	-	0.841
BLO-20-ACJ-03	8.5	9.0	5.246	-	0.854
BLO-20-ACJ-04	8.2	8.8	4.157	-	0.754
BLO-20-ACJ-05	10.7	11.5	10.313	-	0.842
BLO-20-ACJ-06	8.1	8.6	4.265	-	0.803
BLO-20-ACJ-07	8.0	8.6	5.007	-	0.978
BLO-20-ACJ-08	8.2	8.7	4.769	-	0.865
BLO-20-ACJ-09	10.3	11.1	8.912	-	0.816
BLO-20-ACJ-10	6.8	7.2	2.764	-	0.879
BLO-20-ACJ-11	7.3	7.7	3.020	-	0.776
BLO-20-ACJ-12	8.9	9.5	6.097	-	0.865
BLO-20-ACJ-13	6.8	7.2	2.572	-	0.818
BLO-20-ACJ-14	8.9	9.5	7.231	-	1.026
BLO-20-ACJ-15	10.2	11.0	9.647	-	0.909
BLO-20-ACJ-16	8.5	9.1	5.621	-	0.915
BLO-20-ACJ-17	7.3	7.7	3.018	-	0.776
BLO-20-ACJ-18	7.7	8.2	3.623	-	0.794
BLO-20-ACJ-19	8.0	8.6	3.974	-	0.776
BLO-20-ACJ-20	7.9	8.5	4.098	-	0.831
BLO-20-ACJ-21	7.7	8.2	3.944	-	0.864
BLO-20-ACJ-22	7.2	7.7	3.130	-	0.839
BLO-20-ACJ-23	7.1	7.4	2.698	-	0.754
BLO-20-ACJ-24	8.4	8.9	4.702	-	0.793
BLO-20-ACJ-25	8.0	8.6	5.178	-	1.011
BLO-20-ACJ-26	9.8	10.6	8.826	-	0.938
BLO-20-ACJ-27	7.9	8.5	4.180	-	0.848
BLO-20-ACJ-28	6.9	7.3	2.527	-	0.769
BLO-20-ACJ-29	6.7	7.1	2.273	-	0.756
BLO-20-ACJ-30	7.4	7.9	4.242	-	1.047
BLO-20-ACJ-31	8.5	9.1	5.161	-	0.840
BLO-20-ACJ-32	6.3	6.7	1.964	-	0.785
BLO-20-ACJ-33	6.9	7.4	2.621	-	0.798
BLO-20-ACJ-34	8.0	8.5	4.266	-	0.833
BLO-20-ACJ-35	7.6	8.1	3.556	-	0.810
BLO-20-ACJ-36	7.4	7.8	3.378	-	0.834
BLO-20-ACJ-37	8.4	8.9	5.096	-	0.860
BLO-20-ACJ-38	7.7	8.2	3.790	-	0.830
BLO-20-ACJ-39	6.6	7.0	2.347	-	0.816
BLO-20-ACJ-40	7.3	7.8	3.230	-	0.830
BLO-20-ACJ-41	7.2	7.7	3.123	-	0.837
BLO-20-ACJ-42	6.3	6.7	2.091	-	0.836
BLO-20-ACJ-43	6.7	7.2	2.279	-	0.758
BLO-20-ACJ-44	8.5	9.0	5.091	-	0.829
BLO-20-ACJ-45	6.8	7.2	2.745	-	0.873

Note: "-" indicates measurement not taken or no comment.

