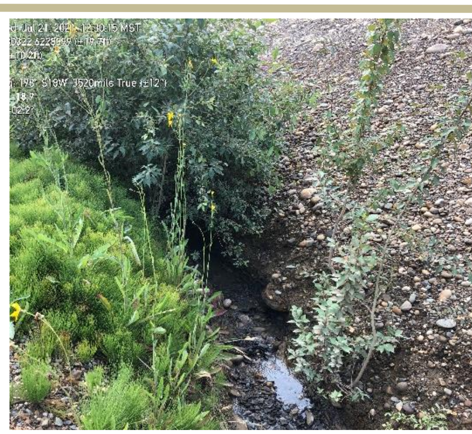
Appendix C

Site C Clean Energy Project
Water Quality Monitoring for
River Road, South Bank Initial Access Road, L3 Creek,
BC Hydro Left Bank Debris Boom and L2 Powerhouse
2021 Annual Report


PRESENTED TO

BC Hydro

MARCH 30, 2022
ISSUED FOR USE
FILE: ENG.VMIN03021-04

Tetra Tech Canada Inc.
150, 1715 Dickson Avenue
Kelowna, BC V1Y 9G6 CANADA
Tel 250.862.4832 Fax 250.862.2941

This page intentionally left blank.

EXECUTIVE SUMMARY

Tetra Tech Canada Inc. (Tetra Tech) was retained by BC Hydro (the client) to develop and implement a surface water quality monitoring program at midstream and discharge locations along River Road ditch near Blind Corner and below Howe Pit, in proximity to the South Bank Initial Access Road (SBIAR), and along the L3 Creek catchment. The River Road and SBIAR locations have been sampled monthly, except when frozen or dry conditions exist, since initiation of the program in 2017. The L3 Creek sampling program wrapped up in April 2021 after also having been completed monthly since 2017. Additional monitoring locations were added in October 2020 at the L2 Powerhouse Area, for evaluation of effectiveness of mitigations, effectively making the slope non-PAG, and the BC Hydro Left Bank Debris Boom (LBDB). Details of the sampling locations, objectives, and requirements for testing at each location are presented in Section 5 of the report.

This water quality sampling program is conducted in accordance with BC Hydro Site C Clean Energy Project Construction Environmental Management Plan (CEMP), Revision 10, Appendix E Acid Rock Drainage and Metal Leachate Management Plan, Section 5.2.1.7 (BC Hydro, 2022), which specifies requirements for road cut monitoring. This water quality program is one component of numerous water quality monitoring programs, including regular monitoring in the Peace River receiving environment, reported under separate cover (Ecofish, 2022).

The monitoring program includes locations at the discharge points and at midstream locations as well as locations upstream from the discharge to characterize variation to water chemistry within the catchment due to mixing and inflow of water from multiple sources. Throughout the report the "RB" and "LB" nomenclature refers to right and left river banks (when facing downstream), respectively.

In accordance with the CEMP, results for the monitoring program locations are evaluated against the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (BCAWQG).

Water quality measurements collected at discharge locations along River Road and downstream locations at SBIAR that exceed the BCAWQG-FST values are reported to BC Hydro within 24 hours of receiving the results, and subsequently to the provincial Emergency Management BC hotline, the Independent Environmental Monitor, and the office of the Comptroller of Water Rights. The complete results of sampling at all locations is presented in a monthly routine memo to BC Hydro.

The results of monthly monitoring are compiled and tracked for changes over time with special interest in metals associated with ARD-ML drainage, e.g., iron, aluminum, arsenic, cadmium, cobalt, copper, manganese, silver and zinc. The results of time series trend analysis are evaluated against the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (BCAWQG) freshwater long-term (FLT) chronic values for sulphate since no short-term (FST) exceedance value is applicable.

River Road

Access road construction in 2016-2017, on the north/left bank, between Howe Pit and the Peace River along River Road cut through bedrock. Current mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone riprap to provide neutralization potential and mitigate against acidic drainage. The limestone in the ditch was replaced in July 2021 to provide fresh surfaces for acid buffering.

A total of eleven (11) monitoring locations were monitored in the River Road catchment near Blind Corner to monitor the effectiveness of the limestone riprap in the ditch line and on the rock slope, and to observe longer term influences from the Potentially Acid Generating (PAG) outcrop at Blind Corner and potential run-off/seepage from Howe Pit (non-Site C impacted area) on the water collected in the River Road ditch. Sampling was attempted on a routine monthly basis from seven of the River Road catchment locations, 1) in the lower chimney drain (LBRR-LC), 2) the upper chimney drain (LBRR-UC); 3) upstream of the lower chimney drain within the River Road ditch (LBRR-12+500), 4) the end of the diversion pipe (LBRR-EDP) that diverts water down-gradient into the River Road ditch between culverts, 5) at the discharge of culvert RR-11 (LBRR-DD), 6) RR-9 culvert (LBRR-RR9) and 7) RR-8 culvert (LBRR-8). In situ testing only is conducted at four additional locations within the River Road ditch at LBRR-12+600, LBRR-12+700, LBRR-12+810 and LBRR-12+920. Occasionally, discharge from the outlet of culverts LBRR-DD, LBRR-RR9 and/or LBRR-RR8 is observed, which potentially reaches the Peace River

During 2021, outside of dry or frozen conditions, lab samples were collected from River Road during five (5) sampling events in February, March, April, July, November resulting in a sum of twelve (12) samples. One sample was collected from LBRR-DD (February), two samples from LBRR-EDP (February, April), two samples from LBRR-LC (February, March), one sample from LBRR-UC (April), four samples from LBRR-12+500 (February, March, April, July), and two samples from LBRR-RR9 (March, November). No in situ or lab samples were collected from RR8 or LBRR-12+430 locations in 2021, therefore, in situ testing was conducted in ten of the twelve locations during 2021.

Of the total twelve (12) samples collected from River Road locations in 2021, exceedances to the BCAWQG-FST were measured for total arsenic (2) and total iron (6). Of the total three discharge locations, exceedances were not located at LBRR-DD, two exceedances were measured for total iron and total arsenic at the RR9 culvert on March 17, 2021, and the RR8 culvert was not sampled in 2021.

Water quality measurements along River Road have indicated that run-off water quality is influenced by active acid rock drainage and metal leaching (ARD-ML) processes within the River Road ditch catchment, particularly from the Blind Corner shale slope. Although flows are generally low and ephemeral, and the ditch is lined with limestone, there is some potential for run-off to impact downstream water quality. As per CEMP Appendix E Section 5.2.1.7, it is recommended that water quality monitoring is continued on a monthly basis at the established locations within the River Road catchment.

SBIAR

The South Bank Initial Access Road (SBIAR) shale slope was initially exposed in 2015 as part of road construction works on the south bank between Relocated Surplus Excavation Material (RSEM) R6 and Area A. The total area of the shale slope is approximately 14,000 m^2, between both the East and West slopes. Management and mitigation measures includes reduction of surface contact water through capture of up-gradient flow and diversion through a pipe to limit flow along the exposed shale slope, and collection of any remaining PAG contact water in ditches which is captured and conveyed to PRHP RSEM R6 Settlement Ponds (permitted for PAG contact water). The effectiveness of the mitigation is evaluated through monthly monitoring of water quality stations along the road.

A total of five (5) monitoring locations were established at the SBIAR location, including the PAG-exposed west and east ditches of the SBIAR, of approximately 200m in length. Sampling and monitoring occur in the western upstream and downstream SBIAR ditches (RBSBIAR-DS, RBSBIAR-US), eastern upstream and downstream SBIAR ditches (RBSBIAR-EDS and RBSBIAR-EUS), and within a preserved portion of the Peace River side channel down-gradient of the SBIAR facility (RBSC-DS), to monitor for potential long-term influence on water quality from construction of the SBIAR facility. The RBSC-DS location was discontinued in June 2021 due to lack of connection to the SBIAR area and distance from the Peace River. Sampling at the SBIAR monitoring locations was conducted monthly in 2017, 2019, 2020, and 2021 and quarterly in 2018.

During 2021, outside of dry or frozen conditions, lab samples were collected from SBIAR during eleven (11) sampling events (January through November) resulting in a sum of forty-one (41) samples. Ten (10) samples were collected from RBSBIAR-DS, eight (8) samples from RBSBIAR-US (March, May, June, July, August, September, October, November) and nine (9) samples from both RBSBIAR-EUS and RBSBIAR-EDS (March to November). Five (5) samples were collected from RBSC-DS (January to May 2021) before sampling was discontinued at this location.

In situ testing was completed on a monthly basis with sufficient water available at some, but not all, SBIAR locations for eleven (11) months between January to November 2021. Frozen conditions in December 2021 prevented any sampling or in situ measurements.

During 2021, BCAWQG-FST exceedances were measured at the downstream RBSBIAR-DS location for total iron (4), dissolved aluminum (3), total arsenic (1), total zinc (1), total cobalt (1), dissolved cadmium (1), dissolved copper (1) and pH (1) below the acceptable guideline range. At the downstream RBSBIAR-EDS location, BCAWQG-FST exceedances were measured for total iron (4), dissolved aluminum (2), total arsenic (1) and total zinc (1). At the RBSC-DS location, one (1) exceedance was measured for dissolved iron.

During 2021, BCAWQG-FST exceedances were measured at the upstream RBSBIAR-US location for total iron (2), total arsenic (1) and total zinc (1). At the RBSBIAR-EUS location, two exceedances were measured for total iron (1) and total arsenic (1).

L3 Creek

A total of five (5) monitoring locations were established in the L3 Creek catchment, including a baseline location up-gradient of RSEM L3 (LBL3C-3.32), slightly upstream from the L4 Creek confluence, LBL3C-1.65, along L4 Creek, LBL4C-0.18, a midstream location below the confluence of L4 Creek and below the Gulley Road box culvert (LBL3C-1.43), and the discharge LBL3C-0.02. These locations were sampled during the two months of January and April 2021 (no flow in the intervening months due to frozen conditions) before discontinuation of sampling occurred at L3 Creek since sufficient data was collected since 2017 at L3 Creek to inform water quality trends over time at these locations.

The catchment for L3 Creek includes RSEM L3 which is currently not considered, nor permitted, for placement of construction related PAG material. Due to the potential influence on L3 Creek discharge water quality from naturally-impacted (non-construction related) water originating in the Howe Pit area and naturally impacted inflow from L4 Creek, the water quality within the L3 Creek catchment was being monitored in context of ARD-ML management.

During 2021, outside of dry or frozen conditions, lab samples were collected from L3 Creek catchment during two (2) sampling events (January and April) resulting in a sum of six (6) samples. One (1) sample was collected from each of the LBL3C-0.02, LBL3C-1.43, LBL3C-1.65, LBL3C-3.32 and LBL4C-0.18 locations in April 2021, and one sample was collected from LBL3C-1.43 in January 2021.

In situ measurements and lab testing occurred only in January and April 2021 due to frozen and/or no flow conditions in February and March 2021, and discontinuation of monitoring at L3 Creek after April 2021.

Of the total six (6) samples collected from L3 Creek catchment locations in 2021, five (5) samples were collected from L3 Creek and one sample (1) was collected from L4 Creek. In the four sample locations in L3 Creek, occurrences of exceedances to the BCAWQG-FST were measured for total iron (3) and total arsenic (3). At the L4 Creek location, LBL4C-0.18, a BCAWQG-FST exceedance was measured for total iron (1).

BC Hydro Left Bank Debris Boom

The BC Hydro LBDB area sample locations were initially established and sampled on October 8, 2020, to characterize water quality for ARD-ML monitoring at LBP Pond, along an armored ditch and LB Side Channel E and W. The purpose of sampling is to monitor PAG contact water from shale exposed during construction. The LBDB PAG slope exposures will eventually be completely inundated with the reservoir formation.

LBP Pond is the only location within the area that has been consistently available for sampling. Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LBP Pond location, is immediately following a significant rainfall event. Two downstream Armor Ditch locations were sampled for the first time in 2021 on July 20-21, 2021. Sampling was possible due to the heavy rainfall event occurring around the sampling event, and these ditches are otherwise generally dry.

During 2021, the LBP Pond was sampled seven (7) times between April to October, and the west and east downstream Armor Ditches (LBWDS and LBEDS) were sampled once in July 2021. Frozen or dry conditions prevailed in the Armor Ditch upstream and downstream locations the remainder of the 2021 sampling events.

The LBP Pond samples reported BCAWQG-FST exceedances in total iron (5), dissolved iron (2), dissolved aluminum (1), total manganese (3) and total zinc (2) between April and October 2021. Water is not commonly observed to discharge from the LBP Pond, but if it does it passes through a limestone lined water management ditch system to the downstream monitoring station.

As a result of the one sample event, July 2021, that included the Armor Ditches, BCAWQG-FST exceedances were measured in the east downstream Armor Ditch (LBEDS) for total iron, dissolved aluminum, total arsenic and total zinc, whereas the west downstream Armor Ditch (LBWDS) measured one BCAWQG-FST exceedance in total iron. Field samplers confirmed that there was no direct discharge to the Peace River, and that both sampled watercourses drain to sufficiently sized sumps to retain water that is noted in the ditches.

L2 Powerhouse Area

The two sample locations were established at the L2 Powerhouse area adjacent to the powerhouse on the Right Bank in October 2020. The L2 area was identified for sampling due to the exposure of a shale slope during excavation for the Powerhouse and continues to evaluate the water quality for potential impact from the PAG slope.

The L2 Area PAG slope is mitigated by covering of the slope that effectively makes it a non-PAG contact surface. The water quality monitoring program has been put in place to verify that the mitigation applied is working and that non-PAG contact water is observed in this area.

During 2021, the L2 Powerhouse area L2-US location was sampled seven (7) times between April to November and the L2-DS location was sampled eleven (11) times between January to November.

The L2-US samples reported BCAWQG-FST exceedances in total iron (3) as a result of the seven samples collected in 2021.

The L2-DS samples reported BCAWQG-FST exceedances in total iron (4), dissolved aluminum (10), total silver (4), total zinc (3), ammonia (1), total arsenic (5) and elevated pH (4) above the accepted guideline value, as a result of the eleven samples collected in 2021.

Water from the L2 Powerhouse area shale slope is conveyed to AFDE RSEM R6 pond from this area is non-PAG contact water. Water from the AFDE RSEM R6 pond is monitored prior to discharge.

TABLE OF CONTENTS

APPENDIX SECTIONS

TABLES

FIGURES

PHOTOGRAPHS

APPENDICES

ACRONYMS & ABBREVIATIONS

Acronyms/Abbreviations	Definition
ARD	Acid Rock Drainage
ARD-ML	Acid Rock Drainage and Metal Leaching
BCMoE	BC Ministry of Environment and Climate Change Strategy Water Protection & Sustainability Branch
BCAWQG	British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture
°C	Degrees Celsius
CEMP	Construction Environmental Management Plan
DOC	Dissolved Organic Carbon
FB	Field Blank
FST	Freshwater Short-Term Maximum
FLT	Long-term Maximum
L/s	Litres per second
LBDB	Left Bank Debris Boom
LBRR	Left Bank River Road (referring to Sample ID)
Lorax	Lorax Environmental Services Ltd.
mg/L	milligrams per litre
ML	Metal Leaching
PAG	Potentially Acid Generating
PRHP	Peace River Hydro Partners
ppm	parts per million
RBSIBAR	Right bank South Bank Initial Access Road (referring to Sample ID)
RPD	Relative Percent Difference
RSEM	Relocated Surplus Excavation Material
SBIAR	South Bank Initial Access Road
TB	Travel Blank
µg/L	micrograms per litre
WQG	Water Quality Guideline

LIMITATIONS OF REPORT

This report and its contents are intended for the sole use of BC Hydro and their agents. Tetra Tech Canada Inc. (Tetra Tech) does not accept any responsibility for the accuracy of any of the data, the analysis, or the recommendations contained or referenced in the report when the report is used or relied upon by any Party other than BC Hydro, or for any Project other than the proposed development at the subject site. Any such unauthorized use of this report is at the sole risk of the user. Use of this document is subject to the Limitations on the Use of this Document attached in the Appendix or Contractual Terms and Conditions executed by both parties.

1.0 INTRODUCTION

Tetra Tech Canada Inc. (Tetra Tech) was retained by BC Hydro (the client) to develop and implement a surface water quality monitoring program at locations around the Site C project site where bedrock shale exposures, classified as potentially acid generating (PAG), may have the potential to contribute to water quality changes due to acid rock drainage and metal leaching (ARD-ML) potential of the bedrock.

We acknowledge this work is being conducted on the traditional territory of Treaty 8 First Nations of Dunne Zaa, Cree and Tse'khene cultural descent.

Monitoring locations were established by Tetra Tech in conjunction with BC Hydro personnel. Where possible (and applicable), they are coincident with the locations and station names used in 2016 by Lorax Environmental Services Ltd. (Lorax) for water quality monitoring on behalf of Peace River Hydro Partners (PRHP) prior to BC Hydro taking over sampling of these stations. Water sampling locations with UTM coordinates are shown in the attached maps in Figures 1 through 3. Photos of the water sampling locations during 2021 are included in the Photographs (1 through 25) section of the Appendix.

Locations along River Road ditch near Blind Corner and below Howe Pit, in proximity to the South Bank Initial Access Road (SBIAR), and along the L3 Creek catchment were established in 2017. These locations have been sampled monthly, except when frozen or dry conditions exist, since initiation of the program in 2017. Sampling at River Road and SBIAR are ongoing, and the sampling at L3 Creek was ended this year with April 2021 being the last sample event. Additional monitoring locations were added in October 2020 at the L2 Powerhouse Area and the BC Hydro Left Bank Debris Boom (LBDB). These locations are also sampled monthly, outside of frozen or dry conditions. The monitoring program includes locations at the discharge points and at midstream locations as well as locations upstream from the discharge to characterize variation to water chemistry within the catchment due to mixing and inflow of water from multiple sources.

This report documents the sampling events conducted monthly between January and December of 2021 and the results of water quality monitoring. Results are discussed in the context of ARD-ML management and mitigation.

The water conveyance facilities at River Road ditch near Blind Corner and SBIAR are identified as having potential for direct ARD-ML impacts due to exposure of shale bedrock during construction related activities.

The catchment for L3 Creek includes RSEM L3 which is currently not considered, nor permitted, for placement of construction related PAG material. Due to potential influence on discharge water quality from the Howe Pit area and inflow from L4 Creek, the water quality within the L3 Creek catchment was monitored in context of ARD-ML management. However, the L3 Creek catchment is not identified as a waterway with potential for ARD-ML impacts arising from construction related activities and is not part of the CEMP requirements. Water quality monitoring was conducted within this catchment to monitor discharge water quality and to maintain a record for potential future use. The BCAWQG-FST values were also used as a benchmark for monitoring the water quality at the discharge location (LBL3C-0.02) from L3 Creek. As of May 2021, sampling is no longer being conducted at the L3/L4 monitoring locations as there is a robust dataset from 2017 to April 2021 to understand the water quality in this area.

The LBDB anchor area commenced water quality sampling on October 8, 2020, to establish upstream and downstream monitoring of PAG contact water from shale exposed during construction. The LBDB area will convey water at some point to discharge into the river or be collected in a ditch then infiltrate to the river, therefore, water quality sampling at LBDB provides data during subsequent phases of increased elevation of the Peace River during water diversion through the Diversion Tunnels.

The L2 Powerhouse area commenced water quality sampling on October 8, 2020, to establish upstream and downstream water quality characterization and for ARD-ML PAG slope monitoring in the L2 Powerhouse area and adjacent to the powerhouse on the Right Bank.

2.0 MONITORING PROGRAM SET-UP AND PURPOSE

Water quality sampling has been scheduled during approximately the third week of each month during from 2017 to 2021 to support a continuous monitoring record for reportable water quality compliance. Completion of the sampling event has been conducted monthly except under frozen or dry conditions. The 2021 monitoring period commenced with the first sample event on January 27-28, 2021, and was completed with the last sample event of the year on November 25-26, 2021. No sampling was undertaken in December 2021 due to frozen conditions. Each sampling event was completed by BC Hydro personnel, and was documented by field notes and photographs, including during dry and frozen conditions.

2.1 Monitoring Program Requirements and Comparison Criteria

Requirements for the development and implementation of the water quality monitoring programs are mandated under the Environmental Assessment Certificate – Condition 3, and the Federal Decision Statement – Condition 7. Reporting of the program results are required on an annual basis. These requirements were carried forward and presented in the BC Hydro Site C Clean Energy Project Construction Environmental Management Plan (CEMP), Revision 10 (March 9, 2022), Appendix E Acid Rock Drainage and Metal Leachate Management Plan.

In accordance with the CEMP Appendix E Section 5.2.1.7, analytical results for all monitoring locations are evaluated against the British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture (BCAWQG) freshwater short-term maximum (FST) values[1](BC MOE, 2019). Water quality measurements recorded at the discharge or downstream locations with exceedances to the BCAWQG-FST were reported to BC Hydro within 24 hours of receiving lab results, and a routine memo is prepared on a monthly basis to summarize field in situ and analytical lab results. The monthly results are compiled for long-term trend analysis in trend charts. The long-term trends data is evaluated against the BCAWQG freshwater long-term (BCAWQG-FLT) chronic values in Appendices B1 to B5.

Water quality measurements collected at discharge locations along River Road and downstream locations at SBIAR that exceed the BCAWQG-FST values are reported to BC Hydro within 24 hours of receiving the results, and subsequently to the provincial Emergency Management BC hotline, the Independent Environmental Monitor, and the office of the Comptroller of Water Rights. The complete results of sampling at all locations is presented in a monthly routine memo to BC Hydro.

Under BCAWQG, the intention of freshwater long-term (FLT; “chronic”) WQG’s are for the protection of the most sensitive species and life stage against sub-lethal and lethal effects for indefinite explores, and uses an averaging period, whereas the freshwater short-term (FST; “acute”) WQG’s are intended to protect against severe effects, e.g., lethality, to the most sensitive species and life stage over a defined short-term exposure period approach

[1] The British Columbia Approved Water Quality Guidelines: Aquatic Life, Wildlife and Agriculture document has been updated frequently during the course of the monitoring program, and has undergone revisions in March 2016, January 2017, March 2018, and August 2019. Screening of the monthly water quality results are performed against the contemporary guideline values. During the 2021 monitoring program, water quality results were evaluated against the August 2019 guidelines. The Total Molybdenum guideline was updated in September 2021 and this updated criteria is being used as of 2022 reporting. The BCAWQ-FST Total Molybdenum value increased by an order of magnitude. This change does not affect 2021 reporting.

(BC Approved WQG Summary Report, 2019). The Working water quality guidelines have not been assessed as part of this monitoring program.

2.2 Analytical Program Parameters

An off-site laboratory analytical program was designed to measure a suite of parameters suitable for screening the water quality against the BCAWQG-FST for surface water. The sampling and analytical procedures implemented during 2021 were commensurate with Tetra Tech's 2017, 2018, 2019 and 2020 monitoring periods and the program previously implemented in 2016 by Lorax for parameters, analytical methods, and detection limits. Samples were collected in a set of clean bottles provided by the lab and were submitted for analysis.

Analysis was conducted for the following parameters:

- Total Metals, Low Level (including Hg);
- Dissolved Metals, Low Level (including Hg);
- Hardness;
- pH;
- Alkalinity: Total/Species (CO_3^{2-} , HCO_3^-, OH^-);
- Acidity;
- Solids: Total Suspended (TSS) and Total Dissolved (TDS);
- Anions: Nitrogen species (nitrite, nitrate, ammonia), Sulphate, Chloride; and
- Dissolved Organic Carbon (DOC) – not collected prior to the September 24, 2019, event.

2.3 Summary of Parameters of Interest

Some of the key parameters that were monitored during this program are described below. Although some of these parameters do not have BCAWQG-FST guidelines, they can be useful indicators to potential changes in water chemistry related to ARD-ML processes.

Alkalinity and pH are important water quality parameters to indicate the ratio between residual alkalinity and acidity in solution and are key indicators for onset of acidic conditions within neutral to alkaline waters when monitored over time. Neutralization of acidity by carbonate, and to a lesser degree silicate, minerals can temporarily increase alkalinity through release of the bicarbonate ion into solution, thereby buffering pH at a near constant value. Bicarbonate will continue to react with, and deplete, any residual acidity. Once all carbonate and bicarbonate sources are depleted, alkalinity no longer is available to neutralize acidity and pH will drop. An indicator for accelerating acid generating processes is when increasing alkalinity is observed without proportional change to pH. The BCAWQG-FST guideline for pH ranges from 6.5-9.0. There is no BCAWQG-FST guideline for alkalinity or acidity.

Water clarity is measured as turbidity (nephelometric turbidity units, NTU) or as total suspended solids (TSS), which is an indicator of the amount of sediment (generally accepted as silt sized particles and coarser, or >0.45 µm in diameter), contained within the water column. TSS can increase if sediment loading occurs due to erosion, or due to rapid precipitation of secondary minerals from chemical reactions such as neutralization of acidic water. The bulk chemistry of water with high TSS tends to mimic the chemical composition of the source sediment being eroded, or in the case of mineral precipitation tends to be high in iron as iron-oxide minerals are the most common secondary mineral to form. Rapid temporal changes to TSS measurements within a catchment due to formation of secondary minerals can indicate presence of active ARD-ML reactions. The BCAWQG-FST guideline is based on deviations relative to background TSS.

Measurements such as total dissolved solids (TDS), electrical conductivity (EC) and salinity are indicators for the concentration of dissolved components and/or ions in solution. Sudden or gradual increases in these parameters can indicate changes in water chemistry such as an increase in reactive ions or dissolved metals as a result of potential metal leaching processes. Changes to these parameters in association with changes to pH or alkalinity may also indicate active metal leaching processes. BCAWQG-FST guidelines are not defined for these parameters.

Dissolved sulphate can originate from anthropogenic sources, microbial processes and through chemical processes related to degradation of rock forming minerals in environments with potential for acid generation through the oxidation of primary sulphide (e.g., pyrite) or dissolution of sulphate minerals (e.g., gypsum). Elevated sulphate concentrations may indicate oxidation, or weathering, of PAG materials in proximity to sample collection locations, however, it may also indicate influence from regional groundwater sources. Water quality with elevated sulphate and pH > 7.0 may indicate ARD-ML processes with sufficient acid neutralizing materials, whereas sulphate with decreasing pH may indicate a shortage of acid neutralizing materials. Sulphate is commonly reactive with several cations and metal ions under ambient environmental conditions forming both soluble and non-soluble mineral precipitates.

Marine shales such as the local Shaftsbury Formation commonly contain sulphide minerals (mainly pyrite, FeS_2) and may also have primary sulphate minerals such as anhydrite ($CaSO_4$), gypsum ($CaSO_4 \cdot 2H_2O$), or barite ($BaSO_4$), and/or other sulphate minerals. Preliminary characterization determined that the primary sulfur species in the shale was sulphide with some detectable sulphate (Klohn Crippen Berger, 2015). Based on this mineral association and site observations, it is possible that groundwater contacting fractured bedrock could contain naturally elevated sulphate concentrations. Only one well from the Main Civil Works (MCW) Site was reported in the baseline groundwater sampling conducted as part of the project’s Environmental Impact Statement (Hemmera Envirochem Inc. and BGC Engineering Inc., 2012) which did indicate groundwater contained elevated sulphate. Ongoing groundwater monitoring (from 2016-2020) up-gradient and down-gradient of RSEM R5a and R5b measured elevated sulphate concentrations below the BCAWQG-FLT guideline, as reported in The Site C Clean Energy Project, 2020 Q4 Groundwater Quality, Monitoring Report for RSEM R5a and R5b (Lorax, 2020). These results indicate the ongoing presence of sulphate in the groundwater systems. It is noted that the down-gradient monitoring wells at RSEM R5b were screened in overburden materials above the bedrock contact. The guideline value for sulphate is not stated in the short-term BCAWQG-FST guideline, however, a long-term average guideline value is stated (variable with hardness) and is referenced in this report.

Water hardness is derived from the total concentration of calcium and magnesium ions in solution, and often reported as mg/L of dissolved $CaCO_3$) is known to mitigate the effect of certain metals on aquatic organisms, and the guidelines are presented with equations derived from experimental data for sulphate and numerous metals (cadmium, copper, fluoride, lead, manganese, silver and zinc that tests a range of hardness specific to each metal or sulphate). Water hardness classification on-site is Hard to Very Hard (180 to >250mg/L, and up to 1,000 mg/L, dependent on location) and is often measured above the guideline threshold used to calculate BCAWQG-FST guideline values. Where the ambient hardness values exceed the guideline limited listed for BCAWQG, the exceedance criteria have been calculated using the upper limit “capped” hardness value instead of the measured ambient hardness.

Water quality screening efforts have focused on elements with BCAWQG-FST guidelines, which include pH, ammonia, chloride, nitrite, total concentrations of arsenic, boron, cobalt, iron, lead, manganese, molybdenum, silver, and zinc, and dissolved concentrations of aluminum, cadmium, and iron. Changes in concentrations of some elements or metals, reported as both total and dissolved, can have various implications for water quality under ARD-ML conditions. The solubility of individual elements can vary with pH. Geochemical modelling completed by Klohn Crippen Berger (2015) identified copper, cobalt, cadmium, and zinc as having high probability of leaching into solution of site water during oxidation of the local shale bedrock under oxic acid rock generating and metal leaching conditions.

Formation of iron-oxide precipitate is a widely recognized indicator of active ARD-ML processes. Total iron concentrations are associated with ARD-ML due to liberation of ferric iron from the oxidation of primary iron bearing sulphides. Subsequent formation of iron-oxide or iron hydroxide minerals can precipitate when acidic waters are neutralized and may be present as suspended solids or can form scaling on reactive surfaces such as limestone.

Aluminum is abundant in rock forming minerals and can be released as part of oxidation and degradation of rocks during ARD-ML processes. Aluminum is soluble in acidic water and is typically not soluble in neutral and alkaline waters. Aluminum, as Al^{3+}, can also contribute to the acidity along with H^{+}. When concentrations of aluminum are measured in detectible concentrations in neutral or alkaline water, it is possible that the formation of very fine aluminum hydroxide clays may occur in previously acidic waters that have been neutralized. Aluminum hydroxide mineral species (e.g., polymorphs of gibbsite or hydrargillite) can form on rock surfaces and are indicators of acid generating conditions. Precipitation of aluminum and iron hydroxide produced by weathering may occur on and reduce the exposure of acid generating and acid neutralizing minerals. (Price, 2009).

Concentrations of aluminum, iron and copper are typically low in neutral pH drainage, however, elements such as antimony, arsenic, cadmium, molybdenum, selenium, and zinc can be present in neutral pH drainage (BC MEM, 1998). Neutral pH metal leaching is an important mechanism to be observed on the Site C project as several of these neutral pH soluble elements are prevalent in the shale bedrock. These elements can be concentrated within secondary mineral formation on shale bedrock during prolonged period of low moisture, then released into run-off water in elevated concentration during high precipitation events.

3.0 SAMPLE LOCATIONS

A list of sample locations is provided in the attached Table 1 and the locations are shown on Figures 1 through 4.

3.1 Description of River Road Sample Locations

Access road construction in 2016-2017, on the north/left bank, between Howe Pit and the Peace River along River Road cut through bedrock. ARD-ML management and mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone riprap to provide neutralization potential and mitigate against acidic drainage. The limestone in the ditch was replaced in July 2021 to provide fresh surfaces for acid buffering.

A total of twelve (12) monitoring locations have been established in the River Road catchment near Blind Corner, shown in Figure 1. Currently in 2021, eleven stations were monitored with lab sampling (7 locations) and in situ only measurements (4 locations). The River Road ditch was refreshed with limestone in July of 2021. See Section 5.3 for additional discussion of management and mitigation of ARD-ML in this area.

Sample locations were initially established in 2017 along the River Road ditch for in situ testing, primarily as a means of monitoring the effectiveness of the limestone riprap and to observe longer term trends related to the PAG outcrop at Blind Corner and run-off/seepage from Howe Pit. Initial laboratory and in situ testing in 2017 were conducted in the 1) lower chimney drain (LBRR-LC), 2) upper chimney (LBRR-US), 3) upstream of the lower chimney drain within the River Road ditch (LBRR-12+500), and at the 4) discharge of culvert RR-11 (LBRR-DD). In situ sample locations since 2017 included LBRR-12+430, LBRR-12+600, LBRR-12+700, LBRR-12+810 and LBRR-12+920, although LBRR-12+430 was discontinued in 2018 and not in the 2021 monitoring period.

In April 2018, the establishment of three additional locations: LBRR-EDP, LBRR RR9 and LBRR-RR8 were added to the water quality monitoring program. LBRR-EDP is located at the end of a diversion pipe installed on March 19, 2018. The diversion pipe inlet is within the River Road ditch at station LBRR-12+430 to divert water down-gradient into the River Road ditch towards culverts RR9 and RR8 (the LBRR-12+430 location was discontinued as a result). The pipe bypasses the lower chimney drain (LBRR-LC), which continues to discharge from culvert RR-11, and bypasses L3 Creek, which continues to discharge from culvert RR-10.

The purpose of the diversion pipe is to address erosion and sediment control by transport of run-off water into an elongated ditchline to reduce flow velocities and to promote settlement of suspended sediment. Inlets to culverts RR9 and RR8 are slightly elevated from the ditch base which will allow water to pond within the ditch and infiltrate or discharge via the culverts only if water levels reach sufficient height. Both culverts are made of HDPE materials. The monitoring program includes collection of discharge from these LBRR-RR8 and LBRR-RR9 culverts.

In 2021, flow was observed from discharge locations during some sampling events at LBRR-DD (February) and LBRR-RR9 (March, November).

In situ observations and measurements were routinely collected at eleven locations within the River Road ditch when flowing water was observed. In the months of July, August and September 2021, the LBRR-12+500 location was dry with no flow; the field sampler collected an in situ measurement (lab sample only in July) for these three sampling events from a nearby puddle at LBRR-12+450.

Sampling with laboratory analysis was attempted on a monthly basis from seven of the River Road catchment locations in 2021 when flowing water was observed. The analyses results were used to understand water quality prior to mixing and discharging into the Peace River. These locations are located: in the upper chimney (LBRR-UC), lower chimney drain (LBRR-LC), upstream of the lower chimney drain within the River Road ditch (LBRR-12+500), the discharge (LBRR-DD), at the end of the diversion pipe (LBRR-EDP), and at the LBRR-RR8 and LBRR-RR9 culverts. No samples were collected at LBRR-RR8 due to no flow or frozen conditions through the year.

The established River Road monitoring locations are shown in Figure 1 and photos of the locations are included in the Photographs (Photos 1 to 11) section of the Appendix. Water quality lab data results are provided in Appendix B, Table B1 and discussed in Section 5.3. A map showing the locations is in Figure 1.

3.2 Description of South Bank Initial Access Road Locations

The South Bank Initial Access Road (SBIAR) shale slope was initially exposed in 2015 as part of road construction works on the south bank between Relocated Surplus Excavation Material (RSEM) R6 and Area A. The total area of the shale slope is approximately 14,000 m^2, between both the East and West slopes. Management and mitigation measures includes reduction of surface contact water through capture of up-gradient flow and diversion through a pipe to limit flow along the exposed shale slope, and collection of any remaining PAG contact water in ditches which is captured and conveyed to PRHP RSEM R6 Settlement Ponds (permitted for PAG contact water). The effectiveness of the mitigation is evaluated through monthly monitoring of water quality stations along the road.

A total of five (5) monitoring locations were established in the SBIAR catchment to monitor water quality flowing in the SBIAR ditches at the toe of the SBIAR road cut. A monitoring location in the side channel down-gradient of the

SBIAR construction (RBSC-DS) was sampled up to and including May 2021. The RBSC-DS sample location was removed from the sample program after May due to lack of surface water connection to the SBIAR catchment. The remaining four sample locations allow for data collection from the east and west SBIAR ditches. This provides long-term characterization of SBIAR water management from the upstream location in the west ditch (RBSBIAR-US) and the downstream location in the west ditch (RBSBIAR-DS), as well as upstream and downstream sampling locations in the east ditch, (RBSBIAR-EUS and RBSBIAR-EDS, respectively). In situ and laboratory analysis are conducted at all five locations between January to May 2021, and at four locations between June and December 2021.

It is noted that the water flowing from the downstream locations do not have a direct downstream receptor; the water from the east ditch passes under the road via culvert to the downstream location in the west ditch where all water flows into a limestone armored spillway into a ditch which conveys to the PRHP RSEM R6 pond. There is an intensive water quality monitoring program in the pond (continuous in situ measurements of pH, conductivity; daily lab analysis for all parameters) conducted prior to discharge by Lorax (Lorax 2022), Ecofish Research Ltd. (Ecofish 2022) and others, as well as Peace River receiving environment monitoring conducted by Ecofish (Ecofish, 2022) and others.

The RBSC-DS location was sampled from 2017 to May 2021 as a verification point to check for potential influence from, or direct connectivity with, the PAG contact water that is collected within the SBIAR facility and diverted to the PRHP RSEM R6 pond. Groundwater and local surface run-off contribute to the local water quality; however, this location remains hydraulically connected to the Peace River which is interpreted as the primary influence of local water quality, particularly TSS measurements.

The RBSBIAR sampling locations were monitored on a monthly basis and water quality samples were collected for twelve months between January and December 2021 when flow outside of frozen or dry conditions occurred.

The established RBSBIAR monitoring locations are shown in Figure 2 and photos of the locations are included in the Photographs (Photos 12 to 16) section of the Appendix. Water quality lab data results are provided in Appendix B, Table B2 and discussed in Section 5.4. A map showing the locations is in Figure 2.

3.3 Description of L3 Catchment Sample Locations

The catchment for L3 Creek includes RSEM L3 which is currently not considered, nor permitted, for placement of construction related PAG material. The L3 Creek catchment was monitored from 2017 to April 2021 for potential influences from non-Site C impacted water originating in the Howe Pit area and naturally impacted inflow from L4 Creek. It was deemed that sufficient data had been collected for understanding the water quality at L3 Creek, therefore no sampling was continued following April 2021.

Five monitoring locations were established within the L3 and L4 Creek catchment to characterize water quality along the creeks and at the discharge location. A baseline location up-gradient of RSEM L3 (LBL3C-3.32) is 3.32 km from the L3 Creek discharge location. One midstream location, LBL3C-1.65, is above, and one midstream location, LBL3C-1.43, is below the confluence of L4 Creek and Gulley Road box culvert. The LBL3C-1.65 and LBL3C-1.43 locations are 1.65 km and 1.43 km, respectively, from the L3 Creek discharge location, and are monitored to characterize changes through the drainage towards the downstream discharge location at culvert RR-10 (LBL3C-0.02), located 20 metres from the L3 Creek discharge location.

L4 Creek is a naturally incised gully which is located downstream from the off-site 85th Avenue Industrial Lands gravel quarry work. One monitoring location established in L4 Creek, LBL4C-0.18, is 180 metres upstream from the confluence with L3 Creek. Comparison of the measurements from the L3 and L4 Creek monitoring locations are used to characterize the mixed waters monitored at the L3 Creek midstream location, LBL3C-1.43.

The L3 Catchment monitoring locations are shown in Figure 3 and representative photos are included in the Photographs (Photos 17 to 21) section of the Appendix. Water quality lab data results are provided in Appendix B, Table B3 and discussed in Section 5.5. A map showing the locations is in Figure 3.

3.4 Description of BC Hydro Left Bank Debris Boom Sampling Locations

Shale was exposed during construction of the BC Hydro Left Bank Debris Boom (LBDB) anchor area in approximately March 2020. In September 2020, the river was currently at Phase 1 elevation (~410 m) followed by a partial block and diversion of the Peace River to allow construction of the main Site C dam in October 2020, causing the river/reservoir to flood up to stage 2 levels (~417-420 m). The final river/reservoir elevation is ~ 460 m.

The ditches above the 420 m elevation are lined with 3–10-inch size fraction limestone as a management measure to provide additional buffering capacity to leachate entering the ditches. The area below 420 m elevation was flooded by the head pond after construction in early Fall 2020, and therefore that area did not require riprap. The area above 420 m elevation will be exposed for 3-4 years, prior to flooding to the final river/reservoir elevation of around 460 m elevation. Seeding with ESC mix completed on exposed soil areas after they were track packed and loosened.

Water quality sampling at LBDB provides data to apply to understanding of water discharge and flooding in subsequent phases of increased elevation of the Peace River and during water diversion through the Diversion Tunnels. Sample locations were established and first sampled on October 8, 2020, to characterize water quality in the LBDB area for ARD-ML monitoring. The purpose of sampling is to monitor PAG contact water from shale exposed during construction in March 2020, and that drains to the Peace River.

The initial sampling locations included the LBP Pond location and LB Side Channel. The LBP Pond sample location has been sampled regularly since initiation. The LB Side Channel was only sampled in 2020 prior to inundation of the Peace River and this station is now back flooded and no longer considered.

Additional sample locations were added in July 2021 following a review of the area during the Tetra Tech site audits. Water management structures and ditch linings were also amended. The water management structures were improved to manage flow and prevent erosion and ditches were lined with limestone to provide acid buffering capacity. These were proactive measures to manage signs of erosion and initial signs of ARD/ML generation on the exposed shale slopes.

Monitoring locations were added to the west and east armor ditch, which captures water from the shale slopes at upstream and downstream locations. These four stations are named as LBDB-WUS (west ditch upstream), LBDB-WDS, LBDB-EUS, and LBDB-EDS. Three stations were also added along the LBP Pond flow path. Station LBDB-LD-US captures water upstream of and draining into the LBP Pond. Station LBLD-LD-MS is downstream of LBP-Pone, and station LDBD-LD-DS is further downstream prior to discharge to the Peace River.

The LBP Pond was sampled between April to October and the Armor Ditch downstream locations (LBLD-WDS and LBLD-EDS) were sampled once in the month of July 2021. The other sample locations were not sampled due to no flow or frozen conditions. Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LBP Pond location, is immediately following a significant rainfall event. Sample staff are instructed to sample these locations outside of regular monitoring events, if possible, when high rainfall is observed.

A representative photo of the LBDB locations is included in Photographs (Photos 22 and 23) section of the Appendix. Water quality lab data results are provided in Appendix B, Table B4 and discussed in Section 5.6. A map showing the locations is in Figure 4.

3.5 Description of L2 Powerhouse Area Sampling Locations

The L2 Area PAG slope is mitigated by covering of the slope that effectively makes it a non-PAG contact surface. The water quality monitoring program has been put in place to verify that the mitigation applied is working and that non-PAG contact water is observed in this area. Water conveyed to AFDE RSEM R6 pond from this area is non-PAG contact and is monitored by PRHP prior to discharge from the RSEM R6 pond.

Water quality monitoring at the L2 Powerhouse area adjacent to the powerhouse on the Right Bank was initiated in October 2020 and continued to be sampled throughout 2021. Water quality samples are collected from the upstream (L2 US) and downstream (L2 DS) in the L2 Area located adjacent to the powerhouse.

The L2 DS sample location is adjacent to the L2 Powerhouse, specifically collected from the pump tubing on the west side of the culvert and approx. 1-2 m from the south rock ditch wall and 1-2 m from the culvert. The L2 US station is located upstream from the L2 Powerhouse in a ditch line.

Representative photos of the L2 Area are included in the Photographs (Photos 24 and 25) section of the Appendix. Water quality lab data results are provided in Appendix B, Table B5 and discussed in Section 5.7. A map showing the locations is in Figure 2.

4.0 LOCAL CONDITIONS

4.1 Weather Conditions - Temperature and Precipitation

The minimum, maximum, and average daily temperature and the seven-day temperature range preceding each sampling event are summarized in the attached Table 2. The total precipitation measured for the seven days preceding each sample event and the precipitation on the day prior to and the day of the sample event are also summarized in Table 2. The temperature and precipitation data was sourced from BC Hydro's Site C Meteorological and Air Quality Station (Figure 4; BC Hydro, 2021), Station 7C Site C North Camp.

Sampling events in 2021 were primarily conducted on dry days with no precipitation, except for sampling in the months of February, May, July, and August. A summary of mean daily temperature recorded on sampling events, and precipitation recorded prior to and during the sampling event is provided in Table 4-1.

Table 4-1: Sample Event Temperature and Precipitation

Routine Memo No.	Sample Event No.	Sample Event Date	Mean Daily Temperature (°C)	Precipitation on Sample Event (mm)	Precipitation for 7 days prior to Sample Event (mm)
1	1	28-Jan-21	-22.3	0.00	3.97
2	2	23-25-Feb-21	-2.30	2.45	0.00
3	3	17-18-Mar-21	4.06	0.00	1.61
4	4	08-Apr-21	-1.20	0.00	0.00
	5	22-23-Apr-21	1.59	0.00	5.07
5	6	18-19-May-21	8.21	6.86	4.32
6	7	24-Jun-21	19.30	0.00	2.07
7	8	20-22-Jul-21	14.40	29.67	14.27
8	9	29-Aug-21	14.00	0.58	18.52

9	10	21-22-Sep-21	13.30	0.00	10.59
10	11	28-29-Oct-21	2.60	0.00	1.19
11	12	25-26-Nov-21	2.53	0.00	10.92

4.2 Classification of Seasonal Flows in Ditch

Residence time for water is low in the investigated area ditches due to their small catchment size. The climate data was used to evaluate water availability and potential water source for flows that were observed in the ditches.

The flows in ditches are susceptible to seasonal change and flow rate is highly influenced by local precipitation events, thus the classification of flow in ditches can assist to interpret the source and subsequent chemical fluctuations in water sampled (attached Table 3). For example, flows in ditches can be attributed to shallow or regional groundwater, spring freshet or surface run-off, dependant on the season and amount of precipitation recorded in the previous 24-hours and 7-days to the sampling event. This association may be less apparent in L3 Creek due to a larger catchment size and residence time for water within the drainage, however, it is interpreted that similar trends may be observed.

Regional bedrock groundwater in locations sampled are suspected to have elevated concentrations of dissolved sulphates due to groundwater interaction with local pyritic-shale bedrock and local bacteria, and may, to some degree, be responsible for the high sulphate-content pervasive in water samples following minimal precipitation during the previous 7-day and 24-hours to the sampling event (e.g., January 28, February 23-25, March 17-18, April 22-23, May 18-19, June 24, and October 28-29).

When significant or moderate precipitation has occurred in the previous 7-days, but minimal precipitation within the prior 24-hour period to the sampling event, the flows in ditches can result from shallow groundwater flow, mainly through unconsolidated overburden. The highest amount of precipitation in the preceding seven days to and during the sampling event was documented to occur in July (43.94 mm), August (18.52 mm), September (10.59 mm) and November (10.92 mm) sampling event. Precipitation data shows limited influence from precipitation and a much stronger correlation with freshet (Table 4). These values in the river are heavily influenced by the freshet and snowmelt during April, May, June as discussed below.

During spring freshet and snow melt, sampling events (e.g., April 22-23, May 18-19, and June 24) can be classified as having a ‘dilution’ effect to the water chemistry, although increased TSS from turbid high flows can counteract this effect. To the contrary, during more arid seasons with little to no precipitation occurring in the previous 7-days and 24-hours (e.g., January 28, February 23-25, March 17-18, April 8, June 24, October 28-29), flows in ditches can be attributed to regional groundwater baseline seepage. In this event, when precipitation and sampling occur following dry periods, the surface chemistry of the rocks will be washed into the ditches and be concentrated.

There was moderate rainfall prior to and including the May 18-19 and July 20-22, 2021, sampling event, which produced increased turbidity and flow in the ditches resulting in short-term effects on measurements such as TDS, TSS and potentially total metal concentrations from flushing of exposed slopes and ditch fill material.

The classification of seasonal flows in ditches, therefore, are important to consider when interpreting fluctuations and exceedances in parameters measured in water quality guidelines over the period of one year.

4.3 Peace River Turbidity and TSS

Turbidity of the Peace River is monitored by BC Hydro through a series of continuous data loggers situated both upstream and downstream of the dam construction area. Time series data is collected from the left and right banks of the Peace River up-gradient of the Moberly River (stations PAM-LB and PAM-RB, respectively) were provided to Tetra Tech by Ecofish to provide a general understanding of influence by precipitation on natural sediment within the Peace River upstream from the construction area surrounding sampling events.

The turbidity data, measured in NTU, is converted to a value representing TSS, in mg/L, using a conversion factor developed by Ecofish using calibration of field measurements with laboratory data. (Ecofish, 2022).

The data considered by Tetra Tech include turbidity measurements for the seven days prior, day prior, during, and day following the January through November 2021 sampling events (Table 4).

Measured turbidity spikes during early spring and freshet, through March-May, then decreases and then decrease through to baseline conditions by October. The precipitation event during July sampling event and the highest 7-day precipitation to occur prior to a sampling event was recorded in August 22-28, 2021 (18.52 mm) were not associated with particular influences on TSS and turbidity levels. Figure 5 and appendix Table 4 illustrates the variability and trends in turbidity and TSS during 2021 (Ecofish, 2022) and can be reviewed in conjunction with precipitation events listed in appendix Table 2.

The daily mean turbidity and TSS that is measured during freshet and snowmelt measures higher values on the Left Bank relative to the Right Bank, that is summarized in Table 4-2.

Table 4-2: Elevated Turbidity and TSS during Water Quality Sample Events in 2021

Sampling Date	Turbidity (NTU)		TSS (mg/L)	
	LB	RB	LB	RB
22-Apr-21	72.6	50.0	52.3	36.0
23-Apr-21	64.3	52.6	46.3	37.9
18-May-21	90.0	58.5	64.8	42.1
19-May-21	138.7	57.5	99.8	41.4
24-June-2021	42.3	30.4	15.8	11.4

NTU: Nephelometric Turbidity Units

5.0 WATER QUALITY MONITORING PROGRAM RESULTS

5.1 Sample Events in 2021

A summary of each water quality sampling event and corresponding analytical results in eleven (11) routine memos summarizing twelve (12) sampling events at the RR, SBIAR, L2 Powerhouse and LBDB catchments reported monthly to BC Hydro between January to November 2021. No sampling event occurred in December due to frozen no flow conditions.

Two (2) sampling events occurred at the L3 Creek catchment (January and April 2021) prior to the termination of sampling at this catchment, due to ample background data collection from 2017 to 2021.

The attached Table 1 presents a summary of the dates of the sampling events and which locations had in situ or lab testing completed.

Field notes document field observations at each monitoring location including estimated flow rate and water clarity, site conditions and construction activities, if applicable to monitoring. In situ tests are completed with record of measurements for water temperature, hardness, alkalinity, pH, and electrical conductivity collected using a hand-held meter. The in situ test data is presented in the appendix Tables 6, 8, 11, 13 and 15.

Laboratory results for all locations are provided in Appendix B (Tables B1 to B5). A summary of BCAWQG-FST water quality exceedances listed by monitoring location and month are listed in Table 7, 9, 12, 14, and 16.

Appendix Table 10 presents a summary of minimum, maximum and mean values for measurements at discharge and downstream Locations in 2021.

5.2 Quality Control and Quality Assurance Program

5.2.1 Overview of QA/QC Program

The Quality Control and Quality Assurance (QA/QC) program is based first and foremost on experienced field staff familiar with the water quality monitoring program adhering to the British Columbia Field Sampling Manual, Part A and Part E (BC MoE, 2013) for sample collection procedures and QA/QC practises. New sample containers were acquired from the laboratory prior to the sampling event and all handling of the containers, sampling devices and equipment during sample collection was completed wearing new nitrile gloves to minimize potential for contamination of the samples. A new disposable syringe and 0.45 µm filter were used for each sample being submitted for dissolved metals, as per field sampling procedures (BC MoE). All samples were stored in a cooler filled with ice packs at a temperature between approximately 4°C and 8°C.

The program incorporates the use of a Travel Blank (TB), Field Blank (FB) and replicate sample to test for potential contamination during sample collection, handling, or laboratory preparation, and to evaluate the precision of laboratory analysis. Travel Blanks were prepared by the laboratory and Field Blanks were prepared in the field at sample collection sites by field staff using the same source water as was used for the Travel Blank.

5.2.2 Laboratory QA/QC

Analytical results were received monthly from ALS Laboratories (ALS). No external lab was contracted during the 2021 monitoring period. The lab implements a detailed QC program into the sample analysis which includes a series of checks and evaluations for consistency in the sample analysis. The QC program includes method blanks, certified reference materials, laboratory control samples and duplicates. The QC Lot reported on Assay Certificates consistently met internal ALS Data Quality Objectives throughout the year.

5.2.3 Tetra Tech QA/QC

The analytical results of the QA samples (TB, FB and replicate samples) were reviewed by Tetra Tech, and if potential contamination or concerns with analytical results were identified, they were discussed with the laboratory and/or the field sampler representatives, with reanalysis of samples completed for verification if necessary. Appendix Table 5 lists the results of the QA program.

5.2.3.1 Blank Samples

Travel Blanks were prepared by the laboratory and Field Blanks were prepared in the field at sample collection sites by field staff using the same sourced water. If the source distilled water was contaminated, similar elemental anomalies would be expected in both the TB and the FB. Blank samples were considered to 'fail' where any measured value was in concentrations above the reported detection limits for that parameter. Elemental concentrations measured above detection limit can be attributed to field contamination or calibration of analytical instrumentation. During 2021, TB and FB data showed minimal occurrences of any significant concentrations of values above the detection limit. As a result, no reruns were required by the lab during 2021.

Elemental concentrations measuring at or slightly above the analytical detection limits in TB and FB samples occurred twice during the 2021 monitoring period, including nitrate (February TB) and molybdenum (November FB). These two blank samples did not measure similar anomalous elemental concentrations in the corresponding travel or field blank and were not considered further.

An average pH value of 5.21 was measured in travel and field blanks collected from the sampling events that occurred between January to November 2021; this pH result is typical for distilled water used for the TB and FB samples.

5.2.3.2 Replicate Samples

Replicate samples were evaluated using Relative Percent Difference (RPD). When an RPD value is less than 30% it is considered an acceptable threshold for variation of surface waters.

Field replicate samples with differences of elemental concentrations above the acceptable threshold of RPD > 30% had occurrences for a variable number of parameters measured on January 28 (10), February 25 (2), March 17 (10), April 8 (3), April 22 (16), May 18 (3), June 24 (5), July 21 (1), August 29 (3) and September 21 (13). Discrepancies are attributed to sediment disturbance during the collection of the first sample. The field staff were informed of these issues and were reminded of the importance of QC procedures during replicate sampling.

5.2.3.3 Total vs Dissolved Concentrations

Tetra Tech also reviewed the data for more general anomalies and inconsistencies. The total and dissolved concentrations for the full suite of elements were continued to be compared since there are frequent occurrences of dissolved concentrations exceeding total concentrations. The results were screened for analytical error, then assessed for expected natural variability of surface waters. Most instances were due to measurements at or near the analytical detection limit and could be explained by being within an acceptable range of error up to five times the lower detection limit for the respective element. In this case of reporting within five times of detection limit, the total concentrations are considered equal to the dissolved concentrations.

Dissolved concentrations exceeding total concentrations in samples were calculated within the acceptable threshold of an RPD < 30%, with exception of the following occurrences in three sampling events in 2021: March (sulfur), May (tungsten), July (cobalt, nickel, tungsten, zinc).

5.3 River Road Water Quality Monitoring

At River Road, sufficient flowing water permitted samples to be collected during 2021 from:

- LBRR-DD (February);
- LBRR-12+500 (February, March, April, July);

- LBRR-EDP (February, April);
- RR9 (March, November);
- LBRR-UC (April); and
- LBRR-LC (February, March).

Dry, freezing and/or low or no flow conditions prevented reliable sampling at the River Road monitoring locations for the remaining months of 2021. In situ measurements were not collected from each station consistently every month due to dry or frozen conditions. Field observations were documented each month and results for each monthly sampling event were plotted on a quarterly basis on time series charts for trend and qualitative correlation analysis.

A summary of water quality exceedances at River Road relative to BCAWQG-FST listed by monitoring location and month are listed in Table 7, and the screening results based on the laboratory data are tabulated in Appendix B1.

5.3.1 Limestone Ditch Status and Maintenance

Current mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone riprap to provide neutralization potential and mitigate against acidic drainage. Water quality monitoring has verified that the limestone is effective mitigation for acidic drainage in that pH of WQ monitoring samples are neutral. Seasonally, typically in March during freshet, elevated iron and arsenic have been observed during high flow conditions. This is believed to be influenced by erosion and sediment control challenges during high surface flow including collection of sediment from road surfaces flowing into the ditch from the roadway.

As the project progressed, the ARD-ML management plan was updated, increased monitoring and evaluation of the WQ along River Road was implemented, and mitigation to seasonal flushing of materials at freshet was adopted using limestone riprap and bentonite liner in the base of the ditch. With increased use of River Road, sediment and erosion control measures also needed to be addressed to manage the sediment load coming off of the road and into the ditch. The limestone is monitored for accumulation of precipitates and sediment and refreshed either by cleaning or replacement as needed.

The placed limestone riprap is effective at mitigating the pH of the drainage when there are fresh surfaces of limestone available for chemical reactions. Mineral precipitates can accumulate on riprap, therefore maintenance to replace limestone was completed in 2021. The new limestone provides fresh surfaces to provide neutralizing potential and buffer against potential ARD processes from the shale slope.

Potentially acidic leachate generated from the rock cut-slopes reacts with the alkaline limestone to help neutralize water as it passes through the riprap lined ditch. The ditch also serves to convey run-off water and fine sediment shed from River Road through the end-of-diversion pipe between 12+430 and LBRR-EDP where water is pooled and infiltrates or is discharged through culvert RR8 and RR9 into the Peace River if water levels exceed the inlet height of culverts. Water from the lower chimney ditch, LBRR-LC, is conveyed through culvert RR-11 to the discharge location, LBRR-DD, and ultimately to the Peace River.

Location LBRR-12+920 is located immediately up-gradient of the upper cut-off chimney and PAG exposure, whereas LBRR-12+810 is located immediately down-gradient the upper cut-off chimney and sits below the PAG exposure at Blind Corner. Notable decrease in water pH and alkalinity generally occurs between these stations with a gradual recovery from acidic to circumneutral pH and available alkalinity towards location 12+500.

Maintenance 2017-2020

In 2017, the collection ditch on the cut-bank (north) side of River Road between approximately 12+340 and 12+960 (Blind Corner) was lined with limestone riprap to assist with mitigating the potential effects of ARD-ML from PAG bedrock that was exposed during the initial road construction in 2015 and early 2016. Limestone was also placed between stations LBRR+920 and LBRR-DD to manage the pH of baseline drainage water at the outflow location. Limestone riprap within the ditch between road stations 12+600 and 12+900 continued to be maintained in 2018, including completion of a hydroseeding program and a limestone buttress as the tow of the shale slope at blind corner to support long-term erosion control and slope stability in March 2018. The hydroseed appeared to remain in place on the slope, however, germination was not successful at year's end. No maintenance activities were completed in 2020.

Maintenance in 2021

In early July 2021, riprap was replaced with fresh limestone from the start of Blind Corner ditch up to but not including under the diversion pipe. During replacement of limestone the contractor removed the previously installed bentonite liner. Placement of new bentonite liner and replacement of limestone was subsequently completed in 2021.

5.3.2 In Situ Measurements and Field Observations

Values for pH, conductivity, hardness, alkalinity, water temperature, estimated flow and turbidity measured at the River Road monitoring locations are included in Table 6. At River Road during 2021, the range in water temperatures was 0.12 °C to 21.9 °C. Measurements of pH ranged between 7.17 to 8.89, alkalinity ranged between 40 and 240 ppm, hardness ranged between 250 to 800 ppm and conductivity between 504 to 2,700 µS/cm.

Flows within the River Road ditch are ephemeral. During 2021, flow was noted at the LBRR-DD discharge location in February 2021, at the LBRR-EDP location in February and April 2021, at RR9 in March and November, and no flow noted at RR8 throughout the year. Flow was observed in February and March at LBRR-LC (Lower Chimney; Midstream) and April at LBRR-UC (Upper Chimney). Flow was observed at the LBRR-12+500 in February, March, April, July, August, and September, and further up the LBRR ditch at LBRR-12+600, LBRR-12+700, LBRR-12+810 and LBRR-12+920 during between four to seven months of the 12-month monitoring period. Dry or frozen conditions prevailed for the remainder of 2021.

In the months of July, August and September 2021, the LBRR-12+500 location was dry with no flow; as a result, the field sampler collected an in situ measurement (lab sample only in July) from a nearby puddle at LBRR-12+450.

In the River Road catchment, considering all sampling conditions, TSS measurement ranged from a low of 4.4 mg/L (November) to a high of 1,370 mg/L (March). For all stations, the combined average TSS was 497 mg/L, and each sample location showed variable TSS that was seasonally correlated with highs typically in March-April, lowest values in the winter months of February and November. The source of TSS is primarily attributed to River Road run-off, scouring of sediment deposited within the River Road ditch and washing from the cut-slopes.

5.3.3 Freshwater Short-Term Maximum Exceedances

The summary of exceedances is presented in Table 7 and summarized below. The complete data results from the samples are summarized in Appendix B1.

Of the total twelve (12) samples collected from River Road during 2021, eight occurrences of elevated total metal concentrations above the BCAWQG-FST were measured, twice for total arsenic and six times for total iron. Neutral to alkaline laboratory pH values were measured with pH ranging between 6.99 to 8.17.

At the three RR discharge locations, there were no exceedances measured at LBRR-DD and two exceedances measured at RR9 (total iron and total arsenic, March). No sampling at RR8 discharge location. Non-discharge locations along River Road measured BCAWQG-FST exceedances in total iron and total arsenic at LBRR-12+500 (February, March, and April) and total iron at LBRR-EDP (February, April). No exceedances were measured at LBRR-UC and LBRR-UC during 2021.

The exceedances are interpreted to be directly related to washing, or flushing, of sediment and secondary mineral precipitant during freshet (or precipitation following a dry period), as water contacted accumulated sediment within the ditch in addition to the exposed shale, colluvium, and overburden cut-banks.

This result suggests active ARD-ML processes on exposed PAG at Blind Corner and within Howe Pit are influencing water quality when there is flowing water.

5.3.4 Trend Monitoring and Details of 2021 Sample Results

Data results from 2017 to 2021 at River Road monitoring stations have been compiled and plotted for trend analysis. Please refer to Figures 7 to 18 for time series charts.

Monthly water quality monitoring measures instantaneous ambient conditions at the time of sampling and as discussed in Section 3.1 the measurements are highly susceptible to temporal climate conditions due to the small catchment and short residence time of water within the River Road ditch. Event data characterizes the influences of seasonal conditions at the site.

Time series charts for pH and alkalinity, TSS and TDS, sulphate, total and dissolved aluminum, and total and dissolved iron at River Road were presented in the 2017 and 2018 annual reports (Tetra Tech 2017 and Tetra Tech 2018), but not in the 2019 annual report due to lack of water quality data in 2019 (Tetra Tech 2019). Water quality sampling has been inconsistent at the River Road locations since 2017 due to frequent low flow or frozen conditions. There is minimal data available from mid-2018 to the end of 2019, and variable amounts of data in 2017 and 2021 from different stations and times. The available data makes it challenging to discern seasonal trends at River Road. Additional data collection and ongoing time series trend analysis is needed to support interpretation of trends.

The measured pH values collected at River Road have remained within an acceptable BCAWQG-FST range (pH 6.5 to 9.0) during 2021 sampling events that show more consistency in 2020-21 relative to more variability in pH during 2017 and 2018 when pH values varied below and above the acceptable BCAWQG-FST. During 2021, alkalinity and pH remain relatively consistent whereas acidity is more variable, especially at the LBRR-12+500 and LBRR-UC locations. The collection of acidity data is limited to primarily 2020-21 and will continue to be monitored.

During 2021, TDS and TSS values at River Road sample locations generally remain within range of measurements in 2017 through 2020. Although limited and inconsistent data is available, the LBRR-12+500 location shows the highest TDS values in 2021 relative to the other RR locations sampled. During 2021, TSS values measured were within range of values measured between 2017 to 2020. During 2021, sulphate concentrations measure within range of values collected from 2017 to 2018, which continue to straddle the BCAWQG-FLT guideline value of 429 mg/L (guideline variable based on hardness) and insufficient data to show any trends in 2021.

During 2021 total and dissolved aluminum are variable and within range of measurements in 2017 to 2020.

During 2021, total iron varies in concentration that measures below and above the BCAWQG-FST guideline and within range of measurements since 2017. Total iron, similar to total aluminum and TSS values, measure similarly and follow a similar trend at the LBRR-12+500 and RR9 locations in 2021. During 2021, dissolved iron remains below the BCAWQG-FST guideline.

TETRA TECH

Metal concentrations for a number of elements, including total aluminum, total iron, total arsenic, total cobalt, total and dissolved copper, and total zinc showed a spike during freshet in March 2021 coincident with elevated TSS values. In 2021, metals generally measure within range of concentrations since 2017.

5.4 SBIAR Water Quality Monitoring

The South Bank Initial Access Road (SBIAR) shale slope was initially exposed in 2015 as part of road construction works on the south bank between Relocated Surplus Excavation Material (RSEM) R6 and Area A. The total area of the shale slope is approximately 14,000 m^2, between both the East and West slopes.

Sufficient flowing water permitted at least one sample to be collected during eleven months in 2021 at SBIAR. Sampling was done for eight months at RBSBIAR-US (March, May through November), ten months at RBSBIAR-DS (February through November), nine months at RBSBIAR-EDS (March through November), nine months at RBSBIAR-EUS (March through November), and five months at RBSC-DS (January through May). Field observations were documented each month. Results for each monthly sampling event were plotted on time series charts for trend analysis.

A summary of BCAWQG-FST water quality exceedances at SBIAR listed by monitoring location and month are listed in Table 9. The complete set of screening results based on the laboratory data are tabulated in Appendix B2.

5.4.1 In Situ Measurements and Field Observations

Values for water temperature, pH, total alkalinity, and electrical conductivity measured at the SBIAR monitoring locations are included in Table 8. At the SBIAR locations during 2021, the range in water temperatures was 0.07 C to 20.1 °C. Measurements of pH ranged between 5.68 to 8.97, alkalinity ranged between 0 and 800 ppm, hardness ranged between 100 to 800 ppm and conductivity between 372 to 1,517 µS/cm.

Flows in the SBIAR ditch system can vary between increase from the upstream to downstream locations, with flows of approximately 0.10 L/s to 4.0 L/s. RBSC-DS is located in the side channel to the Peace River where stagnant to minimal "flow" is observed. Water levels at RBSC-DS are coincident with the actual levels of the Peace River and is not connected to the Peace River given the distance from the river.

5.4.2 Freshwater Short-Term Maximum Exceedances

Concentrations of total and dissolved iron, total arsenic, total zinc, total cobalt, dissolved aluminum, dissolved cadmium, dissolved copper, and pH < 6.5 were measured as exceedances to the BCAWQG-FST at various locations and months during 2021 within the SBIAR catchment (appendix Table 9). Concentrations typically increase at downstream locations due to the influence of sediment washing in the ditchline and influence of SBIAR cut-slope.

At the upstream locations, at RBSBIAR-US occurrences of exceedances were reported for total iron (2), total arsenic (1) and total zinc (1). At RBSBIAR-EUS, occurrences of exceedances were reported for total iron (1) and total arsenic (1).

At the downstream SBIAR locations, at RBSBIAR-DS occurrences of exceedances were reported for total iron (4), total arsenic (1), total zinc (1), total cobalt (1), dissolved aluminum (3), dissolved cadmium (1), dissolved copper (1) and pH < 6.5 (1). At RBSBIAR-EDS, occurrences of exceedances were reported for total iron (4), total arsenic (1), total zinc (1) and dissolved aluminum (2) in 2021.

It is noted that the water flowing from the downstream locations do not have a direct downstream receptor; the water from the east ditch passes under the road via culvert to the downstream location in the west ditch where all water flows into a limestone armored spillway into a ditch which conveys to the RSEM R6 pond. Details of water flow and the intensive water quality monitoring program in RSEM R6 is referenced in Section 3.2 above.

