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Technical Report Overview

Report: 2022 Line Creek Operations Local Aquatic Effects Monitoring Program (LAEMP) Report for Dry Creek

Overview: The Line Creek Operation (LCO) Dry Creek Local Aquatic Effects Monitoring Program (LAEMP) was designed to assess potential effects of Phase II Project of Line Creek Operations (LCOII) on Dry Creek, Grace Creek, and Unnamed Creek (ENV 2013) and was initiated in 2014. This report focuses on data from 2022.

This report was prepared for Teck by Minnow Environmental Inc.

For More Information

If you have questions regarding this report, please:

- Phone toll-free to 1.855.806.6854
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Future studies will be made available at **teck.com/elkvalley.**

2022 Line Creek Operations Local Aquatic Effects Monitoring Program (LAEMP) Report for Dry Creek

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April 2023

2022 Line Creek Operations Local Aquatic Effects Monitoring Program (LAEMP) Report for Dry Creek

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EXECUTIVE SUMMARY

The Line Creek Operation (LCO) Dry Creek Local Aquatic Effects Monitoring Program (LAEMP) was designed to assess potential effects of Phase II Project of Line Creek Operations (LCOII) on Dry Creek, Grace Creek, and Unnamed Creek and was initiated in 2014, prior to spoiling in the watershed (2015; ENV 2013). To comply with discharge requirements outlined in permit 5353 for total suspended solids, Teck constructed the Line Creek Operation (LCO) Dry Creek Water Management System (DCWMS), which began operation in 2015. In 2019, a pathway was theorized that described enhanced primary production in the DCWMS sedimentation ponds that promoted the generation of organic selenium compounds (specifically DMSeO and MeSe[IV]), leading to increased benthic invertebrate tissue selenium concentrations downstream of the DCWMS (Minnow 2020). As a response to this result, a seasonal bypass of the DCWMS was initiated in 2020 to mitigate selenium bioaccumulation in biota, only using the sedimentation ponds during freshet (i.e., higher-flow periods). Further mitigation strategies initiated in 2021 included the use (i.e., filling) of only one of the two available DCWMS sedimentation ponds. The bypass of the DCMWS was operational throughout most of 2022, except from May to July.

This report evaluates Dry Creek monitoring data up to the end of the 2022 calendar year to evaluate five study questions.

Study Question #1: Are aqueous concentrations of mine-related constituents elevated in relation to British Columbia Water Quality Guidelines (BCWQG) and Elk Valley Water Quality Plan (EVWQP) benchmarks, and are concentrations changing over time? Concentrations of many aqueous mine-related constituents have increased in Dry Creek since mining began in 2015. Despite these increases, in 2022, the majority of constituents were below water quality guidelines, SPOs, benchmarks and/or updated effects concentrations. Exceptions to this were total selenium which exceeded the SPO, nitrate which was above the updated effects concentrations, and nickel which was above the proposed benchmarks in 2022. Elevated organoselenium concentrations that were observed in 2018 and 2019 have decreased since that time due to the implementation of the DCWMS bypass. Constituent concentrations were greatest at areas immediately downstream of LCOII spoiling and downstream of the DCWMS and decreased at downstream locations, likely due to inputs of groundwater and surface water from non-mine affected areas between LC_DC2 and LC_DC4 (Golder 2019b). Similar increasing trends in aqueous constituents were generally not detected at the reference areas, in the Fording River downstream of Dry Creek, or in Grace Creek, however, except occasionally nitrate and selenium at the reference area and downstream of Dry Creek in the Fording.

Study Question #2: Is acute or chronic toxicity occurring from water collected at the outlet of the DCWMS (LC_SPDC) or within Dry Creek (LC_DCDS), and is toxicity changing over time? Acute toxicity testing of water from the outlet of the DCWMS as well as within Dry Creek showed no test failures in 2022. Chronic toxicity is monitored in Dry Creek directly downstream of the DCWMS (LC_DCDS), under the regional chronic toxicity program. In 2022, nickel and/or nitrate were identified as potentially causing the observed effects on water fleas and amphipods. All chronic toxicity on rainbow trout and fathead minnow in 2022 were categorized as no effect. Overall, chronic toxicity results have shown a low proportion of adverse responses over time within Dry Creek (LC_DCDS), with a frequency and magnitude of responses that was similar between 2019 to 2022 for most endpoints, and responses have been mostly limited to invertebrate endpoints.

Study Question #3: Are benthic invertebrate community endpoints within normal ranges based on samples collected at regional and local reference areas within the Elk River as part of the Regional Aquatic Effects Monitoring Program (RAEMP), and are the endpoints changing over time? Total abundance and taxonomic richness were generally within regional and site-specific normal ranges at all areas in Dry Creek in 2022. Over the 2019 to 2022 monitoring period, there have been decreases in benthic community endpoints used to evaluate changes in watershed health, at all areas along Dry Creek. Proportions of Ephemeroptera measured at the mine-exposed areas were almost always significantly lower than those associated with the community in the Dry Creek reference area. It is therefore likely that mining activities are contributing to changes in some benthic invertebrate community endpoints in some areas of Dry Creek. Between 2021 and 2022 there was also a decrease in total abundance at all stations on Dry Creek, including the reference station. Currently, there are no water quality parameters that point to a cause of this decrease in 2022. The community in Dry Creek upstream of the DCWMS headpond most frequently had endpoints outside of normal ranges. In 2022, benthic invertebrate communities located upstream and downstream of the mouth of Dry Creek in the Fording River differed from each other; however, community endpoints were generally within regional normal ranges and show no temporal variation in the mainstem.

Study Question #4: How do selenium concentrations in benthic invertebrate tissue compare to normal ranges and BCWQG or EVWQP benchmarks, and are they changing over time? In most areas of Dry Creek downstream of the DCWMS, benthic invertebrate tissue selenium concentrations were the same in 2022 as 2021 and lower than 2020, although were occasionally higher than regional normal ranges and reference concentrations (most often in May). Downstream of the DCWMS the decreases in benthic invertebrate tissue selenium concentrations measured in 2022 and 2021 relative to earlier years (2020) were primarily attributable to changes in the water management of the DCWMS (i.e., bypass the sedimentation ponds throughout most of the year and limiting use of the DCWMS to one rather than two sedimentation ponds). Within the Fording River, benthic invertebrate tissue selenium concentrations upstream and downstream of Dry Creek were generally similar to each other and have remained unchanged in 2022 relative to earlier years (2019 to 2021), indicating that Dry Creek water quality has had limited or no influence on benthic invertebrate tissue selenium concentrations in area of the Fording River mainstem. Additionally, a quarterly benthic invertebrate mean tissue selenium concentrations limit at the monitoring station downstream of the DCWMS (LC_DCDS) will come into effect on April 1, 2023 (ENV 2022).

Study Question #5: Are changes in fish and fish habitat (including instream flow and calcite index) occurring within Dry Creek as a result of mine operations? The fish-bearing portion of Dry Creek (i.e., downstream of the East Tributary) is a coldwater stream with water temperatures that may pose challenges to fish growth and recruitment. Overall, the available observations indicate that all locations in Dry Creek in 2022 had water temperatures that may have limited fish recruitment; that is, growing season degree days were less than the minimum threshold of 800. Streamflow trends were generally consistent with historical records in 2022, with the exception of average flows during rearing and early incubation periods being 22% higher than the previous record high in 2013. Fewer redds were observed in 2022 than in 2021 in the UFR, including in Dry Creek, which may be associated with the cold early season water temperatures in 2022. The number of redds counted is similar to the number counted in the years from 2015 to 2017 in Dry Creek. Body condition and densities of age-1 and age-2+ fish were similar to previous years. Based on a limited dataset, age-0 fish were shorter in 2022 compared to previous years (2015 and 2016). This may be related to a decrease in water temperatures after the seasonal sediment pond by-pass was put into operation in 2020. Similar to previous years, in 2022, calcite concretion was not observed in Dry Creek during the Regional Calcite Monitoring Program. Calcite levels in Dry Creek continue to be below those expected to result in measurable biological effect, although there is a trend toward increased calcite presence.

The results from the Dry Creek LAEMP provide information that supports Teck's Adaptive Management Plan (AMP). The monitoring and management of the DCWMS are adaptive management responses that have been and continue to be actively adjusted to develop our understanding of the watershed and how changes to water management (particularly with respect to the DCWMS) can improve conditions in Dry Creek. The results from this study also support the evaluation of biological triggers, which are intended to identify unexpected monitoring results that may lead to additional monitoring or mitigation responses under the AMP response framework.

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ACRONYMS AND ABBREVIATIONS

%E – relative proportion of Ephemeroptera

%EPT – relative proportion of Ephemeroptera, Plecoptera, and Trichoptera

AMP – Adaptive Management Plan

ANOVA – Analysis of Variance

BC – British Columbia

BCWQG – British Columbia Water Quality Guidelines

BRN – Burnt Ridge North

CABIN – Canadian Aquatic Biomonitoring Network

CI – Calcite Index

CMM – Coal Mountain Mine

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

DCFFHMP – Dry Creek Fish and Fish Habitat Monitoring Program

DCWMS – Dry Creek Water Management System

DFO – Fisheries and Oceans Canada

DMSeO – Dimethyl Selenoxide

DO – Dissolved Oxygen

DQR – Data Quality Review

Ecofish – Ecofish Research Limited

EMC – Environmental Monitoring Committee

EMPR – British Columbia Ministry of Energy, Mines, and Petroleum Resources

ENV – British Columbia Ministry of Environment and Climate Change Strategy (formerly MOE)

EPT – Ephemeroptera (mayflies), Plecoptera (stoneflies), Trichoptera (caddisflies)

EVO – Elkview Operation

EVFFHC – Elk Valley Fish and Fish Habitat Committee

EVWQP – Elk Valley Water Quality Plan

DCWMP – Dry Creek Water Management Plan

dw – Dry Weight

FHAP – Fish Habitat Assessment Procedure

FLNRORD – Ministry of Forests, Lands, Natural Resource Operations, and Rural Development

FRO – Fording River Operation

GHO – Greenhills Operation

GSDD – Growing Season Degree Days

HSD – Honestly, Significant Difference

ICP-MS – Inductively Coupled Plasma Mass Spectrometry

IFRs – Instream Flow Requirements

K-M – Kaplan-Meier

KNC – Ktunaxa Nation Council

LAEMP – Local Aquatic Effects Monitoring Program

LCO – Line Creek Operations

LCOII – Line Creek Operations Phase II

LPL – Lowest Practicable Level, referring to taxonomic identification of benthic invertebrates

LRL – Laboratory Reporting Limit

MBCM – Million Bank Cubic Meters

MCT – Measure of Central Tendency

MeSe(IV) – Methylseleninic Acid

MOD – Magnitude of Difference

MOE – Mistry of the Environment

MWMP – Mine Water Management Plan

MWMxT – Mean weekly maximum water temperature

NCD – non-Chironomidae Diptera

Nupqu – Nupqu Resource Limited Partnership

PC – Principal Components

PCA – Principal Components Analysis

Qx – referring to calendar quarters

QA/QC – Quality Assurance / Quality Control

RAEMP – Regional Aquatic Effects Monitoring Program

SDM – Structured Decision Making

SPO – Site Performance Objective

Teck – Teck Coal Limited

TSS – Total Suspended Solids

UEC – Updated Effects Concentration

UFR – Upper Fording River

WCT – Westslope Cutthroat Trout

1 INTRODUCTION

1.1 Background

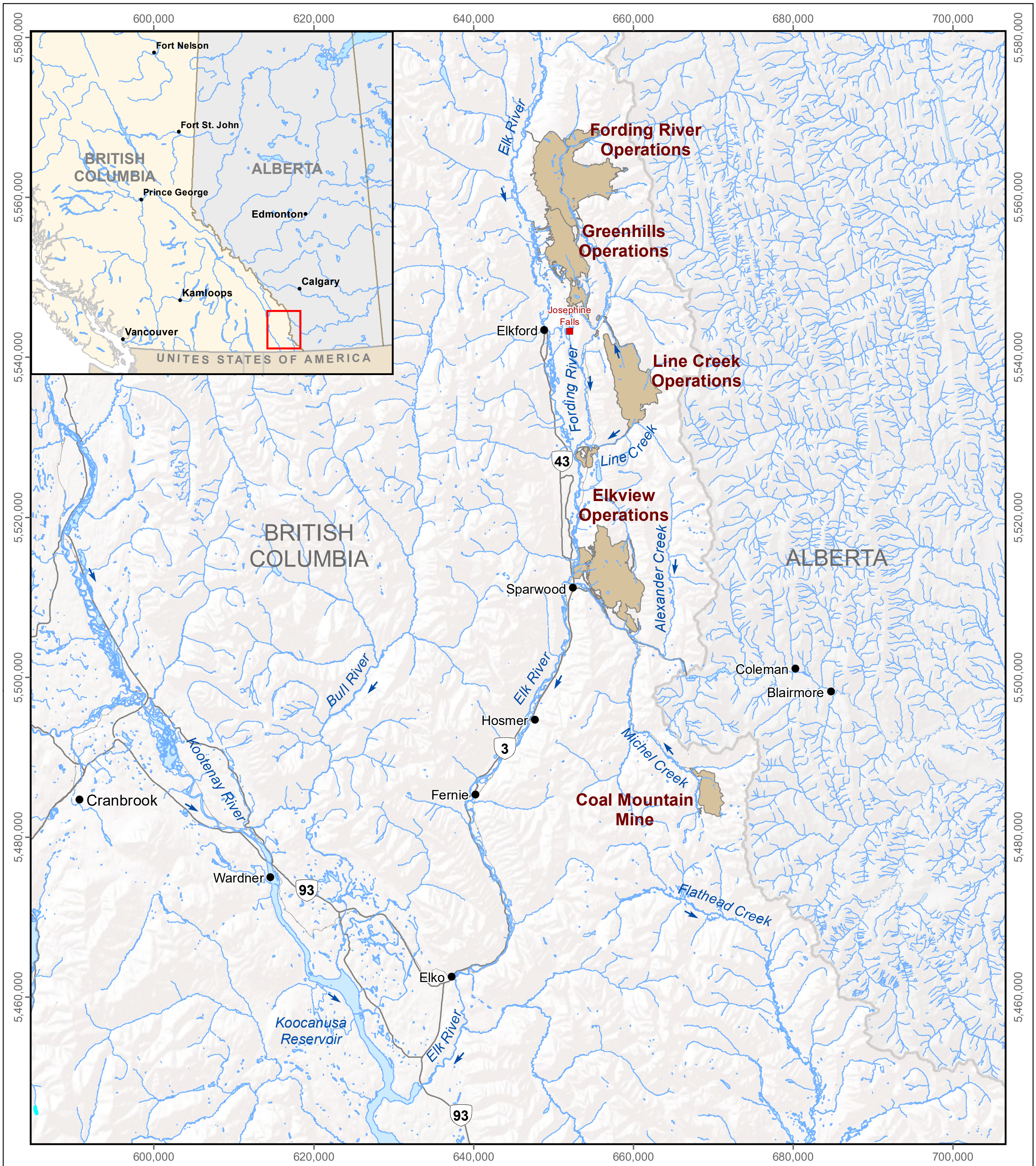
Teck Coal Limited (Teck) currently operates four steelmaking coal mines in the Elk River watershed in southeastern British Columbia (BC) which are the Line Creek Operation (LCO), Fording River Operation (FRO), Greenhills Operation (GHO), and Elkview Operation (EVO; Figure 1.1). A fifth mine, Coal Mountain Mine (CMm), is also owned by Teck and located in the Elk River watershed; however, it is no longer in operation and has been moved into the care and maintenance designation. Teck received a conditional Environmental Assessment Certificate in September 2013 for the LCO Phase II Project (LCOII) and development began in February 2014. The initial placement of waste rock in the Dry Creek watershed occurred in 2015, although minimal spoiling occurred in 2015 (<1 million bank cubic meters [MBCM]) by year increasing up to a current maximum of < 34 MBCB in 2022. The LCOII is expected to continue to 2035 and result in a disturbance of approximately 1,940 ha, with placement of waste rock over approximately 5 km of upper LCO[1] Dry Creek, a second order mountainous tributary to the Fording River at the north end of LCO property (Figure 1.2). Since 2015, surface and shallow groundwater from mine-influenced areas of the upper Dry Creek watershed have been managed through the Dry Creek Water Management System (DCWMS; Figure 1.2), briefly, the DCWMS collects and re-directs mine-influenced surface flow from upper Dry Creek through the sedimentation ponds prior to returning to Dry Creek downstream of the ponds (see Section 1.3 for details).

Section 8.3.1.2 of Permit 107517 (version January 27, 2023; ENV 2023) outlines the requirements for the LCO Dry Creek Local Aquatic Effects Monitoring Program (LAEMP) as follows:

> *"The Permittee must develop and implement a Local Aquatic Effects Monitoring program to determine the effects of mining activities from Line Creek Phase II in the LCO Dry Creek, Grace Creek and Unnamed Creek receiving environments. An annual study design for the program must be prepared in consultation with the EMC[2] and submitted to the Director for approval by May 1 each year.".*

[1] The creek is referred to as LCO Dry Creek to distinguish it from another Dry Creek associated with Teck's Elkview Operation (i.e., EVO Dry Creek).

[2] EMC refers to the Environmental Monitoring Committee, which Teck was required to form under Permit 107517. The EMC consists of representatives from Teck, BC Ministry of Environment and Climate Change, the Ministry of Energy and Mines, Environment Canada, the Ktunaxa Nation Council, Interior Health Authority, and an independent scientist. Environment Canada has agreed to provide input on a case-by-case basis when requested by the other members of the EMC but has not yet been called upon to participate. The EMC reviews submissions and provides technical advice to Teck and the ENV Director regarding monitoring programs.



LEGEND

Teck Coal Mine Operation

Teck's Coal Mine Operations within the Elk River Watershed, Southeast British Columbia

0 10 20 40 km

N W E S

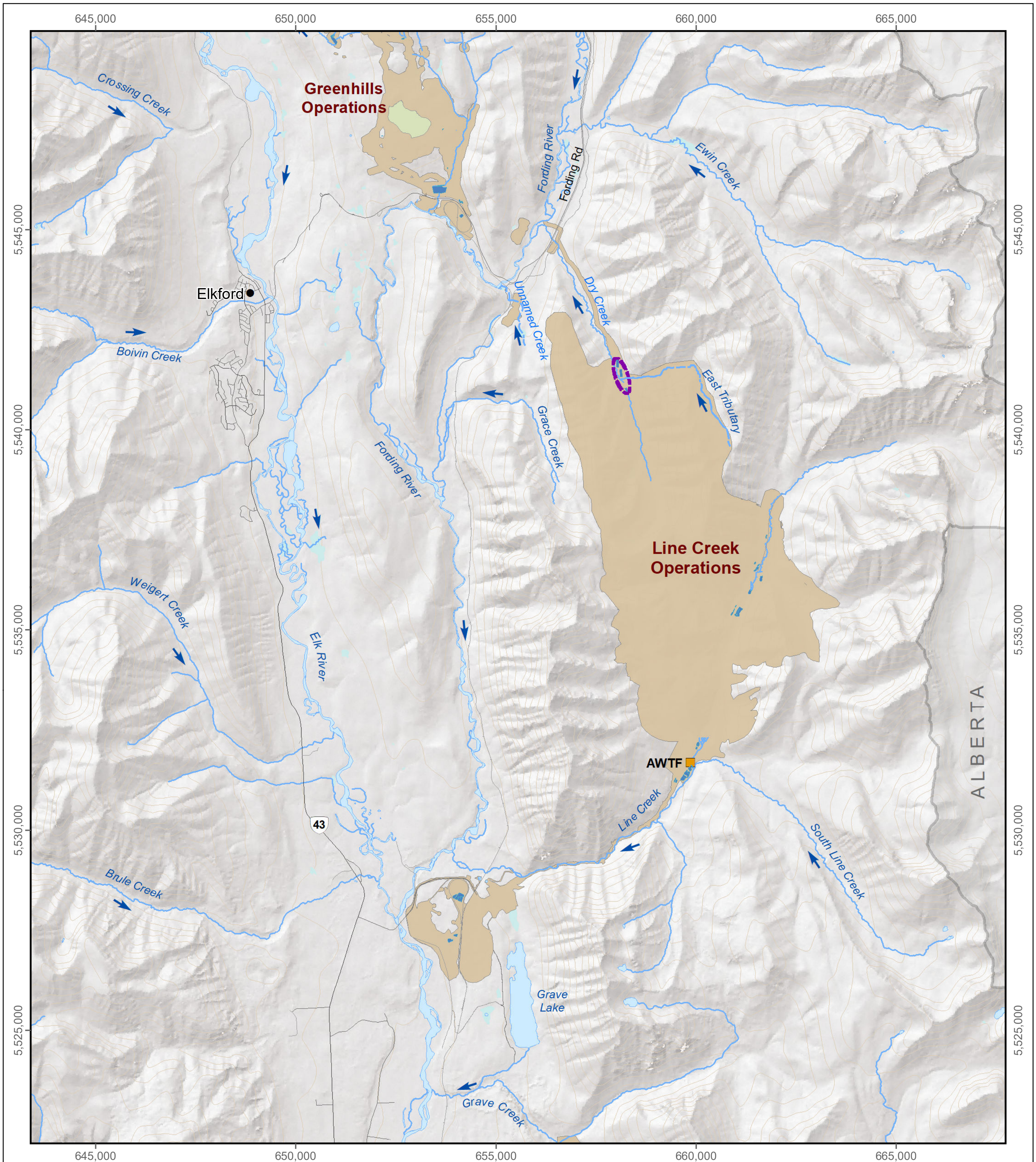
Projection: North American Datum 1983 UTM Zone 11

Date: April 2023
Project: 227202.0019

minnow environmental inc.

Figure 1.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0019 - 2022 LCO Dry Creek LAEMP\D - GIS\Dry Creek LAEMP\22-19 Figure 1.1 Teck Coal Limited Operation.mxd



LEGEND

- Settling Pond
- Tailings Pond
- Dry Creek Water Management System
- Active Water Treatment Facility (AWTF)
- Teck Coal Mine Operation

Overview of Line Creek Operation

0 2.5 5 10 km

N E S W

Projection: North American Datum 1983 UTM Zone 11N
Data Source: Reproduced under licence from Her Majesty the Queen in Right of Canada, Natural Resources Canada, BCGov and GeoBC. All rights reserved.

Date: April 2023
Project: 227202.0019

minnow environmental inc.

Figure 1.2

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0019 - 2022 LCO Dry Creek LAEMP\D - GIS\Dry Creek LAEMP\22-19 Figure 1.2 Overview LCO.mxd

Also, Section 9.5 of Permit 107517 states:

> *The LAEMP Annual Reports must be reported on in accordance with generally accepted standards of good scientific practice in a written report and submitted to the Director by April 30 of each year following the data collection calendar year.*

Concurrent with the LAEMP, site performance objectives (SPOs), instream flow requirements (IFRs), and environmental flow needs (EFNs) for Dry Creek have been proposed through an updated LCO Dry Creek Mine Water Management Plan (DCWMP) which was submitted to ENV May 2021 (as per the permit requirements) that outlined the water management objectives, strategies, and mitigation options to achieve the SPOs and IFRs (Teck 2021c). The updated DCWMP includes proposed SPOs for selenium, nitrate, sulphate, and cadmium and proposed in-stream flow requirements, which include flushing flows and ramping flows (Teck 2021c). In addition, a limit applicable to quarterly benthic invertebrate tissue selenium concentrations at LC_DCDS will come into effect on April 1, 2023, and concurrent benthic invertebrate community sampling will be completed (ENV 2023). Although the tissue selenium limit does not come into effect until April 1, 2023 reporting requirements and sampling began in Q2 2022.

The 2022 LAEMP period of study includes all biological and water quality sampling conducted in LCO Dry Creek from January 2022 through December 2022. The sections below describe the setting in more detail and provide further context for the LCO Dry Creek LAEMP report.

1.2 Study Questions

In consideration of Permit 107517 requirements, the conceptual site model (see Minnow 2020b for details), previous LCO Dry Creek LAEMP reports (Minnow 2015, 2016, 2017, 2018b, 2019, 2020a, 2021a), and input from the Environmental Monitoring Committee (EMC), the following overarching study question has been developed:

- Has there been a change in condition since previous monitoring years with respect to mine-related constituents in water quality, benthic invertebrate community endpoints and tissue selenium concentrations, calcite, fish, fish habitat, and/or flow?

Five specific questions were further developed to help answer the above question and guide data evaluation:

1. Are aqueous concentrations of mine-related constituents elevated in relation to British Columbia Water Quality Guidelines (BCWQG) and Elk Valley Water Quality Plan (EVWQP) benchmarks, and are concentrations changing over time?
2. Is acute or chronic toxicity occurring from water collected at the outlet of the DCWMS (LC_SPDC) or within Dry Creek (LC_DCDS), and is toxicity changing over time?

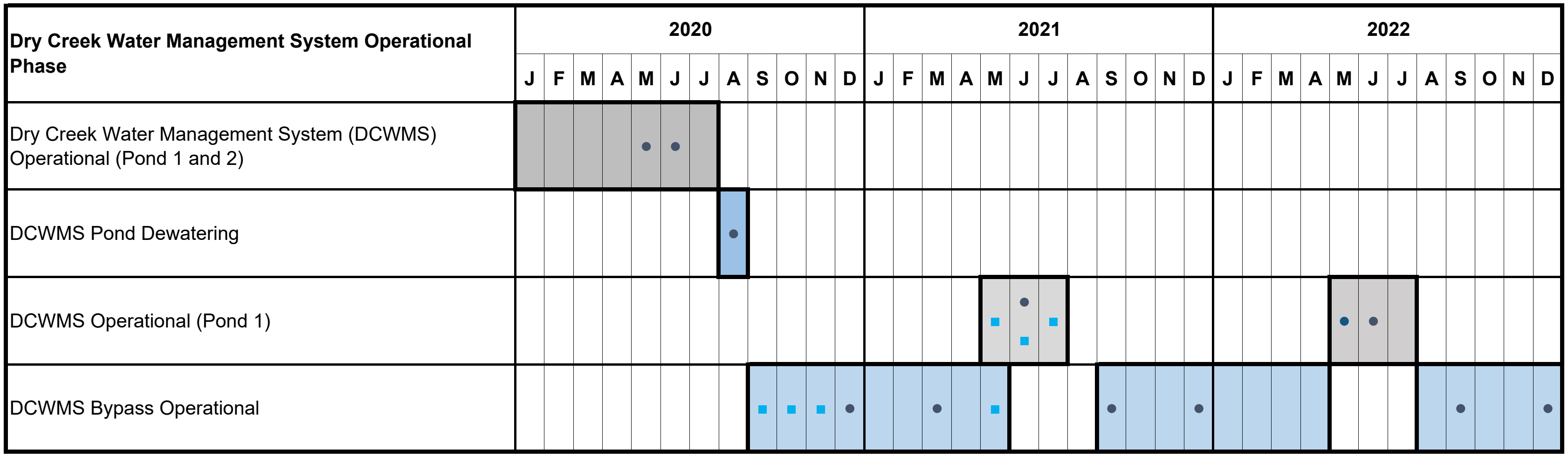
3. Are benthic invertebrate community endpoints within normal ranges derived based on samples collected at regional and local reference areas within the Elk River as part of the Regional Aquatic Effects Monitoring Program (RAEMP), and are the endpoints changing over time?
4. How do selenium concentrations in benthic invertebrate tissue compare to normal ranges and BCWQG or EVWQP benchmarks, and are they changing over time?
5. Are changes in fish and fish habitat (including instream flow and calcite index) occurring within Dry Creek as a result of mine operations?

1.3 Dry Creek Water Management System (DCWMS) Operations

As outlined in Section 1.1, surface and shallow groundwater from mine-influenced areas of the upper Dry Creek watershed (at and above area LC_DC3) have been managed through the DCWMS since 2015 (Figures 1.3 and 1.4). The DCWMS is currently designed to treat total suspended solids (TSS) to meet discharge limits, as outlined in Permit 5353 in Section 1.10. The DCWMS collects and re-directs mine-influenced surface flow from upper Dry Creek through the sedimentation ponds prior to returning to Dry Creek at area LC_SPDC, directly upstream of area LC_DCDS. The upstream end of the DCWMS collects flow from upper Dry Creek into the headpond where it is then piped over the East Tributary to a splitter box (Figure 1.4). At the splitter box (or in 2021 and 2022, upstream of the headpond) flocculant is added, as required, to enhance sediment removal and reduce the amount of TSS in the effluent (Teck 2018b, 2019). The splitter box manages flow to the two sedimentation ponds (i.e., parallel ponds) that are referred to as Sedimentation Pond 1 and Sedimentation Pond 2 (Figure 1.4).

Sampling for the LCO Dry Creek LAEMP began in September 2014, prior to initial commissioning of the DCWMS and supporting infrastructure in 2015 (Figure 1.3). Annual monitoring for the Dry Creek LAEMP in 2014 to 2017 focused on two areas downstream of the DCWMS in Dry Creek (LC_DCDS, LC_DC1) and upstream and downstream of Dry Creek in the Fording River (LC_FRUS, and LC_FRB; Minnow 2015, 2016, 2017, 2018b). In 2018, aqueous concentrations of mine-related constituents in Dry Creek (e.g., nitrate and total selenium), were greater than previously observed (Minnow 2019) and the rate of change was greater than predicted in the LCOII project application (Teck 2011) or in Regional Water Quality Model updates; given this observation, additional monitoring stations were added to help capture the spatial extent in Dry Creek.

Elevated selenium concentrations in benthic invertebrate tissue samples downstream of the DCWMS (i.e., LC_SPDC and LC_DCDS; Figure 1.4) were observed in 2018 and early 2019

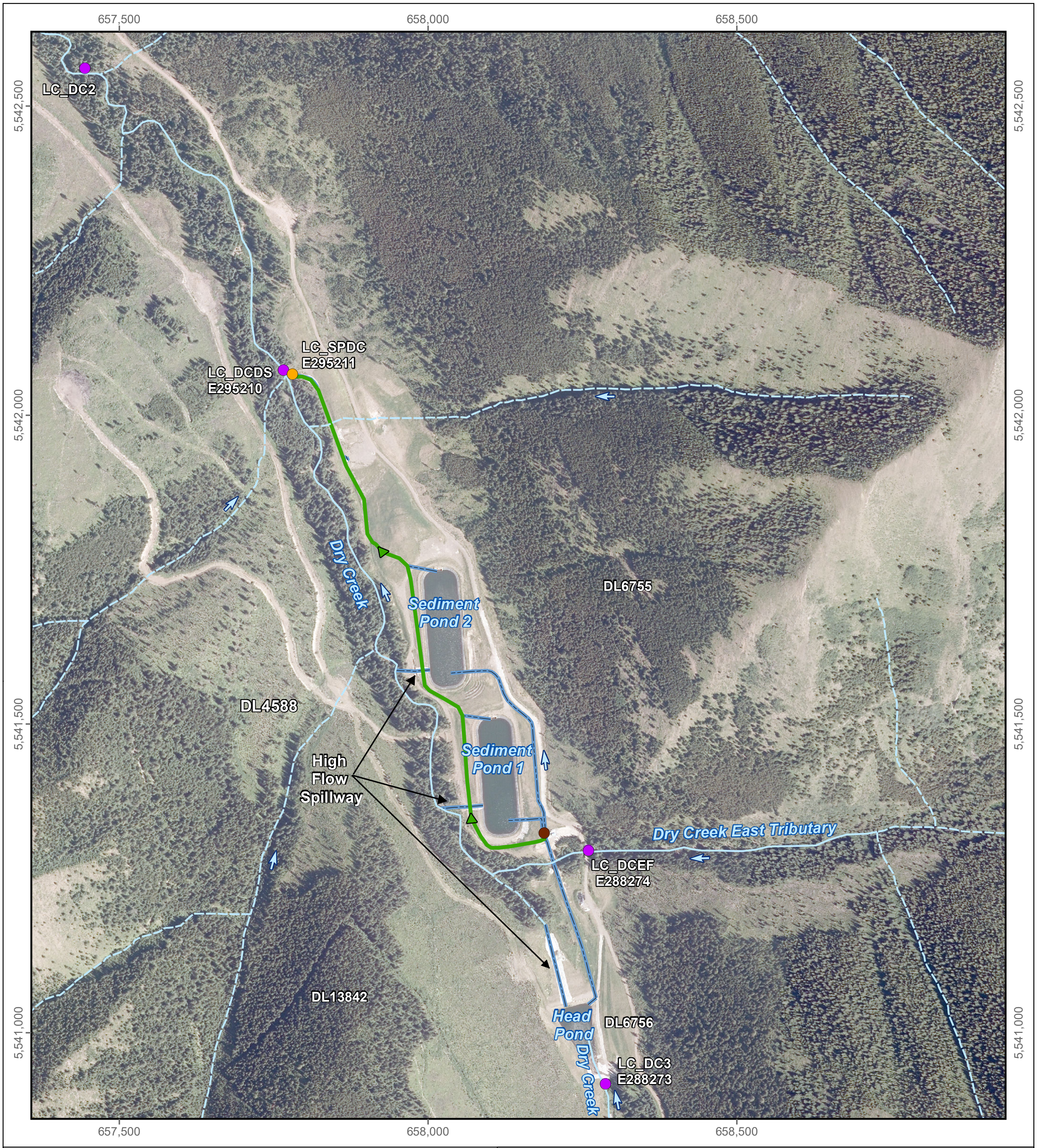


• = Sampling associated with the Dry Creek LAEMP. Collection of Benthic Invertebrate Community and Tissue Samples as well as water quality samples.

▪ = Supplemental Collection of Benthic Invertebrate Tissue and Periphyton Community.

Figure 1.3: Overview of LAEMP and Supplemental Sampling Events in Relation to Operational Phases of the Dry Creek Water Management System Operation, 2020 to 2022

Note: Shading represents changes in DCWMS operational phases



LEGEND

- Dry Creek LAEMP Water Quality Sampling Area
- Dry Creek LAEMP Biological and Water Quality Sampling Area
- Splitter Box
- DCWMS Bypass
- Water Management Structure Piping
- Watercourse
- Intermittent Watercourse

LCO Dry Creek Water Management System

0 150 300 600 Meters

Projection: North American Datum 1983 UTM Zone 11N

Date: April 2023
Project: 227202.0019

minnow environmental inc.

Figure 1.4

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0019 - 2022 LCO Dry Creek LAEMP\D - GIS\Dry Creek LAEMP\22-19 Figure 1.4 LCO Dry Creek Water Management System.mxd

(Minnow 2019, 2020a). In response to these results, a detailed investigation was undertaken in 2019 (particularly during growing season) to better understand the processes and location of organoselenium species generation in Dry Creek thought to be resulting in the enhanced selenium bioaccumulation in benthic invertebrates (Lorax 2020). The investigation concluded that the higher-than-expected concentrations of aqueous and tissue selenium downstream of the DCWMS were occurring due to algal bioaccumulation and reduction of selenium in the sedimentation ponds from selenate to more bioavailable selenite and organoselenium during the growing season (Lorax 2020, Minnow 2020a). As outlined in the LCO Mine Water Management Plan, the operation of the DCWMS was modified (starting in 2020) to bypass the sedimentation ponds seasonally, only filling them during higher-flow periods (e.g., freshet; Figures 1.3 and 1.4; Teck 2020c). The DCWMS bypass diverts water from the DCWMS headpond directly to LC_SPDC[3], therefore it is active only when the sedimentation ponds are not operational. The ponds are dewatered into Dry Creek at LC_SPDC (Figure 1.4). In 2022, DCWMS operation was similar to 2021, the bypass was operational through most of the year (except May to July) and only pond 1 was used rather than both ponds 1 and 2 (which were both used in 2020; Table 1.1).

1.4 Linkage to the Adaptive Management Plan

As required in Permit 107517 Section 10, Teck developed an Adaptive Management Plan (AMP) to support implementation of the EVWQP to achieve water quality targets including calcite targets, ensure that human health and the environment are protected, and where necessary, restored, and to facilitate continuous improvement of water quality in the Elk Valley. The AMP was most recently updated in December 2021 (Teck 2021a). Adaptive management is a systematic, rigorous approach to environmental management that maximises learning about uncertainties while simultaneously striving to meet multiple management objectives and adapt management actions based on what is learned. The adaptive management cycle comprises six stages: assess, design, implement, monitor, evaluate and adjust. The AMP identifies six Management Questions that are re-evaluated at regular intervals. Evaluating these MQs collectively articulates whether Teck is on track to meet the environmental objectives of the EVWQP.

[3] Prior to October 2020, effluent discharge (i.e., combined mine-impacted water from the two sedimentation ponds) was released into a man-made sedimentation pond discharge channel with artificial boulder substrate area prior to entering lower Dry Creek (i.e., LC_SPDC; Figure 1.4). This area was permanently modified in October of 2020 with removal of the pool immediately upstream LC_SPDC as well as the discharge channel itself, and replacement with a culvert pipe conveying water from the sedimentation ponds into Dry Creek upstream of LC_DCDS (Minnow 2021a). The spillway downstream of the DCWMS (LC_SPDC) was removed and replaced with a pipe to mitigate potential dietary uptake of benthic invertebrates by WCT (Teck 2021c).

Table 1.1: Dry Creek Water Management System Operational Phases, 2020 to 2022

Operational Phase	Start Date	End Date
DCWMS Pond 1 & 2 Operational	15-Jul-15	15-Jul-20
Bypass Operational	16-Jul-20	3-Aug-20
Dewatering Pond 1 & 2/Bypass Operational	4-Aug-20	4-Sep-20
Bypass Operational	5-Sep-20	4-May-21
Bypass Operational/Pond 1 Refilling	5-May-21	18-May-21
DCWMS Pond 1 Operational	18-May-21	12-Jul-21
Bypass Operational	13-Jul-21	26-Jul-21
Dewatering Pond 1/Bypass Operational	27-Jul-21	13-Aug-21
Bypass Operational	14-Aug-21	1-May-22
Bypass Operational/Pond 1 Refilling	2-May-22	12-May-22
DCWMS Pond 1 Operational	13-May-22	13-Jul-22
Bypass Operational	14-Jul-22	17-Jul-22
Dewatering Pond 1/Bypass Operational	18-Jul-22	26-Jul-22
Bypass Operational	27-Jul-22	31-Dec-22

The LCO Dry Creek LAEMP was designed to monitor aquatic conditions in Dry Creek, Grace Creek, and Unnamed Creek receiving environment and to answer specific questions on an annual basis (Section 1.2). Each annual LAEMP cycle (results are reported on April 30 of each year for the preceding calendar year) are also used for tracking issues for which a potential need for an adjustment, using the response framework, has been identified, including biological trigger assessments. Biological triggers are intended as a simple and consistent way to flag potential unexpected monitoring results that may require additional investigation and adjustment. In the current report, percent EPT (Ephemeroptera [mayflies], Plecoptera [stoneflies], and Trichoptera [caddisflies]) and composite-taxa benthic invertebrate tissue selenium concentrations in 2022 were assessed against their respective biological triggers (additional information and methods pertaining to this analysis can be found in Appendix H).

As an example of adaptive management in Dry Creek, benthic invertebrate tissue selenium concentrations were elevated and concentrations of mine-related constituents (primarily selenium, nitrate, and sulphate) were increasing more quickly than expected in 2018 downstream of sedimentation ponds. The benthic invertebrate tissue selenium concentrations were not consistent with what would be expected based on the water quality concentrations (Teck 2020a). These results led to additional monitoring, as a potential need for a response was identified via the AMP response framework. Actions associated with the AMP response to elevated benthic invertebrate tissue selenium concentrations in 2019 focused on investigations of temporal duration, spatial extent, and magnitude, all of which are outlined in detail in the 2019 Annual AMP report (Teck 2020d). The investigation of cause identified blasting residue on waste rock as the source of selenium, nitrate, and sulphate in Dry Creek and conditions in the DCWMS sedimentation ponds as a contributing factor to enhanced selenium bioaccumulation downstream of the DCWMS (Teck 2021a). Adjustments implemented as part of the AMP response framework (Stage 6: Adjust) included the addition of more monitoring areas and sampling events to increase the understanding of spatial resolution and seasonality of conditions, replacement of area LC_SPDC and the pool upstream of LC_SPDC with a discharge pipe (Minnow 2021a), and implementation of the DCWMS bypass in 2020. Additionally, the LCO nitrate compliance action plan is under development alongside an updated LCO DCWMP, and the DCWMP outlines a proposed Site Performance Objectives (SPO) for Nitrate (Teck 2021b).

In addition to addressing questions specific to the LCO Dry Creek LAEMP on an annual basis, aquatic monitoring data from the LAEMP will contribute to the broader data set assessed every three years within the RAEMP. The RAEMP is designed to evaluation MQ 5: “Does monitoring indicate that mine-related changes in aquatic ecosystem conditions are consistent with expectations?” Data from the LAEMP and RAEMP also contribute to answering MQ 2: “Will aquatic ecosystem health be protected by meeting the long-term SPOs?”

Results from this report will also be used to determine whether a biological trigger has been reached. Reaching a trigger may lead to an adjustment (Stage 6: Adjust) using the response framework. This is the main report for conveying biological trigger results for LCO Dry under the AMP (Section 8). Implementation of management actions is not constrained to the AMP or LAEMP annual reporting cycles but may be (and have been) triggered at any time during the monitoring and reporting cycle.

Identifying and reducing environmental management uncertainty is a foundational aspect of adaptive management. Therefore, the AMP identifies key uncertainties (KUs) that, as reduced, fill gaps in current understanding to support the achievement of the EVWQP objectives. Aquatic monitoring data assist in reducing KU 5.1: "How will monitoring data be used to identify potentially important mine-related effects on the aquatic ecosystem?" and KU 2.1 "How will the science-based benchmarks be validated and updated?" Progress on reducing these KUs, and associated learnings, are described in annual AMP reports.

Aquatic health monitoring results relevant to MQ 5 and KU 5.1 are discussed in Sections 3 to 7. Please refer to the 2021 AMP Update (Teck 2021a) for more information on the adaptive management framework, including Management Questions, key uncertainties, continuous improvement; linkages between the AMP and other EVWQP programs; and AMP reporting. Progress on gaining new knowledge and reducing KUs is described in annual AMP reports (submitted July 31) and evaluating the answers to MQs are reported in MQ evaluation reports (various submission dates).

2 METHODS

2.1 Overview

The general approach for the LCO Dry Creek LAEMP includes analysis and interpretation of data in relation to the each of the study questions. This report includes data collected up to the end of 2022 calendar year for all study parameters. Historical data are also presented where appropriate.

Water quality and/or biological samples were collected from established monitoring areas in Dry Creek, the Dry Creek East Tributary, Grace Creek, Unnamed Creek, and the Fording River[4] (Table 2.1, Figure 2.1). Monitoring areas sampled in 2022 included mine-exposed areas upstream and downstream of the DCWMS in Dry Creek, upstream and downstream of Dry Creek in the upper Fording River, Grace Creek, and reference areas (Dry Creek East Tributary, Unnamed Creek). It should be noted that water from the east tributary to Dry Creek (LC_DCEF) enters Dry Creek channel either upstream of LC_DCDS as surface water input (approximately 20% of LC_DCEF flow) or enters Dry Creek further downstream as groundwater input (upstream of LC_DC4; approximately 80% of LC_DCEF flow; Golder 2019b). Results from the flow accretion study are used to help interpret water quality and aquatic health results in the Dry Creek LAEMP.

Collection of benthic invertebrate tissue and community samples continued at LC_GRCK in 2022, as the aqueous selenium concentration threshold required for biological monitoring at that area (50% of samples in a given year >2 µg/L) was met in 2021 (62%; Minnow 2021a). The same threshold applies to LC_UC; however, it was not met in 2021 (Minnow 2021a) so biological sampling was not conducted at LC_UC in 2022.

Water quality monitoring and acute and chronic toxicity testing results presented in this report represent requirements specified under Permit 107517 (ENV 2013 and 2021, respectively; Table 2.2). Biological sampling in 2022 was completed in accordance with the 2022 LCO Dry Creek LAEMP study design (Minnow 2022b).

The methods associated with sample collection, laboratory analysis, and data analyses are described in the following sections and in Appendix A.

[4] Areas DC1, DCDS, FRB and FRUS have been sampled since 2014. Areas LC_DC3, LC_DCEF, LC_DC2, and LC_DC4 were not sampled for the LCO Dry Creek LAEMP prior to December 2018. Biological sampling was not conducted at area LC_SPDC prior to December 2018.

Table 2.1: Monitoring Areas Associated with LCO Dry Creek LAEMP, 2022

Area	Area Type	Sampling Location					
		Teck Location Code	Biological Sampling Area (Alternative Names)	Environmental Monitoring Station Number (EMS #)	Location Description	UTM (NAD83, Zone 11U) Easting	UTM (NAD83, Zone 11U) Northing
Dry Creek	Mine-exposed	LC_DC3	-	E288273	Dry Creek upstream of Headpond	658294	5540918
Dry Creek	Reference	LC_DCEF	-	E288274	East Tributary near confluence with Dry Creek	658260	5541295
Dry Creek	Mine-exposed	LC_SPDC[a]	-	E295211	Dry Creek sediment ponds outlet; effluent to Dry Creek	657821	5542042
Dry Creek	Mine-exposed	LC_DCDS	-	E295210	Dry Creek downstream of sediment ponds outlet	657766	5542073
Dry Creek	Mine-exposed	LC_DC2	-	-	Dry Creek approximately 0.6 km downstream from sediment ponds outlet	657445	5542561
Dry Creek	Mine-exposed	LC_DC4	-	-	Dry Creek 1.6 km downstream from the sediment ponds outlet	657172	5543327
Dry Creek	Mine-exposed	LC_DC1	LC_DC1 (DRCK)	E288270	Dry Creek upstream of Fording Mine Road	656519	5544658
Fording River	Mine-exposed	FR_FR5[b]	-	-	Fording River upstream of Dry Creek and Ewin Creek, and downstream of Chauncey Creek	657173	5548723
Fording River	Mine-exposed	-[b]	LC_FRUS (FO28)	E295232	Fording River upstream of Dry Creek and Ewin Creek, and downstream of Chauncey Creek	656307	5545255
Fording River	Mine-exposed	LC_FRB	LC_FRB (FO29)	-	Fording River downstream of Dry Creek	655275	5543711
Unnamed Creek	Reference	LC_UC[c]	-	E295213	Unnamed Creek	655351	5543087
Grace Creek	Mine-exposed	LC_GRCK	-	E288275	Grace Creek upstream of the CP rail tracks	654303	5540755

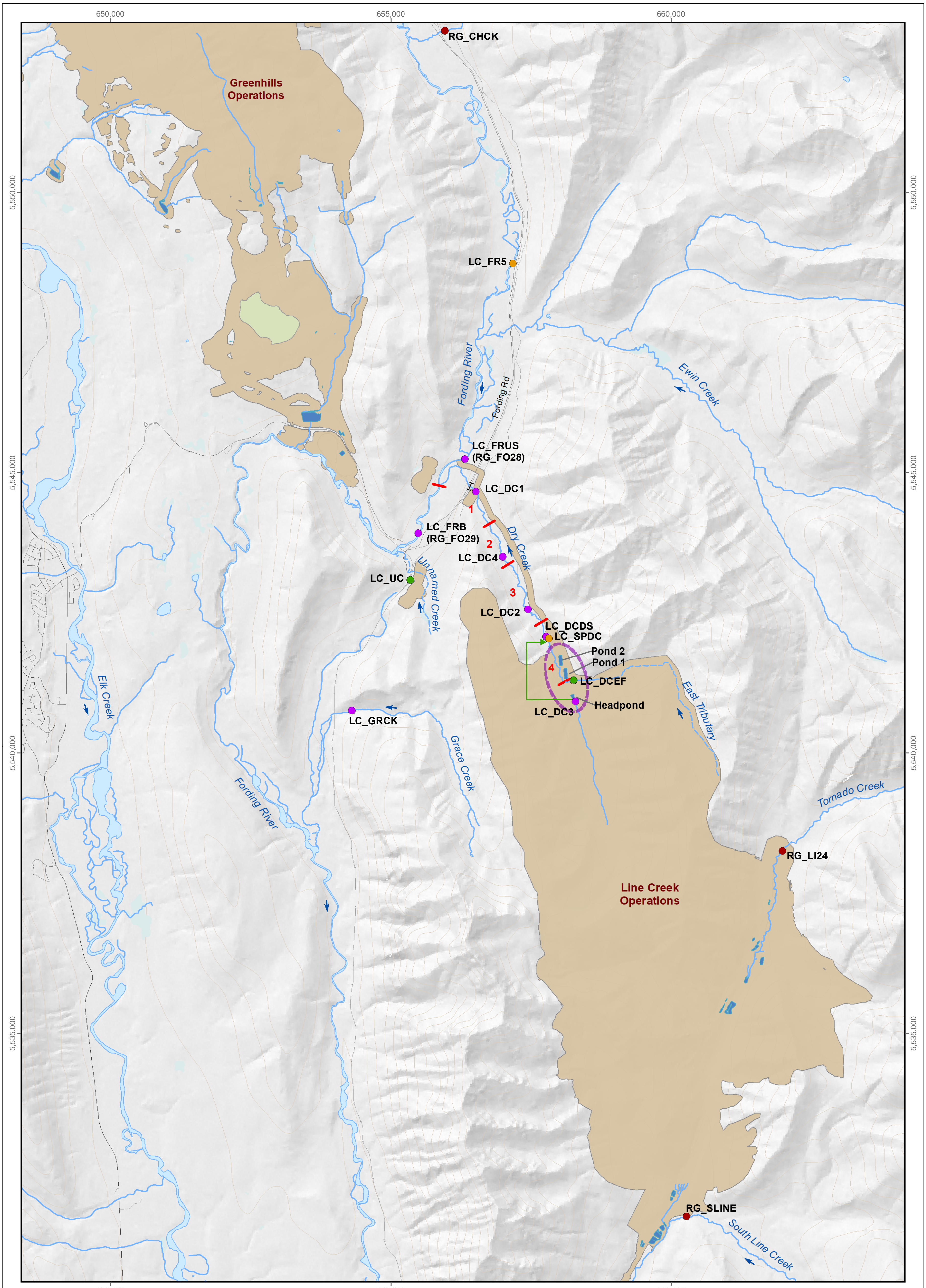
(shaded) Historical Sampling Areas for LCO Dry Creek LAEMP (Minnow 2019).

Note: "-" indicates no data available.

[a] LC_SPDC was discontinued as a biological sampling location when the DCWMS pipe was extended in 2020. 2021 samples were collected for antiscalant addition system monitoring.

[b] The requirement to sample water at LC_FRUS was removed from Permit 106970 in late summer of 2015. FR_FR5 has been included as an alternative station. FR_FR5 is not a permitted water monitoring station, therefore, sampling location and frequency may change.

[c] Unnamed Creek is currently not included as a biological sampling area as it did not trigger the mine effect level necessitating additional monitoring in 2022 (Minnow 2022).



LEGEND

- Reference Biological and Water Quality Sampling Area
- Dry Creek LAEMP Water Quality Sampling Area
- Dry Creek LAEMP Biological and Water Quality Sampling Area
- Sampling Location (Not included in the Dry Creek LAEMP)
- Reach Break
- Sedimentation Ponds Bypass
- Settling Pond
- Tailings Pond
- Teck Coal Mine Operation
- Contour (100m interval)

LCO Dry Creek LAEMP Sampling Locations, 2022

0 1 2 4
km

N W E S

Projection: North American Datum 1983 UTM Zone 11N
Data Source: Reproduced under licence from Her Majesty the Queen in Right of Canada, Department of Natural Resources Canada. All rights reserved.

Date: April 2023
Project 227202.0019

minnow environmental inc.

Figure 2.1

Document Path: C:\Users\MLaPalme\Trinity Consultants, Inc\Teck - 227202.0019 - 2022 LCO Dry Creek LAEMP\D - GIS\Dry Creek LAEMP\22-19 Figure 2.1 LCO Dry Creek LAEMP Sampling LocationsNEW.mxd

Table 2.2: Summary of Water Quality Monitoring for Permit 107517

Area	Area Type	Teck Water Station Code (Biological Station Code)	EMS Number	Location Description	UTM (NAD83, Zone 11U)		Water Quality Samples				
					Easting	Northing	Field Parameters[a]	All Other Parameters Required Under Mine Permits[b]	Selenium Speciation Sampling[c]	Toxicity[d] Acute	Toxicity[d] Chronic
Dry Creek	Mine-exposed	LC_DC3	E288273	Dry Creek upstream of Headpond	658294	5540918	BP-W/M	BP-W/M	BP-W/M	-	-
Dry Creek	Reference	LC_DCEF	E288274	Dry Creek East Tributary near confluence with Dry Creek	658260	5541295	M	M	-	-	-
Dry Creek	Mine-exposed	LC_SPDC[e]	E295211	Dry Creek sediment ponds outlet; effluent to Dry Creek	657821	5542042	M	M	-	Q	-
Dry Creek	Mine-exposed	LC_DCDS	E295210	Dry Creek downstream of sediment ponds outlet	657766	5542073	BP-W/M	BP-W/M	BP-W/M	-	Q/SA[f]
Dry Creek	Mine-exposed	LC_DC2	-	Dry Creek approximately 0.6 km downstream from sediment ponds outlet	657445	5542561	-	-	Q	-	-
Dry Creek	Mine-exposed	LC_DC4	-	Dry Creek 1.6 km downstream from the sediment ponds outlet	657172	5543327	-	-	Q	-	-
Dry Creek	Mine-exposed	LC_DC1 (DRCK)	E288270	Dry Creek upstream of Fording Mine Road	656519	5544658	W/M	W/M	-	-	-
Fording River	Mine-exposed	LC_FRUS[g]	E295232	Fording River upstream of Dry Creek and Ewin Creek, and downstream of Chauncey Creek	656307	5545255	M	M	-	-	-
Fording River	Mine-exposed	LC_FRB (FO29)	-	Fording River downstream of Dry Creek	655275	5543711	M	M	-	-	-
Unnamed Creek	Reference	LC_UC[h]	E295213	Unnamed Creek	655351	5543087	M	M	-	-	-
Grace Creek	Mine-exposed	LC_GRCK	E288275	Grace Creek upstream of the CP rail tracks	654303	5540755	M	M	-	-	-

Notes: "-" indicates no data available; BP-W/M = Weekly frequency March 15 to at least August 31 during bypass of the LCO Dry Creek Water Management System, monthly during the rest of the year; W/M = weekly from March 15 to July 15, monthly for the remainder of the year; M = monthly; SA = semi-annually; Q = quarterly.

[a] Dissolved oxygen, water temperature, specific conductance, conductivity, and pH (see Table A.1).

[b] Parameters consistent with Permit 107517 (see Table A.1 for details).

[c] Samples for selenium speciation analysis collected in April, June, September, and December within a week of biological sampling.

[d] Acute toxicity testing as per permit 107517 requirement. Chronic toxicity testing as per permit 107517 requirement.

[e] LC_SPDC was discontinued as a biological sampling location when the DCWMS pipe was extended in 2020. Sampled as part of antiscalant addition system monitoring.

[f] Quarterly chronic toxicity tests: *Ceriodaphnia dubia* and algae. Semi-annual tests: fathead minnow (Q1 & Q3), rainbow trout (Q2 & Q4), and *Hyalella azteca* (Q2 & Q4).

[g] The requirement to sample water at LC_FRUS was removed from Permit 106970 in late summer of 2015. FR_FR5 has been included as an alternative station. FR_FR5 is not a permitted water monitoring station, therefore, sampling location and frequency may change.

[h] Unnamed Creek is currently not included as a biological sampling area as it has not triggered the mine effect level necessitating additional monitoring (Minnow 2020b).

2.2 Study Question 1: Water Quality

2.2.1 Routine Water Quality

Water quality data assessed as part of the LCO Dry Creek LAEMP included data collected for routine monitoring managed by Teck, as well as data collected concurrently with benthic invertebrate sampling at unpermitted biological monitoring areas (Tables 2.1, 2.2).

2.2.2 Laboratory and Data Analysis

Preparation of the 2014 Elk Valley Water Quality Plan (EVWQP) required derivation of science-based benchmarks for nitrate, sulphate, cadmium, and selenium. Risks associated with these constituents depend on their concentrations, concentrations of other water chemistry parameters known as exposure and toxicity modifying factors (ETMFs), and the sensitivity of aquatic receptors that could be exposed. The EVWQP benchmarks were derived, using a large body of published and site-specific information available at that time, to represent scientific best estimates of concentrations associated with no effects and defined levels of potential effect on chronic, sublethal endpoints for sensitive aquatic species. Margins of safety were incorporated in benchmark derivation to account for uncertainty and Teck committed to undertaking further study and periodic updates to progressively reduce that uncertainty and improve confidence in the benchmarks.

Studies conducted to progressively reduce uncertainty in benchmarks have included additional chronic toxicity studies of nitrate, sulphate, cadmium, and selenium individually and in mixtures, annual evaluation of water quality under the regional chronic toxicity monitoring program, updates to selenium bioaccumulation models in 2017 and 2022, development of new tools to predict bioaccumulation in relation to selenium speciation, and most recently an extensive program of validation and updates to the science-based benchmarks under Teck's Adaptive Management Plan (AMP). This program was undertaken to answer Management Question (MQ) 2 under the AMP: Will the aquatic ecosystem be protected by meeting the long-term site performance objectives? and associated key uncertainty 2.1: How will the science based benchmarks be validated and updated? The MQ2 program was developed with input from the Elk Valley Environmental Monitoring Committee (EMC) and results have been shared with the EMC on an ongoing basis since the program began.

A key outcome of the MQ2 program was the development of an updated compilation of chronic toxicity information for nitrate, sulphate, and selenium, including information available at the time of the EVWQP and studies conducted after the EVWQP. For nitrate and sulphate, the updated compilation represented a substantial increase in available toxicity information for key test species. This updated compilation was used to validate the EVWQP benchmarks and, where warranted, to derive updated effects concentrations that incorporate this new information (WSP Golder 2022). As in the EVWQP, the objective was to derive scientific best estimates of concentrations associated with no effects or defined levels of potential chronic, sublethal effect to sensitive species and life stages relevant to the Elk Valley. The analysis in WSP (2022) concluded that the updated effects concentrations for nitrate and sulphate are supported by a larger dataset covering a wider range of conditions than was available at the time of the EVWQP, and thereby provide an improved basis for evaluating potential effects of these constituents.

Water samples were analyzed by ALS Environmental, Calgary, Alberta, for constituents consistent with Permit 107517 (i.e., conventional parameters, major ions, nutrients, and total and dissolved metals) using standard methods (Appendix A1.3).

Water samples were analyzed by Brooks Applied Labs, Seattle, Washington for selenium speciation analysis (including concentrations of selenate, selenite, DMSeO, MeSe(IV), methaneselenonic acid, selenocyanate, selenomethionine, selenosulphate, and unknown selenium species).

Water quality data were downloaded from Teck's EQuIS database and included both routine monitoring results collected by Teck and samples collected concurrently with biological sampling. Analyses of water quality data were completed using the following approaches (see Appendix A.1 for detailed methodology):

- Tabular and graphical comparison to applicable benchmarks[5], concentration effects limits, SPOs, and BCWQGs;
- Principal Component Analysis (PCA) to condense water quality results for use in benthic invertebrate community correlation analysis;
- Evaluation of temporal trends in monthly mean water quality concentrations using two tests:
    - Non-parametric seasonal Kendall test;
    - Two-way censored regression Analysis of Variance (2-way ANOVA);

Following the completion of the statistical analyses (Appendix A1.4), the following four criteria were applied to the water quality results to focus data interpretation for the present report. Those water quality constituents that met each of criteria 1 to 3 listed below and those that met criteria 4 (either independently of or in addition to meeting criteria 1 to 3 below) were selected

[5] In 2022, potential risks to aquatic life associated with selenium were assessed by evaluation of tissue selenium results in biota as compared to primarily using EVWQP benchmarks for aqueous selenium.

as the focus for data interpretation. The four criteria applied to the water quality results are as follows:

> **Criteria 1:** Constituents had concentrations that were above applicable BCWQGs and/or exceeded site-specific effect benchmarks in the majority (> 50%) of samples in a year at the majority (≥ 50%) of the mine-exposed areas on Dry Creek in 2022 (i.e., ≥ 3 areas);
>
> **Criteria 2:** Seasonal Kendall trend analysis indicated significant increases in concentration with a trend slope (average percentage change in concentration per year) > 50% at the majority (≥ 50%) of the mine-exposed areas on Dry Creek in 2022 (i.e., ≥ 3 areas);
>
> **Criteria 3:** 2-way ANOVA analysis indicated concentrations increased >100% between the first year of sampling and 2022 and were significantly higher in 2022 than 2021 at the majority (≥ 50%) of the mine-exposed areas on Dry Creek in 2022 (i.e., ≥ 3 areas);
>
> **Criteria 4:** Constituents that have existing SPOs for Dry Creek (total selenium and total cadmium) and/or have previously been identified by Structured Decision Making (SDM) and/or AMP response frameworks on Dry Creek (total selenium, nitrate, sulphate, and non-selenate selenium species).

2.3 Study Question 2: Acute and Chronic Toxicity

Permit 107517 requires that water samples be collected quarterly at LC_SPDC by LCO operations for acute toxicity testing[6], however, following a multiple toad mortality event in October of 2022 (RAPP #22-039122) acute toxicity testing was also completed at LC_DC3 and LC_DCDS weekly through October. The acute toxicity tests were conducted at LC_SPDC, LC_DC3, and LC_DCDS using *Oncorhynchus mykiss* and *Daphnia* spp. (see Appendix A2 for detailed methods).

Chronic toxicity tests were also completed on water samples collected quarterly and semi-annually in 2022 at area LC_DCDS (Table 2.2; Figures 1.4 and 2.1) as per the Permit 107517 Chronic Toxicity Program integration amendment (March 4, 2019). The quarterly and semi-annual tests were conducted using *Pseudokirchneriella subcapitata, Ceriodaphnia dubia, Hyalella azteca*, *Oncorhynchus mykiss,* and *Pimephales promelas* (detailed methodology can be found in Appendix A3). Water quality samples were collected during toxicity testing to

[6] Additional testing occurred in May and June 2022 when flocculant blocks are added to Dry Creek.

support evaluation of toxicity results (see Appendix A3 for detailed methods). See Teck 2023 and WSP 2023 for details on acute and chronic toxicity testing, respectively.

2.4 Study Questions 3 and 4: Benthic Invertebrates

2.4.1 Overview

In 2022, biological sampling (i.e., benthic invertebrate community and tissue chemistry) and calcite assessment for the LCO Dry Creek LAEMP met the requirements outlined in the 2022 LCO Dry Creek LAEMP study design (Tables 2.3 and 2.4; Minnow 2022b).

2.4.2 Study Question 3: Benthic Invertebrate Community

Triplicate benthic invertebrate community samples were collected in September except LC_DCDS (n= 5). Benthic invertebrate community was also collected from LC_DCDS in May (n=5) and November (n=2) to comply with the benthic tissue permit limit (ENV 2023; see Section 1.1); however, ice conditions precluded sampling at all three of the five riffles in November. Replicates were collected from three (or five) stations within each sampling area either in separate riffles or in riffle sections a minimum of 50 m apart, where habitat allowed, and sampling could be completed safely. Effort was made to target similar habitats for collection of both benthic invertebrate community and tissue samples within each sampling area. Benthic invertebrate community samples were collected according to the Canadian Aquatic Biomonitoring Network (CABIN) protocol (detailed methodology can be found in Appendix A5.2.1; Environment Canada 2012).

2.4.2.1 Laboratory and Data Analysis

Benthic invertebrate community samples were sent to Cordillera Consulting (lead taxonomist Scott Finlayson), in Summerland, BC, for sorting and taxonomic identification. Total organism abundance was reported for every distinct taxon identified in each sample (see Appendix A5.2.2 for detailed methodology, see Appendix K for raw data).

Benthic invertebrate community condition was evaluated based on total abundance, taxonomic richness (to the lowest practicable level of taxonomy), and the abundances and proportional abundances (%) of major taxonomic groups. Analyses of benthic invertebrate community data were completed using the following approaches (see Appendix A5.2.4 for detailed methodology):

Table 2.3: Benthic Invertebrate Community Sampling for Dry Creek LAEMP, 2022

Area		May	June	September	November
Mine-exposed	LC_DC3	-	-	n=3 (√)	-
Reference	LC_DCEF	-	-	n=3 (√)	-
Mine-exposed	LC_DCDS	n=5 (√)	-	n=5 (√)	n=2
	LC_DC2	-	-	n=3 (√)	-
	LC_DC4	-	-	n=3 (√)	-
	LC_DC1	-	-	n=3 (√)	-
	LC_FRUS	-	-	n=3 (√)	-
	LC_FRB	-	-	n=3 (√)	-
	LC_GRCK	-	-	n=3 (√)	-

Notes: "-" Indicates area was not sampled. "√" = target sample size was met. Target sample sizes were not met at LC_DCDS in November due to ice conditions.

- Graphical comparison of data relative to regional[7] and site-specific normal ranges[8];
- Evaluation of temporal changes in endpoints from mine-exposed areas relative to reference, and in the Fording River downstream relative to upstream of Dry Creek, using a two-way ANOVA;
- Assessment of relationship between benthic invertebrate community structure and physical and chemical parameters using non-parametric (Spearman Rank) correlations.

Benthic invertebrate community data collected in September were the focus of data analyses and interpretation. See Appendix A4.2.4 for additional rationale.

2.4.3 Study Question 4: Benthic Invertebrate Tissue Selenium

Benthic invertebrate tissue chemistry sampling was completed in accordance with the 2022 LCO Dry Creek LAEMP study design (Table 2.4; Minnow 2022b).

Samples were collected using the kick and sweep method described in Appendix A4.2.1, except collections were not timed, and kicking continued only until sufficient organisms were collected. All sampling events included collection of a composite sample of a variety of benthic invertebrate taxa (composite-taxa samples; see Appendix A5.3.1 for detailed methodology).

2.4.3.1 Laboratory and Data Analysis

Frozen samples were shipped by courier to TrichAnalytics Inc. in Saanichton, BC. Analyses of composite-taxa benthic invertebrate tissue selenium data were completed using the following approaches (see Appendix A5.3.3 for detailed methodology):

- Graphical comparison of tissue selenium concentrations relative to applicable benchmarks and the regional normal range;
- Comparison of observed tissue selenium concentrations to those predicted using a selenium bioaccumulation tool;
- Evaluation of changes in tissue selenium concentrations among sampling events in 2022 at mine-exposed areas relative to reference, and in the Fording River downstream relative to upstream of Dry Creek, using a two-way ANOVA;

[7] The reference normal range as presented in the RAEMP represents the 2.5th and 75th percentiles of the distribution of reference area data (pooled 2012 to 2019 data) reported in the 2017 to 2019 RAEMP report (Minnow 2020c).

[8] Site-specific normal ranges represent the 2.5th and 97.5 percentile for a given area as determined by habitat predictors for a given site in relation to the complete set of Elk Valley monitoring areas. The site-specific normal ranges were estimated using regression modelling as presented in the RAEMP (Minnow 2020c).

Table 2.4: Benthic Invertebrate Composite-Taxa Tissue Sampling for Dry Creek LAEMP, 2022

Area		May	June	September	November
Mine-exposed	LC_DC3	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)
Reference	LC_DCEF	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)
Mine-exposed	LC_DCDS	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)
	LC_DC2	n=5 (√)	n=5 (√)	n=5 (√)	-
	LC_DC4	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)
	LC_DC1	n=5 (√)	n=5 (√)	n=5 (√)	-
	LC_FRUS	n=5 (√)	-	n=5 (√)	n=5 (√)
	LC_FRB	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)
	LC_GRCK	n=5 (√)	n=5 (√)	n=5 (√)	n=5 (√)

Notes: "-" = area was not sampled. "√" = target sample size was met. Samples were not collected from LC_FRUS in June due to high water. Samples were not collected from LC_DC2 and LC_DC1 in November due to ice conditions.

2.5 Study Question 5: Fish and Fish Habitat

Annual fish sampling and redd surveys have been conducted in LCO Dry Creek since 2013 and 2015, respectively, to support different monitoring programs. There was minimal fish sampling completed in 2020 and in 2021 to limit stress on WCT populations related to sampling activities. The decision to limit fish handling was based on feedback from the Elk Valley Fish and Fish Habitat Committee (EVFFHC) and it was implemented as a proactive response to an observed decline in the WCT population of the UFR in 2019 (Cope 2020). The sampling and data analysis methods and results for 2022 are summarized from the LCO Dry Creek 2022 Population Monitoring Report (WSP & Poisson 2023).

2.5.1 Physical Habitat, Temperature, Flow, Calcite, and Dissolved Oxygen

2.5.1.1 Water Temperature

The Dry Creek water temperature monitoring program began in 2016 at six locations in Dry Creek and one location in the East Tributary of Dry Creek (DRY-WQ01 to 07; Table 2.5). Two additional monitoring locations (LC_DRY_US_TRB5 and LC_DRY_DS_TRB5) were added in Tributary 5 of Dry Creek in 2022. The temperature sensors at DRY-WQ06 in the old Sedimentation Pond outlet were decommissioned October 5, 2020, and replaced by DRY-WQ07 in the new Sedimentation Pond outlet stream on June 21, 2021. The stations were last downloaded October 25, 2022 except for DRY-WQ04, which ended on August 4, 2022 as a result of data loss caused by data loggers reaching capacity early (Table 2.5). Metrics used to characterize water temperature regime and their processing methods are provided in Table 2.6. Three metrics were used to represent water temperature in Dry Creek: daily mean temperature, mean weekly maximum temperature (MWMxT), and growing season (season length in days and intensity in degree days [growing season degree days], GSDD).

During data collection and analysis steps are taken to ensure high quality data. Two temperature loggers were installed at each monitoring location for duplication and quality assurance (QA). The sensors were installed, to the extent feasible, to avoid freezing, burial under sediment, and dewatering. Loggers were downloaded several times per year to minimize data loss, and the two downloaded time series were reviewed and averaged to generate a single time series for each location. The averaged water temperature data series then underwent further processing and QA by trained staff and senior biologists to identify and remove periods where the water temperature data may not be representative of the stream (e.g., if a dewatered logger is measuring air temperature). Data gaps of less than one-hour duration were infilled using linear interpolation where possible. When the QA process was completed, the data were analyzed to generate the relevant summary metrics provided in (Table 2.6).

Table 2.5: Summary of Water Temperature Monitoring Stations in Dry Creek

Waterbody	Site Name	Site Description[1]	UTM Coordinates (Zone 11 U, NAD83)		Elevation (masl)[1]	Start of Record	End of Record	Number of Days with Valid Data	Gaps in Record (%)
			Easting	Northing					
Dry Creek East Tributary	DRY-WQ03	~20 m upstream of East tributary bridge	658,269	5,541,290	1,701	06-Jun-2016	25-Oct-2022	2,331	0
Dry Creek	DRY-WQ04	~50m upstream from the East tributary confluence	658,132	5,541,240	1,690	06-Jun-2016	04-Aug-2022	2,250	0
	DRY-WQ02	~80m downstream of East tributary	658,069	5,541,281	1,686	06-Jun-2016	25-Oct-2022	2,309	1
	DRY-WQ06[†]	Settling pond outlet channel	657,808	5,542,061	1,642	07-Oct-2016	07-Oct-2020	1,489	0
	DRY-WQ07	Settling pond outlet channel	657,808	5,542,061	1,642	25-Jun-2021	25-Oct-2022	486	10
	DRY-WQ05[†]	Downstream of settling pond	657,749	5,542,082	1,642	07-Sep-2016	25-Oct-2022	2,009	10
	DRY-WQ01	~100m upstream of Dry/Fording River confluence	655,972	5,544,842	1,515	06-Jun-2016	24-Oct-2022	2,330	0
Dry Creek Trib 5	LC_DRY_US_TRB5		657,423	5,542,555	1,617	18-May-2022	25-Oct-2022	130	18
	LC_DRY_DS_TRB5		657,433	5,542,595	1,616	18-May-2022	25-Oct-2022	159	0

[1] Estimated using Google Earth; masl = metres above sea level

[2] FRD-WQ03 data contain a gap from September 3 to October 23, 2021 because the sensor was dewatered

Table 2.6: Summary of Water Temperature Metrics, Calculation Methods and Treatment of Data Gaps

Parameter	Description	Method of Calculation	Treatment of Data Gaps
Daily average water temperature	Mean temperature on each day	Average of all data points (15 minute intervals) in a 24-hour period.	Days with <21 hours data excluded.
MWT	Mean Weekly Temperature (Maximum and Minimum)	A centered 7-day moving-average is applied to the series of daily-maximum water temperatures (see description of daily maximum); e.g., if MWMxT = 15°C on August 1, this is the average of the daily-maximum water temperatures for the 7 days from July 29 to August 4. The same procedure is used for daily-minimum water temperature (MWMinT). MWTs are compared to activity period optima (e.g., spawning, incubation, summer rearing) for species and life stages.	Days without at least one hourly measurement between 11:00 and 18:00 are excluded. Moving average is calculated over period with data. Activity periods with <50% data coverage are not reported.
Growing season degree days (GSDD)	The beginning of the growing season is defined as the date MWT exceeds and remains above 5°C; the end of the growing season is defined as the date MWT drops below 4°C (Coleman and Fausch 2007).	A degree day is the average temperature during a day; GSDD is calculated by taking the sum of daily average water temperatures over the growing season (i.e., from the first day of the first week when weekly average temperatures reach and remain above 5°C until the last day of the first week when weekly average temperature drop below 4°C).	Days with <21 hours data excluded, seasons with data gaps of >14 continuous days or >28 cumulative days excluded.

Results are compared to BC Water Quality Guidelines (WQG) for the protection of aquatic life (Oliver and Fidler 2001) or other reference points for reporting (i.e., Coleman and Fausch 2007). To assess suitability compared to WCT life activity stages, MWMxT is compared to the optimum temperature ranges provided by the BC WQG (Oliver and Fidler 2001) for WCT spawning, incubation and rearing. WQG state that water temperature should not exceed 1°C beyond optima for species and life activity stage; exposure to prolonged periods of warm water is a useful indicator of potential thermal stress experienced by fish or other organisms. The number of growing degree days was also calculated for each water temperature monitoring location. For interior subspecies of Cutthroat Trout, recruitment failure may occur when there are less than 800 degree days in a growing season; recruitment may be uncertain in years when there are 800 to 900 growing degree days; and recruitment sufficient to sustain the population is expected when growing degree days exceed 900 (Coleman and Fausch 2007).

2.5.1.2 Flow

Streamflow is a "master variable" that influences myriad components of flowing water systems (Poff *et al.* 1997; Annear *et al.* 2004). In this report, we focus on timing and magnitude of low flows during the non-freshet period and high flows during freshet. Low flows during the non-freshet period may indicate habitat limitations during an activity period; evidence of anomalous high flows during freshet can be used to infer direct effects to fish (e.g., scour of redds or displacement of free-swimming individuals) or rapid changes to stream morphology. High magnitude flows during freshet also have positive ecological effects and are referred to as channel-maintenance or flushing flows. These high flows maintain gravel quality, sediment dynamics, connectivity with off-channel habitat and riparian communities, and healthy vegetation dynamics in riparian communities. Timing and duration of high and low flows were also examined.

Flow data for Dry Creek were collected in 2022 by Teck and Kerr Wood Leidal (KWL) at the hydrometric station LC_DC1. LC_DC1 is located in Dry Creek upstream of the confluence with the Fording River (Figure 2.1). Instantaneous flow at 5-minute and 15-minute intervals recorded at LC_DC1 were averaged into hourly flow data; days with less than 20 hours of data were excluded from the dataset. Additionally, months with less than 20 days of data were not used in the calculations of mean monthly discharge. Mean monthly flow for the period of record was tabulated and a hydrograph showing mean daily flows was created to present flows relative to timing and duration (periodicity) of life history activity periods for WCT in Dry Creek. The periodicity used here was developed collaboratively and previously reported in Teck (2021c). Monthly flow statistics were also tabulated for the Water Survey of Canada (WSC) gauge at Fording River at the Mouth (WSC 08NK018; Government of Canada 2023) for comparison.

The WSC 08NK018 gauge is in Fording River <0.5 km downstream of the confluence with Line Creek.

Summary statistics were reviewed and examined for anomalies within the main WCT activity periods. Pre-existing thresholds for effects are not available, so the evaluation of low flows was done qualitatively. A preliminary flushing flow threshold of 1.0 m^3/s for a 2-day duration as measured at LC_DC1 was developed and presented in West *et al.* (2021). Recent historical flows as measured at LC_DC1 were calculated and tabulated relative to this flushing flow threshold to describe existing conditions in Dry Creek.

2.5.1.3 Dissolved Oxygen

Dissolved oxygen (DO) is an important parameter of water quality relevant to all aquatic life, and particularly salmonids, which are sensitive to low DO conditions (Committee on the Status of Endangered Wildlife in Canada [COSEWIC] 2016). The annual minimum and 30-day mean DO concentrations (from discrete *in situ* measures, a minimum of four samples a month, except LC_DCEF which is sampled once a month)) at five locations (LC_DCEF, LC_DC1, LC_DC2, LC_DC4, and LC_DCDS) in Dry Creek in 2022 were evaluated for key life history activity periods for WCT (e.g., spawning and incubation) to determine if DO minima may negatively impact WCT recruitment or survival. The annual minimum and 30-day mean DO concentrations were also compared to the water column long-term BCWQG of 11 mg/L for buried embryo/alevin life stages as well as the instantaneous minimum criterion for the protection of embryo/alevin life stages (9 mg/L), the 30-day mean for all other fish life stages (8 mg/L), and the Instantaneous Minimum for All Other Life Stages (5 mg/L).

2.5.2 Fish Abundance, Density and Condition

2.5.2.1 Electrofishing

Backpack electrofishing surveys to estimate juvenile densities were conducted in Dry Creek by Lotic in 2022. Two survey methods were used following the study design of the 2022 UFR WCT monitoring program (Thorley et al. 2022c). A total of four sites were sampled in 2022, one closed site and three open sites (Table 2.7, Figure 2.2). Sites are named for the distance in metres from the confluence with the UFR. Where these sites correspond to locations sampled in previous years, that name is noted.

- A single closed site (DRY-600) sampled was in the same location as the site called DRY1 that was sampled in previous years and, as in previous years (e.g., Cope et al 2016, Faulkner et al. 2020), three mesohabitats were sampled. Removal-depletion methods

Table 2.7: Summary of Electrofishing Sites Sampled in 2022

Site Name	Location (km[a])	Date Sampled	Site Type	Mesohabitat	Number of Passes	Site Length (m)	Average Site Width (m)
DRY-100o	0.12	24 August 2022	Open	NA	2	295	4.4
DRY-600 (DRY1)	0.56	24 August 2022	Closed	Pool	1	16	4.0
DRY-600 (DRY1)	0.56	24 August 2022	Closed	Riffle	1	12	5.0
DRY-600 (DRY1)	0.56	24 August 2022	Closed	Glide	1	25	4.0
DRY-2400o	2.37	25 August 2022	Open	NA	1	295	4.7
DRY-4400o (DRY4.3)	4.37	24 August 2022	Open	NA	1	300	4.2

[a.] km refers to the distance upstream from the confluence of LCO Dry Creek with the upper Fording River.
[b.] NA – not applicable
Source: WSP & Poisson 2023

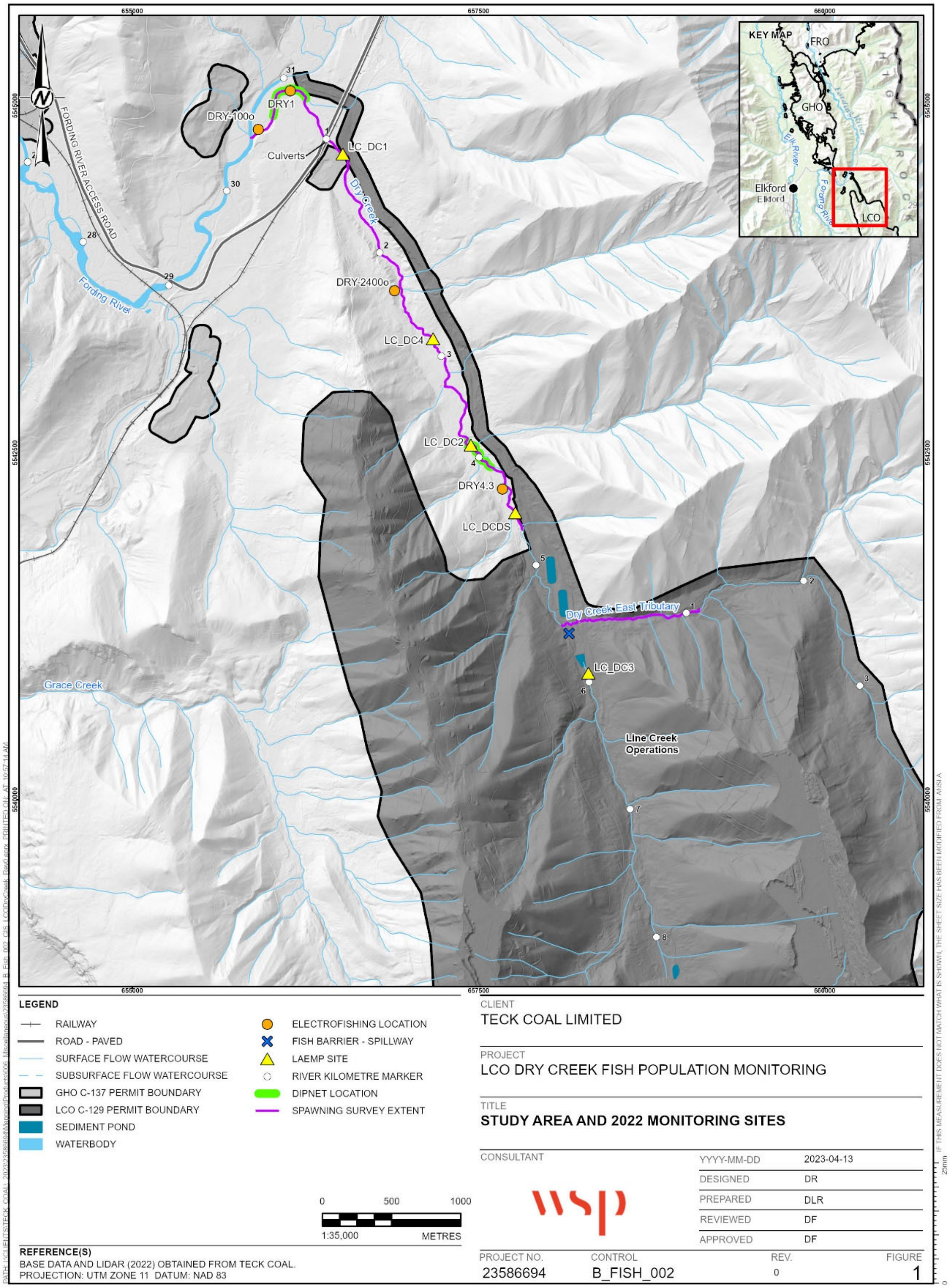


Figure 2.2: LCO Dry Creek Fish Population Monitoring Study Area Sample Sites and Survey Areas

- were used in three mesohabitats of approximately 10 to 35m^2 in length (total of ~100 m^2). The mesohabitats were isolated at the upstream and downstream boundaries using stopnets. One electrofishing pass was conducted in each of the mesohabitats.
- Three open sites of approximately 300 m in length were randomly selected for sampling in 2022, one location downstream of the culverts at km 1 and two sites from upstream of the culverts which are partial barriers that allow upstream fish passage at some flows. Mark-recapture methods were used at large open (not isolated with stop-nets) sites approximately 300m in length, as they were in 2021 (Thorley et al. 2022a). A single electrofishing pass was conducted DRY 2400o and DRY-4400o (DRY4.3) and two passes were conducted at DRY 100o1.

A shift from the small, closed index sites to the large open sites that are randomly selected each year is underway across the UFR population monitoring program (Thorley et al 2022b). Bias associated with site selection of a relatively small area (closed sites) is reduced as a greater portion of the study area is sampled using large, open sites. The use of both electrofishing methods in 2021 and 2022 allows comparison to previous years of data that used only small, closed sites.

Fish processing followed the Teck backpack electrofishing protocol (Thorley et al. 2022c) and the 2022 study design for UFR WCT population monitoring (Thorley et al. 2022b). All captured fish were measured for fork length to the nearest 1 mm, weighed to the nearest 0.1 g, scanned for a Passive Integrated Transponder (PIT) tag (if larger than 99 mm), and photographed. The total number of fish observed but not captured was also recorded. A PIT tag was inserted into all uninjured fish ≥100 mm in fork length. Fish were inspected for any deformities, erosion, lesions, or tumours (DELT) and the information was recorded using the new DELT categories and scale (Ings and Weech 2020). Processed fish were allowed to recover before being released as close to their capture location as possible, preferably near cover and in slow moving water.

2.5.3 Redd Surveys

Surveys have been conducted in LCO Dry Creek each year from 2015 to 2022 to count the number of redds, which are where fish eggs are deposited and may contain multiple nests (e.g., Cope et al. 2016, Faulkner et al. 2019, Thorley et al. 2022a). The same general approach has always been used in these surveys, with two observers, one on each bank, walking in an upstream direction. Prior to 2021, the number of redds was recorded, but not the number of nests within the redd unless more than one spawning pair was observed (Cope 2020, Faulkner et al. 2020). Beginning in 2021, all visible nests were counted each week, which was done to provide data suitable for the modelling approach that estimates the total count of unique nests using an area-under-the-curve model and estimates of the length of time that individual redds remain visible. Under a new standardized protocol which was implemented starting in 2021, each nest is classified as "definitive", that is nests with a distinct pit upstream of a loose mound of clean pebbles and gravels, or "potential", which includes test digs by females to evaluate the substrate, or older nests that are no longer distinct (Smit et al 2022). This is similar to methods used from 2016 to 2019 (Faulkner et al. 2020) where clearly visible redds were distinguished from possible redds, where gravel had been cleared and test digging had occurred but a redd was not clearly visible. The data from spawning surveys contribute to understanding spatial distribution and timing of spawning, but not should not be used to represent the number of fish that spawned.

In 2022, spawning surveys were conducted approximately weekly between early June and early August from the confluence of Dry Creek and the UFR to km 4.5 and 1 km of East Tributary was also surveyed (Figure 2.2). For each redd, the time, spatial coordinates, number of potential and definitive nests within the redd, and the number of adult fish associated with the redd were recorded. These data were used to estimate the total number of unique nests over the whole spawning season and provide information about timing and spatial distribution of spawning.

2.5.4 Dip Net Surveys

Backpack electrofishing rarely captures WCT in their first year (age-0s) because of their small size and patchy distribution. To supplement the electrofishing data, night-time dip-net surveys were conducted in LCO Dry Creek for the first time in 2022. Data from these surveys provides information about size-at-age, and some limited information on spatial distribution (occupancy, not relative density) of age-0 as well as age-1 fish. Dip-net surveys are conducted by a team of two observers walking the stream margins searching for fish less than 100 mm in length. Surveys were conducted on October 12, 13, and 14 at one site upstream of the culverts at km 3.8 (325 m of habitat) and one site downstream of the culverts (370 m of habitat).

The location and estimated body length were recorded for all observed WCT. Fish approximately 100 mm or less were captured using a hand net where possible and were measured, photographed, and a subset were weighed (to 0.01 g) before being released at their location of capture.

2.5.5 Data Analysis

The data from the backpack electrofishing data (2013 to 2022) were used to estimate fish density. The electrofishing data were analyzed using a hierarchical Bayesian removal model (Wyatt 2002). The model estimated capture efficiency using removal-depletion data from the subset of small, closed sites that received more than one electrofishing pass. Capture efficiency was used in the model to estimate the absolute density of fish at each site. Density was estimated separately for the age-1 and age-2+ life stages. Other methods and key assumptions in the density model are discussed in the LCO Dry Creek 2022 Fish Population Monitoring Report (WSP & Poisson 2023).

Body condition was analyzed using weight-length regression. Length and weight data for individuals between 90 and 169 mm were analyzed using an allometric mass-length model to estimate body condition (He et al. 2008; Thorley et al. 2023a, 2023b). The simplified equation for body condition is:

Body condition = W/ (αLβ)

Where W = is the weight (g) of the individual fish

α = 6.6*10^{-6}, the expected weight (g) of a 1 mm fish

L = is the length (mm) of the individual fish

β = scaling term of 3.1

The α and β terms were calculated for fish from 90 to 169 mm using UFR monitoring data collected from 2013 to 2022 (Thorley et al. 2023a, Thorley et al 2023b). The model was used to estimate the percent difference in body condition of an LCO Dry Creek fish relative to a typical subpopulation in the UFR, in a typical year (Thorley et al 2023a). Additional details are available in the technical appendix to the UFR WCT population monitoring report (Thorley et al., 2023b).

Length data were also used to identify the sizes of different age classes in LCO Dry Creek using the electrofishing (2013 to 2022) and dip-net survey data (2022). Using field sampling methods that target the age-0 size range, age-0 were documented in LCO Dry Creek for the first time since 2016. These data were used in the length frequency histograms were used to assign length cutoffs by age class and to calculate the mean length-at-age of age-0s.

Data from all spawning surveys conducted from 2015 to 2022 are used for reporting total unique redds observed prior to 2020 and total definitive nests observed thereafter. In addition, for 2021 and 2022, an Area-Under-the-Curve (AUC) model (Hilborn et al. 1999; Su et al. 2001) was used to estimate the total number of unique definitive nests that would have been recorded over the whole sampling season by a typical observer (WSP & Poisson 2023). The AUC estimate of unique redds is roughly comparable to the previous total count of unique redds, and these data are used to assess trends over time.

3 STUDY QUESTION 1: WATER QUALITY

3.1 Background

The water quality monitoring data were evaluated to address Study Question #1: are aqueous concentrations of mine-related constituents elevated in relation to British Columbia Water Quality Guidelines (BCWQG) and Elk Valley Water Quality Plan (EVWQP) benchmarks, and are concentrations changing over time? To address this study question, monitoring of constituents listed under permit 107517 and selenium species were carried out in 2022 (see Sections 2.1 and Appendix A1 for details.

Water quality data collected concurrent with biological sampling for the present study were of acceptable quality as characterized by good detectability, appropriate LRLs, concentrations below LRLs in almost all method blank samples, minimal field blank contamination, excellent laboratory precision and accuracy, and good field sampling precision and reproducibility, with the exception of methylseleninic acid which had poor field precision (this is expected when results are close to the LRLs). Overall, the associated data are considered acceptable for this study (see Appendix B for details). QA/QC associated with water samples collected routinely by Teck for Permit 107517 were discussed in the 2022 annual water quality report for Permit 107517 (Teck 2023). Temporal changes in concentrations of aqueous constituents evaluated for the Dry Creek LAEMP were statistically evaluated as outlined in Appendix A. Although statistical analyses were completed for: 1) Order Constituents; 2) constituents with early warning triggers under the AMP; and 3) constituents that have previously identified and tracked through SDM and/or AMP response frameworks (listed in Section 2.1.1), detailed data interpretation was focused on those that satisfied the criteria listed in Section 2.1.2. In 2022, the constituents that satisfied the criteria for detailed data interpretation included nitrate, total cadmium, total selenium, and organoselenium species[9] (Table 3.1). For graphical plots and the results of statistical analyses for remaining water quality constituents, see Appendix C.

3.2 Nitrate

Aqueous nitrate concentrations were higher than the BCWQG for long-term chronic exposure in >95% of samples at all Dry Creek and Fording River areas throughout 2022 (Table C.4). Reference and low impact stations (LC_DCEF, LC_UC, and LC_GRCK) were not above the BCWQG in 2022. The BCWQG for short-term acute exposure limit was also surpassed in

[9] This interpretation focused on organoselenium species (particularly DMSeO and MeSe(IV) and specifically excluding selenite, selenate and other individual selenium species) as elevated concentrations of those constituents are captured in AMP response framework in 2020.

Table 3.1: Criteria for Detailed Evaluation of Water Quality Endpoints in 2022 LCO Dry Creek LAEMP

Water Quality Endpoint		Criteria for Inclusion			
		All Three Satisfied			Or Only
		2-Way ANOVA[a]	Seasonal Kendall[b]	Guidelines/ Benchmarks/ Updated Effects Concentration[c]	SPO or AMP/SDM[d]
Nitrate (as N)		-	√	√	√
Total Kjeldahl Nitrogen		√	-	-	-
Sulphate		√	-	-	-
Total Dissolved Solids		√	-	-	-
Cadmium (Cd) -Total		√	-	-	√
Lithium (Li) -Total		√	-	-[e]	-
Molybdenum (Mo) -Total		√	-	-	-
Nickel (Ni) -Total		√	-	√	-
Selenium (Se) -Total		√	√	-[e]	√
Uranium (U) -Total		√	-	-	-
Zinc (Zn) -Total		√	-	-	-
Cadmium (Cd) -Dissolved		√	-	-	-
Se(IV) - Selenite		-	-	-[e]	-
Se(VI) - Selenate		-	-	-[e]	-
Organoselenium[f]	DMSeO - Dimethylselenoxide	√	-	-[e]	√
	MeSe(IV) - Methylseleninic Acid	√	-	-[e]	√

Criteria for detailed evaluation met.

Notes: "√" = criteria met, "-" = criteria not met, ANOVA = Analysis of variance, SPO = site performance objective, AMP = adaptive management plan, SDM = Structured Decision Making.

[a] In 2-way ANOVA results, analyte concentrations increased >100% between first year of sampling and 2022 *and* were significantly higher in 2022 than 2021 at ≥ 50% (i.e., ≥ 3) of the mine exposed areas on Dry Creek (Appendix Table C.3).

[b] In Seasonal Kendall results, analyte concentration trend slope (average percent increase per year) >50% at ≥ 50% (i.e., ≥ 3) of the mine exposed areas on Dry Creek in 2022 (Appendix Table C.2).

[c] Analyte exceeded BCWQG and/or site-specific benchmark(s) and/or updated effects concentration(s) in 2022 (Appendix Table C.4).

[d] Analyte has SPO for Dry Creek LAEMP area(s) under permit 107517 (ENV 2021) and/or elevated analyte concentrations have triggered AMP or SDM response frameworks (Appendix Table C.1).

[e] No guidelines or benchmarks exist for lithium, total selenium, or organoselenium.

[f] The 2020 AMP response framework for LCO Dry Creek (Teck 2021) identified dimethyl selenoxide (DMSeO) and methylseleninic acid (MeSe(IV)) as the two organoselenium species primarily generated by biological productivity within the Dry Creek Water Management System (DCWMS). Therefore, interpretation of organoselenium species herein was focused on these two organoselenium species (DMSeO and MeSe(IV)), and excluded consideration of selenite and other individual selenium species.

Dry Creek at LC_DC3, LC_SPDC, LC_DCDS, and LC_DC2 in 2022 (Figure 3.1; Table 2.2; Appendix Table C.4; Appendix Figure C.13).

Nitrate concentrations were above the level 1 UECs at all stations on Dry Creek, with the level 1 UEC less frequently surpassed at stations located furthest downstream (100% of samples at LC_DC3 and LC_DCDS to 79% of samples at LC_DC1; Figure 3.1; Appendix Table C.4). Approximately 70% of all samples at LC_DC3, LC_SPDC, and LC_DCDS, > 60% at LC_DC2, and > 20% of samples at the remaining stations located further downstream in Dry Creek (LC_DC4 and LC_DC1) had nitrate concentrations that were above the level 2 UECs, while none had concentrations above level 3 UECs in 2022. In the Fording River, at LC_DCEF, LC_UC, and LC_GRCK nitrate concentrations were below the UECs in 2022 (Appendix Table C.4; Appendix Figure C.13).

Nitrate concentrations have increased significantly over time at all Dry Creek areas since mining started in the watershed, as well as LC_DCEF, LC_FRB, and LC_GRCK (2012; Figure 3.1, Table 3.2; Appendix Tables C.2, C.3). Results of the 2-way ANOVA indicated that nitrate did not change in Dry Creek stations in 2022 relative to 2021; however, nitrate concentrations at LC_DCEF and LC_GRCK increased significantly in 2022 relative to 2021 (by ~45% at both stations; Appendix Table C.3). In the Fording River upstream of Dry Creek (LC_FRUS), nitrate concentrations decreased in 2022 relative to 2021 (Table 3.2; Appendix Table C.3). At reference area LC_UC, nitrate concentrations did not change significantly between 2022 and 2021 but did increase between 2020 and 2021 (Table 3.2; Appendix Table C.3). Despite the lack of statistically significant increases between 2022 and 2021 at other areas, annual mean and maximum aqueous nitrate concentrations were higher in 2022 than 2021 at all Dry Creek LAEMP stations and reference stations (LC_DCEF, LC_UC and LC_GRCK; Appendix Figure C.13, Appendix Table C.3; Minnow 2021a).

Annual mean and maximum nitrate concentrations in Dry Creek in 2022 were highest closest to spoiling at area LC_DC3 and decreased moving downstream (Figure 3.1; Appendix Table C.4). At areas LC_DC4 and LC_DC1, mean annual and maximum nitrate concentrations in 2022 were notably less than those observed at LC_DC2 which is adjacent (upstream) of LC_DC4 and LC_DC1 (Appendix Figure C.13; Appendix Table C.4). Annual mean and maximum nitrate concentrations in 2022 were higher at FR_FR5, than LC_FRUS and LC_FRB which are located farther downstream on the Fording River (upstream and downstream of Dry Creek, respectively; Figure 2.1; Appendix Table C.4). Elevated nitrate concentrations at areas FR_FR5, LC_FRUS and LC_FRB are primarily attributed to upstream mining sources from Fording River Operation.

At LC_DCDS in 2022, nitrate was identified as potentially causing observed effects in chronic toxicity tests with water fleas and amphipods (similar to the results seen from 2018 to 2021).

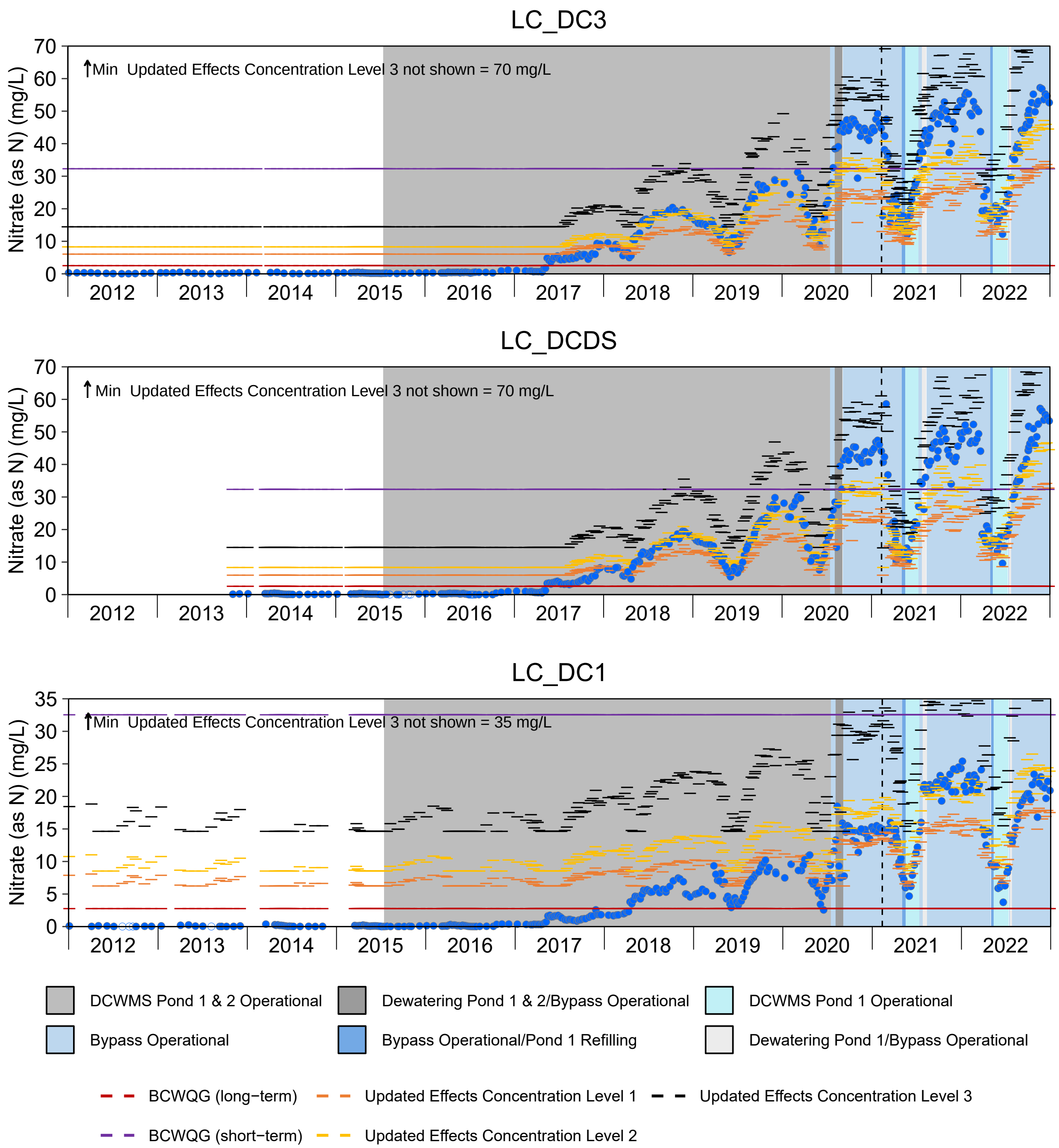


Figure 3.1: Time Series Plots for Nitrate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

Table 3.2: Summary of Water Quality Statistical Results and Comparison with Benchmarks and Guidelines, Dry Creek LAEMP, 2022

Endpoint		Watercourse	Seasonal Kendall			2-way ANOVA			Exceedances
			# of Areas with Significant Change	Change Since the Base Year of Sampling[b]	Range[a] of Mean Annual % Change	Areas with Significant Change Between 2021 and 2022	Change Between 2021 and 2022	Range[a] of % Change Between First Year[b] of Sampling and 2022	BCWQG/ EVWQP Benchmarks/UECs
Total Selenium		Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	29 to 96	LC_DC3, LC_SPDC, LC_DCDS, LC_DC4	√ (n=4)	187 to 5,293 (n=6)	+
		Fording River	2	FR_FR5, LC_FRB	3.0 to 3.3	-	-	NS	+
		Other	2	LC_DCEF, LC_UC, LC_GRCK	0.8 to 5.9	-	-	NS	+
Nitrate		Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	22 to 90	-	-	140 to 77,909 (n=6)	+
		Fording River	2	FR_FR5, LC_FRB	1.2 to 1.8	LC_FRUS	√ (n=1)	NS	+
		Other	0	-	NS	LC_GRCK, LC_DCEF	√ (n=2)	73.3 to 93.3 (n=2)	-
Sulphate		Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	25 to 68	LC_DC3, LC_SPDC, LC_DCDS, LC_DC4, LC_DC1	√ (n=5)	159 to 2,015 (n=6)	-
		Fording River	2	FR_FR5, LC_FRB	2.8 to 3.1	-	-	48.1 (n=1)	-
		Other	2	LC_UC, LC_GRCK	0.75 to 1.9	-	-	19.9 (n=1)	-
Total Cadmium		Dry Creek	6	LC_DC3, LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	8.5 to 28	LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, LC_DC1	√ (n=5)	101 to 408 (n=6)	-
		Fording River	0	-	NS	LC_FRUS	√ (n=1)	-20.4 (n=1)	-
		Other	0	-	NS	-	-	NS	-
Organoselenium[d]	Methylseleninic Acid	Dry Creek	1	LC_SPDC	-11	LC_DCDS	√ (n=1)	-20.9 to - 21.1 (n=2)	-
		Fording River	-	-	NS	-	-	NS	-
		Other	-[c]	-	-	-	-	-	-
	Dimethylseleneoxide	Dry Creek	3	LC_DC3, LC_DC2, LC_DC1	5 to 20	-	-	48.7 to 178 (n=2)	-
		Fording River	-	-	NS	-	-	NS	-
		Other	-[c]	-	-	-	-	-	-

Significant increase.

Significant decrease.

Notes: "Other" refers to Grace Creek (LC_GRCK), Dry Creek East Tributary (LC_DCEF), and Unnamed Creek (LC_UC); "NS" = no significant changes; " √ " = significant change; "+" = at least one value exceeded guideline or benchmark.

[a] Range of increase for areas with significant results only.

[b] First year of sampling: LC_DC3 - 2012, LC_SPDC - 2014, LC_DCDS - 2013, LC_DC2 - 2012, LC_DC4 - 2018, LC_DC1 - 2012, FR_FR5 - 2012, LC_FRUS - 2013, LC_FRB - 2012.

[c] Selenium speciation samples not collected at area LC_UC .

[d] The 2020 AMP response framework for LCO Dry Creek (Teck 2021) identified dimethyl selenoxide (DMSeO) and methylseleninic acid (MeSe(IV)) as the two organoselenium species primarily generated by biological productivity within the Dry Creek Water Management System (DCWMS). Therefore, interpretation of organoselenium species herein was focused on these two organoselenium species (DMSeO and MeSe(IV)), and excluded consideration of selenite and other individual selenium species.

Elevated concentrations of nitrate have been tracked, and future monitoring efforts evaluated, as the need for a response was identified under the AMP response framework in 2018 (Section 1.4 for details; Teck 2019b). Investigations and adjustments as part of that response are currently ongoing. With respect to nitrate, efforts are already underway and include integrated effects assessment modelling to better understand potential effects of nitrate on biota including resident WCT early life stages and thereby guide management planning (Teck 2020b) and implementation of the nitrate compliance action plan. Under the nitrate compliance action plan there has been an increase in explosives bagging (100% bagged at Dry Creek in 2022) to reduce nitrate releases from waste rock placed in the LCO Dry Creek watershed (Golder 2021b). Effects of elevated aqueous nitrate concentrations on biota are discussed in more detail in Sections 4 and 5.4.

3.3 Total Cadmium

Permit 107517 outlines an SPO for total cadmium at Dry Creek area LC_DCDS as well as Grace Creek (LC_GRCK) and Unnamed Creek (LC_UC) that came into effect January 1, 2020 (ENV 2013). There were no exceedances of the SPO for total cadmium at any area in 2022 (Figure 3.2; Appendix Figure C.5, Appendix Table C.1 and C.4).

Total cadmium has increased significantly since the start of spoiling in the watershed (2015) at all monitoring areas of Dry Creek (Figure 3.2; Table 3.2; Appendix Tables C.2 and C.3). Total cadmium concentrations were significantly higher at Dry Creek areas in 2022 compared with 2021, except for LC_DC3 which showed no change (Table 3.2; Appendix Table C.3). In the Fording River temporal trends in total cadmium were not consistent with Dry Creek stations, where concentrations at LC_FRUS were significantly lower in 2022 compared with 2021 (Table 3.2; Appendix Table C.3).

Annual mean and maximum total cadmium concentrations in 2022 were highest on Dry Creek at areas LC_DC3 and LC_SPDC and lowest at area LC_DC1 (Figure 3.2; Appendix Figure C.5; Appendix Table C.4). Annual mean total cadmium concentrations in Fording River areas were highest at FR_FR5 and lowest at LC_FRB, downstream of the mouth of Dry Creek, indicating Dry Creek did not have a detectable impact on Fording River total cadmium concentrations in 2022.

3.4 Total Selenium

Aqueous total selenium concentrations were higher than the BCWQG in all samples from the mine-exposed LAEMP areas in 2022, except at LC_GRCK where 57% of samples where higher

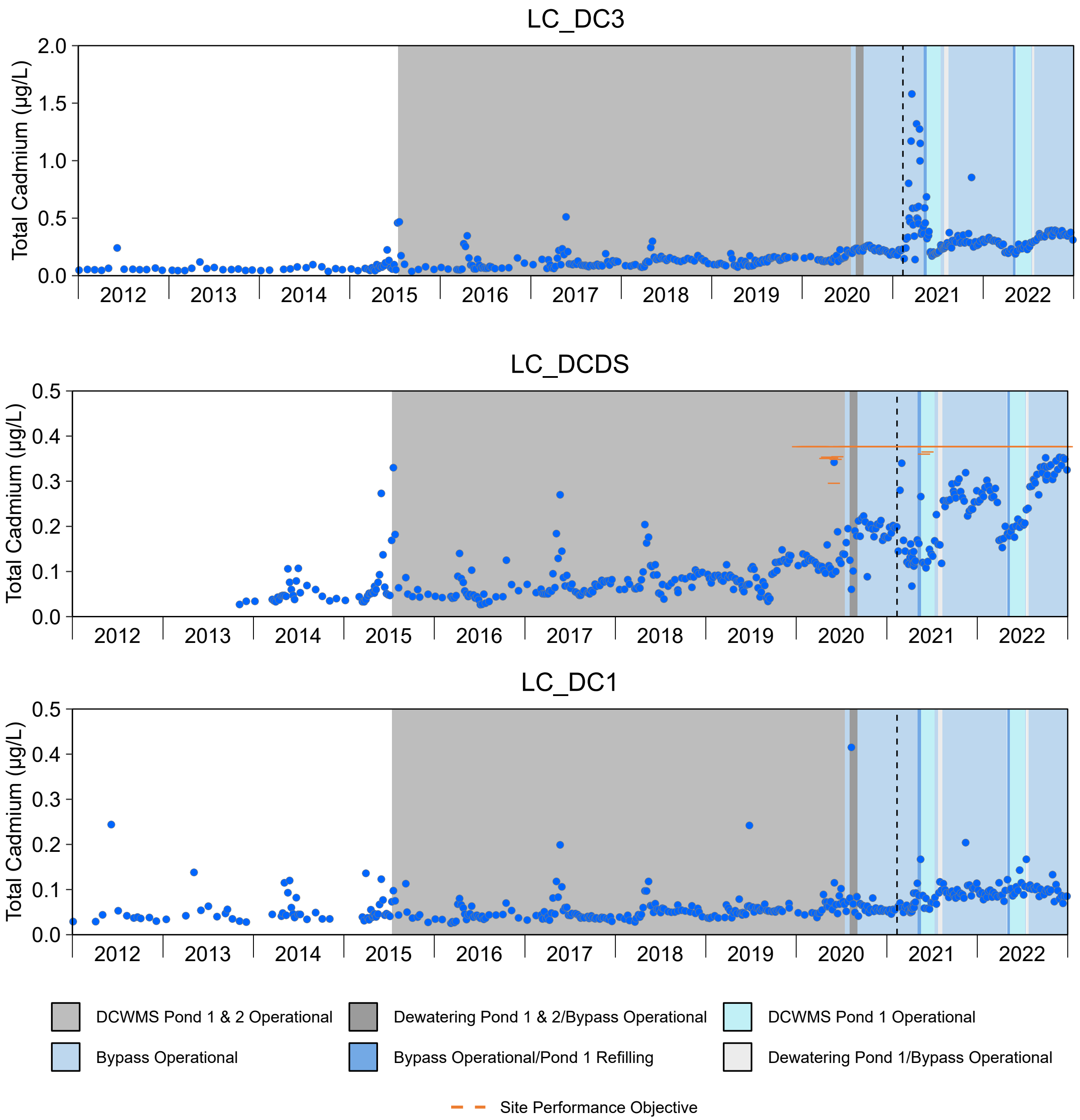


Figure 3.2: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

than the guideline (Appendix Table C.4). The SPO for total selenium[10] was exceeded in all 2022 samples at LC_DCDS; and was not exceeded at LC_GRCK or LC_UC (Teck 2023; Figure 3.3; Appendix Figure C.18). For this report, potential risks to aquatic life associated with selenium were assessed through the evaluation of tissue selenium results in biota as compared to primarily using EVWQP benchmarks for aqueous selenium.

When comparing annual means (2-way ANOVA), total selenium concentrations have increased significantly since the start of baseline and LAEMP monitoring at all Dry Creek LAEMP areas, except LC_GRCK and LC_FRUS (2012 to 2018 depending on site compared to 2022; Figure 3.3, Table 3.2; Appendix Figure C.18, Appendix Table C.3). However, when trends are assessed using a Seasonal Kendall Trend Analysis significant increases are seen at all Dry Creek LAEMP locations except LC_FRUS (Appendix Table C.2). Broadly speaking, the Seasonal Kendal Trend Analysis may be a more appropriate measure of change as there has been a gradual increase overtime with seasonal variation (monotonic) rather than an abrupt point shift (step trend), for which the ANOVA would be more appropriate (Figure 3.3; Appendix Figure C.18). The annual percent increase over time in total selenium concentrations was higher at areas in Dry Creek than at reference (LC_DCEF and LC_UC), Fording River (FR_FR5, LC_FRB), and Grace Creek (LC_GRCK; Table 3.2; Appendix Table C.2). Mean total selenium concentrations were significantly higher in 2022 than 2021 at LC_DC3, LC_SPDC, LC_DCDS, and LC_DC4 (Table 3.2; Appendix Table C.3).

The proportion of water samples in Grace Creek having total selenium concentrations above the BCWQG was above the threshold required for further biological monitoring at that area (50% of samples >2 μg/L; ranging from 1.1 to 2.9 μg/L; total Se) in 2022 (57%, Appendix Table C.4). As a result, biological monitoring will continue at LC_GRCK in 2023. The same threshold applies to LC_UC; however, no samples at LC_UC were above the 2 μg/L total selenium guideline in 2022 (ranged from 0.27 to 0.48 μg/L; Appendix Table C.4). Total selenium concentration at LC_UC were within the range seen at all RAEMP MU1 reference stations in 2022 (0.39 to 1.34 μg/L; Minnow 2023). Screening of 2023 LC_GRCK and LC_UC aqueous total selenium concentrations against this threshold will be included in the 2023 Dry Creek LAEMP report.

Annual maximum and mean total selenium concentrations on Dry Creek were highest at area LC_DC3 (the area farthest upstream on Dry Creek and closest to the LCOII expansion) in 2022.

[10] The SPO for total selenium (10 μg/L) came into effect January 1, 2020, at areas LC_DCDS, LC_GRCK, and LC_UC (ENV 2015).

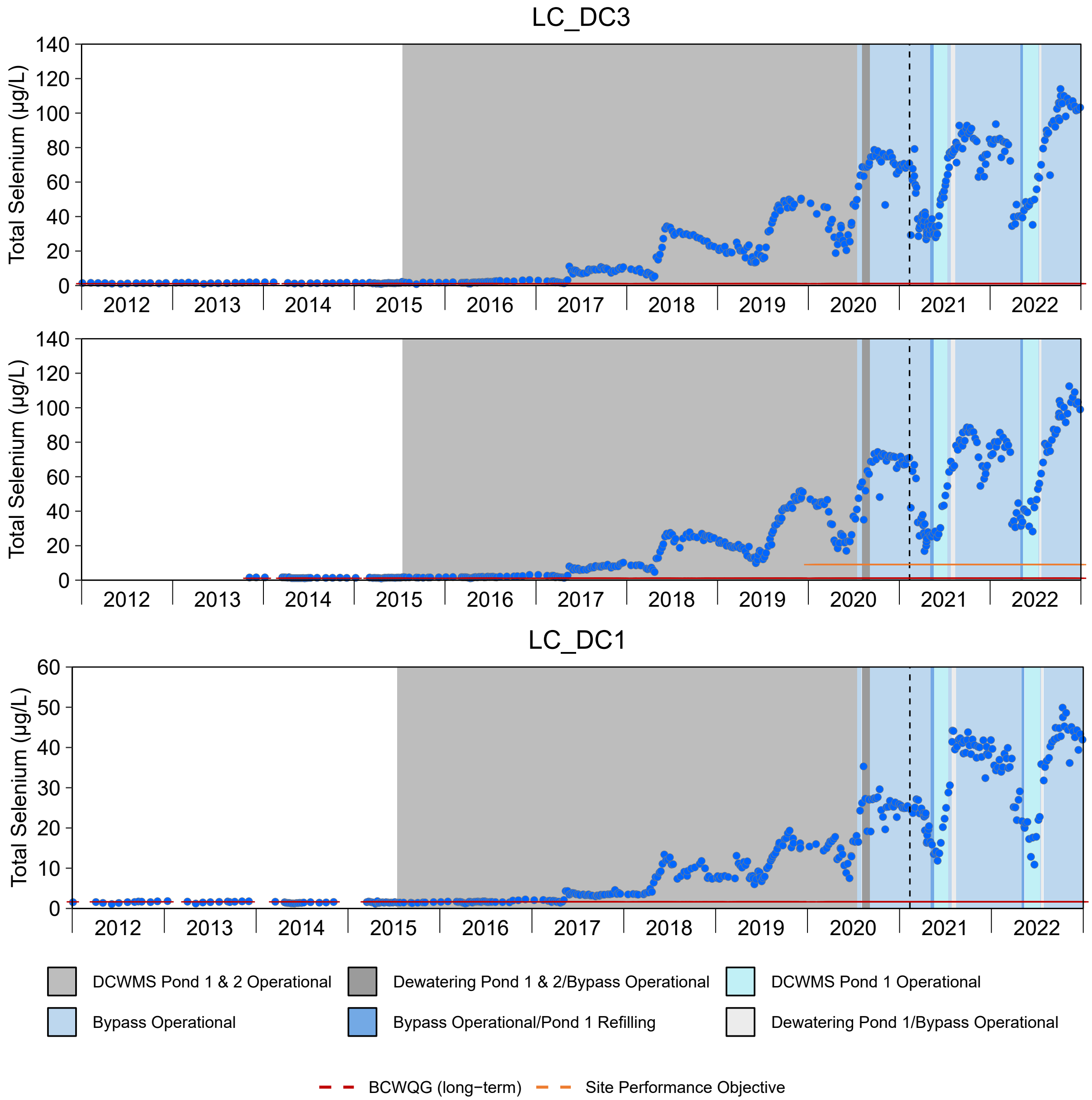


Figure 3.3: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

Selenium concentrations at the three areas closest to the DCWMS outlet (LC_SPDC, LC_DCDS, and LC_DC2) were similar to selenium concentrations at LC_DC3. Selenium concentrations on Dry Creek were lowest at areas LC_DC4 and LC_DC1 in 2022 (Appendix Figure C.18; Appendix Table C.4). Selenium concentrations were higher on Dry Creek than at both reference areas (LC_DCEF and LC_UC) and area LC_GRCK. Annual mean selenium concentrations at Fording River area FR_FR5 (farthest upstream of the mouth of Dry Creek) were higher in 2022 than at Fording River area LC_FRUS and LC_FRB.

3.5 Organoselenium

The most common selenium species detected in the Elk Valley are selenate, selenite, dimethylselenoxide (DMSeO), and methylseleninic acid (MeSe(IV)) and the most important selenium species effecting bioaccumulation are DMSeO and MeSe(IV) (i.e., organoselenium; ADEPT 2022). In 2022, DMSeO concentrations increased from base year (2019) at LC_DC3 and LC_SPDC; however, results of the 2-way ANOVA indicated that DMSeO was not significantly higher in 2022 than 2021 at these or any other stations on Dry Creek (Figure 3.4; Appendix Figure C.23, Appendix Table C.3). Since implementation of the seasonal bypass of the DCWMS (2020), MeSe(IV) concentrations have decreased in Dry Creek. However, results of the 2-way ANOVA indicated that in 2022 compared to 2021, MeSe(IV) concentrations increased at LC_DCDS by approximately 30%. It is notable that annual mean concentrations of MeSe(IV) at LC_DCDS in 2022 were similar to those recorded on 2020 and significantly lower than 2019 (prior to season bypass of DCWMS; Figure 3.4; Appendix Figure C.24, Appendix Tables C.3, C.5). Overall, the DCWMS bypass in 2022 continued to result in decreased organoselenium (DMSeO and MeSe[IV]) concentrations downstream compared to when the DCWMS bypass was not implemented. Downstream of the DCWMS, organoselenium concentrations in 2022 were similar to or lower than in 2020, in contrast upstream of the DCWMS (LC_DC3) organoselenium in 2022 was significantly higher than in 2019 and 2020.

The Selenium Bioaccumulation Tool (B-Tool), which was developed to predict benthic invertebrate selenium tissue concentrations from aqueous selenium speciation concentration, has been used to calculate the concentrations of the combination of MeSe (IV) and DMSeO that would cause a detectable increase in benthic invertebrate tissue selenium concentrations (de Bruyn and Luoma 2021). This information was then used to develop screening levels for the sum of MeSeIV and DMSeO; Level 1 <0.025 µg/L where organoselenium is unlikely to cause a discernible shift in benthic invertebrate selenium concentrations, Level 2 0.025 to 0.05 µg/L is likely to cause a discernible increase in bioaccumulation, and Level 3 < 0.05 µg/L is likely to cause a discernible increase in bioaccumulation and is likely to cause exceedance of 11 mg/kg in benthic invertebrate tissue Se concentrations. In 2022, Dry Creek organoselenium concentrations were

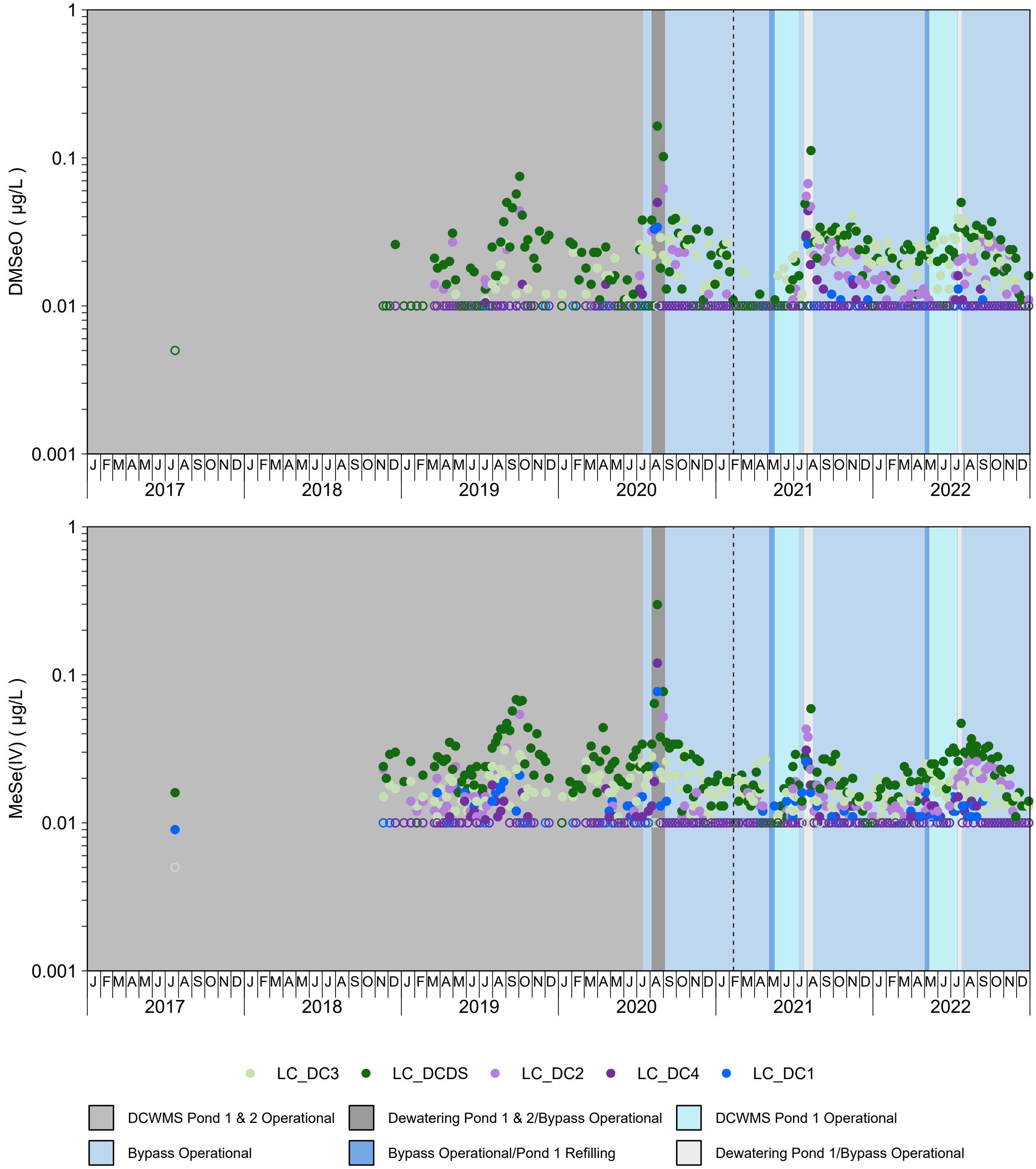


Figure 3.4: Selenium Species Concentrations from LCO Dry Creek LAEMP Sampling Areas, 2017 to 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

frequently above screening levels at LC_DC3, LC_SPDC, LC_DCDS, and LC_DC2 and rarely above screening levels at LC_DC4 and LC_DC1 (Appendix Table C.5). No samples were above screening values in the Fording River, Grace Creek, or at the reference station (LC_DCEF; Appendix Table C.5).

In the surface water of Dry Creek, organoselenium concentrations (DMSeO and MeSe(IV)) were generally highest immediately downstream of the DCWMS at LC_DCDS and decreased downstream. Concentrations of DMSeO and MeSe(IV) were below detectable levels in most samples from LC_DC4 and LC_DC1 in 2019, 2020, 2021, and 2022 likely due to a combination of dilution from LC_DCEF, the presence of a gaining reach downstream of station LC_DC2, uptake by periphyton, and degradation of organoselenium species (via hydrolysis and/or photolysis) into species such as dimethyl selenide and dimethyl diselenide (Appendix Figures C.23 and C.24, Appendix Table C.5; Golder 2021b). Organoselenium concentrations were below detectable levels in all samples collected in 2022 from LC_DCEF, LC_GRCK, and at Fording River areas LC_FRB and LC_FRUS (Appendix Figures C.23 and C.24; Appendix Table C.5).

3.6 Nutrient Status

Dry Creek was nitrogen and phosphorus co-limited (versus solely nitrogen or phosphorus limited) prior to LCOII development owing to high natural phosphorus and low natural nitrogen concentrations (Minnow 2020d). Since 2017, total nitrogen to total phosphorus (TN:TP) ratios have increased in Dry Creek concurrent with increasing nitrate concentrations (Figure 3.1). As a result, Dry Creek nutrient limitation has shifted to phosphorus limitation over the same period since total phosphorus concentrations did not increase (Appendix Figure C.16; Appendix Table C.3).

Trophic status of Dry Creek has also changed since the start of LCOII development, with shifts from oligotrophic to either mesotrophic or meso-eutrophic conditions observed at areas LC_DC3, LC_DCDS, and to a lesser extent, LC_DC1 (based on nutrient concentrations; Minnow 2020d). Changes in nutrient limitation and trophic status were not observed over the same period at reference areas LC_DCEF and LC_UC or Fording River areas LC_FRUS and LC_FRB. It is likely that mine-related nitrogen input has changed nutrient limitation and trophic status in Dry Creek (Minnow 2020d). Initial nutrient enrichment above background levels can increase productivity; however, concentrations can reach nuisance and even toxic levels that cause impairment to biological communities (CCME 2016). As Dry Creek is now phosphorus, it is unlikely that further increases in nitrogen concentrations will contribute to productivity stimulation of existing Dry Creek biological communities.

3.7 Summary

Concentrations of mine-related constituents including nitrate, total cadmium, and total selenium, have increased over time on Dry Creek since spoiling began in this watershed in 2015. Nitrate concentrations were above updated effects concentrations and dissolved nickel concentrations were above proposed benchmarks in Dry Creek in 2022. Constituent concentrations were more frequently elevated at areas LC_DC3 (the Dry Creek area immediately downstream of LCOII spoiling and prior to DCWMS effects) and LC_SPDC, LC_DCDS, and LC_DC2 (the areas immediately downstream of the DCWMS) than at areas LC_DC4 and LC_DC1, likely due to increasing distance from LCOII operations and input of groundwater from reference area LC_DCEF between LC_DC2 and LC_DC4 (Golder 2019b). Similar trends in aqueous constituents were not detected at reference areas (LC_DCEF and LC_UC), in the Fording River downstream of Dry Creek, or in Grace Creek (LC_GRCK), except for nitrate which showed increasing trends at LC_DCEF, LC_FRB and LC_GRCK and total selenium which increased at LC_DCEF, LC_UC and LC_FRB. Operational changes to the DCWMS including development and implementation of the seasonal bypass and modification of discharge channel area LC_SPDC have successfully mitigated organoselenium concentrations in the surface water as well as selenium bioaccumulation and effects to biota.

4 STUDY QUESTION 2: AQUEOUS TOXICITY

Acute toxicity testing was conducted with water samples collected from LC_DC3 (n=5), LC_DCDS (n=4), and LC_SPDC (n=10) using the water flea *D. magna* and rainbow trout in 2022. Out of all samples collected, no samples failed the test criteria for acute toxicity for either organism (i.e., did not cause > 50% mortality to either organism; Table 4.1; Appendix Table D.1).

Chronic toxicity testing was performed quarterly on water flea (*C. dubia*) and green algae (*P. subcapitata*) using water samples collected from LC_DCDS to evaluate the potential effects to benthic invertebrates in Dry Creek. Semi-annual chronic toxicity tests were conducted to evaluate potential effects on amphipods (*H. azteca*), fathead minnow, and rainbow trout. Results of chronic toxicity testing were compared to reference stations on the Fording River, Elk River, Michel Creek, and South Line Creek. The local reference comparison of interest for LC_DCDS is FR_UFR1 on the Fording River. Chronic toxicity test results in 2022 that were categorized by WSP (2023) as 'possible' or 'likely' adverse responses, and the possible causal factors of these responses, are briefly outlined below; see WSP (2023) for a complete discussion of results.

In Q1 2022, a "likely adverse response" was identified for effects on *C. dubia* reproduction, which was similar to 2020 and 2021 (Table 4.2, WSP 2023). Nitrate and/or nickel were identified as potential contributors to the observed responses reported between 2018 and 2022 (including the Q1 2022 responses (Table 4.2, WSP 2023). Chronic toxicity results in 2022 indicated that effects to *C. dubia* reproduction were of similar frequency to 2020, and less frequent than responses in 2021.

In Q1 2022, a "likely adverse response" was identified for cell yield of *P. subcapitata* (Table 4.2, WSP 2023). This is the first year where results have indicated a "likely adverse response," with only a "possible adverse response" being observed in 2020 and 2021, and no adverse responses seen in years before 2020. Similar to previous years, no water quality constituent has been identified as potentially contributing to observed responses. Briefly, constituents are first screened against applicable guidelines/benchmarks and no relevant constituent was identified as contributing to the effect meaning that these results could not be attributed to a specific constituent.

A "possible adverse response" was identified for dry weight of *H. azteca* in Q4 2022 (Table 4.2, WSP 2023). The frequency of possible or likely adverse responses of *H. azteca* to dry weight has remained similar since sampling began in 2019. WSP (2023) have indicated that "nickel and/or nitrate have been identified as potentially contributing factors in all *H. azteca* tests with an observed adverse response, and the evidence from *C. dubia* and *H. azteca* toxicity testing

Table 4.1: Summary of Acute Toxicity Test Results for LCO Dry Creek LAEMP Monitoring Stations, 2022 (Teck 2023)

Water Station			Water Flea *(Daphnia magna)*		Rainbow Trout *(Oncorhynchus mykiss)*	
Teck Code	**Description**	**Year**	**# Tests > 50% mortality**	**Total # tests**	**# Tests > 50% mortality**	**Total # tests**
LC_DC3	Dry Creek upstream of Headpond	2022	0	5	0	5
LC_DCDS	Dry Creek downstream of sediment ponds outlet	2022	0	4	0	4
LC_SPDC	Dry Creek sediment ponds outlet; effluent to Dry Creek	2022	0	10	0	10

Table 4.2: Results of Quarterly and Semi-Annual Chronic Toxicity Tests at LC_DCDS 2015 to2022[a] (Golder [2016, 2017a, 2018, 2019, 2020a, 2021, 2022], WSP 2023)

Area	Quarter		Water Flea (*Ceriodaphnia dubia*)[b]			Amphipod (*Hyalella azteca*)		Green Alga (*Pseudokirchneriella subcapitata*)[c]	Rainbow Trout (*Oncorhynchus mykiss*)[d]				Fathead Minnow (*Pimephales promelas*)[d]				
			Survival (% control-normalized)	Reproduction (% control-normalized; Protocol-specified)	Reproduction (% control-normalized; 8-day)	Survival (% control-normalized)	Dry Weight (% control-normalized)	Cell Yield ($x10^4$ cells/ml)	Survival (% control-normalized)	Viability (% control-normalized)	Length (% control-normalized)	Wet Weight (% control-normalized)	Hatch (% control-normalized)	Survival (% control-normalized)	Biomass (% control-normalized)	Length (% control-normalized)	Normal Development (% control-normalized)
LC_DCDS	2015	Q1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q2	111	87	-	-	-	132.5	-	-	-	-	-	-	-	-	-
		Q3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q4	111	103	-	-	-	118.3	-	-	-	-	-	-	-	-	-
	2016	Q1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q2	90	62[UN]	-	-	-	118.5	-	-	-	-	-	-	-	-	-
		Q3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q4	100	39[UN]	-	-	-	183.5	-	-	-	-	-	-	-	-	-
	2017	Q1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q2	100	87	-	-	-	140.5	-	-	-	-	-	-	-	-	-
		Q3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q4	100	87	-	-	-	123	-	-	-	-	-	-	-	-	-
	2018	Q1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q2	100	77	-	-	-	148.3	-	-	-	-	-	-	-	-	-
		Q3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Q4	100	85[NO3]	-	-	-	100.8	-	-	-	-	-	-	-	-	-
	2019	Q1	100 ± 0	90 ± 19	90 ± 19	-	-	82.8 ± 5.0	-	-	-	-	100 ± 0	100 ± 4	85 ± 7	*88 ± 3*	96 ± 4
		Q2	90 ± 32	87 ± 30	87 ± 30	-	-	*112.0 ± 7.3*	95 ± 13	98 ± 16	105 ± 2	112 ± 6	-	-	-	-	-
		Q3	90 ± 32	111 ± 16	94 ± 14	94 ± 10	65 ± 25[UN]	58.5 ± 6.5	-	-	-	-	98 ± 3	76 ± 20	***74 ± 13***	*98 ± 2*	100 ± 0
		Q4	90 ± 32	100 ± 18	100 ± 11	*35 ± 33*[NO3]	*52 ± 30*[NO3]	102.0 ± 7.0	*73 ± 9*[NO3]	*66 ± 13*[NO3]	101 ± 4	105 ± 3	-	-	-	-	-
	2020	Q1	100 ± 35	68 ± 12[NO3]	*68 ± 12*	-	-	*93 ± 3.7*	-	-	-	-	100 ± 0	**64 ± 43**[UN, HI-RV]	**58 ± 39**[UN, HI-RV]	94 ± 4	100 ± 0
		Q2	100 ± 0	92 ± 22	97 ± 12	87 ± 17	49 ± 13[UN]	134 ± 5.6	104 ± 20[M]	97 ± 31[M]	99 ± 9[M]	109 ± 22[M]	-	-	-	-	-
		Q3	100 ± 0	***89 ± 9***	**93 ± 12**	-	-	***85 ± 5.7***[UN]	-	-	-	-	113 ± 4	99 ± 11	69 ± 9	86 ± 3	100 ± 0
		Q4	100 ± 0	76 ± 17	***77 ± 17***	61 ± 23[UN, HI-RV]	20 ± 6	112 ± 4.1	*86 ± 9*[M]	***86 ± 9***[M]	104 ± 2[M]	106 ± 5[M]	-	-	-	-	-
	2021	Q1	90 ± 32	90 ± 36	-	-	-	***78.5 ± 5***[UN]	-	-	-	-	89 ± 16	100 ± 18	90 ± 7	100 ± 8	98 ± 5
		Q2	100 ± 0	96 ± 27	-	98 ± 9	-[e]	69 ± 9.8	102 ± 4[M]	109 ± 7[M]	107 ± 2[M]	132 ± 16[M]	-	-	-	-	-
		Q3	80 ± 42	*57 ± 42*[Ni, NO3]	-	104 ± 0	*67 ± 7*	***68.5 ± 7.4***[UN]	-	-	-	-	105 ± 0	89 ± 28	94 ± 11	95 ± 4	100 ± 8
		Q4	100 ± 0	***58 ± 16***[Ni, NO3]	-	**83 ± 36**	*92 ± 19*[Ni, NO3]	**74.5 ± 4.9**	105 ± 4[M]	103 ± 7[M]	105 ± 5[M]	107 ± 10[M]	-	-	-	-	-
	2022	Q1	111 ± 0	***70 ± 19***[Ni, NO3]	-	-	-	***49 ± 6.7***[UN]	-	-	-	-	100 ± 4	91 ± 9	114 ± 13	98 ± 7	100 ± 0
		Q2	100 ± 0	96 ± 35	-	96 ± 9	**175 ± 28**	*87.0 ± 6.6*	104 ± 11[M]	114 ± 16[M]	103 ± 6[M]	98 ± 11[M]	-	-	-	-	-
		Q3	100 ± 0	96 ± 38	-	-	-	**108.0 ± 7.0**	-	-	-	-	93 ± 10[M]	90 ± 7[M]	89 ± 10[M]	98 ± 5[M]	100 ± 0[M]
		Q4	100 ± 0	102 ± 16	-	100 ± 0	***57 ± 7***[Ni, NO3]	**66.0 ± 4.2**	85 ± 5	83 ± 8	96 ± 5	97 ± 11	-	-	-	-	-

Bold result significantly lower than Fording River reference (FR_UFR1).
Underline result significantly lower than Elk River reference (GH_ER2).
Italic result significantly lower than Michel Creek reference (CM_MC1).
[box] result significantly lower than South Line Creek reference (LC_SLC).

[white] test categorized as no adverse response.
[yellow] test categorized as possible adverse response.
[orange] test categorized as likely adverse response.
M test had evidence of microbes in one or more replicates.

Notes: Q_x = Calendar year quarters, "-" = no data available. Possible and likely symbols are annotated with constituent identified as potentially contributing to observed response: HI_RV = high inter-replicate variability; NO3 = nitrate; Ni = Nickel; UN =unknown, no water quality constituent identified.

[a] Results presented as percent survival or mean ± standard deviation.

[b] *Ceriodaphnia dubia* survival (% control normalized) and reproduction (% control normalized; protocol specified) toxicity tests were conducted for LC_DCDS between 2015 and 2018 but not under Permit 107517. Standard deviations are not available for these results. Two test lengths were used to evaluate potential effects on *C. dubia* reproduction in 2020. These included: 1) a protocol-specified test length (i.e., reproduction was measured when ≥60 % of controls produced three or more broods; as per Environment Canada [2007c]); and 2) an 8-day test duration (Golder 2021). These two test lengths were used in 2019 and 2020 to evaluate potential brood effect. Prior to 2019, the protocol-specified test length was used.

[c] *Pseudokirchneriella subcapitata* cell yield toxicity tests were conducted for LC_DCDS between 2015 and 2018 but not under Permit 107517. Standard deviations are not available for these results.

[d] Fathead minnow and rainbow trout chronic toxicity testing at LC_DCDS was initiated in 2019

[e] *H. azteca* Q2 test organisms were disposed prior to measured dry weight due to a lab technician error (see Section 2.6), and therefore the initial Q2 tests have only survival data. In response to this, tests were repeated in Q3 for all stations.

collectively indicates that nickel exposure likely explains at least a portion of the variance in chronic crustacean toxicity."

Fathead minnow (Q1 and Q3; via evaluation of hatch, survival, biomass, length, and normal development) and rainbow trout (Q2 and Q4; survival, viability, length, and wet weight) results in 2022 did not differ from reference (Table 4.2, WSP 2023). For rainbow trout, Q2 results are considered the most relevant for evaluating potential effects on early life stages of the congenic westslope cutthroat trout, and all Q2 tests were categorized as no adverse response (Golder 2023).

Overall, acute toxicity testing of Dry Creek DCWMS effluent showed no test failures in all samples collected at LC_DC3, LC_DCDS, and LC_SPDC in 2022 (Teck 2023). Chronic toxicity testing in 2022 identified possible adverse responses to *H. azteca* dry weight and likely adverse responses to *C. dubia* reproduction and *P. subcapitata* cell yield at LC_DCDS, but the frequency and magnitude of these responses was temporally stable (i.e., no apparent consistent pattern of responses over time) except for the *P. subcapitata* response that increased in magnitude in 2022. No "likely" or "possible response" were seen in any of the fish tests in all quarters in Dry Creek in 2022. The chronic toxicity testing identified nickel and/or nitrate as potentially contributors to the observed effects on *C. dubia* reproduction and on *H. azteca* dry weight at LC_DCDS (Golder 2023). Nickel and/or nitrate have been identified as potential contributors to observed effects in all chronic toxicity tests in all *C. dubia* and *H. azteca* tests at LC_DCDS with an observed adverse response between 2018 to 2022. For nitrate, this corresponds to the increasing trend in concentrations observed at LC_DCDS since 2018 (see Sections 5.4 for further discussion of potential effects of nitrate to the receiving environment). Teck has initiated an increase to explosives bagging (100% bagged at Dry Creek in 2022) under the LCO Nitrate Compliance Action Plan to reduce nitrate releases from waste rock placed in the LCO Dry Creek watershed. Chronic toxicity testing is one line of evidence that is used to evaluate the potential effects in a watershed and is used in conjunction with other endpoints to help assess overall effects.

5 STUDY QUESTION 3: BENTHIC INVERTEBRATE COMMUNITY

5.1 Background

Benthic invertebrate communities were sampled in September (Dry Creek, Fording River, and Grace Creek) in 2022 to support Study Question #3: "Are benthic invertebrate community endpoints within normal ranges derived based on samples collected at regional and local reference areas within the Elk River as part of the RAEMP and are the endpoints changing over time?". Benthic invertebrate community samples were also collected in May and November at LC_DCDS to support the upcoming tissue permit limit for benthic invertebrate tissue selenium concentrations. Data collected in September are the focus of this section.

Benthic invertebrate community data collected for the present study were considered to be of good quality based on sorting efficiency, subsampling precision and accuracy, and taxonomic identification accuracy. Therefore, the associated data can be used with a high level of confidence for interpretation (Appendix B).