Table G.25: Arctic Charr Measurements from Fish Captured at Mary Lake by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID	Fork Length (cm)	Total Length (cm)	Total Weight (g)	Age (years)	Fulton's Condition Factor (K)
BLO-20-ACJ-46	7.9	8.4	3.808	-	0.772
BLO-20-ACJ-47	8.2	8.7	4.932	-	0.895
BLO-20-ACJ-48	6.1	6.4	1.737	-	0.765
BLO-20-ACJ-49	6.3	6.7	2.586	-	1.034
BLO-20-ACJ-50	8.2	8.8	4.451	-	0.807
BLO-20-ACJ-51	8.8	9.5	5.333	-	0.783
BLO-20-ACJ-52	6.4	6.7	1.911	-	0.729
BLO-20-ACJ-53	7.4	7.9	3.259	-	0.804
BLO-20-ACJ-54	9.2	9.8	5.922	2	0.761
BLO-20-ACJ-55	7.2	7.6	3.232	1	0.866
BLO-20-ACJ-56	9.8	10.5	8.010	2	0.851
BLO-20-ACJ-57	4.1	4.2	0.503	0	0.730
BLO-20-ACJ-58	7.7	8.1	3.477	1	0.762
BLO-20-ACJ-59	8.5	9.1	5.057	1	0.823
BLO-20-ACJ-60	7.4	7.9	3.588	1	0.885
BLO-20-ACJ-61	6.3	6.7	1.975	1	0.790
BLO-20-ACJ-62	12.8	13.9	23.332	3	1.113
BLO-20-ACJ-63	12.0	13.0	15.624	4	0.904
BLO-20-ACJ-64	8.5	9.1	5.002	-	0.814
BLO-20-ACJ-65	6.6	7.0	2.441	-	0.849
BLO-20-ACJ-66	8.4	9.0	5.394	-	0.910
BLO-20-ACJ-67	9.1	9.8	6.730	-	0.893
BLO-20-ACJ-68	7.0	7.4	2.540	-	0.741
BLO-20-ACJ-69	6.5	6.9	2.852	-	1.039
BLO-20-ACJ-70	10.1	11.0	8.975	-	0.871
BLO-20-ACJ-71	9.3	9.9	6.306	-	0.784
BLO-20-ACJ-72	7.6	8.1	3.335	-	0.760
BLO-20-ACJ-73	10.6	11.4	11.564	-	0.971
BLO-20-ACJ-74	10.6	11.4	9.466	-	0.795
BLO-20-ACJ-75	7.5	8.0	3.579	-	0.848
BLO-20-ACJ-76	10.4	11.2	9.650	-	0.858
BLO-20-ACJ-77	12.0	13.0	17.642	-	1.021
BLO-20-ACJ-78	5.9	6.7	1.784	-	0.869
BLO-20-ACJ-79	6.3	6.7	1.955	-	0.782
BLO-20-ACJ-80	6.8	7.2	2.455	-	0.781
BLO-20-ACJ-81	7.2	7.7	3.094	-	0.829
BLO-20-ACJ-82	6.9	7.4	2.870	-	0.874
BLO-20-ACJ-83	7.4	7.8	3.481	-	0.859
BLO-20-ACJ-84	6.5	6.9	2.361	-	0.860
BLO-20-ACJ-85	5.8	6.2	1.559	-	0.799
BLO-20-ACJ-86	7.3	7.8	3.379	-	0.869
BLO-20-ACJ-87	11.4	12.4	15.115	-	1.020
BLO-20-ACJ-88	7.1	7.5	2.942	-	0.822
BLO-20-ACJ-89	8.3	8.8	5.198	-	0.909
BLO-20-ACJ-90	8.5	9.1	4.962	-	0.808

Note: "-" indicates measurement not taken or no comment.

Table G.25: Arctic Charr Measurements from Fish Captured at Mary Lake by Electrofishing, Mary River Project CREMP, August 2020