At the RBSC-DS side channel, exceedances to the BCAWQG-FST guidelines were measured for dissolved iron (1) from February to May 2021, prior to termination of sampling at this location. This exceedance was considered to be transported by sediment entrainment from run-off and groundwater inflows and elevated concentrations may be in association with algal development in the side channel; these concentrations are not interpreted to be directly influenced by construction related PAG contact water from the SBIAR area.

5.4.3 Trend Monitoring and Details of 2021 Sample Results

Monthly water quality monitoring measures instantaneous ambient conditions at the time of sampling and, as discussed in Section 4.1, the measurements are highly susceptible to temporal climate conditions due to the small catchment and short residence time of water with the SBIAR ditch. Recurring trends at SBIAR over the 2017, 2018, 2019, 2020 and 2021 monitoring periods may be preliminary indications of long-term trends and are discussed below and summarized in the attached Figures 19 to 31.

5.4.3.1 Alkalinity and pH

Alkalinity and pH values indicate that waters have remained alkaline from 2017 through 2021, with one exception at RBSBIAR-DS in March 2021 where a pH of 4.85 was reported. Values for pH measured in 2021 at RBSBIAR-DS range between 4.85 to 8.25 with a mean pH value of 7.65, and at RBSBIAR-EDS range between pH 7.88 to 8.33 with a mean pH value of 8.01 (Table 10). Alkalinity trends between the four ditch locations are variable yet follow relatively similar trends during the 2021 monitoring period; the alkalinity values are similar and higher within the east ditch (RBSBIAR-EUS/-EDS), whereas are similar and lower within the west ditch (RBSBIAR-US/-DS) (Figures 6 and 7).

There is an overall increasing trend for alkalinity in both upstream and downstream (east and west) ditches observed to be a seasonal trend between spring to fall of both 2020 and 2021. A higher alkalinity is generally measured in the east ditch locations compared to the west ditch locations.

Values for alkalinity measured in 2021 at RBSBIAR-DS range between < 2.0 mg/L (detection limit; March 2021) and 261 mg/L $CaCO_3$ equivalent (mean value of 193 mg/L $CaCO_3$ equivalent), and at RBSBIAR-EDS range between 136 mg/L and 354 mg/L $CaCO_3$ equivalent (mean value of 282 mg/L $CaCO_3$ equivalent) (Table 10).

Measured pH at the side channel location RBSC-DS range between 7.56 to 8.04, and alkalinity ranges between 335 to 375 mg/L $CaCO_3$ equivalent. The RBSC-DS location generally measures higher alkalinity values and similar to slightly lower pH values that are more variable relative to the other SBIAR sampled ditch locations.

5.4.3.2 Hardness

Water hardness measured at RBSBIAR-DS ranges between 255 to 670 mg/L, with a mean value of 353 mg/L, and at RBSBIAR-EDS ranges between 279 to 503 mg/L with a mean value of 382 mg/L. The water hardness was commonly above the upper threshold used by the BCAWQG-FST (250 mg/L) to guide calculation and exceedance criteria for various metal or element concentrations (e.g., total sulphate, lead, manganese, silver, zinc; dissolved cadmium). When the maximum hardness value is reached for elements that are hardness-dependent for BCAWQG-FST guideline calculations, the respective maximum hardness values for the above-mentioned metal or elements are used as capped hardness values in the calculations. Elevated ambient water hardness values are also observed in measurements from other catchments on-site and likely is characteristic of elevated background conditions of hard soils and groundwater.

5.4.3.3 Total Suspended Sediment (TSS) and Total Dissolved Sediment (TDS)

TSS measurements at the downstream RBSBIAR-DS/-EDS locations commonly show a higher concentration than the upstream RBSBIAR–US/-EUS locations in 2021. The TSS values spiked in March 2021 followed by a sharp decline then variability for the remainder of the year. The overall variability in TSS is attributable to the relatively small catchment and short residence time of waters within both the west and east SBIAR ditches and sensitivity to flux in surface water inputs from precipitation or seepage inputs from Area 21. TSS concentrations measured at RBSBIAR-DS ion 2021 range between <1.0 and 7,120 mg/L with mean value of 810 mg/L, and at RBSBIAR-EDS range between 3.3 and 1,560 mg/L TSS, with mean value of 216 mg/L. Measured TDS concentrations ranged between 486 to 1,000 mg/L with mean value of 583 mg/L at RBSBIAR-DS, and between 477 to 906 mg/L, with a mean value of 641 mg/L TDS at RBSBIAR-EDS.

Measured TSS values within the RBSC-DS ranged between 8.3 and 14.5 mg/L with mean value of 10.6 mg/L, peaking in April 2021. Since no samples were collected following May 2021, no overall trend is possible. In previous years, an increasing trend occurred in early spring that leveled off and decreased towards the fall and winter months.

Measured TDS values within the RBSC-DS ranged between 549 to 877 mg/L with mean value of 692 mg/L between January to May 2021.

In 2019, a trend for total zinc in the east and west SBIAR ditches showed that a potential progressive increase in metals was occurring, but this does not appear to continue during 2020 and 2021. Conversely, qualitative observations during the 2021 monitoring period suggests less variability with no increasing trend and data that is within range of previous year's values. However, in the west ditch only, the downstream/upstream ratio values in 2021 are situated in the upper range of previous years' values. A correlation analysis exercise conducted in 2019 indicated a correlation between TSS levels with some total metal concentrations and increased TSS levels between the upstream and downstream monitoring locations were thought to result from active erosion from the cut-bank above the west and east SBIAR ditches. In 2020 and 2021, the monitoring results do not indicate a continuance of an increasing trend and will continue to be monitored in the 2022 period.

5.4.3.4 Sulphate

Sulphate values measured at the upstream locations were commonly similar and significantly lower than in the downstream locations during 2018, 2019 and most of 2020, but this trend is not consistent in 2021. Previously, this indicated a net increase downstream in sulphate from groundwater seepage and local shale run-off that is not observed as clearly during the 2021 monitoring period. In May 2021, the upstream locations, spiked to higher levels than the downstream locations, followed by an overall decreasing trend throughout the ditches.

Sulphate concentrations measured at RBSBIAR-DS in 2021 ranged between 108 to 672 mg/L with mean value of 215 mg/L, and at RBSBIAR-EDS ranged between 74.5 to 280 mg/L with mean value of 153 mg/L. There is a seasonal trend of sulphate concentrations peaking in June or July of each year (2017 through 2021), although a spike in sulphate was anomalous at RBSBIAR-DS in March 2021. The RBSC location commonly measures the highest sulphate concentrations relative to the SBIAR ditches between 2017 to 2020, although limited sampling to May 2021 at RBSC-DS limits this trend observation into 2021. Measured sulphate concentrations at the RBSC-DS location in 2021 varied between 172 and 304 mg/L with mean value of 224 mg/L.

A seasonal trend in the SBIAR ditches may be evident whereby sulphate concentration peaks in spring/early summer followed by an overall decrease. Sulphate concentrations at the side channel RBSC-DS location appear to be variable and not follow trends in the SBIAR ditches which is expected given that it is not influenced by the SBIAR area.

The BCAWQG-FLT guideline for sulphate is variable with ambient hardness for each sample location and is plotted referencing the values from the RBSBIAR-DS location. The RBSIBAR-DS location is the only sampling location that measures sulphate above the BCAWQG-FLT guideline in March 2021, which is anomalous to previous values during 2017 to 2020.

5.4.3.5 Total and Dissolved Aluminum

Total aluminum concentrations during 2021 measured at RBSBIAR-DS ranged from 38.9 to 34,200 µg/L with mean value of 3,998 µg/L, and at RBSBIAR-EDS ranged from 32.4 to 13,900 µg/L with mean value of 2,020 µg/L. A seasonal trend from trailing five years suggests that total aluminum concentrations at RBSBIAR-DS peak in early freshet (March/April) and can either peak again in summer (June/August) and/or fall (September).

Dissolved aluminum concentrations during 2021 measured at RBSBIAR-DS ranged from 31.4 to 4,400 µg/L with mean value of 502 µg/L, and at RBSBIAR-EDS ranged from 5.7 to 280 µg/L with mean value of 80.5 µg/L. At the downstream RBSBIAR-DS and RBSBIAR-EDS locations, dissolved aluminum concentrations fluctuate below and above the BCAWQG-FST guideline value (100 µg/L) during 2019, 2020 and 2021, whereas the upstream RBSBIAR-US and RBSBIAR-EUS locations remained below the guideline value. Dissolved aluminum concentration at RBSC-DS remained well below the BCAWQG-FST guideline in 2021.

Exceedances to the BCAWQG-FST guideline for dissolved aluminum at RBSBIAR-DS were measured three times during 2021, including March (4,400 µg/L), July and August (145 µg/L), and twice at RBSBIAR-EDS including July (280 µg/L) and August (169 µg/L) 2021. Although variable, a decreasing trend or 'dip' in both total and dissolved aluminum at RBSBIAR-DS and RBSBIAR-EDS was observed in May and June 2021, which was similarly observed in 2017 to 2019. Increases overall in total and dissolved aluminum are most apparent in July 2021 at the SBIAR ditches, and additionally at RBSBIAR-DS on March 2021. The east and west downstream ditches RBSBIAR-DS/-EDS follow similar trends since 2017. The east downstream RBSBIAR-EDS ditch measures slightly higher in dissolved aluminum than the west downstream RBSBIAR-DS ditch from 2018 to June 2020, switching to higher concentrations in the west downstream RBSBIAR-DS ditch from July to November 2020 for the remainder of the year, followed by similar concentrations with more variability in 2021.

Although the downstream RBSBIAR-DS and RBSBIAR-EDS locations show similar trends in both total and dissolved aluminum, there is a more significant difference in concentrations between upstream and downstream for dissolved than total aluminum.

The RBSC-DS trends for dissolved aluminum values from 2017 to 2021 are more similar to the upstream RBSBIAR-US/-EUS locations that commonly measure near or below the detection limit (1.0 µg/L) and significantly below the BCAWQG-FST guideline (100 µg/L).

An overall decrease of total aluminum at RBSBIAR-US is observed to occur between spring and winter of the 2017, 2018, 2020 and 2021 monitoring periods, whereas an overall slight increase shows during the 2019 sampling period. Total aluminum values measured at the RBSC-DS location remain low in 2021 and seasonal trends at RBSC-DS appear to differ from the four SBIAR ditch locations during 2021.

Dissolved aluminum was more variable during 2020 than in in 2017, 2018, 2019 and 2021 at the five RBSBIAR sample locations, and total aluminum appears less variable in 2021 than in 2019 and 2020.

5.4.3.6 Total and Dissolved Iron

Total iron concentrations during 2021 measured at the RBSBIAR-DS location ranged between 40 to 212,000 µg/L with mean value 22,502 µg/L. At RBSBIAR-DS, exceedances to the BCAWQG-FST guideline (1,000 µg/L) for total iron concentration were measured four times including March (212,000 µg/L), July (5,840 µg/L), August (1,730 µg/L) and September (3,460 µg/L) and significantly decreased to below guideline levels in the other sampled months of especially May and June 2021. At the downstream east ditch RBSBIAR-EDS location, exceedances to the BCAWQG-FST guideline (1000 µg/L) for total iron concentration were measured four times including March (56,000 µg/L), April (4,600 µg/L), August (1,180 µg/L) and October (1,360 µg/L) and decreased to below guideline levels in the other sampled months of especially May and June 2021. Two exceedances to the BCAWQG-FST guideline for total iron concentration was measured at RBSBIAR-US (March and July), one exceedance was measured at RBSBIAR-EUS (March), and no exceedance at RBSC in 2021.

Dissolved iron concentrations measured well below the BCAWQG-FST guideline (350 µg/L) ranging between <10 to 144 µg/L at the four ditch locations, RBSBIAR-EDS, RBSBIAR-DS, RBSBIAR-US and RBSBIAR-EUS through the 2021 sampling season. At RBSBIAR-DS, dissolved iron measured below or near detection limit of 10 or 50 µg/L in five of the ten months sampled in 2021, ranging between <10 µg/L to 144 µg/L. At RBSBIAR-EDS, dissolved iron measured below detection limit, <10 µg/L, in all nine months sampled in 2021. At RBSC-DS dissolved iron measured between 122 to 753 µg/L, and above the BCAWQG-FST guideline once in February (753 µg/L).

5.4.3.7 Metals: Arsenic, Cadmium, Cobalt, Copper, and Zinc

Metals such as arsenic, cadmium, cobalt, copper, and zinc are important indicators of ARD-ML processes and environmental changes in the water supply. In 2021, ten sampling events (February to November) occurred at the downstream west RBSBIAR-DS location, and nine sampling events (March to November) occurred at the downstream east RBSBIAR-EDS location, discussed below. Table 10 summarizes the minimum, maximum and mean concentrations for the following metals. Water quality data for SBIAR monitoring locations are provided in Appendix Table B2.

At the downstream west RBSBIAR-DS, exceedances were measured once in the month of March 2021 for each of the following metals, including arsenic, cadmium, cobalt, copper, and zinc. At the downstream east RBSBIAR-EDS, two exceedances for two metals, total arsenic and total zinc, were measured in the month of March 2021, including total arsenic and zinc. No exceedances for these metals (arsenic, cadmium, cobalt, copper, and zinc) were measured in any other month during the 2021 monitoring period at the downstream RBSBIAR-DS/-EDS ditch locations.

At the upstream locations, an exceedance was measured for total arsenic and total zinc in March at RBSBIAR-US, and for total arsenic at RBSBIAR-EUS. No exceedances were measured at the upstream RBSBIAR-US and -EUS locations in 2021 for the metals: cadmium, cobalt and copper.

Arsenic

Total arsenic concentrations measured during 2021 at RBSBIAR-DS ranged from 0.19 to 92.4 µg/L with mean value of 10.1 µg/L, and dissolved arsenic ranged from 0.16 to 2.24 µg/L with mean value of 0.50 µg/L. Two BCAWQG-FST guideline (5.0 µg/L) exceedances for total arsenic occurred at the RBSBIAR-DS (92.4 µg/L) and RBSBIAR-EDS (22 µg/L) locations in March 2021. Trends for total arsenic at the downstream ditch locations, RBSBIAR-EDS and RBSBIAR-DS will continue to be observed in the upcoming 2022 monitoring period. With exception to the anomalous spike in metals in March 2021, total arsenic concentrations are within range of previous years 2017 to 2020.

Cadmium

Total cadmium concentrations measured during 2021 at RBSBIAR-DS ranged from 0.045 to 8.71 µg/L with mean value of 1.09 µg/L, and dissolved cadmium ranged from 0.045 to 7.73 µg/L with mean value of 0.918 µg/L. Total cadmium measured at the downstream east RBSBIAR-EDS ranged from 0.008 to 1.66 µg/L with mean value of 0.363 µg/L, and dissolved cadmium ranged from 0.005 to 0.402 µg/L with mean value of 0.118 µg/L. One BCAWQG-FST guideline exceedance in dissolved cadmium occurred at RBSBIAR-DS in March 2021. Dissolved cadmium concentrations during 2021 at the downstream ditches measure within range of concentrations measured during 2017 to 2020, with exception of the anomalous spike in March 2021 at RBSBIAR-DS.

Cobalt

Total cobalt concentrations measured at RBSBIAR-DS during 2021 ranged from 0.53 to 125 µg/L with mean value of 15.97 µg/L, and dissolved cobalt ranged from 0.54 to 108 µg/L with mean value of 13.65 µg/L. Total cobalt concentrations measured at RBSBIAR-EDS ranged from 0.82 to 28.8 µg/L with mean value of 8.95 µg/L, and dissolved cobalt ranged from 0.87 to 15.2 µg/L with mean value of 5.76 µg/L. One BCAWQG-FST guideline (110 µg/L) exceedance in total cobalt occurred at RBBIAR-DS (March) from all five SBIAR locations sampled during 2021, which is the first and only occurrence of an exceedance in total cobalt measured at SBIAR locations since 2017. In 2021, total cobalt is generally similar concentrations in the two upstream ditches and similar concentrations in the two downstream ditches and are generally within range of concentrations previously measured from 2017 through 2020.

Copper

Total copper concentrations measured at RBSBIAR-DS during 2021 ranged from 0.93 to 304 µg/L with mean value of 35.5 µg/L, whereas dissolved copper ranged from 0.68 to 85.7 µg/L with mean value of 10.3 µg/L. Total copper concentrations measured at RBSBIAR-EDS during 2021 ranged from 0.53 to 68.4 µg/L with mean value of 11.1 µg/L, whereas dissolved copper ranged from 0.37 to 3.21 µg/L with mean value of 1.00 µg/L. One BCAWQG-FST guideline exceedance in dissolved copper occurred at RBBIAR-DS (March) from all five RBSBIAR locations sampled during 2021. With exception to this one exceedance, dissolved copper values at SBIAR sample locations in 2021 show within range of concentrations previously measured from 2017 through 2020.

Zinc

Total zinc concentrations measured at RBSBIAR-DS during 2021 ranged from 9.3 to 1,390 µg/L with mean value of 176.9 µg/L, whereas dissolved zinc ranged from 7.5 to 1,170 µg/L with mean value of 113.8 µg/L. Total zinc concentrations measured at RBSBIAR-EDS during 2021 ranged from <3.0 to 281 µg/L with mean value of 140.2 µg/L, whereas dissolved zinc ranged from 0.87 to 15.2 µg/L with mean value of 5.76 µg/L. Two BCAWQG-FST guideline exceedances (hardness-dependent) for total zinc occurred at the downstream RBSBIAR-DS (1,390 µg/L; guideline = 340.5 µg/L) and RBSBIAR-EDS (281 µg/L; guideline = 255.75 µg/L) locations in March 2021.

At the upstream ditch locations, one BCAWQG-FST exceedance was measured at RBSBIAR-US in March 2021, and none at RBSBIAR-EUS. With exception to the three exceedances for total zinc measured in March 2021, total zinc values at SBIAR sample locations in 2021 show within range of concentrations previously measured from 2017 through 2020.

The chart shown in Figure 31a (RBSBIAR-DS/-US) and 31b (RBSBIAR-EDS/-EUS) depicts the ratio difference in total zinc concentration between the downstream vs upstream location in the west and east ditch, in order to measure the relative contribution of zinc to water from ARD-ML activity within each RBSBIAR ditch. An increasing trend and overall maximum for total zinc does not appear to extend into the 2020 or 2021 monitoring period that was noted in 2018 and 2019. Previously, a possible overall trend in total zinc concentration showed a progressive increase both seasonally in early spring freshet and summer within each of the previous sampling years of 2018 and 2019, and the overall maximum total zinc concentration reached in 2018 and 2019 progressively increased but has not similarly been observed in 2020 and 2021. The zinc ratio values in the west ditch (downstream/upstream) during are within the higher values measured since 2017, but no increasing trend is observed within 2021. This will be monitored going forward during the 2022 monitoring period.

5.4.3.8 Ammonia and Nitrogen Species

Ammonia (NH_4 as N) is subject to a temperature and pH-dependent BCAWQG-FST and BCAWQG-FLT guideline. Although no exceedances are measured to the BCAWQG-FST, it is observed that ammonia values measure higher in the downstream SBIAR ditches (RBSBIAR-DS/-EDS) than in both the upstream ditches and the RBSC-DS side channel from 2017 to 2021. In 2021, this trend continued with exception to the month of March 2021 when the RBSBIAR-US location measured the highest ammonia concentration. During 2021, a spike in nitrite (NO_2 as N) occurred in March 2021 at the RBSBIAR-US and RBSBIAR-EUS locations. Nitrate (NO_3 as N) remained variable and within range of previous values. Nitrate and nitrite show seasonal sharp peaks primarily at the RBSBIAR-DS in either June, July, or August from 2017 through 2021, and a peak in ammonia in July 2019 coincided with a peak in monitored metals such as copper and cobalt. The source of ammonia and nitrogen species is unknown although it could possibly be related to nearby agricultural inputs into the water supply; no explosives are known on-site. This parameter will continue to be monitored in 2022.

5.4.3.9 Trend Monitoring Summary

Alkalinity and pH values indicate that waters have remained alkaline from 2017 through 2021, with one exception at RBSBIAR-DS in March 2021. Alkalinity is more variable than pH values. In 2020 and 2021, an overall increase in alkalinity is observed to occur between freshet in the spring towards the fall and winter months in the four SBIAR ditch locations. The alkalinity measured at the RBSC-DS location is commonly the highest alkalinity value relative to the SBIAR ditches. Acidity measured during 2021 remains within range of values collected since 2018. Acidity values commonly measure higher in the east ditch (RBSBIAR-EDS and RBSBIAR-EUS) than in the west ditch (RBSBIAR-DS and RBSBIAR-US), although this was not consistently the case in 2021.

Typically, the SBIAR ditches measure variable TSS and TDS values attributable to the relatively small catchment and short residence time of waters that are subsequently sensitive to flux in surface water inputs from precipitation. In 2021, TDS values have remained relatively constant at the SBIAR locations.

During 2021, sulphate measures within range of values collected since 2017, with exception to a spike in sulphate at the RBSBIAR-DS location in March 2021. Sulphate values show more variability during 2020 than in 2021 and previous years (2017 to 2019). At the upstream RBSBIAR-US and RBSBIAR-EUS locations, there is a spike in sulphate in April 2021 followed by a gradual overall decrease, whereas the downstream RBSBIAR-DS and RBSBIAR-EDS locations measure more consistent and higher sulphate values than the upstream locations.

During 2021, total and dissolved aluminum measure within range of values collected since 2017, although total and dissolved aluminum concentrations spike in March 2021 to the highest values since 2017 at the RBSBIAR-DS location. The east ditch commonly measures higher and similar aluminum values than in the west ditch sample locations which is in continuation of trends since 2018.

Total and dissolved iron measure within range of values collected since 2017. Total iron shows a more variable trend below and above the BCAWQG-FST guideline, whereas dissolved iron commonly remains below detection limit and the BCAWQG-FST guideline. The RBSC-DS location commonly measures the highest dissolved and total iron concentrations compared to the SBIAR ditch locations.

During 2021, the concentrations of metals, such as arsenic, cadmium, cobalt, copper, and zinc measure within range of values in previous years from 2018 to 2020 with exception to a common spike in concentration occurring at RBSBIAR-DS in March 2021.

Monthly sampling in the SBIAR catchment occurred from 2017 to 2021 and will need to continue to be monitored going forward into 2022 for effective observations of trends.

5.5 L3 Creek Catchment Water Quality Monitoring

The L3 Creek catchment was sampled twice in 2021 during January 2021 (LBL3C-1.43 only) and April 2021 before sampling ceased. A baseline database has been collected between 2017 to 2021 (April) and represents a robust dataset for evaluating water quality and seasonal trends. The L3 Creek catchment is not being monitored as a construction related PAG waterway and is not a requirement of the CEMP. Water quality monitoring has been conducted within this catchment to monitor discharge water quality and to maintain a record for potential future use. The water quality monitoring is due to potential influence on discharge water quality from the inherited non-construction related Howe Pit area shale and inflow from L4 Creek.

Influence of ARD-ML processes on water within the catchment are limited to natural occurrences within L4 Creek of natural PAG outcrop, reduced pH, and background water quality of local naturally occurring PAG contact waterways.

Sufficient flowing water was available on April 22, 2021, for sampling at the downstream LBL3C-0.02, lower midstream LBL3C-1.43 location, upper midstream LBL3C-1.65 location, upstream LBL3C-3.32 location and the L4 Creek LBL4C-0.18 location. Field observations and in situ measurements were documented (Table 11) and the sampling event was plotted on a time series charts for trend analysis that includes data since 2017.

A summary of water quality exceedances at L3 Creek relative to BCAWQG-FST listed by monitoring location and month are listed in Table 12, and the screening results based on the laboratory data are tabulated in Appendix B3.

5.5.1 In Situ Measurements and Field Observations

Water flow estimated in the April 2021 event noted in increasing flow downstream. Water flow ranged from between 3 L/s (LBL3C-3.32; LBL4C-0.18), 5 L/s (LBL3C-1.65) and 10 L/s (LBL3C-1.43) to the highest flow of 12 L/s measured at the discharge location, LBL3C-0.02 that flows into the RR-10 culvert. The flow was observed to be clear at LBL3C-3.32 and turbid at each sampled location downstream. The range in water temperatures measured between 0.07 to 3.17 °C, pH ranged between 7.35 to 7.80, hardness 80 to 800 ppm, alkalinity 80 to 120 ppm.

5.5.2 Freshwater Short-Term Maximum Exceedances

Within the four L3 Creek sample locations during 2021, BCAWQG-FST exceedances were measured for total iron and total arsenic on April 22, 2021. At the one L4 Creek sample location during 2021, BCAWQG-FST exceedances were measured for total iron on April 22, 2021.

The total iron and total arsenic exceedances measured in L3 and L4 Creek locations during 2021 are interpreted to be related to TSS concentrations within the creek and water inputs from both L4 Creek and seepage into L3 Creek between sample location LBL3C-1.43 and LBL3C-0.02.

5.5.3 Trend Monitoring and Details of 2021 Sample Results

Recurring trends within the L3 catchment in the 2017 to 2021 monitoring periods may be indicative of long-term trends and are discussed below and presented on trend series Figures 32-42.

5.5.3.1 Alkalinity and pH

Alkalinity and pH values measured in the L3 Creek sampling locations indicate that the waters remained alkaline in April 2021.

On April 22, 2021, measured pH value is 7.84, alkalinity 130 mg/L $CaCO_3$ equivalent, acidity 2.7 mg/L, TDS 505 mg/L and TSS 628 mg/L.

Between 2017 to 2021, trends show overall consistency in pH in L3 Creek with neutral to alkaline values and more variability in pH at LBL4C-0.18 location, with fluctuation between neutral and acid pH down to pH 3.5. the consistency in neutral pH values in L3 Creek upstream and downstream of the confluence with L4 demonstrate the dilution and assimilative capacity and that L3 is not adversely impacted by the low pH or elevated metals water of L4 Creek.

A seasonal trend in alkalinity shows a general increase occurs between March and December during 2018, 2019 and 2020, although not enough data is available in 2021 for further trend analysis.

5.5.3.2 Hardness

Water hardness measured at LBL3C-0.02 was 345 mg/L on April 22, 2021. In previous years since 2017, hardness commonly measured above the upper bound (250 mg/L) used by the BCAWQG-FST to guide criteria for metal concentrations.

5.5.3.3 Sulphate

Sulphate measured at LBL3C-0.02 was 206 mg/L on April 22, 2021, which is within range of previous years values for this time of year. Since 2017, sulphate values show some variability and seasonality in the data with concentrations increasing with freshet and snow melt through late spring and early summer.

Measured sulphate have similar trends at the various L3 stations that show an increasing trend during each year between January to May or June and then a gradual levelling out through December in the 2017, 2018 2019 and 2020 monitoring periods. There is not enough data in 2021 to observe further trend. The similar trend in sulphate and TDS suggest that possibly elevated sulphate concentrations represent months where groundwater inputs dominate flow in L3 Creek and relate to the transition from freshet early in the season to regional groundwater input throughout the remainder of the year, especially during the dry or minimal precipitation or summer and autumn months. Significant precipitation contributes to increase surface run-off that is related to decreasing trends in sulphate and TDS.

There is no BCAWQG-FST value for sulphate. The BCAWQG-FLT guideline for sulphate is variable, ranging from 128-429 mg/L, with ambient hardness for each sample. The FLT is plotted on Figure 35 at the LBL3C-0.02 location, for reference.

5.5.3.4 Total Suspended Sediment (TSS) and Total Dissolved Sediment (TDS)

The TSS value measured at LBL3C-0.02 was 628 mg/L on April 22, 2021. In previous years since 2017, TSS commonly measured an overall decreasing trend at all locations between spring and winter. Concentrations were generally observed to be either similar or less at the discharge location (LBL3C-0.02) relative to the immediate upstream location (LBL3C-1.43). It is believed that the decreasing trend in TSS from upstream to downstream locations is due to settlement.

The TDS value measured at LBL3C-0.02 was 505 mg/L on April 22, 2021. In previous years, within the L3 Creek there shows an overall increasing trend between spring and winter months. A seasonal trend each year from 2018 to 2020 shows a sharp increase during freshet, a decrease in TDS in June/July, followed by a consistent to slightly increasing trend for the remainder of the year.

The increasing annual trend observed for TDS appears to be inverse to the decreasing annual trend for TSS in the 2018, 2019 and 2020 monitoring periods. As discussed in Section 4.1, the role of dominant input waters to flow conditions in L3 Creek strongly influences the measured water quality. Events resulting in high TSS measurements may be higher flows related to precipitation or recent precipitation in the form of shallow groundwater flow, whereas events resulting with high TDS and low TSS measurements may be related to low precipitation and high regional groundwater baseflow. As spring freshet wanes and the dominant influent water transitions to regional groundwater, trends in TDS and TSS are influenced. In 2018, 2019 and 2020, it is observed that freshet is related to low concentrations of TDS that gradually increase towards May and June then level off with some more minor variability for the remainder of the year. In 2021, limited data from one month of sampling prevents further trend analysis.

5.5.3.5 Total and Dissolved Aluminum

It is observed that dissolved aluminum concentrations are generally higher at the discharge location LBL3C-0.02 relative to the LBL3C-1.43 location, likely due to input from impacted waters in the Howe Pit area related to exposure of shale or prolonged removal of the overburden cover.

In previous years from 2017 to 2020, the LBL3C-1.43 midstream location commonly measures more variability and lower dissolved aluminum than the LBL3C-0.02 discharge location, indicating that the high inputs from L4 Creek are diluted at LBL4C-1.43 (downstream of the confluence with L4 Creek), followed by an increase due to Howe Pit groundwater influence at LBL3C-0.02.

5.5.3.6 Total and Dissolved Iron

Total iron measured 16.7 mg/L and dissolved iron measured 0.028 mg/L on April 22, 2021.

Elevated concentrations of total iron are commonly elevated and above the BCAWQG-FST guideline in L3 Creek, from 2017 to 2021, whereas dissolved iron does not measure as many occurrences of BCAWQG-FST exceedances. Exceedances of dissolved iron are commonly noted in the L4 Creek sample location.

Throughout the monitoring periods from 2017 to 2021, water quality at the LBL3C-0.02 discharge location measures a consistent pH.

Evidence of PAG outcrop in L4 Creek, reduced pH levels, and the occurrence of anomalous metal concentrations at the LBL4C-0.018 location indicate background water quality of local naturally occurring PAG contact waterways. L4 Creek waters are eventually diluted, or attenuated, by L3 Creek waters and PAG related metal concentrations are commonly reduced towards midstream L3 Creek. Groundwater influence from Howe Pit is thought to provide inputs that can increase metal concentrations towards the LBL3C-0.02 discharge location.

5.5.3.7 Metals: Arsenic, Cadmium, Cobalt, Copper, and Zinc

Metals such as arsenic, cadmium, cobalt, copper, and zinc are important indicators of ARD-ML processes and environmental changes in the water supply. The downstream location, LBL3C-0.02, was sampled once in April 2021 and discussed below. Due to limited sampling only in April 2021, no annual trend can be interpreted for 2021 although values are within range of previous years measured in 2017 to 2020.

Total arsenic concentration at LBL3C-0.02 on April 22, 2021, measured 8.05 µg/L which is an exceedance to the BCAWQG-FST guideline (5.0 µg/L) and dissolved arsenic measured 0.34 µg/L. The total arsenic concentration increased downstream from 0.64 µg/L upstream (LBL3C-3.32) to 7.12 µg/L (LBL3C-1.65) and 5.78 µg/L (LBL3C-1.43) at the midstream locations to the highest total arsenic value at the discharge LBL3C-0.02 location. Three BCAWQG-FST exceedances for total arsenic were measured at LBL3C-1.65, LBL3C-1.43 and LBL3C-0.02.

Total cadmium concentration at LBL3C-0.02 on April 22, 2021, measured 0.849 µg/L, and dissolved cadmium measured 0.106 µg/L. No BCAWQG-FST guideline exceedance in dissolved cadmium occurred at LBL3C-0.02 in 2021 (or previous years of 2017 to 2020), and measure within range of dissolved cadmium measured since 2017.

Total cobalt concentration at LBL3C-0.02 on April 22, 2021, measured 16.1 µg/L, and dissolved cobalt measured 5.29 µg/L. No BCAWQG-FST guideline exceedance in total cobalt occurred at LBL3C-0.02 during 2021 (or previous years of 2017 to 2020), and measure within range of total cobalt concentration values since 2017.

Total copper concentration at LBL3C-0.02 on April 22, 2021, measured 24.8 µg/L, and dissolved copper measured 1.99 µg/L. No BCAWQG-FST guideline exceedances in dissolved copper occurred at LBL3C-0.02 during 2021 and measures within range of dissolved copper concentration values since 2017.

Total zinc concentration at LBL3C-0.02 on April 22, 2021, measured 103 µg/L, and dissolved zinc measured 5.9 µg/L.

At LBL3C-0.02, two parameters, total cobalt and dissolved aluminum exceeded the long-term BCAWQG-FLT guidelines on April 22, 2021. Long-term trends do not generally show an increasing trend in metals to be occurring at L3 Creek. No further water quality sampling is planned in 2022.

The completion of monthly sampling in the L3 catchment occurred in April 2021 following four years of consistent sampling since 2017, providing a useful reference for observing water quality and seasonal trends.

5.6 BC Hydro Left Bank Debris Boom

Water quality sampling commenced at the BC Hydro LBDB area in October 2020 and continued sampling through the 2021 monitoring period. The most consistently sampled location is LBP Pond due to otherwise dry or frozen conditions prevailing at most sample locations in the area during the year. The elevation rise of the Peace River water inundates the former LB Side Channel thus no sampling continued in 2021 at this location. Please see attached map showing the LBDB sample locations in Figure 4.

The LBP Pond was sampled seven times from April through October 2021, and the east and west downstream LB EDS and LB WDS Armor Ditch locations were sampled once in July 2021, outside of dry or frozen conditions.

A summary of water quality exceedances at LBDB relative to BCAWQG-FST listed by monitoring location and month are listed in Table 14, and the screening results based on the laboratory data are tabulated in Appendix B4.

5.6.1 Field Observations and In Situ Measurements

In situ measurements were collected from LBP Pond from April to October 2021, and from LBDB-WDS and LBDB-EDS in July 2021.

At the LBP Pond, a range of in situ measurements were collected between April and October 2021 for pH (6.48 to 7.30), electrical conductivity (2,448 to 4,650 µs/cm), hardness (250 to 800 ppm), alkalinity (80 to 240 ppm), water temperature (2.1 to 23.4 °C) and flow (0.0 to 0.5 L/min). The outflow channel from the LBP Pond was lined at the end of June 2021 with a geotextile and fresh limestone riprap.

At the LBDB-WDS Armor Ditch, on July 21, 2021, in situ measurements for pH (7.91), electrical conductivity (1,719 µs/cm), hardness (800 ppm), alkalinity (120 ppm), water temperature (16.2 °C) and estimated flow (1-2 L/min).

At the LBDB-EDS Armor Ditch, on July 20, 2021, in situ measurements for pH (8.08), electrical conductivity (3,967 µs/cm), hardness (800 ppm), alkalinity (120 ppm), water temperature (16.5 °C) and estimated flow (5-7 L/min).

5.6.2 Freshwater Short-Term Maximum Exceedances

In 2021, at the LBP Pond location there were occurrences of BCAWQG-FST exceedances measured for total iron (5), dissolved iron (2), dissolved aluminum (1), total manganese (3), and total zinc (2). This is not a discharge station and water discharging from the LBP Pond area passes through a limestone lined ditch. Water is not commonly observed to discharge from the LBP Pond, but if it does it passes through a limestone lined water management ditch system to the downstream monitoring station.

On July 20, 2021, at the downstream east Armor Ditch, LBDB-EDS, four BCAWQG-FST exceedances were measured for total iron, total arsenic, total zinc, and dissolved aluminum. On July 21, 2021, at the downstream west Armor Ditch, LBDB-WDS, one BCAWQG-FST exceedance was measured for total iron. Water flow from the Armor Ditch sample locations is considered discharge locations.

5.6.3 Trend Monitoring and Details of 2021 Sample Results

Sampling at BC Hydro's LBDB area has primarily been limited to sampling at the LBP Pond location, therefore comment on trend observations are limited to this location. At LBP Pond, pH values have remained neutral to alkaline with pH values at or above 7.0. Total alkalinity values have gradually increased between April to October 2021, whereas acidity values have remained relatively consistent during this time. Sulphate values show a relatively consistent trend and is noted to consistently measure above the BCAWQG-FLT guideline. TDS values are relatively consistent whereas TSS values are more variable.

Dissolved aluminum measured at LBP Pond is relatively consistent and well below the guideline except for July 2021. Total and dissolved iron concentrations follow similar trends that are variable and show increases in June/July and September/October 2021. At LBP Pond, total iron exceeds the BCAWQG-FST guideline in April, June, July, September, and October 2021, whereas dissolved iron exceeds the BCAWQG-FST in June and July 2021.

Trend charts are not presented for LBDB due to limited sampling at one location, LBP Pond in 2020 and 2021. Trend monitoring will continue in 2022 with the availability of further monthly sampling data.

5.7 L2 Powerhouse

Water quality sampling commenced at the BC Hydro L2 Powerhouse area in October 2020 and continued sampling through the 2021 monitoring period.

The L2 Powerhouse L2 DS location was sampled eleven times from January to November 2021, and the L2 US location was sampled seven times from April to November (except October) 2021, outside of dry or frozen conditions. Please see attached map showing the L2 Powerhouse area sample locations in Figure 2.

The discrete L2 DS sample location is located adjacent to the L2 Powerhouse and is specifically collected from the pump tubing on the west side of the culvert and approx. 1-2 m from the south rock ditch wall and 1-2 m from the culvert. In the April 2021 sampling event, L2 DS was sampled just west of the large scaffolding staircase due to large piles of broken ice and debris preventing access to usual sample location approximately 4 metres to the east.

A summary of water quality exceedances at the L2 Powerhouse area relative to BCAWQG-FST listed by monitoring location and month are listed in Table 16, and the screening results based on the laboratory data are tabulated in Appendix B5.

Water from the L2 Powerhouse area shale slope is conveyed to AFDE RSEM R6 pond from this area is non-PAG contact water. Water from the AFDE RSEM R6 pond is monitored prior to discharge.

5.7.1 Field Observations and In Situ Measurements

In situ measurements collected from January to November 2021 at L2 DS recorded a range of pH 8.22 to 11.26 with mean pH value of 9.71, electrical conductivity 403 to 1,615 µs/cm, hardness 0 to 250 ppm, alkalinity 180 to 240 ppm, water temperature 0.89 to 15.2 °C and flow 0.5 to 2.5 L/s, with turbidity ranging between clear to slightly turbid.

In situ measurements collected from April to November 2021 at L2 US recorded a range of pH 7.61 to 9.20 with mean pH value of 8.21, electrical conductivity 716 to 973 µs/cm, hardness 250 to 450 ppm, alkalinity 180 to 240 ppm, water temperature 3.4 to 19.6 °C, flow from commonly stagnant to 0.10 L/s, and turbidity of clear to turbid conditions.

5.7.2 Freshwater Short-Term Maximum Exceedance

In the eleven sampling events during 2021 at the L2 DS location, there were occurrences of BCAWQG-FST exceedances measured for total iron (4), dissolved aluminum (10), total silver (4), total zinc (3), ammonia (2), total arsenic (5) and pH > 9.0 (4). In the seven sampling events during 2021 at the L2 US location, there were three occurrences of BCAWQG-FST exceedances measured for total iron.

At L2 DS, the pH is consistently alkaline and in four of eleven sampling events the pH value exceeded the upper limit of the BCAWQG-FST guideline (pH 6.5-9.0) in February, June, October, and November 2021. Dissolved aluminum exceeded the BCAWQG-FST guideline (100 µg/L) value in ten out of total eleven sample events with concentrations ranging between 36.6 to 2,640 µg/L and a mean value of 611 µg/L. In the same months of March, May, July, and October 2021 there were exceedances measured for total iron and total silver, and similarly for total zinc in the same months of May, July, and October. Total arsenic exceeded the BCAWQG-FST guideline five times in February, May, July, October, and November 2021. In February and November 2021, an exceedance in ammonia was measured.

Aluminum is primarily in the solid phase than in the dissolved phase at both L2 DS and L2 US. The source of the elevated dissolved aluminum at L2 DS sample location is not thought to be related to ARD-ML processes given the maintenance of neutral/alkaline pH and low overall iron and sulphate. The source of the continued elevated dissolved aluminum at the L2-DS sample location could be related to construction activities including concrete pouring, which is known to contain components high in aluminum concentration. The identification of ammonia supports this, and the source of ammonia is inferred to be from admixtures in concrete cement and/or structure materials at the sample location.

5.7.3 Trend Monitoring and Details of 2021 Sample Results

Trend charts for the L2 Powerhouse sampling stations present consistent neutral to alkaline pH values and slightly higher pH values at L2-DS relative to L2-US. Total alkalinity values are highly variable whereas acidity values are commonly at or below detection limit.

Sulphate, TDS and TSS values show variation with an up and down trend throughout 2021. A similar up and down see-saw trend is observed for metal concentrations such as total and dissolved aluminum, total iron, total arsenic, total cobalt, total zinc, dissolved cadmium (to a lesser degree), and total and dissolved selenium between 2020 and 2021.

The dissolved aluminum concentration is consistently above the BCAWQG-FST guideline at L2 DS and consistently below the BCAWQG-FST guideline at L2-US, although both locations show similar see-saw up and down trending throughout 2021.

Total iron shows a similar up and down trend at both L2-DS and L2-US with BCAWQG-FST guideline exceedances measured in March, May, July, and October 2021 at L2-DS. Dissolved iron concentrations have not exceeded the BCAWQG-FST guideline at L2-DS and L2-US since sampling commenced in October 2020 thru to October 2021.

Total arsenic concentration measured BCAWQG-FST exceedances at L2 DS and not at L2 US in 2021. Total cobalt, total zinc and dissolved cadmium follow a similar up and down see-saw trend although no BCAWQG-FST exceedances have been measured in 2021.

Total and dissolved selenium do not have a BCAWQG-FST guideline for reporting requirements, although it is noted that both total and dissolved selenium measure above the long-term BCAWQG-FLT guideline value at L2 DS in Dec 2020, March, May, July 2021 and three occurrences during this time at L2 US.

6.0 CONCLUSIONS AND RECOMMENDATIONS

A water quality monitoring program was implemented on behalf of BC Hydro to monitor the water quality at PAG exposure locations from River Road at Blind Corner, SBIAR, L3 Creek, LBDB, and L2 Powerhouse. Upstream, midstream, and downstream and discharge monitoring locations were established to characterize water quality and to maintain a continuous monitoring record commensurate with previous sampling completed in 2016 by Lorax on behalf of PRHP (where applicable). The water quality program is conducted in accordance with the CEMP, Appendix E Acid Rock Drainage and Metal Leachate Management Plan, Section 5.2.1.7 (BC Hydro, 2022).

The program has incorporated monthly in situ water quality measurements and observations with laboratory analysis from 2017 through 2021 at almost all locations, and quarterly temporarily at SBIAR in 2018. Field observations were recorded from all areas monthly regardless of weather conditions or ability to collect in situ measurements or take samples for lab testing.

Water chemistry is monitored to identify influence of ARD-ML processes on water quality at River Road from construction related exposed shale at Blind Corner, and from the construction related shale exposed in the east and west ditches within SBIAR. Influence from construction PAG exposures are being monitored in the BC Hydro LBDB and L2 Powerhouse areas. The L3 Creek catchment was monitored from 2017 to April 2021 for potential influences from non-Site C impacted water originating in the Howe Pit area and naturally impacted inflow from L4 Creek.

The sampled locations are generally ephemeral, with the exception of the L3/L4 creek area where a larger catchment size and residence time for water within the drainage is noted. Residence time for water is low in the investigated area ditches due to their small catchment size. The flows in ditches are susceptible to seasonal change and flow rate is highly influenced by local precipitation events, thus the classification of flow in ditches can assist to interpret the source and subsequent chemical fluctuations in water sampled. For example, flows in ditches can be attributed to shallow or regional groundwater, spring freshet or surface run-off, dependent on the season and amount of precipitation recorded before and during the sampling event. Monthly water quality monitoring measures instantaneous water quality and may not be reflective of longer term baseline conditions.

The water quality program is achieving the purpose of evaluating water quality from dam site areas where construction related PAG exposures and PAG contact surface water is identified. The results of the program demonstrate that ARD/ML processes are occurring, however the management and mitigation measures implemented are working and that water quality remains primarily neutral to alkaline with metal concentrations dominantly below the established water quality criteria. The water quality monitoring program provides a framework for identifying water quality concerns from the exposed rock cuts in a timely manner and implementing the required mitigation measures.

6.1 River Road Water Quality Monitoring

Water quality laboratory data was collected from six locations (LBRR-DD, LBR-EDP, LBRR-LC, LBRR-UC, LBRR-12+500 and RR9) and in situ measurements were collected at eleven of a total twelve water sample locations along the River Road catchment in 2021.

Water quality monitoring continues to show that active ARD-ML processes are progressing on PAG shale slopes shown in observed trends, such as elevated concentrations above the BCAWQG-FST for total iron (six occurrences) and total arsenic (two occurrences) at LBRR-12+500, LBRR-EDP and RR9 (Table 7). No BCAWQG-FST exceedances were measured at LBRR-DD, LBRR-UC or LBRR-LC. Samples were not collected each month at all locations due to dry or frozen conditions.

In 2021, a total of thirty-three (33) in situ field measurements of pH within the River Road ditch indicated a neutral to alkaline pH of between 7.17 to 8.89. Previously, especially in 2018 and 2019, acidic waters were collected in the upper portions of the ditch underlying the exposed shale cut-bank. The pH values progressively returned to circumneutral levels at the discharge location in part due to contact with limestone riprap in the ditch, and potential alkalinity input from groundwater or outflow from the upper cut-off ditch.

ARD-ML management and mitigation along River Road adjacent to the PAG slopes includes a cut-off ditch above the slope, which diverts surface flows into limestone lined “Chimney ditches” which then feed into the River Road ditch below the slope. The River Road ditch adjacent to the PAG slope includes a bentonite liner and limestone riprap to provide neutralization potential and mitigate against acidic drainage.

In July/August 2021, the limestone rip rap was refreshed along River Road following observation of orange coating, or mineral precipitate, on the limestone. Chemical efficiency of the limestone to buffer acidic water is decreased when coated in precipitate. The formation of mineral scale can concentrate metals from solution as a result of the aqueous acid-base reactions. The mineral scale and sludge are susceptible to scouring and being washed during heavier rain events which has potential to reduce overall water quality conveyed down-gradient. Therefore, the importance of maintaining the freshness of limestone is imperative and was addressed in July 2021. Sampling at River Road after the limestone replacement was limited due to dry or frozen conditions and therefore it is difficult to interpret specific changes pre- and post- limestone replacement. The effectiveness and impact of the limestone refresh will continue to be monitored in future sampling events and analyzed for trend analysis over time.

It is anticipated that sediment in the ditch will continue to accumulate a small amount of secondary mineral formed by up-gradient ARD-ML processes. These minerals commonly contain an elevated concentration of metals related to ML and mineral precipitation from acid neutralizing reactions.

The purpose of the diversion pipe is to address erosion and sediment control by transport of run-off water into an elongated ditchline to reduce flow velocities and to promote settlement of suspended sediment prior to discharge at RR8 and RR9. Inlets to culverts RR9 and RR8 are slightly elevated from the ditch base which will allow water to pond within the ditch and infiltrate or discharge via the culverts only if water levels reach sufficient height. In previous years it was noted that the diversion pipe was successfully reducing the amount of direct high TSS discharge into the Peace River by allowing the water to be collected and slowly infiltrate into the River Road ditch.

In 2021, limited sampling at multiple stations in a given sampling event makes it difficult to quantify the effectiveness of the system. TSS measurements at RR9 were very high in March and very low in November, compared to other sample locations. Looking at the March event, TSS is higher at RR9 then upstream stations analyzed in the same month. As a result, total iron and total arsenic were elevated above BCAWQG-FST at RR9 in March, and a discharge rate of 400mL/s of turbid flow discharge to the Peace River. The total arsenic and total iron values are significantly higher than the dissolved arsenic and dissolved iron values, confirming further the suspended sediment loading rather than the dissolved phase of the metals are the source of exceedances of the two exceedances. The measured lab pH of 7.83 (LBRR-RR9) and 7.72 (LBRR 12+500) are both within the acceptable range for BCAWQG-FST and indicate neutral to alkaline conditions. Low pH water has capacity to dissolve metals more readily than neutral, or alkaline, water. The routine monthly memo for this event provides further details on this sampling event.

The seasonal flows in ditches are important to consider when interpreting fluctuations and exceedances in parameters measured in water quality guidelines. The source of TSS is primarily from River Road run-off, scouring of sediment deposited within the River Road ditch and washing from the cut-slopes. Seasonally, elevated TSS levels have been noted to occur during spring melt and freshet season, typically April, when water flow can wash elevated precipitates from rock. The March 17, 2021, sampling event represents early spring freshet conditions and appear to be slightly earlier than in 2020.

Based on data from the EcoFish, 2020 annual reporting there were natural exceedances in the Peace River of the BCAWQG values (EcoFish Report, 2021), particularly with the early freshet period in April. Exceedances were most often associated with elevated concentrations of suspended solids in the Peace River. Total iron and total arsenic, along with other parameters, were reported by EcoFish for ten sample events in 2020 from January to July. Fourteen total sample events were conducted through the year. The highest total iron concentrations were reported on April 21, 2020 and dropped considerably in the proceeding sample event on April 28, 2020. The total iron concentration at the upstream station of the Peace River for the freshet April 21 sampling event was 14.3 mg/L. Total iron in the proceeding sample events in 2020 reported less than 4 mg/L total iron, with minor exceedances of the 1 mg/L total iron BCAWQG value in three of those six sample events. From the three sample events in January 22 to March 19 concentrations were less than 0.05 mg/L.

The lower chimney (water quality monitored at LBRR-LC) drains into the River Road ditch down-gradient of LBRR 12+500 and up-gradient of LBRR-RR9. The LBRR-LC location measured no exceedances before water entered the River Road ditch, and therefore there is no indication that the same sediment accumulation is occurring on the limestone of the lower chimney ditch

Recommendations for River Road

The sediment source for elevated TSS is mainly attributed to scouring of accumulated sediment within the ditch from road grading and run-off from previous events, which includes washing, or flushing, of the exposed shale, colluvium, and overburden cut-banks. Continued management of the drainage system is required to reduce the amount of sediment infilling to the ditch from road grading operations as this sediment encases the limestone which reduces chemical efficiency for ARD mitigation and prematurely fills the cistern, which limits its performance to supress TSS.

The limestone contained in the ditch that was replaced in July 2021 must continue to be regularly maintained through cleaning and descaling, or removal and replacement with new limestone. With increased use of River Road, sediment and erosion control measures also needed to be addressed to manage the sediment load coming off of the road and into the ditch. The limestone is monitored for accumulation of precipitates and sediment and refreshed either by cleaning or replacement as needed. Control of sediment erosion was responded to by BC Hydro during 2018; no new maintenance activities occurred during 2020; further maintenance efforts of adding fresh limestone riprap along River Road was successfully completed in 2021. Continued management of the limestone riprap and mitigation of the active ARD-ML processes from the shale exposure at Blind Corner along River Road are recommended, such as implementing hydroseeding on the shale slope for erosion control, in addition to monitoring the effectiveness of controlling sedimentation into the River Road drainage system by the end-of-diversion pipe (LBRR-EDP) and at downstream locations at LBRR-RR8 and LBRR-RR9. The sediment within the ditch, particularly at the outlet of the diversion pipe should be monitored for accumulation.

During the coincident sampling events in the 2020-21 monitoring period, discharge was only observed once in 2020 (February) and twice in 2021 (March and November) at RR9, and no discharge at RR8 in 2021-2021. It is recommended that in situ water quality measurements are collected from any discharge observed from culvert RR8 and/or RR9 during high flow events even if outside of coincident sampling events.

In 2021, water quality samples collected from LBRR-DD (1), LBRR-12+500 (4), LBRR-EDP (2), LBRR-UC (1), LBRR-LC (2) and RR9 (2), in addition to previous years of 2017 to 2020, indicate that run-off water quality is influenced by active ARD-ML processes within the ditch catchment. Although flows are generally low to no flow and/or ephemeral, there is some potential for run-off to impact downstream water quality. As per CEMP Appendix E Section 5.2.1.7, it is recommended that water quality monitoring is continued on a monthly basis at the established locations within the River Road catchment. Continuous monthly monitoring will evaluate the effectiveness of mitigation strategies that are implemented on the shale at Blind Corner.

6.2 SBIAR Water Quality Monitoring

Water quality data was collected from five established sampling locations in 2021, four of which measure water directly from within the SBIAR ditch locations (sampled February to November 2021) and a fifth location in the side channel down-gradient of the SBIAR construction (RBSC-DS) that was sampled up to and including May 2021. The RBSC-DS sample location was removed from the sample program after May due to lack of surface water connection to the SBIAR catchment as indicated in the collected data showing there has not been an apparent correlation in water quality trends between SBIAR and the side channel. The ditch samples provide long-term characterization of SBIAR water management and water quality originating from the SBIAR PAG slope at the upstream and downstream location in the east and west ditches.

Water flowing through the SBIAR ditch has no direct downstream receptor, and all water in the east and west ditches is conveyed directly to the PRHP RSEM R6 pond which is an approved PAG contact water management facility.

Downstream water quality is monitored by PRHP within the PRHP RSEM R6 pond for management prior to discharge into the Peace River.

From 2017 to 2019, that the upstream location in both east and west ditches showed relatively low and consistent sulphate values. In 2020 and 2021, it is observed that there is a sharp increase in sulphate concentrations at the upstream locations during the freshet period around March-May, that levels off or gradually decreases for the remainder of the year. The reason for this is not known although could potentially be related to increased ARD-ML processes at the upstream locations.

Evidence of active ARD-ML processes are observed on the shale slopes in SBIAR through rinse pH analysis and observation of secondary iron hydroxide mineral formation. Alkalinity and pH indicate that the waters in SBIAR have consistently remained alkaline during the 2017, 2018, 2019, 2020 and 2021 monitoring periods. Screening of analytical data during 2021 for the downstream ditch locations resulted in occurrences of BCAWQG-FST guideline exceedances at RBSBIAR-DS (total iron (4), dissolved aluminum (3), total arsenic (1), total zinc (1), total cobalt (1), dissolved cadmium (1), dissolved copper (1), pH < 6.50 (1)) and RBSBIAR-EDS (total iron (4), dissolved aluminum (2), total arsenic (1) and total zinc (2)).

Recommendations for SBIAR Water Quality Monitoring

The collection of one up-gradient and one down-gradient water sample from both the western and eastern SBIAR ditch is suggested to continue through 2022 for comparative purposes.

Downstream water is collected within the PRHP RSEM R6 pond for management prior to discharge into the Peace River. As per CEMP Appendix E, Section 5.2.1.7, since there is low to moderate risk of negative downstream effects on water quality, monitoring of water quality within SBIAR is recommended to be continued on a monthly basis in 2022. It is recommended that BC Hydro implement a long-term solution for the Site C operations phase for the exposed shale slope due to ARD/ML processes.

6.3 L3 Creek Water Quality Monitoring

Water quality data was collected from five established sampling locations once in April 2021 and one location in January 2021 before the sampling and monitoring program was discontinued at L3 Creek and L4 Creek. The L3 Creek catchment is not being monitored as a construction related PAG waterway and is not a requirement of the CEMP. Water quality monitoring has been conducted within this catchment to monitor discharge water quality and to maintain a record for potential future use. The water quality monitoring is due to potential influence on discharge water quality from the inherited non-construction related Howe Pit area shale and inflow from L4 Creek.

Since 2017, the L3 Creek and L4 Creek locations were sampled to maintain a continuous record of water quality within the catchment and to monitor potential changes to water chemistry related to non-Site C impacted water originating in the Howe Pit area and naturally impacted inflow from L4 Creek. PAG indicator elements were observed in elevated concentration on occasion from water quality monitoring occurring from 2017 to April 2021. This monitoring program is not for compliance purposes and is for tracking potential influences over time. The sampling frequency was reduced to quarterly then discontinued in April 2021. It was deemed that sufficient data had been collected for understanding the water quality at L3 Creek at this time.

Screening of analytical data for the LBL3C-0.02 location on April 22, 2021, resulted in occurrences of two parameters, total iron (4) and total arsenic (3), that exceeded the BCAWQG-FST guidelines.

The occurrence of a naturally occurring PAG shale outcrop identified in L4 Creek is monitored by sampling at the LBL4C-0.18 location where signatures of ARD-ML processes are prevalent. Elevated metal concentrations (total iron, cobalt, zinc, copper, arsenic, manganese, and dissolved iron, aluminum, and cadmium) and low pH were measured in routine WQ sampling at LBL4C-0.18 from 2018 to April 2021. Water mixing from L4 Creek with L3 Creek is generally diluted towards the lower midstream LBL3C-1.43 and discharge LBL3C-0.02 locations. Influence from ARD-ML processes at Howe Pit are observed in the lower portions of L3 Creek between locations LBL3C-1.43 and LBL3C-0.02 and can influence increasing concentrations downstream in some months, which is thought to be related to turbidity or rainfall events.

Alkalinity and pH values measured in L3 Creek indicate that the waters have remained alkaline, with exception to the highly variable pH at the L4 Creek LBL4C-0.18 location that commonly measured a pH value below the acceptable BCAWQG-FST guideline range (pH 6.5-9.0). Further observation indicates that decreases in pH align with decreased alkalinity and increased acidity levels at LBL4C-0.18. Trends in pH and alkalinity in 2021 are within normal range of measured pH and alkalinity trends from 2017 through 2020. Overall, there has been more variability in alkalinity and acidity than pH within the L3 Creek.

Water quality in L3 Creek between LBL3C-1.43 and the discharge LBL3C-0.02 is influenced by influent waters originating in the Howe Pit areas. The LBL3C-0.02 location commonly measures higher concentrations at the discharge than midstream at LBL3C-1.43 for dissolved aluminum and total iron, and other metals including dissolved cadmium and total zinc whereas similar concentrations are measured for copper and arsenic.

Sulphate and TDS concentrations both increase significantly during freshet in May 2021, followed by a consistent to slight increase for the remainder of the year. This appears to be a seasonal trend that also occurred in 2019 and 2020.

Trend observations from sulphate, TDS, and dissolved iron and aluminum data indicate additional water input to L3 Creek between the up-gradient LBL3C-1.43 and LBL3C-0.02 discharge location. These inputs may be related to non-Site C related Howe Pit surface run-off or from locally impacted shallow groundwater seepage in the area.

Recommendations for L3 Creek Water Quality Monitoring

Based on the results from the 2017 through 2021 water quality monitoring programs there is low risk of negative downstream effects on water quality due to ARD-ML processes within the L3 Creek catchment. Sampling was discontinued following April 2021 and is not recommended for water quality monitoring in 2022.

6.4 BC Hydro Left Bank Debris Boom Monitoring

Sampling at BC Hydro's LBDB area commended in 2020 and initially included sampling at LBP Pond and a Peace River side channel location, which is now back flooded. Additional sample locations were added in July 2021 following a review of the area during the Tetra Tech site audits to monitor construction contact water. The added monitoring locations are located in the armor ditches at the toe of the exposed construction PAG faces and downstream of the LBP Pond.

In May 2021, there was evidence of erosion and scouring beneath the LBP Pond, issues with water management structures, and evidence of ARD/ML processes on the slopes. In addition to the new sample locations added to address these issues, water management structures and ditch linings were also amended following the July site audit review. The water management structures were improved to manage flow and prevent erosion and ditches were lined with limestone to provide acid buffering capacity. These were proactive measures to manage signs of erosion and initial signs of ARD/ML generation on the exposed shale slopes. Mitigation and management controls have been implemented in the LBDB area as discussed in Section 3.4.1. The exposed PAG slopes are temporary, as PAG cuts will be fully inundated in 2023 with reservoir creation.

The LBP Pond stations is the only station that has been able to be reliably collected on the scheduled monthly sampling program. The other sampling stations are generally dry except after heavy rainfall events.

At LBP Pond, between April to October 2021 during seven sampling events there were BCAWQG-FST exceedances measured for total iron (5), dissolved iron (2), dissolved aluminum (1), total manganese (3), and total zinc (2). Water is not commonly observed to discharge from the LBP Pond, but if it does it passes through a limestone lined water management ditch system.

Two downstream Armor Ditch locations were sampled for the first time in 2021 on July 20-21, 2021. Sampling was possible due to to the heavy rainfall event occurring around the sampling event, and these ditches are otherwise generally dry. No samples were collected from the remaining laydown drainage and armourd ditch sample locations due to dry conditions. The downstream east Armor Ditch, LBDB-EDS, measured four BCAWQG-FST exceedances for total iron, total arsenic, total zinc and dissolved aluminum, and the downstream west Armor Ditch, LBDB-WDS, measured one BCAWQG-FST exceedance for total iron. Field samplers confirmed that there was no direct discharge to the Peace River, and that both sampled watercourses drain to sufficiently sized sumps to retain water that is noted in the ditches.

Recommendations for LBDB Water Quality Monitoring

BC Hydro should continue to monitor water quality on a monthly frequency in order to monitor changing conditions within the LBDB area due to pre-existing facilities and future construction related activities in and around the catchment area. The exposed PAG slopes should continue to be monitored for evidence of ARD-ML processes including precipitate formation and oxidation staining.

LBP Pond is the only location within the area that has been consistently available for sampling. Limited surface flow is observed in this area, and the only time that the sample stations in the LBDB area can be sampled, except for the LBP Pond location, is immediately following a significant rainfall event. Sample staff are instructed to sample these locations outside of regular monitoring events, if possible, when high rainfall is observed.

6.5 L2 Powerhouse Water Quality Monitoring

The L2 Area PAG slope is mitigated by covering of the slope that effectively makes it a non-PAG contact surface. The water quality monitoring program has been put in place to verify that the mitigation applied is working and that non-PAG contact water is observed in this area. Water conveyed to AFDE RSEM R6 pond from this area is non-PAG contact and is monitored by PRHP prior to discharge from the RSEM R6 pond.

In 2021, the L2 DS location next to the L2 Powerhouse had eleven sampling events and BCAWQG-FST exceedances measured for total iron (4), dissolved aluminum (10), total silver (4), total zinc (3), ammonia (2), total arsenic (5) and pH > 9.0 (4). In 2021, the L2 US location had seven sampling events and three BCAWQG-FST exceedances measured for total iron.

At L2 DS, the pH is consistently alkaline and in four of eleven sampling events the pH value exceeded the upper limit of the BCAWQG-FST guideline (pH 6.5-9.0). Some events are coincident with elevated metals of total iron, total silver, and total zinc, whereas other events are not, and rather shows an inconsistent up and down see-saw trend that not confirmatory of a PAG signature, e.g., decreased pH value.

The ammonia BCAWQG-FST guideline value is dependent on pH value, and, since pH is above the upper limit of the guideline it is a capped value that calculates two exceedances in ammonia due to the high pH. The source of ammonia is thought to be from the construction activities at the L2 Powerhouse and is inferred to be structure material and admixtures in concrete cement at the sample location (Bai et al., 2005).

Given the above observations and data, Tetra Tech infers that the elevated dissolved aluminum, elevated pH, and ammonia are connected, and the concentrations are not representative of a PAG leachate issue and are possibly related to the construction activities/concrete in the Powerhouse area. Total concentrations are significantly higher than dissolved concentrations for aluminum and iron, and other metals, e.g., arsenic, cadmium, copper, manganese, and zinc which is a trend at L2-DS and will continue to be monitored in 2022.

It is noted that water quality in the L2 area as well as the adjacent area for the AFDE foundation enhancement trial drilling program, both contained an excess of dissolved aluminum. This was investigated and determined that the most likely source of the dissolved aluminum to be originating from the RCC concrete which contains fly-ash (21.2% aluminum oxide) and GU cement (5% aluminum oxide).

The presence of elevated dissolved aluminum was considered in the context of drilling muds. However, BC Hydro staff confirmed that the drilling being done in the L2 Powerhouse area is not using drill muds. The elevated metal may indicate that ARD-ML processes are occurring however the processes are being buffered and an alkaline pH is being maintained.

Recommendations for L2 Powerhouse Water Quality Monitoring

Due to the evolving nature of this area and significant construction activity, it is important to evaluate the potential for changing flow patterns and confirm that the established sampling locations are appropriate for the purpose and collecting the intended waters. The RB Foundation Enhancement work (January 2022) will include shale excavation, and mitigation and monitoring will be incorporated as per the site's EPPs. The water quality monitoring program will be modified as needed in relation to construction changes associated with this work. Focus on aluminum monitoring and tracking construction activities that may be contributing aluminum and, occasionally, associated with elevated metals or pH that may be related to ARD-ML processes.

The recommendation to field staff is to maintain a consistent single sample location as often as possible at L2 DS and to continue to note observations of change in location in metres when necessary and other observations noted in construction activities. The recommendation applies more generally to the complete water quality monitoring program to allow for consistent interpretation of changes at a monitoring location.

7.0 CLOSURE

We trust this document meets your present requirements. If you have any questions or comments, please contact the undersigned.

Respectfully submitted,
Tetra Tech Canada Inc.

PERMIT TO PRACTICE
TETRA TECH CANADA INC.

PERMIT NUMBER: 1001972

PROFESSIONAL
PROVINCE OF
S. P. KINGSTON
40878
BRITISH COLUMBIA
GEOSCIENTIST

Mar 30, 2022

Prepared by:
Erica Massey, M.Sc., G.I.T.
Geoscientist
Mining Practice
Direct Line: 778.940.1225
erica.massey@tetratech.com

Reviewed by:
Scott Kingston, P.Geo.
Senior Geoscientist
Mining Practice
Direct Line: 604.608.8631
scott.kingston@tetratech.com

/cy/bi

REFERENCES

Bai, Z., Dong, Y., Wang, Z and Zhu, T. (2006). Emission of ammonia from indoor concrete wall and assessment of human exposure. *Environment International*. 32(3):303-11. DOI: 10.1016/j.envint.2005.06.002.

BC Hydro (2022). Construction Environmental Management Plan, Site C Clean Energy Project, Revision 5.0 (February 19, 2019), Revision 5.1 (April 19, 2019), Revision 6.0 (July 15, 2019), and Revision 6.1 (December 12, 2019), Revision 7 (September 4, 2020), Revision 8 (June 21, 2021), Revision 10 (March 9, 2022).

BC Hydro (2021) Site C Meteorological and Air Quality Stations. Retrieved: https://envistaweb.env.gov.bc.ca

BC Ministry of Energy and Mines (1998). Policy for Metal Leaching and Acid Rock Drainage at Mine sites in British Columbia. July 1998.

BC Ministry of Environment, BC Moe (2013). British Columbia Field Sampling Manual: 2013 – For Continuous Monitoring and the Collection of Air, Air-Emission, Water, Wastewater, Soil, Sediment and Biological Samples.

BC Ministry of Environment, BC MoE (August 2019) BC Approved Water Quality Guidelines: Aquatic Life, Wildlife & Agriculture Summary Report. Water Protection & Sustainability Branch.Clark, M.J.R., editor (2003) British Columbia Field Sampling Manual. Water, Air and Climate Change Branch, Ministry of Water, Land and Air Protection, Victoria, BC, Canada. 312pp.

BC Ministry of Environment, BC MoE (2013). B.C. Field Sampling Manual, Part E Water and Wastewater Sampling. Accessed: https://www2.gov.bc.ca/gov/content/environment/research-monitoring-reporting/monitoring/laboratory-standards-quality-assurance/bc-field-sampling-manual

BC Biotic Ligand Model software provided by the BC Ministry of Environment and Climate Change Strategy Water Protection & Sustainability Branch (BCMoE).

EcoFish Research Ltd. (2022). PAG Contact RSEM Pond Monitoring: Peace River Surface Water Quality and Pond Toxicity 2021 Annual Report.