5.2 Dry Creek

Total benthic invertebrate abundance was within regional normal ranges at all Dry Creek sampling areas in September 2022, however, abundance was lower than site specific normal ranges in at least one replicate at all stations except LC_DC3 (Figures 5.1 and 5.2). Taxonomic richness in September 2022 was within the regional normal range at all Dry Creek sampling areas, but at least one replicate from LC_DC3 and LC_DCDS fell outside the site-specific normal range (LC_DC3 fell below and LC_DCDS was higher that site-specific normal ranges; Figures 5.1 and 5.3). Except at station LC_DC3, the proportion of EPT (%EPT) was within the regional normal range for all samples from Dry Creek; however, %EPT fell below the site-specific normal ranges in at least one replicate at LC_DC3, LC_DCDS, LC_DC4 and LC_DC1 (Figures 5.1 and 5.4). Abundance of EPT was similar to total abundance, where results from all Dry Creek areas were within the regional normal ranges; however, at least one replicate from all stations on Dry Creek (except LC_DC3) were below the site-specific normal ranges (Appendix Figures E.1 and E.4). The proportion of Ephemeroptera (%E) was below the regional and/or site-specific normal ranges in at least one replicate from every Dry Creek area, and upstream areas (LC_DC3, LC_DCDS, and LC_DC2) fell below the normal ranges more often than further downstream areas (Figures 5.1 and 5.5). Similarly, abundances of Ephemeroptera were below regional and/or site-specific normal ranges at all areas on Dry Creek (Appendix Figures E.1 and E.5). The proportion of Chironomidae (%C) was within the regional normal range at all Dry Creek

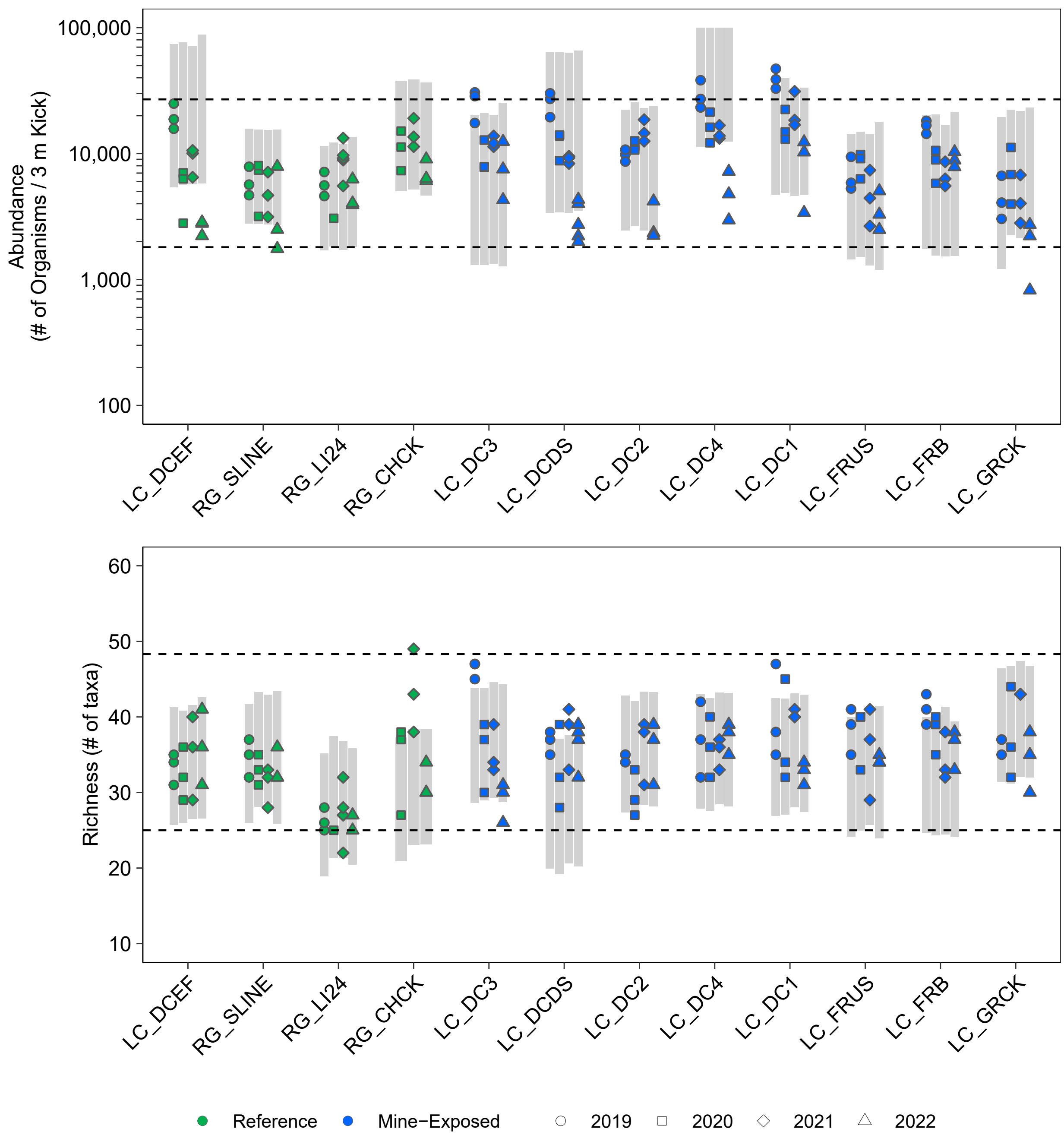


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

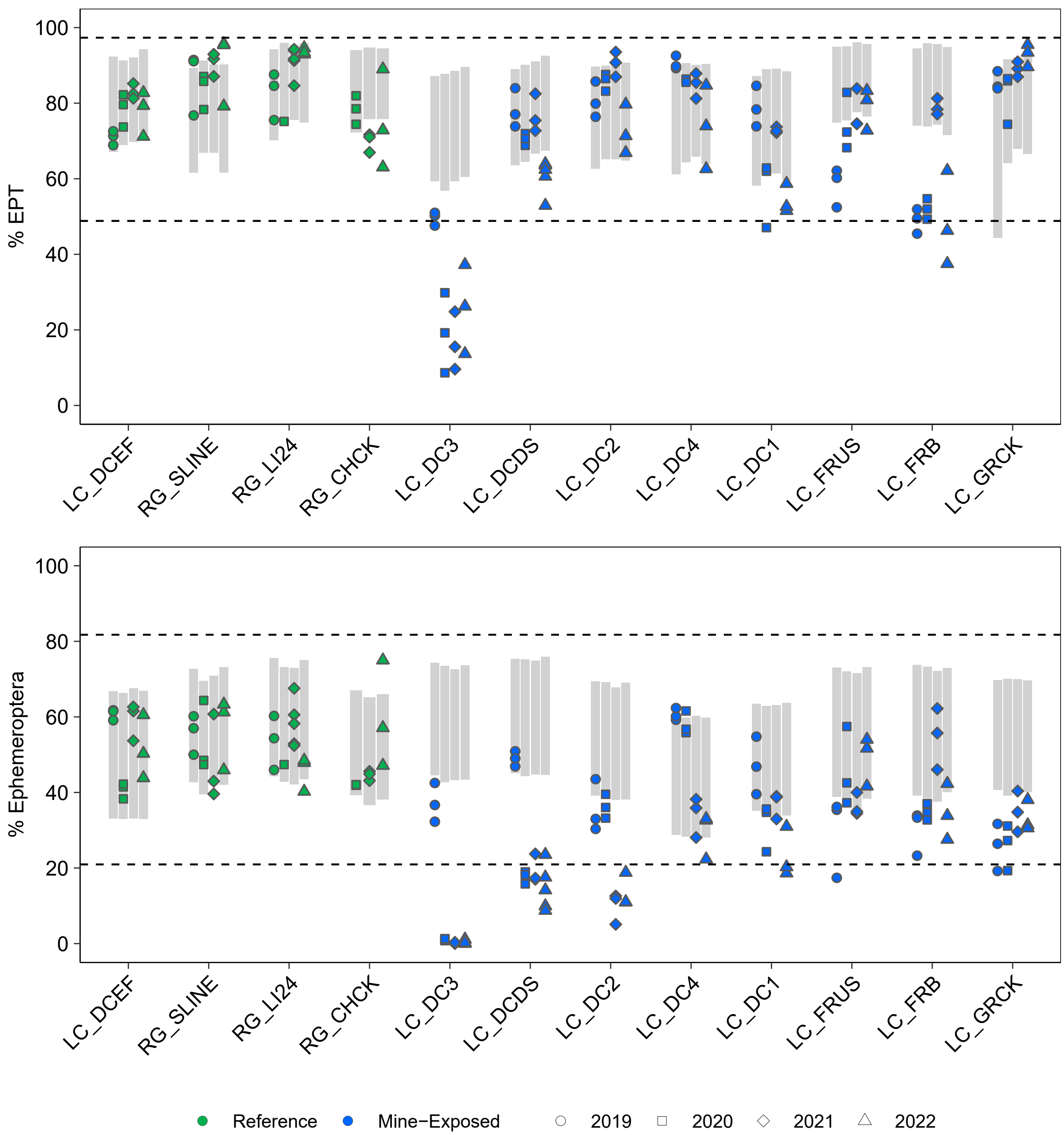


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

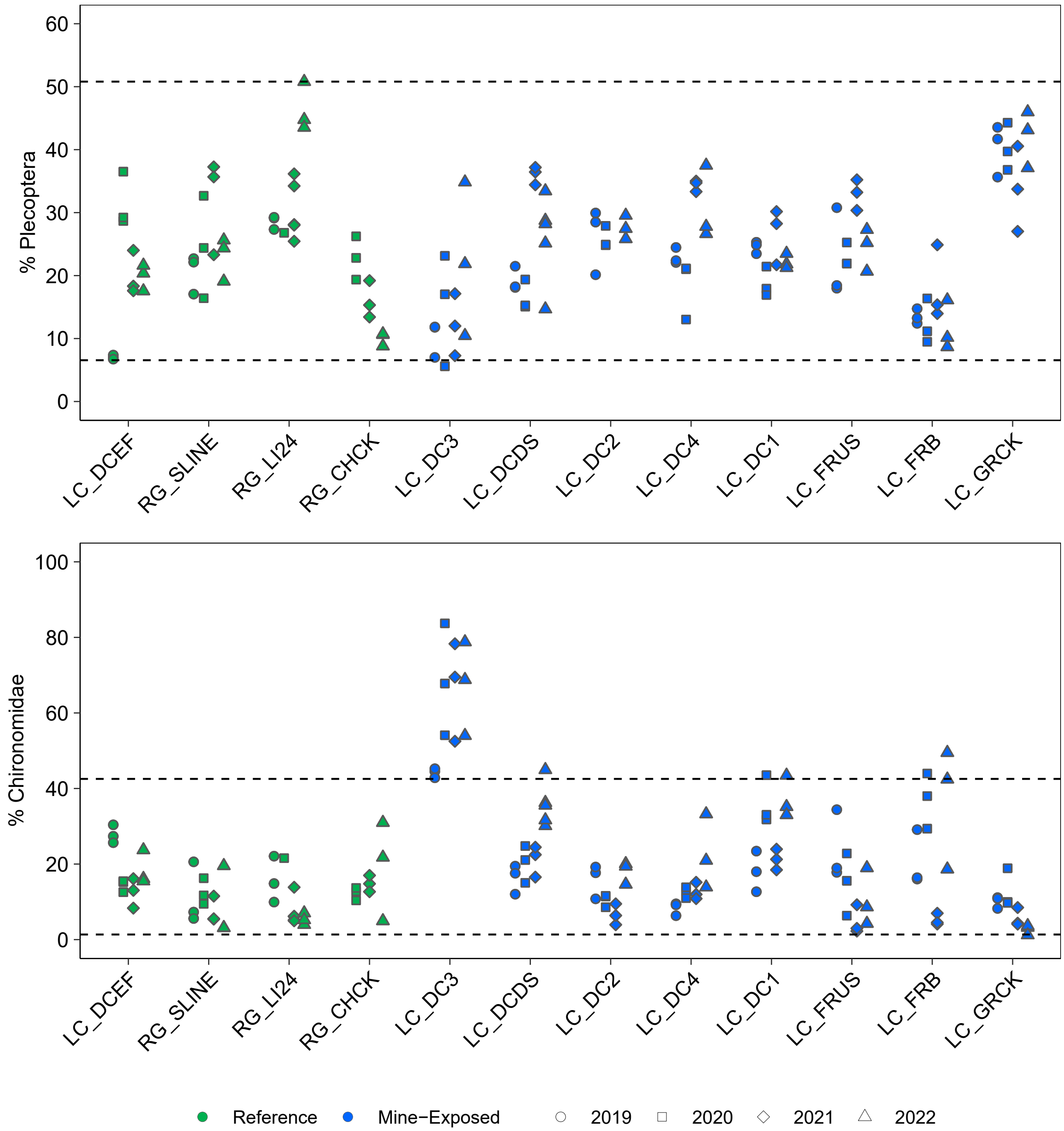


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

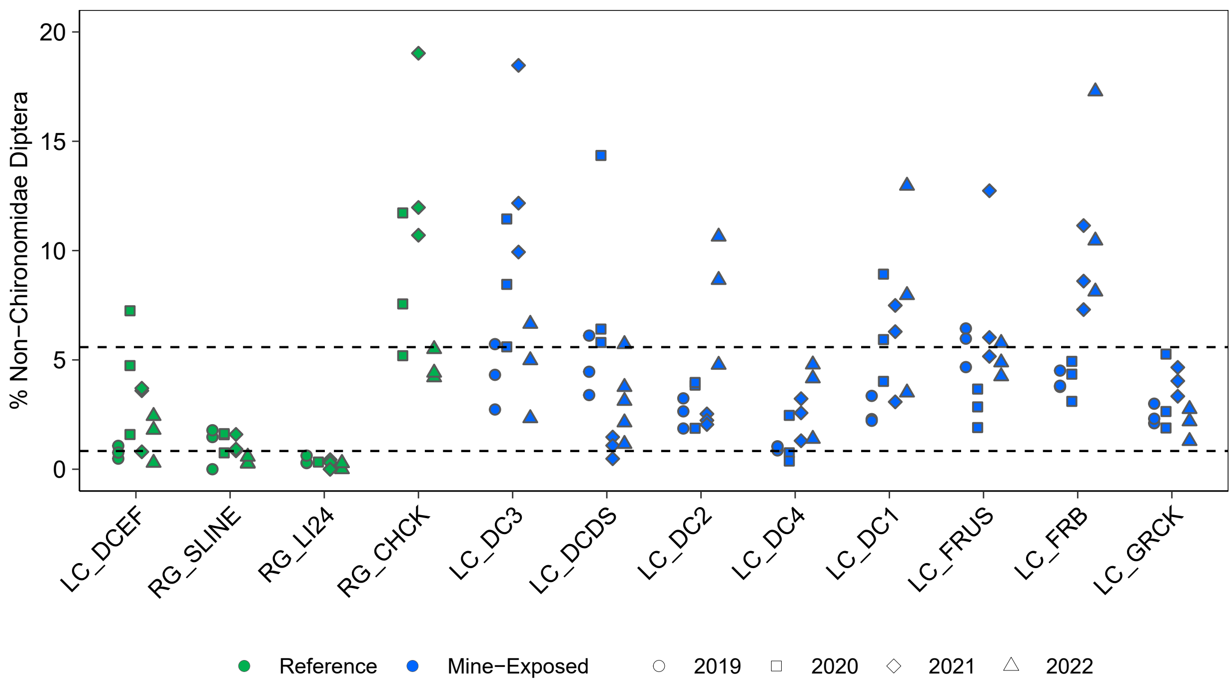


Figure 5.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

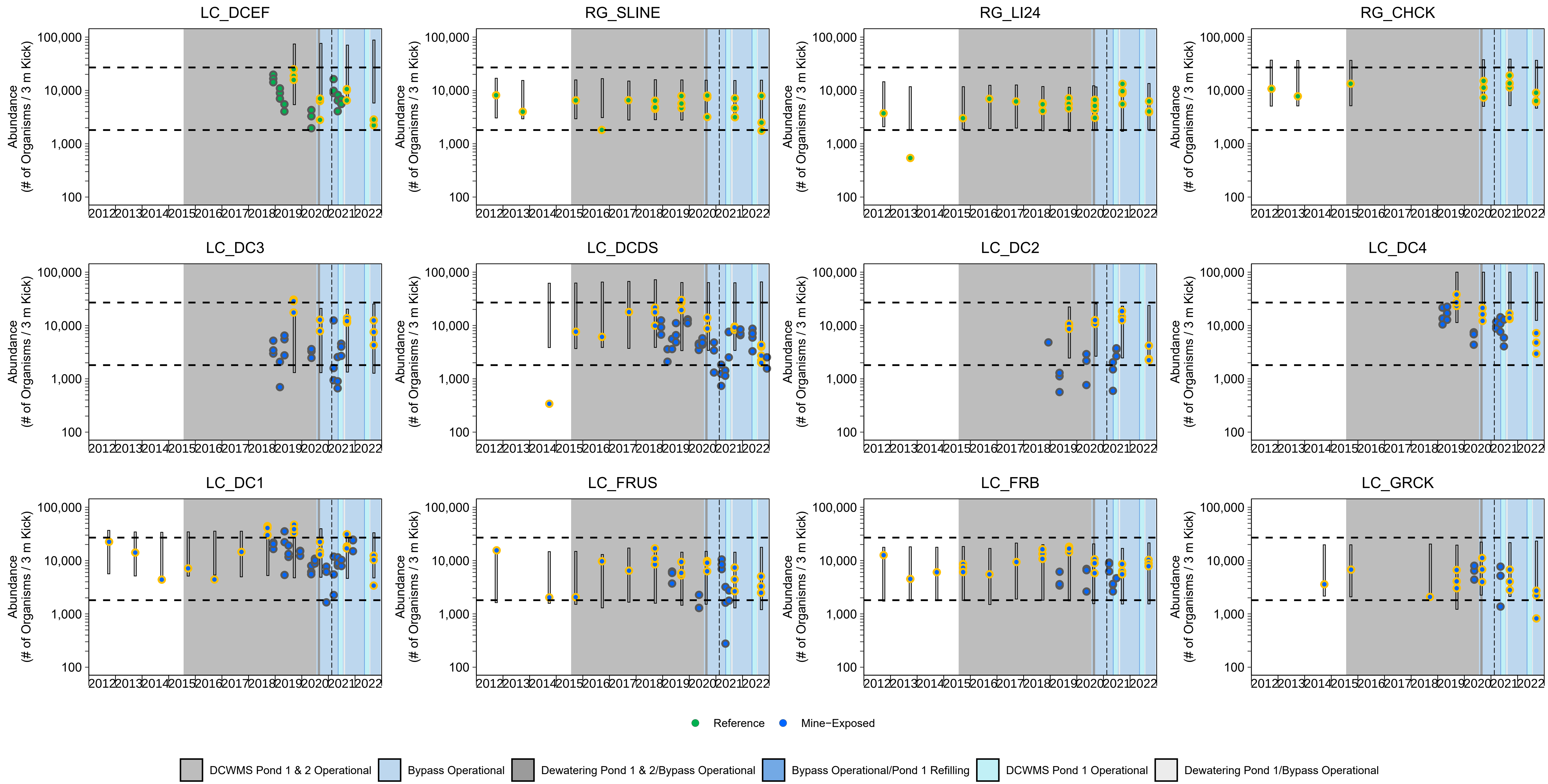


Figure 5.2: Benthic Invertebrate Community Abundance (# of Organisms / 3 m Kick) from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Site specific normal ranges using regression models shown with grey shading and black rectangle (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

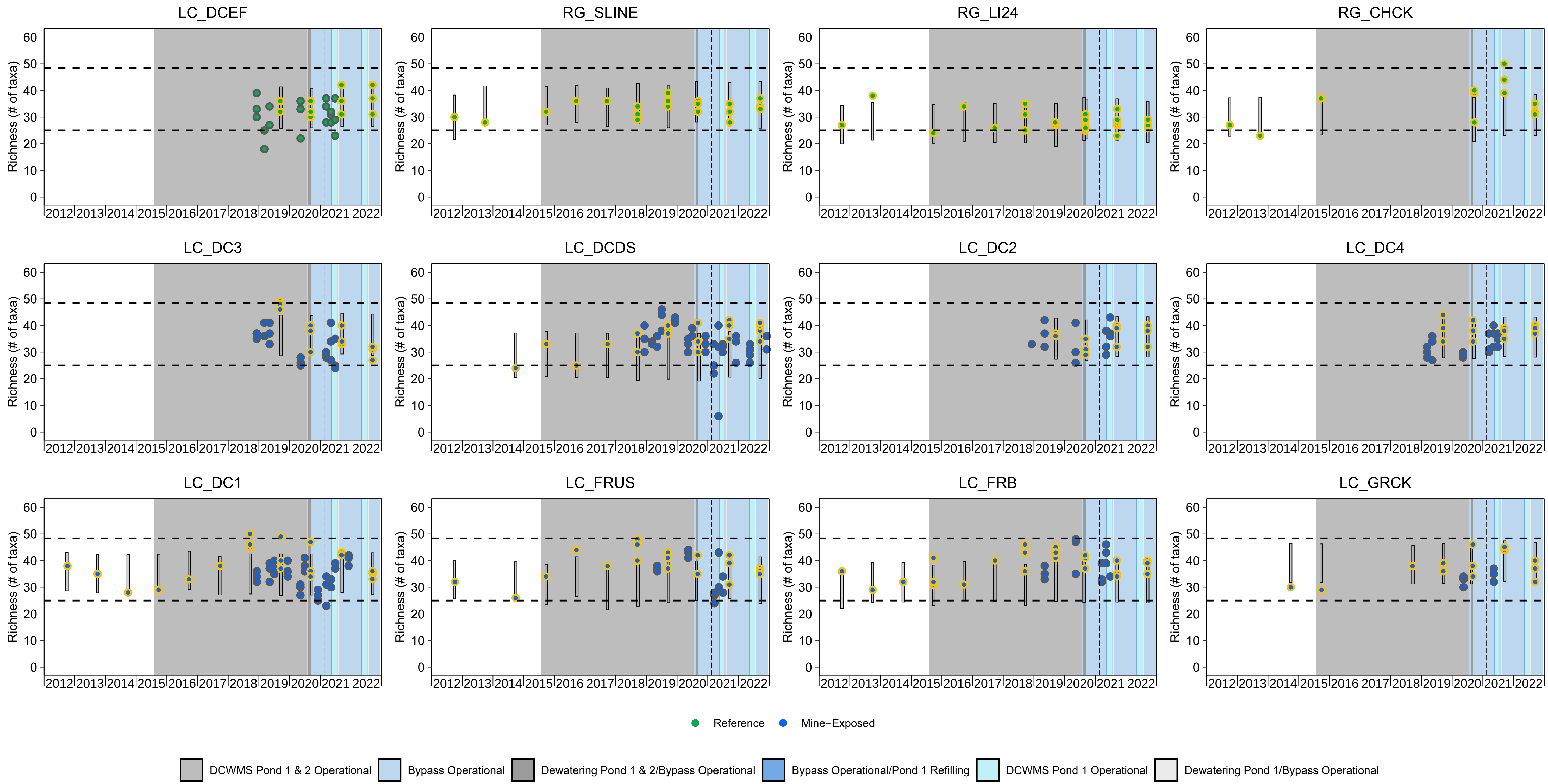


Figure 5.3: Benthic Invertebrate Community Richness (# of taxa) from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Site specific normal ranges using regression models shown with grey shading and black rectangle (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

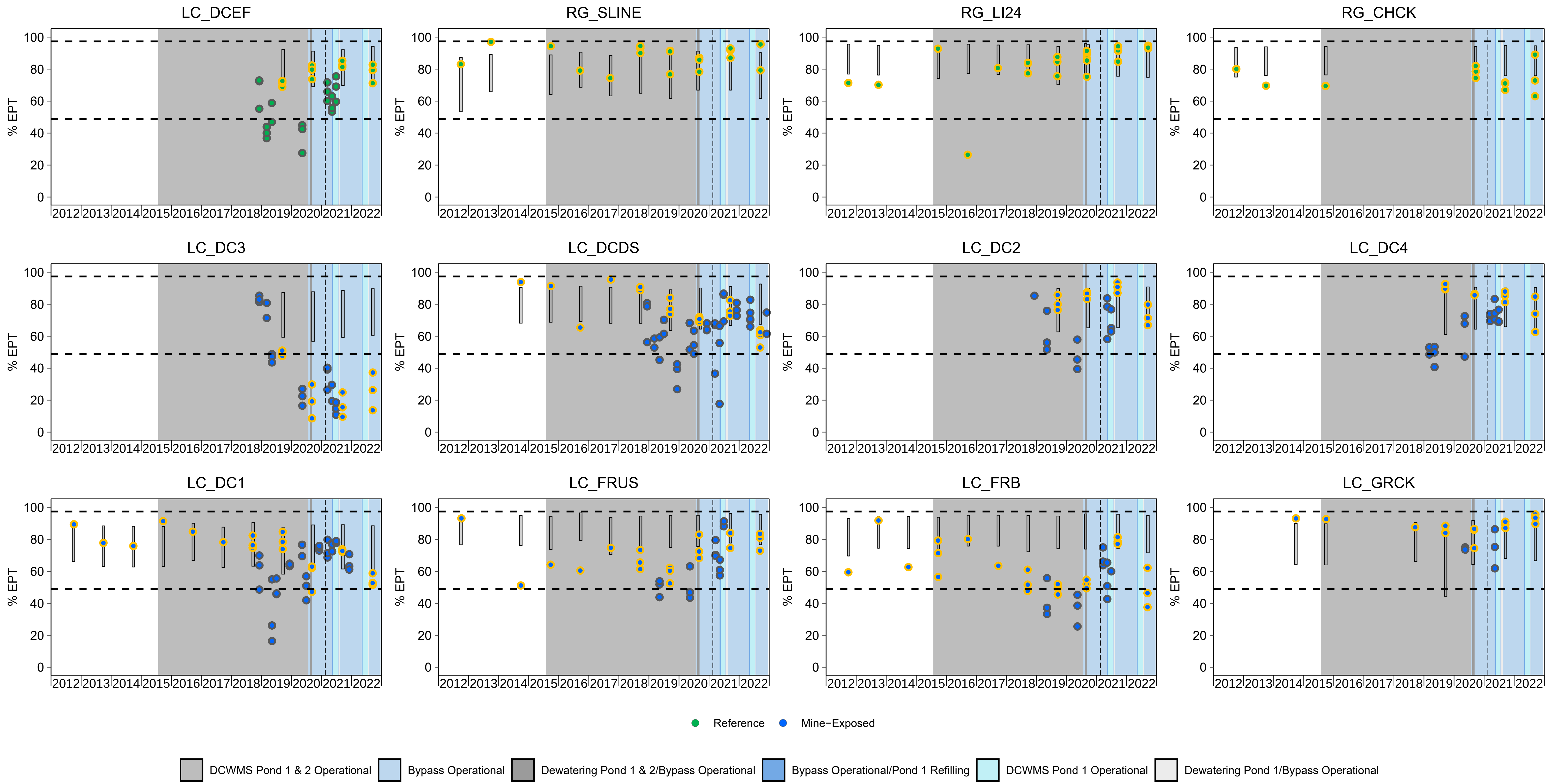


Figure 5.4: Benthic Invertebrate Community % EPT from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Site specific normal ranges using regression models shown with grey shading and black rectangle (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

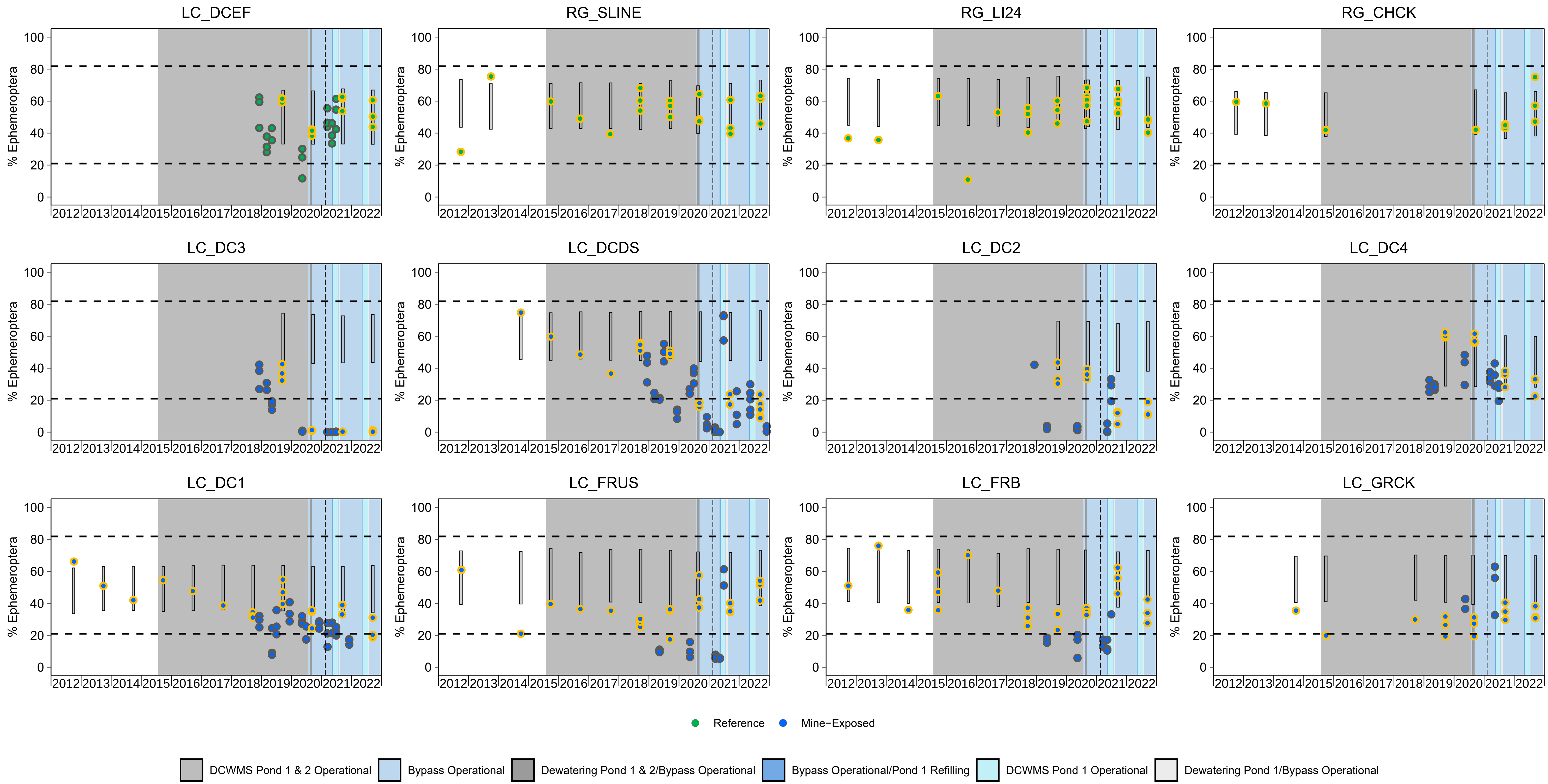


Figure 5.5: Benthic Invertebrate Community % Ephemeroptera from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Site specific normal ranges using regression models shown with grey shading and black rectangle (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

stations except LC_DC3, LC_DCDS and LC_DC1 where at least one replicate was above the range (Figures 5.1, 5.6 and 5.7). In contrast, abundances of Chironomidae were within the regional normal range for all Dry Creek areas (Appendix Figures E.1 and E.7). Proportions of non-Chironomidae Diptera (%NCD; e.g. Simuliidae and Psychodidae) were above regional normal range in at least one replicate from all areas in Dry Creek samples except LC_DC4 (Figures 5.1 and 5.8). Similar to Chironomidae abundance, non-Chironomidae Diptera abundance were within the regional normal range for all Dry Creek areas.

In general, benthic invertebrate communities in Dry Creek upstream of the DCWMS and closest to the LCOII spoil (LC_DC3) were most likely to have endpoints outside of normal ranges. Areas located closest to the outlet of the ponds (LC_DCDS and LC_DC2) also tended to have lower %E than other areas and compared to regional and site-specific normal ranges.

5.2.1 Fording River and Grace Creek

The majority of benthic invertebrate community endpoints associated with samples collected from the Fording River in September 2022 were within the respective regional normal ranges (Figure 5.1; Appendix Figure E.1). Benthic invertebrate community endpoints fell below normal ranges in at least one replicate from both LC_FRUS and LC_FRB for %EPT and in at least one replicate at LC_FRB for %E. Benthic invertebrate community endpoints were above normal ranges for %Chironomidae at LC_FRB and %non-Chironomidae Diptera at LC_FRUS and LC_FRB.

In 2022, %EPT, %E, %P, and %T, were all lower downstream of the mouth of Dry Creek in the Fording River (LC_FRB) compared to upstream of Dry Creek (LC_FRUS), whereas the opposite was true for total abundance, %O, %C, and %NCD (Appendix Table E.3). With this considered, there was no consistent temporal variation in the %EPT, %E, %P, and %T endpoints that was indicative of an influence on the benthic community downstream of Dry Creek (i.e., most endpoints in 2022 were similar to 2018/2019 at LC_FRB; Appendix Table E.3). Secondly, water quality constituents were similar upstream and downstream of the mouth of Dry Creek in the Fording River and/or showed no temporal variation (except nitrite which was higher at LC_FRB, but below guidelines, in 2022 despite being similar to RG_FRUS in prior years; Appendix Table C.6). These together suggest that that there is a minimal influence of Dry Creek on benthic invertebrate community structure in the immediate downstream receiving environment.

The benthic invertebrate community within Grace Creek had endpoints in September 2022 that were generally within regional normal ranges, as expected, based on current lack of mine-related influence. The exception to this was total, EPT and E abundance, which was below both site-specific and regional normal ranges in 2022 in at least one replicate; and %EPT

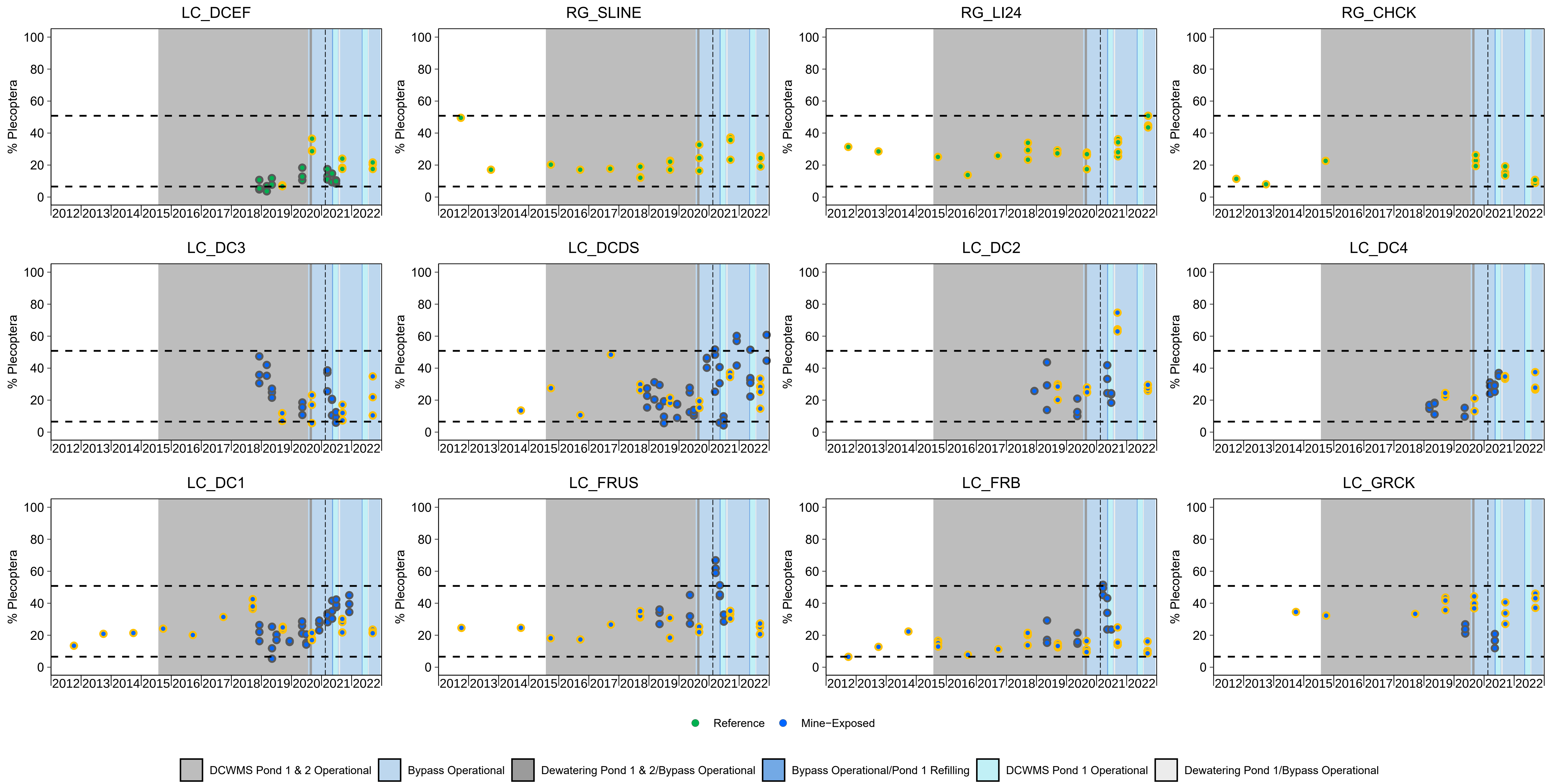


Figure 5.6: Benthic Invertebrate Community % Plecoptera from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

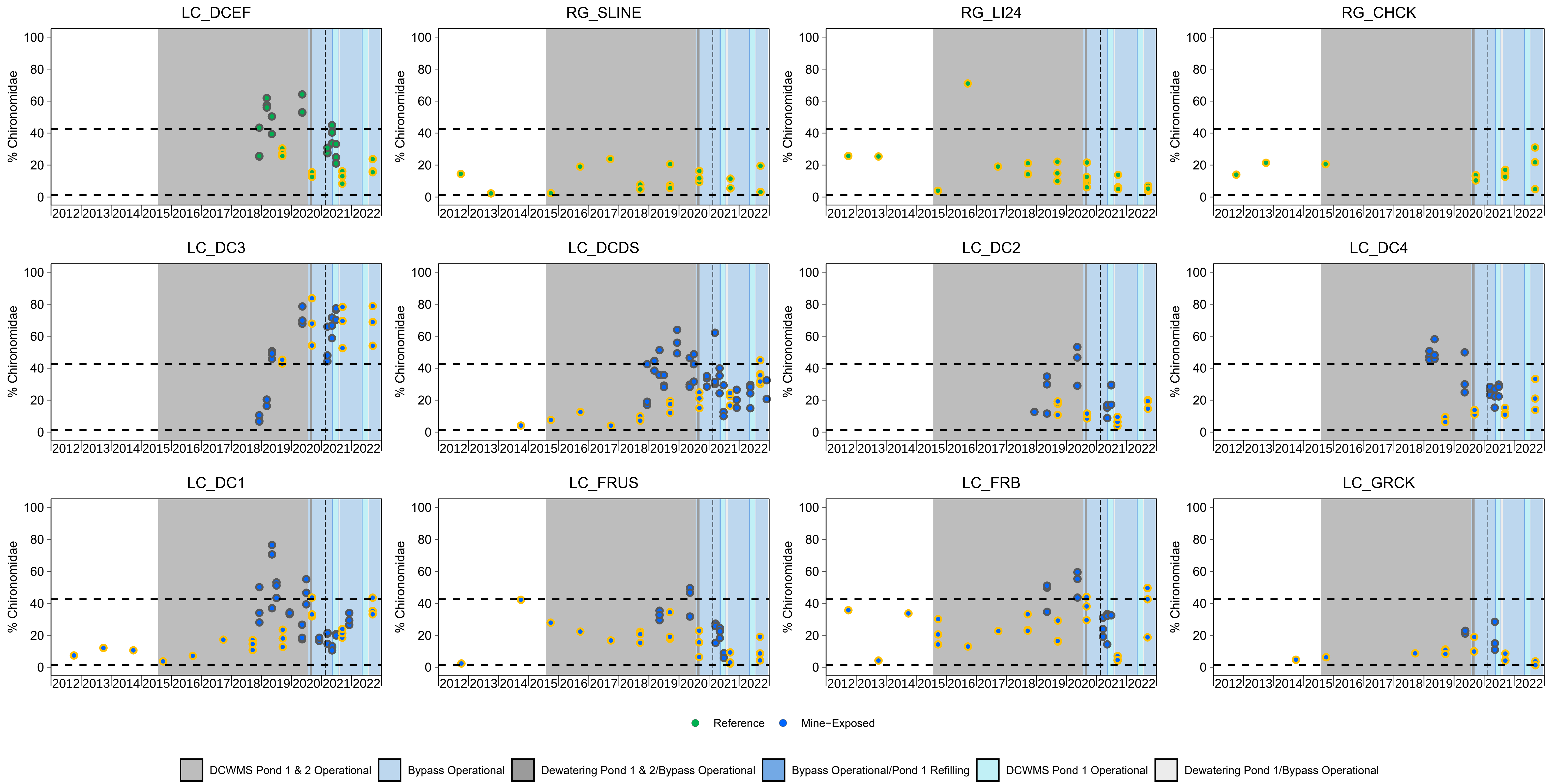


Figure 5.7: Benthic Invertebrate Community % Chironomidae from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

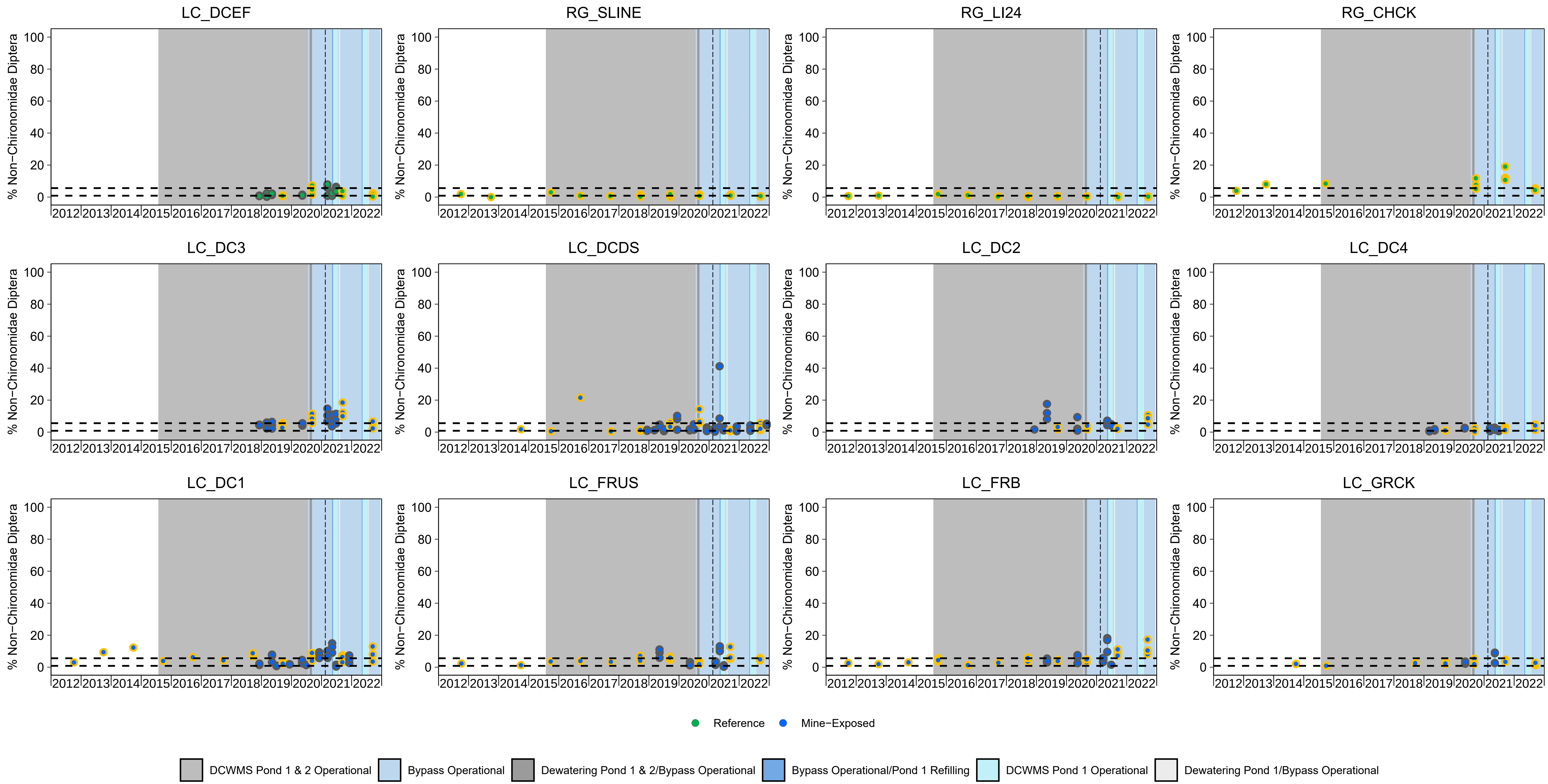


Figure 5.8: Benthic Invertebrate Community % Non−Chironomidae Diptera from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

which was above the site-specific normal ranges and % E which was below the site-specific normal ranges in 2022 (Figure 5.1; Appendix figure E.1).

5.3 Spatiotemporal Changes and Biological Trigger Assessment

Analysis of potential changes in benthic invertebrate community endpoints over time and among mine-exposed areas in Dry Creek and the Fording River relative to changes at upstream reference areas (i.e., LC_DCEF for Dry Creek areas and LC_FRUS[11] for LC_FRB) were explored using data from Dry Creek areas over the 2019 to 2022 period and data from Fording River areas over the 2018 to 2022 period (Figures 5.1 to 5.8; Appendix Figures E.1 to E.10, Appendix Tables E.2 and E.3; see Appendix A for ANOVA methods).

Total abundance, EPT abundance and E abundance of benthic invertebrates significantly decreased between 2021 and 2022 at most areas in Dry Creek, except LC_DC3 (Figures 5.1 and 5.2; Appendix Table E.2). EPT abundance at mine-exposed sites in Dry Creek where similar to those at the reference stations; however, E abundance was lower at LC_DC3 and LC_DCDS in 2022. Total abundance in 2020 to 2022 was significantly lower than in 2019 in all study areas except LC_DC2 (2021 and 2020) and LC_DC4 (2020; where no temporal differences were observed; Appendix Table E.2). There was no change in total abundance at either Fording River area (LC_FRB and LC_FRUS) in 2022 compared to 2021, however total abundance was lower at LC_FRUS in 2022 compared 2018 as was the case in 2021 (Appendix Table E.3).

The decrease in total abundance (driven by a decrease in ETP and E abundance) in most Dry Creek stations in 2022 compared to 2021 was accompanied by a decrease at the reference station (LC_DCEF); all mine-exposed sites fell within the range of abundance seen at LC_DCEF, except LC_DC3 and LC_DC1 where abundance was significantly higher than reference (Figures 5.1 and 5.2; Appendix Table E.2, Appendix Figure E.4). Total abundance and EPT abundance also decreased at RG_CHCK (RAEMP reference station) in 2022 compared to 2021, decreases in abundance across the broader area could point to a regional environmental stressor (e.g., temperature or rainfall; Figure 5.1). RG_CHCK is a second potential reference station located approximately 8 km upstream of Dry Creek (Figure 2.1). It is a small tributary (similar in size to Dry Creek), that flows into the Fording River. RG_CHCK has a similar benthic invertebrate community as LC_DCEF and stations in Dry Creek (specifically, LC_DC2, LC_DC4, and LC_DC1) making is a good candidate as a second reference station for Dry Creek. Similar changes in BIC abundance were not seen at RG_SLINE or

[11] LC_FRUS is not in reference condition; however, due to its position upstream of the mouth of Dry Creek, it is being used as an upstream reference area for LC_FRB (located downstream of the mouth of Dry Creek) to assess potential effects of Dry Creek inputs on Fording River benthic invertebrate communities.

RG_LI24 (LCO LAEMP reference stations; Figure 2.1 and 5.1) which are located slightly further away. It is important to note that at LC_DCEF, in 2022 compared to 2021, the proportions of E and EPT remained relatively stable and for all other benthic invertebrate community endpoints (e.g., %Plecoptera, %Trichoptera, %Oligochaeta, %Chironomidae, and %Non-Chironomidae Diptera), there were no significant differences, or patterns of change over time (Figures 5.1 and 5.4 to 5.8; Appendix Figure E.3).

There were no temporal or spatial (comparison to LC_DCEF) differences in taxonomic richness observed at all Dry Creek study areas in 2022 relative to any other study year, except LC_DC3 which exhibited lower richness than 2019 but has been stable since (2019 to 2021; Figure 5.3; Appendix Table E.2). At the Fording River study areas (LC_FRUS and LC_FRB), a similar pattern was observed for richness in 2022 as 2021 (i.e., lower relative to 2018 but stable from 2019 to 2022, and no difference in between the downstream and upstream area; Figures 5.1 and 5.3; Appendix Table E.3).

Within Dry Creek, percent EPT was significantly lower in 2022 relative to 2021 with the exception of LC_DC3 which decreased in 2020 compared to 2019 but has not changed since (Figures 5.1 and 5.4; Appendix Table E.2). The decrease in %EPT at all Dry Creek sites was largely driven by a decrease in abundance and proportion of Ephemeroptera; however, there is some variability between sites (i.e., a decrease in Plecoptera played a significant role at LC_DCDS in 2022; Appendix Figure E.6). Percent EPT was significantly lower at LC_DC3, LC_DCDS, and LC_DC1 compared to the reference station in 2022. Within the Fording River, a decrease in %EPT was observed at LC_FRB (driven by a decrease in %E, %P and %T) in 2022 relative to 2021; however, proportions are similar to earlier study years (2018 to 2020). This temporal decrease resulted in a significantly lower %EPT at LC_FRB compared to LC_FRUS in 2022 (Appendix Table E.3).

In addition to assessment of spatial and temporal changes, percent EPT was also compared against the biological trigger (i.e., lower limit) established for this endpoint for Dry Creek LAEMP monitoring areas with available water quality predictions (i.e., two mine-exposed areas [LC_DCDS and LC_DC1]; see Appendix H for details). The percentage of EPT in all samples from both study areas was below the trigger and within habitat-adjusted normal ranges. Percent EPT at these areas has previously been flagged for further investigation in the RAEMP based on benthic invertebrate community results (Minnow 2020b). Further information regarding the percent EPT biological trigger as it pertains to the LCO Dry Creek LAEMP can be found in Appendix H.

Significant decreases in %E were observed at all mine-exposed areas in Dry Creek over the 2019 to 2022 period (Figures 5.1 and 5.5; Appendix Table E.2). In some cases, the significant decrease occurred in 2020 (i.e., LC_DC3, LC_DCDS, and LC_DC1), whereas in other cases, the significant decrease occurred in 2021 (i.e., LC_DC2 and LC_DC4) or 2022 (a second decrease for LC_DC1; Figure 5.5; Appendix Table E.2). At the reference area (LC_DCEF), %E initially decreased in 2020 relative to 2019, but returned in 2021 and 2022 to a similar percentage as observed in 2019 (Figures 5.1 and 5.5; Appendix Table E.2). The temporal decreases in %E observed at all mine-exposed areas resulted in all areas having significantly lower %E relative to the reference area in 2022 (and in many cases, 2021, 2020, and 2019; Figure 5.5; Appendix Table E.2).

A nearly opposite pattern to that of %E was observed for %Plecoptera (%P) at the Dry Creek study areas, with LC_DC3 and LC_DCDS exhibiting a significant increase in %P over time (2022 relative to 2019; Figure 5.6; Appendix Table E.2). Over the same time period, %P measured at the reference area (LC_DCEF) ranged from its lowest in 2019 and 2022 to highest in 2020 (Figure 5.6). As a result of the temporal patterns observed at Dry Creek study areas, almost all the mine-exposed areas differed from the reference area with respect to %P over time, due to the substantial increase in %P at the reference area in 2020, most mine-exposed areas exhibited significantly lower %P relative to the reference area that year (Appendix Table E.2). Then in 2021, when %P decreased at the reference area, but increased at almost all mine-exposed areas, significantly higher %P was noted at most mine-exposed areas relative to the reference area (Appendix Table E.2). % P has remained higher than reference at LC_DC2 and LC_DC4 in 2022. In the Fording River, %P was highest at both the downstream and upstream study areas in 2018 and 2021, and lowest in 2019, 2020 and 2022, with the downstream area consistently exhibiting lower %P than the upstream area in all years (Figure 5.6; Appendix Table E.3).

For most other benthic invertebrate community endpoints (e.g., %Trichoptera, %Oligochaeta, %Chironomidae, and %Non-Chironomidae Diptera), there were either no significant differences, or no obvious patterns of change over time or relative to reference within Dry Creek and the Fording River that would potentially be indicative of a mine-related influence (Figures 5.6 to 5.8; Appendix Figures E.7 to E.9, Appendix Tables E.2 and E.3).

Overall, %E appeared to be the endpoint most likely linked to a mine-related influence. Both the relative proportion and total abundance of Ephemeroptera decreased at all mine-exposed areas on Dry Creek over the 2019 to 2022 monitoring period, and percentages measured at the mine-exposed areas were almost always significantly lower than those measured in the reference area, particularly in 2021 and 2022. Unlike previous years where %EPT was unchanged compared to 2019, the decreased in proportion and abundance of Ephemeroptera in 2022 was reflected in a decrease in the proportion and abundance of EPT.

Generally, in previous years (2021 to 2019) proportions of EPT did not reflect the patterns observed in %E because %P often increased to offset the observed changes. In the Fording River in 2022, %EPT, %E, %P, and %T, were all lower downstream of the mouth of Dry Creek in the Fording River (LC_FRB) compared to upstream of Dry Creek (LC_FRUS); however, there has been very few temporal changes in benthic community endpoints (i.e., portions are no different than 2018 at either station) and there were no changes in water quality that would be indicative of an influence of Dry Creek on the downstream receiving environment.

5.4 Correlation Analysis

Spearman Rank Correlation analysis was used to assess relationships between benthic invertebrate community endpoints and physicochemical data (e.g., water quality constituents and habitat variables) collected from all Dry Creek LAEMP study areas in September 2019 to 2022 (Table 5.1; Appendix Figure E.11). Data were not screened against benchmarks or guidelines to refine the assessed physicochemical variables prior to correlation analysis; in addition, although correlation is a fundamental tool applied for exploring data and generating evidence of potential causation, it is not equal to causation (e.g., Suter 2015). Correlations results were discussed if their correlation coefficient (R_s) was less than or equal to -0.6 or greater than or equal to 0.6 and their p-value was less than 0.0001 (Appendix Figure E.11) and the discussion was focused on correlations with %E (for which most significant relationships were reported).

In 2022, total nickel and nitrate were significantly negatively correlated with %E (Table 5.1). Both nickel and nitrate were associated with chronic toxicity responses in *Ceriodaphnia dubia* (*C.dubia*) and *Hyalella azteca* (*H. azteca*) in 2022 (See section 4). Additionally, nitrate concentrations were above updated effects concentrations and dissolved nickel concentrations were above proposed benchmarks at Dry Creek stations in 2022. Thus, the evidence supports the potential for mine-related changes in nickel and nitrate to be influencing benthic invertebrate community structure in Dry Creek.

%E was also significant correlated with, total molybdenum, total thallium, total zinc and some selenium species (i.e., dimethylselenoxide, selenate, and selenite); however, neither molybdenum nor thallium were higher than BCWQGs; therefore, there is no direct causal link between these constituents and mayfly survival. In addition, no relationship between aqueous total molybdenum, total thallium, total zinc and %E was found in the RAEMP or in previous Dry Creek LAEMP reports despite increasing concentrations of these constituents, thus the correlation observed in the current study is likely coincidental (Minnow 2020c). Lastly, various selenium species (i.e., dimethylselenoxide, selenate, and selenite) were also correlated with the decrease in %E; however, benthic invertebrate tissue selenium concentrations are a better indicator of direct effects on community and there was no correlation between any

Table 5.1: Spearman's Correlation Relationships between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, 2019 to 2022

Parameter	Abundance (# organisms/ 3 min kick)		Richness (# taxa)		% EPT		% Ephemeroptera		% Plecoptera		% Trichoptera		% Oligochaeta		% Non-Chironomidae Diptera		% Chironomidae	
	r_s	p-value	r_s	p-value	r_s	p-value	r_s	p-value	r_s	p-value	r_s	p-value	r_s	p-value	r_s	p-value	r_s	p-value
Calcite Index	0.3	0.000491	0.1	0.166	-0.4	0.000209	0.2	0.11	-0.4	0.000135	-0.4	<0.0001	0.1	0.149	0.2	0.0709	0.2	0.0214
Calcite (%)	0.3	0.000492	0.1	0.165	-0.3	0.000497	0.1	0.123	-0.3	0.000471	-0.4	<0.0001	0.2	0.112	0.2	0.0626	0.2	0.046
Concreted (mean)	0.0	0.908	-0.1	0.234	-0.4	0.00016	-0.1	0.378	-0.3	0.00142	-0.4	<0.0001	0.0	0.918	0.1	0.227	0.4	<0.0001
Embeddedness (%)	-0.5	<0.0001	-0.1	0.511	-0.2	0.0568	0.0	0.885	-0.1	0.367	0.0	0.617	0.0	0.715	0.1	0.161	0.1	0.126
D16	0.0	0.61	-0.1	0.167	-0.1	0.419	0.0	0.689	0.0	0.934	0.1	0.429	0.0	0.692	0.1	0.164	0.0	0.974
D84	0.3	0.000793	-0.1	0.415	-0.4	<0.0001	0.1	0.471	-0.5	<0.0001	-0.3	0.000197	0.0	0.722	0.2	0.0963	0.5	<0.0001
Water Velocity (m/s)	0.2	0.0648	0.2	0.0324	0.0	0.694	0.1	0.499	0.0	0.636	0.0	0.717	0.3	0.000421	0.1	0.129	-0.2	0.0585
Water Depth (cm)	-0.2	0.117	0.1	0.235	-0.2	0.0096	0.1	0.323	-0.3	0.00761	-0.2	0.0744	0.2	0.116	0.3	0.000485	0.0	0.999
Annual Temperature (oC)	0.3	0.000259	0.1	0.37	0.2	0.034	0.2	0.105	0.0	0.955	0.3	0.00115	0.1	0.386	0.0	0.676	-0.2	0.0215
Annual Total Alkalinity as CaCO3 (mg/L)	-0.2	0.033	0.2	0.0741	0.0	0.714	0.2	0.0685	0.1	0.552	-0.2	0.0768	0.3	0.00443	0.1	0.152	-0.2	0.0141
Annual Nitrate (mg/L as N)	0.0	0.672	-0.1	0.331	-0.4	<0.0001	-0.6	<0.0001	-0.1	0.419	0.1	0.371	-0.1	0.132	0.3	0.00127	0.4	<0.0001
Annual Nitrite (mg/L s N)	0.4	<0.0001	0.0	0.999	-0.2	0.117	-0.3	0.000699	-0.1	0.368	0.2	0.0502	-0.2	0.0406	0.1	0.191	0.2	0.0122
Annual Ammonia (mg/L as N)	0.6	<0.0001	0.2	0.0407	0.0	0.922	0.1	0.576	-0.2	0.0359	0.0	0.939	-0.1	0.561	-0.1	0.538	0.1	0.452
Annual Phosphorus (mg/L)	0.1		-0.1	0.461	-0.2	0.0337	-0.5	<0.0001	0.0	0.638	0.2	0.0281	-0.2	0.0568	0.2	0.0964	0.4	0.000149
Annual Sulphate (mg/L)	-0.2	0.0409	0.0	0.891	-0.5	<0.0001	-0.5	<0.0001	-0.1	0.186	-0.1	0.526	0.1	0.245	0.4	<0.0001	0.3	0.00165
Annual Total Dissolved Solids (mg/L)	-0.1	0.126	0.0	0.845	-0.5	<0.0001	-0.5	<0.0001	-0.1	0.296	0.0	0.685	0.0	0.651	0.4	<0.0001	0.4	0.000219
Annual Total Antimony (mg/L)	0.2	0.0138	-0.1	0.313	-0.3	0.000402	-0.5	<0.0001	-0.1	0.265	0.1	0.311	-0.3	0.00121	0.1	0.525	0.5	<0.0001
Annual Total Arsenic (mg/L)	0.2	0.0174	-0.1	0.294	-0.3	0.00236	-0.5	<0.0001	-0.1	0.417	0.1	0.129	-0.3	0.00263	0.1	0.138	0.4	<0.0001
Annual Total Barium (mg/L)	0.4	0.000125	-0.1	0.168	0.1	0.609	0.1	0.253	0.0	0.759	0.0	0.783	-0.3	0.000381	-0.2	0.0617	0.1	0.193
Annual Total Boron (mg/L)	-0.4	<0.0001	-0.1	0.415	0.1	0.371	-0.5	<0.0001	0.4	<0.0001	0.3	0.000576	0.0	0.97	-0.1	0.446	0.0	0.64
Annual Dissolved Cadmium (µg/L)	0.2	0.11	-0.2	0.112	-0.4	<0.0001	-0.5	<0.0001	-0.1	0.262	0.1	0.242	-0.3	0.00138	0.1	0.235	0.5	<0.0001
Annual Total Chromium (mg/L)	-0.2	0.0173	0.2	0.0928	0.0	0.703	-0.3	0.00191	0.2	0.0603	0.2	0.0782	0.4	<0.0001	0.3	0.000243	-0.2	0.0239
Annual Total Cobalt (mg/L)	0.2	0.0183	0.1	0.259	0.0	0.734	-0.4	<0.0001	0.0	0.673	0.2	0.0625	0.1	0.267	0.3	0.0051	0.0	0.934
Annual Total Copper (mg/L)	-0.2	0.0264	0.1	0.489	-0.3	0.000411	-0.4	0.000176	-0.1	0.374	0.0	0.789	0.1	0.212	0.5	<0.0001	0.2	0.012
Annual Total Iron (mg/L)	-0.2	0.0767	0.2	0.08	0.0	0.846	-0.3	0.00105	0.2	0.0658	0.1	0.227	0.4	0.000218	0.4	<0.0001	-0.2	0.0546
Annual Total Lead (mg/L)	-0.1	0.163	0.1	0.273	0.1	0.414	-0.3	0.000472	0.2	0.018	0.2	0.013	0.3	0.000451	0.4	0.000158	-0.2	0.0255
Annual Total Lithium (mg/L)	-0.3	0.000673	-0.2	0.0483	-0.5	<0.0001	-0.3	0.000462	-0.2	0.0562	-0.2	0.032	0.0	0.934	0.3	0.000853	0.4	0.000148
Annual Total Manganese (mg/L)	0.0	0.668	0.2	0.0689	0.1	0.323	-0.3	0.000499	0.3	0.00343	0.2	0.0709	0.3	0.00369	0.3	0.00269	-0.2	0.0321
Annual Total Molybdenum (mg/L)	0.1	0.338	0.0	0.68	-0.2	0.0148	-0.6	<0.0001	0.1	0.436	0.3	0.00122	-0.2	0.0349	0.1	0.402	0.4	<0.0001
Annual Total Nickel (mg/L)	0.1	0.243	-0.1	0.401	-0.4	<0.0001	-0.6	<0.0001	-0.1	0.33	0.2	0.0579	-0.2	0.0963	0.3	0.00274	0.5	<0.0001
Annual Total Selenium (µg/L)	-0.1	0.206	0.0	0.668	-0.5	<0.0001	-0.5	<0.0001	-0.1	0.22	0.0	0.743	0.0	0.719	0.4	<0.0001	0.3	0.000234
Annual Total Thallium (mg/L)	0.0	0.666	0.0	0.798	-0.2	0.0129	-0.7	<0.0001	0.1	0.275	0.3	0.000484	0.1	0.563	0.2	0.0101	0.3	0.00566
Annual Total Uranium (mg/L)	-0.3	0.00454	0.0	0.859	-0.4	<0.0001	-0.5	<0.0001	-0.1	0.239	-0.1	0.473	0.2	0.038	0.5	<0.0001	0.2	0.0186
Annual Total Zinc (mg/L)	-0.2	0.0556	-0.2	0.028	-0.4	<0.0001	-0.6	<0.0001	0.0	0.988	0.1	0.128	0.0	0.666	0.3	0.000394	0.4	<0.0001
Annual Dimethylseleneoxide (µg/L)	0.2	0.0292	-0.1	0.322	-0.3	0.000722	-0.6	<0.0001	-0.1	0.452	0.3	0.00294	-0.2	0.0514	0.2	0.127	0.4	<0.0001
Annual Methylseleninic Acid (µg/L)	0.3	0.000441	0.0	0.871	-0.3	0.000769	-0.4	<0.0001	-0.2	0.0377	0.2	0.0193	-0.2	0.117	0.1	0.197	0.4	<0.0001
Annual Selenate (µg/L)	-0.1	0.241	-0.1	0.292	-0.5	<0.0001	-0.6	<0.0001	-0.1	0.311	0.0	0.634	-0.1	0.6	0.4	0.000169	0.4	<0.0001
Annual Selenite (µg/L)	0.3	0.00557	-0.1	0.552	-0.4	<0.0001	-0.6	<0.0001	-0.2	0.0533	0.1	0.153	-0.1	0.14	0.2	0.0322	0.5	<0.0001
Dimethylseleneoxide (% of Total Selenium)	0.1	0.26	0.0	0.881	0.4	<0.0001	0.3	0.000678	0.1	0.288	0.1	0.17	-0.1	0.552	-0.5	<0.0001	-0.2	0.0327
Methylseleninic Acid (% of Total Selenium)	0.1	0.393	0.0	0.857	0.4	0.000244	0.4	0.000189	0.0	0.659	0.1	0.243	0.0	0.689	-0.4	<0.0001	-0.2	0.0905
Selenate (% of Total Selenium)	0.1	0.619	-0.1	0.284	-0.1	0.442	-0.1	0.271	0.0	0.714	0.1	0.231	-0.1	0.354	0.0	0.901	0.2	0.0579
Selenite (% of Total Selenium)	0.3	0.00447	0.0	0.724	0.2	0.1	0.1	0.398	0.0	0.881	0.1	0.355	0.0	0.763	-0.3	0.00501	0.0	0.841
Benthic Invertebrate Tissue Selenium (mg/kg dw)	0.2	0.115	0.0	0.755	-0.3	0.00613	-0.2	0.105	-0.2	0.0676	0.2	0.059	-0.1	0.301	0.2	0.0143	0.3	0.00738

P-value < 0.05/47 (0.05 Bonferroni Corrected for 47 independent comparisons).

$r_s \leq -0.6$ or $r_s \geq 0.6$.

Notes: D16 and D84 are sediment size parameters corresponding to the 16th and 84th percentile of the sediment size distributions (equivalent to +/- 1SD from a normal distribution). For example, D16 is the sediment size for which 16% of the sediment sample is finer. PC1, PC2, and PC3 are axes from Principal Component Analysis (PCA) of annual water chemistry analytes calculated using data from 2019 to 2022. Annual water chemistry variables were calculated using September data from 2019 to 2022 from: LC_DCEF, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DC1, LC_GRCK, LC_FRB.

BIC endpoints and benthic invertebrate tissue concentrations in 2022 (Table 5.1). Additionally, mean tissue concentrations were not higher than EVWQP tissue benchmarks in 2022 (See Section 6.2). It is, therefore, unlikely that aqueous selenium is driving changes in benthic community in 2022.

Decreasing total and relative abundance of Ephemeroptera was noted in all mine-exposed areas of Dry Creek commensurate with increasing aqueous concentrations of many mine-related constituents, including nitrate, and nickel, and other general indicators of mine influence such as total dissolved solid (TDS) and conductivity. Thus, observed changes in benthic invertebrate community may simply reflect a more general response to changing water chemistry (e.g., secondary stress response and energetic cost of ion regulation [Kefford 2019, Buchwalter et al. 2019]), rather than a direct effect on invertebrate survival by one or several specific constituents.

To explore the changes in total abundance in Dry Creek, LC_DCEF, and LC_GRCK a second Spearman Rank Correlation analysis was completed on this reduced data set (i.e., only the above sites; Appendix Figure E.12). Calcite, nitrite, and annual ammonia were positively correlated (p-value < 0.001) with total abundance, whereas embeddedness was negatively correlated (p-value < 0.001) with total abundance; however, they do not meet the above criteria for interpretation (i.e., R_s was greater than -0.6 but less than 0.6 for each variable). Neither ammonia or nitrite increased in 2022 compared to 2021, in Dry Creek, LC_DCEF, or LC_GRCK. Considering this, the decrease in total abundance in these sites can not currently be linked to any changes in water quality and mining related constituents (e.g., nitrate, nickel, and selenium) do not appear to be a driver of total abundance in Dry Creek in 2022.

Overall, there was some evidence that mining activities associated with Dry Creek are having an influence on benthic invertebrate community structure. The relationship between changing water quality and decreasing total and relative abundance of Ephemeroptera was previously documented in the RAEMP, the 2020 and 2021 Dry Creek LAEMP, and observed in the present study.

5.5 Summary

Benthic invertebrate community total abundance and taxonomic richness were generally within regional normal ranges at Dry Creek LAEMP sampling areas in 2022; however, they were occasionally outside site-specific normal ranges. Benthic invertebrate communities in Dry Creek upstream of the DCWMS (LC_DC3) had endpoints outside of normal ranges (particularly %EPT, %E, and %C) most often. Areas located closest to the DCWMS discharge (LC_DCDS and LC_DC2) also tended to have lower %E than other areas and compared to regional and site-specific normal ranges. In 2022, benthic invertebrate communities located upstream and downstream of the mouth of Dry Creek in the Fording River differed from each other; however, community endpoints were generally within regional normal ranges and show no temporal variation. The benthic invertebrate community within Grace Creek also had endpoints within regional normal ranges, as expected, based on current lack of mine-related influence.

Over the 2019 to 2022 monitoring period there have been decreases in total abundance, EPT and E abundance, and the proportion of EPT and E at all areas along Dry Creek were almost always significantly lower than those associated with the community in the Dry Creek reference area (LC_DCEF). Overall, %E appeared to be the endpoint most likely linked to a mine-related influence. Both the relative proportion and total abundance of Ephemeroptera decreased at all mine-exposed areas on Dry Creek over the 2019 to 2022 monitoring period. Unlike previous years where %EPT was unchanged compared to 2019, the decreased in proportion and abundance of Ephemeroptera in 2022 was reflected in a decrease in the proportion and abundance of EPT. In the Fording River, there were no obvious temporal changes in benthic invertebrate community endpoints that would be indicative of an influence of Dry Creek on the downstream receiving environment.

Changes in Dry Creek benthic invertebrate community structure, namely decreases in relative and total abundance of E, may be associated with increasing aqueous concentrations of mine related constituents including nitrate, selenium, and nickel. It is therefore likely that mining activities are contributing to changes in the benthic invertebrate communities of Dry Creek. An AMP framework is already in place to address increasing concentrations of nitrate, sulphate, and selenium on Dry Creek and the updated DCWMP includes proposed in-stream flow requirements, flushing flows, ramping flows, as well as proposed site performance objectives for selenium, nitrate, sulphate, and cadmium (Teck 2021b).

6 STUDY QUESTION 4: BENTHIC INVERTEBRATE TISSUE SELENIUM

6.1 Background

To address Study Question #2: “How do selenium concentrations in benthic invertebrate tissue compare to normal ranges and BCWQG or EVWQP benchmarks, and are they changing over time?”, selenium concentrations in composite-taxa benthic invertebrate tissue samples were evaluated over time and in relation to DCWMS status (see Section 1.3 for additional DCWMS details; Table 1.1; and Appendix Table F.1 for BCWQG and EVWQP benchmarks). In general, benthic invertebrate tissue selenium concentrations measured at each Dry Creek LAEMP study area in 2022 were within or lower than the range of values previously reported for each study area in 2018 to 2021.

Benthic invertebrate tissue chemistry data collected for the present study were of good quality as characterized by appropriate LRLs, measurable (i.e., >LRL) concentrations, and excellent laboratory precision and accuracy. Therefore, the associated data were considered acceptable for the purposes of this evaluation (see Appendix B for details).

6.2 Normal Ranges, Benchmarks and Biological Trigger Evaluation

Generally, mean benthic invertebrate tissue selenium concentrations were within the regional normal reference range in Dry Creek in 2022; however, benthic invertebrate tissue selenium concentrations were higher than the regional normal range in at least one sample from all mine-exposed areas on Dry Creek, the Fording River (LC_FRUS and LC_FRB), and Grace Creek (LC_GRCK) study areas in 2022 (Figure 6.1; Appendix Table F.2). Upstream of the DCWMS (LC_DC3), mean tissue selenium concentrations were higher than the regional normal range in September, however, they were not above normal ranges in any other sampling event (Appendix Table F.2). Downstream of the DCWMS (LC_DCDS), mean tissue selenium concentrations were higher than the regional normal range in every sampling event in 2022, apart from samples taken in June where tissue selenium concentrations were lower than other months (Appendix Table F.2). Further downstream of the DCWMS at areas LC_DC2, LC_DC4 and LC_DC1, mean benthic invertebrate tissue selenium concentrations were above the regional normal range in May 2022, but were not above the normal ranges in any other sampling event in 2022; Appendix Table F.2). In contrast to the mine-exposed sites, mean selenium concentrations were below the regional normal range during all sampling events at the Dry Creek reference area (LC_DCEF, Appendix Table F.2). In the Fording River upstream and downstream

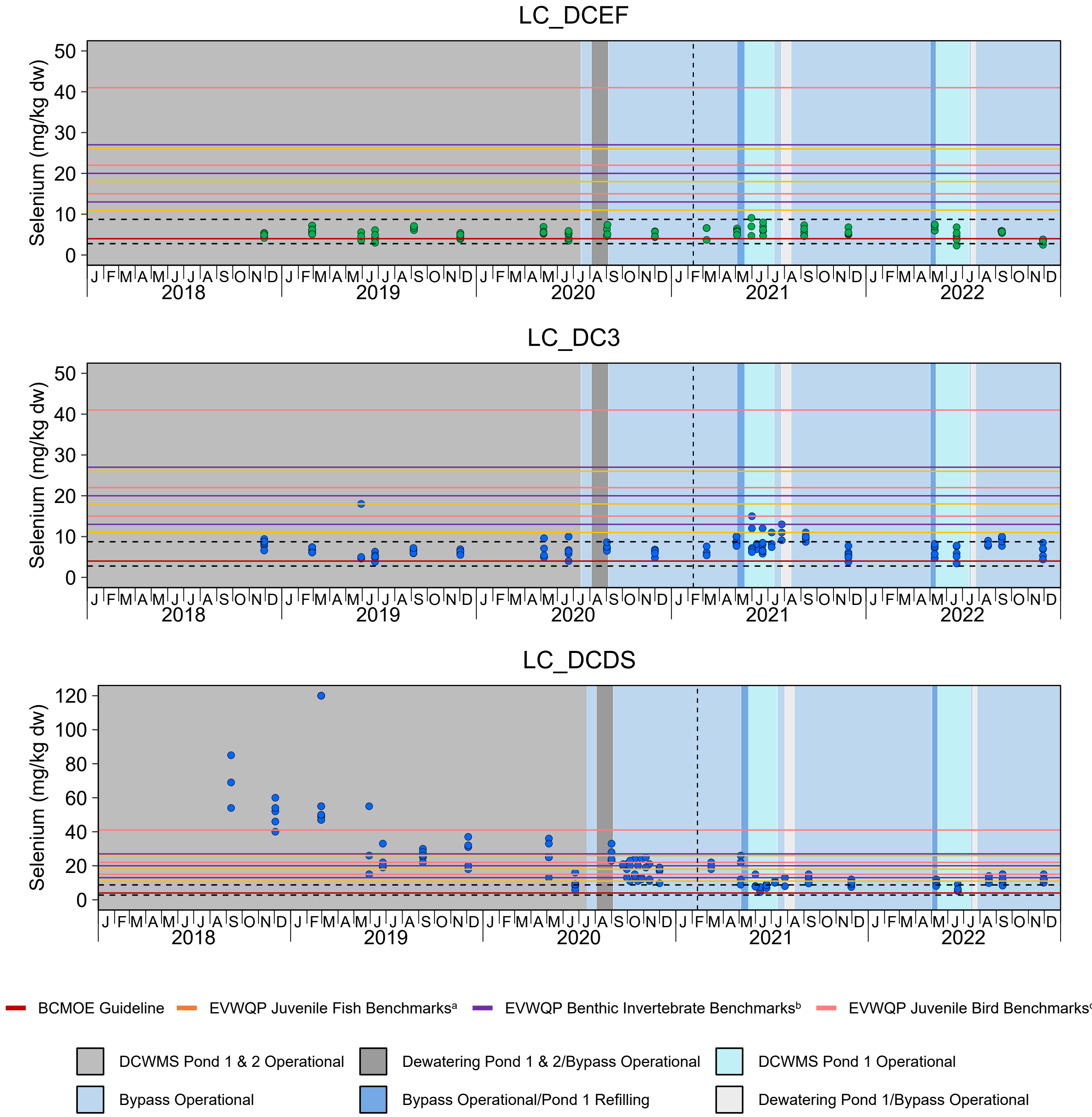


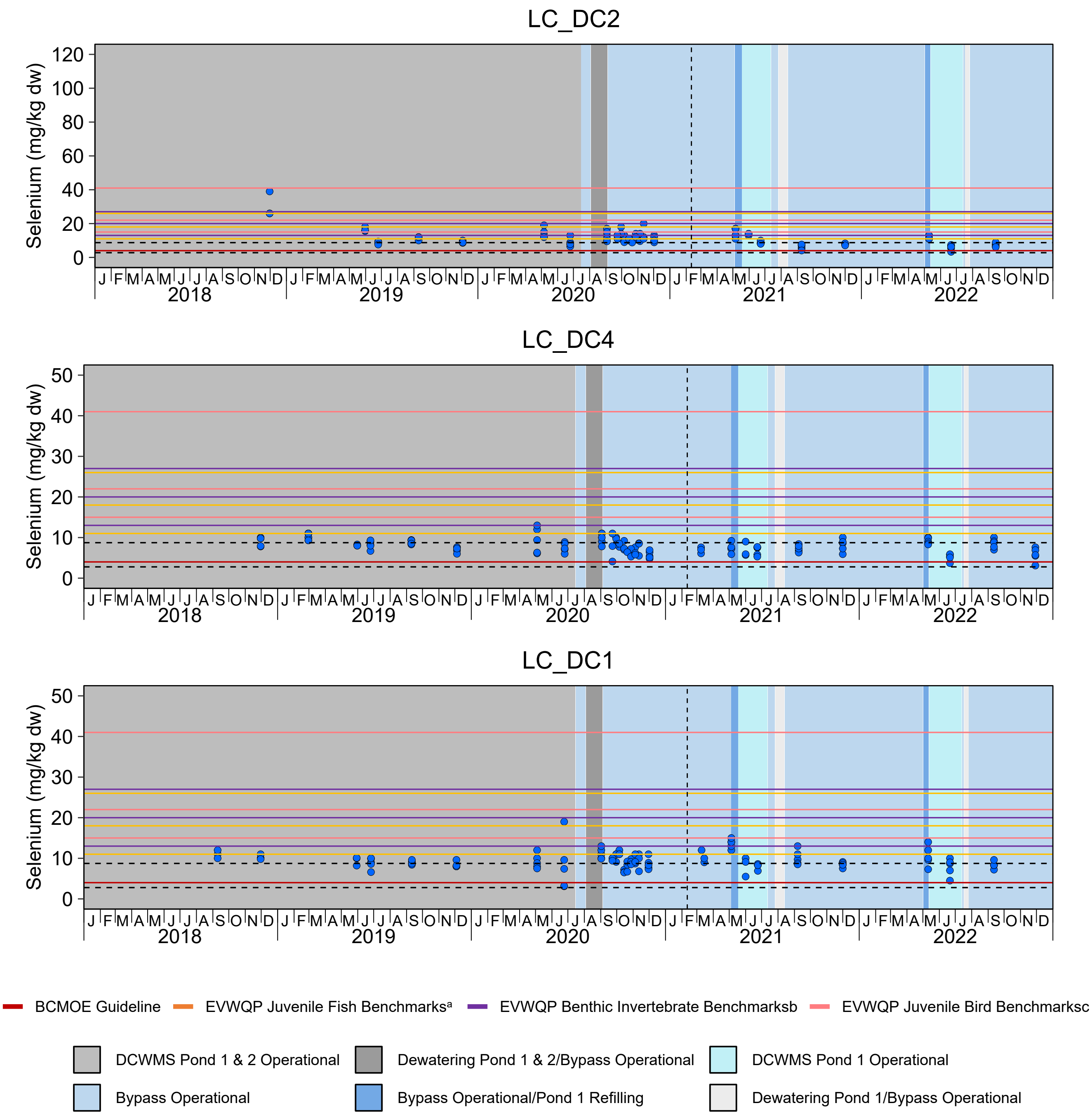
Figure 6.1: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from Dry Creek Sampling Areas, 2018 to 2022

Notes: Dashed black vertical line indicates the Burnt Ridge North spoil failure. Dashed black horizontal lines represent the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) reported in the RAEMP. Reference areas are shown in green and mine−exposed areas are shown in blue. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

[a] 11, 18, and 26 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014),respectively, for dietary effects to juvenile fish.

[b] 13, 20, and 27 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014), respectively, for growth, reproduction, and survival of benthic invertebrates.

[c] 15, 22, and 41 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014), respectively, for dietary effects to juvenile birds.



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Notes: Dashed black vertical line indicates the Burnt Ridge North spoil failure. Dashed black horizontal lines represent the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) reported in the RAEMP. Reference areas are shown in green and mine−exposed areas are shown in blue. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

[a] 11, 18, and 26 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014),respectively, for dietary effects to juvenile fish.

[b] 13, 20, and 27 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014), respectively, for growth, reproduction, and survival of benthic invertebrates.

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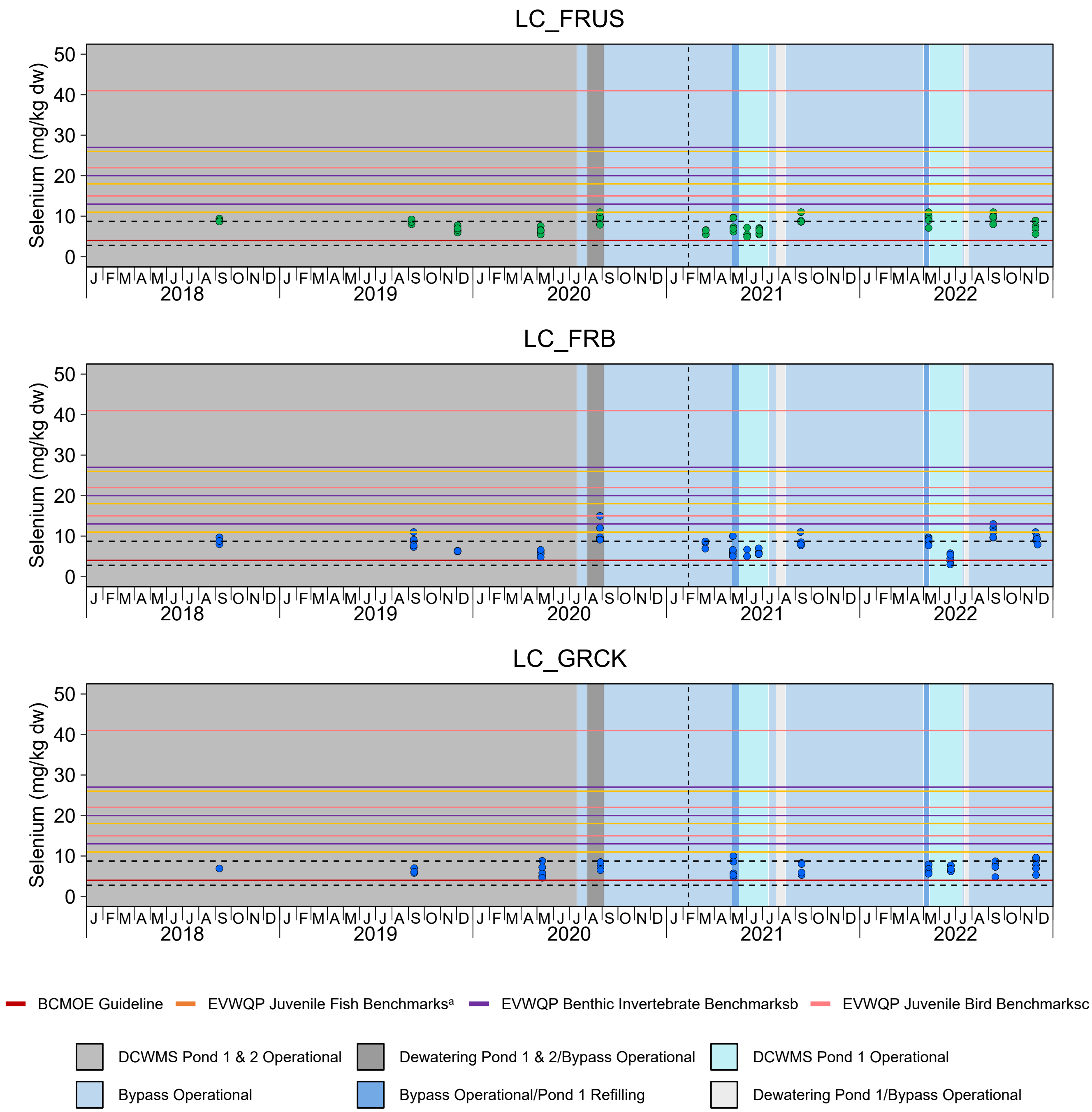


Figure 6.1: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from Dry Creek Sampling Areas, 2018 to 2022

Notes: Dashed black vertical line indicates the Burnt Ridge North spoil failure. Dashed black horizontal lines represent the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) reported in the RAEMP. Reference areas are shown in green and mine−exposed areas are shown in blue. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

[a] 11, 18, and 26 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014),respectively, for dietary effects to juvenile fish.

[b] 13, 20, and 27 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014), respectively, for growth, reproduction, and survival of benthic invertebrates.

[c] 15, 22, and 41 mg/kg dw represent the Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP]; Golder, 2014), respectively, for dietary effects to juvenile birds.

of Dry Creek (LC_FRUS and LC_FRB), mean benthic invertebrate tissue selenium concentrations in 2022 were above the normal range in most sampling events (Figure 6.1; Appendix Table F.2).

Benthic invertebrate tissue selenium concentrations were predicted for Dry Creek areas using the selenium speciation bioaccumulation tool[12] (b-tool; de Bruyn and Luoma 2021; Appendix Table F.3). Field-measured mean benthic invertebrate tissue selenium concentrations were generally below the b-tool predictions, except in the Fording River and Grace Creek where the b-tool under predicted measured tissue selenium concentrations (Appendix Table F.3).

The frequency of tissue selenium results above the EVWQP tissue benchmarks was lower in 2022 than 2021. In Dry Creek mean benthic invertebrate tissue selenium concentrations were not higher than the EVWQP benthic invertebrate benchmark (13 mg/kg dw); however, individual samples were occasionally above the EVWQP level 1 benchmarks for to juvenile fish, benthic invertebrates, and juvenile birds (11, 13, and 15 mg/kg dw, respectively) at stations closest to the DCWMS (LC_DCDS and LC_DC2; Figure 6.1; Appendix Table F.2). The elevated selenium concentrations in benthos from LC_DCDS and LC_DC2 were likely related to enhanced algal selenium bioaccumulation and generation of more bioavailable organoselenium in the DCWMS sedimentation ponds upstream of LC_DCDS (see Section 1.3 for details of DCWMS operations; Lorax 2020, Minnow 2020c). In 2022 no samples from the Dry Creek LAEMP areas were above the EVWQP level 2 and 3 benchmarks for effects to juvenile birds (22 and 41 mg/kg dw, respectively), benthic invertebrates (20 and 27 mg/kg dw, respectively), and juvenile fish (18 and 26 mg/kg dw, respectively) Appendix Tables F.1 and F.2). In the Fording River upstream of Dry Creek mean benthic invertebrate tissue concentrations were not higher than EVWQP benchmarks, whereas downstream of Dry Creek (LC_FRB) samples from September were higher then the EVWQP level 1 benchmark for juvenile fish (11 mg/kg); however, there was no statistical difference between LC_FRUS and LC_FRB in 2022 (Appendix Table F.5).

Selenium concentrations in benthic invertebrate tissue were also assessed against the biological trigger established for this endpoint (information pertaining to the determination of the biological trigger value can be found in Appendix H). Similar to the biological trigger evaluation for %EPT, this was completed for each replicate from each of the Dry Creek LAEMP monitoring areas with available water quality predictions (i.e., two mine-exposed areas [LC_DCDS and LC_DC1], see Appendix H for details). Approximately 15% of samples were higher than the biological trigger value at LC_DCDS and 13% of samples at LC_DC1 (3 of 20 and 2 of 15

[12] The b-tool is a predictive bioaccumulation model that can be used to integrate selenium speciation data and aqueous sulphate concentrations to predict tissue selenium concentrations in benthic invertebrate and periphyton tissue (de Bruyn and Luoma 2021).

samples, respectively). This is considerably lower than in 2021 where ~ 37% of samples were higher than trigger values and LC_DCDS and 27% at LC_DC1 (Minnow 2022a).

6.3 Spatiotemporal Trends

Benthic invertebrate tissue selenium concentrations in 2022 generally decreased relative to earlier years (2020) in areas directly downstream of the DCWMS (LC_DCDS and LC_DC2; while concentrations remained unchanged at the area located upstream of the DCWMS and further downstream (i.e., LC_DC3, LC_DC4 and LC_DC1; Figure 6.1; Appendix Table F.6). Stations located closest to the DCWMS (LC_DCDS and LC_DC2) recorded the greatest decreases from 2020 to 2022 (Appendix Table F.6). There were no changes in benthic invertebrate tissue selenium concentrations in the Fording River in 2022 compared to 2021 and 2020, and measured concentrations did not vary between areas directly upstream of Dry Creek and downstream (Appendix Tables F.5 and F.7).

Spatial variability in benthic invertebrate tissue selenium concentrations was observed among sampling events in Dry Creek in 2022 (Figure 6.2; Appendix Table F.4). In May, tissue selenium concentrations were higher at areas LC_DCDS, LC_DC2, and LC_DC1 than the reference area (LC_DCEF). In June, only LC_DC1 had higher tissue selenium concentrations than LC_DCEF. Concentrations at LC_DC1 were very slightly higher than LC_DCEF in June and based on the current water quality data, cannot be attributed to a specific cause. Additionally, concentrations at LC_DC1 did not differ significantly from the other exposed areas during the June sampling event. In September and November, tissue selenium concentrations were higher at LC_DC3 and LC_DCDS than the reference area (LC_DCEF).

Several temporal trends were observed in tissue selenium concentrations across sampling events in 2022 (Figure 6.2; Appendix Table F.4). In the upstream stations (LC_DC3 and LC_DCDS) benthic invertebrate tissue concentrations were highest in September; however, moving downstream (LC_DC4, LC_DC2 and LC_DC1) concentrations were highest in May. In contrast to the benthic tissue concentrations, the temporal pattern in organoselenium (sum of DMSeO and MeSe(IV)) was consistent at all stations in Dry Creek, with highest concentrations observed in July, August, and September and lower concentrations measured from January to May (Figure 6.3 and 6.4; Appendix Figures C.23, C.24). Across all Dry Creek areas, the lowest mean benthic tissue selenium concentrations were observed in June, possible due to dilution of organoselenium during freshet. At the reference area (LC_DCEF), tissue selenium concentrations were highest in May (aligned with the downstream stations on Dry Creek) and were lowest in November (Figure 6.2). In the Fording River, tissue selenium concentration did not vary significantly between areas and at both LC_FRUS and LC_FRB (Appendix Table F.5), and tissue selenium concentrations were highest in September and

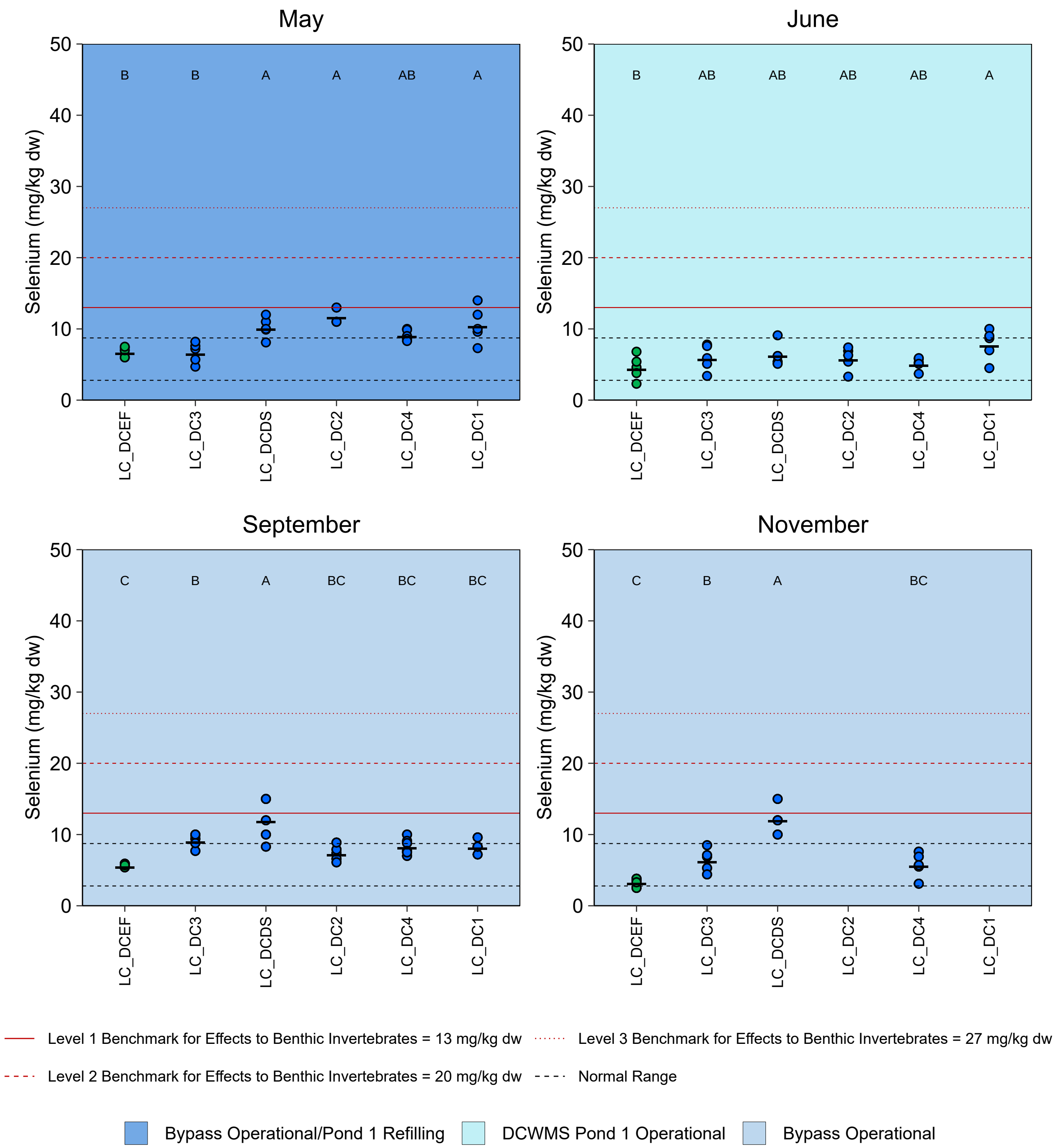


Figure 6.2: Selenium Concentrations (mg/kg dw) in Composite−Taxa Benthic Invertebrate Samples from Dry Creek Sampling Areas, 2022

Notes: Dashed black lines represent the normal range defined as the 2.5th and 97.5th percentiles of the 2012 to 2019 reference area data from the Regional Aquatic Environmental Monitoring Program (RAEMP). Areas that do not share a letter (e.g. a,b,c) are significantly different (p−value = 0.05) in a Tukey's HSD test following a two−way ANOVA by area. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context.

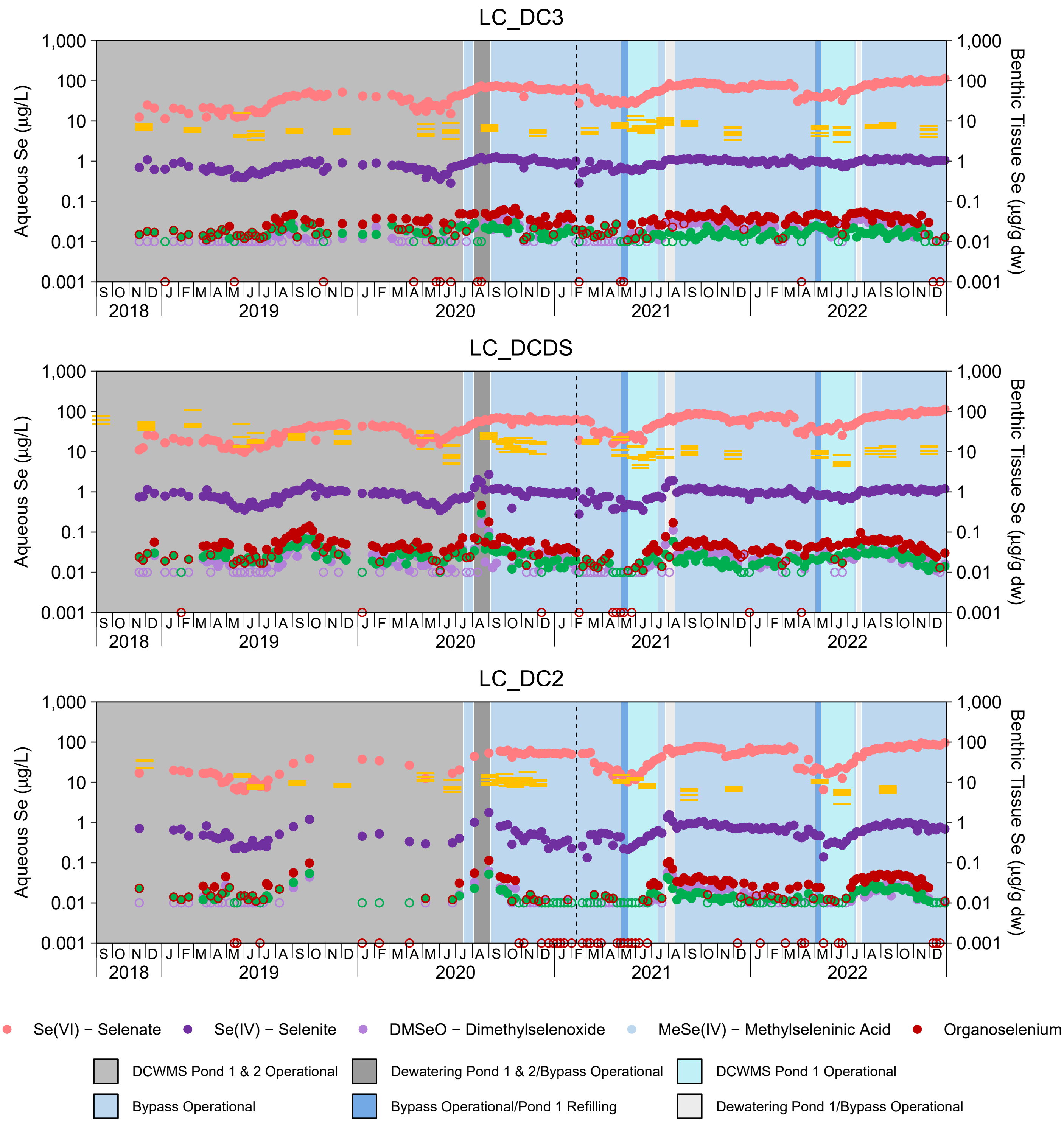


Figure 6.3: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, September 2018 to December 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only appliy to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Biological sampling (including benthic invertebrate tissue selenium monitoring) was discontinued at LC_SPDC following operational changes in October 2020 at this area (see Minnow 2021a).

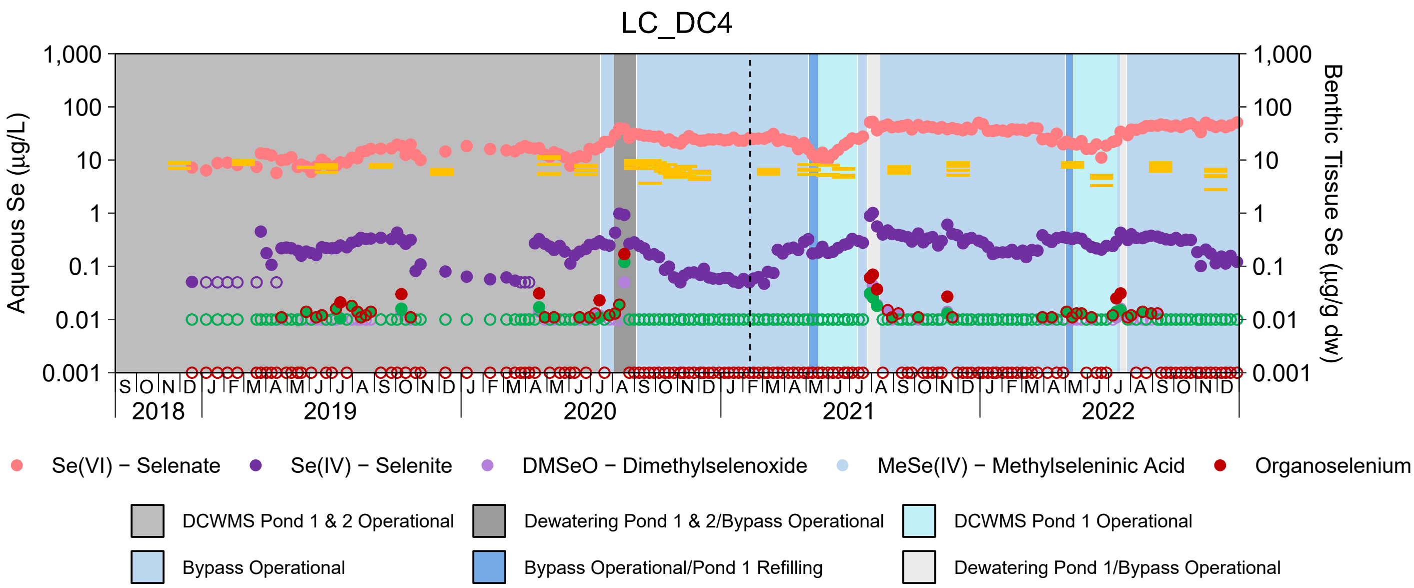


Figure 6.3: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, September 2018 to December 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only appliy to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Biological sampling (including benthic invertebrate tissue selenium monitoring) was discontinued at LC_SPDC following operational changes in October 2020 at this area (see Minnow 2021a).

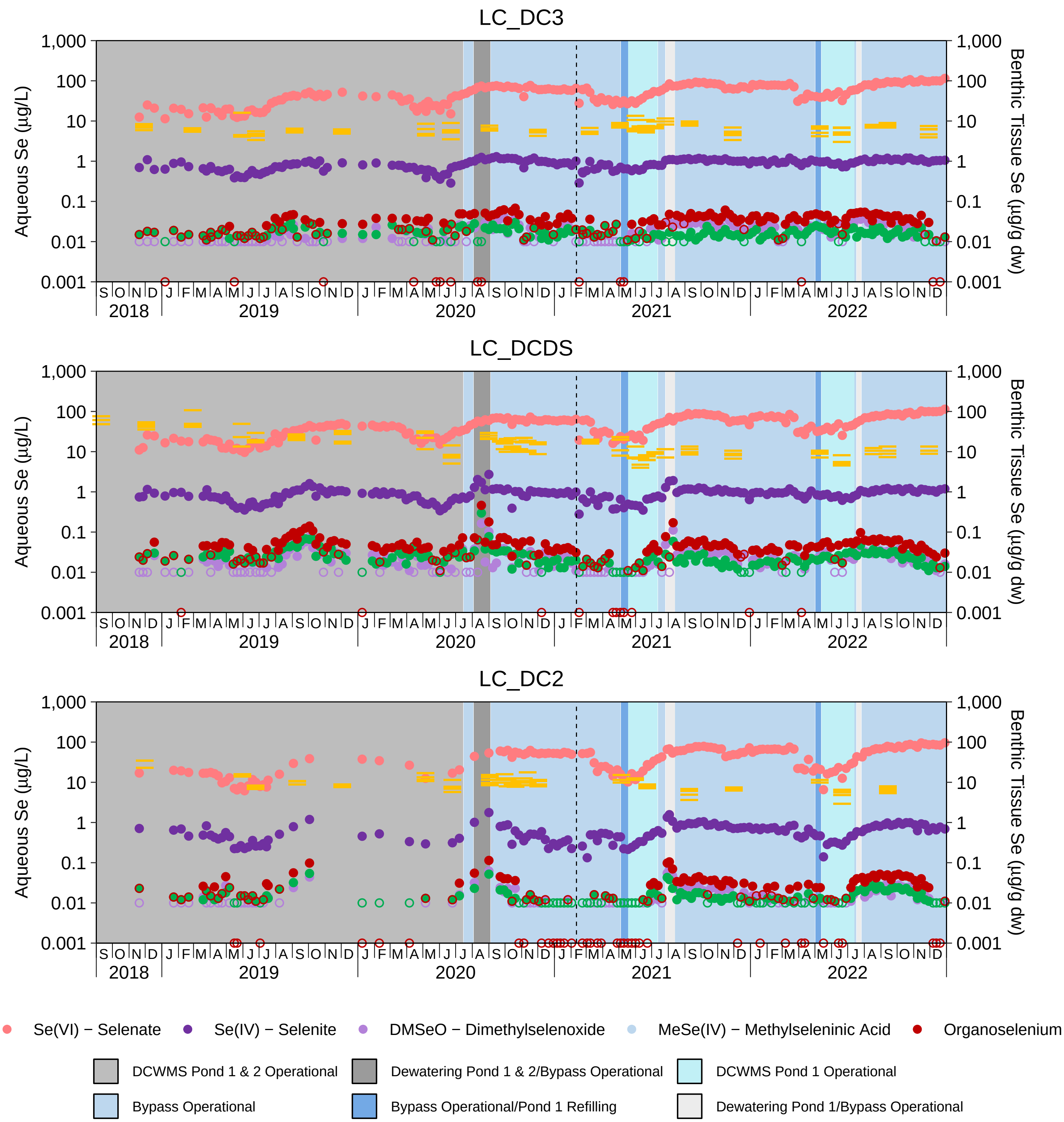
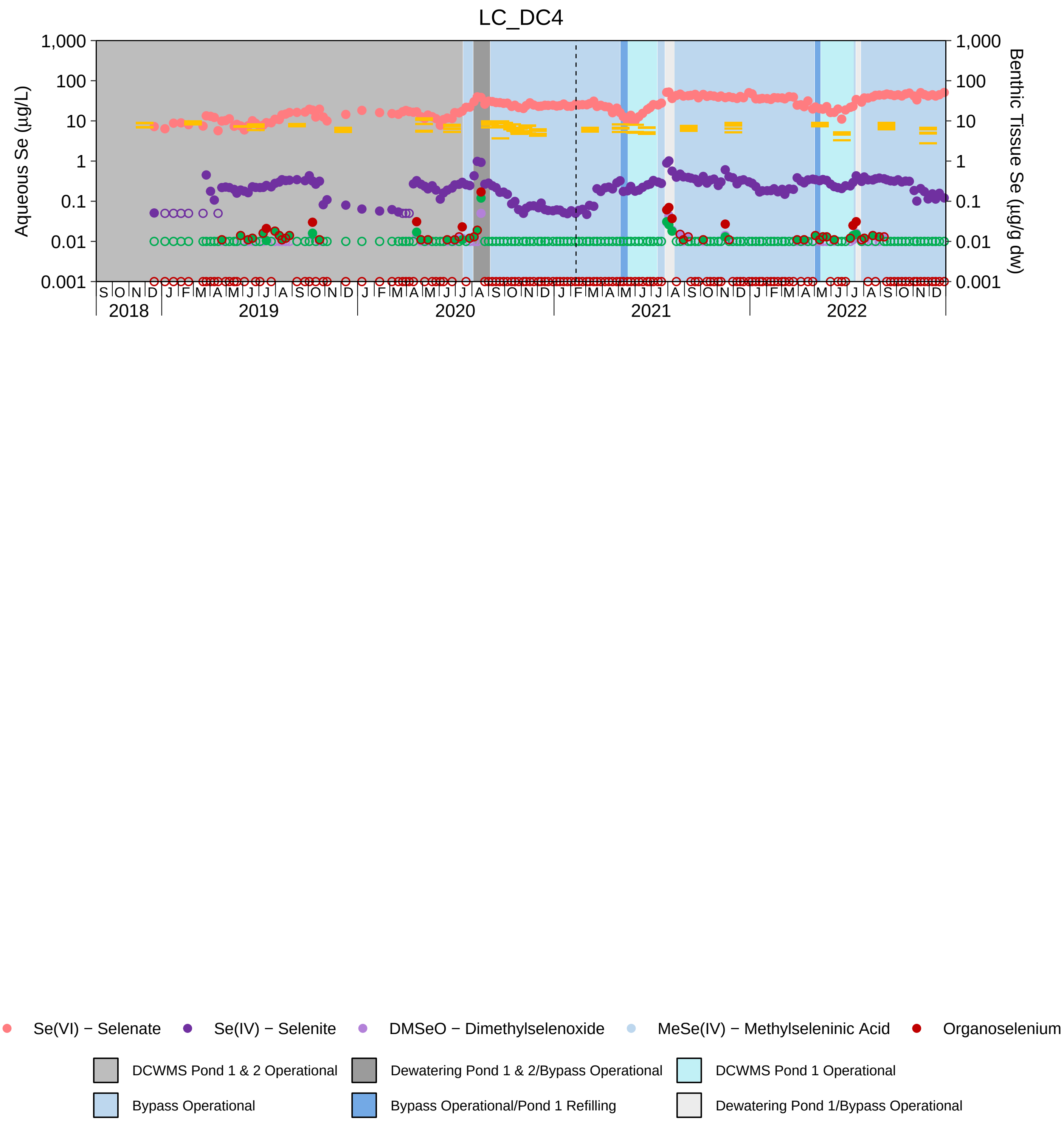


Figure 6.4: Selenium Species and Benthic Invertebrate Tissue Selenium Concentrations from LCO Dry Creek LAEMP Sampling Areas, September 2018 to December 2022

Notes: Concentrations reported below the laboratory reporting limit (LRL) are plotted with an open symbol. Benthic composite tissue concentrations plotted with orange bars. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only appliy to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Biological sampling (including benthic invertebrate tissue selenium monitoring) was discontinued at LC_SPDC following operational changes in October 2020 at this area (see Minnow 2021a



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lowest in June (LC_FRB) or November (LC_FRUS; samples were not collected in June due to high flows and unsafe access; Appendix Figure F.1; Appendix Table F.2).

As described in Sections 3.5 and 3.6, there were statistically significant increases in total selenium, selenite and selenate (and methylseleninic acid at LC_DCDS) in Dry Creek from 2021 to 2022. Despite such increases, no associated increased in tissue selenium concentrations in benthic invertebrates was observed. Benthic invertebrate tissue selenium concentrations were the same in 2022 as 2021 and lower than 2020 (Figure 6.3; Appendix Table F.6).

Overall, the management actions implemented at the DCWMS starting in mid-2020 has been effective in reducing selenium concentrations in benthic invertebrates downstream. Initial re-operation of the DCWMS in mid-May through mid-July 2022 did result in an increase in aqueous organoselenium species during the subsequent dewatering phase; however, this does not appear to be linked to an increase in benthic invertebrate tissue selenium downstream areas. This is evidenced by concentrations of selenium in benthic invertebrates in June were similar at LC_DC3 and LC_DCDS (during operation of the DCWMS), and at LC_DCDS that were similar in May and September (prior to and post DCWMS dewatering; Appendix table F.4). Aqueous Selenium concentrations decreased again shortly after pond 1 operation in 2022 and were in line with those measured during the previous bypass phase in 2022 (Figures 3.4 and 6.3).

6.4 Summary

In areas directly downstream of the DCWMS (LC_DCDC and LC_DC2), benthic invertebrate tissue selenium concentrations decreased in 2022 relative to earlier years (2020 and 2021; although were still often higher than regional normal ranges and concentrations measured at the reference area), while concentrations remained unchanged at the area located upstream of the DCWMS and further downstream (i.e., LC_DC3, LC_DC4 and LC_DC1). Downstream of the DCWMS (particularly from LC_DCDS and LC_DC2), the decreases in benthic invertebrate tissue selenium concentrations measured in 2022 relative to earlier years (2020) can be primarily attributable improvements made in management of the DCWMS (e.g., use of a single DCWMS pond in 2022 compared to both DCWMS ponds in 2020). Within the Fording River, benthic invertebrate tissue selenium concentrations generally the same upstream and downstream of the mouth of Dry Creek, indicating that operations at LCO Dry Creek have had limited influence on benthic invertebrate tissue selenium concentrations in these areas.

7 STUDY QUESTION 5: FISH AND FISH HABITAT

7.1 Background

Relevant fish and fish habitat monitoring data collected in Dry Creek and the East Tributary in 2022 were integrated into this report to address Study Question 5: Are changes in fish and fish habitat (including instream flow and calcite index) occurring within Dry Creek as a result of mine operations? Monitoring included a limited survey of fish health, redd surveys, and fish habitat (water temperature, dissolved oxygen [in Reaches 1 to 4 of Dry Creek], instream flow, and calcite coverages). No fish tissue chemistry results were obtained in 2022 as fish were not retained in planned sampling to reduce fish handling, and no fish mortalities were observed in Dry Creek in 2022. Water temperature was assessed based on data collected at six Dry Creek locations, one location in the Dry Creek East Tributary, and at one location in the Fording River directly near Dry Creek. In 2022, flow in Dry Creek was characterized based on data collected at two hydrometric stations (LC_DC1 and LC_DCDS).

7.2 Fish Habitat

7.2.1 Water Temperature

The available water temperature data indicate that Dry Creek is a coldwater stream in which daily average water temperatures were less than 10°C in 2022 (Figures 7.1 and 7.2). The records for most stations indicated that summer 2022 was cool relative to most other years. For stations not strongly influenced by sedimentation pond operations (i.e., DRY-WQ02,03,04 and 01) 2022 was comparable to 2019 and colder than other years. Locations that are influenced by sedimentation pond operations (i.e., DRY-WQ05 and DRY-WQ06/07) were the coldest since 2016, but this conclusion needs to be understood within the context of changes to operations of the sedimentation pond that were implemented in 2020 and after.

Although the water temperature regime is cold, water temperature in the Dry Creek watershed is spatially heterogenous and seasonally variable. The upstream section of Dry Creek (as measured by DRY-WQ04) is warmer in the summer than other nearby stations downstream of East Tributary, though daily mean temperatures at DRY-WQ04 have been less than 10°C each summer. In the winter, the upstream portions of Dry Creek are cold and close to zero for roughly five months. The East Tributary has a more stable temperature throughout the year, with summer highs around 4°C and winter lows around 2°C. Downstream of its confluence with East Tributary, Dry Creek is relatively cold compared to the upstream section and has water temperatures intermediate between the East Tributary and upstream Dry Creek.

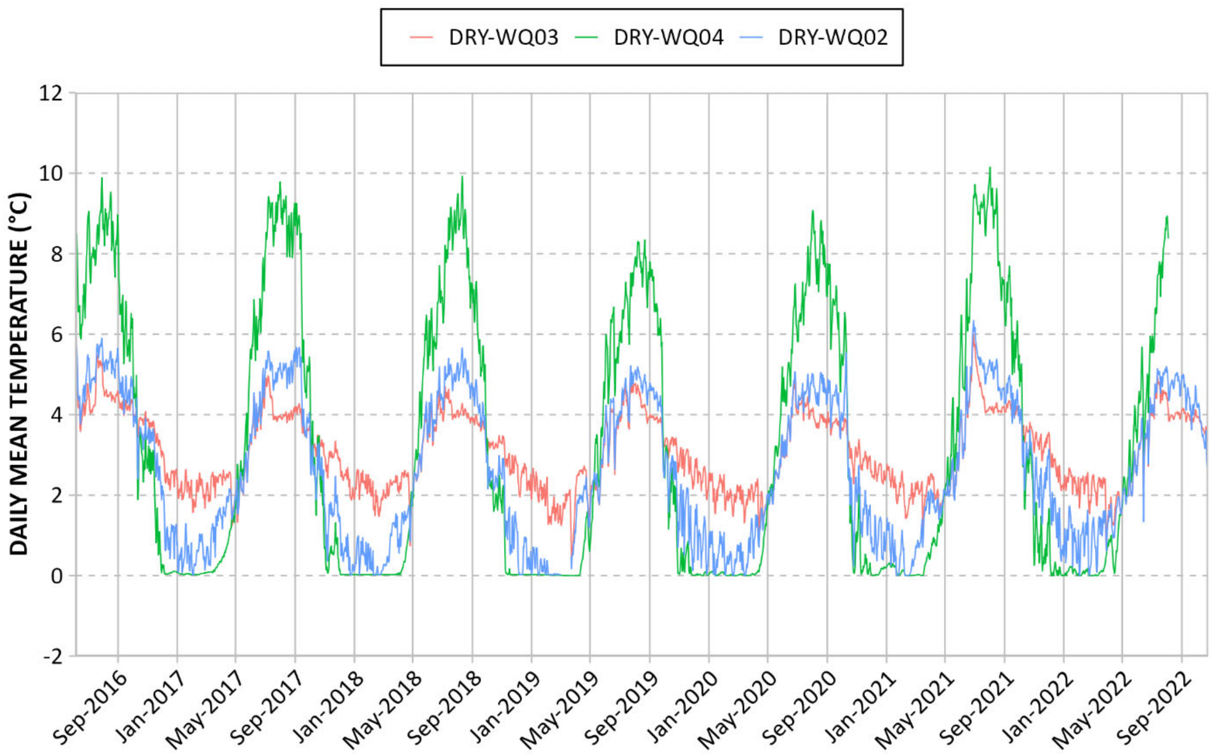


Figure 7.1: Daily Mean Water Temperature from June 2016 to October 2022 at Stations in the Upper Portion of the Dry Creek Watershed

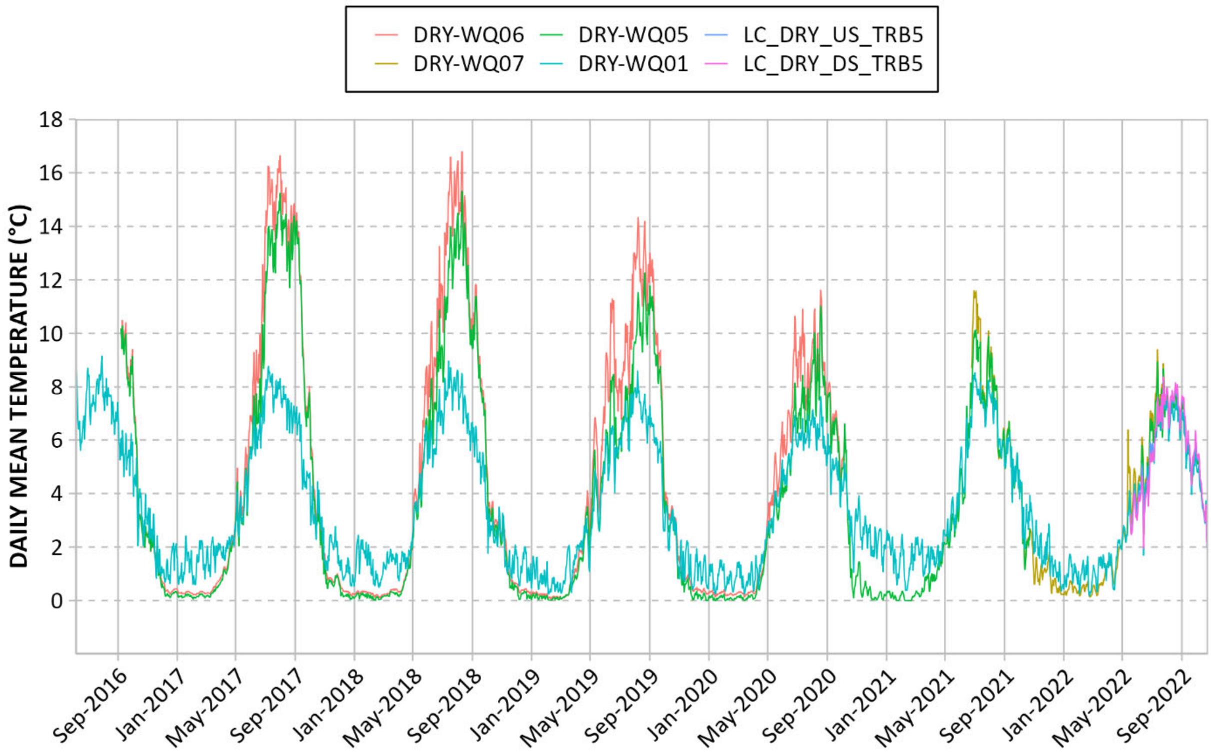


Figure 7.2: **Daily Mean Water Temperature from June 2016 to October 2022 at Stations in the Lower Portion of the Dry Creek watershed and Dry Creek Tributary 5**

Operation of the sedimentation ponds (Section 1.3) changed in 2020 and thereafter (use during freshet only). Prior to this date the ponds were operated with continuous flow through the ponds. The change in operation appears to have resulted in lower mean daily temperatures immediately downstream of the sedimentation ponds in summer (see DRY-WQ05 and DRY-WQ06 in Figure 7.2). As a result, water temperature in Dry Creek downstream of the sedimentation ponds outlet no longer reaches the higher temperatures that occurred in 2017 to 2019. Instead, DRY-WQ05 and DRY-WQ06/07 reached maximum daily average of <12°C in the years since and reached a relatively cool maximum of only ~9°C in 2022.

Dry Creek Tributary 5 is a new station and therefore had records for only one summer. Water temperature at this station had a 2022 summer temperature regime that was similar to Dry Creek mainstem stations nearby (Figure 7.2).

At stations closer to the confluence with the Fording River (DRY-WQ01), Dry Creek is cooler than at stations near the sedimentation ponds outlet. This is contrary to the typical pattern of warming as streams flow downstream, and may indicate inflows from cool sources such as groundwater or cool surface water inflows. Compared to monitoring locations upstream, the temperature of Dry Creek near the Fording River has remained more consistent year to year, including in 2022, despite the operational changes to the sedimentation ponds. In the winter, Dry Creek near the Fording varies between 0.5°C and 1.5°C.

Average daily temperatures did not exceed 18°C at any site within the period of record. Typically, the Dry Creek upstream (DRY-WQ04) and the sedimentation pond outlet (DRY-WQ05) have the most days with water temperature <1°C; however, all stations except Dry Creek near the confluence (DRY-WQ01) had data gaps that prevented the calculation of this metric in 2022. Mean weekly maximum temperature (MWMxT) was assessed in relation BC WQG for optimum temperature ranges for Cutthroat Trout spawning, incubation and rearing periods (Figures 7.3 and 7.4).

Spawning

Overall, spawning temperature observations in Dry Creek in 2022 were slightly cooler than in prior years. MWMxT exceeded the optimal temperature range for spawning in all years at DRY-WQ06/07, and for all years at DRY-WQ05 except for 2020. In 2017 and 2018 MWMxT at these stations surpassed the upper bound of optimum (10°C) near the beginning of the spawning period, and by midway through the spawning period the temperature had reached >16°C. Since 2019, MWMxT exceedances have been fewer and of smaller magnitude. At DRY-WQ04, MWMxT was mostly within the optimal range in 2016, 2017 and 2021, but in other years (including 2022) it did not reach optimum until late in the spawning period. Dry Creek near the confluence with the Fording (DRY-WQ01) had MWMxT within spawning

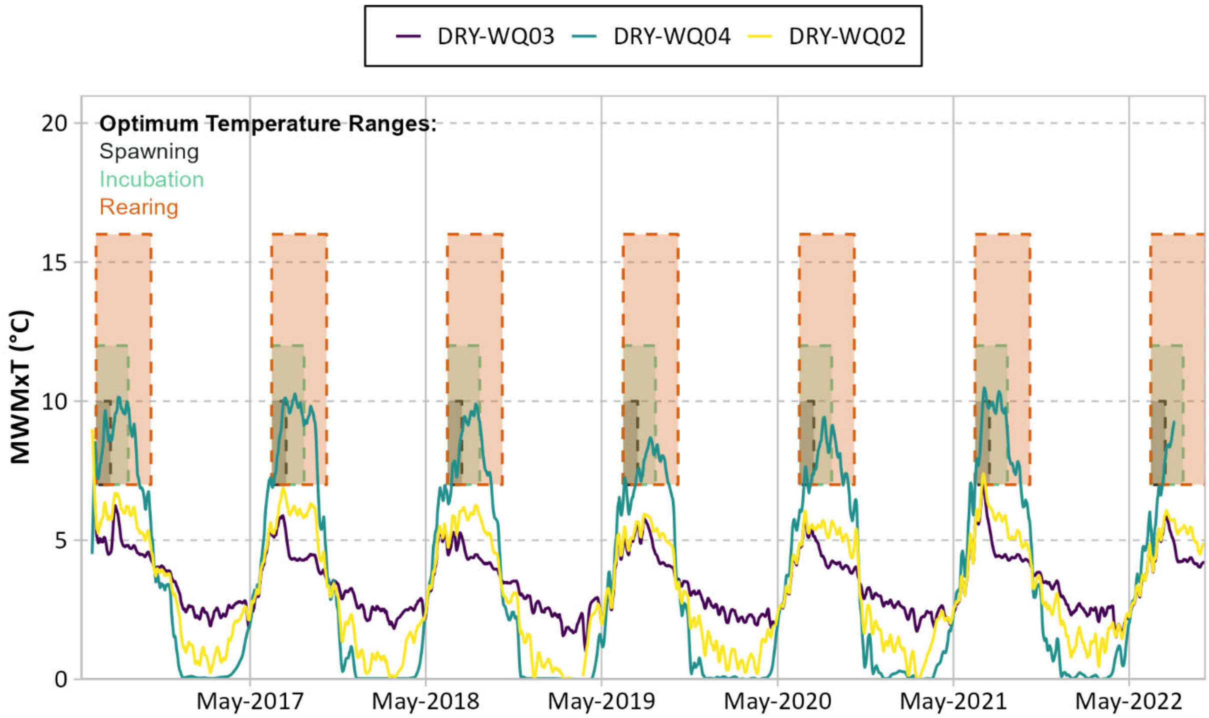


Figure 7.3: Mean Weekly Maximum Temperatures (MWMxT) at Monitoring Stations in Dry Creek Watershed Upstream of Influence of the Sedimentation Ponds

Note: Westslope Cutthroat Trout optimal temperature ranges are indicated for key activity periods.

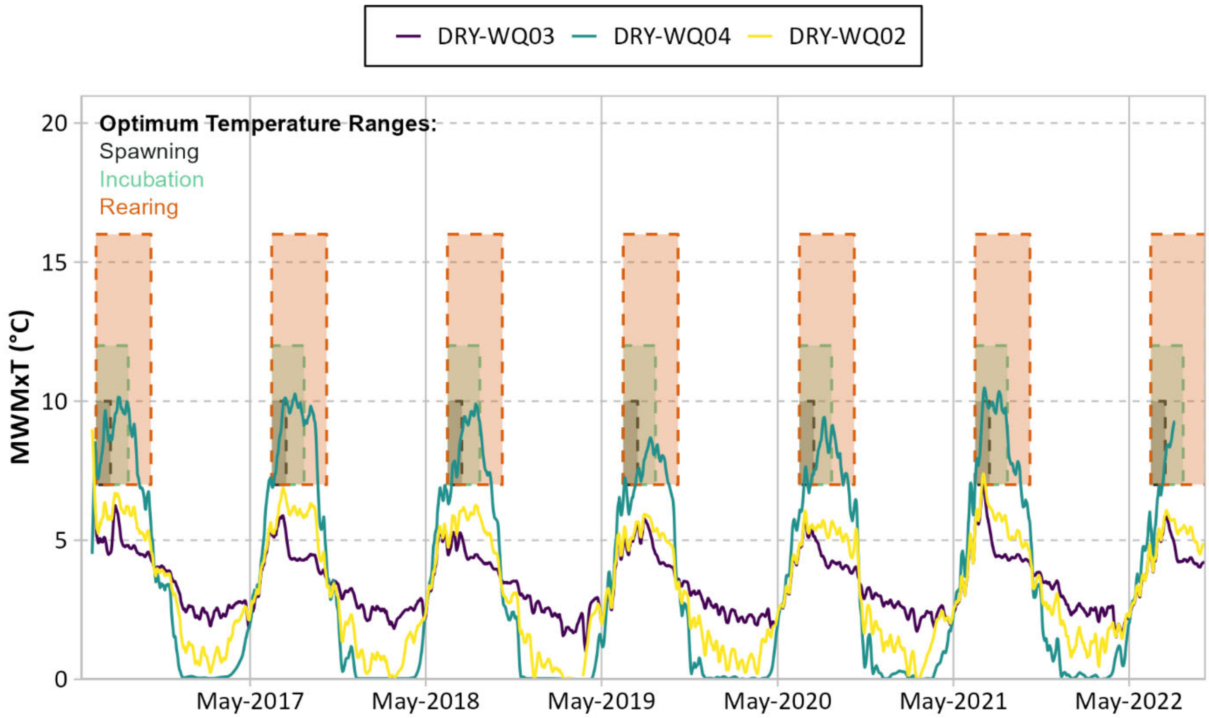


Figure 7.4: Mean Weekly Maximum Temperatures (MWMxT) at Monitoring Stations in Lower Dry Creek and Fording River Overlayed on Westslope Cutthroat Trout Optimum Temperature Ranges

optimum each year but in 2016, 2017 and 2021 this station exceeded optimum by 1 to 2°C in the latter half of the spawning period. In 2022, DRY-WQ01, 05, 07 and TRB5 stations had similar temperatures during spawning, and all were within optimum for the period. Observations in East Tributary have been similar in all years 2016 to 2022.

Incubation

MWMxT during the incubation period in Dry Creek in 2022 were cooler than in previous years. MWMxT at DRY-WQ06/07 and DRY-WQ05 exceeded the incubation optimum temperature range by 5-6°C for most of the incubation period in 2017 and 2018, but generally remained within optimum in 2019 – 2022, although there were exceedances of 1 to 3°C for parts of the period. MWMxT at DRY-WQ04 was within the optimal range for incubation in 2016, 2017, 2021, and 2022 (where data exist) but was below optimum until late in the incubation period in 2018 and 2019. DRY-WQ01 and FRD-WQ01 both had MWMxT within optimum for the entire incubation period. Observations in East Tributary were slightly cooler in 2022 than most previous years but were less than optima throughout the record.

Rearing

MWMxT during the rearing period in Dry Creek in 2022 were cooler than in previous years. In 2017 and 2018, the MWMxT at DRY-WQ06/07 and DRY-WQ05 exceeded the upper bound of optimum by 1 to 2°C for brief periods, but otherwise temperatures were within optimum. Since 2019 MWMxT did not exceeded optimum rearing temperature at these locations, but in 2020 and 2021 was less than optimum for roughly two weeks near the end of the rearing period. MWMxT at DRY-WQ04 reached optimum rearing temperature each year, but not for the full period; in 2022 the data gap after August prevented conclusions for the full period in 2022. MWMxT at DRY-WQ01 in 2022 was within rearing optimum for a shorter time and reached a lower maximum temperature than in previous years. Maximum rearing temperature at DRY-WQ05 and DRY-WQ06 were roughly 4°C cooler in 2022 compared to previous years. The two stations in Tributary 5 had MWMxT that was similar to DRY-WQ05. MWMxT observations in East Tributary in 2022 were similar to previous years. Growing season (i.e., the period when weekly average temperature is greater than 5°C) was summarized by year and monitoring site (Table 7.1). Overall, the available observations indicate that all locations in Dry Creek in 2022 had water temperatures that may have limited fish recruitment; that is, GSDD was less than the 800 degree day threshold proposed in Coleman and Fausch (2007).

Prior to changes in operation of the sedimentation ponds, the outlet of the sedimentation ponds and the section of Dry Creek immediately downstream often exceeded 1000 GSDD, and exceeded 800 GSDD near the confluence with the Fording River. In the years following the operational change (i.e., 2020 to 2022) the growing season has been shorter and cooler.

Table 7.1: Duration and Intensity of the Growing Season (defined in Table 2.6) for Monitoring Sites in Dry Creek and Fording River from June or September 2016 through October 2021

Site Description	Site	Year	Number of days with valid data	Growing Season				
				Start Date	End Date	Length (days)	Gap (days)	GSDD
East Tributary	DRY-WQ03	2016	208	19-Jul	04-Oct	79	0	346
		2017[1]	365	-	-	0	-	0
		2018[1]	365	-	-	0	-	0
		2019[1]	365	-	-	0	-	0
		2020[1]	366	-	-	0	-	0
		2021	365	24-Jun	01-Oct	100	0	434
		2022	297	-	-	0	-	0
Dry Creek upstream of the confluence with East Tributary	DRY-WQ04	2016[2]	208	-	08-Oct	-	-	-
		2017	365	30-May	03-Oct	127	0	959
		2018	365	22-May	29-Sep	130	0	922
		2019	365	31-May	28-Sep	121	0	796
		2020	366	12-Jun	12-Oct	123	0	834
		2021	365	10-Jun	07-Oct	120	0	910
		2022	216	25-Jun	-	-	-	-
Dry Creek downstream of the confluence with the East Tributary	DRY-WQ02	2016	208	16-Jul	04-Oct	81	0	403
		2017	365	19-Aug	17-Sep	30	0	150
		2018	365	29-Jul	17-Sep	51	0	241
		2019	343	03-Aug	25-Sep	53	0	246
		2020[1]	366	-	-	0	-	0
		2021	365	23-Jun	04-Oct	103	0	506
		2022	297	26-Jul	08-Oct	75	0	341
Settling pond outlet channel	DRY-WQ06	2016[2]	115	-	12-Oct	-	-	-
		2017	364	25-May	11-Oct	139	1	1,589
		2018	365	18-May	04-Oct	140	0	1,523
		2019	365	24-May	03-Oct	133	0	1,300
		2020[3]	280	26-May	04-Oct	132	0	1,017
	DRY-WQ07	2021[2]	189	-	05-Oct	-	-	-
		2022	297	23-Jun	12-Oct	112	0	726
Downstream of the settling pond outlet channel	DRY-WQ05	2016[2]	115	-	12-Oct	-	-	-
		2017	365	29-May	09-Oct	134	0	1,419
		2018	365	22-May	02-Oct	134	0	1,309
		2019	365	30-May	01-Oct	125	0	1,023
		2020	366	12-Jun	12-Oct	123	0	850
		2021	296	12-Jun	04-Oct	116	0	793
		2022	137	24-Jun	12-Oct	110	0	707
Dry Creek upstream of the confluence with Fording River	DRY-WQ01	2016[2]	208	-	09-Oct	-	-	-
		2017	365	29-May	01-Oct	126	0	841
		2018	365	22-May	28-Sep	129	0	854
		2019	365	30-May	27-Sep	121	0	767
		2020	366	11-Jun	11-Oct	123	0	694
		2021	365	12-Jun	05-Oct	116	0	737
		2022	296	27-Jun	11-Oct	107	0	652
Trib 5 Upstream	LC_DRY_US_TRB5	2022[4]	130	27-Jun	12-Oct	108	29	-
Trib 5 Downstream	LC_DRY_DS_TRB5	2022	159	28-Jun	12-Oct	107	0	693

[1] Weekly average temperatures never excceded 5°C, no growing season occurred.
[2] Growing season could not be estimated because the period of record does not cover the entire growing season.
[3] Record of growing season was cut short when temperature logger was removed.
[4] Growing degree days could not be estimated because data gaps during the growing season exceed 28 days.
Note: Stations with installation dates too late in the year to measure growing season were omitted for that year.

In 2022, all stations, including those downstream of the sedimentation ponds, had less than 800 GSDD. Other locations in the watershed tend to be cooler (i.e., the East Tributary, Dry Creek downstream of the East Tributary, and Tributary 5) and either do not meet the minimum temperatures for a growing season or do so and have a low GSDD. DRY-WQ04 has had intermediate growing seasons (i.e., 796 to 959 GSDD) in the past but a data gap in 2022 prevented calculation of GSDD at this site.

Water temperature monitoring has been ongoing in Dry Creek since 2016, representing a seven-year period of record. Within the monitoring period, stations upstream of the Dry Creek Sedimentation Ponds have had fairly consistent annual trends in water temperature. The upstream-most station (DRY-WQ04) reaches daily mean temperatures of 8 to 10°C in summer and near zero in winter. Downstream, the input of the East Tributary cools Dry Creek in the summer and warms it in the winter. In 2022 results for stations in this upper part of the watershed area were similar to past years. Further downstream, changes to sedimentation pond management have changed the temperature regime in summer from temperatures regularly >16°C daily mean, to a high of ~8°C in 2022. Dry Creek downstream of the outlet is no longer warmed by the sedimentation ponds during spring and fall.

The changes in operations are reflected in two metrics that are specific to fish health: mean weekly temperature and growing season. Mean weekly temperature within the fish-bearing portions of Dry Creek (i.e., from the downstream of the East Tributary to the Fording confluence, represented by DRY-WQ02,WQ05 and WQ01) indicate that from 2017-2019 Dry Creek at times exceed optimum temperature for spawning, incubation and rearing, but in recent years has been more than 1°C colder than optimum for portions (i.e., 10 to 40% at DRY-WQ05 and WQ01) or nearly all (i.e., >95% at DRY-WQ02) of the activity periods. The 2022 growing season downstream of the East Tributary (DRY-WQ02) had low GSDD but was broadly consistent with past years (341 GSDD in 2022). At the station in Dry Creek downstream of the sedimentation pond outlet (DRY-WQ05), growing season reached a maximum of 1,419 GSDD in 2017 but fell to 793 in 2021 and 707 in 2022. The GSDD recorded near the Fording confluence (DRY-WQ01) has consistently been lower than near the sedimentation ponds, and also declined from a high of 854 GSDD in 2018, to 737 in 2021 and 652 in 2022.

Cumulatively these results suggest that as water management approaches naturalize during the growing season (bypassing sedimentation ponds), the fish-bearing portion of Dry Creek (i.e., downstream of the East Tributary) has water temperatures that may pose challenges to fish growth and recruitment. Portions of the spawning, incubation and rearing activity stages are outside of the BC WQG stated optimums for WCT by more than 1°C, while the growing season measured at three stations between the East Tributary and the confluence were all below the 800

GSDD threshold to meet minimum requirements for interior Cutthroat Trout population recruitment (Coleman and Fausch 2007).

7.2.1.1 Summary

Water temperature monitoring results in 2022 suggest that as water management approaches naturalization, the portion of Dry Creek inhabited by fish (i.e., downstream of the East Tributary), has water temperatures that may pose challenges to fish growth and recruitment. Portions of the spawning, incubation and rearing activity stages are more than 1°C less than the BC WQG optimum for Cutthroat Trout, and the growing season measured at three stations between the East Tributary and the confluence with the Fording River were all below the 800 GSDD threshold recommended to meet minimum requirements for interior Cutthroat Trout population recruitment (Coleman and Fausch 2007).

7.2.2 Dissolved Oxygen

DO is an important water quality parameter relevant to all aquatic life, and particularly salmonids such as WCT, which are sensitive to low DO concentrations (COSEWIC 2016).

In 2022, in situ DO measurements collected at water quality monitoring stations in Dry Creek (excluding LC_DC3 and LC_SPDC due to lack of fish presence, five stations in total) were evaluated to assess mean annual and mean monthly (30-day mean) and instantaneous DO concentrations relative to the BCWQGs (BCMOECCS 2019) and important WCT life history stages. None of the stations exhibited annual minimum or 30-day mean DO concentrations in 2022 that were below the 30-day mean guideline of 8 mg/L or the instantaneous guideline of 5 mg/L (BCWQG applicable all life stages other than buried embryo/alevin (Table 7.2, Appendix Table C.4). However, mean 30-day DO concentrations were below the BCWQG for the protection of buried embryos and alevins (11 mg/L) at all monitoring stations from July to September in 2022, and occasionally in January, May, June, and October (Table 7.2). These results from 2022 are similar to prior years when DO at all or most monitoring stations was below the BCWQG for the protection of buried embryos and alevins in the summer months (2012 to 2022; Appendix Table G.1). In 2022, monthly mean DO concentrations ranged between 9.9 mg/L and 11.2 mg/L from July to September (Table 7.2). These results are consistent with DO concentrations observed at the reference area (LC_DCEF) in all years (Appendix Table G.1), indicating that the occurrence of DO below the guideline in 2022 was not due to a mine-related influence. Overall, DO concentrations in Dry Creek are not considered limiting for juvenile or adult WCT.

The WCT spawning period in Dry Creek has been observed from mid-June to early July and eggs incubate in gravel redds for 6 to 7 weeks prior to hatching (Northcote and Hartman 1988).

Table 7.2: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Dry Creek, 2022

Month	LC_DCEF	LC_DCDS	LC_DC2	LC_DC4	LC_DC1
January	10.5	11.8	11.7	12.0	11.6
February	11.1	11.9	12.1	11.7	12.0
March	11.0	12.0	12.0	11.7	12.0
April	11.8	12.1	12.0	12.2	12.1
May	10.5	10.7	11.1	11.0	11.2
June	11.2	10.9	11.0	10.9	11.0
July	10.9	9.90	10.2	10.2	10.2
August	10.4	10.1	10.3	10.3	10.4
September	10.6	10.6	10.6	10.7	10.8
October	10.6	11.1	11.1	10.9	11.2
November	11.4	12.2	12.3	12.0	12.4
December	11.1	12.2	12.5	12.0	12.1

Mean dissolved oxygen (DO) concentration lower than water column long-term BCWQG of 11 mg/L for buried embryo/alevin life stages (guideline was applied for all months except April, see notes for details).

Note: Spawning, incubation, and alevin stages for westslope cutthroat trout were included in the application of buried embryo/alevin guideline values, and were applicable to at least some portion of each month except April. The timing of life history stages for this species is approximated from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007).

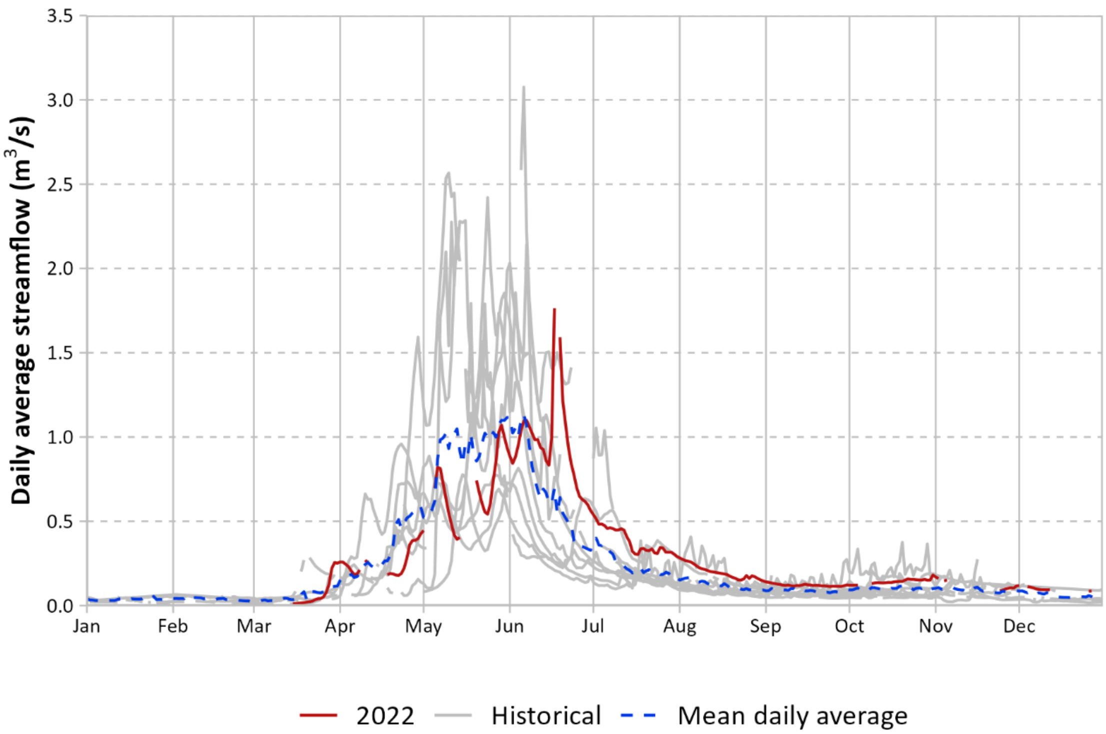
Fry typically spend a further 1 to 2 weeks in the interstitial spaces of gravel prior to emergence in early to mid-August depending on temperature and accumulated thermal units (ATUs). Mean monthly DO conditions in Dry Creek in 2022 suggest that WCT embryos and alevins may have experienced hypoxic; however, *in situ* measurements may not be sufficient for classifying conditions in Dry Creek. Secondly, as indicated above, similar conditions were observed at the reference area (LC_DCEF) suggesting that the decreased DO concentrations may not be mine-related (Table 7.2).

7.2.3 Instream Flow

The annual hydrograph at the LC_DC1 gauge in Dry Creek from 2011 to 2022 and WSC 08NK018 gauge in the Fording River from 1970 to 2022 is shown in Figure 7.5 and 7.6, respectively. The hydrographs demonstrate a strong seasonal trend at both the LC_DC1 and WSC 08NK018 gauge that is broadly typical of snowmelt-dominated streams, generally with peak flow occurring between April and June and low flow occurring between November and March. The timing of peak flow at LC_DC1 occurs approximately one month earlier than at the WSC gauge in the Fording River, where peak flows almost always occur in June (Table 7.3), a time at which flows begin to recede rapidly in Dry Creek (Table 7.4). A summary of data gaps at LC_DC1 is presented Table 7.5; there are no data gaps in the mean daily flow data at WSC gauge from 1970 to 2022. In 2011, 2012, and 2013, there are less than 6 months of data with significant data gaps from December to July. In 2014, although there was only one month with no data, all other months only had 32% or less data available per month. The dates of minimum and maximum daily average flow for each year relative to mean annual discharge (MAD) at LC_DC1 are shown in Table 7.6. Peak daily flows in 2017 and 2019 exceeded 1000% of MAD (0.240 m^3/s) at LC_DC1, while lowest minimum daily flow was at 3% of MAD in 2013.

Monthly flow statistics at the LC_DC1 and WSC gauge from 2011 to 2022 are provided in Table 7.5. The timing of peak and low mean monthly flows in Dry Creek varies slightly from year to year, whereas the timing of peak and low mean monthly flow at Fording River has been consistent since 2011 (with the exception of 2015 and 2017; Table 7.6). The maximum mean monthly flow at LC_DC1 in 2014 and 2019 were low, with less than 200% of MAD (73% and 184% of MAD, respectively; Table 7.4). This is partly a result of significant data gaps in 2014 that included the period of peak flow (May and June; Figure 7.5). The low magnitude of the maximum mean monthly flow in 2019 was not observed at the WSC gauge.

Average daily flow during key WCT activity periods at LC_DC1 are presented in Table 7.5; data from 2011 and 2012 were omitted due to significant data gaps (Table 7.5).



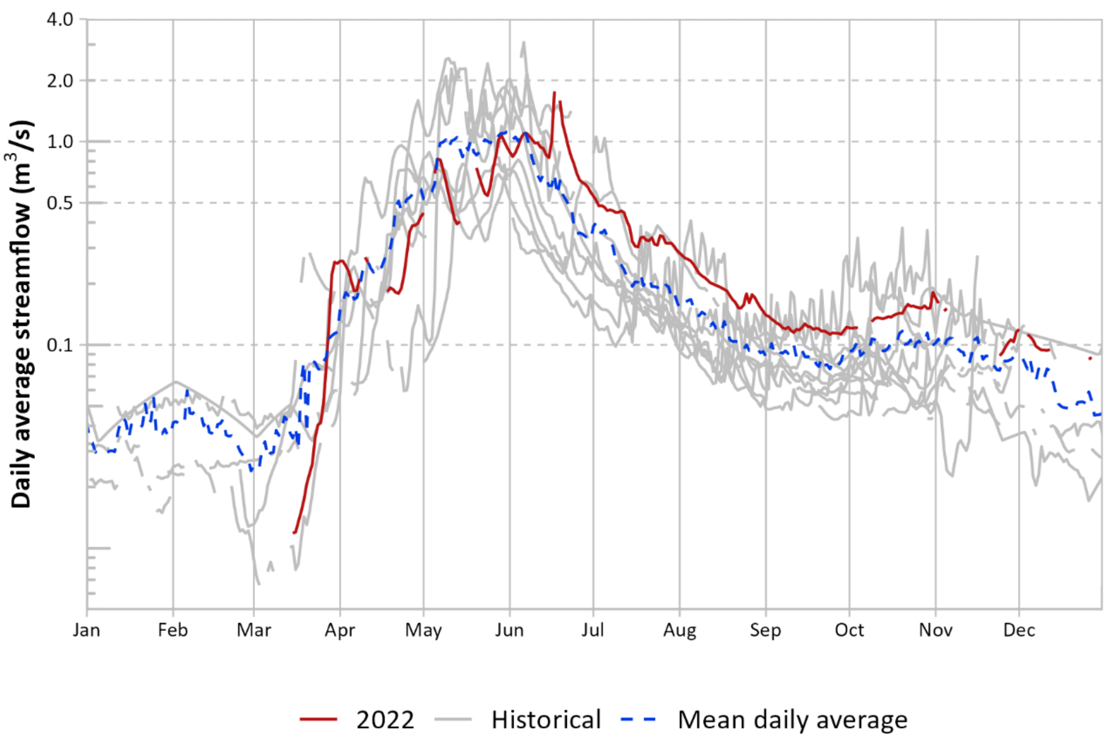
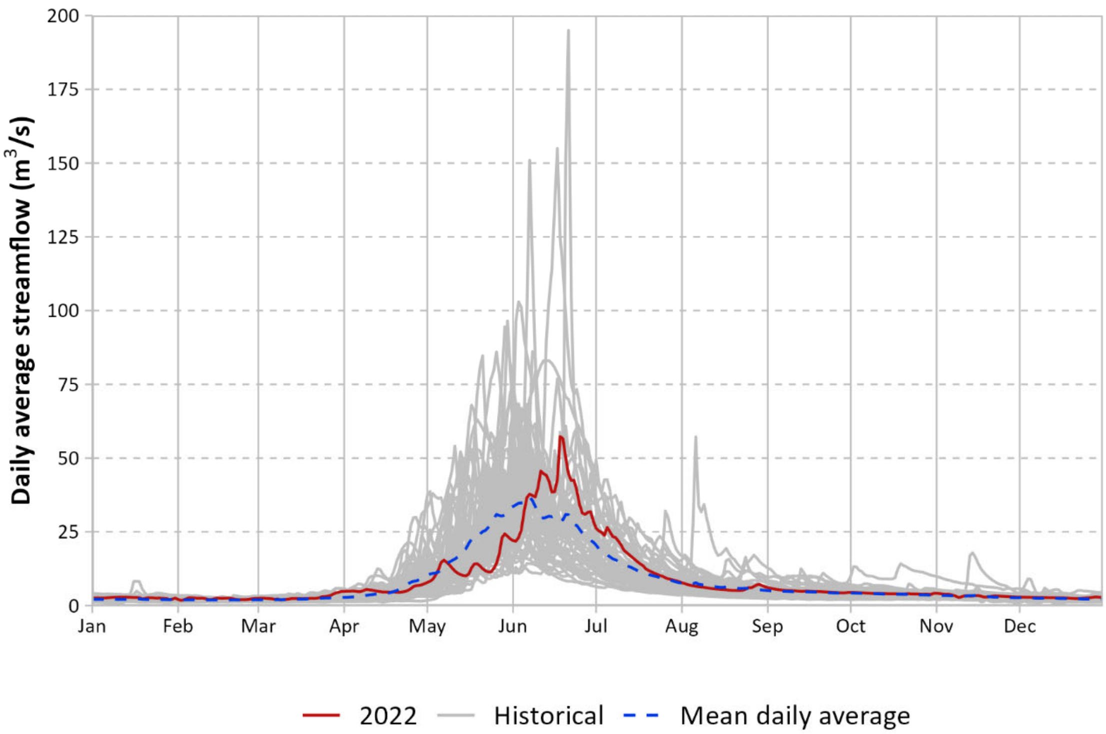


Figure 7.5: Annual Hydrograph at Dry Creek (LC_DC1) for Each Year from 2011 to 2022 on Normal (upper) and Log Scale (lower)



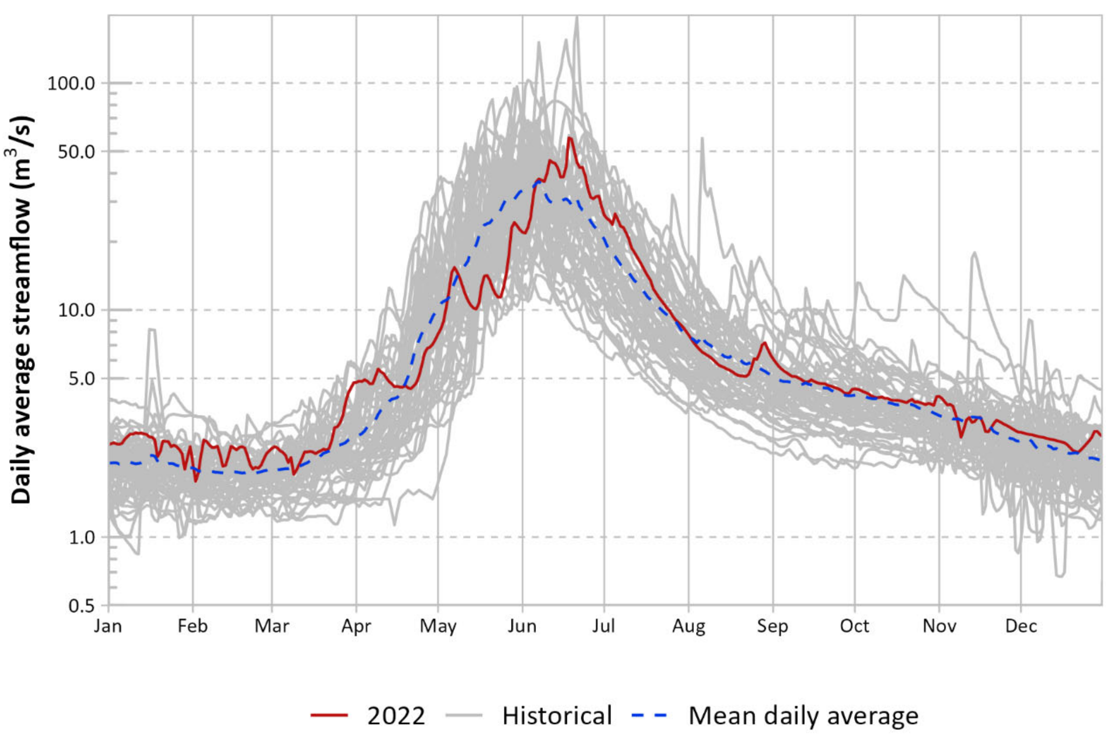


Figure 7.6: Annual Hydrograph for WSC 08NK018 from 1970 to 2022 on Normal (upper) and Log Scale (lower)

Table 7.3: Mean Daily Flow at LC_DC1 during Key Westslope Cutthroat Trout Activity Periods as Defined in Teck (2021)

Year	Mean Flow (m^3/s)				
	Over - Wintering[1]	Rearing	Spawning	Early Incubation	Late Incubation
	October 11 to May 27	May 28 to October 10	June 12 to July 11	June 12 to August 12	July 11 to October 31
2013	0.270	0.402	**0.789**	0.420	**0.192**
2014	0.182	**0.120**	0.256	0.151	0.106
2015	0.297	0.177	0.206	0.162	**0.084**
2016	0.165	0.146	**0.166**	**0.148**	0.101
2017	0.346	0.286	0.329	0.226	0.103
2018	**0.374**	0.173	0.246	0.194	0.107
2019	**0.150**	0.275	0.441	0.361	0.163
2020	0.279	0.382	0.609	0.367	0.106
2021	0.209	0.246	0.287	0.202	0.088
2022	0.214	**0.408**	0.754	**0.512**	0.188
Mean	0.238	0.241	0.356	0.249	0.119
Std dev	0.077	0.108	0.230	0.130	0.041

[1]Overwintering period starts on October 11 of the previous year and goes to May 27 of the current year.

Bold values are highest and lowest on record.

Table 7.4: Summary Statistics of Mean Monthly Discharge as a Percent of Mean Annual Discharge (MAD), at LC_DC1 and WSC 08NK018 from 2011 to 2022

Year	Month	Discharge at LC_DC1[1,2]			% of MAD[3]	Discharge at WSC 08NK018			% of MAD[4]
		Average	Minimum	Maximum		Average	Minimum	Maximum	
2011	Jan	NA	NA	NA	NA	2.21	1.36	2.55	28%
	Feb	NA	NA	NA	NA	2.11	1.73	2.47	26%
	Mar	NA	NA	NA	NA	2.14	1.68	2.81	27%
	Apr	NA	NA	NA	NA	3.18	2.67	4.49	40%
	May	NA	NA	NA	NA	18.85	4.39	38.10	237%
	Jun	NA	NA	NA	NA	41.47	28.10	54.00	520%
	Jul	NA	NA	NA	NA	17.65	8.19	34.00	221%
	Aug	NA	NA	NA	NA	5.65	4.34	8.00	71%
	Sep	-	-	-	-	4.04	3.63	4.91	51%
	Oct	0.060	0.043	0.092	25%	4.13	3.66	5.06	52%
	Nov	-	-	-	-	3.23	2.52	3.89	41%
	Dec	NA	NA	NA	NA	2.77	2.43	3.30	35%
2012	Jan	NA	NA	NA	NA	2.39	1.36	2.68	30%
	Feb	NA	NA	NA	NA	2.29	1.97	2.46	29%
	Mar	NA	NA	NA	NA	2.46	2.22	3.01	31%
	Apr	NA	NA	NA	NA	9.78	2.72	29.90	123%
	May	NA	NA	NA	NA	29.27	16.40	53.00	367%
	Jun	-	-	-	-	43.77	26.20	65.10	549%
	Jul	NA	NA	NA	NA	24.37	12.40	42.30	306%
	Aug	-	-	-	-	8.00	5.57	11.80	100%
	Sep	-	-	-	-	4.39	3.52	5.43	55%
	Oct	0.069	0.061	0.094	29%	3.70	3.42	4.79	46%
	Nov	0.074	0.040	0.154	31%	4.02	3.20	4.68	50%
	Dec	NA	NA	NA	NA	2.95	2.01	4.04	37%
2013	Jan	-	-	-	-	2.39	1.79	2.90	30%
	Feb	0.025	0.022	0.027	10%	2.16	1.48	2.58	27%
	Mar	-	-	-	-	2.67	2.16	3.66	33%
	Apr	0.135	0.058	0.243	56%	5.91	4.17	7.86	74%
	May	1.224	0.103	2.275	511%	31.21	7.19	52.10	392%
	Jun	-	-	-	-	47.92	24.60	195.00	601%
	Jul	0.384	0.103	1.053	160%	17.56	9.20	33.90	220%
	Aug	0.205	0.083	0.408	86%	8.73	5.69	14.40	110%
	Sep	0.140	0.098	0.274	58%	5.58	5.16	6.74	70%
	Oct	0.218	0.141	0.376	91%	5.18	4.32	6.60	65%
	Nov	-	-	-	-	3.51	1.69	4.47	44%
	Dec	NA	NA	NA	NA	2.34	0.95	3.33	29%
2014	Jan	NA	NA	NA	NA	2.27	1.45	2.56	29%
	Feb	NA	NA	NA	NA	1.86	1.69	2.13	23%
	Mar	NA	NA	NA	NA	2.08	1.76	2.40	26%
	Apr	NA	NA	NA	NA	4.81	2.36	7.39	60%
	May	NA	NA	NA	NA	26.20	9.09	58.60	329%
	Jun	NA	NA	NA	NA	35.81	24.70	47.50	449%
	Jul	0.174	0.124	0.261	73%	13.60	7.22	23.30	171%
	Aug	0.084	0.058	0.119	35%	5.72	4.91	7.05	72%
	Sep	-	-	-	-	7.01	5.17	10.00	88%
	Oct	0.091	0.065	0.146	38%	4.38	3.81	5.23	55%
	Nov	-	-	-	-	3.04	2.20	4.15	38%
	Dec	NA	NA	NA	NA	2.51	1.58	2.94	31%

[1] "NA" indicates months with no data.

[2] "-" Indicate months with less than 20 days of data.

[3] MAD at LC_DC1 = 0.238 m^3/s

[4] MAD at WSC 08KN018 = 7.96 m^3/s

Note: Blue shading indicates highest mean monthly discharge and orange shading indicates the lowest mean monthly discharge for each year.

Table 7.4: Summary Statistics of Mean Monthly Discharge as a Percent of Mean Annual Discharge (MAD), at LC_DC1 and WSC 08NK018 from 2011 to 2022

Year	Month	Discharge at LC_DC1[1,2]			% of MAD[3]	Discharge at WSC 08NK018			% of MAD[4]
		Average	Minimum	Maximum		Average	Minimum	Maximum	
2015	Jan	NA	NA	NA	NA	2.34	1.98	2.49	29%
	Feb	NA	NA	NA	NA	2.43	1.70	3.39	31%
	Mar	-	-	-	-	3.42	1.63	5.90	43%
	Apr	-	-	-	-	7.20	4.59	15.30	90%
	May	0.598	0.434	0.774	250%	16.53	11.90	25.70	207%
	Jun	0.397	0.168	0.815	166%	17.50	8.88	32.80	220%
	Jul	0.143	0.100	0.203	60%	6.65	5.14	8.75	83%
	Aug	0.076	0.056	0.103	32%	4.62	4.03	5.26	58%
	Sep	0.072	0.053	0.086	30%	4.37	3.92	4.95	55%
	Oct	0.066	0.048	0.103	27%	3.64	3.27	4.02	46%
	Nov	0.040	0.023	0.061	17%	2.77	1.76	3.71	35%
	Dec	0.026	0.017	0.037	11%	2.21	1.59	3.22	28%
2016	Jan	0.048	0.034	0.064	20%	2.33	1.62	2.61	29%
	Feb	0.052	0.037	0.066	22%	1.90	1.22	2.16	24%
	Mar	0.046	0.034	0.105	19%	2.22	1.95	2.70	28%
	Apr	0.569	0.129	0.959	237%	11.58	2.98	21.40	145%
	May	0.534	0.334	0.780	223%	16.55	12.10	21.30	208%
	Jun	0.266	0.137	0.519	111%	11.82	7.46	18.20	148%
	Jul	0.138	0.098	0.192	58%	8.01	6.16	13.80	101%
	Aug	0.077	0.050	0.117	32%	5.62	4.16	7.45	71%
	Sep	0.055	0.048	0.065	23%	3.78	3.60	4.10	47%
	Oct	0.142	0.073	0.209	59%	4.92	3.90	6.18	62%
	Nov	0.140	0.118	0.182	58%	4.63	3.33	5.38	58%
	Dec	0.103	0.090	0.117	43%	2.45	1.55	3.10	31%
2017	Jan	NA	NA	NA	NA	2.71	2.25	3.36	34%
	Feb	NA	NA	NA	NA	2.04	1.69	2.27	26%
	Mar	-	-	-	-	2.54	1.62	3.61	32%
	Apr	0.253	0.124	0.468	105%	5.81	3.75	9.03	73%
	May	1.548	0.340	2.420	646%	26.90	8.08	44.80	338%
	Jun	0.756	0.274	1.688	315%	26.95	13.50	46.40	338%
	Jul	0.176	0.124	0.263	74%	8.33	5.06	13.20	105%
	Aug	0.105	0.079	0.127	44%	4.06	3.07	4.94	51%
	Sep	0.081	0.074	0.091	34%	2.83	2.61	3.04	36%
	Oct	0.102	0.080	0.191	43%	2.85	2.49	3.53	36%
	Nov	0.091	0.070	0.133	38%	2.83	1.91	3.59	35%
	Dec	-	-	-	-	1.81	1.19	3.24	23%
2018	Jan	0.049	0.043	0.055	20%	1.96	1.31	2.41	25%
	Feb	0.051	0.045	0.057	21%	1.63	1.54	1.77	20%
	Mar	0.059	0.039	0.081	24%	1.95	1.65	2.20	24%
	Apr	0.440	0.064	1.593	183%	5.52	1.77	24.00	69%
	May	1.519	0.642	2.567	634%	34.01	15.90	50.00	427%
	Jun	0.278	0.223	0.422	116%	16.50	12.10	25.90	207%
	Jul	0.187	0.131	0.317	78%	9.45	6.00	13.50	119%
	Aug	0.097	0.066	0.136	40%	4.24	3.60	5.70	53%
	Sep	0.105	0.079	0.147	44%	3.28	3.15	3.56	41%
	Oct	0.078	0.046	0.120	33%	3.23	3.15	3.35	41%
	Nov	-	-	-	-	3.03	2.65	3.23	38%
	Dec	0.040	0.035	0.050	17%	2.28	1.79	3.00	29%

[1] "NA" indicates months with no data.