Specimen ID		Fork Length (cm)	Total Length (cm)	Total Weight (g)	Age (years)	Fulton's Condition Factor (K)
BLO-20-ACJ-91		5.9	6.2	1.765	-	0.859
BLO-20-ACJ-92		8.8	9.4	5.579	-	0.819
BLO-20-ACJ-93		4.1	4.2	0.546	-	0.792
BLO-20-ACJ-94		6.2	6.5	1.882	-	0.790
BLO-20-ACJ-95		6.6	6.9	2.257	-	0.785
BLO-20-ACJ-96		6.2	6.6	2.257	-	0.947
BLO-20-ACJ-97		7.1	7.6	3.349	-	0.936
BLO-20-ACJ-98		7.6	8.1	3.704	-	0.844
BLO-20-ACJ-99		7.0	7.5	3.040	-	0.886
BLO-20-ACJ-100		7.3	7.8	3.212	-	0.826
Overall Catch Summary	Sample Size (N)	100	100	100	10	100
	Average	7.8	8.4	4.684	1.6	0.848
	Median	7.6	8.1	3.606	1.0	0.835
	Standard Deviation	1.5	1.7	3.521	1.2	0.077
	Standard Error	0.15	0.17	0.352	0.37	0.008
	Minimum	4.1	4.2	0.503	0.0	0.729
	Maximum	12.8	13.9	23.332	4.0	1.113
Young-of-the-Year Catch Summary	proportion of YOY	**2%**				
	Sample Size (N)	2	2	2	1	2
	Average	4.1	4.2	0.525	0	0.761
	Median	4.1	4.2	0.525	0	0.761
	Standard Deviation	0.0	0.0	0.030	0	0.044
	Standard Error	0.0	0.0	0.022	0	0.031
	Minimum	4.1	4.2	0.503	0	0.730
	Maximum	4.1	4.2	0.546	0	0.792

Note: "-" indicates measurement not taken or no comment.

Table G.26: Results of Nearshore Arctic Charr Non-Young-of-the-Year (YOY) Health Endpoint Statistical Comparisons between Mary Lake (BLO) and Reference Lake 3 (REF), Mary River Project CREMP, August 2020

Group	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF	BLO		Interaction Model: Interaction P-value	Parallel Slope Model: Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF	BLO		
All Fish	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	100	100	K-S	-	-	-	-	-	-	0.001	-
Non-YOY	Survival	Length Frequency Distribution	Fork Length (cm)	-	79	98	K-S	-	-	-	-	-	-	0.761	-
	Body Size	Fork Length	Fork Length (cm)	-	79	98	M-W	-	-	-	Median	7.70	7.65	0.712	-
		Body Weight	Body Weight (g)	-	79	98	M-W	-	-	-	Median	3.55	3.66	0.555	-
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	79	98	ANCOVA	0.005[e]	<0.001	7.78	Adjusted Mean	3.89	3.99	0.034	2.6

Area P-value < 0.1 or Interaction P-value < 0.05

Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for $\log_{10}$-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CRFDs was observed.