EcoFish (2022) PAM 2021 Data for Tetra Tech. Reviewed January 27, 2022.

Hemmera Envirochem Inc. and BGC Engineering Inc. (2012) Environmental Impact Statement, Site C Clean Energy Project, Volume 2, Appendix F, Groundwater Regime Technical Data Report, document number 06-105, December 2012.

Klohn Crippen Berger Ltd. and SNC-Lavalin Inc. (2015) Site C Clean Energy Project: Implementation design geochemical characterization status at the end of 2014.

Lorax Environmental Services (2022). Site C Clean Energy Project Acid Rock Drainage and Metal Leachate Management 2021 Annual Report.

Lorax Environmental Services (2021b) Site C Clean Energy Project 2021 Q4 Groundwater Quality Monitoring Report for RSEM Areas R5a and R5b.

Price WA. 2009. MEND Report 1.20.1: Prediction Manual for Drainage Chemistry from Sulphidic Geologic Materials.

Tetra Tech (2018) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road and L3 Creek 2017 Annual Report. IFU March 15, 2018.

Tetra Tech (2019) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, and L3 Creek 2018 Annual Report. IFU March 15, 2019.

Tetra Tech (2020) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, and L3 Creek 2019 Annual Report. IFU March 31, 2020.

Tetra Tech (2021) Site C Clean Energy Project Water Quality Monitoring for River Road, South Bank Initial Access Road, and L3 Creek 2020 Annual Report. IFU March 31, 2021.

FIGURES

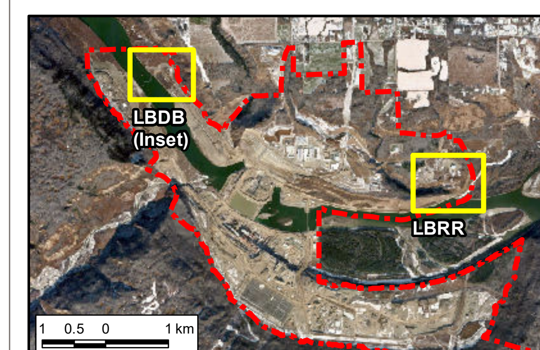
L3 CREEK (Fig 32-43)

L2 Powerhouse (Fig 44-55)

LEGEND

- Water Sample (Insitu Testing Only)
- Water Sample (Insitu Testing & External Lab Testing)
- Culvert
- Ditch
- Ditch Diversion
- Howe Pit
- Blind Corner Outcrop
- Site C Project Boundary

Sample ID	Easting	Northing
LBRR-RR8	632262	6229624
LBRR-RR9	632460	6229680
LBRR-EDP	632715	6229832
LBRR-DD	632853	6229862
LBRR-LC	632856	6229899
LBRR-12+500	632914	6229921
LBRR-12+600	632948	6229983
LBRR-12+700	632992	6230078
LBRR-12+810	633039	6230195
LBRR-12+920	633000	6230282
LBRR-UC	633018	6230253



NOTES
Base data source:
Imagery provided by Google; Maxar (2020).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2021 ANNUAL REPORT

Left Bank - River Road

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:3,500
50 25 0 50
Metres

TETRA TECH

FILE NO.: VMIN03021-04_Fig01_WaterSamplesLBRR.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

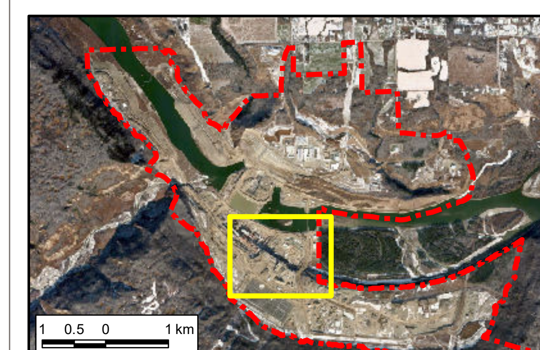
DATE: January 27, 2022
PROJECT NO.: ENG.VMIN03021-04

Figure 1

LEGEND

- Water Sample (Insitu Testing & External Lab Testing)
- Ditch
- Cut Bank
- RSEM R6 Pond
- Site C Project Boundary

Sample ID	Easting	Northing
RBSBIAR-US	630327	6228397
RBSBIAR-EUS	630376	6228399
RBSBIAR-DS	630320	6228645
RBSBIAR-EDS	630370	6228635
RBSC-DS	630475	6228672
L2 US	629701	6229279
L2 DS	629607	6229185



NOTES
Base data source:
Imagery provided by Google; Maxar (2020).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2021 ANNUAL REPORT

Right Bank - SBIAR

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:5,000
100 50 0 100
Metres

TETRA TECH

FILE NO.: VMIN03021-04_Fig02_WaterSamplesRB.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

DATE: January 27, 2022
PROJECT NO.: ENG.VMIN03021-04

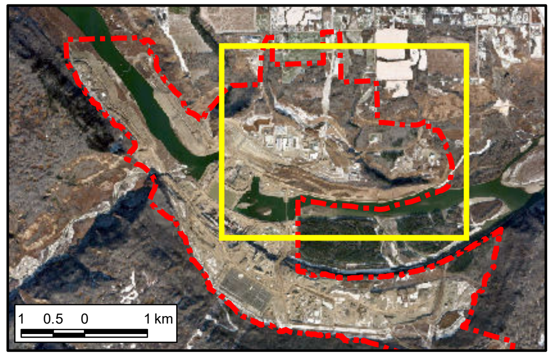
Figure 2

Q:\Vancouver\GIS\ENGINEERING\VMIN\VMIN03021-04\Maps\AnnualReport_2021\VMIN03021-04_Fig02_WaterSamplesRB.mxd modified 1/27/2022 by stephanie.leusink

LEGEND

- Water Sample (Insitu Testing & External Lab Testing)
- Culvert
- Ditch
- Ditch Diversion
- Howe Pit
- Blind Corner Outcrop
- Site C Project Boundary
- Original Watercourse

Sample ID	Easting	Northing
LBL3C-0.02	632767	6229860
LBL3C-1.43	631728	6230210
LBL3C-1.65	631504	6230417
LBL3C-3.32	630244	6231263
LBL4C-0.18	631524	6230578



NOTES
Base data source:
Imagery provided by Google; Maxar (2020).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2021 ANNUAL REPORT

Left Bank - L3 Creek

PROJECTION
UTM Zone 10

DATUM
NAD83

Scale: 1:12,000
200 100 0 200
Metres

CLIENT
BC Hydro
Power smart

TETRA TECH

FILE NO.
VMIN03021-04_Fig03_WaterSamplesLBL3.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

DATE
January 27, 2022

PROJECT NO.
ENG.VMIN03021-04

Figure 3

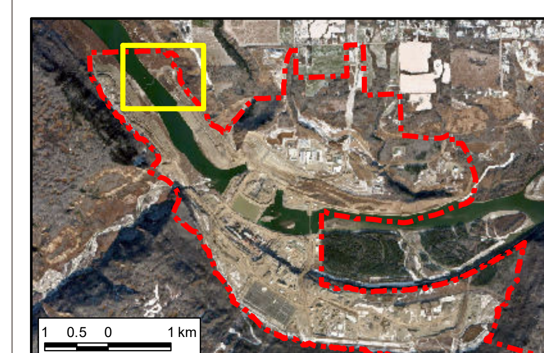
Q:\Vancouver\GIS\ENGINEERING\VMIN\VMIN03021-04\Maps\AnnualReport_2021\VMIN03021-04_Fig03_WaterSamplesLBL3.mxd modified 1/27/2022 by stephanie.leusink

Q:\Vancouver\GIS\ENGINEERING\VMIN\VMIN03021-04\Maps\AnnualReport_2021\VMIN03021-04_Fig04_WaterSamplesLBDB.mxd modified 1/27/2022 by stephanie.leusink

LEGEND

- ✕ Water Sample (Insitu Testing & External Lab Testing)
- Site C Project Boundary

Sampe ID	Easting	Northing
LBDB-EDS	627994	6231856
LBDB-EUS	628202	6231908
LBDB-LD-DS	628093	6231766
LBDB-LD-MS	628147	6231844
LBDB-LD-US	628257	6231876
LBDB-WDS	627969	6231883
LBDB-WUS	628189	6231933
LBP-Pond	628227	6231885
LBDB Side Channel E	628311	6231511



NOTES
Base data source:
Imagery provided by Google; Maxar (June 2021/Oct 2020).

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2021 ANNUAL REPORT

Left Bank Debris Boom (LBDB)

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:4,000
80 40 0 80
Metres

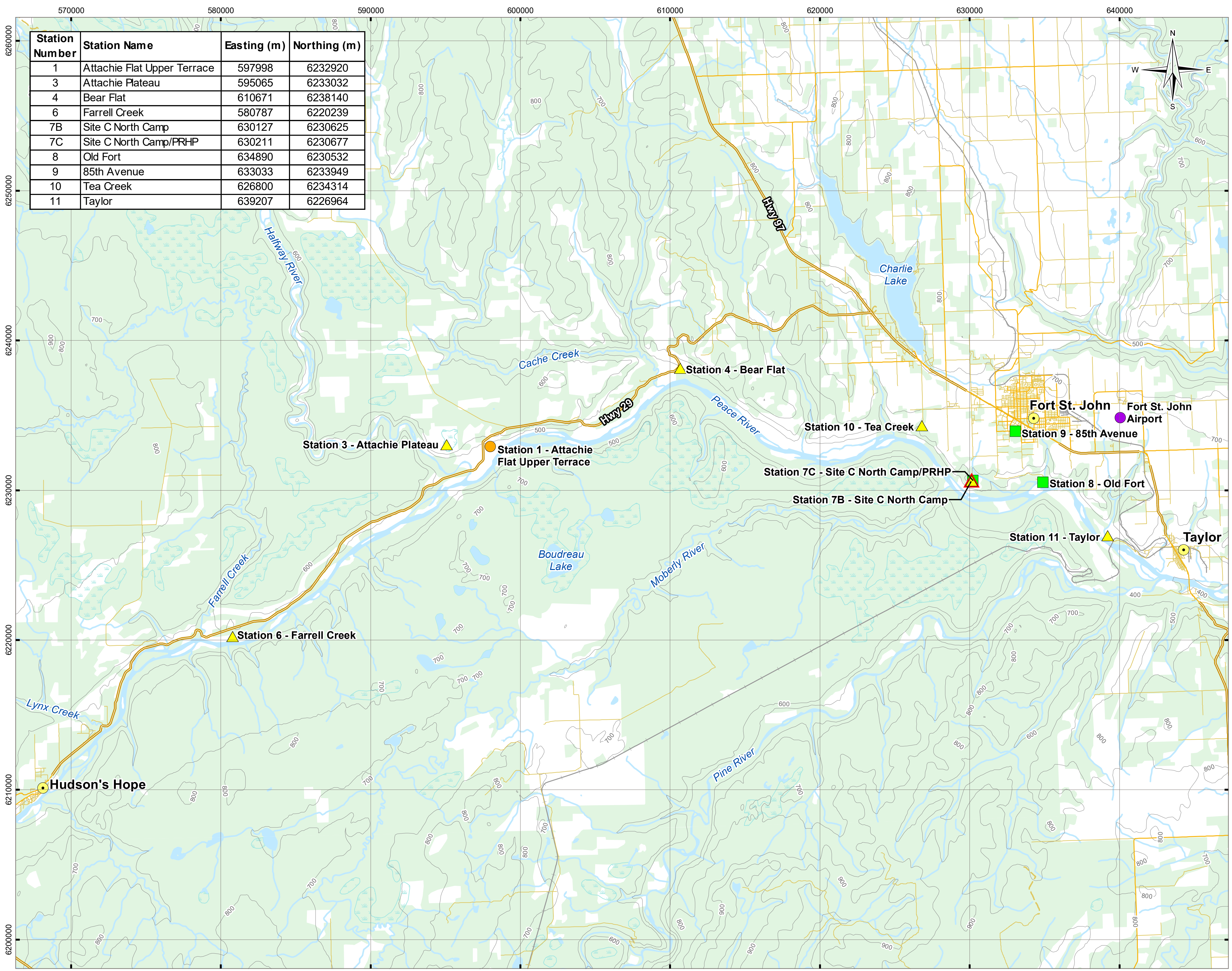
TETRA TECH

FILE NO.: VMIN03021-04_Fig04_WaterSamplesLBDB.mxd

OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	BB	EM	0

DATE: January 27, 2022
PROJECT NO.: ENG.VMIN03021-04

Figure 4



Station Number	Station Name	Easting (m)	Northing (m)
1	Attachie Flat Upper Terrace	597998	6232920
3	Attachie Plateau	595065	6233032
4	Bear Flat	610671	6238140
6	Farrell Creek	580787	6220239
7B	Site C North Camp	630127	6230625
7C	Site C North Camp/PRHP	630211	6230677
8	Old Fort	634890	6230532
9	85th Avenue	633033	6233949
10	Tea Creek	626800	6234314
11	Taylor	639207	6226964

LEGEND

Station Type

- Meteorological Only - used for Temperature and Precipitation data
- Meteorological Only
- Air Quality Only
- Meteorological and Air Quality
- Environment Canada Meteorological Station

Base Features

- City/District Municipality
- Highway
- Main Road
- Local Road
- Resource/Recreational Road
- Railway
- Residential
- Contour (100 m)
- Watercourse
- Waterbody
- Wetland
- Wooded

NOTES
Station locations provided by BC Hydro and RWDI (September 2017).
Base data source: CanVec 1:250,000.

STATUS
ISSUED FOR USE

SITE C WATER QUALITY MONITORING 2021 ANNUAL REPORT

Site C Meteorological and Air Quality Stations

PROJECTION: UTM Zone 10
DATUM: NAD83
CLIENT: BC Hydro Power smart

Scale: 1:250,000
5 2.5 0 5
Kilometres

TETRA TECH

FILE NO.: VMIN03021-04_Fig05_BCH_ClimateStations.mxd

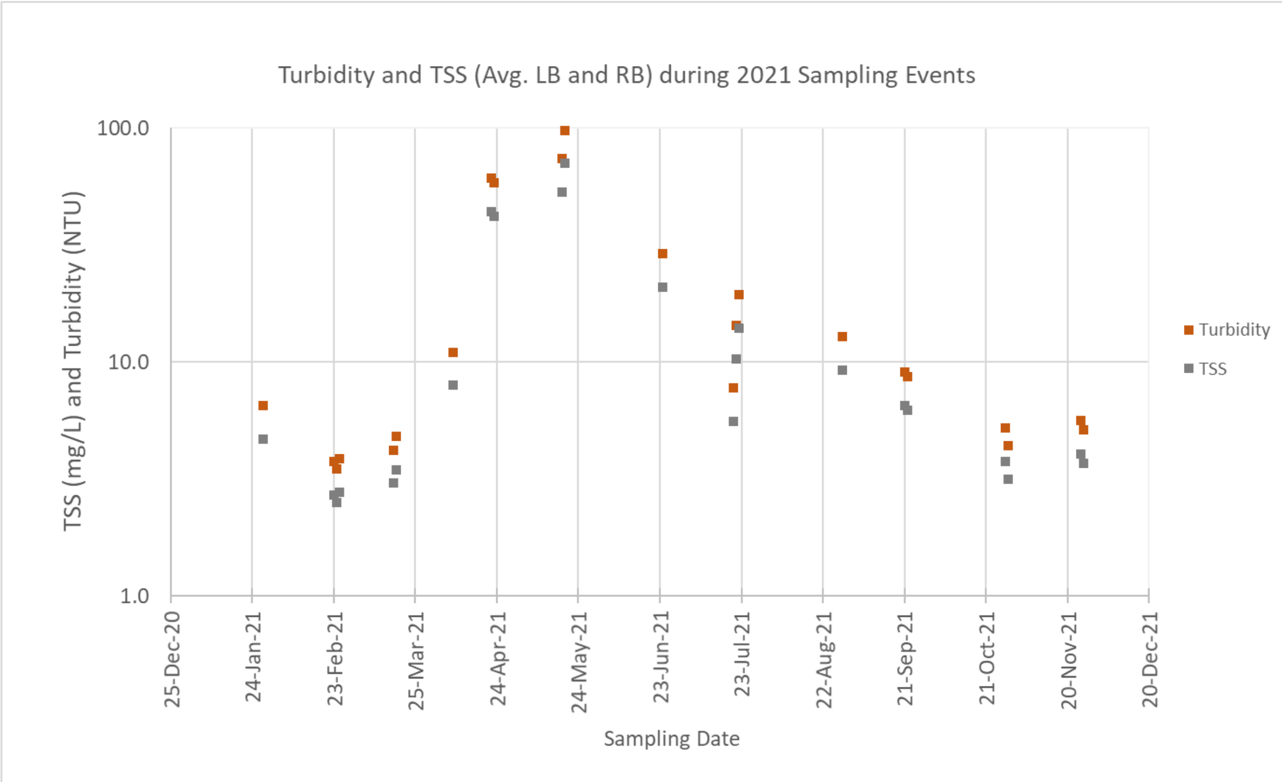
OFFICE	DWN	CKD	APVD	REV
Tt-VANC	SL	YL	EM	0

DATE: January 28, 2022
PROJECT NO.: ENG.VMIN03021-04

Figure 5

Q:\Vancouver\GIS\ENGINEERING\VMIN\VMIN03021-04\Maps\AnnualReport_2021\VMIN03021-04_Fig05_BCH_ClimateStations.mxd modified 1/28/2022 by stephanie.leusink

Figure 6: Average Monthly Turbidity and TSS Measured in the Peace River



**Average turbidity and TSS across the Peace River include both left bank and right bank.*

EcoFish Disclaimer: TSS:turbidity relationship used was the same all year. Note, these relationships are specific to a particular make/model of sensor. Please exercise caution if relationship applied to any data collected.