[2] "-" Indicate months with less than 20 days of data.

[3] MAD at LC_DC1 = 0.240 m^3/s

[4] MAD at WSC 08KN018 = 7.97 m^3/s

Note: Blue shading indicates highest mean monthly discharge and orange shading indicates the lowest mean monthly discharge for each year.

Table 7.4: Summary Statistics of Mean Monthly Discharge as a Percent of Mean Annual Discharge (MAD), at LC_DC1 and WSC 08NK018 from 2011 to 2022

Year	Month	Discharge at LC_DC1[1,2]			% of MAD[3]	Discharge at WSC 08NK018			% of MAD[4]
		Average	Minimum	Maximum		Average	Minimum	Maximum	
2019	Jan	NA	NA	NA	-	1.92	1.58	2.24	24%
	Feb	NA	NA	NA	-	1.64	1.43	1.98	21%
	Mar	NA	NA	NA	-	2.20	1.17	4.20	28%
	Apr	NA	NA	NA	-	3.65	2.96	4.85	46%
	May	0.393	0.082	0.777	164%	10.48	4.34	22.70	131%
	Jun	0.441	0.224	0.726	184%	18.88	12.90	29.30	237%
	Jul	0.397	0.245	0.586	166%	14.04	9.80	19.80	176%
	Aug	0.163	0.107	0.274	68%	6.89	5.08	9.32	86%
	Sep	0.101	0.082	0.127	42%	4.53	4.17	4.96	57%
	Oct	0.102	0.092	0.135	43%	3.66	2.47	4.33	46%
	Nov	-	-	-	-	2.86	2.00	3.41	36%
	Dec	-	-	-	-	2.60	2.08	3.45	33%
2020	Jan	-	-	-	-	2.00	1.42	2.68	25%
	Feb	-	-	-	-	1.98	1.72	2.29	25%
	Mar	0.022	0.007	0.060	9%	2.26	1.63	3.03	28%
	Apr	0.411	0.056	0.738	172%	5.24	2.78	9.67	66%
	May	1.009	0.567	1.985	421%	18.47	9.86	58.90	232%
	Jun	1.044	0.333	2.033	436%	31.14	18.90	66.10	391%
	Jul	0.229	0.144	0.354	96%	12.83	6.98	23.20	161%
	Aug	0.116	0.078	0.153	48%	5.15	3.92	7.16	65%
	Sep	0.065	0.057	0.085	27%	3.52	3.25	3.87	44%
	Oct	0.061	0.045	0.068	26%	3.00	2.09	3.22	38%
	Nov	0.084	0.064	0.106	35%	3.06	2.02	3.51	38%
	Dec	-	-	-	-	2.40	1.78	3.06	30%
2021	Jan	-	-	-	-	2.27	1.85	2.66	28%
	Feb	-	-	-	-	1.95	1.83	2.33	24%
	Mar	0.109	0.013	0.284	46%	3.04	1.87	4.45	38%
	Apr	0.265	0.153	0.453	111%	4.99	3.75	7.42	63%
	May	0.862	0.453	1.736	360%	16.60	8.42	28.40	208%
	Jun	0.583	0.245	1.329	243%	24.72	15.70	49.40	310%
	Jul	0.162	0.099	0.230	68%	8.76	5.30	14.70	110%
	Aug	0.105	0.073	0.160	44%	5.92	4.30	7.88	74%
	Sep	0.069	0.051	0.096	29%	4.41	3.59	5.59	55%
	Oct	0.055	0.045	0.096	23%	3.14	2.86	3.94	39%
	Nov	0.097	0.051	0.275	40%	3.67	2.76	6.05	46%
	Dec	-	-	-	-	3.19	2.23	4.62	40%
2022	Jan	NA	NA	NA	NA	2.60	1.99	2.88	33%
	Feb	NA	NA	NA	NA	2.28	1.76	2.67	29%
	Mar	-	-	-	-	2.70	1.89	4.78	34%
	Apr	0.256	0.179	0.426	107%	5.21	4.50	7.41	65%
	May	0.685	0.393	1.071	286%	13.62	7.84	24.30	171%
	Jun	0.944	0.564	1.765	394%	37.70	21.80	57.30	473%
	Jul	0.384	0.292	0.540	160%	16.09	8.07	26.50	202%
	Aug	0.199	0.146	0.283	83%	6.09	5.10	7.76	76%
	Sep	0.121	0.113	0.140	51%	4.91	4.29	6.09	62%
	Oct	0.143	0.121	0.181	60%	4.07	3.80	4.49	51%
	Nov	-	-	-	-	3.29	2.75	4.16	41%
	Dec	-	-	-	-	2.68	2.36	2.92	34%

[1] "NA" indicates months with no data.

[2] "-" Indicate months with less than 20 days of data.

[3] MAD at LC_DC1 = 0.238 m^3/s

[4] MAD at WSC 08KN018 = 7.96 m^3/s

Note: Blue shading indicates highest mean monthly discharge and orange shading indicates the lowest mean monthly discharge for each year.

Table 7.5: Summary Statistics of Mean Monthly Discharge as a Percent of Mean Annual Discharge (MAD), at LC_DC1 and WSC 08NK018 from 2011 to 2022

Year	% Complete[1]												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Average
2011	-	-	-	-	-	-	-	-	100%	76%	7%	-	15%
2012	-	-	-	-	-	63%	-	13%	54%	100%	69%	-	25%
2013	18%	23%	20%	28%	31%	19%	31%	31%	32%	31%	20%	-	24%
2014	-	-	-	-	-	-	74%	100%	29%	100%	49%	-	29%
2015	-	-	24%	26%	100%	100%	100%	100%	100%	100%	100%	100%	71%
2016	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
2017	-	-	34%	100%	85%	84%	85%	100%	100%	90%	70%	5%	63%
2018	63%	92%	94%	86%	100%	100%	100%	100%	100%	100%	44%	74%	88%
2019	-	-	-	2%	100%	100%	100%	100%	100%	92%	79%	75%	62%
2020	88%	86%	91%	94%	100%	100%	100%	100%	100%	93%	92%	84%	94%
2021	88%	79%	100%	100%	100%	100%	100%	100%	100%	100%	92%	74%	95%
2022	67%	67%	84%	91%	100%	100%	100%	100%	100%	100%	79%	88%	90%

[1] Based on the total number of days within each month (Jan-Dec) and in each year (Total) that data was available.
"-" Indicate months with no available data.

Note: Highlighted cells indicate months with less than 60% data completeness.

Table 7.6: Date of Minimum and Maximum Daily Average Streamflow per Year from 2001 to 2022 Recorded at LC_DC1

Year	Date of Minimum Flow	Date of Maximum Flow	Minimum Flow (m^3/s)	Maximum Flow (m^3/s)	Minimum Flow (% of MAD[1])	Maximum Flow (% of MAD[1])
2011	-	-	-	-	-	-
2012	-	-	-	-	-	-
2013	11-Jan	11-May	0.02	2.28	8%	948%
2014	-	-	-	-	-	-
2015	26-Dec	4-Jun	0.02	0.81	7%	340%
2016	5-Jan	23-Apr	0.03	0.96	14%	400%
2017	11-Nov	24-May	0.07	2.42	29%	1008%
2018	16-Dec	10-May	0.04	2.57	15%	1070%
2019	7-Dec	15-May	0.04	0.78	15%	324%
2020	3-Mar	1-Jun	0.01	2.03	3%	847%
2021	28-Feb	28-May	0.01	1.74	5%	723%
2022	15-Mar	17-Jun	0.01	1.76	5%	735%

"-" Indicates less than 6 months of data
[1] MAD at LC_DC1 = 0.240 m^3/s

Average flow during each WCT activity period from 2013 to 2022 have varied considerably from year to year across all activity periods, as indicated by the high standard deviation of mean flow. The average flow during the rearing and early incubation periods in 2022 was the highest on record; average flow during the early incubation period (0.512 m^3/s) was 22% higher than the previous record high in 2013 (0.420 m^3/s), and average flow during the rearing period (0.408 m^3/s) was 1.5% higher than the previous record high in 2013 (0.402 m^3/s; Table 7.3). If hydraulic habitat is limiting the Dry Creek WCT population, then the higher flows in summer and fall 2022 would likely be beneficial.

Table 7.7 indicates the years in which flows, as measured at LC_DC1 from 2011 to 2022, met the flushing flow threshold of 1.0 m^3/s for a 2-day duration (West *et al.* 2021). The flushing flow threshold was reached in 7 of the 12 years of data, including 2022, with 2019 being the only year in the last five years that did not reach the threshold. The record indicates that flushing flows have been occurring regularly in Dry Creek, but current sediment conditions cannot be directly inferred from this record and would require empirical confirmation.

Table 7.7: Indication of Whether the Historical Flows at LC_DC1 Exceeded the Flushing Flow Threshold of 1.0 m^3/s for a 2-Day Duration (threshold proposed in West *et al.* 2021)

Year	Flushed	Days with no data[1]
2011	Unknown	61
2012	Yes	42
2013	Yes	12
2014	Unknown	61
2015	No	0
2016	No	0
2017	Yes	11
2018	Yes	1
2019	No	0
2020	Yes	2
2021	Yes	0
2022	Yes	8

[1] Number of days in May and June with no recorded flow data.

Note: Years marked as "unknown" did not exceed the threshold during periods when data were available and the data gaps precluded a determination.

7.2.3.1 Summary

General trends of streamflow monitored in 2022 at the LC_DC1 gauge in Dry Creek were consistent with historical records: high flows occurred in May and June, and a low flow period occurred between November and March. Average flows in 2022 during key WCT activity periods were broadly similar to previous years, except during rearing and early incubation periods when average flows in 2022 were the highest on record. The flushing flow threshold, measured as 1.0 m^3/s for a 2-day duration, was met in Dry Creek at LC_DC1 in 2022.

7.2.4 Calcite Coverage

Similar to previous years, in 2022, calcite concretion was not observed in Dry Creek during the Regional Calcite Monitoring Program. Calcite levels in Dry Creek continue to be below those expected to result in measurable biological effect, although there is a clear trend toward increased calcite presence.

In addition to the Regional Calcite Monitoring Program, Calcite Index (CI) was also measured concurrently with benthic invertebrate community sampling as part of the 2022 LCO Dry Creek LAEMP (Table 2.3). Benthic invertebrate sampling targeted riffle habitat, and calcite measurements were taken in the immediate proximity of benthic invertebrate sampling sites. Consistent with previous years, 2022 LCO Dry Creek LAEMP CI values at the reference location remained at 0, were highest at the most upstream mine-exposed station (LC_DC3, CI = 0.88 to 0.97), and all Dry Creek monitoring locations were generally lower than values from 2019[13] and earlier (Table 7.8). Overall, in 2022 at Dry Creek, CI values increased from downstream to upstream at mine-exposed LAEMP monitoring locations, and there were changes in calcite coverage indicative of increased calcite deposition.

7.3 Fish

The 5.5 km of LCO Dry Creek from the confluence of the UFR (km 0) to the LCO Dry Creek Head Pond spillway barrier (at 5.5 km) are accessible to fish. Upstream of the spillway barrier is considered non-fish bearing. East Tributary of LCO Dry Creek is accessible to WCT, though likely has negligible densities of fish due to summer temperatures which result in little to no growing season for WCT (Minnow 2022a).

The fish in LCO Dry Creek are considered part of the interbreeding UFR WCT population as the culverts at km 1 are partial barriers are passable for upstream movement during some

[13] Measuring calcite in the presence of encrusting algae is challenging and potentially prone to errors. Encrusting material identified as calcite at several areas on Dry Creek and LC_DCEF in 2019 was determined to be non-calcite following additional field consultation in 2020 and those values are considered erroneous.

Table 7.8: Calcite Index Values for Dry Creek, Grace Creek, and Fording River Areas, LCO Dry Creek LAEMP 2015 to 2022

Area		Calcite Index (CI)								Calcite index (CI')[a]	
		Sep 2015	Sep 2016	Sep 2017	Sep 2018	Sep 2019	Sep 2020	Sep 2021	Sep 2022	Sep 2021	Sep 2022
Dry Creek	LC_DCEF	-	-	-	-	*0.99*	0	0	0	-	0
						0.96	0	0	0	-	0
						1.19	0	0	0	-	0
	LC_DC3	-	-	-	-	*1.12*	0.1	0.1	0.97	0.02	0.66
						1.16	0.35	0.34	0.95	0.09	0.52
						1.36	0.62	0.78	0.88	0.33	0.41
	LC_DCDS	0	0.8	0	0.6	*1*	0	0	0.71	0	0.4
					1	*1*	0.1	0	0.79	0	0.41
					1	*1*	0.02	0	0.58	0	0.26
	LC_DC2	-	-	-	-	*1*	0	0.04	0.28	0.01	0.06
						1	0	0.01	0.44	0	0.12
						1	0.03	0.09	0.75	0.02	0.27
	LC_DC4	-	-	-	-	*1*	0	0.45	0.29	0.15	0.09
						0	0	0.06	0.29	0.02	0.05
						1	0	0.11	0.17	0	0.04
	LC_DC1	0	0.6	0	0.92	*1*	0.12	0.45	0.39	-	0.14
					1.1	*1*	0.19	0.59	0.2	-	0.07
					1.1	*1*	0.41	0.43	0.26	-	0.07
Fording River	LC_FRUS	1	1	1	1	*1*	0.94	0.96	0.91	0.63	0.59
					1	*1*	0.96	0.99	0.64	0.56	0.28
					1	*1*	0.99	0.99	1.01	0.63	0.69
	LC_FRB	1	1.4	1.2	0.89	*1*	0.11	0.92	0.68	0.46	0.32
					0.85	*1*	0.03	0.87	0.83	0.38	0.47
					0.7	*1*	0.92	0.66	0.88	0.22	0.33
Grace Creek	LC_GRCK	-	-	-	-	0	0	0	0.01	0	0
						0.25	0	0	0	0	0
						0	0	0	0.19	0	0.05

Notes: Italicized values indicate calcite index values considered erroneous due to encrusting algae presence. "-" indicates calcite data not recorded. Calcite monitoring in support of biological sampling was discontinued at LC_SPDC, following operational changes in October 2020 (see Minnow 2021a for details). Calcite monitoring results from LC_SPDC are therefore unavailable for 2021, and this area has been excluded from the table.

[a] Calcite indices (CI') were calculated using calcite proportion rather than calcite presence and therefore cannot be compared with previous years.

flow conditions (AJM Environmental Inc. & Higher Ground Consulting. 2023, WSP & Poisson 2023)., therefore trends in LCO Dry Creek are influenced by those in the larger UFR population and cannot be considered in isolation. For example, the number of spawners in the UFR population can influence how many fish are available to spawn in LCO Dry Creek, at the same time migratory access and possibly water temperature, which can change year to year, may also influence the amount of spawning. The number of redds can in turn influence juvenile densities. In contrast, other indicators, such as age-0 length at age and body condition of age-1s, reflect local conditions.

Between 2015 and 2022 there were a number of influences on fish habitat and/or the UFR fish population that make it challenging to assess trends in LCO Dry Creek fish metrics associated with any specific change or event. In Dry Creek, these operational influences include the Dry Creek Water Management System becoming operational (January 2015), seasonal water diversion to by-pass sedimentation pond (beginning September 2020) and the BRN spoil failure (October 2021). In addition, over the winter of 2018/2019 there was a decline in the adult population of the UFR (Evaluation of Cause Team 2021), which LCO Dry Creek is a part of. There were 25 WCT mortalities associated with a dewatering event October 2020 (Minnow 2021a). Moreover, after several years of consistent fish sampling throughout Dry Creek (2016 – 2019), minimal sampling was conducted in 2020 and 2021 due to concerns regarding fish handling, which limits the statistical comparisons that can be made with previous time periods. However, given the ten years of available data we can consider trends related to WCT in LCO Dry Creek over time with respect to number and distribution of redds, juvenile densities, body condition, and length. For age-0, length-at-age differences before and after implementation of the seasonal water diversion bypassing the sediment ponds are discussed.

7.3.1 Redd Surveys

Using the survey methods introduced in 2021 (Smit 2022), the AUC model was used to estimate the total number of unique definitive nests an average observer would have been expected to count. This approach facilitates comparisons between years. Using the AUC model the estimates were 20 definitive nests in 2021 and 9 definitive nests in 2022. The number of nests observed in other parts of the UFR was also lower in 2022 than other years and may be associated with a relatively cold spring (Thorley et al. 2023a).

The total number of definitive nests counted in LCO Dry Creek in 2022 (n=10) was similar to the number of visible redds (which can consist of multiple nests) counted in 2015 to 2017 but was lower than from 2018 to 2021 (Table 7.9). However, these numbers are not strictly comparable as discussed below. Prior to 2020, the number of nests in a redd were not consistently recorded, nests were not recorded as definitive or potential, and only new redds were recorded.

Table 7.9: Total Redds Counted (2015 to 2020) and Total Definitive Nests Counted (2021 to 2022) in LCO Dry Creek Between 2015 and 2022

Reach	2015[1]	2016[2]	2017[2]	2018[2]	2019[2]	2020[1]	2021[1]	2022[1]
1	9	9	6	26	15	10	18	5
2	0	1	1	5	5	0	0	0
3	0	1	2	8	2	5	0	5
4	0	0	0	0	0	0	0	0
East Tributary	-	-	-	-	-	-	-	0
Total	9	11	9	39	22	15	18	10

[1] WSP & Poisson 2023
[2] Faulkner et al., 2020. Total redds is assumed to be equivalent to total nests counted.

Nonetheless the redd data provides information on the spatial extent of spawning. Redds were observed upstream and downstream of the culverts located at km 1.0 in all years except 2015 and 2021 when they were only observed downstream of the culverts. No definitive nests were observed in the 1.1 km of Dry Creek East Tributary that was surveyed in 2022 (Table 7.9).

7.3.2 Density

Age-1 and age-2+ WCT were captured at three of the four sites sampled in 2022 in LCO Dry Creek (Table 7.10). The number of fish captured during the first electrofishing pass by site and year was used to estimate the densities of age-1 and age-2+ fish over time (Figure 7.7). The site (DRY1; located at km 0.55) that was sampled the most consistently from 2013 to 2022 (i.e., in 8 of 10 years) indicates that juvenile densities have been comparable over these and do not suggest any long-term trend (Figure 7.7). For the five sites sampled yearly from 2016 – 2019, densities have been similar for age-1s and have fluctuated more for age-2+, but are also not suggestive of a long-term trend.

Table 7.10: Summary of Fish Captured by Sampling Site, Kilometre (km), and Age-Class in 2022

Site	km*	Reach	Age-1	Age-2+
DRY-100o	0.12	1	0	10
DRY1	0.56	1	1	5
DRY-2400o	2.37	2	0	1
DRY4.3	4.37	4	0	0

*Distance from the confluence of LCO Dry Creek and the UFR.

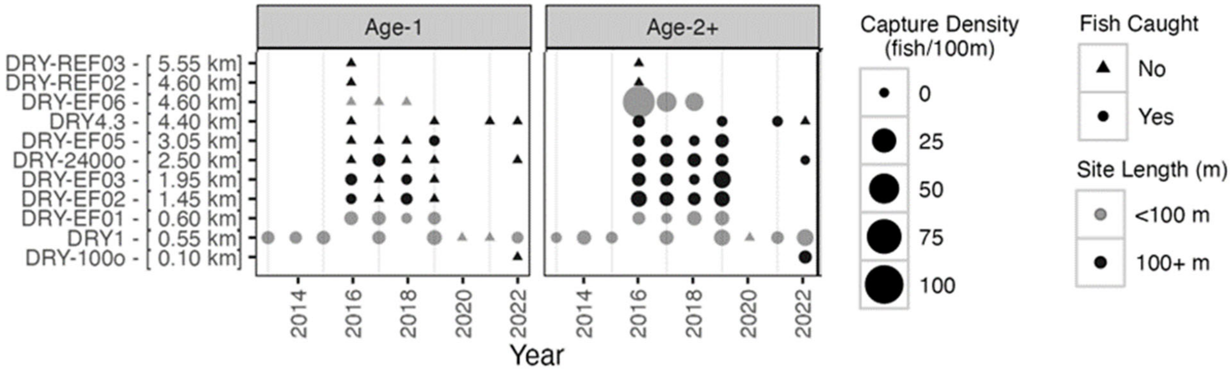


Figure 7.7: Densities of Fish Captured during Electrofishing in LCO Dry Creek on the First Pass by Year, Sampling Site, and Life Stage

7.3.3 Length frequency

Length categories for different age classes of WCT were developed based on data collected from 2013 to 2022 (Table 7.11). To do this, length frequency histograms were used to visualize the size structure of WCT captured by electrofishing under the assumption that size cutoffs between age-0, age-1, and age-2+ WCT can be identified from the length-frequency distributions (Figure 7.8; WSP & Poisson 2023). All fish greater than or equal to 200 mm in fork length were considered a single life stage grouping consisting of both subadult and adult fish . Age-0 and age-1 length categories vary across subpopulations in the UFR due to differences in growth among subpopulations (Thorley & Branton 2023). The age-2+ category includes multiple cohorts and includes fish with fork lengths greater than the maximum for age-1 fish and less than 200 mm.

Table 7.11: Length Categories for Life Stages of WCT in LCO Dry Creek

Life Stage	Fork Length
Age-0	<50 mm
Age-1	50–89 mm
Age-2+	90–199 mm
Subadult and adult	≥200 mm

For plotting purposes, data were grouped for the period before (2013 to 2017) and after (2019 to 2022) as a large decrease in the abundance of subadult and adult WCT occurred in the UFR in 2018 (WSP & Thorley 2023).

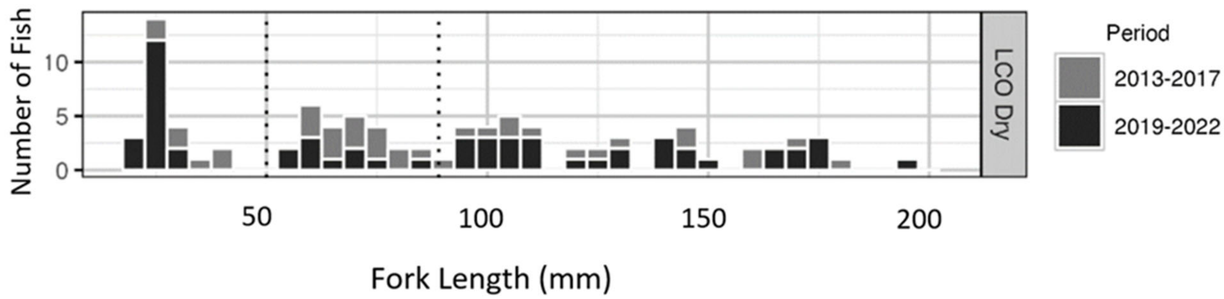


Figure 7.8: Number of Fish Captured by Electrofishing in LCO Dry Creek by Fork Length and Period

Note: Colour of bars represents the period before or after the decrease in counts of WCT during snorkel surveys that occurred between 2017 and 2019. The vertical dotted lines indicate the age-1 life stage cutoffs.

7.3.4 Length-at-age-0

The length of age-0 fish at the onset of winter is a determinant of overwintering survival (Coleman and Fausch 2007) and is sensitive to local conditions as indicated by the range of length at age-0s measured across the UFR (Thorley et al. 2023). Relatively few data are available for age-0s over the years in Dry Creek as sampling methodologies have not specifically targeted age-0s, though dip-net sampling that targets this age-class fish was implemented in 2022 (Figure 7.9). Water temperatures in the growing season influence the growth rates of fish, and GSDD have been lower in Dry Creek since the seasonal bypass of the sedimentation ponds was put into operation (Section 7.2.1). To explore the potential for changes in growth associated with these changes in temperature, a length-at-age analysis was conducted to estimate the length of age-0 fish separately for before and after the seasonal bypass was put into operation (WSP & Poisson 2023). Based on the limited available data, age-0 fish were shorter in 2022 compared to previous years (2015 and 2016). The length of age-0 fish was estimated to be 29% shorter (95% CI 53% shorter to 8% longer) after the seasonal bypass was put into operation (Thorley et al 2023a, WSP & Poisson 2023). These values were estimated as part of the larger UFR length-at-age model (Thorley et al. 2023) and are based on a very limited dataset including two years of data before the sediment pond bypass (2015 n=7 and 2016 n=2) and one year after (2022 n=17). These length estimates account for annual variation across the UFR as well as the expected extent of annual variation within Dry Creek. Given the small dataset there is considerable uncertainty as indicated by the range in 95% CIs. Additional years of age-0 data will reduce the uncertainty with respect to estimating the change in length.

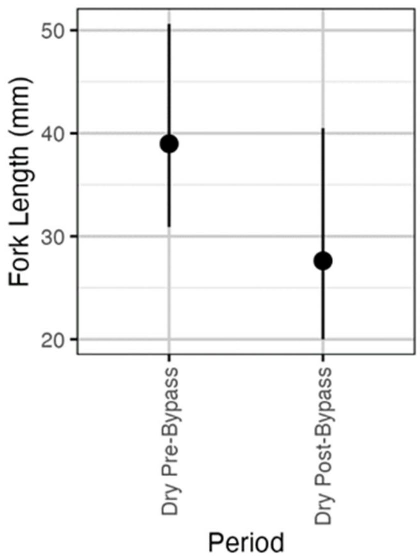


Figure 7.9: Estimated Fork Length of Age-0 Westslope Cutthroat Trout on 1 October in a Typical Year in LCO Dry Creek (with 95% CIs)

Note: The pre-bypass includes data from 2015 (n=7) and 2016 (n=2) and the post-bypass has data from 2022 (n=17).

7.3.5 Condition

Body condition compares an individual's mass relative to its length, and is a measure of health and growth potential (Bentley and Schindler 2013). All else being equal, fish with higher body condition would be expected to have more energy stores for growth, reproduction, and metabolic processes than fish of a similar length but lower body condition. Body condition was estimated based on juvenile fish as sampling in LCO Dry Creek does not target larger size classes. It is expressed as the predicted weight of a 100 mm WCT to estimate the percent difference in body condition relative to a typical stream in the UFR (Thorley et al 2023b) including LCO Dry Creek, in a typical year (Figure 7.10). Body condition in 2022 was estimated to be higher than in 2021. From 2013 to 2022, body condition was variable in LCO Dry Creek but was consistently estimated to be higher than the typical body condition of fish in other parts of the UFR, which is represented by 0% in Figure 7.11. Otherwise, there is no apparent trend over time given the uncertainty represented by the error bars (Figure 7.10).

7.3.6 Summary

Water temperature monitoring results in 2022 suggest that the portion of Dry Creek inhabited by fish (i.e., downstream of the East Tributary) now primarily feature water temperatures that may pose challenges to fish growth and recruitment. Portions of the spawning, incubation and rearing

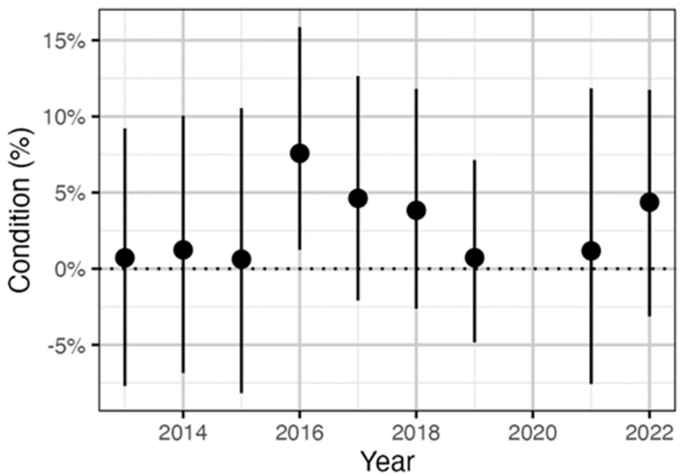


Figure 7.10: Body Condition in LCO Dry Creek Shown as the Percent Change in the Body Weight of a 100 mm Fish in a Typical Year Relative to a Typical Stream in the UFR Watershed (with 95% CIs)

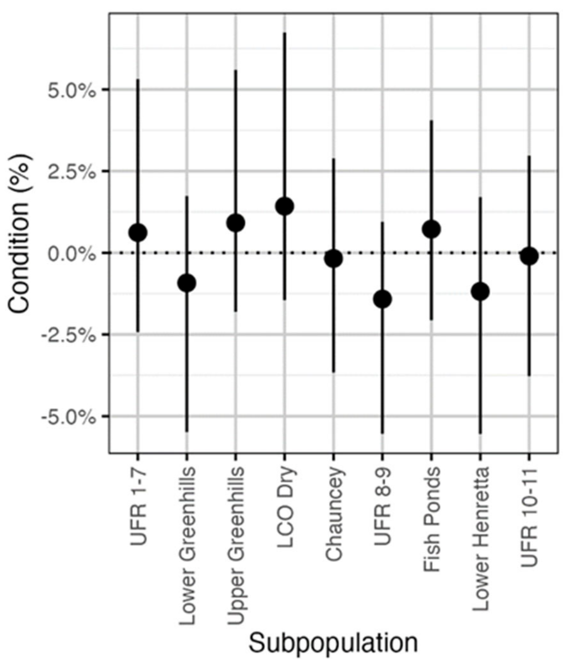


Figure 7.11: Body Condition Shown as the Percent Change in the Body weight of a 100 mm fish in a Typical Year Relative to a Typical Stream by Subpopulation (with 95% CIs)

Note: Subpopulations are different locations within the UFR watershed.

activity stages are outside of the BC WQG stated optimums for WCT by >1°C, while the growing season measured at three stations between the East Tributary and the confluence were all below the 800 GSDD threshold recommended to meet minimum requirements for interior Cutthroat Trout population recruitment (Coleman and Fausch 2007).

General trends of streamflow monitored in 2022 at the LC_DC1 gauge in Dry Creek were consistent with historical records: high flows occurred in May and June, and a low flow period occurred between November and March. Average flows in 2022 during key WCT activity periods were broadly similar to previous years, except during rearing and early incubation periods when average flows in 2022 were the highest on record; biological effects from these high flows are unknown due to a lack of concurrent fish abundance monitoring. The flushing flow threshold, measured as 1.0 m^3/s for a 2-day duration, was met in Dry Creek at LC_DC1 in 2022.

Redds were observed above and below the culvert at km1 which is a barrier to upstream passage in some flow conditions. In 2022 and there were an estimated 9 definitive nests in compared to 20 in 2021. This decrease in nest counts was also observed throughout the UFR and may be associated with the cold early season water temperatures (Thorley et al 2023b). The total number of nests counted in 2022 was similar to the number of redds in 2015 to 2017, but lower than in 2018 to 2021. The densities of age-1 and age-2+ fish in 2022 were similar to previous years and show no apparent trend over time. Body condition was higher in 2022 than in 2021 but was variable over time indicating no long-term trends within LCO Dry Creek. However, the body condition of fish in LCO Dry Creek has been consistently higher than the typical body condition of fish in the UFR population. Based on a limited dataset, the age-0 fish were shorter in 2022 than in previous years with data (2015 and 2016). This may be related to a decrease in water temperatures after the seasonal sedimentation pond by-pass was put into operation in 2020.

8 SUMMARY

Changes to Dry Creek due to LCOII development have been evaluated by addressing five study questions, which focus on: 1) potential effects to water quality; 2) changes in toxicity; 3) potential effects to benthic invertebrate communities; 4) benthic invertebrate tissue selenium; and 5) fish and fish habitat.

Evaluation of Study Question #1 (potential effects to water quality) indicated that in general (2014 to 2022) concentrations of mine-related constituents including nitrate, total cadmium, and total selenium, have increased over time on Dry Creek since spoiling began in this watershed in 2015. Nitrate concentrations were above updated effects concentrations and dissolved nickel concentrations were above proposed benchmarks in Dry Creek in 2022. Constituent concentrations were more frequently elevated at areas LC_DC3 (the Dry Creek area immediately downstream of LCOII spoiling and prior to DCWMS effects) and LC_SPDC, LC_DCDS, and LC_DC2 (the areas immediately downstream of the DCWMS) than at areas LC_DC4 and LC_DC1, likely due to increasing distance from LCOII operations and input of groundwater from reference area LC_DCEF between LC_DC2 and LC_DC4 (Golder 2019b). Similar trends in aqueous constituents were not detected at reference areas (LC_DCEF and LC_UC), in the Fording River downstream of Dry Creek, or in Grace Creek (LC_GRCK), except for nitrate which showed increasing trends at LC_DCEF, LC_FRB and LC_GRCK and total selenium which increased at LC_DCEF, LC_UC and LC_FRB. Operational changes to the DCWMS including development and implementation of the seasonal bypass and modification of discharge channel area LC_SPDC have successfully mitigated organoselenium concentrations in the surface water as well as selenium bioaccumulation and effects to biota.

Evaluation of Study Question #2 (changes in toxicity) indicated that chronic toxicity test occurring at LC_DCDS and acute toxicity occurring at LC_SPDC have not increased in 2022 relative to 2021 (Section 4). Acute toxicity testing of water from the outlet of the DCWMS as well as within Dry Creek showed no test failures in 2022. Chronic toxicity is monitored in Dry Creek directly downstream of the DCWMS (LC_DCDS), under the regional chronic toxicity program. In 2022, nickel and/or nitrate were identified as potentially causing the observed effects on water fleas and amphipods. All chronic toxicity on rainbow trout and fathead minnow in 2022 were categorized as no effect. Overall, chronic toxicity results have shown a low proportion of adverse responses over time within Dry Creek (LC_DCDS), with a frequency and magnitude of responses that was similar between 2019 to 2022 for most endpoints, and responses have been mostly limited to invertebrate endpoints.

Evaluation of Study Question #3 (potential effects to benthic invertebrate communities) indicated that in 2022 benthic invertebrate community total abundance and taxonomic richness were generally within regional normal ranges at Dry Creek LAEMP sampling areas. Benthic invertebrate communities in Dry Creek upstream of the DCWMS (LC_DC3) had endpoints outside of normal ranges (particularly %EPT, %E, and %C) most often. Areas located closest to the DCWMS discharge also tended to have lower %E than other areas and compared to regional and site-specific normal ranges. In 2022, benthic invertebrate communities located upstream and downstream of the mouth of Dry Creek in the Fording River differed from each other; however, community endpoints were generally within regional normal ranges and showed no temporal variation. The benthic invertebrate community within Grace Creek also had endpoints within regional normal ranges, as expected, based on current lack of mine-related influence. Over the 2019 to 2022 monitoring period there have been decreases in total abundance, EPT and E abundance, and the proportion of EPT and E at all areas along Dry Creek. The proportions of EPT and E measured at the mine-exposed areas were almost always significantly lower than those associated with the community in the Dry Creek reference area. Specifically, between 2021 and 2022 there was a decrease in total abundance (driven by a decrease in EPT) at all stations on Dry Creek as well as the reference station and the minimally impacted station. Currently, there are no water quality parameters that point to a cause of this decrease. Overall, %E appeared to be the endpoint most likely linked to a mine-related influence. Both the relative proportion and total abundance of Ephemeroptera decreased at all mine-exposed areas on Dry Creek over the 2019 to 2022 monitoring period. Temporal changes in Dry Creek benthic invertebrate community structure were associated with increasing aqueous concentrations of mine-related constituents including nickel, nitrate, and selenium. It is therefore likely that mining activities are contributing to changes in the benthic invertebrate communities of Dry Creek. Overall, most Dry Creek benthic invertebrate community endpoints were within normal ranges at most areas, but some changes are occurring over time that are likely related to effects of increasing concentrations of mine-related constituents.

Evaluation of Study Question #4 (benthic invertebrate tissue selenium) in most areas of Dry Creek downstream of the DCWMS, benthic invertebrate tissue selenium concentrations were the same in 2022 as 2021 and lower than 2020, although were occasionally higher than regional normal ranges and reference concentrations (most often in May). Downstream of the DCWMS the decreases in benthic invertebrate tissue selenium concentrations measured in 2022 and 2021 relative to earlier years (2020) were primarily attributable to changes in the water management of the DCWMS (i.e., bypass the sedimentation ponds throughout most of the year and limiting use of the DCWMS to one rather than two sedimentation ponds). Within the Fording River, benthic invertebrate tissue selenium concentrations upstream and downstream of Dry Creek were generally similar to each other and have remained unchanged in 2022 relative to earlier years (2019 to 2021), indicating that Dry Creek water quality has had limited or no influence on benthic invertebrate tissue selenium concentrations in area of the Fording River mainstem.

Evaluation of Study Question #5 (fish health and fish habitat) indicated the total number of nests counted in 2022 was similar to the number of redds counted in 2015 to 2017, but lower than in 2018 to 2021. There were fewer redds observed in 2022 than in 2021 in the UFR including in Dry Creek which may be associated with the cold early season water temperatures. Body condition and densities of age-1 and age-2+ fish were similar to previous years. The body condition of fish in Dry Creek has been consistently higher than the typical body condition of fish in the UFR population. Age-0 fish were shorter in 2022 than in previous years (2015 and 2016). This may be related to a decrease in water temperatures after the seasonal sedimentation pond by-pass was put into operation in 2020. Similar to previous years, in 2022, calcite concretion was not observed in Dry Creek during the Regional Calcite Monitoring Program. Calcite levels in Dry Creek continue to be below those expected to result in measurable biological effect, although there is a trend toward increased calcite presence.

The results from the Dry Creek LAEMP provide information that supports Teck's AMP (Teck 2021a), and Table 8.1 summarizes material presented in this report that is relevant to the AMP. The results from this study also supported the evaluation of biological triggers, which are intended to identify unexpected monitoring results that may lead to responses under the AMP response framework. Biological triggers were assessed at two mine-exposed Dry Creek areas, LC_DC1 and LC_DCDS (Appendix H). Results indicated that all the replicates were below the biological trigger values at LC_DC1 and LC_DCDS for %EPT (i.e., were indicative of a biological trigger). EPT at these areas has previously been flagged for further investigation in the RAEMP based on benthic invertebrate community results (Minnow 2020c). Approximately 15% of samples were higher than the biological trigger values at both LC_DCDS and LC_DC1 (2 of 15 and 3 of 20 samples, respectively), this is considerably lower than in 2021 where ~ 37% of samples were higher than trigger values at LC_DCDS and 27% at LC_DC1. Additional responses include development of a biokinetic model for selenium bioaccumulation and modifications to the DCWMS operations in an effort to decrease enhanced primary production and / or heterotrophic microbial activity in the sedimentation ponds that promotes the generation of organoselenium compounds. Monitoring of the benthic invertebrate selenium biological trigger at these areas (and other Dry Creek LAEMP areas) will continue under both the 2023 Dry Creek LAEMP and the RAEMP.

Table 8.1: Summary of Findings, Responses, and Adjustments Related to the Dry Creek LAEMP, 2022

Key Question(s)	Data Evaluation Process	Outcome(s)	Responses & Adjustments in 2022	EMC Engagement
Are aqueous concentrations of mine-related constituents elevated in relation to British Columbia Water Quality Guidelines (BCWQG) and EVWQP benchmarks, and are concentrations changing over time?	Comparison of water quality data to reference areas (LC_DCEF for Dry Creek areas, LC_FRUS for area LC_FRB) regional and site-specific normal ranges, comparison to BCWQGs, EVWQP benchmarks, updated effects concentrations (UEC), and proposed benchmarks. Statistical analysis of temporal trends over time and among years.	Statistical analyses were completed for Order Constituents, constituents with early warning triggers under the AMP, and constituents that have previously identified and tracked through SDM and/or AMP response frameworks (listed in Appendix A), detailed data interpretation was focused on nitrate, total cadmium, total selenium, and organoselenium species. Aqueous concentrations of nitrate, cadmium, selenium, and other constituents increased in 2022 in Dry Creek compared to baseline and 2021. In Dry Creek, total selenium exceeded the SPO (LC_DCDS), nitrate was above the updated effects concentrations, and nickel was above the proposed benchmarks in 2022. Aqueous organoselenium concentrations showed inconsistent changes in 2022.	Ongoing responses through AMP process (triggered in 2018). Implementation of Nitrate Compliance Action Plan, Modification of DCWMS, Implementation of the integrated effects assessment modelling investigation for nitrate, as well as other ongoing investigations into the effects of aqueous mine-related constituents on biota and selenium bioaccumulation.	2022 data delivered to EMC February 8 2023, Presentation with 2022 data delivered to EMC on March 15, 2023. Written input from EMC on March draft data package received March 30, 2023. 2022 LAEMP report delivered to EMC by April 30, 2023 2023 Study Design delivered by May 1, 2023
Is acute or chronic toxicity occurring from water collected at the outlet of the DCWMS (LC_SPDC) or within Dry Creek (LC_DCDS), and is toxicity changing over time?	Quarterly acute toxicity test at LC_SPDC. Comparison of chronic toxicity test results with results from reference area FR_UFR1 and pooled regional references, evaluation of frequency of test failures for acute toxicity tests, comparison to previous years' results.	No acute toxicity test failures at LC_SPDC in 2022. Generally, no change in frequency or severity of potential adverse responses in chronic toxicity testing at LC_DCDS except for algae.		
Are benthic invertebrate community endpoints within normal ranges derived based on samples collected at regional and local reference areas within the Elk River as part of the Regional Aquatic Effects Monitoring Program (RAEMP), and are the endpoints changing over time?	Comparison of benthic invertebrate community endpoints to regional and site-specific normal ranges, statistical evaluation of spatial and temporal trends relative to reference, correlation analysis.	Benthic invertebrate community total abundance and taxonomic richness were generally within regional and site-specific (where available) normal ranges at Dry Creek LAEMP sampling areas in 2022. Within Dry Creek, percent EPT was significantly lower in 2022 relative to 2021 with the exception of LC_DC3 which decreased in 2020 compared to 2019 but has not changed since. Benthic invertebrate communities in Dry Creek upstream of the DCWMS (LC_DC3) were most likely to have endpoints outside of normal ranges (particularly %EPT, %E, and %C).	Adjustments to DCWMS designed to mitigate water quality effects.	
How do selenium concentrations in benthic invertebrate tissue compare to normal ranges and BCWQG or EVWQP benchmarks, and are they changing over time?	Comparison of benthic invertebrate tissue selenium concentrations to regional normal range and EVWQP benchmarks, statistical evaluation of temporal and spatial trends relative to reference.	In Dry Creek mean benthic invertebrate tissue selenium concentrations were below the EVWQP benthic invertebrate benchmark (13 mg/kg dw) but concentrations in individual samples were occasionally above the EVWQP level 1 benchmarks for to juvenile fish, benthic invertebrates, and juvenile birds (11, 13, and 15 mg/kg dw, respectively) at stations closest to the DCWMS (LC_DCDS and LC_DC2). In the Fording River mean benthic invertebrate tissue selenium concentrations in 2022 were above the normal range in most sampling events.	Operational changes to DCWMS to minimize retention time in pond to reduce bioaccumulation potential.	
Are changes in fish and fish habitat (including instream flow and calcite index) occurring within Dry Creek as a result of mine operations?	Flow, temperature, DO, redd survey, and calcite data with previous years' sampling, guidelines, and/or literature (specifically optimal temperature, DO, and flow ranges for different WCT life stages).	There was no fish tissue Se sampling completed in 2022. Mean weekly water temperatures were outside of guidelines in 2022. Calcite concretion was not observed in Dry Creek; however, calcite presence continues to increase annually throughout Dry Creek. Age-0 fish were shorter in 2022 than when last sampled in 2015 and 2016. This may be related to a decreased growth rate associated with lower water temperatures after the seasonal sediment pond by-pass was put into operation in 2020.	The relationship between water temperature and age-0 WCT growth is being evaluated as part of the Population Monitoring program	

9 ACKNOWLEDGEMENTS

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Section 7: Fish and Fish Habitat was co-authored by Minnow Environmental Inc, Ecofish Research, and Branton Environmental Consulting. Sections 7.1, and subsections 7.2.2 and 7.2.4 were authored by Minnow Environmental Inc. Sections 7.2, and subsections 7.2.1 and 7.2.3 were authored by Ecofish research. Section 7.3 and subsections 7.3.1 to 7.3.5 were authored by Branton Environmental Consulting (MB).

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APPENDIX A
DATA ANALYSIS AND METHODS

APPENDIX A METHODS

A1 WATER QUALITY

A1.1 Overview

Permit 107517 requires that Teck prepare annual reports that summarize monitoring data collected during the preceding calendar year at all locations specified in the permit. Observed concentrations were compared to Compliance Limits and Site Performance Objectives (SPO) specified in Permit 107517, Elk Valley Water Quality Plan (EVWQP) benchmarks, and to BC water quality guidelines for protection of aquatic life (BCWQG). Data were also plotted to identify increasing or decreasing trends over time. Water samples were collected at all areas concurrently with biological sampling. Methods are described as follows.

A1.2 Sample Collection

One water sample per area was collected concurrently with biological monitoring and analysis included parameters stipulated in Permit 107517, as well as selenium speciation where applicable. Sample collection procedures were consistent with those outlined in the British Columbia Field Sampling Manual (Province of British Columbia 2013). *In situ* measurements of temperature, dissolved oxygen (DO), pH, and specific conductance were recorded concurrently with biological monitoring. The water quality meter used to collect *in situ* measurements was calibrated regularly and maintained according to manufacturer instructions.

Water samples were collected far enough upstream or downstream of confluences (tributaries, discharges) to avoid areas of incomplete mixing (lateral, vertical), and upstream from bridges or other structures to avoid the potential for associated contamination.

Water samples were collected by wading into a mid-channel area (unless it was not practical or safe to do so), moving from downstream to upstream, so as not to collect water downstream of disturbed substrates. Samples were collected from mid-depth by inverting sample bottles below the surface of the water. Samples were taken to shore prior to adding applicable preservatives. Water samples being analyzed for dissolved parameters were filtered in the field using a clean syringe affixed with a 0.45-μm membrane. Once filtered, the sample was preserved immediately in the manner specified by the analytical laboratory. Station location (i.e., GPS coordinates) and sample date, time, and identifier were recorded on field sheets. Samples were kept cold until analysis. Samples were shipped to the analytical laboratory daily or every other day to achieve compliance with recommended analytical hold times.

Quality assurance and quality control (QA/QC) samples were collected in the field concurrent with water samples. One water chemistry field split duplicate was collected at a minimum of

10 % of samples. Equipment and travel blanks represented approximately 10% of the water chemistry samples submitted to the analytical laboratory.

A1.3 Laboratory Analysis

Laboratory analytical methods were consistent with the British Columbia Environmental Laboratory Manual (Province of British Columbia 2016), where applicable.

Water samples were analyzed by ALS Environmental (ALS; Calgary, AB) for constituents consistent with Permit 107517 (i.e., conventional parameters, major ions, nutrients, and total and dissolved metals; Table A.1) using the following methods indicated in parentheses:

- total organic carbon (TOC) and dissolved organic carbon (DOC) (combustion method; American Public Health Association [APHA] 5310 for TOC);
- total suspended solids (TSS) and total dissolved solids (TDS; gravimetric method; APHA 2540 D and C for TSS and TDS, respectively);
- alkalinity (potentiometric titration; APHA 2320);
- turbidity (nephelometric method; APHA 2130 Turbidity);
- hardness, as $CaCO_3$ (by calculation; APHA 2340 B);
- total and dissolved metals, (collision cell inductively coupled plasma - mass spectrometry and inductively coupled plasma - optical emission spectrophotometry; APHA 3030 B&E/ Environmental Protection Agency [EPA] SW-846 6020A, and EPA 3005A/6010B, respectively);
- bromide, chloride, fluoride, and sulphate (ion chromatography; APHA 4110 B);
- ammonia, as N (fluorescence; J. Env. Monit., 2005, 7:37-42);
- nitrate and nitrite, as N (ion chromatography; EPA 300.0);
- total Kjeldahl nitrogen (TKN) (fluorescence; APHA 4500-NORG D.);
- orthophosphate and total phosphorus (colourimetric method; APHA 4500-P Phosphorus).

Table A.1: Water Quality Parameters Required Under Permit 107517[a]

Category	Parameters
Field Parameters	water temperature, specific conductance, dissolved oxygen (DO), pH
Conventional Parameters	specific conductance, total dissolved solids, total suspended solids, hardness, alkalinity, dissolved organic carbon, total organic carbon, and turbidity
Major Ions	bromide, fluoride, calcium, chloride, magnesium, potassium, sodium, and sulphate
Nutrients	ammonia, nitrate, nitrite, total Kjeldahl nitrogen (TKN), orthophosphate, and total phosphorus
Total and Dissolved Metals	aluminum, antimony, arsenic, barium, beryllium, bismuth, boron, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, mercury, molybdenum, nickel, selenium, silver, strontium, thallium, tin, titanium, uranium, vanadium, zinc

[a] Parameters are consistent with those outlined in Table 27, Appendix 3 of Permit 107517.

Water samples were analysed by Brooks Applied Labs (Bothell, Washington) for selenium speciation analysis using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS). Analytes included selenate, selenite, dimethylselenoxide, methylseleninic acid, methaneselenonic acid, selenocyanate, selenomethionine, selenosulphate, and unknown selenium species. Selenium species were first separated on an ion exchange column and then detected using ICP-CRC-MS. The applied method was optimized to provide interference free quantitation of individual selenium species at part-per-trillion (ppt) levels. Total and dissolved selenium analyses were also performed by Brooks Applied Labs using inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). Water samples were collected into borosilicate glass containers and preserved to a pH < 2 with nitric acid. An aliquot of each preserved sample was further digested with nitric and hydrochloric acids in a closed vessel (bomb) prior to analysis. The applied sample collection, preservation, digestion, and analytical procedures are designed to accurately quantify selenium in the presence of potential interferences (e.g., chloride and bromide) and regardless of the chemical form of selenium present in solution (e.g., ionic, particulate, or volatile molecular forms).

Laboratory QA/QC associated with routine water sampling was described by Teck in the annual water quality report submitted under Permit 107517 (Teck 2023).

A1.4 Data Analysis

Water quality data assessed included data for routine monitoring managed by Teck, and water samples collected at the biological monitoring stations concurrently with biological sampling. Water quality data were downloaded from Teck's EQuIS database, including:

- Nutrient concentrations (i.e., nitrate, nitrite, ammonia, total phosphorus, and orthophosphate); total and dissolved metals, selenium concentrations (i.e., total and dissolved selenium concentrations, and selenium speciation results including concentrations of selenate, selenite, dimethylselenoxide, methylseleninic acid, selenocyanate, selenomethionine, methaneselenonic acid, selenosulphate, and unknown selenium species);

- Concentrations of analytes with early warning triggers under the AMP (i.e., total dissolved solids, sulphate, total concentrations of antimony, barium, boron, lithium, manganese, molybdenum, nickel, selenium, uranium, and zinc, and dissolved concentrations of cadmium and cobalt);

- Concentrations of analytes with British Columbia Water Quality Guidelines (BCWQGs; BCMOECCS 2021a,b) and/or water quality benchmarks (Teck 2014, Golder 2017); and

- *In situ* water quality data (i.e., temperature, pH, specific conductivity, and DO).

Data extracted from Teck's EQuIS database were screened for text values and converted to a common unit (all metal concentrations were converted to mg/L, except for total and dissolved cadmium, dissolved cobalt, total nickel, total selenium which were stored as µg/L).

Aqueous concentrations of the Order Constituents (dissolved cadmium, nitrate, total selenium, sulphate, TDS, and nickel; Teck 2014) measured at each monitoring area for the calendar year (i.e., January to December 2022) were compared to applicable EVWQP level 1, level 2 and/or level 3 benchmarks, proposed benchmarks, or updated effects concentrations (Golder 2014a, 2014b; Teck 2014; Table C.1). Total selenium and total cadmium concentrations were also compared to SPOs outlined in Permit 107517; for designated locations (LC_UC, LC_DCDS, and LC_GRCK). Concentrations of the remaining constituents listed above were compared to applicable BCWQGs (BCMOECCS 2021a,b), if available. Order Constituents, constituents with early warning triggers under the AMP, constituents with an SPO, and nutrients (TKN, phosphorus and orthophosphate) were plotted using available data from 2012 to 2022 for each monitoring area individually relative to BCWQGs, EVWQP benchmarks, and proposed benchmarks, and updated effects concentrations (where applicable). Monthly mean concentrations of aqueous selenium species selenate, selenite, DMSeO, MeSe([V], and combined DMSeO and MeSe(IV) were plotted with benthic invertebrate tissue selenium concentrations for each Dry Creek area.

If replicate sample results were available for a given day, the Kaplan-Meier (K-M) mean of the replicates was used. Monthly and annual means were also calculated using the K-M method. Annual means of water quality data were computed by first taking a mean of results within months and then averaging monthly means. The K-M method is non-parametric and can accommodate multiple Laboratory Reporting Limits (LRLs). This method involved transforming the left censored (i.e., < value) dataset to a right censored (i.e., > value) dataset, and then using the K-M estimator (used to estimate the mean survival time in survival analysis) to estimate the mean. The calculation was conducted using the survfit() function in the *survival* package (Therneau 2017) in R software (R Core Team 2022).

A Principal Component Analysis (PCA) was used to condense water quality results for use in benthic invertebrate community correlation analysis. A PCA is a multivariate approach which transforms a group of ‘n’ variables into a smaller new set of uncorrelated variables (the principal components; PCs). The principal components are defined to be linear combinations of the original ‘n’ variables. A PCA was conducted using K-M mean water chemistry parameters calculated from 2019 to 2022 for the biological monitoring stations reported in the LAEMP except LC_FRUS. LC_FRUS is located on the Fording River upstream of Dry Creek and was excluded due to the large distance relative to Dry Creek. For each year, four seasons were defined: winter (December to March), early spring (May), spring (June) and summer (July). Each season had to have at least one recorded result. The yearly mean was calculated as the mean of the seasonal means. If there were missing data for any season, the entire year was excluded. A PCA cannot incorporate values below the LRL, therefore any parameters with >25% of the mean values below the LRL were excluded from the PCA. Kaplan-Meier mean values at the LRL were replaced with the LRL (Farnham et al. 2002). When there was more than one LRL for a given parameter, or detected values were below the highest LRL, these values were replaced with the highest LRL. The contribution of individual parameters to the first two principal components were quantified by calculating their correlation using a Pearson’s correlation coefficient. The PCA and correlation analyses were conducted in R (R Core Team 2022).

Quantitative tests for temporal trends in monthly mean concentrations of Order Constituents, constituents with early warning triggers under the AMP, and constituents that have previously been identified by SDM and/or AMP response frameworks were completed using available data from 2012 to 2022. The analyses were completed individually for each monitoring area using two different approaches: 1) a non-parametric seasonal Kendall test and 2) a censored regression Analysis of Variance (ANOVA) model with factors Year and Month.

The non-parametric seasonal Kendall test described by Hirsch et al. (1982) was conducted using scripts written in R software (R Core Team 2022). The seasonal Kendall test assesses temporal trends separately for each season (or month in this case) and combines the results for each season into an overall test for trend. The test is non-parametric and assesses whether there is a monotonic increasing or monotonic decreasing trend over time. The test was conducted by calculating the test statistic S_i which is equal to the sum of the number of increases and decreases from a time period t to all time periods after t for each observation in season i. The overall test statistic S is computed as the sum of S_i for all seasons. The significance of the observed S is determined by comparing it to a critical value of S (at the significance level α = 0.05) determined from the exact sampling distribution of S (calculated by determining all possible permutations and combinations of S based on the increases and decreases from the number of pairwise comparisons made; Hirsch et al. 1982). If more than

45 pairwise comparisons are made (equivalent to the number of pairwise comparisons for n = 10 in a single season), then the normal approximation is used to calculate a p-value and to assess significance (Hirsch et al. 1982). The standard normal deviate Z is calculated as:

$$Z = \begin{cases} \frac{S-1}{\sqrt{\sigma_S}} if\ S > 0 \\ 0 \quad if\ S = 0 \\ \frac{S+1}{\sqrt{\sigma_S}} if\ S < 0 \end{cases}$$

where $\sigma_S = \sum_{i=1}^{k} \frac{n_i(n_i-1)(2n_i+5)-\sum_{T_i} t_i(t_i-1)(2t_i+5)}{18}$ and n_i is the number of samples in month i, t_i is the number of tied values for each tied value T_i, and k is the number of seasons (Hirsch et al. 1982).

An estimate of the trend slope over time was estimated by computing the median of all slopes between data pairs within the same month (Helsel and Hirsch 2002). The slope was reported as a change in concentration per year and as a percentage change in concentration per year. The intercept of a line through the time series was estimated as the median intercept of all lines through each point with the estimated slope (Pohlert 2016). The trend analysis was only conducted with a minimum number of five pairwise comparisons, the minimum number required for all consecutive increases or decrease to be significant at α = 0.05.

An ANOVA model with factors Year and Month was also used to assess temporal changes in monthly mean concentrations for water quality parameters each area (reference and mine-exposed) from 2012 to 2022. Only years with at least six months and only areas with at least three years of data were included in the analysis. Replication at area LC_FRUS was too low from 2015 onwards for analysis of temporal effects using this test methodology. Because of the presence of LRLs for most parameters, a censored regression ANOVA model was used and a log-normal distribution of the response variable was assumed and fit with maximum likelihood estimation for each area. The significance of each term in the model was assessed using likelihood-ratio tests to determine if there is a significant change in log-likelihood with the addition of the term in the model. This tested for an overall difference among years (including the Month term in the model controlled for seasonal effects within a year). If the Year term was significant (α = 0.05) then post-hoc contrasts were conducted to test for pairwise differences among years with an α = 0.05 in a Tukey's Honestly Significant Difference (HSD) test which corrects for the number of comparisons. For each year, a percent magnitude of difference from the base year (i.e., first year with minimum number of months) was calculated as:

Magnitude of Difference = $(\bar{x}_i - \bar{x}_{2012})/\bar{x}_{2012}$ × 100%

where $\bar{x}_i$ is the observed mean for a given year and $\bar{x}_{2012}$ is the observed mean in 2012 (i.e., the base year; the first year with available data).

The analysis was completed twice, once evaluating the significance and direction of change in each endpoint at each area since the base year, and once comparing the 2022 annual mean against all historical means and the previous year (2021).

Complete results for statistical testing of Dry Creek LAEMP water quality data from 2012 to 2022 can be found in Tables C.2 and C.3 (i.e., all constituents evaluated). Time-series figures of water quality constituents plotted against BCWQGs, regional benchmarks and normal ranges (where applicable) were included in Appendix C for constituents that were not the focus on more detailed interpretation (i.e., did not meet the criteria listed above).

A2 ACUTE TOXICITY TESTING

Aqueous chronic toxicity was monitored, analyzed, and interpreted under the Annual Water Quality Monitoring Program (Teck 2023). Two acute toxicity tests were conducted on a quarterly basis as part of the Annual Water Quality Monitoring Program (as per Permit 107517):

- Single concentration acute toxicity test (96-hour LC50) using rainbow trout (*Oncorhynchus mykiss*); universal method: EPS 1/RM/9 (Environment Canada 2007a); and
- Single concentration acute toxicity test (48-hour LC50) using Daphnia spp.; universal method: EPS 1/RM/11 (Environment Canada 1996).

A3 CHRONIC TOXICITY TESTING

The following chronic toxicity tests were completed quarterly or semi-annually for water samples collected at mine-exposed and reference sites, as per the Permit 107517 Chronic Toxicity Program:

- 72-hour growth/inhibition test using a freshwater alga (*Pseudokirchneriella subcapitata*) conducted quarterly using method: EPS1/RM/25; Environment Canada 2007b;
- 7-day test of reproduction and survival using the cladoceran, *Ceriodaphnia dubia* conducted quarterly using method: EPS1/RM/21; Environment Canada 2007c;
- 28-day water-only test of growth and survival using the amphipod, *Hyalella azteca* conducted semi-annually (in Q2 and Q4) using methods adapted from USEPA (2000);
- 30-day early life stage toxicity tests using rainbow trout, *Oncorhynchus mykiss* conducted semi-annually (in Q2 and Q4) using method: EPS 1/RM/28- 1E; Environment Canada 1998; and
- 28-day early life stage toxicity test using fathead minnow, *Pimephales promelas* conducted semi-annually (in Q1 and Q3) using methods: EPA-712-C-96-121; USEPA 1998; and E1241-05; ASTM 2013.

Toxicity tests and associated QA/QC measures were completed by a qualified third-party biological testing laboratory. Water quality samples were collected at the same time to support evaluation of toxicity test results. Results were reported quarterly and summarized annually by Teck in accordance with Permit 107517 requirements.

A4 PERIPHYTON

A4.1 Overview

Periphyton consists of assemblages of algae, bacteria, moulds, and fungi that live on bottom substrates (e.g., rocks). Some are autotrophs and others are decomposers. Periphyton represents an important source of food for benthic invertebrates, both during the active growing season and the non-growing season when dead tissue and non-photosynthetic components of periphyton will continue to be a food source. Periphyton abundance is influenced by many environmental factors, such as photoperiod, light intensity, water temperature, aqueous nutrient concentrations, and water flow. Exposure of periphyton to mine-related constituents occurs primarily through the water column (Trapp et al. 1990).

A4.2 Sample Collection

The visual assessment of periphyton was completed once per monitoring area prior to initiation of other sampling activities to avoid disturbance of the periphyton cover within the sampling area, and was based on the categories stipulated by the CABIN protocol (Environment Canada 2012):

- Rocks not slippery, no obvious colour (<0.5 mm thick);
- Rocks slightly slippery, yellow-brown to light green colour (0.5 to 1 mm thick);
- Rocks have noticeable slippery feel, patches of thicker green to brown algae (1 to 5 mm thick);
- Rocks are very slippery, numerous clumps (5 to 20 mm thick); and
- Rocks mostly obscured by algae mat, may have long strands (>20 mm thick).

Photos were collected to document current conditions of periphyton conditions as well as presence of bryophytes.

A5 BENTHIC INVERTEBRATES

A5.1 Overview

Benthic invertebrates are an important component of the aquatic ecosystem of the Elk River watershed. In addition to having intrinsic value, benthic invertebrate communities in lotic habitats can be used as indicators of localized food availability (based on abundance) and habitat quality (based on richness, % Ephemeroptera, Plecoptera and Trichoptera [EPT], and % Ephemeroptera, as well as abundance of EPT and Ephemeroptera, Plecoptera, and Trichoptera individually) for receptors at higher trophic levels.

Benthic invertebrate monitoring consisted of community sampling and composite-taxa tissue chemistry sampling. Supporting measures, including habitat characterization, were also collected concurrent with benthic invertebrate samples, as described below.

Benthic invertebrate samples were collected to address study questions related to community structure, and invertebrate tissue accumulation of selenium. Consistent with other LAEMPs and the RAEMP (Minnow 2021a,b, Minnow and Lotic 2021), benthic invertebrate sampling was completed in September. Individual water samples for routine water quality analysis and selenium speciation analysis were collected from each monitoring area during the sampling event, concurrently with the collection of biological samples (Section A1.2).

A5.2 Community Structure

A5.2.1 Sample Collection

Benthic invertebrate community sampling followed the Canadian Aquatic Biomonitoring Network (CABIN) protocol, which involved a 3-minute travelling kick into a net with a triangular aperture measuring 36 cm per side and a mesh having 400-µm openings (Environment Canada 2012). During sampling, the field technician moved across the stream channel (from bank to bank, depending on stream depth and width) in an upstream direction. With the net being held immediately downstream of the technician’s feet, the detritus and invertebrates disturbed from the substrate were passively collected in the kick-net by the stream current. After three minutes of sampling time, the sampler returned to the stream bank with the sample. The kick-net was rinsed with water to move debris and invertebrates into the collection cup at the bottom of the net. The collection cup was then removed, and the contents poured into a labelled plastic jar and preserved to a concentration of 10% buffered formalin solution in ambient water.

A5.2.2 Laboratory Analysis

Benthic invertebrate community samples were sent to Cordillera Consulting (lead taxonomist Scott Finlayson), in Summerland BC, for sorting and taxonomic identification. Taxonomists at Cordillera have achieved certification for Group 1 (general Arthropods West), 2 (EPT East and West), and 3 (Chironomids West) benthic organisms in the Taxonomic Certification Program of the Society for Freshwater Science. Organisms were identified to the lowest practical level (LPL) (typically genus or species). Following identification, representative specimens of each new taxon were placed in separate vials and added to the reference collection for the project (initiated in 2012).

At the beginning of the sorting process, each sample was examined and evaluated for estimation of total invertebrate numbers. If the total number was estimated to be greater than 300, then the laboratory's sub-sampling protocol was followed. Sorting efficiency and sub-sampling accuracy and precision was quantified using methods specified by Environment Canada (2014).

A5.2.3 Supporting Measures

Consistent with the requirements of the CABIN sampling protocol, supporting habitat information (i.e., water velocity and depth, *in situ* water quality [temperature, DO, conductivity, pH], and substrate characteristics [Wolman 100-pebble count and substrate embeddedness]) were collected concurrently with benthic invertebrate community sampling (Environment Canada 2012). Periphyton scores were also ascribed to each biological monitoring area during September sampling, and according to CABIN sampling protocol (see Section A4; Environment Canada 2012).

A5.2.4 Data Analysis

Community endpoints that were evaluated included total abundance, taxonomic richness (to the lowest practicable level of taxonomy), and the abundances and proportional abundances (%) of major taxonomic groups, including the combined orders of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies), collectively known as EPT, Ephemeroptera alone, Plecoptera alone, Chironomidae, non-Chironomidae Diptera, and Oligochaeta. Community data were plotted to show changes over time relative to regional normal ranges[1] as well as site-specific normal ranges[2].

Only two Dry Creek areas (LC_DCDS and LC_DC1) were sampled prior to 2018, limiting statistical assessments of changes in benthic community endpoints over time to previous LAEMP cycles. Several statistical tests were employed in 2022 to address the temporal component of study question #3 (i.e., are benthic invertebrate endpoints changing over time?), to evaluate spatial differences in the benthic invertebrate community, and to also assess correlations between changes in benthic invertebrate community endpoints and potentially influencing variables (e.g., benthic invertebrate tissue selenium, water chemistry, substrate composition, calcite index, water quality variables, principal component axes from PCA analysis, *in situ* water quality measurements, and habitat variables). The regional and site-specific normal ranges used for evaluation of benthic invertebrate community are applicable only to data from September. As such, benthic invertebrate community data collected in September were the focus of data analyses and interpretation unless otherwise noted below. All statistics were conducted in R (R Core Team 2022).

Temporal changes in benthic invertebrate community endpoints from mine-exposed Dry Creek LAEMP areas relative to reference were assessed using a two-way ANOVA. This was completed for two data groupings: 1) mine-exposed areas of Dry Creek compared to the reference area LC_DCEF, and 2) the Fording River downstream (LC_FRB) and upstream (LC_FRUS; “reference” for the purposes of the analyses) of Dry Creek to evaluate the potential influence of Dry Creek on the benthic invertebrate community in the Fording River.

Benthic invertebrate community endpoints evaluated across years were those listed above. For each endpoint, an overall ANOVA model with factors Year, Area and Year × Area was fit. The ANOVA models and contrasts were conducted in R (R Core Team 2022) using customized scripts. The best transformation for each end point was chosen as the transformation for which a Shapiro-Wilk’s test on the residuals gave the highest p-value (i.e., most normally distributed). Significance of the spatial and temporal pairwise comparisons were assessed separately with an α of 0.1 in a Tukey’s HSD which corrects for the number of comparisons.

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[1] The reference normal range as presented in the RAEMP represents the 2.5th and 75th percentiles of the distribution of reference area data (pooled 2012 to 2019 data) reported in the 2017 to 2019 RAEMP report (Minnow 2020).

[2] Site-specific normal ranges represent the 2.5th and 97.5 percentile for a given area as determined by habitat predictors for a given site in relation to the complete set of Elk Valley monitoring areas. The site-specific normal ranges were estimated using regression modelling as presented in the RAEMP (Minnow 2020).

For each year, a magnitude of difference from the base year (i.e., first year with data) was calculated as:

$$\frac{Year_i - Base\ Year}{SDBase\ Year}$$

For each area, a magnitude of difference from the reference area was calculated as:

$$\frac{Exp - Ref}{SDRef}$$

Tables for visualizing the ANOVA results were prepared in Microsoft Excel, and plots were prepared in R (R Core Team 2022).

Benthic invertebrate community data were collected in multiple seasons (May, June September, and December) in 2021 and earlier. Data from all seasons were plotted over time to visualize temporal changes, and those collected in September were compared to relative to the regional normal (reference area) range and site-specific normal range. Plots were also prepared that display results from September of each year when replicated samples were collected (2019 to 2022) to show the spatial and temporal variability in benthic invertebrate endpoints for September only relative to the regional and site-specific normal ranges.

An assessment of whether changes in physical and chemical parameters may be related to variability in benthic invertebrate community structure was conducted for September from 2019 to 2022[3] data across all Dry Creek and Fording River areas (i.e., September data only from LC_DCEF, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DC1, LC_FRUS, LC_FRB, and LC_GRCK). Spearman Rank Correlations were conducted with benthic invertebrate community endpoints including total abundance, taxonomic richness, %EPT, %Ephemeroptera, %Plecoptera, %Trichoptera, %Oligochaeta, %Chironomidae, and %Non-Chironomidae Diptera, against a variety of physical and chemical parameters (including water quality variables, substrate characteristics, habitat variables, and *in situ* water quality measurements). For water chemistry parameters, annual mean concentrations were calculated for different seasons and then averaged across the year prior to the benthic sampling date (2019 to 2022). Seasons were defined based on changes in water chemistry across a year and designed to capture high and low concentration periods throughout a year. For each year, four seasons were defined: winter (December to March), early spring (May), spring (June) and summer (July). Each season had to have at least one record. Spearman rank correlation analysis is a non-parametric method that tests for monotonic

[3] September benthic invertebrate data were only collected at LC_DC1 and LC_DCDS prior to 2019, so integration of all Dry Creek sampling areas in correlation analysis is only possible from 2019 onwards.

increases, with significantly positive or negative correlation coefficients (rho) suggesting an increase or decrease, respectively, in the ranked data with increasing years. Significant correlations were assessed at alpha = 0.05, Bonferroni corrected for 47 independent comparisons (corrected alpha = 0.05/47 = 0.00106). Water chemistry parameters were also analyzed using PCA (see Section A1.4 for details) to combine multiple water quality variables into PC1 and PC2, which were also included in the correlation analysis. To ensure correlations were comparable among different parameters only complete records (i.e., a value for every water and benthic invertebrate community endpoint) were included in the analysis. Scatterplots of area-wise data indicating relationships and r-values for significantly correlated benthic invertebrate community endpoints were generated to visualize relationships.

A5.3 Benthic Invertebrate Tissue

A5.3.1 Sample Collection

Benthic invertebrate samples were collected for tissue chemistry using the kick and sweep sampling method described in Section A5.2.1, except that sample collection was not timed. Samples were a composite of representative benthic invertebrate taxa in each sampling area and were collected at a similar location to those for benthic invertebrate community sampling (Section A5.2). If more tissue samples than community samples were collected within a monitoring area, the benthic invertebrate tissue replicate samples were collected from locations spaced a minimum of 5 m apart within the area. For each sample, clean tweezers were used to pick invertebrates from the debris until about 1 to 2 g wet weight (ww) was obtained. A photo was taken of each sample, and the dominant taxa added to the sample was recorded. Once sufficient tissue was picked from the debris, the sample was placed in a labelled vial and stored in a cooler with ice packs until it could be transferred to a freezer at the end of the day. Tissue samples were stored in a freezer and shipped frozen.

All sampling events included collection of a composite sample of a variety of benthic invertebrate taxa (composite-taxa samples). These samples are useful for comparison to baseline data, and as an estimate of dietary selenium exposure for consumer organisms (e.g., fish, birds). Field crews paid particular attention to proportions of annelids in kick and sweep collections, as these organisms have been known to hyperaccumulate some metals resulting in potentially biased results (Golder 2021b). If annelids occurred at a proportion greater than 5% of the total sample biomass at a given replicate station, then these organisms were included in the composite sample (at that same proportion). Additionally in this scenario, a separate 'annelid only' sample was collected for analysis from the replicate station. If the proportion of annelids represented less than 5% of the sample biomass for a given station, these organisms were not included in the composite-taxa sample.

A5.3.2 Laboratory Analysis

Tissue samples were kept in a freezer until they were transported by courier in coolers with ice packs to TrichAnalytics Inc. in Saanichton, BC. Samples were dehydrated (<60°C) upon receipt by the laboratory and analyzed using Laser Ablation (ICP-MS). QA/QC measures associated with the tissue chemistry analyses included evaluation of laboratory duplicates and certified refence materials, discussed in greater detail in the Data Quality Review (DQR) in Appendix B. Results for selenium and other constituents were reported on a dry weight basis along with moisture content to allow conversion to wet weight values, as required (see Appendix J for laboratory reports).

A5.3.3 Data Analysis

Composite-taxa benthic invertebrate tissue selenium concentrations were plotted for all areas for 2018 to 2022 relative to:

- the normal (reference area) range (i.e., 1.41 mg/kg dw - 7.79 mg/kg dw), defined as the 2.5th and 97.5th percentiles of tissue selenium concentrations measured in reference areas that have not been disturbed by mining in historical studies completed in the Elk River watershed from 1996 to 2019 reported in the RAEMP (Minnow 2020);
- corresponding EVWQP effect benchmarks (outlined in Table F.1);
- shading indicating the Dry Creek Water Management System (DCWMS) operational status (DCWMS Operational, DCWMS Operational – Sedimentation Pond 1 only, Bypass Operational/Sedimentation Pond 1 Refilling, Bypass Operational/Dewatering, and Bypass Operational).

Benthic invertebrate tissue selenium data are available for temporal comparisons for all areas from December 2018 onwards, and for areas LC_DC1, LC_DCDS, LC_FRUS, and LC_FRB data are available prior to December 2018 as well.

Teck has developed a selenium speciation bioaccumulation tool to help predict and interpret bioaccumulation in areas with detectable organoselenium species (deBruyn and Luoma 2021). For every 2022 biological sampling event, predicted benthic invertebrate tissue selenium concentrations were generated from water quality data (specifically, selenium speciation data and sulphate concentrations) using this bioaccumulation tool and presented alongside field-measured tissue concentrations.

Changes in composite-taxa benthic invertebrate tissue selenium concentrations were compared among months in 2022 for all Dry Creek monitoring areas (including reference; LC_DCEF) and for the Fording River sampling areas (LC_FRUS and LC_FRB). Area differences were quantified using an ANOVA with factors Area and Month and their interaction. The factor Month included March, May, early June, late June, September, and December for each of the sampling areas. Response variables were $\log_{10}$ transformed where necessary to meet the assumption of normality, which was tested using a Shapiro-Wilks test and Q-Q normal plots of the model residuals. When this assumption could not be met, response variables were rank transformed. The significance of the main effects and interaction terms of the ANOVA were assessed using an α of 0.05, and the results of these determined which post-hoc comparisons were then conducted.

When the interaction between Area and Month was significant, it indicated that the differences among the areas changed across months. Post-hoc comparisons were then conducted to 1) test for differences among months for each area, and 2) test for differences among the exposed and reference areas in each month. When the Month was significant rather than the Area and the interaction between Month and Area, it indicated that there were no differences between the areas and monthly differences remained unchanged across areas and post-hoc comparisons were conducted to 1) test for differences between the first month of 2022 sampling and each subsequent month for all areas, and 2) test for differences between the exposed and reference areas in all months.

For all significant post-hoc temporal comparisons, an MOD between years was calculated as:

$$MOD_{Month} = \frac{MCT_{month2} - MCT_{month1}}{MCT_{month1}} \text{ x } 100\%$$

For significant spatial comparisons, a MOD was calculated between the exposed and reference areas within each month as:

$$MOD = \frac{MCT_{Exposed} - MCT_{Reference}}{MCT_{Reference}} \text{ x } 100\%$$

The MCT was calculated as a back-transformed estimated marginal mean. When the analysis was done on the rank-transformed scale, the observed effect size was estimated using median values instead of marginal means.

Spatial differences in tissue selenium concentrations among areas during each sampling event in 2022 were tested using an ANOVA. Prior to analysis, data were $\log_{10}$ transformed to better meet the assumptions of the analysis. When the overall ANOVA was significant ($\alpha = 0.05$), a Tukey's *post hoc* test was conducted for all pairwise comparisons. The ANOVA models and contrasts as well as graphical plots were conducted in R (R Core Team 2022) using customized scripts, with letters used to indicate which years differed significantly from one another.

A6 CALCITE

A6.1 Sample Collection

In addition to the CABIN requirements, measurements of calcite presence and concretion were conducted on 100 particles (pebbles) at each biological sampling location concurrent with (and using the same particles as) the 100-pebble count. Calcite presence (Cp) has historically been a binary assessment (i.e., presence [score = 1] or absence [score = 0]; Teck 2016, Lotic 2021). In 2021, an additional method for assessing calcite presence in lotic environments was included (Cp', Lotic 2021, Zathey 2021, Robinson et al. 2022) that scored the percent of the particle surface area covered by calcite as a decimal to the nearest 10th percentile (0.1, 0.2, 0.3, etc.; see Appendix I)[4]. The degree of concretion (Cc) was assessed by determining if the particle was removed with negligible resistance (not concreted; score = 0), noticeable resistance but removable (partially concreted; score = 1), or immovable (fully concreted; score = 2). If distinct particles were not visible due to heavy calcification, values of 1 (for presence) and 2 (for concretion) were recorded. If fines were encountered and calcite presence could not be visually confirmed, values of 0 (for presence) and 0 (for concretion) were recorded. If rocks were visible under fine material, the rock was selected for calcite measurements.

A6.2 Data Analysis

The results for the 100 particles was expressed as a Calcite Index (CI and CI') based on the following equations (Lotic 2021, Zathey et al. 2021a, Robinson et al. 2022):

$$CI = C_p + C_c \text{ or } CI = C_p{}' + C_c$$

Where:

$$CI \text{ or } CI' = Calcite\ Index^{5}$$

$$C_p = Calcite\ Presence\ Score = \frac{Number\ of\ particles\ with\ calcite}{100\ (binary\ score)}$$

$$C_p{}' = Calcite\ Presence\ Score = \frac{Number\ of\ particles\ with\ calcite}{100\ (proportional\ score)}$$

$$C_c = Calcite\ Concretion\ Score = \frac{Sum\ of\ particle\ concretion\ scores}{100}$$

[4] The new calcite assessment method was developed under the Regional Calcite Monitoring Program as a means to better describe the degree, extent, and trends of calcite deposition (Zathey 2021)

[5] CI refers to the binary assessment of Cp and CI' refers to the proportional assessment of Cp'.

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APPENDIX B
DATA QUALITY REVIEW

APPENDIX B DATA QUALITY REVIEW

B1 INTRODUCTION

B1.1 Introduction

A variety of factors can influence the physical, chemical, and biological measurements made in an environmental study and thus affect the accuracy and/or precision of the data. Depending on their magnitude, inaccuracy or imprecision have the potential to affect the reliability of conclusions made from data. Therefore, it is important to ensure that programs incorporate appropriate steps to control non-natural sources of data variability (i.e., minimize variability that does not reflect authentic spatial and temporal variability in the environment) and thus assure the quality of the data. Data quality as a concept is meaningful only when it relates to the intended use of the data. That is, one must know the context in which the data will be interpreted in order to establish a relevant basis for judging whether or not the data set is adequate. A Data Quality Review (DQR) involves the comparison of field and laboratory measurement performance to Data Quality Objectives (DQOs) established for a particular study, such as evaluation of Laboratory Reporting Limits (LRL), blank sample data, data precision (based on field and laboratory duplicate samples), and data accuracy (based on matrix spike recoveries and/or analysis of standards or certified reference materials). Trusted analytical laboratories certified by Canadian Association for Laboratory Accreditation (CALA) or the National Environmental Laboratory Accreditation Program (NELAP) with a rigorous internal quality assurance program were selected to ensure the highest possible data quality. DQOs were established *a priori* to reflect reasonable and achievable performance expectations (Table B.1). Programs involving many samples and analytes usually yield some results that exceed DQOs. This is particularly so for multi-element scans, as the analytical conditions are not necessarily optimal for every element included in the scan. Generally, scan results may be considered acceptable if no more than 20% of the parameters fail to meet DQOs. Overall, the intent of a DQR is not to reject any measurement that did not meet a DQO, but to ensure that any questionable data received more scrutiny to determine what effect, if any, this had on interpretation of results within the context of the project.

B1.2 Quality Control Samples

A DQR was conducted on all laboratory data collected as part of the 2022 Line Creek Local Aquatic Effects Monitoring Program (LAEMP). The objective of a DQR is to define the overall quality of the data presented in the report, and, by extension, the confidence with which the data can be used to derive conclusions.

A DQR involves the examination of analytical results associated with several types of Quality Control (QC) samples collected or prepared in the field and laboratory. General QC samples collected for this project include the following:

Blanks are samples of de-ionized water and/or appropriate reagent(s) that are handled and analyzed in the same way as regular samples. These samples will reflect any contamination of samples occurring in the field (in the case of field or travel blanks) or in the laboratory (in the case of laboratory or method blanks). Analyte concentrations should be below detection.

Laboratory Duplicates are replicate sub-samples created in the laboratory from randomly selected field samples which are sub-sampled and then analyzed independently using identical analytical methods. The laboratory duplicate sample results reflect any variability introduced during laboratory sample handling and analysis and thus provide a measure of laboratory precision.

Field Duplicates are samples collected from a randomly selected field station that are homogenized to the extent possible, split and analyzed separately in the laboratory. The duplicate samples are handled and analyzed in an identical manner in the laboratory.

Spike Recovery Samples are created in the laboratory by adding a known amount/concentration of a given analyte (or mixture of analytes) to a randomly selected test sample previously divided to create two sub-samples. The spiked and regular sub-samples are then analyzed in an identical manner. The spike recovery represents the difference between the measured spike amount (total amount in the spiked sample minus the amount in the original sample) relative to the known spike amount (as a percentage). Two types of spike recovery samples are commonly analyzed: spiked blanks (or blank spikes) are created using laboratory control materials whereas matrix spikes (MS) are created using field-collected samples and are sometimes further tested in duplicate (matrix spike duplicates, MSD). The analysis of spiked samples provides an indication of the accuracy of analytical results.

Certified Reference Materials (CRM) or Reference Materials (RM) are commercially prepared (or commercially homogenized) samples containing known chemical concentrations that are processed and analyzed along with batches of environmental samples. The sample results are then compared to the known concentrations to provide a measure of analytical accuracy. The results are reported as the percent of the known concentration that was recovered in the analysis.

Laboratory Control Samples are created in the laboratory to have a known analyte concentration in a matrix free of interferences, such as deionized water or reference sand. The sample results are compared to the target results to confirm that the analytical method is accurate in a purified reference sample. The results are reported as the percent of the known concentration that was recovered in the analysis.

Laboratory Sorting Duplicates are randomly selected grabs of the initially sorted benthic invertebrate community material. These samples are recounted and the number of invertebrates that were not recovered during the initial sort was determined. In order to reduce bias, recounting is conducted by an analyst uninvolved in the initial sample processing. This check is performed on 10% of samples and determines the accuracy through assessment of recovery (sorting) efficiency and quantifies any under-estimation of organism enumeration.

Taxonomic Quality Control Samples are a randomly selected portion of a benthic invertebrate community field sample to be assessed by the laboratory using an internal quality control audit. A blind re-enumeration and re-identification of random samples is performed by an analyst uninvolved in the original sample processing. This assessment quantifies taxonomic misidentification among laboratory analysts and ensures accurate organism identities are reported.

Laboratory Subsamples are community samples prepared by the laboratory to ensure that the fraction of the total sample examined was an accurate representation of the total number of organisms. By comparing the amount recovered between at least two sub-samples, one can assess the analytical precision. In addition, comparisons of the sub-samples from the whole community sample allows for an evaluation of sub-sampling accuracy.

B2 WATER CHEMISTRY

B2.1 Laboratory Reporting Limits

The analytical reports for water chemistry from ALS Environmental (ALS; CG2205677, CG2208042, CG2212407, CG2212551, CG2212647, and CG2216696; Appendix J) and Brooks Applied Labs (BAL; see laboratory reports 2205247, 2206435, 22209181, 2209283, and 2212302; Appendix J) were examined to assess LRLs relative to analyte concentrations and applicable guidelines (Tables B.2 and B.3). Water quality data from 2022 were entered directly into Teck's EQuIS database and thus were assessed as part of Teck's annual water quality reporting for 2022. The LRLs for water quality analytes were assessed relative to British Columbia Water Quality Guidelines (BCWQG; BCMOECCS 2021a,b) for the protection of freshwater aquatic life, Elk Valley Water Quality Plan (EVWQP) benchmarks, screening values for water quality (Teck 2014), and relevant site-specific benchmarks. Several analytes were reported at concentrations below the LRL in 100% of samples (Tables B.2 and B.3). For those analytes with one or more result(s) below the LRL, achieved LRLs were consistently lower than the BCWQG, EVWQP benchmarks, and screening values for water quality, if relevant guidelines exist. Therefore, the achieved LRLs were appropriate for this study.

B2.2 Laboratory and Field Blanks

A total of 115 method blank samples were analyzed in the ALS laboratory reports (Appendix J). Of the 532 reported method blank results, only one result for total aluminum had a concentration above detection and therefore did not meet the laboratory DQO (see laboratory report CG2212647 in Appendix J). However, this result was only marginally above detection and so does not suggest significant laboratory contamination. A total of 10 method blank samples were analyzed in the BAL laboratory reports (see laboratory reports in Appendix J). Of the 201 reported method blank results, four total selenium results had detectable concentrations (see laboratory report 2206435 in Appendix J). However, as sample results were greater than 10-times the value of the elevated results in the method blanks, the potential impact of the elevated selenium in the above four MB samples is minimal. As the overall number of DQO exceedances was low (ALS: 0.19%; BAL: 1.99%), the impacted results were considered to have a negligible impact on data interpretability, and laboratory precision was overall considered excellent.

Three field blank and two trip blank samples were submitted to ALS for water chemistry analyses to assess the potential for field sampling contamination (see laboratory reports CG2208042, CG2212647, and CG2216696 in Appendix J). The same DQOs that were used for laboratory blanks were also used for field blanks (i.e., concentrations should be below the

LRL). Of the 273 individual analyte results measured in the field blank samples, 18 results (6.59%) were above the LRL and so did not meet the laboratory DQO (Table B.4). Of the above detectable results, 14 were from one field blank sample indicating significant contamination associated with this sample (see laboratory report CG2216696 in Appendix J). Of the 145 individual analyte results measured in the trip blank samples, only one (0.69% of results) were above the LRL and so did not meet the laboratory DQO (Table B.4; see laboratory report CG2208042 in Appendix J). As relatively few field and trip blank results did not meet the laboratory DQO (6.59% and 0.69%, respectively), potential field and laboratory contamination was considered low and laboratory precision was overall considered good.

Two field blank samples were submitted to BAL for aqueous selenium speciation analyses to assess potential field sampling contamination. Of the 22 analytes results measured in the field blank samples, only one result was above detection (dissolved selenium; Table B.5, see laboratory report 2209283 in Appendix J). While this result only represents 4.55% of all field blank results from BAL, this potential field contamination will be considered during data interpretation. Overall, potential field contamination was considered low and laboratory precision was considered good.

B2.3 Data Precision

A total of 11 laboratory duplicate samples were used to evaluate precision within the ALS laboratory reports (Appendix J), and all 534 individual analyte results met the laboratory DQO. A total of eight laboratory duplicate samples were used to evaluate precision within the BAL laboratory reports (Appendix J), and all 32 individual analyte results met the laboratory DQO. Therefore, ALS laboratory and BAL analytical precision were considered excellent. Overall, water chemistry data was considered to have good field precision and reproducibility.

Three sets of field duplicate samples were collected to assess field sampling precision for water chemistry analyzed by ALS (Table B.6). Several relative percent differences (RPDs) could not be calculated as both analyte concentrations were below the LRL. Of the 205 RPDs that could be calculated, 11 RPDs were greater than 30% (5.37% of RPDs), including one RPD each for alkalinity (as $CaCO_3$ and as CO_3), oxidation-reduction potential (ORP), turbidity, Total Kjeldahl Nitrogen (TKN), total organic carbon (TOC), total and dissolved aluminum, total titanium, dissolved cadmium, and dissolved copper (Table B.6). Of the 11 RPDs greater than 30%, two resulted from one analyte concentration in the pair being below the LRL, where greater variability is expected (TOC and dissolved aluminum). Since only 5.37% of calculable RPDs exceeded the DQO, water chemistry data was considered to have high field precision and reproducibility.

Three sets of field duplicate samples were collected to assess field sampling precision for water chemistry analyzed by BAL (Table B.7). Several RPDs could not be calculated as both analyte concentrations were below the LRL. Of the 14 RPDs that could be calculated, two were greater than 30% (two RPDs for methylseleninic acid; 14.3% of RPDs, Table B.7). One of the above RPDs greater than 30% resulted from one analyte concentration in the pair being near the LRL, where greater variability is expected. While only 14.3% of all calculable RPDs exceeded the DQO, 66.7% of RPDs for methylseleninic acid exceeded the DQO and this variability in field sampling will be taken into account during data interpretation.

B2.4 Data Accuracy

Data accuracy within the ALS laboratory reports was evaluated based on results of 129 LCS and 11 MS samples (Appendix J). All 542 LCS results and 470 MS results met the laboratory DQO. Recovery could not be calculated in numerous MS samples as background levels were greater than or equal to one-times spike levels. However, as several other QC tests were successful and do not imply uncertainties as to ALS data accuracy, we are not concerned by MS recovery not being calculable in several MS samples. Overall, ALS laboratory analytical precision and accuracy was considered excellent.

Data accuracy within the BAL laboratory reports was evaluated based on results of 21 LCS, eight MS samples, eight MSD samples, and 16 RM samples (Appendix J). All 41 LCS results, 17 MS results, 17 MSD results, and 16 RM results met the laboratory DQO. Therefore, BAL laboratory analytical precision and accuracy was considered excellent.

B2.5 Hold Times

The recommended hold times for pH and ORP analyses (0.25 hrs) were exceeded in all samples collected. As *in situ* pH and ORP were used for data interpretation, therefor, these pH and ORP exceedances had no impact on data interpretability. The preparation hold times for nitrate were exceed by two days in one sample and seven days in another sample (see laboratory reports CG2208042 and CG2212657 respectively; Appendix J). Nitrate hold time exceedances are not expected to impact conclusions that can be derived from the data but will still be taken into consideration during data interpretation. All hold times were met for selenium speciation samples submitted to BAL. Overall, few samples exceeded hold times and thus hold time exceedances are expected to have little effect on the interpretation of results.

B2.6 Other Concerns

One total selenium and one dissolved selenium sample arrived at BAL in broken containers (see laboratory report 2212302 in Appendix J). Most of the total selenium sample volume was lost, but enough volume was remaining to undergo an acid digest and subsequent analysis for selenium. Since it is unknown if contamination occurred during shipment or storage, the total recoverable selenium result for 2212302-16 is qualified as an estimate. All of the dissolved selenium sample was lost from the broken container. However, volume from the corresponding field filtered selenium speciation fraction (laboratory ID 2212302-06) was poured off into a new container to support the dissolved selenium analysis. This new dissolved selenium fraction (2212302-17) was preserved (pH < 2) upon receipt at BAL.

B2.7 Data Quality Statement

Water chemistry data collected for the 2022 LCO Dry Creek LAEMP were of acceptable quality as characterized by good detectability, appropriate LRLs, negligible analyte concentrations in method blanks, minimal field contamination, excellent laboratory precision and accuracy, few hold time exceedances, and good field precision and reproducibility, with the exception for methylseleninic acid. Therefore, the associated data can be used with a high level of confidence in the derivation of conclusions.

B3 BENTHIC INVERTEBRATE COMMUNITY

B3.1 Sub-Sampling Proportions, Precision, and Accuracy

The analytical reports from Cordillera Consulting Inc. for benthic invertebrate community taxonomy (see Appendix J for laboratory reports) were examined to assess sub-sampling accuracy. For all samples, Canadian Aquatic Biomonitoring Network (CABIN) protocols were followed for sub-sampling (i.e., identification of a minimum 300 invertebrates), with a minimum of 5% of a sample being assessed. Of the 165 benthic invertebrate community samples analyzed, 36 were subsampled. The proportion of sub-sampled material ranged from 5 to 50% of the total sample material (Table B.8). Both the precision and accuracy of the sub-samples randomly chosen for sub-sample assessment (n = 2) met the DQO in all sub-samples (Table B.9). Thus, the precision and accuracy for sub-sampling of the benthic invertebrate community samples was considered excellent.

B3.2 Organism Sorting Efficiency

To measure the effectiveness of the sorters, at least 10% of samples were selected at random for resorting analysis by a different sorter. Sorting efficiency (i.e., percent recovery) of benthic invertebrate samples was excellent, achieving 98.8% for the five community structure samples evaluated (Table B.10). As recovery in quality control samples was above the laboratory's DQO (95%), organism sorting efficiency was considered excellent.

B3.3 Taxonomic Identification Accuracy

Cordillera Consulting Inc. performed an internal audit of taxonomic identification for at least 10% of all community structure samples (n = 4; Table B.11). The analysts reported total identification error rate (TIR) of 0%, percent difference in enumeration (PDE) of 0 to 0.397%, percent taxonomic disagreement (PTD) of 0.295 to 1.46%, and Bray Curtis Dissimilarity Index (BCDI, a measure of the differences in identifications between different analysts) of 0.003 to 0.013 (Table B.11). The laboratory DQO was based on TIR as per CABIN laboratory methods (< 5% TIR; Environment Canada 2014). As TIR was below 5% for all samples examined, the taxonomic accuracy of the analysis was considered excellent.

B3.4 Data Quality Statement

Benthic community data collected for the 2022 LCO Dry Creek LAEMP were of good quality as characterized by excellent sorting efficiency, subsampling precision and accuracy, and taxonomic identification accuracy. Therefore, the associated data can be used with a high level of confidence in the derivation of conclusions.

B4 BENTHIC INVERTEBRATE TISSUE CHEMISTRY

B4.1 Laboratory Reporting Limits

Analytical reports of benthic invertebrate tissue metal concentrations from TrichAnalytics (see laboratory reports in Appendix J) were examined to provide an inventory of analyte results below the LRL and to compare the LRLs for these analytes to available benchmarks (Table B.12). Most analyte concentrations were consistently above detection limits, except for antimony, arsenic, boron, mercury, and vanadium (2.08 to 31.3% of results). However, all results for selenium were above detection and selenium is the only analyte with an applicable guideline. Therefore, the achieved LRLs were appropriate for this study.

B4.2 Data Accuracy and Precision

Data accuracy and precision were evaluated based on the analysis of 12 CRM samples. Of the 260 analyte results, 12 titanium results could not be calculated as the certified concentrations were too close to the reportable detection limit (see laboratory reports in Appendix J). All 348 calculable CRM results met the laboratory DQO; therefore, laboratory accuracy and precision as determined by CRM analyses was considered excellent.

Laboratory precision was also evaluated by laboratory duplicate analysis of 14 benthic invertebrate tissue samples (see laboratory reports in Appendix J). Of the 420 analyte results, 59 results that were not calculated due to values below the detection limit. All 502 calculable duplicate results met the laboratory DQO; therefore, laboratory precision as determined by duplicate analyses was considered excellent.

B4.3 Data Quality Statement

Benthic invertebrate tissue data collected for the 2022 LCO Dry Creek LAEMP were of good quality as characterized by appropriate LRLs and excellent laboratory precision and accuracy. Therefore, the associated data can be used with a good level of confidence in the derivation of conclusions for this study.

B5 DATA QUALITY REVIEW SUMMARY

Overall, the quality of the data collected for this project was considered acceptable for the derivation of conclusions associated with the objectives of the 2022 LCO Dry Creek LAEMP.

B6 REFERENCES

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Table B.1: Laboratory Data Quality Objectives for the LCO Dry Creek LAEMP, 2022

Quality Control Measure	Quality Control Sample Type/Check	Study Component			
		Water Chemistry	Selenium Speciation	Benthic Invertebrate Community	Benthic Invertebrate Tissue Chemistry
		ALS Environmental	Brooks Applied Labs	Cordillera Consulting	TrichAnalytics
Analytical Laboratory LRLs	Comparison of actual LRL versus target LRL	LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and screening values	LRL for each parameter should be at least as low as applicable guidelines, benchmarks, and screening values	-	LRL for each parameter should be at least as low as applicable guidelines and benchmarks
Blank Analysis	Field, Trip, or Laboratory Blank	Concentrations measured in blank samples should be < LRL	Concentrations measured in blank samples should be < LRL	-	-
Laboratory Precision	Laboratory Duplicates	< 4% (pH) <10% (conductivity) ≤15% RPD or <2x LRL (ORP, turbidity) ≤20% RPD or <2x LRL (all remaining analytes)	≤25% RPD (selenium species) ≤20% RPD (total selenium)	-	≤60% RPD (calcium and strontium) ≤40% RPD (all remaining analytes)
	Organism Sorting Efficiency	-	-	≥95%	-
	Organism Sub-Sampling Precision and Accuracy	-	-	<20% between subsamples	-
Accuracy	Recovery of Blank Spike	-	75 to 125% (methylseleninic acid, selenate, selenite, selenocyanate, selenomethionine, total selenium)	-	-
	Recovery of Matrix Spike	70 to 130% (TKN, orthophosphate, phosphorus, TOC, DOC, total and dissolved metals) 75 to 125% (ammonia, bromide, chloride, fluoride, nitrate, nitrite, sulphate)	75 to 125% (selenate, selenite, selenocyanate, selenomethionine, total selenium)	-	-
	Matrix Spike Duplicate	-	75 to 125% (selenate, selenite, selenocyanate, selenomethionine, total selenium)	-	-
	Recovery of Certified Reference Material	-	75 to 125% (total selenium)	-	60 to 140% (antimony, barium, boron, silver, tin, titanium) 90 to 110% (selenium) 70 to 130% (all remaining analytes)
	Laboratory Control Sample	75 to 125% (TKN) 80 to 120% (orthophosphate, phosphorus, DOC, TOC, total and dissolved metals) 85 to 115% (acidity, alkalinity, ammonia, bromide, TDS, TSS, turbidity) 90 to 110% (conductivity, chloride, fluoride, nitrate, nitrite, sulphate) 98.6-101% (pH), 95.4 to 104% (ORP)	-	-	-
	Taxonomic Accuracy	-	-	<5% TIR	-

Notes: LRL = Laboratory Reporting Limit; "-" = not applicable; < = less than; ≤ = less than or equal to; % = percent; RPD = Relative Percent Difference; ORP = oxidation-reduction potential; TKN = Total Kjeldahl Nitrogen; TOC = total organic carbon; DOC = dissolved organic carbon; TSS = total suspended solids; TDS = total dissolved solids; mg/kg dw = milligrams per kilogram dry weight; TIR = total identification error rate.

Table B.2: Evaluation of Water Chemistry Laboratory Reporting Limits, LCO Dry Creek LAEMP, 2022

Parameter	Units	BC WQG[a]		EVWQP Level 1 Benchmarks/ Relevant Screening Values[b]	Range of LRLs	No. Sample Results < LRL	No. LRLs > Guideline[c]
		Long-term	Short-term				
Physical Tests							
Total Suspended Solids	mg/L	-	-	-	1	4 (36.4%)	-
Acidity (as $CaCO_3$)	mg/L	-	-	-	2	11 (100%)	-
Alkalinity, Carbonate (as CO_3)	mg/L	-	-	-	1	2 (18.2%)	-
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	-	-	-	1	2 (18.2%)	-
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	-	-	-	1	11 (100%)	-
Alkalinity, Hydroxide (as OH)	mg/L	-	-	-	1	11 (100%)	-
Anions And Nutrients							
Bromide (Br)	mg/L	-	-	-	0.1	11 (100%)	-
Ammonia, Total (as N)[c]	mg/L	0.777	4.04	-	0.005	11 (100%)	0
Nitrite (as N)[d]	mg/L	0.02	0.06	-	0.001	5 (45.5%)	0
Total Kjeldahl Nitrogen	mg/L	-	-	-	0.5	5 (45.5%)	-
Orthophosphate	mg/L	-	-	-	0.001	5 (45.5%)	-
Phosphorus (P)-Total	mg/L	-	-	-	0.002	2 (18.2%)	-
Dissolved Organic Carbon	mg/L	-	-	-	0.5	4 (36.4%)	-
Total Organic Carbon	mg/L	-	-	-	0.5	5 (45.5%)	-
Total Metals							
Aluminum	mg/L	-	-	-	0.003	1 (9.09%)	-
Antimony	mg/L	0.009	-	-	0.0001	6 (54.5%)	0
Arsenic	mg/L	-	0.005	-	0.0001	4 (36.4%)	0
Beryllium	µg/L	0.00013	-	-	0.02	11 (100%)	0
Bismuth	mg/L	-	-	-	0.00005	11 (100%)	-
Boron	mg/L	1.2	-	-	0.01	5 (45.5%)	0
Cadmium	µg/L	-	-	-	0.01	1 (9.09%)	-
Cobalt	µg/L	0.004	0.11	-	0.1	9 (81.8%)	0
Copper	mg/L	-	-	-	0.0005	9 (81.8%)	-
Iron	mg/L	-	1	-	0.01	3 (27.3%)	-
Lead	mg/L	0.0082	0.003	-	0.0001	8 (72.7%)	0
Manganese	mg/L	0.7678	0.8155	-	0.0001	1 (9.09%)	0
Nickel	mg/L	0.025	-	-	0.0005	7 (63.6%)	0
Silver	mg/L	0.00005	0.0001	-	0.00001	9 (81.8%)	0
Thallium	mg/L	0.0008	-	-	0.00001	11 (100%)	0
Tin	mg/L	-	-	-	0.0001	11 (100%)	-
Titanium	mg/L	-	-	-	0.0003	8 (72.7%)	-
Vanadium	mg/L	-	-	-	0.0005	6 (54.5%)	-
Zinc	mg/L	0.0075	0.033	-	0.003	9 (81.8%)	0
Dissolved Metals							
Aluminum	mg/L	0.05	0.1	-	0.001	9 (81.8%)	0
Antimony	mg/L	-	-	-	0.0001	6 (54.5%)	-
Arsenic	mg/L	-	-	-	0.0001	8 (72.7%)	-
Beryllium	µg/L	-	-	-	0.02	11 (100%)	-
Bismuth	mg/L	-	-	-	0.0001	11 (100%)	-
Boron	mg/L	-	-	-	0.01	6 (54.5%)	-
Chromium	mg/L	-	-	-	0.0001	2 (18.2%)	-
Cobalt	µg/L	-	-	-	0.1	11 (100%)	-
Copper	mg/L	-	-	-	0.0002	8 (72.7%)	-
Iron	mg/L	-	0.35	-	0.01	10 (90.9%)	-
Lead	mg/L	-	-	-	0.0001	11 (100%)	-
Manganese	mg/L	-	-	-	0.0001	1 (9.09%)	-
Mercury	µg/L	-	-	-	0.000005	11 (100%)	-
Nickel	mg/L	-	-	0.00125	0.0005	7 (63.6%)	0
Silver	mg/L	-	-	-	0.00001	11 (100%)	-
Thallium	mg/L	-	-	-	0.00001	11 (100%)	-
Tin	mg/L	-	-	-	0.0001	11 (100%)	-
Titanium	mg/L	-	-	-	0.0003	11 (100%)	-
Vanadium	mg/L	-	-	-	0.0005	10 (90.9%)	-
Zinc	mg/L	-	-	-	0.001	7 (63.6%)	-

Notes: Only analytes with at least one result < Laboratory Reporting Limit (LRL) or LRL were above guidelines were displayed. The total number of samples in 2022 (n) was 11. EVWQP = Elk Valley Water Quality Plan; "-" = no applicable guideline exists.

[a] British Columbia Water Quality Guidelines for the protection of Aquatic Life (BCMOECCS 2021a,b)

[b] Where more than one EVWQP Level 1 Benchmark or screening value was applicable, the most conservative (lowest) value was used.

[c] Guideline is the most conservative (lowest), based on estimates of a maximum temperature of 20°C and a minimum pH of 9.0.

[d] Minimum water quality guidelines for Nitrite (as N) reported in BCMOECCS (2021a) for chloride concentrations < 2 mg/L.

Table B.3: Evaluation of Selenium Speciation Water Chemistry Laboratory Reporting Limits, LCO Dry Creek LAEMP, 2022

Parameter	Units	Range of LRLs	No. Sample Results < LRL
DMSeO - Dimethylselenoxide	mg/L	0.01	11 (100%)
MeSe(IV) - Methylseleninic Acid	mg/L	0.01	9 (81.8%)
MeSe(VI) - Methaneselenonic Acid	mg/L	0.01	11 (100%)
Se(IV) - Selenite	mg/L	0.01 to 0.02	2 (18.2%)
SeCN - Selenocyanate	mg/L	0.01	11 (100%)
SeMe - Selenomethionine	mg/L	0.01	11 (100%)
Selenosulfate	mg/L	0.01	11 (100%)
Selenium Unknown	mg/L	0.01	11 (100%)

Notes: Only analytes with at least one result < Laboratory Reporting Limit (LRL) or LRL were above guidelines were displayed. No applicable guidelines exist for any analyte for which at least one result was below the LRL. The total number of samples in 2022 (n) was 11.

Table B.4: Field Blank and Trip Blank Evaluation for Water Chemistry Analyses, LCO Dry Creek LAEMP, 2022

Parameter	Units	No. Field Blank Results < LRL	No. Trip Blank Results < LRL
Physical Tests			
Conductivity	µS/cm	2 (66.7%)	2 (100%)
Hardness (as $CaCO_3$)	mg/L	3 (100%)	2 (100%)
Hardness - Dissolved (as $CaCO_3$)	mg/L	3 (100%)	2 (100%)
Turbidity	NTU	3 (100%)	2 (100%)
Total Suspended Solids	mg/L	3 (100%)	2 (100%)
Total Dissolved Solids	mg/L	3 (100%)	2 (100%)
Acidity (as $CaCO_3$)	mg/L	3 (100%)	2 (100%)
Alkalinity, Bicarbonate (as HCO_3)	mg/L	2 (66.7%)	2 (100%)
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	2 (66.7%)	2 (100%)
Alkalinity, Carbonate (as CO_3)	mg/L	3 (100%)	2 (100%)
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	3 (100%)	2 (100%)
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	3 (100%)	2 (100%)
Alkalinity, Hydroxide (as OH)	mg/L	3 (100%)	2 (100%)
Alkalinity, Total (as $CaCO_3$)	mg/L	2 (66.7%)	2 (100%)
Anions And Nutrients			
Bromide	mg/L	3 (100%)	2 (100%)
Chloride	mg/L	3 (100%)	2 (100%)
Fluoride	mg/L	3 (100%)	2 (100%)
Ammonia, Total (as N)	mg/L	3 (100%)	1 (50.0%)
Nitrate (as N)	mg/L	3 (100%)	2 (100%)
Nitrite (as N)	mg/L	3 (100%)	2 (100%)
Total Kjeldahl Nitrogen	mg/L	3 (100%)	2 (100%)
Orthophosphate	mg/L	3 (100%)	2 (100%)
Total Phosphorus	mg/L	3 (100%)	2 (100%)
Sulphate	mg/L	3 (100%)	2 (100%)
Organic / Inorganic Carbon			
Dissolved Organic Carbon	mg/L	3 (100%)	1 (100%)
Total Organic Carbon	mg/L	3 (100%)	2 (100%)
Total Metals			
Aluminum	mg/L	3 (100%)	2 (100%)
Antimony	mg/L	3 (100%)	2 (100%)
Arsenic	mg/L	3 (100%)	2 (100%)
Barium	mg/L	2 (66.7%)	2 (100%)
Beryllium	µg/L	3 (100%)	NA
Bismuth	mg/L	3 (100%)	2 (100%)
Boron	mg/L	3 (100%)	2 (100%)
Cadmium	µg/L	3 (100%)	2 (100%)
Calcium	mg/L	2 (66.7%)	2 (100%)
Chromium	mg/L	3 (100%)	2 (100%)
Cobalt	µg/L	3 (100%)	NA
Copper	mg/L	2 (66.7%)	2 (100%)
Iron	mg/L	3 (100%)	2 (100%)
Lead	mg/L	3 (100%)	2 (100%)
Lithium	mg/L	3 (100%)	2 (100%)
Magnesium	mg/L	2 (66.7%)	2 (100%)
Manganese	mg/L	2 (66.7%)	2 (100%)
Mercury	µg/L	3 (100%)	NA
Molybdenum	mg/L	3 (100%)	2 (100%)
Nickel	mg/L	3 (100%)	2 (100%)
Potassium	mg/L	3 (100%)	2 (100%)
Selenium	µg/L	3 (100%)	NA
Silicon	mg/L	2 (66.7%)	2 (100%)
Silver	mg/L	3 (100%)	2 (100%)
Sodium	mg/L	2 (66.7%)	2 (100%)
Strontium	mg/L	2 (66.7%)	2 (100%)
Sulphur	mg/L	3 (100%)	2 (100%)
Thallium	mg/L	3 (100%)	2 (100%)
Tin	mg/L	3 (100%)	2 (100%)
Titanium	mg/L	3 (100%)	2 (100%)
Uranium	mg/L	3 (100%)	2 (100%)
Vanadium	mg/L	3 (100%)	2 (100%)
Zinc	mg/L	3 (100%)	2 (100%)
Dissolved Metals			
Aluminum	mg/L	3 (100%)	1 (100%)
Antimony	mg/L	3 (100%)	1 (100%)
Arsenic	mg/L	3 (100%)	1 (100%)
Barium	mg/L	2 (66.7%)	1 (100%)
Beryllium	µg/L	3 (100%)	1 (100%)
Bismuth	mg/L	3 (100%)	1 (100%)
Boron	mg/L	3 (100%)	1 (100%)
Cadmium	µg/L	3 (100%)	NA
Calcium	mg/L	3 (100%)	2 (100%)
Chromium	mg/L	3 (100%)	1 (100%)
Cobalt	µg/L	3 (100%)	1 (100%)
Copper	mg/L	2 (66.7%)	1 (100%)
Iron	mg/L	3 (100%)	1 (100%)
Lead	mg/L	3 (100%)	1 (100%)
Lithium	mg/L	3 (100%)	1 (100%)
Magnesium	mg/L	2 (66.7%)	2 (100%)
Manganese	mg/L	2 (66.7%)	1 (100%)
Mercury	µg/L	3 (100%)	1 (100%)
Molybdenum	mg/L	3 (100%)	1 (100%)
Nickel	mg/L	3 (100%)	1 (100%)
Potassium	mg/L	3 (100%)	2 (100%)
Selenium	µg/L	3 (100%)	1 (100%)
Silicon	mg/L	3 (100%)	1 (100%)
Silver	mg/L	3 (100%)	1 (100%)
Sodium	mg/L	2 (66.7%)	2 (100%)
Strontium	mg/L	3 (100%)	1 (100%)
Sulphur	mg/L	3 (100%)	1 (100%)
Thallium	mg/L	3 (100%)	1 (100%)
Tin	mg/L	2 (66.7%)	1 (100%)
Titanium	mg/L	3 (100%)	1 (100%)
Uranium	mg/L	3 (100%)	1 (100%)
Vanadium	mg/L	3 (100%)	1 (100%)
Zinc	mg/L	3 (100%)	1 (100%)

Note: LRL = Laboratory Reporting Limit.

Table B.5: Field Blank Evaluation for Selenium Speciation Analyses, LCO Dry Creek LAEMP, 2022

Parameter	Units	Range of LRLs	No. Field Blank Results > LRL
Dissolved Selenium	µg/L	0.165 to 0.198	1 (50%)

Notes: LRL = Laboratory Reporting Limit. Two field blank samples were collected in 2022. Only analytes with at least one blank results > LRL were displayed.

Table B.6: Comparisons of Water Chemistry Duplicate Samples, LCO Dry Creek LAEMP, 2022

Parameter	Unit	LC_FRUS_WS_LAEMP_DRY_2022-06_N	LC_CC1_WS_LAEMP_DRY_2022-06_N	RPD (%)	LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_CC1_WS_LAEMP_DRY_2022-09_N	RPD (%)	LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_CC1_WS_LAEMP_DRY_2022-11_NP	RPD (%)
Physical Tests										
Acidity (as $CaCO_3$)	mg/L	<2.0	<2.0	-	<2.0	<2.0	-	<2.0	<2.0	-
Alkalinity (as $CaCO_3$)	mg/L	155	155	0	167	175	4.68	211	211	0
Alkalinity, Bicarbonate (as $CaCO_3$)	mg/L	153	151	1.32	161	170	5.44	195	199	2.03
Alkalinity, Bicarbonate (as HCO_3)	mg/L	187	184	1.62	196	207	5.46	238	243	2.08
Alkalinity, Carbonate (as $CaCO_3$)	mg/L	2	4.4	75.0	6.6	5.6	16.4	16.4	12.2	29.4
Alkalinity, Carbonate (as CO_3)	mg/L	1.2	2.6	73.7	4	3.4	16.2	9.8	7.3	29.2
Alkalinity, Hydroxide (as $CaCO_3$)	mg/L	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Alkalinity, Hydroxide (as OH)	mg/L	<1.0	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	-
Conductivity	µS/cm	487	483	0.825	374	374	0.00	862	856	0.70
Hardness (as $CaCO_3$), Dissolved	mg/L	256	251	1.97	214	215	0.466	541	545	0.737
Oxidation-Reduction Potential (ORP	mV	315	499	45.2	294	282	4.17	374	352	6.06
pH	pH units	8.18	8.23	0.609	8.33	8.31	0.240	8.4	8.38	0.238
Total Dissolved Solids (TDS)	mg/L	323	320	0.933	237	248	4.54	596	597	0.168
Total Suspended Solids (TSS)	mg/L	29	27.9	3.87	1.4	1.4	0	<1.0	<1.0	-
Turbidity	NTU	5.26	8.25	44.3	0.6	0.75	22.2	0.34	0.36	5.71
Anions And Nutrients										
Kjeldahl Nitrogen (TKN)	mg/L	0.638	0.394	47.3	<0.050	<0.050	-	0.745	0.987	27.9
Ammonia (as N)	mg/L	<0.0050	<0.0050	-	<0.0050	<0.0050	-	<0.0050	0.0062	21.43
Bromide	mg/L	<0.050	<0.050	-	<0.050	<0.050	-	<0.050	<0.050	-
Chloride	mg/L	1.27	1.13	11.7	0.17	0.18	5.71	5.4	5.22	3.39
Fluoride	mg/L	0.136	0.136	0	0.144	0.146	1.38	0.168	0.162	3.64
Nitrate (as N)	mg/L	6.21	6.2	0.161	0.0455	0.0434	4.72	14.3	14.4	0.697
Nitrite (as N)	mg/L	0.0035	0.0042	18.2	<0.0010	<0.0010	-	0.0035	0.0033	5.88
Orthophosphate, Dissolved (as P)	mg/L	<0.0010	0.0011	-	<0.0010	<0.0010	-	<0.0010	<0.0010	-
Phosphorus	mg/L	0.0218	0.0219	0.5	0.0054	0.0048	11.76	<0.0020	<0.0020	-
Sulfate (as SO_4)	mg/L	77	76.8	0.260	46.8	47	0.426	232	234	0.858
Organic / Inorganic Carbon										
Carbon, Dissolved Organic (DOC)	mg/L	2.02	2.02	0	<0.50	<0.50	-	0.64	0.68	6.06
Carbon, Total Organic (TOC)	mg/L	1.94	1.98	2.04	<0.50	<0.50	-	<0.50	0.71	34.7
Total Metals										
Aluminum	mg/L	0.136	0.168	21.1	<0.0150	<0.0150	-	0.0054	0.0037	37.4
Antimony	mg/L	0.00014	0.00014	0	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Arsenic	mg/L	0.00021	0.00021	0	0.00015	0.00017	12.50	<0.00010	<0.00010	-
Barium	mg/L	0.0549	0.0545	0.731	0.0634	0.0625	1.43	0.123	0.124	0.81
Beryllium	µg/L	<0.020	<0.020	-	<0.020	<0.020	-	<0.020	<0.020	-
Bismuth	mg/L	<0.000050	<0.000050	-	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Boron	mg/L	<0.010	<0.010	-	0.016	0.017	6.06	<0.010	<0.010	-
Cadmium	µg/L	0.0535	0.0588	9.44	0.0061	0.0063	3.23	0.02	0.0255	24.2
Calcium	mg/L	61.2	60.6	0.985	49.2	49.3	0.203	113	112	0.889
Chromium	mg/L	0.0004	0.00034	16.2	0.00022	0.00023	4.44	0.00014	0.00016	13.3
Cobalt	µg/L	0.12	0.13	8.00	<0.10	<0.10	-	<0.10	<0.10	-
Copper	mg/L	0.0005	0.0005	0	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Iron	mg/L	0.185	0.202	8.79	0.017	0.017	0.00	<0.010	<0.010	-
Lead	mg/L	0.000155	0.00016	3.17	<0.000050	<0.000050	-	<0.000050	<0.000050	-
Lithium	mg/L	0.0166	0.0165	0.604	0.0073	0.0072	1.38	0.0289	0.029	0.345
Magnesium	mg/L	24.1	24.5	1.65	18.1	17.7	2.23	48	49.6	3.28
Manganese	mg/L	0.0106	0.011	3.70	0.00378	0.00357	5.71	0.00164	0.00151	8.25
Mercury	mg/L	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-	<0.0000050	<0.0000050	-
Molybdenum	mg/L	0.00133	0.000988	29.5	0.00134	0.00139	3.66	0.000806	0.000844	4.61
Nickel	mg/L	0.00185	0.00191	3.19	<0.00050	<0.00050	-	<0.00050	0.00066	27.59
Potassium	mg/L	0.958	0.971	1.35	0.653	0.642	1.70	1.4	1.51	7.56
Selenium	µg/L	25.5	25.6	0.391	1.82	1.86	2.17	55.8	55.8	0
Silicon	mg/L	2.21	2.29	3.56	2.88	2.81	2.46	2.67	2.62	1.89
Silver	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Sodium	mg/L	1.6	1.6	0	2.56	2.53	1.18	3.4	3.47	2.04
Strontium	mg/L	0.088	0.0878	0.228	0.189	0.19	0.53	0.161	0.158	1.88
Sulfur	mg/L	27.5	27.6	0.363	15.5	15.4	0.65	86.2	85.9	0.35
Thallium	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Tin	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium	mg/L	0.00202	0.00399	65.6	<0.00030	<0.00030	-	<0.00030	<0.00030	-
Uranium	mg/L	0.00148	0.00146	1.36	0.000918	0.000943	2.69	0.00255	0.0026	1.94
Vanadium	mg/L	0.00075	0.00088	16.0	0.00068	0.00069	1.46	<0.00050	<0.00050	-
Zinc	mg/L	0.0039	0.0032	19.7	<0.0030	<0.0030	-	<0.0030	<0.0030	-
Dissolved Metals										
Aluminum	mg/L	0.0021	0.0024	13.3	<0.0010	0.0015	40.0	<0.0010	<0.0010	0
Antimony	mg/L	0.00012	0.00012	0	<0.00010	<0.00010	0	<0.00010	0.00011	9.52
Arsenic	mg/L	0.00011	0.00011	0	<0.00010	<0.00010	0	<0.00010	<0.00010	0
Barium	mg/L	0.0499	0.0503	0.798	0.0748	0.0761	1.72	0.124	0.128	3.17
Beryllium	µg/L	<0.020	<0.020	0	<0.020	<0.020	0	<0.020	<0.020	0
Bismuth	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Boron	mg/L	<0.010	<0.010	0	0.016	0.015	6.45	<0.010	<0.010	0
Cadmium	µg/L	0.0216	0.024	10.5	0.006	0.0058	3.39	0.0186	0.0291	44.0
Calcium	mg/L	62.5	61	2.43	51	51.6	1.17	127	131	3.10
Chromium	mg/L	0.00011	<0.00010	9.52	0.00025	0.0002	22.2	0.00017	0.00017	0
Cobalt	µg/L	<0.10	<0.10	0	<0.10	<0.10	0	<0.10	<0.10	0
Copper	mg/L	<0.00020	<0.00020	0	<0.00020	<0.00020	0	0.00025	0.00038	41.3
Iron	mg/L	<0.010	<0.010	0	<0.010	<0.010	0	<0.010	<0.010	0
Lead	mg/L	<0.000050	<0.000050	0	<0.000050	<0.000050	0	<0.000050	<0.000050	0
Lithium	mg/L	0.0164	0.0168	2.41	0.0071	0.007	1.42	0.0307	0.0312	1.62
Magnesium	mg/L	24.4	24	1.65	21	21	0	54.4	52.9	2.80
Manganese	mg/L	0.00169	0.00164	3.00	0.00084	0.00072	15.4	0.00129	0.00127	1.56
Mercury	mg/L	<0.0000050	<0.0000050	0	<0.0000050	<0.0000050	0	<0.0000050	<0.0000050	0
Molybdenum	mg/L	0.0011	0.00112	1.80	0.00149	0.00143	4.11	0.00089	0.000887	0.338
Nickel	mg/L	0.00135	0.00137	1.47	<0.00050	<0.00050	0	<0.00050	<0.00050	0
Potassium	mg/L	0.954	0.96	0.627	0.649	0.654	0.767	1.48	1.45	2.05
Selenium	µg/L	24.2	24.3	0.412	2.43	2.35	3.35	60.9	59.6	2.16
Silicon	mg/L	1.96	2.1	6.90	2.92	2.97	1.70	2.42	2.4	0.830
Silver	mg/L	<0.000010	<0.000010	0	<0.000010	<0.000010	-	<0.000010	<0.000010	0
Sodium	mg/L	1.53	1.54	0.651	2.8	2.8	0	3.52	3.35	4.95
Strontium	mg/L	0.0932	0.0937	0.535	0.186	0.189	1.60	0.176	0.172	2.30
Sulfur	mg/L	26.8	28.3	5.44	16.8	16.3	3.02	87.4	85.4	2.31
Thallium	mg/L	<0.000010	<0.000010	-	<0.000010	<0.000010	-	<0.000010	<0.000010	-
Tin	mg/L	<0.00010	<0.00010	-	<0.00010	<0.00010	-	<0.00010	<0.00010	-
Titanium	mg/L	<0.00030	<0.00030	-	<0.00030	<0.00030	-	<0.00030	<0.00030	-
Uranium	mg/L	0.0015	0.00151	0.664	0.000902	0.000898	0.444	0.00256	0.00256	0
Vanadium	mg/L	<0.00050	<0.00050	-	<0.00050	<0.00050	-	<0.00050	<0.00050	-
Zinc	mg/L	0.0012	0.0013	8.00	<0.0010	<0.0010	-	0.0013	0.0013	0

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: LRL = Laboratory Reporting Limit. If one result in a duplicate pair was below the LRL, RPD was calculated using the LRL in place of the value below detection results. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

Table B.7: **Comparisons of Selenium Speciation Duplicates, LCO Dry Creek LAEMP, 2022**

Parameter	Unit	LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_CC1_WS_LAEMP_DRY_2022-11_NP	RPD (%)	LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_CC1_WS_LAEMP_DRY_2022-09_N	RPD (%)	LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	LC_CC1_WS_LAEMP_DRY_2022-06_NP	RPD (%)
Total Selenium	µg/L	46.1	45.8	0.65	1.69	1.87	10.1	23.7	23.4	1.27
Dissolved Selenium	µg/L	45.6	47.4	3.87	1.83	1.81	1.10	23.4	24.2	3.36
Dimethylselenoxide	µg/L	0	0	-	0	0		0	0	-
MeSe(IV) - Methylseleninic acid	µg/L	0.004	0	200	0	0	-	0.004	0.008	66.7
Methaneselenonic Acid	µg/L	0	0	-	0	0	-	0	0	-
Se(IV) - Selenite	µg/L	0.191	0.176	8.17	0.035	0.032	8.96	0.079	0.08	1.26
Se(VI) - Selenate	µg/L	50.6	48.2	4.86	1.85	1.53	18.9	21.3	21.2	0.47
SeCN - Selenocyanate	µg/L	0	0	-	0	0	-	0	0	-
SeMe - Selenomethionine	µg/L	0	0	-	0	0	-	0	0	-
Selenosulfate	µg/L	0	0	-	0	0	-	0	0	-
Unknown Selenium Species	µg/L	0	0	-	0	0	-	0	0	-

Value did not meet the data quality objective of ≤ 30% Relative Percent Difference (RPD).

Notes: " - " indicates no data avaialable. LRL = Laboratory Reporting Limit. If one result in a duplicate pair was below the LRL, RPD was calculated using the LRL in place of the value below detection results. RPD was not calculated if both results were < LRL. "-" indicates that the RPD was not calculated.

Table B.8: Percent of Sample Sorted and the Total Number of Benthic Invertebrates Recovered from the Sampled Fraction, LCO Dry Creek LAEMP, 2022

Sample ID	Laboratory ID	% Sampled	# Invertebrates
LC_DCDS_BIC-01_2022-05_NP	CC230046	5	435
LC_DCDS_BIC-02_2022-05_NP	CC230047	6	356
LC_DCDS_BIC-03_2022-05_NP	CC230048	11	361
LC_DCDS_BIC-04_2022-05_NP	CC230049	5	364
LC_DCDS_BIC-05_2022-05_NP	CC230050	5	351
LC_DC1_BIC-1_2022-09-12_N	CC231037	5	617
LC_DC1_BIC-2_2022-09-12_N	CC231038	10	339
LC_DC1_BIC-3_2022-09-12_N	CC231039	5	513
LC_DC2_BIC-1_2022-09-14_N	CC231040	14	329
LC_DC2_BIC-2_2022-09-14_N	CC231041	15	335
LC_DC2_BIC-3_2022-09-14_N	CC231042	8	335
LC_DC3_BIC-1_2022-09-13_N	CC231043	5	622
LC_DC3_BIC-2_2022-09-13_N	CC231044	8	343
LC_DC3_BIC-3_2022-09-13_N	CC231045	5	376
LC_DC4_BIC-1_2022-09-12_N	CC231046	7	334
LC_DC4_BIC-2_2022-09-12_N	CC231047	5	360
LC_DC4_BIC-3_2022-09-12_N	CC231048	13	385
LC_DCDS_BIC-1_2022-09-13_N	CC231049	15	332
LC_DCDS_BIC-2_2022-09-13_N	CC231050	8	320
LC_DCDS_BIC-3_2022-09-13_N	CC231051	16	319
LC_DCDS_BIC-4_2022-09-13_N	CC231052	8	346
LC_DCDS_BIC-5_2022-09-13_N	CC231053	12	327
LC_DCEF_BIC-1_2022-09-13_N	CC231054	12	334
LC_DCEF_BIC-2_2022-09-13_N	CC231055	15	333
LC_DCEF_BIC-3_2022-09-13_N	CC231056	12	342
LC_FRB_BIC-1_2022-09-10_N	CC231057	5	515
LC_FRB_BIC-2_2022-09-10_N	CC231058	5	443
LC_FRB_BIC-3_2022-09-10_N	CC231059	5	392
LC_FRUS_BIC-1_2022-09-10_N	CC231060	7	353
LC_FRUS_BIC-2_2022-09-10_N	CC231061	10	329
LC_FRUS_BIC-3_2022-09-10_N	CC231062	14	348
LC_GRCK_BIC-1_2022-09-14_N	CC231063	14	310
LC_GRCK_BIC-2_2022-09-14_N	CC231064	50	411
LC_GRCK_BIC-3_2022-09-14_N	CC231065	12	327
LC_DCDS_BIC-1_2022-11_N	CC232235	21	327
LC_DCDS_BIC-2_2022-11_N	CC232236	13	329

Notes: Only samples that were sub-sampled are displayed. All other benthic invertebrate community samples were examined in their entirety.

Table B.9: Benthic Invertebrate Community Sub-sampling Precision and Accuracy, LCO Dry Creek LAEMP, 2022

Station ID		Organisms in Subsample																				Total	Precision Error		Accuracy Error	
Sample ID	Laboratory ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20		Min (%)	Max (%)	Min (%)	Max (%)
LC_DCDS_BIC05_2022-05_NP	CC230050	349	300	314	300	301	317	302	300	308	290	290	308	301	302	314	298	333	328	327	330	6,212	0	17	1	12
																							0.00	**16.9**	**0.84**	**12.4**

Table B.10: Benthic Invertebrate Community Sorting Efficiency, LCO Dry Creek LAEMP, 2022

Sample ID	Laboratory ID	Number of Organisms Recovered (Initial Sort)	Number of Organisms in Re-sort	Sorting Efficiency
LC_DCDS_BIC-01_2022-05_NP	CC230046	435	5	98.9%
LC_DC2_BIC-3_2022-09-14_N	CC231042	335	4	98.8%
LC_DC3_BIC-2_2022-09-13_N	CC231044	343	6	98.3%
LC_FRUS_BIC-3_2022-09-10_N	CC231062	348	3	99.1%
LC_DCDS_BIC-2_2022-11_N	CC232236	329	5	98.5%
			Average	**98.8%**

Table B.11: **Percent Benthic Invertebrate Community Organism Recovery[a], LCO Dry Creek LAEMP, 2022**

Sample ID	Laboratory ID	Percent Sampled (%)	Taxa Identified	TIR (%)	PDE (%)	PTD (%)	BCDI
LC_DCDS_BIC-03_2022-05_NP	CC230048	11	362	0	0.138	0.552	0.004
LC_DC1_BIC-2_2022-09-12_N	CC231038	10	339	0	0.000	0.295	0.003
LC_DC3_BIC-3_2022-09-13_N	CC231045	5	379	0	0.397	0.792	0.004
LC_DCEF_BIC-3_2022-09-13_N	CC231056	12	341	0	0.146	1.46	0.013

Notes: TIR = Total Identification Error Rate, PDE = Percent Difference in Enumeration, PTD = Percent Taxonomic Disagreement, BCDI = Bray Curtis Dissimilarity Index to quantify differences in identifications.

[a] For error rationale and calculations, refer to Cordillera report (Appendix J).

Table B.12: **Comparisons of Benthic Invertebrate Tissue Duplicates, LCO Dry Creek LAEMP, 2022**

Parameter	Units	Range of LRLs	No. Sample Results < LRL
Antimony	mg/kg dw	0.003 to 0.004	1 (2.08%)
Arsenic	mg/kg dw	0.327 to 0.514	15 (31.3%)
Boron	mg/kg dw	0.067 to 0.107	2 (4.17%)
Mercury	mg/kg dw	0.022 to 0.029	5 (8.33%)
Vanadium	mg/kg dw	0.025 to 0.065	1 (2.08%)

Notes: mg/kg = milligrams per kilogram dry weight. Only analytes with at least one result < Laboratory Reporting Limit (LRL) or LRL were above guidelines were displayed. No applicable guidelines exist for any analyte that had at least one result below the LRL. The total number of samples in 2022 (n) was 48.

APPENDIX C
WATER QUALITY

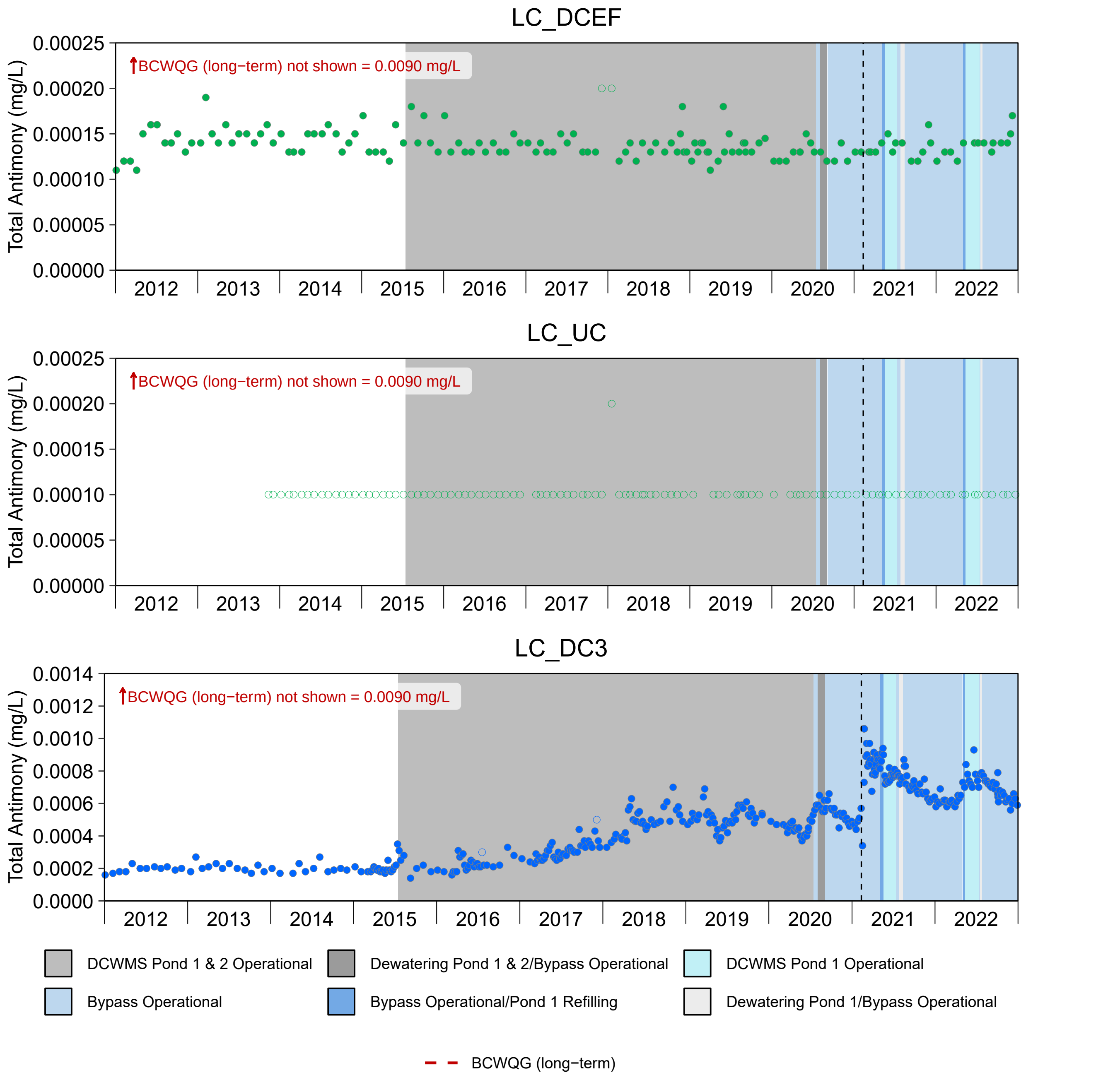
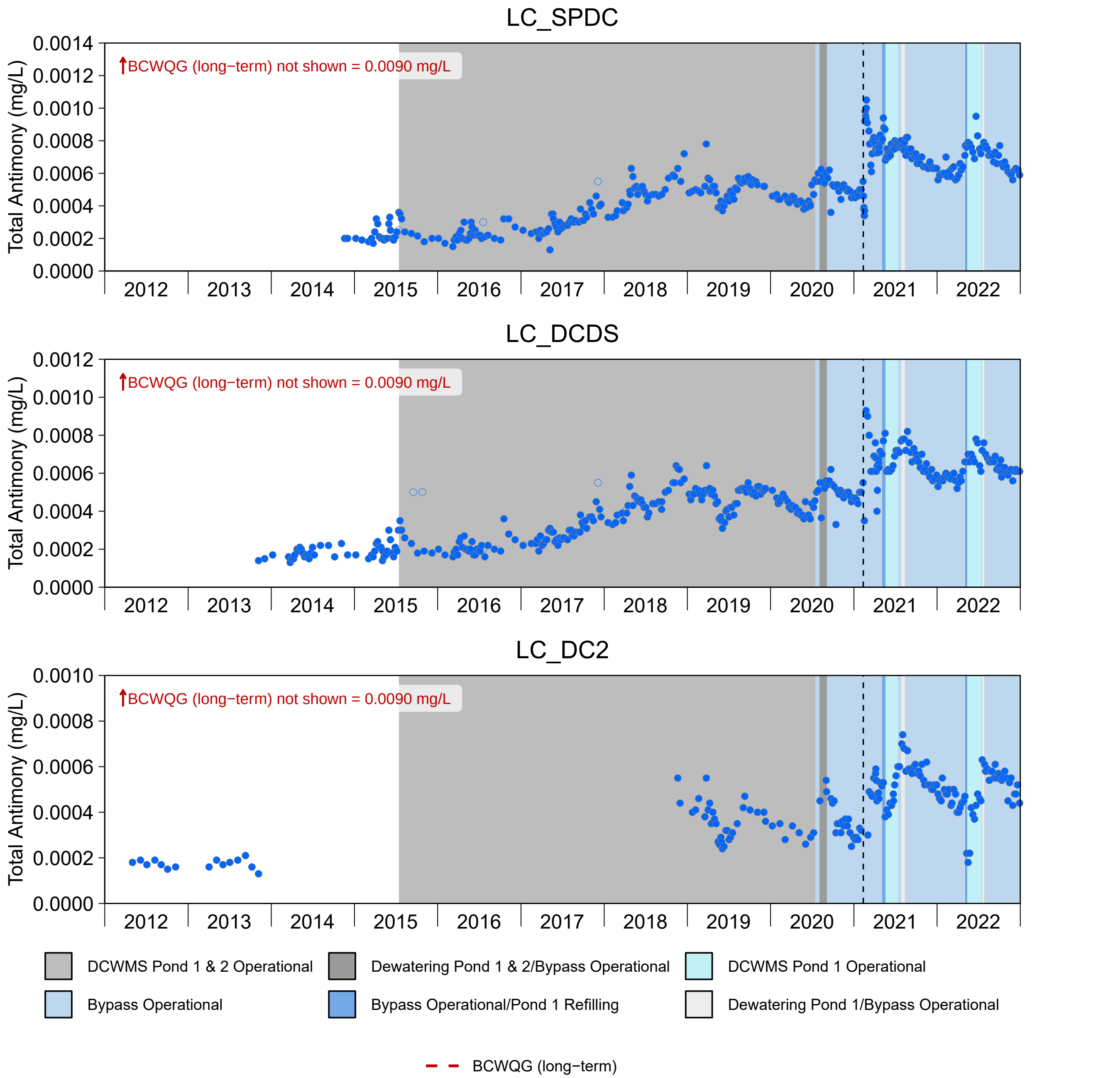


Figure C.1: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).