[e] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9838 and R2 of parallel slope model = 0.9831; a difference < 0.02) following Environment Canada (2012).

Table G.27: Arctic Charr Estimated Sample Sizes to Detect Various Effect Sizes as a Percentage Change in Respective Fish Health Endpoints at Mary Lake (BLO) Using 2020 Data Relative to Reference Lake 3 Data (2020) or Mary Lake Baseline Data (2006 to 2013) with α=β=0.1, Mary River Project 2020 CREMP

Comparison	Group	Indicator	Endpoint	Variables		Test [a]	S[b]	COV (%)[c]	Minimum Sample Size to Detect an Effect Size (% Increase/Decrease Relative to Reference) with α=β=0.1									
				Response	Covariate				log(Response)	5%	10%	20%	25%	30%	33%	40%	50%	100%
										-5%	-9%	-17%	-20%	-23%	-25%	-29%	-33%	-50%
									Response	±5%	±10%	±20%	±25%	±30%	±33%	±40%	±50%	±100%
Nearshore Arctic Charr (Electrofishing) versus Ref. Lake 3, 2020 Data	Non-YOY	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0854	21.9	Response	323	86	25	17	12	11	7	6	4
			Body Weight	Body Weight (g)	-	M-W	0.265	99.1	Response	3,095	813	224	150	109	91	66	47	17
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0346	-	log(Response)	48	14	6	5	4	4	4	3	3
Littoral/Profundal Arctic Charr (Gill Netting) versus Ref. Lake 3, 2020 Data	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0901	24.7	Response	360	95	27	19	14	12	10	7	4
			Body Weight	Body Weight (g)	-	M-W	0.274	115	Response	3,316	871	239	160	116	98	71	50	18
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0465	-	log(Response)	85	24	8	6	5	5	4	4	3
			Condition[d]	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0437	-	log(Response)	75	21	8	6	5	5	4	4	3
Littoral/Profundal Arctic Charr (Gill Netting) 2020 versus Baseline	All fish	Body Size	Fork Length	Fork Length (cm)	-	M-W	0.0973	21.5	Response	369	93	25	17	12	10	7	6	4
			Body Weight	Body Weight (g)	-	M-W	0.28	77.0	Response	3,461	909	249	167	122	101	75	49	13
		Energy Storage	Condition	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0563	-	log(Response)	123	34	11	8	7	6	5	4	3
			Conditione	log[Adjusted Body Weight (g)]	log[Fork Length (cm)]	ANCOVA	0.0547	-	log(Response)	117	32	10	8	6	6	5	4	3