Figure 7: pH at River Road Locations

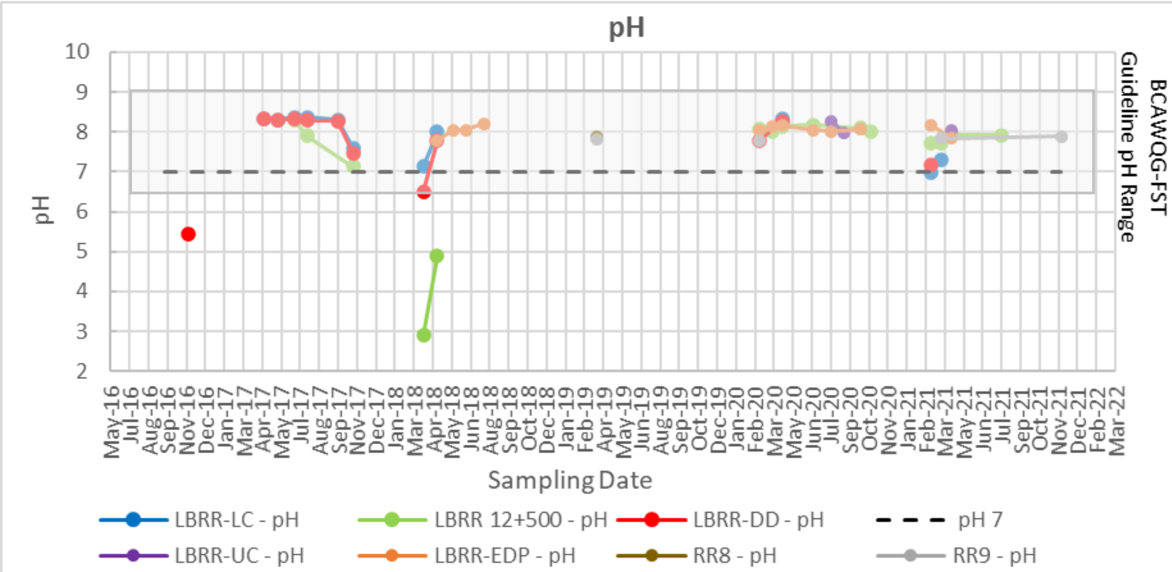


Figure 8: Total Alkalinity at River Road Locations

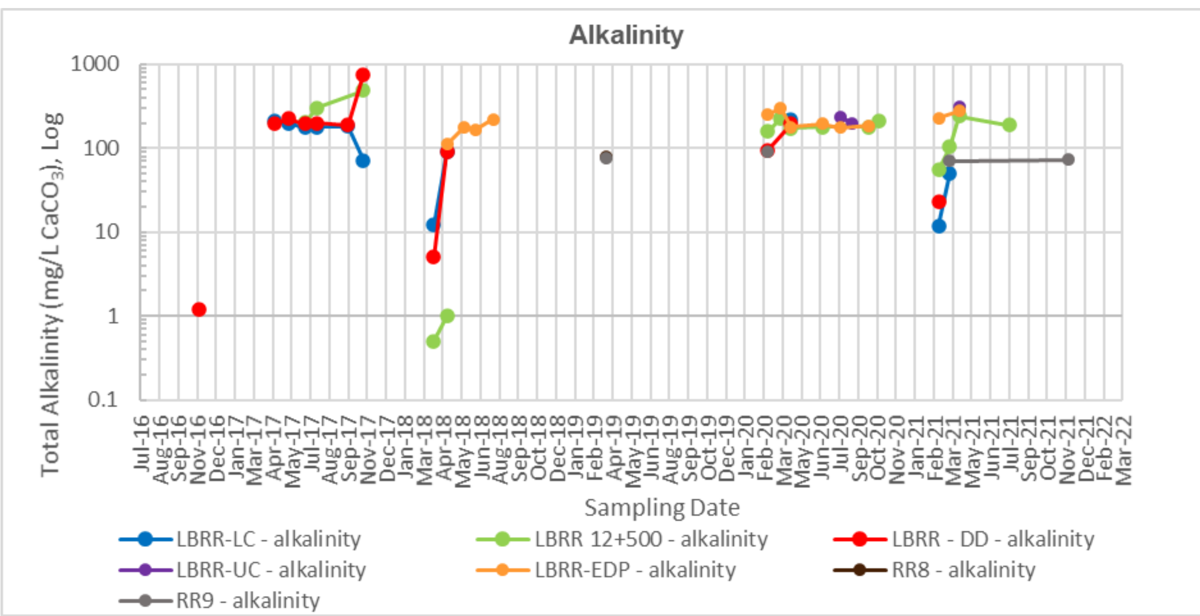


Figure 9: Acidity at River Road Locations

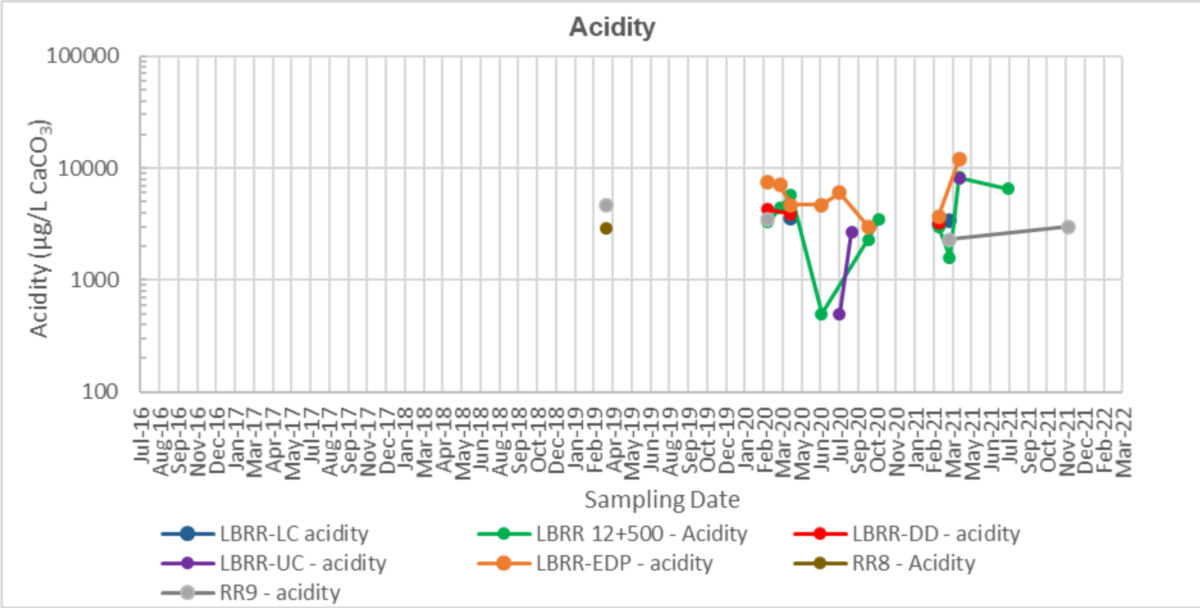


Figure 10: Sulphate at River Road Locations

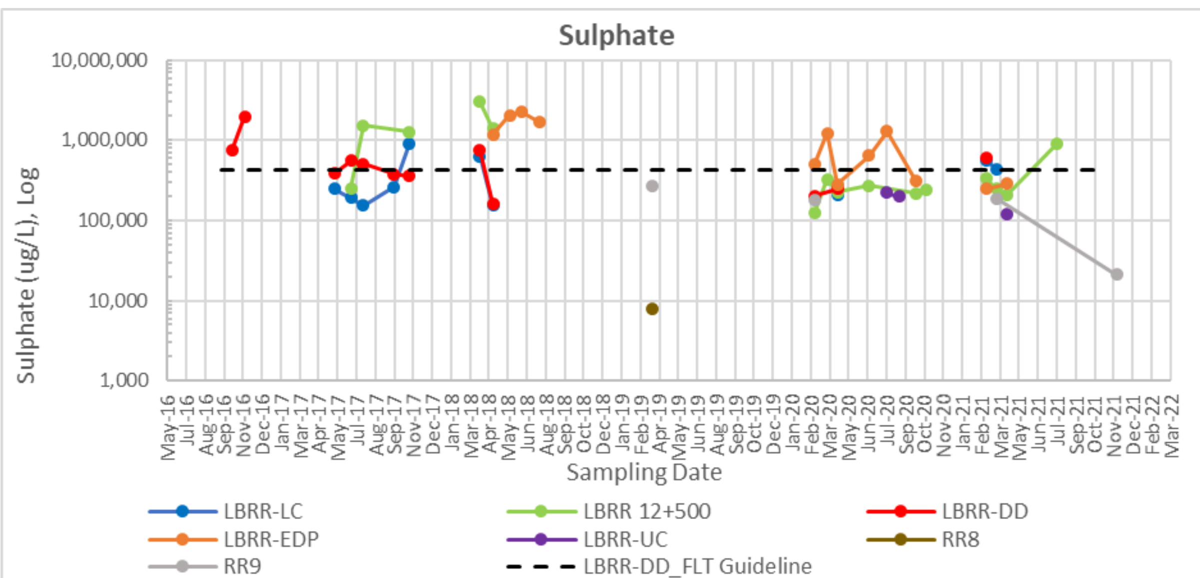


Figure 11a: Total Dissolved Solids (TDS) at River Road Locations

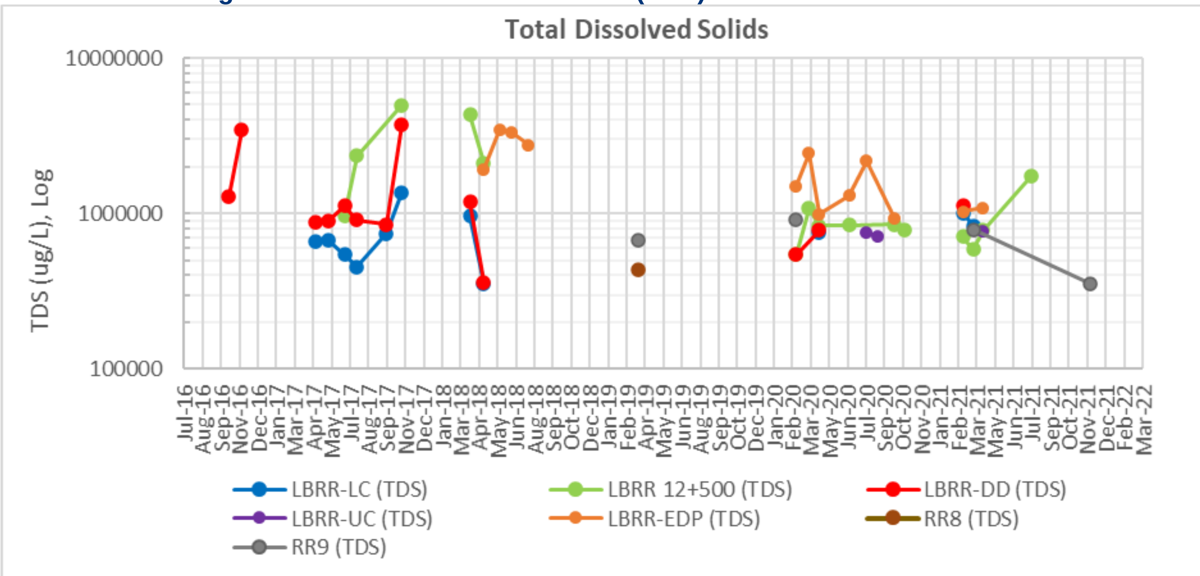


Figure 11b: Total Suspended Solids (TSS) at River Road Locations

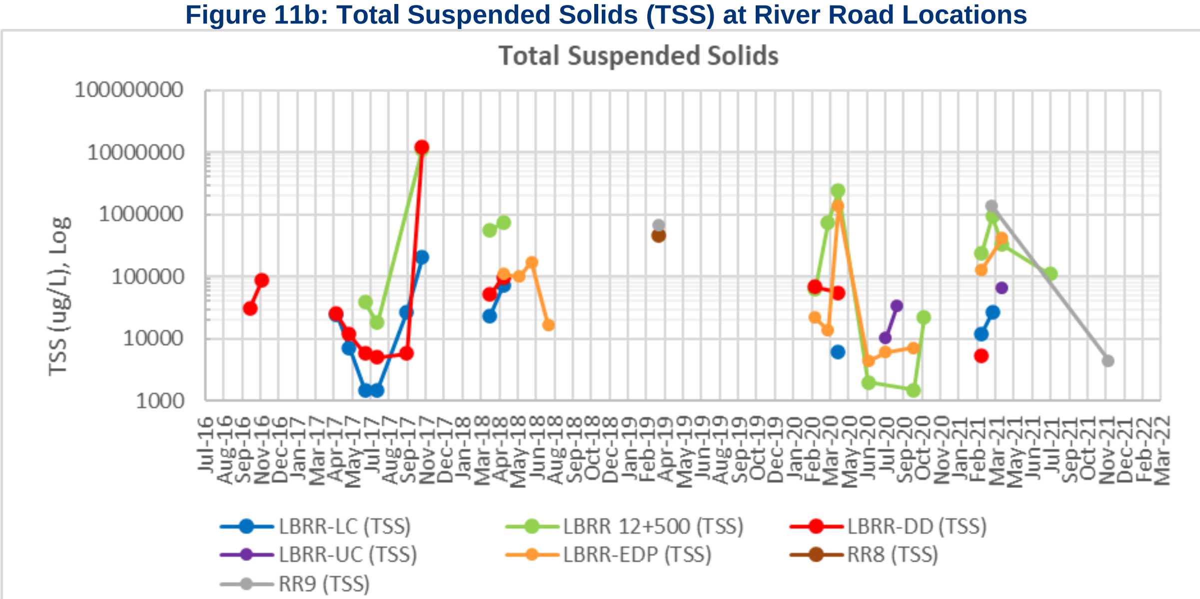


Figure 12a: Total Aluminum at River Road Locations

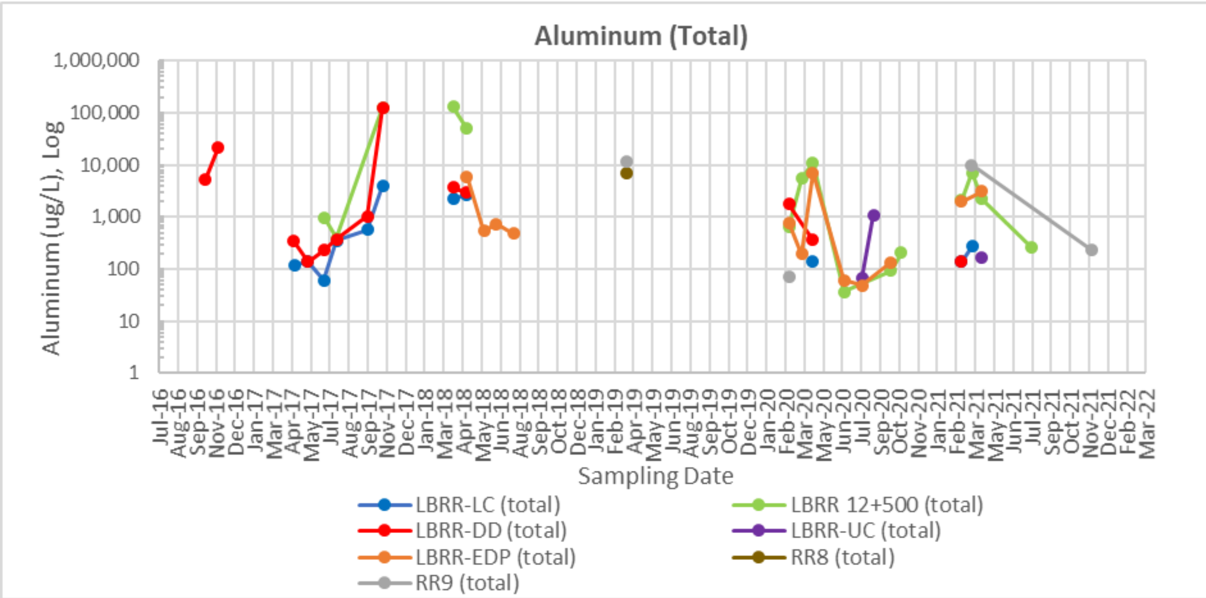


Figure 12b: Dissolved Aluminum at River Road Locations

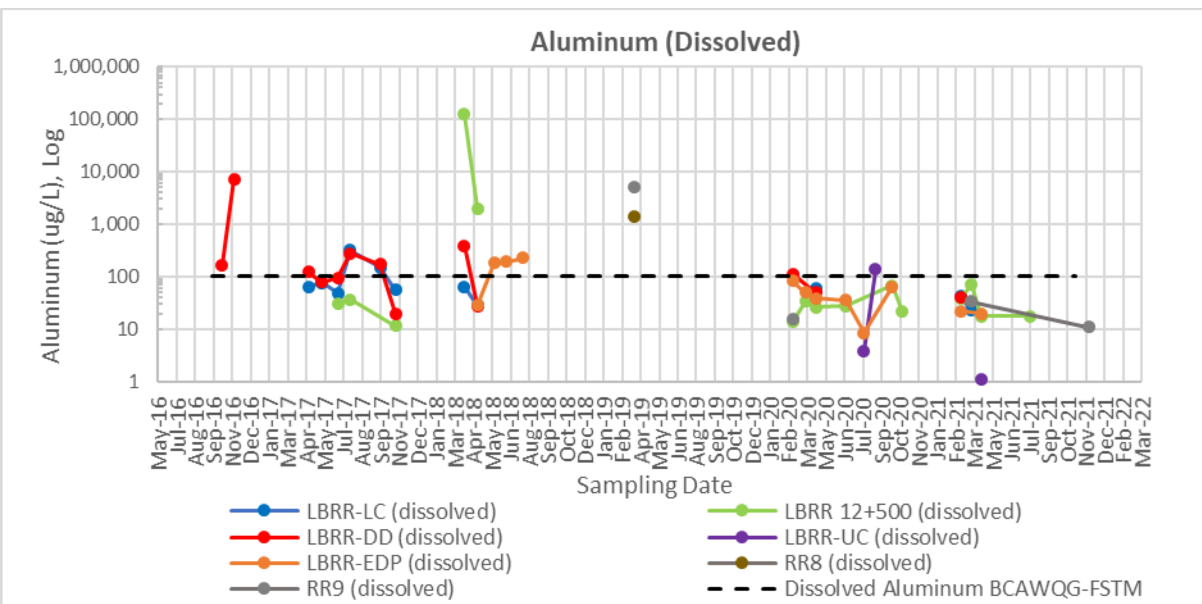


Figure 13a: Total Iron at River Road Locations

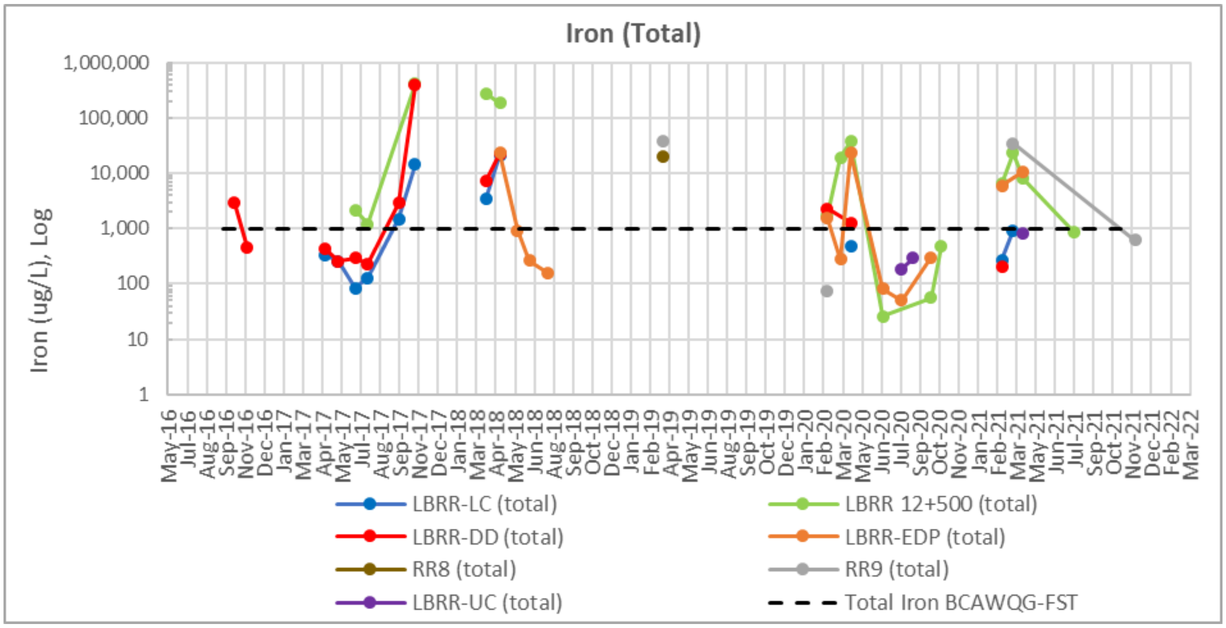


Figure 13b: Dissolved Iron at River Road Locations

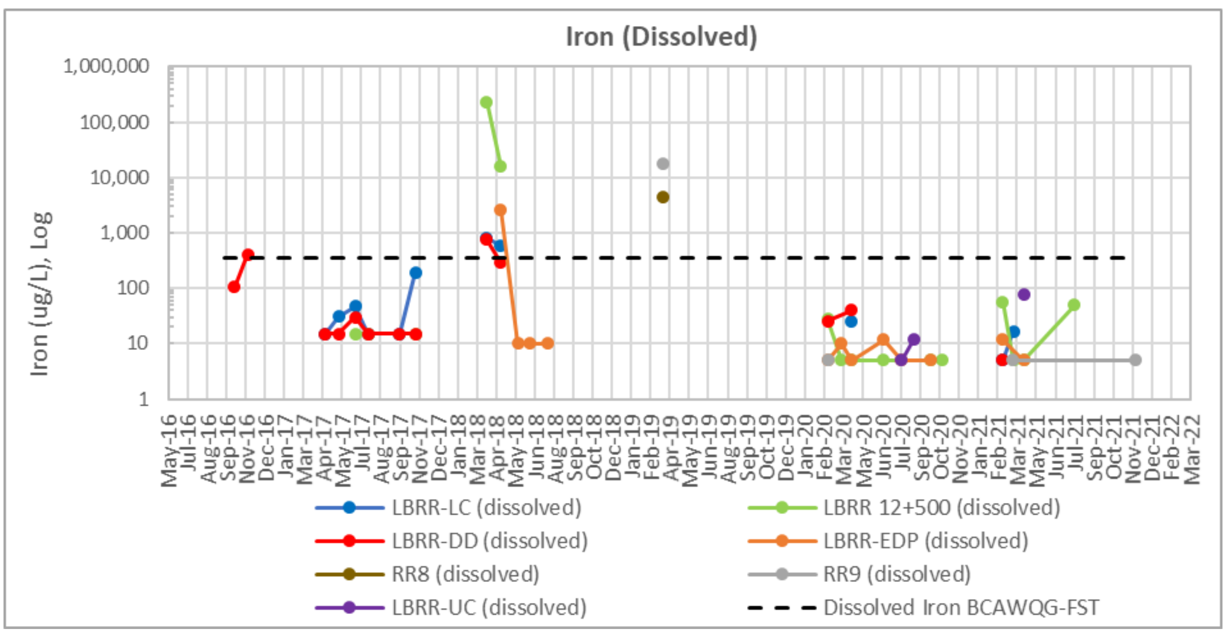


Figure 14a: Total Arsenic at River Road Locations

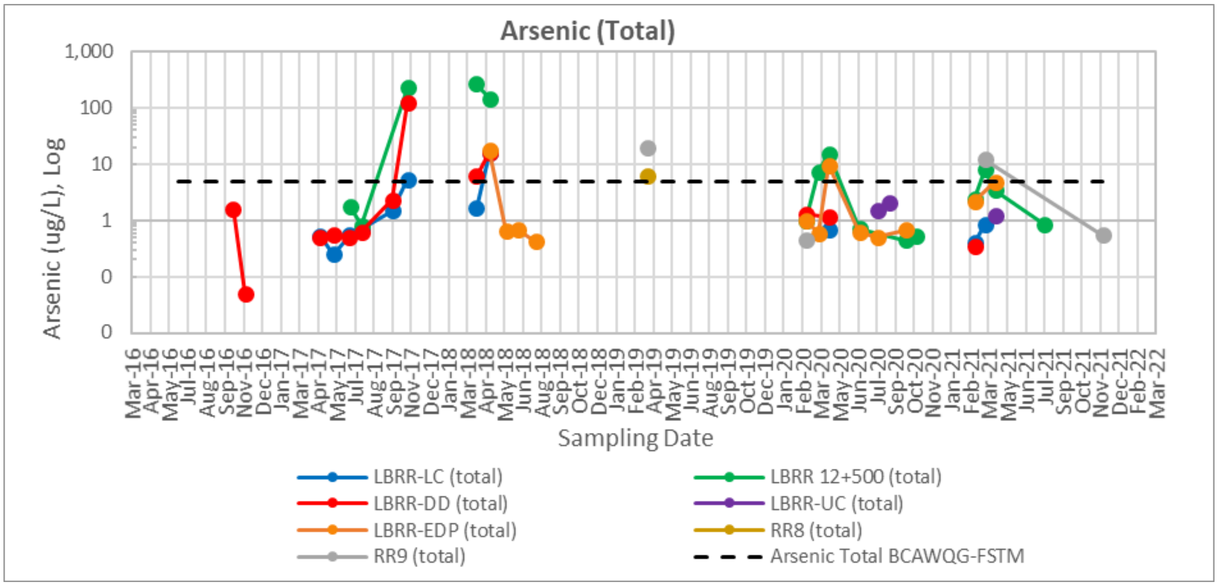


Figure 14b: Dissolved Arsenic at River Road Locations

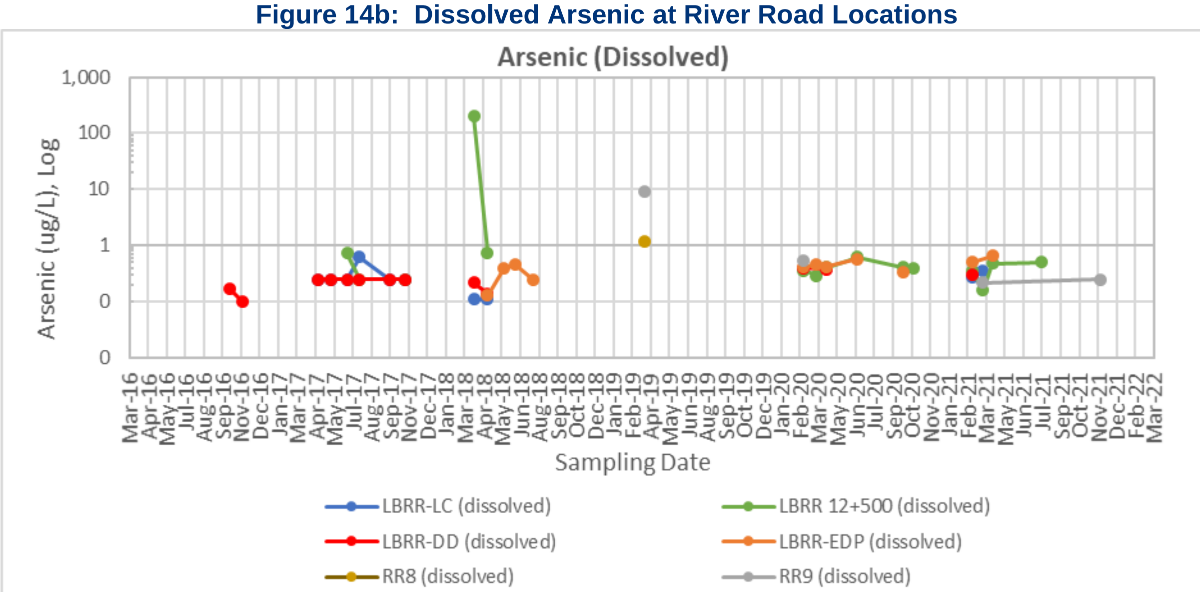


Figure 15a: Total Cadmium at River Road Locations

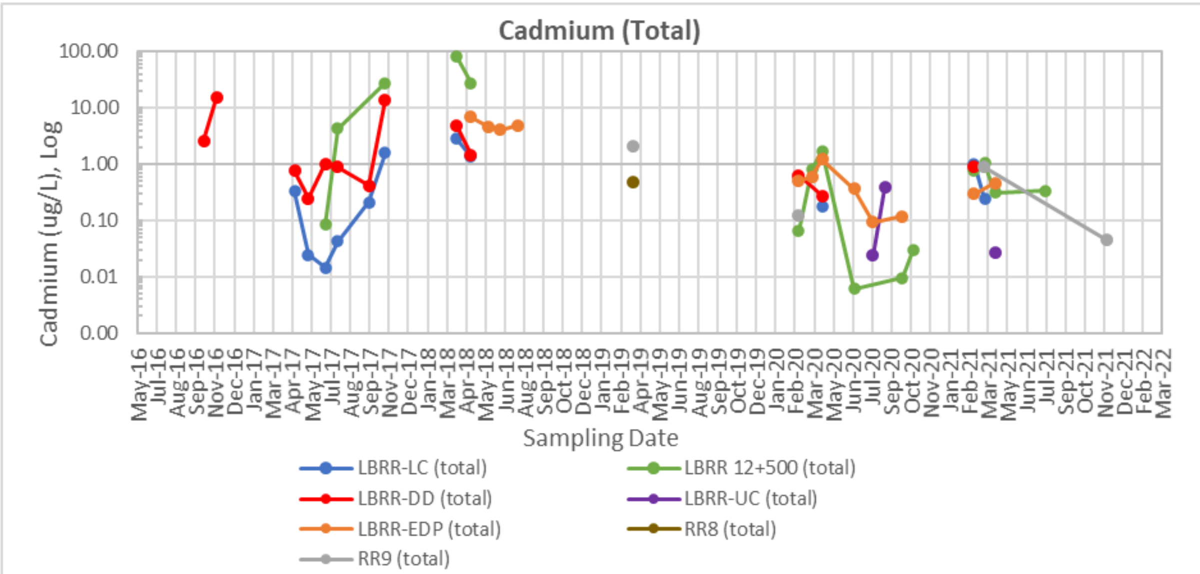


Figure 15b: Dissolved Cadmium at River Road Locations

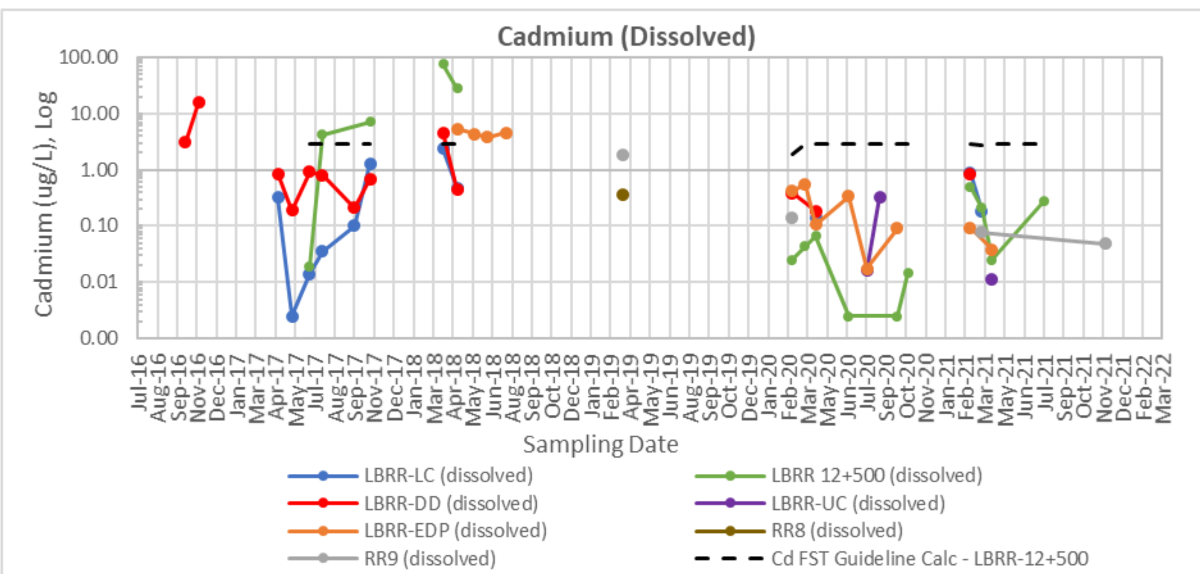


Figure 16a: Total Cobalt at River Road Locations

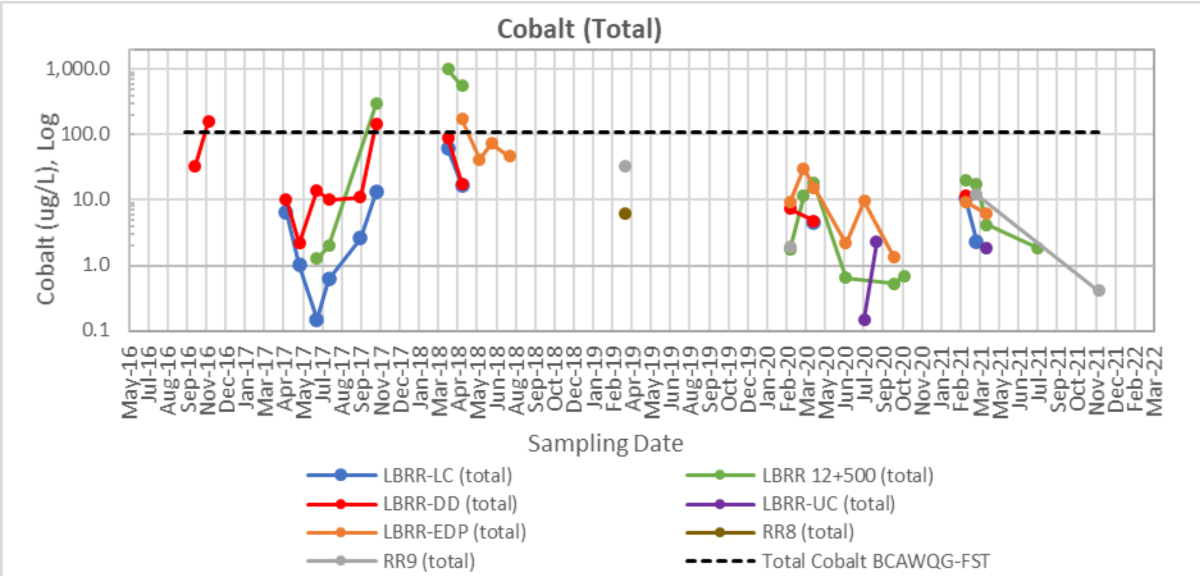


Figure 16b: Dissolved Cobalt at River Road Locations

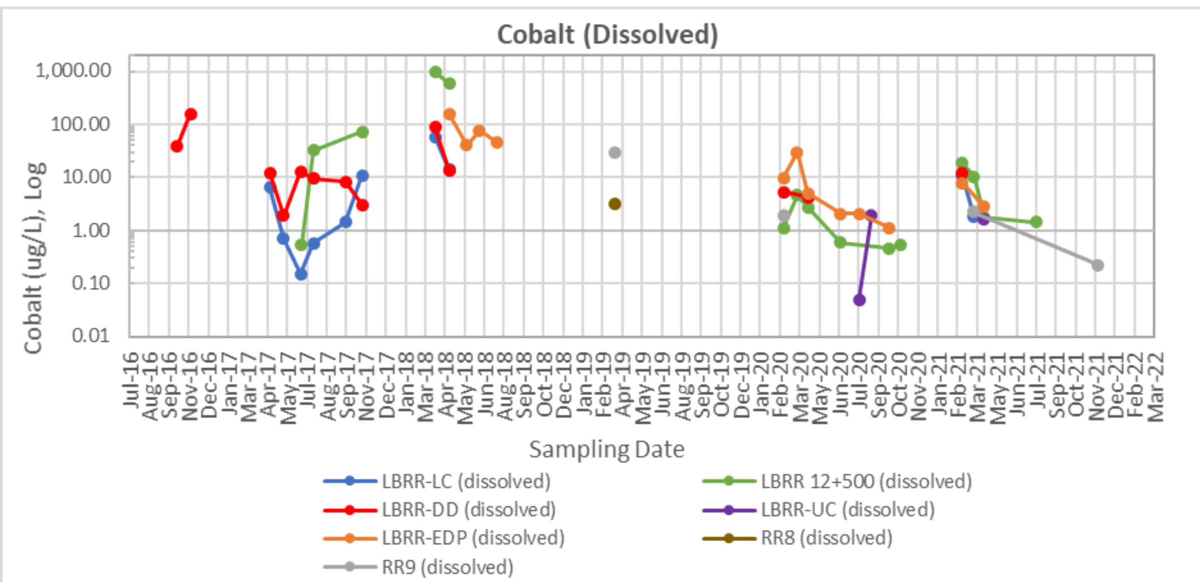


Figure 17a: Total Copper at River Road Locations

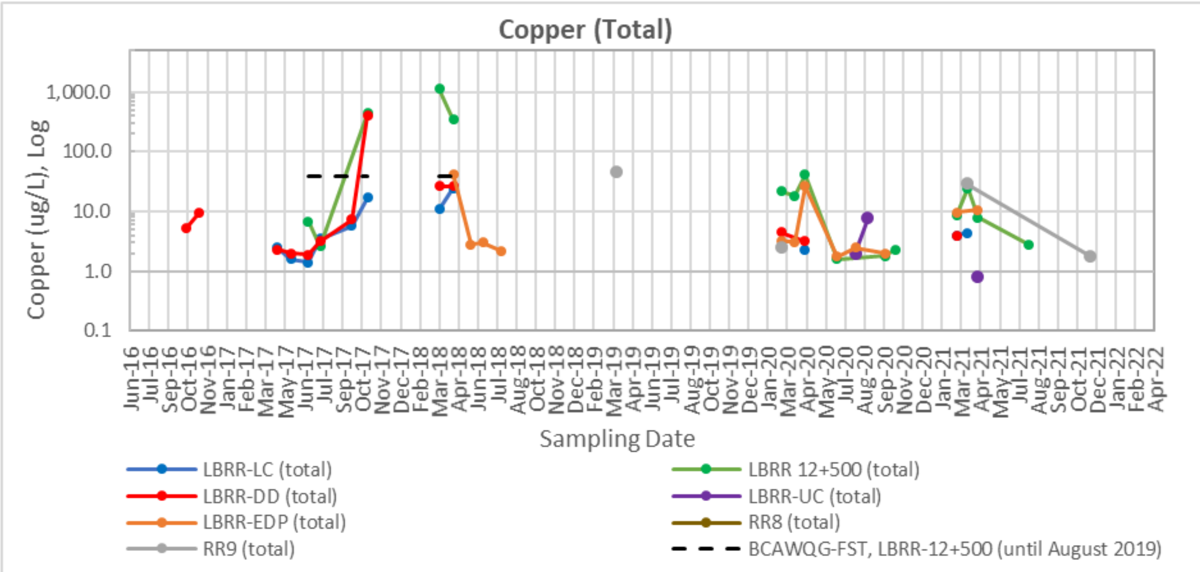


Figure 17b: Dissolved Copper at River Road Locations

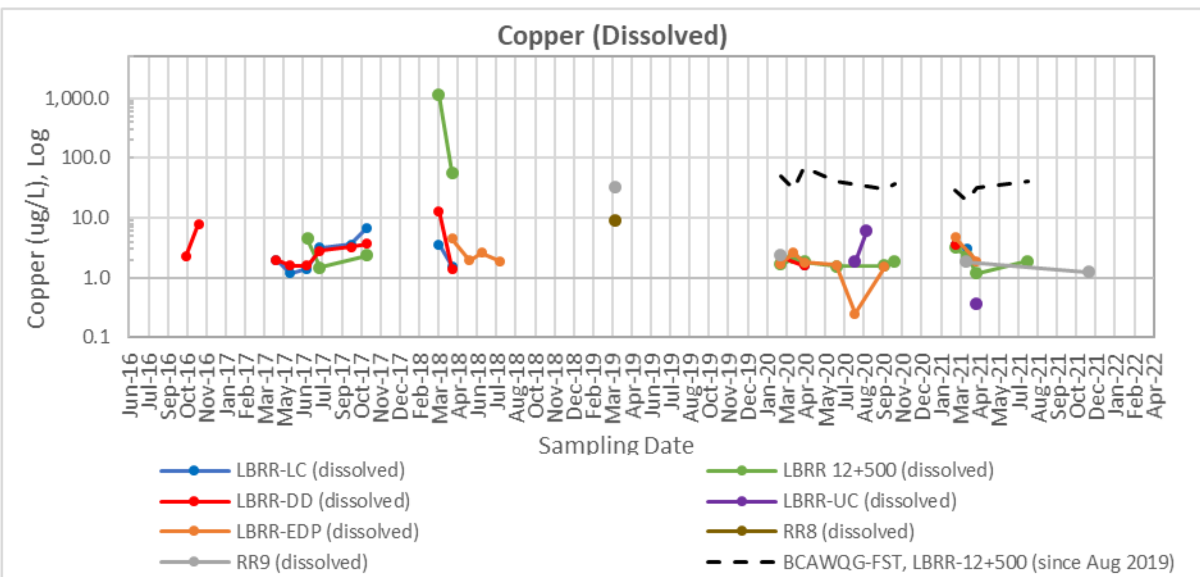


Figure 18a: Total Zinc at River Road Locations

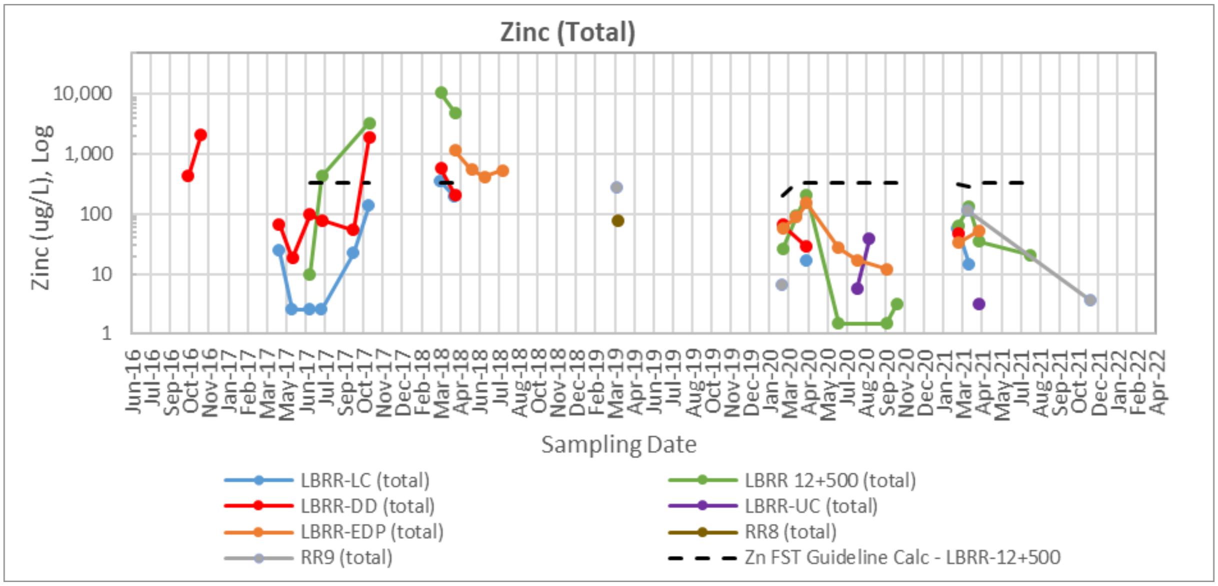


Figure 18b: Dissolved Zinc at River Road Locations

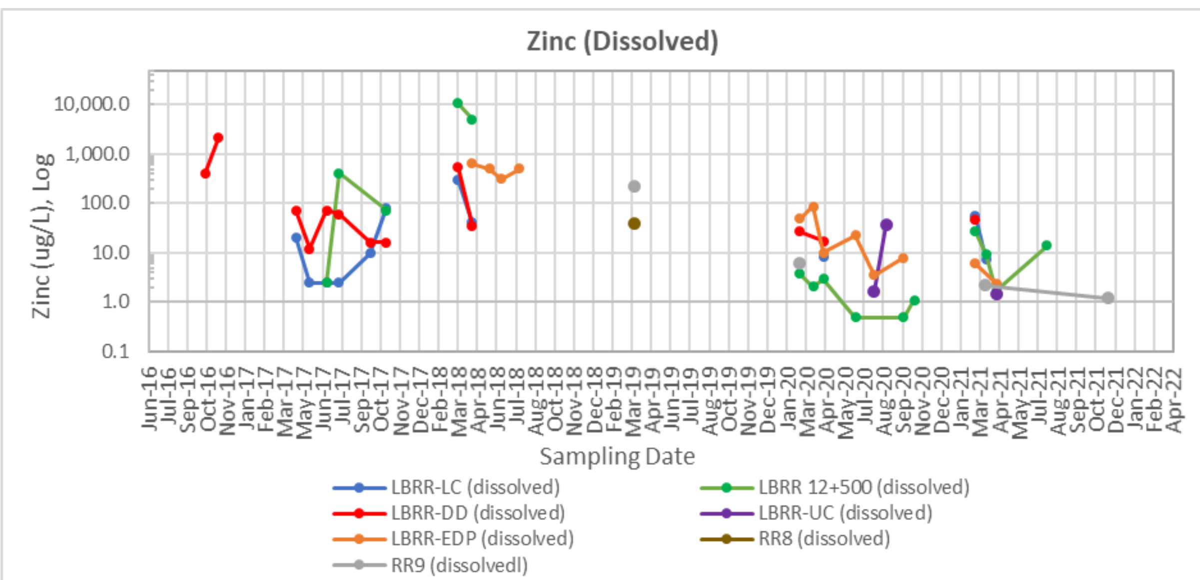


Figure 19: pH at RBSBIAR Locations

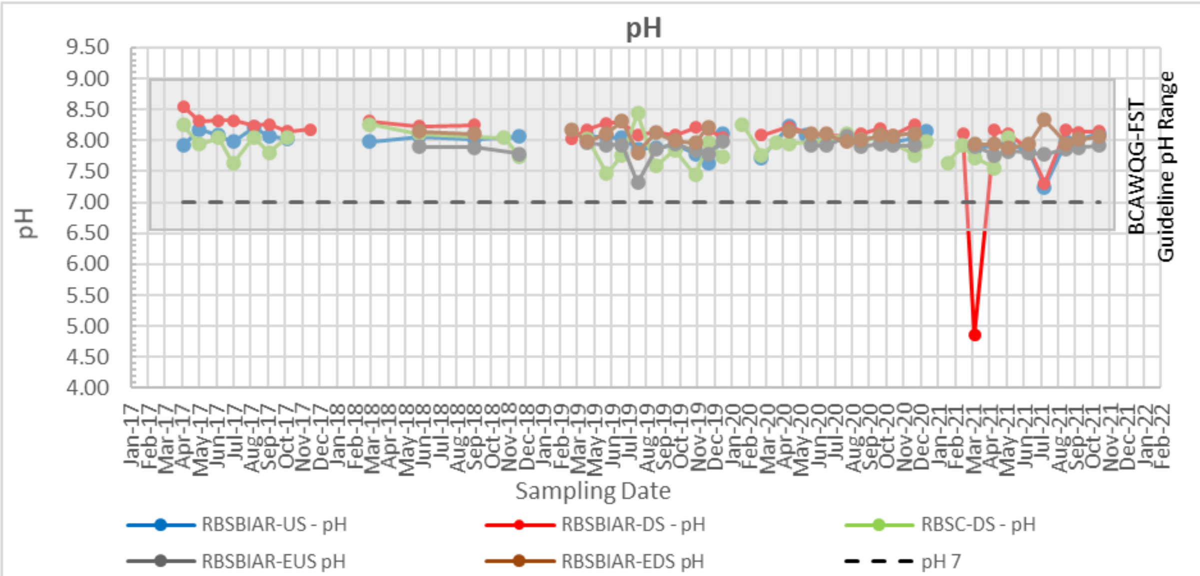


Figure 20: Total Alkalinity at RBSBIAR Locations

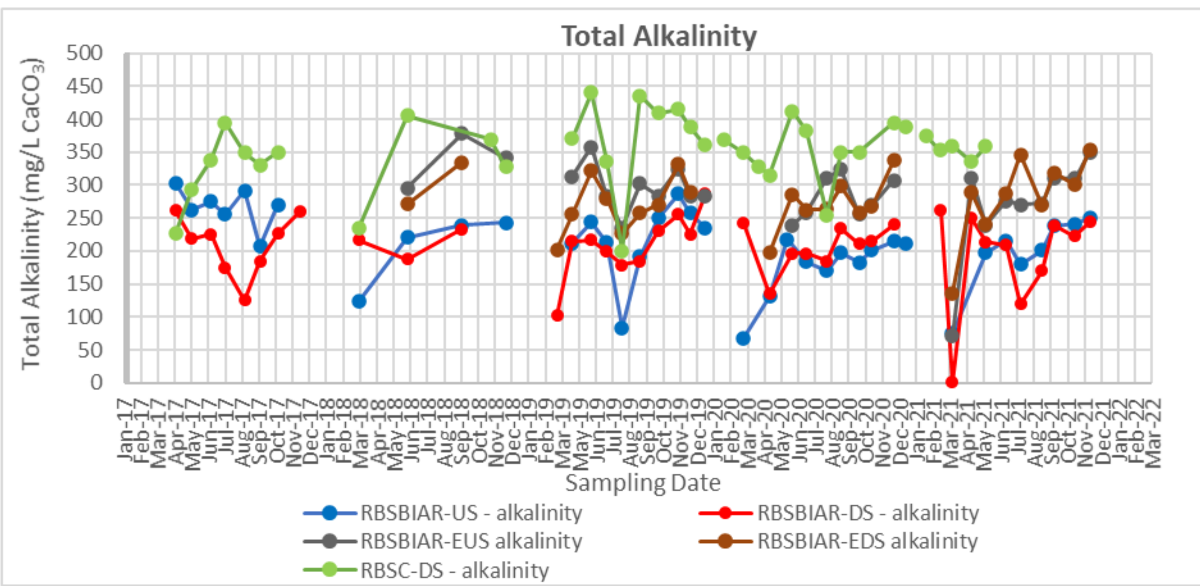


Figure 21: Acidity at RBSBIAR Locations

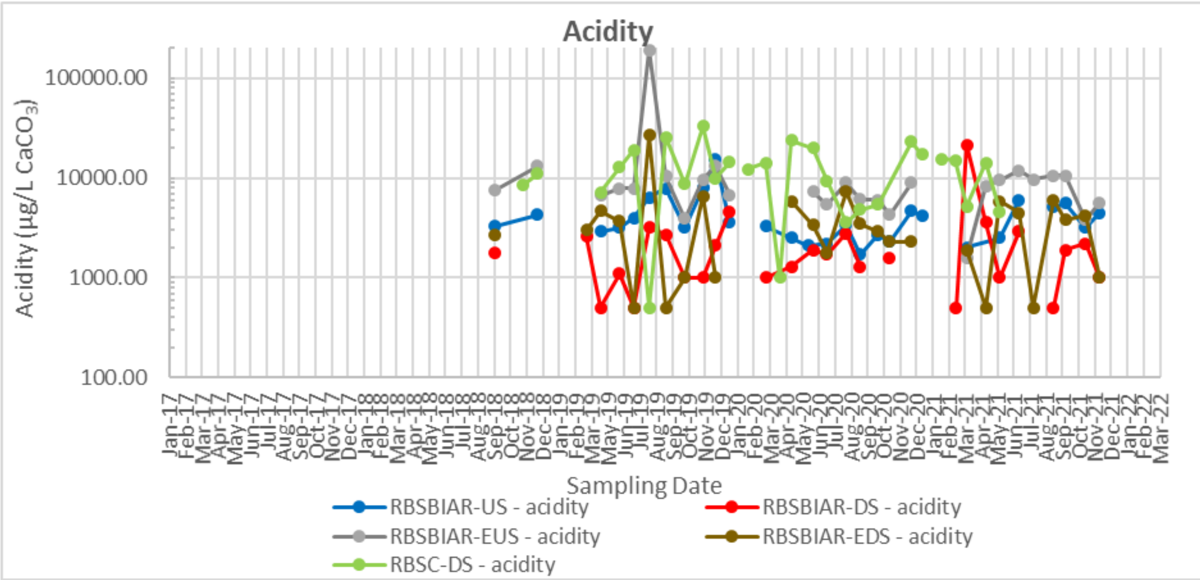


Figure 22: Sulphate at RBSBIAR Locations

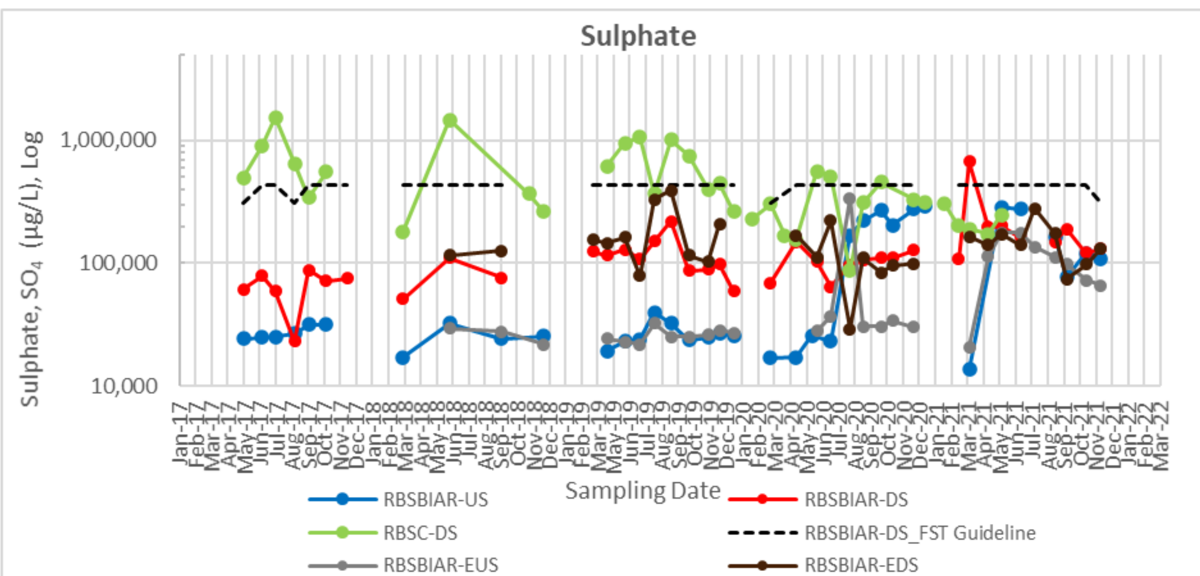


Figure 23a: Total Dissolved Solids (TDS) at RBSBIAR Locations

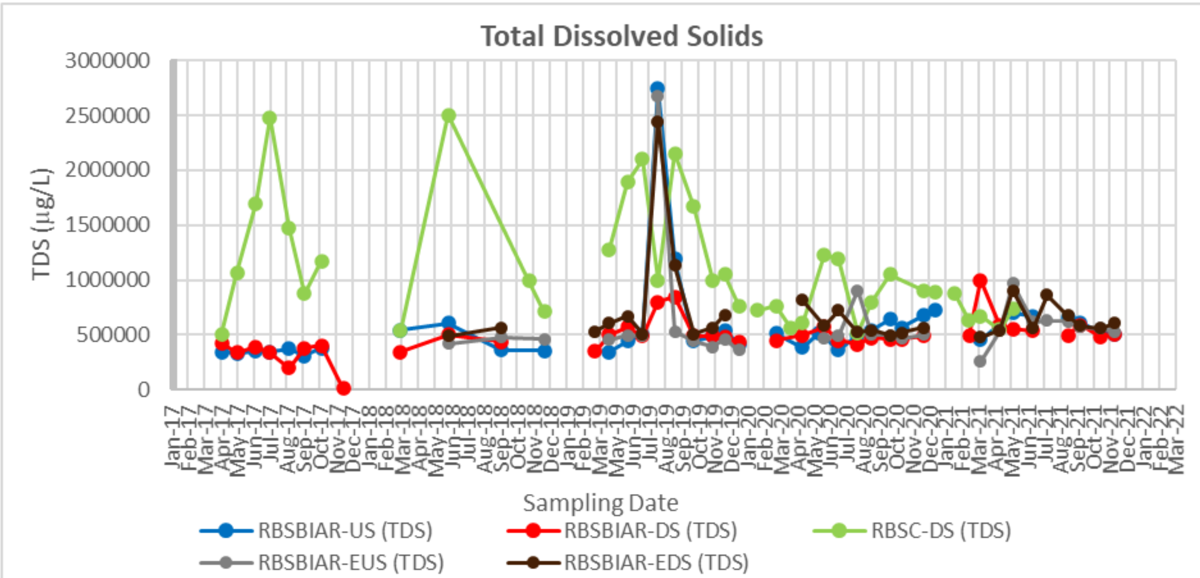


Figure 23b: Total Suspended Solids (TSS) at RBSBIAR Locations

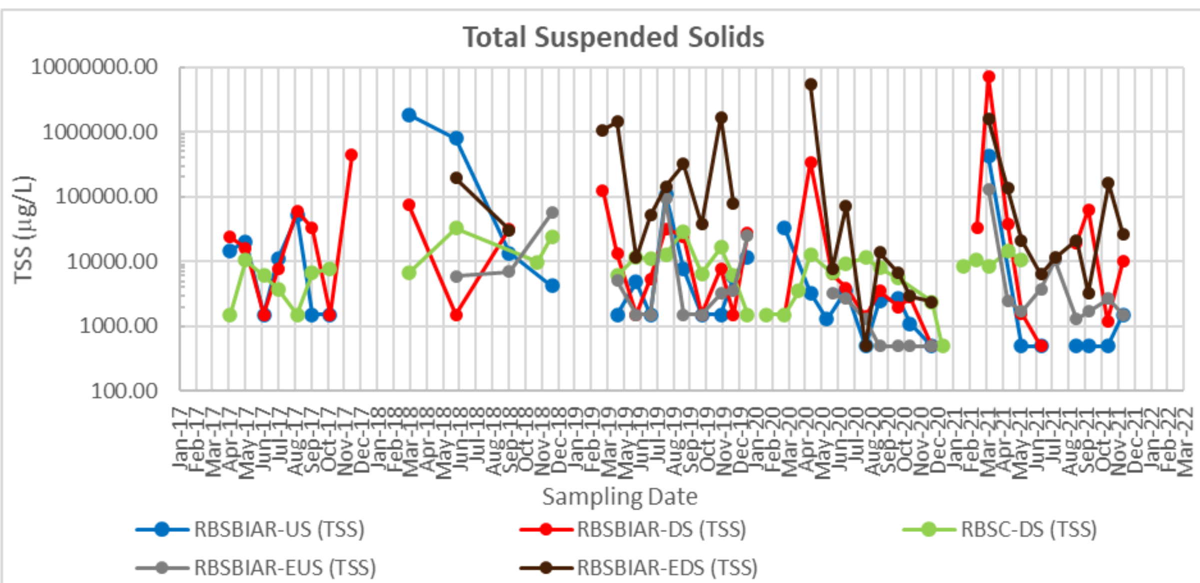


Figure 24a: Total Aluminum at RBSBIAR Locations

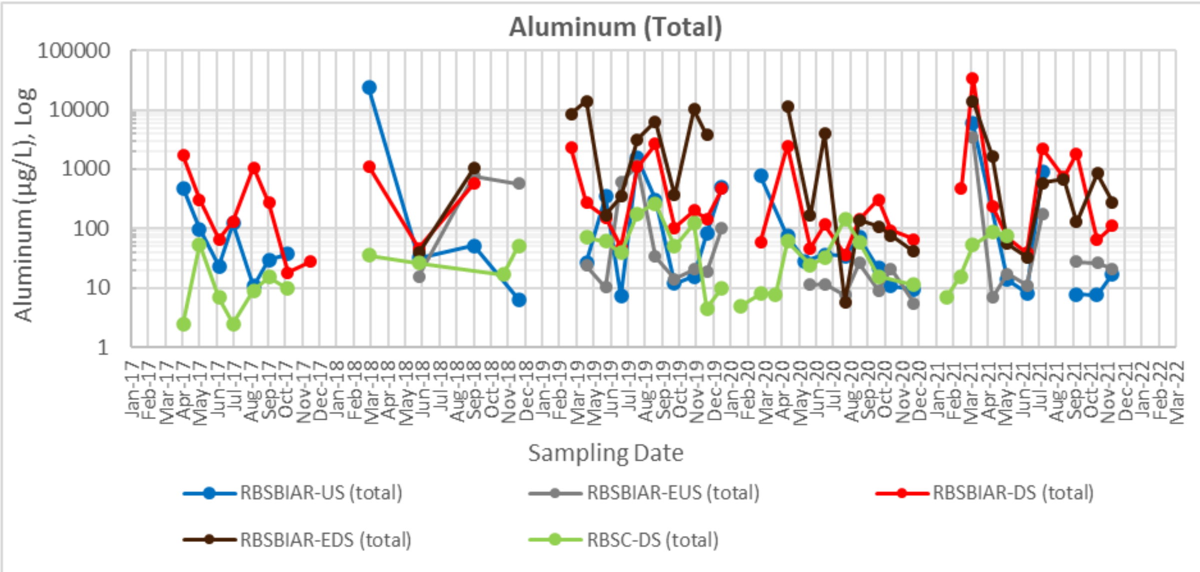


Figure 24b: Dissolved Aluminum at RBSBIAR Locations

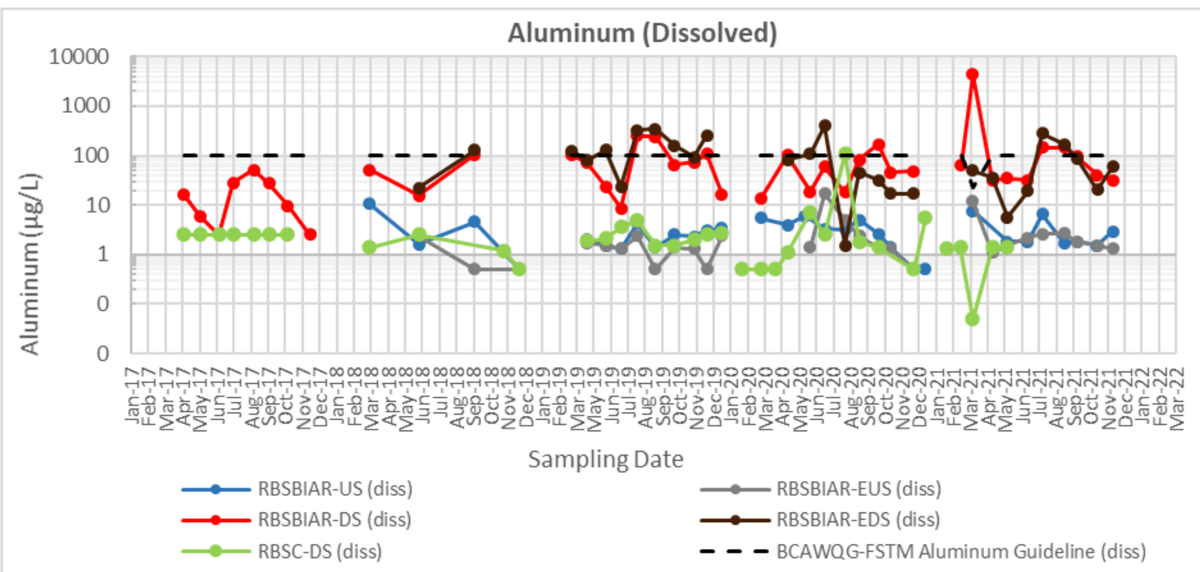


Figure 25a: Total Iron at RBSBIAR Locations

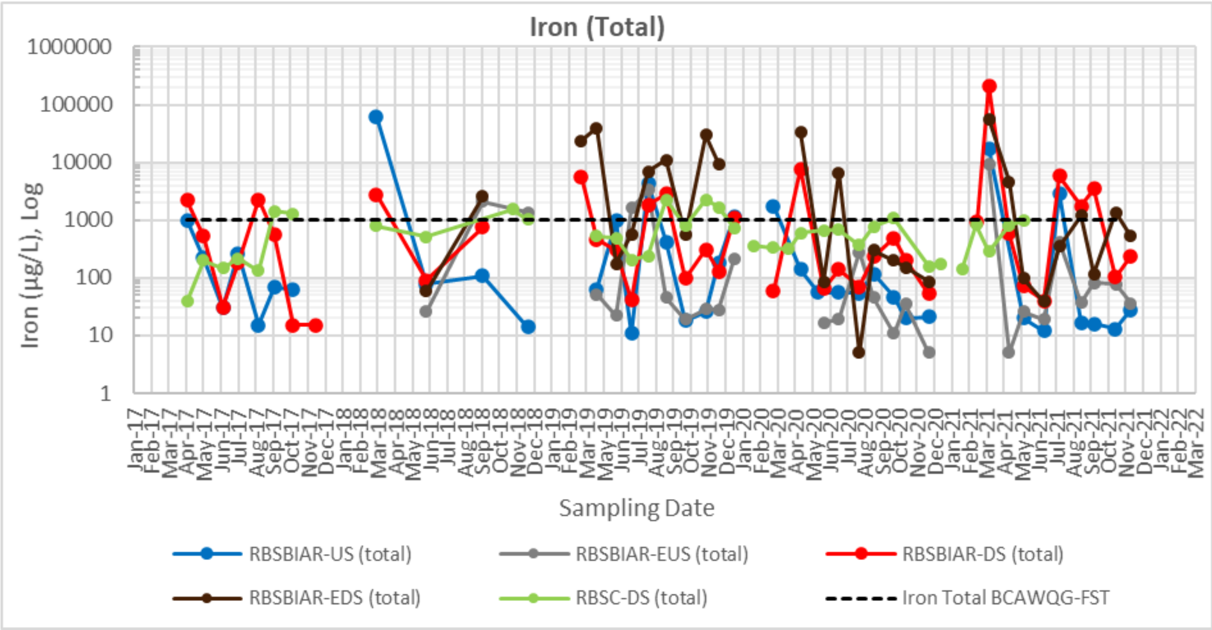


Figure 25b: Dissolved Iron at RBSBIAR Locations

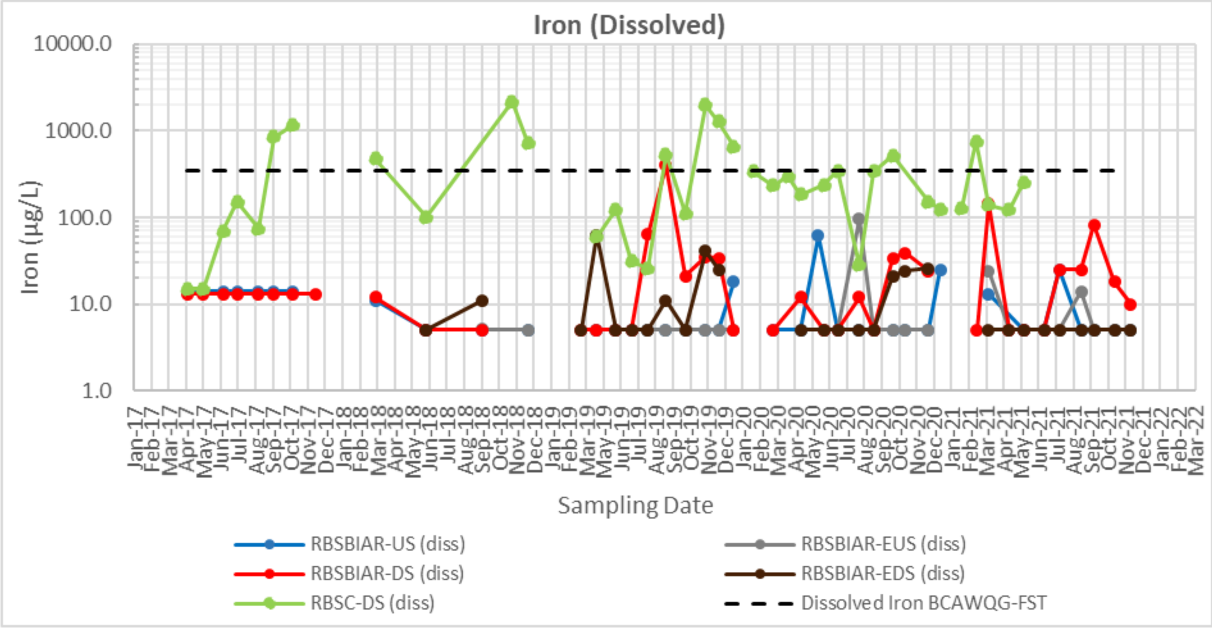


Figure 26a: Total Arsenic at RBSBIAR Locations

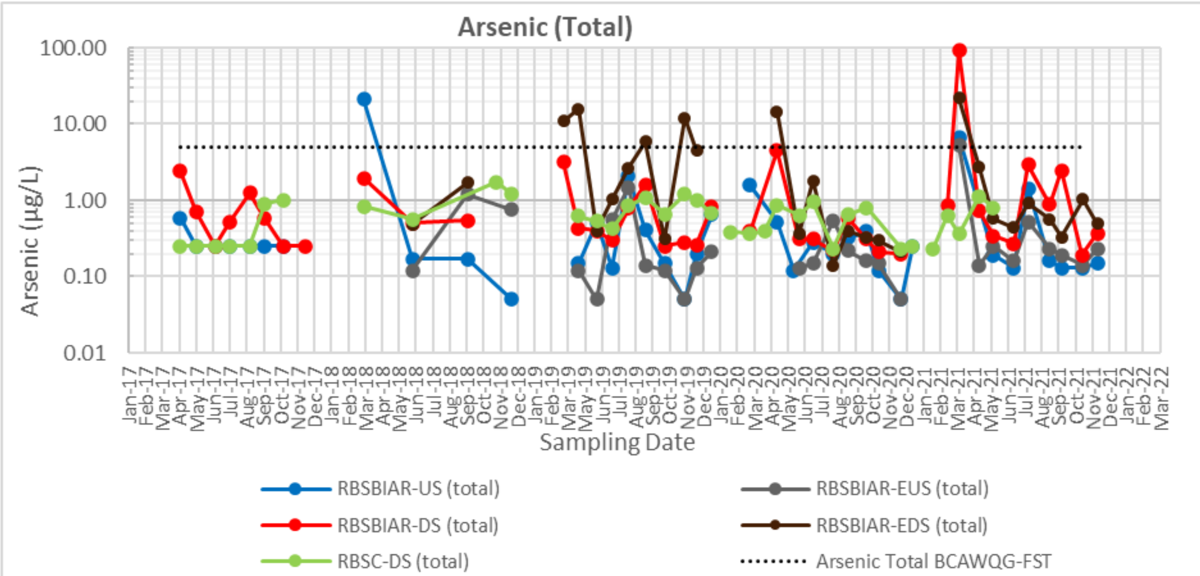


Figure 26b: Dissolved Arsenic at RBSBIAR Locations

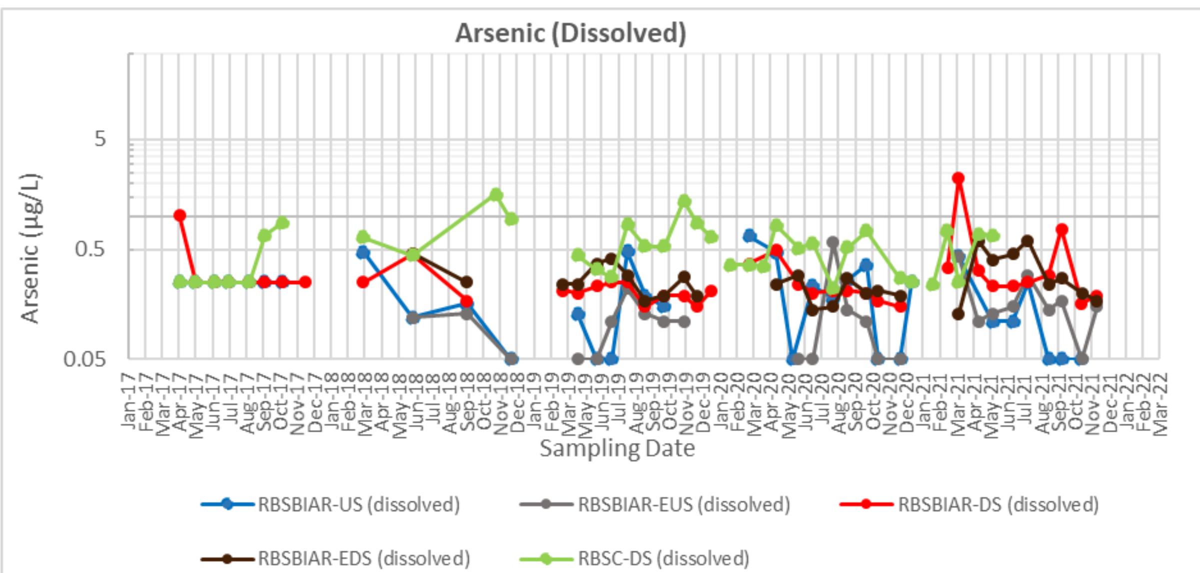


Figure 27a: Total Cadmium at RBSBIAR Locations

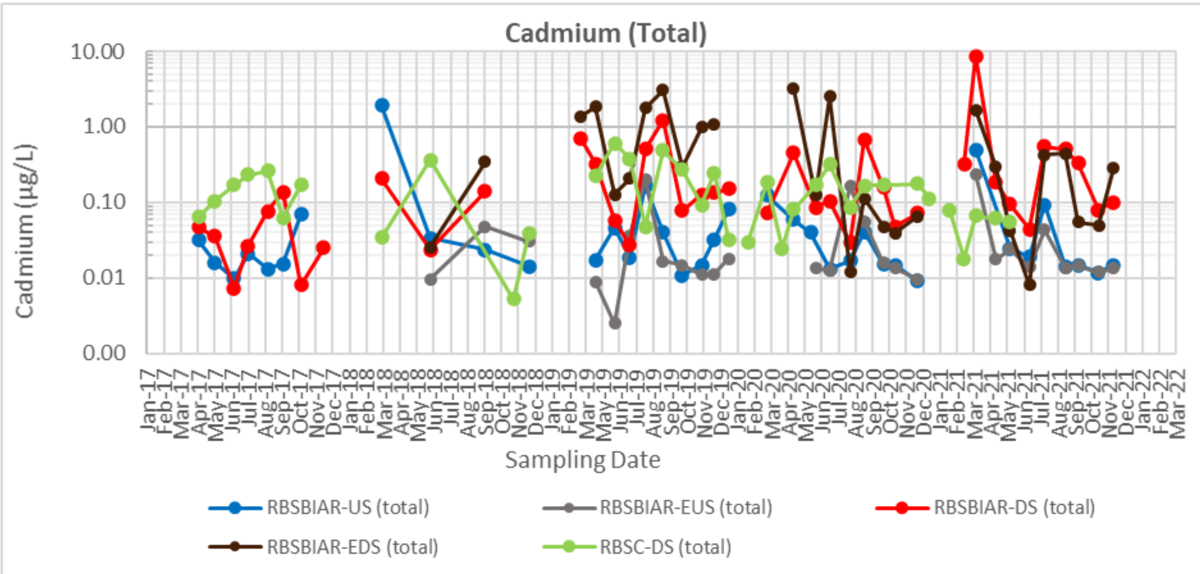


Figure 27b: Dissolved Cadmium at RBSBIAR Locations

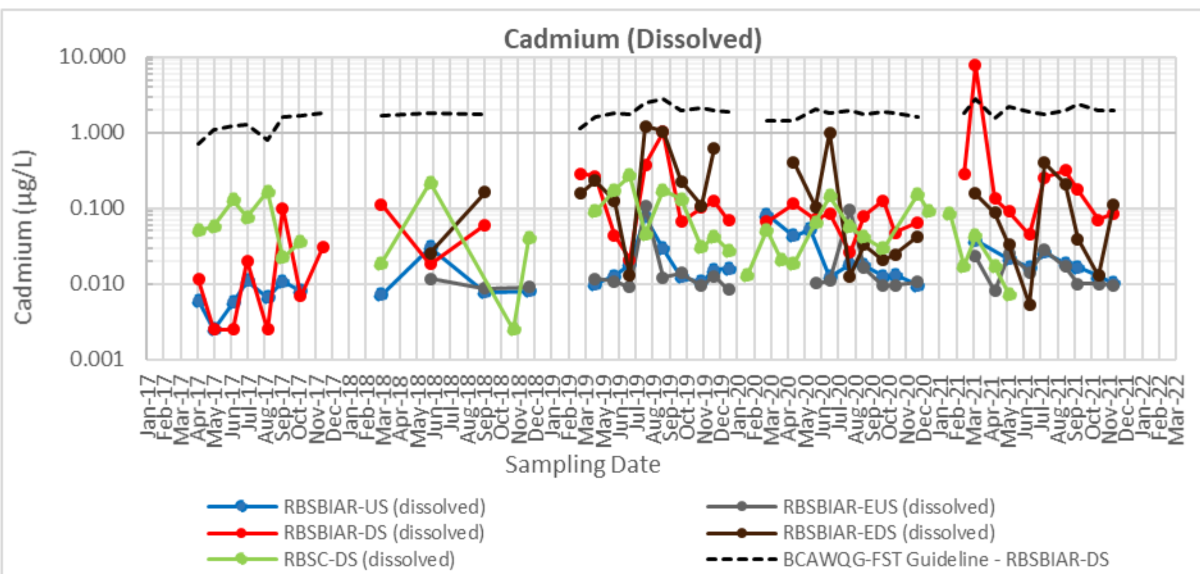


Figure 28a: Total Cobalt at RBSBIAR Locations

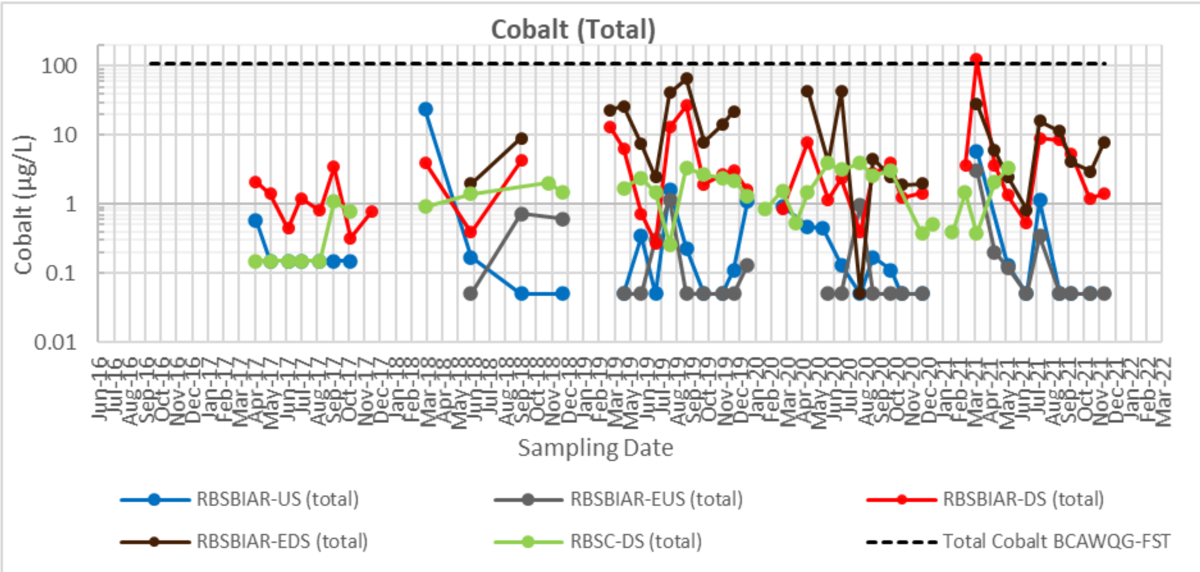


Figure 28b: Dissolved Cobalt at RBSBIAR Locations

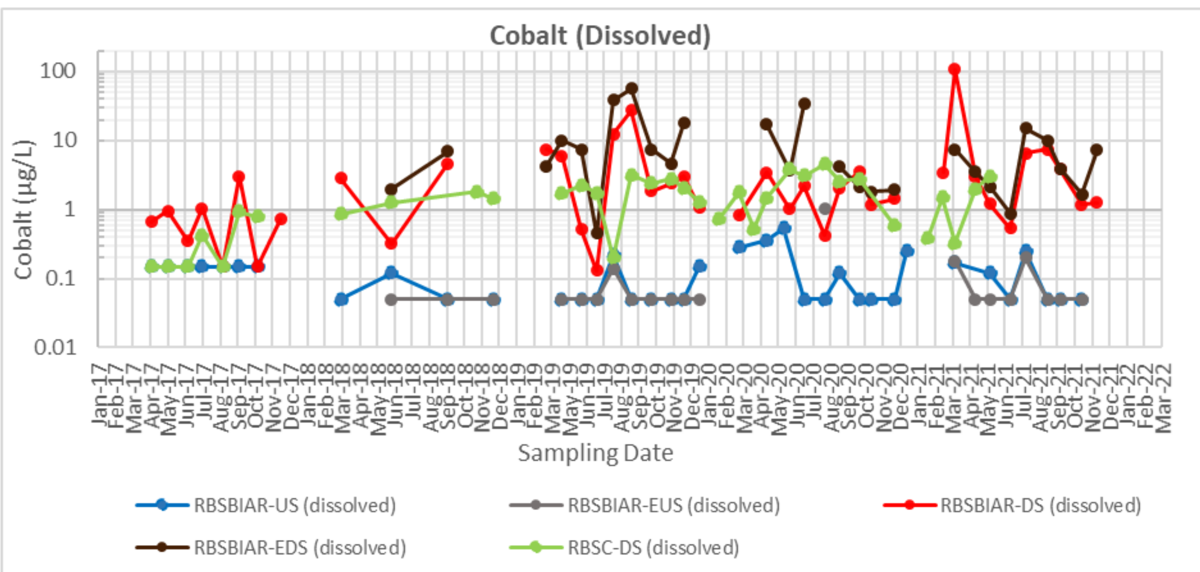


Figure 29a: Total Copper at RBSBIAR Locations

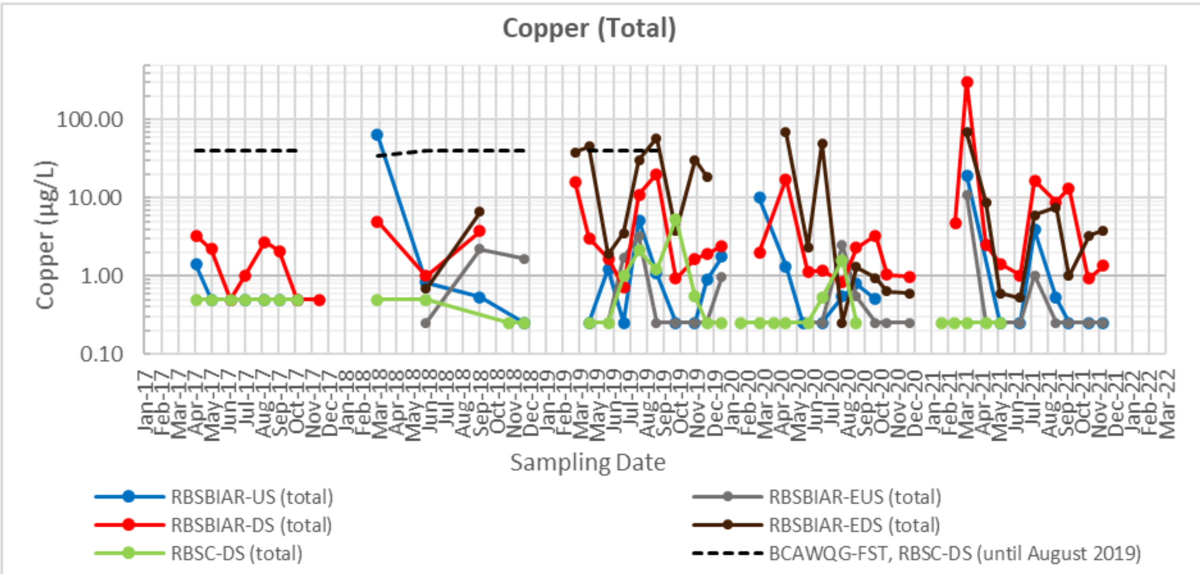
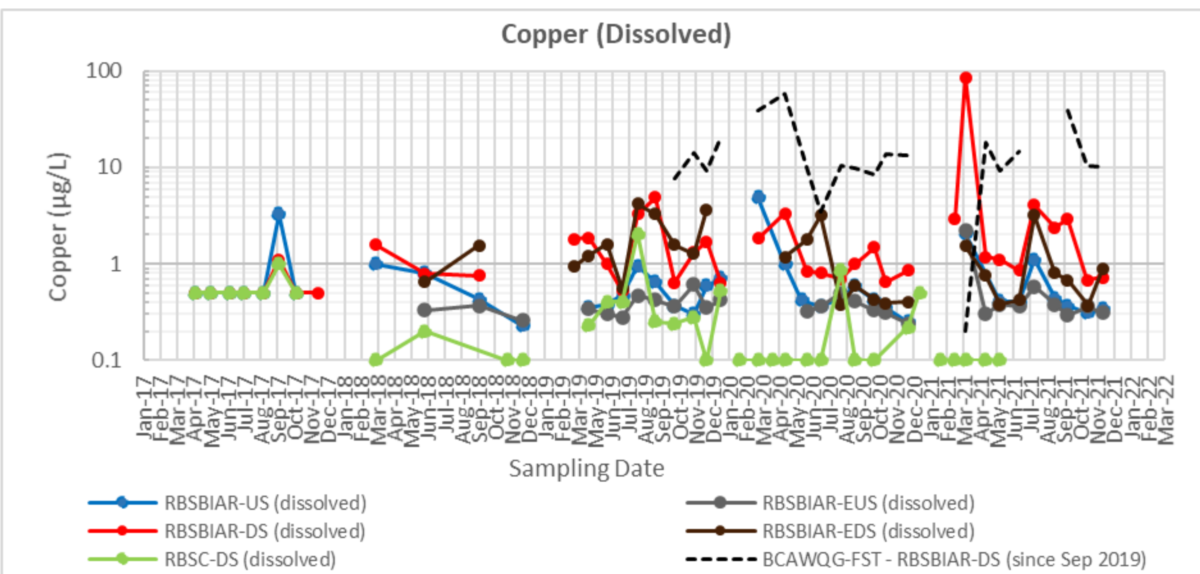


Figure 29b: Dissolved Copper at RBSBIAR Locations



TETRA TECH

Figure 30a: Total Zinc at RBSBIAR Locations

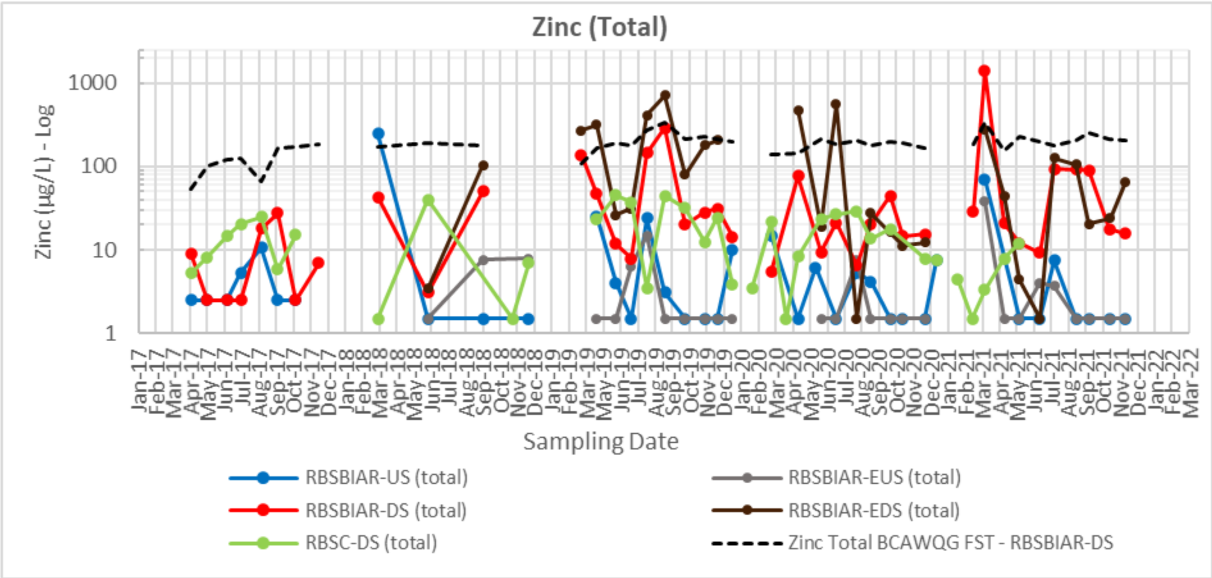


Figure 30b: Dissolved Zinc at RBSBIAR Locations

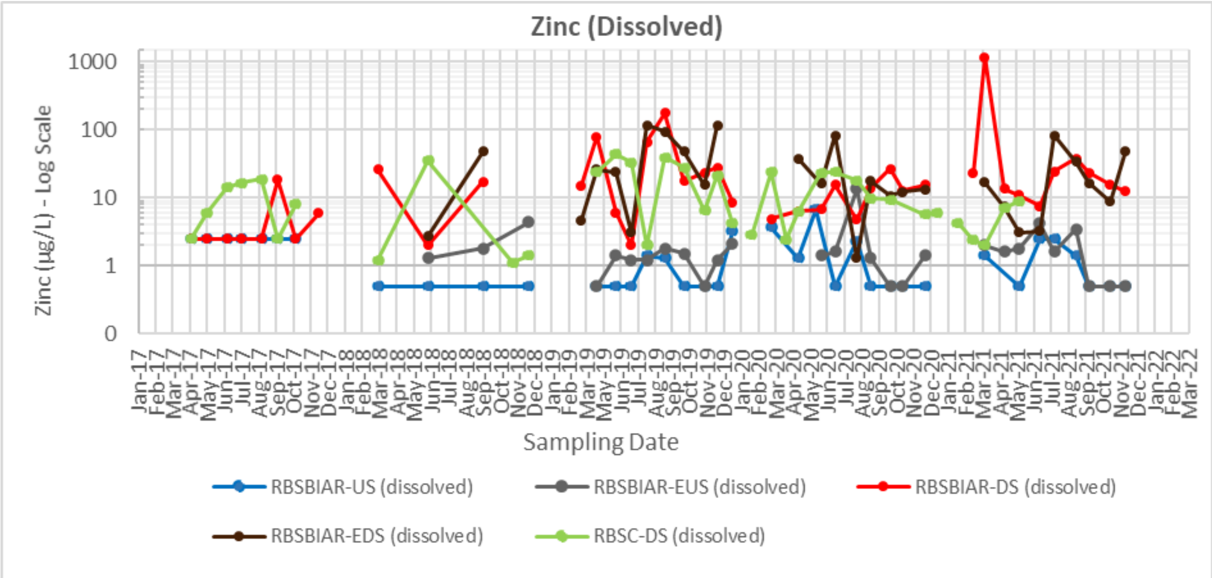


Figure 31a: RBSBIAR West Ditch Downstream (DS), Upstream (US) Ratio - Total Zinc

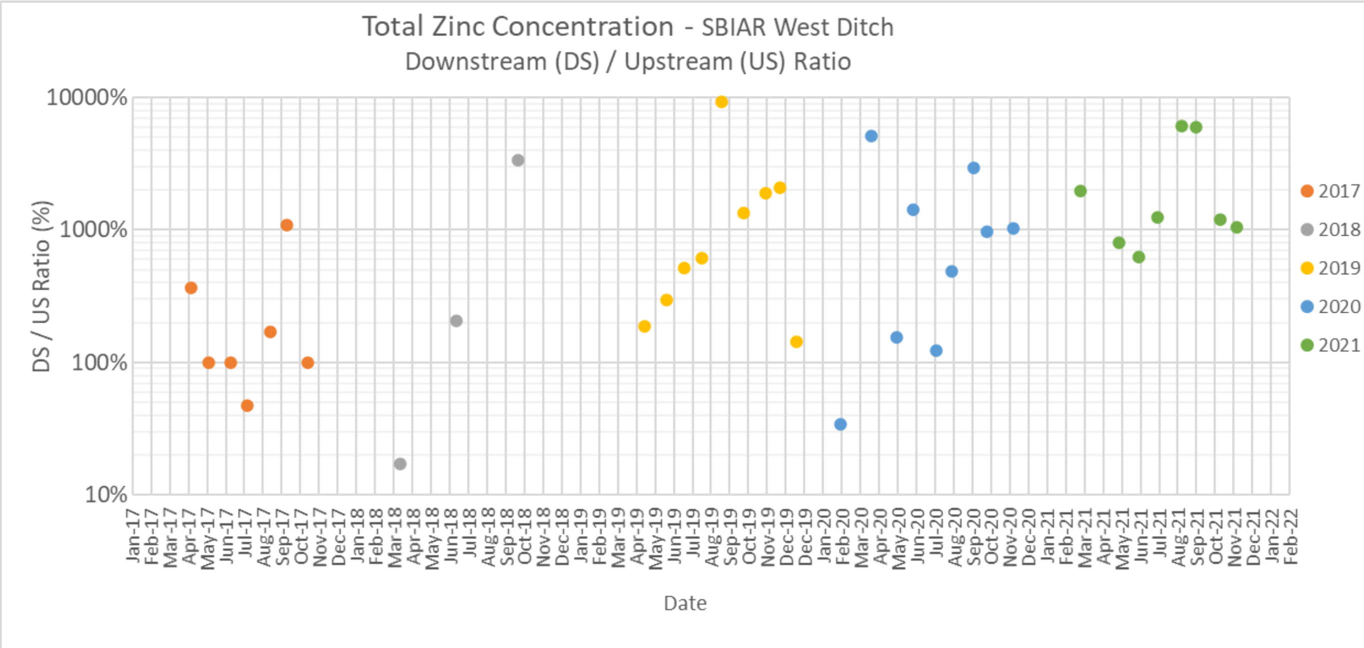


Figure 31b: RBSBIAR East Ditch Downstream (DS), Upstream (US) Ratio - Total Zinc

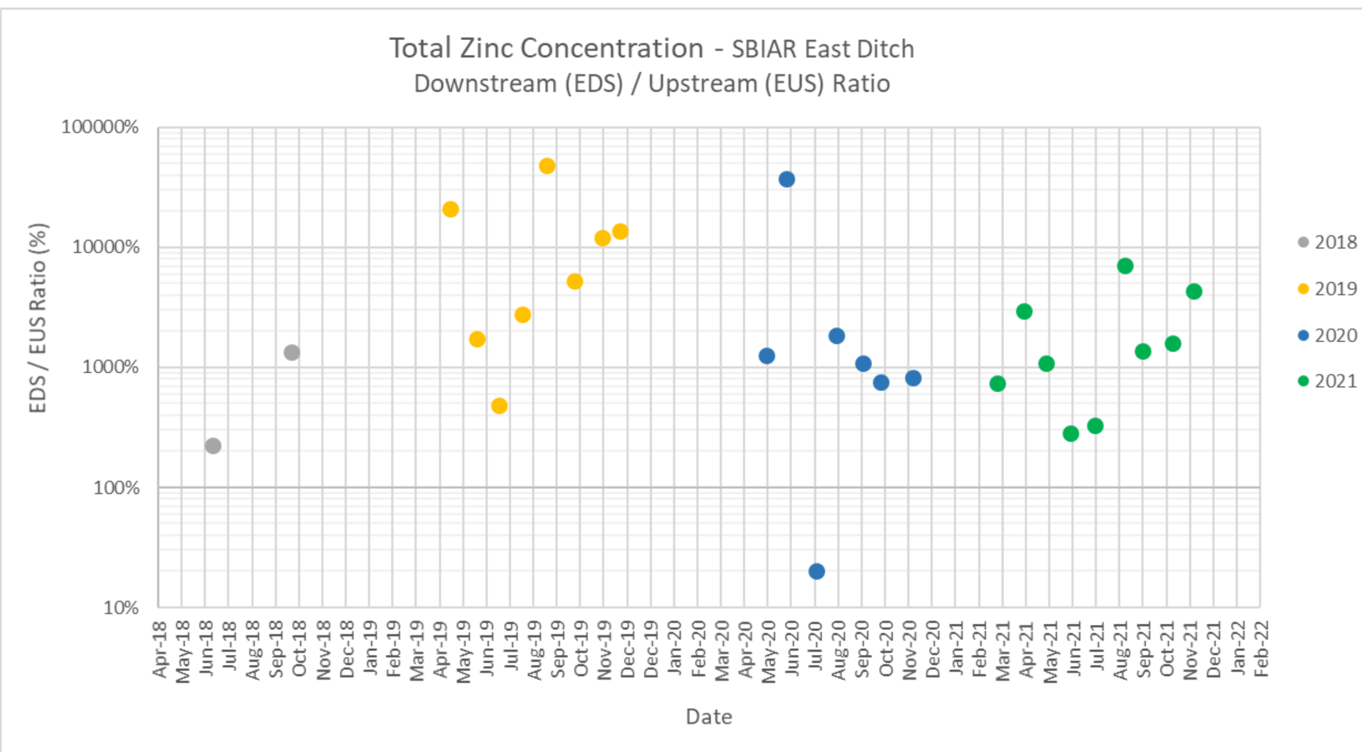


Figure 32: pH at L3 Creek Locations

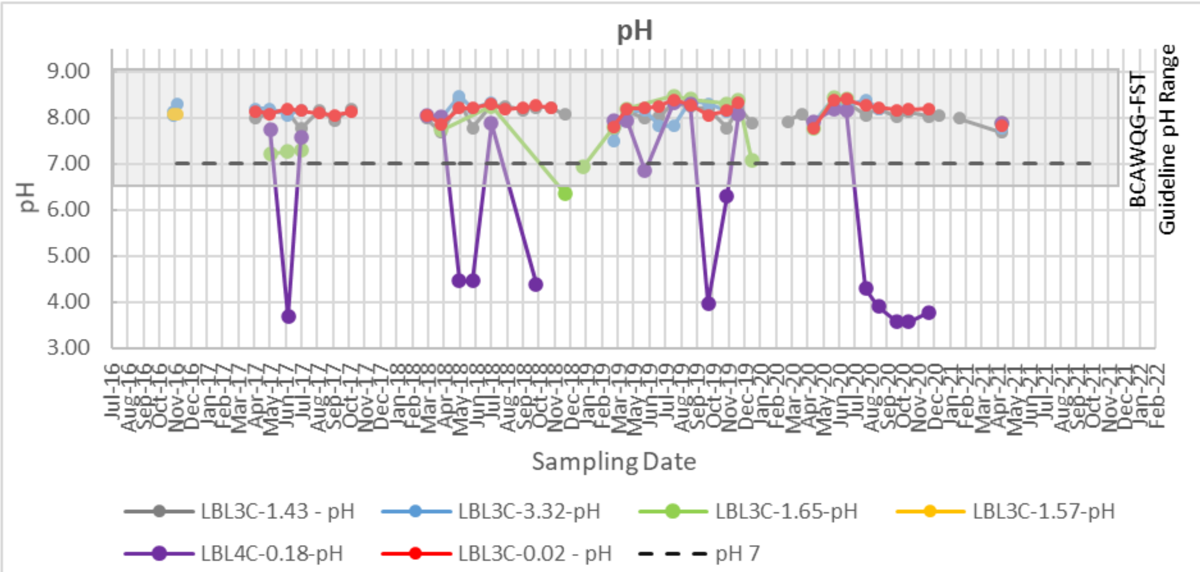


Figure 33: Total Alkalinity at L3 Creek Locations

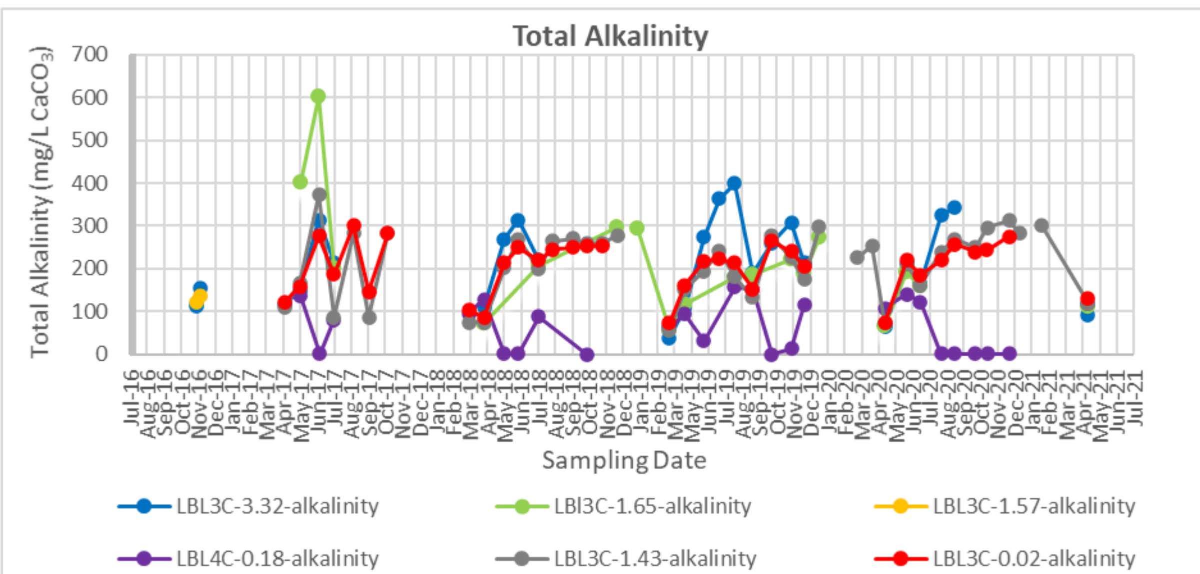


Figure 34: Acidity at L3 Creek Locations

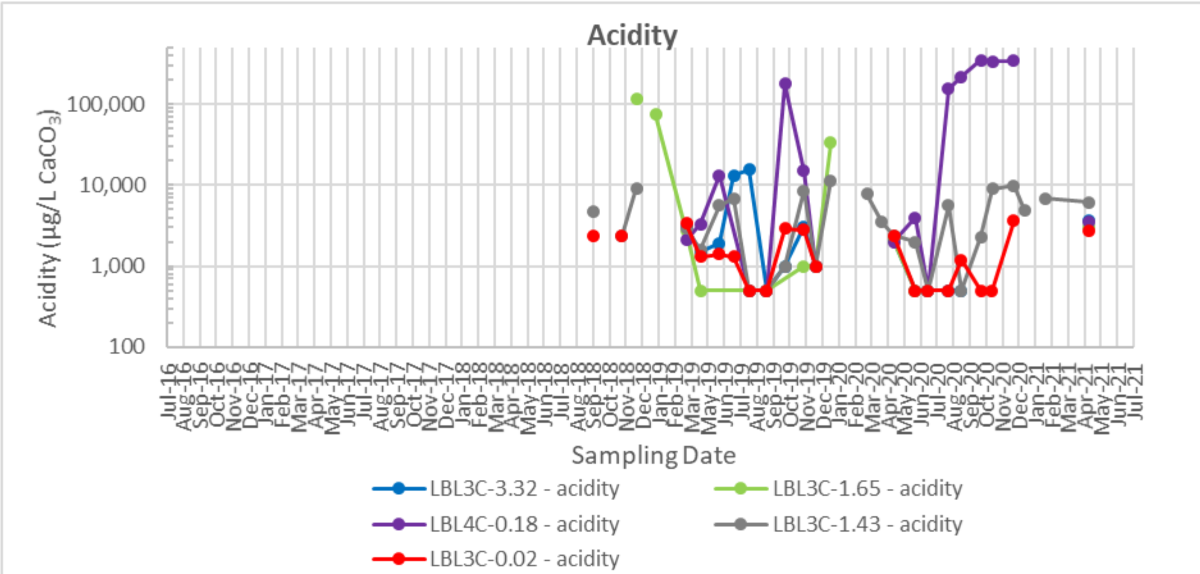


Figure 35: Sulphate at L3 Creek Locations

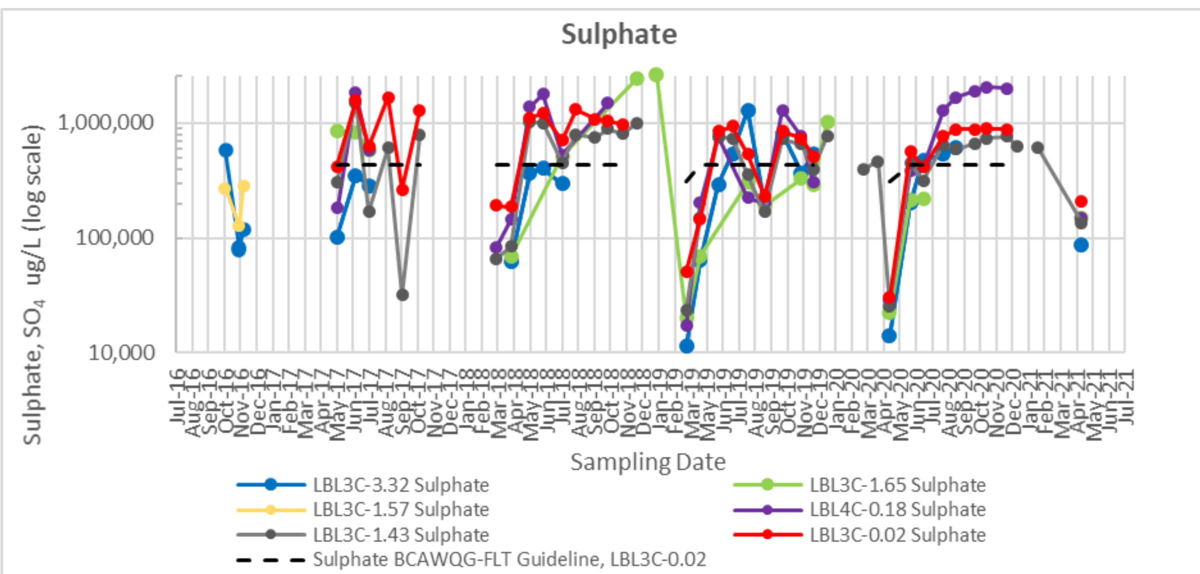


Figure 36a: Total Suspended Solids at L3 Creek Locations

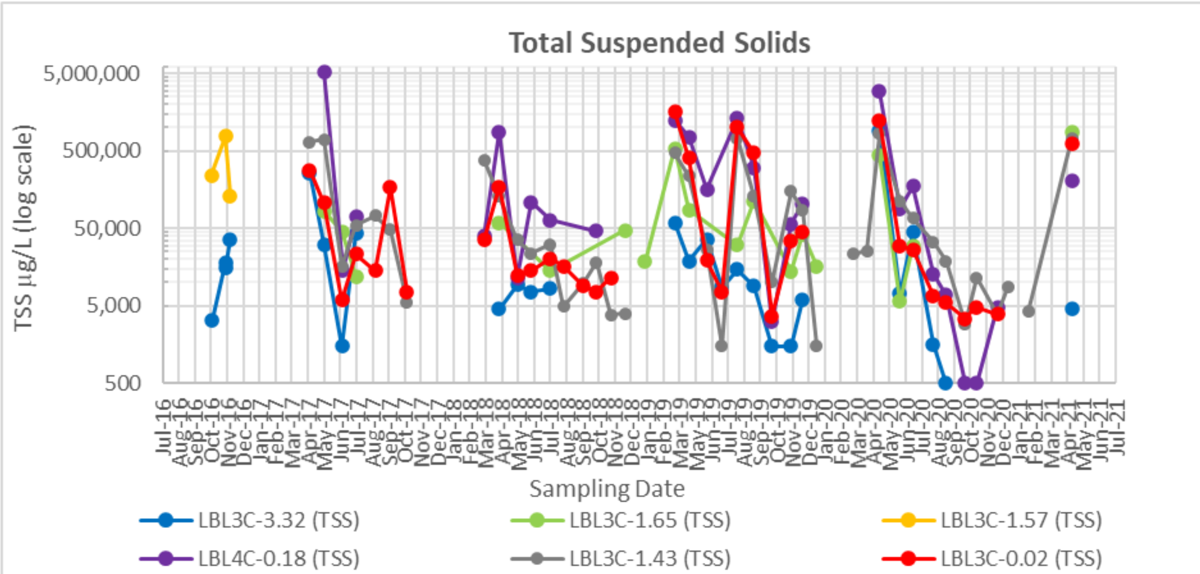


Figure 36b: Total Dissolved Solids at L3 Creek Locations

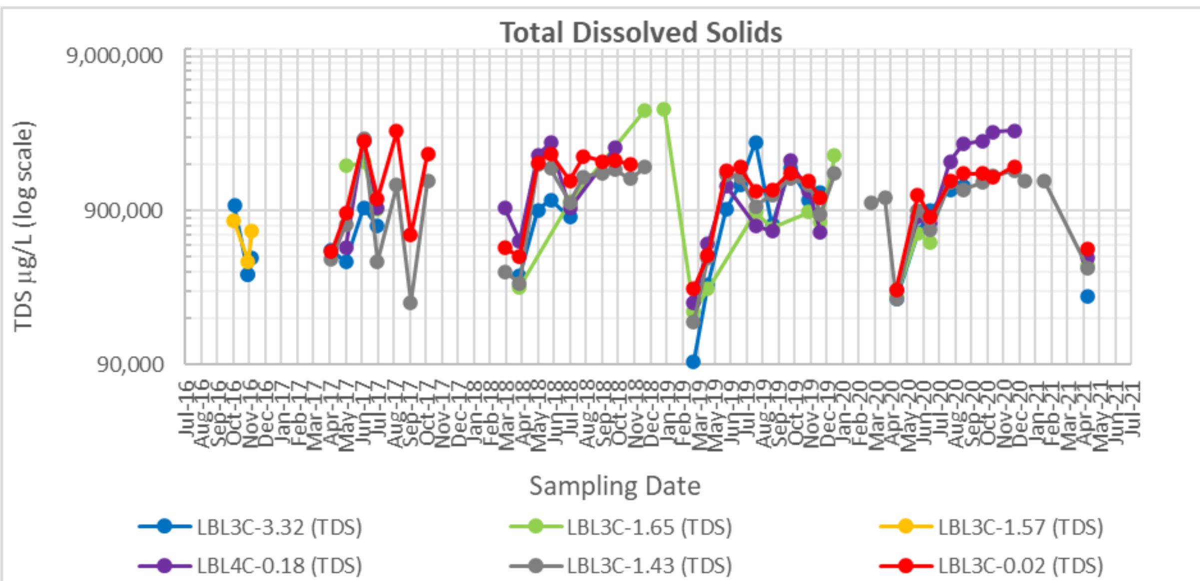


Figure 37a: Total Aluminum at L3 Creek Locations

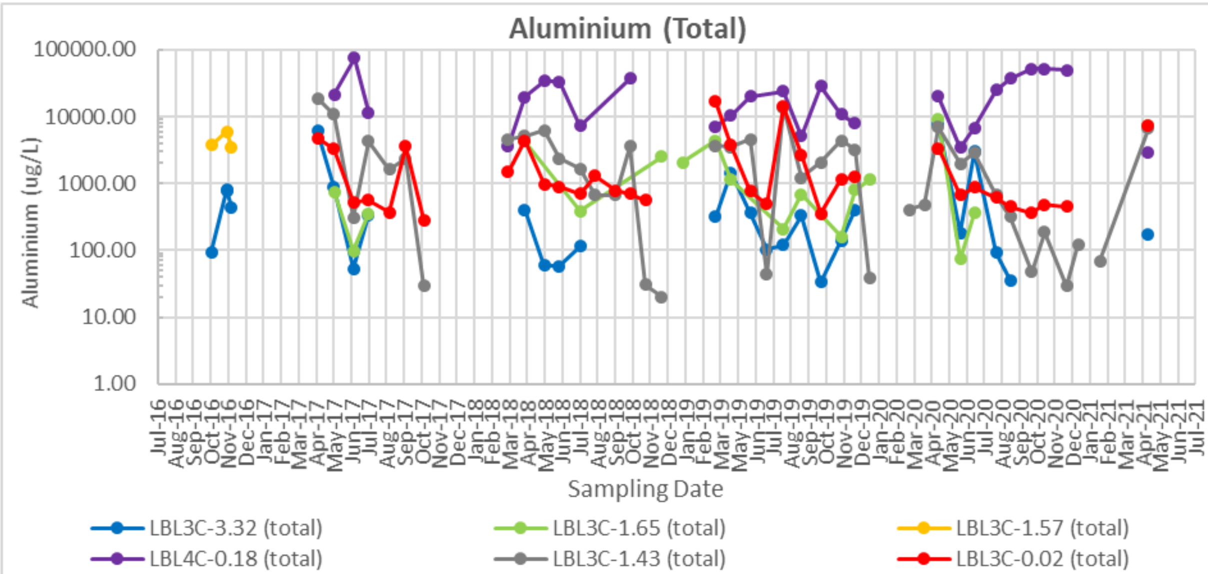


Figure 37b: Dissolved Aluminum at L3 Creek Locations

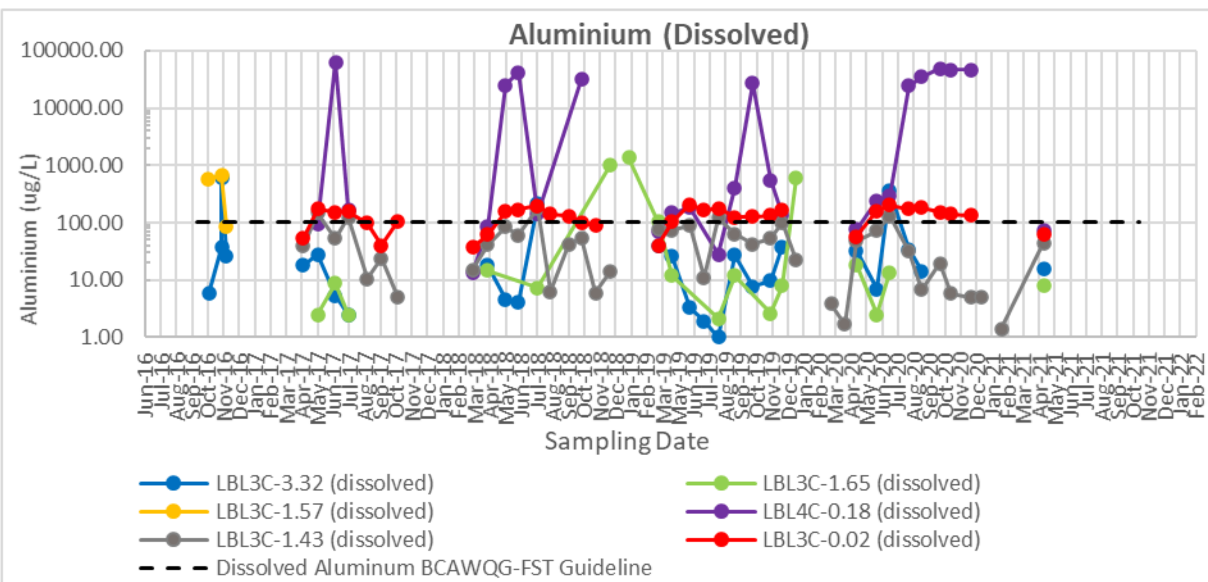


Figure 38a: Total Iron at L3 Creek Locations

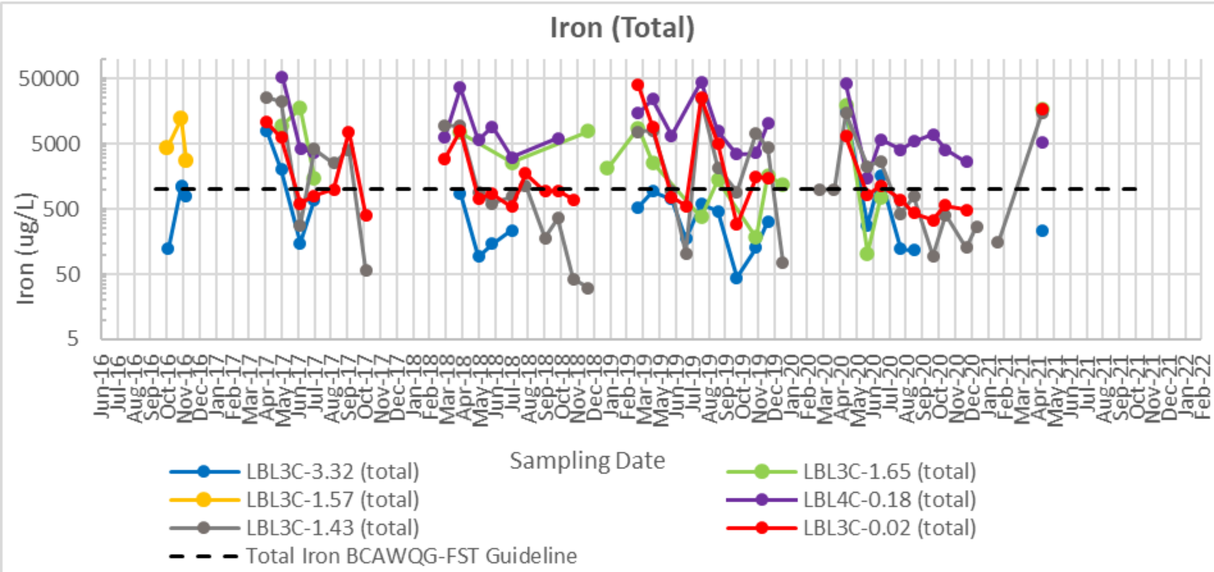
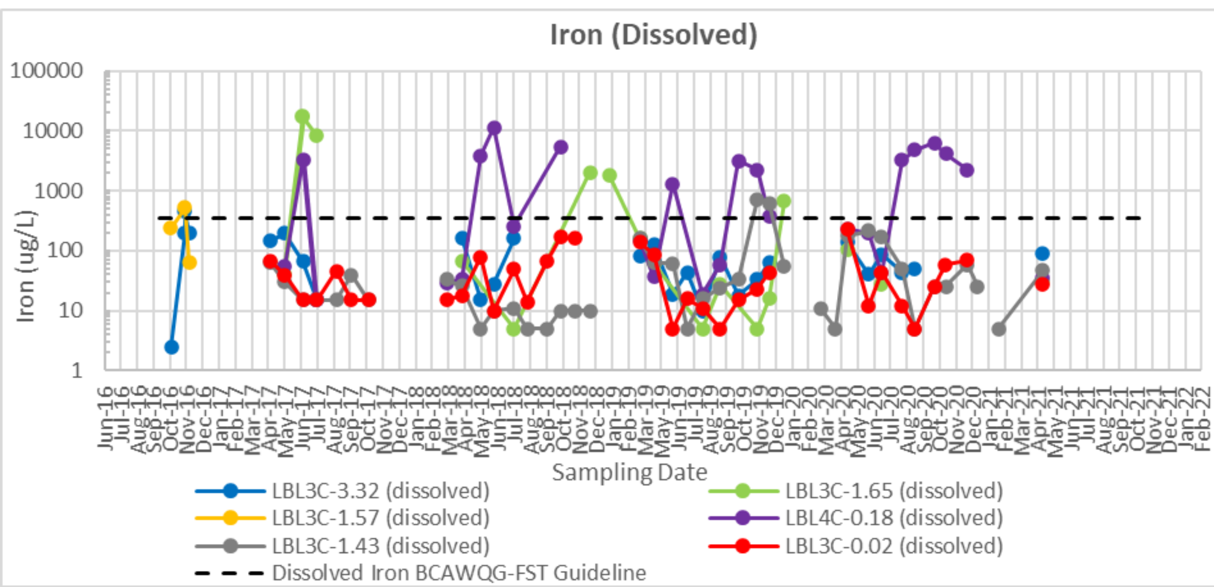