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Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

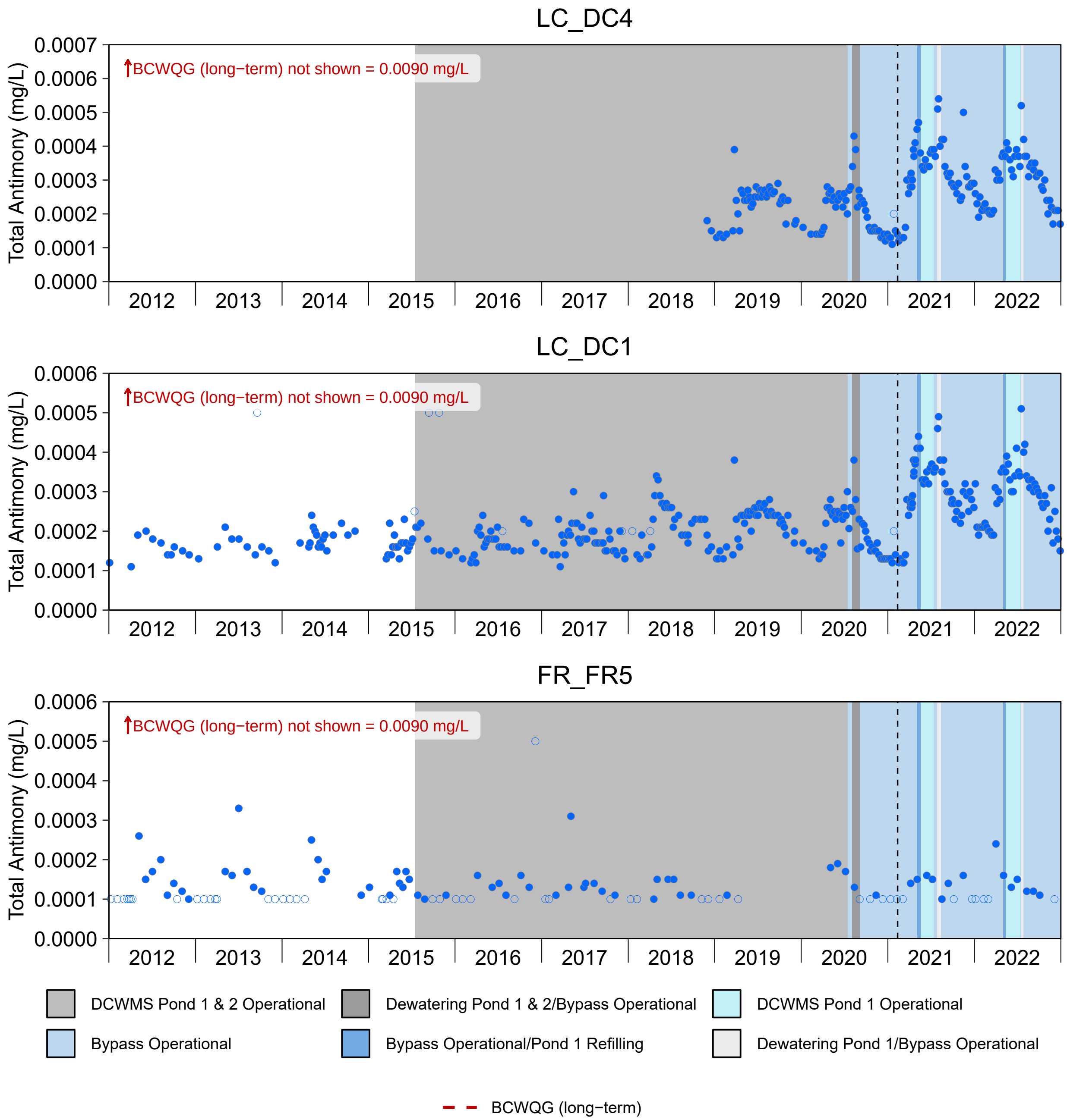

Figure C.1: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2022

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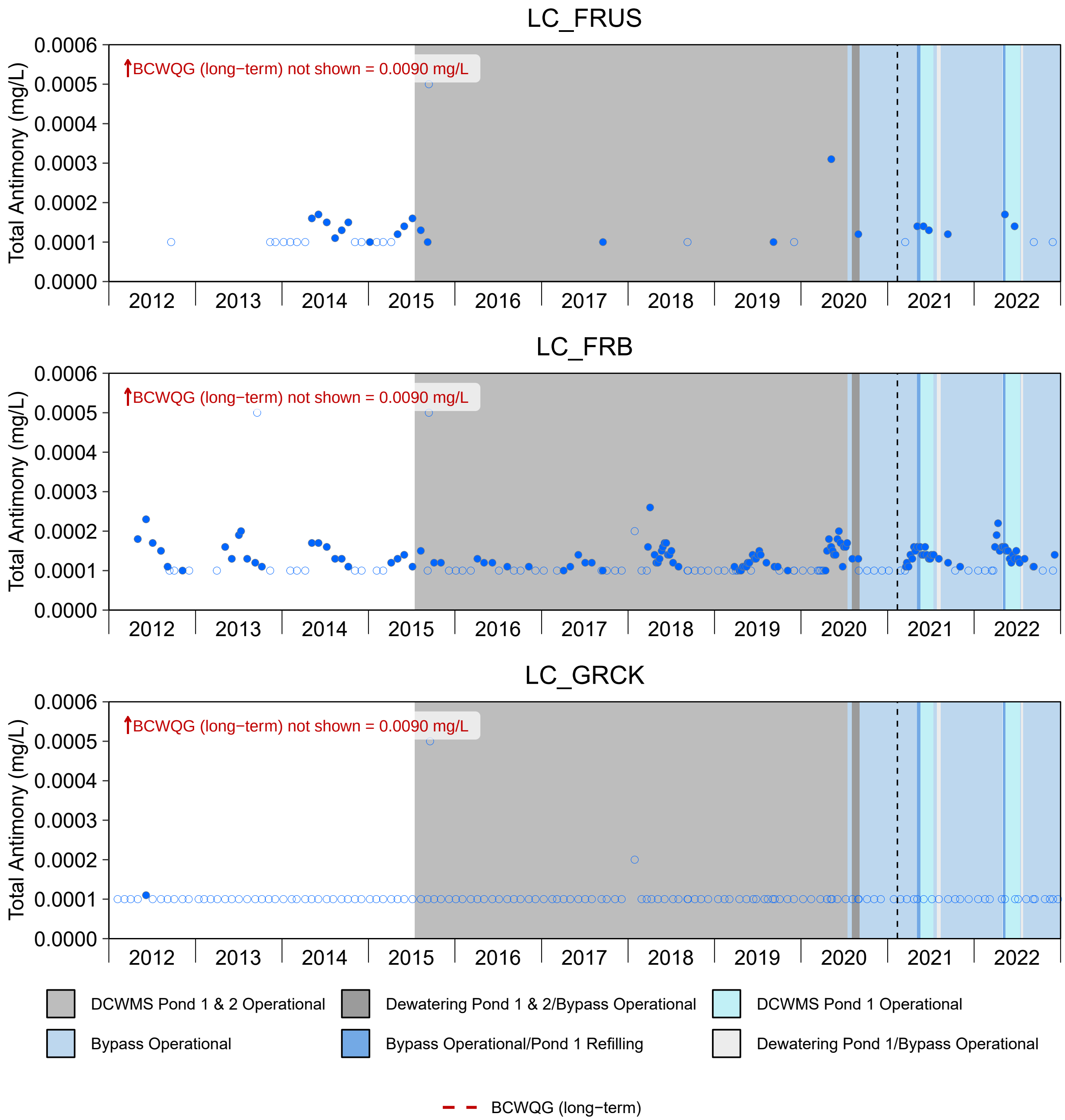

Figure C.1: Time Series Plots for Total Antimony from LCO Dry Creek LAEMP Areas, 2012 to 2022

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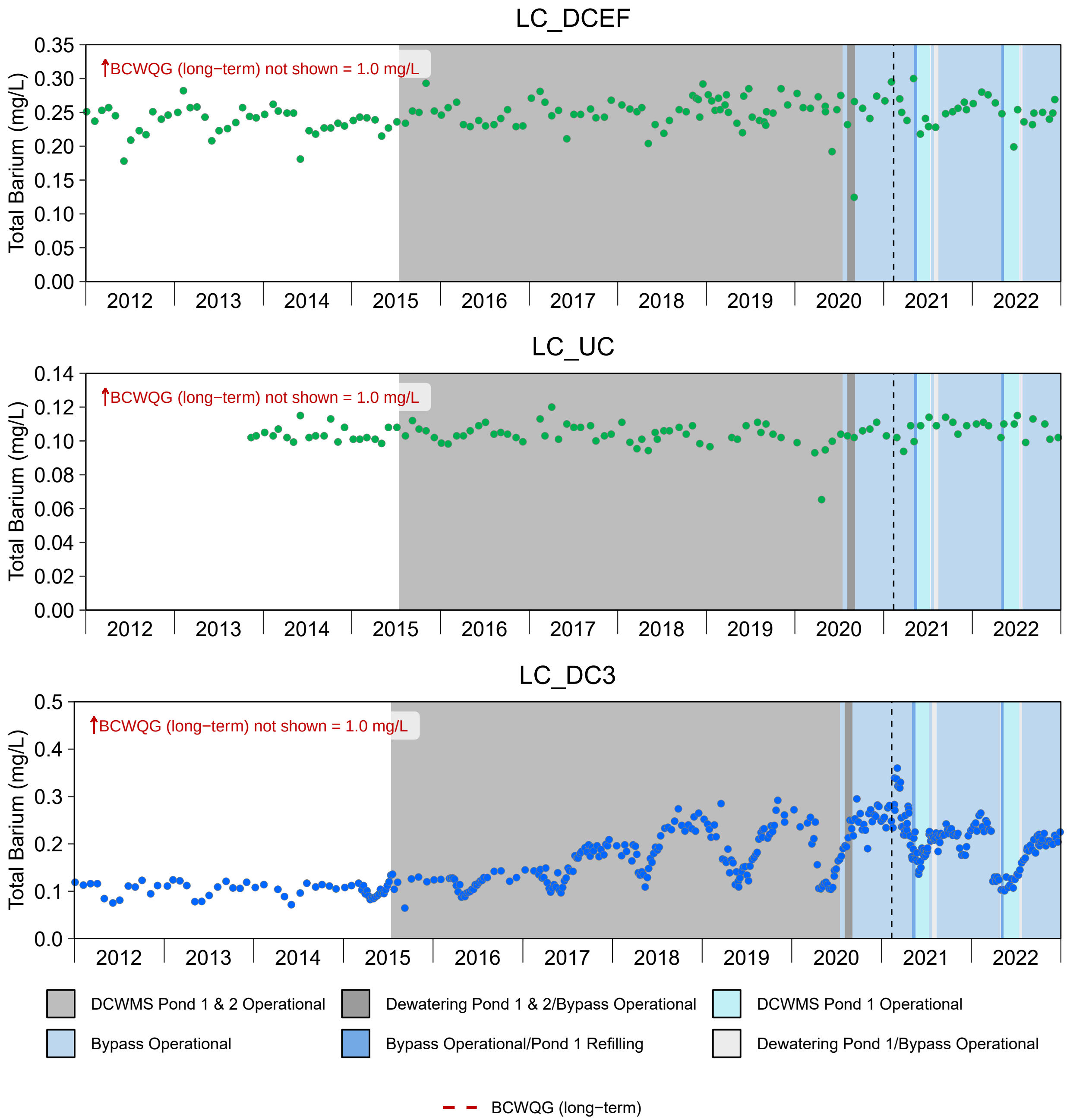


Figure C.2: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

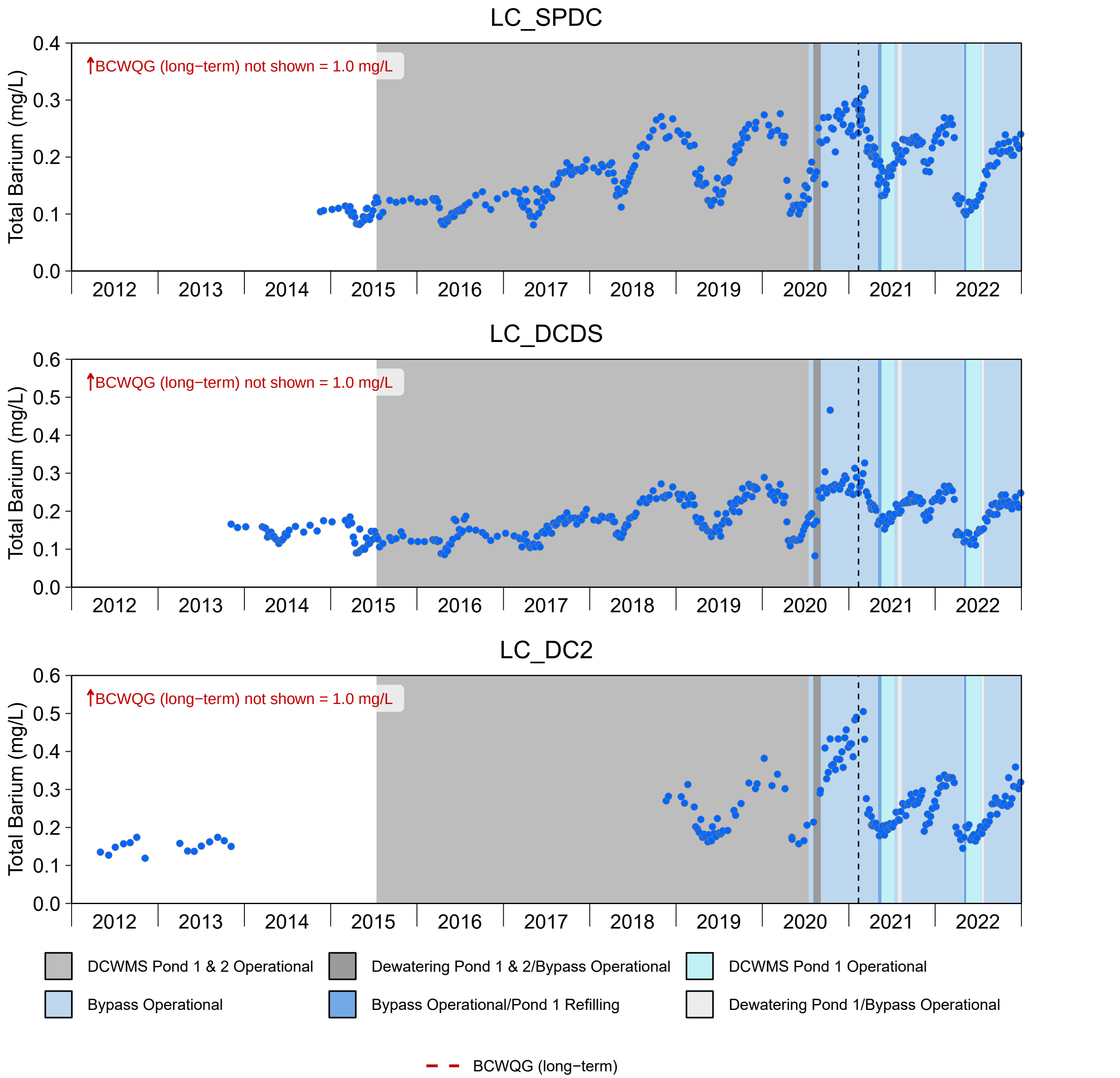


Figure C.2: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

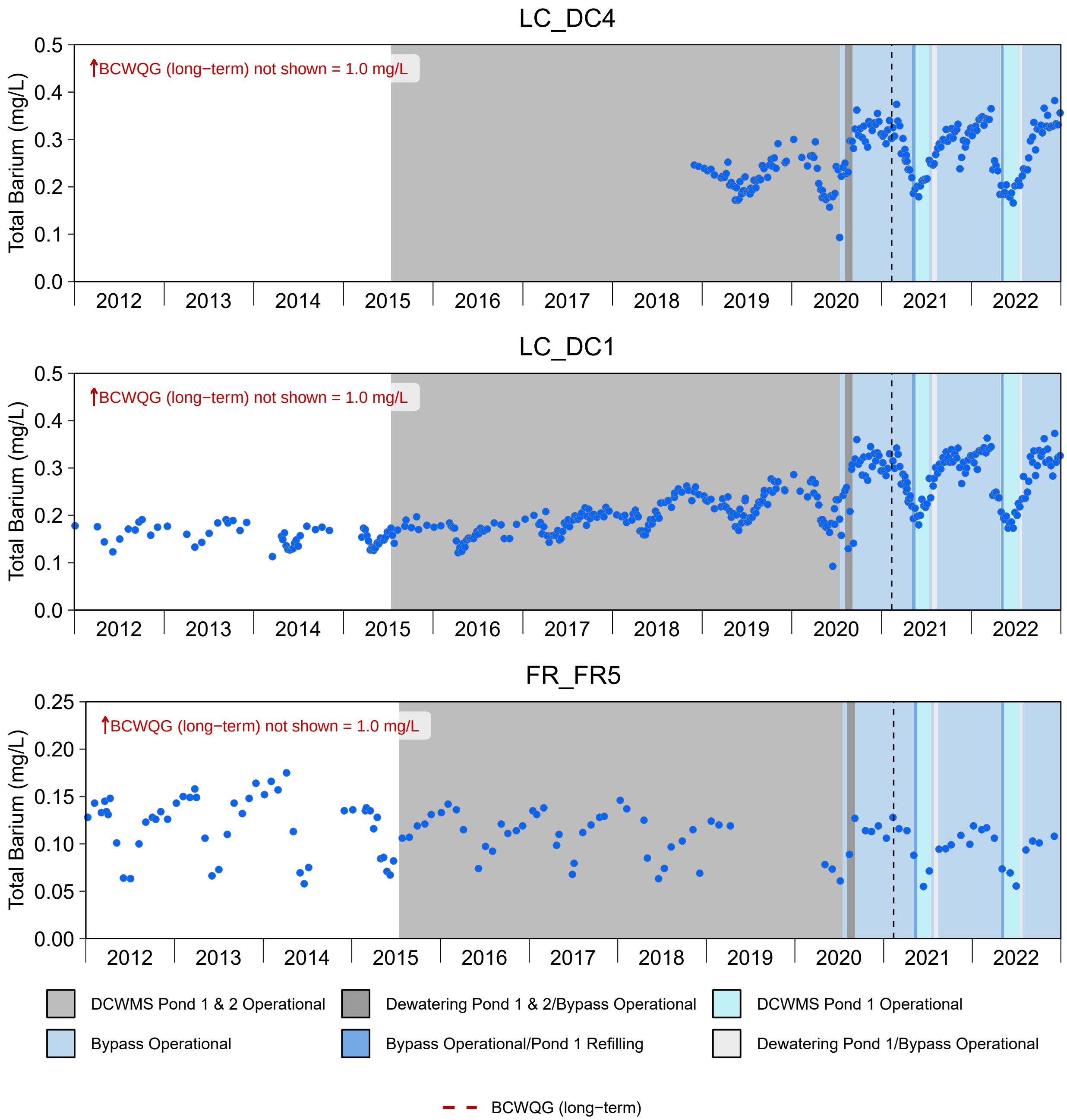


Figure C.2: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

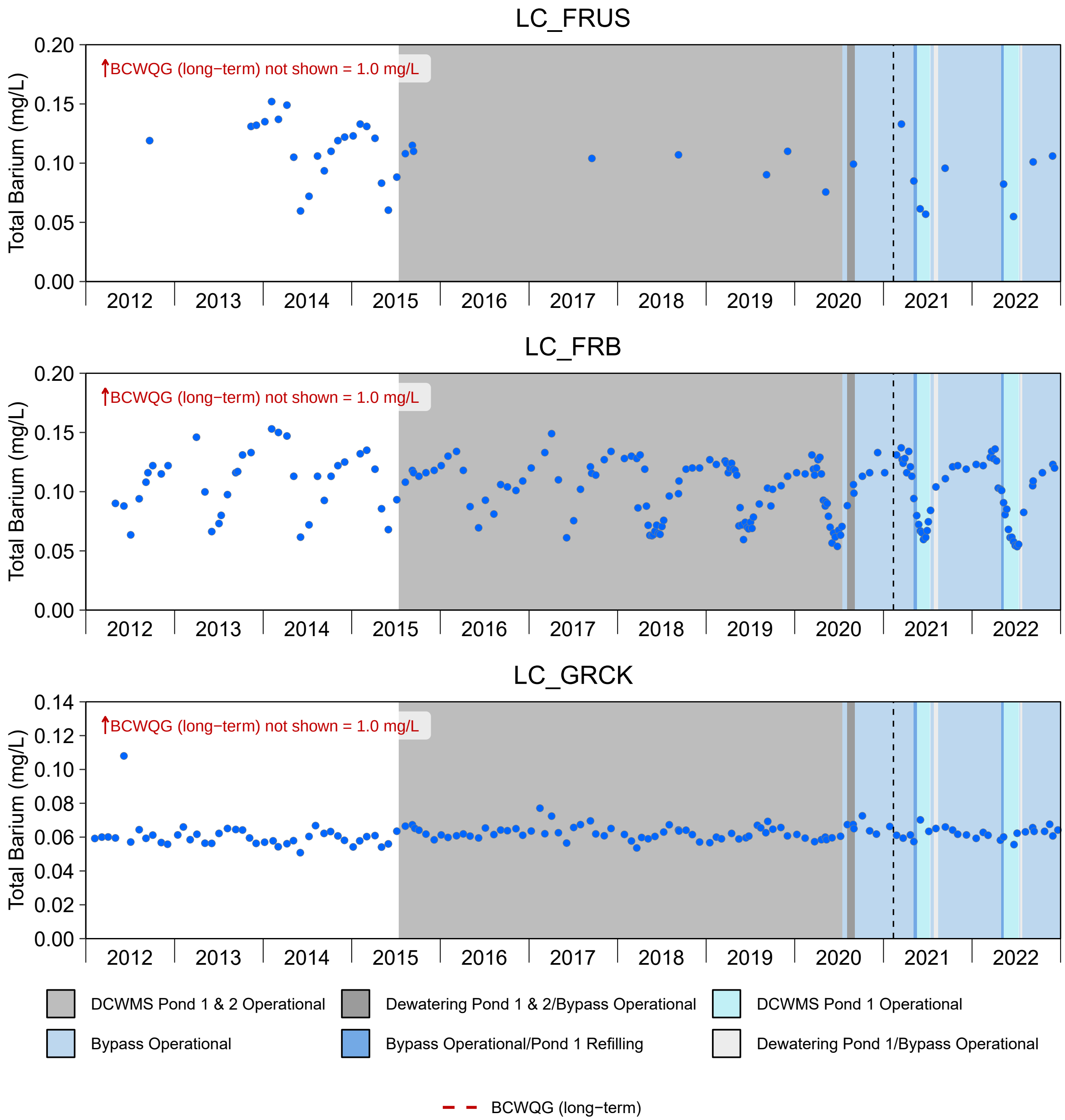


Figure C.2: Time Series Plots for Total Barium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

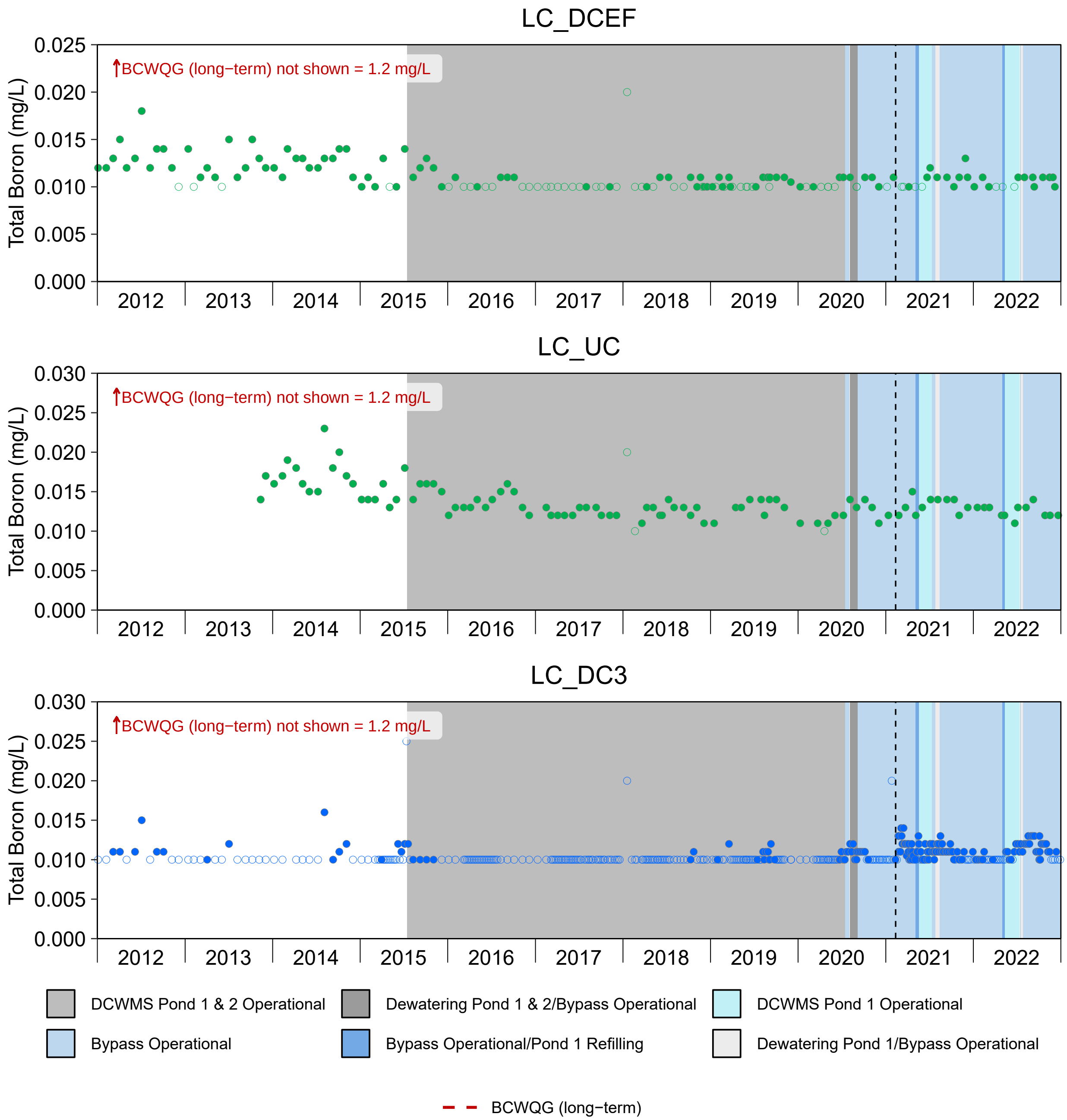


Figure C.3: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

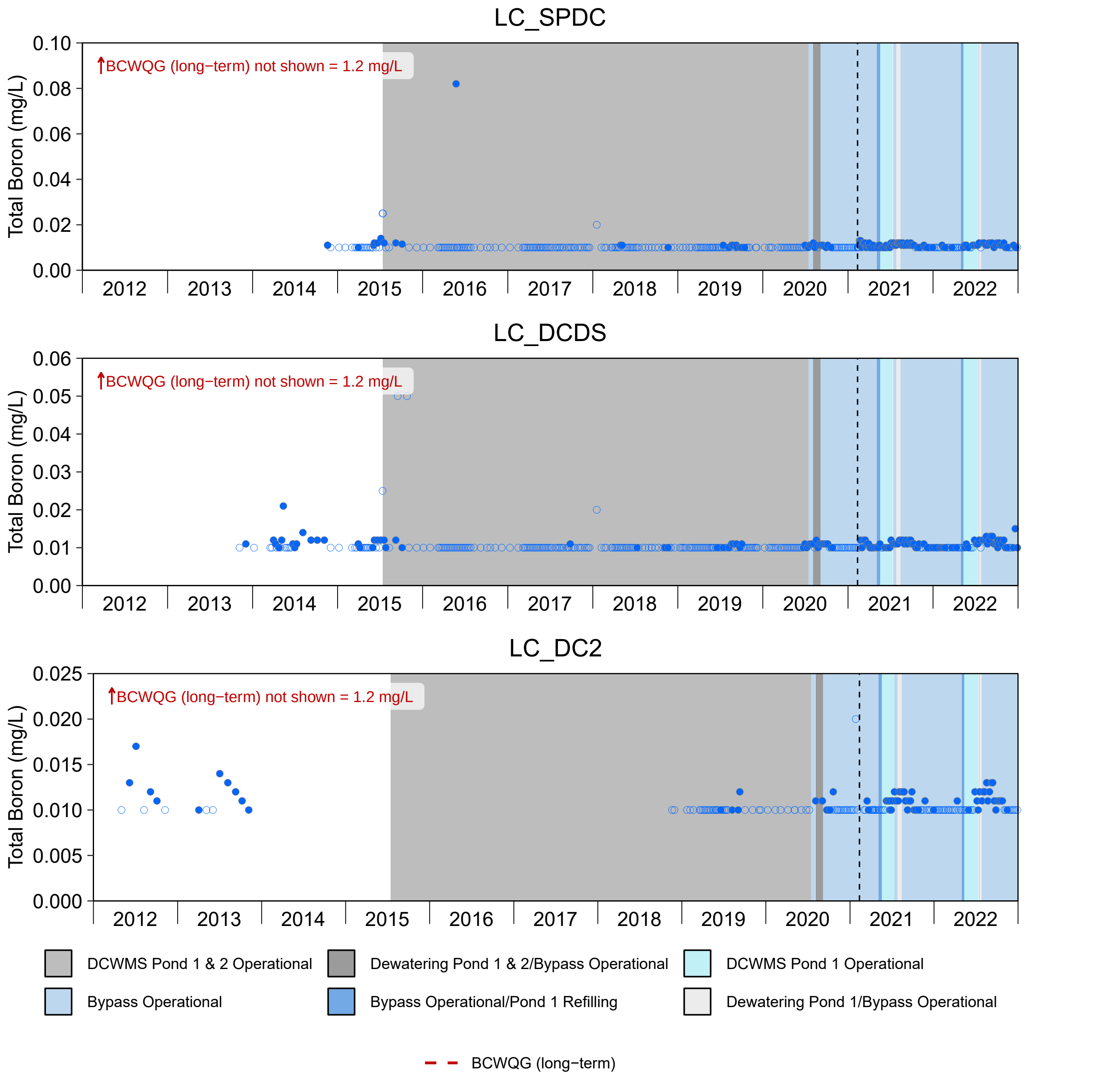


Figure C.3: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

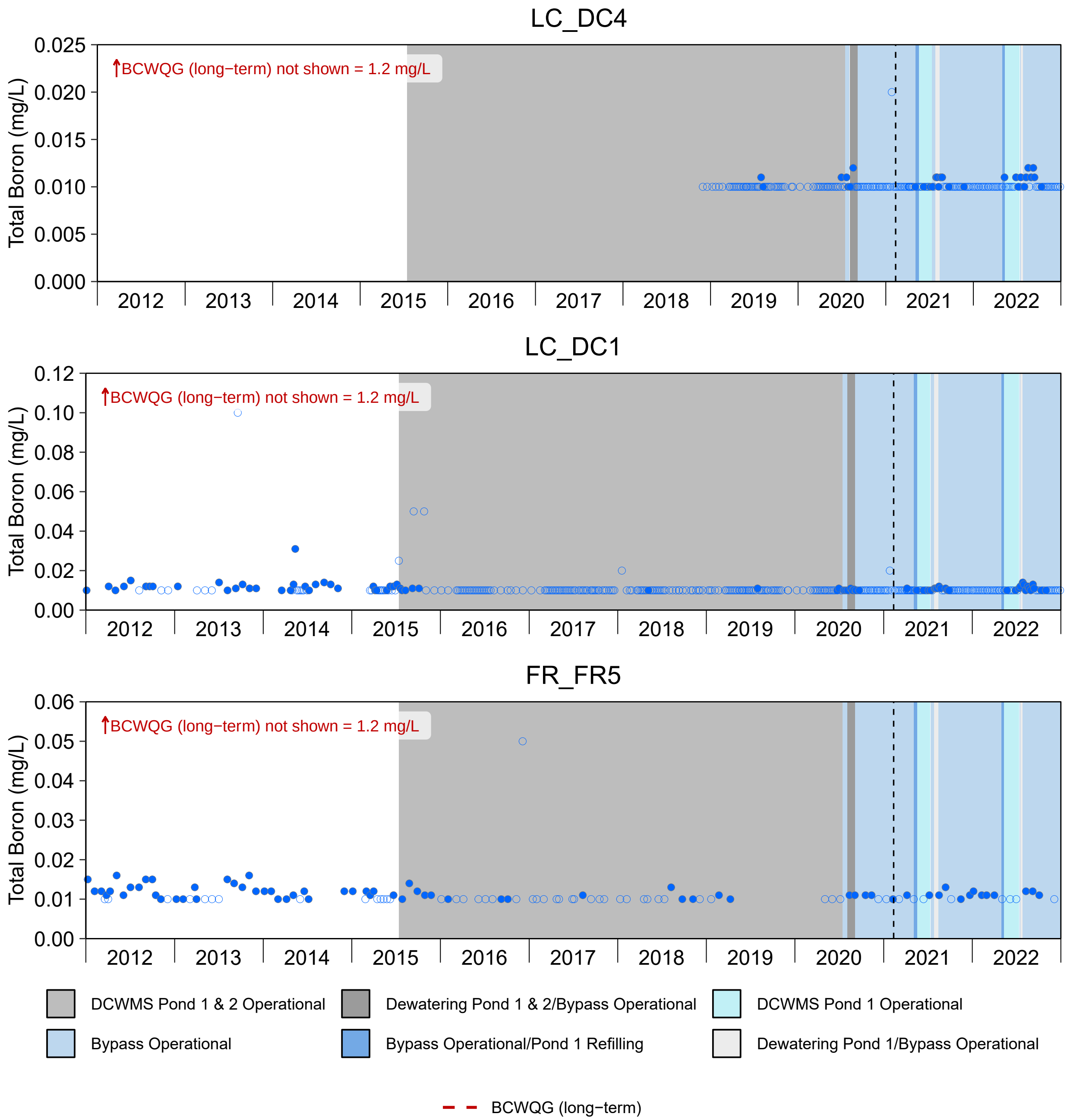


Figure C.3: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

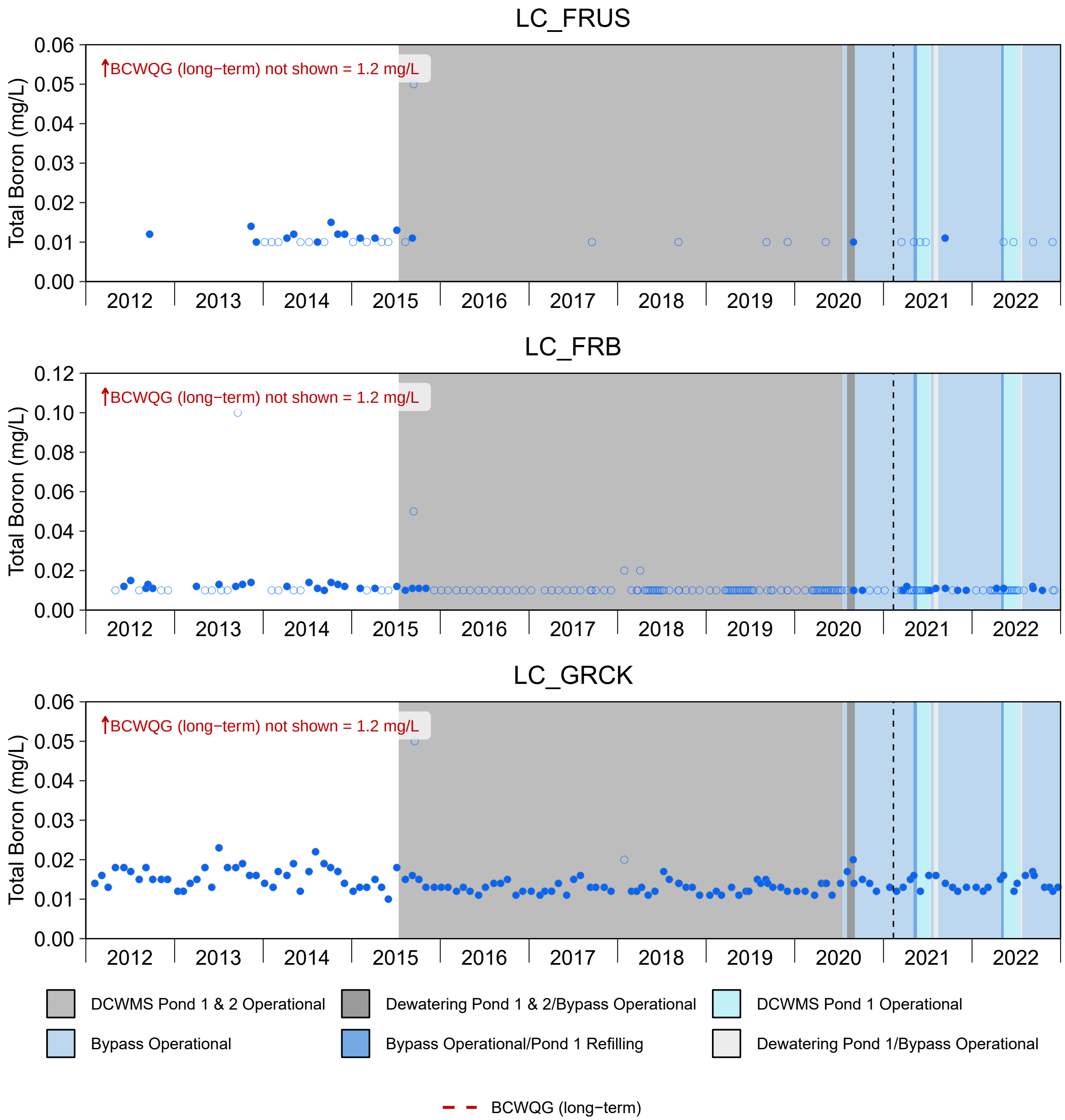


Figure C.3: Time Series Plots for Total Boron from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

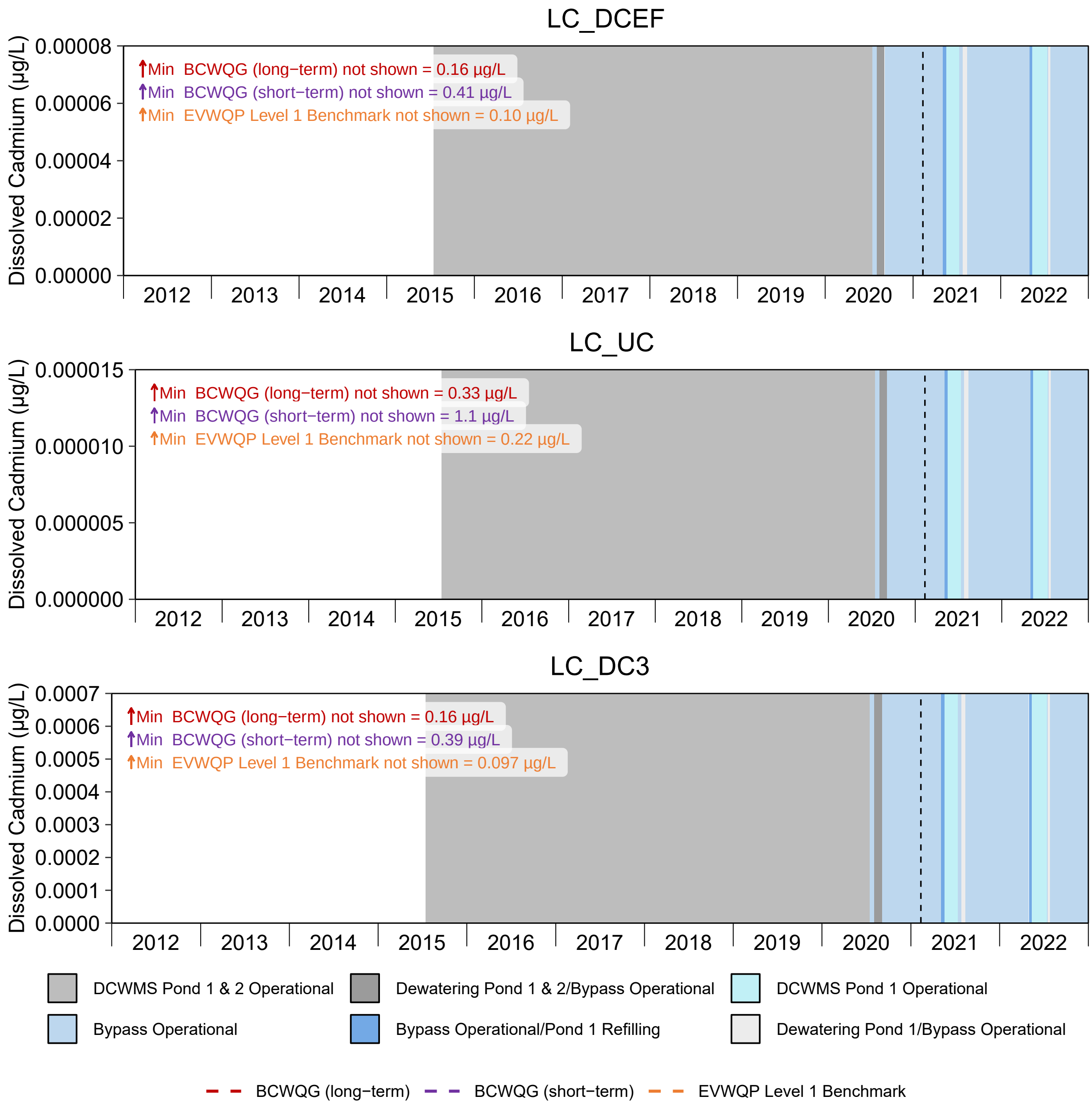


Figure C.4: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

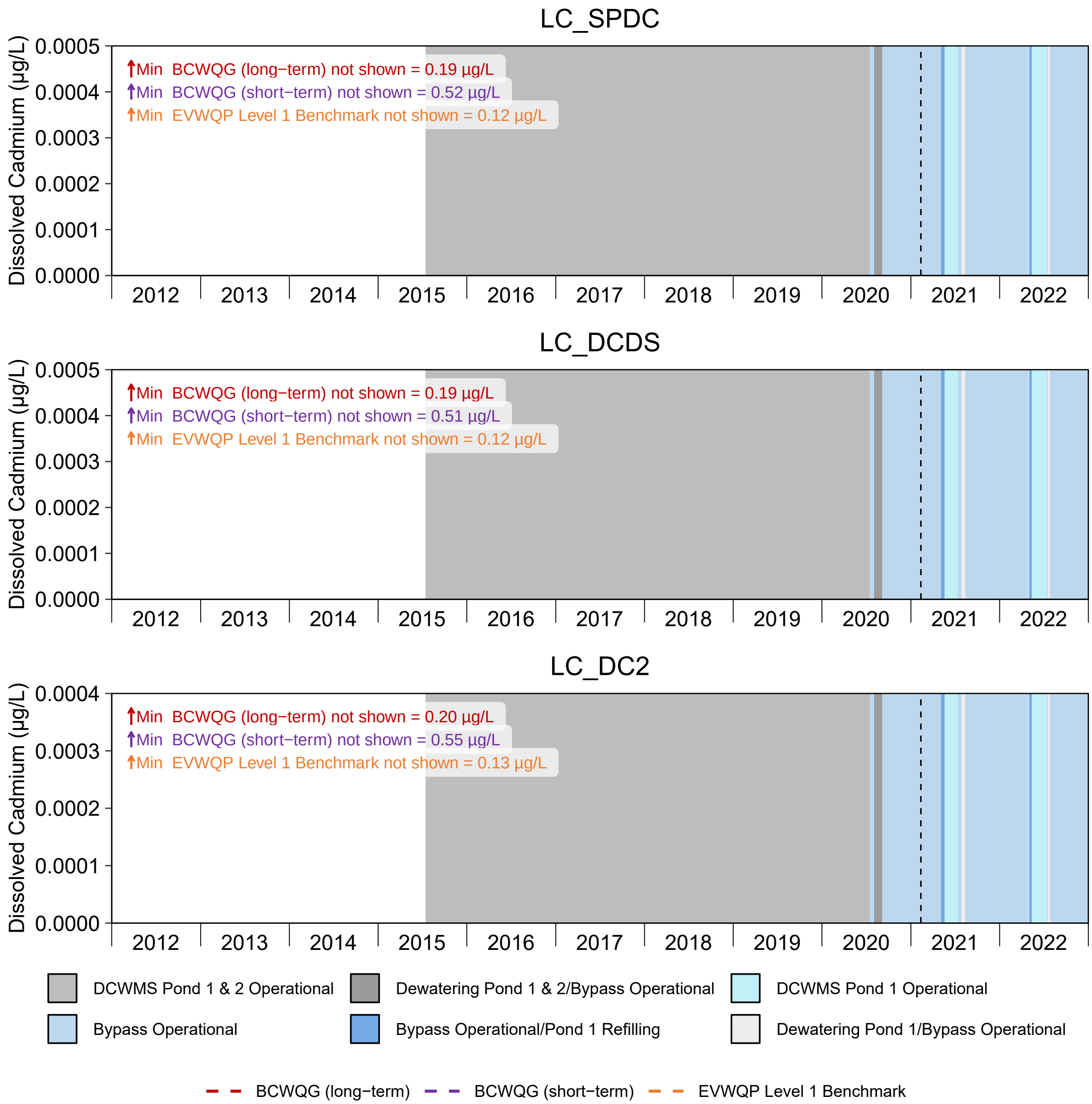


Figure C.4: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

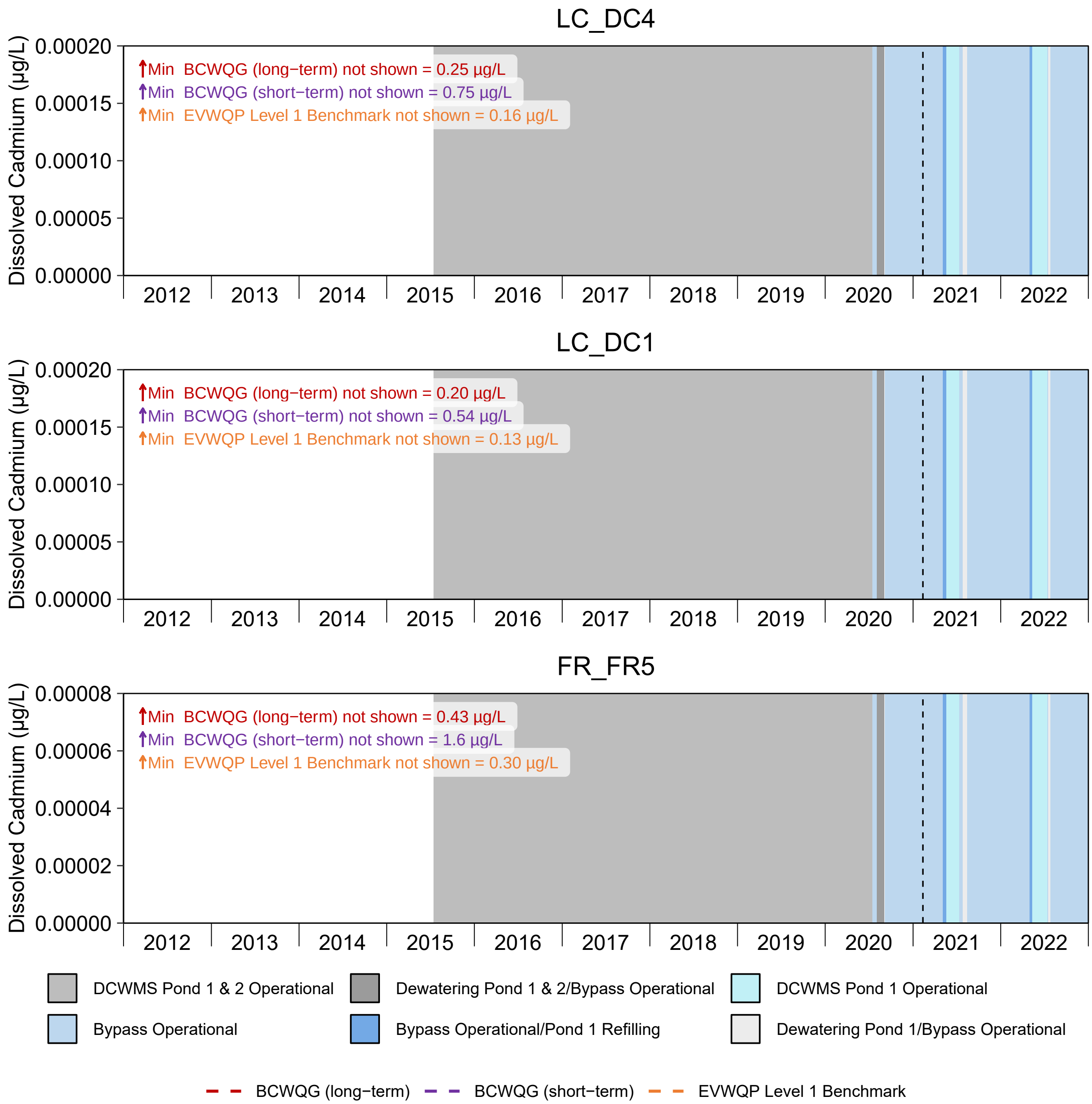


Figure C.4: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

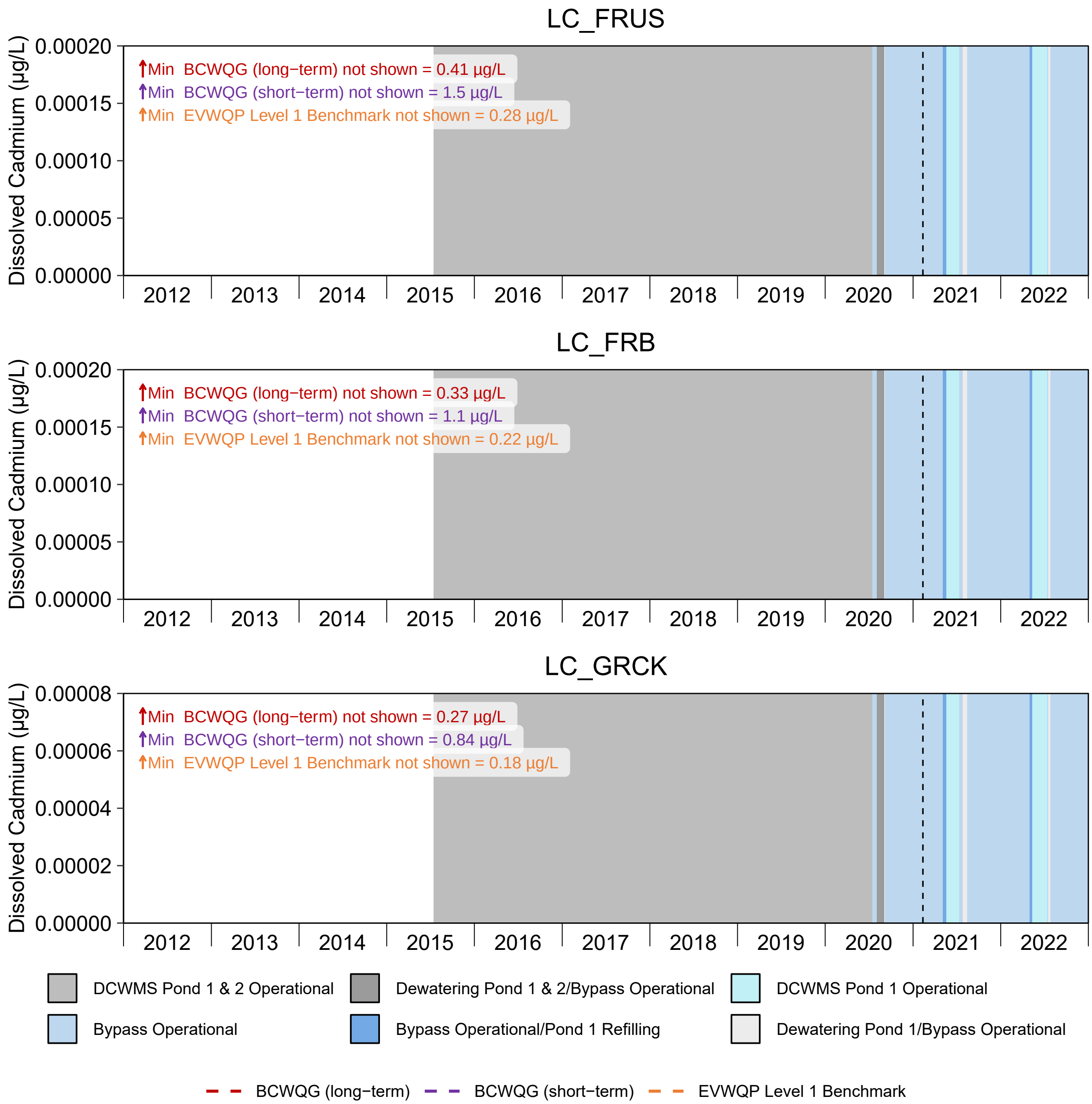


Figure C.4: Time Series Plots for Dissolved Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

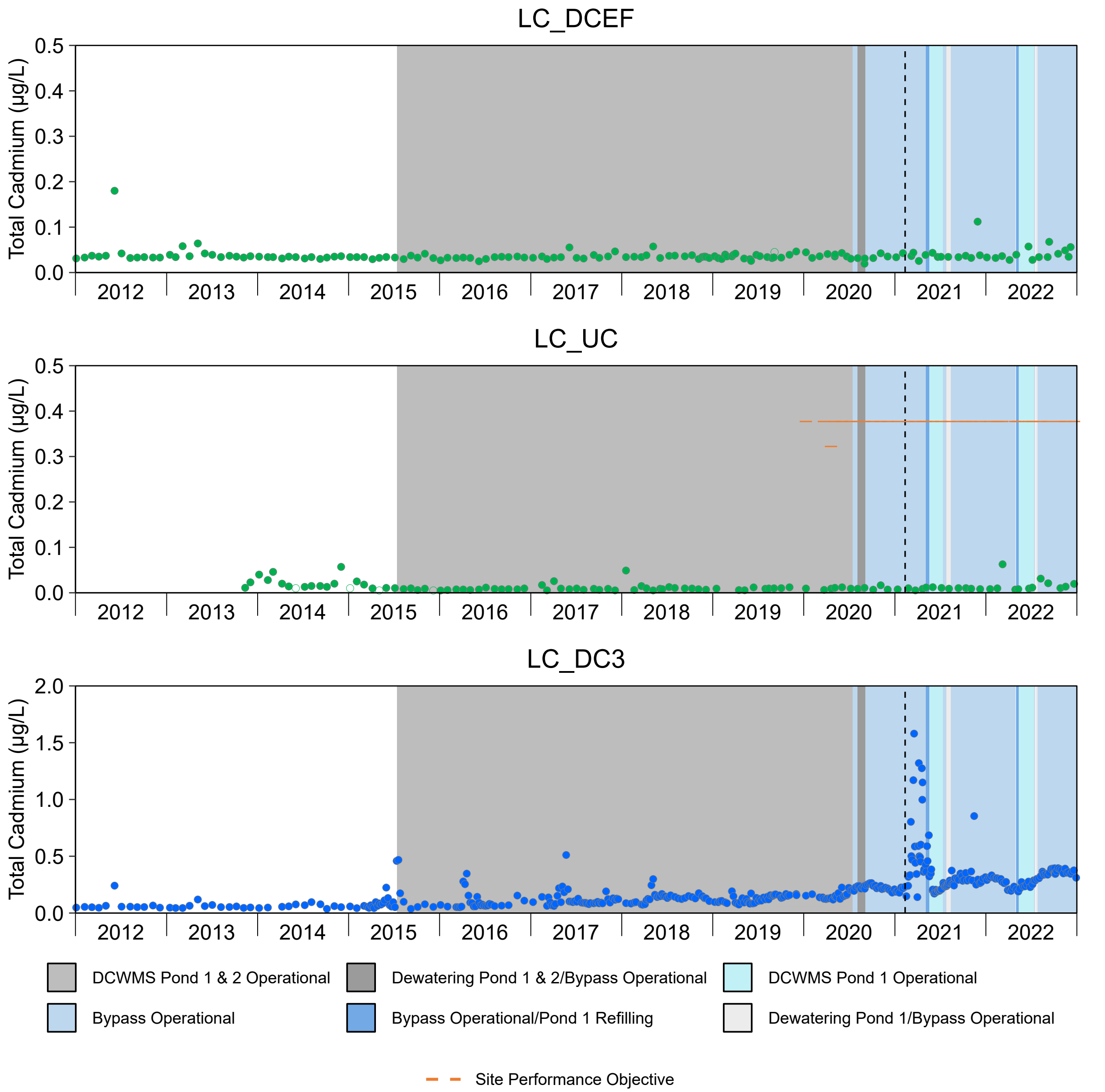


Figure C.5: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

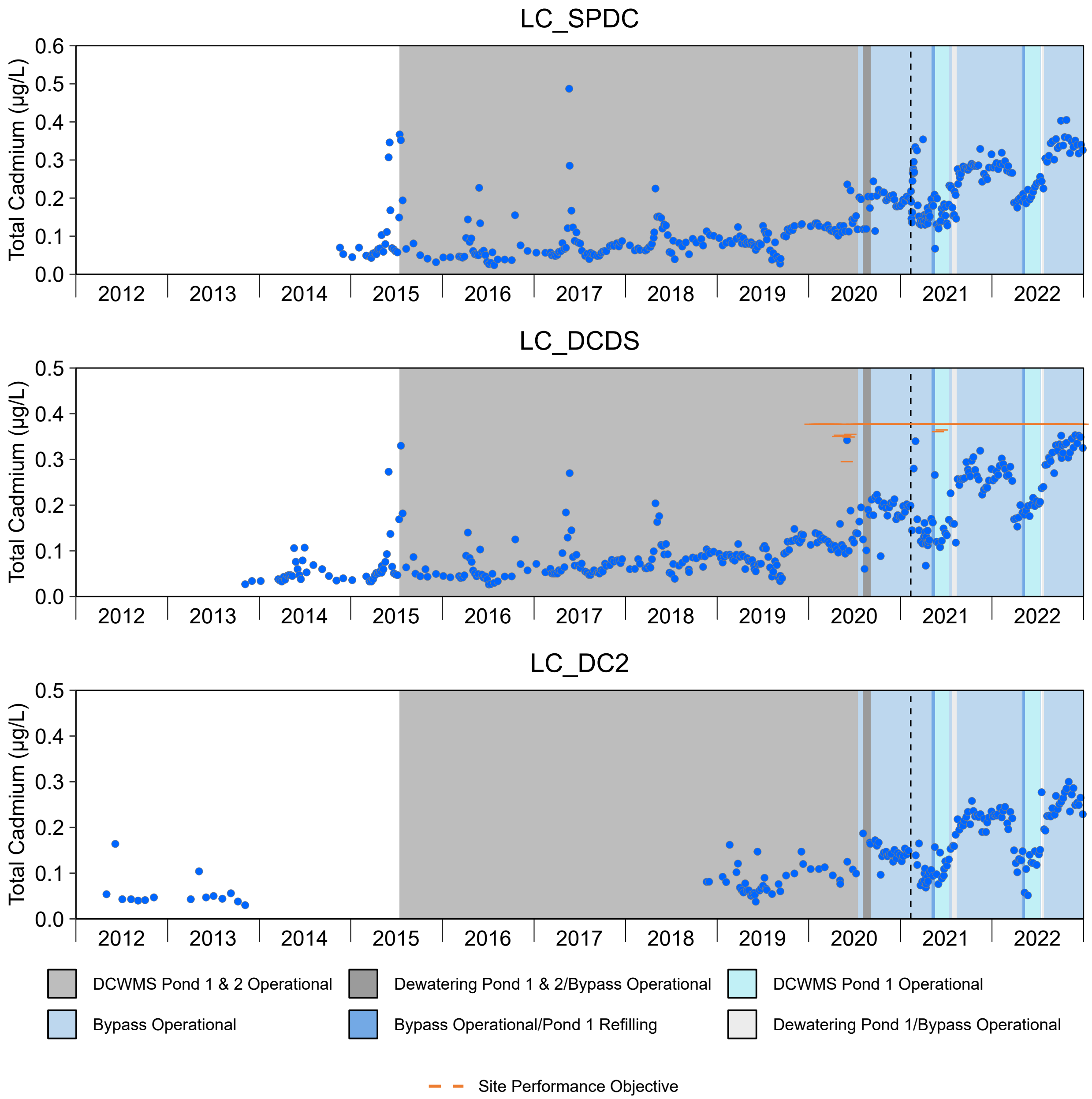


Figure C.5: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

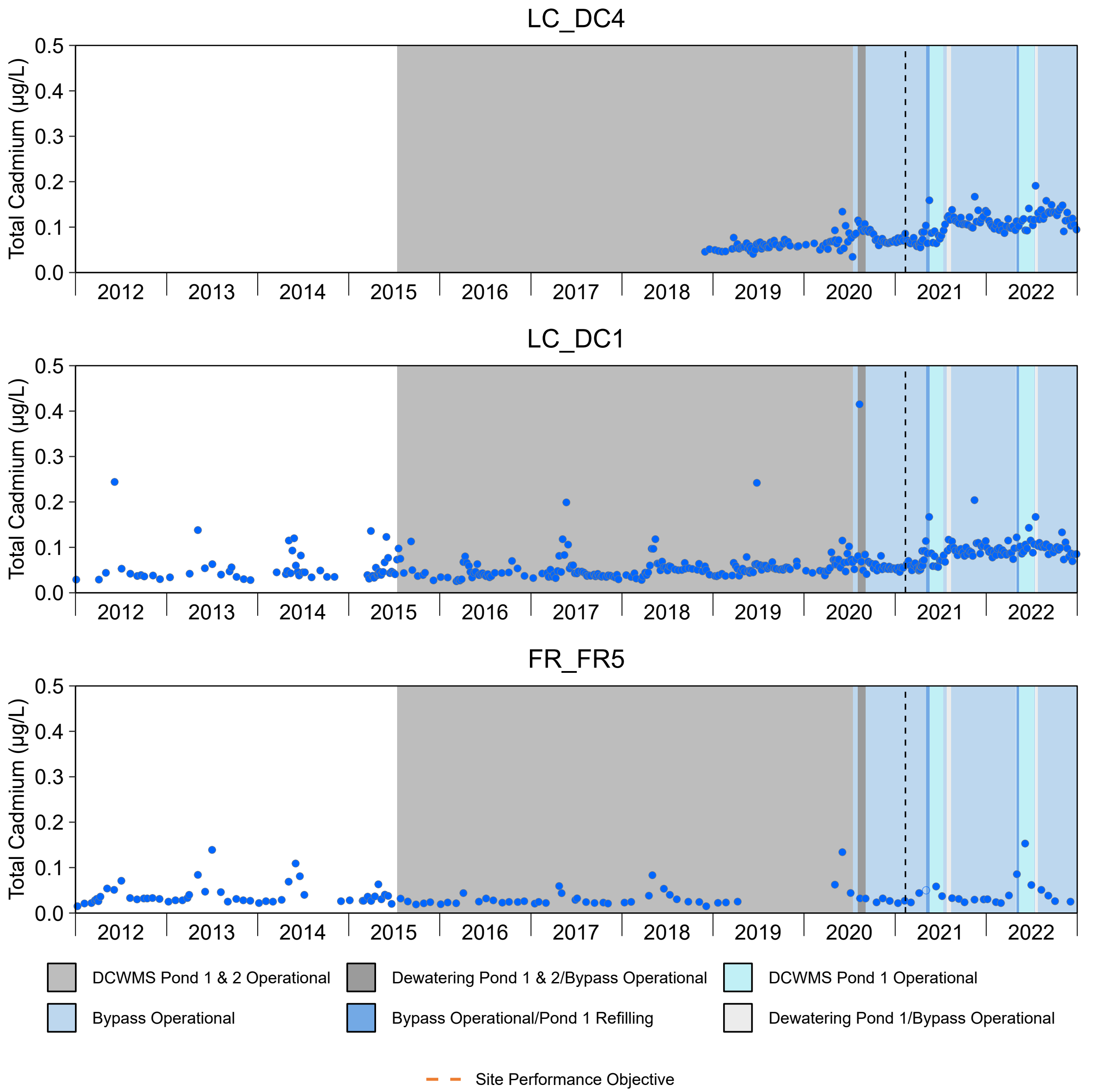


Figure C.5: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

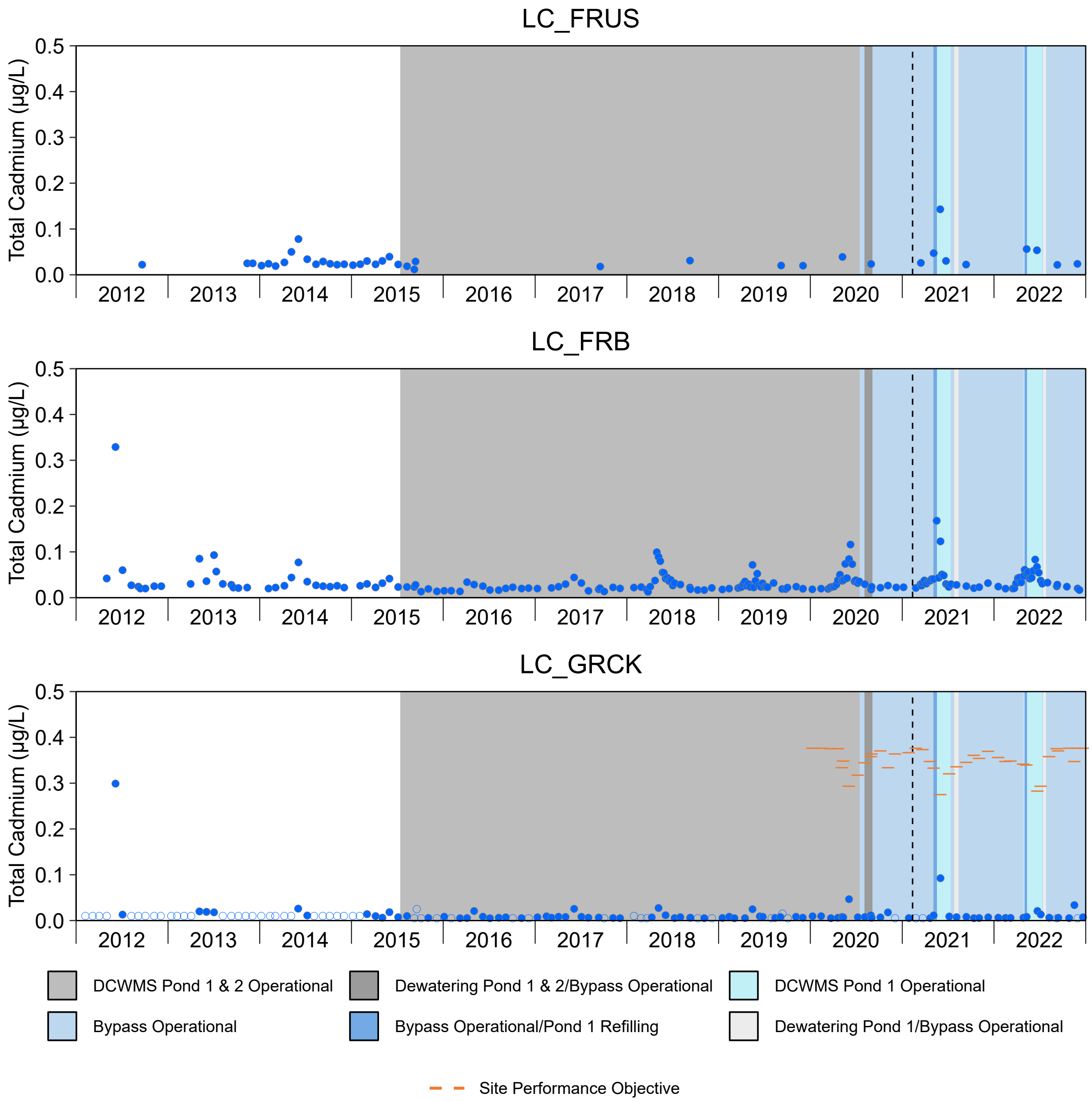


Figure C.5: Time Series Plots for Total Cadmium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

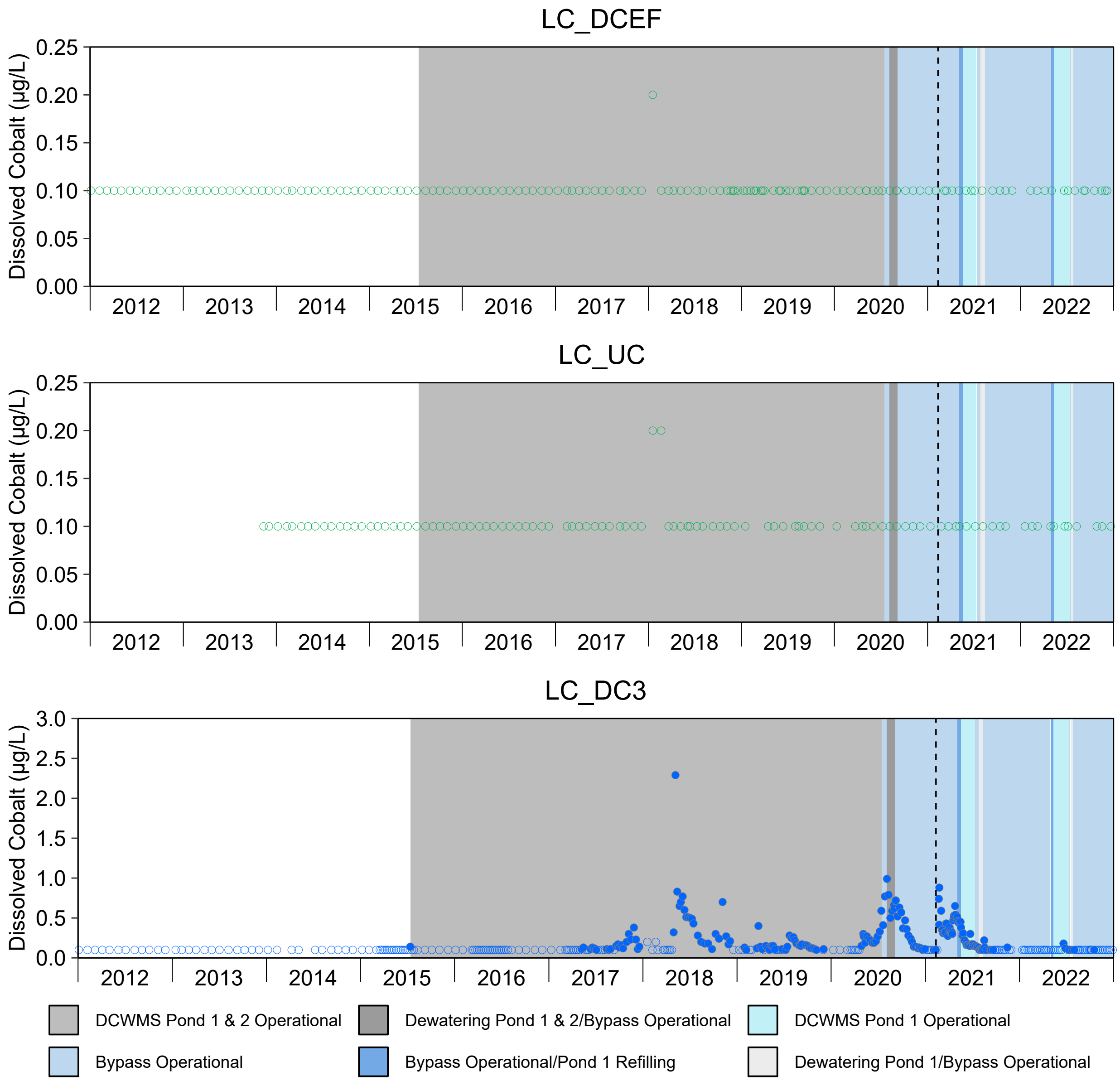


Figure C.6: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dissolved cobalt was used because bioavailability and toxicity has been associated with the dissolved fraction (Environment Canada 2017; Azimuth 2018). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

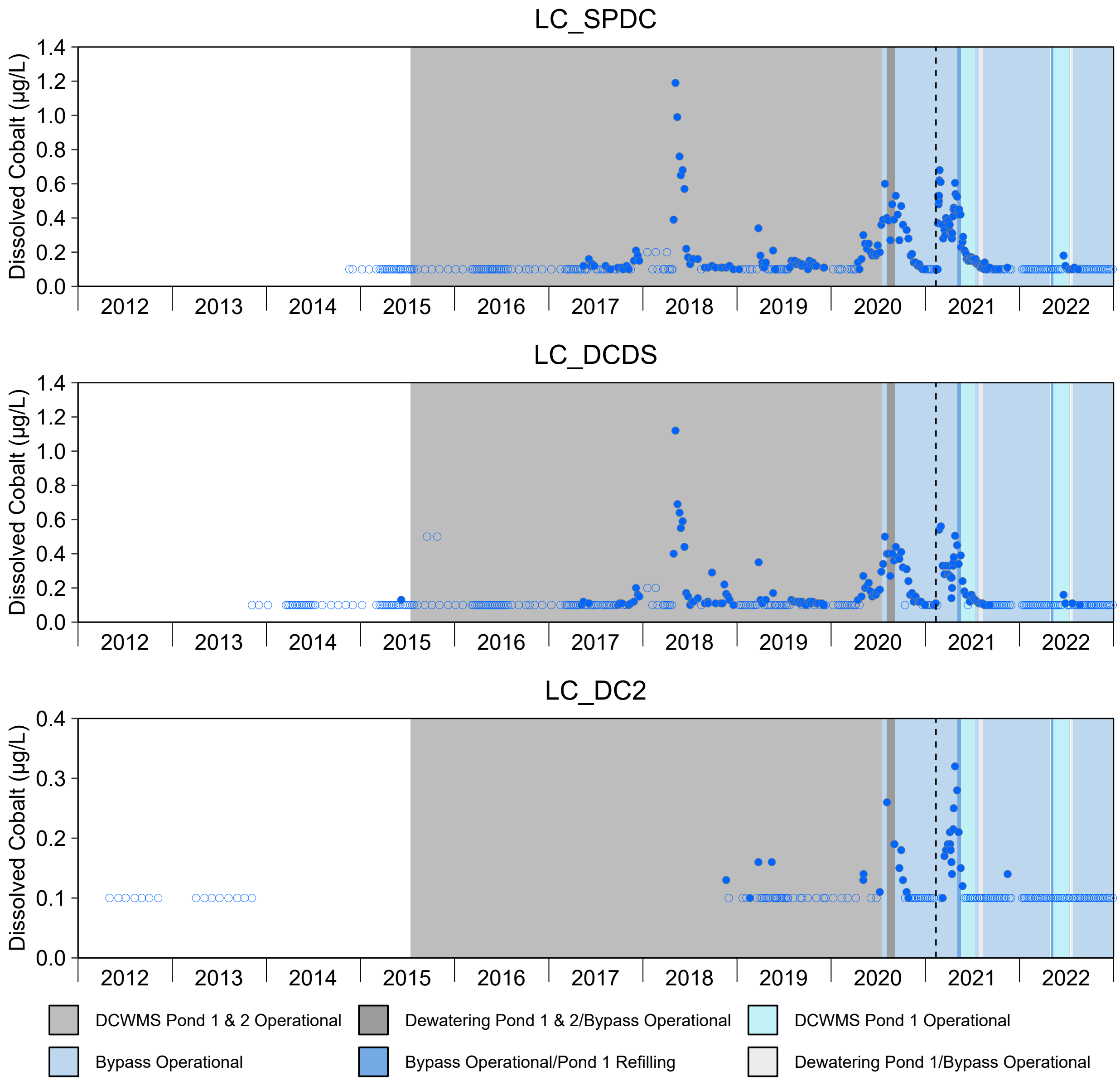


Figure C.6: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dissolved cobalt was used because bioavailability and toxicity has been associated with the dissolved fraction (Environment Canada 2017; Azimuth 2018). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

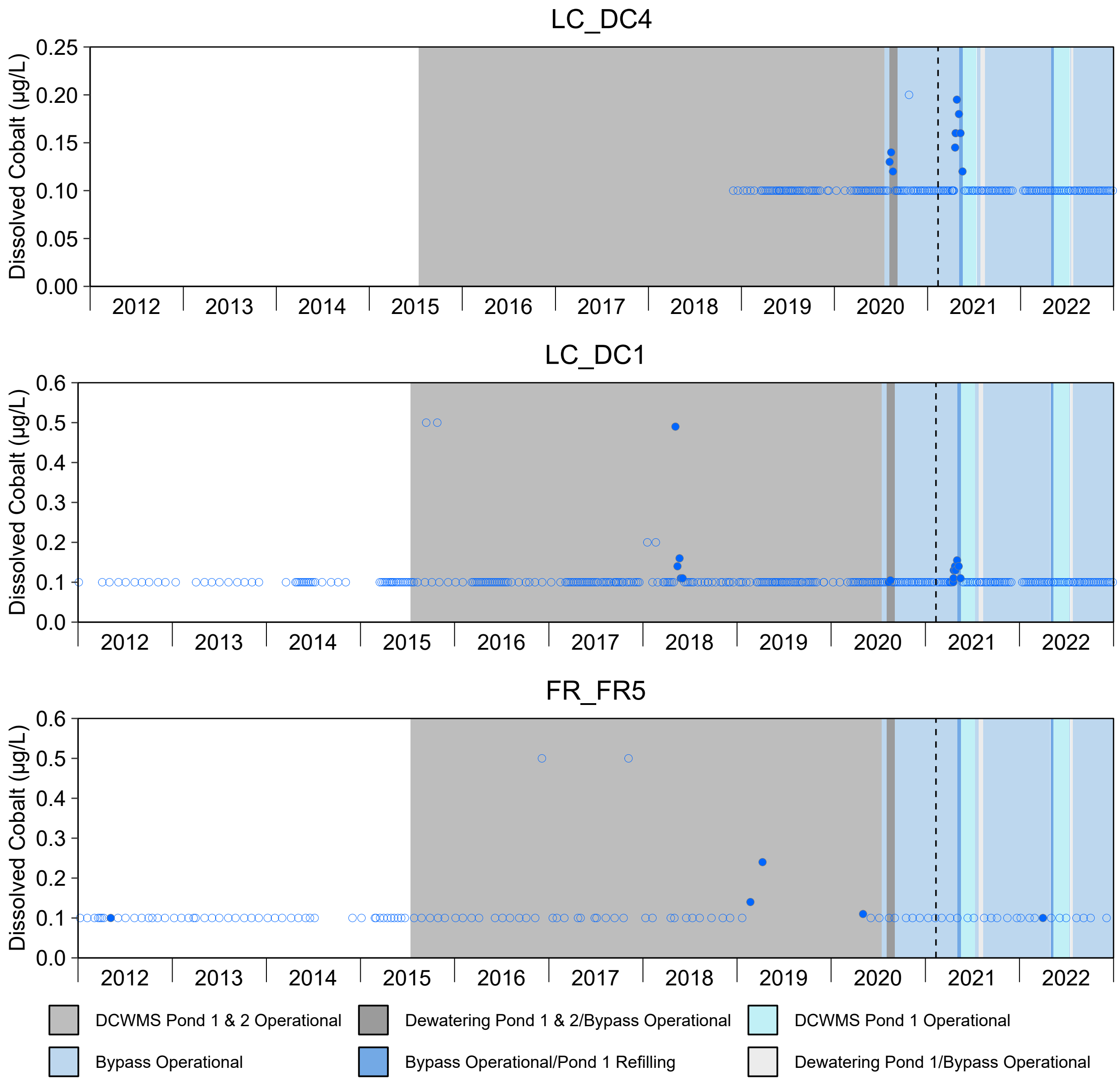


Figure C.6: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dissolved cobalt was used because bioavailability and toxicity has been associated with the dissolved fraction (Environment Canada 2017; Azimuth 2018). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

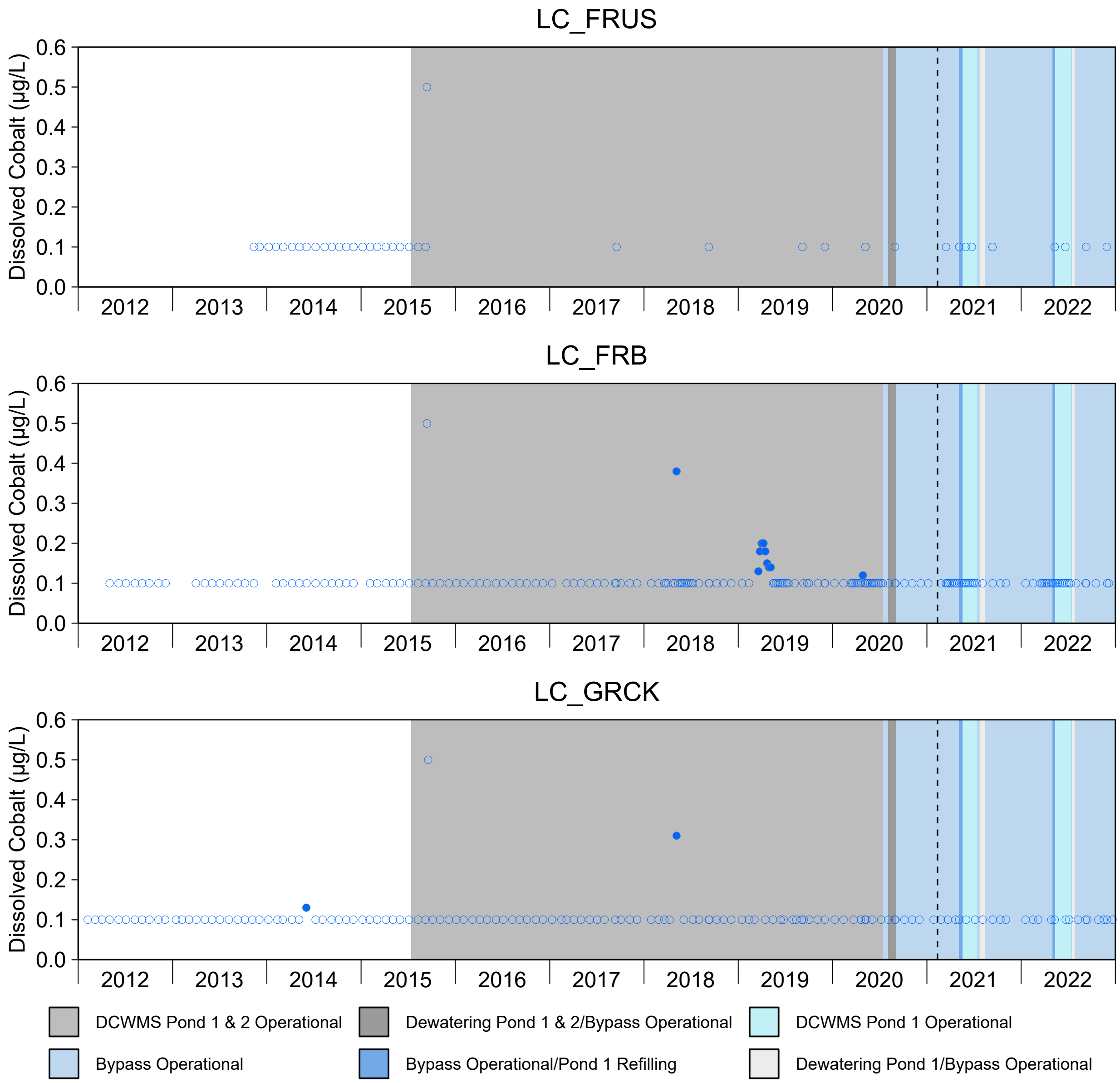


Figure C.6: Time Series Plots for Dissolved Cobalt from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dissolved cobalt was used because bioavailability and toxicity has been associated with the dissolved fraction (Environment Canada 2017; Azimuth 2018). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

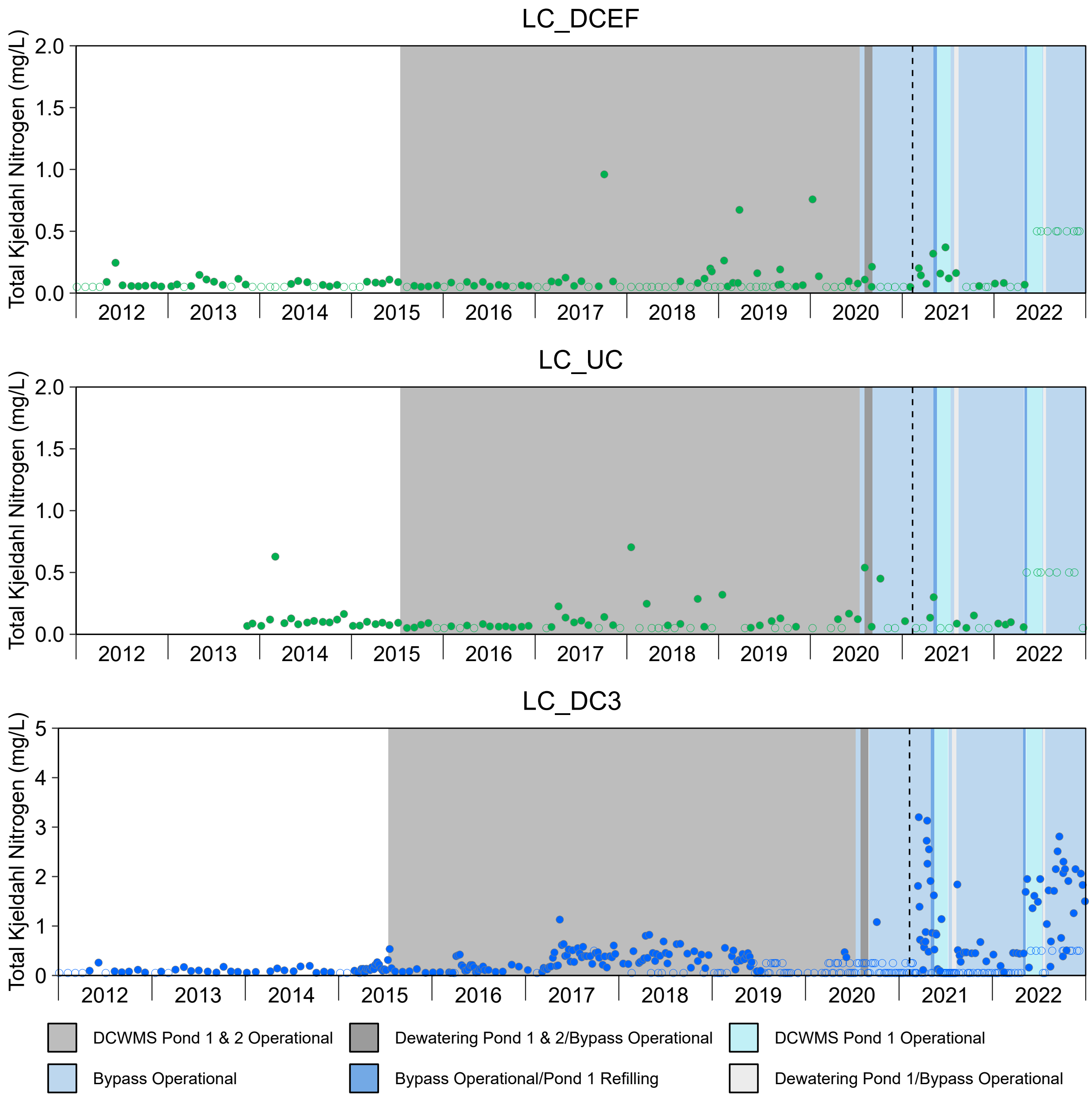


Figure C.7: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

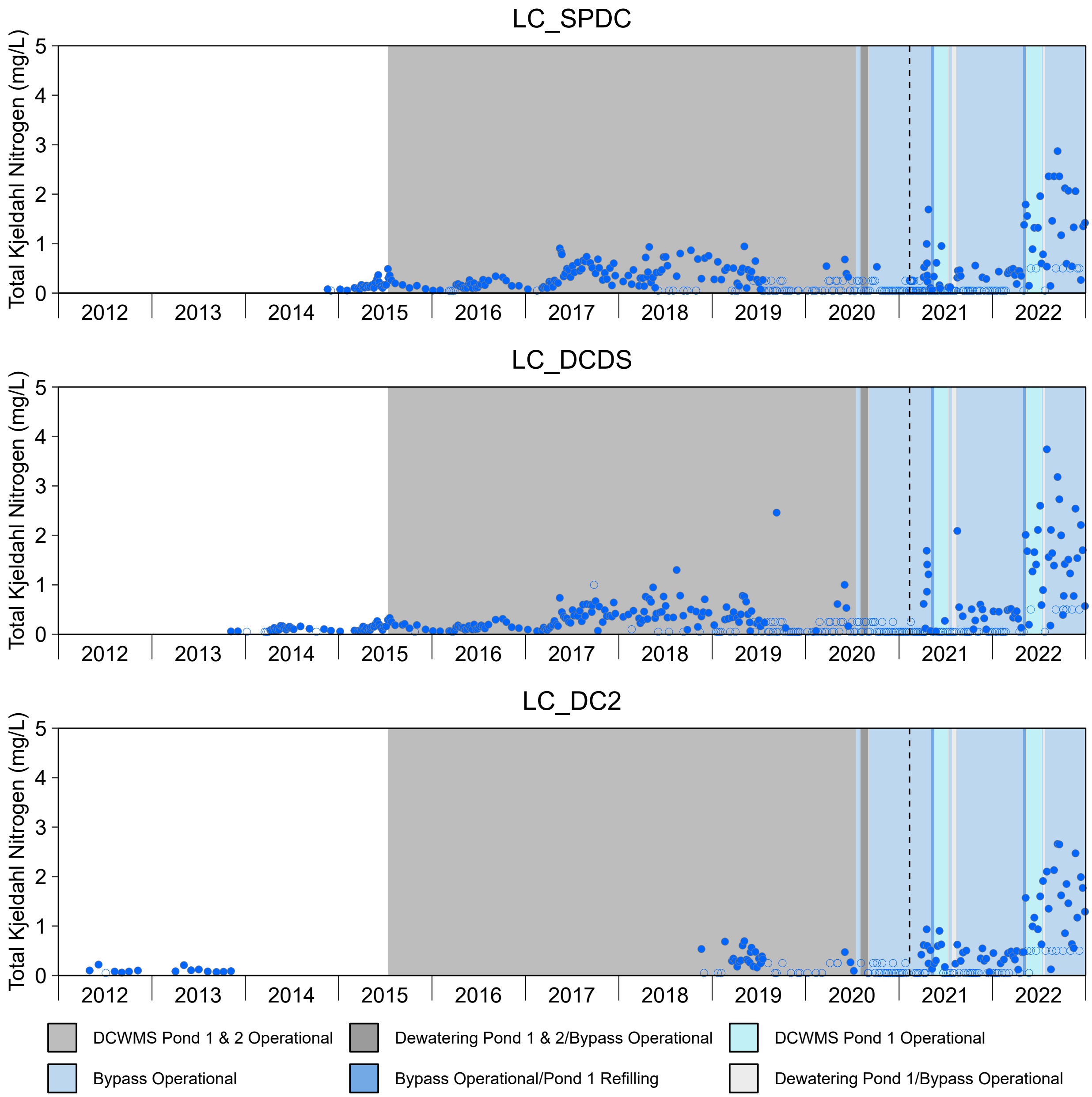


Figure C.7: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

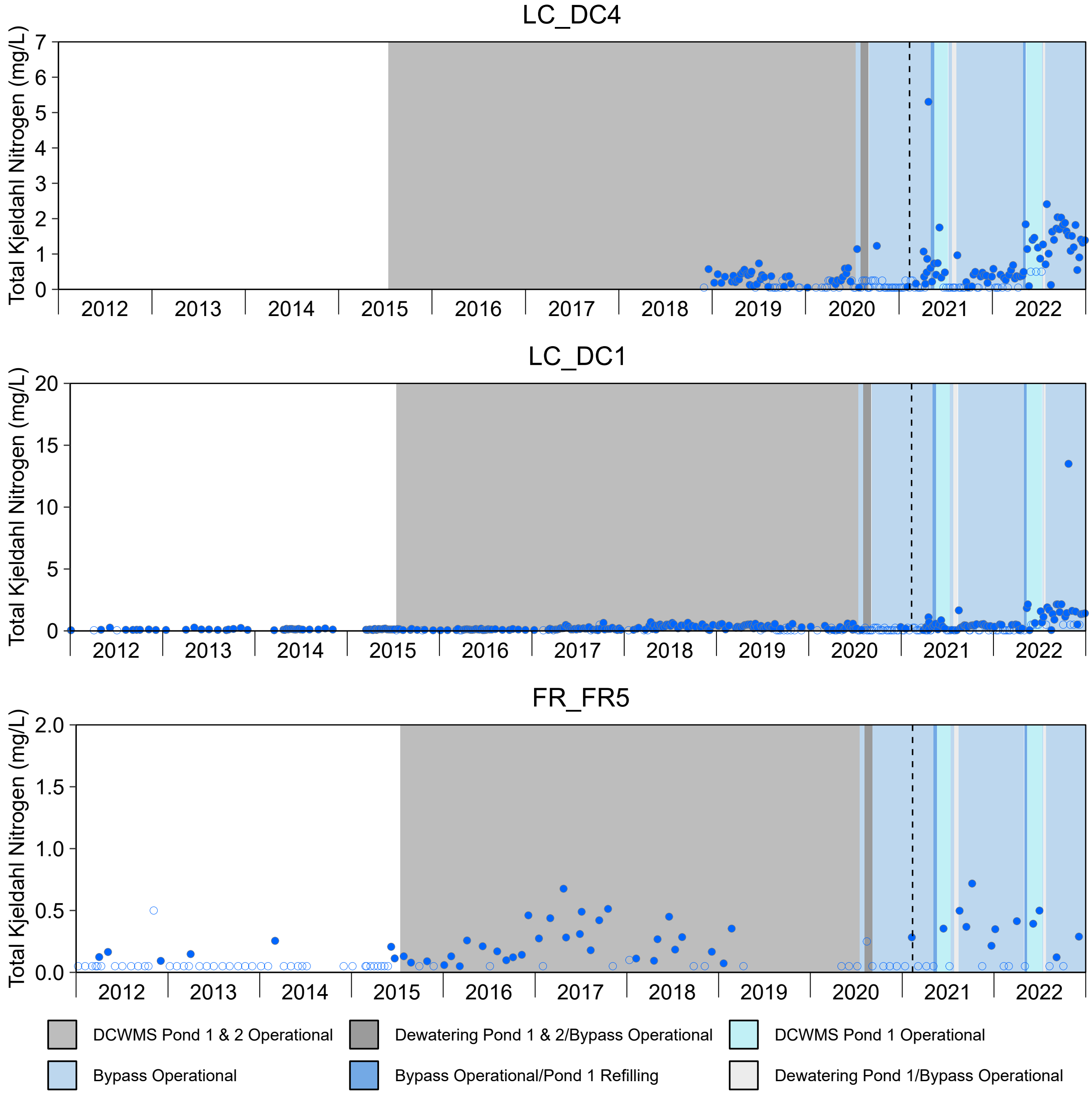


Figure C.7: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

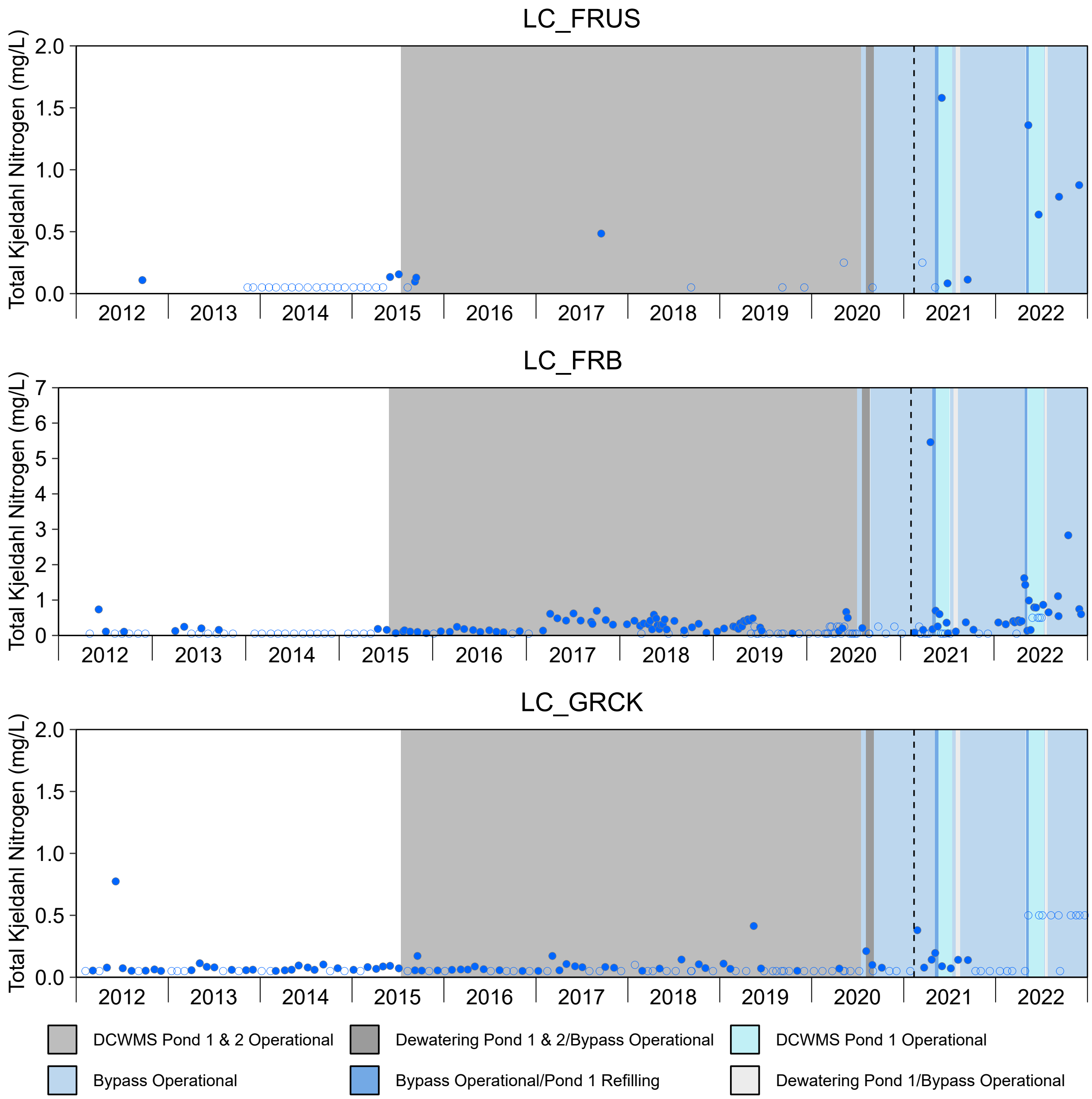


Figure C.7: Time Series Plots for Total Kjeldahl Nitrogen from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

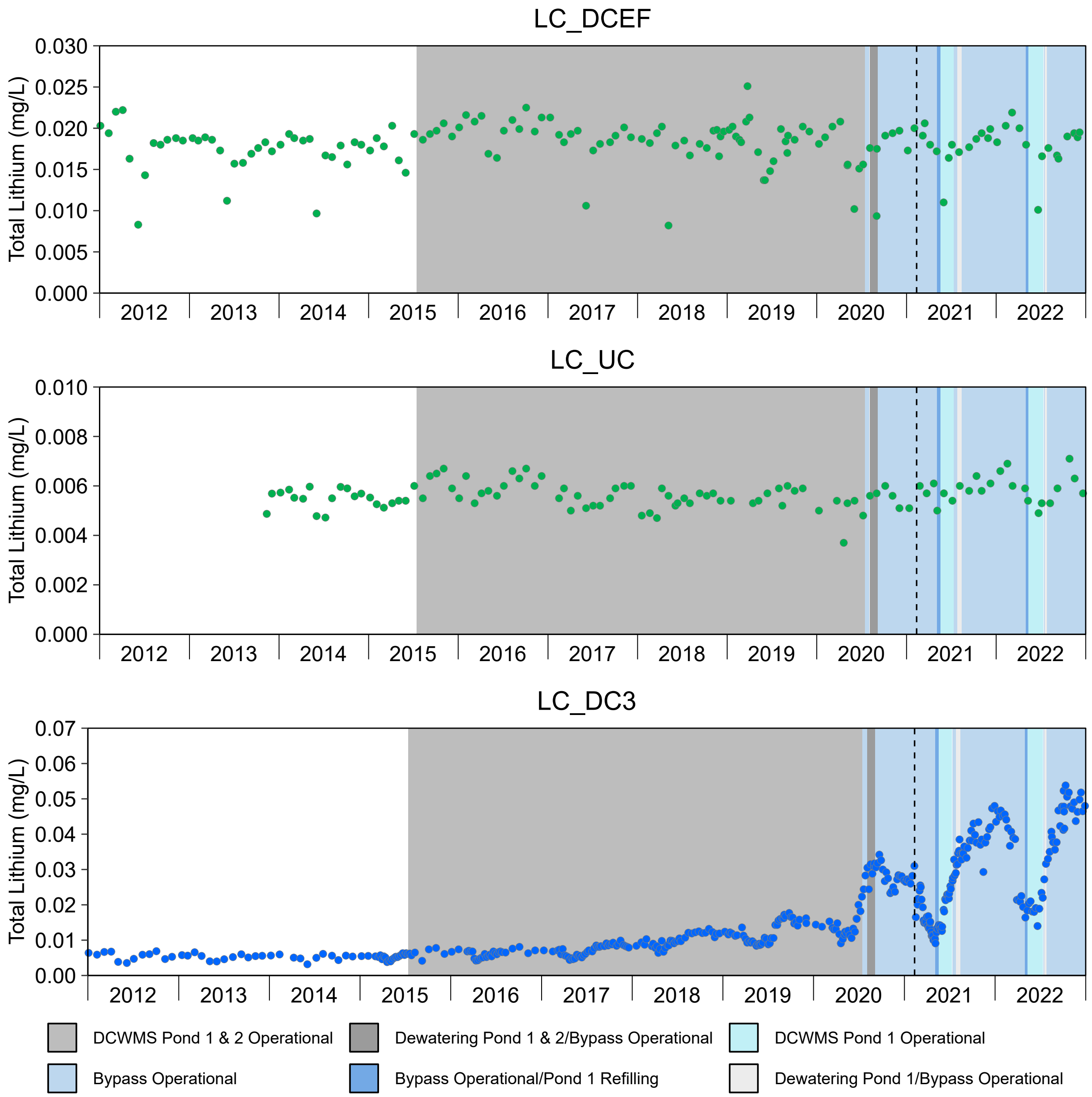


Figure C.8: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

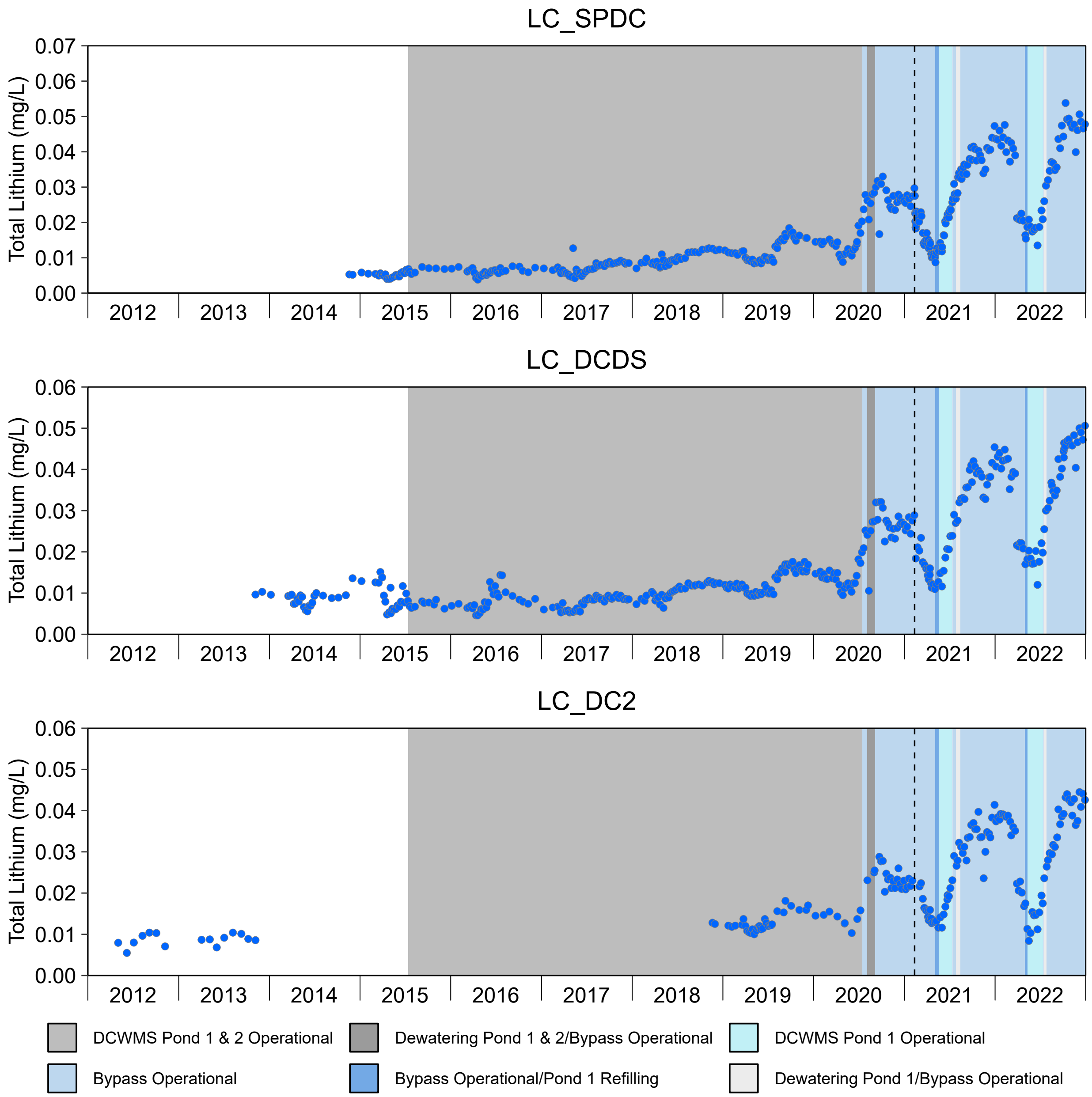


Figure C.8: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

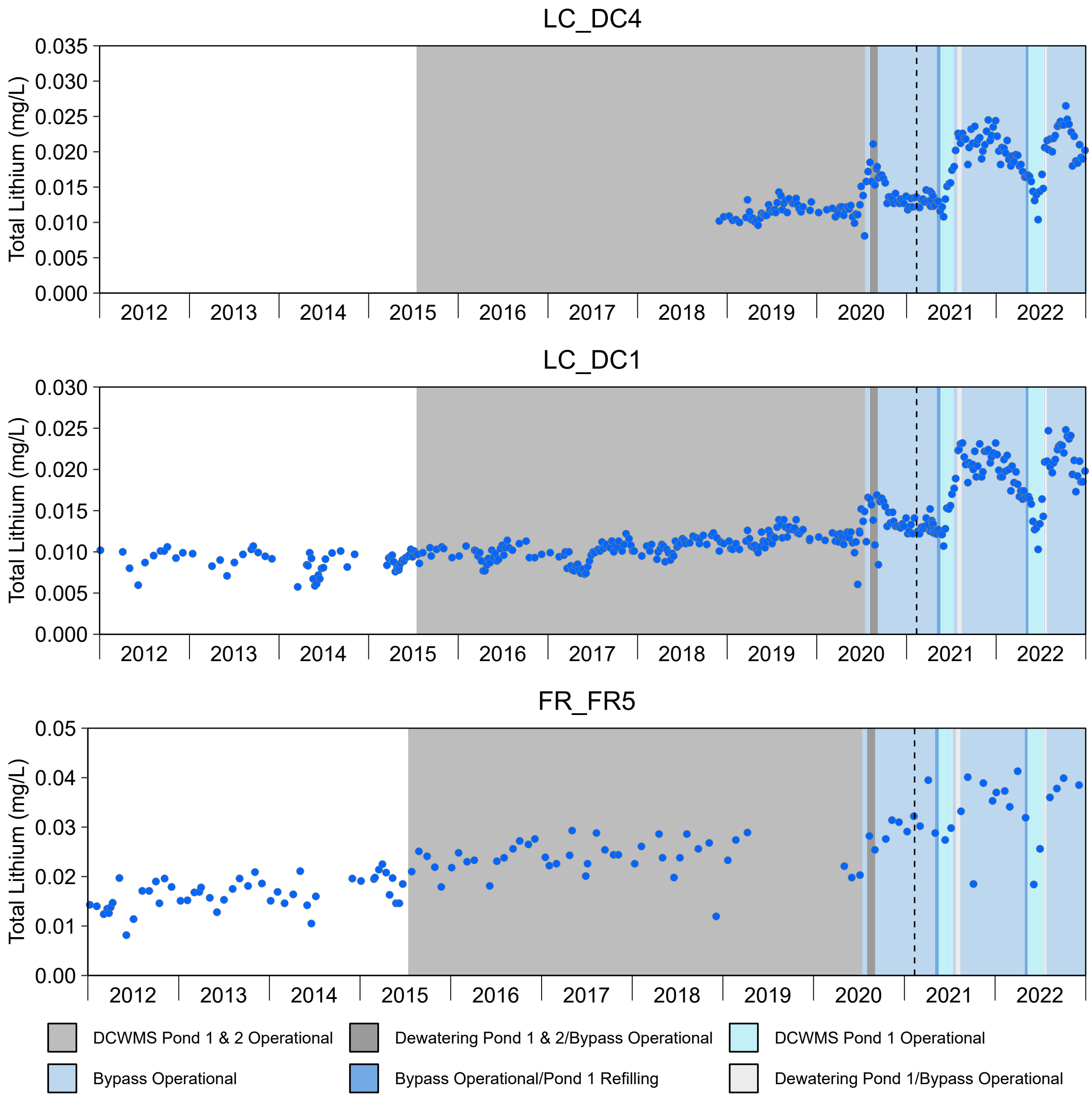


Figure C.8: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

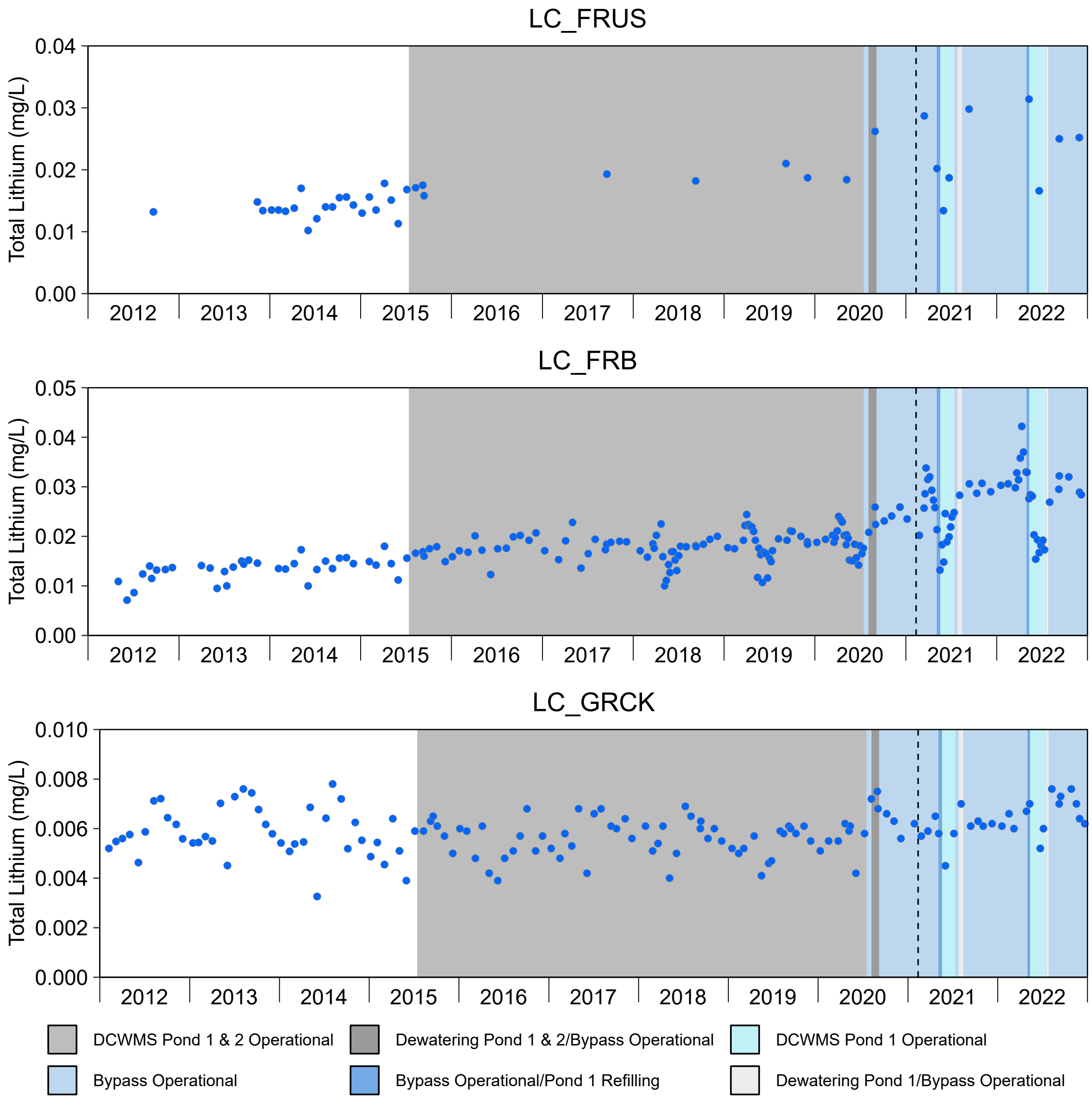


Figure C.8: Time Series Plots for Total Lithium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

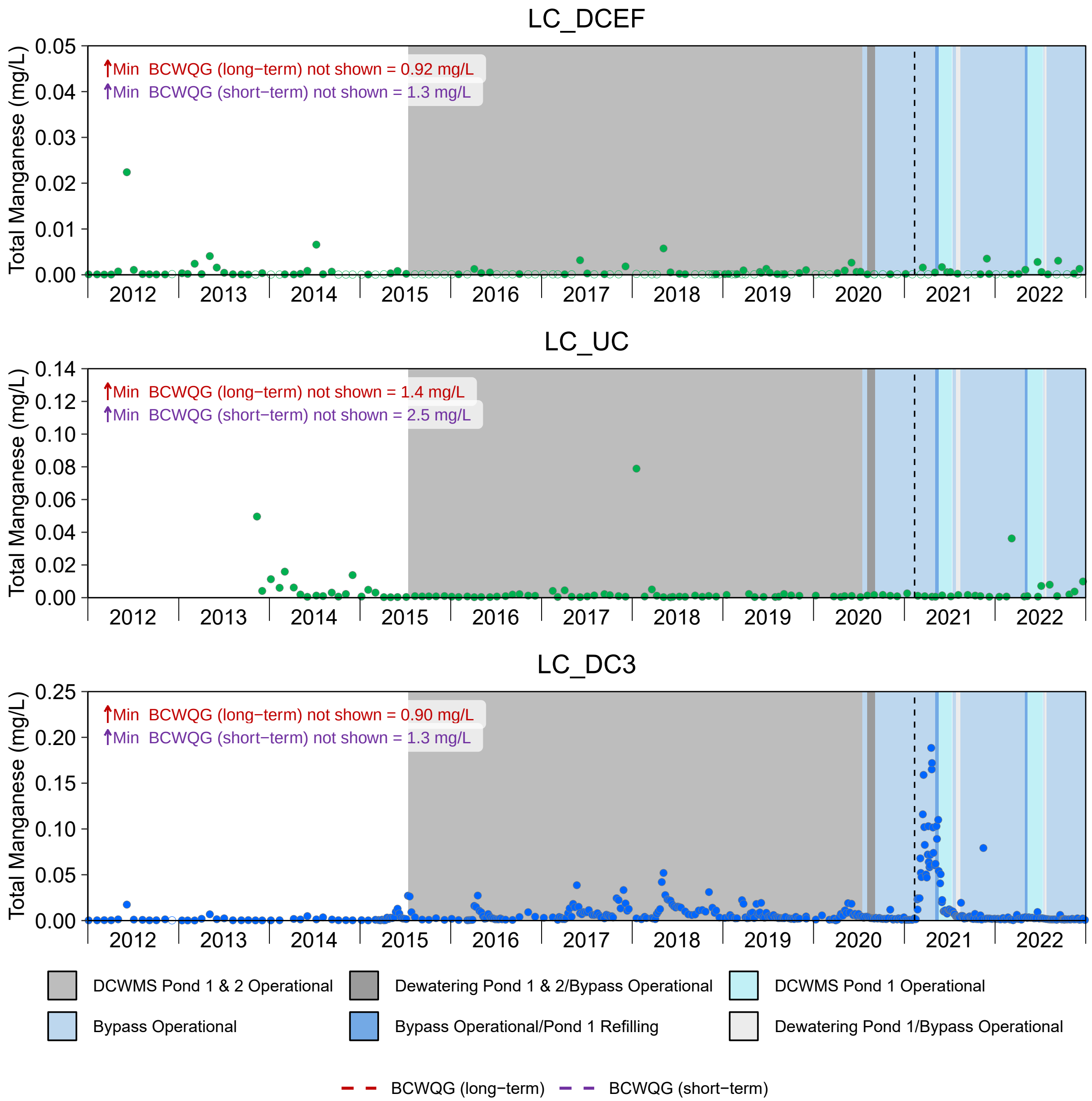


Figure C.9: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness.

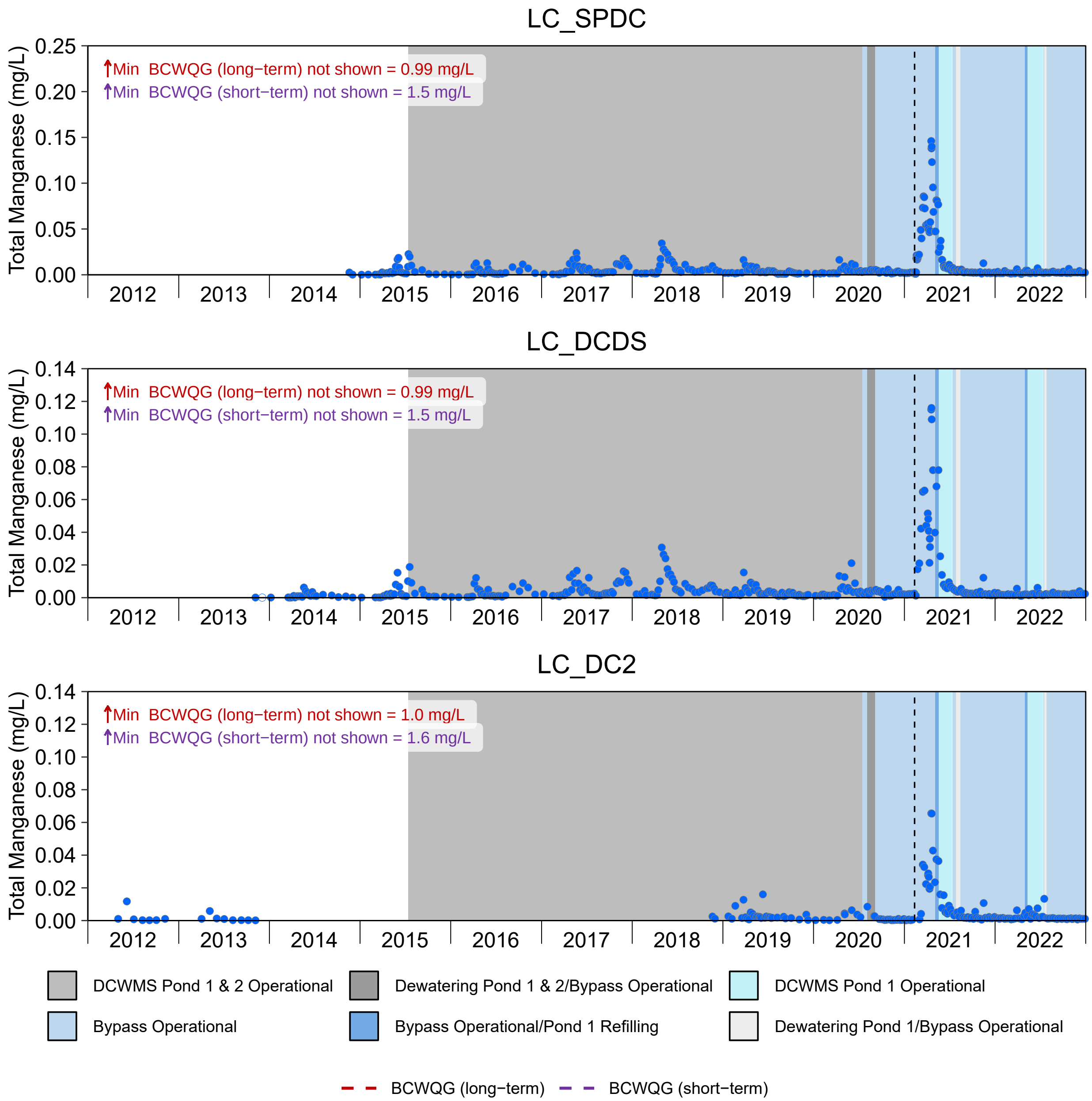


Figure C.9: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness.

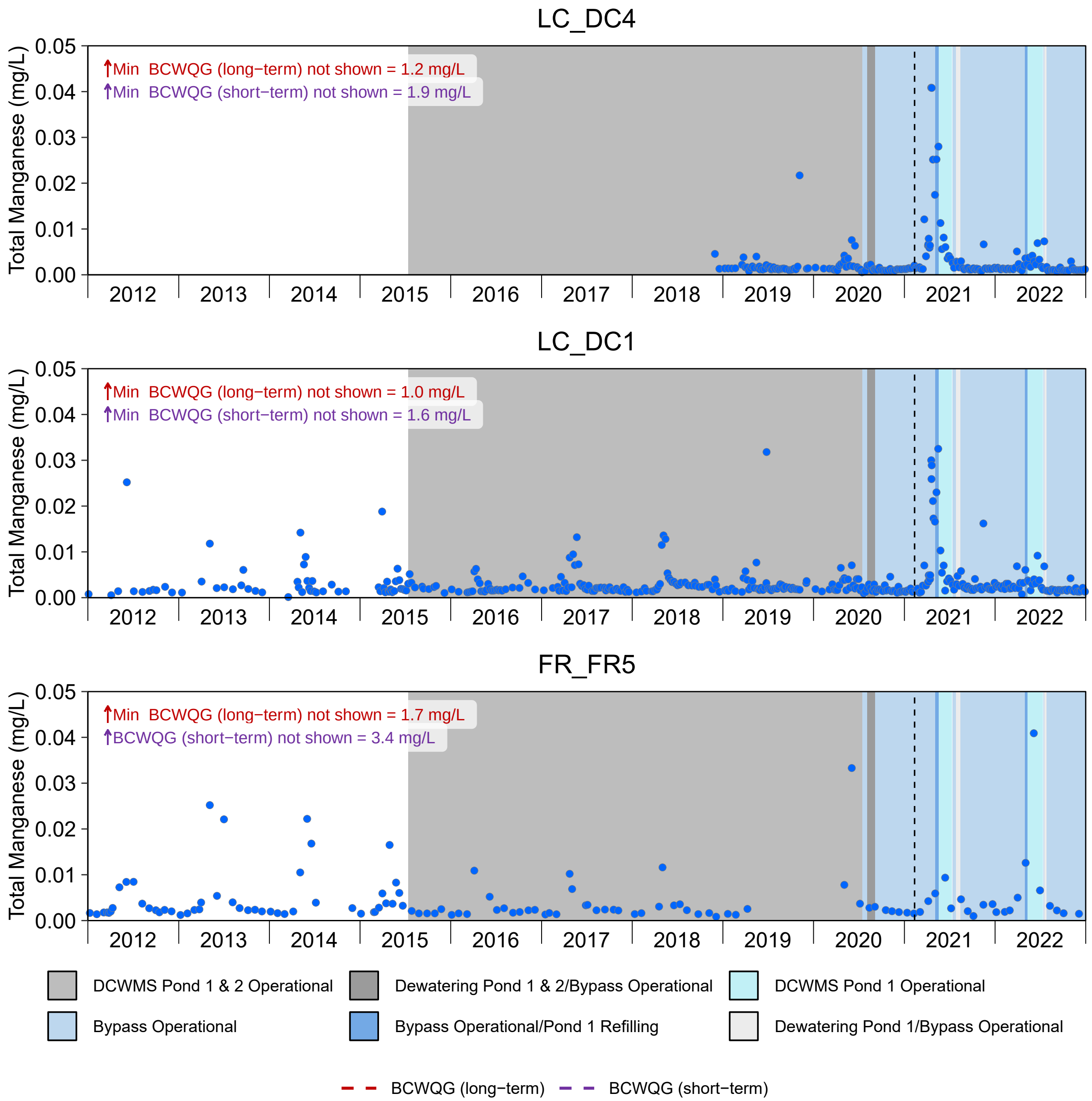


Figure C.9: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness.

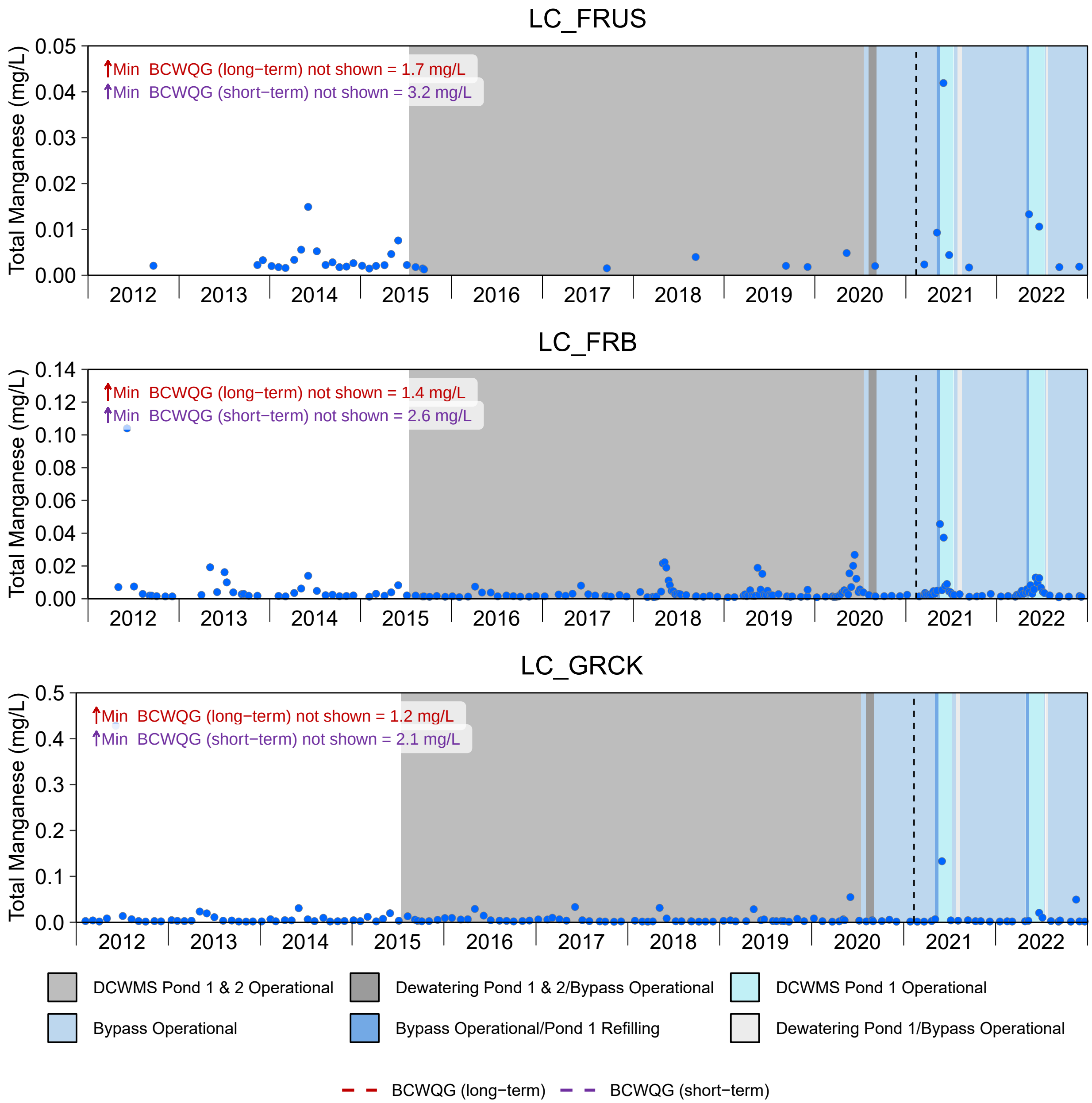


Figure C.9: Time Series Plots for Total Manganese from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness.

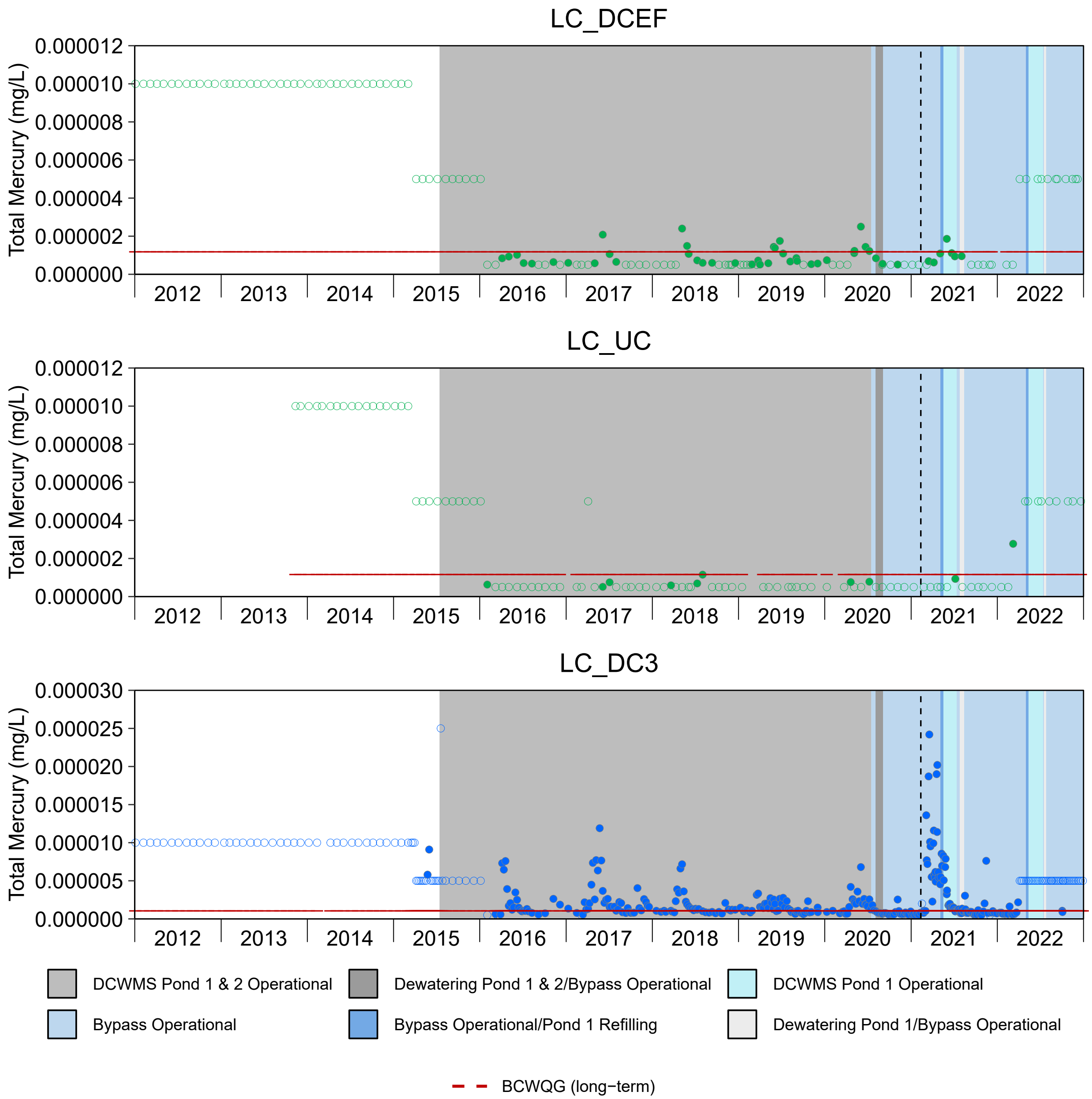


Figure C.10: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

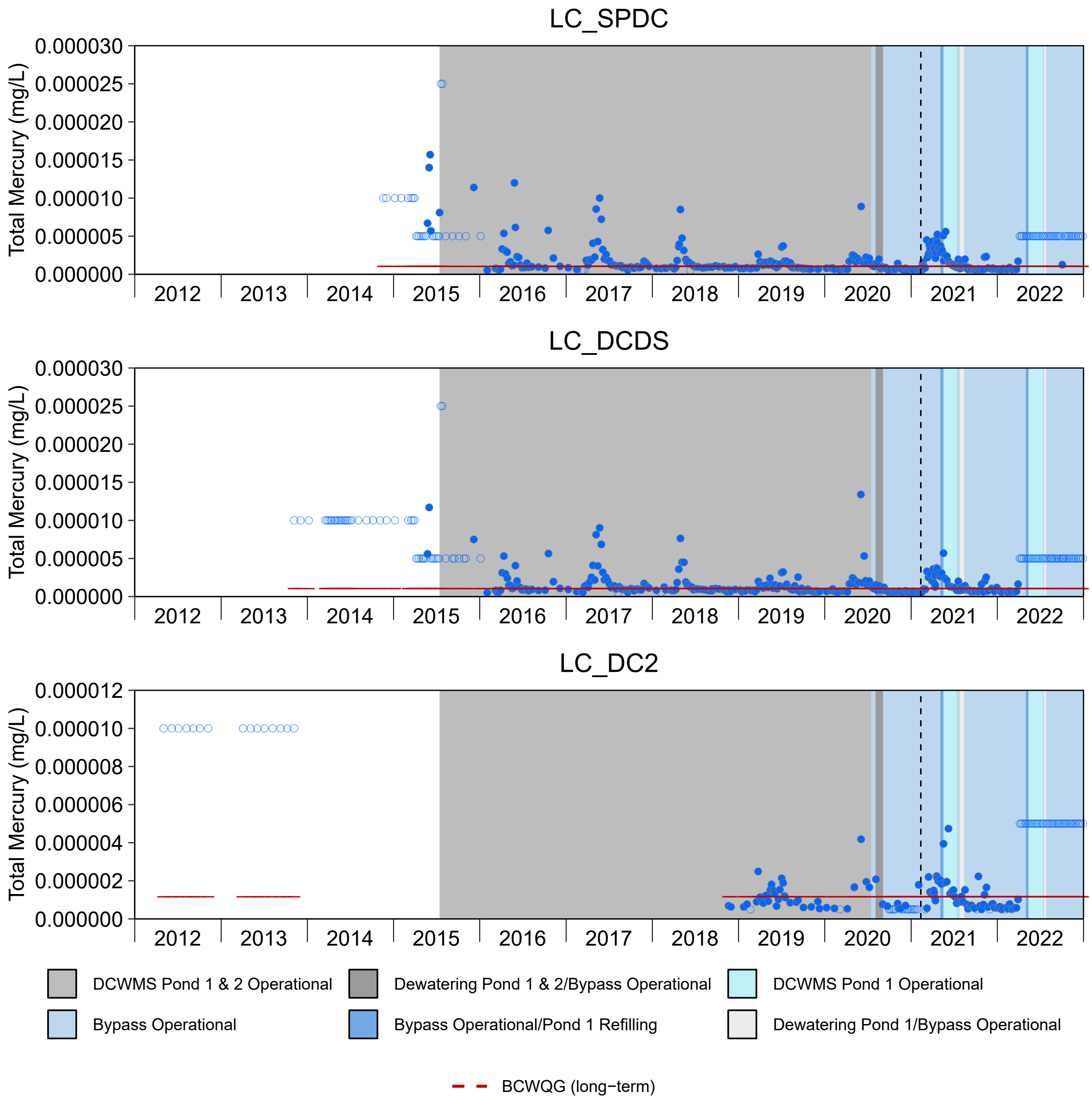


Figure C.10: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

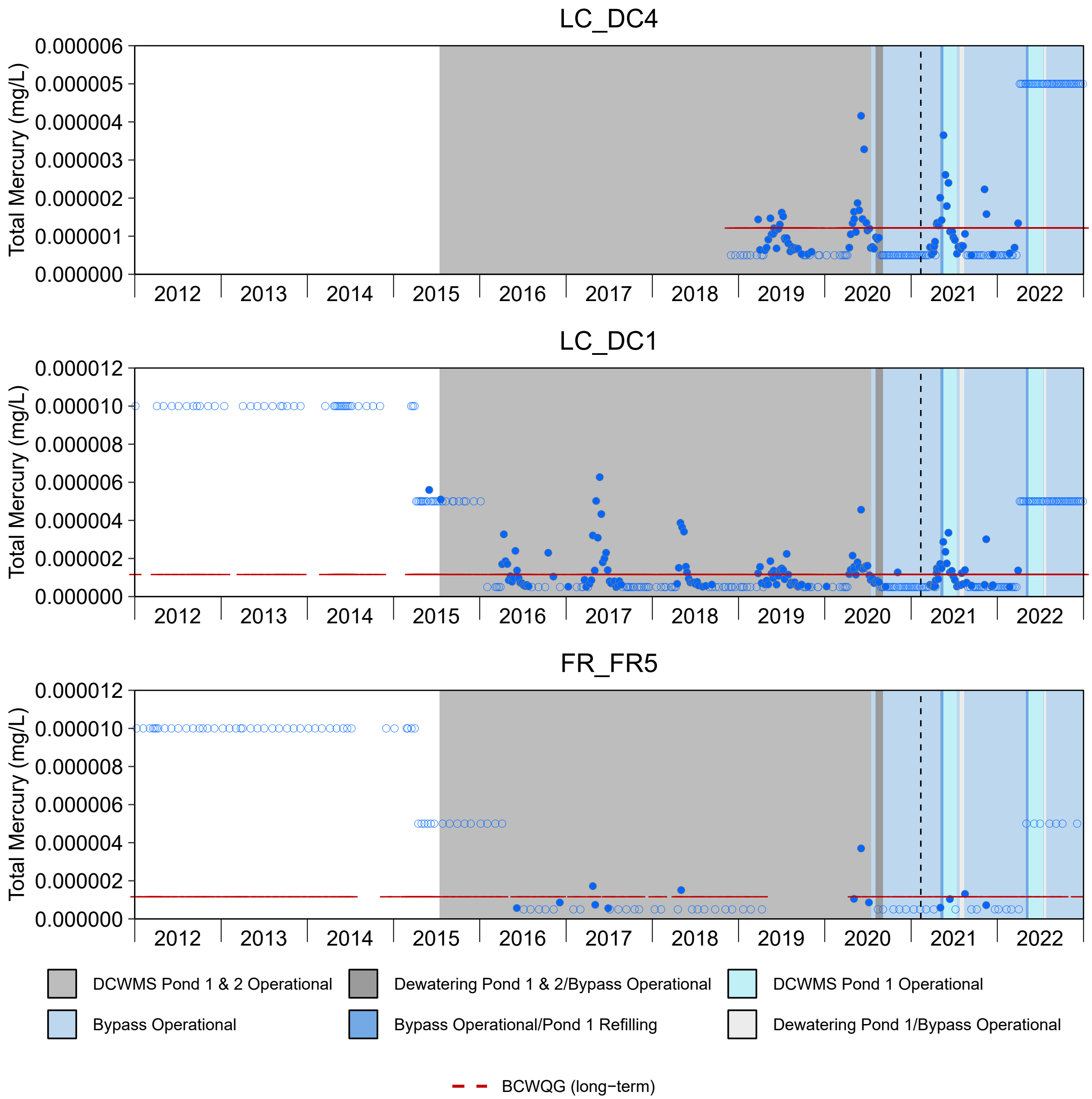


Figure C.10: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

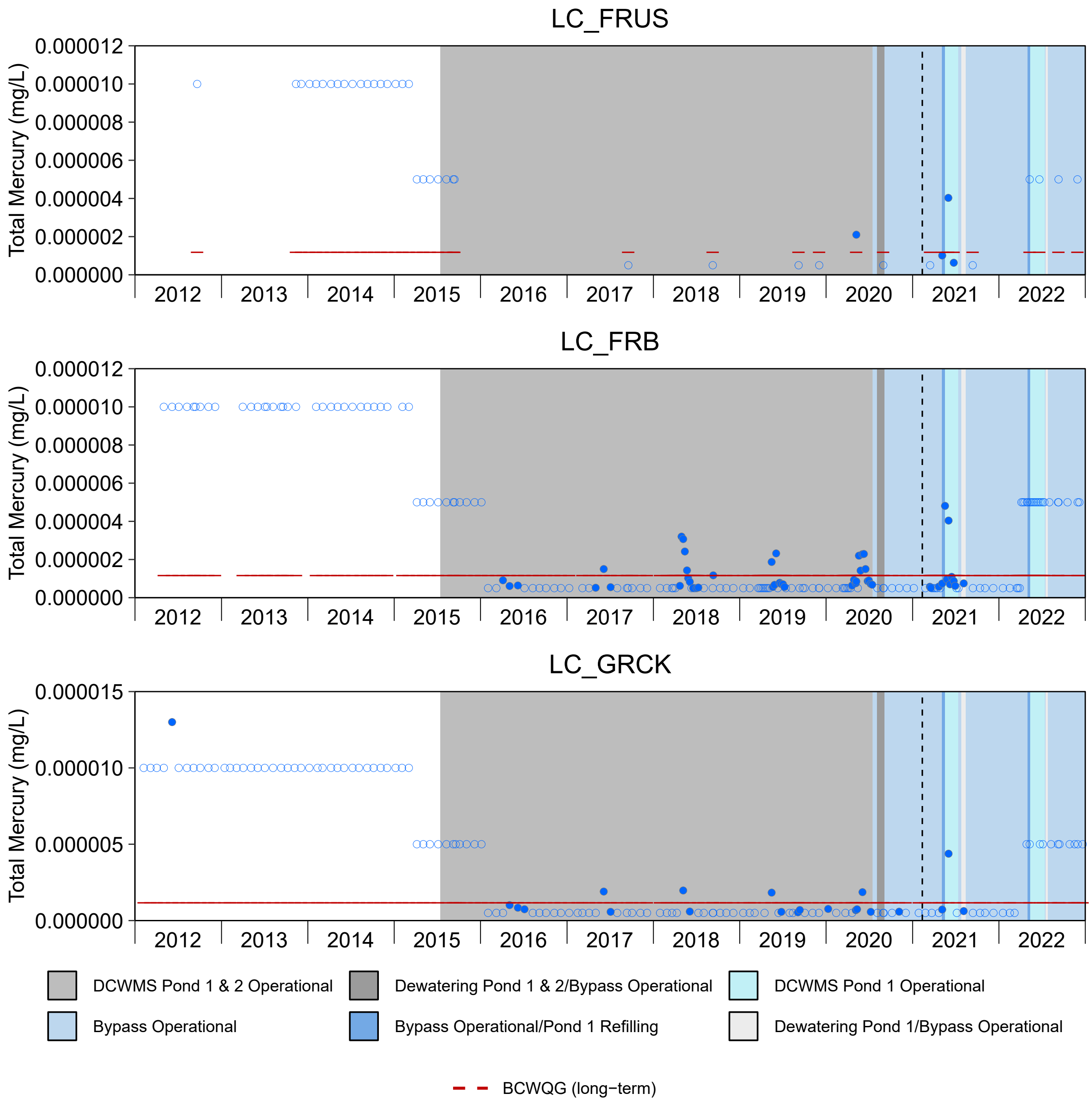


Figure C.10: Time Series Plots for Total Mercury from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

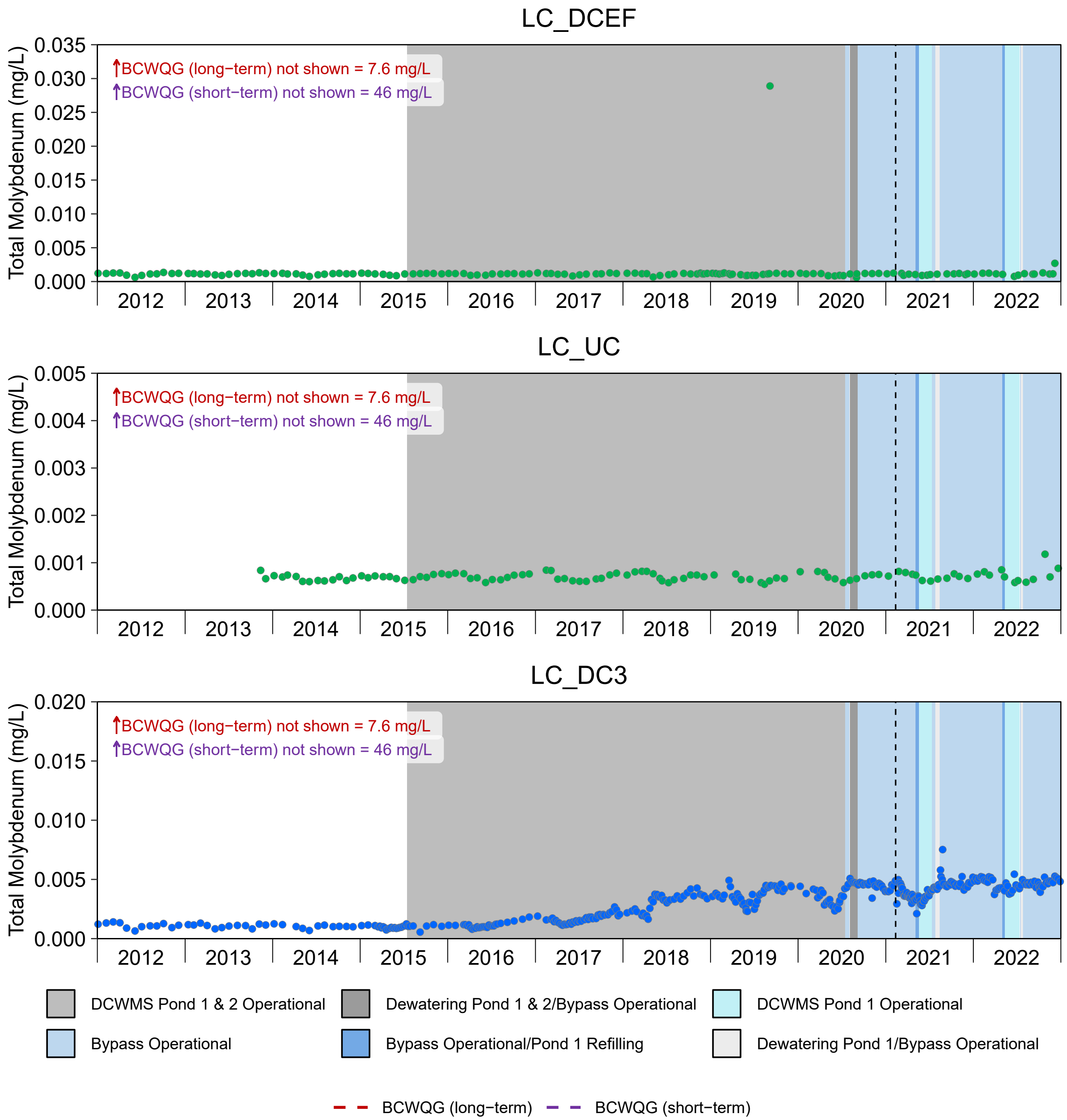


Figure C.11: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

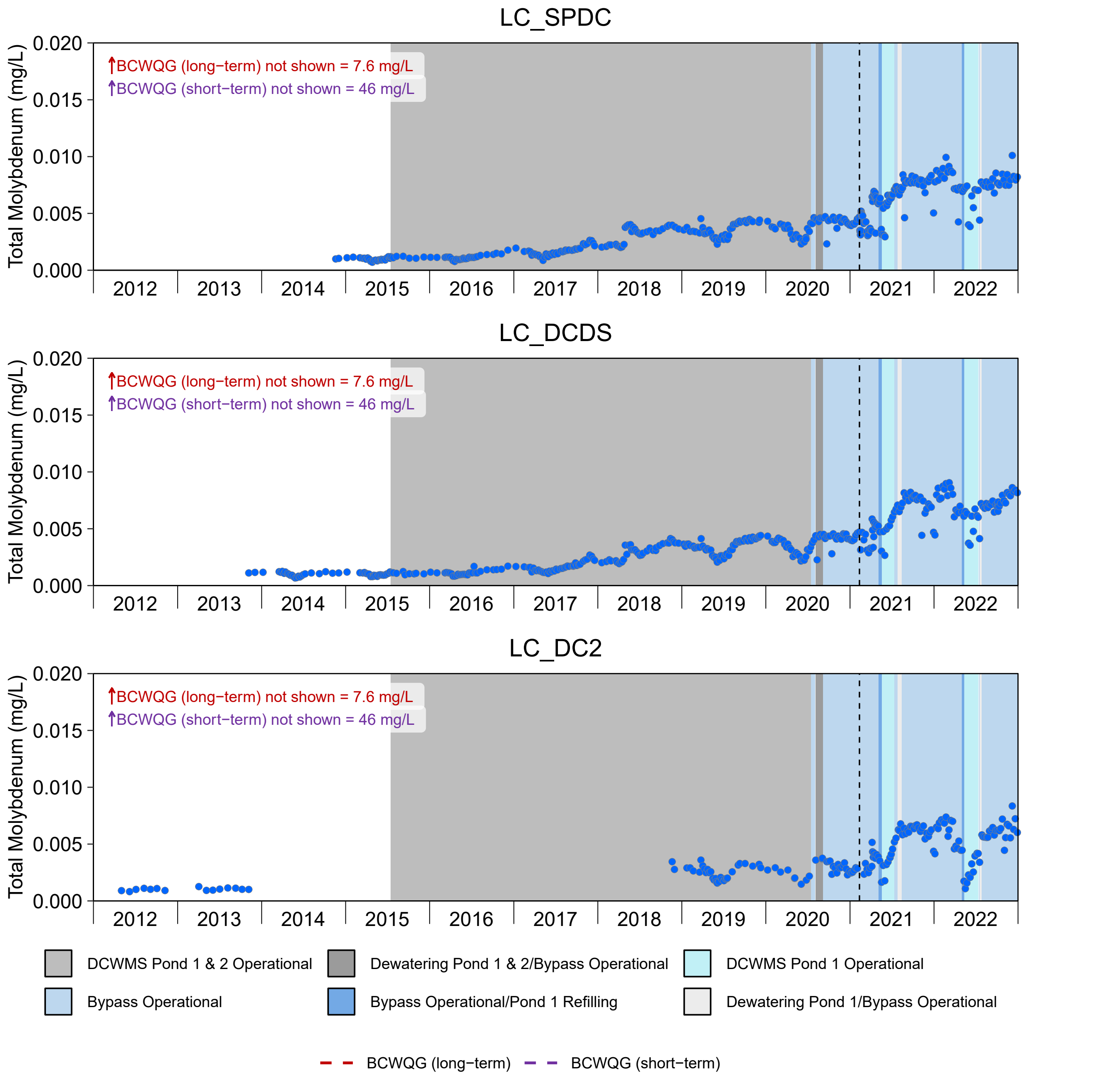


Figure C.11: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

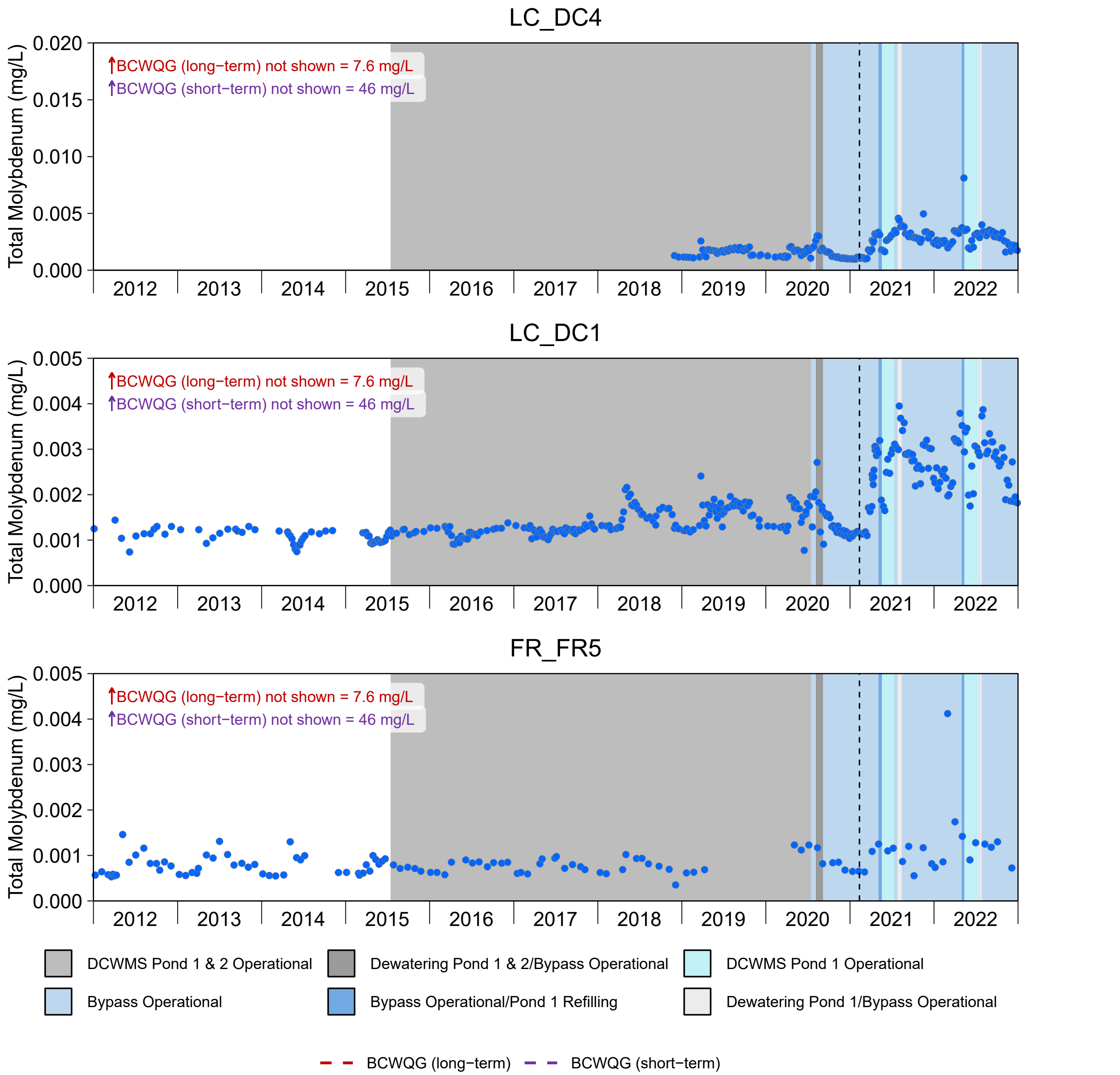


Figure C.11: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

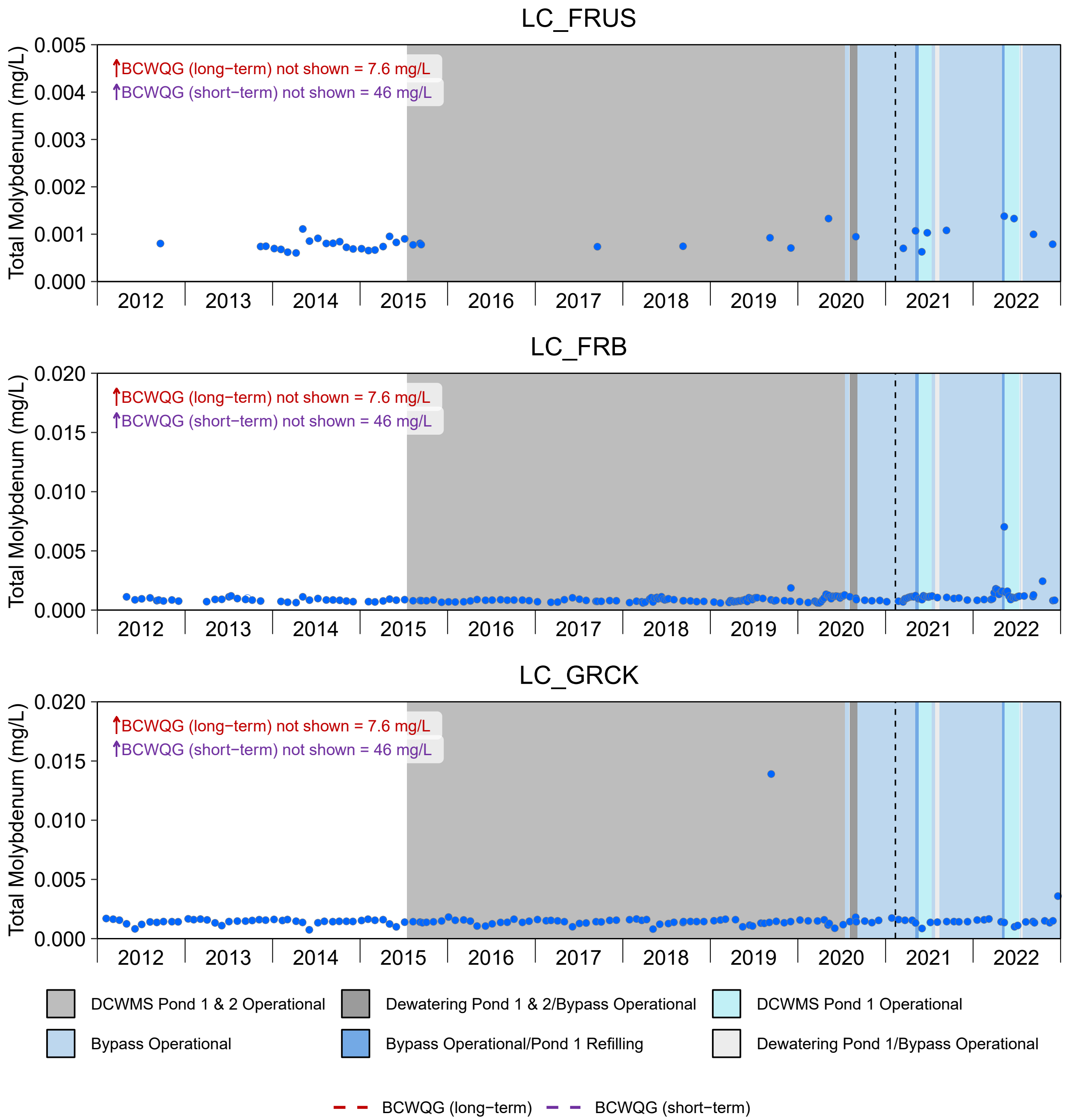


Figure C.11: Time Series Plots for Total Molybdenum from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

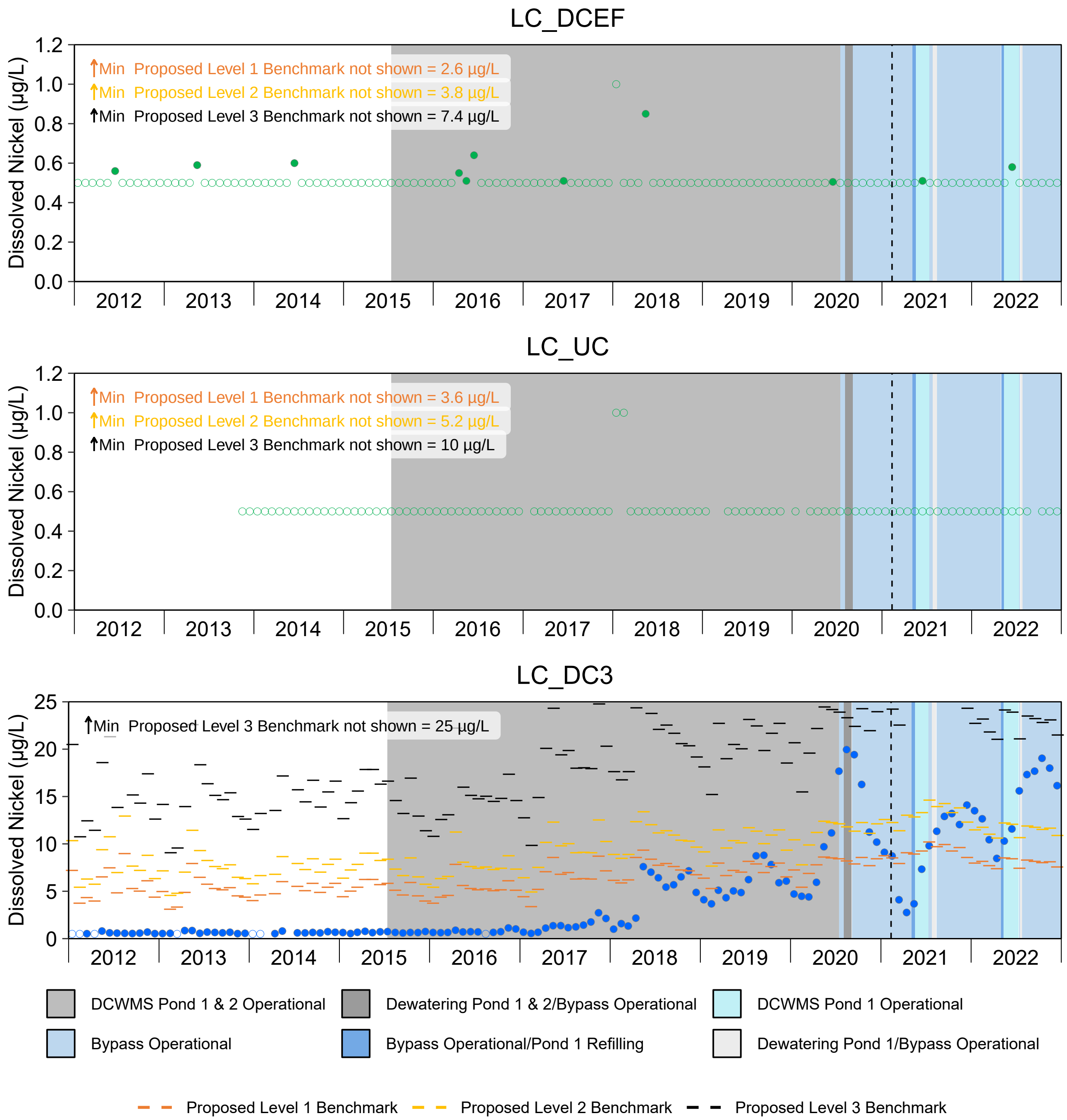


Figure C.12: Time Series Plots for Dissolved Nickel Concentrations fromLCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on dissolved organic carbon, water hardness and bicarbonate concentrations. Values and effects concentrations were averaged by month according to screening guidance. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

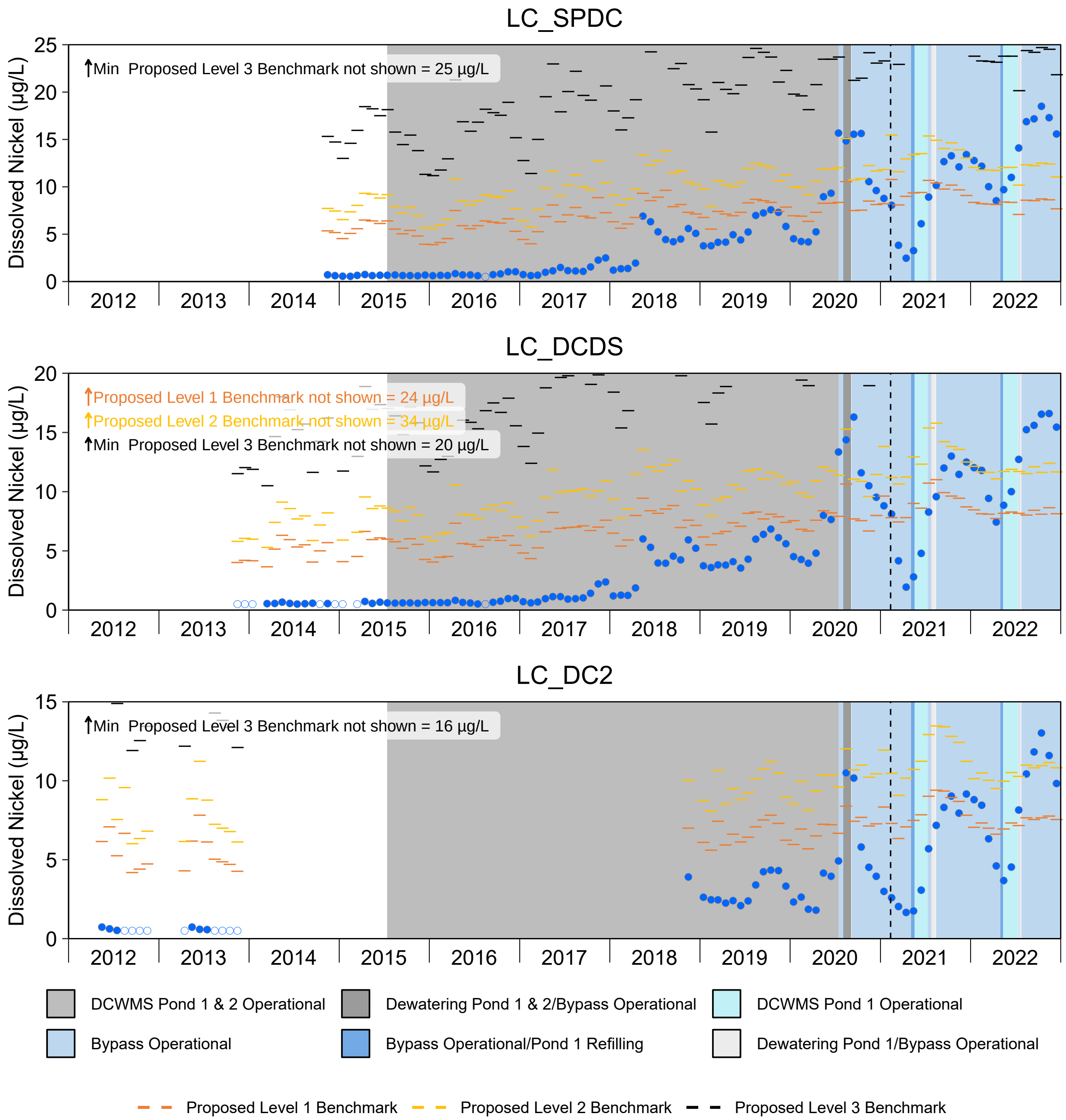


Figure C.12: Time Series Plots for Dissolved Nickel Concentrations from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on dissolved organic carbon, water hardness and bicarbonate concentrations. Values and effects concentrations were averaged by month according to screening guidance. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