[a] Sample size estimates for the M-W test were estimated based for a two-sample t-test using sample sizes multiplied by 0.864. The 0.864 is the lower bound of the asymptotic relative efficiency of the Mann-Whitney test and the two-sample t-test (Hodges and Lehmann 1956). Estimates were generated for the response variable on the untransformed and log $_{10}$-transformed scales and the lowest sample size is reported.

[b] Pooled standard deviation of the regression residuals

[c] Coefficient of variation (pooled standard deviation/reference mean)×100%

[d] One outlier (REF3-20-AC-03, Stdnt resid: -4.722) was removed from the analysis.

[e] One outlier (MLS-06-AC-11, Stdnt resid: 4.102) was removed from analysis.

Table G.28: Gill Netting Catch Records for Mary Lake, Mary River Project CREMP, August 2020

Gill Net Set ID	Location (NAD83, UTM Zone 17W)		Length (m)	Set Date	Lift Date	Set Time	Lift Time	Fishing Hours	Effort (m*hrs/100 m)	Arctic Charr Catch per Mesh Size			Total Catch	CPUE
	Easting	Northing								1½"	2"	3"		
BLO-20-GN-1	555150	7905810	91.4	15-Aug-20	15-Aug-20	15:06	15:53	0.783	0.716	1	0	0	1	1.40
BLO-20-GN-2	554964	7906049	91.4	15-Aug-20	15-Aug-20	15:13	16:02	0.817	0.747	1	1	2	4	5.36
BLO-20-GN-3A	554852	7906039	91.4	15-Aug-20	15-Aug-20	15:18	16:25	1.12	1.02	1	3	4	8	7.83
BLO-20-GN-3B	554852	7906039	91.4	15-Aug-20	15-Aug-20	16:55	17:35	0.667	0.610	1	2	0	3	4.92
BLO-20-GN-4	554852	7905955	91.4	15-Aug-20	15-Aug-20	16:25	17:14	0.817	0.746	0	2	4	6	8.04
BLO-20-GN-5	554800	7906071	91.4	15-Aug-20	15-Aug-20	17:00	17:47	0.783	0.716	2	2	1	5	6.98
BLO-20-GN-6A	554536	7906390	91.4	16-Aug-20	16-Aug-20	8:52	9:47	0.917	0.838	2	4	4	10	11.9
BLO-20-GN-6B	554536	7906390	91.4	16-Aug-20	16-Aug-20	10:30	11:48	1.30	1.19	0	3	2	5	4.21
BLO-20-GN-6C	554536	7906390	91.4	16-Aug-20	16-Aug-20	12:23	13:36	1.22	1.11	0	1	1	2	1.80
BLO-20-GN-6D	554536	7906390	91.4	16-Aug-20	16-Aug-20	13:52	15:11	1.32	1.20	0	1	2	3	2.49
BLO-20-GN-7A	554639	7906204	91.4	16-Aug-20	16-Aug-20	9:02	10:32	1.50	1.37	1	2	4	7	5.11
BLO-20-GN-7B	554639	7906204	91.4	16-Aug-20	16-Aug-20	11:10	12:26	1.27	1.16	0	2	1	3	2.59
BLO-20-GN-7C	554639	7906204	91.4	16-Aug-20	16-Aug-20	12:43	13:54	1.18	1.08	0	3	1	4	3.70
BLO-20-GN-7D	554639	7906204	91.4	16-Aug-20	16-Aug-20	14:13	15:33	1.33	1.22	2	0	1	3	2.46
BLO-20-GN-8A	554834	7906040	91.4	16-Aug-20	16-Aug-20	9:11	11:13	2.03	1.86	0	4	4	8	4.30
BLO-20-GN-8B	554834	7906040	91.4	16-Aug-20	16-Aug-20	11:44	12:46	1.03	0.944	1	1	1	3	3.18
BLO-20-GN-8C	554834	7906040	91.4	16-Aug-20	16-Aug-20	13:08	14:18	1.17	1.07	0	2	1	3	2.81
BLO-20-GN-8D	554834	7906040	91.4	16-Aug-20	16-Aug-20	14:33	16:07	1.57	1.43	1	2	2	5	3.49
BLO-20-GN-9A	554926	7906000	91.4	16-Aug-20	16-Aug-20	13:30	14:43	1.22	1.11	1	4	1	6	5.40
BLO-20-GN-9B	554926	7906000	91.4	16-Aug-20	16-Aug-20	15:03	16:27	1.40	1.28	0	2	3	5	3.91
Total									**21.4**	**14**	**41**	**39**	**94**	**4.60**