Figure 38b: Dissolved Iron at L3 Creek Locations



TETRA TECH

Figure 39a: Total Arsenic at L3 Creek Locations

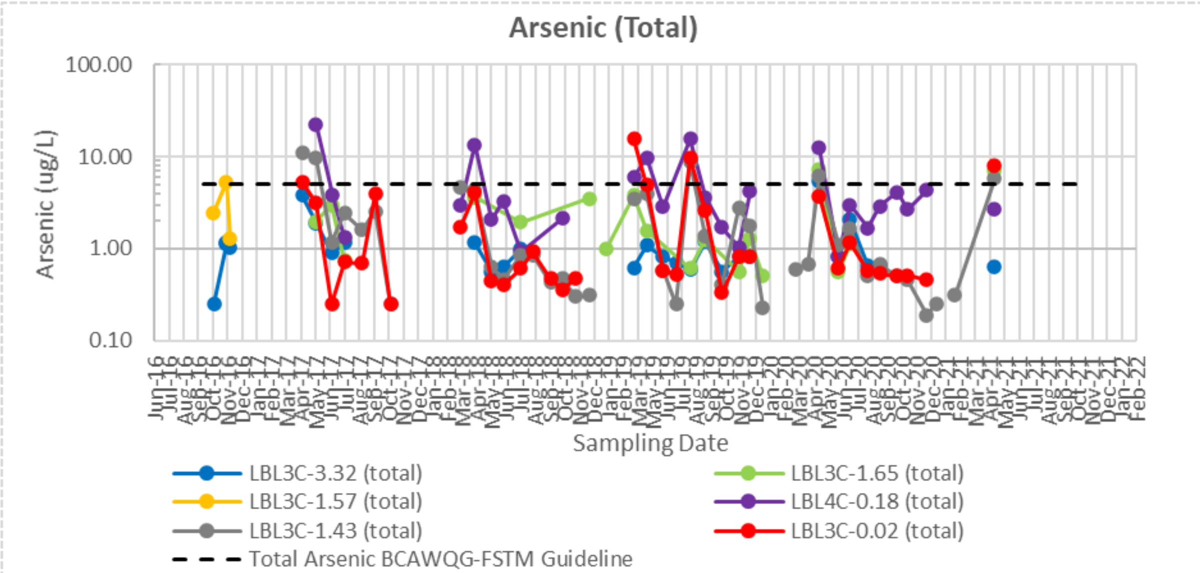


Figure 39b: Dissolved Arsenic at L3 Creek Locations

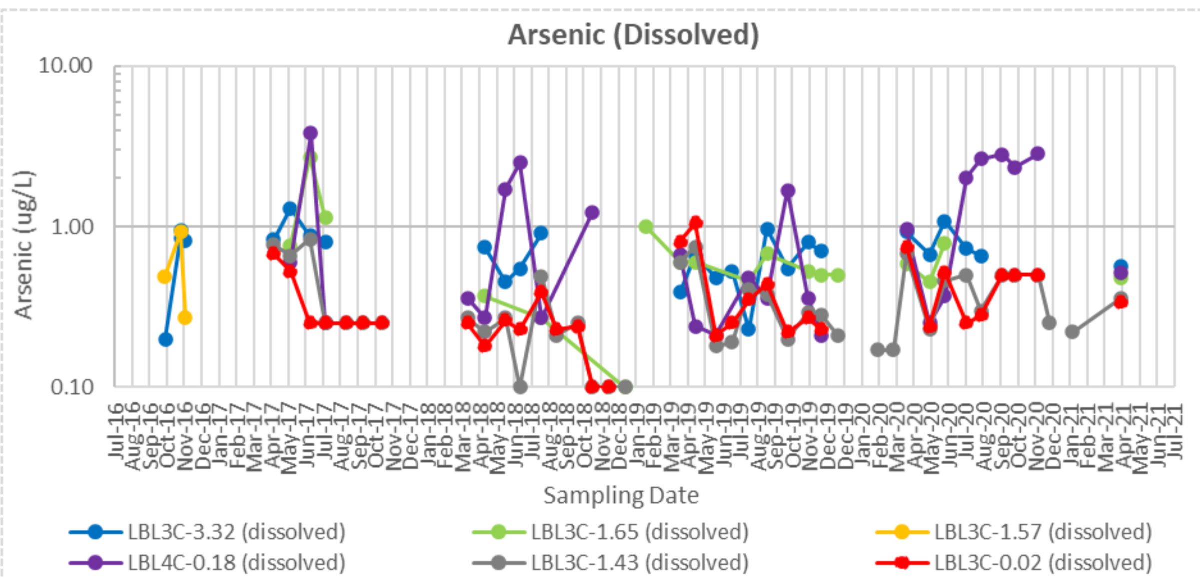


Figure 40a: Total Cadmium at L3 Creek Locations

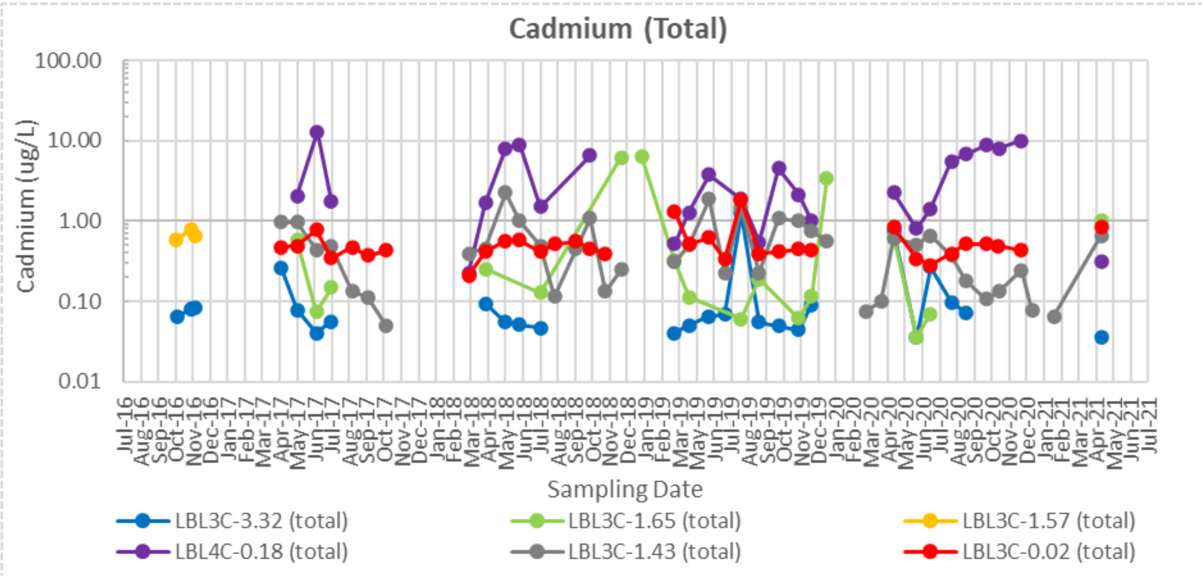


Figure 40b: Dissolved Cadmium at L3 Creek Locations

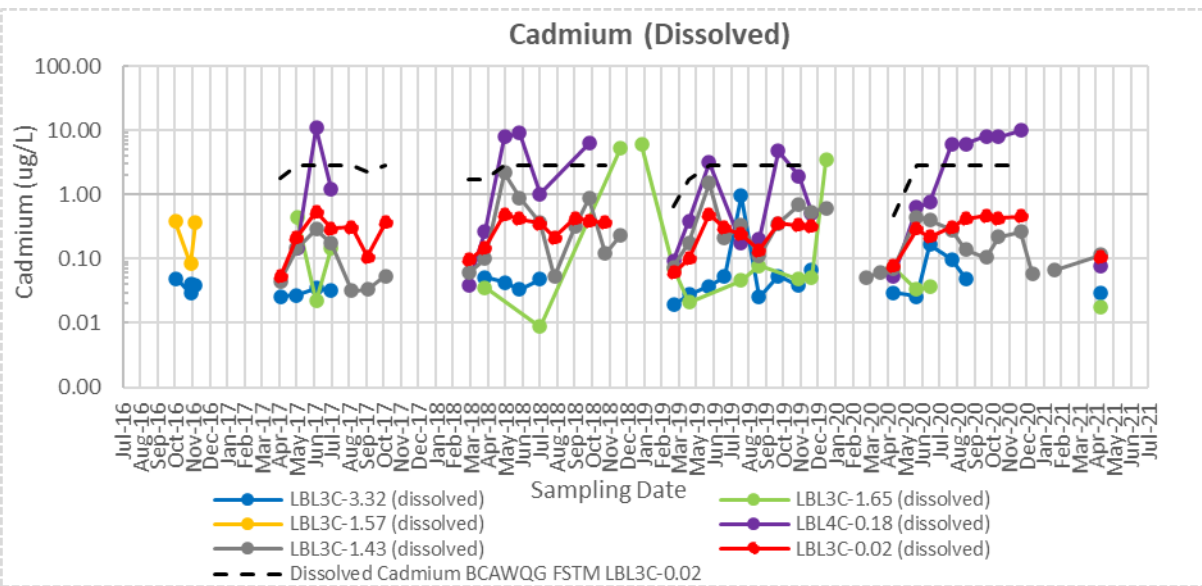


Figure 41a: Total Cobalt at L3 Creek Locations

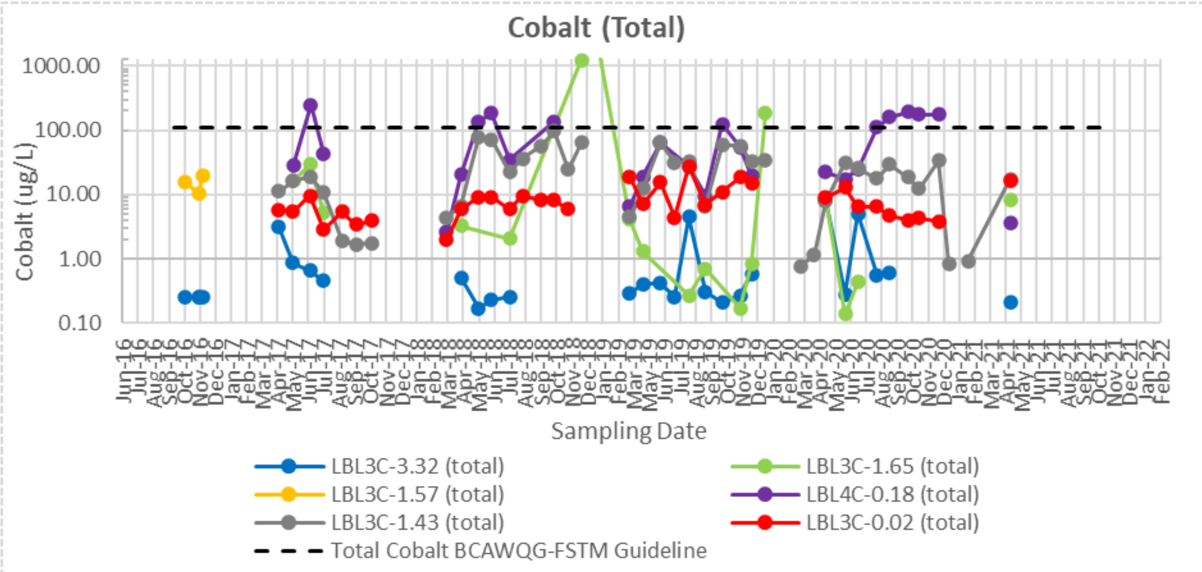


Figure 41b: Dissolved Cobalt at L3 Creek Locations

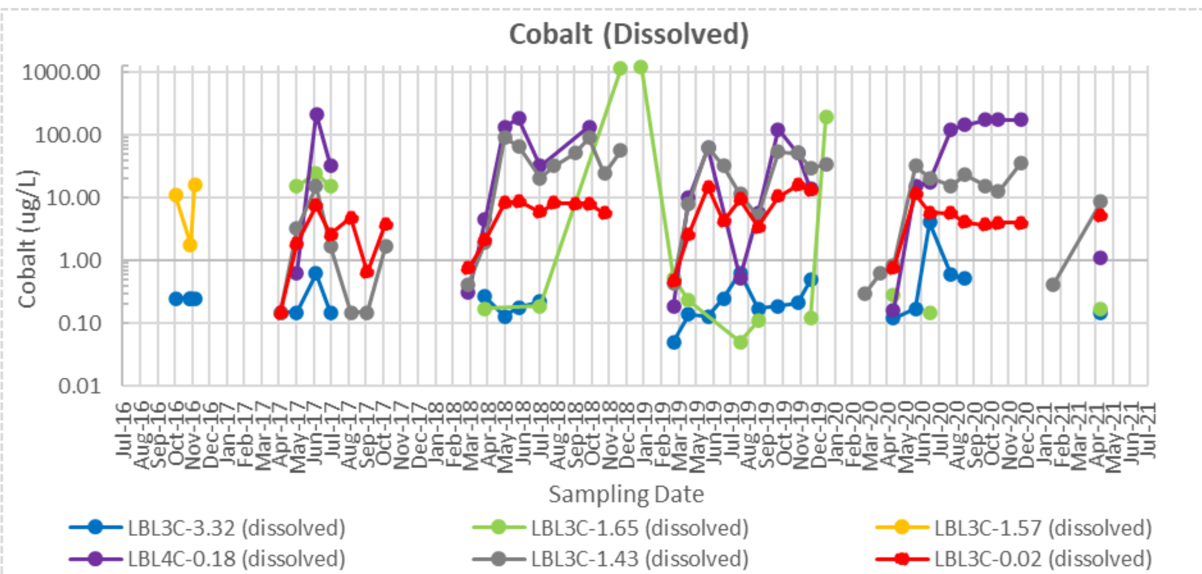


Figure 42a: Total Copper at L3 Creek Locations

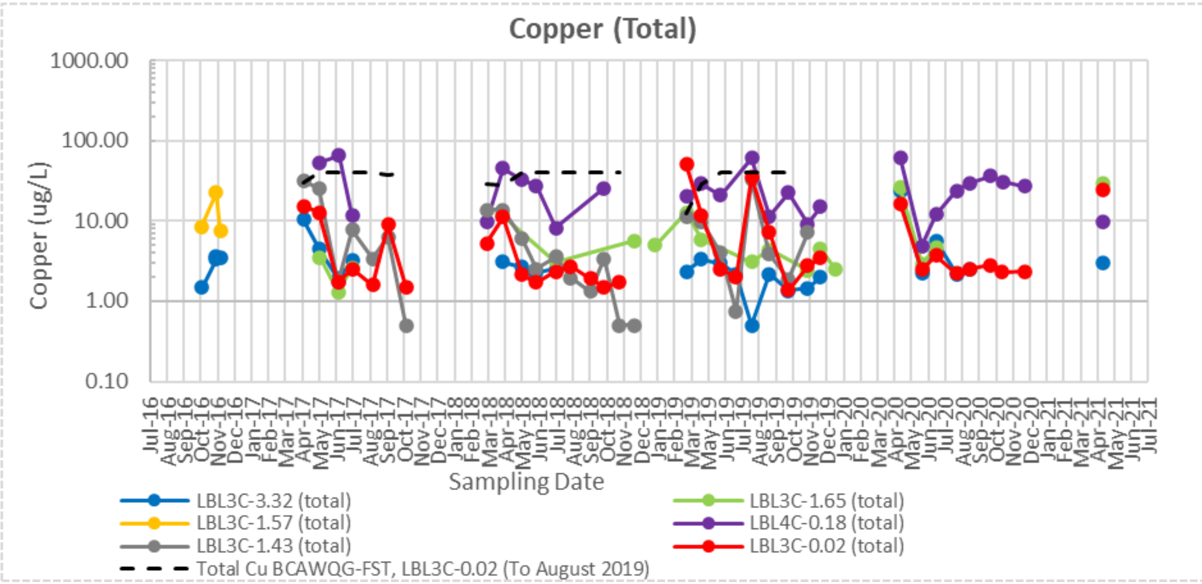


Figure 42b: Dissolved Copper at L3 Creek Locations

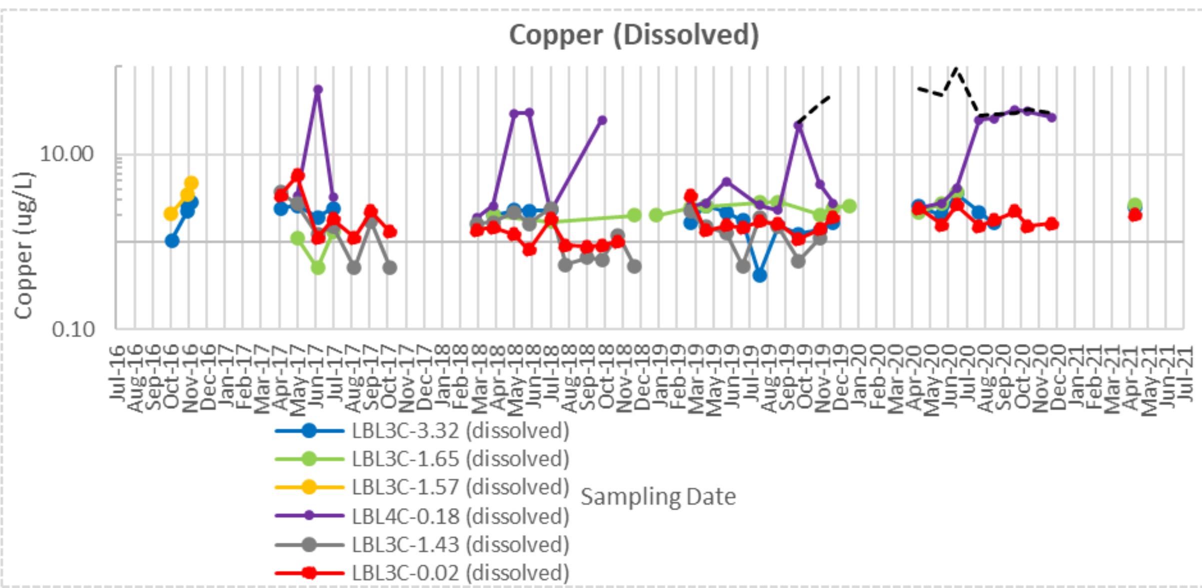


Figure 43a: Total Zinc at L3 Creek Locations

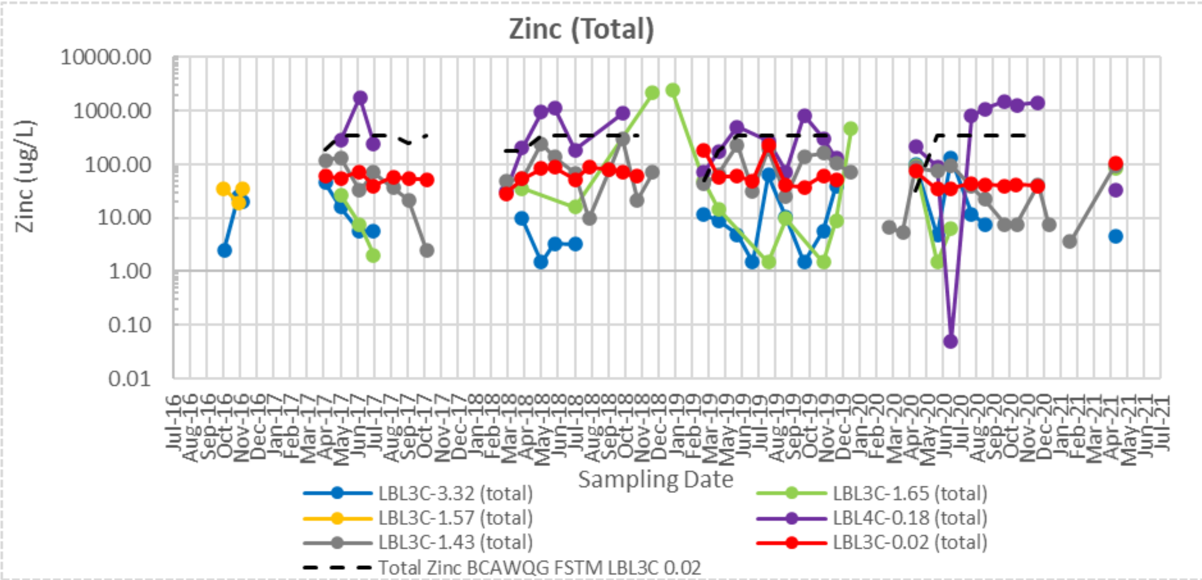


Figure 43b: Dissolved Zinc at L3 Creek Locations

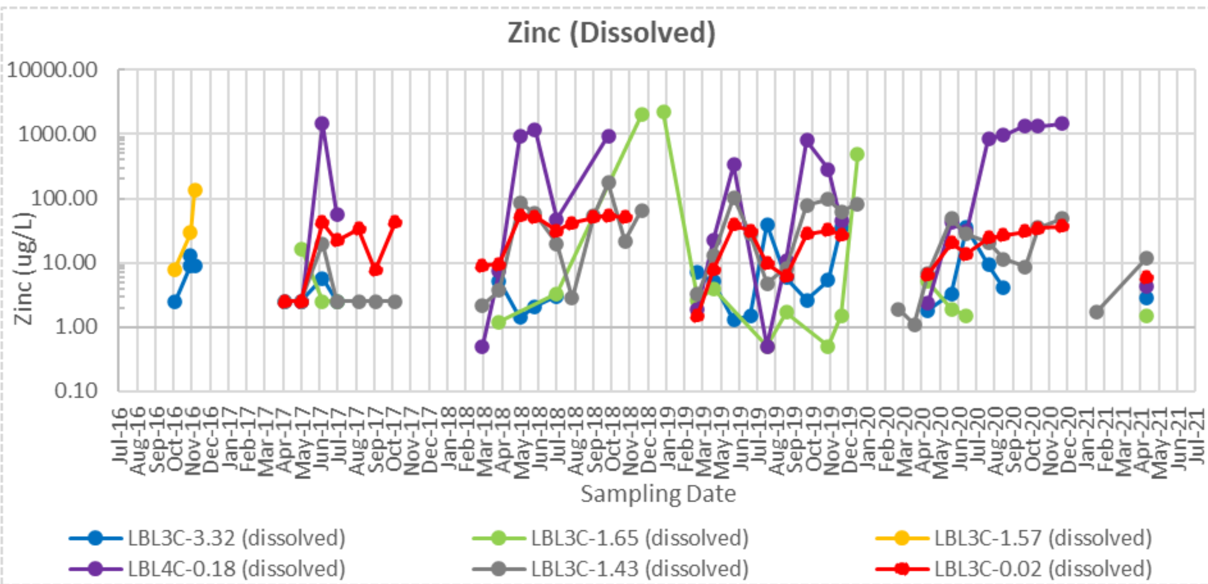


Figure 44: pH at L2 Powerhouse Locations

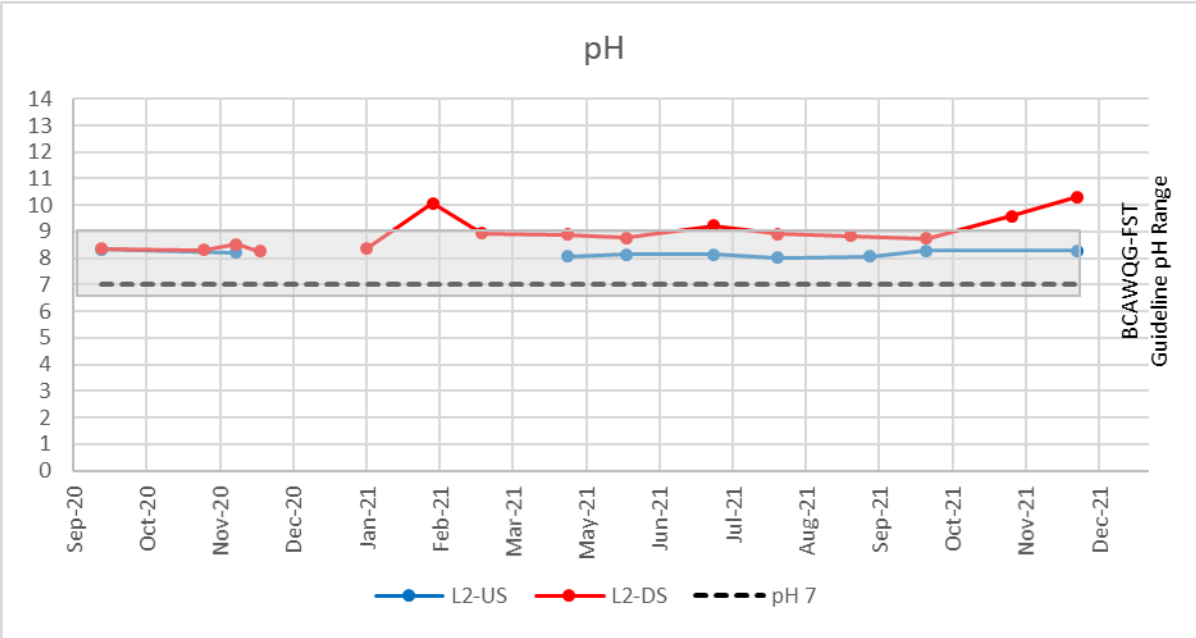
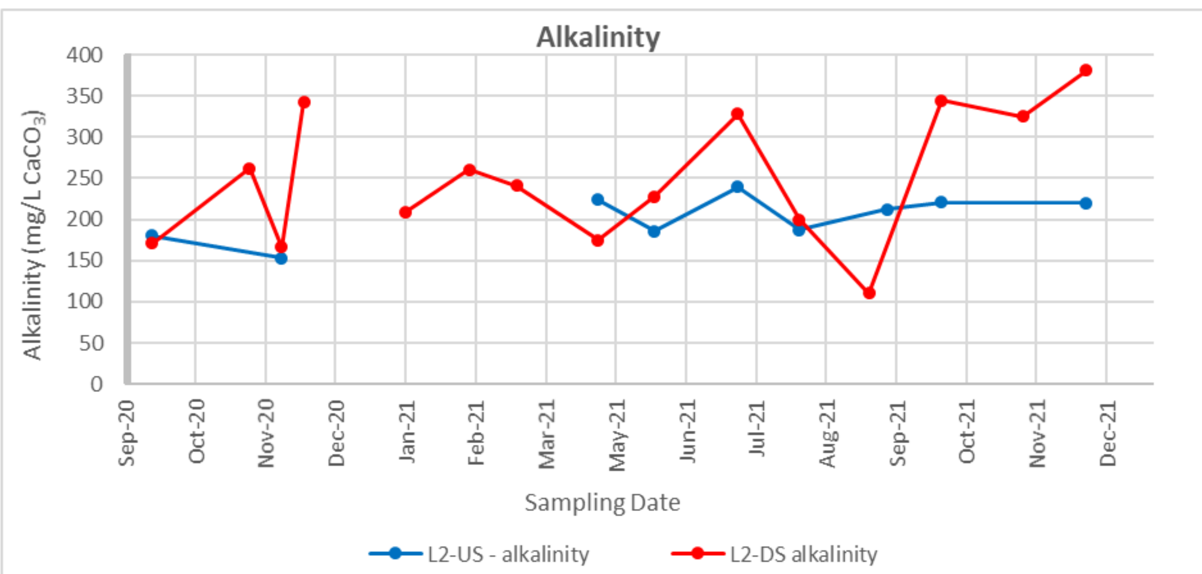


Figure 45: Total Alkalinity at L2 Powerhouse Locations



TETRA TECH

Figure 46: Acidity at L2 Powerhouse Locations

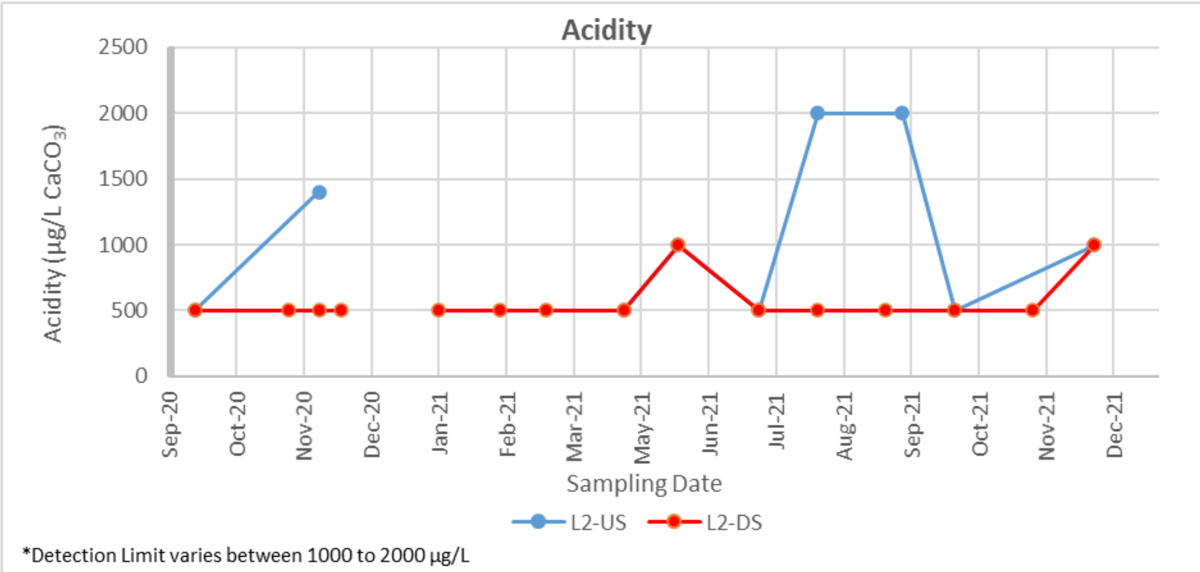


Figure 47: Sulphate at L2 Powerhouse Locations

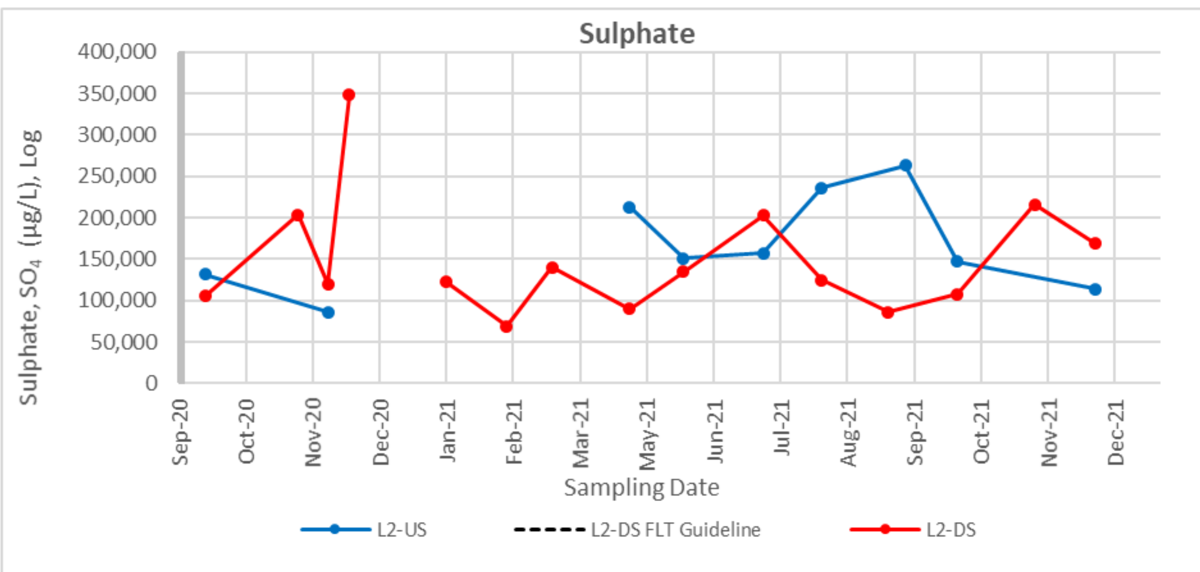


Figure 48a: Total Suspended Solids at L2 Powerhouse Locations

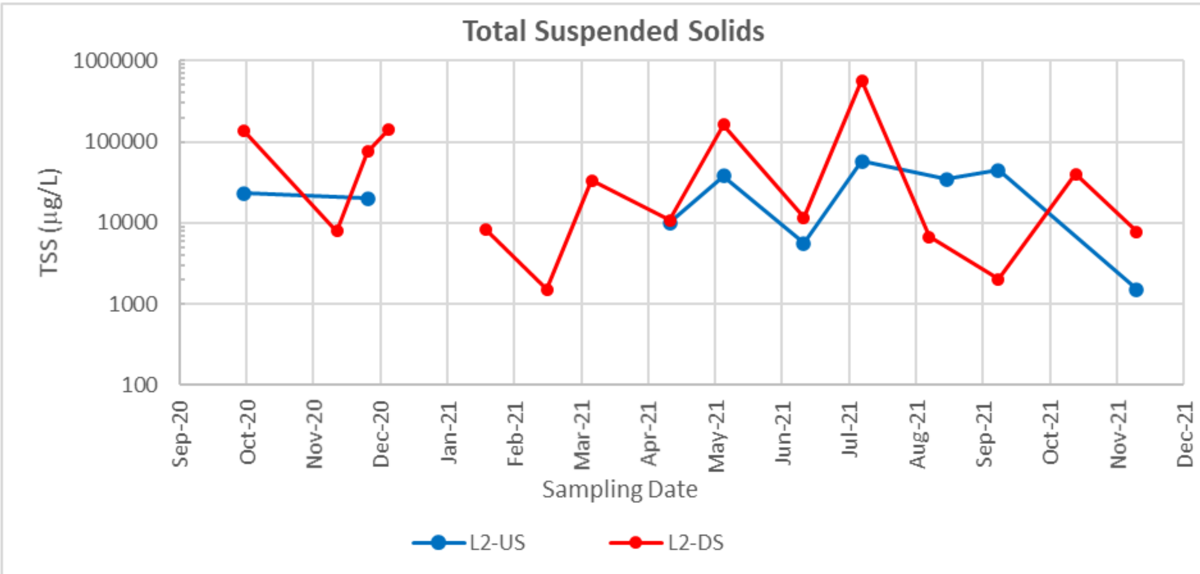


Figure 48b: Total Dissolved Solids at L2 Powerhouse Locations

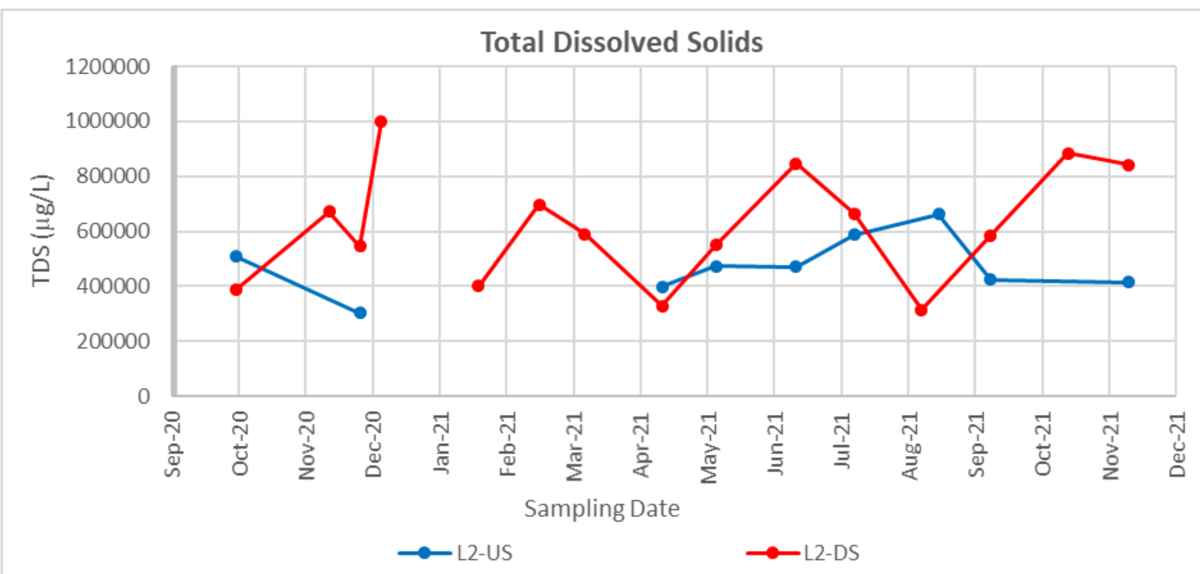


Figure 49a: Total Aluminum at L2 Powerhouse Locations

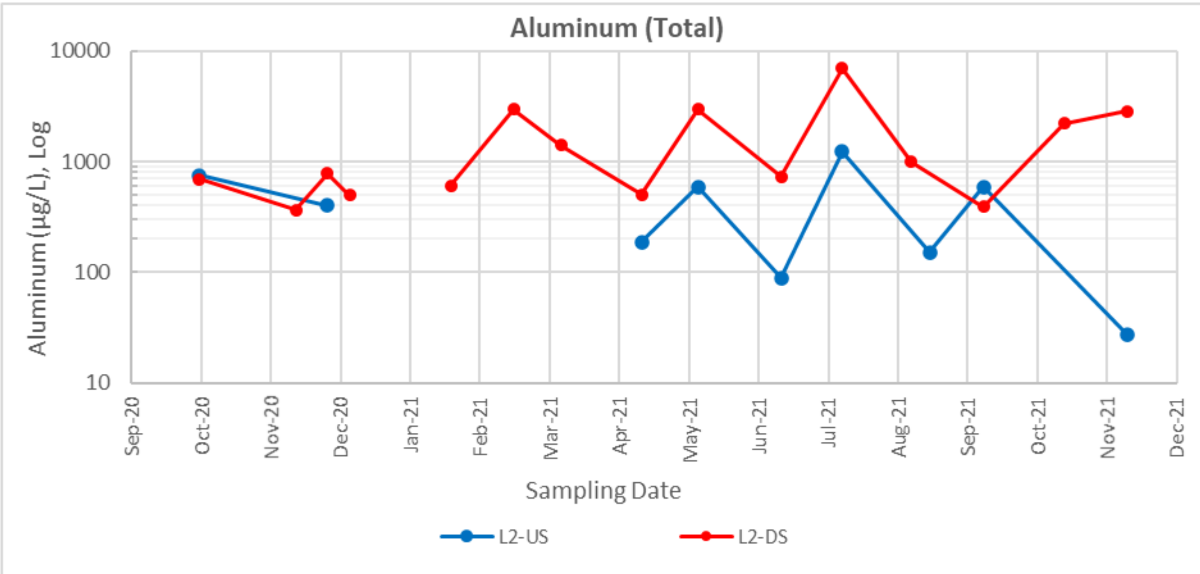


Figure 49b: Dissolved Aluminum at L2 Powerhouse Locations

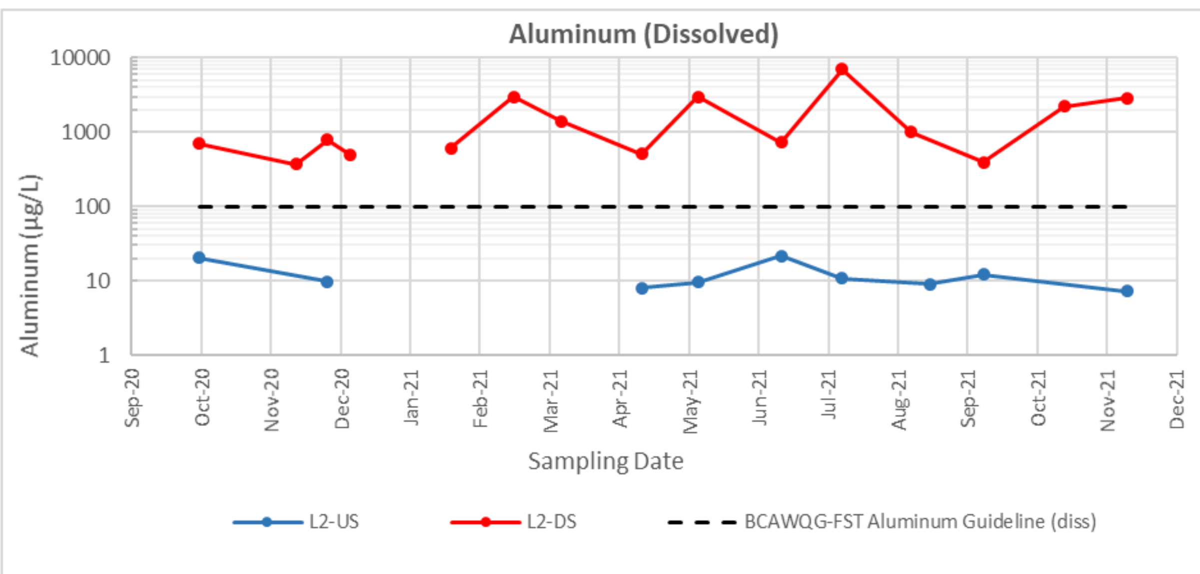


Figure 50a: Total Iron at L2 Powerhouse Locations

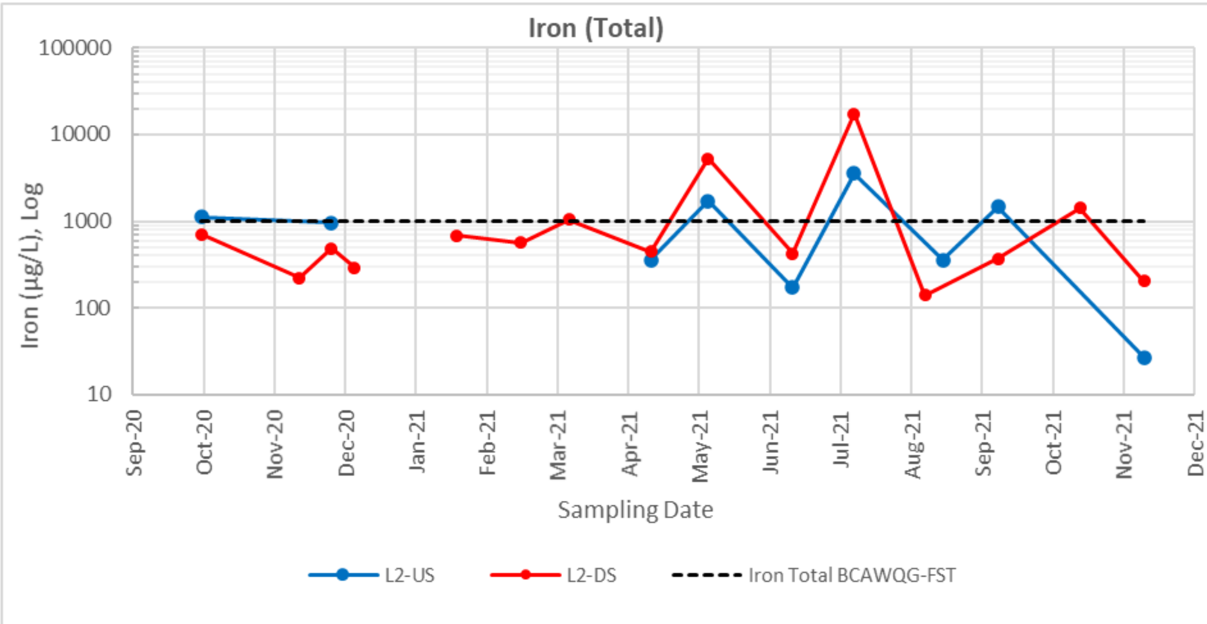


Figure 50b: Dissolved Iron at L2 Powerhouse Locations

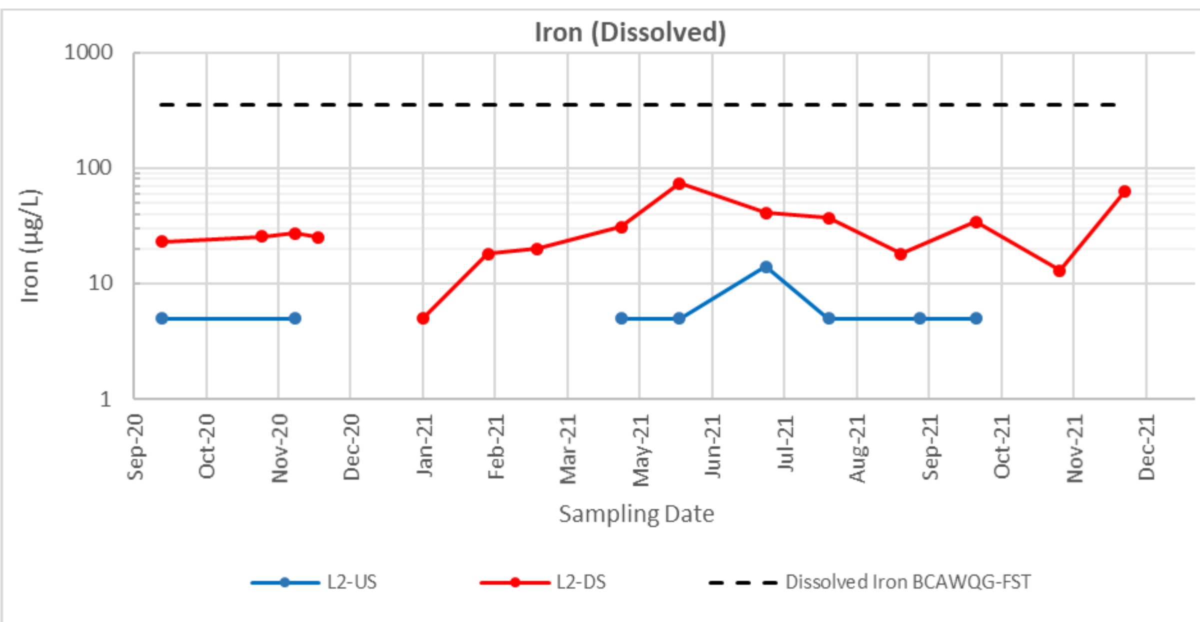


Figure 51: Total Arsenic at L2 Powerhouse Locations

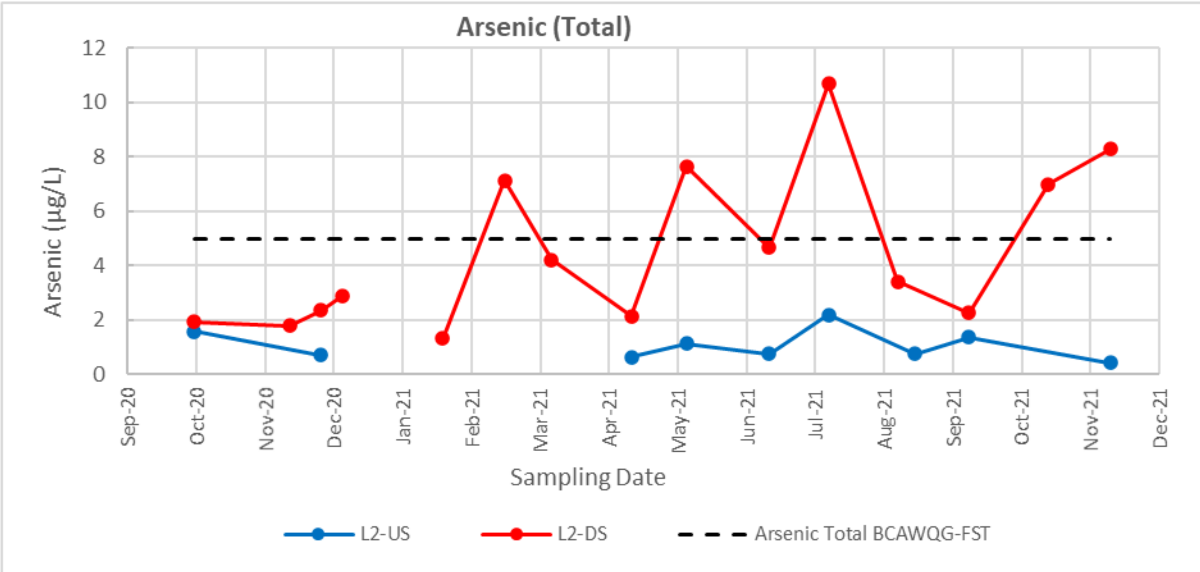


Figure 52: Dissolved Cadmium at L2 Powerhouse Locations

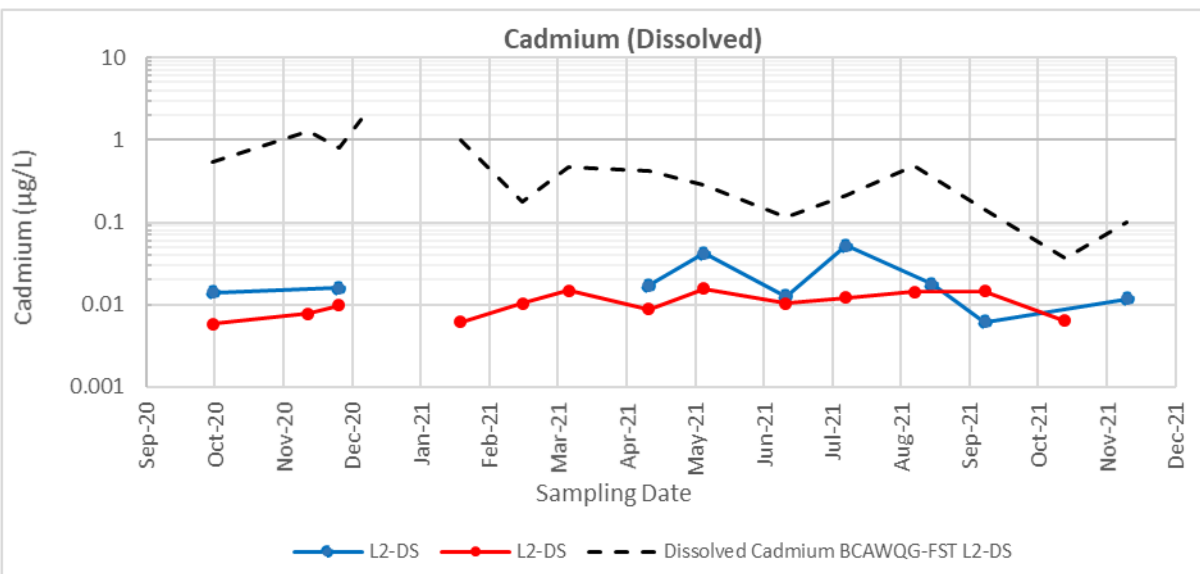


Figure 53: Total Cobalt at L2 Powerhouse Locations

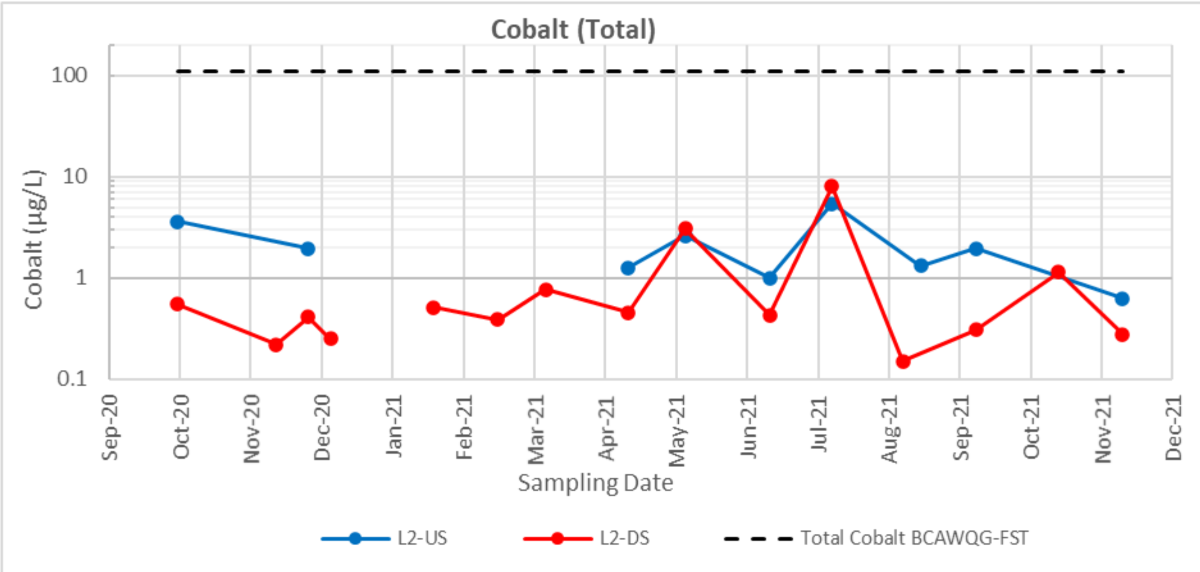


Figure 54: Dissolved Copper at L2 Powerhouse Locations

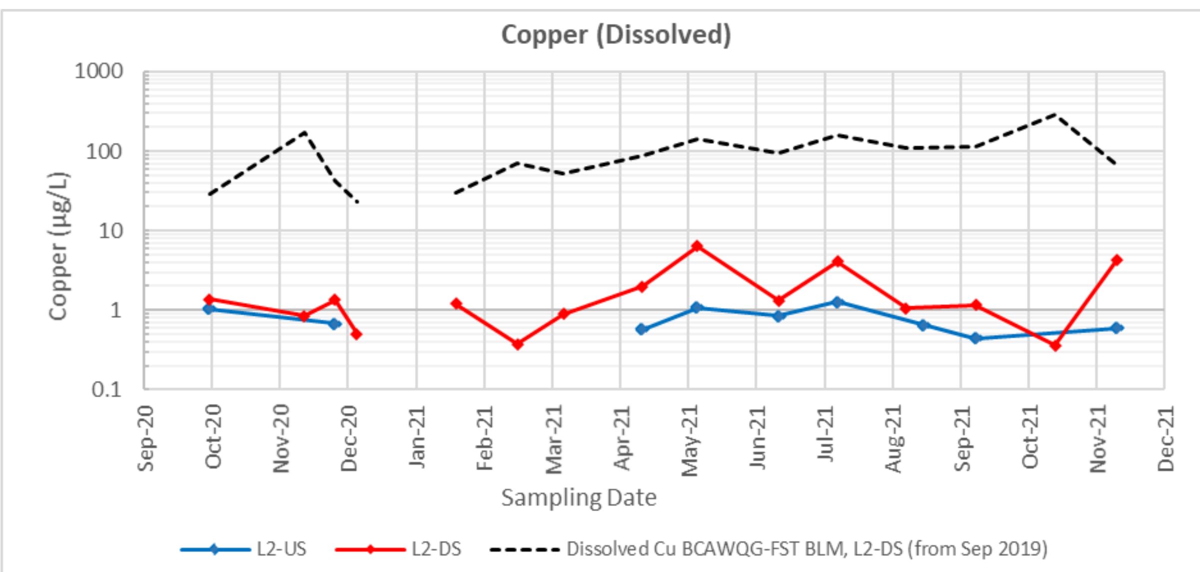
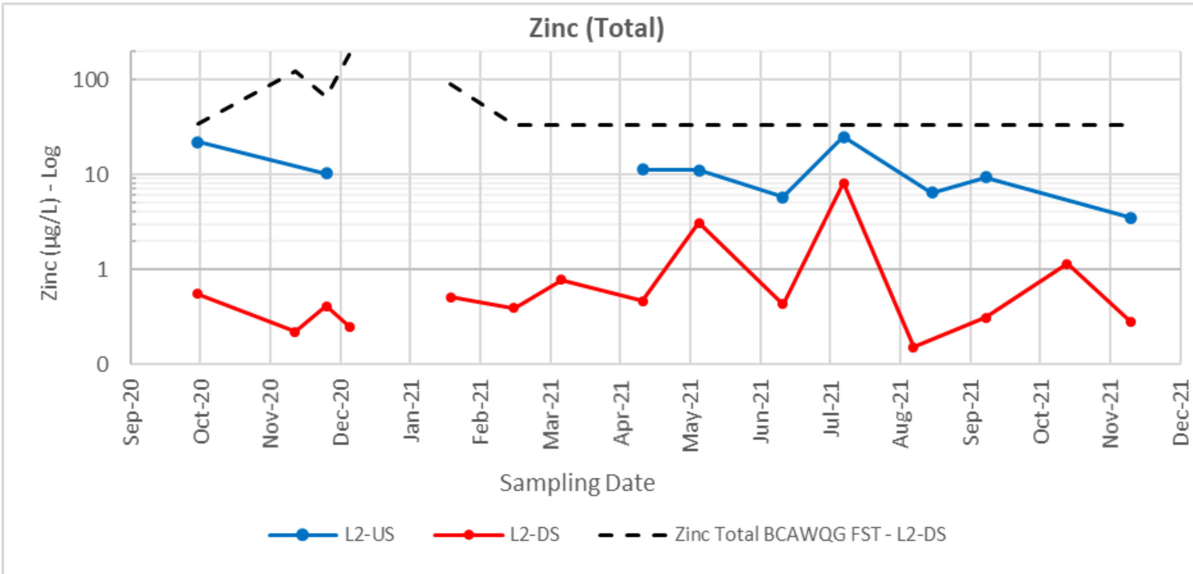


Figure 55: Total Zinc at L2 Powerhouse Locations



TABLES

Table 1: Water Sampling Locations and In Situ and Lab Events

		Routine Memo Number:			1		2		3		4				5		6		7		8		9		10		11			
		Sampling Event Number:			1		2		3		4		5		6		7		8		9		10		11		12			
Catchment	Sample Site	UTM Coordinates Zone 10 (NAD83)		Elevation	28-Jan-21		23-25-Feb-21		17-18-Mar-21		8-Apr-21		22-23-Apr-21		18-19-May-21		24-Jun-21		20-22-Jul-21		29-Aug-21		21-Sep-21		28-29-Oct-21		25-26-Nov-21		Dec 2021	
		Easting	Northing		In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	In-Situ	Lab	No Samples	
Right Bank - South Bank Initial Access Road	RBSBIAR-US	630327	6228397	468.0					✓	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	RBSBIAR-DS	630320	6228645	445.2			✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	RBSBIAR-EUS	630376	6228399	464.6					✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	RBSBIAR-EDS	630370	6228635	437.4					✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	RBSC-DS	630475	6228672	418.6	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓														
Left Bank River Road	LBRR-DD*	632853	6229862	422.0			✓	✓																						
	LBRR-EDP	632715	6229832	416.4			✓	✓			✓	✓																		
	LBRR-LC	632856	6229899	427.2			✓	✓	✓	✓																				
	LBRR-UC	633018	6230253	463.2							✓	✓																		
	LBRR-12+500	632914	6229921	432			✓	✓	✓	✓	✓	✓							✓	✓	✓		✓							
	LBRR-12+600	632948	6229983	436			✓		✓		✓				✓															
	LBRR-12+700	632992	6230078	443			✓		✓		✓				✓															
	LBRR-12+810	633039	6230195	454					✓		✓				✓												✓			
	LBRR-12+920	633000	6230282	463					✓		✓				✓		✓		✓		✓		✓							
	RR8*	632262	6229624	412																										
	RR9*	632460	6229680	413					✓	✓																	✓	✓		
L3 Creek	LBL3C-0.02	632767	6229860	418									✓	✓																
	LBL3C-1.43	631728	6230210	487	✓	✓							✓	✓																
	LBL3C-1.65	631504	6230417	493									✓	✓																
	LBL3C-3.32	630248	6231262	579									✓	✓																
L4 Creek	LBL4C-0.18	631524	6230578	507									✓	✓																
Left Bank Debris Boom	LBP Pond	628227	6231885	458									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓				
	LBDB-WUS	628189	6231933	-															✓	✓										
	LBDB-WDS	627969	6231883	-																										
	LBDB-EUS	628202	6231908	-																										
	LBDB-EDS	627994	6231856	-															✓	✓										
	LBDB-LD-US	628257	6231876	-																										
	LBDB-LD-MS	628147	6231844	-																										
	LBDB-LD-DS*	628093	6231766	-																										
L2 Powerhouse	L2 DS	629607	6229185	385	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
	L2 US	629701	6229279	414									✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓		

*Discharge Location.

No sampling in December 2021 due to frozen condtions at all locations

All elevations are approximate

Table 2: Daily and 7-Day Mean Temperature and Precipitation

Date	Time	Precipitation[1]		Temperature[1]			Summary
Sample Event Date Bolded	Time Period	Precipitation Event	Total (mm)	Mean (°C)	Minimum (°C)	Maximum (°C)	24 Hr and 7 Day Precipitation
January 21-27, 2021	7 days	January 24-27	3.97	-13.2	-23.5	-1.6	Minimal Precipitation (3.97 mm) in previous 7 days
January 27, 2021	24 hrs.	27-Jan	0.30	-21.4	-23.5	-19.0	Minimial precipitaiton (0.30 mm) precipitation
January 28, 2021	**24 hrs.**	**none**	**0.00**	**-22.3**	**-25.1**	**-19.2**	**No precipitation.**
February 16-22, 2021	7 days	none	0.00	-5.2	-22.5	8.1	No precipitation.
February 22, 2021	24 hrs.	none	0.00	3.3	0.3	5.4	No precipitation.
February 23-25, 2021	**24 hrs.**	**25-Feb**	**2.45**	**-2.3**	**-15.5**	**3.8**	**Minimal precipitation (2.45mm) on Feb 25; light snowfall**
March 10-16, 2021	7 days	Mar 12 and 14	1.61	-4.12	-17.1	7.2	Minimal precipitation Mar 12 (0.30 mm) and Mar 14 (1.31 mm)
March 16, 2021	24 hrs.	none	0.00	4.23	0.3	7.2	No precipitation.
March 17-18, 2021	**24 hrs.**	**none**	**0.00**	**4.06**	**-2.9**	**12.1**	**No precipitation.**
April 1-7, 2021	7 days	**none**	**0.00**	**1.6**	**-7.4**	**10.6**	No precipitation.
April 7, 2021	24 hrs.	**none**	**0.00**	**0.6**	**-8.0**	**8.1**	No precipitation.
April 8, 2021	**24 hrs.**	**none**	**0.00**	**-1.2**	**-8.7**	**5.4**	**No precipitation.**
April 15-21, 2021	7 days	April 17-18	5.07	8.1	-2.1	21.2	Minimal (5.07 mm) precipitation.
April 21, 2021	24 hrs.	none	0.00	4.1	-2.3	11.1	No precipitation.
April 22-23, 2021	**24 hrs.**	**none**	**0.00**	**1.59**	**-5.3**	**7.0**	**No precipitation.**
May 11-17, 2021	7 days	17-May-21	4.32	13.0	5.7	20.0	Minimal (4.32 mm) precipitation.
May 17, 2021	24 hrs.	17-May	4.66	7.4	12.5	9.8	Moderate (4.66 mm) precipitation.
May 18-19, 2021	**24 hrs.**	**18-May**	**6.86**	**8.21**	**1.1**	**15.1**	**Moderate (6.86 mm) precipitation.**
June 17-23, 2021	7 days	June 17 and 19	2.07	17.1	6.6	29.7	Minimal (2.07 mm) precipitation.
June 23, 2021	24 hrs.	none	0.00	16.2	8.5	22.3	No precipitation.
June 24, 2021	**24 hrs.**	**none**	**0.00**	**19.3**	**10.9**	**25.7**	**No precipitation.**
July 13-19, 2021	7 days	July 16-17, 2021	14.27	16.3	7.5	30.8	Moderate precipitation (14.27 mm) in previous 7 days.
July 19, 2021	24 hrs.	none	0.00	16.3	11.9	21.6	No precipitation.
July 20-22, 2021	**24 hrs.**	**July 20 and 21**	**29.67**	**14.4**	**10.2**	**19.9**	**Moderate precipitation on July 20 (6.72 mm) and July 21 (22.95 mm)**
August 22-28, 2021	7 days	Aug 22-23, 2021	18.52	13.6	4.8	23.9	Moderate (18.52 mm) precipitation.
August 28, 2021	24 hrs.	none	0.00	16.4	13.3	19.8	No precipitation.
August 29 2021	**24 hrs.**	**29-Aug**	**0.58**	**14**	**9.1**	**17.4**	**Minimal precipitation.**
September 14-20, 2021	7 days	Sept 14, 15, 17, 18, 20	10.59	8.9	3.3	15.8	Moderate (10.59 mm) precipitation in previous 7 days
September 20, 2021	24 hrs.	20-Sep	0.32	10.7	6.0	15.5	Minimal (0.32 mm) precipitation
September 21-22, 2021	**24 hrs.**	**none**	**0.00**	**13.3**	**5.6**	**18**	**No precipitation.**
October 21-27, 2021	7 days	Oct 24, 25, 2021	1.19	3.9	0.0	10.6	Minimal (1.18 mm) precipitation in previous 7 days
October 27, 2021	24 hrs.	none	0.00	1.9	10.2	6.4	No precipitation
October 28-29, 2021	**24 hrs.**	**none**	**0.00**	**2.6**	**-1.7**	**5.6**	**No precipitation**
November 18-24, 2021	7 days	Nov 19-23, 2021	10.92	-10	-17.5	2.8	Moderate (10.92 mm) precipitation in previous 7 days
November 24, 2021	24 hrs.	**none**	**0.00**	-14.2	-17.5	-9.0	No precipitation
November 25-26, 2021	**24 hrs.**	**none**	**0.00**	**2.53**	**-7.7**	**7.7**	**No precipitation**

[1] BC Ministry of Environment, BC Air quality data: Fort St John North Camp C_Met_60 weather station. https://envistaweb.env.gov.bc.ca/.