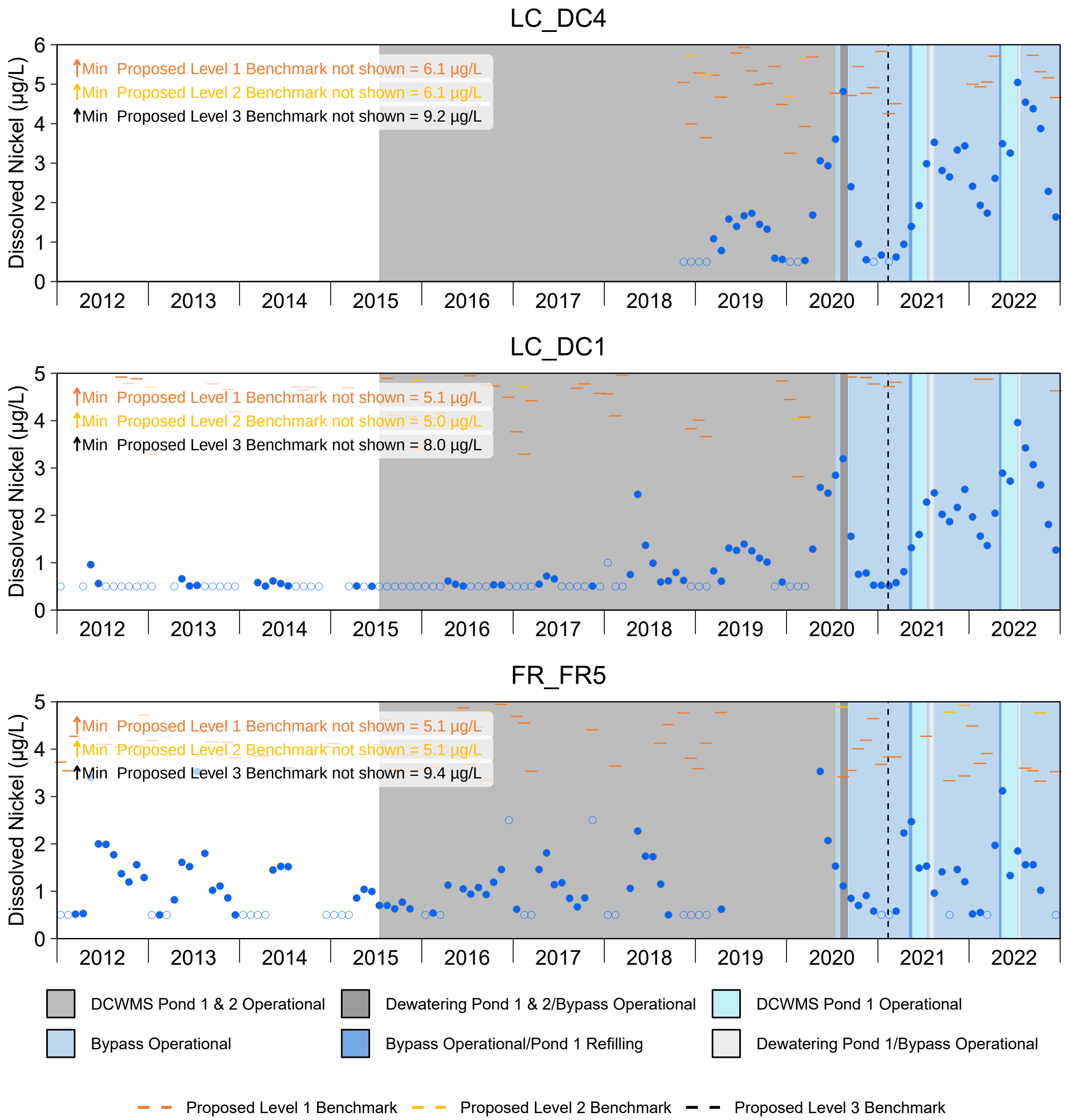


Figure C.12: Time Series Plots for Dissolved Nickel Concentrations from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on dissolved organic carbon, water hardness and bicarbonate concentrations. Values and effects concentrations were averaged by month according to screening guidance. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

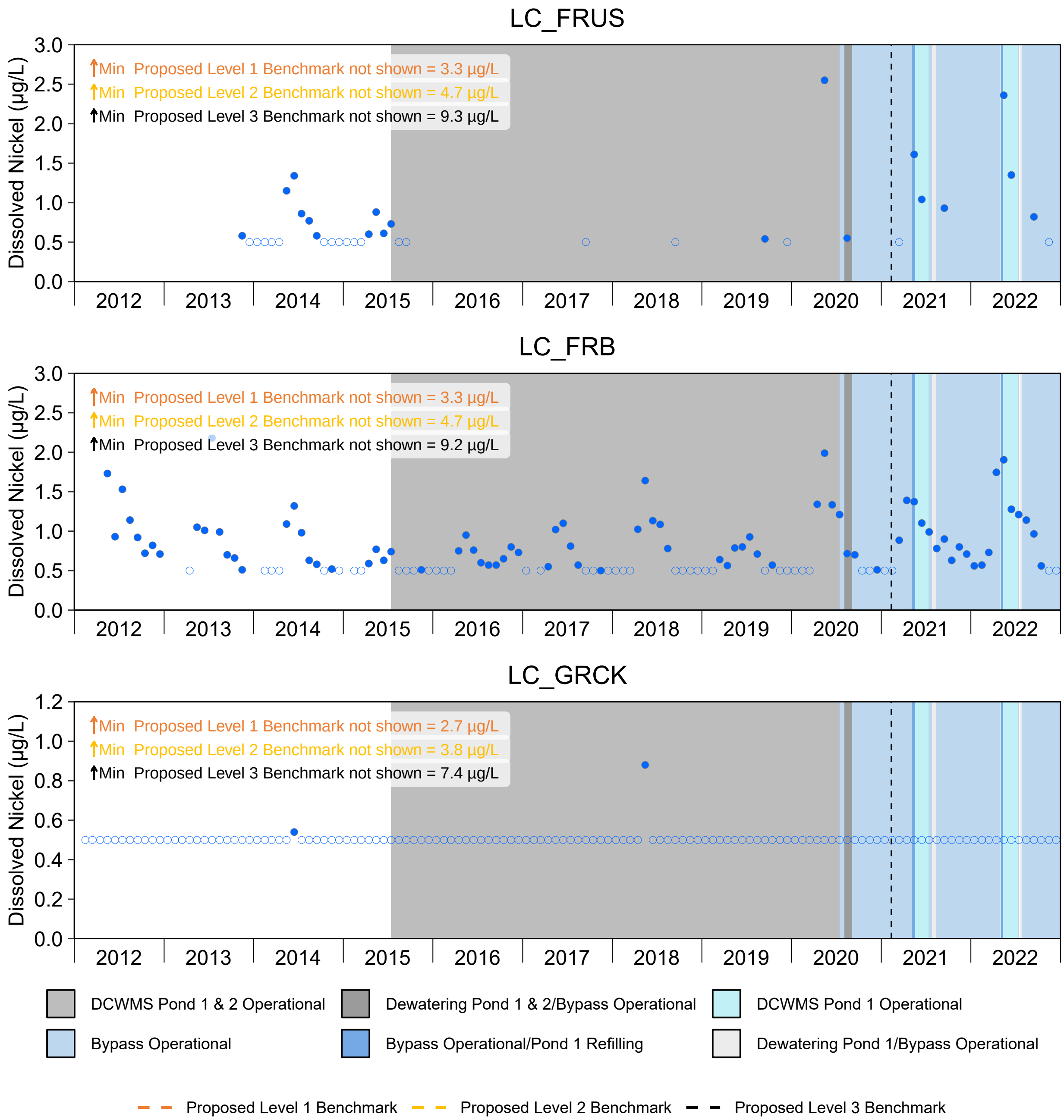


Figure C.12: Time Series Plots for Dissolved Nickel Concentrations from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on dissolved organic carbon, water hardness and bicarbonate concentrations. Values and effects concentrations were averaged by month according to screening guidance. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

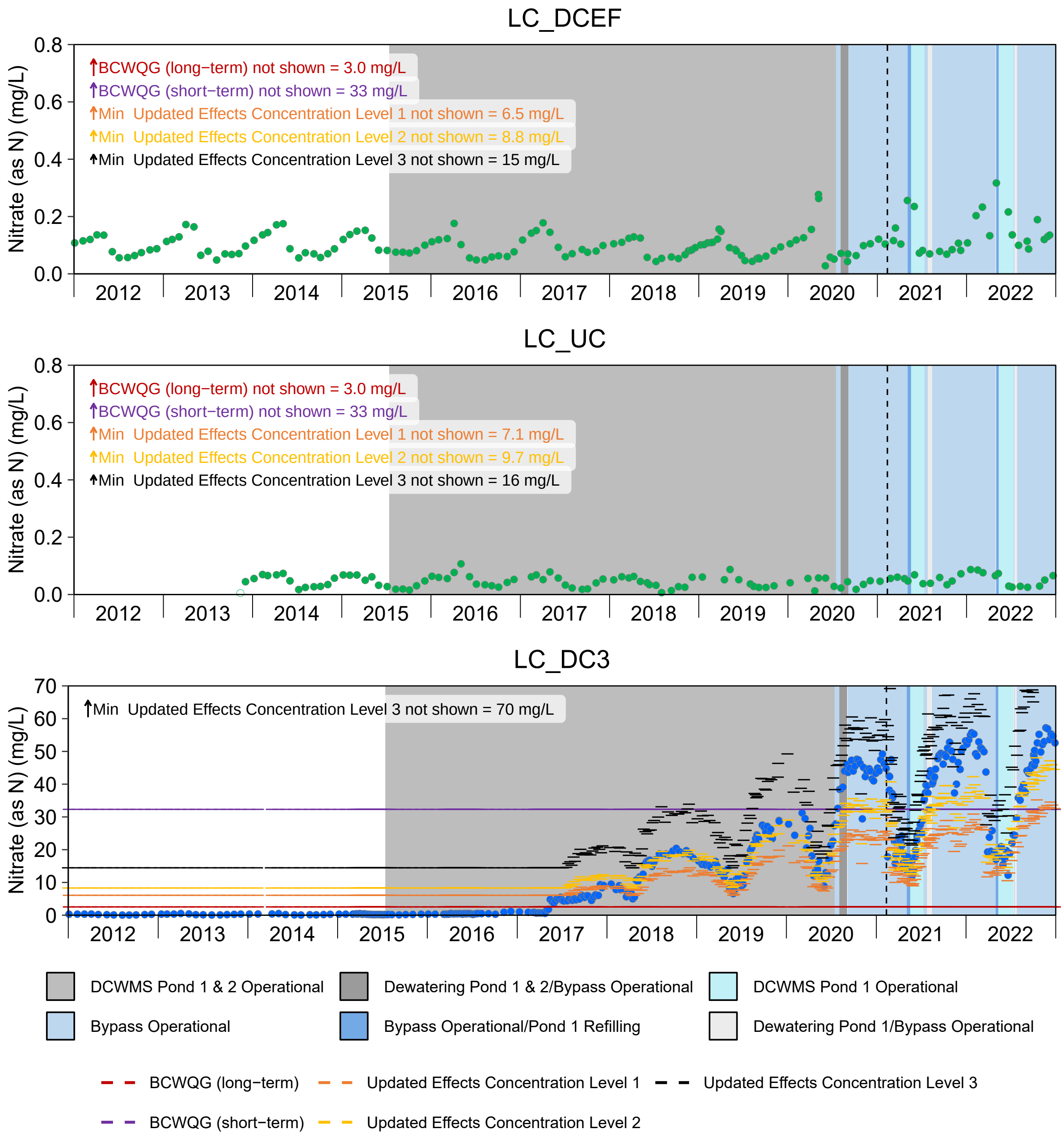


Figure C.13: Time Series Plots for Nitrate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

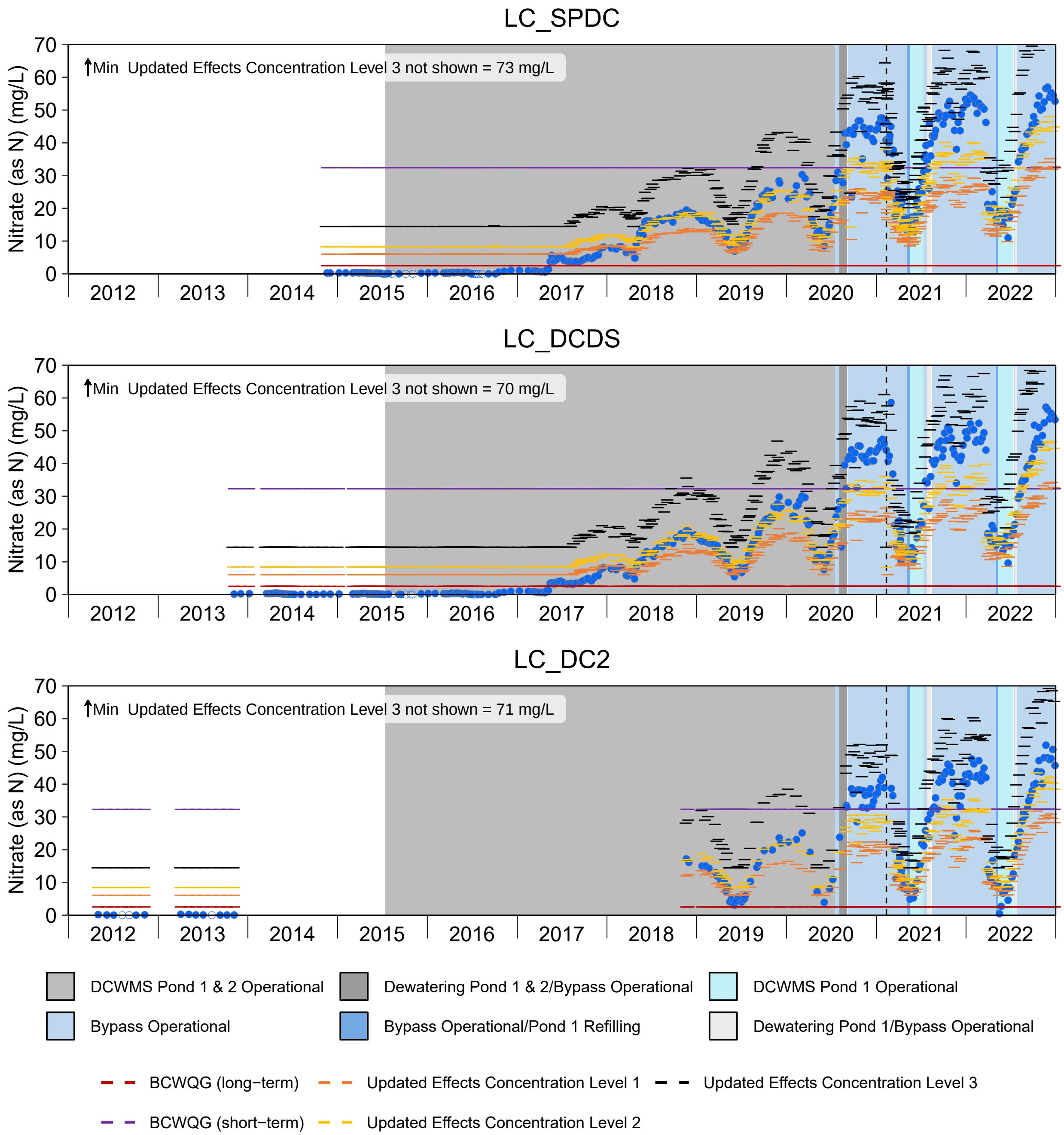


Figure C.13: Time Series Plots for Nitrate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

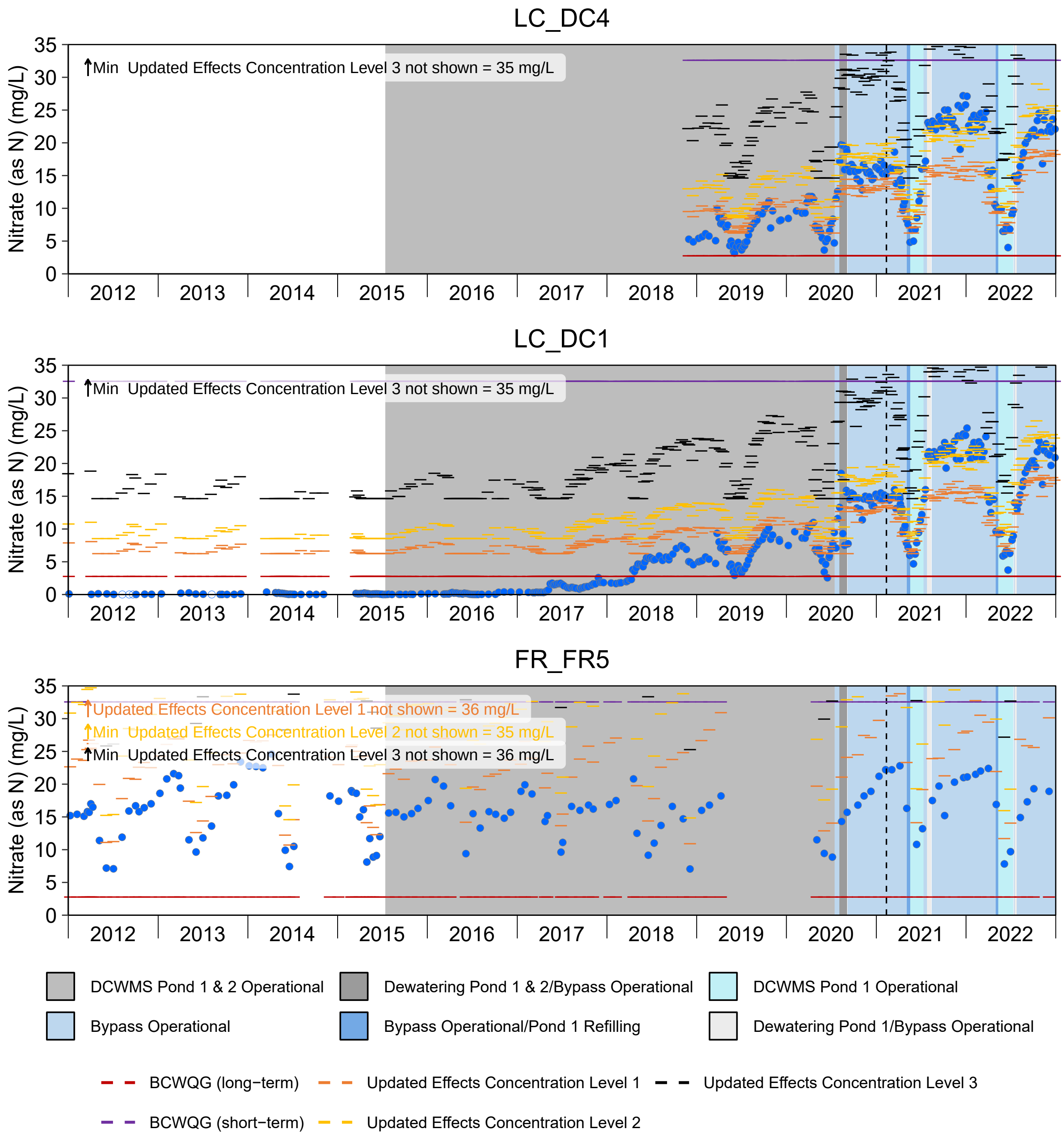


Figure C.13: Time Series Plots for Nitrate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

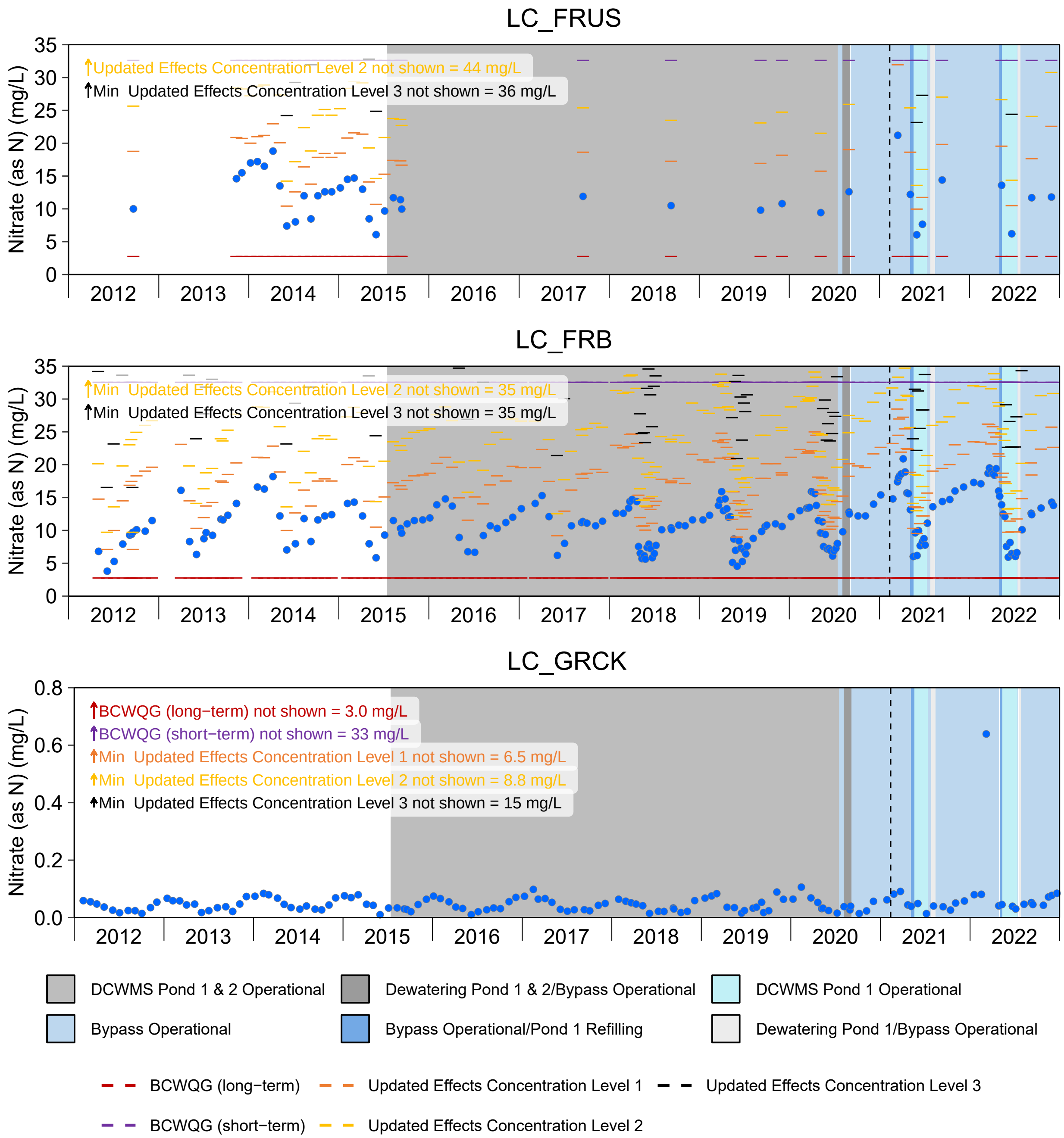


Figure C.13: Time Series Plots for Nitrate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

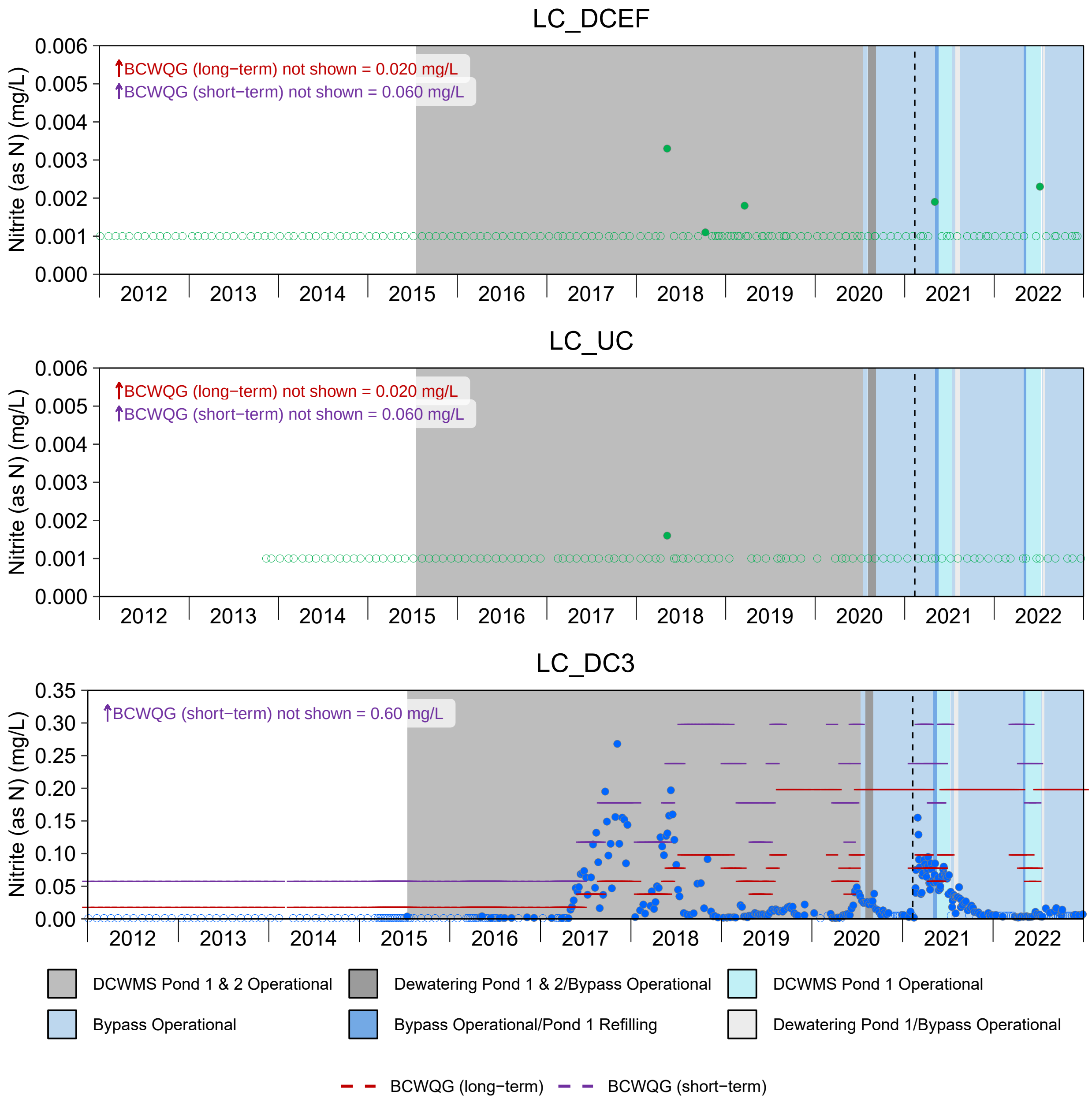


Figure C.14: Time Series Plots for Nitrite (as N) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

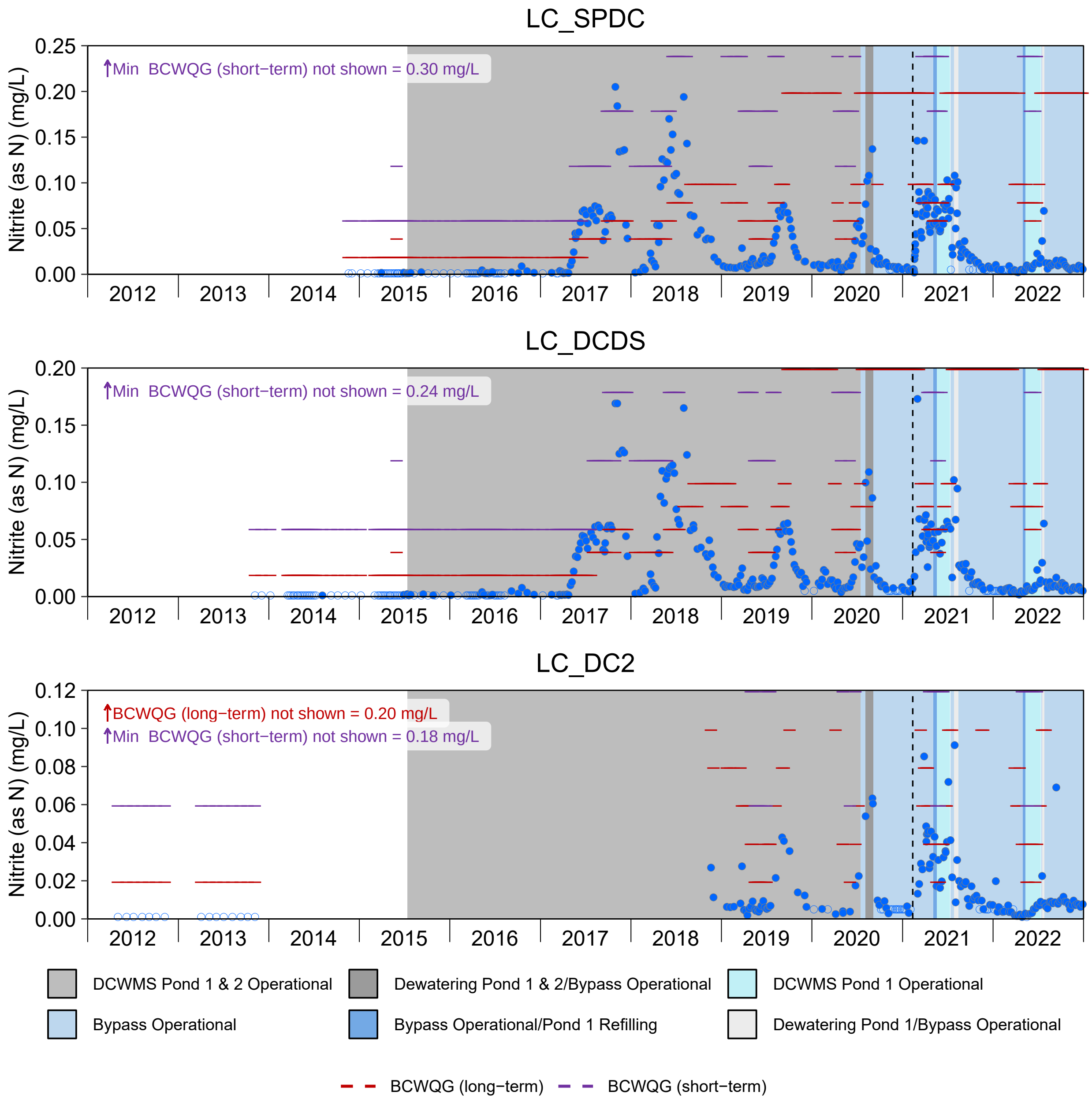


Figure C.14: Time Series Plots for Nitrite (as N) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

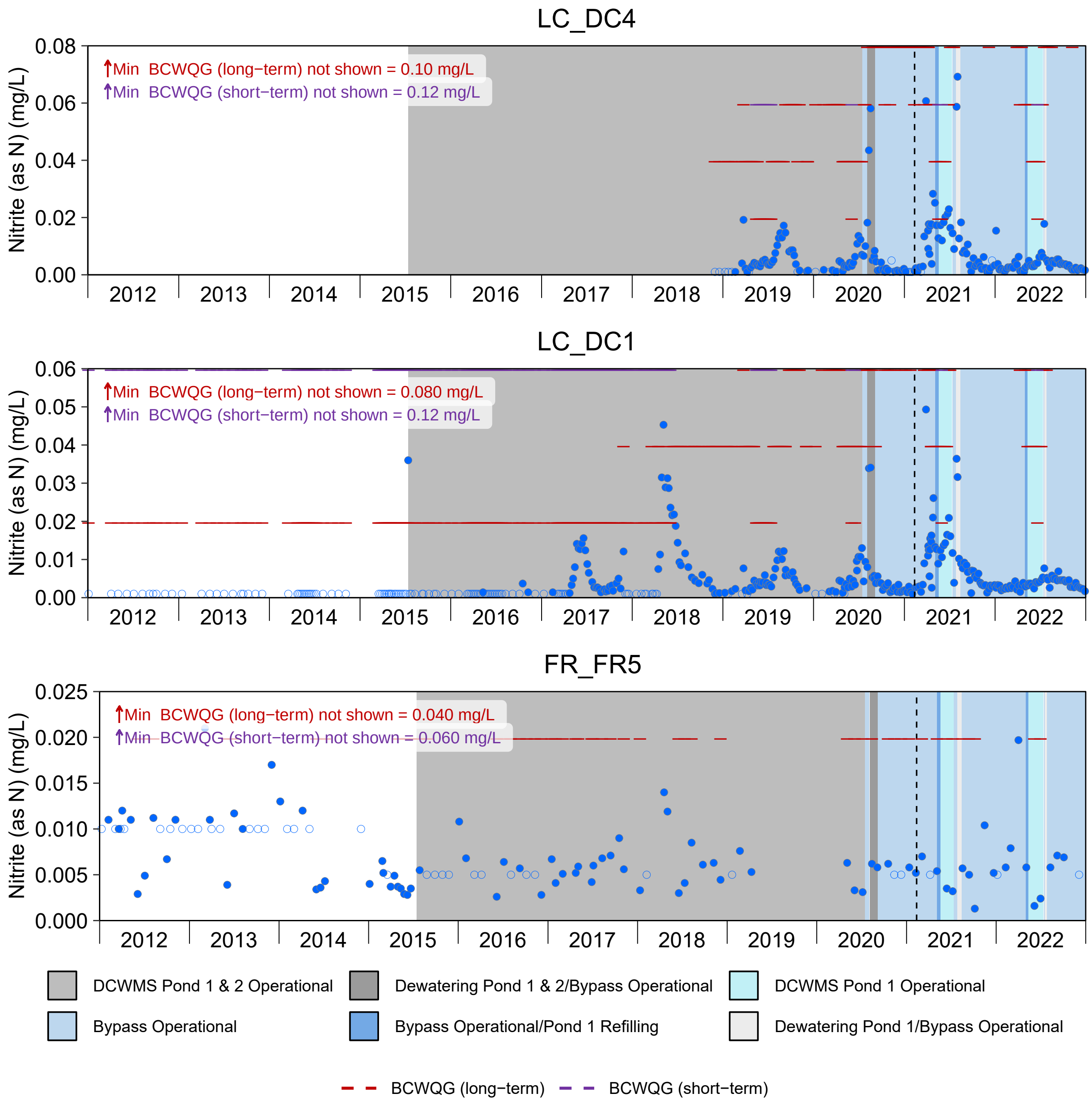


Figure C.14: Time Series Plots for Nitrite (as N) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

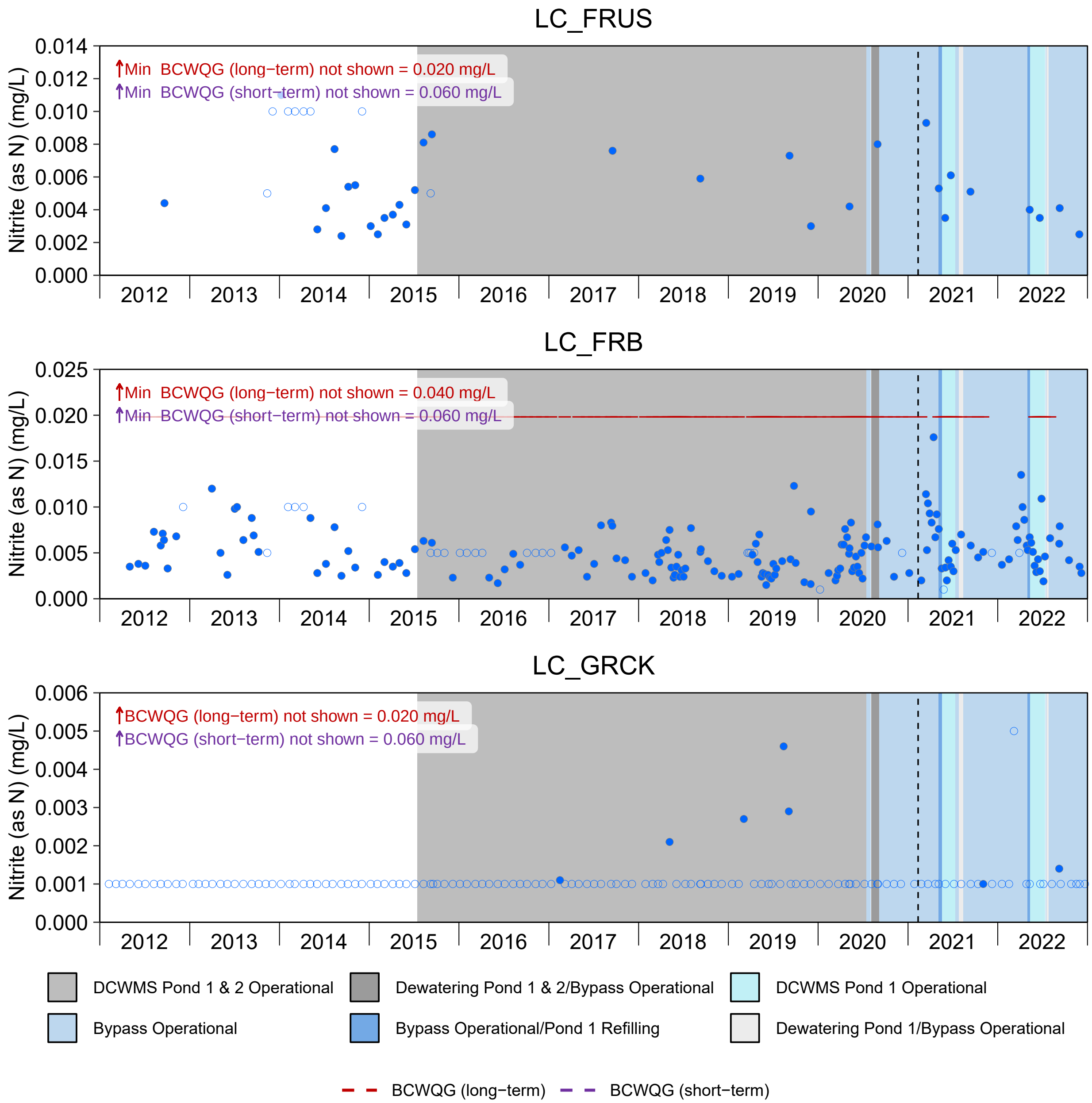


Figure C.14: Time Series Plots for Nitrite (as N) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

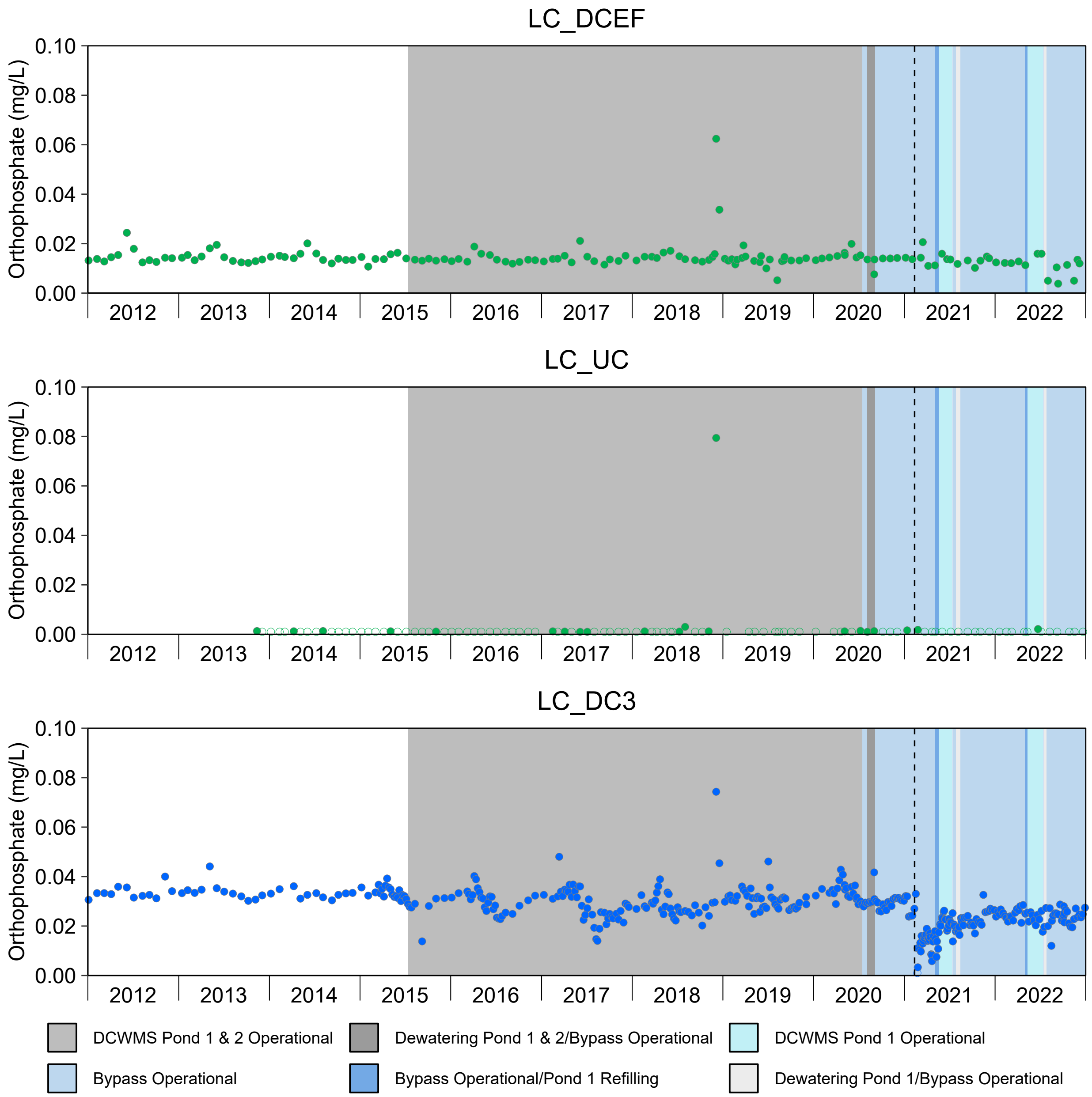


Figure C.15: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

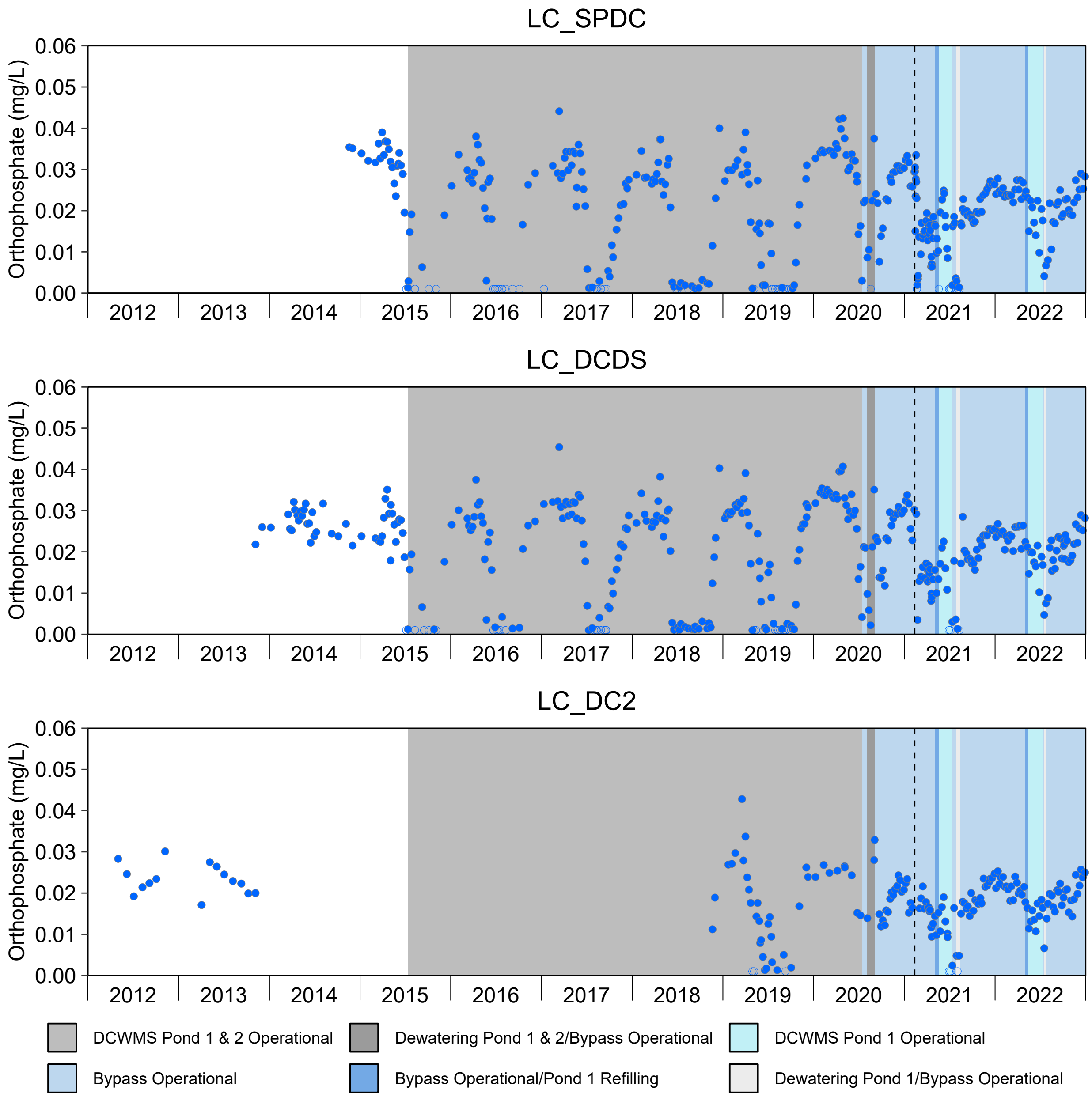


Figure C.15: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

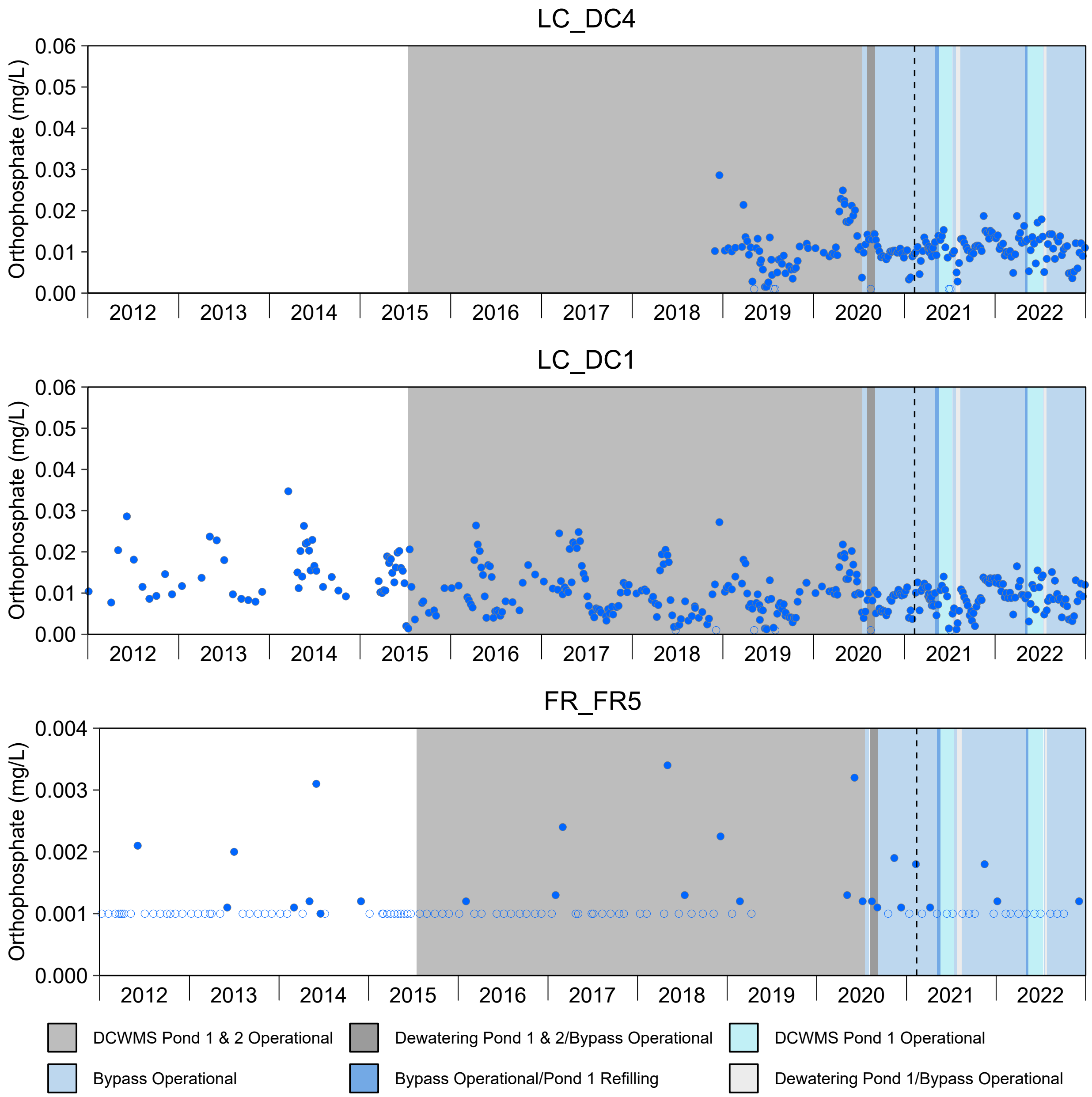


Figure C.15: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

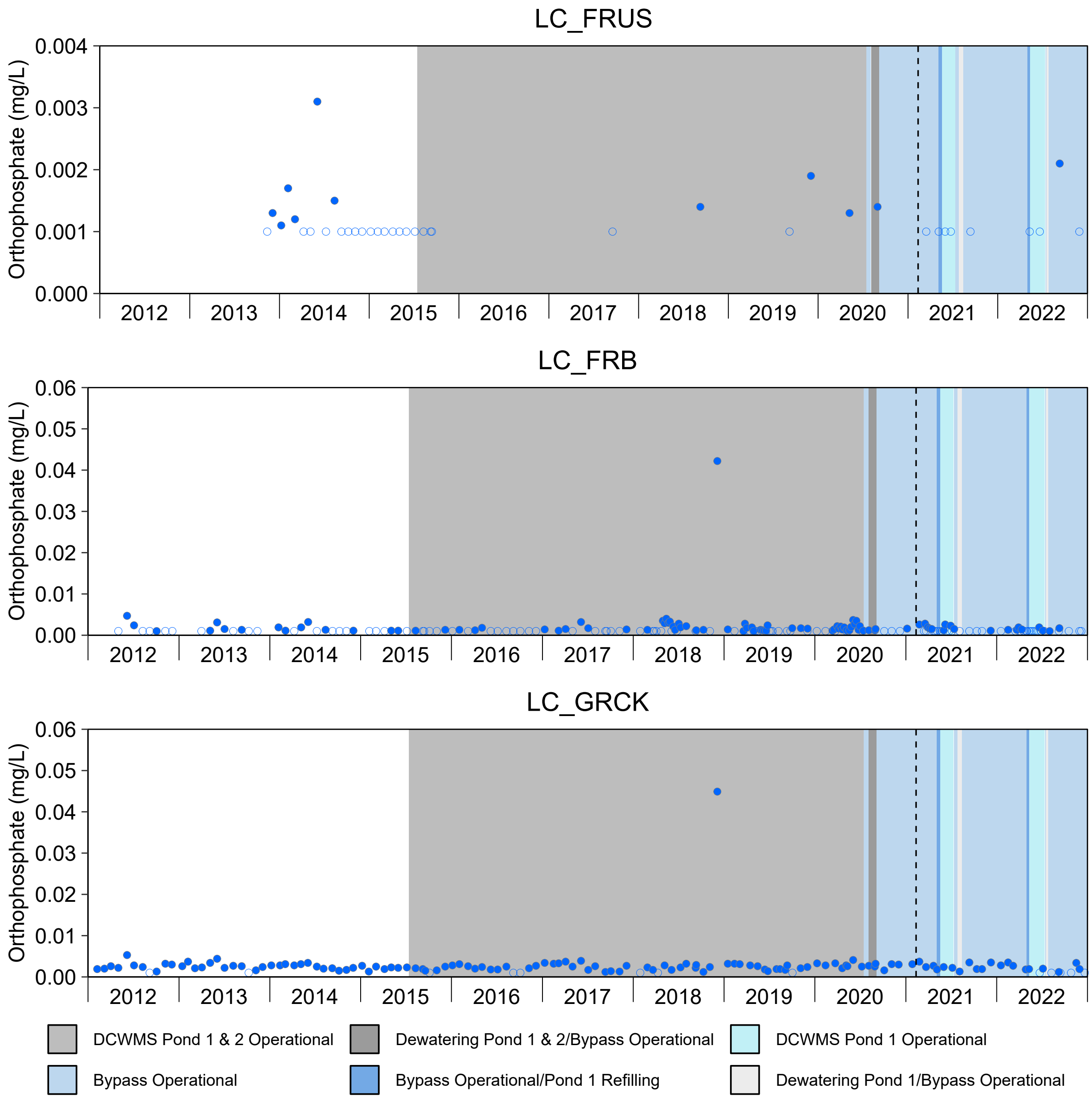


Figure C.15: Time Series Plots for Orthophosphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

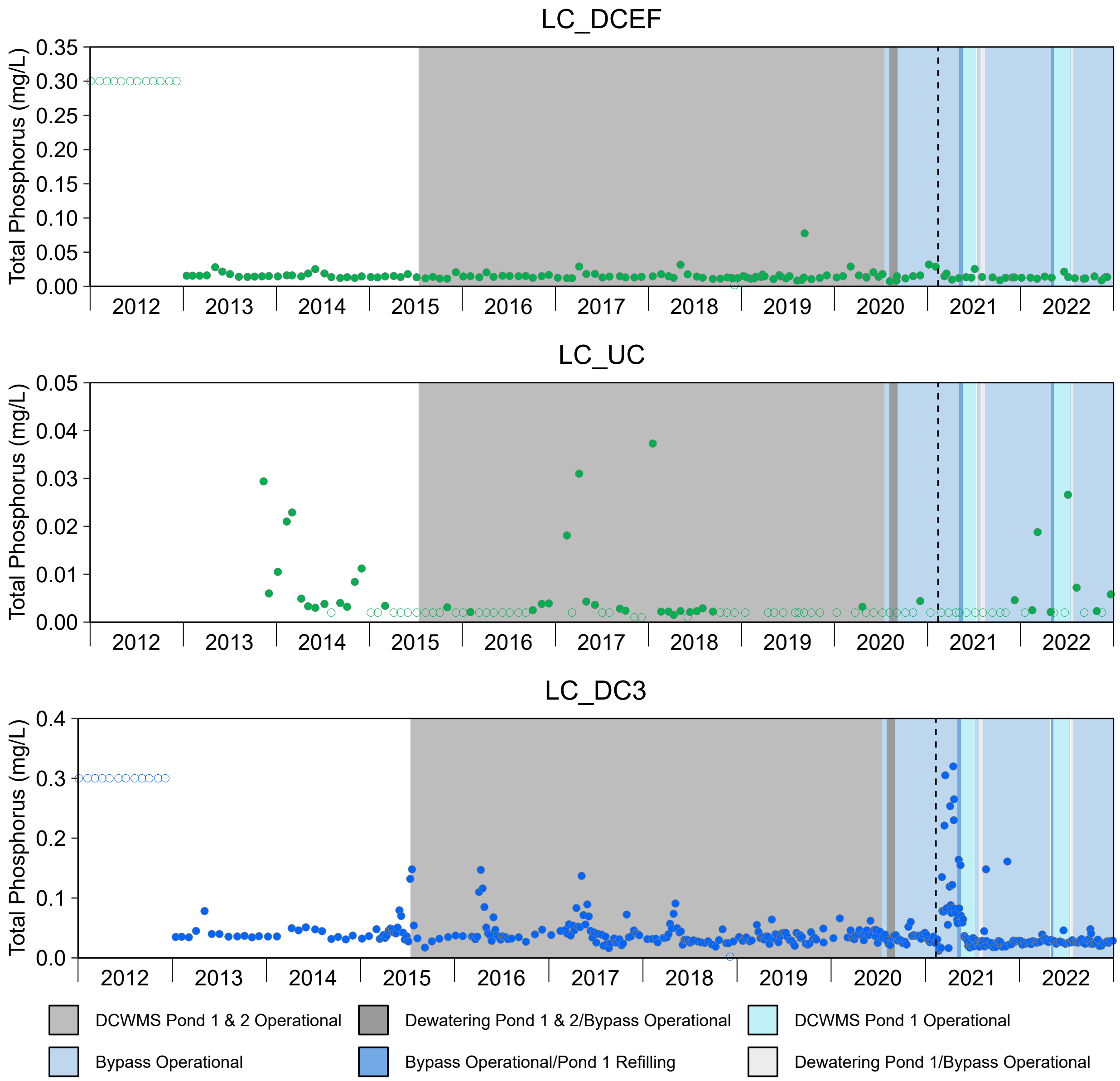


Figure C.16: Time Series Plots for Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. High non−detect data from 2012 was removed. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Values with high LRLs of 0.3 mg/L in 2012 are not shown. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

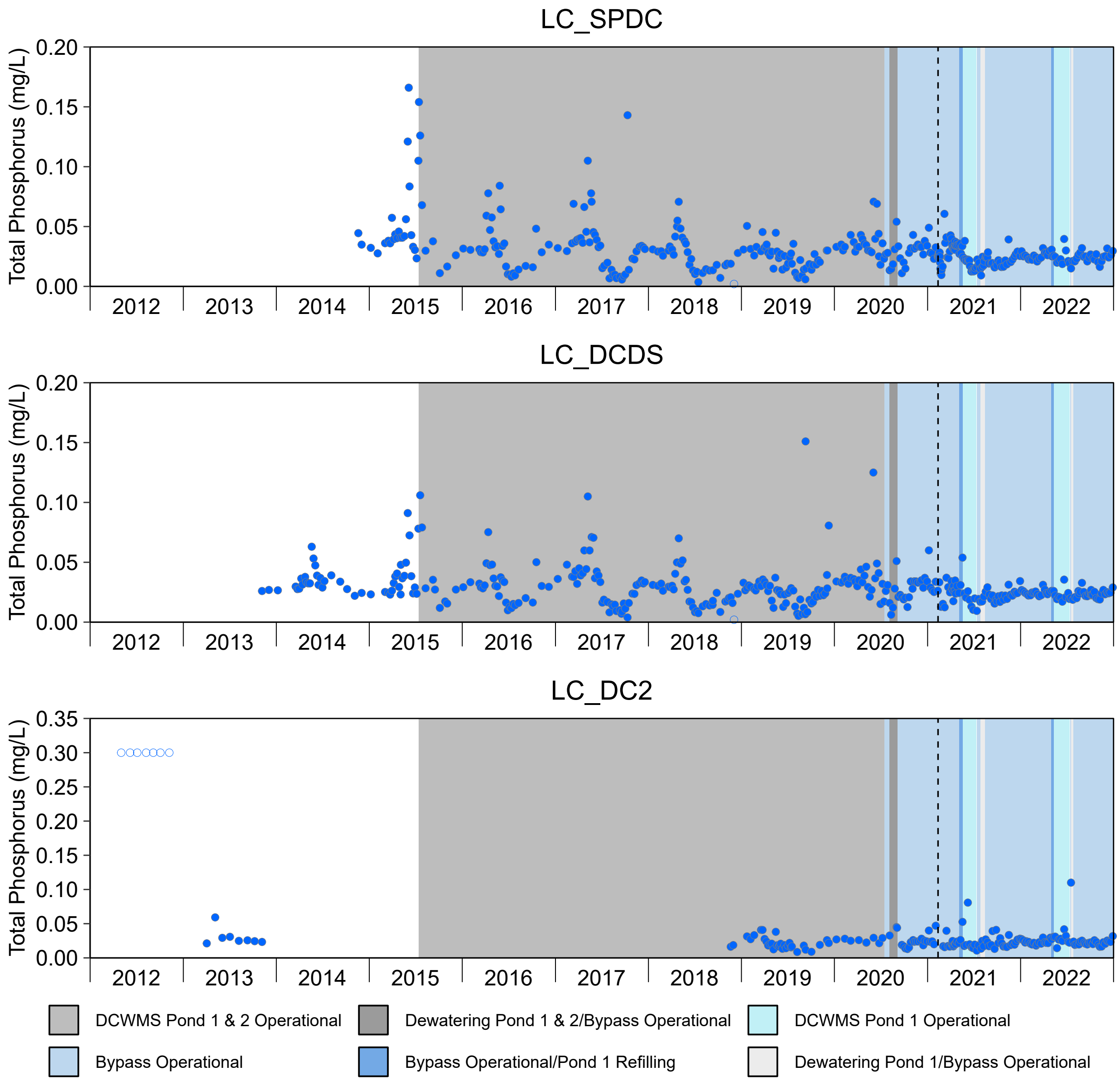


Figure C.16: Time Series Plots for Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. High non−detect data from 2012 was removed. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Values with high LRLs of 0.3 mg/L in 2012 are not shown. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

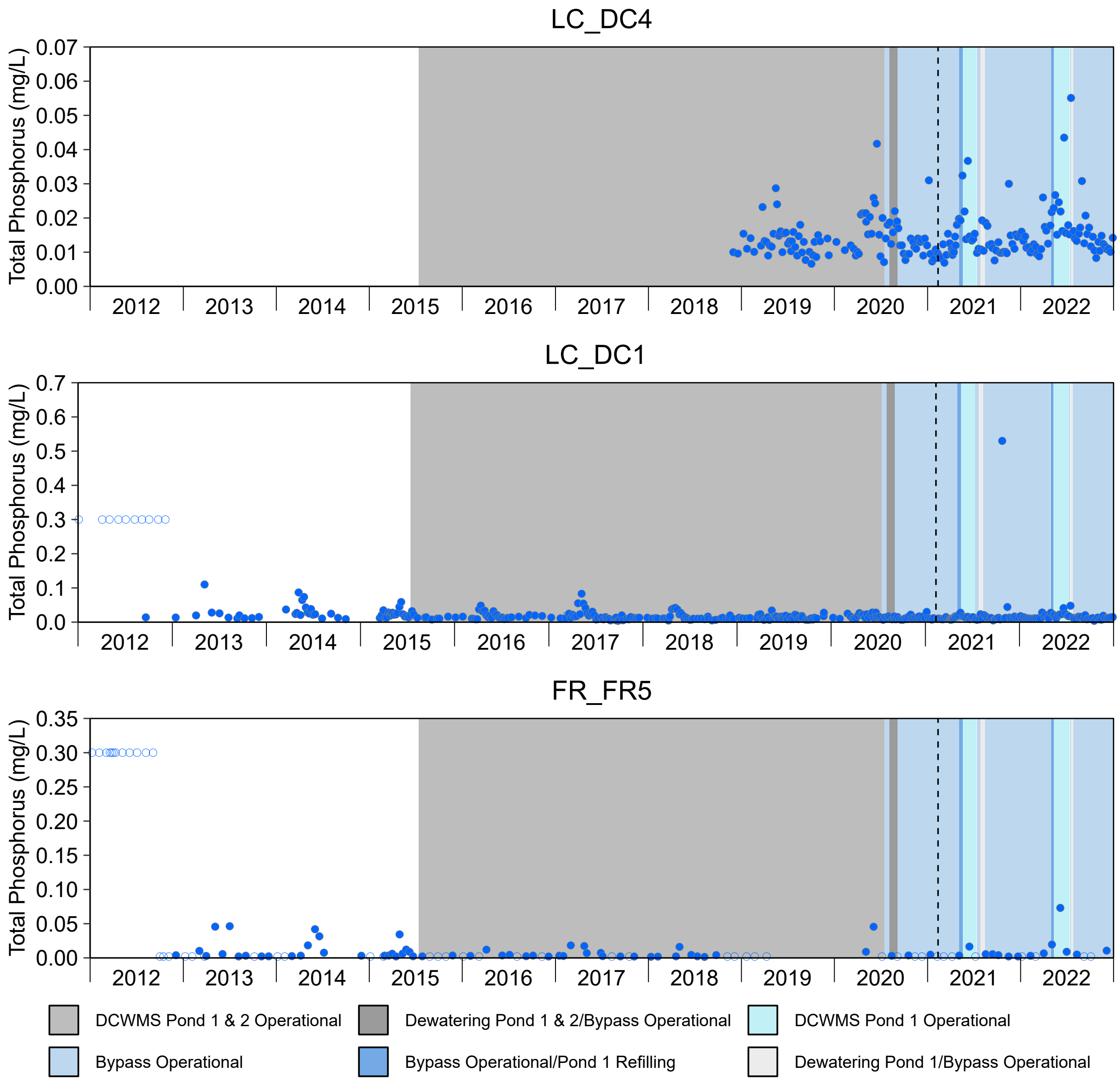


Figure C.16: Time Series Plots for Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. High non−detect data from 2012 was removed. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Values with high LRLs of 0.3 mg/L in 2012 are not shown. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

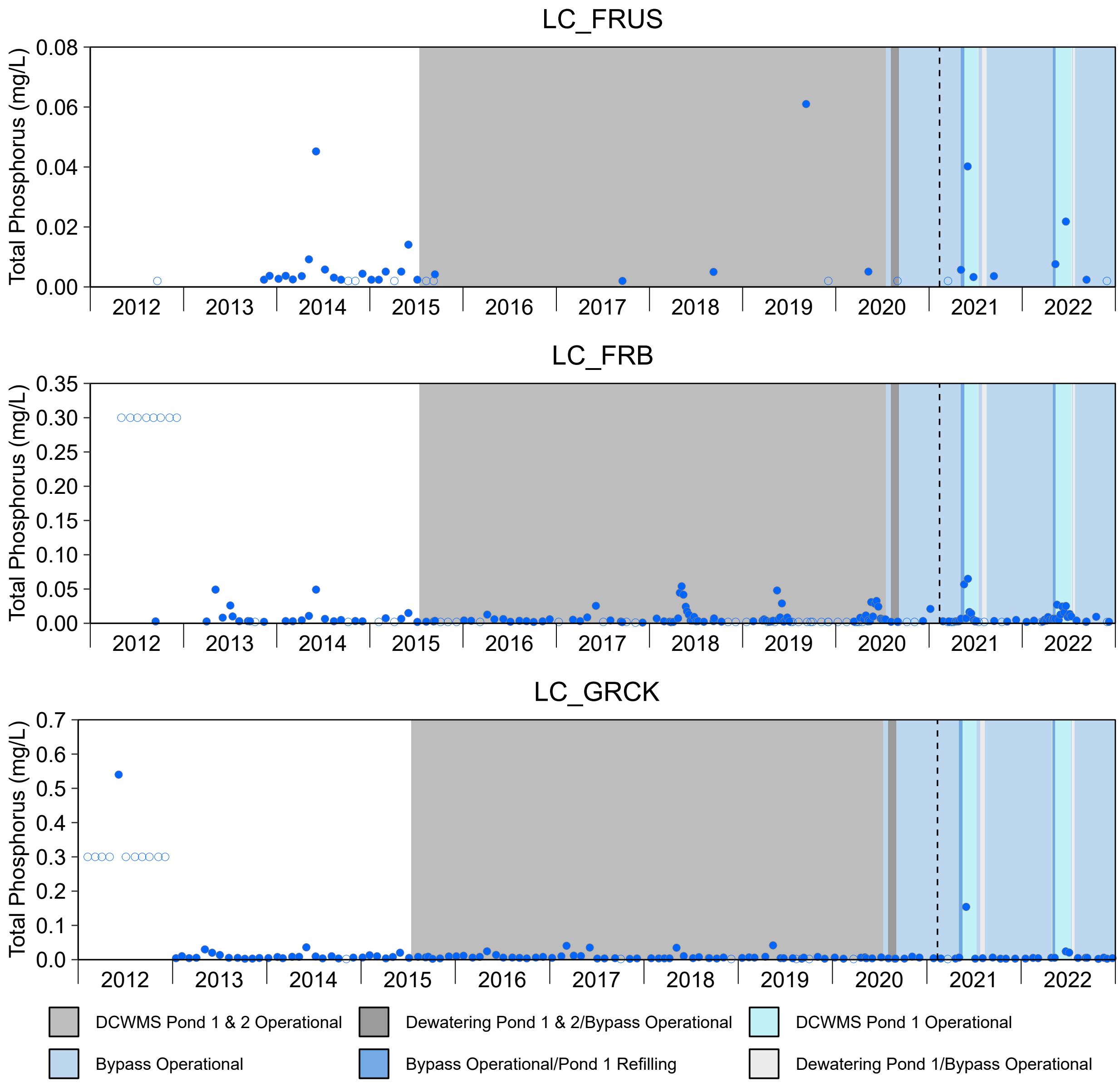


Figure C.16: Time Series Plots for Phosphorus from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. High non−detect data from 2012 was removed. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. The interim screening values for total phosphorus (0.03 mg/L) and orthophosphate (0.006 mg/L) represent the 97.5th percentile of concentrations observed in reference areas over the growing season (Minnow 2020). Values with high LRLs of 0.3 mg/L in 2012 are not shown. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

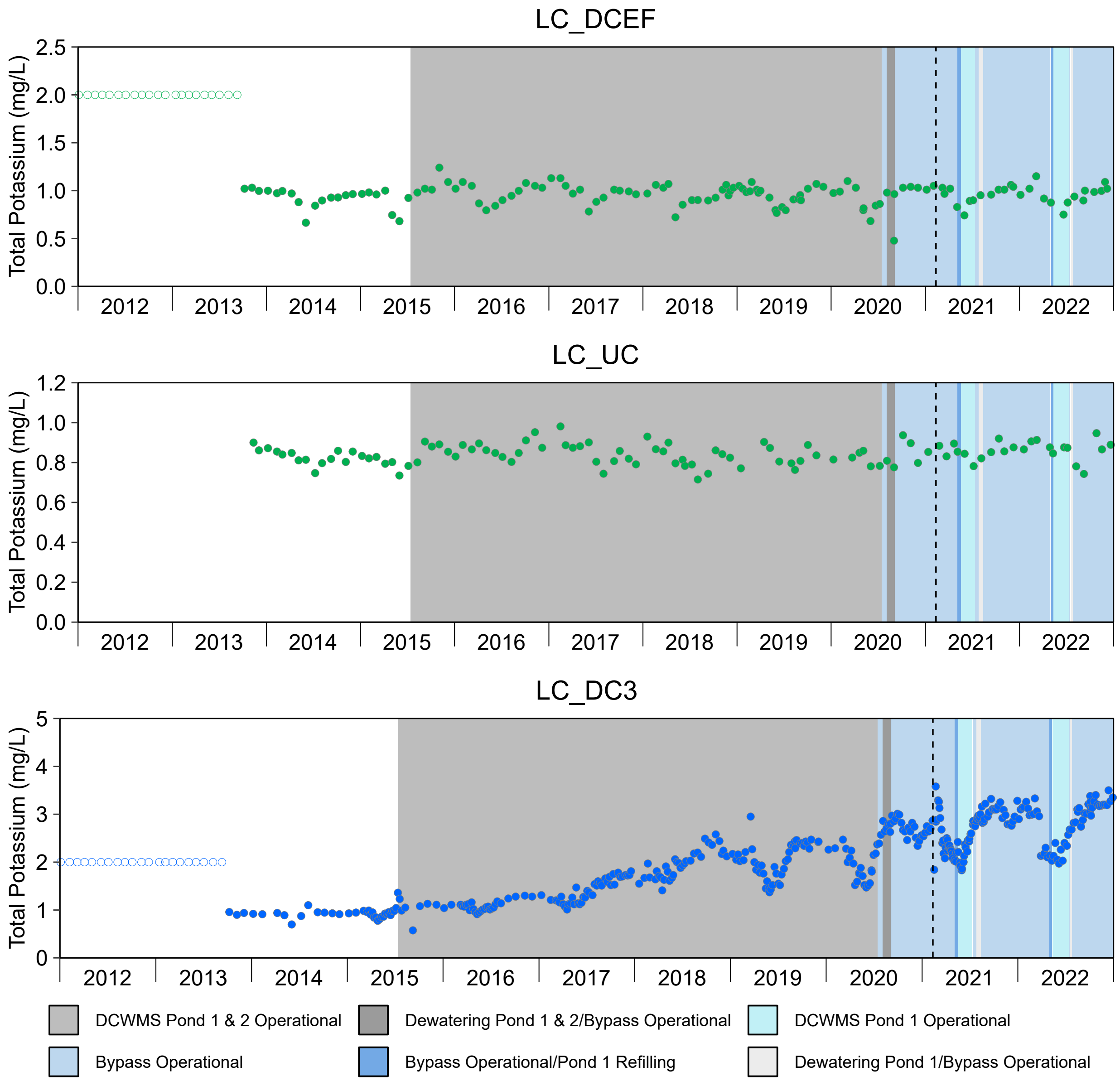


Figure C.17: Time Series Plots for Total Potassium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

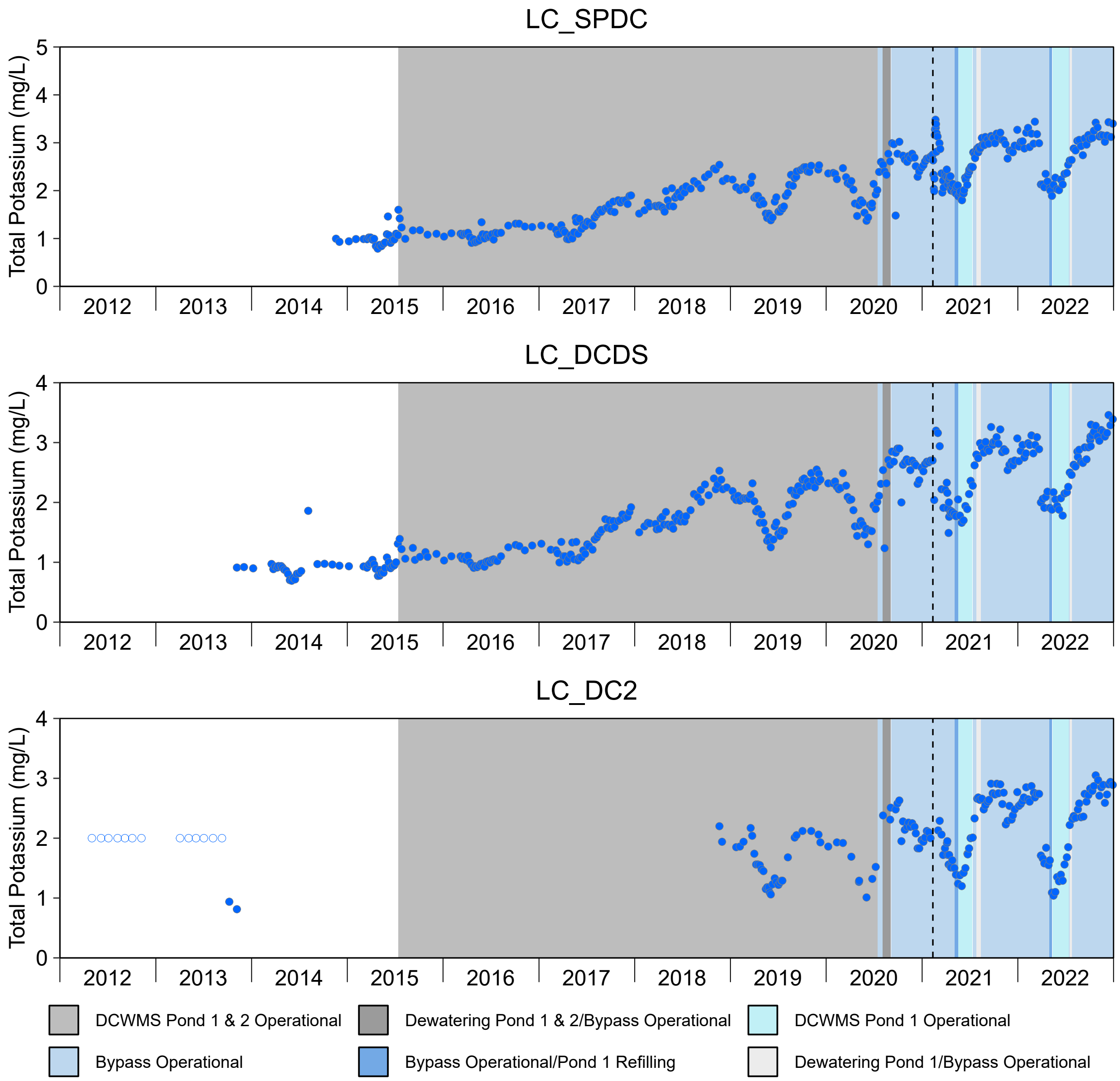


Figure C.17: Time Series Plots for Total Potassium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

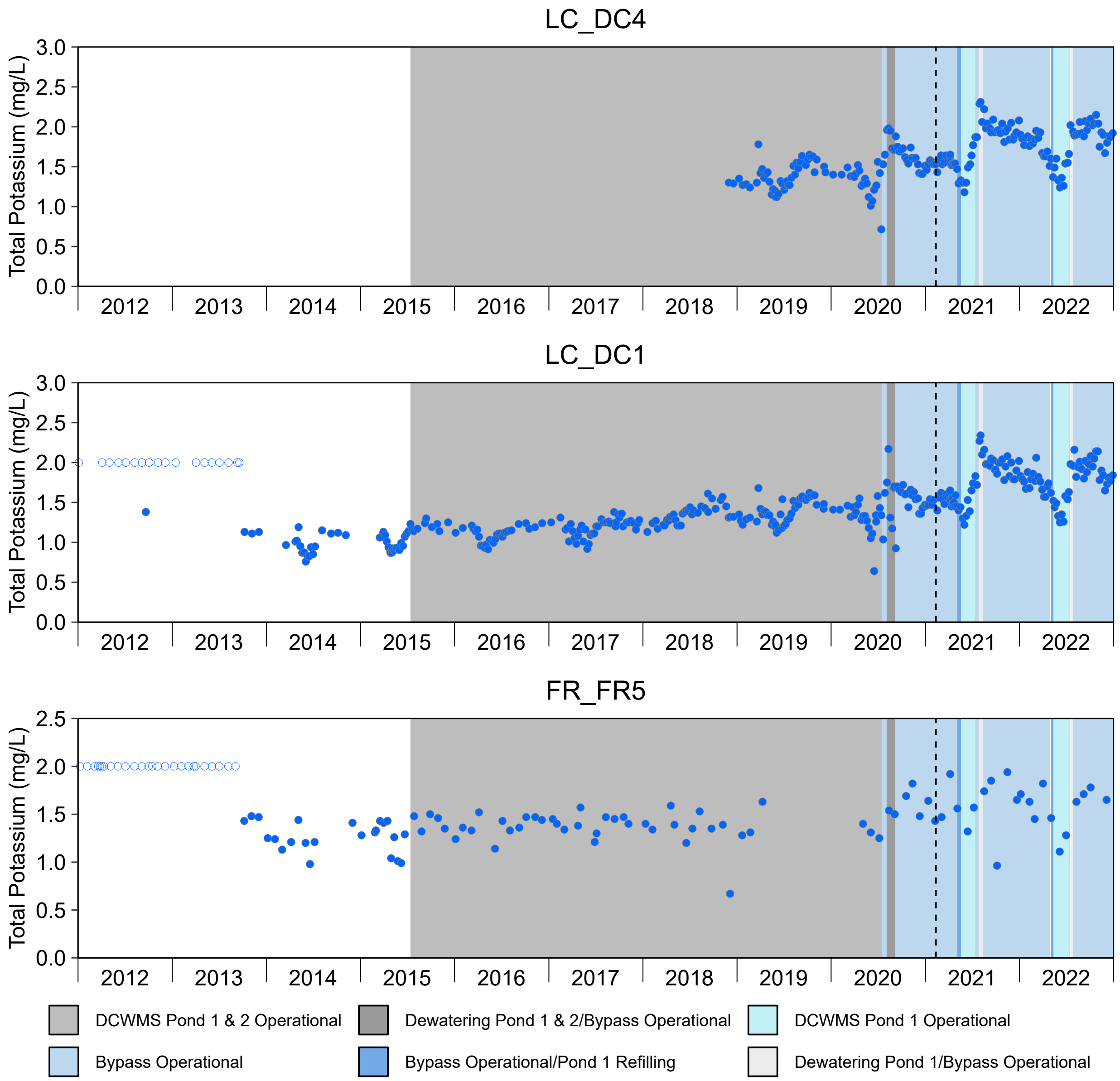


Figure C.17: Time Series Plots for Total Potassium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

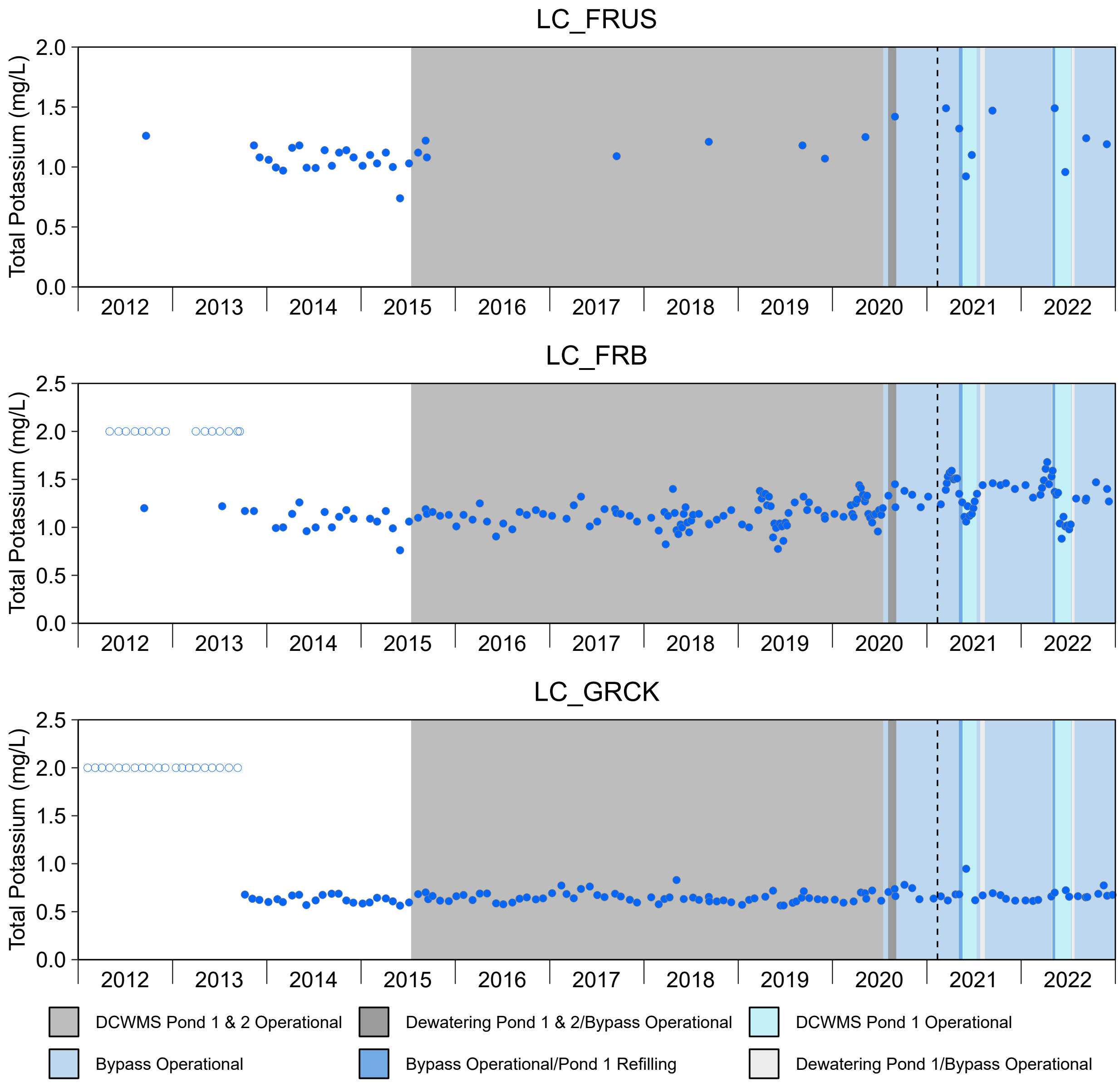


Figure C.17: Time Series Plots for Total Potassium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water chloride concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

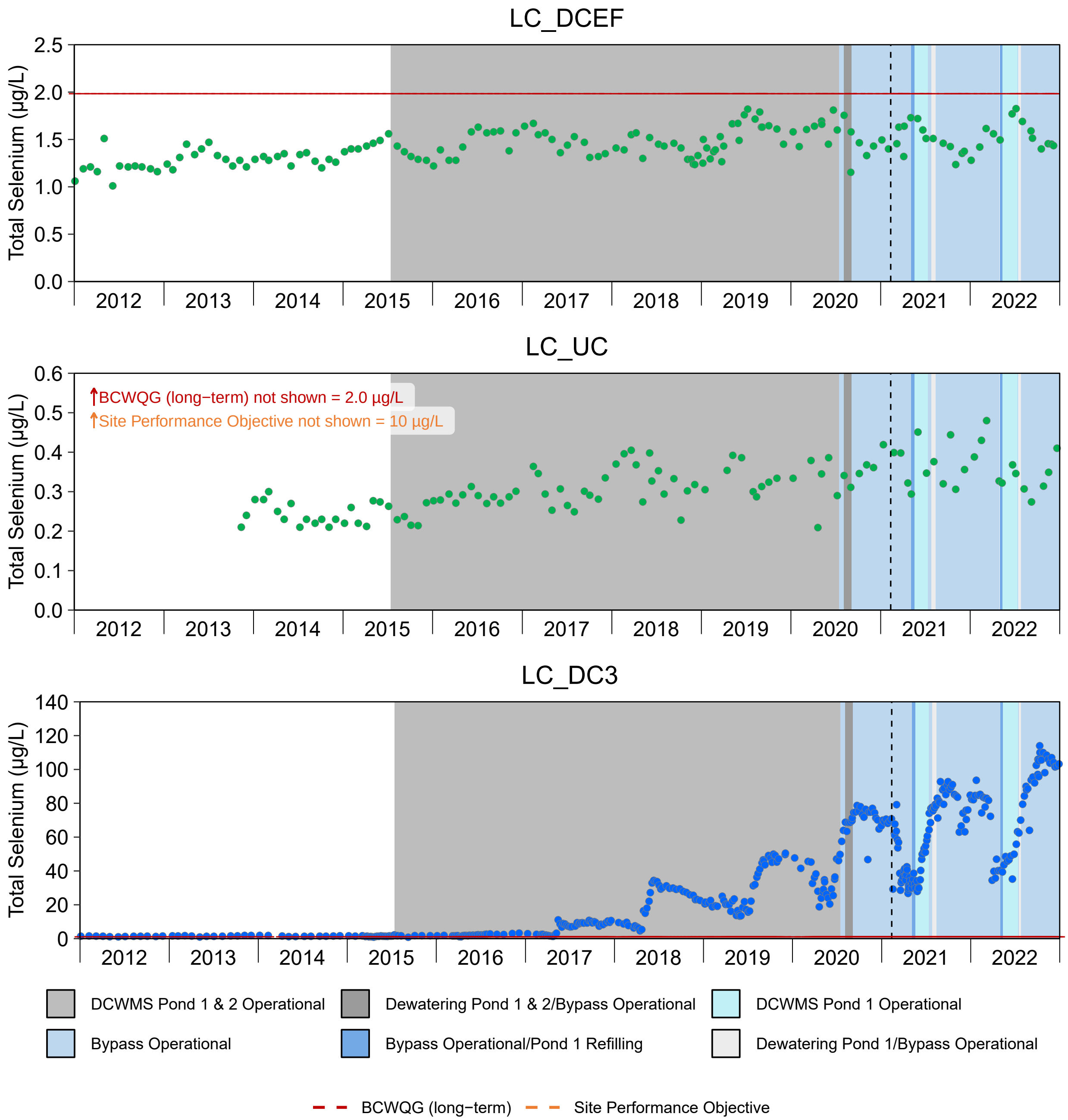


Figure C.18: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

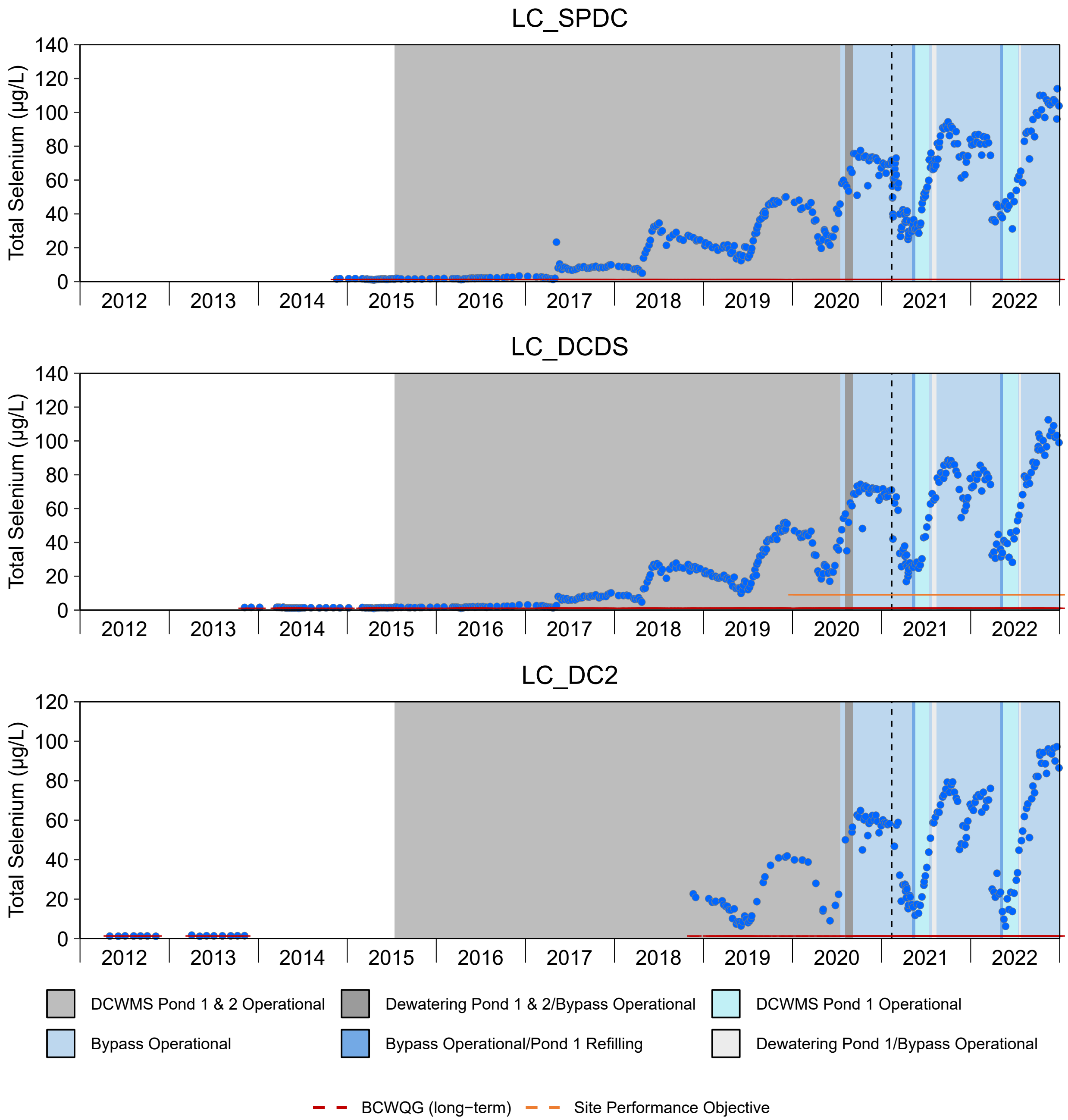


Figure C.18: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

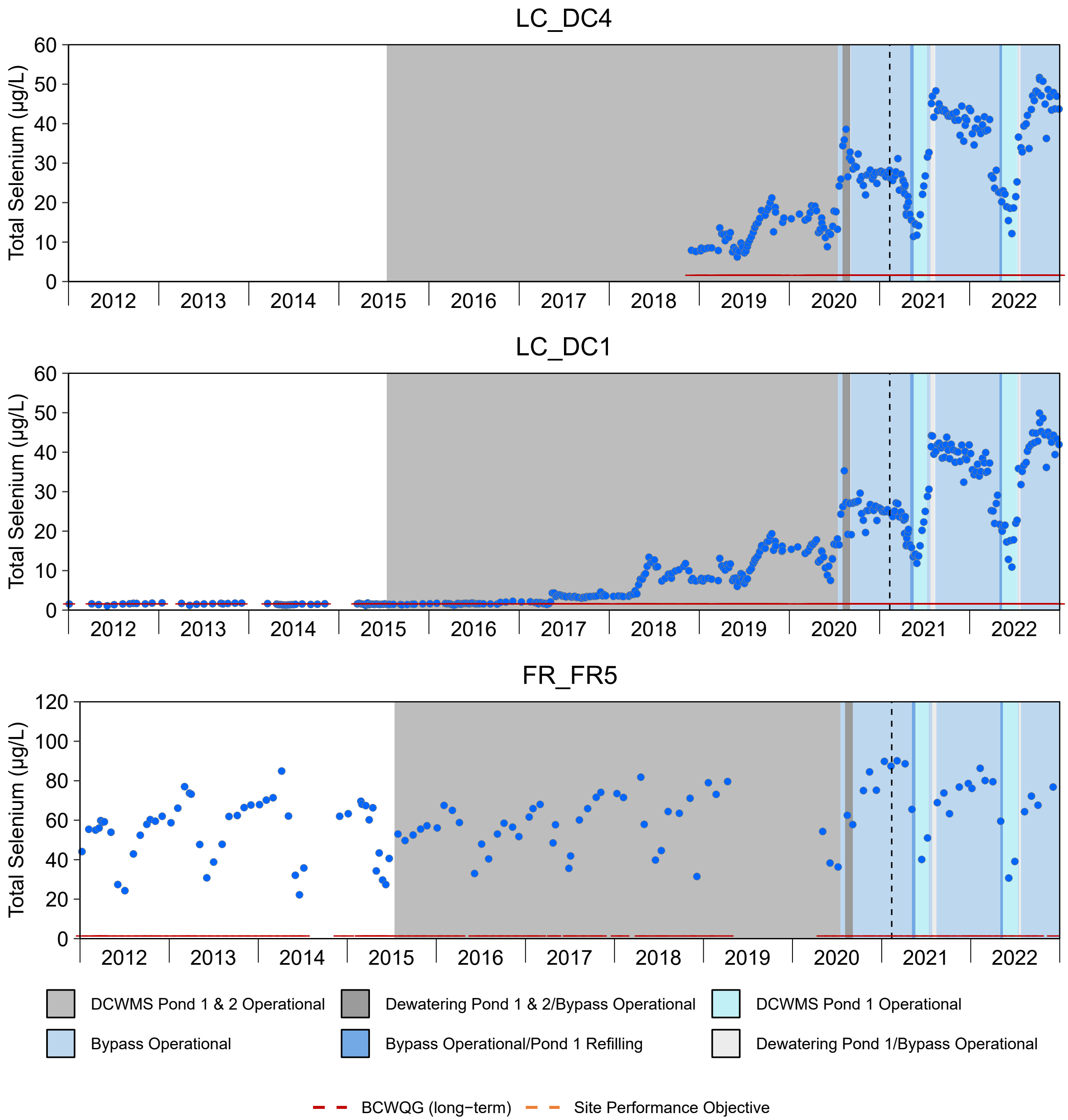


Figure C.18: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

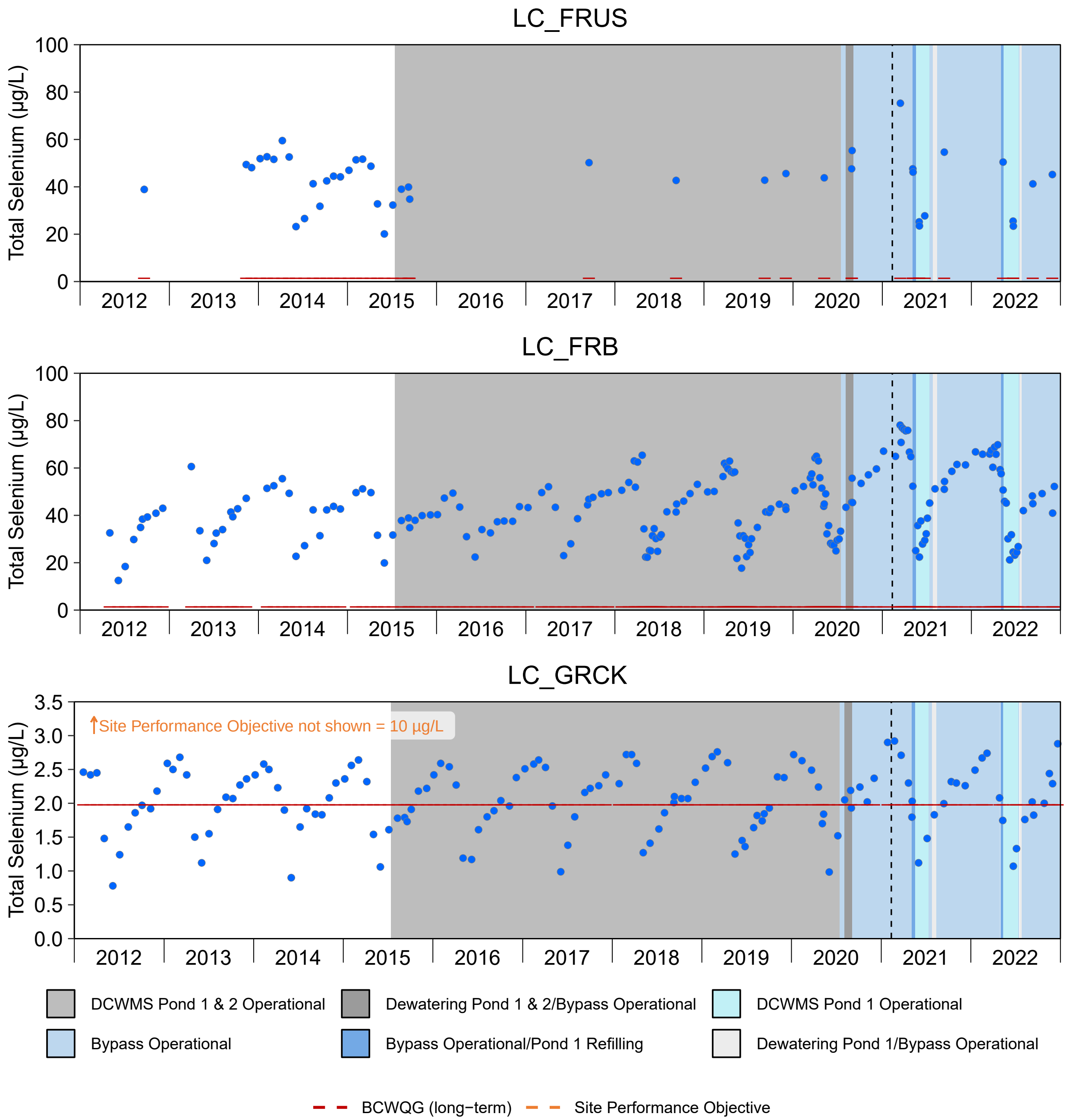


Figure C.18: Time Series Plots for Total Selenium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

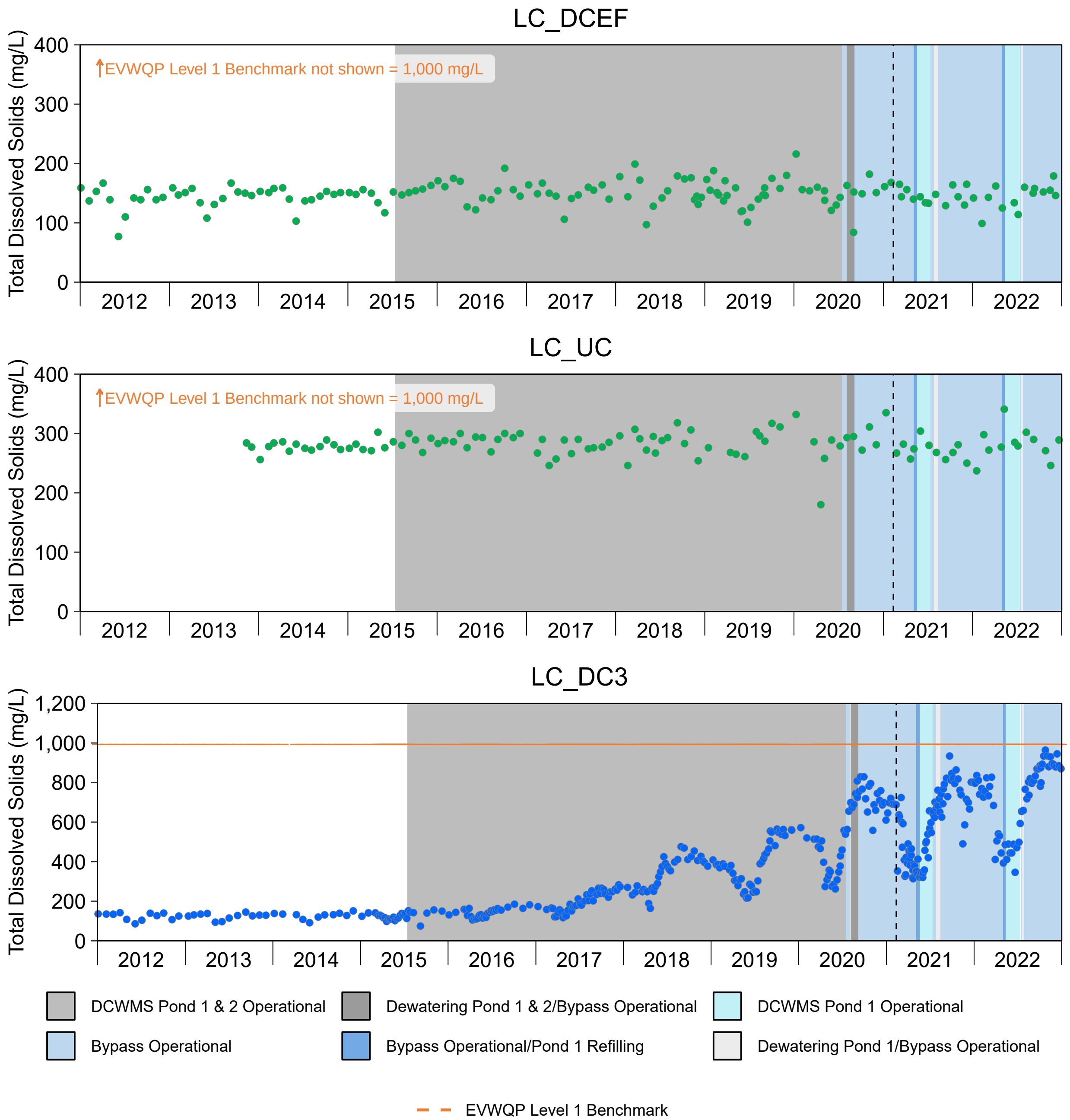


Figure C.19: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

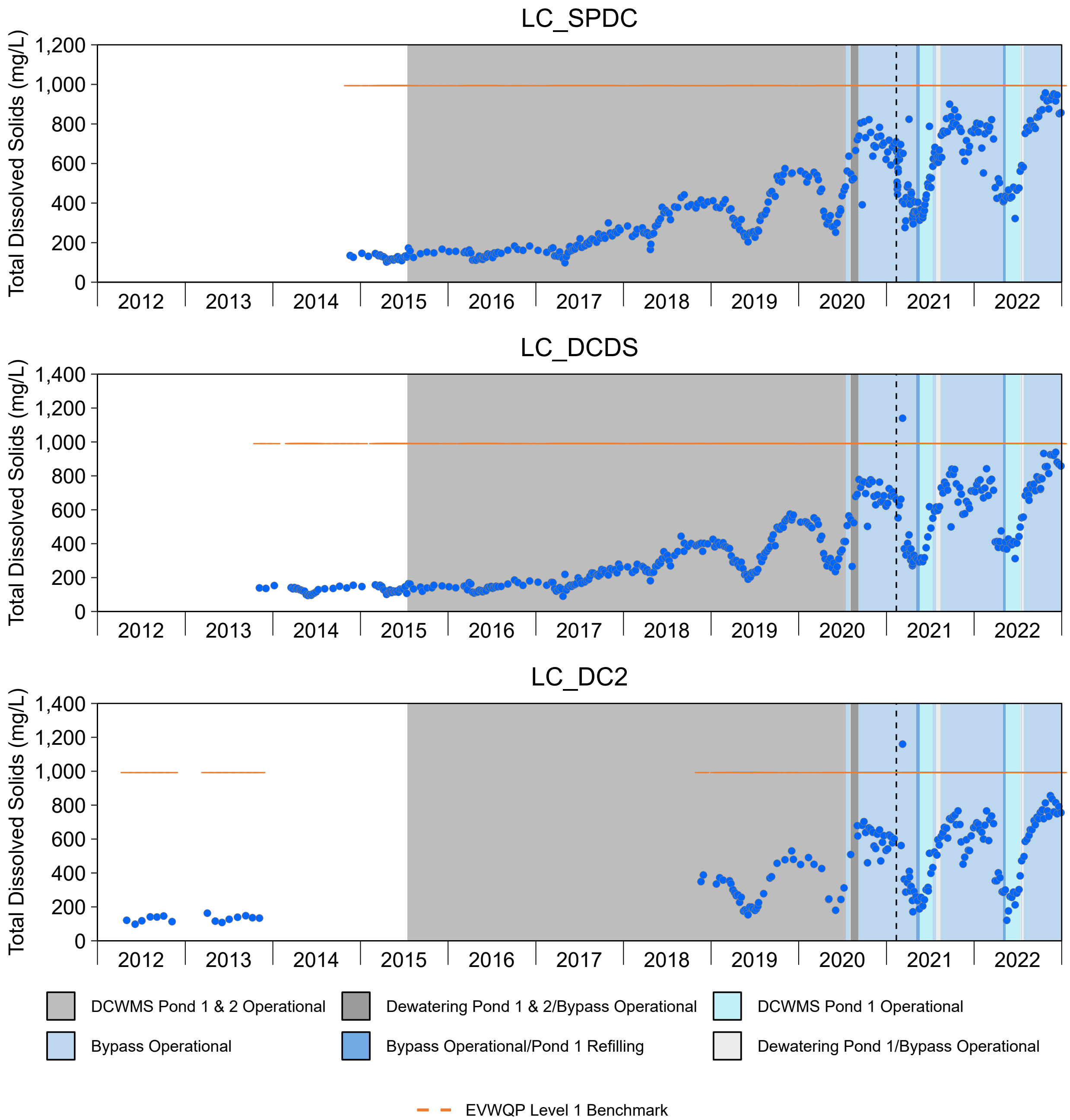


Figure C.19: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

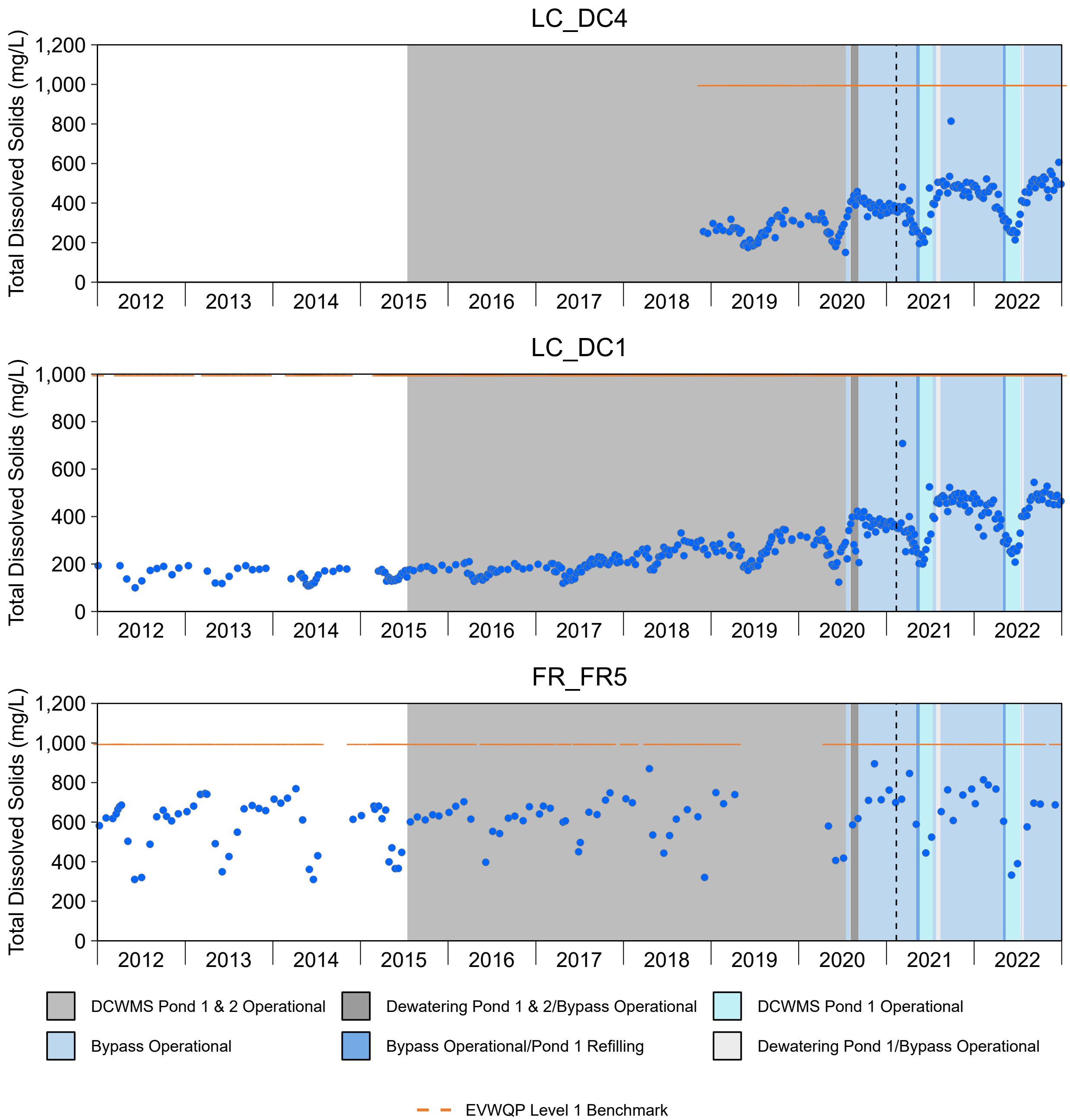


Figure C.19: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

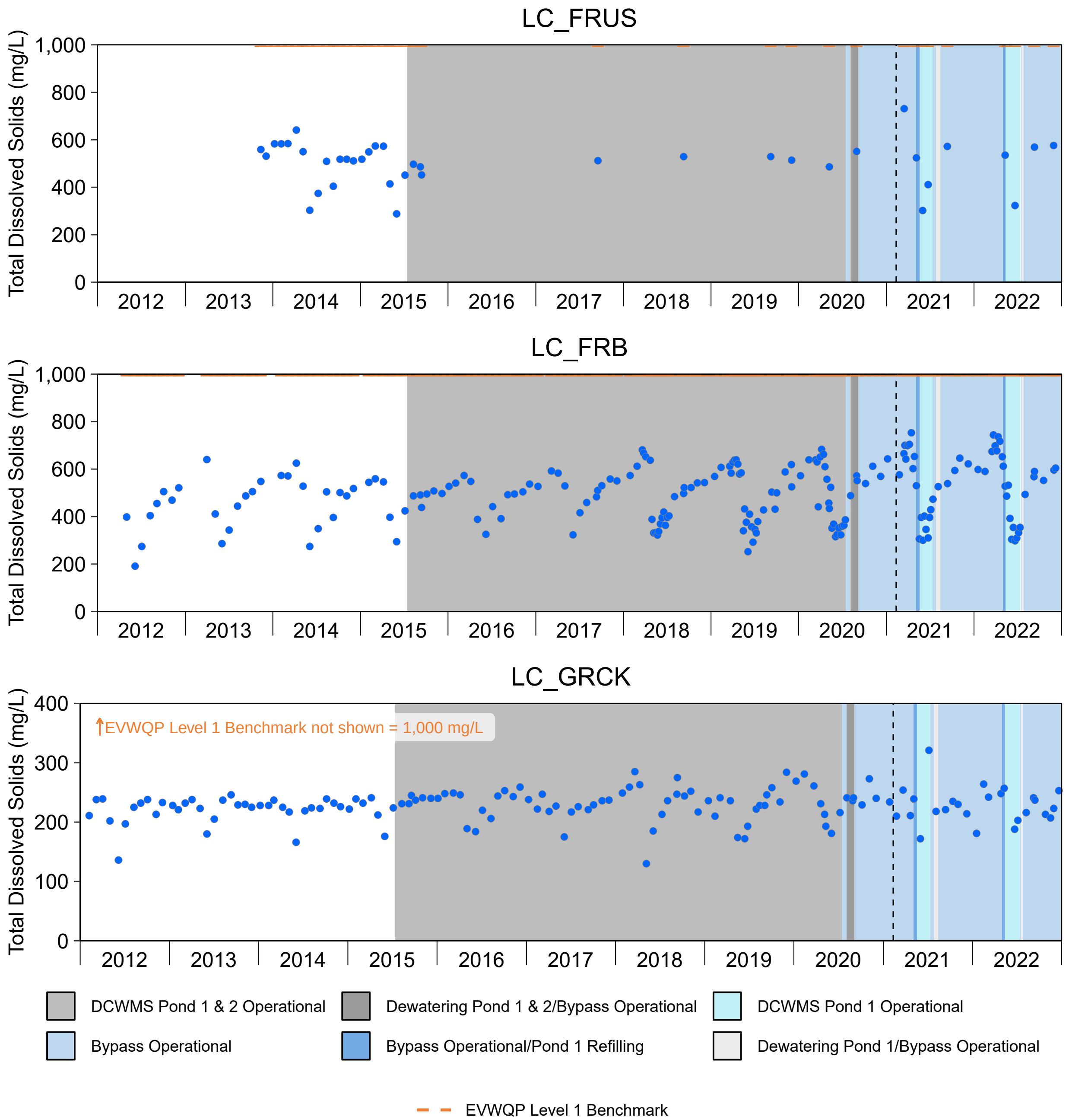


Figure C.19: Time Series Plots for Total Dissolved Solids from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

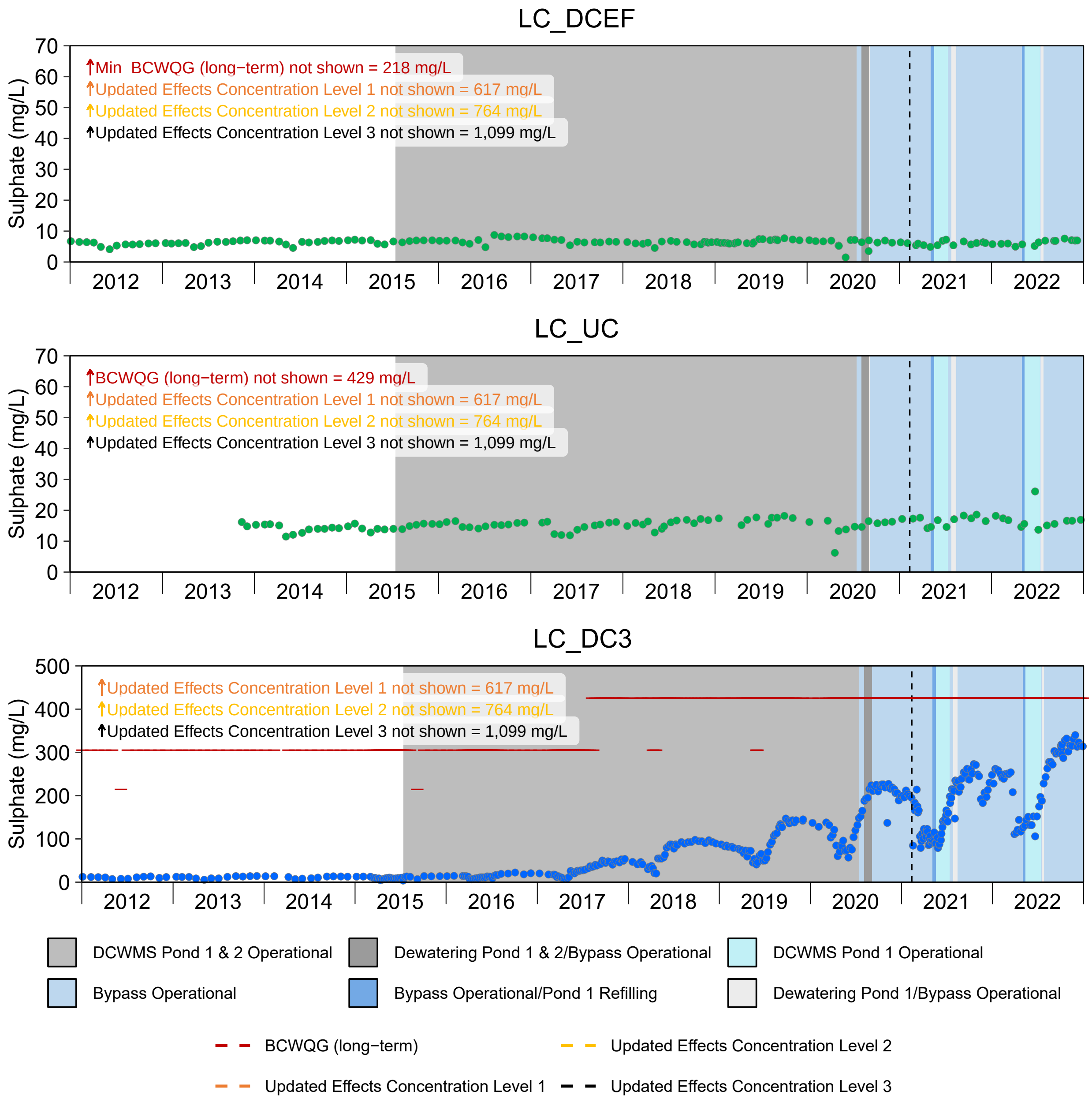


Figure C.20: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal.

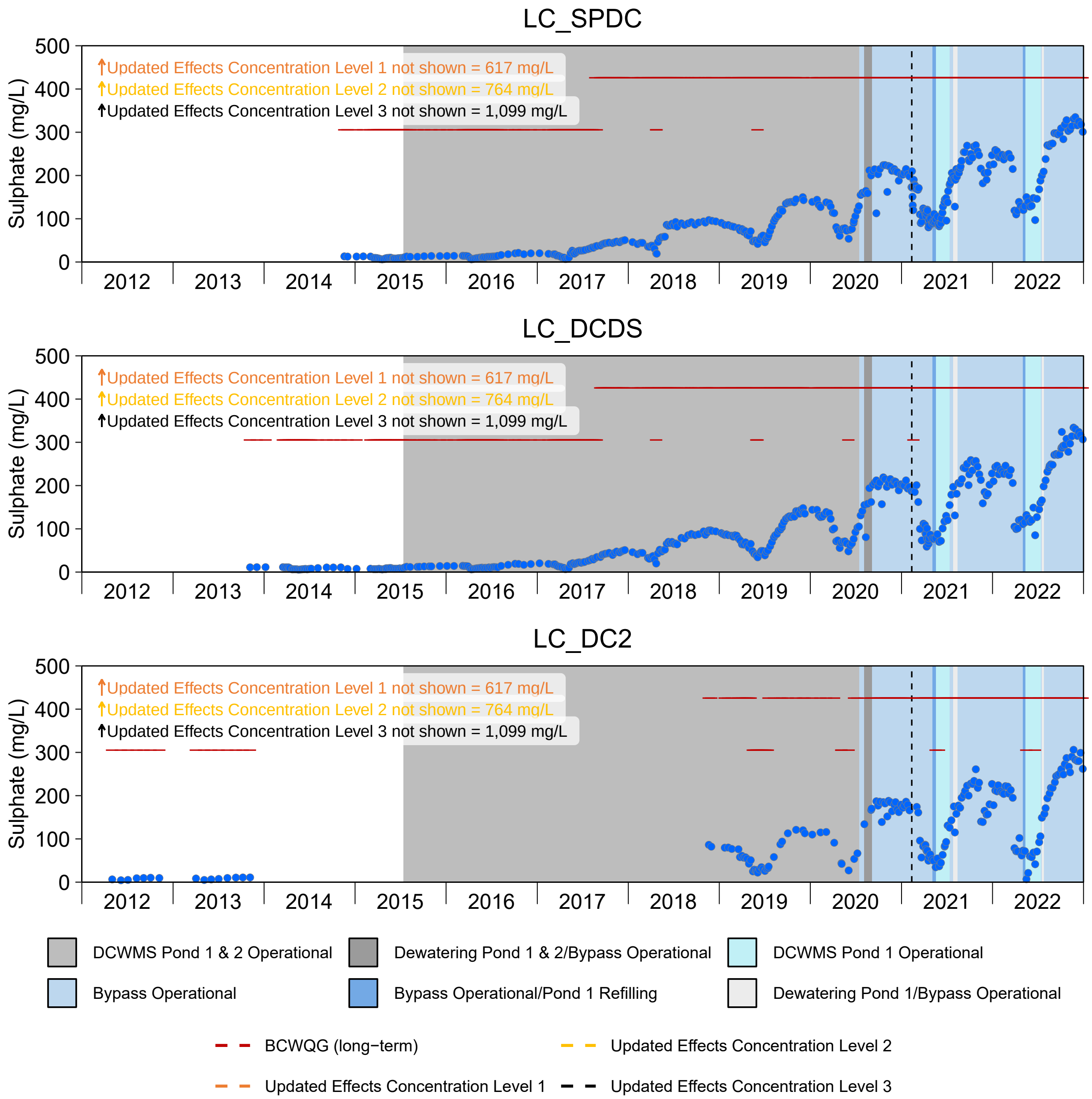


Figure C.20: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal.

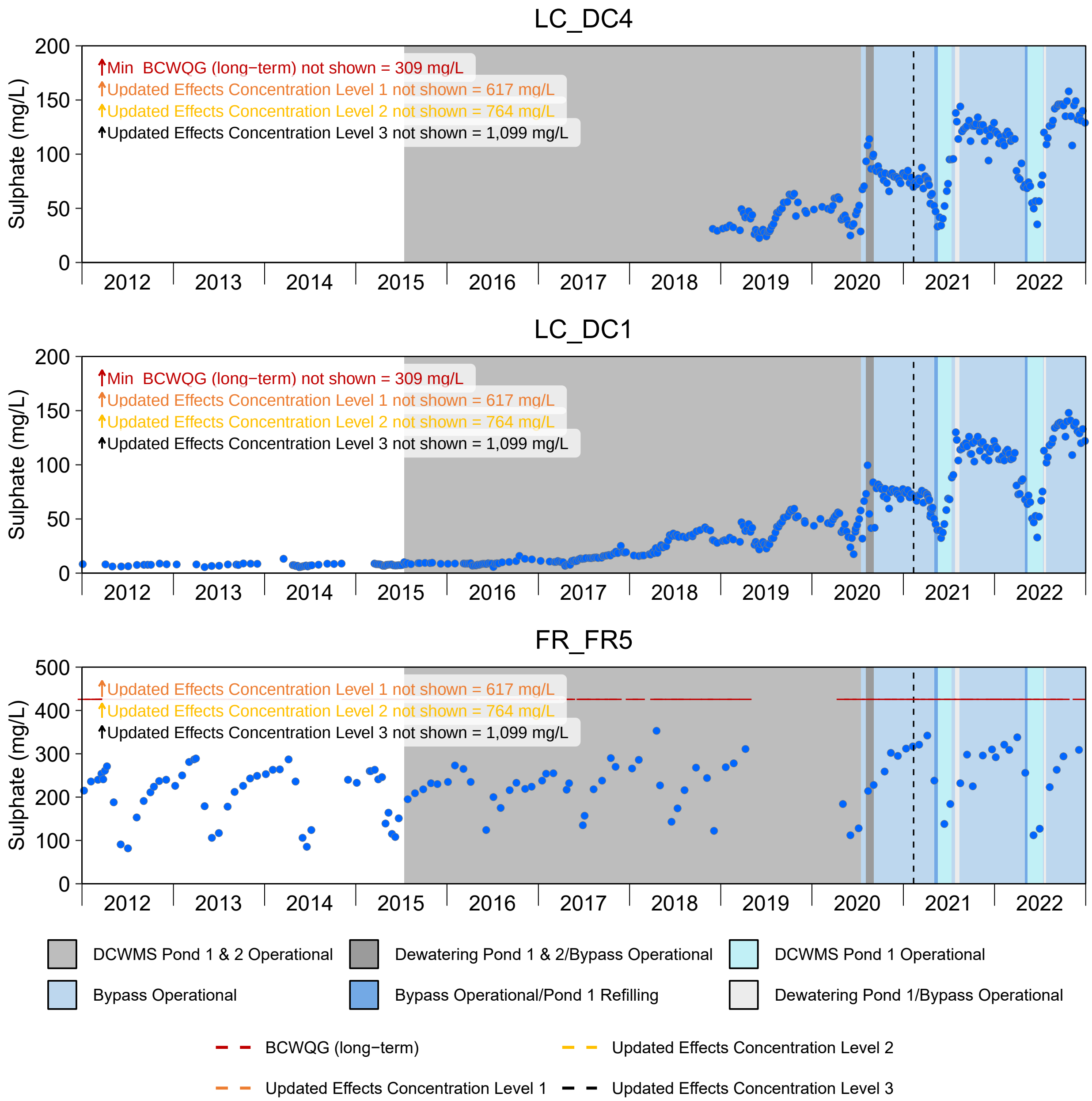


Figure C.20: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal.

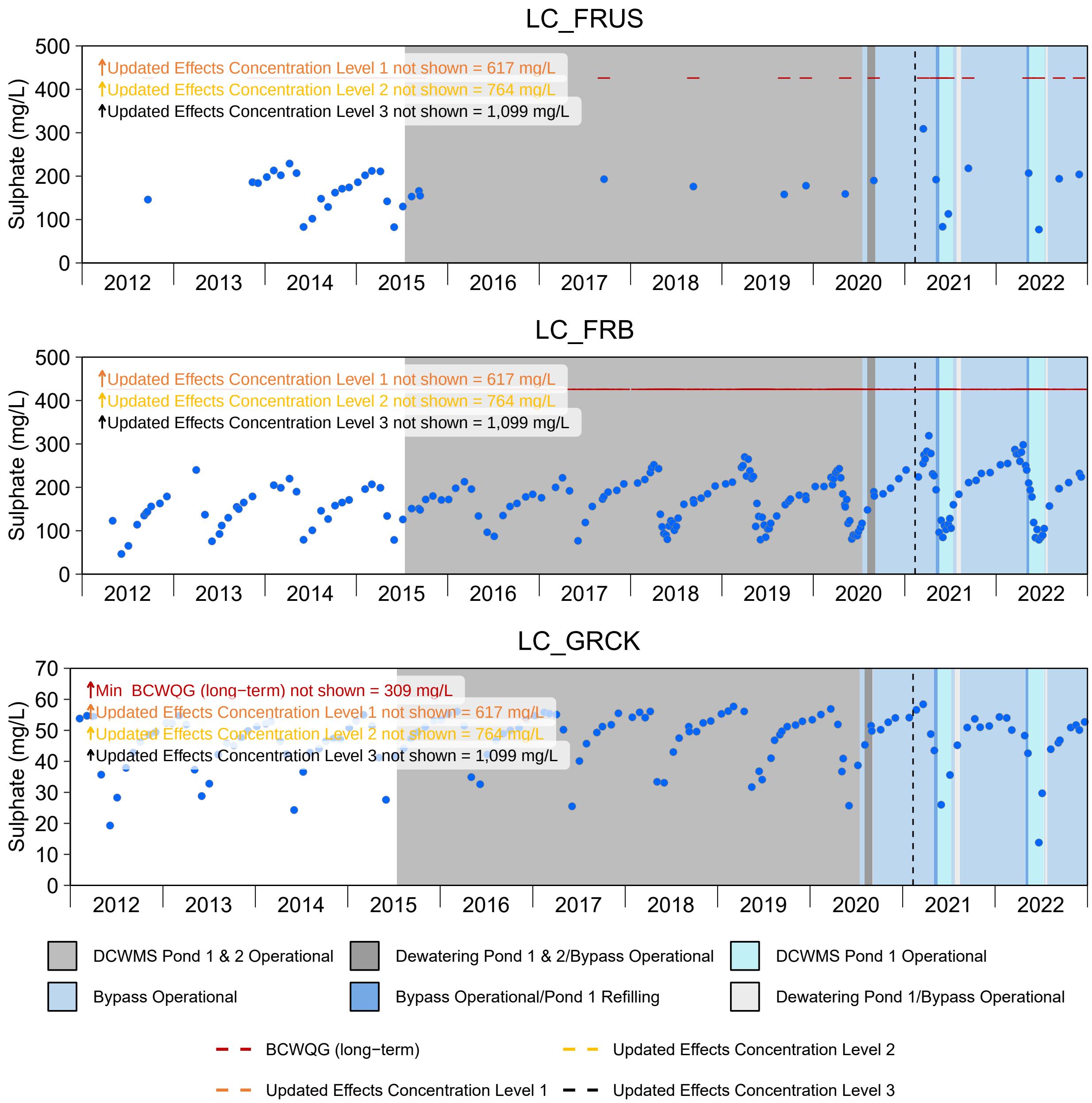


Figure C.20: Time Series Plots for Sulphate from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1). Guidelines are dependent on water hardness. EVWQP Level 1 Benchmark is shown in plots where the EVWQP Level 1 Benchmark and the BCWQG are equal.