Note: Catch-per-unit-effort (CPUE) represents the number of fish captured per 100 m·hours of net.

Table G.29: Arctic Charr Measurements from Fish Captured at Mary Lake by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
BLO-20-AC-01	BLO-GN-1	1½	38.5	41.8	545	-	0.955
BLO-20-AC-02	BLO-GN-2	3	38.9	42.5	495	-	0.841
BLO-20-AC-03	BLO-GN-2	3	41.0	45.2	590	-	0.856
BLO-20-AC-04	BLO-GN-2	2	39.3	42.2	500	-	0.824
BLO-20-AC-05	BLO-GN-2	1½	36.6	40.2	480	-	0.979
BLO-20-AC-06	BLO-GN-3A	3	37.0	40.6	435	-	0.859
BLO-20-AC-07	BLO-GN-3A	3	38.6	41.9	560	-	0.974
BLO-20-AC-08	BLO-GN-3A	3	38.9	42.2	585	-	0.994
BLO-20-AC-09	BLO-GN-3A	3	36.7	39.9	465	-	0.941
BLO-20-AC-10	BLO-GN-3A	2	39.6	43.1	600	-	0.966
BLO-20-AC-11	BLO-GN-3A	2	38.3	41.4	495	-	0.881
BLO-20-AC-12	BLO-GN-3A	2	37.9	40.5	520	-	0.955
BLO-20-AC-13	BLO-GN-3A	1½	41.2	44.8	540	-	0.772
BLO-20-AC-14	BLO-GN-4	3	36.5	39.9	455	-	0.936
BLO-20-AC-15	BLO-GN-4	3	40.3	43.5	585	-	0.894
BLO-20-AC-16	BLO-GN-4	3	37.4	41.0	490	-	0.937
BLO-20-AC-17	BLO-GN-4	3	38.0	41.0	520	-	0.948
BLO-20-AC-18	BLO-GN-4	2	37.9	40.8	460	Mortality	0.845
BLO-20-AC-19	BLO-GN-4	2	33.2	35.3	370	-	1.011
BLO-20-AC-20	BLO-GN-3B	2	45.1	48.1	920	-	1.003
BLO-20-AC-21	BLO-GN-3B	2	33.6	36.5	400	-	1.054
BLO-20-AC-22	BLO-GN-3B	1½	33.8	36.5	330	-	0.855
BLO-20-AC-23	BLO-GN-5	3	41.9	45.3	550	-	0.748
BLO-20-AC-24	BLO-GN-5	2	39.2	43.1	450	-	0.747
BLO-20-AC-25	BLO-GN-5	2	40.5	43.5	605	-	0.911
BLO-20-AC-26	BLO-GN-5	1½	23.8	25.9	115	Mortality	0.853
BLO-20-AC-27	BLO-GN-5	1½	31.9	34.8	295	-	0.909
BLO-20-AC-28	BLO-GN-6A	1½	18.1	19.5	60	-	1.012
BLO-20-AC-29	BLO-GN-6A	1½	31.3	34.0	255	Mortality	0.832
BLO-20-AC-30	BLO-GN-6A	2	39.6	43.1	595	-	0.958
BLO-20-AC-31	BLO-GN-6A	2	37.6	41.0	565	Mortality	1.063
BLO-20-AC-32	BLO-GN-6A	2	36.4	39.2	460	Mortality	0.954
BLO-20-AC-33	BLO-GN-6A	3	38.1	42.0	510	-	0.922
BLO-20-AC-34	BLO-GN-6A	2	36.9	40.1	420	-	0.836
BLO-20-AC-35	BLO-GN-6A	3	36.1	39.3	400	-	0.850
BLO-20-AC-36	BLO-GN-6A	3	36.5	40.1	560	-	1.152
BLO-20-AC-37	BLO-GN-6A	3	37.0	39.8	480	-	0.948
BLO-20-AC-38	BLO-GN-7A	3	38.9	42.3	530	-	0.900
BLO-20-AC-39	BLO-GN-7A	3	36.0	39.0	450	-	0.965
BLO-20-AC-40	BLO-GN-7A	3	39.5	43.4	490	-	0.795
BLO-20-AC-41	BLO-GN-7A	3	38.8	41.7	510	-	0.873
BLO-20-AC-42	BLO-GN-7A	2	38.9	42.2	460	-	0.781
BLO-20-AC-43	BLO-GN-7A	2	65.3	68.8	2,525	-	0.907
BLO-20-AC-44	BLO-GN-7A	1½	40.6	44.2	580	-	0.867
BLO-20-AC-45	BLO-GN-8A	3	39.9	43.6	520	-	0.819
BLO-20-AC-46	BLO-GN-8A	3	36.6	39.9	465	-	0.948
BLO-20-AC-47	BLO-GN-8A	3	64.0	67.5	2,150	Gill parasites	0.820
BLO-20-AC-48	BLO-GN-8A	3	38.5	41.6	510	-	0.894
BLO-20-AC-49	BLO-GN-8A	2	38.8	41.8	495	-	0.847