Table 3: Classification of Flows in Ditch

Sample Event Date Bolded	Time Period	Precipitation Event	Total (mm)	Mean (°C)	24 Hr and 7 Day Precipitation	Classification
January 21-27, 2021	7 days	January 24-27	3.97	-13.2	Minimal Precipitation (3.97 mm) in previous 7 days	Regional groundwater flow; precipitation as snowfall; frozen conditions.
January 27, 2021	24 hrs.	27-Jan	0.30	-21.4	Minimal precipitation (0.30 mm) precipitation	
January 28, 2021	**24 hrs.**	**none**	**0.00**	**-22.3**	**No precipitation.**	
February 16-22, 2021	7 days	none	0.00	-5.2	No precipitation.	Regional groundwater flow; precipitation as snowfall; frozen to near frozen conditions.
February 22, 2021	24 hrs.	none	0.00	3.3	No precipitation.	
February 23-25, 2021	**24 hrs.**	**25-Feb**	**2.45**	**-2.3**	**Minimal precipitation (2.45mm) on Feb 25; light snowfall**	
March 10-16, 2021	7 days	Mar 12 and 14	1.61	-4.12	Minimal precipitation Mar 12 (0.30 mm) and Mar 14 (1.31 mm)	Regional groundwater flow; frozen to near frozen conditions.
March 16, 2021	24 hrs.	none	0.00	4.23	No precipitation.	
March 17-18, 2021	**24 hrs.**	**none**	**0.00**	**4.06**	**No precipitation.**	
April 1-7, 2021	7 days	**none**	**0.00**	**1.6**	No precipitation.	Regional groundwater flow; frozen to near frozen conditions.
April 7, 2021	24 hrs.	**none**	**0.00**	**0.6**	No precipitation.	
April 8, 2021	**24 hrs.**	**none**	**0.00**	**-1.2**	**No precipitation.**	
April 15-21, 2021	7 days	April 17-18	5.07	8.1	Minimal (5.07 mm) precipitation.	Surface runoff and early spring freshet; melting and slightly warming conditions.
April 21, 2021	24 hrs.	none	0.00	4.1	No precipitation.	
April 22-23, 2021	**24 hrs.**	**none**	**0.00**	**1.59**	**No precipitation.**	
May 11-17, 2021	7 days	17-May-21	4.32	13.0	Minimal (4.32 mm) precipitation.	Surface runoff, freshet and shallow groundwater flow.
May 17, 2021	24 hrs.	17-May	4.66	7.4	Moderate (4.66 mm) precipitation.	
May 18-19, 2021	**24 hrs.**	**18-May**	**6.86**	**8.21**	**Moderate (6.86 mm) precipitation.**	
June 17-23, 2021	7 days	June 17 and 19	2.07	17.1	Minimal (2.07 mm) precipitation.	Shallow or regional groundwater flow with late freshet runoff; rapid increase in temperatures.
June 23, 2021	24 hrs.	none	0.00	16.2	No precipitation.	
June 24, 2021	**24 hrs.**	**none**	**0.00**	**19.3**	**No precipitation.**	
July 13-19, 2021	7 days	July 16-17, 2021	14.27	16.3	Moderate precipitation (14.27 mm) in previous 7 days.	Shallow or regional groundwater flow, and surface runoff.
July 19, 2021	24 hrs.	none	0.00	16.3	No precipitation.	
July 20-22, 2021	**24 hrs.**	**July 20 and 21**	**29.67**	**14.4**	**Moderate precipitation on July 20 (6.72 mm) and July 21 (22.95 mm)**	
August 22-28, 2021	7 days	Aug 22-23, 2021	18.52	13.6	Significant (18.52 mm) precipitation.	Shallow or regional groundwater flow and surface runoff.
August 28, 2021	24 hrs.	none	0.00	16.4	No precipitation.	
August 29 2021	**24 hrs.**	**29-Aug**	**0.58**	**14**	**Minimal precipitation.**	
September 14-20, 2021	7 days	Sept 14, 15, 17, 18, 20	10.59	8.9	Moderate (10.59 mm) precipitation in previous 7 days	Shallow or regional groundwater flow, and surface runoff.
September 20, 2021	24 hrs.	20-Sep	0.32	10.7	Minimal (0.32 mm) precipitation	
September 21-22, 2021	**24 hrs.**	**none**	**0.00**	**13.3**	**No precipitation.**	
October 21-27, 2021	7 days	Oct 24, 25, 2021	1.19	3.9	Minimal (1.18 mm) precipitation in previous 7 days	Regional groundwater flow; lowering temperatures.
October 27, 2021	24 hrs.	none	0.00	1.9	No precipitation	
October 28-29, 2021	**24 hrs.**	**none**	**0.00**	**2.6**	**No precipitation**	
November 18-24, 2021	7 days	Nov 19-23, 2021	10.92	-10	Moderate (10.92 mm) precipitation in previous 7 days	Regional groundwater flow; below to just above frozen conditions.
November 24, 2021	24 hrs.	**none**	**0.00**	-14.2	No precipitation	
November 25-26, 2021	**24 hrs.**	**none**	**0.00**	**2.53**	**No precipitation**	

Table 4: Daily Mean Turbidity and TSS Measurements with the Peace River 2021

Date	Turbidity (Daily Mean) and TSS Measurements and Calculations Peace River above Moberly River			
Sampling Event Date Bolded	Left Bank		Right Bank	
	NTU [1]	TSS [1] (mg/L)	NTU [1]	TSS [1] (mg/L)
January 21-27, 2021	5.0	3.6	5.0	3.6
January 27, 2021	5.9	4.2	5.9	4.3
January 28, 2022	6.5	4.7	6.5	4.7
January 29, 2021	6.2	4.5	6.3	4.6
February 16-22, 2021	4.8	3.5	5.0	3.6
February 22, 2021	4.8	3.5	5.0	3.6
February 23, 2021	3.6	2.6	3.9	2.8
February 24, 2021	3.4	2.4	3.6	2.6
February 25, 2021	3.7	2.7	4.0	2.9
February 26, 2021	3.0	2.1	3.2	2.3
March 10-16, 2021	3.8	2.7	5.0	3.6
March 16, 2021	3.5	2.6	4.3	3.1
March 17, 2021	3.8	2.7	4.7	3.4
March 18, 2021	4.1	2.9	5.6	4.0
March 19, 2021	9.4	6.8	9.4	6.8
April 1-7, 2021	19.3	13.9	9.8	7.1
April 7, 2021	22.3	16.0	12.7	9.2
April 8, 2021	10.5	7.6	11.6	8.3
April 9, 2021	13.1	9.4	12.1	8.7
April 15-21, 2021	85.0	61.2	48.1	34.6
April 21, 2021	100.3	72.2	61.3	44.1
April 22, 2021	72.6	52.3	50.0	36.0
April 23, 2021	64.3	46.3	52.6	37.9
April 24, 2021	67.2	48.4	44.1	31.8
May 11-17, 2021	74.0	53.3	40.5	29.2
May 17, 2021	73.1	52.6	44.4	32.0
May 18, 2021	90.0	64.8	58.5	42.1
May 19, 2021	138.7	99.8	57.5	41.4
May 20, 2021	104.1	75.0	32.7	23.5
June 17-23, 2021	83.3	59.9	39.8	28.6
June 23, 2021	52.9	38.1	20.5	14.7
June 24, 2021	42.3	30.4	15.8	11.4
June 25, 2021	35.1	25.3	14.3	10.3
July 13-19, 2021	10.2	7.3	5.7	4.1
July 19, 2021	8.4	6.0	5.2	3.7
July 20, 2021	7.9	5.7	7.6	5.5
July 21, 2021	19.7	14.2	9.0	6.5
July 22, 2021	23.6	17.0	15.2	11.0
July 23, 2021	22.2	16.0	10.7	7.7
August 22-28, 2021	43.3	31.2	29.4	21.2
August 28, 2021	19.4	14.0	12.8	9.2
August 29, 2021	15.5	11.2	10.2	7.4
August 30, 2021	14.1	10.1	9.5	6.8
September 14-20, 2021	7.9	5.7	7.3	5.2
September 20, 2021	7.4	5.3	6.8	4.9
September 21, 2021	9.6	6.9	8.5	6.1
September 22, 2021	10.0	7.2	7.3	5.3
September 23, 2021	7.3	5.3	5.6	4.1
October 21-27, 2021	6.9	4.9	5.5	4.0
October 27, 2021	7.0	5.0	5.5	3.9
October 28, 2021	5.8	4.1	4.7	3.4
October 29, 2021	4.7	3.4	4.1	2.9
October 30, 2021	11.2	8.1	10.6	7.6
November 18-24, 2021	6.1	4.4	5.7	4.1
November 24, 2021	6.5	4.7	5.6	4.1
November 25, 2021	5.8	4.2	5.5	3.9
November 26, 2021	5.6	4.0	4.7	3.4
November 27, 2021	4.7	3.4	4.9	3.5

[1] NTU (Nephelometric Turbidity Unit) and TSS (total suspended sediment) data provided by Ecofish Ltd., January 24, 2022.

NTU: to some extent, measures (scattered light at 90 degrees from the incident light beam) how much light reflects for a given amount of particulates dependent upon properties of the particles, e.g. their shape, color, and reflectivity.

Note: 7-day average turbidity values are calculated as the average turbidity measured during the prior seven days to the sampling event.

Table 5: 2021 Quality Assurance/Quality Control for Water Quality Sample Results

Parameter	Unit	RDL	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank
			28-Jan-21	28-Jan-21	24-Feb-21	24-Feb-21	25-Feb-21	25-Feb-21	18-Mar-21	18-Mar-21	8-Apr-21	8-Apr-21
Physical Parameters												
Acidity (as $CaCO_3$)	µg/L	1000	1700	1800	1100	1200	1400	1800	1200	1900	1200	<1000
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Electrical Conductivity (EC)	µS/cm	2.0	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Hardness as $CaCO_3$, dissolved	µg/L	500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Hardness as $CaCO_3$, from total Ca/Mg	µg/L											
pH	pH Units	0.1	**5.36**	**5.37**	**5.69**	**5.49**	**5.54**	**5.51**	**5.5**	5.48	5.46	5.61
Total Dissolved Solids (TDS)	µg/L	10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Total Suspended Solids (TSS)	µg/L	3000	<3000	<3000	<1000	<1000	<3000	<3000	<1000	<1000	<1000	<1000
Alkalinity (Hydroxide as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	-	-	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	-	-	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	<1000	<1000	<1000	<1000	<1000	<1000	-	-	<1000	<1000
Anions and Nutrients												
Ammonia (NH_4 as N)	µg/L	5.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Chloride (Cl^-)	µg/L	500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Nitrate (NO_3^- as N)	µg/L	5.0	<5	<5	<5	<5	<5	6.7	<5	<5	<5	<5
Nitrite (NO_2^- as N)	µg/L	1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO_4)	µg/L	300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Dissolved Organic Carbon (DOC)	µg/L											
Metals, Total												
Aluminum	µg/L	3.0	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Antimony	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Arsenic	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Barium	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beryllium	µg/L	0.10	<0.02	<0.02	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium	µg/L	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cesium	µg/L	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Cobalt	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Copper	µg/L	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron	µg/L	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Lead	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	µg/L	1.0	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	µg/L	5.0	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Manganese	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	µg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosphorus	µg/L	50.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	<100	<100	<50	<50	<50	<50	<50	<50	<50	<50
Rubidium	µg/L	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Selenium	µg/L	0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Silicon	µg/L	100	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Silver	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Strontium	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Sulfur	µg/L	500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Tellurium	µg/L	0.2			<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	µg/L	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.10	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.30	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	0.10			<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	µg/L	0.50	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	3.0	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zirconium	µg/L	0.06	<0.3	<0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Metals, Dissolved												
Aluminum	µg/L	1.0	<1				<1					
Antimony	µg/L	0.10	<0.1				<0.1					
Arsenic	µg/L	0.10	<0.1				<0.1					
Barium	µg/L	0.10	<0.1				<0.1					
Beryllium	µg/L	0.10	<0.02				<0.1					
Bismuth	µg/L	0.05	<0.05				<0.05					
Boron	µg/L	10.0	<10				<10					
Cadmium	µg/L	0.005	<0.005				<0.005					
Calcium	µg/L	50.0	<50				<50					
Cesium	µg/L	0.01					<0.01					
Chromium	µg/L	0.10	<0.1				<0.1					
Cobalt	µg/L	0.10	<0.1				<0.1					
Copper	µg/L	0.20	<0.2				<0.2					
Iron	µg/L	10.0	<10				<10					
Lead	µg/L	0.05	<0.05				<0.05					
Lithium	µg/L	1.0	<1				<1					
Magnesium	µg/L	5.0	<5				<5					
Manganese	µg/L	0.10	<0.1				<0.1					
Mercury	µg/L	0.005	<0.005				<0.005					
Molybdenum	µg/L	0.05	<0.05				<0.05					
Nickel	µg/L	0.50	<0.5				<0.5					
Phosphorus	µg/L	50.0	<50				<50					
Potassium	µg/L	50.0	<100				<50					
Rubidium	µg/L	0.20					<0.2					
Selenium	µg/L	0.05	<0.05				<0.05					
Silicon	µg/L	50.0	<50				<50					
Silver	µg/L	0.01	<0.01				<0.01					
Sodium	µg/L	50.0	<50				<50					
Strontium	µg/L	0.2	<0.2				<0.2					
Sulfur	µg/L	500	<500				<500					
Tellurium	µg/L	0.20					<0.2					
Thallium	µg/L	0.01	<0.01				<0.01					
Thorium	µg/L	0.10					<0.1					
Tin	µg/L	0.10	<0.1				<0.1					
Titanium	µg/L	0.30	<0.3				<0.3					
Tungsten	µg/L	0.10					<0.1					
Uranium	µg/L	0.01	<0.01				<0.01					
Vanadium	µg/L	0.50	<0.5				<0.5					
Zinc	µg/L	1.0	<1				<1					
Zirconium	µg/L	0.06	<0.3				<0.2					
Laboratory Work Order Number			L2552704	L2552704	L2560753	L2560753	L2561396	L2561396	L2568765	L2568765	L2574718	L2574718
Laboratory Identification Number			L2552704-5	L2552704-6	L2560753-4	L2560753-5	L2561396-3	L2561396-4	L2568765-4	L2568765-5	L2574718-6	L2574718-5

Parameter	Field Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank	Travel Blank	Field Blank
	22-Apr-21	19-May-21	19-May-21	24-Jun-21	24-Jun-21	21-Jul-21	21-Jul-21	29-Aug-21	29-Aug-21	29-Sep-20	29-Sep-20	29-Oct-21	28-Oct-21	25-Nov-21	26-Nov-21
Physical Parameters															
Acidity (as $CaCO_3$)	<1000	<2000	<2000	1500	1100	1300	<1000	1700	<1000	2100	2100	1800	1900	2100	2000
Alkalinity (Total as $CaCO_3$)	<1	<2	<2	<1	<1	<2	<2	<1	<1	<1	<1	<1	<1	<1	<1
Electrical Conductivity (EC)	<2	1.9	1.5	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Hardness as $CaCO_3$, dissolved	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Hardness as $CaCO_3$, from total Ca/Mg															
pH	5.25	5.54	5.33	4.07	3.96	5.27	5.59	5.30	5.29	4.69	4.82	5.00	4.94	5.28	5
Total Dissolved Solids (TDS)	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000	<10000
Total Suspended Solids (TSS)	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Hydroxide as $CaCO_3$)	<1000	<2000	<2000	<1000	<1000	<5000	<5000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	<1000	<2000	<2000	<1000	<1000	<5000	<5000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	<1000	<2000	<2000	<1000	<1000	<5000	<5000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Anions and Nutrients															
Ammonia (NH_4 as N)	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Chloride (Cl^-)	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500
Nitrate (NO_3^- as N)	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Nitrite (NO_2^- as N)	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Sulphate (SO_4)	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300	<300
Dissolved Organic Carbon (DOC)															
Metals, Total															
Aluminum	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Antimony	<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
Arsenic	<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
Barium	<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
Beryllium	<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
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cadmium	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.006	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Calcium	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Cesium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	<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
Cobalt	<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
Copper	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.19	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Iron	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Magnesium	<5	<5	<5	<5	<5	<5	<5	<5	<9.7	<5	5.3	<5	<5	<5	<5
Manganese	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mercury	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.463
Nickel	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosphorus	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Rubidium	<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
Selenium	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Silicon	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	<50	<50	<50	<50	<50	<50	<50	<50	<69	<50	<50	<50	<50	<50	<50
Strontium	<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
Sulfur	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<500	<750	<500	<500
Tellurium	<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
Thallium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	<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
Tin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.11	0.12	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	<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
Uranium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Vanadium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.55	0.53	<3	<3	<0.5	<0.5	<0.5	<0.5
Zinc	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3	<3
Zirconium	<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
Metals, Dissolved															
Aluminum													<1		
Antimony													<0.1		
Arsenic													<0.1		
Barium													<0.1		
Beryllium													<0.1		
Bismuth													<0.05		
Boron													<10		
Cadmium													<0.005		
Calcium													<50		
Cesium													<0.01		
Chromium													<0.1		
Cobalt													<0.1		
Copper													<0.2		
Iron													<10		
Lead													<0.05		
Lithium													<1		
Magnesium													<5		
Manganese													<0.1		
Mercury													<0.005		
Molybdenum													<0.05		
Nickel													<0.5		
Phosphorus													<50		
Potassium													<50		
Rubidium													<0.2		
Selenium													<0.05		
Silicon													<50		
Silver													<0.01		
Sodium													<50		
Strontium													<0.2		
Sulfur													<500		
Tellurium													<0.2		
Thallium													<0.01		
Thorium													<0.1		
Tin													<0.1		
Titanium													<0.3		
Tungsten													<0.1		
Uranium													<0.01		
Vanadium													<0.5		
Zinc													<1		
Zirconium													<0.2		
Laboratory Work Order Number	L2579726	L2590139	L2590139	L2606393	L2606393	L2617671	L2617671	L2633133	L2633133	L2642120	L2642120	L2657182	L2656849	L2666805-2	L2666805-1
Laboratory Identification Number	L2579726-11	L2590139-2	L2590139-3	L2606393-9	L2606393-8	L2617671-8	L2617671-7	L2633133-10	L2633134-9	L2642120-3	L2642120-2	L2657182-3	L2656849-6	25-Nov-2021	26-Nov-2021

Parameter	L2-DS	L2-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	L2-DS
	28-Jan-21			24-Feb-21			25-Fe
Physical Parameters							
Acidity (as $CaCO_3$)	<1000	<1000	-	<1000	<1000		<1000
Alkalinity (Total as $CaCO_3$)	209	170	20.6	261	259	0.77	260
Electrical Conductivity (EC)	683	520	27.1	755	754	0.13	763
Hardness as $CaCO_3$, dissolved	166000	166000	0.0	293000	291000	0.68	31800
Hardness as $CaCO_3$, from total Ca/Mg							
pH	8.36	8.31	0.6	8.11	8.07	0.49	**10.06**
Total Dissolved Solids (TDS)	400000	395000	1.3	495000	483000	2.45	698000
Total Suspended Solids (TSS)	8200	7800	5.0	33300	34800	4.41	<3000
Alkalinity (Hydroxide as $CaCO_3$)	<1000	<1000	-	<1000	<1000		<1000
Alkalinity (Carbonate as $CaCO_3$)	6000	3600	50.0	<1000	<1000		196000
Alkalinity (Bicarbonate as $CaCO_3$)	203000	166000	20.1	261000	259000	0.77	63900
Anions and Nutrients							
Ammonia (NH_4 as N)	113	<50		283	263	7.33	1210
Chloride (Cl^-)	29700	19300	42.4	34400	34000	1.17	40500
Nitrate (NO_3^- as N)	221	191	14.6	782	773	1.16	371
Nitrite (NO_2^- as N)	<16.1	<10.9		18.8	18.8	0.00	23.1
Sulphate (SO_4)	122000	85900	34.7	108000	109000	0.92	69200
Dissolved Organic Carbon (DOC)				3.7	3.7	0.00	
Metals, Total							
Aluminum	607	769	23.5	483	487	0.82	2960
Antimony	0.92	0.77	17.8	0.36	0.36	0.00	4.73
Arsenic	1.31	1.14	13.9	0.85	0.78	8.59	7.13
Barium	65.4	73.6	11.8	117	120	2.53	62.8
Beryllium	0.038	0.04	5.1	<0.1	<0.1		<0.1
Bismuth	<0.05	<0.05		<0.05	<0.05		<0.05
Boron	101	68	39.1	94	94	0.00	341
Cadmium	0.036	0.0421	15.6	0.323	0.322	0.31	0.0507
Calcium	57800	48600	17.3	86500	86700	0.23	11400
Cesium				0.121	0.124	2.45	0.152
Chromium	1.63	1.61	1.2	1.26	1.31	3.89	2.79
Cobalt	0.51	0.65	24.1	3.7	3.75	1.34	0.39
Copper	3.9	4.37	11.4	4.81	4.78	0.63	3.15
Iron	685	923	29.6	953	933	2.12	566
Lead	0.591	0.723	20.1	0.552	0.55	0.36	0.602
Lithium	18	12.5	36.1	28.2	28.2	0.00	27.8
Magnesium	15500	12400	22.2	21100	21500	1.88	2310
Manganese	16.1	21	26.4	65.3	64.6	1.08	9.86
Mercury	<0.005	<0.005		<0.005	<0.005		<0.005
Molybdenum	10.3	6.84	40.4	8.12	8.51	4.69	39.2
Nickel	1.75	1.82	3.9	16.6	17	2.38	1.86
Phosphorus	<50	<50		57	63	10.00	79
Potassium	2090	1520	31.6	3650	3660	0.27	14900
Rubidium				2.94	3.21	8.78	18.4
Selenium	1.62	1.12	36.5	1.12	1.16	3.51	1.4
Silicon	4530	4340	4.3	4780	4760	0.42	10800
Silver	<0.017	<0.019		<0.012	<0.011		0.023
Sodium	83200	55200	40.5	67800	67600	0.30	160000
Strontium	212	182	15.2	405	407	0.49	76.8
Sulfur	46400	32300	35.8	38100	37400	1.85	27100
Tellurium				<0.2	<0.2		<0.2
Thallium	0.012	0.014	15.4	0.027	0.026	3.77	0.034
Thorium				0.23	0.22	4.44	0.11
Tin	0.75	0.83	10.1	<0.1	<0.1		1.56
Titanium	21.9	28	24.4	6.37	5.93	7.15	8.43
Tungsten				<0.1	<0.1		2.24
Uranium	1.55	1.22	23.8	1.57	1.58	0.63	0.564
Vanadium	2.77	2.62	5.6	1.35	1.34	0.74	13
Zinc	19.9	20.8	4.4	28.7	28.9	0.69	8.2
Zirconium	0.97	1.08	10.7	<0.22	<0.23		0.45
Metals, Dissolved							
Aluminum	36.6	36.9	0.8	64.9	67	3.18	2640
Antimony	0.49	0.49	0.0	0.36	0.33	8.70	3.26
Arsenic	0.87	0.86	1.2	0.34	0.35	2.90	6.87
Barium	39	39	0.0	90.6	87	4.05	35
Beryllium	<0.02	<0.02		<0.1	<0.1		<0.1
Bismuth	<0.05	<0.05		<0.05	<0.05		<0.05
Boron	67	67	0.0	91	89	2.22	341
Cadmium	0.0061	0.007	13.7	0.282	0.276	2.15	0.0103
Calcium	46300	46000	0.7	83700	83000	0.84	9170
Cesium				0.018	0.019	5.41	0.071
Chromium	0.54	0.58	7.1	0.5	0.48	4.08	1.82
Cobalt	<0.1	<0.1		3.41	3.41	0.00	<0.1
Copper	1.2	1.16	3.4	2.92	2.85	2.43	0.37
Iron	<10	<10		<10	<10		18
Lead	<0.05	<0.05		0.075	0.073	2.70	<0.05
Lithium	14.1	13.6	3.6	27	26.2	3.01	28.4
Magnesium	12300	12300	0.0	20500	20200	1.47	2170
Manganese	1.72	1.66	3.6	51.5	52.7	2.30	0.98
Mercury	<0.005	<0.005		<0.005	<0.005		<0.005
Molybdenum	7.55	7.58	0.4	8.37	8.23	1.69	37.4
Nickel	1.45	1.44	0.7	15.7	15.7	0.00	0.98
Phosphorus	<50	<50		<50	<50		<50
Potassium	1490	1510	1.3	3710	3670	1.08	15100
Rubidium				2.24	2.22	0.90	16.8
Selenium	1.33	1.35	1.5	1.33	1.27	4.62	1.6
Silicon	3280	3250	0.9	4350	4240	2.56	10400
Silver	<0.01	<0.01		<0.01	<0.01		<0.01
Sodium	56900	56000	1.6	69300	68200	1.60	160000
Strontium	177	176	0.6	379	372	1.86	69.9
Sulfur	33400	33500	0.3	40900	40300	1.48	28500
Tellurium				<0.2	<0.2		<0.2
Thallium	<0.01	<0.01		0.017	0.016	6.06	<0.01
Thorium				<0.1	<0.1		<0.1
Tin	0.11	0.11	0.0	<0.1	<0.1		1.34
Titanium	<0.3	0.38		<0.3	<0.3		1.28
Tungsten				<0.1	<0.1		2.37
Uranium	1.15	1.15	0.0	1.46	1.41	3.48	0.481
Vanadium	0.81	0.82	1.2	<0.5	<0.5		12.2
Zinc	3.7	3.3	11.4	22.8	22.9	0.44	1.1
Zirconium	<0.3	<0.3		<0.2	<0.2		<0.2
Laboratory Work Order Number	L2552704	L2552704		L2560753	L2560753		L2561396
Laboratory Identification Number	L2552704-1	L2552704-2		L2560753-1	L2560753-3		L2561396-1

Notes:

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (ABS[(difference between two values)]/((sum of two values/2))*100

Blank indicates RPD not calculated. RPD cannot be calculated if one or more of the analytical results is less than detection limits or within 5 times the RDL.

RPD greater than 30%

Shaded gray only - exceeds BCAWQG-FSTM guideline.

Blank - not analyzed.

TETRA TECH

Table 5: 2021 Quality Assurance/Quality Control for W

Parameter	Unit	RDL	L2-DS-R	RPD %	RBSC-DS	RBSC-DS-R	RPD %	LBRR-EDP	LBRR-EDP-R	RPD %	LBL3C-1.43	LBL3C-1.43-R	RPD %	RBSC-DS	RBSC-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-EUS	RBSBIAR-EUS-R	RPD %	LBP-Pond	LBP-Pond-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-DS	RBSBIAR-DS-R	RPD %	RBSBIAR-US	RBSBIAR-US-R	RPD %
			b-21		17-Mar-21			8-Apr-21			22-Apr-21			18-May-21			24-Jun-21			21-Jul-21			29-Aug-21			21-Sep-21			28-Oct-21			25-Nov-21		
Physical Parameters																																		
Acidity (as $CaCO_3$)	µg/L	1000	<1000		5200	6300	19.1	10200	11900	15.4	6200	6000	3.3	4600	3600	3.6	2900	6300	73.9	9600	10000	4.1	10200	10700	4.8	1900	2400	23.3	2200	2900	27.5	4500	4000	11.8
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	257	1.16	360	358	0.6	258	278	7.5	119	113	5.2	359	346	3.7	209	213	1.9	270	266	1.5	180	184	2.2	239	219	8.7	223	224	0.4	250000	252000	0.8
Electrical Conductivity (EC)	µS/cm	2.0	769	0.78	927	929	0.2	1490	1710	13.8	629	620	1.4	1040	1020	1.9	812	786	3.3	923	909	1.5	2720	2630	3.4	833	868	4.1	738	740	0.3	759	763	0.5
Hardness as $CaCO_3$, dissolved	µg/L	500	30400	4.50	516000	491000	5.0	798000	959000	18.3	247000	257000	4.0	512000	494000	3.6	314000	357000	12.8	485000	487000	0.4	1370000	1380000	0.7	388000	382000	1.6	326000	349000	6.8	342000	358000	4.6
Hardness as $CaCO_3$, from total Ca/Mg	µg/L																															328000	330000	0.6
pH	pH Units	0.1	**10.05**	0.10	7.72	7.69	0.4	7.9	7.85	0.6	7.68	7.73	0.6	8.04	8.05	0.1	7.86	7.96	1.3	7.77	7.81	0.5	7.83	7.87	0.5	8.14	8.17	0.4	8.15	8.14	0.1	7.88	7.93	0.6
Total Dissolved Solids (TDS)	µg/L	10000	456000	41.94	671000	622000	7.6	975000	1090000	11.1	379000	394000	3.9	734000	723000	1.5	535000	519000	3.0	628000	637000	1.4	2510000	2380000	5.3	591000	579000	2.1	486000	490000	0.8	499000	498000	0.2
Total Suspended Solids (TSS)	µg/L	3000	9700		8300	10100	19.6	319000	410000	25.0	718000	977000	30.6	10800	12200	12.2	<1000	<1000		10500	22400	72.3	5800	3000	63.6	62800	78700	22.5	1200	1300	8.0	<3000	<3000	
Alkalinity (Hydroxide as $CaCO_3$)	µg/L	1000	<1000		<5000	<5000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<5000	<5000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000	
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	193000	1.54	<5000	<5000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000		<5000	<5000		<1000	<1000		<1000	<1000		<1000	<1000		<1000	<1000	
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	64100	0.31	439000	437000	0.5	258000	278000	7.5	119000	113000	5.2	359000	346000	3.7	209000	213000	1.9	330000	324000	1.8	180000	184000	2.2	239000	219000	8.7	223000	224000	0.4	250000	252000	0.8
Anions and Nutrients																																		
Ammonia (NH_4 as N)	µg/L	5.0	1180	2.51	<50	<50		157	172	9.1	<50	<50		<50	<50		227	143	45.4	<50	<50		<50	<50		132	127	3.9	458	<173		<5	5.9	
Chloride (Cl^-)	µg/L	500	40900	0.98	16200	16100	0.6	225000	269000	17.8	42100	42200	0.2	22300	22700	1.8	53500	53500	0.0	80600	80200	0.5	6700	6300	6.2	39600	197000	133.1	38000	37700	0.8	49500	49200	0.6
Nitrate (NO_3^- as N)	µg/L	5.0	364	1.90	26.8	11.6	79.2	321	351	8.9	1110	1040	6.5	<25	<25		923	929	0.6	537	468	13.7	<25	<25		627	3130	133.2	758	752	0.8	1270	1280	0.8
Nitrite (NO_2^- as N)	µg/L	1.0	23.2	0.43	3.4	1.8	61.5	<8.8	<10.9		1.1	1.2	8.7	<7	<8.6		35.9	39.2	8.8	<5	<6.1		<5	<5		7.4	41.4	139.3	4.8	5.2	8.0	<1	<1	
Sulphate (SO_4)	µg/L	300	68000	1.75	191000	189000	1.1	250000	287000	13.8	135000	136000	0.7	246000	239000	2.9	163000	163000	0.0	135000	136000	0.7	1570000	1610000	2.5	191000	980000	134.8	121000	121000	0.0	109000	109000	0.0
Dissolved Organic Carbon (DOC)	µg/L				2.49	2.81	12.1							2.7	2.1	25.0	2.5	2.5	0.0													1340	1420	5.8
Metals, Total																																		
Aluminum	µg/L	3.0	3030	2.34	52.2	86.7	49.7	2430	3070	23.3	6690	9510	34.8	76.3	79.6	4.2	38.9	43.1	10.2	172	161	6.6	83	114	31.5	1830	1480	21.1	63.4	65.5	3.3	17.2	15.2	12.3
Antimony	µg/L	0.10	4.7	0.64	<0.1	<0.1		0.45	0.56	21.8	0.53	0.62	15.7	<0.1	<0.1		0.37	0.4	7.8	0.22	0.22	0.0	0.5	0.5	0.0	2.35	1.95	18.6	0.15	0.15	0.0	<0.1	<0.1	
Arsenic	µg/L	0.10	7.11	0.28	0.36	0.42	15.4	3.82	4.83	23.4	5.78	8.05	32.8	0.8	0.92	14.0	0.27	0.25	7.7	0.52	0.53	1.9	0.83	0.75	10.1	2.45	1.89	25.8	0.19	0.21	10.0	0.15	0.15	0.0
Barium	µg/L	0.10	64	1.89	30.4	32.8	7.6	190	241	23.7	334	470	33.8	50.8	56.3	10.3	72.3	69.8	3.5	235	234	0.4	52.7	52.8	0.2	242	205	16.6	72.5	72	0.7	59.3	60	1.2
Beryllium	µg/L	0.10	<0.1		<0.1	<0.1		0.16	0.19	17.1	0.5	0.63	23.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.5	0.5	0.0	0.19	0.17	11.1	<0.1	<0.1		<0.1	<0.1	
Bismuth	µg/L	0.05	<0.05		<0.05	<0.05		<0.05	<0.05		0.25	0.25	0.0	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		0.25	0.25	0.0	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Boron	µg/L	10	352	3.17	62	62	0.0	59	68	14.2	50	50	0.0	62	64	3.2	129	128	0.8	35	35	0.0	256	243	5.2	104	106	1.9	85	85	0.0	26	27	3.8
Cadmium	µg/L	0.005	0.0533	5.00	0.0672	0.0692	2.9	0.357	0.46	25.2	0.661	1	40.8	0.0563	0.0525	7.0	0.0445	0.0446	0.2	0.0433	0.043	0.7	0.314	0.289	8.3	0.334	0.332	0.6	0.0789	0.0786	0.4	0.015	0.0171	13.1
Calcium	µg/L	50	11600	1.74	158000	152000	3.9	247000	291000	16.4	90500	103000	12.9	153000	145000	5.4	100000	95000	5.1	144000	143000	0.7	363000	354000	2.5	117000	118000	0.9	96300	96300	0.0	97400	98000	0.6
Cesium	µg/L	0.01	0.145	4.71	0.018	0.023	24.4	0.364	0.431	16.9	1.21	1.69	33.1	0.037	0.027	31.3	0.036	0.036	0.0	0.028	0.024	15.4	0.05	0.05	0.0	0.329	0.181	58.0	0.016	0.017	6.1	<0.01	<0.01	
Chromium	µg/L	0.10	2.76	1.08	0.13	0.19	37.5	6.58	8.52	25.7	12.6	17.8	34.2	0.15	0.15	0.0	0.11	0.28	87.2	0.55	0.57	3.6	0.5	0.5	0.0	23.9	25.2	5.3	0.14	0.14	0.0	<0.5	<0.5	
Cobalt	µg/L	0.10	0.4	2.53	0.37	0.45	19.5	4.87	6.17	23.6	17.5	20.8	17.2	3.31	3.19	3.7	0.53	0.56	5.5	0.34	0.35	2.9	2.58	2.49	3.6	5.33	5.39	1.1	1.21	1.21	0.0	<0.1	<0.1	
Copper	µg/L	0.50	3.39	7.34	<0.5	<0.5		8.43	10.7	23.7	20.3	29.7	37.6	<0.5	<0.5		1.01	1	1.0	1.02	1.01	1.0	2.5	4.6	59.2	13.3	13.5	1.5	0.93	0.93	0.0	<0.5	<0.5	
Iron	µg/L	10	584	3.13	287	497	53.6	8580	10800	22.9	14600	20500	33.6	981	**1040**	5.8	40	44	9.5	422	395	6.6	370	449	19.3	3460	2170	45.8	104	107	2.8	28	23	19.6
Lead	µg/L	0.05	0.618	2.62	0.069	0.109	44.9	2.75	3.34	19.4	7.76	12	42.9	0.145	0.13	10.9	<0.05	0.051		0.213	0.213	0.0	0.25	0.25	0.0	2.77	2.42	13.5	<0.05	<0.05		<0.05	<0.05	
Lithium	µg/L	1.0	28	0.72	26.5	24.6	7.4	31.3	35.4	12.3	18.2	22.2	19.8	34.6	34.7	0.3	26.1	24.4	6.7	10	10.2	2.0	81.8	81.7	0.1	26.8	26.1	2.6	20.8	21	1.0	8.3	8.3	0.0
Magnesium	µg/L	5.0	2340	1.29	38700	37600	2.9	63500	76800	19.0	30000	32300	7.4	35900	37100	3.3	24100	23200	3.8	30900	31600	2.2	188000	187000	0.5	21400	21500	0.5	24200	24400	0.8	20600	20800	1.0
Manganese	µg/L	0.10	10	1.41	1530	1630	6.3	301	386	24.7	923	1040	11.9	3080	3070	0.3	11.9	18.3	42.4	57.2	58.3	1.9	1470	1460	0.7	131	130	0.8	23	23.1	0.4	2.9	2.46	16.4
Mercury	µg/L	0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		0.0058	<0.005		<0.005	<0.005		0.0216	0.0272	23.0	<0.005	<0.005		<0.005	<0.005	
Molybdenum	µg/L	0.05	39.7	1.27	0.724	0.692	4.5	4.09	5.09	21.8	2.08	2.12	1.9	1.15	1.17	1.7	5.77	5.26	9.2	0.969	0.944	2.6	1.56	1.48	5.3	26.5	22.6	15.9	3.97	4	0.8	1.16	1.11	4.4
Nickel	µg/L	0.5	1.91	2.65	15.7	15	4.6	21.2	26.9	23.7	40.5	51.1	23.1	31.3	30.1	3.9	7.21	7.15	0.8	1.28	1.29	0.8	33.4	33	1.2	19.8	18.7	5.7	8.8	8.77	0.3	0.64	0.67	4.6
Phosphorus	µg/L	50.0	80	1.26	<50	<50		386	486	22.9	580	800	31.9	<50	<50		<50	<50		<50	<50		<250	<250		123	119	3.3	<50	<50		<50	<50	
Potassium	µg/L	50.0	15200	1.99	1730	1720	0.6	8260	9940	18.5	6640	6930	4.3	1800	1790	0.6	3850	3740	2.9	4470	4530	1.3	16300	16100	1.2	11100	12000	7.8	3770	3750	0.5	3620	3610	0.3
Rubidium	µg/L	0.2	18.2	1.09	1.4	1.45	3.5	5.1	6.04	16.9	10.3	13.6	27.6	1.71	1.59	7.3	2.16	1.79	18.7	1.01	0.95	6.1	4.7	4.6	2.2	20.5	21.3	3.8	1.3	1.31	0.8	0.59	0.53	10.7
Selenium	µg/L	0.05	1.47	4.88	0.079	0.078	1.3	0.939	1.15	20.2	1.16	1.24	6.7	0.076	0.075	1.3	0.966	0.898	7.3	0.742	0.765	3.1	0.64	0.58	9.8	1.34	1.15	15.3	0.708	0.718	1.4	0.889	1.01	12.7
Silicon	µg/L	100	10900	0.92	4360	4170	4.5	8370	10400	21.6	11700	15600	28.6	4270	4350	1.9	4050	3990	1.5	5850	6110	4.3	1540	1540	0.0	9800	8060	19.5	4280	4350	1.6	4320	4370	1.2
Silver	µg/L	0.01	<0.019		<0.01	<0.01		0.088	0.08	9.5	0.153	0.226	38.5	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		0.05	0.05	0.0	0.078	0.042	60.0	<0.01	<0.01		<0.01	<0.01	
Sodium	µg/L	50.0	163000	1.86	42000	40100	4.6	60800	73500	18.9	27800	27300	1.8	43600	42600	2.3	59600	58100	2.5	12800	13000	1.6	264000	261000	1.1	36500	37200	1.9	42000	42200	0.5	35000	35700	2.0
Strontium	µg/L	0.2	78.1	1.68	433	408	5.9	1110	1350	19.5	310	343	10.1	460	456	0.9	536	488	9.4	516	534	3.4	941	915	2.8	633	650	2.7	454	455	0.2	247	247	0.0
Sulfur	µg/L	500	26800	1.11	83000	78400	5.7	108000	137000	23.7	53000	51000	3.8	91700	95900	4.5	55500	53200	4.2	49700	50700	2.0	698000	690000	1.2	64100	65000	1.4	45200	46100	2.0	38600	38500	0.3
Tellurium	µg/L	0.2	<0.2		<0.2	<0.2		0.3	0.35	15.4	1	1	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		1	1	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Thallium	µg/L	0.01	0.032	6.06	0.011	<0.01		0.076	0.093	20.1	0.165	0.217	27.2	0.02	0.014	35.3	0.013	0.015	14.3	0.011	<0.01		0.05	0.05	0.0	0.049	0.034	36.1	<0.01	<0.01		<0.01	<0.01	
Thorium	µg/L	0.10	<0.1		<0.1	<0.1		1.03	1.27	20.9	2.19	3.14	35.6	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.5	0.5	0.0	0.67	0.46	37.2	<0.1	<0.1		<0.1	<0.1	
Tin	µg/L	0.10	1.6	2.53	<0.1	<0.1		0.17	0.18	5.7	0.5	0.5	0.0	<0.1	0.23		<0.1	<0.1		<0.1	<0.1		0.5	0.5	0.0	2.22	0.5	126.5	<0.1	<0.1		<0.1	0.18	
Titanium	µg/L	0.30	8.58	1.76	0.94	1.72	58.6	62.1	79.8	24.9	103	145	33.9	0.99	1.64	49.4	<0.3	0.35		4.84	4.25	13.0	1.5	1.5	0.0	52.4	33.6	43.7	<0.3	0.39		0.39	0.34	13.7
Tungsten	µg/L	0.10	2.25	0.45	<0.1	<0.1		0.11	0.15	30.8	0.5	0.5	0.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.5	0.5	0.0	0.25	0.15	50.0	<0.1	<0.1		<0.1	<0.1	
Uranium	µg/L	0.01	0.581	2.97	1.31	1.24	5.5	5.55	6.36	13.6	2.36	2.76	15.6	1.6	1.47	8.5	1.23	1.17	5.0	1.3	1.33	2.3	4.15	4.05	2.4	1.71	1.72	0.6	1.01	1	1.0	1.27	1.26	0.8
Vanadium	µg/L	0.50	13.5	3.77	<0.5	0.58		8.72	11	23.1	22.3	31.7	34.8	0.55	0.69	22.6	<0.5	<0.5		1.1	1.11	0.9	2.5	2.5	0.0	5.18	4.01	25.5	<0.5	<0.5		<0.5	<0.5	
Zinc	µg/L	3.0	8.3	1.21	3.3	3.3	0.0	41.5	52.6	23.6	96	128	28.6	12.1	10.7	12.3	9.3	5.9	44.7	<3.7	<4.1		66	68	3.0	89.6	90.1	0.6	17.9	17	5.2	<3	<3	
Zirconium	µg/L	0.06	0.43	4.55	<0.2	<0.2		7.92	0.5	176.2	1	1	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2		1	1	0.0	1.47	0.74	66.1	<0.2	<0.2		<0.2	<0.2	
Metals, Dissolved																																		
Aluminum	µg/L	1.0	2590	1.91	<1	<1		19.7	19.6	0.5	44.1	42.8	3.0	1.4	1.5	6.9	31.8	31.6	0.6	2.6	2.6	0.0	14.4	17.3	18.3	96.1	88.4	8.3	40.5	40.7	0.5	2.9	2.6	10.9
Antimony	µg/L	0.10	3.52	7.67	<0.1	<0.1		0.19	0.22	14.6	0.14	0.16	13.3	<0.1	<0.1		0.3	0.35	15.4	0.2	0.2	0.0	0.5	0.5	0.0	1.55	1.61	3.8	0.14	0.16	13.3	0.15	0.13	14.3
Arsenic	µg/L	0.10	6.7	2.51	0.25	0.32	24.6	0.52	0.65	22.2	0.36	0.37	2.7	0.67	0.7	4.4	0.23	0.29	23.1	0.29	0.29	0.0	0.51	0.53	3.8	0.77	0.76	1.3	0.16	0.16	0.0	<0.1	<0.1	
Barium	µg/L	0.10	34.7	0.86	28.3	28.7	1.4	63	75.5	18.1	60.8	59.5	2.2	60	60.4	0.7	76.7	82	6.7	231	231	0.0	42	44.8	6.5	136	138	1.5	72.8	74.6	2.4	62.4	61.9	0.8
Beryllium	µg/L	0.10	<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		0.5	0.5	0.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Bismuth	µg/L	0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		0.25	0.25	0.0	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Boron	µg/L	10.0	321	6.04	59	54	8.8	53	61	14.0	28	29	3.5	51	52	1.9	116	134	14.4	34	33	3.0	222	210	5.6	103	102	1.0	79	84	6.1	26	25	3.9
Cadmium	µg/L	0.005	0.0134	26.16	0.0431	0.0243	55.8	0.03	0.038	23.5	0.116	0.112	3.5	0.0073	0.0097	28.2	0.0447	0.0462	3.3	0.0281	0.0262	7.0	0.187	0.199	6.2	0.175	0.15	15.4	0.0703	0.0758	7.5	0.0102	0.009	12.5
Calcium	µg/L	50.0	8620	6.18	150000	142000	5.5	221000	262000	17.0	62100	67000	7.6	147000	138000	6.3	85200	99600	15.6	144000	145000	0.7	299000	294000	1.7	116000	114000	1.7	90600	98000	7.8	102000	108000	5.7
Cesium	µg/L	0.01	0.07	1.42	<0.01	<0.01		0.012	0.014	15.4	<0.01	<0.01		<0.01	<0.01		0.032	0.038	17.1	<0.01	<0.01		0.05	0.05	0.0	0.058	0.059	1.7	0.014	0.016	13.3	<0.01	<0.01	
Chromium	µg/L	0.10	1.79	1.66	<0.1	<0.1		<0.1	<0.1		0.12	0.16	28.6	<0.1	<0.1		<0.1	0.13		0.16	0.16	0.0	0.5	0.5	0.0	18.1	18.7	3.3	<0.1	<0.1		<0.5	<0.5	
Cobalt	µg/L	0.10	<0.1		0.33	0.56	51.7	2.14	2.77	25.7	8.65	8.37	3.3	3.04	3.05	0.3	0.54	0.57	5.4	0.2	0.2	0.0	2	2.06	3.0	3.84	3.65	5.1	1.19	1.22	2.5	<0.1	<0.1	
Copper	µg/L	0.20	0.48	25.88	<0.2	<0.2		1.39	1.92	32.0	1.72	1.71	0.6	<0.2	<0.2		0.86	0.95	9.9	0.58	0.59	1.7	1.3	1.4	7.4	2.89	2.82	2.5	0.68	0.7	2.9	0.34	0.36	5.7
Iron	µg/L	10.0	18	0.00	140	226	47.0	<10	<10		47	44	6.6	253	238	6.1	<10	12		<10	<10		50	62	21.4	82	72	13.0	18	15	18.2	<10	<10	
Lead	µg/L	0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		<0.05	<0.05		0.25	0.25	0.0	<0.05	<0.05		<0.05	<0.05		<0.05	<0.05	
Lithium	µg/L	1.0	26.7	6.17	25.5	23.6	7.7	30.5	35.7	15.7	8.8	9.4	6.6	33.9	30.1	11.9	24.7	28	12.5	9.6	9.8	2.1	68.7	68.4	0.4	26.8	27.1	1.1	21	22.7	7.8	8.4	8.5	1.2
Magnesium	µg/L	5.0	2160	0.46	34500	33100	4.1	59700	73900	21.3	22200	21800	1.8	35200	36400	3.4	24600	26400	7.1	30300	30500	0.7	152000	156000	2.6	24000	23600	1.7	24300	25300	4.0	21100	21400	1.4
Manganese	µg/L	0.10	0.98	0.00	1370	1600	15.5	122	158	25.7	550	529	3.9	2890	2980	3.1	12.3	13.1	6.3	48.1	48.3	0.4	1200	1230	2.5	70.9	69.8	1.6	22.3	22.9	2.7	2.09	2.1	0.5
Mercury	µg/L	0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005		<0.005	<0.005	
Molybdenum	µg/L	0.05	36.5	2.44	0.707	0.714	1.0	3.21	3.99	21.7	1.25	1.38	9.9	1.06	1.05	0.9	5.32	6.13	14.1	1.04	1.04	0.0	1.3	1.22	6.3	27.3	28.1	2.9	3.7	3.99	7.5	1.14	1.17	2.6
Nickel	µg/L	0.50	0.99	1.02	14.1	14.3	1.4	10.8	14.7	30.6	16.3	15.9	2.5	28.6	29.2	2.1	7.6	7.82	2.9	0.81	0.82	1.2	26.7	27.4	2.6	15.6	15	3.9	8.75	9.01	2.9	<0.5	0.52	
Phosphorus	µg/L	50.0	<50		<50	<50		<50	<50		<50	<50		<50	<50		<50	<50		<50	<50		<250	<250		<50	<50		<50	<50		<50	<50	
Potassium	µg/L	50.0	15200	0.66	1590	1610	1.3	8710	10600	19.6	5430	5500	1.3	1760	1810	2.8	4160	4360	4.7	4540	4520	0.4	13100	13500	3.0	12300	12200	0.8	3840	3930	2.3	3730	3720	0.3
Rubidium	µg/L	0.20	16.8	0.00	1.1	1.13	2.7	1.73	2.2	23.9	0.71	0.63	11.9	1.42	1.37	3.6	2.27	2.36	3.9	0.8	0.8	0.0	4	4.2	4.9	20.3	20.4	0.5	1.34	1.4	4.4	0.54	0.46	16.0
Selenium	µg/L	0.05	1.51	5.79	0.058	0.073	22.9	0.974	1.08	10.3	0.836	0.833	0.4	<0.05	0.059		1.21	1.18	2.5	0.809	0.794	1.9	0.81	0.69	16.0	1.41	1.43	1.4	0.814	0.801	1.6	1.09	1.03	5.7
Silicon	µg/L	50.0	9920	4.72	3760	3550	5.7	4780	5310	10.5	1850	1930	4.2	3870	3860	0.3	4110	4630	11.9	5220	5150	1.4	1200	1170	2.5	6300	6280	0.3	4330	4320	0.2	4640	4700	1.3
Silver	µg/L	0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		<0.01	<0.01		0.05	0.05	0.0	<0.01	<0.01		<0.01	<0.01		<0.01	<0.01	
Sodium	µg/L	50.0	158000	1.26	37100	35800	3.6	57200	67900	17.1	25500	25200	1.2	42400	43900	3.5	62200	66000	5.9	12600	12800	1.6	206000	211000	2.4	40100	39000	2.8	42900	44000	2.5	35300	35300	0.0
Strontium	µg/L	0.2	65.5	6.50	399	373	6.7	1040	1230	16.7	239	256	6.9	481	439	9.1	495	554	11.2	515	517	0.4	781	748	4.3	613	616	0.5	429	462	7.4	238	245	2.9
Sulfur	µg/L	500	27300	4.30	74600	68100	9.1	100000	122000	19.8	51100	52800	3.3	80700	80900	0.2	58800	64900	9.9	47400	46600	1.7	572000	575000	0.5	72500	72100	0.6	46000	45700	0.7	38100	39000	2.3
Tellurium	µg/L	0.20	<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		1	1	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Thallium	µg/L	0.01	<0.01		<0.01	<0.01		0.013	0.017	26.7	<0.01	<0.01		<0.01	<0.01		0.014	0.016	13.3	<0.01	<0.01		0.05	0.05	0.0	0.015	0.016	6.5	<0.01	<0.01		<0.01	<0.01	
Thorium	µg/L	0.10	<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		0.5	0.5	0.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Tin	µg/L	0.10	1.33	0.75	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.5	0.5	0.0	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1	
Titanium	µg/L	0.30	1.55	19.08	<0.3	<0.3		<0.3	<0.3		0.71	0.99	32.9	<0.3	<0.3		<0.3	<0.3		<0.3	<0.3		1.5	1.5	0.0	2.32	2.23	4.0	<0.3	<0.3		<0.3	<0.3	
Tungsten	µg/L	0.10	2.29	3.43	<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		<0.1	<0.1		0.5	0.5	0.0	0.2	0.2	0.0	<0.1	<0.1		<0.1	<0.1	
Uranium	µg/L	0.01	0.465	3.38	1.22	1.11	9.4	4.28	5.03	16.1	1.44	1.58	9.3	1.61	1.49	7.7	1.2	1.34	11.0	1.29	1.28	0.8	3.33	3.2	4.0	1.41	1.39	1.4	0.892	0.985	9.9	1.25	1.28	2.4
Vanadium	µg/L	0.50	12.1	0.82	<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		<0.5	<0.5		2.5	2.5	0.0	0.87	0.87	0.0	<0.5	<0.5		<0.5	<0.5	
Zinc	µg/L	1.0	2.4	74.29	2	1.7	16.2	2.4	2.4	0.0	11.6	9.7	17.8	9	8.9	1.1	7.5	6.4	15.8	1.6	1.5	6.5	52.4	54.5	3.9	23	22.8	0.9	15.7	16.3	3.8	<1	<1	
Zirconium	µg/L	0.06	<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		1	1	0.0	<0.2	<0.2		<0.2	<0.2		<0.2	<0.2	
Laboratory Work Order Number			L2561396		L2568228	L2568228		L2574718	L2574718		L2579726	L2579726		L2589443	L2589443		L2606393	L2606393		L2617671	L2617671		L2633133	L2633133		L2642120	L2642120		L2656849	L2656849		CG2106088-002	CG2106088-007	
Laboratory Identification Number			L2561396-2		L2568228-1	L2568228-2		L2574718-1	L2574718-4		L2579726-10	L2579726-9		L2589443-6	L2589443-5		L2606393-3	L2606393-10		L2617671-3	L2617671-4		L2633133-7	L2633133-8		L2642120-1	L2642120-5		L2656849-3	L2656849-4		CG2106088	CG2106088	

Notes:

RDL - Reportable detection limit

RPD - Relative percent difference calculated as (ABS[(difference betwe

Blank indicates RPD not calculated. RPD cannot be calculated if one o

RPD greater than 30%

Shaded gray only - exceeds BCAWQG-FSTM guideline.

Blank - not analyzed.

TETRA TECH

Table 6: In Situ Water Quality Sampling Along the River Road Ditch

Sample Site	Date	In-Situ Tests - 2021	
		Estimated Flow (L/sec)	Turbidity
LBRR-DD	23/Feb/21	0.080	clear
LBRR-LC	23/Feb/21	0.400	clear
	18/Mar/21	0.200	clear
LBRR-UC	08/Apr/21	0.15	clear
LBRR-12+500	23-Feb-21	0.15	clear
	18/Mar/21	0.50	turbid
	08/Apr/21	0.20	slightly turbid
	22/Jul/21	0.10	clear
	29/Aug/21	0.20	-
	21/Sep/21	0.01	clear (puddle)
LBRR-12+600	23/Feb/21	0.15	clear
	18/Mar/21	0.50	turbid
	08/Apr/21	0.20	slightly turbid
	19/May/21	0.08	clear
LBRR-12+700	23/Feb/21	0.10	clear
	18/Mar/21	0.30	turbid
	08/Apr/21	0.20	slightly turbid
	19/May/21	0.10	clear
LBRR-12+810	18/Mar/21	0.20	turbid
	08-Apr-21	0.20	slightly turbid
	19/May/21	0.10	clear
	26/Nov/21	0.10	clear
LBRR-12+920	18/Mar/21	0.20	turbid
	08/Apr/21	0.10	clear
	19-May-21	0.12	clear
	24/Jun/21	0.10	clear
	22/Jul/21	0.15	clear
	29/Aug/21	0.20	turbid
	21/Sep/21	0.08	clear
RR8	No Measurements		
RR9	17/Mar/21	0.40	highly turbid
	26/Nov/21	0.02	clear
LBRR-EDP	23/Feb/21	0.20	slight turbidity
	08/Apr/21	0.30	clear

Table 7: Summary of Water Quality Exceedances (BCAWQG-FST) Along River Road from Water Sampling Events in 2021

	Sampling Dates	Total Iron (Fe)	Total Arsenic (As)
LBRR-DD	23/Feb/21		
LBRR-12+500	23/Feb/21	✓	
	18/Mar/21	✓	✓
	08/Apr/21	✓	
	21/Jul/21		
LBRR-EDP	23/Feb/21	✓	
	08/Apr/21	✓	
RR9	17/Mar/21	✓	✓
	26/Nov/21		
LBRR-UC	08/Apr/21		
LBRR-LC	23/Feb/21		
	18/Mar/21		

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life water use and Short Term Maximum (FST) WQG. Exceedances denoted by a check mark.

Table 8: In Situ Water Quality Measurements Along the South Bank Initial Access Road

Sample Site	Date	Time	In-Situ Tests - 2021						
			pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/sec)	Turbidity
RBSBIAR-US	17/Mar/21	12:45	6.71	533	100	80	0.29	0.30	highly turbid
	18/May/21	12:11	7.81	1022	450	120	6.97	0.80	clear
	24/Jun/21	12:55	7.56	1043	450	180	11.74	0.30	clear
	21/Jul/21	12:50	7.24	1101	450	180	15.09	0.50	clear
	29/Aug/21	10:20	7.40	1036	450	240	15.47	0.30	clear
	21/Sep/21	12:30	7.20	1088	450	240	14.10	0.30	clear
	28/Oct/21	16:05	7.94	925	450	180	8.50	0.30	clear
	25/Nov/21	12:20	7.85	839	450	240	4.60	0.30	clear
RBSBIAR-DS	24/Feb/21	11:40	7.83	813	450	120	0.07	0.15	clear
	17/Mar/21	12:10	5.68	1203	450	0	0.43	0.50	highly turbid
	18/May/21	11:45	8.07	937	450	180	7.76	3.00	clear
	24/Jun/21	12:00	8.14	830	450	240	16.13	2.50	clear
	21/Jul/21	12:15	7.31	801	250	120	17.42	4.00	slightly turbid
	29/Aug/21	10:00	7.70	763	450	180	13.73	4.00	clear
	21/Sep/21	11:30	8.18	971	450	180	13.80	4.00	clear
	28/Oct/21	15:15	8.81	880	450	180	5.40	2.00	clear
	25/Nov/21	11:50	8.95	827	450	180	1.60	2.00	clear
RBSBIAR-EUS	17/Mar/21	13:20	7.47	372	100	80	0.78	0.20	highly turbid
	18/May/21	12:35	7.50	1418	800	180	8.05	0.80	clear
	24/Jun/21	13:35	7.54	894	450	240	15.47	0.25	clear
	21/Jul/21	14:55	7.28	966	250	180	16.84	0.20	clear
	29/Aug/21	10:50	7.38	949	450	240	14.83	0.25	clear
	21/Sep/21	13:10	7.21	1003	450	240	14.40	0.10	clear
	29/Oct/21	9:30	7.91	1001	450	180	7.20	0.20	clear
	25/Nov/21	12:59	7.89	918	450	180	4.30	0.15	clear
RBSBIAR-EDS	17/Mar/21	13:50	6.99	715	450	80	0.97	0.30	highly turbid
	18/May/21	12:56	7.86	1517	450	240	9.67	1.00	clear
	24/Jun/21	13:55	8.18	944	250	240	18.60	0.50	clear
	21/Jul/21	15:50	7.9	1301	450	240	20.10	0.25	clear
	29/Aug/21	11:18	8.32	1092	450	240	14.71	0.40	clear
	21/Sep/21	13:40	8.27	1091	450	180	13.70	0.40	clear
	29/Oct/21	10:00	8.97	1082	450	180	1.00	0.30	clear
	25/Nov/21	13:30	8.32	1030	450	180	0.50	0.40	clear
RBSC-DS	28/Jan/21	15:10	7.38	882	180	800	4.44	no flow	clear
	24/Feb/21	12:40	7.09	1092	450	180	5.26	stagnant	clear
	17/Mar/21	11:10	6.78	980	450	180	4.98	stagnant	clear
	22/Apr/21	16:23	7.48	712	450	180	8.05	stagnant	clear
	18/May/21	13:44	7.37	1069	450	240	9.53	stagnant	clear

Table 9: Summary of Water Quality Exceedances (BCAWQG-FST) RBSBIAR from Water Sampling Events in 2021

	Sampling Dates	Total Iron (Fe)	Dissolved Iron (Fe)	Dissolved Aluminum (Al)[3]	Total Arsenic (As)	Total Zinc (Zn)[2]	Total Cobalt (Co)	Dissolved Cadmium (Cd)[2]	Dissolved Copper (Cu)[1]	pH < 6.5
RBSBIAR-US (West ditch; upstream)	17/Mar/21	✓			✓	✓				
	18/May/21									
	24/Jun/21									
	21/Jul/21	✓								
	29/Aug/21									
	21/Sep/21									
	28/Oct/21									
	25/Nov/21									
RBSBIAR-DS (West ditch; downstream)	24/Feb/21									
	17/Mar/21	✓		✓	✓	✓	✓	✓	✓	✓
	22/Apr/21									
	18/May/21									
	24/Jun/21									
	21/Jul/21	✓		✓						
	29/Aug/21	✓		✓						
	21/Sep/21	✓								
	28/Oct/21									
	25/Nov/21									
RBSBIAR-EUS (East ditch; upstream)	17/Mar/21	✓			✓					
	22/Apr/21									
	18/May/21									
	24/Jun/21									
	21/Jul/21									
	29/Aug/21									
	21/Sep/21									
	29/Oct/21									
	25/Nov/21									
RBSBIAR-EDS (East ditch; downstream)	17/Mar/21	✓			✓	✓				
	22/Apr/21	✓								
	18/May/21									
	24/Jun/21									
	21/Jul/21			✓						
	29/Aug/21	✓		✓						
	21/Sep/21									
	29/Oct/21	✓								
	25/Nov/21									
RBSC-DS (side channel)	28/Jan/21									
	24/Feb/21		✓							
	17/Mar/21									
	22/Apr/21									
	18/May/21									

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life (F) water use and Short Term Maximum (ST) WQG. Exceedances denoted by a check mark.

[1]Copper-dissolved guideline is dependant on pH, hardness and Dissolved Organic Carbon

[2]Hardness-dependent parameters (Zn, Cd) use capped hardness values in guideline calculations.

[3]Calculated guideline is pH dependent for dissolved Aluminum.

Table 10: Minimum, Maximum and Mean Values for Measurements at Discharge and Downstream Locations in 2021

Discharge/Downstream Locations	Unit	RR9			LBRR-EDP			RBSBIAR-DS			RBSBIAR-EDS			L2-DS			LBRR-DD	LBL3C-0.02	LB EDS Armor	LB WDS Armor
		Two Sample Events			Two Sample Events			Nine Sample Events			Eight Sample Events			Eleven Sample Events			Single Sample Events			
		Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean				
Hardness as CaCO3	mg/L	188	539	364	669	959	814	255	670	353	279	503	382	6.65	166.00	53.62	734	345	1,200	647
pH	pH Units	7.83	7.88	7.86	7.85	8.17	8.01	4.85	8.25	7.71	7.88	8.33	8.03	8.36	10.30	9.15	7.18	7.84	7.78	7.92
Acidity (Total as CaCO3)	mg/L	2.30	3.00	2.65	3.7	11.9	7.8	<1.0	21.5	4.26	0.14	0.35	0.28	0.50	1.00	0.59	3.2	2.70	0.10	0.11
Alkalinity (Total as CaCO3)	mg/L	71.9	72.9	72.4	229	278	253.5	<2	261	193.1	500	6,000	3,133	110	381	255	23	130	2,300	1,500
Total Dissolved Solids (TDS)	mg/L	356	791	574	1,030	1,090	1,060	486	1,000	583	477	906	641	315	884	609	1,130	505	3,450	1,440
Total Suspended Solids (TSS)	mg/L	4.40	1,370	687	129	410	270	<1.0	7,120	810	3,300	1,560	216	1.50	573	77.93	5.4	628	717	41.7
Anions and Nutrients																				
Chloride (Cl-)	µg/L	16,300	100,000	58,150	215,000	269,000	242,000	24,200	59,000	40,133	26,600	250,000	73,478	28,600	124,000	64,773	92,700	39,200	5,200	6,200
Sulphate (SO4)	µg/L	21,000	190,000	105,500	248,000	287,000	267,500	108,000	672,000	215,000	74,500	280,000	153,133	69,200	216,000	132,991	615,000	206,000	2,470,000	942,000
Metals, Total																				
Aluminum	µg/L	230	9,820	5,025	1,960	3,070	2,515	38.9	34,200	3,998	32.4	13,900	2,020	389	6,940	2,050	140	7,380	15,700	1,130
Iron	µg/L	615	35,000	17,808	5,890	10,800	8,345	40	212,000	22,502	39	56,000	7,141	141	17,400	2,541	208	16,700	37,500	2,870
Arsenic	µg/L	0.55	12.1	6.33	2.21	4.83	3.52	0.19	92.4	10.1	0.3	22	3.2	1.3	10.7	5.3	0.34	8.1	21	1.9
Cadmium	µg/L	0.044	0.878	0.461	0.293	0.46	0.3765	0.0445	8.71	1.09	0.01	1.66	0.363	0.029	0.477	0.093	0.885	0.849	2.16	0.117
Cobalt	µg/L	0.41	12.3	6.355	6.17	9.4	7.785	0.53	125	15.97	0.82	28.8	8.95	0.15	8.05	1.42	11.9	16.1	17.7	1.40
Copper	µg/L	1.82	29.2	15.5	9.6	10.7	10.2	0.93	304	35.49	0.53	68.4	11.1	1.7	39.6	9.5	3.89	24.80	64.7	5.9
Zinc	µg/L	3.5	111	57.25	33.5	52.6	43.05	9.3	1,390	176.9	<3.0	281	75	4	303	64	47.9	103.0	422	<15
Metals, Dissolved																				
Aluminum	µg/L	11.00	34.2	22.6	19.6	22.3	20.95	31.4	4400	502.20	5.7	280	80.49	36.60	2640.00	758.60	40.2	62.3	122	12.5
Iron	µg/L	<10	<10	<10	5.00	12.00	8.50	<10	144	32.40	<10	<10	5.00	5.00	74.00	32.18	<10	28.0	150	<50
Arsenic	µg/L	0.22	0.25	0.235	0.5	0.65	0.575	0.16	2.24	0.50	0.130	0.6	0.34	0.87	7.59	3.95	0.3	0.34	1	0.61
Cadmium	µg/L	0.049	0.078	0.063	0.038	0.093	0.066	0.045	7.73	0.918	0.005	0.402	0.118	0.006	0.016	0.011	0.822	0.106	0.198	<0.025
Cobalt	µg/L	0.22	2.24	1.23	2.77	7.78	5.275	0.54	108	13.65	0.87	15.2	5.76	0.13	0.29	0.19	11.9	5.29	1.0	<0.5
Copper	µg/L	1.26	1.86	1.56	1.92	4.78	3.35	0.68	85.7	10.3	0.37	3.21	1.00	0.36	6.41	2.09	3.48	1.99	5.1	3.0
Zinc	µg/L	1.2	2.2	1.7	2.4	6.1	4.25	7.5	1,170	133.8	0.87	15.2	5.76	1.10	6.80	3.52	48.1	5.90	30	<5

*<Detection Limit values use half the value to calculate mean values.

Table 11: In Situ Water Quality Measurements Along L3 Creek

Sample Site	Date	Time	In-Situ Tests - 2021						
			pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/sec)	Turbidity
LBL3C-0.02 (Discharge)	22/Apr/21	14:20	7.80	672	450	80	2.12	12.00	turbid
LBL3C-1.43	28/Jan/21	13:52	7.47	1310	120	800	2.16	1.50	clear
	22/Apr/21	12:50	7.58	589	450	120	3.17	10.00	turbid
LBL3C-1.65	22/Apr/21	12:15	7.77	506	450	80	0.56	5.00	turbid
LBL3C-3.32	22/Apr/21	10:54	7.35	378	250	120	0.80	3.00	clear
LBL4C-0.18	22/Apr/21	11:35	7.67	602	450	120	0.07	3.00	turbid

Table 12: Summary of Water Quality Exceedances (BCAWQG-FST) L3/L4 Creek From Water Sampling Events in 2021

	Sampling Dates	Total Iron (Fe)	Total Arsenic (As)
LBL3C-0.02 (discharge)	22/Apr/21	✓	✓
LBL3C-1.43 (midstream)	28/Jan/21		
	22/Apr/21	✓	✓
LBL3C-1.65	22/Apr/21	✓	✓
LBL3C-3.32 (upstream)	22/Apr/21		
LBL4C-0.18	22/Apr/21	✓	

[1] British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life water use and Short Term Maximum (FST) WQG. Exceedances denoted by a check mark.

Note: L3 and L4 Creek are not considered a construction-related PAG management facility and are not monitored under requirement of the CEMP.