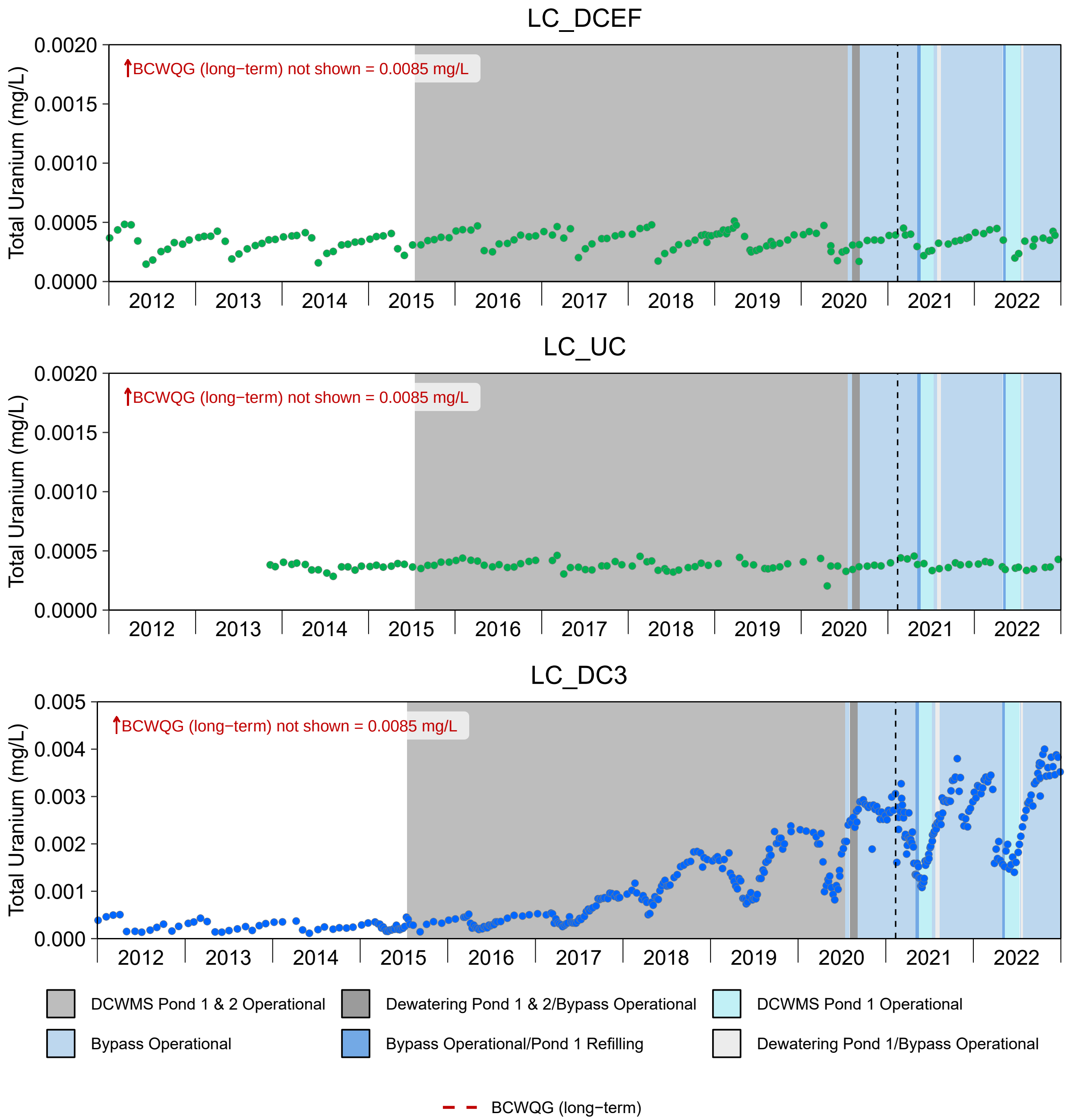


Figure C.21: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

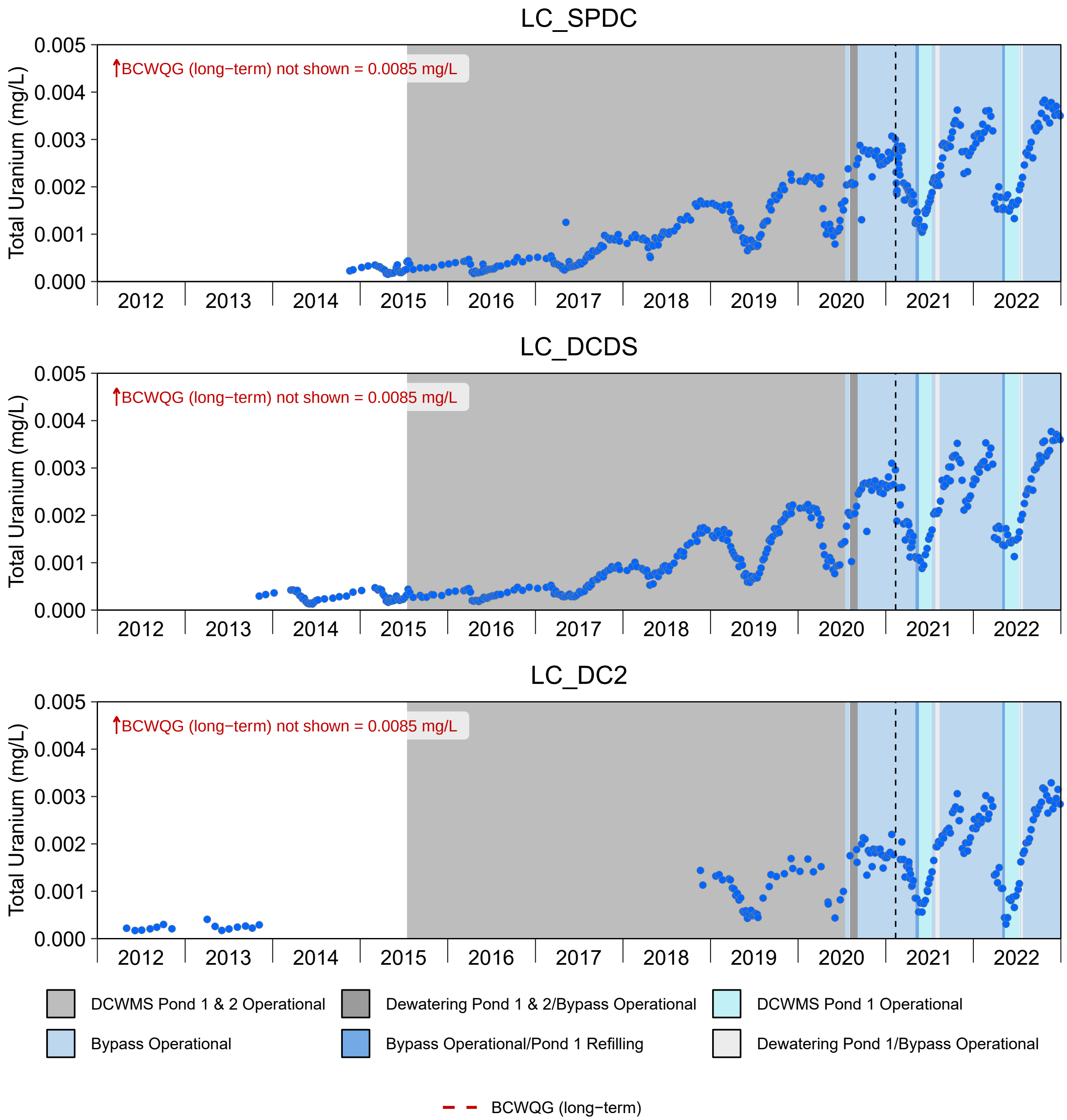


Figure C.21: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

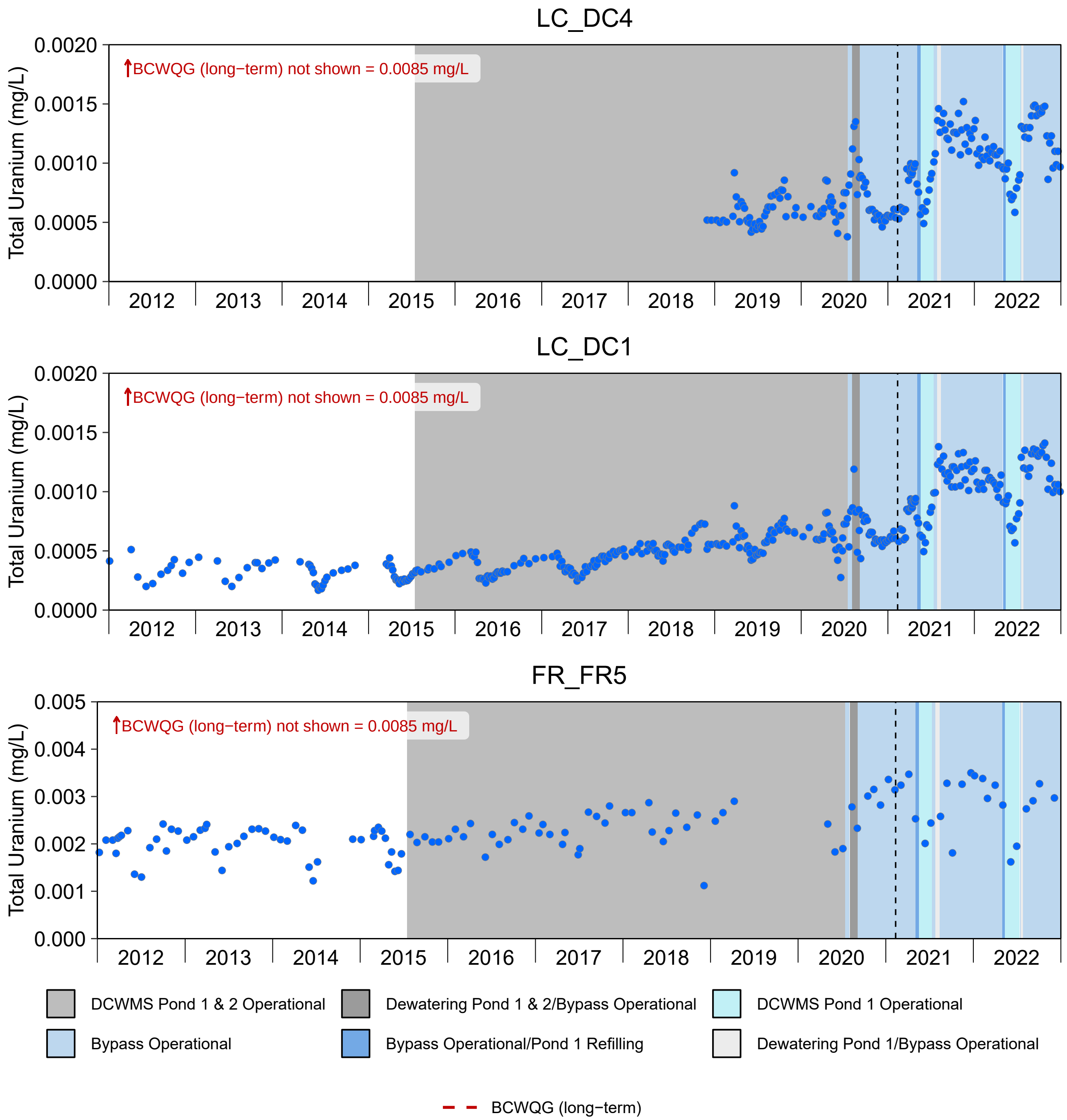


Figure C.21: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

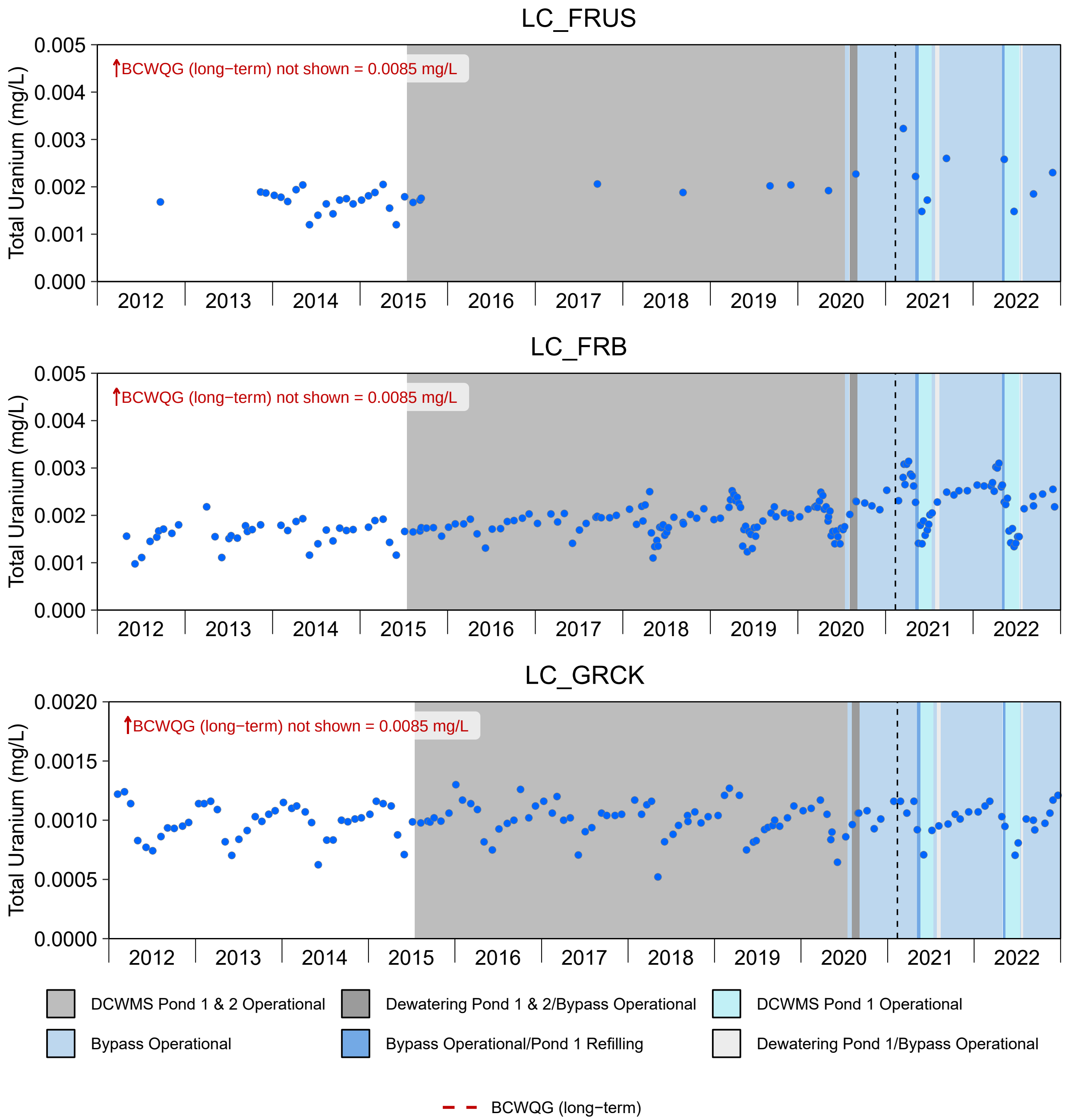


Figure C.21: Time Series Plots for Total Uranium from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b). Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

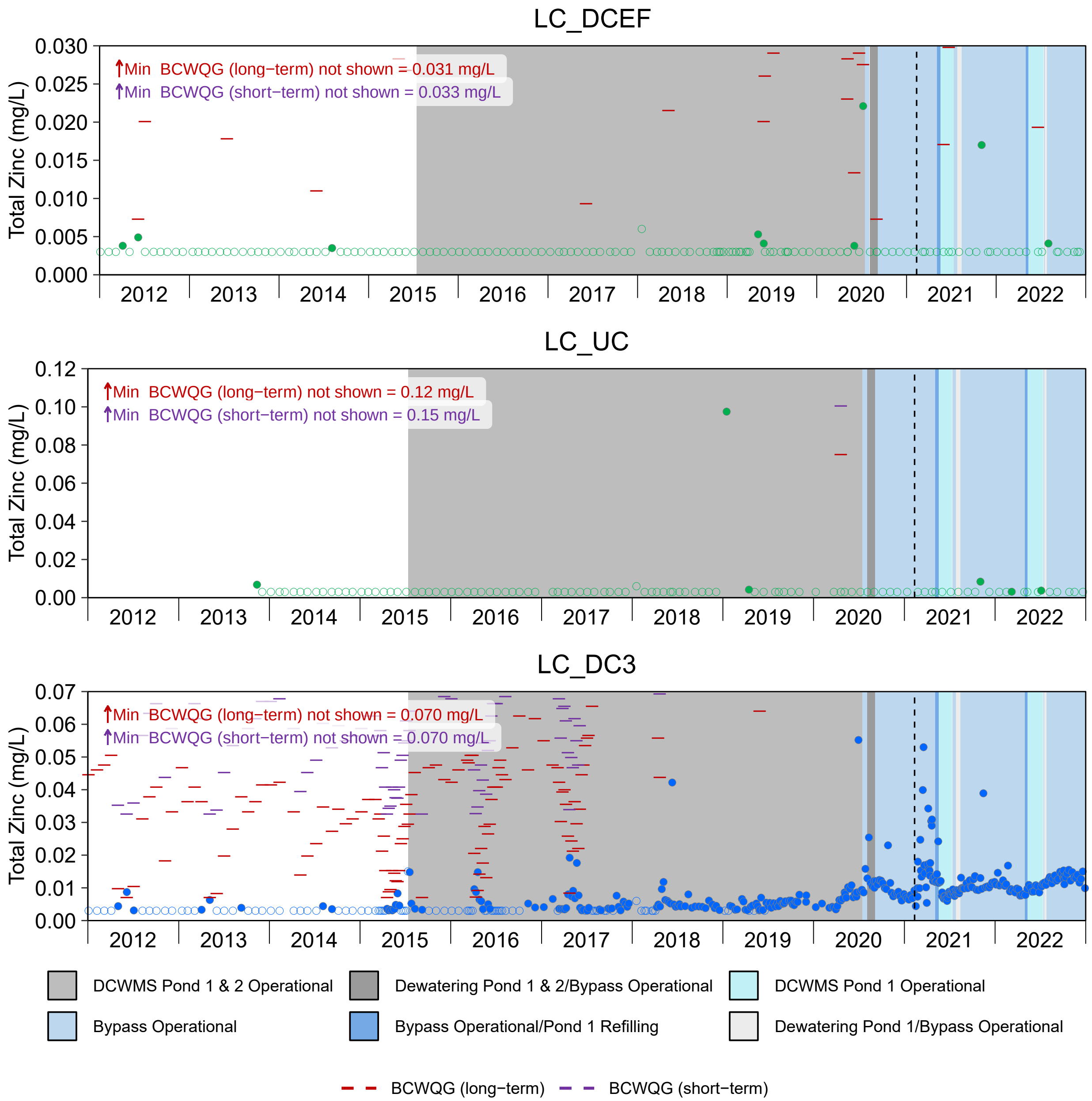


Figure C.22: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

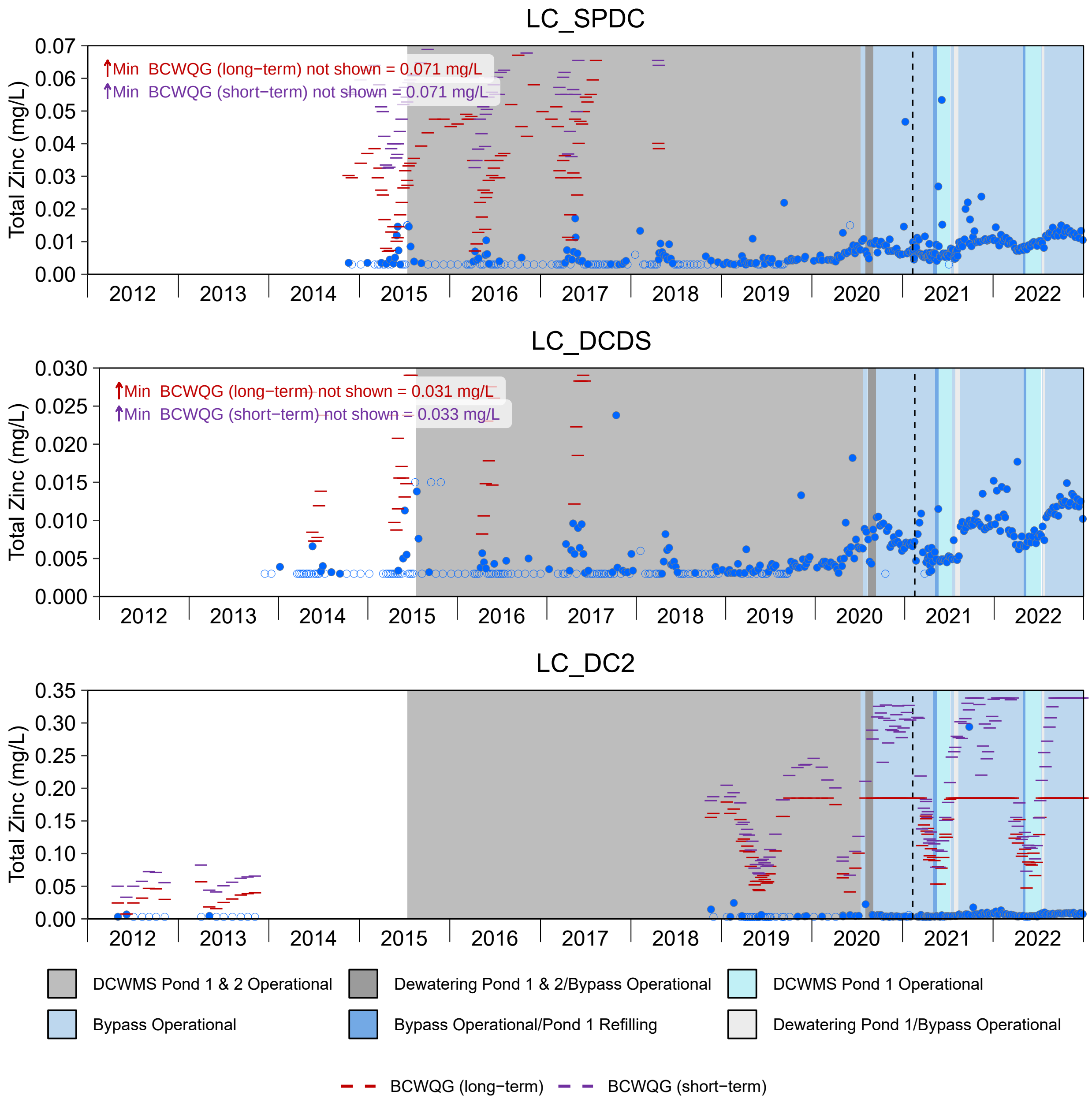


Figure C.22: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

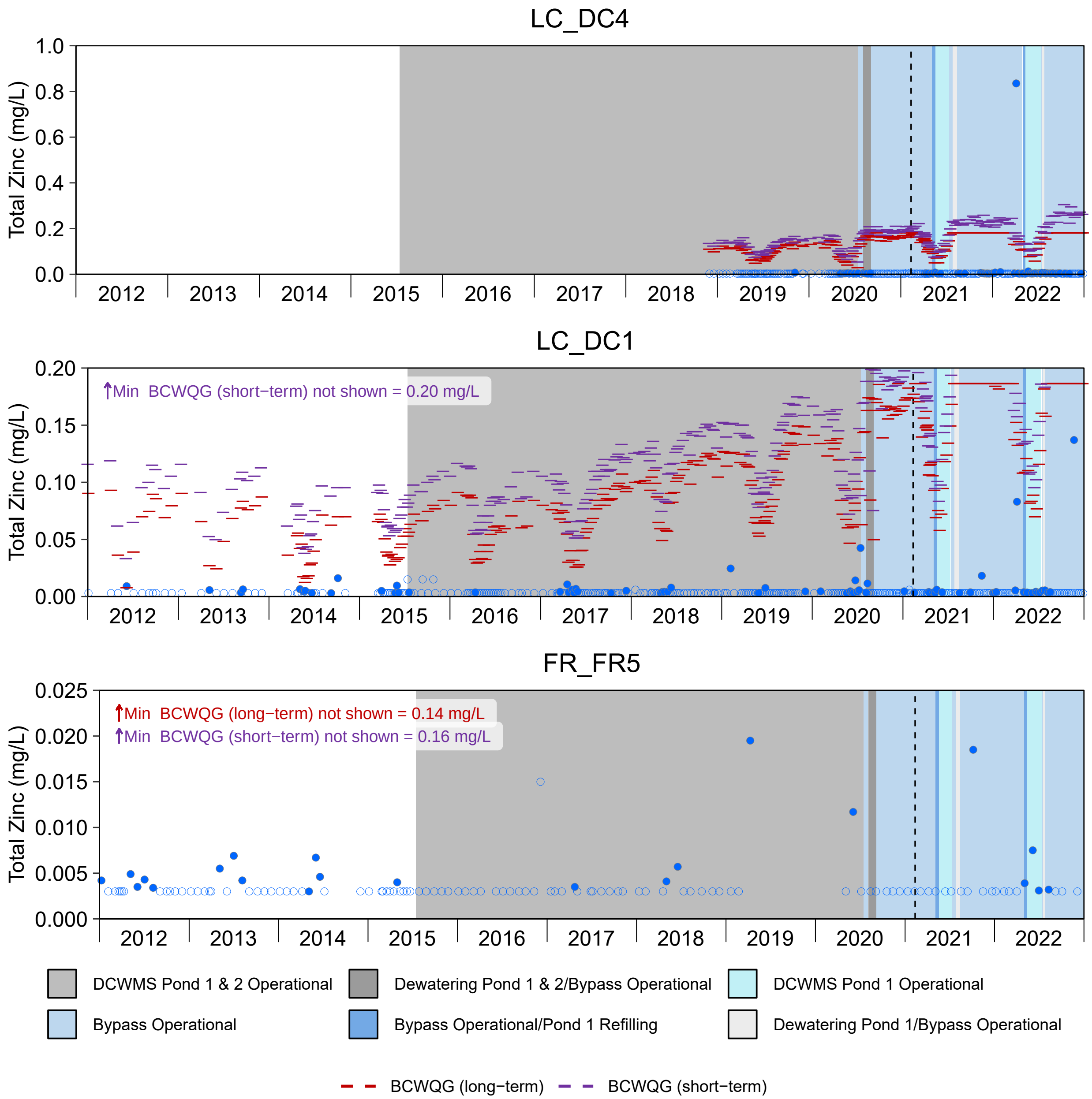


Figure C.22: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

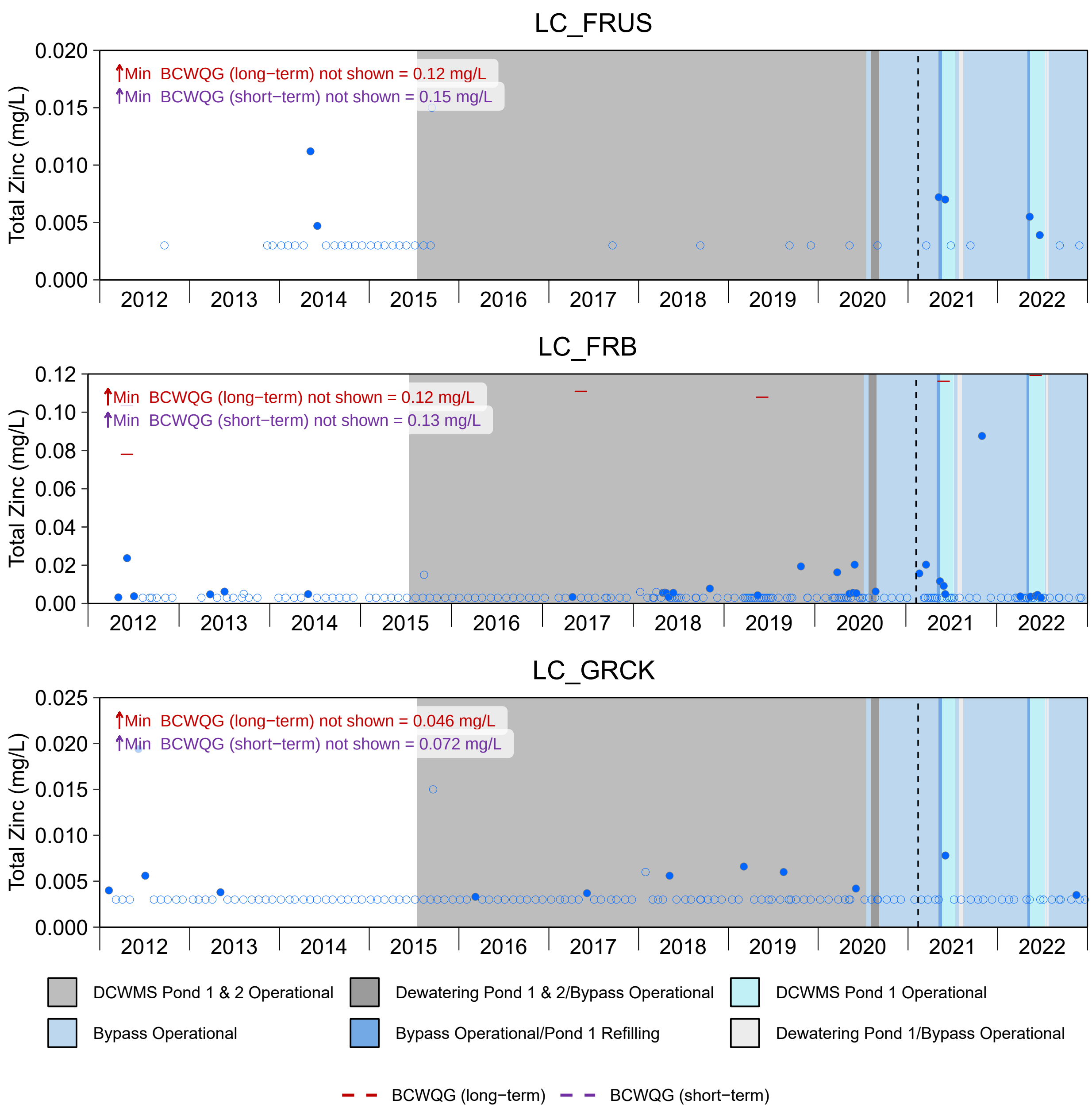


Figure C.22: Time Series Plots for Total Zinc from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: BCWQG = British Columbia Water Quality Guideline (BCMOECCS 2021a,b).Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. Guidelines are dependent on water hardness concentrations. Constituent was plotted because it was identified as a mine−related constituent in the Adaptive Management Plan and an early warning trigger was defined (Azimuth 2018). When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

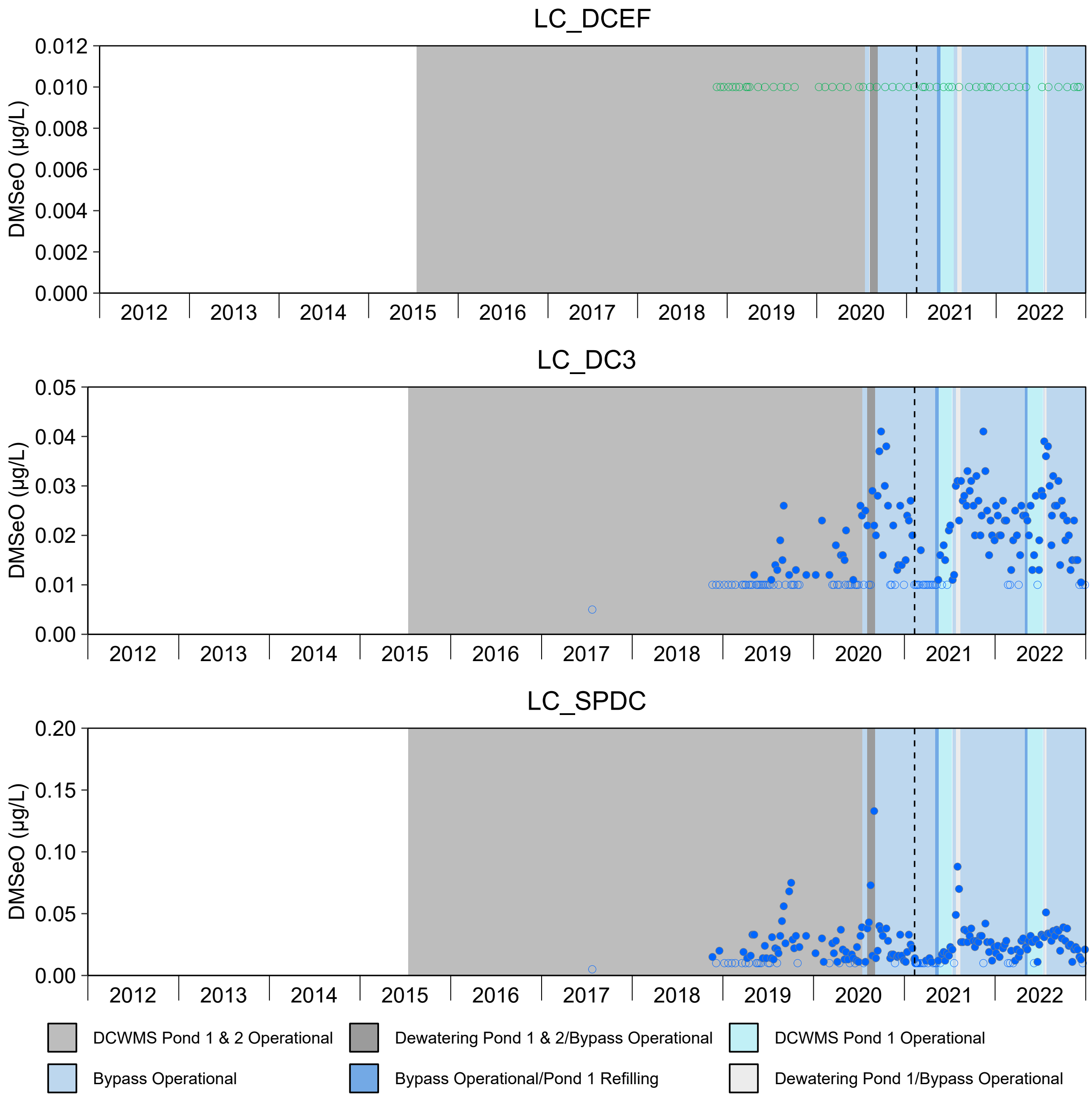


Figure C.23: Time Series Plots for Dimethylselenoxide (DMSeO) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

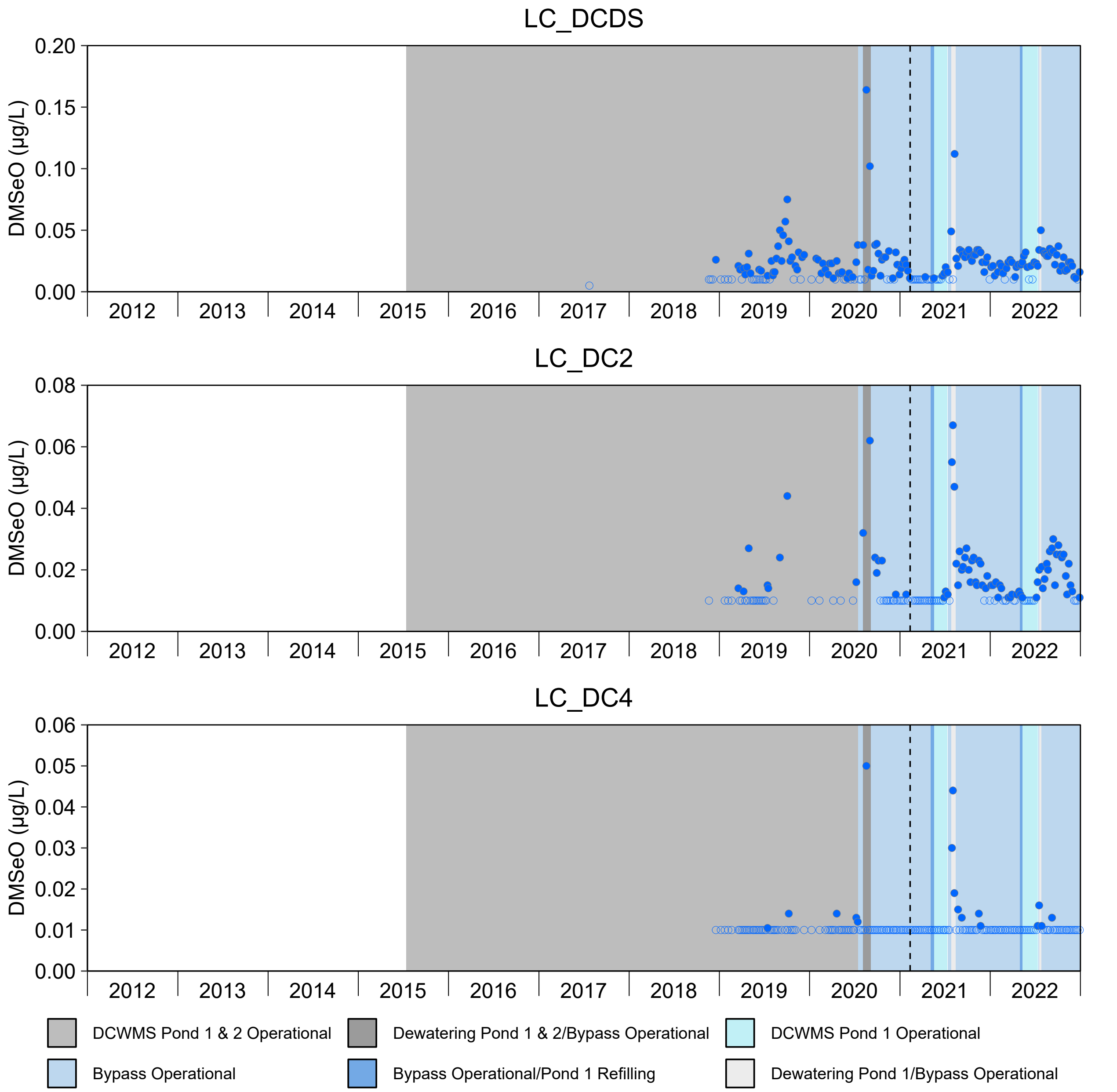


Figure C.23: Time Series Plots for Dimethylselenoxide (DMSeO) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

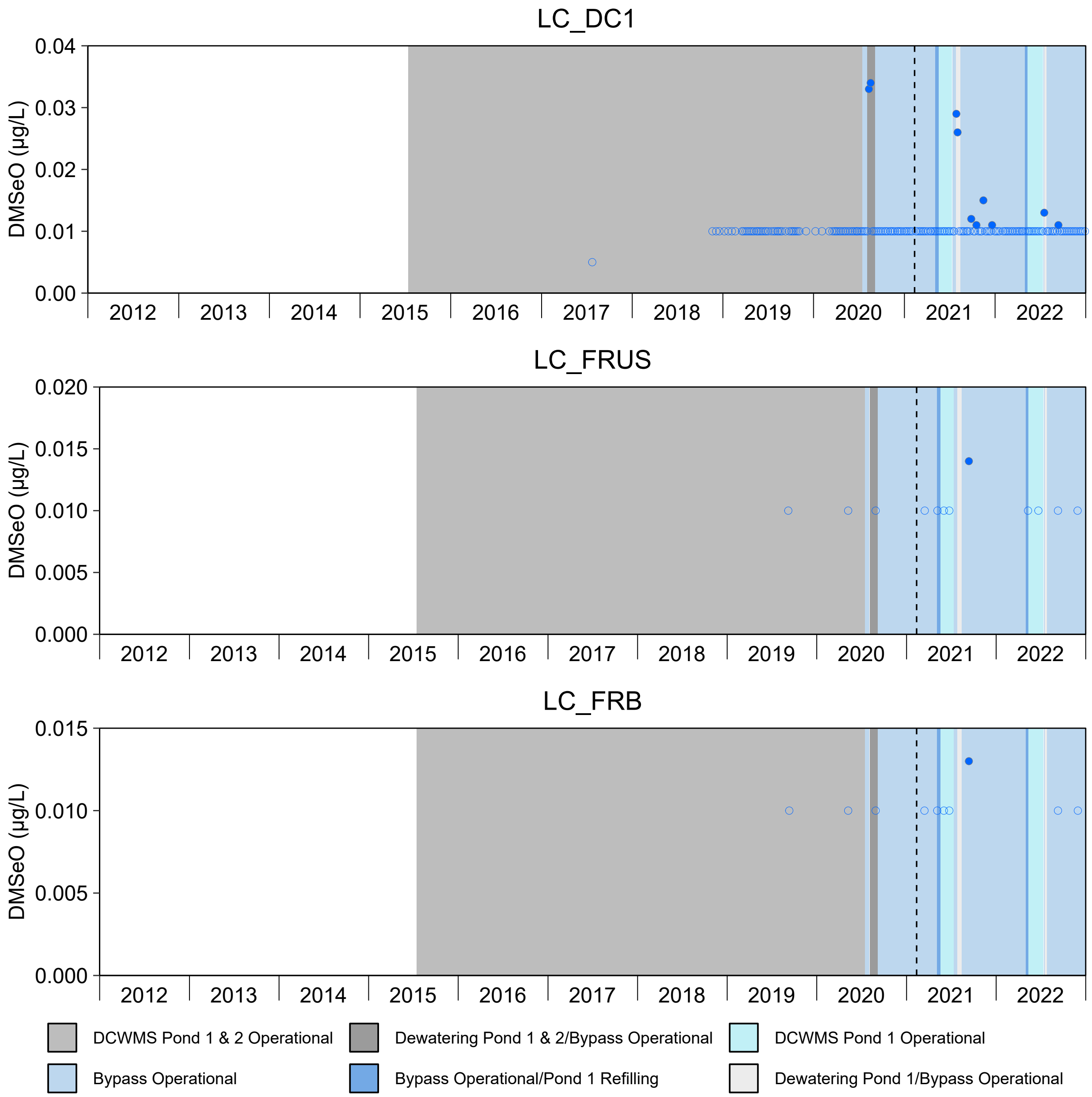


Figure C.23: Time Series Plots for Dimethylselenoxide (DMSeO) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

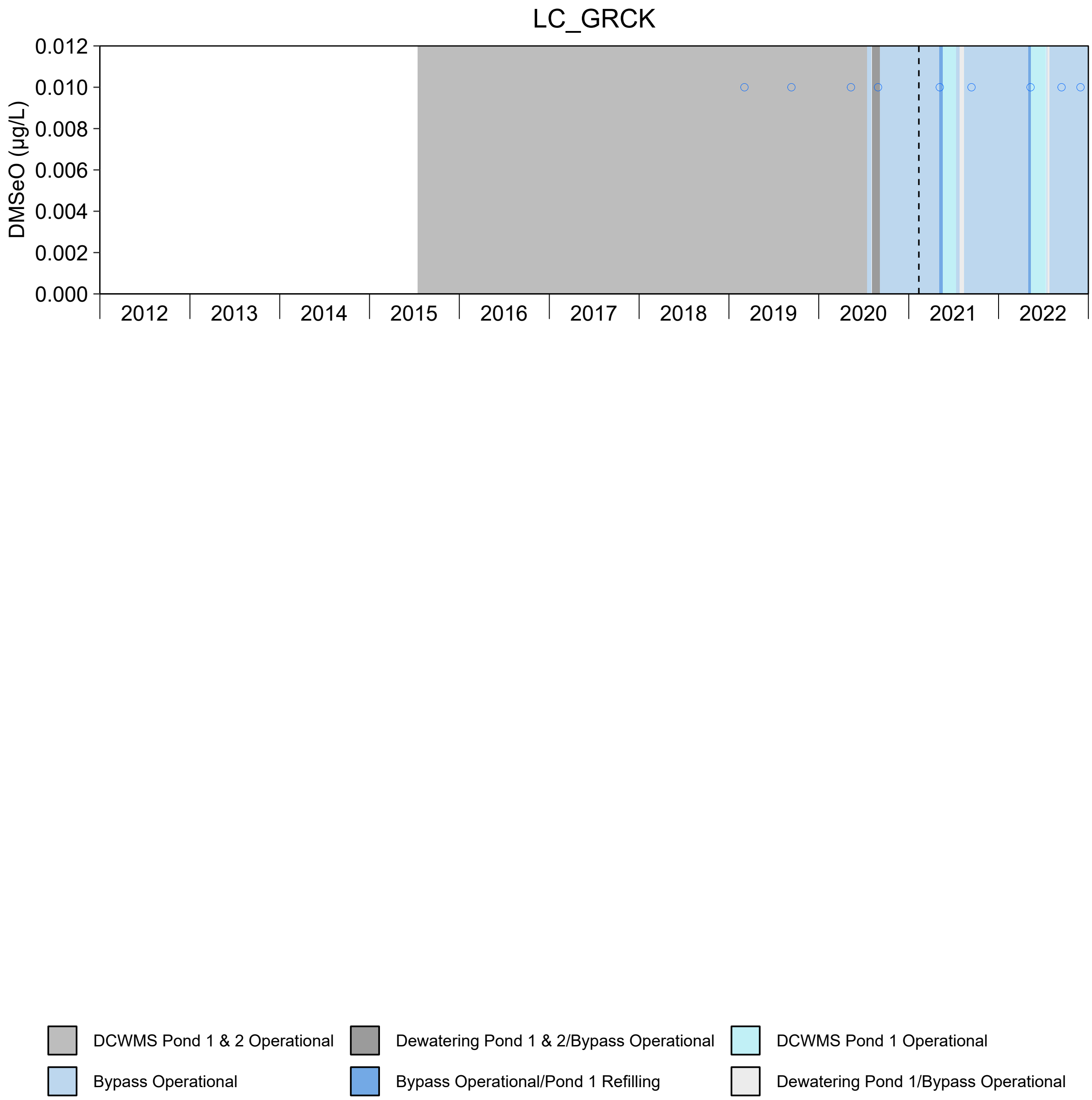


Figure C.23: Time Series Plots for Dimethylselenoxide (DMSeO) from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

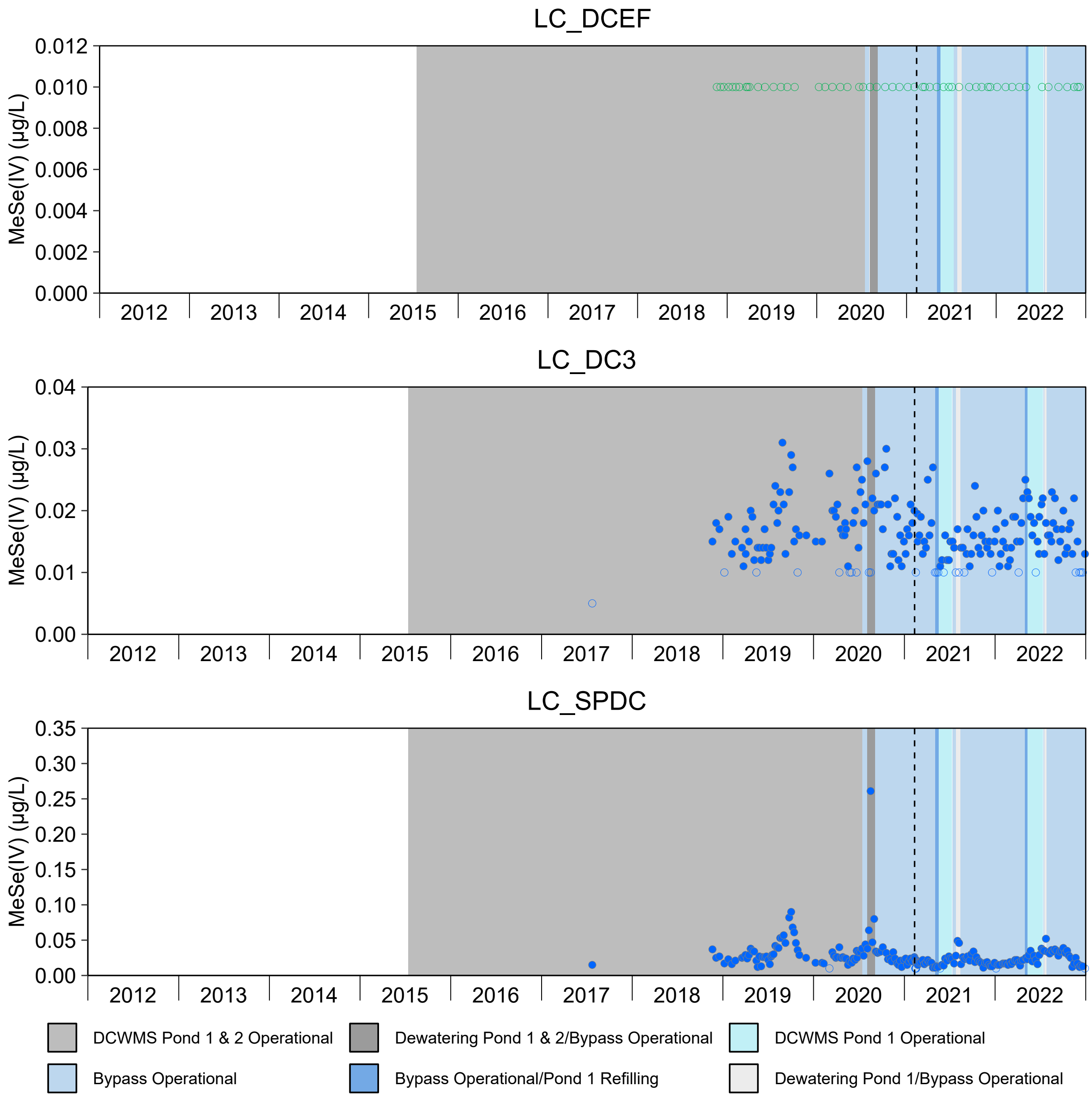


Figure C.24: Time Series Plots for Methylseleninic Acid [MeSe(IV)] from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

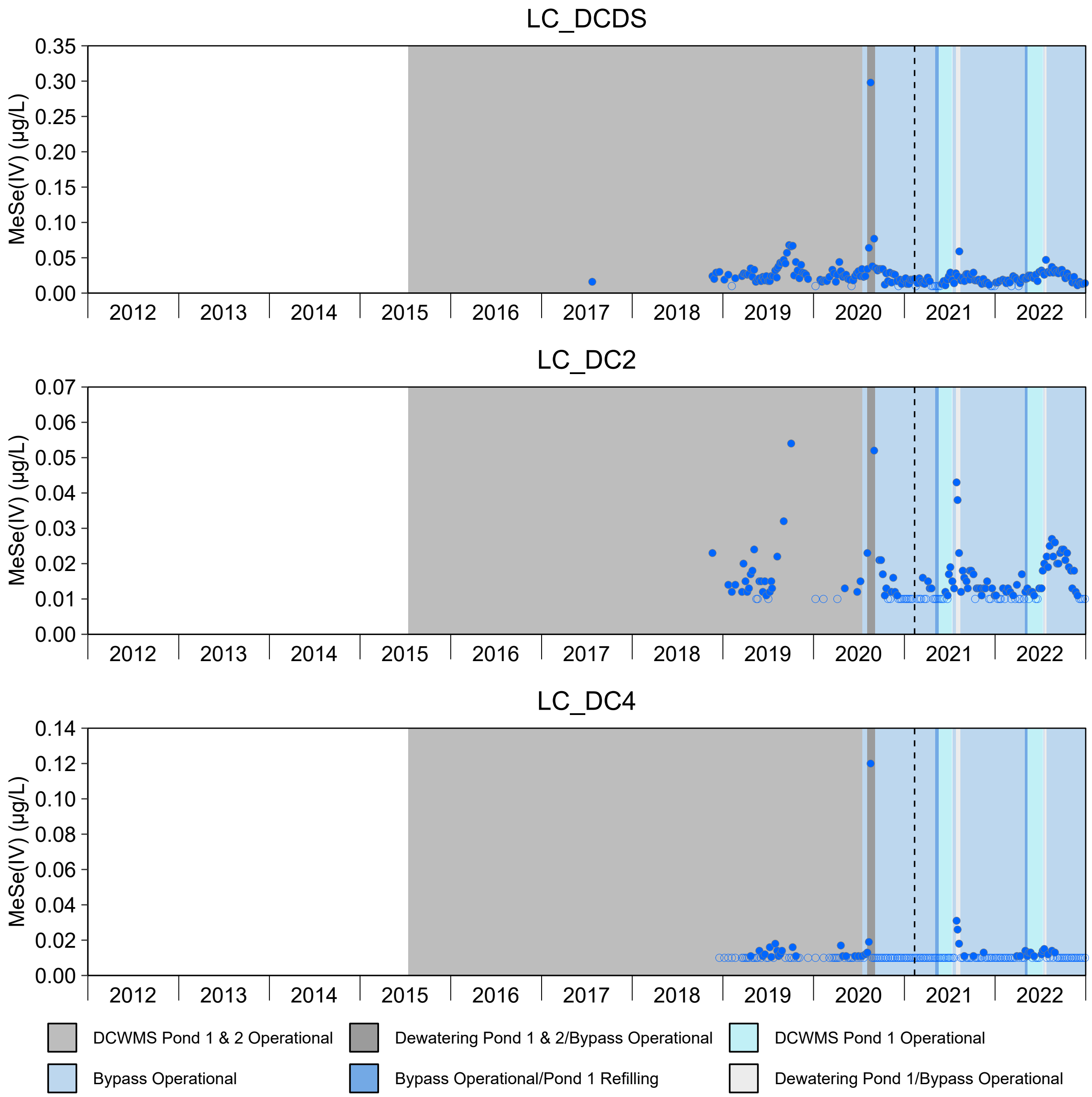
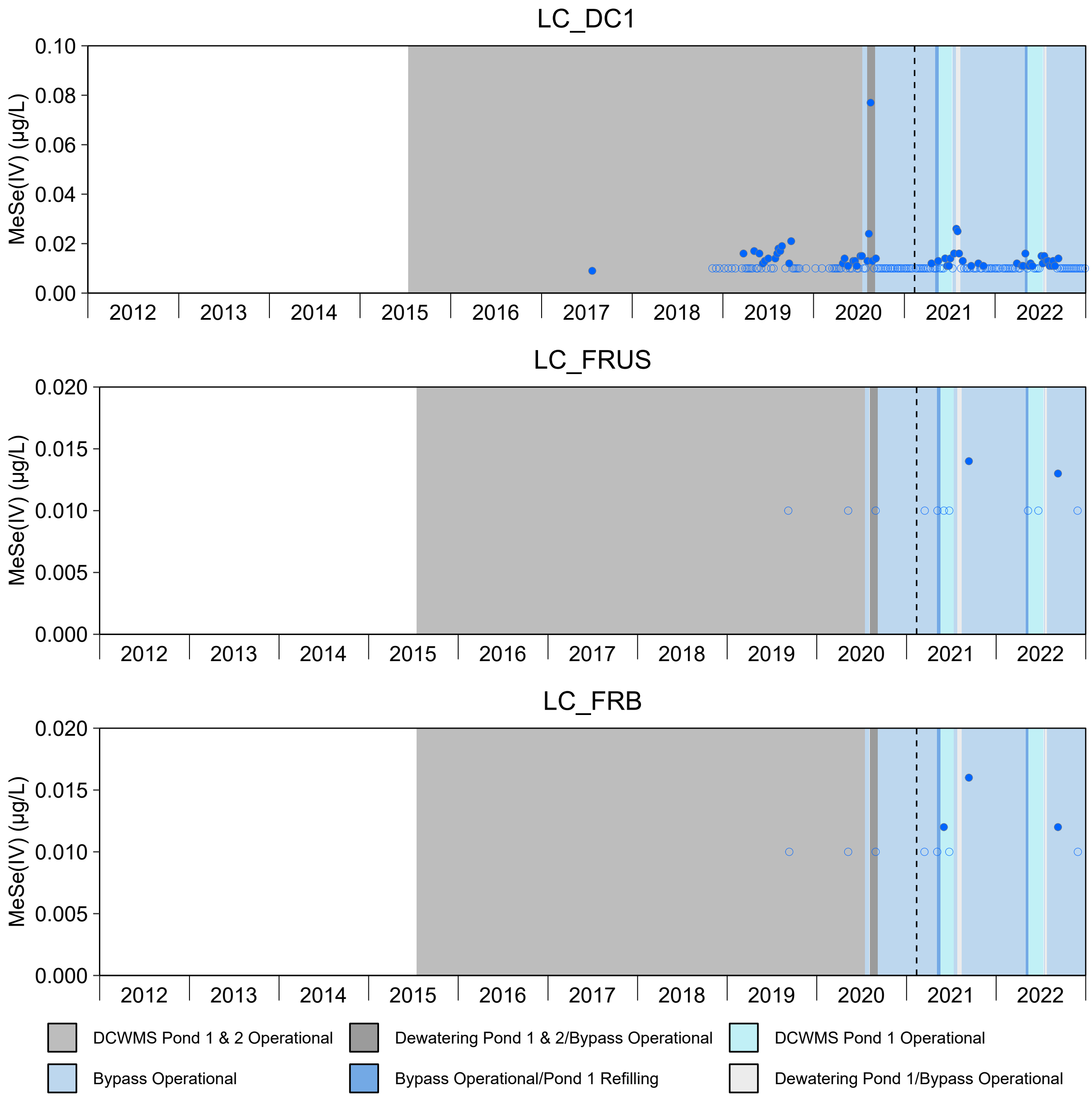


Figure C.24: Time Series Plots for Methylseleninic Acid [MeSe(IV)] from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).



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Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

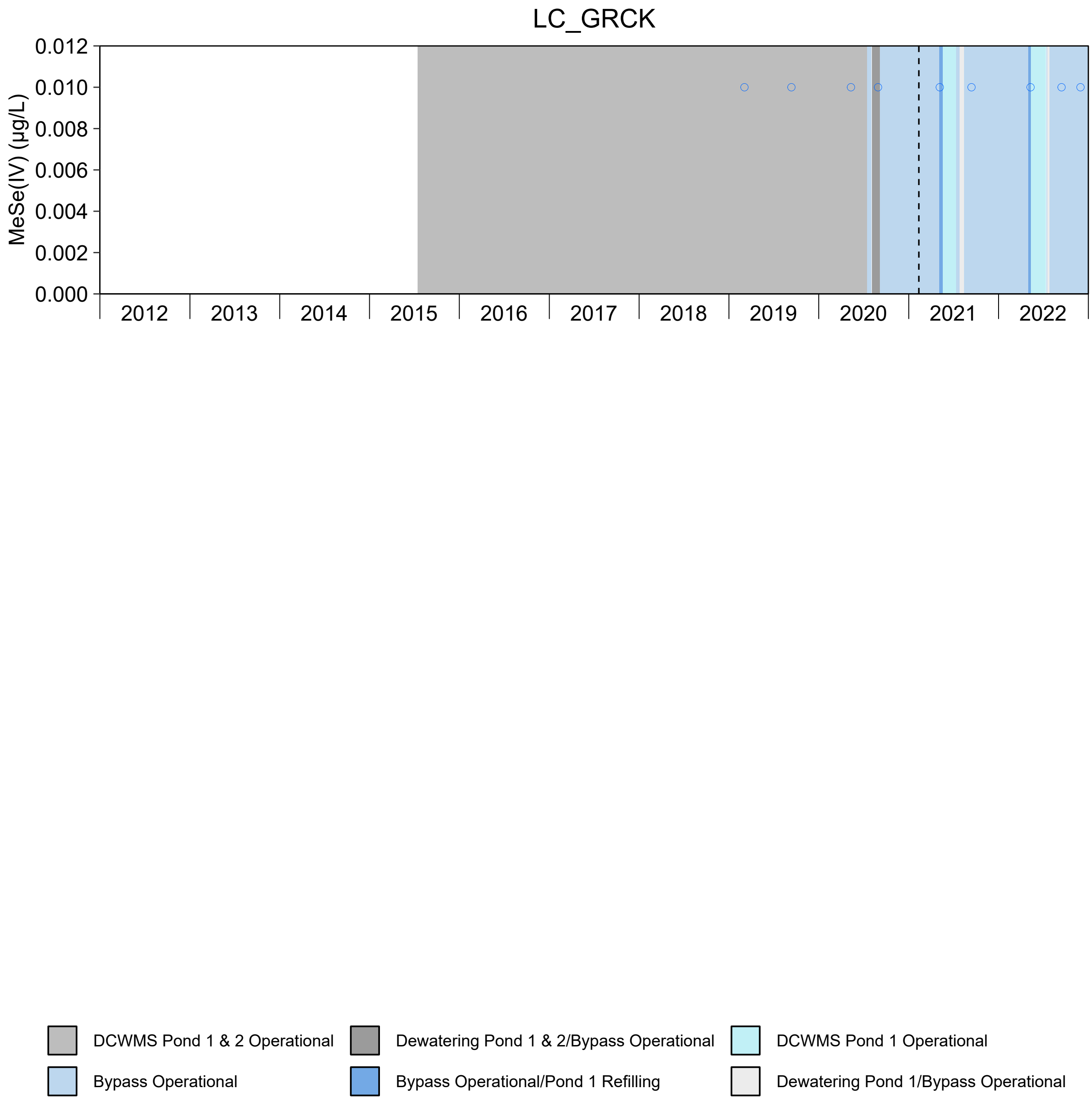

Figure C.24: Time Series Plots for Methylseleninic Acid [MeSe(IV)] from LCO Dry Creek LAEMP Areas, 2012 to 2022

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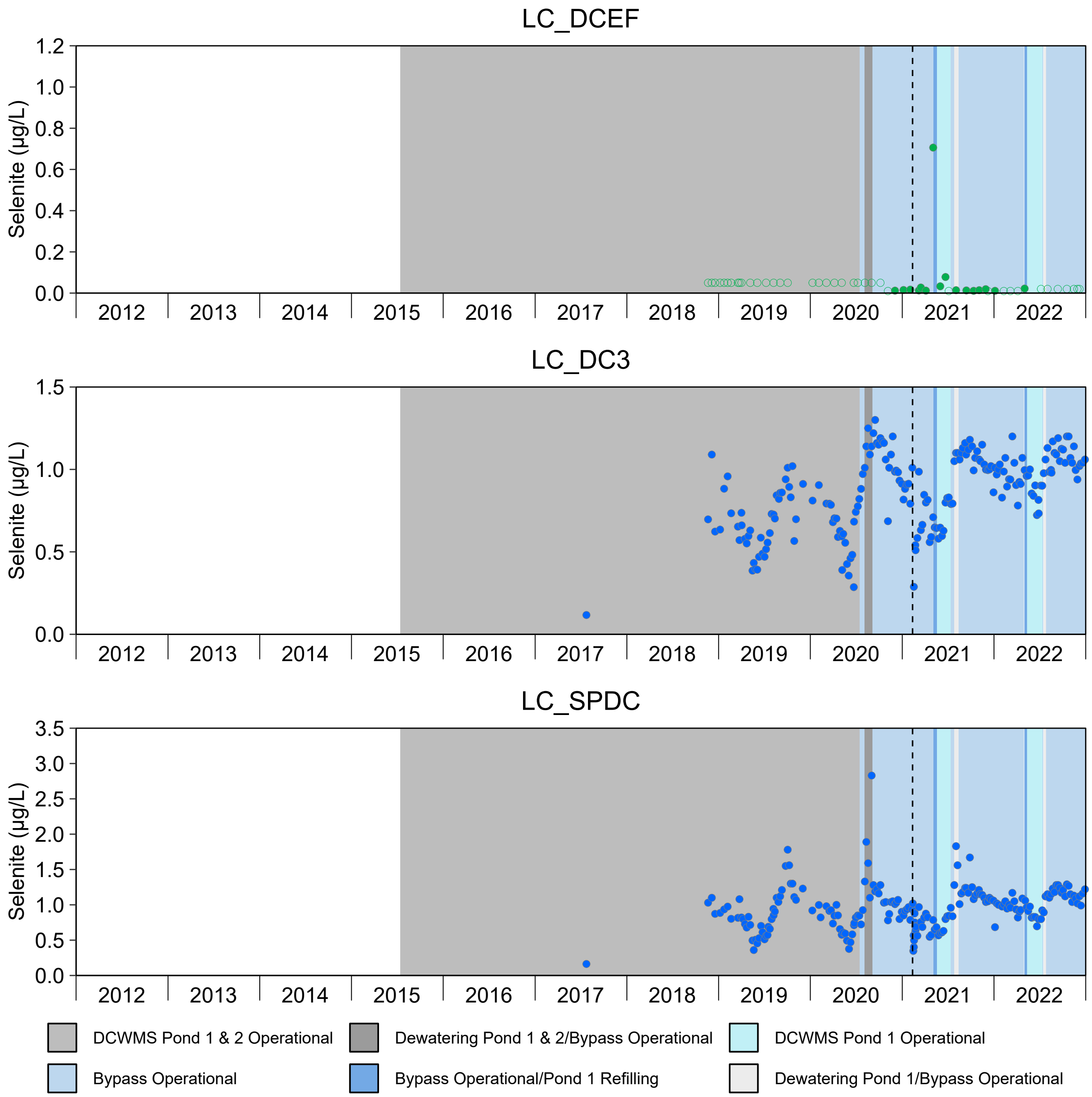

Figure C.25: Time Series Plots for Selenite from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

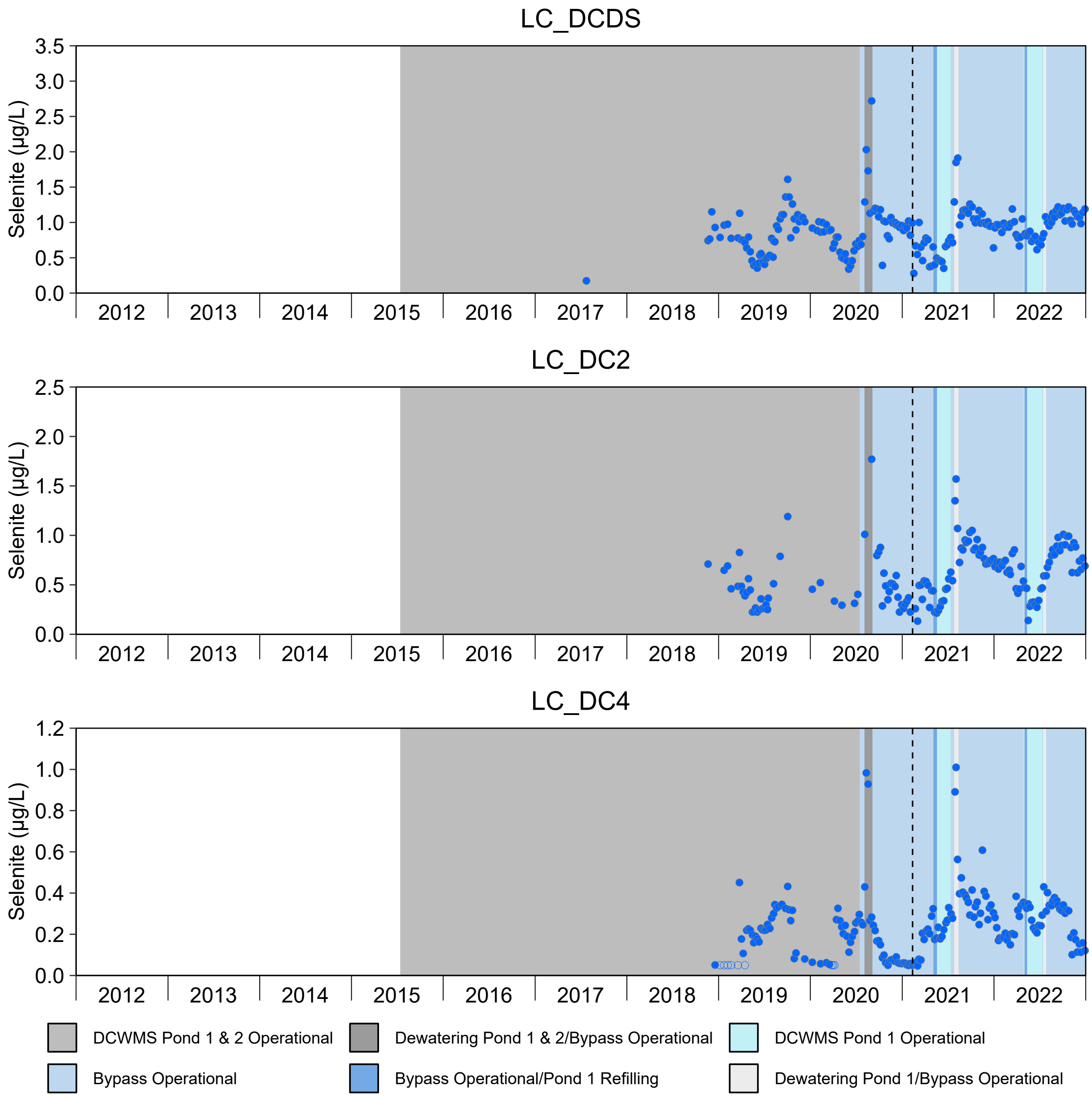

Figure C.25: Time Series Plots for Selenite from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

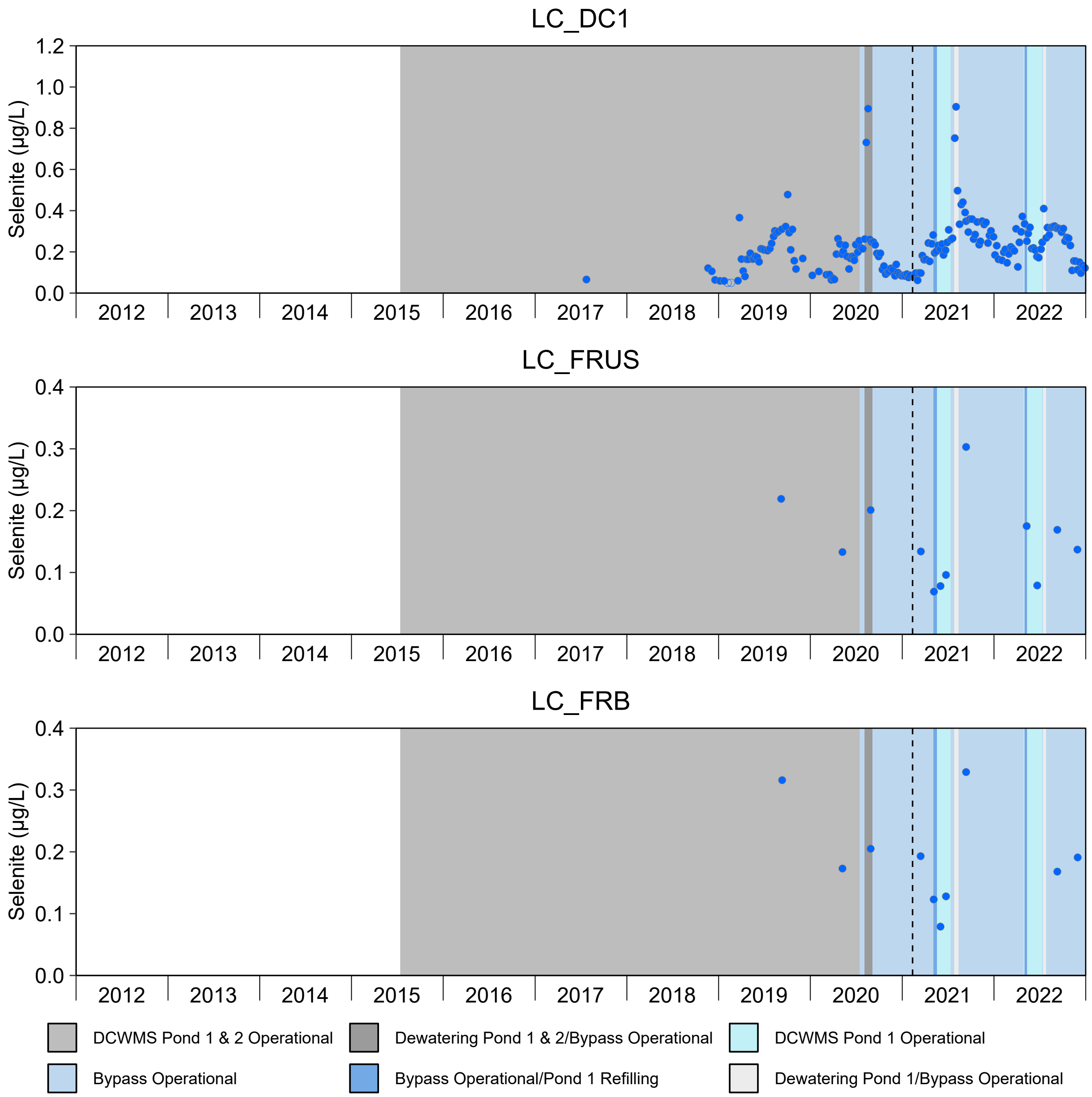

Figure C.25: Time Series Plots for Selenite from LCO Dry Creek LAEMP Areas, 2012 to 2022

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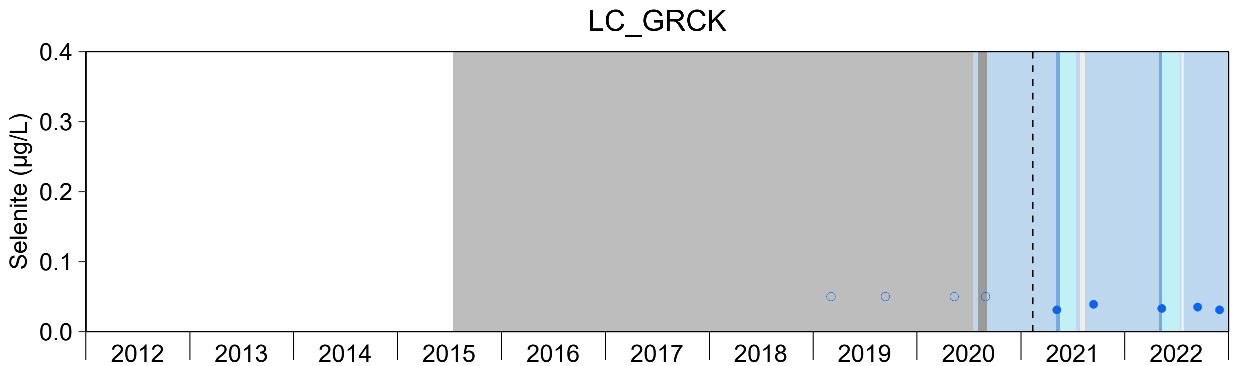

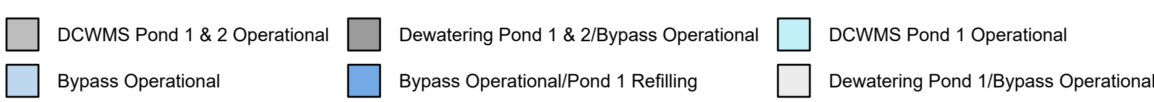

Figure C.25: Time Series Plots for Selenite from LCO Dry Creek LAEMP Areas, 2012 to 2022

Notes: Green data points are used for reference sites and blue data points are used for mine−exposed sites. Concentrations reported below the laboratory reporting limit (LRL) are plotted as open symbols at the LRL. When biological monitoring areas and routine water quality stations were in close proximity to each other and with no additional inputs between them, data collected at the biological monitoring area were combined with routine data and plotted together with the biological monitoring area depicted in parenthesis. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only apply to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

Table C.1: British Columbia Water Quality Guidelines, Site-Specific Elk Valley Water Quality Plan (EVWQP) Benchmarks, and Interim Screening Values for Constituents Assessed in the Line Creek Dry Creek LAEMP, 2022

		Constituent	Units	British Columbia Water Quality Guidelines[a]				Site-Specific Benchmark[b]	Updated Effects Concentraiton[k]/ Proposed Benckmark
				Long-term Average	Short-term Maximum	Year	Status		
Non-Metals		Total Alkalinity	mg/L	For dissolved calcium = < 4mg/L, BCWQG = <10 For dissolved calcium = 4 to 8 mg/L, BCWQG = 10 to 20 For dissolved calcium = > 8 mg/L, BCWQG = > 20	-	2015	Working	-	-
		Unionized Ammonia[c]	mg/L	pH and Temperature dependent (tabular)	pH and Temperature dependent (tabular)	2009	Approved	-	-
		Chloride	mg/L	150	600	2003	Approved	-	-
		Fluoride	mg/L	-	For hardness ≤ 10 mg/L, BCWQG = 0.4 For hardness > 10 mg/L, BCWQG = [-51.73 + 92.57 × $\log_{10}$(hardness)]×0.01 Maximum applicable hardness = 385 mg/L	1990	Approved	-	-
		Nitrate-N	mg/L	3	33	2009	Approved	-	Level 1 Updated Effects Concentration = $10^{((log10(9)/(-2.64))-(1.45-1.18*(log10(hardness))))}$ Level 2 Updated Effects Concentration = $10^{((log10(4)/(-2.64))-(1.45-1.18*(log10(hardness))))}$ Level 3 Updated Effects Concentration = $10^{((log10(1)/(-2.64))-(1.45-1.18*(log10(hardness))))}$
		Nitrite-N[d]	mg/L	0.02 to 0.20	0.06 to 0.60	2009	Approved	-	-
		Dissolved oxygen[e]	mg/L	For buried embryo/alevin life stages, BCWQG (water column) = 11; BCWQG (interstitial) = 8; for other life stages, BCWQG (water column) = 8	For buried embryo/alevin life stages, BCWQG (water column) = 9; BCWQG (interstitial) = 6 For other life stages, BCWQG (water column) = 5	1997	Approved	-	-
		pH[f]	pH units	6.5 - 9.0		1991	Approved	-	-
		Sulphate[g]	mg/L	128 to 429 Maximum applicable hardness = 250 mg/L	-	2013	Approved	-	Level 1 Updated Effects Concentration = 617 Level 2 Updated Effects Concentration = 764 Level 3 Updated Effects Concentration = 1099
		Total Dissolved Solids	mg/L	-	-	-	-	Screening Level 1 Benchmark = 1,000	-
Metals and Metalloids	Total	Aluminum	mg/L	Biotic Ligand Model	-	2023	Approved	-	-
		Antimony (III)	mg/L	0.009	-	2015	Working	-	-
		Arsenic	mg/L	-	0.005	2002	Approved	-	-
		Barium	mg/L	1	-	2015	Working	-	-
		Beryllium	mg/L	0.00013	-	2015	Working	-	-
		Cadmium	mg/L	-	-	-	-	Site Performance Objective[j] = $\leq 0.001 \times 10^{0.83(log700-log(hardness))}$ Maximum applicable hardness = 0.00038 mg/L	-
		Boron	mg/L	1.2	-	2003	Approved	-	-
		Chromium[h]	mg/L	For Cr(VI), BCWQG = 0.001 For Cr(III), BCWQG = 0.0089	-	2015	Working	-	-
		Cobalt	mg/L	0.004	0.11	2004	Approved	-	-
		Iron	mg/L	-	1	2008	Approved	-	-

Note: "-" = no data available.
[a] British Columbia Working (BCMOECCS 2021a) or Accepted (BCMOECCS 2021b) Water Quality Guidelines (BCWQG) for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness), guidelines were screened using concurrent values.
[b] When appropriate, site-specific Elk Valley Water Quality Plan Benchmarks (EVWQP; Teck 2014) or interim screening values were applied in addition to or instead of BC water quality guidelines. Interim screening values are displayed for nickel (Golder 2017b).
[c] Temperature and pH dependent; range of minimum and maximum values.
[d] Dependent on concurrent chloride, range of values reported (BCMOECCS 2021a).
[e] Dissolved oxygen guidelines represent a minimum value, and so exceedances were quantified below this guideline.
[f] Unrestricted change permitted within this pH range.
[g] For hardness-based guidelines, concurrent hardness values were used for calculating guidelines. If hardness values exceeding the maximum applicable hardness, then guidelines were determined using the maximum applicable hardness. If hardness values is lower than the minimum hardness, then guidelines were determined using the minimum hardness.
[h] Chromium(VI) is the dominant oxidation state in oxygenated environments, and so its guideline was applied.
[i] The most conservative guideline (0.00000125 mg/L) was applied.
[j] As outlined in Permit 107517.
[k] As oulined in WSP Golder. 2022. Task 1: Elk Valley Water Quality Plan Benchmark Validation Nitrate, Sulphate, Selenium

Table C.1: British Columbia Water Quality Guidelines, Site-Specific Elk Valley Water Quality Plan (EVWQP) Benchmarks, and Interim Screening Values for Constituents Assessed in the Line Creek Dry Creek LAEMP, 2022

		Constituent	Units	British Columbia Water Quality Guidelines[a]				Site-Specific Benchmark[b]	Updated Effects Concentraiton[k]/ Proposed Benckmark
				Long-term Average	Short-term Maximum	Year	Status		
Metals and Metalloids	Total	Lead[g]	mg/L	For hardness ≤ 8 mg/L, none proposed. For hardness 8 to 360 mg/L, BCWQG = 0.001×{3.31+ exp[1.273 × ln(hardness) - 4.704]} No more than 20% of samples in a 30-d period should be >1.5x the guideline. Maximum applicable hardness = 360 mg/L	For hardness ≤ 8 mg/L, BCWQG ≤ 0.003 For hardness 8 to 360 mg/L, BCWQG = 0.001×{exp[1.273 × ln(hardness) - 1.460]} Maximum applicable hardness = 360 mg/L	1987	Approved	-	-
		Manganese[g]	mg/L	For hardness 37 to 450 mg/L, BCWQG ≤ 0.004 × hardness + 0.605 Maximum applicable hardness = 450 mg/L	For hardness 25 to 259 mg/L, BCWQG ≤ 0.01102 × hardness + 0.54 Maximum applicable hardness = 259 mg/L	2001	Approved	-	-
		Mercury[i]	mg/L	MeHg ≤ 0.5% of THg, BCWQG = 0.00002 Else, BCWQG = [0.0001/(MeHg/THg)] OR When MeHg = 0.5% of THg, BCWQG= 0.00002 When MeHg = 1.0% of THg, BCWQG = 0.00001 When MeHg = 8.0% of THg, BCWQG= 0.00000125	-	2001	Approved	-	-
		Molybdenum	mg/L	7.6	46	2021	Approved	-	-
		Selenium	µg/L	2	-	2014	Approved	-	-
		Silver[f]	mg/L	For hardness ≤ 100 mg/L, BCWQG = 0.00005 For hardness > 100 mg/L, BCWQG = 0.0015	For hardness ≤ 100 mg/L, BCWQG = 0.0001 For hardness > 100 mg/L, BCWQG = 0.003	1996	Approved	-	-
		Thallium	mg/L	0.0008	-	1997	Working	-	-
		Uranium	mg/L	0.0085	-	2011	Working	-	-
		Zinc[g]	mg/L	For hardness ≤ 90 mg/L, BCWQG = 0.0075 For hardness 90 to 330 mg/L, BCWQG = [7.5 + 0.75 (hardness - 90)]×0.001; Maximum applicable hardness = 330 mg/L	For hardness ≤ 90 mg/L, BCWQG = 0.033 For hardness 90 to 500 mg/L, BCWQG = [33 + 0.75 (hardness - 90)]×0.001; Maximum applicable hardness = 500 mg/L	1999	Approved	-	-
	Dissolved	Cadmium[g]	µg/L	For hardness = 3.4 to 285 mg/L, BCWQG = {exp[0.736×ln(hardness) - 4.943]} Maximum applicable hardness = 285 mg/L	For hardness = 7 to 455 mg/L, BCWQG = {exp[1.03×ln(hardness)-5.274]} Maximum applicable hardness = 455 mg/L	2015	Approved	Level 1 EVWQP Benchmark = $10^{0.83(\log(hardness))-2.53}$ Maximum applicable hardness = 285 mg/L	-
		Copper	mg/L	Biotic Ligand Model	Biotic Ligand Model	2019	Approved	-	-
		Nickel	µg/L	-	-	-	Proposed		Level 1 Benchmark = log(Benchmark) = 0.547 x (log(DOC)) + 0.411 x (log(Hardness)) - 0.520 x (log(Bicarbonate)) + 0.856 Level 2 Benchmark = log(Benchmark) = 0.547 x (log(DOC)) + 0.411 x (log(Hardness)) - 0.520 x (log(Bicarbonate))) + 1.011 Level 3 Benchmark = log(Benchmark) = 0.547 x (log(DOC)) + 0.411 x (log(Hardness)) - 0.520 x (log(Bicarbonate)) + 1.304
		Iron	mg/L	-	BCWQG = 0.35 mg/L	2008	Approved	-	-

Note: "-" = no data available.
[a] British Columbia Working (BCMOECCS 2021a) or Accepted (BCMOECCS 2021b) Water Quality Guidelines (BCWQG) for the Protection of Aquatic Life. For guidelines dependent on other analytes (e.g., hardness), guidelines were screened using concurrent values.
[b] When appropriate, site-specific Elk Valley Water Quality Plan Benchmarks (EVWQP; Teck 2014) or interim screening values were applied in addition to or instead of BC water quality guidelines. Interim screening values are displayed for nickel (Golder 2017b).
[c] Temperature and pH dependent; range of minimum and maximum values.
[d] Dependent on concurrent chloride, range of values reported (BCMOECCS 2021a).
[e] Dissolved oxygen guidelines represent a minimum value, and so exceedances were quantified below this guideline.
[f] Unrestricted change permitted within this pH range.
[g] For hardness-based guidelines, concurrent hardness values were used for calculating guidelines. If hardness values exceeding the maximum applicable hardness, then guidelines were determined using the maximum applicable hardness. If hardness values is lower than the minimum hardness, then guidelines were determined using the minimum hardness.
[h] Chromium(VI) is the dominant oxidation state in oxygenated environments, and so its guideline was applied.
[i] The most conservative guideline (0.00000125 mg/L) was applied.
[j] As outlined in Permit 107517.
[k] As oulined in WSP Golder. 2022. Task 1: Elk Valley Water Quality Plan Benchmark Validation Nitrate, Sulphate, Selenium

Table C.2: Seasonal Kendall Trend Analysis For Water Quality Constituents Collected at Routine Monitoring Stations, Dry Creek LAEMP, 2012 to 2022

Constituent	Units	Reference		Mine-exposed									
		LC_DCEF	LC_UC	LC_DC3	LC_SPDC	LC_DCDS	LC_DC2	LC_DC4	LC_DC1	FR_FR5	LC_FRUS	LC_FRB	LC_GRCK
Nitrate (as N)	mg/L	NS	NS	77	42	53	22	38	90	1.2	NS	1.8	1.9
Nitrite (as N)	mg/L	NS	NS	37	12	17	12	6.3	24	NS	NS	NS	NS
Total Kjeldahl Nitrogen	mg/L	NS	NS	17	NS	16	30	50	20	58	147	26	NS
Phosphorus (P)-Total	mg/L	-1.6	-11	-2.6	-3.5	NS	NS	4.6	-2.8	NS	NS	NS	-4.7
Orthophosphate	mg/L	-0.96	NS	-2.9	NS	NS	-3.1	NS	-4.6	NS	NS	NS	NS
Sulphate	mg/L	NS	1.9	68	40	51	25	36	51	2.8	NS	3.1	0.75
Total Dissolved Solids	mg/L	0.63	NS	32	26	27	14	17	13	1.4	2.1	1.8	NS
Antimony (Sb)-Total	mg/L	-1.5	NS	17	15	16	9.3	13	6.8	NS	NS	NS	-
Barium (Ba)-Total	mg/L	0.81	NS	9.4	9.2	6.4	3.3	6.8	6.9	-2.3	-1.7	-0.88	0.44
Boron (B)-Total	mg/L	-2.3	-3.8	0.50	0.83	NS	NS	0.54	0	-1.4	NS	-2.0	-2.6
Cadmium (Cd)-Total	mg/L	NS	NS	20	28	26	16	27	8.5	NS	NS	NS	NS
Iron (Fe)-Total	mg/L	NS	-14	NS	-9.9	-8.8	NS	NS	NS	NS	NS	NS	-8.1
Lithium (Li)-Total	mg/L	NS	NS	23	29	21	17	18	6.9	8.5	7.5	7.8	0.69
Manganese (Mn)-Total	mg/L	NS	NS	13	8.1	10	9.4	NS	4.3	NS	NS	NS	-2.8
Mercury (Hg)-Total	mg/L	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Molybdenum (Mo)-Total	mg/L	NS	NS	23	24	26	12	26	7.9	1.7	NS	2.0	NS
Nickel (Ni)-Total	mg/L	NS	NS	64	38	38	20	34	25	NS	NS	NS	NS
Potassium (K)-Total	mg/L	NS	NS	15	15	14	4.9	8.8	6.7	2.6	NS	2.9	NS
Selenium (Se)-Total	mg/L	2.2	5.9	96	52	53	29	42	81	3.0	NS	3.3	0.80
Uranium (U)-Total	mg/L	0.90	NS	50	34	35	15	22	13	4.1	3.7	4.1	NS
Zinc (Zn)-Total	mg/L	NS	NS	20	23	19	11	6.1	0.87	NS	NS	NS	NS
Cadmium (Cd)-Dissolved	mg/L	NS	NS	28	46	41	22	27	9.7	NS	NS	NS	NS
Cobalt (Co)-Dissolved	mg/L	NS	NS	6.5	4.2	3.4	NS	LRL	NS	NS	NS	NS	NS
Iron (Fe)-Dissolved	mg/L	NS	NS	NS	-5.8	NS	NS	NS	NS	NS	LRL	NS	NS
Selenium (Se)-Dissolved	mg/L	1.9	6.2	87	50	53	28	42	77	4.0	NS	3.5	NS
Ammonia, Total (as N)	mg/L	15	NS	13	NS	8.8	NS	-35	8.3	NS	13	11	14
Total Organic Carbon	mg/L	-1.5	NS	2.0	NS	NS	NS	NS	-2.1	-2.7	NS	NS	-3.5
Dissolved Organic Carbon	mg/L	NS	NS	2.2	NS	3.3	NS	NS	NS	NS	NS	NS	NS
DMSeO - Dimethylselenoxide	mg/L	NS	-	20	NS	NS	5.4	NS	5.0	-	LRL	LRL	LRL
MeSe(IV) - Methylseleninic Acid	mg/L	NS	-	NS	-11	NS	NS	NS	NS	-	LRL	-	LRL
Se(IV) - Selenite	mg/L	NS	-	9.6	4.1	3.2	NS	12	13	-	-	-	-
Selenium Unknown	mg/L	NS	-	NS	NS	NS	NS	NS	NS	-	LRL	LRL	LRL
MeSe(VI) - Methaneselenonic Acid	mg/L	NS	-	NS	NS	NS	NS	NS	NS	-	LRL	LRL	LRL
Se(VI) - Selenate	mg/L	NS	-	33	32	34	36	42	41	-	-	-	-

Significant decreasing temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). Value reported is the Sen's slope reported as a percentage of the median concentration or value.

Significant increasing temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). Value reported is the Sen's slope reported as a percentage of the median concentration or value.

Notes: ""NS" = no significant temporal trend (Seasonal Kendall test for monotonic trend at α = 0.05). "-" = no data or insufficient data (n < 5) to test for trend. LRL = >75% censored data.

Table C.3: Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022

Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b) [c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Nitrate (as N)	Reference	LC_DCEF	10	0.001	b	4.39	8.15	13.4	-9.98	15.1	-8.40	-9.97	1.72	19.2	**73.3**	BC	BC	BC	BC	C	BC	C	C	BC	B	A	↑	↑	**45.5**
		LC_UC	8	0.002	-	-	b	-13.6	15.8	-1.63	-20.8	5.93	-16.5	17.9	11.4	-	-	AB	AB	A	AB	B	AB	AB	A	AB	No	No	-5.58
	Mine-Exposed	LC_DC3	10	0.001	b	46.2	30.9	**99.5**	**246**	**2,122**	**9,309**	**11,462**	**19,403**	**22,622**	**24,780**	F	EF	EF	E	D	C	B	B	A	A	A	No	No	9.50
		LC_SPDC	7	0.001	-	-	-	b	12.5	**2,370**	**10,708**	**13,589**	**21,659**	**26,580**	**28,896**	-	-	-	E	E	D	C	BC	AB	A	A	No	No	8.68
		LC_DCDS	8	0.001	-	-	b	**-52.8**	-22.6	**1,459**	**6,841**	**8,496**	**14,243**	**16,664**	**18,948**	-	-	D	E	DE	C	B	B	A	A	A	No	No	13.6
		LC_DC2	5	0.001	b	118	-	-	-	-	-	**39,427**	**74,438**	**85,760**	**83,295**	C	C	-	-	-	-	-	B	A	A	A	No	No	-2.87
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**64.9**	**136**	**140**	-	-	-	-	-	-	-	C	B	A	A	No	No	1.73
		LC_DC1	10	0.001	b	**102**	**288**	**200**	**370**	**4,525**	**21,207**	**31,284**	**48,141**	**73,225**	**77,909**	G	FG	EF	EF	E	D	C	BC	B	A	A	No	No	6.39
		FR_FR5	9	0.001	b	**24.6**	**28.6**	7.28	14.6	15.9	3.07	-	12.9	**35.4**	**25.7**	C	AB	AB	BC	ABC	ABC	BC	-	ABC	A	AB	No	No	-7.19
		LC_FRUS	1	0.023	-	-	b	**-11.1**	-	-	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-	↓	↓	-
		LC_FRB	10	0.001	b	**34.1**	**35.2**	20.8	19.4	**27.5**	11.7	15.3	**28.1**	**51.6**	**46.6**	E	ABCD	ABC	CDE	CDE	BCD	DE	CDE	C	A	AB	No	No	-3.26
		LC_GRCK	10	0.001	b	20.3	43.0	18.2	11.1	27.5	-0.0779	27.5	10.4	32.7	**93.3**	B	B	AB	B	B	B	B	B	B	B	A	No	↑	**45.6**
Nitrite (as N)	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	6	0.001	-	-	-	-	b	**4,869**	**6,780**	**1,566**	**1,436**	**6,521**	**621**	-	-	-	-	D	A	A	B	B	A	C	No	↓	**-89.1**
		LC_SPDC	6	0.001	-	-	-	-	b	**2,660**	**5,460**	**2,126**	**1,691**	**3,981**	**832**	-	-	-	-	E	BC	A	C	C	AB	D	No	↓	**-77.2**
		LC_DCDS	6	0.001	-	-	-	-	b	**2,190**	**4,465**	**1,931**	**1,348**	**2,969**	**692**	-	-	-	-	E	BC	A	BC	C	AB	D	No	↓	**-74.2**
		LC_DC2	3	0.001	-	-	-	-	-	-	-	b	-33.3	**106**	-32.2	-	-	-	-	-	-	-	B	B	A	B	No	↓	**-67.0**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	-15.0	**103**	10.4	-	-	-	-	-	-	-	B	B	A	B	No	↓	**-45.8**
		LC_DC1	5	0.001	-	-	-	-	-	b	**105**	38.4	33.6	**210**	**64.3**	-	-	-	-	-	C	AB	BC	BC	A	B	No	↓	**-47.1**
		FR_FR5	9	0.001	b	19.1	-8.36	**-48.5**	-38.1	-20.7	-20.7	-	-32.0	-36.0	-27.5	AB	A	ABC	C	BC	ABC	ABC	-	ABC	BC	ABC	No	No	13.4
		LC_FRUS	1	0.833	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	26.8	-7.56	-21.3	-43.7	-1.93	-15.8	-25.9	-11.0	9.61	13.4	AB	A	AB	AB	B	AB	AB	B	AB	A	A	No	No	3.48
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
Total Kjeldahl Nitrogen	Reference	LC_DCEF	9	0.683	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	8	0.282	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
	Mine-Exposed	LC_DC3	9	0.001	b	69.6	119	107	138	**471**	345	18.1	-	76.8	**594**	CD	BCD	ABCD	BCD	BCD	AB	ABC	D	-	D	A	No	↑	**293**
		LC_SPDC	6	0.001	-	-	-	b	-22.0	105	67.2	-37.8	-	**-73.9**	**183**	-	-	-	BCD	CD	AB	ABC	D	-	E	A	No	↑	**986**
		LC_DCDS	7	0.001	-	-	b	78.4	78.3	**286**	**340**	29.4	-	-24.4	**616**	-	-	CD	BC	BC	AB	A	CD	-	D	A	No	↑	**847**
		LC_DC2	4	0.001	b	27.7	-	-	-	-	-	154	-	10.3	**650**	B	B	-	-	-	-	-	B	-	B	A	↑	↑	**580**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**-73.4**	-31.0	**344**	-	-	-	-	-	-	-	B	C	B	A	↑	↑	**544**
		LC_DC1	10	0.001	b	54.8	42.2	31.3	31.2	93.3	**279**	179	-23.1	77.0	**469**	CD	BCD	BCD	CD	CD	BC	AB	BC	D	C	A	No	↑	**222**
		FR_FR5	5	0.001	-	-	-	b	**302**	**777**	266	-	-	230	209	-	-	-	B	A	A	AB	-	-	AB	AB	No	No	-6.46
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	8	0.001	b	-0.364	-	52.4	135	**697**	334	106	-	70.2	**824**	CD	D	-	CD	BCD	AB	ABC	CD	-	CD	A	No	↑	**443**
		LC_GRCK	9	0.124	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc

P-value < 0.05 (annual variation).
\> 20% Decrease in concentration.
\> 33% Decrease in concentration.
\> 43% Decrease in concentration.
\> 50% Decrease in concentration.
\> 25% Increase in concentration.
\> 50% Increase in concentration.
\> 75% Increase in concentration.
\> 100% Increase in concentration.
***Bold** Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: **Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022**

Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring?											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
					Magnitude of Difference (MOD)[b] from Base Year (b) [c]																						2022 vs. 2012-2021	2022 vs. 2021	
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022		Trend	MOD
Orthophosphate	Reference	LC_DCEF	10	0.001	b	-1.81	-0.132	-5.77	-5.55	-4.26	15.2	-11.0	-3.91	-8.63	**-29.3**	AB	AB	AB	AB	AB	AB	A	BC	AB	AB	C	No	↓	**-22.6**
		LC_UC	2	0.379	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
	Mine-Exposed	LC_DC3	10	0.001	b	0.900	-1.84	-6.83	-11.5	-18.1	-13.1	-8.64	-6.14	**-47.1**	**-28.8**	A	A	A	A	A	AB	A	A	A	C	B	No	↑	**34.7**
		LC_SPDC	7	0.001	-	-	-	b	-47.2	-23.1	-40.7	**-57.7**	78.3	-23.0	46.8	-	-	-	ABC	CD	BCD	CD	D	A	C	AB	No	↑	**90.5**
		LC_DCDS	8	0.001	-	-	b	**-56.9**	**-65.3**	**-52.9**	**-68.5**	**-72.1**	-1.53	-47.3	-15.2	-	-	AB	CD	CD	CD	CD	D	A	BC	AB	No	No	60.8
		LC_DC2	5	0.001	b	-10.7	-	-	-	-	-	**-70.3**	-36.3	**-56.0**	-39.2	A	A	-	-	-	-	-	C	AB	BC	AB	No	No	38.1
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**75.0**	**41.2**	**57.9**	-	-	-	-	-	-	-	B	A	A	A	No	No	11.9
		LC_DC1	10	0.001	b	-2.24	25.0	-22.9	-28.2	-24.4	**-52.4**	**-54.1**	-27.9	**-46.0**	-34.5	AB	AB	A	ABC	BCD	BC	DE	E	BC	CDE	BCDE	No	No	21.4
		FR_FR5	3	0.185	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	10	0.009	b	2.60	-3.89	-39.4	-41.2	-4.24	45.2	-14.3	8.77	-18.4	-37.2	AB	AB	AB	AB	AB	AB	A	AB	AB	AB	B	No	No	-23.1
		LC_GRCK	10	0.042	b	2.84	5.51	-17.8	-15.7	3.55	5.84	-7.22	19.9	5.16	-32.3	AB	AB	AB	AB	AB	AB	AB	AB	A	AB	B	No	No	-35.6
Phosphorus (P)-Total	Reference	LC_DCEF	9	0.531	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	4	0.011	-	-	b	-	**-81.0**	-55.1	-64.5	-	-	-	-52.8	-	-	A	-	B	AB	AB	-	-	-	AB	No	No	0
	Mine-Exposed	LC_DC3	9	0.001	-	b	3.53	-3.93	-3.18	-0.847	-27.1	-16.9	-8.53	-1.72	-30.3	-	ABC	ABC	ABC	AB	AB	BC	ABC	AB	A	C	No	↓	**-29.1**
		LC_SPDC	7	0.001	-	-	-	b	**-39.8**	**-36.1**	**-51.8**	**-47.6**	-26.3	**-46.4**	**-42.1**	-	-	-	A	BC	BC	C	C	AB	C	BC	No	No	7.94
		LC_DCDS	8	0.001	-	-	b	4.45	-18.1	-14.6	**-34.7**	-26.3	-4.74	-26.7	-22.0	-	-	ABC	A	ABCD	ABCD	D	BCD	AB	CD	ABCD	No	No	6.32
		LC_DC2	4	0.007	-	b	-	-	-	-	-	**-34.4**	-17.6	-25.2	-19.6	-	A	-	-	-	-	-	B	AB	AB	AB	No	No	7.59
		LC_DC4	3	0.005	-	-	-	-	-	-	-	b	12.3	3.76	**22.3**	-	-	-	-	-	-	-	B	AB	B	A	No	↑	**17.9**
		LC_DC1	9	0.001	-	b	24.2	-9.43	-22.0	-26.8	-36.2	-35.7	-28.6	-34.0	-27.0	-	AB	A	AB	B	B	B	B	B	B	B	No	No	10.6
		FR_FR5	8	0.555	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRUS	1	0.008	-	-	b	**-34.8**	-	-	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-	↓	↓	-
		LC_FRB	9	0.004	-	b	-5.20	-51.4	-22.9	-50.1	-20.9	**-62.6**	-47.5	-42.2	-19.2	-	A	AB	AB	AB	AB	AB	B	AB	AB	A	No	No	39.8
		LC_GRCK	9	0.081	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Sulphate	Reference	LC_DCEF	10	0.002	b	7.18	11.8	16.6	**23.8**	18.1	5.65	16.7	0.549	4.72	9.12	B	AB	AB	AB	A	AB	AB	AB	B	AB	AB	No	No	4.20
		LC_UC	8	0.001	-	-	b	4.17	9.87	3.68	12.2	**24.7**	2.01	**19.2**	**19.9**	-	-	B	B	AB	B	AB	A	B	A	A	No	No	0.550
	Mine-Exposed	LC_DC3	10	0.001	b	3.84	4.48	6.73	**45.1**	**159**	**552**	**751**	**1,258**	**1,540**	**2,015**	H	H	H	H	G	F	E	D	C	B	A	↑	↑	**29.0**
		LC_SPDC	7	0.001	-	-	-	b	**27.0**	**125**	**476**	**641**	**1,052**	**1,327**	**1,749**	-	-	-	H	G	F	E	D	C	B	A	↑	↑	**29.6**
		LC_DCDS	8	0.001	-	-	b	4.94	**37.5**	**146**	**524**	**699**	**1,156**	**1,400**	**1,895**	-	-	H	H	G	F	E	D	C	B	A	↑	↑	**33.0**
		LC_DC2	5	0.001	b	18.8	-	-	-	-	-	**731**	**1,232**	**1,506**	**1,791**	D	D	-	-	-	-	-	C	B	AB	A	No	No	17.7
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**52.0**	**116**	**159**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**20.1**
		LC_DC1	10	0.001	b	2.37	15.5	24.4	**38.6**	**84.3**	**297**	**435**	**650**	**1,041**	**1,292**	H	H	GH	GH	G	F	E	D	C	B	A	↑	↑	**22.0**
		FR_FR5	9	0.001	b	9.11	10.9	5.23	12.5	19.1	20.9	-	19.7	**37.7**	**31.8**	C	BC	ABC	C	ABC	ABC	ABC	-	ABC	A	AB	No	No	-4.31
		LC_FRUS	1	0.919	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	19.5	19.4	20.3	18.0	**30.9**	**25.2**	**33.0**	**30.4**	**48.3**	**48.1**	C	BC	BC	BC	BC	AB	B	AB	AB	A	A	No	No	-0.188
		LC_GRCK	10	0.001	b	6.41	4.95	11.8	**13.8**	**15.9**	**15.1**	**17.3**	**13.1**	12.8	3.00	C	ABC	ABC	ABC	AB	A	AB	A	AB	ABC	BC	No	No	-8.66

P-value < 0.05 (annual variation).
\> 20% Decrease in concentration.
\> 33% Decrease in concentration.
\> 43% Decrease in concentration.
\> 50% Decrease in concentration.
\> 25% Increase in concentration.
\> 50% Increase in concentration.
\> 75% Increase in concentration.
\> 100% Increase in concentration.
***Bold** Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022

Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b) [c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Total Dissolved Solids	Reference	LC_DCEF	10	0.293	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	8	0.645	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
	Mine-Exposed	LC_DC3	10	0.001	b	0.984	2.37	14.4	**30.4**	**60.7**	**182**	**212**	**341**	**374**	**461**	F	F	F	EF	E	D	C	C	B	B	A	↑	↑	**18.4**
		LC_SPDC	7	0.001	-	-	-	b	7.75	**29.3**	**125**	**145**	**248**	**291**	**352**	-	-	-	F	F	E	D	D	C	B	A	↑	↑	**15.8**
		LC_DCDS	8	0.001	-	-	b	3.11	9.63	**30.1**	**122**	**147**	**241**	**274**	**335**	-	-	E	E	E	D	C	C	B	B	A	↑	↑	**16.5**
		LC_DC2	5	0.001	b	10.7	-	-	-	-	-	**143**	**234**	**261**	**299**	D	D	-	-	-	-	-	C	B	AB	A	No	No	10.5
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**23.1**	**46.8**	**58.9**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**8.28**
		LC_DC1	10	0.001	b	2.17	-1.99	7.50	11.6	**17.1**	**57.6**	**61.7**	**89.8**	**137**	**150**	E	DE	E	DE	DE	D	C	C	B	A	A	No	No	5.64
		FR_FR5	9	0.005	b	9.52	10.3	2.83	8.79	13.9	9.69	-	17.4	**22.0**	14.7	B	AB	AB	B	AB	AB	AB	-	AB	A	AB	No	No	-5.98
		LC_FRUS	1	0.309	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	14.7	14.2	12.9	13.5	**21.0**	**18.8**	**18.5**	**22.7**	**30.2**	**30.4**	C	ABC	ABC	BC	BC	AB	AB	AB	AB	A	A	No	No	0.114
		LC_GRCK	10	0.347	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Antimony (Sb)-Total	Reference	LC_DCEF	10	0.001	b	**11.5**	6.10	6.74	2.35	1.16	-0.167	0.0183	-5.48	-0.797	1.77	BC	A	AB	AB	ABC	ABC	BC	BC	C	BC	ABC	No	No	2.59
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	10	0.001	b	6.09	1.30	5.14	14.8	**53.8**	**146**	**161**	**152**	**284**	**246**	E	E	E	E	E	D	C	C	C	A	B	No	↓	**-10.0**
		LC_SPDC	7	0.001	-	-	-	b	-2.91	**24.9**	**107**	**116**	**107**	**215**	**194**	-	-	-	D	D	C	B	B	B	A	A	No	No	-6.53
		LC_DCDS	8	0.001	-	-	b	**15.4**	**16.5**	**55.7**	**150**	**160**	**153**	**256**	**245**	-	-	E	D	D	C	B	B	B	A	A	No	No	-3.17
		LC_DC2	5	0.001	b	0.226	-	-	-	-	-	**117**	**104**	**200**	**181**	C	C	-	-	-	-	-	B	B	A	A	No	No	-6.16
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	-8.77	**34.7**	**36.6**	-	-	-	-	-	-	-	B	B	A	A	No	No	1.42
		LC_DC1	10	0.001	b	3.59	10.7	4.30	10.5	16.3	**39.9**	**43.2**	**27.8**	**84.1**	**91.2**	D	D	CD	D	D	CD	B	B	BC	A	A	No	No	3.87
		FR_FR5	9	0.637	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRUS	1	0.176	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	-4.63	-7.59	-11.9	-24.0	-24.3	-8.63	-21.9	-10.3	-6.52	-3.55	AB	AB	AB	AB	AB	AB	AB	B	AB	AB	A	No	No	3.18
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
Barium (Ba)-Total	Reference	LC_DCEF	10	0.040	b	4.42	-0.202	4.31	3.10	8.15	6.87	9.62	5.17	8.84	7.53	A	A	A	A	A	A	A	A	A	A	A	No	No	-1.20
		LC_UC	8	0.005	-	-	b	-0.777	-1.26	1.99	-2.20	-0.955	-6.86	1.35	2.56	-	-	AB	AB	AB	A	AB	AB	B	A	A	No	No	1.20
	Mine-Exposed	LC_DC3	10	0.001	b	2.01	0.194	10.00	**22.4**	**48.9**	**93.7**	**87.2**	**90.0**	**122**	**70.9**	F	F	F	EF	E	D	B	BC	B	A	C	No	↓	**-23.1**
		LC_SPDC	7	0.001	-	-	-	b	2.72	**25.7**	**68.1**	**59.2**	**65.9**	**87.8**	**53.1**	-	-	-	D	D	C	B	B	B	A	B	No	↓	**-18.5**
		LC_DCDS	8	0.001	-	-	b	-12.1	-11.7	-3.13	**27.2**	**27.9**	**31.6**	**39.8**	**19.6**	-	-	C	C	C	C	AB	AB	AB	A	B	No	↓	**-14.4**
		LC_DC2	5	0.001	b	8.11	-	-	-	-	-	**47.0**	**90.1**	**62.2**	**52.8**	D	D	-	-	-	-	-	C	A	B	BC	No	No	-5.83
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**11.6**	**19.1**	**19.1**	-	-	-	-	-	-	-	C	B	A	A	No	No	-0.0185
		LC_DC1	10	0.001	b	3.12	-1.26	2.17	3.31	**14.6**	**30.6**	**38.8**	**47.7**	**70.1**	**67.8**	E	DE	E	E	E	D	C	BC	B	A	A	No	No	-1.33
		FR_FR5	9	0.001	b	9.67	9.34	-3.03	-2.02	-0.937	-10.8	-	-8.42	**-15.0**	**-15.6**	ABC	A	AB	ABCD	ABCD	ABC	CD	-	BCD	D	D	No	No	-0.683
		LC_FRUS	1	0.436	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	5.25	3.36	0.941	-5.49	3.40	-10.6	-6.47	-8.41	-3.84	-8.96	ABC	A	A	AB	ABC	A	C	ABC	BC	ABC	BC	No	No	-5.32
		LC_GRCK	10	0.052	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Boron (B)-Total	Reference	LC_DCEF	9	0.001	b	-7.26	-2.29	**-13.3**	**-23.7**	-	**-23.8**	**-21.4**	**-22.5**	**-18.9**	**-20.6**	A	AB	A	BC	D	-	D	CD	CD	CD	CD	No	No	-2.09
		LC_UC	8	0.001	-	-	b	**-14.0**	**-22.1**	**-29.4**	**-30.2**	**-25.8**	**-31.7**	**-24.4**	**-28.2**	-	-	A	B	C	DE	DE	CDE	E	CD	CDE	No	No	-4.98

P-value < 0.05 (annual variation).
\> 20% Decrease in concentration.
\> 33% Decrease in concentration.
\> 43% Decrease in concentration.
\> 50% Decrease in concentration.
\> 25% Increase in concentration.
\> 50% Increase in concentration.
\> 75% Increase in concentration.
\> 100% Increase in concentration.
*Bold Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022

Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b) [c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Boron (B)-Total	Mine-Exposed	LC_DC3	5	0.001	b	-	-2.05	-8.44	-	-	-	-	-8.89	3.79	1.49	AB	-	AB	B	-	-	-	-	B	A	A	No	No	-2.22
		LC_SPDC	3	0.001	-	-	-	b	-	-	-	-	-6.64	5.80	2.94	-	-	-	AB	-	-	-	-	B	A	A	No	No	-2.70
		LC_DCDS	4	0.001	-	-	b	**-9.61**	-	-	-	-	**-14.7**	-4.91	-4.60	-	-	A	BC	-	-	-	-	C	AB	AB	No	No	0.318
		LC_DC2	3	0.047	b	-1.65	-	-	-	-	-	-	-	-9.17	-8.00	A	A	-	-	-	-	-	-	-	A	A	No	No	1.29
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_DC1	4	0.002	b	-0.537	3.08	-10.5	-	-	-	-	-	-	-19.2	AB	AB	A	AB	-	-	-	-	-	-	B	No	No	0
		FR_FR5	8	0.001	b	-5.84	-3.49	-10.3	**-28.6**	-	**-25.2**	-	**-21.1**	**-16.4**	-12.8	A	AB	AB	ABC	D	-	CD	-	BCD	BCD	ABCD	No	No	4.32
		LC_FRUS	1	0.267	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	4	0.044	b	0.0951	3.72	-4.59	-	-	-	-	-	-12.0	-	AB	AB	A	AB	-	-	-	-	-	B	-	No	No	-
		LC_GRCK	10	0.001	b	1.90	4.41	**-12.1**	**-18.5**	**-18.1**	**-18.2**	**-18.7**	**-13.5**	**-12.3**	**-11.7**	A	A	A	B	B	B	B	B	B	B	B	No	No	0.636
Cadmium (Cd)-Total	Reference	LC_DCEF	10	0.097	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	8	0.001	-	-	b	**-56.4**	**-63.0**	**-55.6**	**-50.3**	**-54.5**	**-53.3**	**-54.9**	-31.7	-	-	A	BC	C	BC	BC	BC	BC	BC	AB	No	No	51.5
	Mine-Exposed	LC_DC3	10	0.001	b	-6.96	-2.94	33.6	39.8	**78.3**	**110**	**98.3**	**198**	**440**	**393**	E	E	E	DE	DE	CD	C	C	B	A	A	No	No	-8.66
		LC_SPDC	7	0.001	-	-	-	b	**-32.0**	-15.8	2.98	-2.45	**78.4**	**136**	**220**	-	-	-	D	E	DE	D	D	C	B	A	↑	↑	**35.6**
		LC_DCDS	8	0.001	-	-	b	30.7	2.60	**35.4**	**59.0**	**62.0**	**182**	**266**	**408**	-	-	E	DE	E	D	D	D	C	B	A	↑	↑	**38.7**
		LC_DC2	5	0.001	b	-5.00	-	-	-	-	-	**59.8**	**122**	**182**	**261**	E	E	-	-	-	-	-	D	C	B	A	↑	↑	**28.1**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**25.8**	**60.4**	**101**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**25.4**
		LC_DC1	10	0.001	b	5.18	12.5	14.3	-1.33	5.21	21.9	24.7	45.6	**86.4**	**159**	CD	CD	CD	CD	D	D	CD	CD	BC	B	A	↑	↑	**39.2**
		FR_FR5	9	0.001	b	18.9	8.34	-18.5	-17.2	-18.1	-7.00	-	15.7	-2.20	25.2	AB	A	AB	B	B	B	AB	-	AB	AB	A	No	No	28.0
		LC_FRUS	1	0.022	-	-	b	**-20.4**	-	-	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-	↓	↓	-
		LC_FRB	10	0.001	b	-7.69	-21.6	-35.5	**-44.9**	**-39.0**	-26.5	**-39.5**	-24.3	-18.0	-17.6	A	AB	ABC	ABC	C	BC	ABC	C	ABC	AB	AB	No	No	0.490
		LC_GRCK	8	0.495	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Cobalt (Co)-Total	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	7	0.001	-	-	-	b	7.65	**142**	**351**	**207**	**385**	**341**	41.0	-	-	-	C	C	B	A	AB	A	A	C	No	↓	**-68.1**
		LC_SPDC	7	0.001	-	-	-	b	-23.8	54.1	**150**	67.7	**148**	**144**	-19.9	-	-	-	CD	D	BC	AB	ABC	A	A	D	No	↓	**-67.2**
		LC_DCDS	6	0.001	-	-	-	b	-	64.0	**192**	**80.9**	**163**	**136**	-15.1	-	-	-	CD	-	BC	A	B	A	AB	D	No	↓	**-64.0**
		LC_DC2	2	0.068	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_DC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		FR_FR5	3	0.037	-	-	b	-	-	-	-	-	31.6	-31.3	22.6	-	-	AB	-	-	-	-	-	A	B	A	No	↑	**78.5**
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	2	0.166	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-

P-value < 0.05 (annual variation).
\> 20% Decrease in concentration.
\> 33% Decrease in concentration.
\> 43% Decrease in concentration.
\> 50% Decrease in concentration.
\> 25% Increase in concentration.
\> 50% Increase in concentration.
\> 75% Increase in concentration.
\> 100% Increase in concentration.
*Bold Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022

Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b) [c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Lithium (Li)-Total	Reference	LC_DCEF	10	0.011	b	-2.96	-2.91	5.36	14.9	3.94	-0.801	6.39	-2.33	3.07	1.84	AB	B	B	AB	A	AB	B	AB	B	AB	AB	No	No	-1.19
		LC_UC	8	0.001	-	-	b	3.38	8.44	-0.632	-3.20	1.49	-6.01	3.66	6.58	-	-	ABC	AB	A	ABC	BC	ABC	C	AB	A	No	No	2.82
	Mine-Exposed	LC_DC3	10	0.001	b	-3.61	-7.39	15.7	**30.2**	**31.7**	**92.3**	**131**	**267**	**357**	**523**	GH	GH	H	FG	F	F	E	D	C	B	A	↑	↑	**36.5**
		LC_SPDC	7	0.001	-	-	-	b	10.0	13.2	**65.9**	**94.8**	**193**	**274**	**418**	-	-	-	F	F	F	E	D	C	B	A	↑	↑	**38.5**
		LC_DCDS	8	0.001	-	-	b	-7.68	-8.24	**-22.1**	10.8	**31.8**	**88.8**	**152**	**234**	-	-	EF	F	F	G	E	D	C	B	A	↑	↑	**32.5**
		LC_DC2	5	0.001	b	13.0	-	-	-	-	-	**78.3**	**115**	**185**	**244**	E	E	-	-	-	-	-	D	C	B	A	↑	↑	**20.6**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**11.8**	**42.0**	**64.0**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**15.4**
		LC_DC1	10	0.001	b	0.289	-7.18	7.08	12.6	6.36	**20.8**	**32.0**	**41.9**	**82.0**	**110**	FG	FG	G	F	EF	F	DE	CD	C	B	A	↑	↑	**15.3**
		FR_FR5	9	0.001	b	15.1	16.1	**36.0**	**63.1**	**65.8**	**57.5**	-	**71.6**	**113**	**132**	E	DE	DE	CD	B	B	BC	-	B	A	A	No	No	8.54
		LC_FRUS	1	0.001	-	-	b	**12.7**	-	-	-	-	-	-	-	-	-	B	A	-	-	-	-	-	-	-	↑	↑	-
		LC_FRB	10	0.001	b	16.4	**22.9**	**35.0**	**55.1**	**54.8**	**49.9**	**61.6**	**78.5**	**122**	**144**	F	EF	E	DE	BCD	BCD	CD	BC	B	A	A	No	No	9.96
		LC_GRCK	10	0.001	b	5.09	-2.59	-7.58	-9.74	-1.79	-3.78	-7.15	1.01	2.23	11.2	ABCD	AB	BCD	CD	D	BCD	BCD	CD	ABCD	ABC	A	No	No	8.82
Manganese (Mn)-Total	Reference	LC_DCEF	10	0.016	b	49.6	-46.8	-79.1	-55.6	-52.8	-66.4	-24.2	-44.5	0.994	14.2	AB	A	AB	B	AB	AB	AB	AB	AB	AB	AB	No	No	13.1
		LC_UC	8	0.001	-	-	b	**-73.6**	**-74.3**	-59.6	-61.4	-62.5	**-66.8**	-65.1	-23.3	-	-	A	C	C	ABC	ABC	ABC	BC	ABC	AB	No	No	120
	Mine-Exposed	LC_DC3	10	0.001	b	-27.9	36.1	133	**189**	**882**	**1,178**	**514**	**355**	**1,578**	**189**	FG	G	EFG	DEF	DE	AB	A	BC	CD	A	DE	No	↓	**-82.8**
		LC_SPDC	7	0.001	-	-	-	b	-6.43	**117**	**187**	42.7	**93.7**	**471**	44.0	-	-	-	D	D	BC	B	CD	BC	A	CD	No	↓	**-74.8**
		LC_DCDS	8	0.001	-	-	b	**127**	**161**	**597**	**826**	**361**	**453**	**1,380**	**314**	-	-	F	E	DE	BC	AB	CD	BC	A	CD	No	↓	**-72.0**
		LC_DC2	5	0.001	b	-29.6	-	-	-	-	-	123	54.7	**484**	131	BC	C	-	-	-	-	-	B	BC	A	B	No	↓	**-60.4**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	-5.27	**93.7**	4.89	-	-	-	-	-	-	-	B	B	A	B	No	↓	**-45.8**
		LC_DC1	10	0.001	b	47.8	2.54	14.8	4.79	35.5	59.2	35.1	21.7	**111**	35.4	B	AB	B	B	B	B	AB	B	B	A	B	No	↓	**-35.8**
		FR_FR5	9	0.060	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRUS	1	0.001	-	-	b	**-29.4**	-	-	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-	↓	↓	-
		LC_FRB	10	0.006	b	6.08	-24.5	-44.6	-47.0	-40.9	-34.9	**-49.4**	-39.2	-24.9	-36.4	A	A	AB	AB	AB	AB	AB	B	AB	AB	AB	No	No	-15.2
		LC_GRCK	10	0.140	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Mercury (Hg)-Total	Reference	LC_DCEF	5	0.414	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	6	0.001	-	-	-	-	b	**67.3**	23.8	29.4	9.84	**79.6**	-7.75	-	-	-	-	C	AB	BC	ABC	C	A	C	No	↓	**-48.6**
		LC_SPDC	5	0.081	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_DCDS	5	0.032	-	-	-	-	b	27.9	0.703	-0.256	-2.21	16.0	-	-	-	-	-	A	A	A	A	A	A	-	No	No	-
		LC_DC2	2	0.065	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_DC4	2	0.421	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_DC1	5	0.482	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		FR_FR5	2	0.384	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	5	0.199	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_GRCK	3	0.689	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc

P-value < 0.05 (annual variation).
> 20% Decrease in concentration.
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> 43% Decrease in concentration.
> 50% Decrease in concentration.
> 25% Increase in concentration.
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*Bold Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022

Parameter	Area Type	Area	Annual Variation[a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b)[c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Molybdenum (Mo)-Total	Reference	LC_DCEF	10	0.722	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	8	0.005	-	-	b	5.47	5.97	5.36	8.53	0.950	8.38	7.00	**11.9**	-	-	B	AB	AB	AB	AB	B	AB	AB	A	No	No	4.57
	Mine-Exposed	LC_DC3	10	0.001	b	-1.36	-6.80	-4.64	9.07	**53.0**	**188**	**243**	**262**	**279**	**320**	FG	FG	FG	G	F	E	D	C	BC	B	A	↑	↑	**10.7**
		LC_SPDC	7	0.001	-	-	-	b	10.5	**50.9**	**191**	**230**	**244**	**436**	**588**	-	-	-	F	F	E	D	CD	C	B	A	↑	↑	**28.3**
		LC_DCDS	8	0.001	-	-	b	0.311	12.0	**48.8**	**177**	**215**	**234**	**407**	**538**	-	-	F	F	F	E	D	C	C	B	A	↑	↑	**25.7**
		LC_DC2	5	0.001	b	8.10	-	-	-	-	-	**170**	**159**	**345**	**406**	C	C	-	-	-	-	-	B	B	A	A	No	No	13.7
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	-5.99	**55.8**	**83.4**	-	-	-	-	-	-	-	C	C	B	A	↑	↑	**17.7**
		LC_DC1	10	0.001	b	2.13	-10.8	-7.11	0.379	4.80	**36.3**	**41.4**	**27.0**	**105**	**137**	D	D	D	D	D	D	C	C	C	B	A	↑	↑	**15.5**
		FR_FR5	9	0.001	b	4.51	-2.11	-6.12	4.01	-2.52	-7.84	-	17.6	17.4	**62.8**	B	B	B	B	B	B	B	-	B	B	A	↑	↑	**38.7**
		LC_FRUS	1	0.877	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	0.242	-4.55	-6.34	-3.37	-6.78	-2.94	-2.42	9.88	18.4	**49.5**	BC	BC	BC	C	BC	C	C	C	BC	B	A	↑	↑	**26.3**
		LC_GRCK	10	0.693	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Nickel (Ni)-Total	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	10	0.001	b	-11.2	-16.0	31.8	36.4	**114**	**459**	**673**	**1,293**	**1,158**	**1,720**	FG	G	G	F	F	E	D	C	B	B	A	↑	↑	**44.6**
		LC_SPDC	7	0.001	-	-	-	b	-14.9	25.7	**235**	**365**	**683**	**559**	**1,049**	-	-	-	EF	F	E	D	C	B	B	A	↑	↑	**74.3**
		LC_DCDS	8	0.001	-	-	b	**44.9**	**42.3**	**126**	**510**	**716**	**1,278**	**1,089**	**2,004**	-	-	G	F	F	E	D	C	B	B	A	↑	↑	**77.0**
		LC_DC2	5	0.001	b	-7.96	-	-	-	-	-	**522**	**677**	**780**	**1,348**	D	D	-	-	-	-	-	C	BC	B	A	↑	↑	**64.5**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	20.8	**66.0**	**195**	-	-	-	-	-	-	-	C	C	B	A	↑	↑	**77.7**
		LC_DC1	10	0.001	b	-0.146	26.5	23.6	10.1	22.5	**124**	**173**	**252**	**332**	**653**	E	E	E	E	E	E	D	CD	BC	B	A	↑	↑	**74.4**
		FR_FR5	9	0.013	b	12.8	-26.2	-36.9	28.5	-10.5	-12.1	-	-2.14	3.73	32.3	AB	AB	AB	B	A	AB	AB	-	AB	AB	A	No	No	27.5
		LC_FRUS	1	0.033	-	-	b	-23.8	-	-	-	-	-	-	-	-	-	A	A	-	-	-	-	-	-	-	No	No	-
		LC_FRB	10	0.001	b	-25.1	**-55.9**	**-63.0**	**-45.7**	**-49.9**	**-43.2**	**-51.2**	-32.7	-16.9	-15.2	A	ABCD	DE	E	BCDE	DE	CDE	DE	ABCD	ABC	AB	No	No	2.08
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
Selenium (Se)-Total	Reference	LC_DCEF	10	0.001	b	9.77	8.40	**17.4**	**21.8**	**23.6**	**18.1**	**28.7**	**28.1**	**24.8**	**29.1**	D	CD	CD	BC	AB	AB	BC	A	AB	AB	AB	No	No	3.42
		LC_UC	8	0.001	-	-	b	-1.45	**17.4**	**22.2**	**35.2**	**40.6**	**37.0**	**50.3**	**46.0**	-	-	D	D	C	BC	AB	AB	AB	A	A	No	No	-2.84
	Mine-Exposed	LC_DC3	10	0.001	b	12.8	6.86	24.1	**74.4**	**332**	**1,325**	**1,922**	**3,446**	**4,306**	**5,293**	H	H	H	H	G	F	E	D	C	B	A	↑	↑	**22.4**
		LC_SPDC	7	0.001	-	-	-	b	**32.2**	**253**	**994**	**1,445**	**2,616**	**3,376**	**4,066**	-	-	-	H	G	F	E	D	C	B	A	↑	↑	**19.9**
		LC_DCDS	8	0.001	-	-	b	2.42	**34.0**	**223**	**974**	**1,413**	**2,603**	**3,136**	**3,957**	-	-	H	H	G	F	E	D	C	B	A	↑	↑	**25.4**
		LC_DC2	5	0.001	b	16.1	-	-	-	-	-	**1,315**	**2,508**	**2,993**	**3,529**	D	D	-	-	-	-	-	C	B	AB	A	No	No	17.4
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**75.6**	**149**	**187**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**15.1**
		LC_DC1	10	0.001	b	6.43	6.45	10.2	23.4	**99.1**	**421**	**661**	**1,177**	**1,847**	**2,143**	F	F	F	F	F	E	D	C	B	A	A	No	No	15.2
		FR_FR5	9	0.001	b	17.8	19.1	6.17	8.33	20.9	**24.1**	-	**32.1**	**47.8**	**35.0**	E	BCDE	BCDE	DE	CDE	ABCDE	ABCD	-	ABC	A	AB	No	No	-8.61
		LC_FRUS	1	0.136	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	22.9	22.5	13.5	11.3	**27.4**	**24.5**	**25.9**	**41.0**	**59.1**	**42.3**	D	BCD	BCD	CD	CD	BC	BC	BC	AB	A	AB	No	No	-10.6
		LC_GRCK	10	0.002	b	12.4	8.12	6.99	6.81	**13.5**	**12.8**	**13.9**	**13.7**	**17.5**	12.0	B	AB	AB	AB	AB	A	A	A	A	A	AB	No	No	-4.75

(grey)	P-value < 0.05 (annual variation).
(light green)	> 20% Decrease in concentration.
(green)	> 33% Decrease in concentration.
(green)	> 43% Decrease in concentration.
(dark green)	> 50% Decrease in concentration.
(light blue)	> 25% Increase in concentration.
(blue)	> 50% Increase in concentration.
(blue)	> 75% Increase in concentration.
(dark blue)	> 100% Increase in concentration.
*Bold	Significant increase or decrease from base year[b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.

[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.

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Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b) [c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Uranium (U)-Total	Reference	LC_DCEF	10	0.002	b	2.72	0.397	7.82	16.1	14.9	8.71	14.1	2.53	8.68	12.4	A	A	A	A	A	A	A	A	A	A	A	No	No	3.44
		LC_UC	8	0.009	-	-	b	6.33	**11.5**	5.31	4.08	9.67	0.346	10.1	4.27	-	-	B	AB	A	AB	AB	AB	B	AB	AB	No	No	-5.27
	Mine-Exposed	LC_DC3	10	0.001	b	-4.31	-8.33	13.6	**47.2**	**113**	**367**	**468**	**706**	**833**	**942**	G	G	G	G	F	E	D	C	B	A	A	No	No	11.6
		LC_SPDC	7	0.001	-	-	-	b	14.6	**73.9**	**258**	**329**	**519**	**622**	**739**	-	-	-	G	G	F	E	D	C	B	A	↑	↑	**16.3**
		LC_DCDS	8	0.001	-	-	b	8.57	17.5	**64.5**	**246**	**316**	**489**	**569**	**693**	-	-	G	G	G	F	E	D	C	B	A	↑	↑	**18.6**
		LC_DC2	5	0.001	b	17.7	-	-	-	-	-	**324**	**459**	**597**	**674**	D	D	-	-	-	-	-	C	B	A	A	No	No	11.0
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**12.9**	**59.9**	**89.2**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**18.3**
		LC_DC1	10	0.001	b	4.08	-7.28	-0.728	10.0	18.1	**67.9**	**81.9**	**94.5**	**175**	**225**	EFG	EFG	G	FG	EF	E	D	CD	C	B	A	↑	↑	**18.4**
		FR_FR5	9	0.001	b	7.50	3.47	1.80	12.7	16.9	18.7	-	**32.5**	**45.2**	**44.7**	C	C	C	C	BC	BC	BC	-	AB	A	A	No	No	-0.361
		LC_FRUS	1	0.199	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRB	10	0.001	b	10.2	7.32	8.03	16.3	**22.7**	**21.7**	**28.0**	**33.7**	**52.8**	**48.8**	E	DE	DE	DE	CDE	BCD	BCD	BC	B	A	A	No	No	-2.66
		LC_GRCK	10	0.357	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
Zinc (Zn)-Total	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	9	0.001	b	-7.32	-	17.2	21.8	65.6	**84.6**	**83.1**	**255**	**368**	**375**	D	D	-	D	D	CD	C	C	B	A	A	No	No	1.49
		LC_SPDC	7	0.001	-	-	-	b	-20.5	-17.1	-6.99	2.65	**95.5**	**136**	**201**	-	-	-	C	C	C	C	C	B	B	A	↑	↑	**27.3**
		LC_DCDS	6	0.001	-	-	b	-	-	38.6	16.0	33.5	**152**	**182**	**308**	-	-	C	-	-	C	C	C	B	B	A	↑	↑	**44.7**
		LC_DC2	4	0.001	b	-	-	-	-	-	-	5.83	50.5	**125**	**173**	B	-	-	-	-	-	-	B	B	A	A	No	No	21.4
		LC_DC4	2	0.001	-	-	-	-	-	-	-	-	b	13.2	**124**	-	-	-	-	-	-	-	-	B	B	A	↑	↑	**97.9**
		LC_DC1	2	0.805	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		FR_FR5	2	0.264	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	1	0.162	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
Cadmium (Cd)-Dissolved	Reference	LC_DCEF	10	0.002	b	6.37	-3.77	-11.9	-8.58	-4.96	6.61	-1.64	-6.97	-3.13	-4.42	AB	A	AB	B	AB	AB	A	AB	AB	AB	AB	No	No	-1.33
		LC_UC	8	0.008	-	-	b	-16.2	-25.3	-22.5	-5.66	-14.0	-4.58	-5.26	-0.271	-	-	AB	AB	B	AB	AB	AB	AB	AB	A	No	No	5.27
	Mine-Exposed	LC_DC3	10	0.001	b	-2.30	-7.48	3.83	4.31	42.6	**139**	**122**	**238**	**190**	**492**	EF	EF	F	F	F	E	CD	D	B	BC	A	↑	↑	**104**
		LC_SPDC	7	0.001	-	-	-	b	-14.8	28.2	**67.3**	**82.4**	**306**	**255**	**643**	-	-	-	EF	F	DE	CD	C	B	B	A	↑	↑	**109**
		LC_DCDS	8	0.001	-	-	b	-14.0	-24.1	15.7	**49.4**	**61.6**	**254**	**215**	**561**	-	-	EF	EF	F	DE	CD	C	B	B	A	↑	↑	**110**
		LC_DC2	5	0.001	b	7.20	-	-	-	-	-	**68.1**	**153**	**175**	**354**	D	D	-	-	-	-	-	C	B	B	A	↑	↑	**65.0**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**32.9**	**54.7**	**116**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**39.4**
		LC_DC1	10	0.001	b	1.62	-3.30	-8.95	-7.41	4.61	23.5	21.5	**61.2**	**95.8**	**168**	DE	DE	E	E	E	E	D	D	C	B	A	↑	↑	**37.1**
		FR_FR5	9	0.005	b	-10.4	-6.32	-18.6	-24.3	-22.4	-9.23	-	4.50	0.0160	6.24	AB	AB	AB	AB	B	AB	AB	-	AB	AB	A	No	No	6.23
		LC_FRUS	1	0.004	-	-	b	**-34.0**	-	-	-	-	-	-	-	-	-	A	B	-	-	-	-	-	-	-	↓	↓	-
		LC_FRB	10	0.001	b	14.4	7.69	-26.2	**-33.1**	-26.7	7.49	-22.0	-2.25	5.91	11.8	ABC	A	A	BCD	D	CD	A	CD	AB	A	A	No	No	5.52
		LC_GRCK	5	0.503	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc

P-value < 0.05 (annual variation).
> 20% Decrease in concentration.
> 33% Decrease in concentration.
> 43% Decrease in concentration.
> 50% Decrease in concentration.
> 25% Increase in concentration.
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*Bold Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: **Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022**

Parameter	Area Type	Area	Annual Variation[a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b)[c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Cobalt (Co)-Dissolved	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	4	0.001	-	-	-	-	-	b	**154**	31.2	**150**	**108**	-	-	-	-	-	-	B	A	B	A	A	-	No	No	-
		LC_SPDC	4	0.001	-	-	-	-	-	b	**99.5**	32.4	**157**	**153**	-	-	-	-	-	-	C	AB	BC	A	A	-	No	No	-
		LC_DCDS	4	0.001	-	-	-	-	-	b	**141**	25.8	**174**	**142**	-	-	-	-	-	-	B	A	B	A	A	-	No	No	-
		LC_DC2	1	0.069	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_DC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
DMSeO - Dimethylselenoxide	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	3	0.001	-	-	-	-	-	-	-	b	**99.2**	**137**	**178**	-	-	-	-	-	-	-	C	B	AB	A	No	No	17.4
		LC_SPDC	3	0.005	-	-	-	-	-	-	-	b	27.3	13.4	**48.7**	-	-	-	-	-	-	-	B	AB	AB	A	No	No	31.2
		LC_DCDS	3	0.046	-	-	-	-	-	-	-	b	9.87	1.40	33.6	-	-	-	-	-	-	-	A	A	A	A	No	No	31.8
		LC_DC2	3	0.018	-	-	-	-	-	-	-	b	-16.5	13.4	24.8	-	-	-	-	-	-	-	AB	B	AB	A	No	No	10.0
		LC_DC4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_DC1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
MeSe(IV) - Methylseleninic Acid	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	3	0.023	-	-	-	-	-	-	-	b	9.96	-8.71	-0.135	-	-	-	-	-	-	-	AB	A	B	AB	No	No	9.39
		LC_SPDC	3	0.001	-	-	-	-	-	-	-	b	-3.79	**-32.5**	**-21.1**	-	-	-	-	-	-	-	A	A	B	B	No	No	16.9
		LC_DCDS	3	0.001	-	-	-	-	-	-	-	b	-6.36	**-39.6**	**-20.9**	-	-	-	-	-	-	-	A	AB	C	B	No	↑	**31.0**
		LC_DC2	3	0.001	-	-	-	-	-	-	-	b	**-27.5**	**-28.4**	-17.5	-	-	-	-	-	-	-	A	B	B	AB	No	No	15.2
		LC_DC4	1	0.688	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_DC1	3	0.806	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-

P-value < 0.05 (annual variation).
> 20% Decrease in concentration.
> 33% Decrease in concentration.
> 43% Decrease in concentration.
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Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.3: Temporal Changes in Water Chemistry Constituents at Stations, Dry Creek LAEMP, 2012 to 2022

Parameter	Area Type	Area	Annual Variation [a]		Q1: Is there a positive or negative change in concentrations since the base year (b) of monitoring? Magnitude of Difference (MOD)[b] from Base Year (b) [c]											Q2: Is the 2022 annual mean greater or less than all annual historical means (2012 to 2022) and the previous year (2022)?[c]													
			DF	P-Value	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2022 vs. 2012-2021	2022 vs. 2021 Trend	2022 vs. 2021 MOD
Se(VI) - Selenate	Reference	LC_DCEF	3	0.624	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	No	No	nc
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	3	0.001	-	-	-	-	-	-	-	b	**74.3**	**115**	**172**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**26.6**
		LC_SPDC	3	0.001	-	-	-	-	-	-	-	b	**77.7**	**121**	**174**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**24.2**
		LC_DCDS	3	0.001	-	-	-	-	-	-	-	b	**78.8**	**109**	**174**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**31.5**
		LC_DC2	3	0.001	-	-	-	-	-	-	-	b	**83.3**	**126**	**168**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**18.5**
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	**75.4**	**154**	**197**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**16.7**
		LC_DC1	3	0.001	-	-	-	-	-	-	-	b	**62.0**	**141**	**175**	-	-	-	-	-	-	-	D	C	B	A	↑	↑	**14.4**
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
Se(IV) - Selenite	Reference	LC_DCEF	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_UC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
	Mine-Exposed	LC_DC3	3	0.001	-	-	-	-	-	-	-	b	**21.3**	**26.0**	**48.3**	-	-	-	-	-	-	-	C	B	B	A	↑	↑	**17.7**
		LC_SPDC	3	0.001	-	-	-	-	-	-	-	b	7.58	6.34	**21.2**	-	-	-	-	-	-	-	B	B	B	A	↑	↑	**14.0**
		LC_DCDS	3	0.001	-	-	-	-	-	-	-	b	9.71	4.33	**23.9**	-	-	-	-	-	-	-	B	AB	B	A	No	↑	**18.7**
		LC_DC2	3	0.001	-	-	-	-	-	-	-	b	-16.1	9.39	**23.9**	-	-	-	-	-	-	-	BC	C	AB	A	No	No	13.3
		LC_DC4	3	0.001	-	-	-	-	-	-	-	b	-13.5	**52.9**	**71.1**	-	-	-	-	-	-	-	B	B	A	A	No	No	11.9
		LC_DC1	3	0.001	-	-	-	-	-	-	-	b	-6.43	**42.7**	**40.8**	-	-	-	-	-	-	-	B	B	A	A	No	No	-1.35
		FR_FR5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRUS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_FRB	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-
		LC_GRCK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	-

P-value < 0.05 (annual variation).
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\> 100% Increase in concentration.
*Bold Significant increase or decrease from base year [b].

Notes: "ns" = not significant; "-" insufficient data for comparison, where insufficient data is less than 6 months of recorded data or > 75% LRL data in a given year. "nc" = post-hoc test not conducted because of non-significant year term.
[a] The presence of annual variation was determined by a significant Year term (α = 0.05) using an ANOVA with factors Year and Month.
[b] Magnitude of Difference (MOD) was calculated as the concentrations in each year (or 2022) minus the concentration in the first year (or 2021) divided by the concentration in the first year (or 2021) × 100.
[c] Significance between each year determined using all pairwise comparisons with Tukey correction.

Table C.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2022

Area	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Total Phosphorus (mg/L)	Orthophosphate (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Aluminum (mg/L)
	n	14	14	14	24	14	14	14	14	14	14	14	14	14	14
	Annual Minimum	99	7.8	7.5	10	111	0.087	<0.001	<0.005	0.0088	0.0038	5	0.19	0.068	<0.003
	Annual Maximum	179	8.4	8.1	85	160	0.32	0.0023	0.011	0.021	0.016	7.6	0.34	0.11	0.06
	Annual Mean	144	8.1	7.8	40	145	0.16	0.0011	0.0054	0.013	0.011	6.4	0.27	0.099	0.01
	Annual Median	148	8.2	7.9	11	149	0.13	0.001	0.005	0.013	0.012	6.6	0.29	0.11	0.0038
LC_DCEF	% < LRL	0%	0%	0%	0%	0%	0%	93%	86%	0%	0%	0%	0%	0%	29%
	% > BCWQG[a]	-	-	0%	0%	0%	0%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	57	57	65	105	63	57	57	57	57	57	57	57	57	57
	Annual Minimum	346	6.8	7	10	110	12	0.002	<0.005	0.02	0.012	106	5.1	0.073	0.0038
	Annual Maximum	964	8.3	8.6	87	189	57	0.016	0.013	0.048	0.029	340	25	0.16	0.1
	Annual Mean	723	8.2	8	41	149	40	0.005	0.0054	0.028	0.024	241	17	0.089	0.018
	Annual Median	781	8.2	8.1	12	150	46	0.0035	0.005	0.026	0.024	258	19	0.088	0.012
LC_DC3	% < LRL	0%	0%	0%	0%	0%	0%	46%	88%	0%	0%	0%	0%	54%	0%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	68%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	100%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	79%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	53	53	64	102	61	53	53	53	53	53	53	53	53	53
	Annual Minimum	322	7.2	7.3	8.3	109	11	0.0022	<0.005	0.015	0.0041	97	4.6	0.072	0.0047
	Annual Maximum	957	8.4	8.5	88	173	57	0.069	0.07	0.04	0.029	335	25	0.14	0.2
	Annual Mean	694	8.2	8.1	40	146	38	0.0095	0.0093	0.025	0.021	230	16	0.089	0.017
	Annual Median	766	8.2	8.1	12	147	44	0.0071	0.0062	0.025	0.023	246	18	0.092	0.0086
LC_SPDC	% < LRL	0%	0%	0%	0%	0%	0.0%	13%	43%	0%	0%	0%	0%	53%	0%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	64%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	100%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	75%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	56	56	65	104	62	56	56	56	56	56	56	56	56	56
	Annual Minimum	312	6.9	7.5	9	107	9.6	0.0017	<0.005	0.017	0.0047	85	4	0.054	0.0054
	Annual Maximum	939	8.4	8.5	94	176	57	0.064	0.035	0.036	0.029	334	25	0.1	0.069
	Annual Mean	667	8.2	8.1	41	147	37	0.0089	0.0087	0.024	0.021	223	16	0.086	0.012
	Annual Median	718	8.2	8.1	12	148	43	0.007	0.0064	0.024	0.022	236	17	0.085	0.0082
LC_DCDS	% < LRL	0%	0%	0%	0%	0%	0.0%	11%	41%	0%	0%	0%	0%	54%	0%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	64%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC[c]	0%	-	-	-	-	100%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	77%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	52	52	61	95	59	52	52	52	52	52	52	52	52	52
	Annual Minimum	121	7.2	7	9.9	101	0.46	0.001	<0.005	0.014	0.0066	7	0.26	0.062	0.0043
	Annual Maximum	856	8.4	8.4	88	177	52	0.069	0.024	0.11	0.026	306	34	0.1	0.26
	Annual Mean	574	8.2	8.1	41	148	30	0.0075	0.0065	0.025	0.019	181	13	0.084	0.022
	Annual Median	656	8.2	8.1	12	148	37	0.0064	0.005	0.023	0.02	208	16	0.082	0.009
LC_DC2	% < LRL	0%	0%	0%	0%	0%	0%	10%	69%	0%	0%	0%	0%	44%	0%
	% > BCWQG[a]	-	-	0%	0%	0%	96%	0%	0%	-	-	0%	0%	-	2%
	% > BCWQG[b]	-	-	-	0%	-	54%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	88%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	62%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "UEC" = Updated Effects Concentration. "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. UEC's are shown for Nitrate and Sulphate, Interim Screen Vaues are shown for Total Nickel, and EVWQP benchmarks are shown for all other relevant parameters. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

[c] LC_DCDS, LC_UC, and LC_GRCK Site Performance Objective for Total Cadmium and Total Selenium

Table C.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2022

Area	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Total Phosphorus (mg/L)	Orthophosphate (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Aluminum (mg/L)
	n	52	52	58	92	58	52	52	52	52	52	52	52	52	52
	Annual Minimum	214	7.2	7.6	9.8	107	4	0.0011	<0.005	0.0083	0.0036	35	1.7	0.051	<0.003
	Annual Maximum	606	8.4	8.3	96	204	27	0.018	0.015	0.055	0.019	158	12	0.11	0.14
	Annual Mean	430	8.2	8	41	166	18	0.0038	0.0054	0.016	0.011	110	7.7	0.089	0.018
	Annual Median	456	8.2	8	12	172	21	0.0032	0.005	0.015	0.011	117	8.8	0.092	0.0076
LC_DC4	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	88%	0%	0%	0%	0%	2%	8%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	85%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	23%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	52	52	59	95	58	52	52	52	52	52	52	52	52	52
	Annual Minimum	208	7.2	7.6	9.6	112	3.7	0.0015	<0.005	0.0038	0.0031	33	1.6	0.073	<0.003
	Annual Maximum	544	8.5	8.8	91	206	25	0.0077	0.032	0.048	0.016	148	10	0.11	0.13
	Annual Mean	410	8.3	8.2	42	169	17	0.0036	0.0069	0.015	0.0095	105	7.2	0.096	0.021
	Annual Median	442	8.3	8.2	12	170	20	0.0032	0.005	0.012	0.0094	110	8.3	0.098	0.0087
LC_DC1	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	63%	0%	0%	0%	0%	0%	2%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	79%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	21%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	11	11	12	20	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	332	7.8	6.8	7.6	155	7.8	0.0016	<0.005	<0.002	<0.001	112	1.3	0.12	<0.003
	Annual Maximum	814	8.3	8.4	102	250	22	0.02	0.013	0.073	0.0012	338	6.6	0.22	0.21
	Annual Mean	640	8.2	7.9	40	219	17	0.0061	0.0065	0.012	0.001	259	3.2	0.15	0.041
	Annual Median	691	8.2	8	12	229	19	0.0058	0.005	0.0049	0.001	292	2.9	0.14	0.0079
FR_FR5	% < LRL	0%	0%	0%	0%	0%	0.0%	18%	64%	36%	82%	0%	0%	0%	9%
	% > BCWQG[a]	-	-	0%	5%	0%	100%	0%	0%	-	-	0%	0%	-	9%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	4	4	4	5	4	4	4	4	4	4	4	4	4	4
	Annual Minimum	323	8.2	7.7	10	155	6.2	0.0025	<0.005	<0.002	<0.001	77	1.3	0.12	0.006
	Annual Maximum	576	8.4	8.4	84	218	14	0.0041	<0.005	0.022	0.0021	207	4.2	0.18	0.14
	Annual Mean	501	8.3	8.1	27	192	11	0.0035	<0.005	0.0084	0.0013	170	2.8	0.15	0.049
	Annual Median	552	8.3	8.2	13	197	12	0.0038	<0.005	0.005	0.001	199	2.8	0.15	0.027
LC_FRUS	% < LRL	0%	0%	0%	0%	0%	0.0%	0%	100%	25%	75%	0%	0%	0%	0%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	n	26	26	25	46	26	26	26	26	26	26	26	26	26	26
	Annual Minimum	298	8.2	7.7	9.5	146	5.9	0.0019	<0.005	<0.002	<0.001	79	1	0.1	0.0037
	Annual Maximum	744	8.5	8.4	92	255	20	0.014	0.014	0.027	0.0019	298	5.4	0.19	0.13
	Annual Mean	538	8.3	8.1	46	195	13	0.0057	0.0054	0.0084	0.0011	198	2.8	0.15	0.032
	Annual Median	579	8.3	8.2	13	200	14	0.0052	0.005	0.0052	0.001	210	2.6	0.14	0.022
LC_FRB	% < LRL	0%	0%	0%	0%	0%	0.0%	4%	85%	8%	69%	0%	0%	0%	0%
	% > BCWQG[a]	-	-	0%	0%	0%	100%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-

> 5% of samples exceed the guideline or benchmark.
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Notes: "UEC" = Updated Effects Concentration. "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. UEC's are shown for Nitrate and Sulphate, Interim Screen Vaues are shown for Total Nickel, and EVWQP benchmarks are shown for all other relevant parameters. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

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[c] LC_DCDS, LC_UC, and LC_GRCK Site Performance Objective for Total Cadmium and Total Selenium

Table C.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2022

Area	Summary Statistic	Total Dissolved Solids (mg/L)	Lab pH	Field pH	Dissolved Oxygen (mg/L)	Alkalinity (mg/L)	Nitrate-N (mg/L)	Nitrite-N (mg/L)	Ammonia (mg/L)	Total Phosphorus (mg/L)	Orthophosphate (mg/L)	Sulphate (mg/L)	Total Chloride (mg/L)	Total Fluoride (mg/L)	Total Aluminum (mg/L)
LC_GRCK	n	14	14	14	24	14	14	14	14	14	14	14	14	14	14
	Annual Minimum	181	8.2	8	10	155	0.03	<0.001	<0.005	0.0023	<0.001	14	<0.1	0.098	0.0035
	Annual Maximum	264	8.4	8.6	103	193	0.64	0.0014	0.0083	0.024	0.0035	54	0.55	0.15	0.23
	Annual Mean	227	8.3	8.3	43	172	0.098	0.001	0.0052	0.0071	0.0019	45	0.19	0.13	0.04
	Annual Median	230	8.4	8.3	13	172	0.049	0.001	0.005	0.0052	0.0018	49	0.17	0.13	0.011
	% < LRL	0%	0%	0%	0%	0%	0.0%	93%	93%	0%	36%	0%	7%	0%	7%
	% > BCWQG[a]	-	-	0%	0%	0%	0%	0%	0%	-	-	0%	0%	-	14%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC[c]	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
LC_UC	n	12	12	12	21	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	237	8.1	7.8	11	255	0.025	<0.001	<0.005	<0.002	<0.001	14	0.12	0.094	<0.003
	Annual Maximum	341	8.4	8.2	87	281	0.087	<0.001	0.011	0.027	0.0021	26	0.33	0.16	0.096
	Annual Mean	282	8.3	8	42	267	0.053	<0.001	0.0055	0.0063	0.0011	17	0.16	0.14	0.014
	Annual Median	282	8.3	8	12	266	0.058	<0.001	0.005	0.0022	0.001	17	0.14	0.14	0.0048
	% < LRL	0%	0%	0%	0%	0%	0.0%	100%	92%	42%	92%	0%	0%	0%	33%
	% > BCWQG[a]	-	-	0%	0%	0%	0%	0%	0%	-	-	0%	0%	-	0%
	% > BCWQG[b]	-	-	-	0%	-	0%	0%	0%	-	-	-	0%	0%	-
	% > Level 1 Benchmark/UEC[c]	0%	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	0%	-	-	-	-	0%	-	-	-

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Table C.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2022

Area	Summary Statistic	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Cadmium (µg/L)	Total Chromium (mg/L)	Total Cobalt (µg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (µg/L)
	n	14	14	14	14	14	14	14	14	14	14	14	14	13	14	14
	Annual Minimum	0.00012	0.00012	0.2	<0.00002	0.01	0.028	<0.0001	<0.0001	<0.01	<0.00005	0.01	<0.0001	<0.0000005	0.00076	<0.5
	Annual Maximum	0.00017	0.00028	0.28	<0.00002	0.011	0.068	0.00086	<0.0001	0.05	0.00008	0.022	0.0031	<0.0000005	0.0027	0.73
	Annual Mean	0.00014	0.00019	0.25	<0.00002	0.01	0.041	0.00018	<0.0001	0.018	0.000053	0.018	0.00072	<0.0000005	0.0012	0.52
	Annual Median	0.00014	0.00018	0.25	<0.00002	0.01	0.035	0.00011	<0.0001	0.01	0.00005	0.019	0.00015	<0.0000005	0.0011	0.5
LC_DCEF	% < LRL	0%	0%	0%	100%	21%	0%	43%	100%	57%	86%	0%	36%	100%	0%	86%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	85%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	57	57	57	57	57	57	57	57	57	57	57	57	56	57	57
	Annual Minimum	0.00056	0.0003	0.1	<0.00002	<0.01	0.19	<0.0001	0.0001	<0.01	<0.00005	0.014	0.00041	0.00000057	0.0037	8.8
	Annual Maximum	0.00093	0.00046	0.26	<0.00002	0.013	0.4	0.00036	0.0004	0.18	0.00023	0.054	0.0093	0.0000022	0.0054	22
	Annual Mean	0.00068	0.00035	0.18	<0.00002	0.011	0.31	0.00012	0.00012	0.022	0.000054	0.037	0.002	0.00000091	0.0046	15
	Annual Median	0.00066	0.00035	0.2	<0.00002	0.01	0.31	0.0001	0.00011	0.014	0.00005	0.041	0.0016	0.00000074	0.0047	16
LC_DC3	% < LRL	0%	0%	0%	100%	35%	0%	46%	32%	28%	95%	0%	0%	75%	0%	0%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	79%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	53	53	53	53	53	53	53	53	53	53	53	53	53	53	53
	Annual Minimum	0.00056	0.00027	0.099	<0.00002	<0.01	0.18	<0.0001	<0.0001	<0.01	<0.00005	0.014	0.00089	<0.0000005	0.0038	8
	Annual Maximum	0.00095	0.00047	0.27	<0.00002	0.012	0.4	0.00047	0.00034	0.21	0.00022	0.054	0.0072	0.0000017	0.01	21
	Annual Mean	0.00067	0.00035	0.19	<0.00002	0.011	0.28	0.00013	0.00011	0.018	0.000054	0.035	0.0026	0.00000076	0.0075	14
	Annual Median	0.00066	0.00034	0.2	<0.00002	0.01	0.29	0.00011	0.0001	0.01	0.00005	0.039	0.0023	0.00000065	0.0076	14
LC_SPDC	% < LRL	0%	0%	0%	100%	42%	0%	43%	60%	57%	92%	0%	0%	75%	0%	0%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	77%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	56	56	56	56	56	56	56	56	56	56	56	56	56	56	56
	Annual Minimum	0.00052	0.00024	0.11	<0.00002	<0.01	0.15	<0.0001	<0.0001	<0.01	<0.00005	0.012	0.0011	<0.0000005	0.0036	7.2
	Annual Maximum	0.00078	0.00043	0.27	0.000046	0.015	0.35	0.00057	0.00026	0.1	0.00013	0.051	0.0061	0.0000016	0.0091	19
	Annual Mean	0.00063	0.00033	0.2	0.00002	0.011	0.27	0.00013	0.00011	0.014	0.000051	0.035	0.0022	0.00000069	0.0071	14
	Annual Median	0.00061	0.00033	0.21	0.00002	0.01	0.28	0.0001	0.0001	0.01	0.00005	0.039	0.0019	0.00000064	0.0071	13
LC_DCDS	% < LRL	0%	0%	0%	98%	34%	0%	52%	70%	68%	98%	0%	0%	82%	0%	0%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	79%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC[c]	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	52	52	52	52	52	52	52	52	52	52	52	52	52	52	52
	Annual Minimum	0.00018	0.00023	0.14	<0.00002	<0.01	0.051	0.0001	<0.0001	<0.01	<0.00005	0.0084	0.00066	0.0000005	0.0011	1.6
	Annual Maximum	0.00063	0.0005	0.36	0.00004	0.013	0.3	0.0034	0.00024	0.27	0.0004	0.044	0.013	0.000001	0.0084	14
	Annual Mean	0.00048	0.00029	0.25	0.00002	0.011	0.2	0.00019	0.0001	0.031	0.000062	0.031	0.002	0.00000061	0.0054	8.8
	Annual Median	0.00048	0.00029	0.26	0.00002	0.01	0.23	0.0001	0.0001	0.01	0.00005	0.036	0.0013	0.0000006	0.0057	9.2
LC_DC2	% < LRL	0%	0%	0%	98%	60%	0%	52%	92%	52%	83%	0%	0%	77%	0%	0%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	2%	0%	-	0%	-	0%	75%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
> 95% of samples exceed the guideline or benchmark.

Notes: "UEC" = Updated Effects Concentration. "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. UEC's are shown for Nitrate and Sulphate, Interim Screen Vaues are shown for Total Nickel, and EVWQP benchmarks are shown for all other relevant parameters. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

[c] LC_DCDS, LC_UC, and LC_GRCK Site Performance Objective for Total Cadmium and Total Selenium

Table C.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2022

Area	Summary Statistic	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Cadmium (µg/L)	Total Chromium (mg/L)	Total Cobalt (µg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (µg/L)
	n	52	52	52	52	52	52	52	52	52	52	52	52	51	52	52
	Annual Minimum	0.00017	0.00014	0.17	<0.00002	<0.01	0.087	<0.0001	<0.0001	<0.01	<0.00005	0.01	0.0007	<0.0000005	0.0016	1.2
	Annual Maximum	0.00052	0.00038	0.38	<0.00002	0.012	0.19	0.00028	0.00017	0.14	0.00021	0.026	0.0073	0.0000013	0.0081	7.6
	Annual Mean	0.00029	0.00021	0.28	<0.00002	0.01	0.12	0.00012	0.0001	0.025	0.000056	0.019	0.0018	0.00000059	0.0029	3.4
	Annual Median	0.0003	0.0002	0.31	<0.00002	0.01	0.11	0.0001	0.0001	0.011	0.00005	0.02	0.0013	0.000005	0.0028	3.6
LC_DC4	% < LRL	0%	0%	0%	100%	79%	2%	56%	94%	48%	88%	0%	0%	94%	0%	0%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	78%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	52	52	52	52	52	51	52	52	52	52	52	52	52	52	52
	Annual Minimum	0.00015	0.00011	0.17	<0.00002	<0.01	0.07	<0.0001	<0.0001	<0.01	<0.00005	0.01	0.00075	<0.0000005	0.0018	1.1
	Annual Maximum	0.00051	0.00035	0.37	<0.00002	0.014	0.17	0.00063	0.00018	0.16	0.00019	0.025	0.0092	0.0000014	0.0039	6.4
	Annual Mean	0.00029	0.00021	0.28	<0.00002	0.01	0.098	0.00013	0.0001	0.03	0.000057	0.019	0.0025	0.00000058	0.0027	2.7
	Annual Median	0.0003	0.0002	0.3	<0.00002	0.01	0.098	0.0001	0.0001	0.018	0.00005	0.02	0.002	0.000005	0.0027	2.9
LC_DC1	% < LRL	0%	0%	0%	100%	73%	0%	52%	92%	13%	83%	0%	0%	96%	0%	0%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	77%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
	Annual Minimum	<0.0001	<0.0001	0.056	<0.00002	<0.01	0.022	0.00012	<0.0001	<0.01	<0.00005	0.018	0.0015	<0.0000005	0.00072	<0.5
	Annual Maximum	0.00024	0.00033	0.12	0.000033	0.012	0.15	0.00041	0.00042	0.43	0.00045	0.041	0.041	<0.0000005	0.0041	3.5
	Annual Mean	0.00013	0.00015	0.096	0.000021	0.011	0.051	0.00022	0.00014	0.077	0.000097	0.034	0.0072	<0.0000005	0.0014	1.7
	Annual Median	0.00012	0.00014	0.1	0.00002	0.011	0.038	0.00017	0.0001	0.015	0.00005	0.037	0.0022	<0.0000005	0.0012	1.8
FR_FR5	% < LRL	36%	36%	0%	91%	36%	0%	0%	73%	27%	73%	0%	0%	100%	0%	9%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	64%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	Annual Minimum	<0.0001	<0.0001	0.055	<0.00002	<0.01	0.022	0.00013	<0.0001	0.01	<0.00005	0.017	0.0018	<0.000005	0.00079	<0.5
	Annual Maximum	0.00017	0.00021	0.11	<0.00002	<0.01	0.056	0.0004	0.00012	0.18	0.00035	0.031	0.013	<0.000005	0.0014	2.7
	Annual Mean	0.00013	0.00016	0.086	<0.00002	<0.01	0.039	0.00025	0.00011	0.07	0.00015	0.025	0.0069	<0.000005	0.0011	1.5
	Annual Median	0.00012	0.00016	0.092	<0.00002	<0.01	0.039	0.00024	0.0001	0.042	0.0001	0.025	0.0062	<0.000005	0.0012	1.4
LC_FRUS	% < LRL	50%	25%	0%	100%	100%	0%	0%	50%	0%	50%	0%	0%	100%	0%	25%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	100%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	n	26	26	26	26	26	26	26	26	26	26	26	26	26	26	26
	Annual Minimum	<0.0001	<0.0001	0.054	<0.00002	<0.01	0.017	0.00011	<0.0001	0.01	<0.00005	0.015	0.00086	<0.0000005	0.00081	<0.5
	Annual Maximum	0.00022	0.00023	0.14	<0.00002	0.012	0.083	0.00066	0.00015	0.16	0.00015	0.042	0.013	<0.0000005	0.007	2.6
	Annual Mean	0.00014	0.00014	0.097	<0.00002	0.01	0.039	0.0002	0.00011	0.055	0.000066	0.028	0.0042	<0.0000005	0.0015	1.4
	Annual Median	0.00013	0.00012	0.1	<0.00002	0.01	0.035	0.00016	0.0001	0.042	0.00005	0.029	0.003	<0.0000005	0.0012	1.5
LC_FRB	% < LRL	23%	27%	0%	100%	81%	0%	0%	85%	19%	65%	0%	0%	100%	0%	15%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	81%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.

> 50% of samples exceed the guideline or benchmark.

> 95% of samples exceed the guideline or benchmark.

Notes: "UEC" = Updated Effects Concentration. "LRL" = laboratory reporting limit. "BCWQG" = British Columbia Working or Accepted Water Quality Guideline. UEC's are shown for Nitrate and Sulphate, Interim Screen Vaues are shown for Total Nickel, and EVWQP benchmarks are shown for all other relevant parameters. For guidelines dependent on other analytes (e.g., hardness or chloride), guidelines were screened using concurrent concentrations. When concurrent hardness or chloride concentrations were not measured, the most conservative concentration observed for that station was used to estimate the guidelines or benchmark. All summary statistics are reported to 3 significant figures.

[a] Long-term average BCQWG for the Protection of Aquatic Life.

[b] Short-term maximum BCQWG for the Protection of Aquatic Life.

[c] LC_DCDS, LC_UC, and LC_GRCK Site Performance Objective for Total Cadmium and Total Selenium

Table C.4: Summary of Water Chemistry Data for Key Parameters for the Dry Creek LAEMP Monitoring Stations, 2022

Area	Summary Statistic	Total Antimony (mg/L)	Total Arsenic (mg/L)	Total Barium (mg/L)	Total Beryllium (mg/L)	Total Boron (mg/L)	Total Cadmium (µg/L)	Total Chromium (mg/L)	Total Cobalt (µg/L)	Total Iron (mg/L)	Total Lead (mg/L)	Total Lithium (mg/L)	Total Manganese (mg/L)	Total Mercury (mg/L)	Total Molybdenum (mg/L)	Total Nickel (µg/L)
LC_GRCK	n	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14
	Annual Minimum	<0.0001	<0.0001	0.056	<0.00002	0.012	<0.005	0.00013	<0.0001	<0.01	<0.00005	0.0052	0.0013	<0.0000005	0.001	<0.5
	Annual Maximum	<0.0001	0.00025	0.068	0.000022	0.017	0.034	0.0005	0.00028	0.45	0.00036	0.0076	0.049	<0.0000005	0.0036	1
	Annual Mean	<0.0001	0.00014	0.062	0.00002	0.014	0.0096	0.00026	0.00012	0.075	0.000085	0.0066	0.0073	<0.0000005	0.0016	0.54
	Annual Median	<0.0001	0.00012	0.063	0.00002	0.013	0.0063	0.00022	0.0001	0.018	0.00005	0.0066	0.002	<0.0000005	0.0014	0.5
	% < LRL	100%	29%	0%	93%	0%	14%	0%	86%	7%	79%	0%	0%	100%	0%	86%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	0%	0%	-	0%	-	0%	79%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC[c]	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LC_UC	n	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Annual Minimum	<0.0001	<0.0001	0.099	<0.00002	0.011	0.007	<0.0001	<0.0001	<0.01	<0.00005	0.0049	0.00055	<0.0000005	0.00058	<0.5
	Annual Maximum	<0.0001	0.00016	0.12	<0.00002	0.014	0.063	0.0012	<0.0001	0.23	0.00011	0.0071	0.036	0.0000028	0.0012	<0.5
	Annual Mean	<0.0001	0.00011	0.11	<0.00002	0.012	0.018	0.00022	<0.0001	0.036	0.000055	0.0059	0.0059	0.0000013	0.00076	<0.5
	Annual Median	<0.0001	0.0001	0.11	<0.00002	0.012	0.011	0.0001	<0.0001	0.012	0.00005	0.0059	0.0015	0.000005	0.00072	<0.5
	% < LRL	100%	50%	0%	100%	0%	0%	42%	100%	50%	92%	0%	0%	92%	0%	100%
	% > BCWQG[a]	0%	-	0%	0%	0%	-	8%	0%	-	0%	-	0%	83%	0%	-
	% > BCWQG[b]	-	0%	-	-	-	-	-	0%	0%	0%	-	0%	-	0%	-
	% > Level 1 Benchmark/UEC[c]	-	-	-	-	-	0%	-	-	-	-	-	-	-	-	-
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

> 5% of samples exceed the guideline or benchmark.
> 50% of samples exceed the guideline or benchmark.
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Area	Summary Statistic	Total Selenium (µg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Cadmium (µg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Nickel (µg/L)
LC_DCEF	n	14	14	14	14	14	14	14	14	12
	Annual Minimum	1.3	<0.00001	<0.00001	0.0002	<0.003	0.021	<0.0002	<0.01	<0.5
	Annual Maximum	1.8	<0.00001	<0.00001	0.00045	0.0041	0.044	0.0004	<0.01	0.58
	Annual Mean	1.5	<0.00001	<0.00001	0.00036	0.0031	0.032	0.00025	<0.01	0.51
	Annual Median	1.5	<0.00001	<0.00001	0.00036	0.003	0.031	0.00022	<0.01	0.5
	% < LRL	0%	100%	100%	0%	93%	0%	36%	100%	92%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	0%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
LC_DC3	n	59	57	57	57	57	58	58	58	12
	Annual Minimum	34	<0.00001	0.000013	0.0014	0.0076	0.16	0.0002	0.01	8.5
	Annual Maximum	114	<0.00001	0.000044	0.004	0.017	0.46	0.0073	0.012	19
	Annual Mean	79	<0.00001	0.00002	0.0028	0.012	0.29	0.00041	0.01	14
	Annual Median	84	<0.00001	0.000019	0.0031	0.011	0.29	0.00026	0.01	15
	% < LRL	0%	100%	0%	0%	0%	0%	10%	95%	0%
	% > BCWQG[a]	100%	0%	0%	0%	0%	2%	2%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	2%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	100%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	67%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
LC_SPDC	n	55	53	53	53	53	53	53	53	12
	Annual Minimum	31	<0.00001	0.000014	0.0013	0.0072	0.15	<0.0002	<0.01	8.5
	Annual Maximum	114	0.000015	0.000028	0.0038	0.015	0.38	0.0017	0.014	18
	Annual Mean	76	0.00001	0.000019	0.0027	0.011	0.26	0.00031	0.01	14
	Annual Median	82	0.00001	0.000018	0.003	0.01	0.26	0.00028	0.01	13
	% < LRL	0%	98%	0%	0%	0%	0%	9%	96%	0%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	4%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	100%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	67%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
LC_DCDS	n	57	56	56	56	56	56	56	56	12
	Annual Minimum	28	<0.00001	0.000012	0.0011	0.0062	0.14	<0.0002	<0.01	7.4
	Annual Maximum	112	<0.00001	0.00004	0.0038	0.018	0.37	0.0019	0.012	17
	Annual Mean	72	<0.00001	0.000018	0.0026	0.01	0.26	0.00031	0.01	13
	Annual Median	78	<0.00001	0.000018	0.0029	0.011	0.26	0.00026	0.01	12
	% < LRL	0%	100%	0%	0%	0%	0%	20%	98%	0%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	2%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC[c]	100%	-	-	-	-	0%	-	-	92%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	58%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
LC_DC2	n	53	52	52	52	52	52	52	52	12
	Annual Minimum	6.2	<0.00001	<0.00001	0.00031	<0.003	0.043	0.0002	<0.01	3.7
	Annual Maximum	97	<0.00001	0.000022	0.0033	0.013	0.31	0.003	0.01	13
	Annual Mean	60	<0.00001	0.000013	0.0021	0.0069	0.19	0.00035	0.01	8.4
	Annual Median	68	<0.00001	0.000012	0.0025	0.007	0.2	0.00023	0.01	8.6
	% < LRL	0%	100%	23%	0%	4%	0%	27%	98%	0%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	4%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	67%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	25%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%

> 5% of samples exceed the guideline or benchmark.