Note: "-" indicates measurement not taken or no comment.

Table G.29: Arctic Charr Measurements from Fish Captured at Mary Lake by Gill Netting, Mary River Project CREMP, August 2020

Specimen ID	Net ID	Net Mesh Size (inches)	Fork Length (cm)	Total Length (cm)	Body Weight (g)	Abnormalities	Fulton's Condition Factor (K)
BLO-20-AC-50	BLO-GN-8A	2	31.9	34.5	295	Mortality	0.909
BLO-20-AC-51	BLO-GN-8A	2	35.2	37.7	420	Mortality	0.963
BLO-20-AC-52	BLO-GN-8A	2	40.5	44.2	580	Mortality	0.873
BLO-20-AC-53	BLO-GN-6B	3	36.7	39.0	460	-	0.931
BLO-20-AC-54	BLO-GN-6B	3	36.9	39.9	490	-	0.975
BLO-20-AC-55	BLO-GN-6B	2	35.5	38.4	430	Mortality	0.961
BLO-20-AC-56	BLO-GN-6B	2	34.9	37.7	405	Mortality	0.953
BLO-20-AC-57	BLO-GN-6B	2	36.1	39.0	415	Mortality	0.882
BLO-20-AC-58	BLO-GN-7B	3	37.9	41.1	495	-	0.909
BLO-20-AC-59	BLO-GN-7B	2	33.4	36.1	370	-	0.993
BLO-20-AC-60	BLO-GN-7B	2	35.6	38.4	445	-	0.986
BLO-20-AC-61	BLO-GN-8B	3	37.9	41.4	530	-	0.974
BLO-20-AC-62	BLO-GN-8B	2	32.9	35.7	345	-	0.969
BLO-20-AC-63	BLO-GN-8B	1½	46.8	49.9	910	-	0.888
BLO-20-AC-64	BLO-GN-6C	3	37.4	40.4	515	-	0.984
BLO-20-AC-65	BLO-GN-6C	2	37.1	39.7	420	Mortality	0.822
BLO-20-AC-66	BLO-GN-7C	3	38.6	41.4	495	-	0.861
BLO-20-AC-67	BLO-GN-7C	2	37.9	41.0	440	-	0.808
BLO-20-AC-68	BLO-GN-7C	2	28.4	31.0	212	-	0.926
BLO-20-AC-69	BLO-GN-7C	2	32.5	35.7	320	Mortality	0.932
BLO-20-AC-70	BLO-GN-8C	3	67.5	71.6	2,550	-	0.829
BLO-20-AC-71	BLO-GN-8C	2	38.2	41.5	360	-	0.646
BLO-20-AC-72	BLO-GN-8C	2	64.5	69.3	2,325	-	0.866
BLO-20-AC-73	BLO-GN-9A	2	32.8	35.4	355	-	1.006
BLO-20-AC-74	BLO-GN-9A	3	39.9	43.1	485	-	0.764
BLO-20-AC-75	BLO-GN-9A	2	34.0	36.9	380	Mortality	0.967
BLO-20-AC-76	BLO-GN-9A	2	39.9	42.9	565	-	0.889
BLO-20-AC-77	BLO-GN-9A	2	37.7	40.6	510	-	0.952
BLO-20-AC-78	BLO-GN-9A	1½	34.1	36.8	373	-	0.941
BLO-20-AC-79	BLO-GN-6D	3	40.9	44.0	573	-	0.837
BLO-20-AC-80	BLO-GN-6D	3	39.6	43.1	555	-	0.894
BLO-20-AC-81	BLO-GN-6D	2	61.1	65.4	2,100	Mortality	0.921
BLO-20-AC-82	BLO-GN-7D	3	37.0	39.9	505	-	0.997
BLO-20-AC-83	BLO-GN-7D	1½	33.4	36.3	365	Mortality	0.980
BLO-20-AC-84	BLO-GN-7D	1½	33.6	35.9	475	-	1.252
BLO-20-AC-85	BLO-GN-8D	3	38.4	41.5	560	-	0.989
BLO-20-AC-86	BLO-GN-8D	3	39.1	42.2	520	-	0.870
BLO-20-AC-87	BLO-GN-8D	2	36.7	39.9	485	Mortality	0.981
BLO-20-AC-88	BLO-GN-8D	2	35.9	38.8	360	-	0.778
BLO-20-AC-89	BLO-GN-8D	1½	36.7	39.3	455	-	0.920
BLO-20-AC-90	BLO-GN-9B	3	38.3	41.1	540	-	0.961
BLO-20-AC-91	BLO-GN-9B	3	39.9	43.4	495	-	0.779
BLO-20-AC-92	BLO-GN-9B	3	37.1	40.1	480	-	0.940
BLO-20-AC-93	BLO-GN-9B	2	40.0	43.1	595	-	0.930
BLO-20-AC-94	BLO-GN-9B	2	36.2	38.6	425	Mortality	0.896
Overall Catch Summary	Sample Size (N)		94	94	94	-	94
	Average		38.5	41.6	572	-	0.911
	Median		37.9	41.0	490	-	0.921
	Standard Deviation		7.2	7.6	437	-	0.087
	Standard Error		0.75	0.78	45	-	0.009
	Minimum		18.1	19.5	60	-	0.646
	Maximum		67.5	71.6	2,550	-	1.252

Note: "-" indicates measurement not taken or no comment.