Table 13: In Situ Water Quality Sampling - Left Bank Debris Boom

Sample Site	Date	Time	In-Situ Tests - 2021								Notes
			pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/min)	Turbidity		
LBP Pond	23/Apr/21	-	7.02	2448	450	120	7.35	6	-		
	19/May/21	12:44	7.07	2604	800	180	14.5	stagnant	-		
	24/Jun/21	11:05	7.14	3936	800	180	23.41	stagnant	clear		
	21/Jul/21	10:30	6.48	3049	250	80	16.76	0.50	-		
	29/Aug/21	14:05	7.30	2925	800	240	17.97	stagnant	clear		
	22/Sep/21	10:50	7.14	4030	800	240	12.1	stagnant	slightly turbid		
	28/Oct/21	12:00	6.96	4650	800	240	2.1	stagnant	slightly turbid		
LB-WDS Armor Ditch	21/Jul/21	9:42	7.91	1719	800	120	16.21	1-2	-		Armor Ditch, west downstream; sampled in previously excavated 'sump'
LB-EDS Armor Ditch	20/Jul/21	14:20	8.08	3967	800	120	16.52	5-7	no flow thru CSP. inlet		Armor Ditch, east downstream; culvert outlet flow E.Ditch to culvert outlet.
LBDB-WUS	not sampled	-	-	-	-	-	-	-	-		Armor Ditch, west upstream
LBDB-EUS	not sampled	-	-	-	-	-	-	-	-		Armor Ditch, east downstream
LBDB-LD-US	not sampled	-	-	-	-	-	-	-	-		Laydown drainage, upstream
LBDB-LD-MS	not sampled	-	-	-	-	-	-	-	-		Laydown drainage, midstream
LBDB-LD-DS	not sampled	-	-	-	-	-	-	-	-		Laydown drainage, downstream

TETRA TECH

Table 14: Summary of Water Quality Exceedances (BCAWQG-FST) at the Left Bank Debris Boom From Water Sampling Events in 2021

	Sampling Dates	Total Iron (Fe)	Dissolved Iron (Fe)	Dissolved Aluminum (Al)[1]	Total Arsenic (As)	Total Manganese (Mn)[2]	Total Zinc (Zn)[2]
LBP Pond	23/Apr/21	✓				✓	✓
	19/May/21					✓	✓
	24/Jun/21	✓	✓				
	21/Jul/21	✓	✓	✓			
	29/Aug/21						
	22/Sep/21	✓					
	28/Oct/21	✓				✓	
LBDB-EDS Armor Ditch	20/Jul/21	✓		✓	✓		✓
LBDB-WDS Armor Ditch	21/Jul/21	✓					

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life water use and Short Term Maximum (FST) WQG. Exceedances denoted by a check mark.

[1]Calculated guideline is pH dependent for dissolved Aluminum.

[2]Hardness-dependent parameters (Mn, Zn) use capped hardness values in guideline calculations.

Table 15: In Situ Water Quality Sampling - L2 Powerhouse

Sample Site	Date	Time	In-Situ Tests - 2021							Notes
			pH	EC (µS/cm)	Hardness (ppm)	Alkalinity (ppm)	Water Temp (°C)	Estimated Flow (L/s), unless otherwise noted	Turbidity	
L2 DS	28/Jan/21	12:20	8.22	403	250	180	0.89	0.5	clear	
	24/Feb/21	13:00	10.75	818	100	180	5.32	.5-1.0 L/min	clear	
	18/Mar/21	12:45	9.40	1025	100	240	3.71	3-5 gal/min	-	
	23/Apr/21	9:25	9.06	596	100	120	4.26	0.50	clear	
	18/May/21	14:35	9.48	848	100	240	9.59	2.50	slightly turbid	
	24/Jun/21	10:00	9.16	1320	0-100	240	14.98	0.25	clear	
	21/Jul/21	13:41	9.33	784	100	180	13.71	1.50	turbid	
	29/Aug/21	12:35	9.66	616	100	120	15.22	0.20	clear	
	22/Sep/21	14:40	9.28	1090	100	240	10.7	0.20	clear	
	28/Oct/21	13:50	10.52	1615	100	240	9.3	no estimate - flow not consistent	clear	
	25/Nov/21	14:25	11.26	1613	0-100	240	1.9	2.00	clear	
L2 US	23/Apr/21	9:53	7.88	661.00	250.00	180.00	4.93	stagnant	clear	
	18/May/21	15:05	8.38	752	450	180	12.1	stagnant	slightly turbid	
	24/Jun/21	10:20	7.72	719	250	180	19.4	stagnant	clear	
	21/Jul/21	14:05	7.61	883	250	240	19.6	stagnant	turbid	
	29/Aug/21	13:10	8.05	973	450	240	17.2	stagnant	slightly turbid	
	22/Sep/21	15:10	8.40	770	250	180	13.3	0.05	slightly turbid	
	28/Oct/21	14:15	9.20	881	450	240	3.4	<0.05	clear	
	25/Nov/21	14:50	8.12	716	250	240	8.9	0.10	clear	

Table 16: Summary of Water Quality Exceedances (BCAWQG-FST) at the L2 Powerhouse Area From Water Sampling Events in 2021

	Sampling Dates	Total Iron (Fe)	Dissolved Aluminum (Al)[1]	Total Silver (Ag)	Total Zinc (Zn)[2]	Ammonia (NH4 as N)[3]	Total Arsenic (As)	pH > 9.0
L2 DS	28/Jan/21							
	25/Feb/21		✓			✓	✓	✓
	18/Mar/21	✓	✓	✓				
	23/Apr/21		✓					
	18/May/21	✓	✓	✓	✓		✓	
	24/Jun/21		✓					✓
	21/Jul/21	✓	✓	✓	✓		✓	
	29/Aug/21		✓					
	22/Sep/21		✓					
	28/Oct/21	✓	✓	✓	✓		✓	✓
	25/Nov/21		✓			✓	✓	✓
L2 US	23/Apr/21							
	18/May/21	✓						
	24/Jun/21							
	21/Jul/21	✓						
	29/Aug/21							
	22/Sep/21	✓						
	25/Nov/21							

British Columbia Ministry of Environment, Water Protection & Sustainability Branch. 2019. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. Referenced Guidelines are for Freshwater Aquatic Life (F) water use and Short Term Maximum (ST) WQG. Exceedances denoted by a check mark.

[1]Calculated guideline is pH dependent for dissolved Aluminum.

[2]Hardness-dependent parameters (Zn) use capped hardness values in guideline calculations.

[3]Ammonia guideline is based on temperatrue and pH

PHOTOGRAPHS

Photo 1: River Road LBRR-UC location, July 22, 2021.

Photo 2: River Road LBRR-LC location, July 22, 2021.

Photo 3: River Road LBRR-12+920 location, July 22, 2021.

Photo 4: River Road LBRR-12+810 location, July 22, 2021.

Photo 5: River Road LBRR-12+700 location, July 22, 2021.

Photo 6: River Road LBRR-12+600 location, July 22, 2021.

Photo 7: River Road LBRR-12+500 location, July 22, 2021.

Photo 8: River Road LBRR-450 location, sampled as proxy for LBRR-12+500, July 22, 2021.

Photo 9: River Road LBRR-DD culvert location, July 22, 2021.

Photo 10: River Road LBRR-DD, culvert location looking towards Peace River, July 22, 2021.

Photo 11: River Road RR9 location, July 22, 2021.

Photo 12: River Road RR8 location, July 22, 2021.

Photo 13: RBSBIAR-US upstream west ditch, July 21, 2021.

Photo 14: RBSBIAR-DS downstream west ditch, July 21, 2021.

Photo 15: RBSBIAR-EUS upstream east ditch, July 21, 2021.

Photo 16: RBSBIAR-EDS downstream east ditch, July 21, 2021.

Photo 17: LBP-Pond location viewing upstream, July 21, 2021.

Photo 18: LBP-Pond location and viewing downstream, July 21, 2021.

Photo 19: LBP-Pond location showing sheen on surface, July 21, 2021.

Photo 20: LBLD-US Laydown drainage through pond location, July 20, 2021.

Photo 21: LBLD-DS Laydown drainage through pond location, July 20, 2021.

Photo 22: LB WUS Armor Ditch location, July 21, 2021.

Photo 23: LB WDS Armor Ditch looking downstream, July 20, 2021.

.

Photo 24: LB WDS Armor Ditch sample location, July 20, 2021.

.

Photo 25: LB EUS Armor Ditch upstream location, April 23, 2021.

Photo 26: LB EDS Armor Ditch downstream location, July 20, 2021.

Photo 27: LB Side Channel East and West locations, April 23, 2021.

Photo 28: L2-US location at L2 Powerhouse, June 13, 2021.

Photo 29: L2-US location at L2 Powerhouse, June 24, 2021.

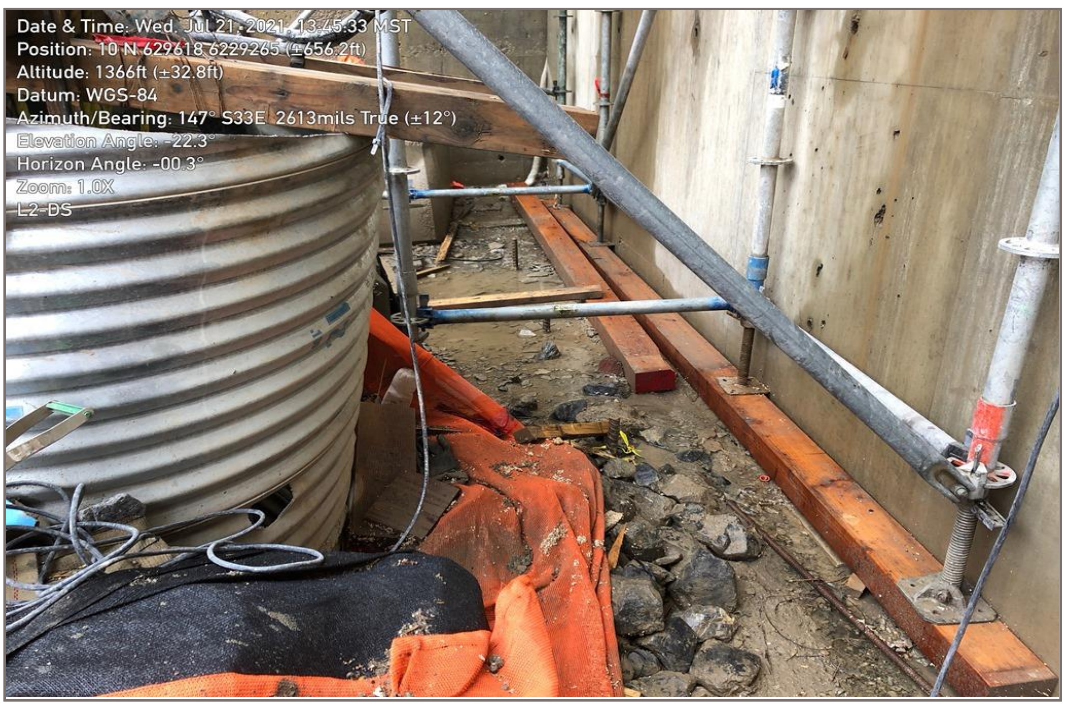


Photo 30: L2-DS location at L2 Powerhouse, June 21, 2021.

Photo 31: L2-DS location at L2 Powerhouse, June 21, 2021.

Photo 32: L2-DS location at L2 Powerhouse, June 21, 2021.

Photo 33: LBL3C-3.32 upstream location in L3 Creek, April 22, 2021.

Photo 34: LBL3C-1.65 midstream location at L3 Creek, April 22, 2021.

Photo 35: LBL3C-1.65 midstream location at L3 Creek viewing upstream, April 22, 2021.

Photo 36: LBL3C-1.43 midstream location at L3 Creek, April 22, 2021.

Photo 37: LBL3C-0.02 discharge location in L3 Creek, April 22, 2021.

Photo 38: LBL3C-0.02 discharge location in L3 Creek looking upstream, April 22, 2021.

APPENDIX A

TETRA TECH'S LIMITATIONS ON THE USE OF THIS DOCUMENT

LIMITATIONS ON USE OF THIS DOCUMENT

GEOENVIRONMENTAL

1.1 USE OF DOCUMENT AND OWNERSHIP

This document pertains to a specific site, a specific development, and a specific scope of work. The document may include plans, drawings, profiles and other supporting documents that collectively constitute the document (the "Professional Document").

The Professional Document is intended for the sole use of TETRA TECH's Client (the "Client") as specifically identified in the TETRA TECH Services Agreement or other Contractual Agreement entered into with the Client (either of which is termed the "Contract" herein). TETRA TECH does not accept any responsibility for the accuracy of any of the data, analyses, recommendations or other contents of the Professional Document when it is used or relied upon by any party other than the Client, unless authorized in writing by TETRA TECH.

Any unauthorized use of the Professional Document is at the sole risk of the user. TETRA TECH accepts no responsibility whatsoever for any loss or damage where such loss or damage is alleged to be or, is in fact, caused by the unauthorized use of the Professional Document.

Where TETRA TECH has expressly authorized the use of the Professional Document by a third party (an "Authorized Party"), consideration for such authorization is the Authorized Party's acceptance of these Limitations on Use of this Document as well as any limitations on liability contained in the Contract with the Client (all of which is collectively termed the "Limitations on Liability"). The Authorized Party should carefully review both these Limitations on Use of this Document and the Contract prior to making any use of the Professional Document. Any use made of the Professional Document by an Authorized Party constitutes the Authorized Party's express acceptance of, and agreement to, the Limitations on Liability.

The Professional Document and any other form or type of data or documents generated by TETRA TECH during the performance of the work are TETRA TECH's professional work product and shall remain the copyright property of TETRA TECH.

The Professional Document is subject to copyright and shall not be reproduced either wholly or in part without the prior, written permission of TETRA TECH. Additional copies of the Document, if required, may be obtained upon request.

1.2 ALTERNATIVE DOCUMENT FORMAT

Where TETRA TECH submits electronic file and/or hard copy versions of the Professional Document or any drawings or other project-related documents and deliverables (collectively termed TETRA TECH's "Instruments of Professional Service"), only the signed and/or sealed versions shall be considered final. The original signed and/or sealed electronic file and/or hard copy version archived by TETRA TECH shall be deemed to be the original. TETRA TECH will archive a protected digital copy of the original signed and/or sealed version for a period of 10 years.

Both electronic file and/or hard copy versions of TETRA TECH's Instruments of Professional Service shall not, under any circumstances, be altered by any party except TETRA TECH. TETRA TECH's Instruments of Professional Service will be used only and exactly as submitted by TETRA TECH.

Electronic files submitted by TETRA TECH have been prepared and submitted using specific software and hardware systems. TETRA TECH makes no representation about the compatibility of these files with the Client's current or future software and hardware systems.

1.3 STANDARD OF CARE

Services performed by TETRA TECH for the Professional Document have been conducted in accordance with the Contract, in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions in the jurisdiction in which the services are provided. Professional judgment has been applied in developing the conclusions and/or recommendations provided in this Professional Document. No warranty or guarantee, express or implied, is made concerning the test results, comments, recommendations, or any other portion of the Professional Document.

If any error or omission is detected by the Client or an Authorized Party, the error or omission must be immediately brought to the attention of TETRA TECH.

1.4 DISCLOSURE OF INFORMATION BY CLIENT

The Client acknowledges that it has fully cooperated with TETRA TECH with respect to the provision of all available information on the past, present, and proposed conditions on the site, including historical information respecting the use of the site. The Client further acknowledges that in order for TETRA TECH to properly provide the services contracted for in the Contract, TETRA TECH has relied upon the Client with respect to both the full disclosure and accuracy of any such information.

1.5 INFORMATION PROVIDED TO TETRA TECH BY OTHERS

During the performance of the work and the preparation of this Professional Document, TETRA TECH may have relied on information provided by third parties other than the Client.

While TETRA TECH endeavours to verify the accuracy of such information, TETRA TECH accepts no responsibility for the accuracy or the reliability of such information even where inaccurate or unreliable information impacts any recommendations, design or other deliverables and causes the Client or an Authorized Party loss or damage.

1.6 GENERAL LIMITATIONS OF DOCUMENT

This Professional Document is based solely on the conditions presented and the data available to TETRA TECH at the time the data were collected in the field or gathered from available databases.

The Client, and any Authorized Party, acknowledges that the Professional Document is based on limited data and that the conclusions, opinions, and recommendations contained in the Professional Document are the result of the application of professional judgment to such limited data.

The Professional Document is not applicable to any other sites, nor should it be relied upon for types of development other than those to which it refers. Any variation from the site conditions present, or variation in assumed conditions which might form the basis of design or recommendations as outlined in this report, at or on the development proposed as of the date of the Professional Document requires a supplementary exploration, investigation, and assessment.

TETRA TECH is neither qualified to, nor is it making, any recommendations with respect to the purchase, sale, investment or development of the property, the decisions on which are the sole responsibility of the Client.

1.7 NOTIFICATION OF AUTHORITIES

In certain instances, the discovery of hazardous substances or conditions and materials may require that regulatory agencies and other persons be informed and the client agrees that notification to such bodies or persons as required may be done by TETRA TECH in its reasonably exercised discretion.

APPENDIX B

SURFACE WATER ANALYTICAL LABORATORY RESULT TABLES

B1 – 2021 Surface Water Laboratory Analytical Results from River Road Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B2 – 2021 Surface Water Laboratory Analytical Results from SBIAR Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B3 – 2021 Surface Water Laboratory Analytical Results from L3 Creek Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B4 – 2021 Surface Water Laboratory Analytical Results from Left Bank Debris Boom Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

B5 – 2021 Surface Water Laboratory Analytical Results from L2 Powerhouse Monitoring Locations Evaluated against the BCAWQG-FST Guidelines

Appendix B1: LBRR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBRR-DD	LBRR-LC	LBRR-LC	LBRR-12+500	LBRR-12+500	LBRR-12+500	LBRR-12+500	LBRR-EDP	LBRR-EDP	LBRR-UC	RR9	RR9
					23-Feb-21	23-Feb-21	18-Mar-21	23-Feb-21	18-Mar-21	8-Apr-21	22-Jul-21	23-Feb-21	8-Apr-21	8-Apr-21	17-Mar-21	26-Nov-21
Physical Parameters																
Temperature (°C)	°C															
Flow Rate (L/sec)	L/s															
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	3200	3100	3400	3000	1600	8300	6500	3700	11900	8200	2300	3000
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	23	11.8	50.7	54.7	103	242	189	229	278	307	71.9	72.9
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	1360	1230	1020	954	828	1310	2060	1450	1710	1290	1100	500
Hardness as CaCO3, dissolved	µg/L	500	NG (Acceptable ranges exist when calculating exceedances for Cd, Cu, Pb, Mn, Zn)	NG (Acceptable ranges exist when calculating exceedances for Cd, Cu, Pb, Mn, Zn)	734000	637000	543000	460000	438000	654000	1120000	669000	959000	662000	539000	188000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L	500														
pH	pH Units	0.10	6.5 - 9	6.5-9.0	7.18	6.99	7.29	7.71	7.72	7.94	7.92	8.17	7.85	8.04	7.83	7.88
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	1130000	1010000	838000	709000	590000	782000	1750000	1030000	1090000	768000	791000	356000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	5400	12100	26600	239000	917000	323000	109000	129000	410000	64700	1370000	4400
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<5000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<5000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	23000	11800	103000	54700	50700	242000	231000	229000	278000	307000	87700	72900
Anions and Nutrients (Matrix: Water)																
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	570	620	170	399	157	122	<50	356	172	<50	459	202
Ammonia FST Guideline	µg/L		pH dependent (at Temp 4 °C or in situ T)		18.8	21900	17100	10300	10300	7420	7.42	3950	7420	6220	8770	7420
Ammonia FLT Guideline	µg/L			pH dependent (at Temp 4 °C or in situ T)	1970	1970	1970	1980	1980	1430	1430	759	1430	1200	1690	1430
Chloride (Cl^-)	µg/L	500	600,000	150,000	92700	81600	76000	77900	93800	190000	162000	215000	269000	197000	16300	100000
Nitrate (NO_3^- as N)	µg/L	5.0-100	NG	NG	647	542	268	512	300	270	711	884	351	<25	11.6	299
Nitrite (NO_2^- as N)	µg/L	1.0-20	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	20.9	11.8	16.5	12.1	10.3	11.7	5.2	18.5	10.9	<5	2	22.7
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	615000	560000	441000	331000	248000	206000	890000	248000	287000	118000	190000	21000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	429000	429000	429000	429000	429000	429000	429000	429000	429000	429000	429000	429000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	7.7	6.9	4.8	7.8	8.8	5.7	9.0	10.1	7.6	5.1	6.78	6.5
Metals, Total																
Aluminum	µg/L	3.00	NG	NG	140	139	270	2070	7120	2200	258	1960	3070	167	9820	230
Antimony	µg/L	0.1-0.2	NG	NG	0.13	<0.1	0.14	0.35	0.7	0.41	0.28	0.51	0.56	0.16	1.01	0.26
Arsenic	µg/L	0.10	5.0	5.0	0.34	0.4	0.85	2.47	**7.94**	3.43	0.86	2.21	4.83	1.23	**12.1**	0.55
Barium	µg/L	0.10	NG	NG	45.9	33.6	30.2	164	345	166	58.1	205	241	113	568	134
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	0.13	0.59	0.14	<0.1	0.13	0.19	<0.1	0.55	<0.1
Bismuth	µg/L	0.05-0.10	NG	NG	<0.05	<0.05	<0.05	<0.05	0.074	<0.05	<0.05	<0.05	<0.05	<0.05	0.25	<0.05
Boron	µg/L	10.0	1200	1200	37	36	30	29	33	49	123	62	68	36	69	18
Cadmium	µg/L	0.005	NG	NG	0.885	1	0.239	0.786	1.05	0.309	0.334	0.293	0.46	0.0272	0.878	0.044
Calcium	µg/L	50	NG	NG	232000	206000	151000	150000	152000	205000	339000	203000	291000	189000	215000	56300
Cesium	µg/L	0.01		NG	0.025	0.045	0.081	0.214	0.692	0.305	0.048	0.192	0.431	0.057	1.17	0.04
Chromium [4]	µg/L	0.1-0.7	NG	NG	0.18	<0.1	0.4	5.75	20.3	6.45	1.02	5.16	8.52	0.39	28.2	1.11
Cobalt	µg/L	0.10	110	4.0	11.9	10.8	2.31	20.5	17.9	4.22	1.85	9.4	6.17	1.82	12.3	0.41
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	3.89	3.99	4.33	8.56	24.3	7.83	2.79	9.61	10.7	0.81	29.2	1.82
Cu STM Guideline Calc.	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness > 400,000 is Capped Value of 400,000		39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	19.672
Cu LTA Guideline Calc.	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10	10.0	10.0	10	10	10	10	10	10	10	10	10	7.52
Iron	µg/L	10	1000	NG	208	269	918	**6430**	**23200**	**7980**	867	**5890**	**10800**	810	**35000**	615
Lead [3]	µg/L	0.05-0.1	Calc. based on Hardness	Calc. based on Hardness	0.094	0.145	0.42	1.93	7.06	2.52	0.366	1.78	3.34	0.386	12.9	0.301
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Hardness ≤ 8000 is 3; Hardness 8000-360,000: calc. Hardness>360,000 is Capped Value of 360,000		417	417	417	417	417	417	417	417	417	417	417	182
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Hardness 8000-360,000: calc. Hardness > 360,000 is Capped Value of 360,000	20	20	20	20	20	20	20	20	20	20	20	10
Lithium	µg/L	1.0	NG	NG	31.2	25.1	12	42.6	39.1	26.2	50.2	31.4	35.4	20.5	37.1	7.5
Magnesium	µg/L	5.0	NG	NG	49000	42700	39500	34500	38300	52100	76200	56300	76800	52300	40900	7260
Manganese [3]	µg/L	0.10	Calc. based on hardness	Calc. based on Hardness	433	384	127	496	743	293	142	274	386	160	911	89.5
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Hardness 25,000 - 259,000 : calc.; Hardness > 259,000 is Capped Value of 259,000		3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.0	3394	2612
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Hardness 37,000 - 450,000: calc.; Hardness > 450,000 is Capped Value of 450,000	2585.0	2585.0	2585.0	2585.0	2532.2	2585.0	2585.0	2585.0	2585.0	2427.0	2585	1432
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	1.65	1.45	2.45	2.09	4.08	3.37	2.94	4.57	5.09	3.11	5.27	2.3
Nickel	µg/L	0.5	NG		43.4	38.6	12.3	81.5	65.7	15.6	26.4	41	26.9	3.12	48.1	2.26
Phosphorus	µg/L	50-100	NG	NG	77	<50	122	566	1080	457	<80	343	486	63	1200	108
Potassium	µg/L	50.0	NG	NG	13700	13000	10300	7690	5870	6990	9570	12500	9940	6160	13200	6000
Rubidium	µg/L	0.2	NG	NG	3.44	3.71	2.76	4.15	9.22	4.33	3.06	4.79	6.04	1.51	17	1.73
Selenium	µg/L	0.05	NG	2.0	2.23	2.04	2.68	0.941	1.41	0.728	2.42	1.04	1.15	0.264	1.26	0.274
Silicon	µg/L	100		NG	2820	2840	2220	5060	10000	7520	5200	7130	10400	5660	17100	1370
Silver [3]	µg/L	0.01-0.02	0.10 - 3.0	0.05 - 1.5	<0.01	<0.01	0.023	0.032	0.12	0.057	<0.01	0.033	0.08	0.013	0.228	<0.01
Ag FST Guideline Calc			Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3
Ag FLT Guideline Calc				Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	25100	22400	16400	21200	25700	50200	39300	56100	73500	43300	35500	19900
Strontium	µg/L	0.2	NG	NG	433	346	314	469	621	920	1400	851	1350	550	1830	711
Sulfur	µg/L	500	NG	NG	218000	194000	166000	112000	94200	87200	273000	87400	137000	52500	89700	8410
Tellerium	µg/L	0.2-0.4	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	0.23	0.38	<0.2	0.35	<0.2	1	<0.2
Thallium	µg/L	0.01-0.055	NG	NG	0.017	0.02	0.028	0.051	0.149	0.063	0.037	0.053	0.093	0.023	0.272	0.016
Thorium	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	0.11	0.64	3.29	0.98	0.14	0.62	1.27	0.11	3.75	<0.1

TETRA TECH

Appendix B1: LBRR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBRR-DD	LBRR-LC	LBRR-LC	LBRR-12+500	LBRR-12+500	LBRR-12+500	LBRR-12+500	LBRR-EDP	LBRR-EDP	LBRR-UC	RR9	RR9
					23-Feb-21	23-Feb-21	18-Mar-21	23-Feb-21	18-Mar-21	8-Apr-21	22-Jul-21	23-Feb-21	8-Apr-21	8-Apr-21	17-Mar-21	26-Nov-21
Tin	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	0.13	0.26	0.17	<0.1	0.12	0.18	<0.1	0.5	<0.1
Titanium	µg/L	0.3-1.2	NG	NG	2.03	0.81	2.74	55.4	139	60.3	5.92	52.6	79.8	4.64	185	5.32
Tungsten	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	0.14	<0.1	0.21	<0.1	<0.1	0.13	0.15	<0.1	0.5	<0.1
Uranium	µg/L	0.01	NG	NG	0.69	0.387	1.85	1.48	4.28	4.66	4.8	4.13	6.36	5.67	2.7	0.399
Vanadium	µg/L	0.5-1.0	NG	NG	<0.5	<0.5	0.92	6.94	20.9	8.39	1.38	6.86	11	1.35	35.6	1.24
Zinc [3]	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	47.9	56.4	14.4	64.8	132	35	20.7	33.5	52.6	3.2	111	3.5
Zn FST Guideline Calc.	µg/L		Hardness < 90,000 = 33.0 Hardness 90,000 - 500,000, Calc. Hardness > 500,000, Capped Value		340.5	340.5	340.5	310.5	294.0	340.5	340.5	340.5	340.5	276.0	340.5	106.5
Zn FLT Guideline Calc.	µg/L			Hardness < 90,000 = 7.5 Hardness 90,000 - 330,000, Calc. Hardness > 330,000, Capped Value	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	81
Zirconium	µg/L	0.06-0.12	NG	NG	<0.2	<0.2	<0.2	1.1	0.55	0.36	<0.2	0.61	0.5	<0.2	1	<0.2
Metals, Dissolved																
Aluminum [5]	µg/L	1.0	100	50	40.2	42.5	23	39.4	70.1	17.9	17.7	22.3	19.6	1.1	34.2	11
Al FST Guideline Calc (based on pH)	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50	50	50	50	50	50	50
Antimony	µg/L	0.1-0.2	NG	NG	0.11	<0.1	0.12	0.12	0.14	0.17	0.5	0.26	0.22	0.12	0.21	0.19
Arsenic	µg/L	0.10	NG	NG	0.3	0.28	0.35	0.36	0.16	0.48	0.5	0.5	0.65	0.84	0.22	0.25
Barium	µg/L	0.10	NG	NG	43.4	29.7	14.4	67.3	43.4	56.2	53.3	116	75.5	96.2	74.9	136
Beryllium	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05-0.1	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.25	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	34	34	27	26	28	44	126	55	61	32	56	19
Cadmium [3]	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.822	0.896	0.183	0.503	0.21	0.0252	0.273	0.0932	0.038	0.0111	0.0778	0.0491
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.80	2.80	2.80	2.80	2.69	2.80	2.80	2.80	2.80	2.54	2.80	1.13
Cd FLT Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.46	0.34
Calcium	µg/L	50.0	NG	NG	221000	189000	154000	134000	124000	181000	332000	185000	262000	179000	166000	61800
Cesium	µg/L	0.01	NG	NG	0.018	0.024	0.012	<0.01	<0.01	<0.01	0.05	<0.01	0.014	<0.01	<0.01	<0.01
Chromium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	0.13	0.11	<0.1	0.5	0.23	<0.1	<0.1	0.45	0.53
Cobalt	µg/L	0.10	NG	NG	11.9	10.7	1.77	18.7	10.3	1.8	1.43	7.78	2.77	1.64	2.24	0.22
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	3.48	3.62	3.12	3.16	2.33	1.2	1.9	4.78	1.92	0.36	1.86	1.26
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		14	9.5	18.2	29	19.1	32.3	41.1	72.4	42.9	31.2	32.6	29.7
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	2.4	1.6	3.10	5.1	3.4	5.0	189	14.4	5.6	5.7	6.0	5.3
Iron	µg/L	10.0-20.0	350	NG	<10	5	17	57	5	5	50	12	5	77	5	<10
Lead	µg/L	0.05-0.1	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.25	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	µg/L	1.0	NG	NG	29.9	24.2	11.9	40.3	36.4	25.7	49.9	28.9	35.7	21.4	34.7	7.2
Magnesium	µg/L	5.0	NG	NG	44200	39800	38400	30100	31100	48900	71200	50100	73900	52400	30000	8120
Manganese	µg/L	0.10	NG	NG	426	370	110	361	258	115	118	144	158	150	224	82.3
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	1.59	1.34	2.32	1.4	2.54	2.82	3.55	3.9	3.99	2.5	3.49	2.43
Nickel	µg/L	0.50	NG	NG	43	37.9	10.2	74	42.2	7.4	24	33.8	14.7	2.52	13.9	1.43
Phosphorus	µg/L	50.0-100.0	NG	NG	<50	<50	<50	179	<50	<50	<250	102	<50	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	12500	12700	9910	7440	4650	7330	8590	11000	10600	6740	11900	6470
Rubidium	µg/L	0.20	NG	NG	3.27	3.31	1.85	1.78	1.29	1.57	2.6	2.44	2.2	0.84	2.82	1.54
Selenium	µg/L	0.05	NG	2.0	2.26	2.12	2.67	0.889	1.17	0.592	2.02	1.16	1.08	0.254	0.82	0.209
Silicon	µg/L	50.0	NG	NG	2590	2720	1930	1970	2050	4050	3990	4080	5310	4960	1810	1030
Silver	µg/L	0.01-0.02	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	NG	NG	25100	22500	16500	20900	26300	47300	37000	54700	67900	40200	33000	21800
Strontium	µg/L	0.20	NG	NG	403	320	305	402	550	844	1320	751	1230	516	1570	712
Sulfur	µg/L	500	NG	NG	230000	203000	154000	120000	97900	78300	287000	92900	122000	46900	89100	7570
Tellerium	µg/L	0.2-0.4	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	0.017	0.014	<0.01	0.014	<0.01	0.012	0.05	0.021	0.017	<0.01	0.021	0.014
Thorium	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.3-0.6	NG	NG	<0.3	<0.3	<0.3	0.8	<0.3	<0.3	1.5	0.31	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	0.1-0.2	NG	NG	<0.1	<0.1	0.15	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	0.644	0.361	1.67	1.05	2.71	3.68	4.63	3.81	5.03	4.69	1.59	0.387
Vanadium	µg/L	0.5-1.0	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	1.00	NG	NG	48.1	56.3	7.4	27.3	9.4	1.7	14	6.1	2.4	1.5	2.2	1.2
Zirconium	µg/L	0.06-0.12	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<0.2	<0.2	<0.2	<0.2	<0.2
Laboratory Work Order Number					L2560607	L2560607	L2568765	L2560607	L2568765	L2574718	L2617671	L2560607	L2574718	L2574718	L2568228	L2666805
Laboratory Identification Number					L2560607-2	L2560607-3	L2568765-2	L2560607-4	L2568765-3	L2574718-3	L2617671-6	L2560607-1	L2574718-1	L2574718-2	L2568228-7	L2666805-3

Notes:

Screening completed on BCAWQG-FST [1] and FLT [2] guideline values.

[1] BC Ministry of Environment, Water Protection & Sustainability Branch (2019). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (F) water use and Short Term Maximum (ST) guidelines.

[2] BC Ministry of Environment, Water Protection & Sustainability Branch (2018). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (F) water use and Long Term Average (LT) guidelines.

[3] Guideline is hardness dependant. Where results are above laboratory reportable detection limits, guideline limits have been evaluated based on individual sample hardness. Sample-specific guideline values are listed in parentheses after the laboratory result, where applicable.

[4] Guideline is for Chromium (IV) cation. Analytical results are for unspeciated Chromium. Where analytical results exceed the guideline, speciated analysis may be warranted.

[5] Guideline is pH dependant.

NG - No Guideline

Detection limit can vary as described in the COA. Detection limit can be raised when dilution is required due to high Dissolved Solids/Electrical Conductivity (DLDS), e.g. nitrite.

BOLD and shaded dark gray: Exceeds BCAWQG-FST (Freshwater Short Term) guideline.

Shaded Light Gray: Exceeds BCAWQG-FLT (Freshwater Long Term) guideline.

RED - Measured value is below detection limit (DL); value shown is 50% of DL

Blank - Not analyzed

TETRA TECH

Appendix B2: SBIAR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSC-DS
					24-Feb-21	17-Mar-21	22-Apr-21	18-May-21	24-Jun-21	21-Jul-21	29-Aug-21	21-Sep-21	28-Oct-21	25-Nov-21	17-Mar-21	18-May-21	24-Jun-21	21-Jul-21	29-Aug-21	21-Sep-21	28-Oct-21	25-Nov-21	28-Jan-21
Physical Parameters																							
Temperature	°C																						
Flow Rate	L/sec																						
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	500	21500	3600	1000	2900	-	500	1900	2200	<2000	2000	2500	6000	-	5100	5600	3200	4500	15400
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	261	1	250	214	209	120	170	239	223	244	74.8	197	216	180	201	238	241	250	375
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	755	1230	920	925	812	801	709	833	738	740	533	1010	1050	1101	970	954	794	759	1190
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	293000	670000	255000	355000	314000	286000	323000	388000	326000	320000	126000	502000	476000	438000	431000	415000	368000	342000	623000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L													315000								328000	
pH	pH Units	0.10	6.5 - 9	6.5-9.0	8.11	**4.85**	8.17	8.10	7.86	7.31	8.18	8.14	8.15	8.25	7.87	7.95	7.81	7.24	7.99	8.02	8.11	7.88	7.64
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	495000	1000000	585000	556000	535000	-	496000	591000	486000	500000	454000	698000	673000	-	655000	613000	524000	499000	877000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	33300	7120000	38700	1600	500	-	19200	62800	1200	10100	415000	500	500	-	500	500	500	<3000	8600
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<5000	<1000	<1000	<1000	-	<1000	<1000	<1000	<1000	<5000	<1000	<1000	-	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<5000	<1000	<1000	<1000	-	<1000	<1000	<1000	<1000	<5000	<1000	<1000	-	<1000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	261000	<5000	250000	214000	209000	-	170000	239000	223000	244000	91300	197000	216000	-	201000	238000	241000	250000	375000
Anions and Nutrients																							
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	283	560	273	279	227	560	135	132	458	140	1280	25	25	276	25	25	98	2.5	25
Ammonia FST Guideline	µg/L		pH dependent (at Temp 4 ˚C or in situ T)		4950	27200	3950	4950	7420	17100	3950	4950	3950	3150	7420	6220	8770	18800	6220	6220	4950	7420	11900
Ammonia FLT Guideline				pH dependent (at Temp 4 ˚C or in situ T)	952	1970	759	952	1430	1970	759	952	759	606	1430	1200	1690	1970	1200	1200	952	1430	1970
Chloride (Cl^-)	µg/L	500	600000	150,000	34400	24200	36800	59000	53500	-	39200	39600	38000	36500	115000	69500	76900	-	101000	57100	49900	49500	23300
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	782	1980	1070	2330	923	-	611	627	758	833	565	1260	1360	-	1260	644	1190	1270	125
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	18.8	25	30.4	25.8	35.9	-	7.4	7.4	4.8	5.9	118	<5	<5	-	<5	<5	<1	<1	<5
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	108000	672000	198000	202000	163000	-	149000	191000	121000	131000	13700	285000	277000	-	165000	76900	120000	109000	304000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	429000	429000	429000	429000	429000	429000	429000	429000	429000	309000	309000	429000	429000	429000	429000	429000	429000	309000	429000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	3.7	2.95	2.3	1.2	2.5	7.0	8.1	6.0	1.5	1330	10.4	1.4	2.4	4.1	6.8	<1.0	1.5	1340	4.24
Metals, Total																							
Aluminum	µg/L	3.00	NG	NG	483	34200	239	68.4	38.9	2220	723	1830	63.4	110	5840	13.8	8.2	908	<8.4	7.7	7.6	17.2	6.8
Antimony	µg/L	0.10	NG	NG	0.36	0.53	0.4	0.32	0.37	1.18	0.35	2.35	0.15	0.19	0.92	0.14	0.2	<0.5	0.15	0.15	0.11	<0.1	<0.1
Arsenic	µg/L	0.10	5.0	5.0	0.85	**92.4**	0.73	0.34	0.27	2.95	0.88	2.45	0.19	0.37	**6.72**	0.19	0.13	1.44	0.16	0.13	0.13	0.15	0.23
Barium	µg/L	0.10	NG	NG	117	3540	73.7	71.7	72.3	176	95.3	242	72.5	60.6	381	52.7	63	170	79.3	82.2	68	59.3	30.9
Beryllium	µg/L	0.10	NG	NG	<0.1	5.28	<0.1	<0.1	<0.1	<0.5	0.18	0.19	<0.1	<0.1	0.5	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.02
Bismuth	µg/L	0.05	NG	NG	<0.05	1.48	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	0.25	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	1200	1200	94	175	192	155	129	111	99	104	85	76	50	19	19	<52	41	35	28	26	82
Cadmium	µg/L	0.005	NG	NG	0.323	8.71	0.186	0.0953	0.0445	0.545	0.51	0.334	0.0789	0.101	0.499	0.0245	0.0191	0.093	0.0144	0.0148	0.0118	0.015	0.0776
Calcium	µg/L	50	NG	NG	86500	209000	74900	96500	100000	94800	94200	117000	96300	89300	58600	153000	164000	142000	134000	121000	108000	97400	163000
Cesium	µg/L	0.01	NG	NG	0.121	9.49	0.102	0.044	0.036	0.275	0.067	0.329	0.016	0.031	0.753	<0.01	<0.01	0.147	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium [4]	µg/L	0.1-1.0	NG	NG	1.26	53.6	0.51	0.15	0.11	5.63	2.99	23.9	0.14	<0.5	14.5	0.17	0.15	2.9	0.18	0.13	<0.1	<0.5	<0.1
Cobalt	µg/L	0.10	110	4.0	3.7	**125**	3.67	1.36	0.53	8.95	8.52	5.33	1.21	1.41	5.88	0.13	0.05	1.13	0.05	0.05	0.05	0.05	0.39
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	4.81	304	2.53	1.42	1.01	16.8	8.69	13.3	0.93	1.36	19.5	0.25	0.25	3.9	0.53	0.25	0.25	0.25	0.25
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000		29.5	39.6	26.0	35.4	31.5	28.9	32.4	38.5	32.6	32.6	13.8	39.6	39.6	39.6	39.6	39.6	36.6	39.6	39.6
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10	10.0	10	10	10	10	10	10	10	10	10	5.04	10	10	10	10	10	10	10	10.0
Iron	µg/L	10	1000	NG	953	**212000**	585	72	40	**5840**	**1730**	**3460**	104	236	**17600**	20	12	**2890**	17	16	13	28	140
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	0.552	114	0.323	0.055	0.025	1.86	0.353	2.77	0.025	0.092	7.25	0.025	0.025	1.12	0.025	0.025	0.025	<0.05	0.025
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		320.8	417.0	268.8	409.6	350.4	311.1	363.2	417.0	367.5	358.9	109.6	417.0	417.0	417.0	417.0	417.0	417.0	390.6	417.0
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	15.8	19.6	13.8	19.3	17.0	15.4	17.5	19.6	17.6	17.3	7.6	19.6	19.6	19.6	19.6	19.6	19.6	18.5	19.6
Lithium	µg/L	1.0	NG	NG	28.2	158	52.3	31.1	26.1	24.6	28.2	26.8	20.8	22.2	12.3	8.3	9.8	10.7	11.9	11.4	8.5	8.3	37.7
Magnesium	µg/L	5.0	NG	NG	21100	55100	19900	25900	24100	18100	24100	21400	24200	22300	8530	33200	31300	26600	27600	23500	23000	20600	44800
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	65.3	1350	65.5	23.4	11.9	182	120	131	23	24.5	427	3.43	2.98	81.9	7.93	2.74	1.8	2.9	1760
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		3394.2	3394.2	3350.1	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	1928.5	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	1894.2	2585.0	1727.0	2167.0	1986.6	1863.4	2026.2	2312.2	2039.4	2013.0	1159.4	2585.0	2585.0	2532.2	2501.4	2431.0	2224.2	2109.8	2585.0
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	<0.005	<0.005	0.0124	<0.005	0.0216	<0.005	<0.005	0.0095	<0.005	<0.005	0.0056	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	8.12	12	11.6	9.22	5.77	7.5	7.49	26.5	3.97	4.14	3.6	1.19	1.11	3.08	1.29	1.31	1.18	1.16	0.651
Nickel	µg/L	0.50	NG	NG	16.6	445	18.2	12	7.21	32	30.1	19.8	8.8	10.5	20.6	1.48	0.64	4	0.6	<0.5	<0.5	0.64	20.7
Phosphorus	µg/L	50.0	NG	NG	57	5940	<62	<50	<50	290	<75	123	<50	<50	680	<50	<50	<250	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	3650	15300	3110	3670	3850	5550	4940	11100	3770	3270	5830	3950	4230	6350	5350	5040	4310	3620	1920
Rubidium	µg/L	0.2	NG	NG	2.94	140	2.77	1.99	2.16	5.7	4.5	20.5	1.3	1.52	9.4	0.63	0.7	3.2	0.98	0.9	0.64	0.59	1.35
Selenium	µg/L	0.05	NG	2.0	1.12	9.17	1.62	3.04	0.966	1.44	0.946	1.34	0.708	0.856	0.47	2.32	1.54	1.02	0.915	0.688	0.818	0.889	0.059
Silicon	µg/L	100.0	NG	NG	4780	30100	3550	3630	4050	6240	5590	9800	4280	3900	11500	4350	4720	6140	6160	5550	4890	4320	4350
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	0.012	2.64	0.005	0.005	0.005	0.05	0.005	0.078	0.005	<0.01	0.109	0.005	0.005	0.05	0.005	0.005	0.005	<0.01	0.005
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	67800	57900	123000	82000	59600	34800	34300	36500	42000	43100	51200	33800	40400	40100	44000	41400	37700	35000	54800
Strontium	µg/L	0.2	NG	NG	405	1240	521	616	536	701	450	633	454	470	384	380	350	744	330	298	258	247	468
Sulfur	µg/L	500.0	NG	NG	38100	318000	70300	84100	55500	59300	55000	64100	45200	46900	3100	118000	95400	67400	61800	43800	44800	38600	113000
Tellerium	µg/L	0.2	NG	NG	<0.2	1	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	0.027	2.5	0.024	0.014	0.013	0.065	0.02	0.049	<0.01	<0.01	0.142	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	0.011
Thorium	µg/L	0.10	NG	NG	0.23	74.9	0.12	<0.1	<0.1	1.92	0.75	0.67	<0.1	<0.1	2.13	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.10	NG	NG	<0.1	0.5	<0.1	0.28	<0.1	<0.5	0.23	2.22	<0.1	<0.1	0.5	0.26	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.3-4.5	NG	NG	6.37	25.5	3.71	0.56	<0.3	38.9	7.31	52.4	<0.3	0.93	111	<0.3	<0.3	27.3	<0.3	<0.3	<0.3	0.39	<0.3
Tungsten	µg/L	0.10	NG	NG	<0.1	0.5	<0.1	<0.1	<0.1	<0.5	<0.1	0.25	<0.1	<0.1	0.5	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	1.57	11.3	1.69	1.46	1.23	2.19	1.52	1.71	1.01	1.22	1.33	1.47	1.43	1.23	1.15	1.17	1.14	1.27	1.9
Vanadium	µg/L	0.50	NG	NG	1.35	79.9	1.09	0.52	<0.5	6.7	1.5	5.18	<0.5	<0.5	22	<0.5	<0.5	4.3	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	28.7	**1390**	20.7	12	9.3	94	91.1	89.6	17.9	15.6	**70**	1.5	1.5	7.5	1.5	1.5	1.5	1.5	4.4
Zn FST Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		185.25	340.50	156.75	231.75	201.00	180.00	207.75	256.50	210.00	205.50	60	340.5	322.5	294	288.75	276.75	241.5	222	340.50
Zn FLT Guideline Calc.				Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	160	188	131	188	176	155	182	188	185	180	34.5	187.5	187.5	187.5	187.5	187.5	187.5	187.5	188
Zircronium	µg/L	0.06	NG	NG	0.22	<1	<0.2	<0.2	<0.2	1	0.31	1.47	<0.2	<0.2	<1	<0.2	<0.2	1	<0.2	<0.2	<0.2	<0.2	<0.3
Metals, Dissolved																							
Aluminum [5]	µg/L	1.0	100	50	64.9	**4400**	32.2	35.1	31.8	**145**	**145**	96.1	40.5	31.4	7.6	1.8	1.8	6.5	1.7	1.8	1.5	2.9	1.3

Appendix B2: SBIAR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	RBSC-DS 23-Feb-21	RBSC-DS 17-Mar-21	RBSC-DS 22-Apr-21	RBSC-DS 18-May-21	RBSBIAR-EDS 17-Mar-21	RBSBIAR-EDS 22-Apr-21	RBSBIAR-EDS 18-May-21	RBSBIAR-EDS 24-Jun-21	RBSBIAR-EDS 21-Jul-21	RBSBIAR-EDS 29-Aug-21	RBSBIAR-EDS 21-Sep-21	RBSBIAR-EDS 29-Oct-21	RBSBIAR-EDS 25-Nov-21
Physical Parameters																	
Temperature	°C																
Flow Rate	L/sec																282.33
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	15000	5200	14200	4600	1900	500	5800	4500	500	6000	3800	4200	<2000
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	353	360	335	359	136	289	241	287	346	269	319	300	354
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	971	927	885	1040	696	914	1410	888	1280	967	927	826	912
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	533000	516000	431000	512000	387000	279000	503000	287000	437000	429000	369000	368000	377000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L																364000
pH	pH Units	0.10	6.5 - 9	6.5-9.0	7.92	7.72	7.56	8.04	7.94	7.94	7.88	7.95	8.33	7.95	8.02	8.06	8.22
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	630000	671000	549000	734000	477000	542000	906000	559000	863000	678000	583000	558000	604000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	10600	8300	14500	10800	1560000	133000	21000	6400	11500	21300	3300	161000	26500
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<5000	<1000	<1000	<5000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<5000	<1000	<1000	<5000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	353000	439000	335000	359000	165000	289000	241000	287000	416000	269000	319000	300000	354000
Anions and Nutrients																	
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	25	25	25	25	221	660	670	395	570	472	203	173	286
Ammonia FST Guideline	µg/L		pH dependent (at Temp 4 °C or in situ T)		7420	10300	11900	6220	6220	6220	7420	6220	3150	6220	6220	4950	3950
Ammonia FLT Guideline				pH dependent (at Temp 4 °C or in situ T)	1430	1980	1970	1200	1430	1430	1430	1200	606	1200	1200	952	759
Chloride (Cl^-)	µg/L	500	600000	150,000	18800	16200	14000	22300	51800	51300	250000	51000	88100	55700	26600	44000	42800
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	<25	26.8	<24.3	<25	576	463	362	157	268	323	343	716	758
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	<5	3.4	<1	<7	30.2	26.7	26.1	19.1	21.3	9.7	16.2	6.9	8.8
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	205000	191000	172000	246000	165000	140000	173000	141000	280000	175000	74500	97700	132000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	429000	429000	429000	429000	429000	429000	429000	429000	429000	429000	429000	429000	309000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	2.7	2.49	3.4	2.7	4.13	2.4	1.2	2.2	4.4	6.4	1.0	2.4	1690
Metals, Total																	
Aluminum	µg/L	3.00	NG	NG	15.5	52.2	87.4	76.3	13900	1670	55.6	32.4	590	684	130	842	279
Antimony	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	0.85	1.29	0.45	0.3	0.41	0.17	0.19	0.5	<0.1
Arsenic	µg/L	0.10	5.0	5.0	0.64	0.36	1.14	0.8	22	2.69	0.58	0.44	0.91	0.56	0.33	1.02	0.49
Barium	µg/L	0.10	NG	NG	36.9	30.4	61.5	50.8	1340	234	147	99.8	114	149	124	220	98.9
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	1.36	0.18	<0.1	<0.1	0.28	0.2	<0.1	0.5	<0.1
Bismuth	µg/L	0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	0.36	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.25	<0.05
Boron	µg/L	10.0	1200	1200	61	62	51	62	56	178	258	254	340	258	239	165	172
Cadmium	µg/L	0.005	NG	NG	0.0181	0.0672	0.0619	0.0563	1.66	0.295	0.0425	0.0081	0.429	0.443	0.0554	0.05	0.287
Calcium	µg/L	50	NG	NG	153000	158000	131000	153000	175000	89500	153000	75800	119000	123000	94800	101000	99100
Cesium	µg/L	0.01	NG	NG	<0.01	0.018	0.032	0.037	3.19	0.431	0.05	0.041	0.092	0.055	0.037	0.433	0.042
Chromium [4]	µg/L	0.1-1.0	NG	NG	<0.1	0.13	0.56	0.15	31.3	3.42	0.22	<0.1	0.34	0.38	<0.1	1.32	<0.5
Cobalt	µg/L	0.10	110	4.0	1.48	0.37	2.07	3.31	28.8	6.01	2.51	0.82	16.2	11.3	4.06	2.99	7.83
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	0.25	0.25	0.25	0.25	68.4	8.71	0.6	0.53	6.05	7.51	1	3.3	3.8
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000		39.6	39.6	39.6	39.6	38.4	28.2	39.6	29.0	39.6	39.6	36.7	36.6	39.6
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10	10.0	10	10	10	10.0	10	10	10	10	10	10	10	10
Iron	µg/L	10	1000	NG	830	287	823	981	56000	4600	98	39	355	1180	118	1360	522
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	0.025	0.069	0.177	0.145	27.4	1.87	0.061	0.025	0.145	0.088	0.061	1.37	0.166
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		417.0	417.0	417.0	417.0	417.0	301.4	417.0	312.5	417.0	417.0	417.0	417.0	417.0
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	19.6	19.6	19.6	19.6	19.6	15.1	19.6	15.5	19.6	19.6	19.6	19.6	19.6
Lithium	µg/L	1.0	NG	NG	31.1	26.5	25.8	34.6	32.8	50.9	57.1	44	63.6	49.7	45.7	34.6	42.8
Magnesium	µg/L	5.0	NG	NG	39600	38700	31000	35900	30800	24900	38200	23900	32300	35000	26700	28600	28200
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	2160	1530	2030	3080	937	157	90	31.2	206	158	60.8	50.6	116
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	2585.0	2585.0	2501.4	2585.0	2307.8	1832.6	2585.0	1867.8	2527.8	2492.6	2228.6	2224.2	2263.8
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.0084	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	0.741	0.724	1.15	1.15	3.72	3.86	2.7	1.83	2.97	1.51	1.46	0.96	1.3
Nickel	µg/L	0.50	NG	NG	14.8	15.7	19.3	31.3	91.8	18.4	11.9	4.95	46.6	38.6	15.7	12.6	31
Phosphorus	µg/L	50.0	NG	NG	57	<50	<50	<50	1910	<222	<50	<50	<50	<55	<50	<250	50
Potassium	µg/L	50.0	NG	NG	1770	1730	1690	1800	6020	2780	6890	2760	4490	4020	3380	3100	2550
Rubidium	µg/L	0.2	NG	NG	1.29	1.4	1.31	1.71	35.7	5.26	5.11	1.94	3.59	2.06	1.54	4.3	1.3
Selenium	µg/L	0.05	NG	2.0	0.055	0.079	0.07	0.076	2.53	1.37	1.67	0.349	1.15	0.513	0.43	0.39	0.572
Silicon	µg/L	100.0	NG	NG	4160	4360	4030	4270	21900	5100	4430	4080	4970	6110	4730	5580	4270
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	0.005	0.005	0.005	0.005	0.496	0.031	0.005	0.005	0.005	0.005	0.005	0.05	<0.01
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	42500	42000	37600	43600	13000	120000	144000	110000	130000	85900	90600	73900	77800
Strontium	µg/L	0.2	NG	NG	451	433	406	460	649	624	1900	497	986	651	533	485	546
Sulfur	µg/L	500.0	NG	NG	76600	83000	58600	91700	61300	51800	77000	46400	89800	69400	44000	33600	47200
Tellerium	µg/L	0.2	NG	NG	<0.2	<0.2	<0.2	<0.2	1	<0.2	0.62	<0.2	0.27	<0.2	<0.2	1	<0.2
Thallium	µg/L	0.01	NG	NG	<0.01	0.011	0.012	0.02	0.544	0.055	0.032	0.011	0.03	0.012	<0.01	0.05	<0.01
Thorium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	11.3	1.27	<0.1	<0.1	0.17	1.19	<0.1	0.54	0.21
Tin	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	0.5	0.12	0.19	<0.1	<0.1	<0.1	<0.1	0.5	<0.1
Titanium	µg/L	0.3-4.5	NG	NG	0.34	0.94	1.06	0.99	77.1	28.6	1.33	0.53	2.34	0.99	0.69	4	1.72
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5	<0.1
Uranium	µg/L	0.01	NG	NG	1.52	1.31	1.33	1.6	3.22	2.22	1.36	0.824	3.39	1.61	1.17	0.947	1.42
Vanadium	µg/L	0.50	NG	NG	<0.5	<0.5	0.74	0.55	45.7	5.1	0.67	<0.5	0.94	0.62	<0.5	3	0.62
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	1.5	3.3	7.9	12.1	281	44.7	4.4	1.5	127	106	20.6	24	65.7
Zn FST Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		340.50	340.50	288.75	340.50	255.75	174.75	340.50	180.75	293.25	287.25	242.25	241.50	248.25
Zn FLT Guideline Calc.				Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	188	188	188	188	188	149	188	155	188	188	188	188	188
Zirconium	µg/L	0.06	NG	NG	<0.2	<0.2	<0.2	<0.2	<1	<0.4	<0.2	<0.2	<0.2	<0.2	<0.2	1	<0.2
Metals, Dissolved																	
Aluminum [5]	µg/L	1.0	100	50	1.4	0.05	1.4	1.4	49.7	35.3	5.7	18.9	280	169	87.1	20.1	58.6

Parameter	RBSBIAR-EUS 17-Mar-21	RBSBIAR-EUS 22-Apr-21	RBSBIAR-EUS 18-May-21	RBSBIAR-EUS 24-Jun-21	RBSBIAR-EUS 21-Jul-21	RBSBIAR-EUS 29-Aug-21	RBSBIAR-EUS 21-Sep-21	RBSBIAR-EUS 29-Oct-21	RBSBIAR-EUS 25-Nov-21
Physical Parameters									
Temperature									
Flow Rate									
Acidity (Total as $CaCO_3$)	1600	8300	9500	11800	9600	10500	10600	3800	5700
Alkalinity (Total as $CaCO_3$)	71	311	239	276	270	272	311	310	350
Electrical Conductivity (EC)	340	846	1330	856	923	837	836	782	818
Hardness as CaCO3, dissolved	116000	491000	693000	489000	485000	487000	477000	458000	450000
Hardness as CaCO3, from total Ca/Mg (New January 2020)									434000
pH	7.91	7.76	7.83	7.80	7.77	7.87	7.89	7.92	7.90
Total Dissolved Solids (TDS)	255000	537000	966000	619000	628000	621000	570000	560000	528000
Total Suspended Solids (TSS)	130000	2500	1700	3800	10500	1300	1700	2700	<3000
Alkalinity (Hydroxide) as $CaCO_3$	<5000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	<5000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	86600	311000	239000	276000	330000	272000	311000	310000	350000
Anions and Nutrients									
Ammonia (NH_4 as N)	307	25	25	25	25	25	25	99	9
Ammonia FST Guideline	7420	8770	8770	8770	8770	7420	7420	7420	7420
Ammonia FLT Guideline	1430	1690	1690	1690	1690	1430	1430	1430	1430
Chloride (Cl^-)	50500	48100	234000	38700	80600	46500	43300	43300	46900
Nitrate (NO_3^- as N)	534	609	766	401	537	688	899	1130	1220
Nitrite (NO_2^- as N)	96	<5	<5	<1	<5	<5	2.3	<1	2.8
Sulphate (SO_4) [3]	20700	113000	177000	176000	135000	112000	97800	72400	65600
SO4 FLT Guideline Calc	309000	429000	429000	429000	429000	429000	429000	429000	309000
Dissolved Organic Carbon (DOC)	8.48	2.3	1.4	2.4	5.1	6.8	2.3	1.8	1490
Metals, Total									
Aluminum	3430	6.8	17.3	11	172	<11.1	27.6	25.9	20.7
Antimony	0.93	<0.1	0.14	0.17	0.22	0.14	0.14	<0.1	<0.1
Arsenic	5.22	0.14	0.25	0.16	0.52	0.23	0.19	0.14	0.23
Barium	225	230	323	184	235	279	260	267	226
Beryllium	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	69	15	34	17	35	29	24	20	19
Cadmium	0.237	0.0176	0.0243	0.0139	0.0433	0.0138	0.0145	0.012	0.0134
Calcium	44300	139000	221000	147000	144000	149000	132000	137000	127000
Cesium	0.508	<0.01	<0.01	<0.01	0.028	<0.01	<0.01	<0.01	<0.01
Chromium [4]	7.81	0.3	0.18	<0.1	0.55	0.11	0.11	0.13	<0.5
Cobalt	3.11	0.2	0.12	0.05	0.34	0.05	0.05	0.05	0.05
Copper [3]	11.1	0.25	0.25	0.25	1.02	0.25	0.25	0.25	0.25
Cu FST Guideline Calc. (relevant prior to August 2019)	12.9	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
Cu FLT Guideline Calc. (relevant prior to August 2019)	4.64	10	10	10	10	10	10	10	10
Iron	9100	5	26	19	422	37	81	77	36
Lead [3]	4.64	0.025	0.025	0.025	0.213	0.025	0.025	0.025	<0.05
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	98.6	417.0	417.0	417.0	417.0	417.0	417.0	417.0	417.0
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	7.2	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
Lithium	6.3	7.4	12.9	9	10	12.4	11.8	10.4	9.8
Magnesium	6160	30900	46300	32300	30900	32100	28500	31500	28400
Manganese [3]	219	2.95	14.9	8.69	57.2	18.6	6.9	6.28	7.37
Mn FST Guideline Calc (Based on Hardness as CaCO3)	1818.3	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	1115.4	2585.0	2585.0	2585.0	2585.0	2585.0	2585.0	2585.0	2585.0
Mercury (Based on methyl Hg & total mass Hg)	0.0088	<0.005	<0.005	<0.005	0.0058	<0.005	<0.005	<0.005	<0.005
Molybdenum	4.48	0.636	0.738	0.624	0.969	0.742	0.741	0.742	0.849
Nickel	11.4	1.59	0.8	0.54	1.28	0.53	<0.5	<0.5	0.61
Phosphorus	400	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	4210	2930	5610	3430	4470	5210	4870	4510	3860
Rubidium	6.6	0.34	0.94	0.55	1.01	0.86	0.71	0.63	0.57
Selenium	0.67	0.776	1.05	0.823	0.742	0.717	0.765	0.642	0.597
Silicon	7640	4400	5220	4890	5850	7310	6470	6140	5340
Silver [3] (Based on Hardness < or > 100000)	0.075	0.005	0.005	0.005	0.005	0.005	0.005	0.005	<0.01
Ag FST Guideline Calc	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	21200	7320	17600	10900	12800	11700	10900	11500	10600
Strontium	314	323	1230	379	516	399	331	315	313
Sulfur	5000	36700	75800	57000	49700	43000	30600	27200	23600
Tellerium	1	<0.2	0.41	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	0.12	<0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	<0.01
Thorium	0.88	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	0.5	<0.1	0.24	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	63.2	<0.3	0.53	<0.3	4.84	0.33	1.04	0.64	0.51
Tungsten	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	1.28	1.77	1.64	1.3	1.3	1.29	1.44	1.36	1.65
Vanadium	12.4	<0.5	0.53	<0.5	1.1	0.54	<0.5	<0.5	<0.5
Zinc [3] (Based on Hardness < or > 90,000)	38	1.5	1.5	4	3.7	1.5	1.5	1.5	1.5
Zn FST Guideline Calc.	52.50	333.75	340.50	332.25	329.25	330.75	323.25	309.00	303.00
Zn FLT Guideline Calc.	27	188	188	188	188	188	188	188	188
Zirconium	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Metals, Dissolved									
Aluminum [5]	11.8	1.1	1.5	2.2	2.6	2.7	1.8	1.5	1.3

Appendix B2: SBIAR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-DS	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSBIAR-US	RBSC-DS
					24-Feb-21	17-Mar-21	22-Apr-21	18-May-21	24-Jun-21	21-Jul-21	29-Aug-21	21-Sep-21	28-Oct-21	25-Nov-21	17-Mar-21	18-May-21	24-Jun-21	21-Jul-21	29-Aug-21	21-Sep-21	28-Oct-21	25-Nov-21	28-Jan-21
Al FST Guideline Calc (based on pH)	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	22.1	100.0	100.0	100.0	100.0	100	100	100	100	100	100	100	100.0	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	6.2	50.0	50.0	50.0	50.0	50	50	50	50	50	50	50	50.0	50	50	50	50	50
Antimony	µg/L	0.10	NG	NG	0.36	<0.1	0.37	0.32	0.3	0.95	0.32	1.55	0.14	0.18	0.53	0.12	0.12	<0.5	0.14	0.13	0.11	0.15	<0.1
Arsenic	µg/L	0.10	NG	NG	0.34	2.24	0.32	0.23	0.23	0.25	0.29	0.77	0.16	0.19	0.43	0.11	0.11	0.25	0.05	0.05	0.05	<0.1	0.24
Barium	µg/L	0.10	NG	NG	90.6	18.4	51.7	73.5	76.7	94.7	82.8	136	72.8	57.2	129	61.6	65.6	119	82.3	81	69.8	62.4	33.7
Beryllium	µg/L	0.10	NG	NG	<0.1	1.6	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.02
Bismuth		0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	91	67	179	146	116	<98	92	103	79	70	35	17	23	<50	37	32	28	26	80
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.282	**7.73**	0.134	0.0897	0.0447	0.256	0.315	0.175	0.0703	0.0846	0.0375	0.0213	0.0166	0.026	0.0188	0.0166	0.0127	0.0102	0.0858
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		1.780	2.801	1.543	2.169	1.911	1.736	1.968	2.377	1.987	1.949	0.746	2.801	2.801	2.693	2.649	2.548	2.251	2.087	2.801
Cd FLT Guideline Calc.				Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.457	0.457	0.421	0.457	0.457	0.457	0.457	0.457	0.457	0.457	0.251	0.457	0.457	0.457	0.457	0.457	0.457	0.457	0.457
Calcium	µg/L	50.0	NG	NG	83700	191000	72300	101000	85200	85800	91600	116000	90600	91400	42300	148000	139000	134000	128000	122000	109000	102000	176000
Cesium		0.01	NG	NG	0.018	0.04	0.034	0.036	0.032	<0.05	0.028	0.058	0.014	0.017	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	0.10	NG	NG	0.5	0.41	<0.1	<0.1	<0.1	1.28	1.14	18.1	<0.1	<0.5	0.67	0.15	0.12	0.65	0.13	0.11	<0.1	<0.5	<0.1
Cobalt	µg/L	0.10	NG	NG	3.41	108	3.05	1.22	0.54	6.56	7.45	3.84	1.19	1.26	0.17	0.12	0.05	0.25	0.05	0.05	0.05	0.05	0.39
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	2.92	**85.7**	1.18	1.1	0.86	4.1	2.39	2.89	0.68	0.72	2.06	0.41	0.4	1.1	0.44	0.37	0.31	0.34	0.1
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		27.6	0.2	18.1	9.2	14.5	-	53.4	39.4	10.6	10.2	7420	7.5	11.5	-	39.8	6220	10	7.2	11900
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	4.7	0.2	3.1	1.4	1.9	-	10.3	7.6	2.0	2.0	10.7	1.2	1.6	-	6.9	0.6	1.9	1.1	2.1
Iron	µg/L	10.0	350	NG	5	144	5	5	5	25	25	82	18	10	13	5	5	25	5	5	5	5	128
Lead	µg/L	0.05	NG	NG	0.075	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	µg/L	1.0	NG	NG	27	123	52	36.4	24.7	23.2	28.1	26.8	21	21.2	5.6	9	9.4	10.6	12.3	11.6	9.9	8.4	39
Magnesium	µg/L	5.0	NG	NG	20500	47000	18000	24600	24600	17500	23000	24000	24300	22300	5010	32000	31200	25000	26800	26700	23000	21100	44400
Manganese	µg/L	0.10	NG	NG	51.5	1120	51.3	20.8	12.3	95.1	103	70.9	22.3	20.4	25.8	2.7	2.87	24.6	7.67	2.49	1.64	2.09	1870
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	8.37	0.181	11.5	9.02	5.32	6.53	8.22	27.3	3.7	4.02	4.43	1.08	1.06	2.65	1.33	1.32	1.17	1.14	0.725
Nickel	µg/L	0.50	NG	NG	15.7	389	15.7	11.5	7.6	24.8	27.2	15.6	8.75	9.54	1.31	1.42	0.65	<2.5	0.53	<0.5	<0.5	<0.5	21.3
Phosphorus	µg/L	50.0	NG	NG	<50	<50	<50	<50	<50	<250	<50	<50	<50	<50	<50	<50	<50	<250	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	3710	1920	2920	3550	4160	5010	4930	12300	3840	3280	5070	3860	4440	5700	5430	5420	4370	3730	1940
Rubidium	µg/L	0.20	NG	NG	2.24	3.35	2.39	2	2.27	3.7	4.18	20.3	1.34	1.31	1.15	0.66	0.7	1.6	0.92	0.83	0.63	0.54	1.43
Selenium	µg/L	0.05	NG	2.0	1.33	1.52	1.72	3.38	1.21	1.26	0.946	1.41	0.814	0.989	0.355	2.42	1.55	1.05	0.914	0.735	0.869	1.09	0.072
Silicon	µg/L	50.0	NG	NG	4350	3220	3100	3470	4110	3720	4960	6300	4330	3960	2150	4260	4840	4650	6140	5470	5040	4640	4540
Silver	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	NG	NG	69300	47900	112000	78000	62200	34500	33100	40100	42900	42800	50800	32700	41300	38300	42600	43800	38300	35300	53300
Strontium	µg/L	0.20	NG	NG	379	437	490	646	495	632	463	613	429	440	315	375	325	636	335	306	259	238	500
Sulfur	µg/L	500	NG	NG	40900	259000	75700	76300	58800	58800	54300	72500	46000	46500	5110	110000	102000	66400	60600	50700	46000	38100	117000
Tellurium	µg/L	0.20	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	0.017	0.019	0.017	0.014	0.014	<0.05	0.015	0.015	<0.01	0.019	0.012	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	0.011
Thorium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.30	NG	NG	<0.3	<0.3	<0.3	<0.3	<0.3	<1.5	<0.3	2.32	<0.3	<0.3	<0.3	<0.3	<0.3	<1.5	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	1.46	3.16	1.57	1.63	1.2	1.79	1.34	1.41	0.892	1.14	0.688	1.5	1.4	1.09	1.11	1.09	1.09	1.25	1.97
Vanadium	µg/L	0.50	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	0.87	<0.5	<0.5	<0.5	<0.5	<0.5	<2.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	1.00	NG	NG	22.8	1170	13.6	10.9	7.5	24.3	37.7	23	15.7	12.5	1.4	0.5	2.5	2.5	1.4	0.5	0.5	0.5	4.3
Zirconium	µg/L	0.06	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<1.0	<0.2	<0.2	<0.2	<0.2	<0.3
Laboratory Work Order Number					L2560753	L2568228	L2579726	L2589443	L2606393	L2615413	L2633133	L2642120	L2656849	CG2106088	L2568228	L2589443	L2606393	L2615413	L2633133	L2642120	L2656849	CG2106088	L2552704
Laboratory Identification Number					L2560753-1	L2568228-3	L2579726-1	L2589443-1	L2606393-3	L2615413-4	L2633133-1	L2642120-1	L2656849-3	CG2106088-001	L2568228-4	L2589443-2	L2606393-1	L2615413-5	L2633133-2	L2642120-2	L2656849-5	CG2106088-002	L2552704-4