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Area	Summary Statistic	Total Selenium (µg/L)	Total Silver (mg/L)	Total Thallium (mg/L)	Total Uranium (mg/L)	Total Zinc (mg/L)	Dissolved Cadmium (µg/L)	Dissolved Copper (mg/L)	Dissolved Iron (mg/L)	Dissolved Nickel (µg/L)
	n	53	52	52	52	52	52	52	52	12
	Annual Minimum	12	<0.00001	<0.00001	0.00058	<0.003	0.068	<0.0002	<0.01	1.6
	Annual Maximum	52	<0.00001	0.000015	0.0015	0.84	0.15	0.0015	<0.01	5
	Annual Mean	36	<0.00001	0.00001	0.0011	0.02	0.1	0.00029	<0.01	3.1
	Annual Median	38	<0.00001	0.00001	0.0011	0.0032	0.099	0.0002	<0.01	2.9
LC_DC4	% < LRL	0%	100%	94%	0%	42%	0%	52%	100%	0%
	% > BCWQG[a]	100%	0%	0%	0%	2%	0%	4%	-	-
	% > BCWQG[b]	-	0%	-	-	2%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	n	55	52	52	52	52	52	52	52	12
	Annual Minimum	11	<0.00001	<0.00001	0.00057	<0.003	0.06	<0.0002	<0.01	1.3
	Annual Maximum	50	<0.00001	0.000025	0.0014	0.14	0.12	0.0007	0.017	4
	Annual Mean	34	<0.00001	0.00001	0.0011	0.0074	0.082	0.00025	0.01	2.4
	Annual Median	36	<0.00001	0.00001	0.0011	0.003	0.079	0.0002	0.01	2.3
LC_DC1	% < LRL	0%	100%	92%	0%	71%	0%	58%	96%	0%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	0%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	n	11	11	11	11	11	11	11	11	11
	Annual Minimum	31	<0.00001	<0.00001	0.0016	<0.003	0.02	<0.0002	<0.01	<0.5
	Annual Maximum	86	<0.00001	0.000013	0.0034	0.0075	0.058	0.00022	<0.01	3.1
	Annual Mean	67	<0.00001	0.00001	0.0028	0.0035	0.032	0.0002	<0.01	1.3
	Annual Median	72	<0.00001	0.00001	0.003	0.003	0.028	0.0002	<0.01	1.3
FR_FR5	% < LRL	0%	100%	91%	0%	64%	0%	82%	100%	18%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	0%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	n	5	4	4	4	4	4	4	4	4
	Annual Minimum	23	<0.00001	<0.00001	0.0015	<0.003	0.02	<0.0002	0.01	<0.5
	Annual Maximum	50	0.0015	<0.00001	0.0026	0.0055	0.037	0.00026	0.01	2.4
	Annual Mean	37	0.00037	<0.00001	0.0021	0.0038	0.025	0.00022	0.01	1.3
	Annual Median	41	0.000012	<0.00001	0.0021	0.0034	0.021	0.0002	0.01	1.1
LC_FRUS	% < LRL	0%	50%	100%	0%	50%	0%	75%	75%	25%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	0%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	n	26	26	26	26	26	26	26	26	12
	Annual Minimum	21	<0.00001	<0.00001	0.0013	<0.003	0.012	<0.0002	<0.01	<0.5
	Annual Maximum	70	<0.00001	<0.00001	0.0031	0.0045	0.044	0.0029	0.016	1.9
	Annual Mean	48	<0.00001	<0.00001	0.0023	0.0031	0.028	0.00031	0.01	0.97
	Annual Median	49	<0.00001	<0.00001	0.0024	0.003	0.028	0.0002	0.01	0.85
LC_FRB	% < LRL	0%	100%	100%	0%	81%	0%	62%	88%	17%
	% > BCWQG[a]	100%	0%	0%	0%	0%	0%	4%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC	-	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%

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LC_GRCK	n	14	14	14	14	14	14	14	14	12
	Annual Minimum	1.1	<0.00001	<0.00001	0.0007	<0.003	<0.005	<0.0002	<0.01	<0.5
	Annual Maximum	2.9	<0.00001	0.000015	0.0012	0.0035	0.0072	0.00032	<0.01	<0.5
	Annual Mean	2.1	<0.00001	0.000011	0.001	0.003	0.0056	0.00021	<0.01	<0.5
	Annual Median	2	<0.00001	0.00001	0.001	0.003	0.0052	0.0002	<0.01	<0.5
	% < LRL	0%	100%	79%	0%	93%	50%	86%	100%	100%
	% > BCWQG[a]	57%	0%	0%	0%	0%	0%	0%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC[c]	0%	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
LC_UC	n	12	12	12	12	12	11	11	11	11
	Annual Minimum	0.27	<0.00001	<0.00001	0.00034	<0.003	0.0061	<0.0002	<0.01	<0.5
	Annual Maximum	0.48	<0.00001	<0.00001	0.00043	0.0037	0.012	0.00029	0.015	<0.5
	Annual Mean	0.36	<0.00001	<0.00001	0.00037	0.0031	0.0083	0.00021	0.01	<0.5
	Annual Median	0.35	<0.00001	<0.00001	0.00036	0.003	0.0082	0.0002	0.01	<0.5
	% < LRL	0%	100%	100%	0%	83%	0%	73%	82%	100%
	% > BCWQG[a]	0%	0%	0%	0%	0%	0%	0%	-	-
	% > BCWQG[b]	-	0%	-	-	0%	0%	0%	0%	-
	% > Level 1 Benchmark/UEC[c]	0%	-	-	-	-	0%	-	-	0%
	% > Level 2 Benchmark/UEC	-	-	-	-	-	-	-	-	0%
	% > Level 3 Benchmark/UEC	-	-	-	-	-	-	-	-	0%

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Table C.5: Raw Selenium Speciation Data (Brooks) from Dry Creek, Fording River, and Grace Creek, 2022

Water Body		station	Sample Date	DMSeO - Dimethylselenoxide (mg/L)	MeSe(IV) - Methylseleninic Acid (mg/L)	MeSe(VI) - Methaneselenonic Acid (mg/L)	Se(IV) - Selenite (mg/L)	Se(VI) - Selenate (mg/L)	SeCN - Selenocyanate (mg/L)	Selenium Unknown (mg/L)	Selenosulfate (mg/L)	SeMe - Selenomethionine (mg/L)	DMDSe- Dimethyl Diselenide (mg/L)	DMSe - Dimethyl selenide (mg/L)	Organoselenium (mg/L)[a]
Dry Creek East Tributary	Reference	LC_DCEF	5-Jan-22	<0.00001	<0.00001	<0.00001	0.00001	0.00130	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			9-Feb-22	<0.00001	<0.00001	<0.00001	<0.00001	0.00131	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Mar-22	<0.00001	<0.00001	<0.00001	<0.00001	0.00133	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			6-Apr-22	<0.00001	<0.00001	<0.00001	<0.00001	0.00136	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			3-May-22	<0.00001	<0.00001	<0.00001	0.00002	0.00155	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Jul-22	<0.00001	<0.00001	<0.00001	<0.00002	0.00151	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			2-Aug-22	<0.00001	<0.00001	<0.00001	<0.00002	0.00167	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Sep-22	<0.00001	<0.00001	<0.00001	<0.00002	0.00149	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			18-Oct-22	<0.00001	<0.00001	<0.00001	<0.00002	0.00135	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Nov-22	<0.00001	<0.00001	<0.00001	<0.00002	0.00138	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Dec-22	<0.00001	<0.00001	<0.00001	<0.00002	0.00128	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
Grace Creek	Mine-exposed	LC_GRCK	11-May-22	<0.00001	<0.00001	<0.00001	0.00003	0.00152	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			14-Jun-22	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			14-Sep-22	<0.00001	<0.00001	<0.00001	0.00004	0.00185	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
Dry Creek		LC_DC1	5-Jan-22	<0.00001	<0.00001	<0.00001	0.00019	0.02690	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Jan-22	<0.00001	<0.00001	<0.00001	0.00023	0.03340	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			19-Jan-22	<0.00001	<0.00001	<0.00001	0.00016	0.03390	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			2-Feb-22	<0.00001	<0.00001	<0.00001	0.00016	0.03380	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			9-Feb-22	<0.00001	<0.00001	<0.00001	0.00020	0.03410	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Feb-22	<0.00001	<0.00001	<0.00001	0.00021	0.03750	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			22-Feb-22	<0.00001	<0.00001	<0.00001	0.00015	0.03450	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			1-Mar-22	<0.00001	<0.00001	<0.00001	0.00019	0.03480	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			9-Mar-22	<0.00001	<0.00001	<0.00001	0.00022	0.03400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Mar-22	<0.00001	<0.00001	<0.00001	0.00022	0.03780	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			23-Mar-22	<0.00001	<0.00001	<0.00001	0.00021	0.03730	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			30-Mar-22	<0.00001	0.00001	<0.00001	0.00031	0.02330	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			6-Apr-22	<0.00001	<0.00001	<0.00001	0.00013	0.01020	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Apr-22	<0.00001	<0.00001	<0.00001	0.00025	0.02190	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			19-Apr-22	<0.00001	0.00001	<0.00001	0.00030	0.03080	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			24-Apr-22	<0.00001	0.00001	<0.00001	0.00037	0.03010	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			3-May-22	<0.00001	0.00002	<0.00001	0.00034	0.02160	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			12-May-22	<0.00001	<0.00001	<0.00001	0.00025	0.01800	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			17-May-22	<0.00001	0.00001	<0.00001	0.00029	0.01900	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			24-May-22	<0.00001	0.00001	<0.00001	0.00032	0.02090	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			31-May-22	<0.00001	0.00001	<0.00001	0.00022	0.01510	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			7-Jun-22	<0.00001	<0.00001	<0.00001	0.00022	0.01540	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			14-Jun-22	<0.00001	<0.00001	<0.00001	0.00021	0.01810	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			21-Jun-22	<0.00001	<0.00001	<0.00001	0.00018	0.01020	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			28-Jun-22	<0.00001	<0.00001	<0.00001	0.00017	0.01420	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Jul-22	<0.00001	0.00002	<0.00001	0.00021	0.01870	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			12-Jul-22	<0.00001	0.00001	<0.00001	0.00025	0.02140	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			18-Jul-22	0.000013	0.00002	<0.00001	0.00041	0.03280	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			28-Jul-22	<0.00001	0.00001	<0.00001	0.00027	0.02770	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			2-Aug-22	<0.00001	0.00001	<0.00001	0.00032	0.03480	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			9-Aug-22	<0.00001	0.00001	<0.00001	0.00028	0.03470	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			18-Aug-22	<0.00001	0.00001	<0.00001	0.00032	0.03710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			23-Aug-22	<0.00001	0.00001	<0.00001	0.00032	0.03990	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			30-Aug-22	<0.00001	0.00001	<0.00001	0.00033	0.04160	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			8-Sep-22	<0.00001	<0.00001	<0.00001	0.00031	0.04100	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			13-Sep-22	0.00001	0.00001	<0.00001	0.00032	0.04400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			20-Sep-22	<0.00001	<0.00001	<0.00001	0.00031	0.04280	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			27-Sep-22	<0.00001	<0.00001	<0.00001	0.00030	0.04040	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			4-Oct-22	<0.00001	<0.00001	<0.00001	0.00031	0.04200	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			11-Oct-22	<0.00001	<0.00001	<0.00001	0.00025	0.03900	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			18-Oct-22	<0.00001	<0.00001	<0.00001	0.00027	0.04420	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			25-Oct-22	<0.00001	<0.00001	<0.00001	0.00027	0.04710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			1-Nov-22	<0.00001	<0.00001	<0.00001	0.00023	0.04420	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			8-Nov-22	<0.00001	<0.00001	<0.00001	0.00011	0.03220	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Nov-22	<0.00001	<0.00001	<0.00001	0.00016	0.04550	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			22-Nov-22	<0.00001	<0.00001	<0.00001	0.00016	0.04120	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			29-Nov-22	<0.00001	<0.00001	<0.00001	0.00011	0.03650	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Dec-22	<0.00001	<0.00001	<0.00001	0.00015	0.04240	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			13-Dec-22	<0.00001	<0.00001	<0.00001	0.00010	0.03830	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			20-Dec-22	<0.00001	<0.00001	<0.00001	0.00013	0.04180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			29-Dec-22	<0.00001	<0.00001	<0.00001	0.00012	0.04680	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
		LC_DC2	5-Jan-22	0.00002	0.00001	<0.00001	0.00068	0.05590	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			12-Jan-22	0.00002	<0.00001	<0.00001	0.00073	0.06200	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			19-Jan-22	<0.00001	<0.00001	<0.00001	0.00066	0.06570	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			24-Jan-22	0.00002	<0.00001	<0.00001	0.00073	0.06660	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			2-Feb-22	0.00001	0.00001	<0.00001	0.00069	0.06630	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			9-Feb-22	0.00002	<0.00001	<0.00001	0.00073	0.06610	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			15-Feb-22	0.00001	0.00001	<0.00001	0.00075	0.06740	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			22-Feb-22	<0.00001	0.00001	<0.00001	0.00063	0.06650	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			3-Mar-22	<0.00001	0.00001	<0.00001	0.00065	0.06210	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			7-Mar-22	<0.00001	<0.00001	<0.00001	0.00061	0.06340	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Mar-22	0.00001	0.00001	<0.00001	0.00082	0.07550	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			23-Mar-22	0.00001	<0.00001	<0.00001	0.00085	0.06700	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			30-Mar-22	0.00001	0.00001	<0.00001	0.00046	0.02200	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			6-Apr-22	<0.00001	<0.00001	<0.00001	0.00042	0.02230	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Apr-22	<0.00001	<0.00001	<0.00001	0.00046	0.02030	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			19-Apr-22	0.00001	0.00002	<0.00001	0.00069	0.03710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			28-Apr-22	0.00001	<0.00001	<0.00001	0.00054	0.01900	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			3-May-22	0.00001	0.00001	<0.00001	0.00047	0.02290	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			11-May-22	0.00001	0.00001	<0.00001	0.00047	0.02090	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			17-May-22	<0.00001	<0.00001	<0.00001	0.00014	0.00656	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			24-May-22	<0.00001	0.00001	<0.00001	0.00028	0.01610	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			31-May-22	<0.00001	0.00001	<0.00001	0.00032	0.01760	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			7-Jun-22	<0.00001	0.00001	<0.00001	0.00033	0.01870	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			14-Jun-22	<0.00001	<0.00001	<0.00001	0.00030	0.02330	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			21-Jun-22	<0.00001	<0.00001	<0.00001	0.00027	0.01260	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			28-Jun-22	<0.00001	0.00001	<0.00001	0.00034	0.02220	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			7-Jul-22	0.00001	0.00001	<0.00001	0.00046	0.02850	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			12-Jul-22	0.00002	0.00002	<0.00001	0.00047	0.03070	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003

Table C.5: Raw Selenium Speciation Data (Brooks) from Dry Creek, Fording River, and Grace Creek, 2022

Water Body		station	Sample Date	DMSeO - Dimethylselenoxide (mg/L)	MeSe(IV) - Methylseleninic Acid (mg/L)	MeSe(VI) - Methaneselenonic Acid (mg/L)	Se(IV) - Selenite (mg/L)	Se(VI) - Selenate (mg/L)	SeCN - Selenocyanate (mg/L)	Selenium Unknown (mg/L)	Selenosulfate (mg/L)	SeMe - Selenomethionine (mg/L)	DMDSe- Dimethyl Diselenide (mg/L)	DMSe - Dimethyl selenide (mg/L)	Organoselenium (mg/L)[a]
Dry Creek	Mine-exposed	LC_DC2	18-Jul-22	0.00002	0.00002	<0.00001	0.00059	0.04330	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			28-Jul-22	0.00002	0.00002	<0.00001	0.00059	0.04280	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			2-Aug-22	0.00001	0.00002	<0.00001	0.00068	0.05650	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			9-Aug-22	0.00002	0.00003	<0.00001	0.00073	0.05790	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			18-Aug-22	0.00002	0.00003	<0.00001	0.00080	0.06490	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			23-Aug-22	0.00002	0.00002	<0.00001	0.00086	0.06860	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			30-Aug-22	0.00003	0.00003	<0.00001	0.00081	0.06770	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			8-Sep-22	0.00003	0.00002	<0.00001	0.00089	0.07190	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			13-Sep-22	0.00003	0.00002	<0.00001	0.00098	0.07860	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			20-Sep-22	0.00002	0.00002	<0.00001	0.00085	0.07540	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			27-Sep-22	0.00003	0.00002	<0.00001	0.00090	0.07020	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			4-Oct-22	0.00003	0.00002	<0.00001	0.00101	0.07930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			11-Oct-22	0.00003	0.00002	<0.00001	0.00091	0.07230	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			18-Oct-22	0.00002	0.00002	<0.00001	0.00099	0.08400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			25-Oct-22	0.00003	0.00002	<0.00001	0.00099	0.08800	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			3-Nov-22	0.00002	0.00002	<0.00001	0.00088	0.08230	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			8-Nov-22	0.00001	0.00001	<0.00001	0.00062	0.07450	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			15-Nov-22	0.00002	0.00002	<0.00001	0.00093	0.09550	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			22-Nov-22	0.00002	0.00001	<0.00001	0.00088	0.08980	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			29-Nov-22	0.00001	0.00001	<0.00001	0.00062	0.08580	<0.00001	<0.00001	0.00001	<0.00001	-	-	0.00002
			7-Dec-22	<0.00001	<0.00001	<0.00001	0.00074	0.08800	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			13-Dec-22	<0.00001	<0.00001	<0.00001	0.00066	0.08530	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			20-Dec-22	<0.00001	<0.00001	<0.00001	0.00077	0.08420	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			29-Dec-22	0.00001	<0.00001	<0.00001	0.00069	0.09620	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
		LC_DC3	5-Jan-22	0.00003	0.00002	<0.00001	0.00101	0.08070	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			12-Jan-22	0.00002	0.00002	<0.00001	0.00097	0.07700	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			19-Jan-22	0.00002	0.00001	<0.00001	0.00100	0.08180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			24-Jan-22	0.00002	0.00001	<0.00001	0.00103	0.07950	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			2-Feb-22	0.00003	0.00002	<0.00001	0.00083	0.07680	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			9-Feb-22	0.00002	0.00002	<0.00001	0.00099	0.07820	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			15-Feb-22	0.00002	0.00001	<0.00001	0.00107	0.07860	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			22-Feb-22	<0.00001	0.00001	<0.00001	0.00090	0.07800	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			2-Mar-22	<0.00001	0.00001	<0.00001	0.00094	0.07640	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			7-Mar-22	0.00001	0.00001	<0.00001	0.00094	0.07650	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			15-Mar-22	0.00002	0.00002	<0.00001	0.00120	0.08580	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			23-Mar-22	0.00003	0.00002	<0.00001	0.00104	0.07110	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			30-Mar-22	0.00002	0.00002	<0.00001	0.00091	0.03080	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			6-Apr-22	<0.00001	<0.00001	<0.00001	0.00078	0.03600	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Apr-22	0.00002	0.00002	<0.00001	0.00092	0.03520	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			17-Apr-22	0.00003	0.00002	<0.00001	0.00091	0.04670	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			24-Apr-22	0.00002	0.00002	<0.00001	0.00107	0.04190	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			3-May-22	0.00002	0.00003	<0.00001	0.00100	0.04060	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			11-May-22	0.00002	0.00002	<0.00001	0.00096	0.03870	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			17-May-22	0.00002	0.00002	<0.00001	0.00096	0.03970	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			24-May-22	0.00003	0.00002	<0.00001	0.00100	0.04890	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			31-May-22	0.00001	0.00002	<0.00001	0.00085	0.03930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			7-Jun-22	0.00002	0.00002	<0.00001	0.00084	0.04560	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			14-Jun-22	0.00003	<0.00001	<0.00001	0.00090	0.05340	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			21-Jun-22	<0.00001	0.00002	<0.00001	0.00072	0.03220	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			27-Jun-22	0.00001	0.00001	<0.00001	0.00082	0.04460	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			28-Jun-22	0.00002	0.00002	<0.00001	0.00073	0.04530	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			7-Jul-22	0.00003	0.00002	<0.00001	0.00090	0.05700	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			12-Jul-22	0.00003	0.00002	<0.00001	0.00090	0.05890	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			18-Jul-22	0.00004	0.00001	<0.00001	0.00098	0.06030	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			25-Jul-22	0.00004	0.00002	<0.00001	0.00106	0.06810	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			2-Aug-22	0.00004	0.00002	<0.00001	0.00113	0.07910	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			9-Aug-22	0.00003	0.00002	<0.00001	0.00099	0.07980	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			16-Aug-22	0.00002	0.00002	<0.00001	0.00100	0.07930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			18-Aug-22	0.00002	0.00002	<0.00001	0.00098	0.07290	<0.00001	<0.00001	<0.00001	<0.00001	<0.000022	<0.000047	0.00005
			23-Aug-22	0.00003	0.00002	<0.00001	0.00117	0.09120	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			30-Aug-22	0.00003	0.00002	<0.00001	0.00110	0.08490	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			6-Sep-22	0.00003	0.00002	<0.00001	0.00109	0.08690	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			13-Sep-22	0.00003	0.00001	<0.00001	0.00119	0.09510	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			20-Sep-22	0.00001	0.00002	<0.00001	0.00105	0.09160	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			27-Sep-22	0.00003	0.00002	<0.00001	0.00113	0.09455	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			3-Oct-22	0.00002	0.00002	<0.00001	0.00112	0.09310	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			11-Oct-22	0.00002	0.00001	<0.00001	0.00104	0.08710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			18-Oct-22	0.00002	0.00001	<0.00001	0.00120	0.09900	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			25-Oct-22	0.00002	0.00002	<0.00001	0.00120	0.10700	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			1-Nov-22	0.00001	0.00002	<0.00001	0.00107	0.09260	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			8-Nov-22	0.00002	0.00001	<0.00001	0.00104	0.09440	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			15-Nov-22	0.00002	0.00002	<0.00001	0.00114	0.10600	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			22-Nov-22	0.00002	<0.00001	<0.00001	0.00100	0.09710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			29-Nov-22	0.00002	0.00002	<0.00001	0.00094	0.09570	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			7-Dec-22	<0.00001	<0.00001	<0.00001	0.00102	0.10000	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			13-Dec-22	0.00001	<0.00001	<0.00001	0.00099	0.10000	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			20-Dec-22	<0.00001	<0.00001	<0.00001	0.00104	0.09940	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			29-Dec-22	<0.00001	0.00001	<0.00001	0.00106	0.11500	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
		LC_DC4	5-Jan-22	<0.00001	<0.00001	<0.00001	0.00028	0.04710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Jan-22	<0.00001	<0.00001	<0.00001	0.00023	0.03550	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			19-Jan-22	<0.00001	<0.00001	<0.00001	0.00017	0.03520	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			24-Jan-22	<0.00001	<0.00001	<0.00001	0.00018	0.03630	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			2-Feb-22	<0.00001	<0.00001	<0.00001	0.00018	0.03590	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			9-Feb-22	<0.00001	<0.00001	<0.00001	0.00018	0.03430	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Feb-22	<0.00001	<0.00001	<0.00001	0.00021	0.03790	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			22-Feb-22	<0.00001	<0.00001	<0.00001	0.00017	0.03740	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			2-Mar-22	<0.00001	<0.00001	<0.00001	0.00020	0.03730	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Mar-22	<0.00001	<0.00001	<0.00001	0.00015	0.03550	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Mar-22	<0.00001	<0.00001	<0.00001	0.00020	0.04020	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			23-Mar-22	<0.00001	<0.00001	<0.00001	0.00020	0.03930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			30-Mar-22	<0.00001	0.00001	<0.00001	0.00038	0.02470	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			6-Apr-22	<0.00001	<0.00001	<0.00001	0.00032	0.02520	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Apr-22	<0.00001	0.00001	<0.00001	0.00029	0.02260	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			19-Apr-22	<0.00001	<0.00001	<0.00001	0.00034	0.03140	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001

Table C.5: Raw Selenium Speciation Data (Brooks) from Dry Creek, Fording River, and Grace Creek, 2022

Water Body		station	Sample Date	DMSeO - Dimethylselenoxide (mg/L)	MeSe(IV) - Methylseleninic Acid (mg/L)	MeSe(VI) - Methaneselenonic Acid (mg/L)	Se(IV) - Selenite (mg/L)	Se(VI) - Selenate (mg/L)	SeCN - Selenocyanate (mg/L)	Selenium Unknown (mg/L)	Selenosulfate (mg/L)	SeMe - Selenomethionine (mg/L)	DMDSe- Dimethyl Diselenide (mg/L)	DMSe - Dimethyl selenide (mg/L)	Organoselenium (mg/L)[a]
Dry Creek	Mine-exposed	LC_DC4	28-Apr-22	<0.00001	<0.00001	<0.00001	0.00036	0.01980	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			3-May-22	<0.00001	0.00001	<0.00001	0.00034	0.02220	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			11-May-22	<0.00001	0.00001	<0.00001	0.00033	0.02020	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			17-May-22	<0.00001	0.00001	<0.00001	0.00035	0.01960	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			24-May-22	<0.00001	0.00001	<0.00001	0.00033	0.02270	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			31-May-22	<0.00001	<0.00001	<0.00001	0.00027	0.01620	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Jun-22	<0.00001	0.00001	<0.00001	0.00023	0.01630	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			14-Jun-22	<0.00001	<0.00001	<0.00001	0.00022	0.01970	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			21-Jun-22	<0.00001	<0.00001	<0.00001	0.00021	0.01110	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			28-Jun-22	<0.00001	<0.00001	<0.00001	0.00024	0.01870	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Jul-22	<0.00001	0.00001	<0.00001	0.00024	0.02180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			12-Jul-22	0.00001	0.00001	<0.00001	0.00029	0.02300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			18-Jul-22	0.00002	0.00002	<0.00001	0.00043	0.03410	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			28-Jul-22	0.00001	<0.00001	<0.00001	0.00031	0.02940	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			2-Aug-22	<0.00001	0.00001	<0.00001	0.00040	0.03730	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			9-Aug-22	<0.00001	<0.00001	<0.00001	0.00034	0.03700	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			18-Aug-22	<0.00001	0.00001	<0.00001	0.00034	0.03970	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			23-Aug-22	<0.00001	<0.00001	<0.00001	0.00036	0.04330	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			30-Aug-22	<0.00001	0.00001	<0.00001	0.00038	0.04390	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			8-Sep-22	0.00001	<0.00001	<0.00001	0.00036	0.04420	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			13-Sep-22	<0.00001	<0.00001	<0.00001	0.00034	0.04670	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			20-Sep-22	<0.00001	<0.00001	<0.00001	0.00032	0.04510	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			27-Sep-22	<0.00001	<0.00001	<0.00001	0.00032	0.04270	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			4-Oct-22	<0.00001	<0.00001	<0.00001	0.00034	0.04460	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			11-Oct-22	<0.00001	<0.00001	<0.00001	0.00030	0.04180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			18-Oct-22	<0.00001	<0.00001	<0.00001	0.00032	0.04680	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			25-Oct-22	<0.00001	<0.00001	<0.00001	0.00031	0.04930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			3-Nov-22	<0.00001	<0.00001	<0.00001	0.00019	0.04160	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			8-Nov-22	<0.00001	<0.00001	<0.00001	0.00010	0.03340	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			15-Nov-22	<0.00001	<0.00001	<0.00001	0.00021	0.05050	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			22-Nov-22	<0.00001	<0.00001	<0.00001	0.00017	0.04520	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			29-Nov-22	<0.00001	<0.00001	<0.00001	0.00011	0.04180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			7-Dec-22	<0.00001	<0.00001	<0.00001	0.00015	0.04470	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			13-Dec-22	<0.00001	<0.00001	<0.00001	0.00011	0.04160	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			20-Dec-22	<0.00001	<0.00001	<0.00001	0.00016	0.04480	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			29-Dec-22	<0.00001	<0.00001	<0.00001	0.00012	0.05100	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
		LC_DCDS	5-Jan-22	0.00002	0.00002	<0.00001	0.00092	0.07150	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			12-Jan-22	0.00002	0.00002	<0.00001	0.00097	0.07340	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			19-Jan-22	0.00001	0.00002	<0.00001	0.00097	0.07810	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			1-Feb-22	0.00002	0.00002	<0.00001	0.00086	0.07230	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			9-Feb-22	0.00002	0.00002	<0.00001	0.00099	0.07800	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			15-Feb-22	0.00002	0.00001	<0.00001	0.00093	0.07090	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			22-Feb-22	0.00002	0.00002	<0.00001	0.00095	0.07500	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			1-Mar-22	<0.00001	0.00002	<0.00001	0.00093	0.06910	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			8-Mar-22	0.00002	<0.00001	<0.00001	0.00098	0.05260	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			15-Mar-22	0.00002	0.00002	<0.00001	0.00119	0.08450	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			23-Mar-22	0.00003	0.00002	<0.00001	0.00101	0.07080	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			30-Mar-22	0.00002	0.00002	<0.00001	0.00083	0.03010	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			6-Apr-22	<0.00001	<0.00001	<0.00001	0.00078	0.03190	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			12-Apr-22	0.00001	0.00001	<0.00001	0.00067	0.02660	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			17-Apr-22	0.00002	0.00002	<0.00001	0.00079	0.03720	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			24-Apr-22	0.00002	0.00002	<0.00001	0.00105	0.04300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			5-May-22	0.00002	0.00002	<0.00001	0.00084	0.03180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			11-May-22	0.00002	0.00002	<0.00001	0.00081	0.03320	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			17-May-22	0.00003	0.00003	<0.00001	0.00085	0.03550	<0.00001	<0.00002	<0.00001	<0.00001	-	-	0.00005
			24-May-22	0.00003	0.00003	<0.00001	0.00087	0.04050	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			31-May-22	0.00002	0.00002	<0.00001	0.00073	0.03310	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			7-Jun-22	<0.00001	0.00002	<0.00001	0.00076	0.04000	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			14-Jun-22	0.00002	0.00003	<0.00001	0.00080	0.04920	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			21-Jun-22	<0.00001	0.00002	<0.00001	0.00062	0.02540	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			28-Jun-22	0.00002	0.00003	<0.00001	0.00072	0.04130	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			7-Jul-22	0.00002	0.00003	<0.00001	0.00068	0.04400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			12-Jul-22	0.00002	0.00003	<0.00001	0.00078	0.04630	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			18-Jul-22	0.00003	0.00003	<0.00001	0.00084	0.05330	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			25-Jul-22	0.00005	0.00005	<0.00001	0.00108	0.05970	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00010
			2-Aug-22	0.00003	0.00003	<0.00001	0.00100	0.06970	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			9-Aug-22	0.00003	0.00003	<0.00001	0.00095	0.07020	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			16-Aug-22	0.00003	0.00003	<0.00001	0.00107	0.07610	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			18-Aug-22	0.00003	0.00004	<0.00001	0.00100	0.07340	<0.00001	<0.00001	<0.00001	<0.00001	<0.000022	<0.000047	0.00007
			23-Aug-22	0.00003	0.00003	<0.00001	0.00113	0.07930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			30-Aug-22	0.00004	0.00003	<0.00001	0.00107	0.07660	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			6-Sep-22	0.00003	0.00003	<0.00001	0.00117	0.07990	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			13-Sep-22	0.00003	0.00003	<0.00001	0.00122	0.08720	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			20-Sep-22	0.00002	0.00003	<0.00001	0.00111	0.08400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			27-Sep-22	0.00003	0.00003	<0.00001	0.00113	0.08300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			4-Oct-22	0.00004	0.00003	<0.00001	0.00120	0.08620	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			11-Oct-22	0.00002	0.00002	<0.00001	0.00102	0.07720	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			18-Oct-22	0.00002	0.00003	<0.00001	0.00118	0.09060	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			25-Oct-22	0.00003	0.00002	<0.00001	0.00122	0.09500	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			1-Nov-22	0.00002	0.00002	<0.00001	0.00103	0.08360	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			8-Nov-22	0.00002	0.00002	<0.00001	0.00098	0.08660	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			15-Nov-22	0.00002	0.00002	<0.00001	0.00117	0.10300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			22-Nov-22	0.00002	0.00001	<0.00001	0.00113	0.09810	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			29-Nov-22	0.00002	0.00001	<0.00001	0.00108	0.09960	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			7-Dec-22	0.00001	0.00002	<0.00001	0.00107	0.09880	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			13-Dec-22	0.00001	0.00001	<0.00001	0.00098	0.09890	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			20-Dec-22	<0.00001	0.00001	<0.00001	0.00114	0.10100	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			29-Dec-22	0.00002	0.00001	<0.00001	0.00119	0.11400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
		LC_SPDC	5-Jan-22	0.00002	<0.00001	<0.00001	0.00068	0.04580	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			12-Jan-22	0.00002	0.00002	<0.00001	0.00102	0.07440	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			19-Jan-22	0.00002	0.00002	<0.00001	0.00100	0.07830	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			2-Feb-22	0.00002	0.00002	<0.00001	0.00098	0.07500	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			9-Feb-22	0.00003	0.00002	<0.00001	0.00101	0.07710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			15-Feb-22	0.00003	0.00002	<0.00001	0.00105	0.07610	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005

Table C.5: Raw Selenium Speciation Data (Brooks) from Dry Creek, Fording River, and Grace Creek, 2022

Water Body		station	Sample Date	DMSeO - Dimethylselenoxide (mg/L)	MeSe(IV) - Methylseleninic Acid (mg/L)	MeSe(VI) - Methaneselenonic Acid (mg/L)	Se(IV) - Selenite (mg/L)	Se(VI) - Selenate (mg/L)	SeCN - Selenocyanate (mg/L)	Selenium Unknown (mg/L)	Selenosulfate (mg/L)	SeMe - Selenomethionine (mg/L)	DMDSe- Dimethyl Diselenide (mg/L)	DMSe - Dimethyl selenide (mg/L)	Organoselenium (mg/L)[a]
Dry Creek	Mine-exposed	LC_SPDC	22-Feb-22	<0.00001	0.00002	<0.00001	0.00095	0.07890	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			2-Mar-22	<0.00001	0.00002	<0.00001	0.00100	0.07540	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			7-Mar-22	0.00002	0.00002	<0.00001	0.00096	0.07480	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			15-Mar-22	<0.00001	0.00002	<0.00001	0.00117	0.08500	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			23-Mar-22	0.00001	0.00002	<0.00001	0.00105	0.07130	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			30-Mar-22	0.00002	0.00002	<0.00001	0.00094	0.03350	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			6-Apr-22	0.00002	0.00002	<0.00001	0.00082	0.03380	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			12-Apr-22	0.00002	0.00001	<0.00001	0.00090	0.03260	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			17-Apr-22	0.00003	0.00002	<0.00001	0.00093	0.04360	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			24-Apr-22	0.00003	0.00002	<0.00001	0.00109	0.04580	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			5-May-22	0.00002	0.00003	<0.00001	0.00106	0.03870	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			11-May-22	0.00002	0.00002	<0.00001	0.00096	0.03680	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			17-May-22	0.00003	0.00003	<0.00001	0.00091	0.03990	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			24-May-22	0.00003	0.00004	<0.00001	0.00098	0.04580	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			31-May-22	0.00003	0.00002	<0.00001	0.00082	0.03770	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			7-Jun-22	<0.00001	0.00003	<0.00001	0.00083	0.04400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			14-Jun-22	0.00003	0.00002	<0.00001	0.00083	0.05220	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			21-Jun-22	0.00001	0.00002	<0.00001	0.00070	0.02880	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			28-Jun-22	0.00003	0.00003	<0.00001	0.00080	0.04570	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			7-Jul-22	0.00003	0.00004	<0.00001	0.00080	0.05180	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			12-Jul-22	0.00003	0.00004	<0.00001	0.00092	0.05590	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			18-Jul-22	0.00003	0.00004	<0.00001	0.00089	0.05850	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			25-Jul-22	0.00005	0.00005	<0.00001	0.00112	0.06300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00010
			2-Aug-22	0.00003	0.00003	<0.00001	0.00115	0.07890	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			9-Aug-22	0.00003	0.00003	<0.00001	0.00110	0.07880	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			16-Aug-22	0.00003	0.00004	<0.00001	0.00115	0.08070	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			23-Aug-22	0.00004	0.00003	<0.00001	0.00123	0.08680	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			30-Aug-22	0.00003	0.00004	<0.00001	0.00118	0.08390	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			6-Sep-22	0.00004	0.00004	<0.00001	0.00128	0.08660	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			13-Sep-22	0.00004	0.00003	<0.00001	0.00128	0.09050	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			20-Sep-22	0.00002	0.00003	<0.00001	0.00124	0.09170	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			27-Sep-22	0.00003	0.00004	<0.00001	0.00117	0.09040	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			3-Oct-22	0.00004	0.00004	<0.00001	0.00121	0.08860	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00008
			11-Oct-22	0.00003	0.00003	<0.00001	0.00112	0.08430	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00006
			18-Oct-22	0.00004	0.00004	<0.00001	0.00129	0.09920	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00007
			25-Oct-22	0.00002	0.00003	<0.00001	0.00127	0.10300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			1-Nov-22	0.00003	0.00003	<0.00001	0.00115	0.09170	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			8-Nov-22	0.00001	0.00001	<0.00001	0.00104	0.09240	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
			15-Nov-22	0.00002	0.00002	<0.00001	0.00113	0.10300	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			22-Nov-22	0.00002	0.00003	<0.00001	0.00109	0.09710	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00005
			29-Nov-22	0.00002	0.00002	<0.00001	0.00102	0.09930	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00004
			7-Dec-22	0.00002	0.00001	<0.00001	0.00112	0.10000	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			13-Dec-22	0.00001	0.00001	<0.00001	0.00099	0.09700	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00003
			20-Dec-22	<0.00001	0.00001	<0.00001	0.00116	0.10100	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			29-Dec-22	0.00002	<0.00001	<0.00001	0.00122	0.11400	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00002
Fording River		LC_FRB	10-Sep-22	<0.00001	0.00001	<0.00001	0.00017	0.03470	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			30-Nov-22	<0.00001	<0.00001	<0.00001	0.00019	0.05060	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
		LC_FRUS	11-May-22	<0.00001	<0.00001	<0.00001	0.00018	0.05270	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			22-Jun-22	<0.00001	<0.00001	<0.00001	0.00008	0.02130	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001
			10-Sep-22	<0.00001	0.00001	<0.00001	0.00017	0.04220	<0.00001	<0.00001	<0.00001	<0.00001	-	-	0.00001
			30-Nov-22	<0.00001	<0.00001	<0.00001	0.00014	0.04260	<0.00001	<0.00001	<0.00001	<0.00001	-	-	<0.00001

Level 2: Sum of MeSeIV and DMSeO ≥ 0.000025 mg/L

Level 3: Sum of MeSeIV and DMSeO > 0.00005 mg/L

Notes:

'-' = No data available

[a] For the calculation of organoselenium, if both dimethylselenoxide and methylseleninic acid were non-detect values the result is reported as <0.01

Table C.6: Differences in Concentrations Between Areas Upstream (LC_FRUS) and Downstream (LC_FRB) of Dry Creek Input into Fording River, 2014 to 2022

Parameter	Year	Q1. Do differences in Concentrations (downstream - upstream) vary among years?	Q2. Is there a difference in concentrations downstream compared to upstream?[b]
		Year P-value[a]	Magnitude of Difference (%)
Nitrate (as N)	2014	0.126	NS
	2015		
	2021		
	2022		
Nitrite (as N)	2014	0.001	NS
	2015		NS
	2021		NS
	2022		50
Total Kjeldahl Nitrogen	<LRL	0.606	NS
	2015		
	2021		
	2022		
Orthophosphate	2014	0.782	NS
	2015		
	<LRL		
	<LRL		
Phosphorus (P)-Total	2014	0.444	NS
	2015		
	2021		
	2022		
Sulphate	2014	0.046	NS
	2015		NS
	2021		-11
	2022		NS
Total Dissolved Solids	2014	0.009	-3.2
	2015		NS
	2021		-9.5
	2022		NS
Antimony (Sb)-Total	2014	0.883	NS
	2015		
	2021		
	2022		
Barium (Ba)-Total	2014	0.503	3.9
	2015		
	2021		
	2022		
Boron (B)-Total	2014	0.412	NS
	2015		
	<LRL		
	<LRL		

Year difference P-value < 0.05.

Downstream value higher than upstream.

Downstream value lower than upstream.

Notes: "ns" indicates non-significant difference (p-value > 0.05) between upstream and downstream. <LRL = Insufficient sample size (<3) for values above detection limits to complete analyses.

[a] P-value from an Analysis of Variance conducted on the difference in concentrations upstream and downstream of Dry creek. If significant, each year was compared to upstream separately.

[b] Post-hoc contrasts testing the difference DS- US against zero with the magnitude of difference (MOD) calculated as (DS-US)/US*100% and application of Kaplan-Meier means for concentrations. Post-hoc tests were adjusted for the number of comparisons using Tukey's Honestly Significant Difference (HSD) tests.

Table C.6: **Differences in Concentrations Between Areas Upstream (LC_FRUS) and Downstream (LC_FRB) of Dry Creek Input into Fording River, 2014 to 2022**

Parameter	Year	Q1. Do differences in Concentrations (downstream - upstream) vary among years?	Q2. Is there a difference in concentrations downstream compared to upstream?[b]
		Year P-value[a]	Magnitude of Difference (%)
Cobalt (Co)-Total	<LRL	<LRL	<LRL
	<LRL		
	<LRL		
	<LRL		
Lithium (Li)-Total	2014	0.403	NS
	2015		
	2021		
	2022		
Manganese (Mn)-Total	2014	0.710	NS
	2015		
	2021		
	2022		
Mercury (Hg)-Total	<LRL	<LRL	<LRL
	<LRL		
	<LRL		
	<LRL		
Molybdenum (Mo)-Total	2014	0.316	NS
	2015		
	2021		
	2022		
Nickel (Ni)-Total	2014	0.315	NS
	2015		
	2021		
	2022		
Selenium (Se)-Total	2014	0.951	NS
	2015		
	2021		
	2022		
Uranium (U)-Total	2014	0.094	NS
	2015		
	2021		
	2022		
Zinc (Zn)-Total	<LRL	<LRL	<LRL
	<LRL		
	<LRL		
	<LRL		
Cadmium (Cd)-Dissolved	2014	0.746	NS
	2015		
	2021		
	2022		

Year difference P-value < 0.05.

Downstream value higher than upstream.

Downstream value lower than upstream.

Notes: "ns" indicates non-significant difference (p-value > 0.05) between upstream and downstream. <LRL = Insufficient sample size (<3) for values above detection limits to complete analyses.

[a] P-value from an Analysis of Variance conducted on the difference in concentrations upstream and downstream of Dry creek. If significant, each year was compared to upstream separately.

[b] Post-hoc contrasts testing the difference DS- US against zero with the magnitude of difference (MOD) calculated as (DS-US)/US*100% and application of Kaplan-Meier means for concentrations. Post-hoc tests were adjusted for the number of comparisons using Tukey's Honestly Significant Difference (HSD) tests.

APPENDIX D
TOXICITY

Table D.1: Summary of 2022 LC_SPDC, Acute Toxicity Results

EMS ID	Area	Sample Date	Endpoint	Result 96-Hour Rainbow Trout	Result 48-Hour *Daphnia magna*
E288273	LC_DC3	3-Oct-22	% mortality	0	0
		4-Oct-22		0	0
		5-Oct-22		0	0
		6-Oct-22		0	0
		7-Oct-22		0	0
E295210	LC_DCDS	4-Oct-22		0	0
		5-Oct-22		0	0
		6-Oct-22		0	0
		7-Oct-22		0	0
E295211	LC_SPDC	12-Jan-22		0	0
		5-May-22		0	0
		11-May-22		0	0
		17-May-22		0	0
		24-May-22		0	0
		31-May-22		0	0
		7-Jun-22		0	0
		15-Jun-22		0	0
		16-Aug-22		0	0
		3-Oct-22		0	0
		15-Nov-22		0	0

APPENDIX E
BENTHIC INVERTEBRATE COMMUNITY

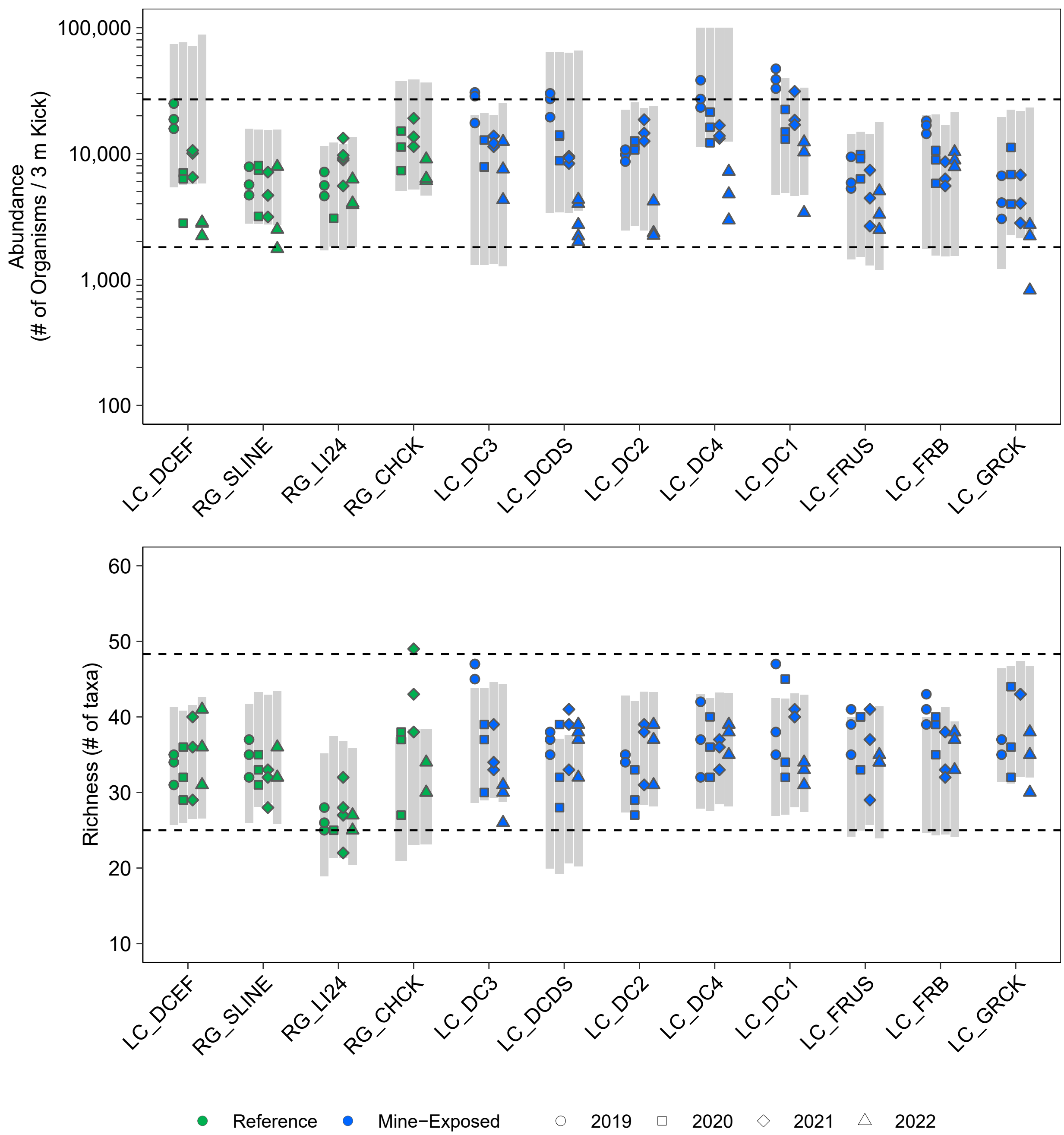

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

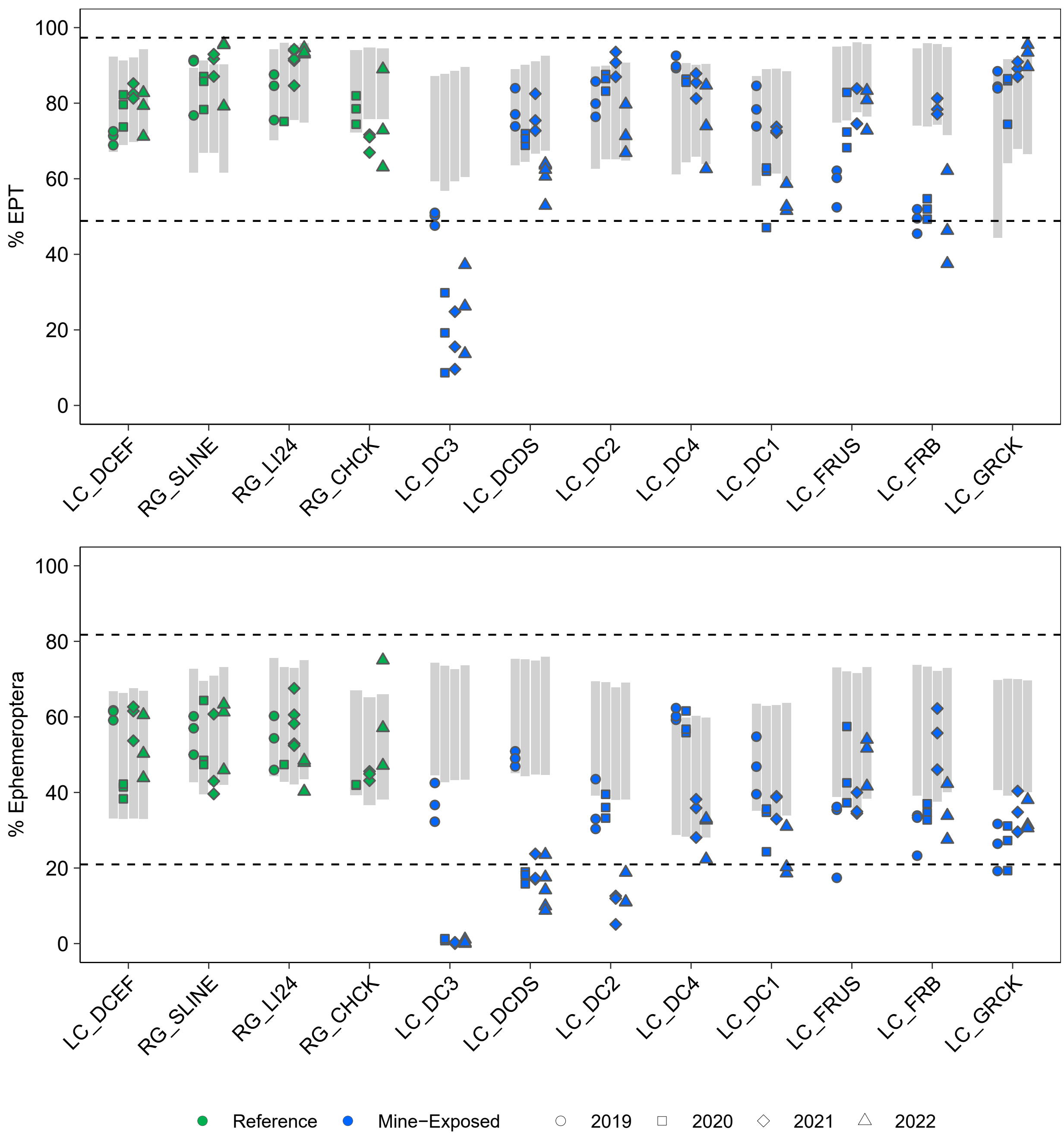

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

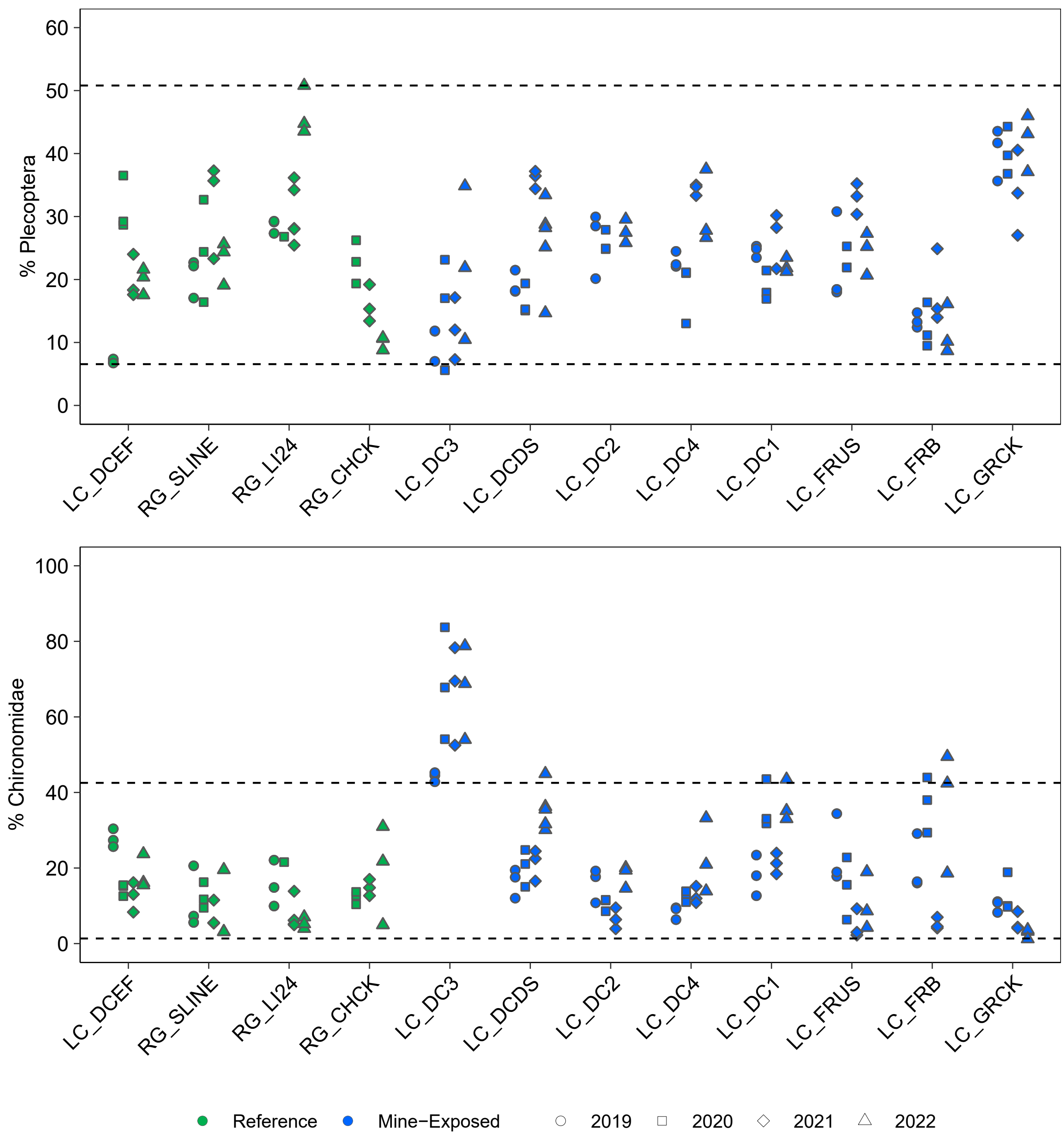

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

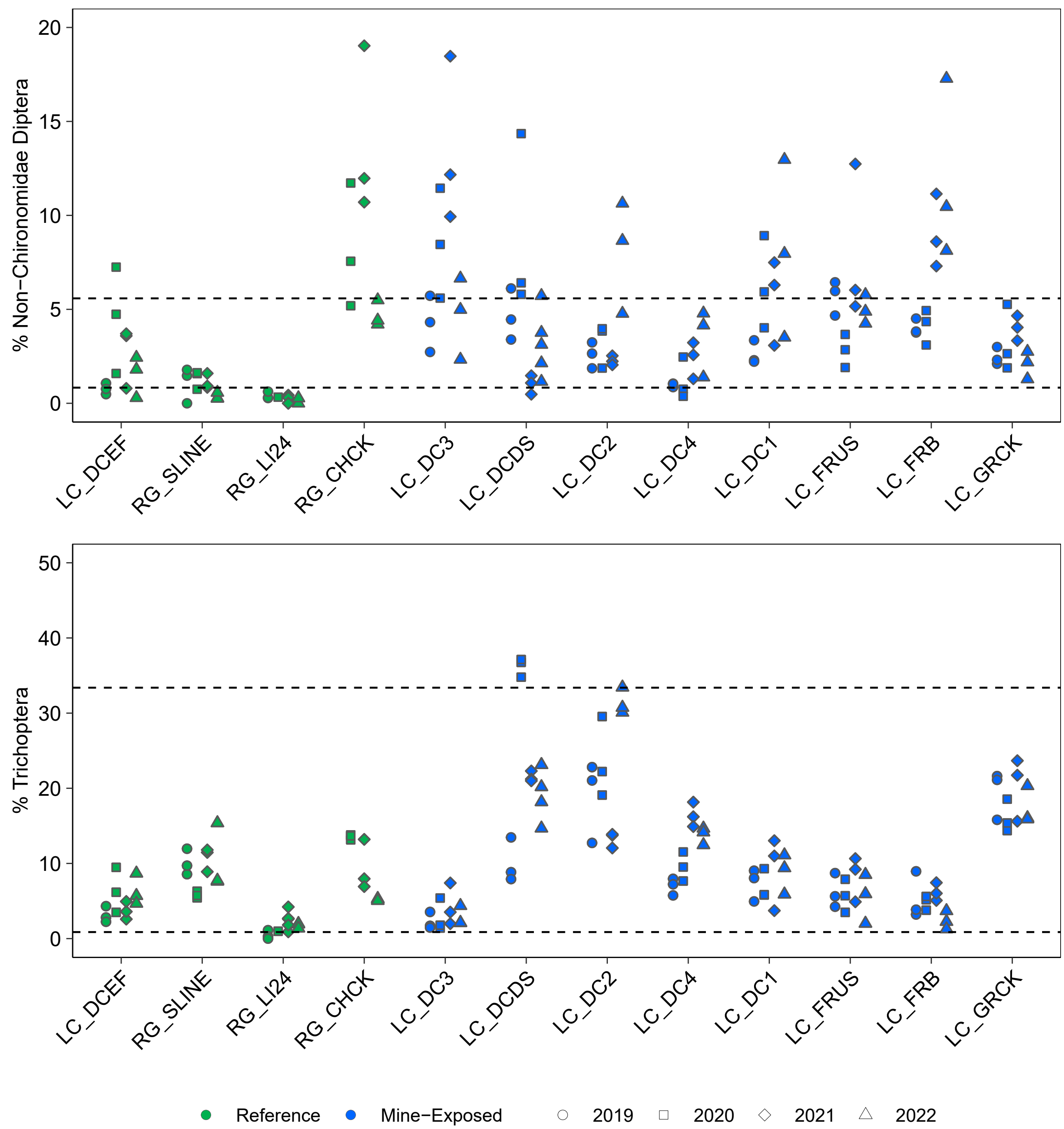

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

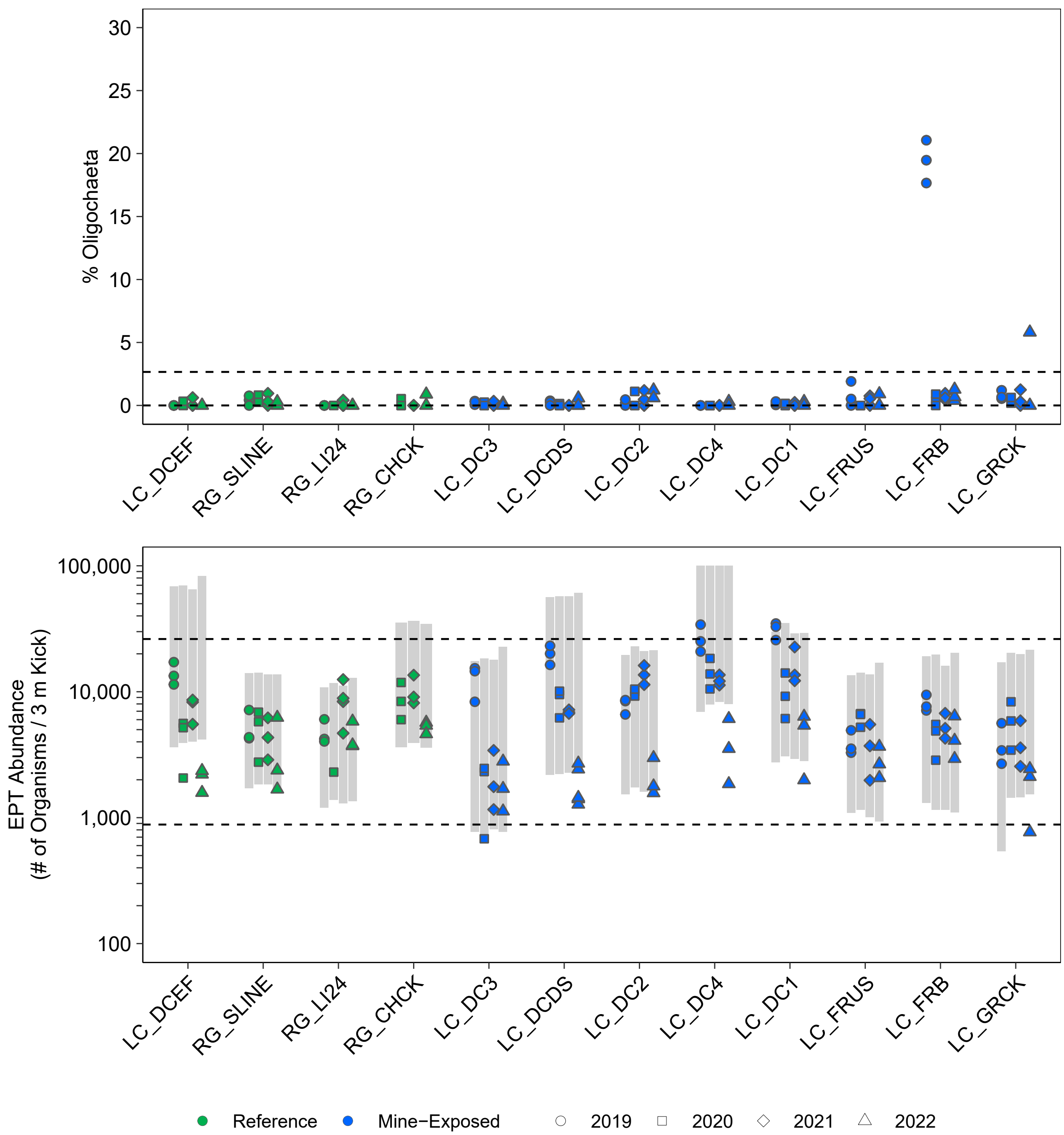

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

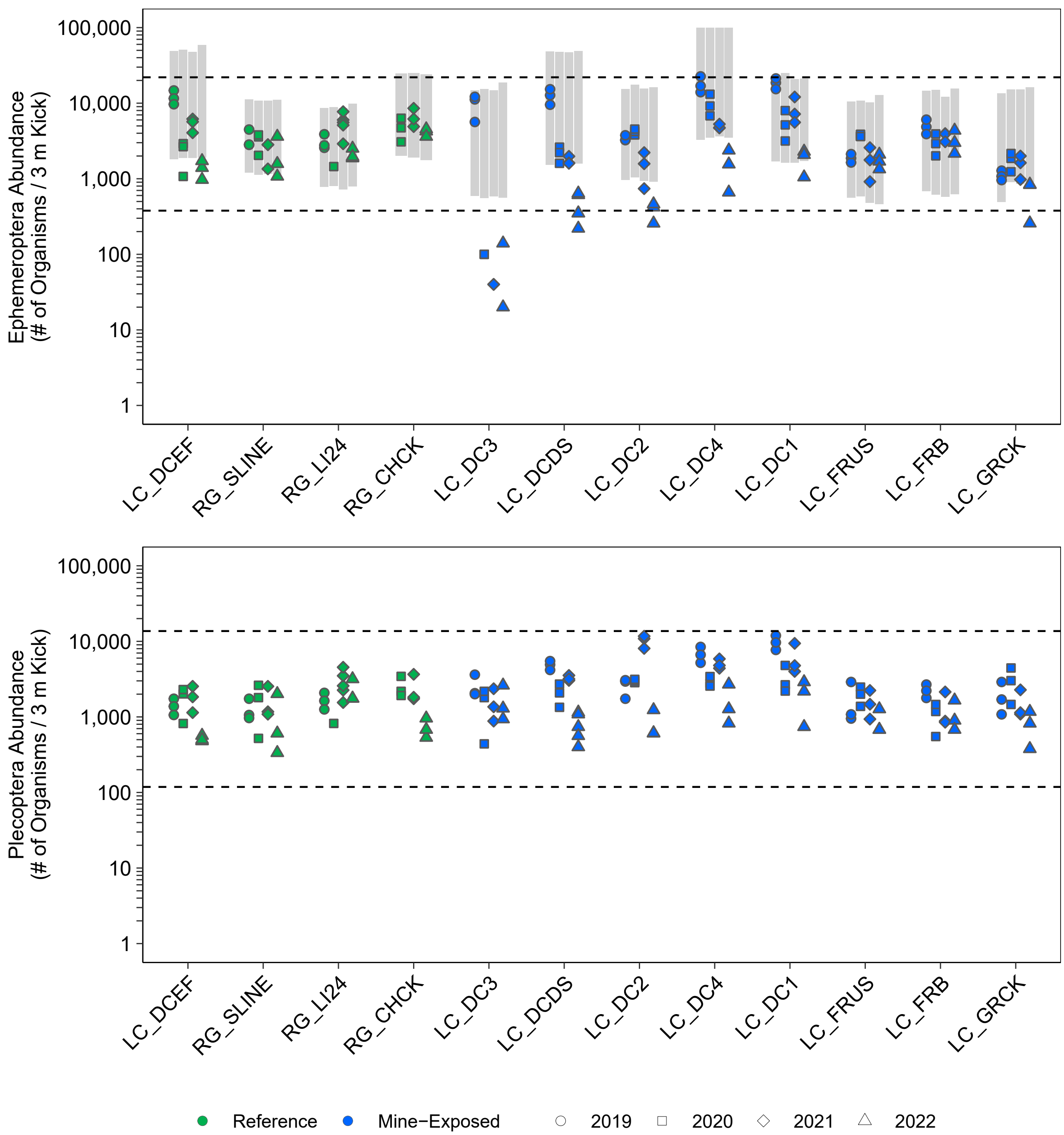

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

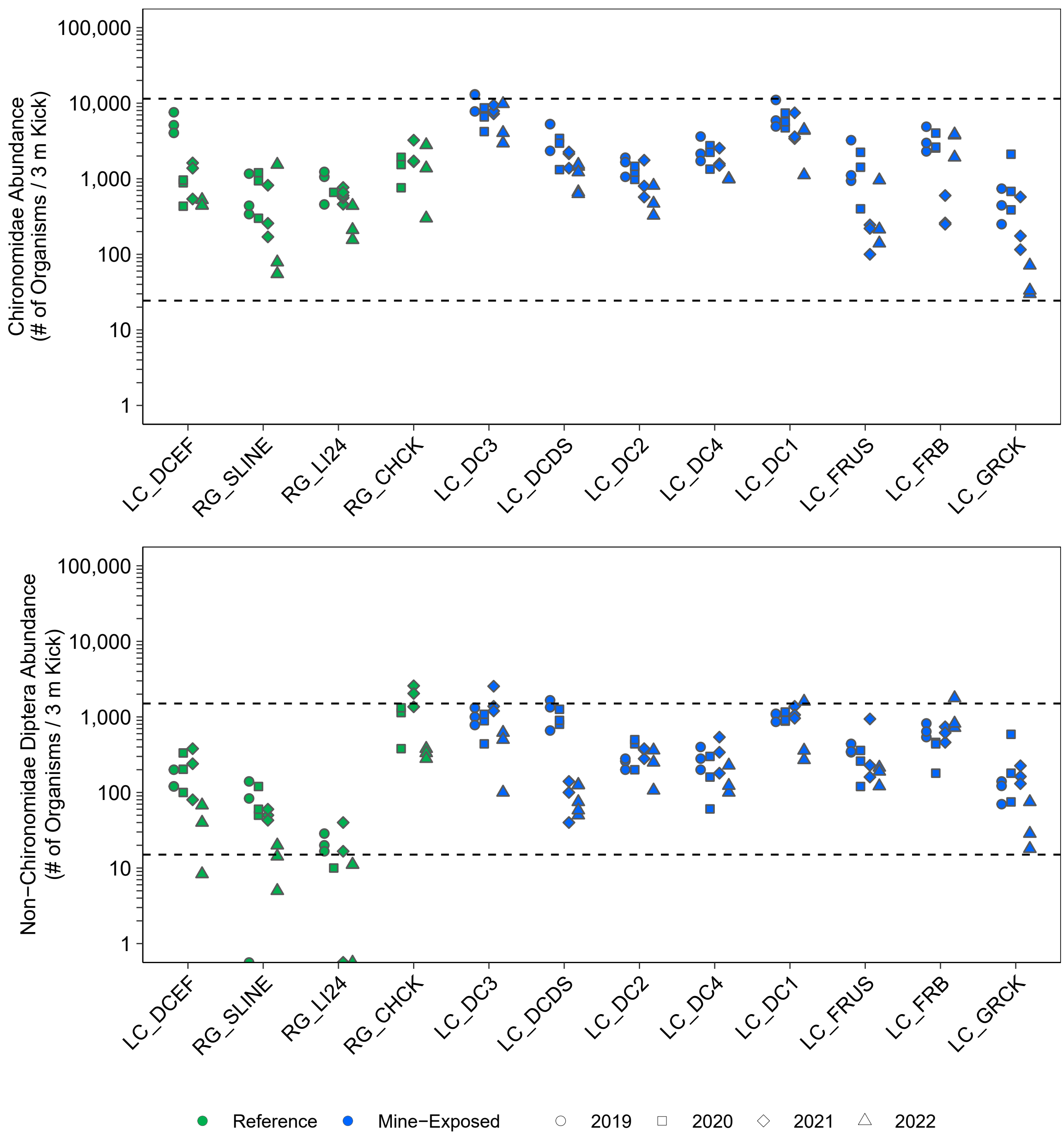

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

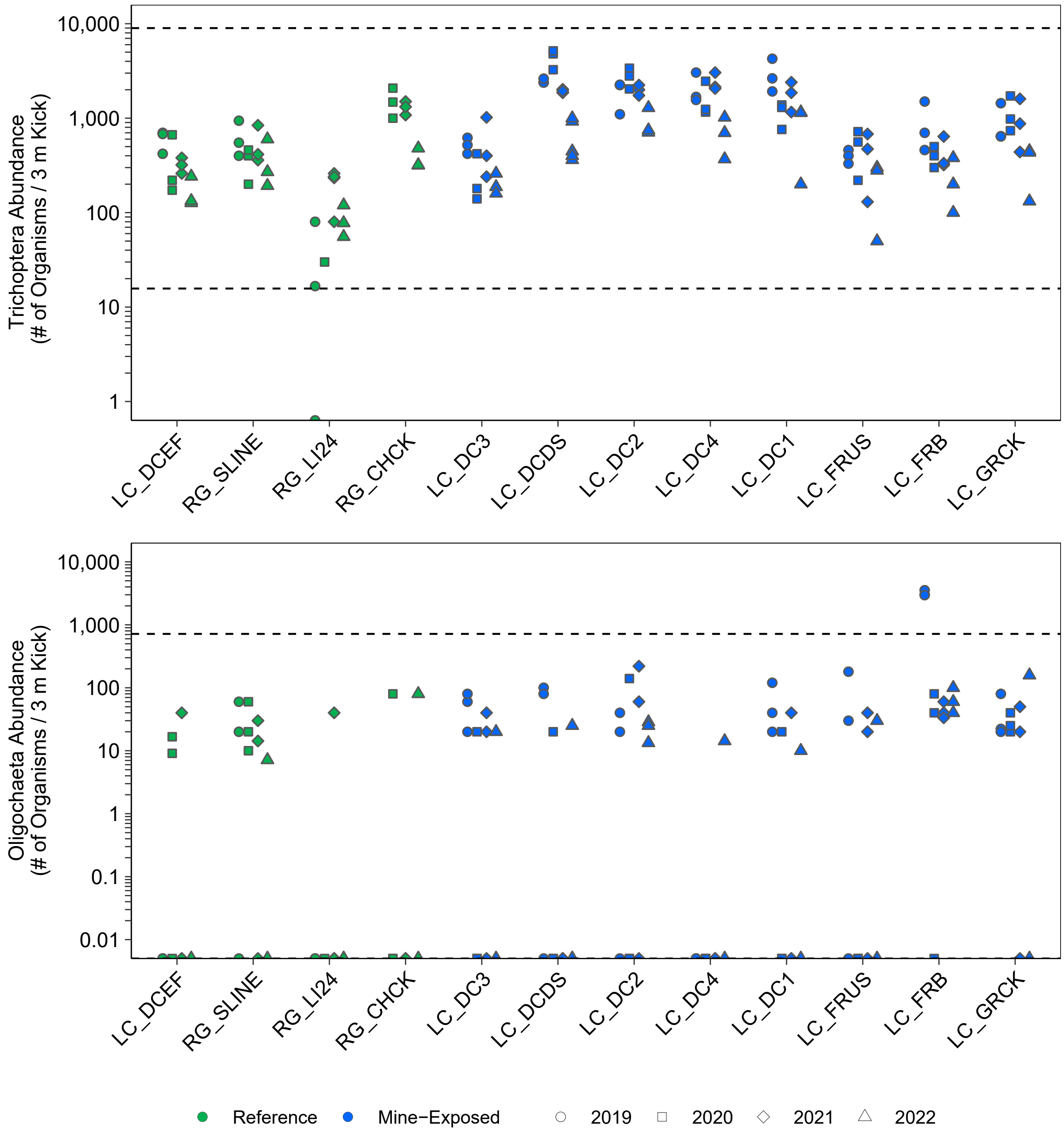

Figure E.1: Benthic Invertebrate Community Endpoints at Dry Creek, Fording River, Grace Creek, and Dry Creek East Tributary Sampling Areas, LCO Dry Creek LAEMP, September 2019 to 2022

Notes: Upper and Lower Dry Creek = LC_DCDS and LC_DC1, respectively, and upstream and downstream in the Fording River = FR_FR5/LC_FRUS and LC_FRB , respectively. Site specific normal ranges using regression models shown with grey shading (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines.

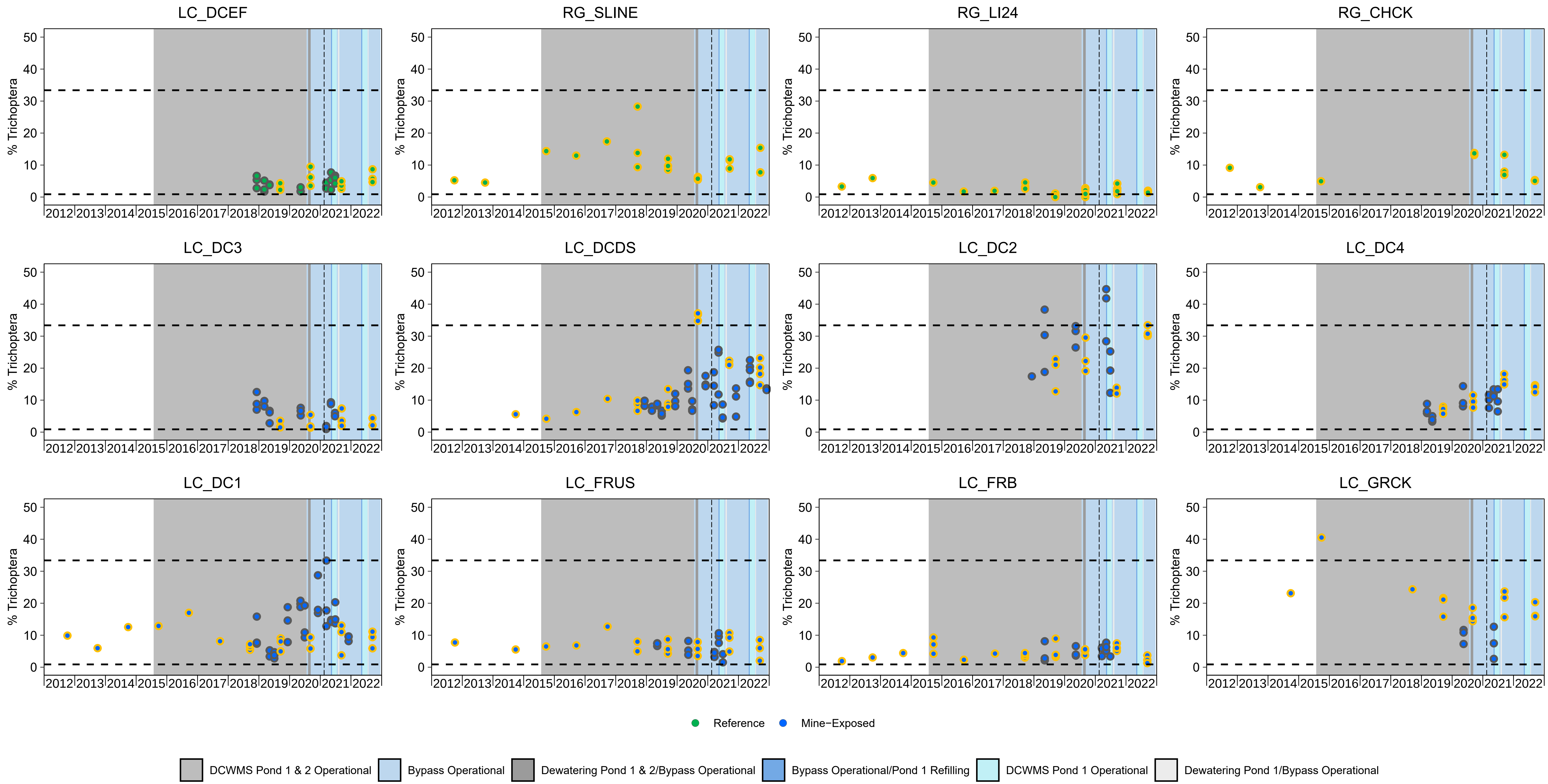

Figure E.2: Benthic Invertebrate Community % Trichoptera from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

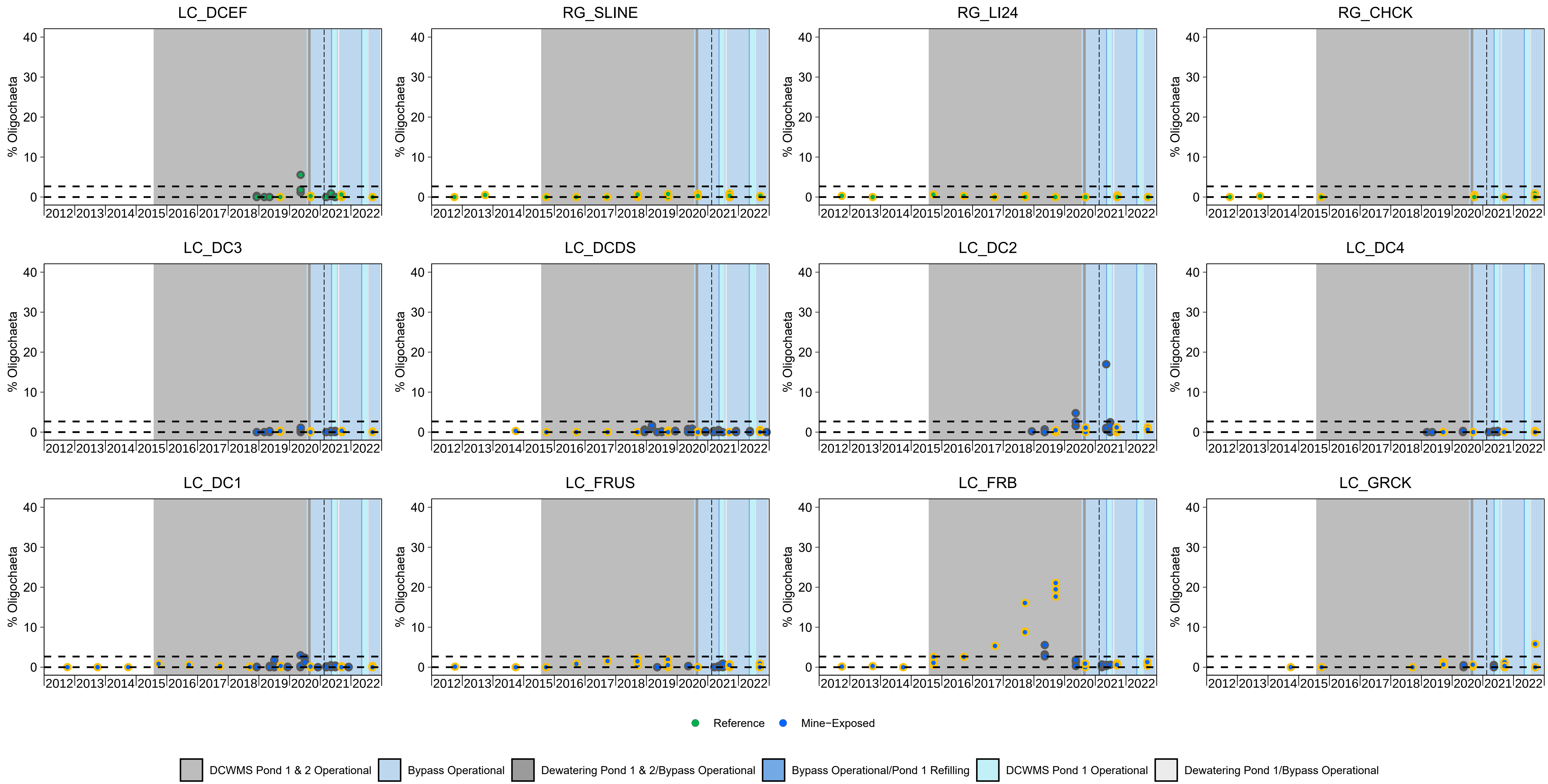

Figure E.3: Benthic Invertebrate Community % Oligochaeta from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

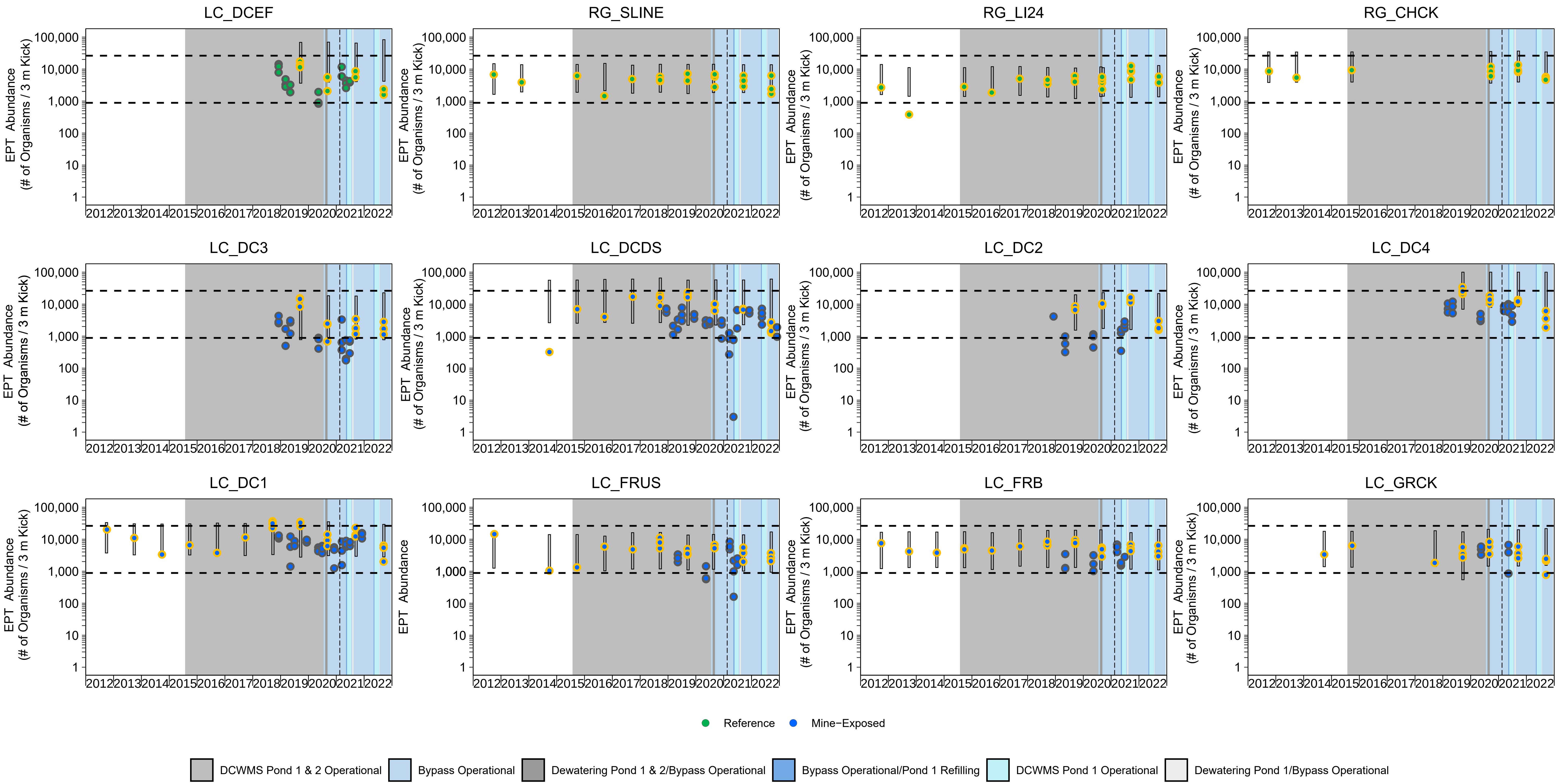

Figure E.4: Benthic Invertebrate Community EPT Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Site specific normal ranges using regression models shown with grey shading and black rectangle (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

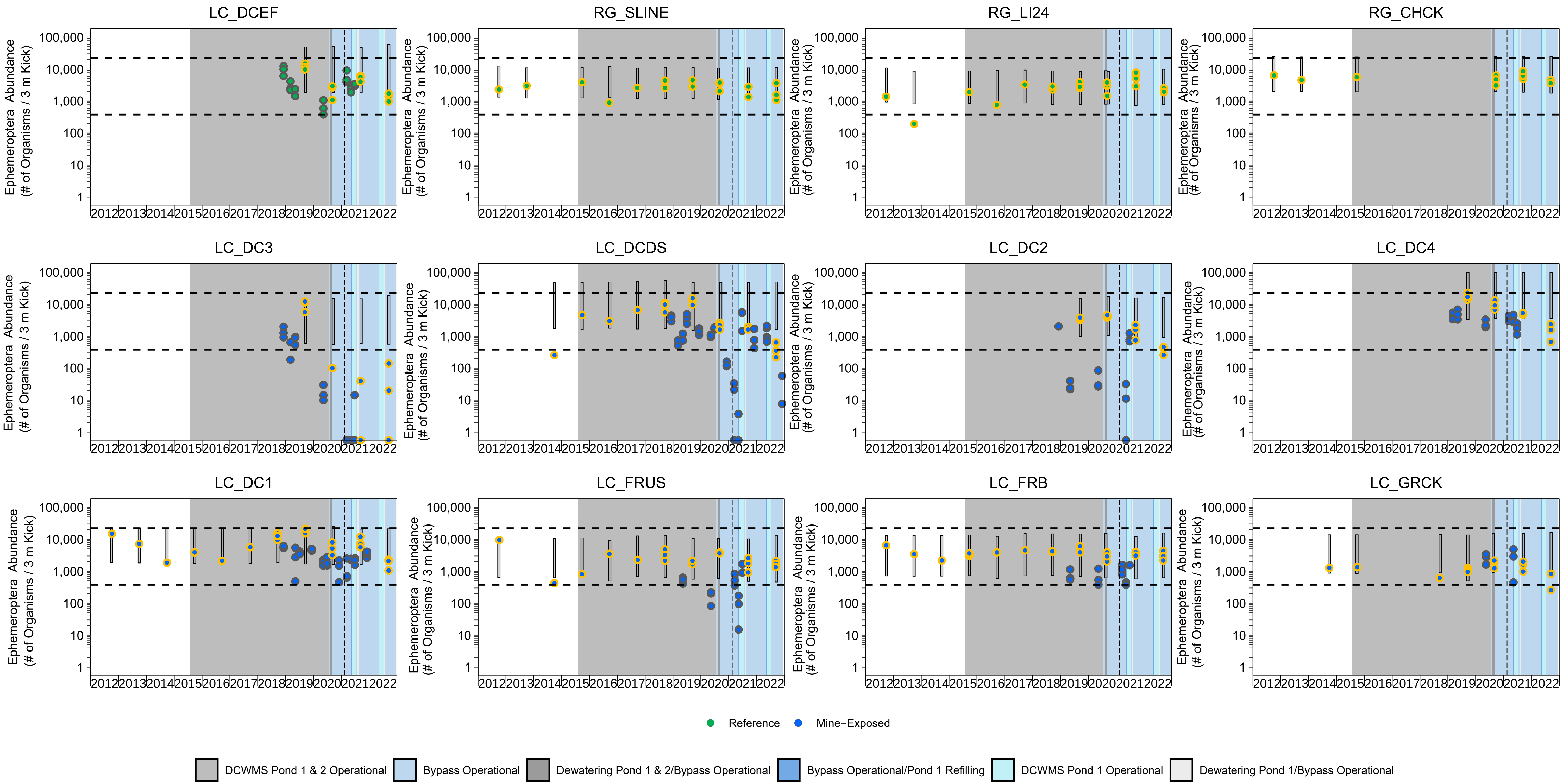

Figure E.5: Benthic Invertebrate Community Ephemeroptera Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Site specific normal ranges using regression models shown with grey shading and black rectangle (when available). Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

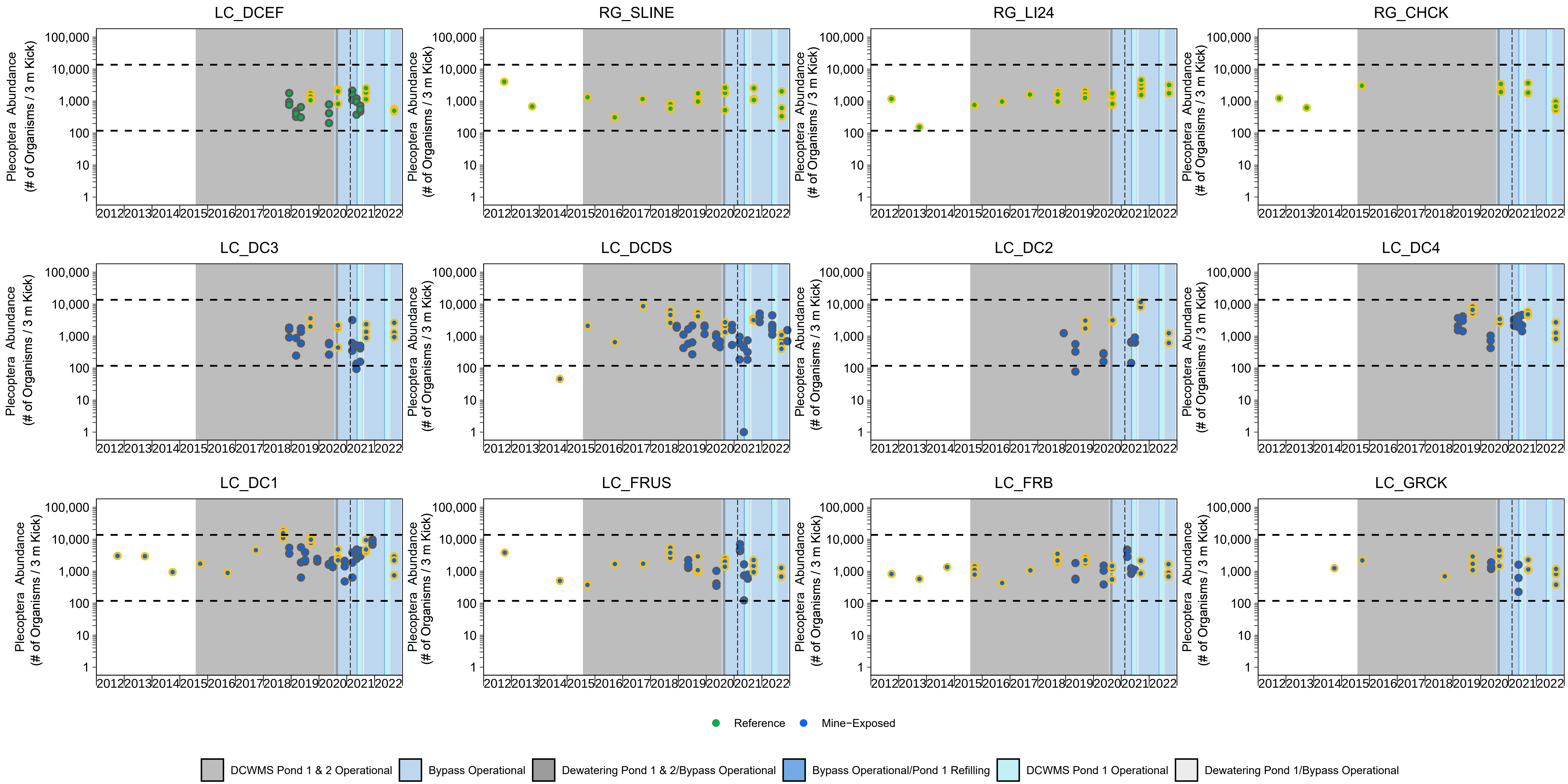

Figure E.6: Benthic Invertebrate Community Plecoptera Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

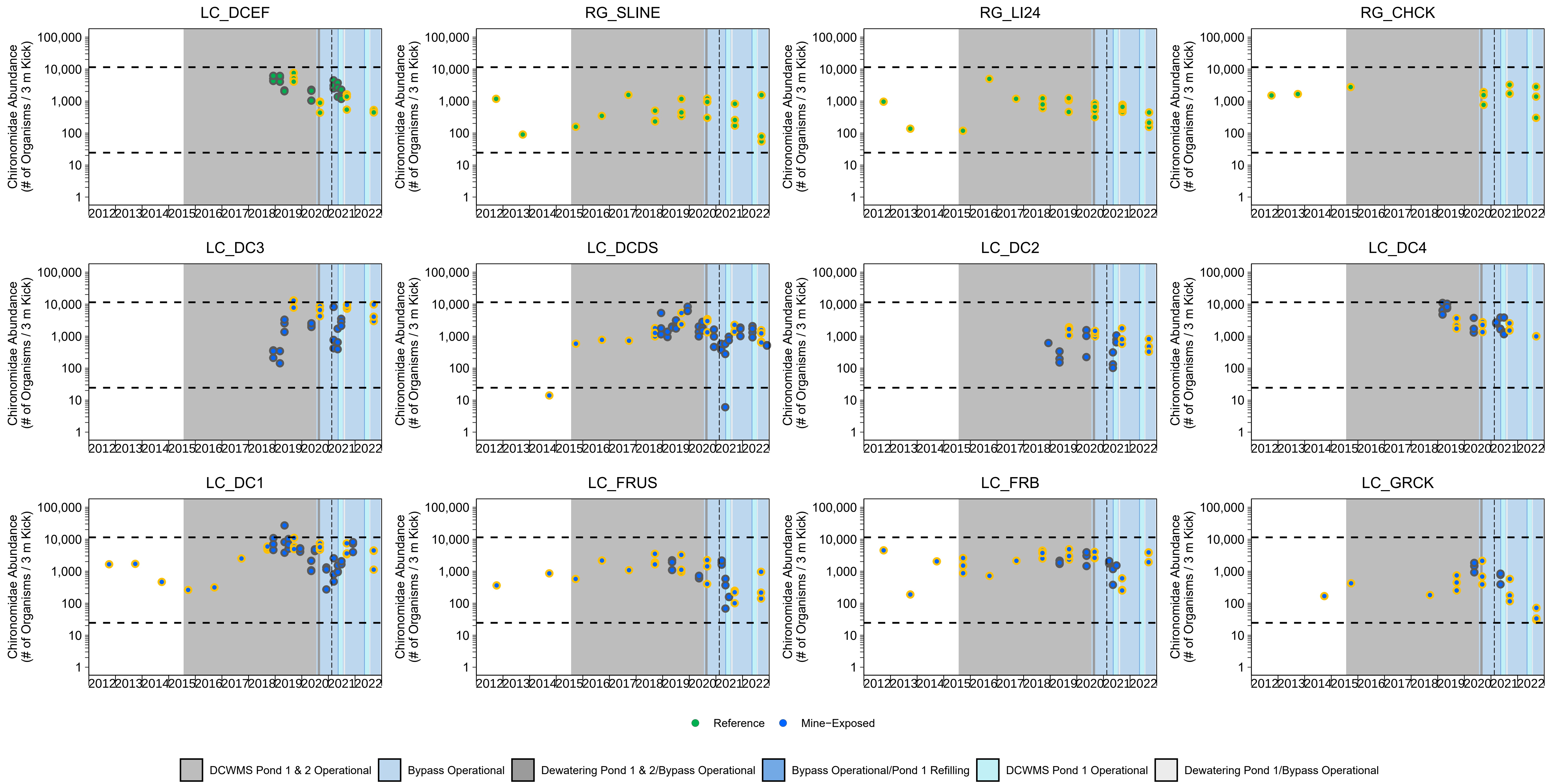

Figure E.7: Benthic Invertebrate Community Chironomidae Abundance (# of Organisms / 3 m Kick) from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

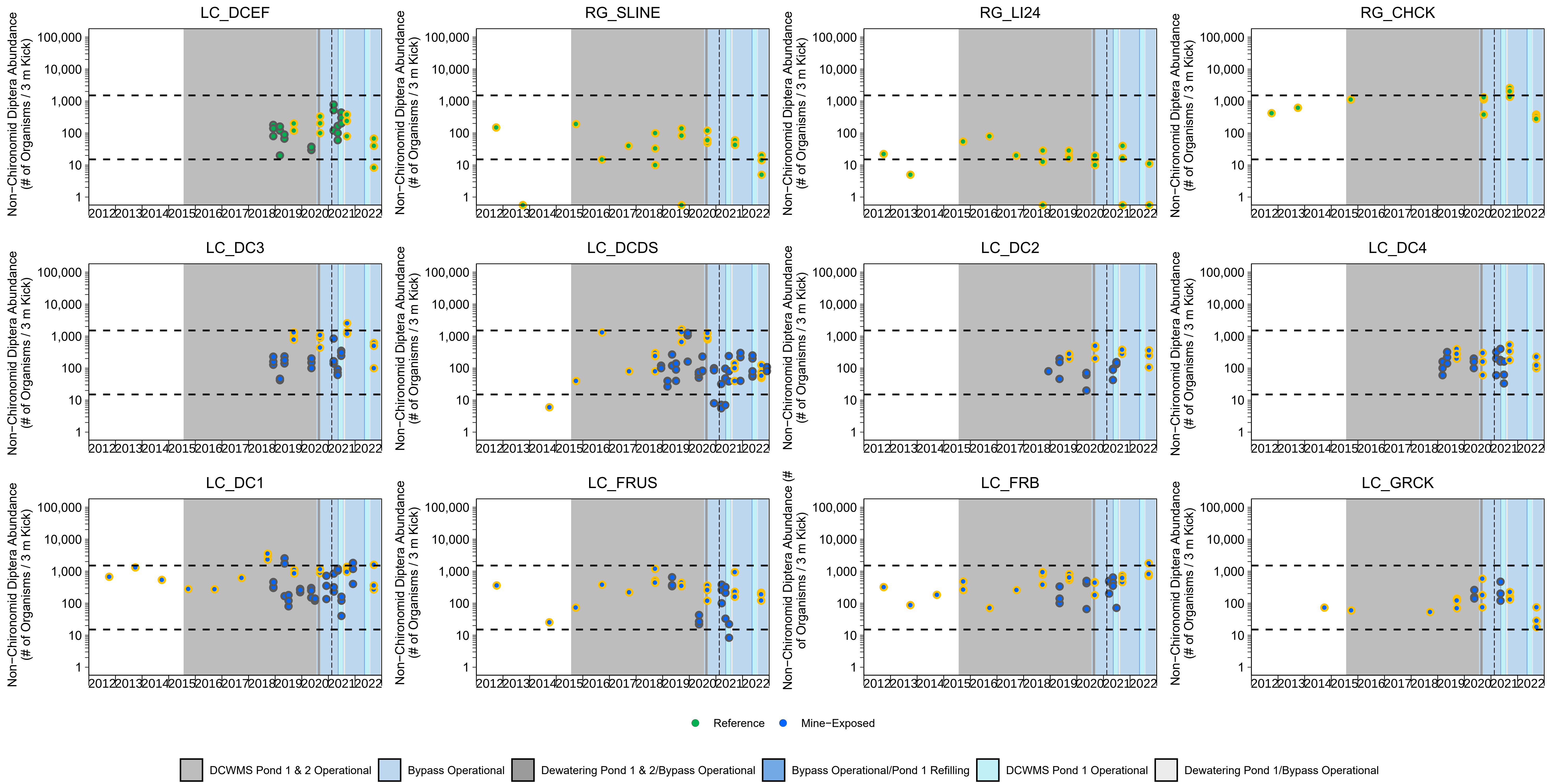

Figure E.8: Benthic Invertebrate Community Non−Chironomid Diptera Abundance (# of Organisms / 3 m Kick) from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

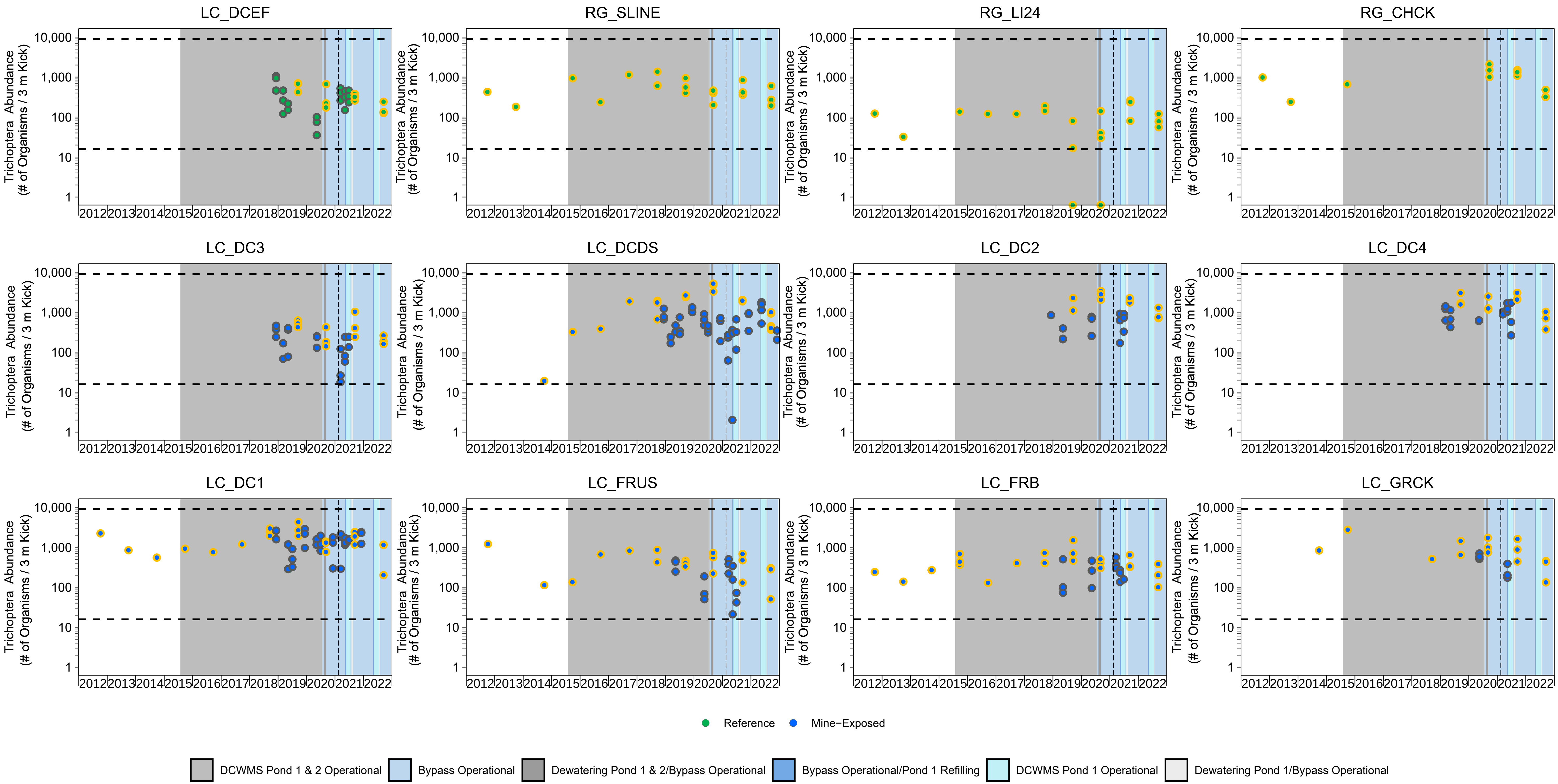

Figure E.9: Benthic Invertebrate Community Trichoptera Abundance from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

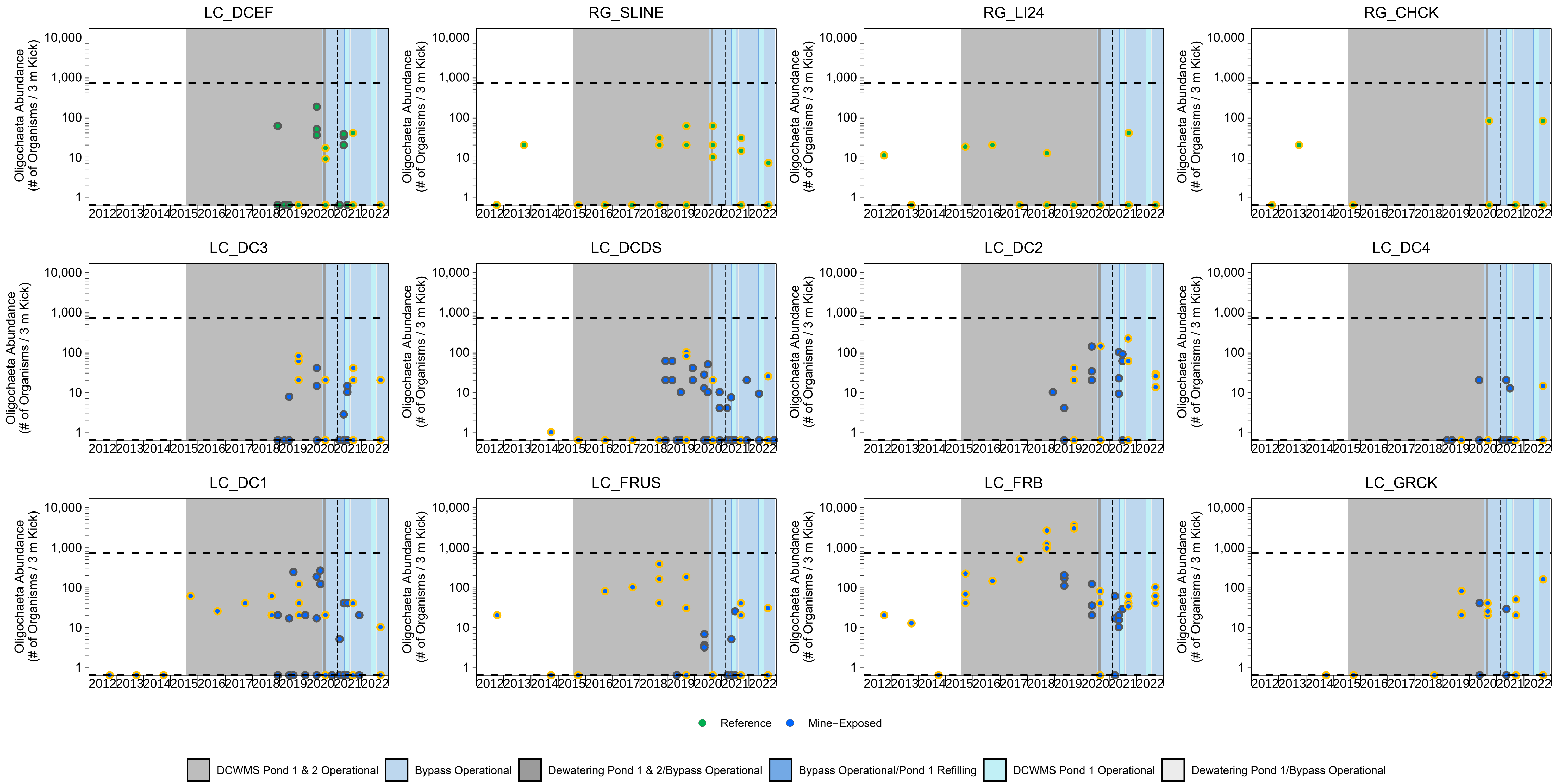

Figure E.10: Benthic Invertebrate Community Oligochaeta Abundance (# of Organisms / 3 m Kick) from Dry Creek LAEMP Sampling Areas, 2012 to 2022

Notes: Normal ranges using percentiles of reference areas from 2012 to 2019 shown as dashed horizontal lines. Orange outline indicates September sampling. Dashed vertical line indicates the Burnt Ridge North spoil failure. Dry Creek Water Management System (DCWMS) operational timelines are displayed for each monitoring area to provide context, but only applies to Dry Creek areas downstream of the DCWMS (LC_SPDC, LC_DCDS, LC_DC2, LC_DC4, and LC_DC1).

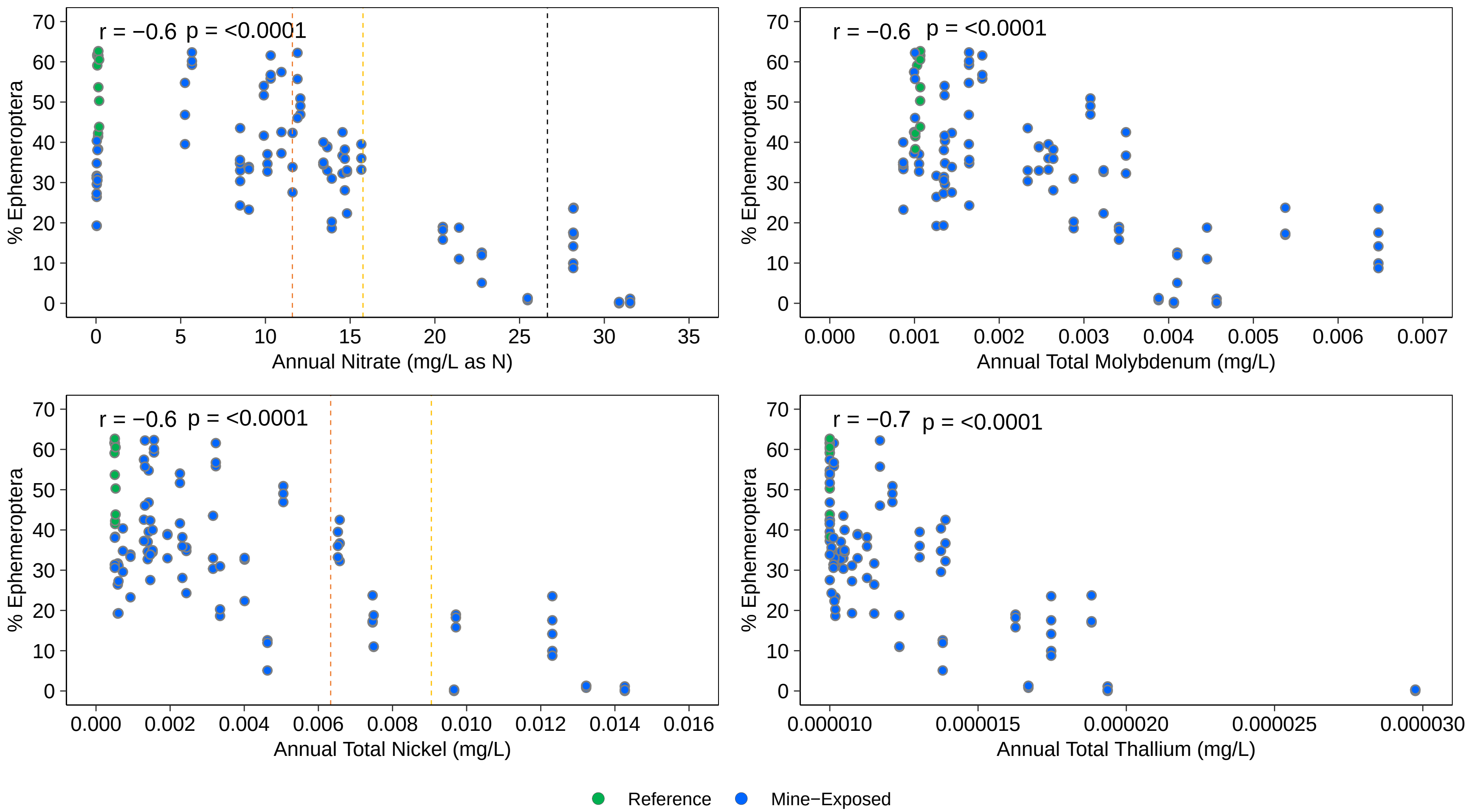

Figure E.11: Scatterplots of Spearman's Correlation Relationships (r > 0.6 or r < −0.6) Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, 2019 to 2022

Notes: Parameters were selected because they were identified as a mine− related early warning triggers. Annual = Averaged mean based on the previous year of water quality sampling. See methods for details. For Benthic Invertebrate Tissue, orange, yellow, and black represent Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP];Golder, 2014), respectively, for growth, reproduction, and survival of benthic invertebrates.

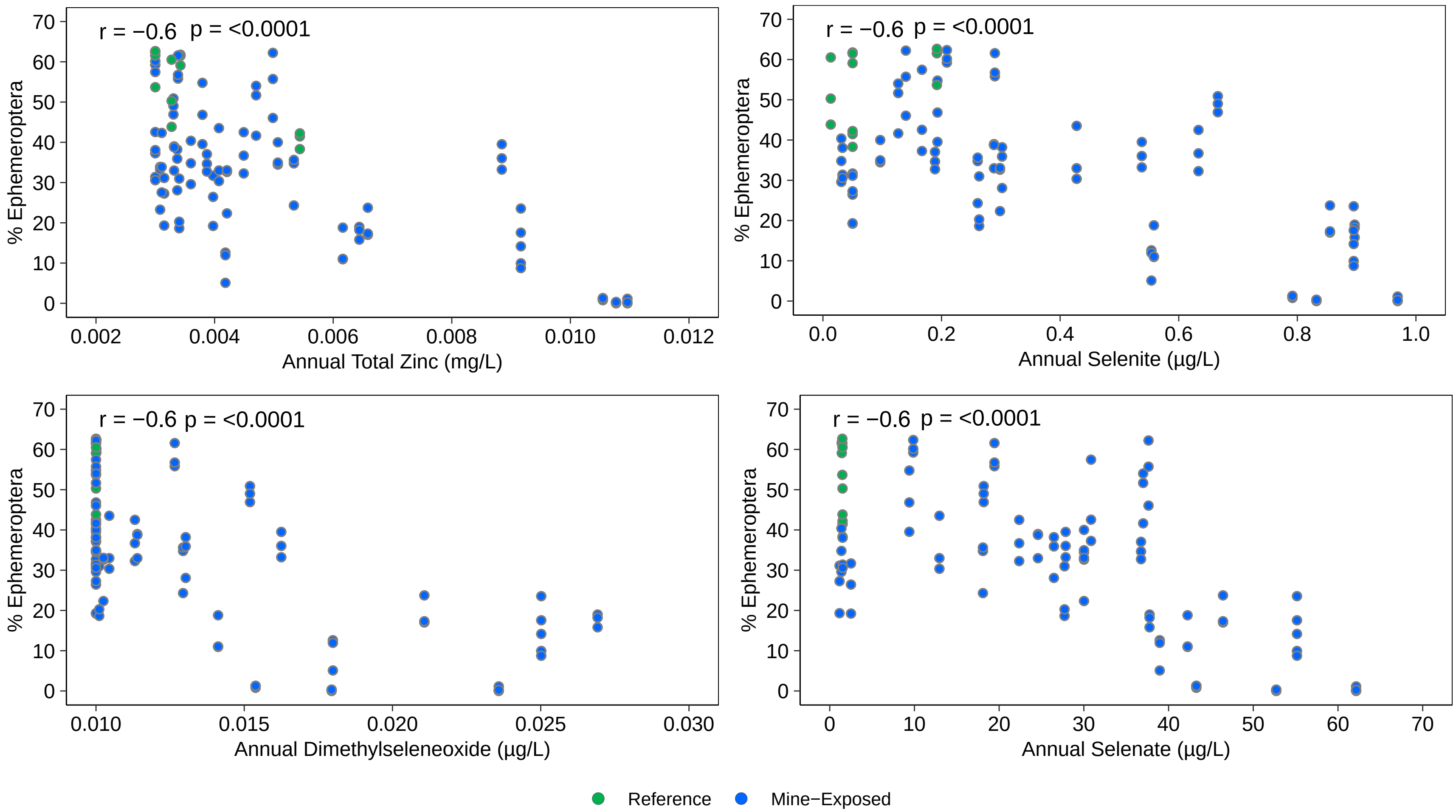

Figure E.11: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, Dry Creek, 2019 to 2022

Notes: Parameters were selected because they were identified as a mine− related early warning triggers. Annual = Averaged mean based on the previous year of water quality sampling. See methods for details. For Benthic Invertebrate Tissue, orange, yellow, and black represent Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP];Golder, 2014), respectively, for growth, reproduction, and survival of benthic invertebrates.

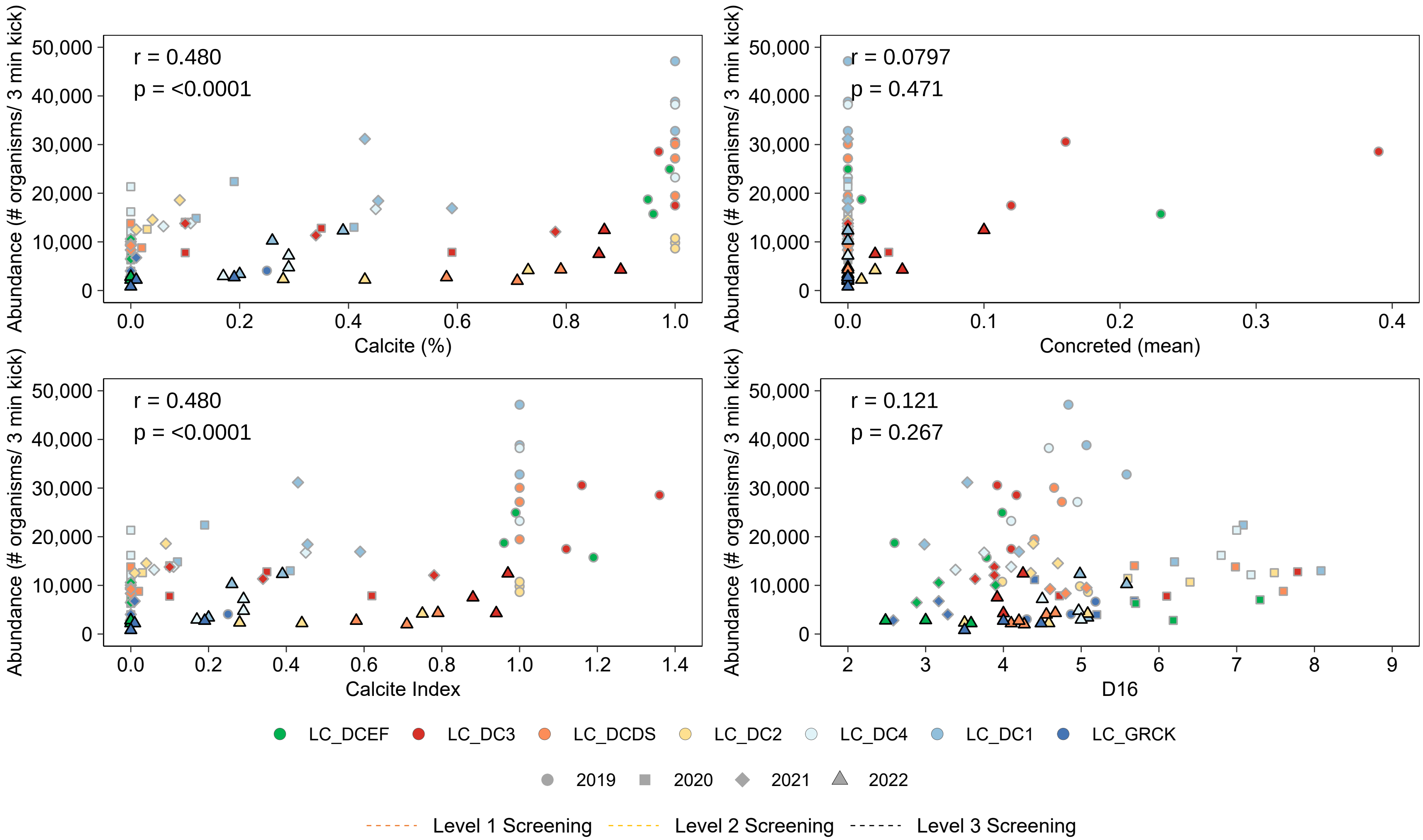

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

Notes: Parameters were selected because they were identified as a mine− related early warning triggers. Annual = Averaged mean based on the previous year of water quality sampling. See methods for details. For Benthic Invertebrate Tissue, orange, yellow, and black represent Level 1, 2, and 3 Benchmarks (Elk Valley Water Quality Plan [EVWQP];Golder, 2014), respectively, for growth, reproduction, and survival of benthic invertebrates.

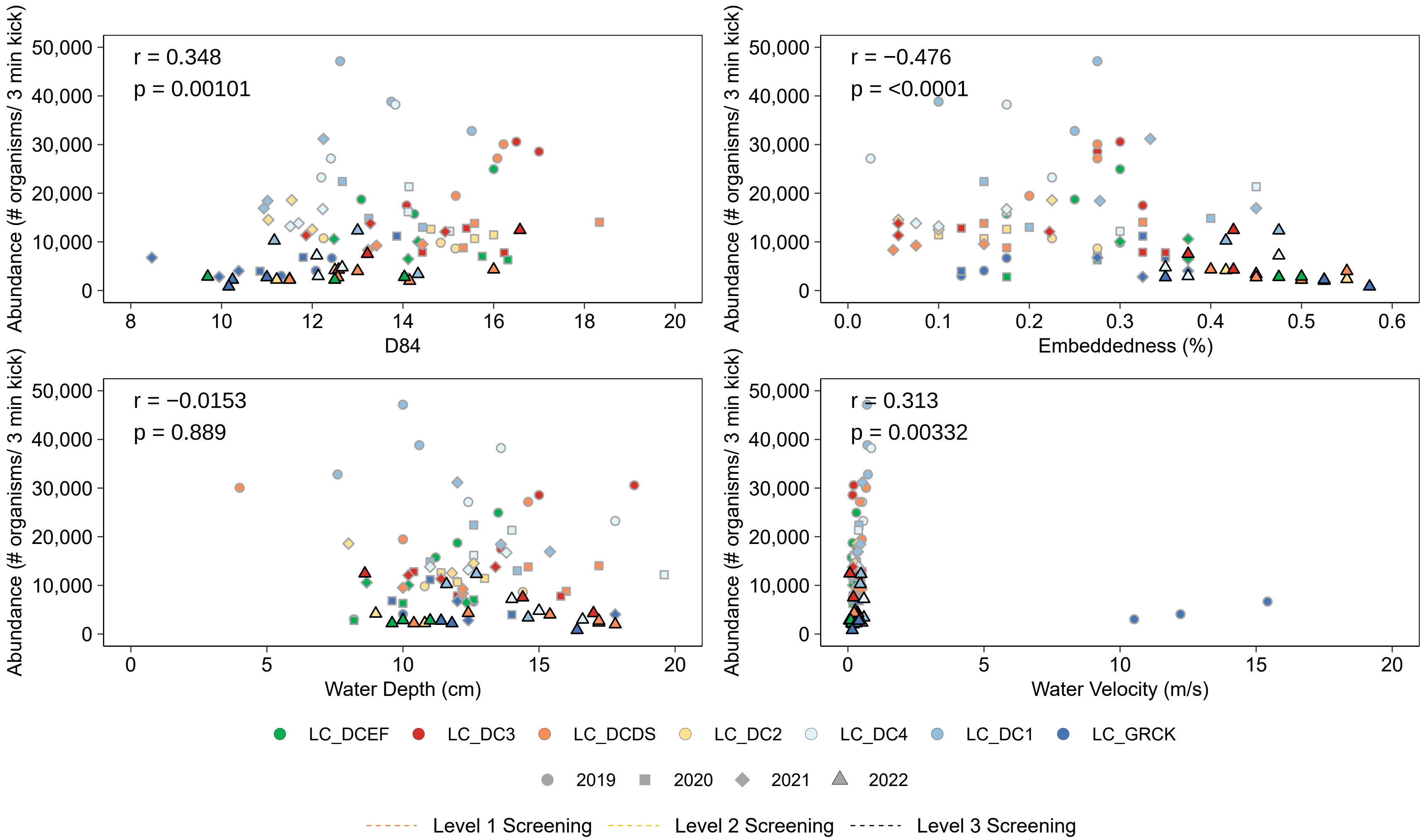

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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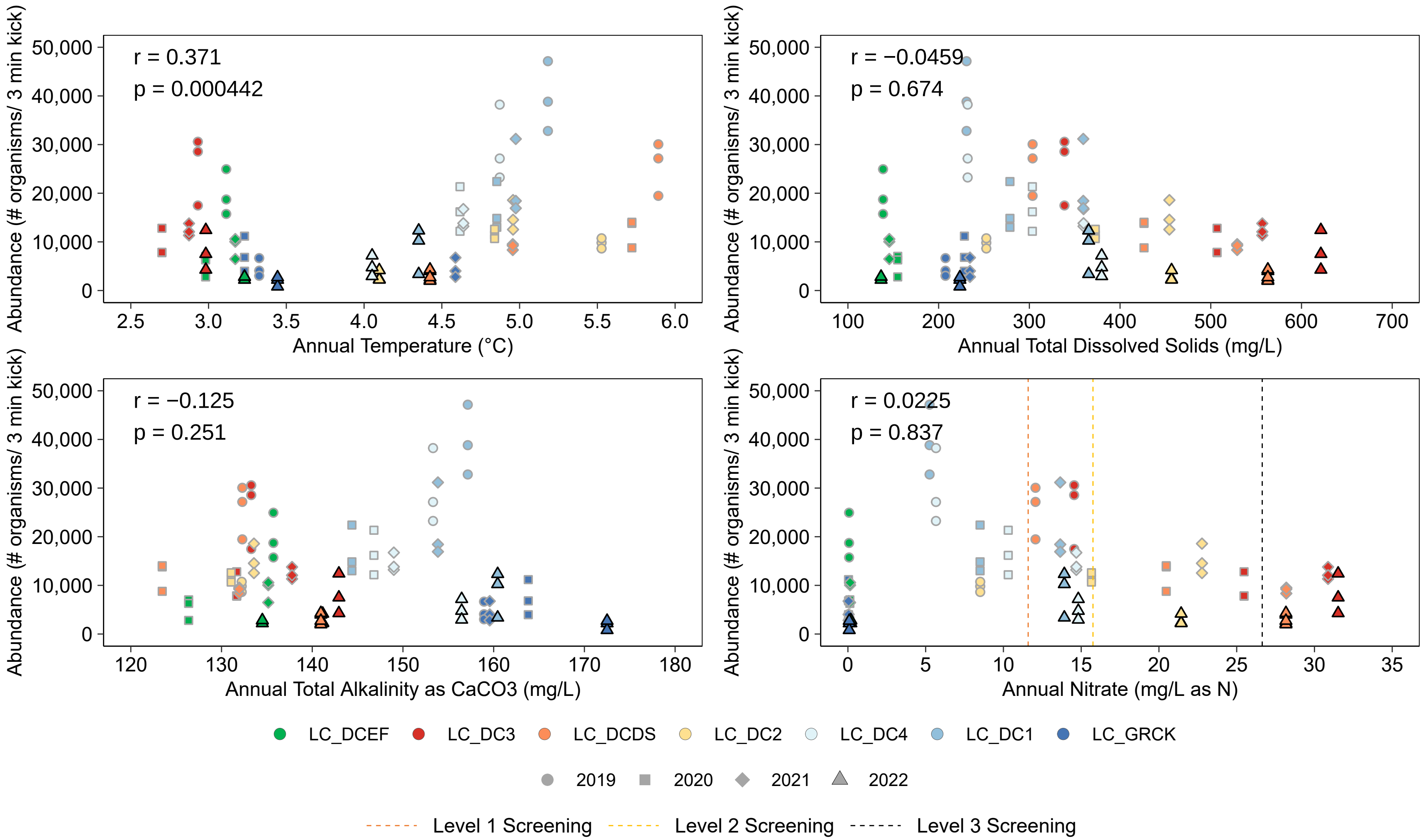

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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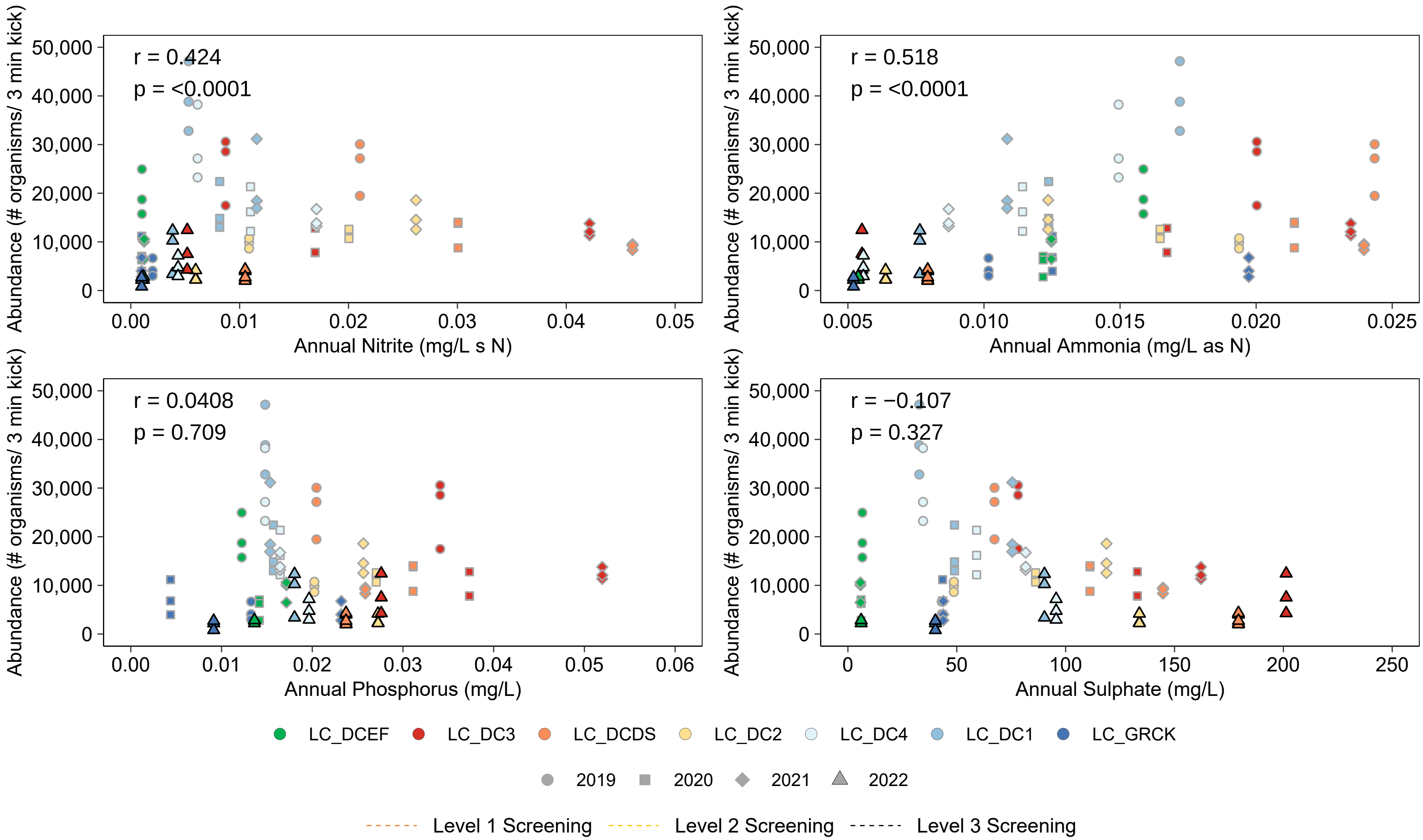

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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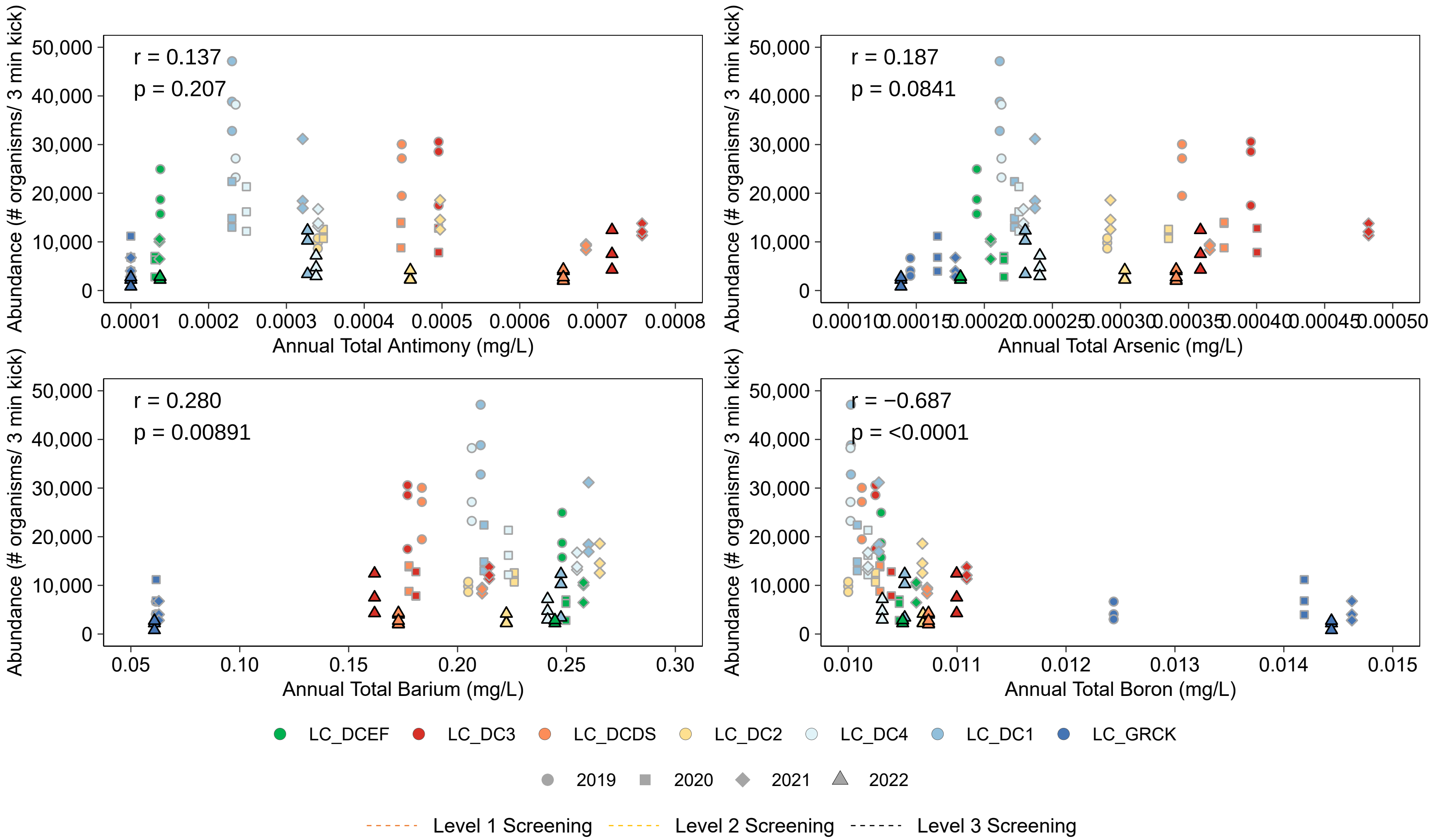

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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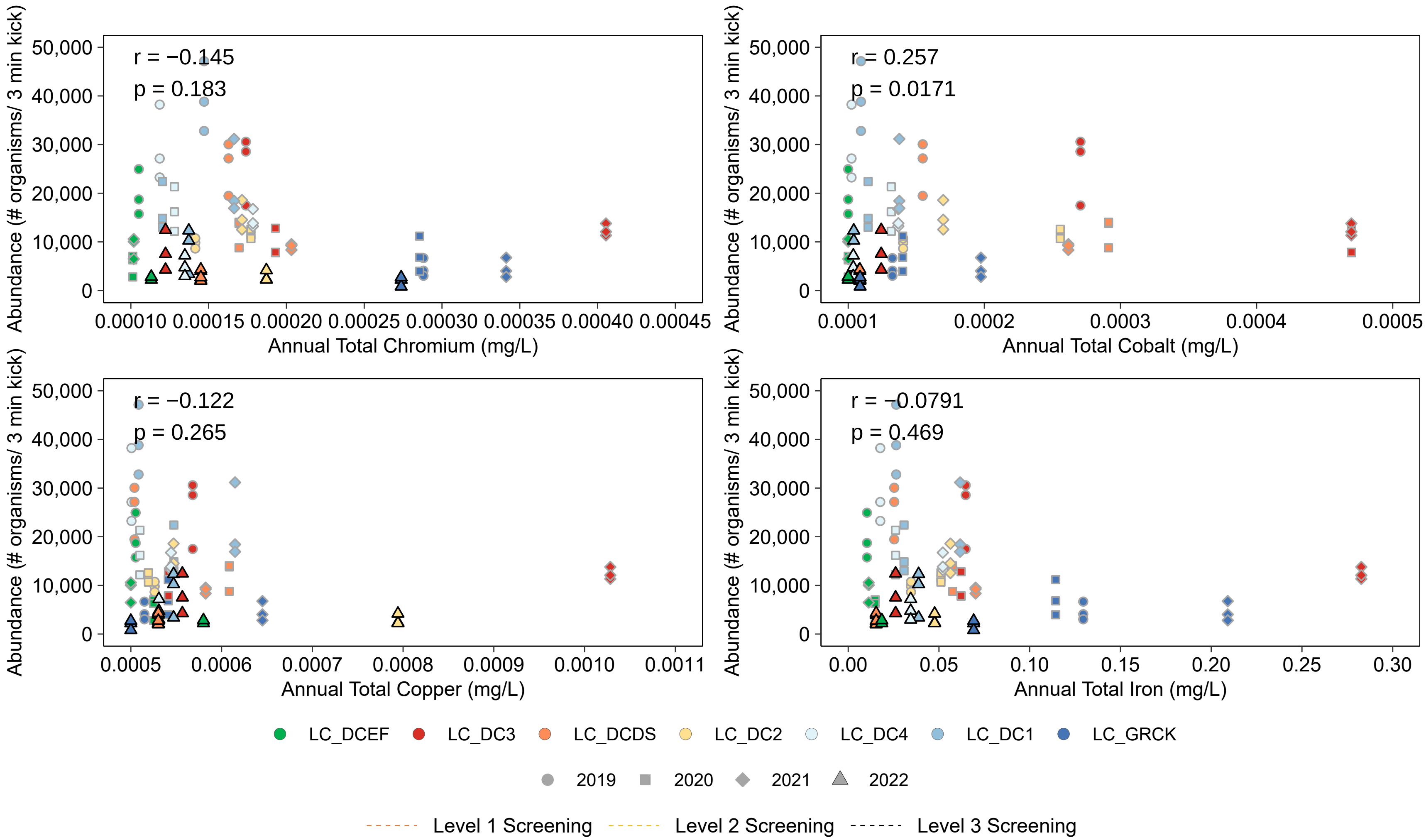

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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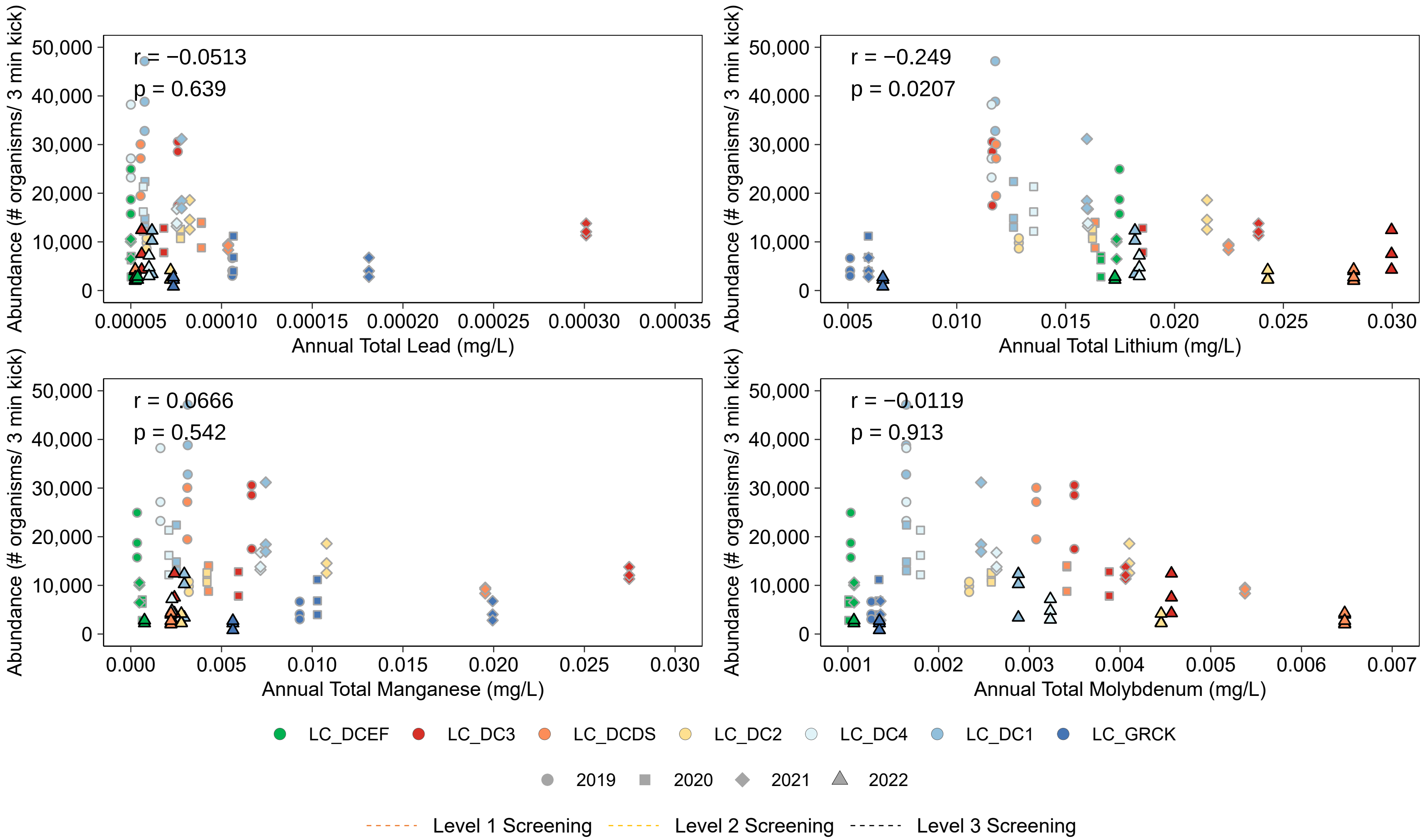

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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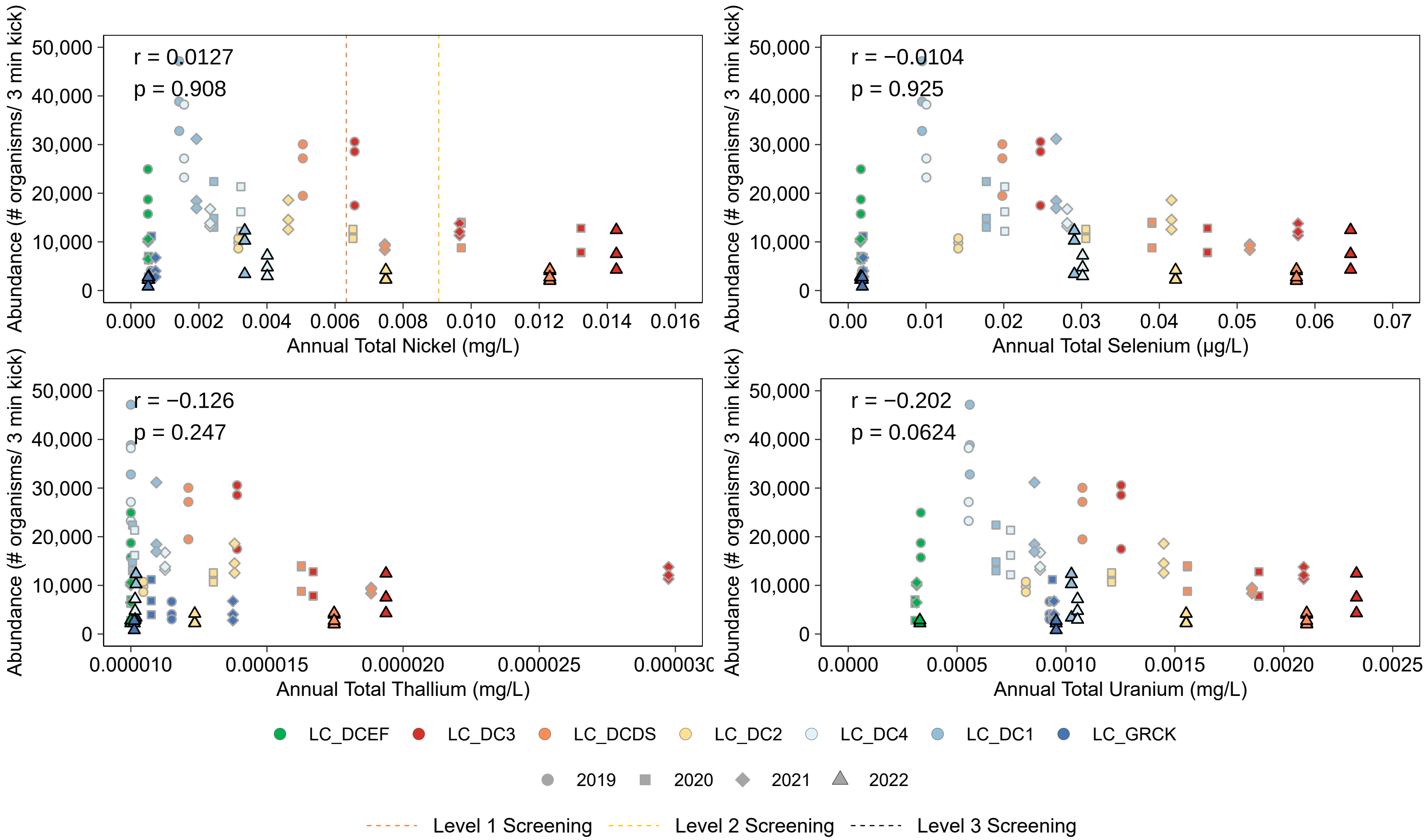

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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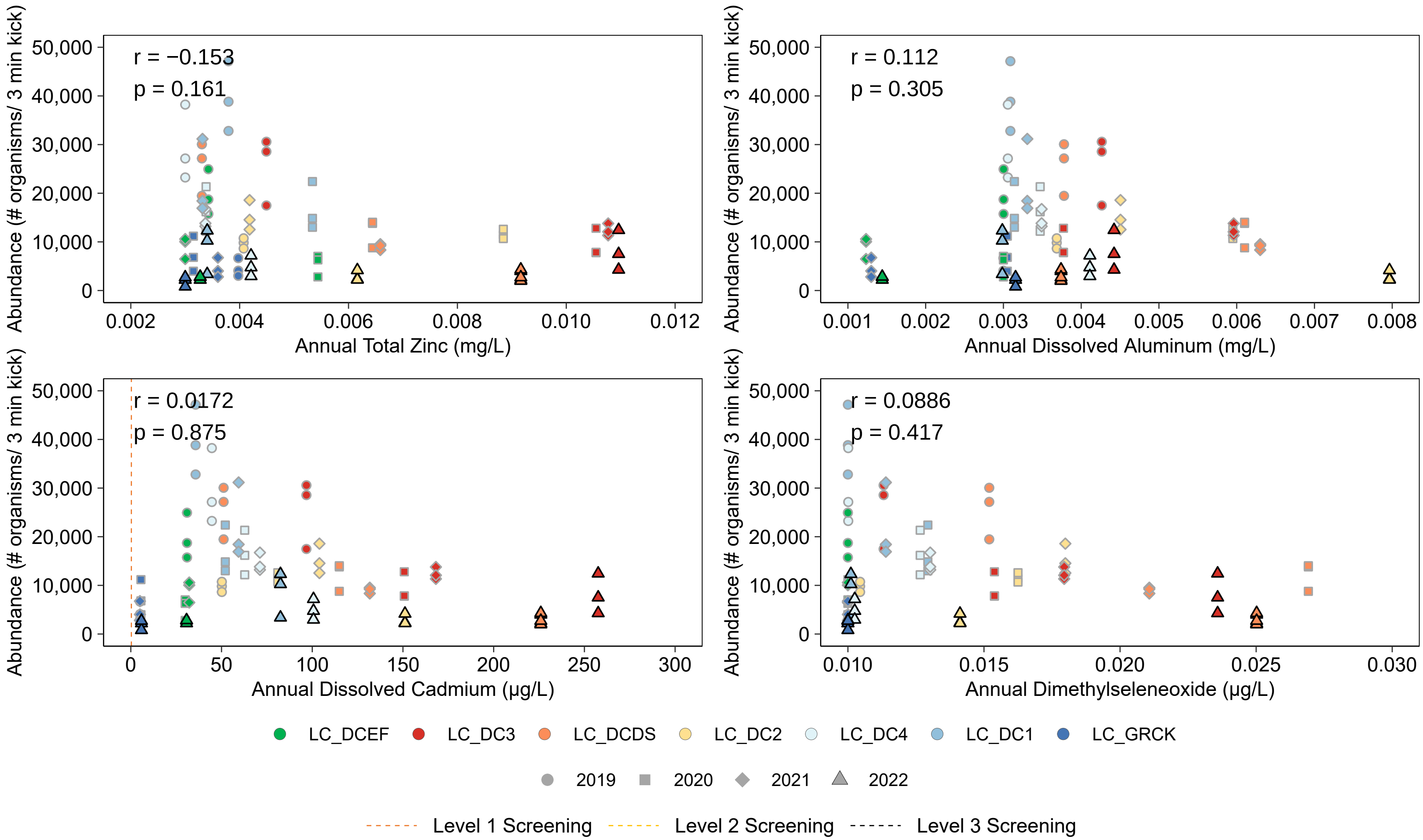

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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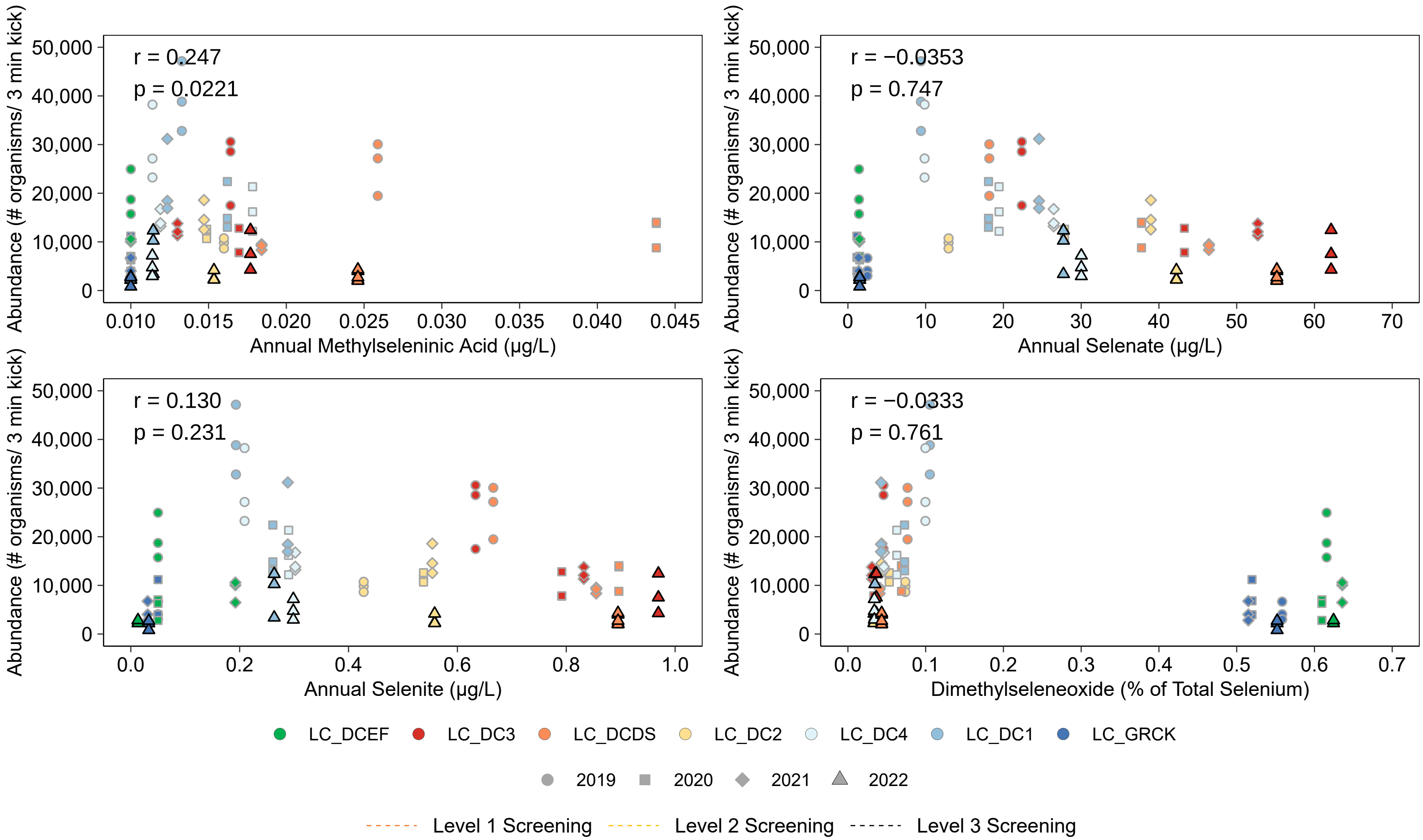

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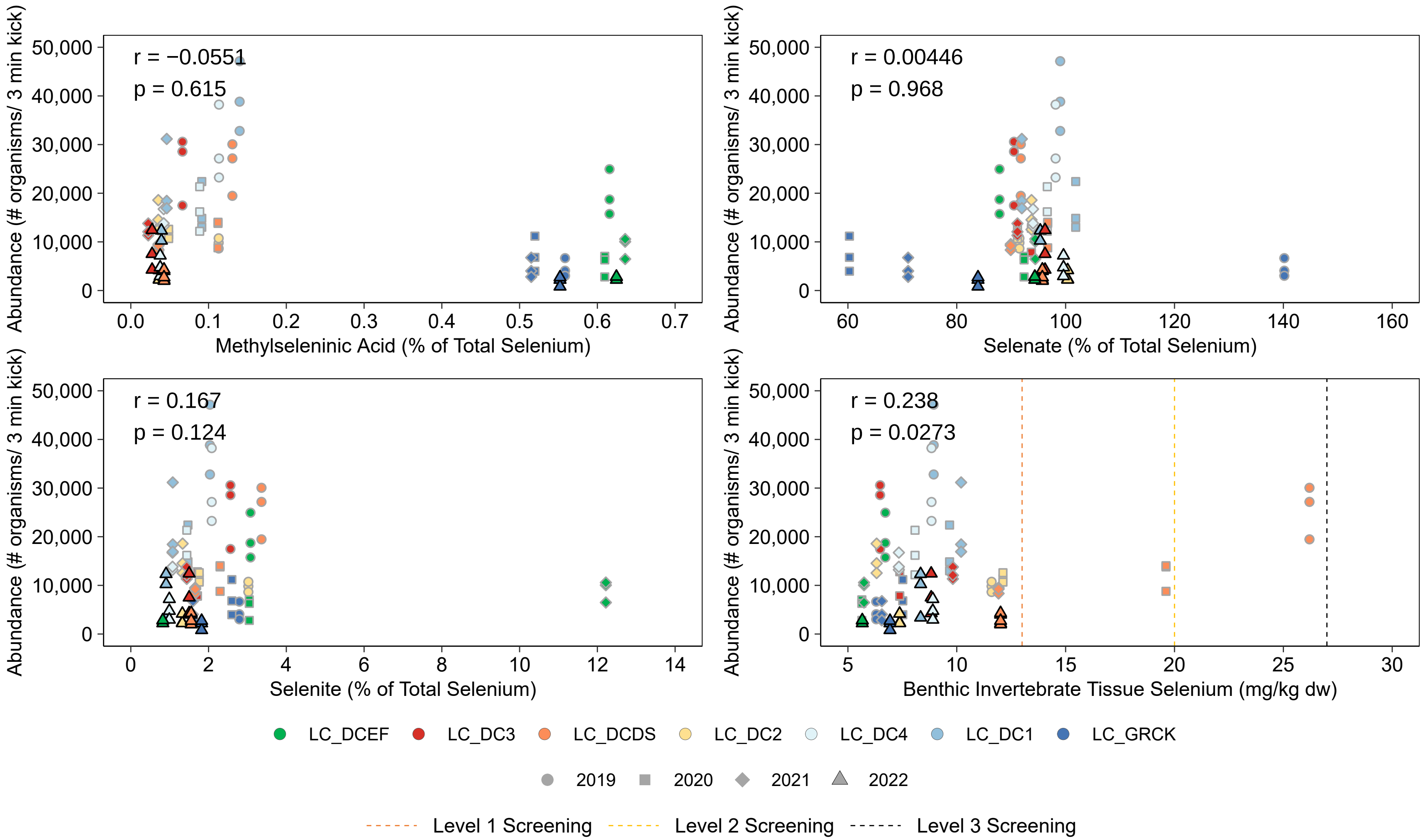

Figure E.12: Scatterplots of Spearman's Correlation Relationships Between Benthic Invertebrate Community Metrics and Physical and Chemical Parameters, LC_DC3, LC_DCDS, LC_DC2, LC_DC4, LC_DCDS and LC_DCEF, 2019 to 2022

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Table E.1: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Dry Creek, Fording River, and Grace Creek, 2022

Area		Biological Area Code	Station	Month	Abundance[a]	LPL Richness (# of taxa)	EPT		Ephemeroptera		Chironomidae		Non-Chironomidae Diptera		Oligochaeta		Trichoptera		Plecoptera	
							Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)
Dry Creek	Mine-Exposed	LC_DCDS	LC_DCDS-1	May	8,700	33	7,200	0.828	940	0.108	1,300	0.149	200	0.0230	0	0	1,780	0.205	4,480	0.515
		LC_DCDS	LC_DCDS-2		5,933	31	3,917	0.660	833	0.140	1,750	0.295	250	0.0421	0	0	1,150	0.194	1,933	0.326
		LC_DCDS	LC_DCDS-3		3,282	31	2,300	0.701	673	0.205	918	0.280	54.5	0.0166	9.09	0.00277	518	0.158	1,109	0.338
		LC_DCDS	LC_DCDS-4		7,280	26	5,140	0.706	1,780	0.245	2,060	0.283	60.0	0.00824	0	0	1,120	0.154	2,240	0.308
		LC_DCDS	LC_DCDS-5		7,020	29	5,240	0.746	2,100	0.299	1,700	0.242	80.0	0.0114	0	0	1,580	0.225	1,560	0.222
	Reference	LC_DCEF	LC_DCEF-1	September	2,783	37	2,208	0.793	1,400	0.503	449	0.161	67.8	0.0243	0	0	242	0.0868	567	0.204
		LC_DCEF	LC_DCEF-2		2,220	42	1,580	0.712	973	0.438	527	0.237	40.0	0.0180	0	0	127	0.0571	480	0.216
		LC_DCEF	LC_DCEF-3		2,850	31	2,358	0.827	1,725	0.605	442	0.155	8.33	0.00292	0	0	133	0.0468	500	0.175
	Mine-Exposed	LC_DC3	LC_DC3-1		12,440	31	1,700	0.137	140	0.0113	9,800	0.788	620	0.0498	20.0	0.00161	260	0.0209	1,300	0.105
		LC_DC3	LC_DC3-2		4,288	27	1,125	0.262	0	0	2,950	0.688	100	0.0233	0	0	188	0.0437	938	0.219
		LC_DC3	LC_DC3-3		7,520	32	2,800	0.372	20.0	0.00266	4,060	0.540	500	0.0665	0	0	160	0.0213	2,620	0.348
		LC_DCDS	LC_DCDS-1		2,213	40	1,407	0.636	220	0.0994	667	0.301	127	0.0572	0	0	447	0.202	740	0.334
		LC_DCDS	LC_DCDS-2		4,000	38	2,425	0.606	350	0.0875	1,450	0.362	125	0.0312	0	0	925	0.231	1,150	0.288
		LC_DCDS	LC_DCDS-3		1,994	40	1,275	0.639	350	0.176	631	0.317	75.0	0.0376	0	0	362	0.182	562	0.282
		LC_DCDS	LC_DCDS-4		4,325	41	2,700	0.624	613	0.142	1,538	0.355	50.0	0.0116	25.0	0.00578	1,000	0.231	1,088	0.251
		LC_DCDS	LC_DCDS-5		2,725	34	1,442	0.529	642	0.235	1,225	0.450	58.3	0.0214	0	0	400	0.147	400	0.147
		LC_DC2	LC_DC2-1		2,350	40	1,571	0.669	257	0.109	471	0.201	250	0.106	28.6	0.0122	707	0.301	607	0.258
		LC_DC2	LC_DC2-2		2,233	32	1,780	0.797	420	0.188	327	0.146	107	0.0478	13.3	0.00597	747	0.334	613	0.275
		LC_DC2	LC_DC2-3		4,188	38	2,988	0.713	463	0.110	813	0.194	362	0.0866	25.0	0.00597	1,288	0.307	1,238	0.296
		LC_DC4	LC_DC4-1		4,771	40	3,529	0.740	1,557	0.326	1,000	0.210	229	0.0479	14.3	0.00299	700	0.147	1,271	0.266
		LC_DC4	LC_DC4-2		7,200	37	6,100	0.847	2,380	0.331	1,000	0.139	100	0.0139	0	0	1,020	0.142	2,700	0.375
		LC_DC4	LC_DC4-3		2,962	39	1,854	0.626	662	0.223	985	0.332	123	0.0416	0	0	369	0.125	823	0.278
		LC_DC1	LC_DC1-1		12,340	35	6,360	0.515	2,300	0.186	4,340	0.352	1,600	0.130	0	0	1,160	0.0940	2,900	0.235
		LC_DC1	LC_DC1-2		3,390	33	1,990	0.587	1,050	0.310	1,120	0.330	270	0.0796	10.00	0.00295	200	0.0590	740	0.218
		LC_DC1	LC_DC1-3		10,260	36	5,400	0.526	2,080	0.203	4,460	0.435	360	0.0351	0	0	1,140	0.111	2,180	0.212

Notes: LPL= Lowest Practical Level; EPT= Ephemeroptera, Plecoptera, and Trichoptera.