Table G.30: Results of Littoral/Profundal Arctic Charr Health Endpoint Statistical Comparisons between 2020 Mary Lake (BLO) and 2020 Reference Lake 3 (REF) Data, and for Camp Lake between 2020 and the Mine Baseline Period (2005 to 2013), Mary River Project 2020 CREMP

Comparison	Indicator	Endpoint	Variables		Sample Size		Test	ANCOVA Model Statistics			Summary Statistics[b]			Test P-value	Magnitude of Difference (%)[c,d]
			Response	Covariate	REF 2020 or BLO Base	BLO 2020		Interaction Model Interaction P-value	Parallel Slope Model Covariate P-value	Covariate Value for Comparisons[a]	Statistic	REF 2020 or BLO Base	BLO 2020		
Camp Lake versus Reference Lake 3, 2020	Recruitment/ Survival	Length Frequency Distribution	Fork Length (cm)	-	69	94	K-S	-	-	-	-	-	-	<0.001	-
	Body Size	Fork Length	Fork Length (cm)	-	69	94	M-W	-	-	-	Median	30.9	37.9	<0.001	23
		Body Weight	Body Weight (g)	-	69	94	M-W	-	-	-	Median	225	490	<0.001	118
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	69	94	ANCOVA	0.004[e]	<0.001	35.3	Adjusted Mean	349	399	<0.001	14
		Condition	log[Body Weight (g)]	log[Fork Length (cm)]	68	94	ANCOVA	0.003[g]	<0.001	35.3	Adjusted Mean	352	401	<0.001	14
Camp Lake 2020 versus Baseline	Survival	Length Frequency Distribution	Fork Length (cm)	-	183	94	K-S	-	-	-	-	-	-	0.008	-
	Body Size	Fork Length	Fork Length (cm)	-	183	94	M-W	-	-	-	Median	38.4	37.9	0.492	-
		Body Weight	Body Weight (g)	-	183	94	M-W	-	-	-	Median	500	490	0.606	-
	Energy Storage	Condition	log[Body Weight (g)]	log[Fork Length (cm)]	183	94	ANCOVA	0.613	<0.001	36.5	Adjusted Mean	440	445	0.471	-
		Condition	log[Body Weight (g)]	log[Fork Length (cm)]	182[h]	94	ANCOVA	0.784	<0.001	36.6	Adjusted Mean	441	447	0.389	-

(grey shading) Area P-value < 0.1 or Interaction P-value < 0.05

(blue shading) Absolute Magnitude of Difference ≥ 10% for Condition (EEM effect endpoint)

[a] The mean value of the covariate (that corresponds to the adjusted means for the response variable) for the parallel slope ANCOVA model or the minimum and maximum values of the overlap in covariate values for the interaction ANCOVA model.

[b] The median, mean (geometric mean for $\log_{10}$-transformed variables), and adjusted mean are reported for Mann-Whitney, t-test and ANCOVA, respectively, and the predicted mean values from the regression line equations for minimum and maximum values of the covariate (where the data sets overlap) for ANCOVAs where a significant interaction was detected.

[c] The magnitude of difference calculated as: [(exposed area mean - reference area mean) / reference area mean] x 100. When there is a significant interaction in the ANCOVA, the magnitude of difference is calculated at the minimum and maximum values of overlap in covariate values as : [(exposed area predicted mean - reference area predicted mean) / reference area predicted mean] x 100.

[d] Calculated as the maximum difference in the cumulative relative frequency distributions (CRFD) between areas. A negative difference implies that the exposed area has more fish less than the length where the maximum difference in CRFDs was observed. A positive difference implies that the exposed area has fewer fish less than the length where the maximum difference in CRFDs was observed.

[e] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9783 and R2 of parallel slope model = 0.9772; a difference < 0.02) following Environment Canada (2012).

[f] One outlier (REF3-20-AC-03, Stdnt resid: -4.722) was removed from the analysis.

[g] ANCOVA proceeded under the assumption that the slopes are practically parallel (R2 of interaction model = 0.9807 and R2 of parallel slope model = 0.9796; a difference < 0.02) following Environment Canada (2012).

[h] One outlier (MLS-06-AC-11, Stdnt resid: 4.102) was removed from analysis.