TETRA TECH

Appendix B2: SBIAR Surface Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	RBSC-DS 23-Feb-21	RBSC-DS 17-Mar-21	RBSC-DS 22-Apr-21	RBSC-DS 18-May-21	RBSBIAR-EDS 17-Mar-21	RBSBIAR-EDS 22-Apr-21	RBSBIAR-EDS 18-May-21	RBSBIAR-EDS 24-Jun-21	RBSBIAR-EDS 21-Jul-21	RBSBIAR-EDS 29-Aug-21	RBSBIAR-EDS 21-Sep-21	RBSBIAR-EDS 29-Oct-21	RBSBIAR-EDS 25-Nov-21
Al FST Guideline Calc (based on pH)	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100	100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50	50	50	50	50	50	50	50
Antimony	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	0.22	1.15	0.38	0.28	0.42	0.18	0.16	0.12	0.2
Arsenic	µg/L	0.10	NG	NG	0.73	0.25	0.69	0.67	0.13	0.6	0.4	0.45	0.6	0.24	0.27	0.2	0.17
Barium	µg/L	0.10	NG	NG	36.5	28.3	52	60	44.9	102	149	114	112	141	129	122	87.3
Beryllium	µg/L	0.10	NG	NG	<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
Bismuth		0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	58	59	53	51	26	160	210	243	320	238	238	159	163
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.0174	0.0431	0.017	0.0073	0.155	0.0873	0.0329	0.0053	0.402	0.21	0.0393	0.0128	0.113
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.801	2.801	2.649	2.801	2.371	1.692	2.801	1.742	2.687	2.636	2.257	2.251	2.308
Cd FLT Guideline Calc.				Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.457	0.457	0.457	0.457	0.457	0.450	0.457	0.457	0.457	0.457	0.457	0.457	0.457
Calcium	µg/L	50.0	NG	NG	151000	150000	126000	147000	120000	76300	146000	72900	122000	117000	98600	102000	104000
Cesium		0.01	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	0.035	0.042	0.046	0.077	0.04	0.024	0.014	0.013
Chromium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	0.16	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.5
Cobalt	µg/L	0.10	NG	NG	1.5	0.33	1.98	3.04	7.41	3.49	2.13	0.87	15.2	9.96	3.88	1.67	7.22
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	0.1	0.1	0.1	0.1	1.52	0.76	0.38	0.42	3.21	0.8	0.68	0.37	0.88
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		15	10300	11900	16.5	7420	7420	7.5	14.5	38.1	41.4	6220	17.6	14.2
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	2.3	1.5	1.6	2.8	3.4	2.1	0.9	2.0	8.1	5.9	1.1	2.7	2.6
Iron	µg/L	10.0	350	NG	**753**	140	122	253	5	5	5	5	5	5	5	5	5
Lead	µg/L	0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	µg/L	1.0	NG	NG	29.9	25.5	30.1	33.9	19.4	49.3	65.5	46.7	65.7	50.3	50.7	32.4	42.8
Magnesium	µg/L	5.0	NG	NG	37800	34500	28600	35200	21200	21500	33900	25500	32200	33100	29900	27600	28500
Manganese	µg/L	0.10	NG	NG	2070	1370	1920	2890	138	84	73.9	34.9	198	146	58	38.9	105
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	0.71	0.707	1.17	1.06	1.33	3.42	2.39	1.9	3.2	1.45	1.46	1.07	1.36
Nickel	µg/L	0.50	NG	NG	15.8	14.1	21.7	28.6	29.9	12.9	10.3	5.77	43.6	34	14.8	8.85	28.1
Phosphorus	µg/L	50.0	NG	NG	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	1740	1590	1590	1760	2670	2270	6280	3120	4510	3760	3190	2870	2580
Rubidium	µg/L	0.20	NG	NG	1.24	1.1	1.06	1.42	1.61	1.94	4.49	1.93	3.32	1.81	1.42	1.06	1.18
Selenium	µg/L	0.05	NG	2.0	0.056	0.058	0.099	0.025	0.786	1.33	1.52	0.334	1.23	0.466	0.394	0.421	0.642
Silicon	µg/L	50.0	NG	NG	4220	3760	3600	3870	2850	2810	3760	4490	4260	5630	4540	4560	4250
Silver	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	NG	NG	42600	37100	34200	42400	11000	108000	129000	120000	128000	79700	95000	70500	76200
Strontium	µg/L	0.20	NG	NG	417	399	386	481	412	561	1730	513	1010	636	542	487	523
Sulfur	µg/L	500	NG	NG	83300	74600	65500	80700	56500	54200	59900	54000	82600	65400	49600	34500	44400
Tellurium	µg/L	0.20	NG	NG	<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
Thallium	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01	<0.01	0.012	0.016	0.031	0.013	0.029	<0.01	<0.01	<0.01	<0.01
Thorium	µg/L	0.10	NG	NG	<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
Tin	µg/L	0.10	NG	NG	<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
Titanium	µg/L	0.30	NG	NG	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	µg/L	0.10	NG	NG	<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
Uranium	µg/L	0.01	NG	NG	1.45	1.22	1.29	1.61	1.19	1.63	1.34	0.88	3.27	1.31	1.08	0.779	1.34
Vanadium	µg/L	0.50	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	1.00	NG	NG	2.4	2	7	9	16.8	7.4	3.1	3.2	81.2	33.3	16.3	8.8	48.3
Zircronium	µg/L	0.06	NG	NG	<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
Laboratory Work Order Number					L2560753	L2568228	L2579726	L2589443	L2568228	L2579726	L2589443	L2606393	L2617671	L2633133	L2642120	L2657182	CG2106088
Laboratory Identification Number					L2560753-2	L2568228-1	L2579726-4	L2589443-6	L2568228-6	L2579726-3	L2589443-4	L2606393-4	L2617671-5	L2633133-4	L2642120-4	L2657182-2	CG2106088-004

Parameter	RBSBIAR-EUS 17-Mar-21	RBSBIAR-EUS 22-Apr-21	RBSBIAR-EUS 18-May-21	RBSBIAR-EUS 24-Jun-21	RBSBIAR-EUS 21-Jul-21	RBSBIAR-EUS 29-Aug-21	RBSBIAR-EUS 21-Sep-21	RBSBIAR-EUS 29-Oct-21	RBSBIAR-EUS 25-Nov-21
Al FST Guideline Calc (based on pH)	100	100	100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	50	50	50	50	50	50	50	50	50
Antimony	0.58	<0.1	0.11	0.11	0.2	0.13	0.12	<0.1	0.14
Arsenic	0.43	0.11	0.13	0.15	0.29	0.14	0.17	0.05	0.15
Barium	91.9	235	324	199	231	280	266	259	228
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	65	14	25	19	34	27	23	19	18
Cadmium [3] (Based on Hardness as $CaCO_3$)	0.0232	0.0081	0.0249	0.0142	0.0281	0.0168	0.01	0.01	0.0096
Cd FST Guideline Calc.	0.685	2.801	2.801	2.801	2.801	2.801	2.801	2.801	2.769
Cd FLT Guideline Calc.	0.236	0.457	0.457	0.457	0.457	0.457	0.457	0.457	0.457
Calcium	38900	146000	209000	139000	144000	144000	138000	134000	133000
Cesium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	0.92	<0.1	0.12	<0.1	0.16	<0.1	<0.1	<0.1	<0.5
Cobalt	0.18	0.05	0.05	0.05	0.2	0.05	0.05	0.05	0.05
Copper [6]	2.24	0.3	0.38	0.36	0.58	0.38	0.29	0.36	0.31
Cu FST Guideline Value (Acute)	7420	8770	6.1	9.8	20.3	30	7420	8.7	7.1
Cu FLT Guideline Value (Chronic)	6.7	1.5	1.0	1.6	3.5	5.3	1.9	1.5	1.3
Iron	24	5	5	5	5	14	5	5	5
Lead	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	4.2	7.7	13.2	9.3	9.6	12.9	12.9	10.1	9.8
Magnesium	4640	30900	41700	34200	30300	31100	32300	30200	28700
Manganese	25.8	2.54	12.6	9.32	48.1	17.4	4.75	4.5	6.52
Mercury	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	4.73	0.579	0.618	0.668	1.04	0.723	0.786	0.664	0.801
Nickel	1.45	0.65	0.65	0.54	0.81	<0.5	<0.5	<0.5	<0.5
Phosphorus	<50	<50	<50	<50	<50	<50	<50	<50	<50
Potassium	3670	3000	4950	3870	4540	5070	5050	4350	3960
Rubidium	0.71	0.32	0.91	0.66	0.8	0.8	0.79	0.56	0.47
Selenium	0.437	0.891	1.05	1.07	0.809	0.705	0.794	0.773	0.699
Silicon	2220	4510	4540	5410	5220	7080	6450	5900	5510
Silver	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	22200	7370	16200	11700	12600	11200	11700	10700	10600
Strontium	292	340	1180	392	515	388	336	308	300
Sulfur	7770	43800	61300	65700	47400	40800	36600	26000	23100
Tellurium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	0.8	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	0.951	1.68	1.61	1.4	1.29	1.27	1.34	1.33	1.56
Vanadium	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	2	1.6	1.8	4.2	1.6	3.4	0.5	0.5	0.5
Zircronium	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Laboratory Work Order Number	L2568228	L2579726	L2589443	L2606393	L2617671	L2633133	L2642120	L2657182	CG2106088
Laboratory Identification Number	L2568228-5	L2579726-2	L2589443-3	L2606393-2	L2617671-3	L2633133-3	L2642120-3	L2657182-1	CG2106088-003

Notes:

Screening completed on BC AWQG-FWAL FST 1 and FLT 2 guideline values.

[1] BC Ministry of Environment, Water Protection & Sustainability Branch (2019), British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (FWAL) water use and Short Term Maximum (FST) guidelines.

[2] BC Ministry of Environment, Water Protection & Sustainability Branch (2018). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (FWAL) water use and Long Term Average (FLT) guidelines.

[3] Guideline is hardness dependant. Where results are above laboratory reportable detection limits, guideline limits have been evaluated based on individual sample hardness. Sample-specific guideline values are listed in parentheses after the laboratory result, where applicable.

[4] Guideline is for Chromium (IV) cation. Analytical results are for unspeciated Chromium. Where analytical results exceed the guideline, speciated analysis may be warranted.

[5] Guideline is pH dependant.

[6] Guideline is Dissolved Organic Carbon (DOC) dependent. BML Model assumed 10% DOC and Humic acid 10% of DOC value, due to no DOC in lab analysis.

NG - No Guideline

Detection limit can vary as described in the COA. Detection limit can be raised when dilution is requited due to high Dissolved Solids/Electrical Conductivity (DLDS), e.g. nitrite.

BOLD and shaded dark gray: Exceeds BCAWQG-FFST (Short-term Maximum) guideline.

Shaded Light Gray: Exceeds BCAWQG-FLT (Long-term Average) guideline.

RED - Measured value is below detection limit (DL); value shown is 50% of DL

Blank - Not analyzed

Appendix B3: L3 Creek Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBL3C-0.02 22-Apr-21	LBL3C-1.43 28-Jan-21	LBL3C-1.43 22-Apr-21	LBL3C-1.65 22-Apr-21	LBL3C-3.32 22-Apr-21	LBL4C-0.18 22-Apr-21
Physical Parameters										
Temperature	°C									
Flow Rate	L/sec									
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	2700	6800	6200	3000	3700	3500
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	130	300	119	111	91	119
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	752	1700	629	566	418	701
Hardness as $CaCO_3$, dissolved	µg/L	500	NG (Acceptable ranges exist when calculating exceedances for Cd, Cu, Pb, Mn, Zn, F)	NG (Acceptable ranges exist when calculating exceedances for Cd, Cu, Pb, Mn, Zn, F)	345000	1010000	247000	248000	178000	268000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L									
pH	pH Units	0.10	6.5 - 9.0	6.5-9.0	7.84	7.99	7.68	7.89	7.76	7.88
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	505000	1390000	379000	395000	252000	440000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	628000	4200	718000	871000	4500	202000
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	130000	300000	119000	111000	91000	119000
Anions and Nutrients										
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	<56	<50	<50	<89	<56	<70
Ammonia FST Guideline	µg/L		pH dependent (at Temp 4 °C or in situ T)		8770	6220	10300	7420	8770	7420
Ammonia FLT Guideline	µg/L			pH dependent (at Temp 4 C or in situ T)	1690	1200	1980	1430	1690	1430
Chloride (Cl^-)	µg/L	500	600000	150,000	39200	48500	42100	20100	19600	58100
Nitrate (NO_3^- as N)	µg/L	5.0-100	NG	NG	1770	21000	1110	584	198	186
Nitrite (NO_2^- as N)	µg/L	1.0-20.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	3	<5	1.1	1.5	3.9	1.8
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	206000	611000	135000	151000	88300	151000
SO_4 LTA Guideline Calc (Based on Hardness as CaCO3)	µg/L		NG	Hardness 0-30,000 = 128,000; Hardness 31,000-75,000 = 218,000; Hardness 76,000-180,000 = 309,000; Hardness 181,000-250,000 = 429,000; Hardness > 250,000 site-specific	429000	429000	429000	429000	309000	429000
Total Dissolved Carbon (DOC)	mg/L		NG	NG	11.5	3.35	10	13.7	14.1	15.5
Metals, Total										
Aluminum	µg/L	3.00	NG	NG	7380	68.8	6690	7450	171	2870
Antimony	µg/L	0.1-1.0	NG	NG	0.56	<0.1	0.53	0.74	0.2	0.4
Arsenic	µg/L	0.10	5.0	5.0	**8.05**	0.31	**5.78**	**7.12**	0.64	2.67
Barium	µg/L	0.10	NG	NG	333	30.5	334	288	50.5	110
Beryllium	µg/L	0.1-1.0	NG	NG	0.51	<0.02	0.5	0.47	<0.1	0.18
Bismuth	µg/L	0.05-0.10	NG	NG	0.147	<0.05	0.25	0.128	<0.05	<0.05
Boron	µg/L	10.0	1200	1200	53	111	50	50	41	34
Cadmium	µg/L	0.005	NG	NG	0.849	0.0646	0.661	1.01	0.0353	0.312
Calcium	µg/L	50	NG	NG	114000	223000	90500	112000	47500	81800
Cesium	µg/L	0.01-0.02	NG	NG	1.53	0.018	1.21	0.982	0.022	0.501
Chromium [4]	µg/L	0.10	NG	NG	12.5	0.29	12.6	14.2	0.43	4.91
Cobalt	µg/L	0.10	110.0	4.0	16.1	0.92	17.5	8.23	0.21	3.65
Copper [3]	µg/L	0.5-1.0	Calc. based on Hardness	2 to 10	24.8	0.7	20.3	29.8	2.96	9.62
Cu STM Guideline Calc. (relevant prior to Aug. 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000		34.43	39.6	25.218	25.312	18.732	27.192
Cu LTA Guideline Calc. (relevant prior to Aug. 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10	10	10	9.88	9.92	7.12	10
Iron	µg/L	10	1000	NG	**16700**	154	**14600**	**17000**	237	**5320**
Lead [3]	µg/L	0.05-0.1	Calc. based on Hardness	Calc. based on Hardness	9.99	0.089	7.76	10.8	0.153	2.98
Pb STM Guideline Calc.	µg/L		Hardness ≤ 8000 is 3; Hardness 8000-360,000: calc. Hardness>360,000 is Capped Value of 360,000		394.98	416.97	258.13	259.46	170.10	286.38
Pb LTA Guideline Calc.	µg/L			Hardness 8000-360,000: calc. Hardness > 360,000 is Capped Value of 360,000	18.71	19.57	13.38	13.43	9.94	14.48
Lithium	µg/L	1.0	NG	NG	26.1	48.3	18.2	15.8	5	11
Magnesium	µg/L	5.0	NG	NG	36400	101000	30000	34600	16000	29400
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	778	36.3	923	374	13.7	166
Mn STM Guideline Calc.	µg/L		Hardness 25,000 - 259,000 : calc.; Hardness > 259,000 is Capped Value of 259,000		3394	3394	3262	3273	2502	3394
Mn LTA Guideline Calc.	µg/L			Hardness 37,000 - 450,000: calc.; Hardness > 450,000 is Capped Value of 450,000	2123	2585.0	1691.8	1696.2	1388	1784
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05-0.10	2000	≤ 1000	3.17	0.881	2.08	2.44	0.957	1.79
Nickel	µg/L	0.5	NG	NG	39.1	16	40.5	25.4	3.51	14.2
Phosphorus	µg/L	50-500	NG	NG	614	<50	580	752	<84	<238
Potassium	µg/L	50.0	NG	NG	7440	4540	6640	10100	10300	7800
Rubidium	µg/L	0.2	NG	NG	14.1	0.6	10.3	8.75	1.27	4.97
Selenium	µg/L	0.05	NG	2.0	1.91	6.05	1.16	0.887	0.293	1.03
Silicon	µg/L	100.0	NG	NG	12700	5880	11700	13400	2890	7170
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01-0.02	0.10 - 3.0	0.05 - 1.5	0.214	<0.01	0.153	0.184	<0.011	0.056
Ag STM Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0
Ag LTA Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	30300	35000	27800	15900	12900	41500
Strontium	µg/L	0.2	NG	NG	400	725	310	355	165	303
Sulfur	µg/L	500.0	NG	NG	74600	222000	53000	55100	34700	55200
Tellurium	µg/L	0.2-2.0	NG	NG	<0.2	<0.2	1	<0.2	<0.2	<0.2
Thallium	µg/L	0.01-0.02	NG	NG	0.232	<0.01	0.165	0.163	<0.01	0.066
Thorium	µg/L	0.1-1.0	NG	NG	2.95	<0.1	2.19	2.96	<0.1	0.87
Tin	µg/L	0.1-1.0	NG	NG	<0.1	<0.1	0.5	<0.1	<0.1	<0.1
Titanium	µg/L	0.3-6.3	NG	NG	71.1	1.29	103	120	9.23	48.3
Tungsten	µg/L	0.1-1.0	NG	NG	<0.1	<0.1	0.5	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	3.06	7.07	2.36	3.31	0.932	2.28
Vanadium	µg/L	0.5-1.0	NG	NG	25.1	<0.5	22.3	28.2	1.32	10.2
Zinc [3]	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	103	3.6	96	85	4.6	32.3
Zn STM Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		224.25	340.50	150.75	151.50	99.00	166.50
Zn LTA Guideline Calc.	µg/L			Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	187.5	187.5	125.3	126.0	73.5	141.0
Zirconium	µg/L	0.06-0.28	NG	NG	0.88	<0.3	<1	1.62	0.66	1.15
Metals, Dissolved										
Aluminum [5]	µg/L	1.0	100.0	50.0	62.3	1.4	44.1	7.8	16	73.7
Al STM Guideline Calc.	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100.0	100.0	100.0	100.0	100.0	100.0
Al LTA Guideline Calc.	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50.0	50.0	50.0	50.0	50.0	50.0
Antimony	µg/L	0.1-2.0	NG	NG	0.15	<0.1	0.14	0.22	0.19	0.19
Arsenic	µg/L	0.1-2.0	NG	NG	0.34	0.22	0.36	0.48	0.57	0.52
Barium	µg/L	0.10	NG	NG	41.5	31.3	60.8	43.1	49.9	29.4
Beryllium	µg/L	0.1-2.0	NG	NG	<0.1	<0.02	<0.1	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05-1.0	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	40	110	28	38	37	28
Cadmium [3]	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.106	0.0664	0.116	0.0181	0.0297	0.0763

Appendix B3: L3 Creek Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST [1]	BCAWQG-FLT [2]	LBL3C-0.02	LBL3C-1.43	LBL3C-1.43	LBL3C-1.65	LBL3C-3.32	LBL4C-0.18
					22-Apr-21	28-Jan-21	22-Apr-21	22-Apr-21	22-Apr-21	22-Apr-21
Cd STM Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.106	2.801	1.493	1.499	1.065	1.624
Cd LTA Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.457	0.457	0.411	0.413	0.323	0.437
Calcium	µg/L	50.0	NG	NG	89700	239000	62100	60600	44200	68300
Cesium	µg/L	0.01-0.2	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	µg/L	0.1-2.0	NG	NG	<0.1	0.18	0.12	<0.1	0.13	<0.1
Cobalt	µg/L	0.10	NG	NG	5.29	0.42	8.65	0.17	0.15	1.11
Copper [6]	µg/L	0.2-4.0	Calc. based on BLM Model	Calc. based on BLM Model	1.99	0.58	1.72	2.68	2.5	2.13
Cu STM (Acute) Guideline Value	µg/L		BLM Ligand Model value		53	17.1	39	60.2	52.6	79.3
Cu LTA (Chronic) Guideline Value	µg/L			BLM Ligand Model value	9.6	2.8	6.9	10.7	9.3	14.7
Iron	µg/L	10.0	350	NG	28	5	47	30	89	36
Lead	µg/L	0.05-1.0	NG	NG	<0.05	<0.05	<0.05	0.058	0.054	<0.05
Lithium	µg/L	1.0	NG	NG	16	52	8.8	4.5	4.4	6.9
Magnesium	µg/L	5.0	NG	NG	29300	100000	22200	23400	16500	23700
Manganese	µg/L	0.10	NG	NG	413	0.38	550	12	11.3	70.7
Mercury	µg/L	0.005-0.1	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05-1.0	NG	NG	1.48	0.944	1.25	1.57	0.903	1.41
Nickel	µg/L	0.50	NG	NG	14.7	15.5	16.3	2.68	3.37	6.76
Phosphorus	µg/L	50-1000	NG	NG	<50	<50	<50	<50	65	<50
Potassium	µg/L	50.0	NG	NG	5870	4570	5430	8570	10800	6740
Rubidium	µg/L	0.20	NG	NG	0.78	0.47	0.71	0.37	0.93	0.99
Selenium	µg/L	0.05-1.0	NG	2.0	1.27	7.13	0.836	0.562	0.291	0.835
Silicon	µg/L	50.0	NG	NG	2260	5920	1850	2400	2520	2540
Silver	µg/L	0.01-0.2	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	µg/L	50.0	NG	NG	26600	34300	25500	14000	13100	35400
Strontium	µg/L	0.20	NG	NG	309	786	239	223	162	257
Sulfur	µg/L	500	NG	NG	79500	236000	51100	58100	35000	57600
Tellurium	µg/L	0.2-4.0	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01-0.2	NG	NG	0.011	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	µg/L	0.1-2.0	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.1-2.0	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Titanium	µg/L	0.3-6.0	NG	NG	1.16	<0.3	0.71	1.54	2.75	1.25
Tungsten	µg/L	0.1-2.0	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Uranium	µg/L	0.01	NG	NG	2.06	7.01	1.44	2.1	0.786	1.76
Vanadium	µg/L	0.5-10	NG	NG	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	µg/L	1.00	NG	NG	5.9	1.7	11.6	1.5	2.9	4.2
Zirconium	µg/L	0.06-1.2	NG	NG	<0.2	<0.3	<0.2	0.22	0.36	0.28
Laboratory Work Order Number					L2579726	L2552704	L2579726	L2579726	L2579726	L2579726
Laboratory Identification Number					L2579726-5	L2552704-3	L2579726-10	L2579726-7	L2579726-6	L2579726-8

Notes:

Screening completed on BC AWQG-FWAL STM [1] and LTA [2] guideline values.

[1] BC Ministry of Environment, Water Protection & Sustainability Branch (2018). British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (FWAL) water use and Short Term Maximum (STM) guidelines.

[2] BC Ministry of Environment, Water Protection & Sustainability Branch. 2018. British Columbia Approved Water Quality Guidelines (BCAWQG): Aquatic Life, Wildlife & Agriculture Summary Report. 36 pp. Referenced for Freshwater Aquatic Life (FWAL) water use and Long Term Average (LTA) guidelines.

[3] Guideline is hardness dependant. Where results are above laboratory reportable detection limits, guideline limits have been evaluated based on individual sample hardness. Sample-specific guideline values are listed in parentheses after the laboratory result, where applicable.

[4] Guideline is for Chromium (IV) cation. Analytical results are for unspeciated Chromium. Where analytical results exceed the guideline, speciated analysis may be warranted.

[5] Guideline is pH dependant.

[6] Guideline is Dissolved Organic Carbon (DOC) dependent. BML Model assumed 10% DOC and Humic acid 10% of DOC value, due to no DOC in lab analysis.

NG - No Guideline

Detection limit can vary as described in the COA. Detection limit can be raised when dilutation is requited due to high Dissolved Solids/Electrical Conductivity (DLDS), e.g. nitrite.

BOLD and shaded dark gray: Exceeds BCAWQG-FSTM (Short-term Maximum) guideline.

Shaded Light Gray: Exceeds BCAWQG-LTA (Long-term Average) guideline.

RED - Measured value is below detection limit (DL); value shown is 50% of DL

Blank - Not analyzed

TETRA TECH

Appendix B4 LBDB Area Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND	LBP POND	LB EDS Armor	LB WDS Armor
					23-Apr-21	19-May-21	24-Jun-21	21-Jul-21	29-Aug-21	21-Sep-21	28-Oct-21	20-Jul-21	21-Jul-21
Physical Parameters													
Temperature	°C												
Flow Rate	L/sec												
Acidity (Total as $CaCO_3$)	µg/L	1000	NG	NG	10300	3800	9300	26700	10200	17100	11400	2300	1500
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	92.3	150	161	89	180	295	363	98.7	106
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	2730	3490	3830	3340	2720	<2	3940	3790	1720
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	1180000	1700000	2120000	1650000	1370000	1940000	222000	1200000	647000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L												
pH	pH Units	0.10	6.5 - 9	6.5-9.0	7.15	7.84	7.69	6.82	7.83	7.74	8.07	7.78	7.92
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	2250000	2860000	3500000	3150000	2510000	3140000	3740000	3450000	1440000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	9800	2300	34600	137000	5800	15900	23500	717000	41700
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<2000	<1000	<5000	<1000	<1000	<1000	<5000	<5000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	<1000	<2000	<1000	<5000	<1000	<1000	<1000	<5000	<5000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	92300	150000	161000	109000	180000	295000	363000	120000	129000
Anions and Nutrients													
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0)	pH dependent (6.5-9.0)	84	<50	<50	177	<50	<50	<50	232	78
Ammonia FST Guideline	µg/L		pH dependent (**at Temp 4 °C** or in situ T)		18800	8770	10300	24500	8770	10300	4950	8770	7420
Ammonia FLT Guideline	µg/L			pH dependent (**at Temp 4 °C** or in situ T)	1970	1690	1980	1970	1690	1980	952	1690	1430
Chloride (Cl^-)	µg/L	500	600000	150,000	5200	6400	7700	8200	6700	11000	12500	5200	6200
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	39	34	42	492	<25	50	50	2090	1290
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 µg/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 µg/L	<5	<5	<5	7.9	<5	<10	<10	42	8.1
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	1540000	2160000	2560000	2220000	1570000	2200000	2290000	2470000	942000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000 Hardness 181,000-250,000 = 429,000 Hardness > 250,000 site-specific	429000	429000	429000	429000	429000	429000	429000	429000	429000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	11.3	17.8	22.9	23.1	21.5	19	29.3	16.9	13.4
Metals, Total													
Aluminum	µg/L	3.00	NG	NG	697	164	389	2540	83	334	245	15700	1130
Antimony	µg/L	0.10	NG	NG	0.13	0.5	1	1	0.5	1	1	1	<0.5
Arsenic	µg/L	0.10	5.0	5.0	0.61	0.6	1.1	3.7	0.83	1.1	1	**21**	1.94
Barium	µg/L	0.10	NG	NG	36.5	27.8	60.2	149	52.7	42.5	31.5	929	79.3
Beryllium	µg/L	0.10	NG	NG	0.13	0.5	1	1	0.5	1	1	1	<0.5
Bismuth	µg/L	0.05	NG	NG	<0.05	0.25	0.5	0.5	0.25	0.5	0.5	0.5	<0.25
Boron	µg/L	10.0	1200	1200	135	153	250	250	256	250	240	180	83
Cadmium	µg/L	0.005	NG	NG	1.14	0.493	0.111	0.507	0.314	0.055	0.07	2.16	0.117
Calcium	µg/L	50	NG	NG	242000	365000	469000	345000	363000	425000	460000	285000	149000
Cesium	µg/L	0.01	NG	NG	0.045	0.05	0.1	0.57	0.05	0.1	0.1	3.42	0.299
Chromium [4]	µg/L	0.1-1.0	NG	NG	0.88	0.5	1	4.3	0.5	1	1	30.5	4.77
Cobalt	µg/L	0.10	110	4.0	77.2	45.9	9.5	12.9	2.58	5.1	7.9	17.7	1.4
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	1.44	2.5	5	8.2	2.5	5	5	64.7	5.9
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000		39.6	39.6	39.6	39.6	39.6	39.6	22.868	39.6	39.6
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10	10	10	10	10	10	10	8.88	10	10
Iron	µg/L	10	1000	NG	**1260**	360	**4280**	**9810**	370	**1140**	**2950**	**37500**	**2870**
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	0.175	0.25	0.5	3.43	0.25	0.5	0.5	27.1	1.61
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		417.0	417.0	417.0	417.0	417.0	417.0	225.3	417.0	417.0
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	19.6	19.6	19.6	19.6	19.6	19.6	12.1	19.6	19.6
Lithium	µg/L	1.0	NG	NG	78.7	96.5	103	71	81.8	67	72	142	21.2
Magnesium	µg/L	5.0	NG	NG	139000	176000	246000	198000	188000	247000	249000	167000	67600
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	**5880**	**5310**	**2590**	2170	1470	2630	**5940**	820	81.2
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		3394.2	3394.2	3394.2	3394.2	3394.2	3394.2	2986.4	3394.2	3394.2
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	2585	2585	2585	2585	2585	2585	1581.8	2585	2585
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	0.0117	<0.005	<0.005	0.0056	0.12	0.0134
Molybdenum	µg/L	0.05	2000	≤ 1000	0.735	0.54	1	1.75	1.56	1.29	0.74	13.8	12.5
Nickel	µg/L	0.50	NG		116	130	43.4	41.5	33.4	29	34.2	79.9	6.5
Phosphorus	µg/L	50.0	NG	NG	<50	<250	500	500	<250	500	500	1140	<250
Potassium	µg/L	50.0	NG	NG	13500	17300	16600	12400	16300	15000	16100	12200	6000
Rubidium	µg/L	0.2	NG	NG	4.01	6.1	5.5	9.9	4.7	5.7	5.1	31.2	3.3
Selenium	µg/L	0.05	NG	2.0	0.346	0.42	0.5	0.73	0.64	0.5	0.5	9.87	1.28
Silicon	µg/L	100.0	NG	NG	4190	4380	1540	4610	1540	1370	1060	25500	6060
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	<0.01	0.05	0.1	0.1	0.05	0.1	0.1	0.5	0.05
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	261000	312000	371000	296000	264000	293000	306000	521000	148000
Strontium	µg/L	0.2	NG	NG	598	866	1070	854	941	938	1030	1630	534
Sulfur	µg/L	500.0	NG	NG	563000	760000	920000	681000	698000	772000	799000	687000	303000
Tellerium	µg/L	0.2	NG	NG	<0.2	1	2.0	2	1	2	2	2	<1
Thallium	µg/L	0.01	NG	NG	0.028	0.05	0.1	0.1	0.05	0.1	0.1	0.61	<0.05
Thorium	µg/L	0.10	NG	NG	<0.1	0.5	1.0	1	0.5	1	1	8.4	<0.5
Tin	µg/L	0.10	NG	NG	<0.1	0.5	1.0	1	0.5	1	1	1	<0.5
Titanium	µg/L	0.3-4.5	NG	NG	3.74	1.5	3.8	21.7	1.5	4.1	3	99.8	20.5
Tungsten	µg/L	0.10	NG	NG	<0.1	0.5	1.0	1	0.5	1	1	1	<0.5
Uranium	µg/L	0.01	NG	NG	1.4	2.34	4.1	2.29	4.15	6.36	5.86	9.1	3.82
Vanadium	µg/L	0.50	NG	NG	0.82	2.5	5.0	9.8	2.5	5	5	51.4	5.2
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	**627**	**517**	70.0	198	66	30	40	**422**	<15
Zn FST Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		340.5	340.5	340.5	340.5	340.5	340.5	132.0	340.5	340.5
Zn FLT Guideline Calc.	µg/L			Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	187.5	187.5	187.5	187.5	187.5	187.5	106.5	187.5	187.5
Zircronium	µg/L	0.06	NG	NG	0.32	<1	<2	<2	<1	<2	<2	4.9	<1
Metals, Dissolved													
Aluminum [5]	µg/L	1.0	100	50	26	36.9	44.0	**110**	14.4	12	2.3	**122**	12.5
Al FST Guideline Calc (based on pH)	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50	50	50	50
Antimony	µg/L	0.10	NG	NG	0.11	<0.5	1.0	1	0.5	1	<0.1	1	<0.5
Arsenic	µg/L	0.10	NG	NG	0.35	0.61	1.0	1	0.51	1	<0.1	1	0.61
Barium	µg/L	0.10	NG	NG	32.9	26.9	61.4	45.5	42	33.6	2.7	61.9	30.9
Beryllium	µg/L	0.10	NG	NG	<0.1	<0.5	1.0	1	0.5	1	<0.1	1	<0.5
Bismuth		0.05	NG	NG	<0.05	<0.25	0.5	0.5	0.25	0.5	<0.05	0.5	<0.25
Boron	µg/L	10.0	NG	NG	115	200	310	230	222	230	25	130	<71
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	1.15	0.268	0.098	0.605	0.187	0.05	0.0025	0.198	<0.025
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		2.80	2.80	2.80	2.80	2.80	2.80	1.34	2.80	2.80
Cd FLT Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.46	0.46	0.46	0.46	0.46	0.46	0.38	0.46	0.46
Calcium	µg/L	50.0	NG	NG	253000	380000	437000	331000	299000	391000	44400	242000	145000
Cesium	µg/L	0.01	NG	NG	<0.01	<0.05	0.1	0.1	0.05	0.1	<0.01	0.1	<0.05
Chromium	µg/L	0.10	NG	NG	0.11	<0.5	1.0	1	0.5	1	<0.1	1	2.58
Cobalt	µg/L	0.10	NG	NG	80.5	46.2	9.8	20.8	2	4.5	0.83	1	<0.5
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	0.98	1.1	2.0	2	1.3	<2	0.1	5.1	3
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		24.2	90	85.8	26.6	100.3	86.2	95.6	80.1	76.3
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	3.5	11	9.1	89	11.6	9.3	15.6	98.7	106
Iron	µg/L	10.0	350	NG	98	<50	**2620**	**9730**	50	100	100	150	<50
Lead	µg/L	0.05	NG	NG	<0.05	<0.25	0.5	0.5	0.25	0.5	<0.05	0.5	<0.25
Lithium	µg/L	1.0	NG	NG	74.1	96.4	104	84	68.7	73	7.8	116	19.8
Magnesium	µg/L	5.0	NG	NG	132000	182000	250000	199000	152000	233000	27000	146000	69100
Manganese	µg/L	0.10	NG	NG	5850	5730	2770	2500	1200	2560	640	172	21.3
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	0.717	0.51	1.11	0.67	1.3	1.3	0.074	10.2	11.8
Nickel	µg/L	0.50	NG	NG	118	129	44.7	64.5	26.7	26.2	3.67	8.1	3.3
Phosphorus	µg/L	50.0	NG	NG	<50	<250	500	500	<250	500	<50	500	<250
Potassium	µg/L	50.0	NG	NG	13900	19200	17600	11400	13100	15200	1740	8410	5630
Rubidium	µg/L	0.20	NG	NG	3.96	6.1	4.7	5.3	4	5.1	0.54	2.2	<1
Selenium	µg/L	0.05	NG	2.0	0.367	0.46	0.5	0.5	0.81	0.5	<0.05	7.49	1.18
Silicon	µg/L	50.0	NG	NG	3960	4710	1280	2540	1200	890	82	2500	4250
Silver	µg/L	0.01	NG	NG	<0.01	0.05	0.1	0.1	0.05	0.1	<0.01	0.1	0.05
Sodium	µg/L	50.0	NG	NG	261000	333000	379000	302000	206000	288000	33700	482000	146000
Strontium	µg/L	0.20	NG	NG	626	858	1090	775	781	942	98.1	1260	502
Sulfur	µg/L	500	NG	NG	616000	823000	1010000	728000	572000	785000	87800	705000	297000
Tellurium	µg/L	0.20	NG	NG	<0.2	<1	2.0	2	1	2	<0.2	2	<1
Thallium	µg/L	0.01	NG	NG	0.023	<0.05	0.1	0.1	0.05	0.1	<0.01	0.1	<0.05
Thorium	µg/L	0.10	NG	NG	<0.1	<0.5	1.0	1	0.5	1	<0.1	1	<0.5
Tin	µg/L	0.10	NG	NG	<0.1	<0.5	1.0	1	0.5	1	<0.1	1	<0.5
Titanium	µg/L	0.30	NG	NG	<0.3	<1.5	3.0	3	1.5	3	<0.3	3.3	<1.5
Tungsten	µg/L	0.10	NG	NG	<0.1	<0.5	1.0	1	0.5	1	<0.1	1	<0.5
Uranium	µg/L	0.01	NG	NG	1.28	2.26	4.2	1.65	3.33	6.04	0.548	6.37	3.6
Vanadium	µg/L	0.50	NG	NG	<0.5	<2.5	5.0	5	2.5	5	<0.5	5	<2.5
Zinc	µg/L	1.00	NG	NG	653	570	70.0	275	52.4	16	3.7	30	<5
Zircronium	µg/L	0.06	NG	NG	<0.2	<1.0	<2.0	<2.0	<1	<2	<0.2	<2	<1
Laboratory Work Order Number					L2579940	L2590139	L2606393	L2615413	L2633133	L2642773	L2656849	L2615413	L2615413
Laboratory Identification Number					L2579940-4	L2590139-1	L2606393-6	L2615413-1	L2633133-7	L2642773-1	L2656849-1	L2615413-2	L2615413-3

Appendix B5 L2 Powerhouse Area Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 US	L2 US	L2 US	L2 US	L2 US	L2 US	L2 US
					28-Jan-21	25-Feb-21	18-Mar-21	23-Apr-21	18-May-21	24-Jun-21	21-Jul-21	21-Aug-21	22-Sep-21	28-Oct-21	25-Nov-21	23-Apr-21	18-May-21	24-Jun-21	21-Jul-21	29-Aug-21	22-Sep-21	25-Nov-21
Physical Parameters																						
Temperature	°C																					
Flow Rate	L/sec																					
Acidity (Total as $CaCO_3$)	µg/L	1000; 2000	NG	NG	500	500	500	500	1000	500	500	500	500	500	1000	500	1000	500	2000	2000	500	1000
Alkalinity (Total as $CaCO_3$)	mg/L	1.0	NG	NG	209	260	241	175	228	328	200	110	344	325	381	224	186	239	187	212	221	220
Electrical Conductivity (EC)	µS/cm	2.0	NG	NG	683	763	854	513	824	1320	765	491	766	1470	1370	653	753	712	850	912	677	625
Hardness as CaCO3, dissolved	µg/L	500	NG	NG	166000	31800	81000	72500	49000	20400	37200	82600	25000	6650	17700	168000	264000	209000	299000	307000	224000	264000
Hardness as CaCO3, from total Ca/Mg (New January 2020)	µg/L																					
pH	pH Units	0.10	6.5 - 9.0	6.5-9.0	8.36	**10.06**	8.94	8.88	8.77	**9.22**	8.91	8.84	8.75	**9.58**	**10.3**	8.06	8.13	8.13	8.01	8.08	8.28	8.28
Total Dissolved Solids (TDS)	µg/L	10000	NG	NG	400000	698000	590000	329000	549000	847000	665000	315000	585000	884000	841000	397000	472000	470000	587000	661000	424000	414000
Total Suspended Solids (TSS)	µg/L	3000	NG	NG	8200	1500	33500	10800	162000	11500	573000	6700	2000	40300	7700	10100	38000	5600	57400	34500	44800	1500
Alkalinity (Hydroxide) as $CaCO_3$	µg/L	1000	NG	NG	<1000	<1000	<1000	<1000	<1000	<1000	<5000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<5000	<1000	<1000	<1000
Alkalinity (Carbonate as $CaCO_3$)	µg/L	1000	NG	NG	6000	196000	40000	28200	32600	85400	14200	19800	35800	129000	309000	<1000	<1000	<1000	<5000	<1000	<1000	<1000
Alkalinity (Bicarbonate as $CaCO_3$)	µg/L	1000	NG	NG	203000	63900	201000	146000	195000	243000	215000	90100	308000	195000	72100	224000	186000	239000	228000	212000	221000	220000
Anions and Nutrients																						
Ammonia (NH_4 as N)	µg/L	5.0	pH dependent (6.5-9.0); GL capped at pH 9.0	pH dependent (6.5-9.0); GL capped at pH 9.0	113	**1210**	412	241	391	335	381	400	191	640	**1140**	<50	<50	<50	<50	<50	<50	5.9
Ammonia FST Guideline	µg/L		pH dependent (**at Temp 4 °C** or in situ T)		2520	685	844	844	1040	685	844	1040	1040	685	685	4950	4950	4950	6220	4950	3150	3150
Ammonia FLT Guideline				pH dependent (**at Temp 4 °C** or in situ T)	484	132	162	162	201	132	162	201	201	132	132	952	952	952	1200	952	606	606
Chloride (Cl^-)	µg/L	500	600000	150,000	29700	40500	73300	39800	60800	124000	52900	28600	43900	116000	103000	30700	44900	9080	25000	11500	6830	17100
Nitrate (NO_3^- as N)	µg/L	5.0-25.0	NG	NG	221	371	200	179	288	122	366	199	33.2	280	198	697	1130	282	826	196	143	975
Nitrite (NO_2^- as N)	µg/L	1.0-5.0	Cl-dependent (> 10,000 µg/L) Guideline: 600 ug/L	Cl-dependent (> 10,000 µg/L) Guideline: 200 ug/L	16.1	23.1	74.2	19.8	110	18.1	61.5	16.2	<3	53.2	45.3	32.3	4.8	1.7	2.3	<5	<1	1.1
Sulphate (SO_4) [3]	µg/L	300	NG	309,000 - 429,000	122000	69200	140000	89600	135000	203000	125000	86100	108000	216000	169000	213000	151000	157000	236000	263000	147000	114000
SO4 FLT Guideline Calc	µg/L		NG	Hardness 76,000-180,000 = 309,000; Hardness 181,000-250,000 = 429,000; Hardness > 250,000 site-specific	309000	218000	309000	218000	218000	128000	218000	309000	128000	128000	309000	309000	429000	429000	429000	429000	429000	309000
Dissolved Organic Carbon (DOC)	mg/L	1.0	NG	NG	3.67	5.06	4.1	7.2	12	6.7	12	9.1	9.2	19.3	4720	1.8	3.8	2.5	7.6	7.4	3.0	1840
Metals, Total																						
Aluminum	µg/L	3.00	NG	NG	607	2960	1410	506	2960	728	6940	994	389	2200	2860	187	593	88.5	1230	151	593	27.6
Antimony	µg/L	0.10	NG	NG	0.92	4.73	2.94	1.74	7.43	4.33	5.31	2.02	1.25	4.74	5.7	0.62	0.87	0.73	0.87	0.47	0.46	0.72
Arsenic	µg/L	0.10	5.0	5.0	1.31	**7.13**	4.21	2.14	**7.65**	4.66	**10.7**	3.4	2.26	**6.98**	8.28	0.62	1.13	0.74	2.19	0.75	1.35	0.41
Barium	µg/L	0.10	NG	NG	65.4	62.8	75.3	60.8	225	57.5	468	63.1	50.5	91.2	51.6	90.3	114	95.6	181	89.4	108	105
Beryllium	µg/L	0.10	NG	NG	0.038	<0.1	<0.1	<0.1	0.17	<0.1	0.5	<0.1	<0.1	0.5	<0.1	<0.1	<0.1	<0.1	0.5	<0.1	<0.1	<0.1
Bismuth	µg/L	0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	0.083	<0.05	0.25	<0.05	<0.05	0.25	<0.05	<0.05	<0.05	<0.05	0.25	<0.05	<0.05	<0.05
Boron	µg/L	10.0	1200	1200	101	341	274	185	325	493	325	225	523	436	474	198	210	311	244	341	331	99
Cadmium	µg/L	0.005	NG	NG	0.036	0.0507	0.038	0.0365	0.193	0.0314	0.477	0.0293	0.0372	0.064	0.0291	0.0429	0.0865	0.0191	0.132	0.0315	0.041	0.01
Calcium	µg/L	50	NG	NG	57800	11400	28100	22600	32300	6810	49000	23600	8750	13300	4570	46100	81000	66100	94400	91700	72300	71800
Cesium	µg/L	0.01	NG	NG	0.053	0.152	0.134	0.067	0.47	0.079	0.896	0.047	0.055	0.143	0.093	0.035	0.122	0.014	0.246	0.03	0.114	<0.01
Chromium [4]	µg/L	0.1-1.0	NG	NG	1.63	2.79	3.42	1.91	16.3	1.22	18.1	1.24	0.93	3.12	2.82	0.97	2.47	0.35	3.45	0.47	1.23	6.26
Cobalt	µg/L	0.10	110	4.0	0.51	0.39	0.77	0.46	3.08	0.43	8.05	0.15	0.31	1.14	0.28	2.3	0.79	0.22	1.37	0.4	0.7	<0.1
Copper [3]	µg/L	0.50	Calc. based on Hardness	2 to 10	3.9	3.15	5.79	4.13	25.5	4.69	39.6	1.71	3.13	8.5	4.82	1.27	2.64	1.0	5.4	1.32	1.96	0.63
Cu FST Guideline Calc. (relevant prior to August 2019)	µg/L		Hardness 13,000 - 400,000 : calc.; Hardness ≥ 400,000 is Capped Value of 400,000		17.604	4.9892	9.614	8.82	6.61	3.9	5.4968	9.7644	4.35	2.6251	3.6638	17.8	26.8	21.6	30.106	30.858	23.056	26.816
Cu FLT Guideline Calc. (relevant prior to August 2019)	µg/L			Hardness 50,000 - 250,000: calc.; Hardness > 250,000, Cu = 10	6.64	1.272	3.24	2.90	1.96	0.8	1.488	3.304	1.0	0.266	0.708	6.7	10.0	8.4	10	10	8.96	10
Iron	µg/L	10	1000	NG	685	566	**1040**	444	**5260**	424	**17400**	141	372	**1420**	204	357	**1720**	172	**3580**	360	**1460**	27
Lead [3]	µg/L	0.05	101 - 348	Calc. based on Hardness	0.591	0.602	0.796	0.436	4.23	0.497	8.86	0.114	0.366	1.18	0.285	0.299	0.658	0.087	1.64	0.2	0.575	<0.05
Pb FST Guideline Calc (Based on Hardness as CaCO3), applies to water hardness 8000-360,000 µg/L	µg/L		Based on Hardness 8000-360,000 Hardness ≤ 8000: 3 Hardness > 8000 : calc.		155.6	19.0	62.4	54.2	32.9	10.8	23.2	64.0	14.0	3.0	9.0	158.0	158.0	158.0	158.0	158.0	227.9	281.0
Pb FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 8000-360,000 Hardness ≤ 8000, NG Hardness > 8000 : calc.	9.4	4.1	5.7	5.4	4.6	3.7	4.2	5.8	3.9	3.4	3.7	9.5	9.5	9.5	9.5	9.5	12.2	14.3
Lithium	µg/L	1.0	NG	NG	18	27.8	42.4	27.7	39.5	58	36.2	25.9	53.3	55.9	51.2	28.5	33.5	37.4	34.6	58.7	43.2	10.8
Magnesium	µg/L	5.0	NG	NG	15500	2310	9220	6110	4920	1620	6850	6780	1880	3900	1150	14300	15500	14600	19000	22700	17200	17000
Manganese [3]	µg/L	0.10	Calc. based on Hardness	Calc. based on Hardness	16.1	9.86	24.4	13.3	107	10.4	428	3.14	13.9	30.1	4.97	95.7	86.2	99.3	115	95.6	230	1.98
Mn FST Guideline Calc (Based on Hardness as CaCO3)	µg/L		Applies to Hardness 25000-259000 µg/L Mn : calc.		2369.3	890.4	1432.6	1339.0	1080.0	764.8	949.9	1450.3	815.5	613.3	735.1	2391	3394.18	2843.18	3394.18	3394.18	3008.48	3394.18
Mn FLT Guideline Calc (Based on Hardness as CaCO3)	µg/L			Applies to Hardness 37000-450000 µg/L Mn : calc.	1335.4	744.9	961.4	924.0	820.6	694.8	768.7	968.4	715.0	634.3	682.9	1344	1766.6	1524.6	1920.6	1955.8	1590.6	1766.6
Mercury (Based on methyl Hg & total mass Hg)	µg/L	0.005	NG	Calc.	<0.005	<0.005	<0.005	<0.005	0.0209	<0.005	0.0662	<0.005	<0.005	0.0107	<0.005	<0.005	<0.005	<0.005	0.0113	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	2000	≤ 1000	10.3	39.2	26.8	16.2	33	32.2	20.9	32	15.3	69.9	64.2	2.65	5.28	3.34	4.95	2.87	2.77	6.16
Nickel	µg/L	0.50	NG		1.75	1.86	2.57	1.87	7.77	2.51	22	1.36	1.73	3.3	2.02	6.69	5.04	2.41	6.6	4.96	3.12	0.84
Phosphorus	µg/L	50.0	NG	NG	<50	79	67	<50	214	61	700	<50	103	<250	60	<50	92	<50	<250	<50	88	<50
Potassium	µg/L	50.0	NG	NG	2090	14900	10100	3990	14700	8660	10600	8370	3410	15100	21500	2040	3230	2490	3500	2740	2050	3950
Rubidium	µg/L	0.2	NG	NG	1.89	18.4	12	4.88	19.3	9.11	19.6	8.47	3.66	16.4	24.3	1.26	2.36	1.43	3.5	1.63	2.09	1.75
Selenium	µg/L	0.05	NG	2.0	1.62	1.4	1.81	1.16	2.11	0.84	2.07	1.7	0.436	1.83	1.43	1.93	3.43	1.17	2.92	1.5	1.11	3.47
Silicon	µg/L	100.0	NG	NG	4530	10800	7010	4280	13000	6330	16500	5730	5030	10100	10600	2710	5050	4260	6290	5510	5240	4480
Silver [3] (Based on Hardness < or > 100000)	µg/L	0.01	0.10 - 3.0	0.05 - 1.5	<0.017	0.023	**0.147**	0.014	**0.174**	0.025	**0.193**	<0.01	0.026	**0.105**	0.022	<0.01	0.016	<0.01	0.05	<0.01	<0.01	<0.01
Ag FST Guideline Calc	µg/L		Hardness ≤ 100,000 Ag = 0.10 Hardness > 100,000 Ag = 3.0		3.0	0.1	0.1	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Ag FLT Guideline Calc	µg/L			Hardness ≤ 100,000 Ag = 0.05 Hardness > 100,000 Ag = 1.5	1.5	0.05	0.05	0.050	0.050	0.050	0.050	0.050	0.050	0.050	0.050	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Sodium	µg/L	50.0	NG	NG	83200	160000	190000	110000	150000	281000	156000	141000	230000	297000	294000	76800	60100	78700	69900	93500	72600	38400
Strontium	µg/L	0.2	NG	NG	212	76.8	144	127	151	62.9	204	130	60.3	100	58.8	349	542	451	544	588	521	268
Sulfur	µg/L	500.0	NG	NG	46400	27100	53200	31800	47900	57600	47800	50400	40700	77500	59200	31500	54600	51600	87300	96800	54300	39800
Tellerium	µg/L	0.2	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	1	<0.2	<0.2	1	<0.2	<0.2	<0.2	<0.2	1	<0.2	0.27	<0.2
Thallium	µg/L	0.01	NG	NG	0.012	0.034	0.02	0.012	0.063	0.013	0.279	<0.01	0.012	0.05	<0.01	0.018	0.028	0.017	0.05	0.018	0.021	<0.01
Thorium	µg/L	0.10	NG	NG	0.14	0.11	0.19	<0.1	0.75	<0.1	1.97	<0.1	<0.1	0.5	<0.1	<0.1	0.2	<0.1	0.5	<0.1	0.17	<0.1
Tin	µg/L	0.10	NG	NG	0.75	1.56	4.26	1.77	6.8	2.63	5.92	0.82	32.2	1.9	1.41	0.12	2.61	0.39	0.85	0.26	0.28	0.13
Titanium	µg/L	0.3-4.5	NG	NG	21.9	8.43	20.8	9.21	72.6	7.06	112	1.89	5.75	24.6	4.68	3.32	16.1	2.3	31.4	2.9	13.3	0.55
Tungsten	µg/L	0.10	NG	NG	0.3	2.24	71	24.1	28.1	29	4.22	2.33	4.76	6.88	22.6	<0.1	0.13	0.12	0.5	<0.1	<0.1	0.15
Uranium	µg/L	0.01	NG	NG	1.55	0.564	1.47	0.939	1.47	0.901	1.88	0.761	0.703	0.92	0.736	2.17	1.7	1.34	1.61	1.78	1.26	1.51
Vanadium	µg/L	0.50	NG	NG	2.77	13	13.3	5.75	19.8	8.68	28.1	6.1	<3	18.5	37.6	1.13	2.59	0.69	5.2	1.16	<3	0.71
Zinc [3] (Based on Hardness < or > 90,000)	µg/L	3.0	Calc. based on Hardness	Calc. based on Hardness	19.9	8.2	24.7	21.4	**225**	14.1	**303**	4.4	14.9	**63**	6.5	11.3	11	5.8	25	6.4	9.3	3.5
Zn FST Guideline Calc.	µg/L		Hardness 90,000 - 500,000, Calc. Hardness > 500,000, is Capped Value of 500,000		90.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	91.5	163.5	122.3	189.8	195.8	133.5	163.5

Appendix B5 L2 Powerhouse Area Water Analytical Results

Parameter	Unit	RDL	BCAWQG - FST 1	BCAWQG - FLT 2	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS
					28-Jan-21	25-Feb-21	18-Mar-21	23-Apr-21	18-May-21	24-Jun-21
Zn FLT Guideline Calc.	µg/L			Hardness 90,000 - 330,000, Calc. Hardness > 330,000, is Capped Value of 330,000	64.5	7.5	7.5	7.5	7.5	7.5
Zirconium	µg/L	0.06	NG	NG	0.97	0.45	1.27	0.49	3.07	0.54
Metals, Dissolved										
Aluminum [5]	µg/L	1.0	100	50	36.6	2640	714	167	265	506
Al FST Guideline Calc (based on pH)	µg/L		pH < 6.5 : calc. Al pH ≥ 6.5 : 100.0 Al		100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	µg/L			median pH < 6.5 : calc. Al median pH ≥ 6.5 : 50.0 Al	50	50	50	50	50	50
Antimony	µg/L	0.10	NG	NG	0.49	3.26	2.39	1.71	7.72	4.63
Arsenic	µg/L	0.10	NG	NG	0.87	6.87	4.16	2.04	6.08	5.1
Barium	µg/L	0.10	NG	NG	39	35	30.6	43.8	43.5	38.6
Beryllium	µg/L	0.10	NG	NG	<0.02	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth		0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	µg/L	10.0	NG	NG	67	341	236	158	329	457
Cadmium [3] (Based on Hardness as $CaCO_3$)	µg/L	0.005	Calc. based on Hardness	Calc. based on hardness	0.0061	0.0103	0.0147	0.0088	0.0156	0.0103
Cd FST Guideline Calc.	µg/L		Hardness 7,000 - 455,000, Calc. Hardness > 455,000, is Capped Value of 455,000		0.99	0.18	0.47	0.42	0.28	0.11
Cd FLT Guideline Calc.	µg/L			Hardness 3,400 - 285,000, Calc. Hardness > 285,000, is Capped Value of 285,000	0.31	0.09	0.18	0.17	0.13	0.07
Calcium	µg/L	50.0	NG	NG	46300	9170	18100	20000	13900	5390
Cesium	µg/L	0.01	NG	NG	<0.01	0.071	0.03	0.016	0.029	0.032
Chromium	µg/L	0.10	NG	NG	0.54	1.82	2.15	1.4	11.4	0.61
Cobalt	µg/L	0.10	NG	NG	<0.1	<0.1	0.13	0.13	0.29	0.13
Copper [6]	µg/L	0.20	Calc. based on BLM Model	Calc. based on BLM Model	1.2	0.37	0.9	1.98	6.41	1.31
Cu FST Guideline Value (Acute)	µg/L		BLM Ligand Model value		30.4	70.1	51.7	88.4	142.4	94.4
Cu FLT Guideline Value (Chronic)	µg/L			BLM Ligand Model value	6.3	20	13.2	22.4	37.9	29.8
Iron	µg/L	10.0	350	NG	5	18	20	31	74	41
Lead	µg/L	0.05	NG	NG	<0.05	<0.05	<0.05	<0.05	0.126	<0.05
Lithium	µg/L	1.0	NG	NG	14.1	28.4	37.2	25.8	40.7	58.6
Magnesium	µg/L	5.0	NG	NG	12300	2170	8690	5500	3470	1690
Manganese	µg/L	0.10	NG	NG	1.72	0.98	2.41	4.97	3.06	2.59
Mercury	µg/L	0.005	NG	NG	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	µg/L	0.05	NG	NG	7.55	37.4	23.3	17.8	34.6	34
Nickel	µg/L	0.50	NG	NG	1.45	0.98	1.03	1.51	1.79	1.75
Phosphorus	µg/L	50.0	NG	NG	<50	<50	<50	<50	<50	<50
Potassium	µg/L	50.0	NG	NG	1490	15100	9990	3940	15000	9950
Rubidium	µg/L	0.20	NG	NG	1.13	16.8	11.4	4.66	15	10
Selenium	µg/L	0.05	NG	2.0	1.33	1.6	2.36	1.24	2.39	0.918
Silicon	µg/L	50.0	NG	NG	3280	10400	5630	3480	7070	6340
Silver	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.012	<0.01
Sodium	µg/L	50.0	NG	NG	56900	160000	189000	111000	158000	311000
Strontium	µg/L	0.20	NG	NG	177	69.9	109	123	92	58.2
Sulfur	µg/L	500	NG	NG	33400	28500	50900	33900	47300	64900
Tellurium	µg/L	0.20	NG	NG	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	µg/L	0.01	NG	NG	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Thorium	µg/L	0.10	NG	NG	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	µg/L	0.10	NG	NG	0.11	1.34	3.22	1.6	4.33	2.59
Titanium	µg/L	0.30	NG	NG	<0.3	1.28	0.82	0.8	2.15	2.25
Tungsten	µg/L	0.10	NG	NG	0.15	2.37	75	27.5	39	31.4
Uranium	µg/L	0.01	NG	NG	1.15	0.481	1.15	0.88	1.27	0.891
Vanadium	µg/L	0.50	NG	NG	0.81	12.2	12	4.79	13.4	9.18
Zinc	µg/L	1.00	NG	NG	3.7	1.1	1.1	2.4	6.8	4.4
Zirconium	µg/L	0.06	NG	NG	<0.3	<0.2	<0.2	<0.2	0.23	0.21
Laboratory Work Order Number					L2552704	L2561396	L2568765	L2579940	L2589443	L2606393
Laboratory Identification Number					L2552704-1	L2561396-1	L2568765-1	L2579940-1	L2589443-7	L2606393-7

Parameter	L2 DS	L2 DS	L2 DS	L2 DS	L2 DS	L2 US	L2 US	L2 US	L2 US	L2 US	L2 US	L2 US
	21-Jul-21	21-Aug-21	22-Sep-21	28-Oct-21	25-Nov-21	23-Apr-21	18-May-21	24-Jun-21	21-Jul-21	29-Aug-21	22-Sep-21	25-Nov-21
Zn FLT Guideline Calc.	7.5	7.5	7.5	7.5	7.5	66	138	96.75	164.25	170.25	108	138
Zirconium	3	<0.2	0.49	1.4	0.27	<0.2	0.49	<0.2	<1	<0.2	0.22	<0.2
Metals, Dissolved												
Aluminum [5]	227	920	164	255	2450	7.9	9.5	21.6	10.7	8.9	12	7.2
Al FST Guideline Calc (based on pH)	100	100	100	100	100	100	100	100	100	100	100	100
Al FLT Guideline Calc (based on median pH)	50	50	50	50	50	50	50	50	50	50	50	50
Antimony	5.75	1.95	1.18	0.93	6.84	0.62	0.94	0.74	0.72	0.47	0.44	0.7
Arsenic	4.08	3.31	2.15	1.25	7.59	0.47	0.58	0.65	0.59	0.5	0.66	0.32
Barium	44.2	59.2	37.4	7.75	38.7	82.7	96	99.6	141	81.7	82.1	107
Beryllium	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bismuth	<0.05	<0.05	<0.05	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Boron	295	221	423	92	447	165	204	283	248	333	275	93
Cadmium [3] (Based on Hardness as $CaCO_3$)	0.0122	0.0142	0.0145	0.0064	<0.025	0.0172	0.0423	0.0125	0.0517	0.0176	0.0062	0.0118
Cd FST Guideline Calc.	0.21	0.48	0.14	0.04	0.10	1.00	1.60	1.26	1.82	1.87	1.35	1.60
Cd FLT Guideline Calc.	0.10	0.18	0.08	0.03	0.06	0.31	0.43	0.36	0.46	0.46	0.38	0.43
Calcium	10800	22300	7250	1560	4940	45500	80000	58400	90300	86700	62800	76700
Cesium	0.017	0.03	<0.01	<0.01	0.088	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chromium	4.31	1.1	0.18	0.25	<2.5	0.25	1.4	0.3	1.05	0.17	0.12	5.89
Cobalt	0.25	<0.1	<0.1	<0.1	<0.5	1.78	0.26	0.17	0.21	0.21	0.18	<0.1
Copper [6]	4.05	1.06	1.16	0.36	4.22	0.57	1.08	0.84	1.28	0.65	0.44	0.59
Cu FST Guideline Value (Acute)	157.2	109	113.7	282.4	67.1	12.7	28.2	18.9	50.9	53	25.6	14
Cu FLT Guideline Value (Chronic)	200	27	26.1	103.2	21.2	1.6	4.9	2.9	187	8.6	4.9	2.7
Iron	37	18	34	13	63	5	5	14	5	5	5	<10
Lead	0.122	<0.05	0.108	<0.05	<0.25	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Lithium	28.7	26.1	55.4	11.5	54.1	26.4	36.2	37	36.8	57.4	43.7	10.7
Magnesium	2490	6510	1680	665	1300	13300	15700	15400	17900	22000	16300	17600
Manganese	3.08	0.74	7.17	0.35	1.19	81	51.5	98.5	39.6	79.2	161	0.9
Mercury	0.0085	0.0061	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Molybdenum	25.5	30.7	15.2	14.7	63.1	3.2	5.75	3.51	5.12	2.89	2.95	6.21
Nickel	1.42	1.06	1.06	<0.5	<2.5	5.57	3.67	2.36	2.82	4.13	1.59	0.64
Phosphorus	<50	<50	58	<50	<250	<50	<50	<50	<50	<50	<50	<50
Potassium	9720	8260	3460	3020	20600	2000	3420	2740	3760	2650	2030	4120
Rubidium	9.04	8.47	3.22	3.04	22.8	0.94	1.32	1.52	1.68	1.28	1.01	1.49
Selenium	1.97	1.51	0.47	0.342	1.36	2.26	3.74	1.23	2.94	1.47	1.15	4.09
Silicon	5110	5670	4140	1640	10200	2320	4150	4320	4510	5100	3770	4730
Silver	<0.01	<0.01	<0.01	<0.01	<0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Sodium	147000	133000	227000	60600	306000	76200	66200	85700	68500	86500	74100	38500
Strontium	79	126	54.6	16.6	62.1	355	622	437	537	570	507	264
Sulfur	45100	50200	39300	15400	61400	32900	56100	59700	75600	94000	54600	39100
Tellurium	<0.2	<0.2	<0.2	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Thallium	0.041	<0.01	<0.01	<0.01	<0.05	<0.01	0.013	0.017	0.02	0.013	<0.01	<0.01
Thorium	<0.1	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Tin	3.31	0.75	30.1	0.25	1.44	<0.1	2.36	0.35	0.57	0.22	0.18	0.1
Titanium	1.27	0.54	1.69	0.54	1.93	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Tungsten	9.42	2.38	4.74	1.45	28.7	<0.1	0.24	0.14	0.18	<0.1	<0.1	0.12
Uranium	1	0.757	0.657	0.162	0.963	2.09	1.79	1.32	1.53	1.64	1.19	1.55
Vanadium	7.88	5.37	2.02	3.24	39.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Zinc	6.1	2.4	3.7	<1	<5	7.8	2.7	5.2	2.3	3.2	1.8	2.9
Zirconium	<0.2	<0.2	0.31	<0.2	<1	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Laboratory Work Order Number	L2617671	L2633133	L2642773	L2656849	CG2106088	L2579940	L2589443	L2606393	L2617671	L2633133	L2642773	CG2106088
Laboratory Identification Number	L2617671-1	L2633133-5	L2642773-4	L2656849-2	CG2106088-005	L2579940-2	L2589443-8	L2606393-5	L2617671-2	L2633133-6	L2642773-5	CG2106088-006

TETRA TECH