[a] Units for abundance are number of organisms per 3-minute kick (org/ 3-min kick).

Table E.1: Summary of Benthic Invertebrate Endpoints Collected by 3-Minute Kick and Sweep Sampling at Dry Creek, Fording River, and Grace Creek, 2022

Area		Biological Area Code	Station	Month	Abundance[a]	LPL Richness (# of taxa)	EPT		Ephemeroptera		Chironomidae		Non-Chironomidae Diptera		Oligochaeta		Trichoptera		Plecoptera	
							Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)	Abundance[a]	Relative Abundance (%)
Grace Creek	Mine-Exposed	LC_GRCK	LC_GRCK-1	September	2,214	32	2,114	0.955	843	0.381	71.4	0.0323	28.6	0.0129	0	0	450	0.203	821	0.371
		LC_GRCK	LC_GRCK-2		822	40	768	0.934	258	0.314	30.0	0.0365	18.0	0.0219	0	0	132	0.161	378	0.460
		LC_GRCK	LC_GRCK-3		2,725	37	2,442	0.896	833	0.306	33.3	0.0122	75.0	0.0275	158	0.0581	433	0.159	1,175	0.431
Fording River	Mine-Exposed	LC_FRUS	LC_FRUS-1		5,043	37	3,671	0.728	2,100	0.416	957	0.190	214	0.0425	0	0	300	0.0595	1,271	0.252
		LC_FRUS	LC_FRUS-2		3,290	36	2,660	0.809	1,700	0.517	140	0.0426	190	0.0578	30.0	0.00912	280	0.0851	680	0.207
		LC_FRUS	LC_FRUS-3		2,486	35	2,071	0.833	1,343	0.540	214	0.0862	121	0.0489	0	0	50.0	0.0201	679	0.273
		LC_FRB	LC_FRB-1		10,300	40	6,400	0.621	4,360	0.423	1,920	0.186	1,780	0.173	40.0	0.00388	380	0.0369	1,660	0.161
		LC_FRB	LC_FRB-2		8,860	39	4,100	0.463	3,000	0.339	3,760	0.424	720	0.0813	60.0	0.00677	200	0.0226	900	0.102
		LC_FRB	LC_FRB-3		7,840	35	2,940	0.375	2,160	0.276	3,880	0.495	820	0.105	100.0	0.0128	100.0	0.0128	680	0.0867
Dry Creek	Mine-Exposed	LC_DCDS	LC_DCDS-1	November	1,557	36	957	0.615	57.1	0.0367	505	0.324	81.0	0.0520	0	0	205	0.131	695	0.446
		LC_DCDS	LC_DCDS-2		2,531	31	1,892	0.748	7.69	0.00304	523	0.207	108	0.0426	0	0	346	0.137	1,538	0.608

Notes: LPL= Lowest Practical Level; EPT= Ephemeroptera, Plecoptera, and Trichoptera.

[a] Units for abundance are number of organisms per 3-minute kick (org/ 3-min kick).

Table E.2: Preliminary Statistical Comparison of Benthic Invertebrate Community Endpoints in Dry Creek, September 2019 to 2022

Endpoint	Transformation	Year	Area	Year:Area	Station		Do endpoints differ between years for each station?[a]							Do endpoints for exposed areas differ from the reference area within each year?[b]			
							2019	2020	2021	2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2019	2020	2021	2022
Abundance	log10	<0.001	<0.001	0.002	Reference	LC_DCEF	A	B	B	C	-5.9	-3.4	-8.7	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	B	B	B	-3.2	-2.3	-4.0	ns	ns	ns	7.6
						LC_DCDS	A	B	B	C	-3.3	-4.5	-9.5	ns	1.7	ns	ns
						LC_DC2	A	A	A	B	ns	ns	-11	-3.0	1.7	ns	ns
						LC_DC4	A	AB	B	C	ns	-2.7	-7.2	ns	2.3	ns	ns
						LC_DC1	A	B	B	C	-4.8	-3.3	-9.1	3.0	2.4	3.3	7.7
LPL Richness	log10	0.011	0.191	0.012	Reference	LC_DCEF	A	A	A	A	ns	ns	ns	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	B	B	B	-11	-11	-19	5.2	ns	ns	ns
						LC_DCDS	A	A	A	A	ns	ns	ns	ns	ns	ns	ns
						LC_DC2	A	A	A	A	ns	ns	ns	ns	ns	ns	ns
						LC_DC4	A	A	A	A	ns	ns	ns	ns	ns	ns	ns
						LC_DC1	AB	AB	A	B	ns	ns	ns	ns	ns	ns	ns
% EPT	none	<0.001	<0.001	<0.001	Reference	LC_DCEF	B	AB	A	AB	ns	6.4	ns	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	B	B	B	-17	-19	-13	-11	-14	-33	-8.7
						LC_DCDS	A	AB	A	B	ns	ns	-3.4	ns	ns	ns	-2.9
						LC_DC2	AB	A	A	B	ns	ns	ns	ns	ns	ns	ns
						LC_DC4	A	A	A	B	ns	ns	-9.5	10	ns	ns	ns
						LC_DC1	A	B	A	B	-4.0	ns	-4.6	ns	-4.9	ns	-3.9
% Ephemeroptera	log10	<0.001	<0.001	<0.001	Reference	LC_DCEF	A	B	A	A	-15	ns	ns	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	B	B	B	-8.1	-8.4	-8.3	-17	-22	-15	-7.4
						LC_DCDS	A	B	B	B	-18	-17	-19	ns	-12	-9.3	-5.0
						LC_DC2	A	A	B	B	ns	-4.1	-3.5	-19	ns	-12	-5.2
						LC_DC4	A	A	B	B	ns	-18	-22	ns	7.9	-5.6	-2.9
						LC_DC1	A	BC	B	C	-2.1	-1.4	-3.4	-9.9	ns	-4.9	-3.7
% Plecoptera	rank	<0.001	<0.001	<0.001	Reference	LC_DCEF	C	A	B	BC	62	32	ns	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	B	AB	B	A	ns	ns	129	ns	-15	ns	ns
						LC_DCDS	C	C	A	B	ns	107	58	ns	-17	17	ns
						LC_DC2	B	B	A	AB	ns	17	ns	60	ns	42	3.8
						LC_DC4	BC	C	A	AB	ns	28	ns	43	-10	15	4.0
						LC_DC1	AB	B	A	AB	ns	ns	ns	50	-14	ns	ns
% Trichoptera	log10	<0.001	<0.001	0.014	Reference	LC_DCEF	B	A	AB	A	2.0	ns	2.1	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	A	A	A	ns	ns	ns	ns	-1.8	ns	-2.6
						LC_DCDS	C	A	AB	B	4.7	2.8	2.5	3.5	3.6	5.6	3.7
						LC_DC2	AB	AB	B	A	ns	ns	ns	5.4	2.7	4.0	5.2
						LC_DC4	B	AB	A	A	ns	5.2	4.1	2.5	ns	4.7	2.5
						LC_DC1	A	A	A	A	ns	ns	ns	2.6	ns	2.5	ns

P-value < 0.1

MOD > 2

MOD < -2

Notes: "nc" = no relevant comparison; "ns" = not significant.

[a] MOD = MCT_{year2}-MCT_{year1}/SD_{year1} where MCT is the median for rank transformed data and the back-transformed estimated marginal means for others. Median Absolute Deviation (MAD) was used instead of standard deviation for rank-transformed data.

[b] MOD = MCT_{stn}-MCT_{LC_DCEF}/SD_{LC_DCEF} where MCT is the median for rank transformed data and the back-transformed estimated marginal means for others. Median Absolute Deviation (MAD) was used instead of standard deviation for rank-transformed data.

Table E.2: Preliminary Statistical Comparison of Benthic Invertebrate Community Endpoints in Dry Creek, September 2019 to 2022

Endpoint	Transformation	Year	Area	Year:Area	Station		Do endpoints differ between years for each station?[a]							Do endpoints for exposed areas differ from the reference area within each year?[b]			
							2019	2020	2021	2022	2019 vs 2020	2019 vs 2021	2019 vs 2022	2019	2020	2021	2022
% Oligochaeta	rank	0.648	0.009	0.264	Reference	LC_DCEF	A	A	A	A	ns	ns	ns	nc			
					Mine-Exposed	LC_DC3								ns			
						LC_DCDS								ns			
						LC_DC2								ns			
						LC_DC4								ns			
						LC_DC1								ns			
% Chironomidae	log10	<0.001	<0.001	<0.001	Reference	LC_DCEF	A	B	B	AB	-7.7	-9.8	ns	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	A	A	A	ns	ns	ns	ns	13	5.0	5.5
						LC_DCDS	B	B	B	A	ns	ns	3.1	-6.4	ns	1.6	2.8
						LC_DC2	AB	B	C	A	ns	-2.9	ns	-6.9	ns	-2.0	ns
						LC_DC4	B	B	B	A	ns	ns	4.3	-14	ns	ns	ns
						LC_DC1	B	A	B	A	2.3	ns	2.4	ns	7.8	1.7	3.0
% Non-Chironomidae Diptera	log10	0.007	<0.001	<0.001	Reference	LC_DCEF	C	A	AB	BC	4.1	2.8	ns	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	B	AB	A	B	ns	3.1	ns	4.3	ns	2.0	1.2
						LC_DCDS	AB	A	C	B	ns	-5.4	ns	4.6	ns	ns	ns
						LC_DC2	B	AB	B	A	ns	ns	3.9	3.1	ns	ns	1.7
						LC_DC4	B	B	AB	A	ns	ns	10	ns	-1.9	ns	ns
						LC_DC1	A	A	A	A	ns	ns	ns	3.2	ns	ns	1.6
EPT Abundance	log10	<0.001	<0.001	<0.001	Reference	LC_DCEF	A	BC	AB	C	-6.1	ns	-9.3	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	B	B	B	-6.1	-5.5	-5.7	ns	-1.6	-5.5	ns
						LC_DCDS	A	B	B	C	-4.8	-6.0	-14	ns	ns	ns	ns
						LC_DC2	A	A	A	B	ns	ns	-9.2	ns	1.7	ns	ns
						LC_DC4	A	AB	B	C	ns	-3.0	-8.2	ns	2.3	ns	ns
						LC_DC1	A	B	AB	C	-7.5	ns	-13	3.9	1.6	ns	ns
Ephemeroptera Abundance	rank	<0.001	<0.001	<0.001	Reference	LC_DCEF	A	C	B	C	-3.2	-2.1	-3.6	nc	nc	nc	nc
					Mine-Exposed	LC_DC3	A	B	B	B	-8.2	-8.2	-8.2	ns	-6.7	-7.6	-2.9
						LC_DCDS	A	B	B	C	-2.8	-2.9	-3.3	ns	ns	-5.5	-2.2
						LC_DC2	A	A	B	C	ns	-57	-96	-3.0	4.1	-5.5	ns
						LC_DC4	A	B	C	D	-1.8	-2.8	-3.5	ns	17	ns	ns
						LC_DC1	A	B	B	C	-3.5	-3.0	-4.3	ns	6.6	ns	ns

P-value < 0.1

MOD > 2

MOD < -2

Notes: "nc" = no relevant comparison; "ns" = not significant.

[a] MOD = MCT_{year2}-MCT_{year1}/SD_{year1} where MCT is the median for rank transformed data and the back-transformed estimated marginal means for others. Median Absolute Deviation (MAD) was used instead of standard deviation for rank-transformed data.

[b] MOD = MCT_{stn}-MCT_{LC_DCEF}/SD_{LC_DCEF} where MCT is the median for rank transformed data and the back-transformed estimated marginal means for others. Median Absolute Deviation (MAD) was used instead of standard deviation for rank-transformed data.

Table E.3: **Statistical Comparison of Benthic Invertebrate Community Endpoints in Fording River, September 2018 to 2022**

Endpoint	Transformation	Year	Area	Year:Area	Station		Do endpoints differ between years for each station?[a]									Do endpoints differ from LC_FRUS within a year?[b]				
							2018	2019	2020	2021	2022	2018 vs 2019	2018 vs 2020	2018 vs 2021	2018 vs 2022	2018	2019	2020	2021	2022
Abundance	log10	<0.001	<0.001	0.034	Reference	LC_FRUS	A	AB	AB	BC	C	ns	ns	-2.7	-3.4	nc	nc	nc	nc	nc
					Mine-Exposed	LC_FRB	AB	A	BC	C	ABC	ns	ns	-3.3	ns	ns	2.9	ns	ns	2.7
LPL Richness	log10	0.038	0.917	0.732	Reference	LC_FRUS	A	AB	AB	B	B	ns	ns	-1.4	-1.4	nc				
					Mine-Exposed	LC_FRB										ns				
% EPT	none	<0.001	<0.001	0.004	Reference	LC_FRUS	AB	B	A	A	A	ns	ns	ns	ns	nc	nc	nc	nc	nc
					Mine-Exposed	LC_FRB	B	B	B	A	B	ns	ns	3.7	ns	-2.2	-1.8	-3.0	ns	-5.5
% Ephemeroptera	none	0.001	0.785	0.005	Reference	LC_FRUS	B	B	A	AB	A	ns	7.0	ns	8.3	nc	nc	nc	nc	nc
					Mine-Exposed	LC_FRB	B	B	B	A	B	ns	ns	4.1	ns	ns	ns	-1.0	5.9	-2.2
% Plecoptera	none	0.001	<0.001	0.681	Reference	LC_FRUS	A	B	B	A	B	-0.91	-0.94	ns	-0.90	nc	nc	nc	nc	nc
					Mine-Exposed	LC_FRB										-2.1				
% Trichoptera	log10	0.069	0.032	0.713	Reference	LC_FRUS	AB	AB	AB	A	B	ns	ns	ns	ns	nc				
					Mine-Exposed	LC_FRB										-0.83				
% Oligochaeta	rank	<0.001	0.002	0.466	Reference	LC_FRUS	A	AB	C	BC	C	ns	-1.0	-0.90	-0.91	nc				
					Mine-Exposed	LC_FRB										0.69				
% Chironomidae	log10	<0.001	0.005	0.080	Reference	LC_FRUS	A	A	A	B	AB	ns	ns	-7.9	ns	nc	nc	nc	nc	nc
					Mine-Exposed	LC_FRB	A	A	A	B	A	ns	ns	-7.8	ns	ns	ns	1.6	ns	1.8
% Non-Chironomidae Diptera	log10	<0.001	0.081	0.018	Reference	LC_FRUS	A	A	B	A	AB	ns	-2.5	ns	ns	nc	nc	nc	nc	nc
					Mine-Exposed	LC_FRB	BC	C	C	AB	A	ns	ns	ns	2.8	ns	ns	ns	ns	5.4

P-value < 0.1

MOD > 2

MOD < -2

Notes: "nc" = no relevant comparison; "ns" = not significant.

[a] MOD = MCT_{year2}-MCT_{year1}/SD_{year1} where Measure of Central Tendency (MCT) is the median for rank transformed data and the back-transformed estimated marginal means for others. Median Absolute Deviation (MAD) was used instead of standard deviation for rank-transformed data.

[b] MOD = MCT_{stn}-MCT_{LC_FRUS}/SD_{LC_FRUS} where Measure of Central Tendency (MCT) is the median for rank transformed data and the back-transformed estimated marginal means for others. Median Absolute Deviation (MAD) was used instead of standard deviation for rank-transformed data.

APPENDIX F
BENTHIC INVERTEBRATE TISSUE CHEMISTRY

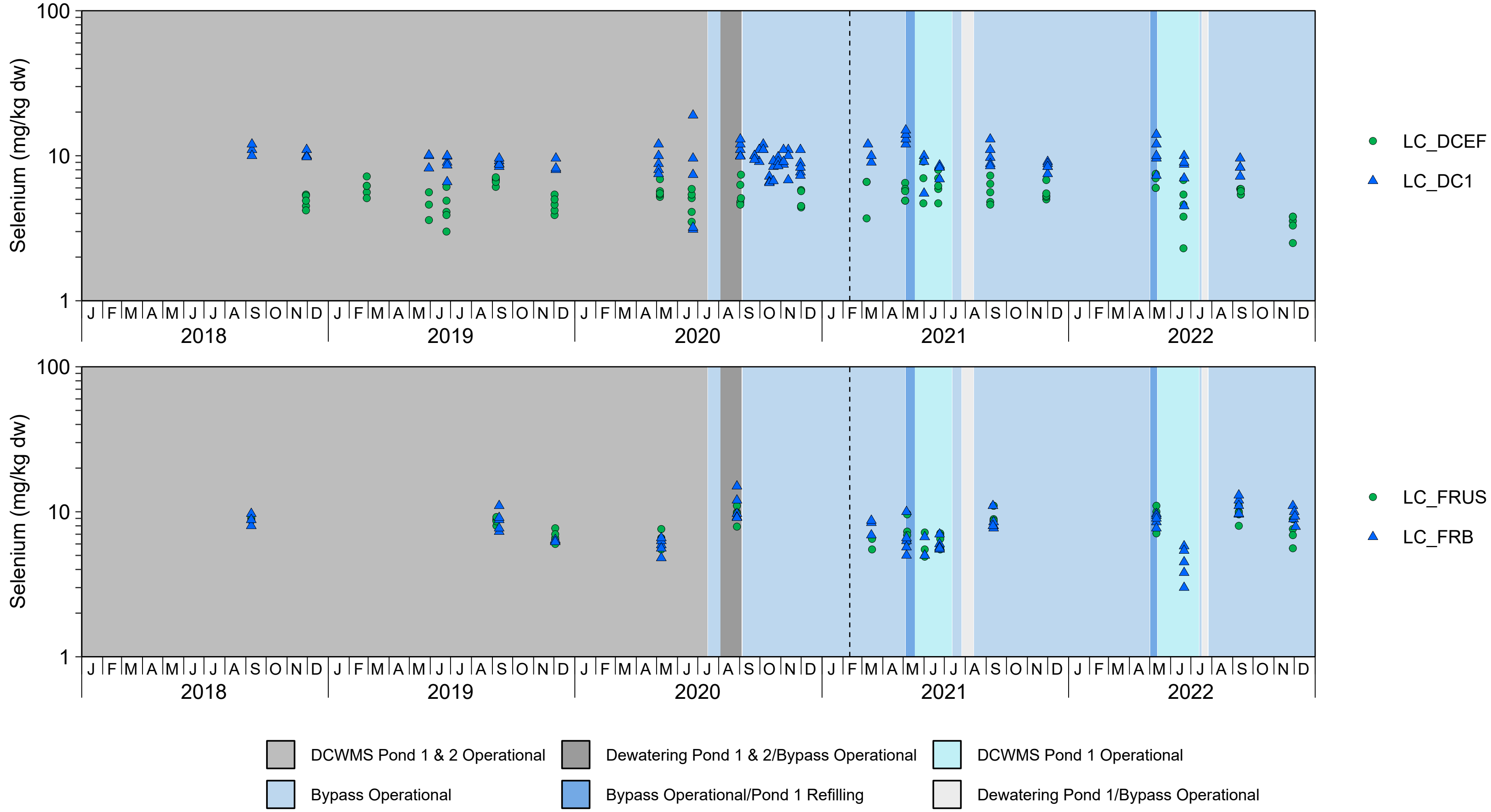

Figure F.1: Benthic Invertebrate Selenium Concentrations, for LC_DC1 (Mine−exposed Areas) Relative to LC_DCEF (Reference Area) and for LC_FRB (Downstream) Relative to LC_FRUS (Upstream), 2018 to 2022

Notes: mg/kg dw = milligrams per kilogram dry weight. Dashed black vertical line indicates the Burnt Ridge North spoil failure. Only data collected simultaneously at both stations are displayed.

Table F.1: Selenium Benchmarks for Benthic Invertebrates in the Elk Valley

Endpoint	Tissue Type	Benchmark			Source
		Value (µg/g dw)	Type	Description	
Westslope cutthroat trout	Egg/ovary	25	Site-specific benchmark	Level 1 (~10% effect) benchmark for westslope cutthroat trout reproduction	Teck (2014)
	Egg/ovary	27	Site-specific benchmark	Level 2 (~20% effect) benchmark for westslope cutthroat trout reproduction	Teck (2014)
	Egg/ovary	33	Site-specific benchmark	Level 3 (~50% effect) benchmark for westslope cutthroat trout reproduction	Golder (2014)
	Muscle/ muscle plug	15.5	Site-specific benchmark	Muscle equivalent to the 25 mg/kg dw ovary benchmark, based on the relationship observed between selenium in muscle and ovary in westslope cutthroat trout	Nautilus Environmental and Interior Reforestation (2011)
Benthic Invertebrates	Whole body	4[a]	BC guideline	Interim guideline for aquatic dietary tissue based on weight of evidence of lowest published toxicity thresholds and no uncertainty factor applied	BCMOE (2014)
	Whole body	13	Site-specific benchmark	Level 1 (~10% effect) benchmark for growth, reproduction and survival of invertebrates	Teck (2014)
	Whole body	20	Site-specific benchmark	Level 2 (~20% effect) benchmark for growth, reproduction and survival of invertebrates	Teck (2014)
	Whole body	27	Site-specific benchmark	Level 3 (~50% effect) benchmark for growth, reproduction and survival of invertebrates	Golder (2014)
	Whole body	11[b]	Site-specific benchmark	Level 1 (~10% effect) benchmark for dietary effects to juvenile fish (growth)	Teck (2014)
	Whole body	18	Site-specific benchmark	Level 2 (~20% effect) benchmark for dietary effects to juvenile fish (growth)	Teck (2014)
	Whole body	26	Site-specific benchmark	Level 3 (~50% effect) benchmark for dietary effects to juvenile fish (growth)	Golder (2014)
	Whole body	15	Site-specific benchmark	Level 1 (~10% effect) benchmark for dietary effects to juvenile birds	Teck (2014)
	Whole body	22	Site-specific benchmark	Level 2 (~20% effect) benchmark for dietary effects to juvenile birds	Teck (2014)
	Whole body	41	Site-specific benchmark	Level 3 (~50% effect) benchmark for dietary effects to juvenile birds	Golder (2014)

[a] BC guidelines were not used in assessment of benthic invertebrate and fish tissue selenium concentrations. Assessment was completed relative to site-specific benchmarks only.

[b] Site-specific benchmark is not applicable to effects to juvenile westslope cutthroat trout because studies with Yellowstone cutthroat trout have reported no effects at the Level 1 benchmark (see Teck [2014], Annex E, Appendix D [Elk Valley Water Quality Plan – Selenium Toxicity Literature Review]).

Table F.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa and Taxon-Specific Samples Collected from Dry Creek, Fording River, and Grace Creek, Dry Creek LAEMP, January to December 2022

Waterbody		Sample Type	Area	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
						Sample Result	Area Mean	Area Median	Area Minimum	Area Maximum	Area Standard Deviation
Dry Creek	Mine-Exposed	Composite	LC_DC3	LC_DC3_INV-1_2022-05_NP	10-May-22	7.20	6.68	7.20	4.70	8.20	1.44
				LC_DC3_INV-2_2022-05_NP	10-May-22	4.70					
				LC_DC3_INV-3_2022-05_NP	10-May-22	7.60					
				LC_DC3_INV-4_2022-05_NP	10-May-22	8.20					
				LC_DC3_INV-5_2022-05_NP	10-May-22	5.70					
				LC_DC3_INV-1_2022-06_NP	20-Jun-22	5.90	5.96	5.90	3.40	7.80	1.83
				LC_DC3_INV-2_2022-06_NP	20-Jun-22	3.40					
				LC_DC3_INV-3_2022-06_NP	20-Jun-22	5.10					
				LC_DC3_INV-4_2022-06_NP	20-Jun-22	7.80					
				LC_DC3_INV-5_2022-06_NP	20-Jun-22	7.60					
				LC_DC3_INV-1_2022-09-13_N	13-Sep-22	7.70	9.16	9.40	7.70	10.0	0.945
				LC_DC3_INV-2_2022-09-13_N	13-Sep-22	9.40					
				LC_DC3_INV-3_2022-09-13_N	13-Sep-22	9.90					
				LC_DC3_INV-4_2022-09-13_N	13-Sep-22	8.80					
				LC_DC3_INV-5_2022-09-13_N	13-Sep-22	10.0					
				LC_DC3_INV-1_2022-11_N	29-Nov-22	6.90	6.44	6.90	4.40	8.50	1.61
				LC_DC3_INV-2_2022-11_N	29-Nov-22	5.30					
				LC_DC3_INV-3_2022-11_N	29-Nov-22	4.40					
				LC_DC3_INV-4_2022-11_N	29-Nov-22	8.50					
				LC_DC3_INV-5_2022-11_N	29-Nov-22	7.10					
			LC_DCDS	LC_DCDS_INV-1_2022-05_NP	10-May-22	11.0	10.2	10.0	8.10	12.0	1.45
				LC_DCDS_INV-2_2022-05_NP	10-May-22	12.0					
				LC_DCDS_INV-3_2022-05_NP	10-May-22	9.90					
				LC_DCDS_INV-4_2022-05_NP	10-May-22	10.0					
				LC_DCDS_INV-5_2022-05_NP	10-May-22	8.10					
				LC_DCDS_INV-1_2022-06_NP	20-Jun-22	5.40	6.40	6.20	5.10	9.10	1.59
				LC_DCDS_INV-2_2022-06_NP	20-Jun-22	6.20					
				LC_DCDS_INV-3_2022-06_NP	20-Jun-22	5.10					
				LC_DCDS_INV-4_2022-06_NP	20-Jun-22	9.10					
				LC_DCDS_INV-5_2022-06_NP	20-Jun-22	6.20					
				LC_DCDS_INV-1_2022-09-13_N	13-Sep-22	15.0	12.1	12.0	8.30	15.0	2.99
				LC_DCDS_INV-2_2022-09-13_N	13-Sep-22	10.0					
				LC_DCDS_INV-3_2022-09-13_N	13-Sep-22	12.0					
				LC_DCDS_INV-4_2022-09-13_N	13-Sep-22	8.30					
				LC_DCDS_INV-5_2022-09-13_N	13-Sep-22	15.0					
				LC_DCDS_INV-1_2022-11_N	30-Nov-22	15.0	12.2	12.0	10.0	15.0	1.79
				LC_DCDS_INV-2_2022-11_N	30-Nov-22	12.0					
				LC_DCDS_INV-3_2022-11_N	30-Nov-22	12.0					
				LC_DCDS_INV-4_2022-11_N	30-Nov-22	10.0					
				LC_DCDS_INV-5_2022-11_N	30-Nov-22	12.0					
			LC_DC4	LC_DC4_INV-1_2022-05_NP	11-May-22	10.0	9.16	9.00	8.30	10.0	0.759
				LC_DC4_INV-2_2022-05_NP	11-May-22	9.88					
				LC_DC4_INV-3_2022-05_NP	11-May-22	9.00					
				LC_DC4_INV-4_2022-05_NP	11-May-22	8.60					
				LC_DC4_INV-5_2022-05_NP	11-May-22	8.30					
				LC_DC4_INV-1_2022-06_NP	21-Jun-22	3.70	5.16	5.30	3.70	5.90	0.882
				LC_DC4_INV-2_2022-06_NP	21-Jun-22	5.30					
				LC_DC4_INV-3_2022-06_NP	21-Jun-22	5.80					
				LC_DC4_INV-4_2022-06_NP	21-Jun-22	5.90					
				LC_DC4_INV-5_2022-06_NP	21-Jun-22	5.10					
				LC_DC4_COMPNOLI-1_2022-09-12_N	12-Sep-22	7.00	8.52	8.80	7.00	10.0	1.18
				LC_DC4_INV-2_2022-09-12_N	12-Sep-22	10.0					
				LC_DC4_INV-3_2022-09-12_N	12-Sep-22	9.10					
				LC_DC4_INV-4_2022-09-12_N	12-Sep-22	8.80					
				LC_DC4_INV-5_2022-09-12_N	12-Sep-22	7.70					
		Oligochaeta		LC_DC4_INVOLI-1_2022-09-12_N	12-Sep-22	7.50	7.50	7.50	7.50	7.50	-
		Composite		LC_DC4_INV-1_2022-11_N	29-Nov-22	3.10	5.76	5.70	3.10	7.60	1.72
				LC_DC4_INV-2_2022-11_N	29-Nov-22	7.60					
				LC_DC4_INV-3_2022-11_N	29-Nov-22	6.90					
				LC_DC4_INV-4_2022-11_N	29-Nov-22	5.50					
				LC_DC4_INV-5_2022-11_N	29-Nov-22	5.70					
			LC_DC2	LC_DC2_INV-1_2022-05_NP	10-May-22	11.0	11.8	11.0	11.0	13.0	1.10
				LC_DC2_INV-2_2022-05_NP	10-May-22	11.0					
				LC_DC2_INV-3_2022-05_NP	10-May-22	13.0					
				LC_DC2_INV-4_2022-05_NP	10-May-22	13.0					
				LC_DC2_INV-5_2022-05_NP	10-May-22	11.0					
				LC_DC2_INV-1_2022-06_NP	21-Jun-22	5.40	5.86	6.30	3.30	7.40	1.61
				LC_DC2_INV-2_2022-06_NP	21-Jun-22	3.30					
				LC_DC2_INV-3_2022-06_NP	21-Jun-22	6.90					
				LC_DC2_INV-4_2022-06_NP	21-Jun-22	7.40					
				LC_DC2_INV-5_2022-06_NP	21-Jun-22	6.30					
				LC_DC2_INV-1_2022-09-14_N	14-Sep-22	7.40	7.38	7.40	6.10	8.88	1.09
				LC_DC2_INV-2_2022-09-14_N	14-Sep-22	7.90					
				LC_DC2_INV-3_2022-09-14_N	14-Sep-22	6.60					
				LC_DC2_INV-4_2022-09-14_N	14-Sep-22	8.88					
				LC_DC2_INV-5_2022-09-14_N	14-Sep-22	6.10					
			LC_DC1	LC_DC1_INV-1_2022-05_NP	11-May-22	7.30	10.6	10.0	7.30	14.0	2.54
				LC_DC1_INV-2_2022-05_NP	11-May-22	14.0					
				LC_DC1_INV-3_2022-05_NP	11-May-22	12.0					
				LC_DC1_INV-4_2022-05_NP	11-May-22	9.60					
				LC_DC1_INV-5_2022-05_NP	11-May-22	10.0					
				LC_DC1_INV-1_2022-06_NP	21-Jun-22	10.0	7.84	8.70	4.50	10.0	2.16
				LC_DC1_INV-2_2022-06_NP	21-Jun-22	8.70					
				LC_DC1_INV-3_2022-06_NP	21-Jun-22	7.00					
				LC_DC1_INV-4_2022-06_NP	21-Jun-22	9.00					
				LC_DC1_INV-5_2022-06_NP	21-Jun-22	4.50					
				LC_DC1_INV-1_2022-09-12_N	12-Sep-22	8.30	8.34	8.30	7.20	9.60	0.850
				LC_DC1_INV-2_2022-09-12_N	12-Sep-22	7.20					
				LC_DC1_INV-3_2022-09-12_N	12-Sep-22	8.30					
				LC_DC1_INV-4_2022-09-12_N	12-Sep-22	8.30					
				LC_DC1_INV-5_2022-09-12_N	12-Sep-22	9.60					

Notes: June sample at LC_FRUS were not collected due to high water levels. November samples for LC_DC1 and LC_DC2 samples were not collected due to ice conditions.

Table F.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa and Taxon-Specific Samples Collected from Dry Creek, Fording River, and Grace Creek, Dry Creek LAEMP, January to December 2022

Waterbody		Sample Type	Area	Sample Code	Sample Date	Selenium Concentration (mg/kg dw)					
						Sample Result	Area Mean	Area Median	Area Minimum	Area Maximum	Area Standard Deviation
Fording River	Mine-Exposed	Composite	LC_FRUS	LC_FRUS_INV-1_2022-05_NP	11-May-22	9.20	9.26	9.20	7.10	11.0	1.44
				LC_FRUS_INV-2_2022-05_NP	11-May-22	7.10					
				LC_FRUS_INV-3_2022-05_NP	11-May-22	10.0					
				LC_FRUS_INV-4_2022-05_NP	11-May-22	9.00					
				LC_FRUS_INV-5_2022-05_NP	11-May-22	11.0					
				LC_FRUS_INV-1_2022-09-10_N	10-Sep-22	11.0	9.70	9.90	8.00	11.0	1.09
				LC_FRUS_INV-2_2022-09-10_N	10-Sep-22	9.60					
				LC_FRUS_INV-3_2022-09-10_N	10-Sep-22	8.00					
				LC_FRUS_INV-4_2022-09-10_N	10-Sep-22	10.0					
				LC_FRUS_INV-5_2022-09-10_N	10-Sep-22	9.90					
				LC_FRUS_INV-1_2022-11_N	29-Nov-22	7.60	7.58	7.60	5.60	8.90	1.40
				LC_FRUS_INV-2_2022-11_N	29-Nov-22	6.90					
				LC_FRUS_INV-3_2022-11_N	29-Nov-22	8.90					
				LC_FRUS_INV-4_2022-11_N	29-Nov-22	8.90					
				LC_FRUS_INV-5_2022-11_N	29-Nov-22	5.60					
			LC_FRB	LC_FRB_INV-1_2022-05_NP	11-May-22	9.69	8.86	9.00	7.70	9.69	0.786
				LC_FRB_INV-2_2022-05_NP	11-May-22	9.40					
				LC_FRB_INV-3_2022-05_NP	11-May-22	8.50					
				LC_FRB_INV-4_2022-05_NP	11-May-22	9.00					
				LC_FRB_INV-5_2022-05_NP	11-May-22	7.70					
				LC_FRB_INV-1_2022-06_NP	21-Jun-22	3.80	4.50	4.50	3.00	5.80	1.14
				LC_FRB_INV-2_2022-06_NP	21-Jun-22	5.80					
				LC_FRB_INV-3_2022-06_NP	21-Jun-22	3.00					
				LC_FRB_INV-4_2022-06_NP	21-Jun-22	4.50					
				LC_FRB_INV-5_2022-06_NP	21-Jun-22	5.40					
				LC_FRB_INV-1_2022-09-10_N	10-Sep-22	12.0	11.1	11.0	9.60	13.0	1.47
				LC_FRB_INV-2_2022-09-10_N	10-Sep-22	11.0					
				LC_FRB_INV-3_2022-09-10_N	10-Sep-22	9.60					
				LC_FRB_INV-4_2022-09-10_N	10-Sep-22	9.70					
				LC_FRB_INV-5_2022-09-10_N	10-Sep-22	13.0					
				LC_FRB_INV-1_2022-11_N	29-Nov-22	11.0	9.42	9.30	7.90	11.0	1.16
				LC_FRB_INV-2_2022-11_N	30-Nov-22	8.90					
				LC_FRB_INV-3_2022-11_N	01-Dec-22	10.0					
				LC_FRB_INV-4_2022-11_N	02-Dec-22	9.30					
				LC_FRB_INV-5_2022-11_N	03-Dec-22	7.90					
Dry Creek East Tributary	Reference		LC_DCEF	LC_DCEF_INV-1_2022-05_NP	10-May-22	6.00	6.78	7.00	6.00	7.50	0.736
				LC_DCEF_INV-2_2022-05_NP	10-May-22	6.00					
				LC_DCEF_INV-3_2022-05_NP	10-May-22	7.40					
				LC_DCEF_INV-4_2022-05_NP	10-May-22	7.00					
				LC_DCEF_INV-5_2022-05_NP	10-May-22	7.50					
				LC_DCEF_INV-1_2022-06_NP	20-Jun-22	2.30	4.58	4.60	2.30	6.80	1.69
				LC_DCEF_INV-2_2022-06_NP	20-Jun-22	4.60					
				LC_DCEF_INV-3_2022-06_NP	20-Jun-22	6.80					
				LC_DCEF_INV-4_2022-06_NP	20-Jun-22	3.80					
				LC_DCEF_INV-5_2022-06_NP	20-Jun-22	5.40					
				LC_DCEF_INV-1_2022-09-12_N	12-Sep-22	5.90	5.66	5.70	5.40	5.90	0.251
				LC_DCEF_INV-2_2022-09-13_N	13-Sep-22	5.90					
				LC_DCEF_INV-3_2022-09-13_N	13-Sep-22	5.40					
				LC_DCEF_INV-4_2022-09-13_N	13-Sep-22	5.40					
				LC_DCEF_INV-5_2022-09-13_N	13-Sep-22	5.70					
				LC_DCEF_INV-1_2022-11_N	29-Nov-22	2.50	3.39	3.55	2.50	3.80	0.539
				LC_DCEF_INV-2_2022-11_N	29-Nov-22	3.80					
				LC_DCEF_INV-3_2022-11_N	29-Nov-22	3.55					
				LC_DCEF_INV-4_2022-11_N	29-Nov-22	3.80					
				LC_DCEF_INV-5_2022-11_N	29-Nov-22	3.30					
Grace Creek	Mine-Exposed		LC_GRCK	LC_GRCK_INV-1_2022-05_NP	11-May-22	7.90	6.84	6.80	5.60	7.90	1.06
				LC_GRCK_INV-2_2022-05_NP	11-May-22	7.90					
				LC_GRCK_INV-3_2022-05_NP	11-May-22	6.80					
				LC_GRCK_INV-4_2022-05_NP	11-May-22	6.00					
				LC_GRCK_INV-5_2022-05_NP	11-May-22	5.60					
				LC_GRCK_INV-1_2022-06_NP	22-Jun-22	7.60	6.94	6.80	6.20	7.70	0.684
				LC_GRCK_INV-2_2022-06_NP	22-Jun-22	6.40					
				LC_GRCK_INV-3_2022-06_NP	22-Jun-22	6.20					
				LC_GRCK_INV-4_2022-06_NP	22-Jun-22	7.70					
				LC_GRCK_INV-5_2022-06_NP	22-Jun-22	6.80					
				LC_GRCK_COMPNOLI-1_2022-09-14_N	14-Sep-22	7.30	7.18	7.30	4.80	8.70	1.45
				LC_GRCK_COMPNOLI-2_2022-09-14_N	14-Sep-22	7.80					
				LC_GRCK_INV-3_2022-09-14_N	14-Sep-22	4.80					
				LC_GRCK_INV-4_2022-09-14_N	14-Sep-22	8.70					
				LC_GRCK_INV-5_2022-09-14_N	14-Sep-22	7.30					
		Oligochaeta		LC_GRCK_INVOLI-1_2022-09-14_N	14-Sep-22	6.60	5.10	5.10	3.60	6.60	2.12
				LC_GRCK_INVOLI-2_2022-09-14_N	14-Sep-22	3.60					
		Composite		LC_GRCK_INV-1_2022-11_N	30-Nov-22	5.30	7.70	7.80	5.30	9.60	1.69
				LC_GRCK_INV-2_2022-11_N	30-Nov-22	8.90					
				LC_GRCK_INV-3_2022-11_N	30-Nov-22	7.80					
				LC_GRCK_INV-4_2022-11_N	30-Nov-22	9.60					
				LC_GRCK_INV-5_2022-11_N	30-Nov-22	6.90					

Notes: June sample at LC_FRUS were not collected due to high water levels. November samples for LC_DC1 and LC_DC2 samples were not collected due to ice conditions.

Table F.3: Selenium Species Bioaccumulation Tool[a] Predicted Benthic Invertebrate Tissue Selenium Concentrations Compared to Measured Values, Dry Creek, 2022

Waterbody	Area	B-tool Prediction[a]		Field Measurements	
		Date	Predicted Benthic Invertebrate Tissue Selenium Concentration	Date	Mean Benthic Invertebrate Tissue Selenium Concentration
			µg/g dw		µg/g dw
Dry Creek East Tributary (Reference)	LC_DCEF	3-May-22	10.2	10-May-22	6.78
		12-Sep-22	9.54	13-Sep-22	5.66
		29-Nov-22	9.37	29-Nov-22	3.39
Grace Creek (Reference)	LC_GRCK	11-May-22	5.43	11-May-22	6.84
		14-Sep-22	5.50	14-Sep-22	7.18
		30-Nov-22	5.60	30-Nov-22	7.70
Dry Creek (Mine-Exposed)	LC_DC3	11-May-22	12.8	10-May-22	6.68
		21-Jun-22	10.2	20-Jun-22	5.96
		13-Sep-22	12.4	13-Sep-22	9.16
		29-Nov-22	10.7	29-Nov-22	6.44
	LC_DCDS	11-May-22	12.6	10-May-22	10.2
		21-Jun-22	10.4	20-Jun-22	6.40
		13-Sep-22	13.9	13-Sep-22	12.1
		29-Nov-22	11.2	30-Nov-22	12.2
	LC_DC4	11-May-22	9.55	11-May-22	9.16
		21-Jun-22	9.15	21-Jun-22	5.16
		13-Sep-22	8.22	12-Sep-22	8.52
		29-Nov-22	7.76	29-Nov-22	5.76
	LC_DC2	11-May-22	10.8	10-May-22	11.8
		21-Jun-22	9.08	21-Jun-22	5.86
		13-Sep-22	12.8	14-Sep-22	7.38
	LC_DC1	12-May-22	8.53	11-May-22	10.6
		21-Jun-22	9.11	21-Jun-22	7.84
		13-Sep-22	10.2	12-Sep-22	8.34
Fording River (Mine-Exposed)	LC_FRUS	11-May-22	7.25	11-May-22	9.26
		10-Sep-22	8.08	10-Sep-22	9.70
		29-Nov-22	6.89	29-Nov-22	7.58
	LC_FRB	10-Sep-22	7.71	10-Sep-22	11.1
		30-Nov-22	6.99	29-Nov-22	9.42

Note: LC_FRB had no May Se speciation samples and therefore could not be included. LC_DCEF, LC_GRCK, and LC_FRUS had no June Se speciation samples and therefore could not be include. LC_DC2 and LC_DC1 had no June Se speciation samples and therefore could not be include.

[a] Values derived from de Bruyn and Luoma (2021) using selenium speciation data and sulphate concentrations for each area on each date to predict benthic invertebrate tissue selenium concentrations. Five days range was used to match dates between selenium speciation and sulphate data.

Table F.4: Spatial and Temporal Comparisons of Benthic Invertebrate Tissue Selenium Concentration Among Months, Dry Creek Sampling Areas, 2022

ANOVA Model[a]				Area		Month	Do concentrations differ among months for each areas?[b]			Do concentrations differ between reference (LC_DCEF) and exposed areas within months?[c]			
Transformation	Area	Month	Month x Area				May	June	September	May	June	September	November
none	<0.001	<0.001	<0.001	Reference	LC-DCEF	May	nc	nc	nc	nc	nc	nc	nc
						June	ns	nc	nc				
						September	ns	ns	nc				
						November	-50	ns	ns				
				Exposed	LC_DC3	May	nc	nc	nc	ns	ns	62	90
						June	ns	nc	nc				
						September	ns	54	nc				
						November	ns	ns	-30				
					LC_DCDS	May	nc	nc	nc	50	ns	113	260
						June	-37	nc	nc				
						September	ns	88	nc				
						November	ns	91	ns				
					LC_DC2	May	nc	nc	nc	74	ns	ns	-
						June	-50	nc	nc				
						September	-38	ns	nc				
						November	nc	nc	nc				
					LC_DC4	May	nc	nc	nc	ns	ns	ns	ns
						June	-44	nc	nc				
						September	ns	62	nc				
						November	-37	ns	-31				
					LC_DC1	May	nc	nc	nc	56	71	ns	-
						June	-26	nc	nc				
						September	ns	ns	nc				
						November	nc	nc	nc				

P-value < 0.05. (grey)

P-value for post-hoc pair-wise comparison < 0.05 and MOD > 0. (blue)

P-value for post-hoc pair-wise comparison < 0.05 and MOD < 0. (green)

Notes: "nc" = not comparable; "-" = no data for comparison.

[a] *P*-values from Analysis of Variance (ANOVA) including the terms Area, Month and Area x Month.

[b] Magnitude of Difference (MOD) was calculated as $(MCT_{month2} - MCT_{month1})/MCT_{month1}$ *100 using the measure of central tendency (MCT; mean).

[c] Magnitude of Difference (MOD) was calculated as $(MCT_{exp} - MCT_{ref})/MCT_{ref}$ *100 using the measure of central tendency (MCT; mean).

Table F.5: Spatial and Temporal Comparisons of Benthic Invertebrate Tissue Selenium Concentration Among Months, Fording River Sampling Areas, 2022

ANOVA Model[a]				Month	Do concentrations differ among months for each areas?[b]			Do concentrations differ between reference and exposed areas?[c] LC_FRUS vs LC_FRB			
Transformation	Area	Month	Month x Area		May	June	September	May	June	September	November
log10	0.090	<0.001	0.215	May	nc	nc	nc	ns			
				June	-54	nc	nc				
				September	ns	148	nc				
				November	ns	101	-19				

P-value < 0.05.

P-value for post-hoc paired-wise comparison < 0.05 and MOD > 0.

P-value for post-hoc paired-wise comparison < 0.05 and MOD < 0.

Notes: "nc" = not comparable; "-" = no data for comparison.

[a] *P*-values from Analysis of Variance (ANOVA) including the terms Station, Month and Station x Month.

[b] Magnitude of Difference (MOD) was calculated as $(MCT_{month2} - MCT_{month1})/MCT_{month1} * 100$ using the measure of central tendency (MCT; geometric mean due to log_{10} transformation).

[c] Magnitude of Difference (MOD) was calculated as $(MCT_{LC\_FRB} - MCT_{LC\_FRUS})/MCT_{LC\_FRUS} * 100$ using the measure of central tendency (geometric mean due to log10 transformation).

Table F.6: Spatial and Temporal Comparisons of Benthic Invertebrate Tissue Selenium Concentration Among Years, Dry Creek Sampling Areas, 2020 to 2022

ANOVA Model[a]				Area		Year	Do concentrations differ among years for each areas?[b]		Do concentrations differ between reference (LC_DCEF) and exposed areas within years?[c]		
Transformation	Area	Year	Year x Area				2020	2021	2020	2021	2022
log10	<0.001	<0.001	<0.001	Reference	LC-DCEF	2020	nc	nc	nc	nc	nc
						2021	ns	nc			
						2022	ns	ns			
				Exposed	LC_DC3	2020	nc	nc	ns	73	61
						2021	33	nc			
						2022	ns	ns			
					LC_DCDS	2020	nc	nc	290	108	108
						2021	-46	nc			
						2022	-46	ns			
					LC_DC2	2020	nc	nc	134	ns	ns
						2021	-53	nc			
						2022	-44	ns			
					LC_DC4	2020	nc	nc	59	ns	50
						2021	ns	nc			
						2022	ns	ns			
					LC_DC1	2020	nc	nc	90	78	47
						2021	ns	nc			
						2022	ns	ns			

P-value < 0.05.

P-value for post-hoc pair-wise comparison < 0.05 and MOD > 0.

P-value for post-hoc pair-wise comparison < 0.05 and MOD < 0.

Notes: "nc" = not comparable; "-" = no data for comparison.

[a] *P*-values from Analysis of Variance (ANOVA) including the terms Area, Year and Area x Year.

[b] Magnitude of Difference (MOD) was calculated as $(MCT_{year2} - MCT_{year1})/MCT_{year1}$ *100 using the measure of central tendency (MCT; mean).

[c] Magnitude of Difference (MOD) was calculated as $(MCT_{exp} - MCT_{ref})/MCT_{ref}$ *100 using the measure of central tendency (MCT; mean).

Table F.7: Spatial and Temporal Comparisons of Benthic Invertebrate Tissue Selenium Concentration Among Years, Fording River Sampling Areas, 2020 to 2022

ANOVA Model[a]				Year	Do concentrations differ among years for each areas?[b]		Do concentrations differ between reference and exposed areas?[c] LC_FRUS vs LC_FRB		
Transformation	Area	Year	Year x Area		2020	2021	2020	2021	2022
log10	0.391	0.123	0.133	2020	nc	nc	ns		
				2021	ns	nc			
				2022	ns	ns			

P -value < 0.05.

P -value for post-hoc paired-wise comparison < 0.05 and MOD > 0.

P -value for post-hoc paired-wise comparison < 0.05 and MOD < 0.

Notes: "nc" = not comparable; "ns" = not significante; "-" = no data for comparison.

[a] *P* -values from Analysis of Variance (ANOVA) including the terms Area, Year and Area x Year.

[b] Magnitude of Difference (MOD) was calculated as (MCT_{year2} - MCT_{year1})/MCT_{year1} *100 using the measure of central tendency (MCT; geometric mean due to log_{10} transformation).

[c] Magnitude of Difference (MOD) was calculated as (MCT_{LC_FRB} - MCT_{LC_FRUS})/MCT_{LC_FRUS}*100 using the measure of central tendency (geometric mean due to log10 transformation).

APPENDIX G

FISH HABITAT

Table G.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Dry Creek, 2012 to 2022

Year	Month	LC_DCEF	LC_SPDC	LC_DCDS	LC_DC2	LC_DC4	LC_DC1
2012	January	11.9	-	-	-	-	13.8
	February	-	-	-	-	-	-
	March	12.5	-	-	-	-	-
	April	13.8	-	-	-	-	16.6
	May	11.7	-	-	12.1	-	12.4
	June	11.8	-	-	11.4	-	11.8
	July	10.7	-	-	10.1	-	10.4
	August	10.0	-	-	9.8	-	9.5
	September	10.2	-	-	10.0	-	10.6
	October	10.7	-	-	11.3	-	11.8
	November	9.9	-	-	11.4	-	11.3
	December	10.2	-	-	-	-	12.2
2013	January	11.2	-	-	-	-	11.4
	February	10.6	-	-	-	-	-
	March	11.2	-	-	-	-	-
	April	10.7	-	-	11.8	-	11.8
	May	12.7	-	-	12.8	-	13.3
	June	10.8	-	-	10.6	-	10.9
	July	10.9	-	-	10.1	-	10.2
	August	10.4	-	-	9.8	-	9.9
	September	9.9	-	-	9.5	-	10.3
	October	-	-	-	-	-	-
	November	10.0	-	11.9	11.3	-	11.6
	December	10.8	-	12.0	-	-	12.2
2014	January	9.6	-	11.2	-	-	-
	February	10.5	-	-	-	-	-
	March	8.2	-	12.2	-	-	12.4
	April	8.7	-	11.5	-	-	11.2
	May	12.4	-	12.7	-	-	12.9
	June	11.3	-	10.8	-	-	10.8
	July	9.6	-	10.5	-	-	10.2
	August	10.8	-	10.1	-	-	10.1
	September	11.5	-	12.1	-	-	11.9
	October	10.1	-	10.8	-	-	10.9
	November	9.8	12.6	11.4	-	-	11.5
	December	1.6	7.0	5.9	-	-	-
2015	January	11.3	-	12.1	-	-	-
	February	10.0	11.0	-	-	-	-
	March	9.4	11.8	11.7	-	-	13.2
	April	12.5	12.2	12.3	-	-	12.3
	May	10.7	10.9	10.6	-	-	11.4
	June	11.2	9.9	9.7	-	-	10.3
	July	11.6	8.5	9.0	-	-	10.0
	August	10.1	7.3	8.4	-	-	9.7
	September	10.6	9.9	9.9	-	-	10.7
	October	10.4	9.7	10.4	-	-	10.4
	November	10.5	10.8	11.0	-	-	12.0
	December	10.2	11.7	11.5	-	-	11.6
2016	January	9.9	11.4	11.5	-	-	11.1
	February	10.1	10.7	9.3	-	-	8.2
	March	13.0	12.6	12.9	-	-	12.4
	April	12.3	11.3	11.2	-	-	11.4
	May	11.9	10.8	11.0	-	-	11.3
	June	11.1	9.4	9.6	-	-	10.8
	July	11.1	8.6	9.3	-	-	10.5
	August	10.2	7.5	7.9	-	-	10.1
	September	10.9	8.7	8.7	-	-	10.5
	October	9.5	9.8	10.2	-	-	11.0
	November	10.0	11.2	10.8	-	-	11.0
	December	11.6	10.3	11.9	-	-	13.1
2017	January	11.1	12.2	12.3	-	-	12.4
	February	11.1	13.6	12.6	-	-	12.6
	March	11.3	10.4	10.5	-	-	11.5
	April	12.6	12.3	12.4	-	-	11.9
	May	11.6	11.4	11.4	-	-	11.4
	June	10.4	11.4	10.1	-	-	10.3
	July	8.9	8.2	8.1	-	-	9.8
	August	10.5	7.9	8.5	-	-	10.1
	September	10.5	9.1	9.8	-	-	12.0
	October	10.0	10.7	10.8	-	-	11.7
	November	10.1	12.2	12.3	-	-	12.0
	December	10.5	10.9	11.4	-	-	12.2

Less than 30-day water column mean criterion of 11 mg/L for buried embryo/alevin life stages (guideline was applied for all months except April, see notes for details).

Notes: "-" = no data/not recorded. Spawning, incubation, and alevin stages for westslope cutthroat trout were included in the application of buried embryo/alevin guideline values, and were applicable to at least some portion of each month except April. The timing of life history stages for this species is approximated from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007).

Table G.1: Monthly Mean Dissolved Oxygen Concentrations (mg/L) in Dry Creek, 2012 to 2022

Year	Month	LC_DCEF	LC_SPDC	LC_DCDS	LC_DC2	LC_DC4	LC_DC1
2018	January	10.1	10.0	9.8	-	-	9.7
	February	10.6	11.5	11.6	-	-	11.8
	March	10.3	11.6	11.6	-	-	11.6
	April	11.4	12.3	12.1	-	-	12.2
	May	11.9	10.2	11.2	-	-	11.4
	June	10.5	9.2	9.5	-	-	10.4
	July	11.6	9.1	9.4	-	-	11.0
	August	10.4	8.6	8.9	-	-	10.6
	September	10.4	9.3	9.3	-	-	10.8
	October	10.9	11.4	11.4	-	-	11.9
	November	10.3	11.3	11.6	11.8	11.0	11.7
	December	10.5	12.1	12.1	-	11.2	12.6
2019	January	10.4	10.5	12.8	7.5	11.4	12.1
	February	11.7	10.9	12.0	8.0	11.4	13.2
	March	14.3	14.3	17.5	16.1	15.5	15.9
	April	11.3	11.7	11.9	11.9	11.7	11.9
	May	10.2	10.5	11.4	10.9	11.1	11.0
	June	11.1	10.1	10.5	10.7	10.8	10.7
	July	10.3	9.4	9.7	10.2	10.2	10.3
	August	10.4	8.9	9.0	9.6	10.5	10.6
	September	10.5	9.3	9.4	10.0	10.4	11.0
	October	10.5	11.2	11.3	11.3	11.3	11.9
	November	10.5	11.8	11.7	11.6	11.3	12.3
	December	10.9	13.1	12.7	13.3	12.4	13.2
2020	January	10.8	11.7	11.8	11.9	11.7	12.1
	February	11.1	11.8	12.2	-	-	12.3
	March	11.1	12.0	12.1	12.1	11.5	12.1
	April	10.7	11.8	11.9	11.7	11.6	11.7
	May	11.9	11.1	10.9	11.8	11.3	11.3
	June	11.1	10.4	10.4	11.0	10.8	10.7
	July	10.7	10.1	10.4	10.5	10.8	10.7
	August	10.5	9.1	9.0	9.2	9.8	10.1
	September	10.1	10.7	10.8	10.3	10.6	11.0
	October	10.6	11.5	11.6	11.6	11.2	11.8
	November	10.5	12.3	11.9	11.9	11.2	11.8
	December	10.9	12.1	12.1	12.0	11.4	12.0
2021	January	10.8	12.0	12.1	11.8	11.5	12.2
	February	10.7	11.9	12.4	12.0	11.5	12.0
	March	11.1	11.3	11.4	11.2	10.6	11.3
	April	10.3	11.3	11.8	11.7	11.6	11.6
	May	10.6	10.7	10.9	11.2	11.0	11.0
	June	10.3	9.8	9.8	9.7	10.0	9.8
	July	10.0	9.2	9.2	9.4	9.9	9.8
	August	10.2	9.8	9.9	10.0	10.1	10.2
	September	10.3	10.6	10.8	10.8	10.6	10.8
	October	10.6	11.2	11.4	11.6	11.1	11.4
	November	10.8	11.7	11.7	11.9	11.3	11.8
	December	10.6	11.5	11.6	11.5	11.3	11.8
2022	January	10.5	11.7	11.8	11.7	12.0	11.6
	February	11.1	12.0	11.9	12.1	11.7	12.0
	March	11.0	12.0	12.0	12.0	11.7	12.0
	April	11.8	12.1	12.1	12.0	12.2	12.1
	May	10.5	11.0	10.7	11.1	11.0	11.2
	June	11.2	10.9	10.9	11.0	10.9	11.0
	July	10.9	9.9	9.9	10.2	10.2	10.2
	August	10.4	10.2	10.1	10.3	10.3	10.4
	September	10.6	10.5	10.6	10.6	10.7	10.8
	October	10.6	11.1	11.1	11.1	10.9	11.2
	November	11.4	12.0	12.2	12.3	12.0	12.4
	December	11.1	12.3	12.2	12.5	12.0	12.1

Less than 30-day water column mean criterion of 11 mg/L for buried embryo/alevin life stages (guideline was applied for all months except April, see notes for details).

Notes: "-" = no data/not recorded. Spawning, incubation, and alevin stages for westslope cutthroat trout were included in the application of buried embryo/alevin guideline values, and were applicable to at least some portion of each month except April. The timing of life history stages for this species is approximated from COSEWIC (2016), McPhail and Baxter (1996), and McPhail (2007).

APPENDIX H
BIOTRIGGERS

APPENDIX H BIOLOGICAL TRIGGERS

H1 INTRODUCTION

H1.1 Background

Biological triggers were developed and implemented to assist with identifying and communicating unexpected and potentially important changes in aquatic ecosystem conditions and are required as part of Teck's Adaptive Management Plan (AMP; Teck 2018). Biological triggers were developed in consultation with the Environmental Monitoring Committee (EMC) for a subset of the biological monitoring endpoints that are effective indicators of changes at the ecosystem level. The purpose of the biological triggers is to quickly identify biological monitoring areas where unexpected biological conditions may be occurring that may require management action. Additionally, information provided from the analysis of biological triggers may lead to responses under the AMP response framework.

Draft biological triggers were developed in the 2018 AMP (Teck 2018) under Management Question 5, with these initially reported on in 2021 in the 2020 Local Aquatic Effects Monitoring Program (LAEMP) reports and Regional Aquatic Effects Monitoring Program (RAEMP) data package, and summarized in the 2020 Annual AMP Report (Teck 2021a). When the 2018 AMP was approved, there was an expectation that the 2018 AMP draft/interim biological triggers would be finalized, through engagement with the EMC, prior to December 15, 2021 AMP Update. The biological triggers were finalized in 2021 (Teck 2021b) and the methods applied in this report reflect the finalized biological triggers (Teck 2021b). It is important to note that the process and/or biological triggers may adjust over time as the purpose of the biological triggers is to be reflective of not only changes in the Elk Valley, but also the current state of knowledge in the area.

The finalized biological triggers (Teck 2021b) include three measurement endpoints:

- Percent EPT (% EPT; Ephemeroptera, Plecoptera, and Trichoptera) – based on travelling kick samples (Canadian Aquatic Biomonitoring Network (CABIN) protocol.
- Benthic invertebrate tissue selenium (BIT Se) – generally several replicates collected per location per sampling event, where each replicate is a composite sample of invertebrates (i.e. composite-taxa sample).
- Westslope cutthroat trout muscle tissue selenium (WCT Se) – generally eight samples collected per location per sampling event, where each sample is taken from a single fish.

Evaluation of these three biological trigger endpoints is complementary to the fulsome evaluation of biological endpoints that is integrated into the LAEMP and the RAEMP data evaluations. The fulsome evaluation of biological endpoints is used to support answering the specific LAEMP and RAEMP study questions through the consideration of not only the endpoints used in the biological trigger evaluation, but also a full suite of additional biological, chemical, and physical endpoints. Biological triggers do not provide information on cause and effect, report on trends, or feed directly into decision-making processes. Instead, the biological triggers act to flag areas for further evaluation, which would then take place under existing monitoring programs, through the development of supporting studies or through the response framework, as necessary.

Biological monitoring data are compared to triggers annually, and summaries of the LAEMP and RAEMP trigger evaluations and responses are summarized within annual AMP reports.

H2 METHODS

H2.1 Overview

As outlined in Section H1.1, analyses for biological triggers are meant to be complementary to other analyses conducted in the LAEMPs and RAEMP. For the 2022 LCO Dry Creek LAEMP, biological trigger analyses only included two of the three measurement endpoints (%EPT and BIT Se).

For the purpose of application of the biological triggers, expectations for the endpoints evaluated (%EPT and BIT Se) were based on projected water quality, not on measured water quality. Thus, the triggers should detect biological results that were unexpected, regardless of whether those results were due to unexpected water quality or due to unexpected relationships between water quality and biological endpoints. Biological triggers were therefore only applied at locations where water quality projections were available, which for this study were mine-exposed areas LC_DCDS and LC_DC1. Although data for other areas studied under the LCO Dry Creek LAEMP (i.e., LC_DCEF, LC_DC3, LC_DC2, LC_DC4, LC_FRUS, LC_FRB, and LC_GRCK) were not evaluated relative to biological triggers, they were assessed as part of the main LCO Dry Creek LAEMP report.

Detailed methods associated with the evaluation of data associated with each of the applicable biological triggers are provided below.

H2.2 Percent EPT

Data for percent EPT were compared to:

- Normal range: The lower limit of the habitat-adjusted normal range (2.5th percentile). Up-to-date limits for normal ranges[1] are provided in the RAEMP and LAEMPs, where they are recalculated when new data become available (Teck 2019). The derivation of habitat-adjusted normal ranges is described in Appendix J of the 2020 RAEMP, and was based on consideration of more than 30 habitat, (geographic information system) GIS, and land cover variables (Minnow 2020).
- Expectations: The lower limit of the range of %EPT corresponds to the predicted Aquatic Data Integration Tool (ADIT) score. The predicted ADIT scores correspond to potential effects on benthic invertebrate community (BIC) endpoints, based on relationships between water quality projections (for nitrate, sulphate and cadmium)[2]

[1] The normal range will be updated as part of the three-year reporting cycle of the RAEMP (Minnow 2021).

[2] Selenium was not included because selenium effects on BIC endpoints are not expected. Projections were based on the highest maximum monthly mean across all flow scenarios (low, average, and high).

and invertebrate toxicity endpoints originally developed for the Elk Valley Water Quality Plan (EVWQP; Teck 2014; Golder 2020a). A predicted ADIT score of 3 corresponds to 50% or greater effects to reproduction of the water flea *Ceriodaphnia dubia,* 2 corresponds to effects in 20 to 50% of organisms, 1 corresponds to effects in 10 to 20% of organisms, and 0 corresponds to effects in 10% or fewer organisms. Once %EPT is actually measured, the measured results are converted to an ADIT score in relation to the habitat adjusted normal range as follows: an ADIT score of 0 corresponds to expected %EPT ≥ the 10th percentile of the habitat-adjusted normal range; an ADIT score of 1 corresponds to expected %EPT between the 10th percentile and the 2.5th percentile of the habitat-adjusted normal range (and is therefore identical in application to the lower limit of normal range); an ADIT score of 2 corresponds to expected %EPT between the 2.5th percentile and half of the 2.5th percentile of the habitat-adjusted normal range; and finally, an ADIT score of 3 corresponds to expected %EPT ≤ half of the 2.5th percentile and ≥ 0. Individual replicate habitat-adjusted normal ranges were used at each location for establishing the %EPT limits associated with each ADIT score (replicates were evaluated individually). In summary, this component of the biological trigger for %EPT asks whether the ADIT score – calculated based on measured %EPT relative to normal ranges – is greater than the ADIT score that was predicted based on water quality projections.

Benthic invertebrate community data for %EPT collected in the fall (September) for the 2022 LCO Dry Creek LAEMP were included in the biological trigger analysis.

H2.3 Benthic Invertebrate Tissue Selenium (BIT Se)

Data for BIT Se were compared to:

- Normal range: The upper limit of the regional normal range (97.5th percentile) for individual replicates. Up-to-date limits of normal ranges[3] are provided in the RAEMP and LAEMPs, where they are recalculated when new data become available (Teck 2019).
- Expectations: The upper limit of the 95% prediction interval based on the water to BIT Se bioaccumulation model for lotic environments. The model originally developed in the EVWQP (Golder 2014) was updated (Golder 2020b) and the updated data set was used to calculate prediction intervals for individual replicates. Methods for estimating the upper limit of the 95% prediction for BIT Se (given any projected value of aqueous selenium) are discussed further in the Biological Trigger Development for the Elk Valley Adaptive Management Plan (Azimuth 2021).

[3] The normal range will be updated as part of the three-year reporting cycle of the RAEMP (Minnow 2021).

Benthic invertebrate tissue selenium data from sampling events completed throughout 2022 for the LCO Dry Creek LAEMP (May, June, September, November) were included in the biological trigger analysis although normal range information is based on fall (September) information.

Although EVWQP effects benchmarks are not part of the trigger, they are relevant for interpreting potential significance and responses. Consequently, the level 1, 2 and 3 EVWQP benchmarks for the most sensitive receptor (juvenile fish via dietary exposure) are included in benthic invertebrate tissue plots (11, 18 and 26 mg/kg respectively).

H3 RESULTS

H3.1 Percent EPT

Individual replicates for the %EPT endpoint for both mine-exposed areas (LC_DCDS and LC_DC1) evaluated in the LCO Dry Creek LAEMP were assessed against their respective biological trigger values for the September sampling period (Table H.1, Figure H.1). Each replicate evaluated from LC_DCDS (n=5) and LC_DC1 (n=3) was below the biological trigger values (Table H.1, Figure H.1).

H3.2 Benthic Invertebrate Tissue Selenium (BIT Se)

Benthic invertebrate tissue selenium concentrations at LC_DCDS and LC_DC1 were assessed against their respective biological triggers for individual replicates from each of the sampling events, (May, June, September, and November [only LC_DCDS]; Table H.2, Figure H.2). two replicates in May at LC_DC1 exceeded the biological trigger for BIT Se. Of the 20 samples evaluated in 2022 at LC_DCDS, three exceeded the biological trigger (12.1 mg/kg dw) with BIT Se concentrations of 15 mg/kg dw (two replicates in September and one in November). Of the 15 samples evaluated in 2022 at LC_DC1, two exceeded the biological trigger (12.0 mg/kg dw) in May, with BIT Se concentrations ranging from 12 to 14 mg/kg dw (Table H.2, Figure H.2).

H4 SUMMARY

All the benthic invertebrate community samples from LC_DC1 and LC_DCDS were below the biological trigger values for %EPT. Previously, all %EPT samples were above the biological trigger value (2021 Dry Creek LAEMP; Minnow 2022); the Dry Creek LAEMP will continue monitoring at these sites, with the support of the results of this biological triggers analysis. Efforts to resolve uncertainty around the combined and individual effects of water quality, habitat, and other mine-related stressors on benthic invertebrate communities in lotic areas in the Elk River watershed are underway as Minnow is developing a predictive model for benthic invertebrate community endpoints. Uncertainties are expected to be reduced through these efforts, and additional monitoring or potential management responses will continue to be assessed through the adaptive management process.

Two replicates in September and one replicate in November at LC_DCDS and two replicates from May from LC_DC1 exceeded the biological trigger for benthic invertebrate tissue selenium concentrations. The higher frequency and magnitude of exceedances at LC_DCDS are likely related to its proximity to the DCWMS discharge, while further downstream at LC_DC1 benthic invertebrate tissue selenium concentrations exceeded the biological trigger values slightly less frequently and at a lower magnitude. The biological trigger exceedance for benthic invertebrate tissue selenium concentrations at these areas is likely the result of enhanced selenium bioaccumulation due to the generation of more bioavailable organoselenium in the DCWMS sedimentation ponds (see main report). Mitigation steps were implemented in 2022 to address the elevated benthic invertebrate tissue selenium concentrations observed in the LCO Dry Creek LAEMP. These measures appear to have helped reduce the overall number of biological trigger exceedances in both of these areas in 2022 compared to 2021 (Minnow 2022). Overall, current biological triggers were sufficient to identify monitoring areas where biological responses are occurring, and no additional triggers are recommended at this time.

H5 REFERENCES

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Teck. 2021b. Water Quality Adaptive Management Plan for Teck Coal Operations in the Elk Valley – 2020 Annual Report. Prepared by Teck Coal Limited. July 31, 2021.

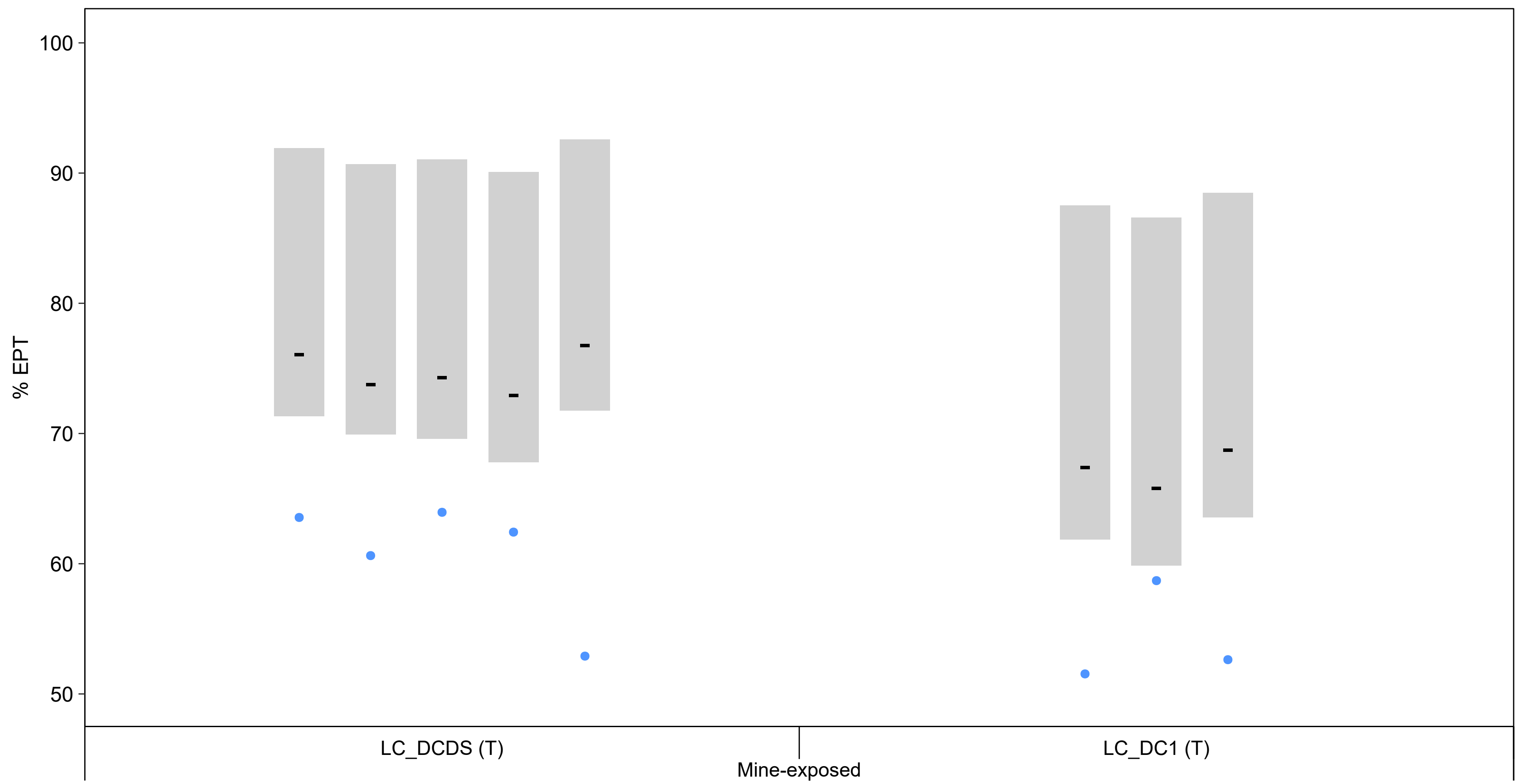

Figure H.1: Biological Trigger Analysis for % EPT Compared to Predicted Values, Dry Creek LAEMP, September 2022

Notes: Black bars indicate the lower limit of the predicted ADIT score for the location. Blue dots represent values exceeding the trigger (below 2.5th percentile of NR and below lower limit of predicted ADIT score). Gray shading represents the habitat-adjusted normal range for each replicate. T = Tributary, M = Mainstem.

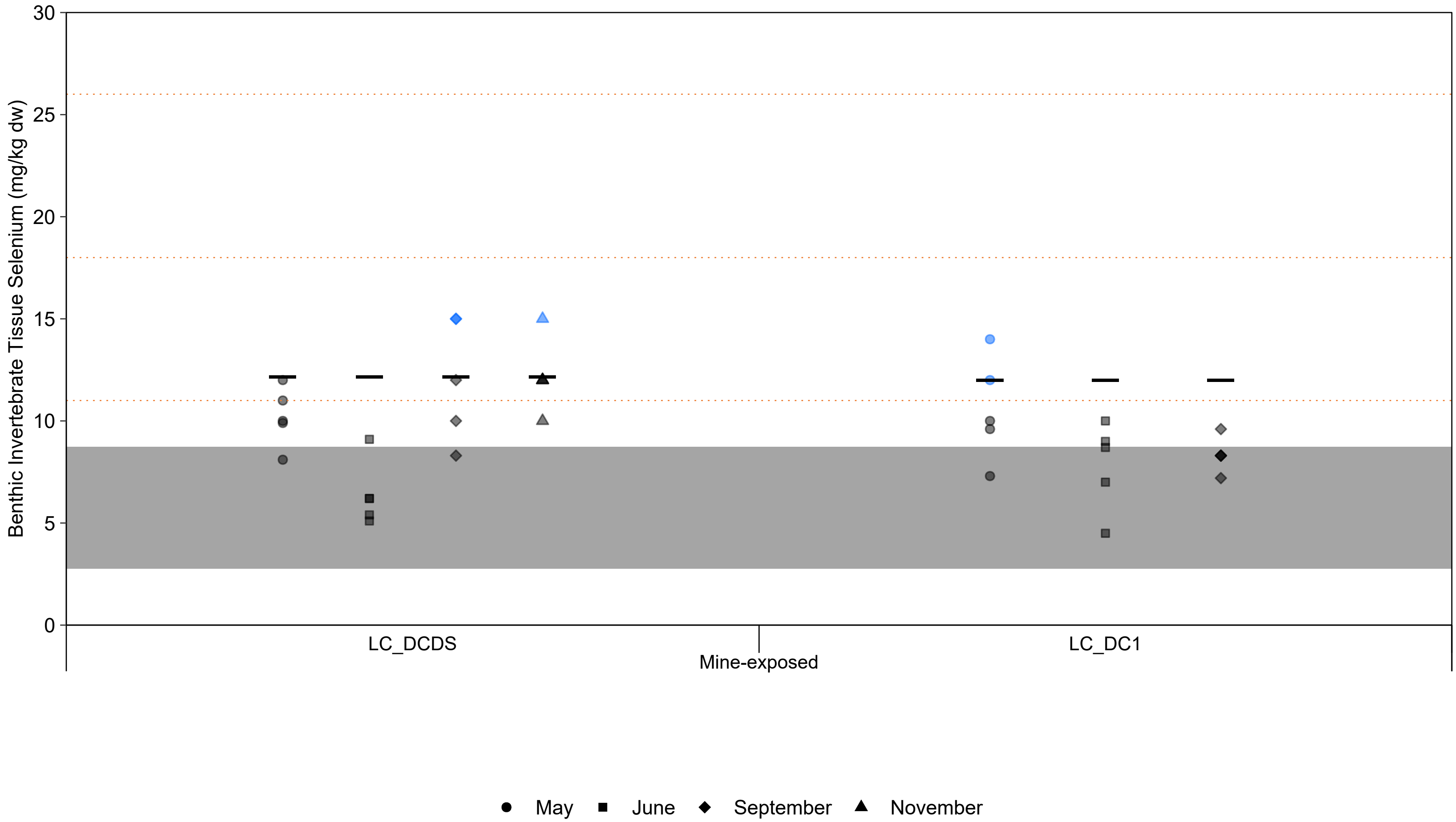

Figure H.2: Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples Compared to Predicted Values, Dry Creek LAEMP, 2022

Notes: Black bars indicate the upper 95th prediction interval of the bioaccumulation model. Blue dots represent values exceeding the trigger (above the 97.5th percentile of normal range and above upper 95% prediction interval). Dotted lines indicate EVWQP benchmarks (11, 18, and 26 mg/kg respectively) for juvenile fish. Gray shading represents the reference area normal range defined as the 2.5th and 97.5th percentiles of the distribution of reference area data (pooled 1996 to 2019 data) reported in the RAEMP. Samples were not collected from LC_DC1 in November due to ice conditions.

Table H.1: Biological Trigger Analysis for %EPT in Dry Creek, September 2022

Waterbody	Exposure	Type	Area	Replicate	Reported Value	ADIT Value	Lower 2.5th Percentile of the Habitat Adjusted Normal Range
Dry Creek	Mine-exposed	T	LC_DCDS	1	63.5	76.0	71.4
				2	60.6	73.8	69.9
				3	64.0	74.3	69.6
				4	62.4	72.9	67.8
				5	52.9	76.8	71.8
			LC_DC1	1	51.5	67.4	61.9
				2	58.7	65.8	59.8
				3	52.6	68.7	63.5

Shaded cells signify those individual replicates that were associated with a biological trigger (i.e. lower than both the ADIT value [as based on predicted water quality] and the lower 2.5th percentile of habitat-adjusted normal range).

Note: T = Tributary.

Table H.2: Biological Trigger Analysis for Selenium Concentrations in Benthic Invertebrate Composite-Taxa Samples in Dry Creek, May to November 2022

Waterbody		Stream Type	Area	Date	Predicted Selenium Water Concentration (mg/L)	Benthic Invertebrate Selenium Tissue		
						Upper 95% Prediction Limit (mg/kg dw)	Upper 97.5th Percentile of Normal Range (mg/kg dw)	Reported Concentration (mg/kg dw)
Dry Creek	Mine-Exposed	T	LC_DCDS	10-May-22	7.03	12.1	8.74	11.0
					7.03	12.1	8.74	12.0
					7.03	12.1	8.74	9.90
					7.03	12.1	8.74	10.0
					7.03	12.1	8.74	8.10
				20-Jun-22	7.03	12.1	8.74	5.40
					7.03	12.1	8.74	6.20
					7.03	12.1	8.74	5.10
					7.03	12.1	8.74	9.10
					7.03	12.1	8.74	6.20
				13-Sep-22	7.03	12.1	8.74	15.0
					7.03	12.1	8.74	10.0
					7.03	12.1	8.74	12.0
					7.03	12.1	8.74	8.30
					7.03	12.1	8.74	15.0
				30-Nov-22	7.03	12.1	8.74	15.0
					7.03	12.1	8.74	12.0
					7.03	12.1	8.74	12.0
					7.03	12.1	8.74	10.0
					7.03	12.1	8.74	12.0
			LC_DC1	11-May-22	5.86	12.0	8.74	7.30
					5.86	12.0	8.74	14.0
					5.86	12.0	8.74	12.0
					5.86	12.0	8.74	9.60
					5.86	12.0	8.74	10.0
				21-Jun-22	5.86	12.0	8.74	10.0
					5.86	12.0	8.74	8.70
					5.86	12.0	8.74	7.00
					5.86	12.0	8.74	9.00
					5.86	12.0	8.74	4.50
				12-Sep-22	5.86	12.0	8.74	8.30
					5.86	12.0	8.74	7.20
					5.86	12.0	8.74	8.30
					5.86	12.0	8.74	8.30
					5.86	12.0	8.74	9.60

Shaded cells signify those individual replicates that were associated with a biological trigger (i.e. higher than both the upper 95% prediction limit [as based on predicted water quality] and the upper 97.5th percentile of normal range).

Note: T = Tributary. Samples were not collected from LC_DC1 in November due to ice conditions.

APPENDIX I
SUPPORTING INFORMATION

Table I.1: Visual Periphyton Coverage Scores from Dry Creek, Fording River, and Grace Creek, 2022

Area		Biological Area Code	Date	Station					Mean	Standard Deviation
				1	2	3	4	5		
Reference	Dry Creek	LC_DCEF	13-Sep-22	3	3	3	-	-	3	0
Mine-exposed	Dry Creek	LC_DC3	13-Sep-22	2	2	2	-	-	2	0
		LC_DCDS	10-May-22	2	2	2	2	2	2	0
			13-Sep-22	2	2	2	2	2	2	0
		LC_DC4	12-Sep-02	3	3	3	-	-	3	0
		LC_DC2	14-Sep-22	3	3	3	-	-	3	0
		LC_DC1	12-Sep-22	3	3	3	-	-	3	0
	Fording River	LC_FRUS	10-Sep-22	2	2	2	-	-	2	0
		LC_FRB	10-Sep-22	2	2	2	-	-	2	0
	Grace Creek	LC_GRCK	14-Sep-22	2	2	2	-	-	2	0

Note: "-" indicates data not collected.

Periphyton Coverage Scores (Environment Canada, 2012):
1 = Rocks not slippery, no obvious colour (<0.5mm thick)
2 = Rocks slightly slippery, yellow-brown to light green colour (0.5-1mm thick)
3 = Rocks have noticeable slippery feel, patches of thicker green to brown algae (1-5mm thick)
4 = Rocks are very slippery, numerous clumps (5-20mm thick)
5 = Rocks mostly obscured by algae mat, may have long strands (>20mm thick)

Table I.2: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling, 2022

	Date	Replicate		1	2	3	4	5	Mean
		LC_DCDS							
Mine-Exposed	10-May-22	1	Depth (cm)	24	26	21	20	14	21
			Velocity (m/s)	0.21	1.084	0.09	0.149	0.145	0.3356
			Bankfull Width (m)			6.2			-
			Wetted Width (m)			4			-
			Bankfull-Wetted Depth (cm)			13			-
		2	Depth (cm)	17	25.5	33.5	35	32.5	28.7
			Velocity (m/s)	0.46	0.649	1.262	1.203	0.651	0.845
			Bankfull Width (m)			4.8			-
			Wetted Width (m)			2.85			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	17	30	30	41	37	31
			Velocity (m/s)	0.011	0.087	0.794	1.958	0.142	0.5984
			Bankfull Width (m)			3.9			-
			Wetted Width (m)			2.8			-
			Bankfull-Wetted Depth (cm)			-			-
		4	Depth (cm)	24.5	22.6	20.8	29	18.7	23.12
			Velocity (m/s)	0.633	1.005	0.697	0.987	0.057	0.6758
			Bankfull Width (m)			4.9			-
			Wetted Width (m)			3.6			-
			Bankfull-Wetted Depth (cm)			-			-
		5	Depth (cm)	21.5	22	32.5	31	27	26.8
			Velocity (m/s)	0.895	1.424	0.334	1.046	0.753	0.8904
			Bankfull Width (m)			4.4			-
			Wetted Width (m)			3.6			-
			Bankfull-Wetted Depth (cm)			-			-
		LC_DC1							
Mine-Exposed	12-Sep-22	1	Depth (cm)	17	15	14.5	10	7	12.7
			Velocity (m/s)	0.209	0.711	0.497	0.463	0.508	0.4776
			Bankfull Width (m)			5.1			-
			Wetted Width (m)			3.6			-
			Bankfull-Wetted Depth (cm)			20			-
		2	Depth (cm)	9	21	13	13	17	14.6
			Velocity (m/s)	0.275	0.472	0.706	1.476	0.014	0.5886
			Bankfull Width (m)			5.5			-
			Wetted Width (m)			3.4			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	11	10	15	13	9	11.6
			Velocity (m/s)	0.39	0.469	0.257	0.551	0.61	0.4554
			Bankfull Width (m)			8.1			-
			Wetted Width (m)			5.6			-
			Bankfull-Wetted Depth (cm)			-			-
		LC_DC2							
Mine-Exposed	14-Sep-22	1	Depth (cm)	12	9	25	23	17	17.2
			Velocity (m/s)	0.081	0.572	0.862	0.627	0.425	0.5134
			Bankfull Width (m)			-			-
			Wetted Width (m)			-			-
			Bankfull-Wetted Depth (cm)			-			-
		2	Depth (cm)	14	8	8	15	9	10.8
			Velocity (m/s)	0.463	0.081	0.633	0.316	0.019	0.3024
			Bankfull Width (m)			4.6			-
			Wetted Width (m)			3.3			-
			Bankfull-Wetted Depth (cm)			15			-
		3	Depth (cm)	4	7	10	6	18	9
			Velocity (m/s)	0.032	0.136	0.113	0.881	0.226	0.2776
			Bankfull Width (m)			5.8			-
			Wetted Width (m)			3.7			-
			Bankfull-Wetted Depth (cm)			-			-
		LC_DC3							
Mine-Exposed	13-Sep-22	1	Depth (cm)	10	6	7	16	4	8.6
			Velocity (m/s)	0.011	0.025	0.019	0.016	0.291	0.0724
			Bankfull Width (m)			4.5			-
			Wetted Width (m)			3.15			-
			Bankfull-Wetted Depth (cm)			12			-
		2	Depth (cm)	8	22	22	17	16	17
			Velocity (m/s)	0.08	0.02	0.383	0.566	0.756	0.361
			Bankfull Width (m)			5.6			-
			Wetted Width (m)			3.2			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	13	18	19	13	9	14.4
			Velocity (m/s)	0.019	0.183	0.036	0.539	0.243	0.204
			Bankfull Width (m)			6.5			-
			Wetted Width (m)			2.9			-
			Bankfull-Wetted Depth (cm)			-			-

Table I.2: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling, 2022

		Replicate		1	2	3	4	5	Mean
Mine-Exposed	12-Sep-22	LC_DC4							
		1	Depth (cm)	11	14	23	17	10	15
			Velocity (m/s)	0.011	0.224	0.413	0.171	0.498	0.2634
			Bankfull Width (m)			5.5			-
			Wetted Width (m)			3.7			-
			Bankfull-Wetted Depth (cm)			26			-
		2	Depth (cm)	11	12	16	14	17	14
			Velocity (m/s)	0.75	0.55	0.562	0.436	0.637	0.587
			Bankfull Width (m)			10.1			-
			Wetted Width (m)			3.9			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	13	13	24	21	12	16.6
			Velocity (m/s)	0.196	0.107	0.427	0.299	0.316	0.269
			Bankfull Width (m)			6.7			-
			Wetted Width (m)			5.2			-
			Bankfull-Wetted Depth (cm)			-			-
Mine-Exposed	13-Sep-22	LC_DCDS							
		1	Depth (cm)	9	16	18	5	4	10.4
			Velocity (m/s)	0.054	0.471	0.322	0.046	0.042	0.187
			Bankfull Width (m)			4.2			-
			Wetted Width (m)			2.9			-
			Bankfull-Wetted Depth (cm)			30			-
		2	Depth (cm)	14	13	20	16	14	15.4
			Velocity (m/s)	0.166	0.382	0.272	0.347	0.275	0.2884
			Bankfull Width (m)			5.5			-
			Wetted Width (m)			2.3			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	10	23	21	19	16	17.8
			Velocity (m/s)	0.184	0.219	0.021	0.319	0.223	0.1932
			Bankfull Width (m)			3.9			-
			Wetted Width (m)			2.55			-
			Bankfull-Wetted Depth (cm)			-			-
		4	Depth (cm)	19	18	12	7	6	12.4
			Velocity (m/s)	0.579	0.076	0.323	0.08	0.09	0.2296
			Bankfull Width (m)			4.9			-
			Wetted Width (m)			3.5			-
			Bankfull-Wetted Depth (cm)			-			-
		5	Depth (cm)	17	27	15	15	12	17.2
			Velocity (m/s)	0.068	0.137	0.189	0.013	0.124	0.1062
			Bankfull Width (m)			4.9			-
			Wetted Width (m)			3.1			-
			Bankfull-Wetted Depth (cm)			-			-
Reference	13-Sep-22	LC_DCEF							
		1	Depth (cm)	14	19	10	7	5	11
			Velocity (m/s)	0.011	0.039	0.119	0.082	0.011	0.0524
			Bankfull Width (m)			3.3			-
			Wetted Width (m)			2			-
			Bankfull-Wetted Depth (cm)			27			-
		2	Depth (cm)	15	10	4	5	14	9.6
			Velocity (m/s)	0.015	0.249	0.126	0.022	0.277	0.1378
			Bankfull Width (m)			4.4			-
			Wetted Width (m)			2.2			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	11	8	13	7	11	10
			Velocity (m/s)	0.094	0.046	0.05	0.224	0.082	0.0992
			Bankfull Width (m)			3.1			-
			Wetted Width (m)			2.1			-
			Bankfull-Wetted Depth (cm)			-			-
Mine-Exposed	10-Sep-22	LC_FRB							
		1	Depth (cm)	16	22	20	20	29	21.4
			Velocity (m/s)	0.276	0.157	0.216	0.582	0.461	0.3384
			Bankfull Width (m)			17			-
			Wetted Width (m)			15			-
			Bankfull-Wetted Depth (cm)			-			-
		2	Depth (cm)	14	33	36	28	55	33.2
			Velocity (m/s)	0.25	0.036	1.355	2.708	0.916	1.053
			Bankfull Width (m)			20			-
			Wetted Width (m)			15			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	17	32	21	20	37	25.4
			Velocity (m/s)	0.984	0.367	0.468	1.712	2.001	1.1064
			Bankfull Width (m)			31			-
			Wetted Width (m)			28			-
			Bankfull-Wetted Depth (cm)			-			-

Table I.2: Supporting Measures Associated with 3-Minute Kick and Sweep Benthic Invertebrate Community Sampling, 2022

		Replicate		1	2	3	4	5	Mean
Mine-Exposed	10-Sep-22	LC_FRUS							
		1	Depth (cm)	42	33	20	12	39	29.2
			Velocity (m/s)	0.014	0.481	0.271	0.124	0.366	0.2512
			Bankfull Width (m)			18			-
			Wetted Width (m)			17			-
			Bankfull-Wetted Depth (cm)			-			-
		2	Depth (cm)	47	64	37	48	40	47.2
			Velocity (m/s)	0.145	1.332	0.636	1.266	0.482	0.7722
			Bankfull Width (m)			20			-
			Wetted Width (m)			17			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	20	30	20	10	15	19
			Velocity (m/s)	0.145	0.265	0.147	0.379	1.002	0.3876
			Bankfull Width (m)			20			-
			Wetted Width (m)			17			-
			Bankfull-Wetted Depth (cm)			-			-
Mine-Exposed	14-Sep-22	LC_GRCK							
		1	Depth (cm)	19	10	13	9	8	11.8
			Velocity (m/s)	0.057	0.307	0.719	0.199	0.166	0.2896
			Bankfull Width (m)			6.3			-
			Wetted Width (m)			2.6			-
			Bankfull-Wetted Depth (cm)			33			-
		2	Depth (cm)	19	16	22	13	12	16.4
			Velocity (m/s)	0.223	0.198	0.103	0.215	0.067	0.1612
			Bankfull Width (m)			4.2			-
			Wetted Width (m)			2			-
			Bankfull-Wetted Depth (cm)			-			-
		3	Depth (cm)	12	10	10	12	13	11.4
			Velocity (m/s)	0.026	0.659	0.674	0.538	0.139	0.4072
			Bankfull Width (m)			3.6			-
			Wetted Width (m)			1.8			-
			Bankfull-Wetted Depth (cm)			-			-
Mine-Exposed	30-Nov-22	LC_DCDS							
		1	Depth (cm)	9	18	12	7	7	10.6
			Velocity (m/s)	0.379	0.043	0.426	0.071	0.094	0.2026
			Bankfull Width (m)			6			-
			Wetted Width (m)			4.8			-
			Bankfull-Wetted Depth (cm)			10			-
		2	Depth (cm)	10	17	10	5	7	9.8
			Velocity (m/s)	0.068	0.117	0.094	0.053	0.009	0.0682
			Bankfull Width (m)			4.9			-
			Wetted Width (m)			3.8			-
			Bankfull-Wetted Depth (cm)			-			-

Table I.3: ***In Situ*** **Water Quality from Dry Creek, Fording River, and Grace Creek, 2022**

Sampling Event	Station	Field Parameters	Reference	Mine-exposed Dry Creek					Mine-exposed Fording River		Mine-exposed Grace Creek
			LC_DCEF	LC_DC3	LC_DCDS	LC_DC4	LC_DC2	LC_DC1	LC_FRB	LC_FRUS	LC_GRCK
May 10 - 11	Station 1	Date	10-May-22	10-May-22	10-May-22	11-May-22	10-May-22	11-May-22	11-May-22	11-May-22	11-May-22
		Temperature (°C)	2.00	1.8	2.6	1.5	3.00	1.7	3.20	2.80	2.00
		Dissolved Oxygen (mg/L)	13.7	13.7	13.7	13.7	13.4	14.3	15.1	13.6	14.2
		Dissolved Oxygen (%)	98.9	99.1	101.1	98.6	99.5	102.5	105.3	100.7	102.9
		Conductivity (µS/cm)	132.6	364.5	267.2	269.2	267	265.1	486.9	489.6	219
		Specific Conductivity (µS/cm)	236.1	645.0	466.5	488.7	460	478.5	835	850	389
		pH	8.47	8.45	8.54	8.28	8.53	8.50	8.46	8.35	8.63
	Station 2	Date	-	-	10-May-22	-	-	-	-	-	-
		Temperature (°C)	-	-	2.7	-	-	-	-	-	-
		Dissolved Oxygen (mg/L)	-	-	14.0	-	-	-	-	-	-
		Dissolved Oxygen (%)	-	-	100.9	-	-	-	-	-	-
		Conductivity (µS/cm)	-	-	277.5	-	-	-	-	-	-
		Specific Conductivity (µS/cm)	-	-	483.4	-	-	-	-	-	-
		pH	-	-	8.52	-	-	-	-	-	-
	Station 3	Date	-	-	10-May-22	-	-	-	-	-	-
		Temperature (°C)	-	-	2.7	-	-	-	-	-	-
		Dissolved Oxygen (mg/L)	-	-	13.7	-	-	-	-	-	-
		Dissolved Oxygen (%)	-	-	100.4	-	-	-	-	-	-
		Conductivity (µS/cm)	-	-	293.5	-	-	-	-	-	-
		Specific Conductivity (µS/cm)	-	-	511.0	-	-	-	-	-	-
		pH	-	-	8.49	-	-	-	-	-	-
	Station 4	Date	-	-	10-May-22	-	-	-	-	-	-
		Temperature (°C)	-	-	2.6	-	-	-	-	-	-
		Dissolved Oxygen (mg/L)	-	-	13.5	-	-	-	-	-	-
		Dissolved Oxygen (%)	-	-	99.6	-	-	-	-	-	-
		Conductivity (µS/cm)	-	-	313.2	-	-	-	-	-	-
		Specific Conductivity (µS/cm)	-	-	548.0	-	-	-	-	-	-
		pH	-	-	8.46	-	-	-	-	-	-
	Station 5	Date	-	-	10-May-22	-	-	-	-	-	-
		Temperature (°C)	-	-	2.6	-	-	-	-	-	-
		Dissolved Oxygen (mg/L)	-	-	13.6	-	-	-	-	-	-
		Dissolved Oxygen (%)	-	-	100.4	-	-	-	-	-	-
		Conductivity (µS/cm)	-	-	341.4	-	-	-	-	-	-
		Specific Conductivity (µS/cm)	-	-	596.0	-	-	-	-	-	-
		pH	-	-	8.45	-	-	-	-	-	-
June 21 - 23	Station 1	Date	20-Jun-22	20-Jun-22	20-Jun-22	21-Jun-22	21-Jun-22	21-Jun-22	21-Jun-22	21-Jun-22	22-Jun-22
		Temperature (°C)	3.50	3.4	4.4	4.0	3.70	4.8	5.90	5.50	4.00
		Dissolved Oxygen (mg/L)	13.5	13.3	13.3	13.4	13.5	13.4	12.8	13.0	13.9
		Dissolved Oxygen (%)	101.1	99.9	101.2	101.5	102.3	104.3	103.1	103.1	105.8
		Conductivity (µS/cm)	113.5	302.1	272.9	203.7	204	208.2	305.4	304.8	184
		Specific Conductivity (µS/cm)	192.5	515.0	448.3	335.3	344	338.8	481	485	295
		pH	8.18	7.93	8.21	8.15	8.22	8.29	8.17	8.15	8.41

Table I.3: ***In Situ*** **Water Quality from Dry Creek, Fording River, and Grace Creek, 2022**

Sampling Event	Station	Field Parameters	Reference	Mine-exposed Dry Creek					Mine-exposed Fording River		Mine-exposed Grace Creek
			LC_DCEF	LC_DC3	LC_DCDS	LC_DC4	LC_DC2	LC_DC1	LC_FRB	LC_FRUS	LC_GRCK
September 10 - 15	Station 1	Date	13-Sep-22	13-Sep-22	13-Sep-22	12-Sep-22	14-Sep-22	12-Sep-22	10-Sep-22	10-Sep-22	14-Sep-22
		Temperature (°C)	4.00	4.1	6.0	5.1	6.00	4.7	7.00	5.00	5.90
		Dissolved Oxygen (mg/L)	10.8	10.8	10.6	10.6	10.6	11.2	11.0	10.4	10.6
		Dissolved Oxygen (%)	101.0	102.0	105.0	100.0	104.0	104.0	108.0	97.0	102.0
		Conductivity (µS/cm)	180.0	769.0	740.0	527.0	710	503.0	579.0	544.0	277
		Specific Conductivity (µS/cm)	300.0	1282.0	1161.0	809.0	1,114	823.0	882	880	436
		pH	7.95	8.07	8.32	7.85	8.26	8.28	8.32	8.18	8.35
	Station 2	Date	13-Sep-22	13-Sep-22	13-Sep-22	12-Sep-22	13-Sep-22	12-Sep-22	10-Sep-22	10-Sep-22	14-Sep-22
		Temperature (°C)	3.90	4.1	6.0	5.2	5.90	4.9	7.40	5.00	5.70
		Dissolved Oxygen (mg/L)	107.0	10.8	10.6	10.6	10.7	11.1	11.0	10.5	10.7
		Dissolved Oxygen (%)	100.0	102.0	104.0	100.0	105.0	103.0	109.0	98.0	102.0
		Conductivity (µS/cm)	180.0	771.0	742.0	551.0	709	509.0	584.0	541.0	275
		Specific Conductivity (µS/cm)	301.0	1282.0	1164.0	847.0	116	822.0	881	88	435
		pH	7.96	8.14	8.34	7.87	8.23	8.27	8.28	8.17	8.35
	Station 3	Date	13-Sep-22	13-Sep-22	13-Sep-22	12-Sep-22	13-Sep-22	12-Sep-22	10-Sep-22	10-Sep-22	14-Sep-22
		Temperature (°C)	3.90	4.1	5.8	5.3	5.80	5.1	7.90	5.20	5.60
		Dissolved Oxygen (mg/L)	10.6	10.8	10.6	10.5	10.7	11.1	10.8	10.5	107.0
		Dissolved Oxygen (%)	98.0	102.0	104.0	100.0	104.0	104.0	108.0	99.0	102.0
		Conductivity (µS/cm)	179.8	773.0	735.0	530.0	708	509.0	594.0	541.0	274
		Specific Conductivity (µS/cm)	301.0	1286.0	1162.0	849.0	112	821.0	881	870	435
		pH	7.85	8.12	8.28	7.89	8.19	8.25	8.30	8.19	8.40
	Station 4	Date	-	-	13-Sep-22	-	-	-	-	-	-
		Temperature (°C)	-	-	5.7	-	-	-	-	-	-
		Dissolved Oxygen (mg/L)	-	-	10.6	-	-	-	-	-	-
		Dissolved Oxygen (%)	-	-	104.0	-	-	-	-	-	-
		Conductivity (µS/cm)	-	-	726.0	-	-	-	-	-	-
		Specific Conductivity (µS/cm)	-	-	1152.0	-	-	-	-	-	-
		pH	-	-	8.29	-	-	-	-	-	-
	Station 5	Date	-	-	13-Sep-22	-	-	-	-	-	-
		Temperature (°C)	-	-	5.5	-	-	-	-	-	-
		Dissolved Oxygen (mg/L)	-	-	10.6	-	-	-	-	-	-
		Dissolved Oxygen (%)	-	-	103.0	-	-	-	-	-	-
		Conductivity (µS/cm)	-	-	739.0	-	-	-	-	-	-
		Specific Conductivity (µS/cm)	-	-	1180.0	-	-	-	-	-	-
		pH	-	-	8.23	-	-	-	-	-	-
November 29 - 30	Station 1	Date	29-Nov-22	29-Nov-22	30-Nov-22	29-Nov-22	-	-	29-Nov-22	29-Nov-22	30-Nov-22
		Temperature (°C)	2.00	-0.1	0.2	0.7	-	-	-.10	.00	0.20
		Dissolved Oxygen (mg/L)	11.1	12.0	12.3	12.1	-	-	12.2	12.3	12.5
		Dissolved Oxygen (%)	80.4	82.3	85.3	84.3	-	-	83.9	84.2	85.7
		Conductivity (µS/cm)	222.9	969.0	967.0	565.0	-	-	665.0	618.0	295
		Specific Conductivity (µS/cm)	397.6	1860.0	1838.0	1056.0	-	-	1,276	1,184	561
		pH	7.74	7.89	7.78	7.83	-	-	7.77	7.74	8.19

Table I.4: **Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022**

LC_DCDS-1			LC_DCDS-2			LC_DCDS-3			LC_DCDS-4		
10-May-22			10-May-22			10-May-22			10-May-22		
Pebble	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)
1	5.1	-	**1**	12.5	-	**1**	18.5	-	**1**	7.5	-
2	6.8	-	**2**	8.1	-	**2**	7.7	-	**2**	10.1	-
3	8.6	-	**3**	11.7	-	**3**	5.9	-	**3**	16.2	-
4	8.5	-	**4**	10.2	-	**4**	14.5	-	**4**	27	-
5	24.5	-	**5**	7.2	-	**5**	12.8	-	**5**	10.5	-
6	4.1	-	**6**	13.2	-	**6**	17	-	**6**	17	-
7	12.5	-	**7**	8.9	-	**7**	8.1	-	**7**	12.1	-
8	6.5	-	**8**	19	-	**8**	15.2	-	**8**	21.5	-
9	5.4	-	**9**	5.2	-	**9**	10.3	-	**9**	9.8	-
10	6.2	0.5	**10**	13.3	0	**10**	8.5	0	**10**	27	0.5
11	7.5	-	**11**	8.4	-	**11**	2.2	-	**11**	15.2	-
12	5.1	-	**12**	3.5	-	**12**	13.2	-	**12**	24	-
13	2.1	-	**13**	12.8	-	**13**	8.7	-	**13**	4.1	-
14	3.4	-	**14**	14.5	-	**14**	5.2	-	**14**	5.2	-
15	6.8	-	**15**	8.2	-	**15**	10.3	-	**15**	14.6	-
16	13	-	**16**	5.6	-	**16**	4.1	-	**16**	4.3	-
17	2.1	-	**17**	2.1	-	**17**	9.2	-	**17**	8.8	-
18	3.6	-	**18**	-	-	**18**	1.3	-	**18**	3.1	-
19	4.5	-	**19**	11.6	-	**19**	8.6	-	**19**	1.9	-
20	5.5	0.5	**20**	6.3	0	**20**	3.4	0.25	**20**	10.2	0.5
21	3.8	-	**21**	3.1	-	**21**	9	-	**21**	7.3	-
22	11	-	**22**	4.5	-	**22**	13	-	**22**	24.5	-
23	13.5	-	**23**	4.8	-	**23**	6.7	-	**23**	6.1	-
24	3.5	-	**24**	6.4	-	**24**	13	-	**24**	4.2	-
25	6.5	-	**25**	3.2	-	**25**	8.6	-	**25**	10.5	-
26	8.2	-	**26**	8.3	-	**26**	5.1	-	**26**	5.3	-
27	3.8	-	**27**	1.9	-	**27**	4.7	-	**27**	5.4	-
28	3.5	-	**28**	9.5	-	**28**	14.6	-	**28**	7.3	-
29	6.8	-	**29**	9.7	-	**29**	6.5	-	**29**	5.1	-
30	24	0.25	**30**	17.2	-	**30**	19.3	0.5	**30**	7.3	0
31	16	-	**31**	14.1	-	**31**	12.2	-	**31**	21.2	-
32	8.5	-	**32**	7.3	-	**32**	17.5	-	**32**	4.5	-
33	27	-	**33**	7.6	-	**33**	7.4	-	**33**	2.5	-
34	12.8	-	**34**	15.7	-	**34**	4.9	-	**34**	25	-
35	5.4	-	**35**	-	-	**35**	2.7	-	**35**	10.3	-
36	6.5	-	**36**	10.4	-	**36**	9	-	**36**	17.5	-
37	21	-	**37**	9.9	-	**37**	6.1	-	**37**	20.6	-
38	3.5	-	**38**	6.3	-	**38**	8.5	-	**38**	7.3	-
39	4.4	-	**39**	2.8	-	**39**	12.6	-	**39**	17.1	-
40	2	0	**40**	4	0	**40**	12.7	0	**40**	1.8	0.5
41	8.5	-	**41**	4.6	-	**41**	0.9	-	**41**	26.1	-
42	11	-	**42**	7.1	-	**42**	3.7	-	**42**	5.2	-
43	8.5	-	**43**	3	-	**43**	5.5	-	**43**	11.1	-
44	-	-	**44**	16.5	-	**44**	9.7	-	**44**	-	-
45	7.5	-	**45**	6.8	-	**45**	1.1	-	**45**	17.2	-
46	11.6	-	**46**	5	-	**46**	8.7	-	**46**	4.2	-
47	10.5	-	**47**	6.2	-	**47**	17.4	-	**47**	7.6	-
48	6.5	-	**48**	9.7	-	**48**	11.8	-	**48**	3.7	-
49	7.6	-	**49**	6.8	-	**49**	5.4	-	**49**	18.2	-
50	9.2	0	**50**	2.1	0	**50**	1.2	0.5	**50**	4.3	0
51	17.5	-	**51**	4	-	**51**	4.5	-	**51**	13.1	-
52	13.4	-	**52**	19.6	-	**52**	6.7	-	**52**	1.6	-
53	14.5	-	**53**	6.5	-	**53**	4.1	-	**53**	13.2	-
54	13	-	**54**	5.8	-	**54**	10.6	-	**54**	3.8	-
55	3.5	-	**55**	7.5	-	**55**	9.4	-	**55**	18.5	-
56	1	-	**56**	13	-	**56**	9.1	-	**56**	11.2	-
57	4	-	**57**	7	-	**57**	3.2	-	**57**	13.5	-
58	3	-	**58**	12.5	-	**58**	9.7	-	**58**	4.4	-
59	14	-	**59**	12.8	-	**59**	1.6	-	**59**	5.5	-
60	13	0	**60**	18	0	**60**	3.3	0.25	**60**	3	0
61	12.5	-	**61**	11	-	**61**	4.9	-	**61**	16.1	-
62	4.5	-	**62**	12	-	**62**	13.5	-	**62**	0.5	-
63	10.5	-	**63**	4.9	-	**63**	12.5	-	**63**	12.2	-
64	3	-	**64**	7.6	-	**64**	10.5	-	**64**	5.7	-
65	9.5	-	**65**	5.1	-	**65**	9.2	-	**65**	9.6	-
66	12	-	**66**	4.5	-	**66**	6.4	-	**66**	11.7	-
67	7.8	-	**67**	6.2	-	**67**	15.3	-	**67**	15.1	-
68	6	-	**68**	-	-	**68**	13.4	-	**68**	6.1	-
69	8	-	**69**	2.3	-	**69**	8.7	-	**69**	8.2	-
70	4	0	**70**	10.3	0.25	**70**	8.8	0	**70**	22.1	0.5
71	4.2	-	**71**	10.5	-	**71**	10.4	-	**71**	10.5	-
72	11.5	-	**72**	11.4	-	**72**	3.3	-	**72**	20.3	-
73	3.3	-	**73**	9	-	**73**	5.1	-	**73**	2.6	-
74	5	-	**74**	3.7	-	**74**	6.2	-	**74**	16.2	-
75	10.2	-	**75**	11	-	**75**	9	-	**75**	17	-
76	7.5	-	**76**	7.5	-	**76**	10.5	-	**76**	6.1	-
77	8	-	**77**	6.2	-	**77**	6.7	-	**77**	12.6	-
78	17	-	**78**	7.2	-	**78**	19.3	-	**78**	11.7	-
79	8	-	**79**	9.5	-	**79**	14.2	-	**79**	10.5	-
80	10.5	0	**80**	5.8	0.5	**80**	4.3	0.75	**80**	15.8	0
81	9.8	-	**81**	5.3	-	**81**	3.7	-	**81**	5.2	-
82	17	-	**82**	6	-	**82**	5.9	-	**82**	16.2	-
83	7.2	-	**83**	7.3	-	**83**	8.9	-	**83**	12.1	-
84	13.8	-	**84**	7.1	-	**84**	1.6	-	**84**	12.3	-
85	7.8	-	**85**	-	-	**85**	5.5	-	**85**	25.2	-
86	17	-	**86**	6.4	-	**86**	7.7	-	**86**	12	-
87	8.5	-	**87**	9.4	-	**87**	6.3	-	**87**	20.1	-
88	5.2	-	**88**	15.5	-	**88**	2.7	-	**88**	5.7	-
89	6.1	-	**89**	5.6	-	**89**	2.6	-	**89**	11.1	-
90	8.6	0.25	**90**	8.1	0.25	**90**	16.5	0.25	**90**	5.2	0
91	3.8	-	**91**	12.5	-	**91**	10.3	-	**91**	8.9	-
92	13.5	-	**92**	7.2	-	**92**	7.6	-	**92**	7.6	-
93	5.2	-	**93**	11.5	-	**93**	22	-	**93**	9.5	-
94	10.7	-	**94**	14	-	**94**	4.2	-	**94**	-	-
95	9.5	-	**95**	15.2	-	**95**	11.1	-	**95**	7.2	-
96	6.2	-	**96**	2.5	-	**96**	9.6	-	**96**	6.1	-
97	14.1	-	**97**	2.1	-	**97**	7.6	-	**97**	16.3	-
98	9.8	-	**98**	9.5	-	**98**	5.2	-	**98**	7.2	-
99	17	-	**99**	5.7	-	**99**	7	-	**99**	7.3	-
100	7.6	0	**100**	8.6	0	**100**	14.3	0.25	**100**	5.8	0.75
Average Cic, Cip and Embed. =	**8.82**	**0.15**	**Average Cic, Cip and Embed. =**	**8.42**	**0.11**	**Average Cic, Cip and Embed. =**	**8.59**	**0.28**	**Average Cic, Cip and Embed. =**	**11.0**	**0.28**

Notes: nm = not measurable, "-" indicates no data. Intermediate axis is the measurement across the intermediate access of the pebble and presented in cm.

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DCDS-5			LC_DC1-1					
10-May-22			12-Sep-22					
Pebble	**Intermediate Axis (cm)**	**Embeddedness (%)**	**Pebble**	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**
1	1.2	-	**1**	0	0.6	1	17.5	-
2	3.4	-	**2**	0	0.5	1	8.3	-
3	6.5	-	**3**	0	0.6	1	24	-
4	3.5	-	**4**	0	0.7	1	11	-
5	7.2	-	**5**	0	0.4	1	7.3	-
6	14.7	-	**6**	0	0	0	5	-
7	4.9	-	**7**	0	0.2	1	6.5	-
8	5.1	-	**8**	0	0	0	25	-
9	10.4	-	**9**	0	0	0	13	-
10	11.6	0.25	**10**	0	0	0	10.5	0.5
11	13.4	-	**11**	0	0	0	8	-
12	5	-	**12**	0	0	0	18	-
13	5.5	-	**13**	0	0	0	3.6	-
14	11.7	-	**14**	0	0	0	10.5	-
15	6.9	-	**15**	0	0	0	6	-
16	13	-	**16**	0	0.5	1	4.9	-
17	4.7	-	**17**	0	0.5	1	5.5	-
18	0.8	-	**18**	0	0.5	1	14	-
19	4.1	-	**19**	0	0	0	4	-
20	7.3	0.5	**20**	0	0.7	1	17	0.25
21	5.3	-	**21**	0	0	0	23.5	-
22	8.6	-	**22**	0	0	0	9.5	-
23	8.4	-	**23**	0	0.7	1	5.3	-
24	27.5	-	**24**	0	0	0	1.8	-
25	5.7	-	**25**	0	0	0	2.2	-
26	2.8	-	**26**	0	0.7	1	7.6	-
27	7.2	-	**27**	0	0	0	4.5	-
28	7.5	-	**28**	0	0.3	1	13	-
29	11.6	-	**29**	0	0	0	7	-
30	3.5	0.25	**30**	0	0	0	4.2	0.5
31	9.4	-	**31**	0	0	0	6.6	-
32	4.8	-	**32**	0	0	0	4.5	-
33	9.2	-	**33**	0	0	0	10.6	-
34	11.1	-	**34**	0	0	0	5.7	-
35	7	-	**35**	0	0.7	1	10.3	-
36	1.4	-	**36**	0	0.4	1	7.1	-
37	16.5	-	**37**	0	0.4	1	12	-
38	9.1	-	**38**	0	0	0	7.5	-
39	15.4	-	**39**	0	0	0	9	-
40	6.8	0	**40**	0	0	0	7	0.5
41	12	-	**41**	0	0	0	10.2	-
42	10.2	-	**42**	0	0	0	11	-
43	17.2	-	**43**	0	0	0	7	-
44	6.6	-	**44**	0	0	0	6.7	-
45	7.7	-	**45**	0	0	0	23.2	-
46	10.2	-	**46**	0	0	0	13	-
47	29.5	-	**47**	0	0	0	12	-
48	8	-	**48**	0	0	0	11.9	-
49	16.8	-	**49**	0	0	0	25.6	-
50	21.2	0.25	**50**	0	0	0	7.5	0.25
51	5.5	-	**51**	0	0	0	5.5	-
52	8.1	-	**52**	0	0.3	1	17.3	-
53	22.6	-	**53**	0	0.1	1	3.9	-
54	14.9	-	**54**	0	0	0	1.9	-
55	9.5	-	**55**	0	0.2	1	8.4	-
56	7.1	-	**56**	0	0	0	17	-
57	4	-	**57**	0	0	0	7.2	-
58	2.2	-	**58**	0	0	0	4.5	-
59	5.5	-	**59**	0	0	0	6.2	-
60	10	0.75	**60**	0	0.1	1	4.8	0.5
61	4.3	-	**61**	0	0.1	1	6.8	-
62	9.5	-	**62**	0	0	0	7.3	-
63	13.9	-	**63**	0	0.1	1	10.5	-
64	2	-	**64**	0	0.1	1	5.5	-
65	8.6	-	**65**	0	0	0	6.8	-
66	5.8	-	**66**	0	0.1	1	8.2	-
67	10.8	-	**67**	0	0.3	1	7.5	-
68	24.7	-	**68**	0	0.5	1	10.5	-
69	6.2	-	**69**	0	0.1	1	6.5	-
70	24	0.25	**70**	0	0	0	13	0.5
71	4.8	-	**71**	0	0	0	6.8	-
72	6.5	-	**72**	0	0	0	15	-
73	16.5	-	**73**	0	0.2	1	8.3	-
74	15.7	-	**74**	0	0	0	7	-
75	6.5	-	**75**	0	0	0	4.5	-
76	9	-	**76**	0	0.2	1	6.3	-
77	5.8	-	**77**	0	0	0	7.6	-
78	9.6	-	**78**	0	0.5	1	12.3	-
79	4.4	-	**79**	0	0	0	8.8	-
80	15.5	0.5	**80**	0	0.5	1	11.8	0.5
81	8.6	-	**81**	0	0.5	1	5.5	-
82	13.4	-	**82**	0	0	0	5.4	-
83	2.9	-	**83**	0	0.4	1	11	-
84	3.3	-	**84**	0	0	0	7	-
85	15.2	-	**85**	0	0.1	1	8.6	-
86	8.7	-	**86**	0	0.3	1	16	-
87	12	-	**87**	0	0.2	1	11	-
88	4.5	-	**88**	0	0	0	8.2	-
89	17.7	-	**89**	0	0	0	4.3	-
90	5	0.5	**90**	0	0	0	7.8	0.75
91	3.3	-	**91**	0	0	0	8.8	-
92	23.5	-	**92**	0	0.2	1	6.7	-
93	10.4	-	**93**	0	0.3	1	18	-
94	6.5	-	**94**	0	0	0	4.3	-
95	5.7	-	**95**	0	0	0	5.8	-
96	15.8	-	**96**	0	0	0	3.7	-
97	6.8	-	**97**	0	0	0	6.5	-
98	2.1	-	**98**	0	0.2	1	8	-
99	11.4	-	**99**	0	0	0	10.5	-
100	1.3	0	**100**	0	0	0	8.8	0.5
Average Cic, Cip and Embed. =	**9.31**	**0.33**	**Average Cic, Cip and Embed. =**	**0**	**0.14**	**0.39**	**9.202**	**0.48**
			Old Calcite Index (CI) =		**0.39**			
			New Calcite Index (CI) =		**0.14**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DC1-2						LC_DC1-3					
12-Sep-22						12-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0.3	1	8.4	-	**1**	0	0.5	1	10.2	-
2	0	0	0	13.2	-	**2**	0	0.1	1	5	-
3	0	0	0	8.3	-	**3**	0	0	0	4.5	-
4	0	0	0	6	-	**4**	0	0.1	1	4.5	-
5	0	0.5	1	14.5	-	**5**	0	0.7	1	11.5	-
6	0	0	0	8	-	**6**	0	0	0	8.5	-
7	0	0.1	1	8	-	**7**	0	0	0	7.2	-
8	0	0	0	9	-	**8**	0	0	0	9	-
9	0	0	0	11.3	-	**9**	0	0.4	1	9.5	-
10	0	0	0	16	0.5	**10**	0	0.4	1	7.8	0.5
11	0	0	0	7.4	-	**11**	0	0.5	1	11	-
12	0	0	0	8.2	-	**12**	0	0	0	6.3	-
13	0	0	0	7.3	-	**13**	0	0	0	5.3	-
14	0	0	0	14	-	**14**	0	0	0	9.3	-
15	0	0	0	4	-	**15**	0	0	0	17.9	-
16	0	0	0	5	-	**16**	0	0	0	6.6	-
17	0	0	0	20.5	-	**17**	0	0	0	6.7	-
18	0	0	0	13	-	**18**	0	0	0	8.3	-
19	0	0	0	11	-	**19**	0	0	0	9.5	-
20	0	0	0	14.9	0.5	**20**	0	0.1	1	8.5	0.25
21	0	0	0	14	-	**21**	0	0	0	10.6	-
22	0	0	0	6	-	**22**	0	0	0	6.2	-
23	0	0	0	5	-	**23**	0	0.4	1	7	-
24	0	0	0	22.3	-	**24**	0	0.1	1	11.6	-
25	0	0	0	5	-	**25**	0	0	0	11.5	-
26	0	0	0	8	-	**26**	0	0	0	6.1	-
27	0	0	0	25	-	**27**	0	0	0	10.1	-
28	0	0.4	1	24.8	-	**28**	0	0	0	11	-
29	0	0	0	11	-	**29**	0	0	0	9	-
30	0	0	0	15	0.75	**30**	0	0	0	6.5	0.25
31	0	0	0	11.4	-	**31**	0	0	0	7.6	-
32	0	0	0	5	-	**32**	0	0	0	5.8	-
33	0	0	0	9.3	-	**33**	0	0	0	16.3	-
34	0	0	0	13	-	**34**	0	0	0	8.9	-
35	0	0	0	12	-	**35**	0	0	0	9	-
36	0	0	0	6	-	**36**	0	0	0	5.6	-
37	0	0	0	8.5	-	**37**	0	0	0	10.3	-
38	0	0	0	12.3	-	**38**	0	0.1	1	9	-
39	0	0	0	7.5	-	**39**	0	0	0	20	-
40	0	0	0	7.5	0.5	**40**	0	0	0	16	0.25
41	0	0	0	22.5	-	**41**	0	0	0	7	-
42	0	0	0	18.5	-	**42**	0	0	0	9	-
43	0	0	0	6.5	-	**43**	0	0	0	8	-
44	0	0	0	8.1	-	**44**	0	0.3	1	9	-
45	0	0	0	6.2	-	**45**	0	0	0	10	-
46	0	0	0	9.3	-	**46**	0	0	0	9.3	-
47	0	0	0	31.5	-	**47**	0	0.3	1	8.6	-
48	0	0	0	4.5	-	**48**	0	0	0	9.5	-
49	0	0.5	1	7	-	**49**	0	0	0	9.2	-
50	0	0	0	19	0.5	**50**	0	0.5	1	16.5	0.5
51	0	0	0	9.3	-	**51**	0	0.3	1	5.3	-
52	0	0	0	3.8	-	**52**	0	0	0	10.6	-
53	0	0.1	1	4.5	-	**53**	0	0	0	6.6	-
54	0	0	0	11.2	-	**54**	0	0	0	10.4	-
55	0	0.3	1	9.6	-	**55**	0	0	0	5.2	-
56	0	0	0	4.5	-	**56**	0	0.5	1	10.3	-
57	0	0	0	4.7	-	**57**	0	0	0	8.4	-
58	0	0	0	3.8	-	**58**	0	0	0	8.9	-
59	0	0.1	1	5	-	**59**	0	0	0	12.1	-
60	0	0.2	1	12.4	0.5	**60**	0	0	0	4.8	-
61	0	0	0	8.5	-	**61**	0	0.1	1	10.5	-
62	0	0	0	11	-	**62**	0	0	0	8.1	-
63	0	0	0	6.3	-	**63**	0	0	0	13.5	-
64	0	0	0	11.5	-	**64**	0	0	0	4.8	-
65	0	0.2	1	4.2	-	**65**	0	0.3	1	7.9	-
66	0	0	0	5.1	-	**66**	0	0.3	1	6.5	-
67	0	0.5	1	13.5	-	**67**	0	0.1	1	5.2	-
68	0	0	0	5.8	-	**68**	0	0	0	10.5	-
69	0	0	0	7.1	-	**69**	0	0	0	5.5	-
70	0	0.2	1	7.2	0	**70**	0	0	0	4.3	0.5
71	0	0.5	1	5.1	-	**71**	0	0	0	9.5	-
72	0	0	0	7.2	-	**72**	0	0	0	3.9	-
73	0	0.8	1	12.5	-	**73**	0	0	0	6.5	-
74	0	0	0	16	-	**74**	0	0	0	9.5	-
75	0	0.1	1	6.3	-	**75**	0	0	0	5.3	-
76	0	0.2	1	8.5	-	**76**	0	0	0	5.5	-
77	0	0	0	8.9	-	**77**	0	0	0	4.3	-
78	0	0.5	1	7.5	-	**78**	0	0	0	6.5	-
79	0	0	0	10.2	-	**79**	0	0	0	5.6	-
80	0	0.5	1	3.8	0.25	**80**	0	0	0	8.1	0.5
81	0	0	0	8.5	-	**81**	0	0	0	8.3	-
82	0	0	0	11.5	-	**82**	0	0.1	1	7.5	-
83	0	0	0	4.3	-	**83**	0	0	0	10.5	-
84	0	0	0	19	-	**84**	0	0	0	11.1	-
85	0	0	0	11	-	**85**	0	0	0	12	-
86	0	0	0	25	-	**86**	0	0	0	6.5	-
87	0	0	0	7.3	-	**87**	0	0	0	4.1	-
88	0	0	0	8.2	-	**88**	0	0	0	11.5	-
89	0	0	0	8.5	-	**89**	0	0.1	1	7.2	-
90	0	0	0	7.3	0.25	**90**	0	0	0	13.4	0.25
91	0	0	0	7.8	-	**91**	0	0	0	6.5	-
92	0	0	0	14.3	-	**92**	0	0	0	18.3	-
93	0	0.3	1	5.5	-	**93**	0	0	0	6.5	-
94	0	0	0	7.6	-	**94**	0	0.1	1	5.8	-
95	0	0	0	6.2	-	**95**	0	0.1	1	9.6	-
96	0	0.5	1	7.8	-	**96**	0	0.5	1	12.4	-
97	0	0	0	1.4	-	**97**	0	0	0	13.6	-
98	0	0	0	13	-	**98**	0	0	0	9.8	-
99	0	0	0	5.4	-	**99**	0	0.3	1	8.4	-
100	0	0	0	15	0.75	**100**	0	0	0	7.6	0.75
Average Cic, Cip and Embed. =	**0**	**0.07**	**0.20**	**9.993**	**0.45**	**Average Cic, Cip and Embed. =**	**0**	**0.07**	**0.26**	**8.76**	**0.42**
Old Calcite Index (CI) =		**0.20**				**Old Calcite Index (CI) =**		**0.26**			
New Calcite Index (CI) =		**0.07**				**New Calcite Index (CI) =**		**0.07**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DC2-1						LC_DC2-2					
14-Sep-22						14-Sep-22					
Pebble	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**	**Pebble**	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**
1	0	0	0	4	-	**1**	0	0.1	1	6.2	-
2	0	0	0	8.3	-	**2**	0	0	0	4.7	-
3	0	0	0	6	-	**3**	0	0.3	1	11	-
4	0	0	0	4	-	**4**	0	0	0	3	-
5	0	0	0	4.5	-	**5**	0	0	0	1.5	-
6	0	0.1	1	5	-	**6**	0	0.2	1	6.2	-
7	0	0	0	6	-	**7**	0	0.3	1	14.3	-
8	0	0	0	4.6	-	**8**	0	0	0	9.2	-
9	0	0	0	2	-	**9**	0	0	0	5	-
10	0	0.3	1	13	0.75	**10**	0	0	0	6.5	0.25
11	0	0	0	6	-	**11**	0	0.2	1	11.2	-
12	0	0	0	3	-	**12**	0	0.2	1	10.5	-
13	0	0	0	1.5	-	**13**	0	0.1	1	8	-
14	0	0	0	5	-	**14**	0	0	0	11.3	-
15	0	0.2	1	11	-	**15**	1	0.1	1	58	-
16	0	0.3	1	8	-	**16**	0	0	0	3	-
17	0	0.2	1	9	-	**17**	0	0.5	1	5.1	-
18	0	0	0	3.5	-	**18**	0	0	0	11.4	-
19	0	0.3	1	6	-	**19**	0	0	0	5	-
20	0	0	0	7.5	0.5	**20**	0	0.1	1	5.6	0.75
21	0	0.1	1	8	-	**21**	0	0	0	14	-
22	0	0.1	1	4.5	-	**22**	0	0	0	6.1	-
23	0	0.2	1	10.5	-	**23**	0	0.2	1	7	-
24	0	0.2	1	3.5	-	**24**	0	0.4	1	10.2	-
25	0	0	0	3	-	**25**	0	0.4	1	4	-
26	0	0.2	1	9	-	**26**	0	0.2	1	9	-
27	0	0.2	1	4.1	-	**27**	0	0.2	1	11	-
28	0	0	0	4.6	-	**28**	0	0.1	1	11.3	-
29	0	0	0	15	-	**29**	0	0	0	6.5	-
30	0	0	0	9	0.5	**30**	0	0.2	1	9.3	0.75
31	0	0	0	9.5	-	**31**	0	0	0	4.5	-
32	0	0.4	1	5	-	**32**	0	0	0	5.6	-
33	0	0	0	3.5	-	**33**	0	0	0	2.6	-
34	0	0.1	1	12	-	**34**	0	0	0	2	-
35	0	0	0	3.1	-	**35**	0	0.2	1	6	-
36	0	0	0	21	-	**36**	0	0.5	1	6	-
37	0	0	0	5	-	**37**	0	0	0	9.9	-
38	0	0.1	1	3	-	**38**	0	0	0	7.6	-
39	0	0	0	7	-	**39**	0	0	0	5	-
40	0	0	0	7	0.75	**40**	0	0	0	1	0
41	0	0	0	8.5	-	**41**	0	0.3	1	6	-
42	0	0	0	8	-	**42**	0	0	0	21	-
43	0	0	0	9	-	**43**	0	0	0	6.4	-
44	0	0	0	4.5	-	**44**	0	0	0	6.1	-
45	0	0	0	7	-	**45**	0	0	0	7	-
46	0	0	0	18	-	**46**	0	0	0	3	-
47	0	0	0	8	-	**47**	0	0	0	12.5	-
48	0	0	0	12.6	-	**48**	0	0	0	7.1	-
49	0	0	0	7	-	**49**	0	0	0	9	-
50	0	0	0	8	0.5	**50**	0	0	0	7.6	0.75
51	0	0	0	5.1	-	**51**	0	0.3	1	6.1	-
52	0	0.1	1	11.5	-	**52**	0	0.2	1	9.5	-
53	0	0	0	5.5	-	**53**	0	0	0	10.1	-
54	0	0.1	1	6.1	-	**54**	0	0	0	3.1	-
55	0	0.1	1	11	-	**55**	0	0	0	7.5	-
56	0	0	0	3.5	-	**56**	0	0	0	7.4	-
57	0	0	0	3	-	**57**	0	0.3	1	9.5	-
58	0	0	0	6.1	-	**58**	0	0.3	1	10.3	-
59	0	0	0	6	-	**59**	0	0.5	1	16.5	-
60	0	0.5	1	10	0.25	**60**	0	0	0	6.5	0.75
61	0	0	0	6	-	**61**	0	0	0	3.4	-
62	0	0	0	4.3	-	**62**	0	0.5	1	11.4	-
63	0	0	0	8.2	-	**63**	0	0	0	4.6	-
64	0	0	0	3	-	**64**	0	0.1	1	9.6	-
65	0	0	0	2.3	-	**65**	0	0	0	15	-
66	0	0	0	13.5	-	**66**	0	0.1	1	9.3	-
67	0	0	0	17.5	-	**67**	0	0.5	1	6.6	-
68	0	0	0	4.5	-	**68**	0	0	0	7.5	-
69	0	0	0	4.1	-	**69**	0	0	0	10.4	-
70	0	0	0	11	0.75	**70**	0	0	0	8.3	0.5
71	0	0.1	1	13.5	-	**71**	0	0.1	1	5.2	-
72	0	0	0	4.5	-	**72**	0	0	0	7.8	-
73	0	0	0	7.5	-	**73**	0	0.1	1	8.9	-
74	0	0.5	1	15.5	-	**74**	0	0	0	8.5	-
75	0	0	0	4.5	-	**75**	0	0	0	9.1	-
76	0	0	0	2.5	-	**76**	0	0	0	4	-
77	0	0	0	2	-	**77**	0	0	0	2.1	-
78	0	0	0	4.5	-	**78**	0	0	0	3	-
79	0	0	0	19	-	**79**	0	0.1	1	12.4	-
80	0	0.6	1	16.5	0	**80**	0	0	0	7	0.5
81	0	0	0	9.5	-	**81**	0	0	0	3.9	-
82	0	0	0	9.5	-	**82**	0	0.3	1	14.2	-
83	0	0	0	10	-	**83**	0	0	0	7.5	-
84	0	0	0	7.6	-	**84**	0	0.1	1	11.3	-
85	0	0.3	1	10.5	-	**85**	0	0.2	1	9.5	-
86	0	0.1	1	8.5	-	**86**	0	0	0	9	-
87	0	0	0	19.5	-	**87**	0	0.1	1	11	-
88	0	0	0	3.5	-	**88**	0	0.3	1	9.2	-
89	0	0.3	1	5.6	-	**89**	0	0.3	1	7.5	-
90	0	0.3	1	13	0.75	**90**	0	0	0	5.2	0.25
91	0	0	0	5	-	**91**	0	0.5	1	12	-
92	0	0	0	4.5	-	**92**	0	0	0	9.5	-
93	0	0.1	1	2.2	-	**93**	0	0	0	7.2	-
94	0	0	0	4.6	-	**94**	0	0.3	1	8.5	-
95	0	0	0	11.5	-	**95**	0	0.5	1	12	-
96	0	0	0	4.2	-	**96**	0	0	0	6.5	-
97	0	0	0	2	-	**97**	0	0	0	5.2	-
98	0	0	0	6.3	-	**98**	0	0.1	1	6.6	-
99	0	0.1	1	12.5	-	**99**	0	0.1	1	4	-
100	0	0	0	7.5	0.75	**100**	0	0	0	6.5	0.5
Average Cic, Cip and Embed. =	**0**	**0.06**	**0.28**	**7.5**	**0.55**	**Average Cic, Cip and Embed. =**	**0.01**	**0.11**	**0.43**	**8.3**	**0.50**
Old Calcite Index (CI) =		**0.28**				**Old Calcite Index (CI) =**		**0.44**			
New Calcite Index (CI) =		**0.06**				**New Calcite Index (CI) =**		**0.12**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DC2-3						LC_DC3-1					
14-Sep-22						13-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0.3	1	5.2	-	**1**	0	0.7	1	17	-
2	0	0.6	1	5.5	-	**2**	0	0.3	1	8	-
3	0	0.2	1	8.9	-	**3**	0	0	0	5	-
4	0	0.1	1	7	-	**4**	0	0.7	1	9.5	-
5	0	0.5	1	6	-	**5**	1	0.7	1	19	-
6	0	0.4	1	11	-	**6**	0	0.5	1	18	-
7	0	0.5	1	7	-	**7**	0	0.1	1	2.1	-
8	0	0.3	1	3.3	-	**8**	0	0.5	1	7.2	-
9	0	0.5	1	14.6	-	**9**	1	0.7	1	13.5	-
10	0	0.3	1	7.6	0.75	**10**	0	0.7	1	20	0.5
11	0	0.4	1	10.5	-	**11**	0	0	0	14.5	-
12	0	0.5	1	19.3	-	**12**	0	0	0	3.1	-
13	0	0.3	1	7	-	**13**	0	0	0	3.5	-
14	0	0.3	1	14	-	**14**	0	0	0	0.2	-
15	0	0.2	1	15	-	**15**	0	0	0	1	-
16	0	0.2	1	11	-	**16**	0	0	0	4	-
17	0	0.5	1	10	-	**17**	0	0.7	1	11	-
18	0	0.1	1	6.7	-	**18**	0	0.5	1	19	-
19	0	0	0	8.7	-	**19**	0	0.7	1	10	-
20	0	0.2	1	10	0.5	**20**	0	0.5	1	14.5	0.5
21	0	0.4	1	8	-	**21**	1	0.4	1	13	-
22	0	0	0	5	-	**22**	0	0.7	1	7.5	-
23	0	0.2	1	6	-	**23**	0	0.7	1	22.5	-
24	0	0.1	1	5.1	-	**24**	0	0.7	1	7.6	-
25	0	0.5	1	4.2	-	**25**	0	0.7	1	6.6	-
26	0	0.4	1	11	-	**26**	0	0.7	1	15	-
27	0	0.3	1	13	-	**27**	0	0.7	1	21.5	-
28	0	0	0	6	-	**28**	0	0.8	1	15	-
29	0	0.1	1	7	-	**29**	0	0.8	1	6.5	-
30	0	0	0	3.2	0.75	**30**	0	0.7	1	7.5	0
31	0	0	0	23.5	-	**31**	0	0.5	1	8.2	-
32	0	0	0	11.5	-	**32**	0	0.4	1	12	-
33	0	0.3	1	8.2	-	**33**	0	0	0	2	-
34	0	0.2	1	5.5	-	**34**	0	0.6	1	6.7	-
35	0	0	0	11	-	**35**	0	0.3	1	14	-
36	1	1	1	16.5	-	**36**	0	0.5	1	8.2	-
37	0	0.1	1	9.5	-	**37**	0	0.8	1	13	-
38	0	0	0	7.5	-	**38**	0	0	0	4.9	-
39	0	0	0	13	-	**39**	0	0	0	14.6	-
40	0	0	0	3	0	**40**	0	0.7	1	5.6	0.25
41	0	0.3	1	11.6	-	**41**	0	0	0	7.1	-
42	0	0	0	7	-	**42**	0	0.3	1	4.5	-
43	0	0	0	3.4	-	**43**	1	0.8	1	18.3	-
44	0	0	0	4.6	-	**44**	0	0.5	1	4.3	-
45	0	0	0	1.8	-	**45**	1	1	1	35	-
46	0	0.2	1	11	-	**46**	0	0.8	1	20	-
47	1	0.7	1	24	-	**47**	0	0.8	1	8.5	-
48	0	0.1	1	7.3	-	**48**	0	0.9	1	25	-
49	0	0.3	1	14	-	**49**	0	0.8	1	18	-
50	0	0.1	1	4	-	**50**	0	0	0	9.1	0.5
51	0	0.3	1	5.5	-	**51**	0	0.5	1	18.5	-
52	0	0	0	4.3	-	**52**	0	0.6	1	16	-
53	0	0.1	1	4.9	-	**53**	0	1	1	2.5	-
54	0	0.1	1	8.3	-	**54**	0	0.5	1	1.5	-
55	0	0	0	5.6	-	**55**	0	0.5	1	2.5	-
56	0	0.5	1	8.5	-	**56**	1	1	1	12	-
57	0	0.5	1	11.6	-	**57**	1	0.8	1	27	-
58	0	0.3	1	7.6	-	**58**	0	0.9	1	15.5	-
59	0	0	0	7.8	-	**59**	0	0.6	1	11.5	-
60	0	0	0	5.6	0.25	**60**	0	0.8	1	9.8	0.5
61	0	0.4	1	12.5	-	**61**	0	0.6	1	18.5	-
62	0	0	0	7.5	-	**62**	1	1	1	15.5	-
63	0	0.3	1	7.6	-	**63**	0	0.8	1	15	-
64	0	0.8	1	9.2	-	**64**	0	0.9	1	14.5	-
65	0	0.3	1	7.3	-	**65**	0	0.5	1	8.5	-
66	0	0.1	1	8.6	-	**66**	1	0.5	1	16	-
67	0	0	0	5.4	-	**67**	0	0.6	1	15.5	-
68	0	0.5	1	6.6	-	**68**	1	0.5	1	12.5	-
69	0	0	0	3.1	-	**69**	0	0.6	1	4.3	-
70	0	0.5	1	9.2	0.25	**70**	0	0.5	1	3.5	0.5
71	0	0.3	1	4.3	-	**71**	0	0.3	1	2.1	-
72	0	0.5	1	7.9	-	**72**	0	0.6	1	7	-
73	0	0.5	1	9.3	-	**73**	0	0.6	1	12.5	-
74	0	0	0	11.5	-	**74**	0	1	1	10.5	-
75	0	0.5	1	14.2	-	**75**	0	0.9	1	5.5	-
76	0	0.3	1	12.5	-	**76**	0	0.6	1	9.6	-
77	0	0.5	1	6	-	**77**	0	0.5	1	10.1	-
78	0	0.3	1	7.6	-	**78**	0	0.5	1	5.2	-
79	0	0	0	8.2	-	**79**	0	0.5	1	5.1	-
80	0	0.5	1	12.8	0.25	**80**	0	0.3	1	2.2	0.5
81	0	0.5	1	6.3	-	**81**	0	0.5	1	16.5	-
82	0	0.2	1	4.8	-	**82**	0	0.6	1	4.7	-
83	0	0.3	1	5.1	-	**83**	0	1	1	15.7	-
84	0	0.5	1	8.4	-	**84**	0	0.9	1	12.5	-
85	0	0	0	8.9	-	**85**	0	0	0	2.5	-
86	0	0.5	1	16.4	-	**86**	0	0.9	1	8.5	-
87	0	0.4	1	5.8	-	**87**	0	0.5	1	3.5	-
88	0	0.5	1	11.8	-	**88**	0	0.1	1	5.6	-
89	0	0.2	1	4.3	-	**89**	0	0.7	1	5.9	-
90	0	0.5	1	13.5	0.25	**90**	0	0.3	1	4.8	0.75
91	0	0.1	1	6.4	-	**91**	0	0.7	1	13	-
92	0	0.2	1	6.5	-	**92**	0	0.5	1	6.5	-
93	0	0.1	1	6.3	-	**93**	0	0.7	1	34	-
94	0	0.3	1	8.5	-	**94**	0	0.7	1	16	-
95	0	0.2	1	6.2	-	**95**	0	0.8	1	13	-
96	0	0.3	1	6.4	-	**96**	0	0.3	1	3.8	-
97	0	0	0	3	-	**97**	0	0.9	1	8.5	-
98	0	0	0	6.5	-	**98**	0	1	1	10.1	-
99	0	0	0	5.2	-	**99**	0	1	1	6.5	-
100	0	0.5	1	14.5	0.75	**100**	0	0.9	1	10.3	0.25
Average Cic, Cip and Embed. =	**0.02**	**0.25**	**0.73**	**8.5**	**0.42**	**Average Cic, Cip and Embed. =**	**0.10**	**0.56**	**0.87**	**10.7**	**0.43**
Old Calcite Index (CI) =		**0.75**				**Old Calcite Index (CI) =**		**0.97**			
New Calcite Index (CI) =		**0.27**				**New Calcite Index (CI) =**		**0.66**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DC3-2						LC_DC3-3					
13-Sep-22						13-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0	0	5.3	-	**1**	0	0.5	1	9.4	-
2	0	0.1	1	4.4	-	**2**	0	0.4	1	22.6	-
3	0	0	0	3	-	**3**	0	0.5	1	13.2	-
4	0	0	0	2.1	-	**4**	0	0.2	1	16	-
5	0	0	0	4.9	-	**5**	0	0.5	1	4.1	-
6	0	0.5	1	26.1	-	**6**	0	0.2	1	6.6	-
7	0	0.5	1	9	-	**7**	0	0.5	1	10.2	-
8	0	0	0	3.2	-	**8**	0	0.4	1	14.8	-
9	0	0.5	1	8.2	-	**9**	0	0.5	1	5.2	-
10	0	0.5	1	10	0.5	**10**	0	0	0	4.6	0
11	0	0.2	1	7.5	-	**11**	0	0.5	1	14.5	-
12	0	0.5	1	6.1	-	**12**	0	0.5	1	5.6	-
13	0	0.5	1	5.3	-	**13**	0	0.1	1	4	-
14	0	0.1	1	4.7	-	**14**	0	0.4	1	15.1	-
15	0	0.8	1	3.6	-	**15**	0	0	0	3.1	-
16	0	0.5	1	12	-	**16**	0	0.2	1	2.6	-
17	0	0.5	1	10.9	-	**17**	0	0.2	1	2.5	-
18	0	0.3	1	5	-	**18**	0	0.5	1	16.9	-
19	0	0.4	1	5.9	-	**19**	0	0	0	4.6	-
20	0	0.7	1	22	0.25	**20**	0	0.3	1	5.7	0.25
21	0	0.7	1	8	-	**21**	0	0.1	1	4.4	-
22	0	0.4	1	5.5	-	**22**	0	0.5	1	8	-
23	0	0.4	1	10.5	-	**23**	0	0.5	1	3.5	-
24	0	0.4	1	2.6	-	**24**	0	0.9	1	7	-
25	0	0.3	1	6.1	-	**25**	0	0.1	1	4	-
26	1	0.7	1	16	-	**26**	0	0.1	1	4.5	-
27	0	0.4	1	6.5	-	**27**	0	0.5	1	17	-
28	0	0.4	1	8.4	-	**28**	0	0.9	1	21	-
29	0	0	0	3.2	-	**29**	0	0.5	1	7	-
30	0	0.2	1	5.6	0.5	**30**	0	0	0	4.1	0.75
31	0	0.5	1	8	-	**31**	0	0.4	1	6	-
32	1	0.8	1	17	-	**32**	0	0.1	1	5.1	-
33	0	0.5	1	9	-	**33**	0	0.1	1	5.1	-
34	0	0.4	1	7.1	-	**34**	0	0.4	1	5.7	-
35	0	0.2	1	6	-	**35**	0	0	0	2.7	-
36	0	0.6	1	13	-	**36**	0	0.7	1	6.6	-
37	0	0	0	1.5	-	**37**	1	0.8	1	17	-
38	0	0	0	2	-	**38**	0	0.5	1	10	-
39	0	0	0	2	-	**39**	0	0.6	1	11.5	-
40	0	0	0	2.4	0.75	**40**	0	0.5	1	7	0.75
41	0	0.6	1	8.5	-	**41**	0	0.4	1	4	-
42	0	0.5	1	4	-	**42**	0	0.3	1	8.2	-
43	0	0.5	1	10.1	-	**43**	0	0.5	1	12.6	-
44	0	0.4	1	5.1	-	**44**	0	0.2	1	3.5	-
45	0	0.9	1	14	-	**45**	0	0	0	2	-
46	0	0.5	1	4	-	**46**	0	0.1	1	3	-
47	0	0.1	1	3.6	-	**47**	0	0.1	1	7	-
48	0	0.8	1	13.6	-	**48**	0	0.7	1	11	-
49	0	0.8	1	20.3	-	**49**	0	0.9	1	20	-
50	0	0.9	1	12.3	0.5	**50**	0	0	0	3	0.75
51	0	0.6	1	9.3	-	**51**	0	0.3	1	5.5	-
52	1	0.5	1	6.5	-	**52**	0	0	0	3.5	-
53	0	0.6	1	9.5	-	**53**	0	0.5	1	5.3	-
54	0	0.5	1	7.3	-	**54**	0	0.3	1	3.5	-
55	0	0.4	1	3.8	-	**55**	0	0	0	3	-
56	0	0.3	1	8.2	-	**56**	0	0	0	4	-
57	0	0.6	1	8.7	-	**57**	0	0	0	2.2	-
58	0	0.5	1	5.1	-	**58**	0	0.5	1	6.8	-
59	0	0.5	1	7.1	-	**59**	0	0	0	5.3	-
60	0	0.5	1	3.6	0	**60**	0	0.1	1	3.5	0.25
61	0	0.5	1	3.4	-	**61**	0	0.5	1	7.5	-
62	0	0.7	1	6.2	-	**62**	0	0.5	1	5.1	-
63	0	0.6	1	9.8	-	**63**	0	0.6	1	2.5	-
64	0	0.8	1	10.2	-	**64**	1	0.5	1	14.5	-
65	0	0.6	1	6.3	-	**65**	0	0.5	1	8.5	-
66	0	0.7	1	8.4	-	**66**	0	0.3	1	4.5	-
67	0	0.6	1	3.6	-	**67**	0	0	0	6.3	-
68	0	0.4	1	4.2	-	**68**	0	0.6	1	6.2	-
69	0	0.3	1	12.5	-	**69**	0	0.8	1	21	-
70	0	0.3	1	6.6	0.75	**70**	0	0.5	1	4.5	0.25
71	0	0.6	1	15.5	-	**71**	0	0.8	1	15.5	-
72	0	0.7	1	12.5	-	**72**	0	0.5	1	10.2	-
73	0	0.8	1	7.8	-	**73**	0	0.6	1	6.3	-
74	0	0.5	1	6.5	-	**74**	0	0.5	1	19	-
75	0	0.3	1	4.5	-	**75**	0	0.5	1	6.5	-
76	0	0.2	1	4.6	-	**76**	0	0.7	1	4.5	-
77	1	0.8	1	14	-	**77**	0	0.8	1	9.5	-
78	0	0.6	1	15	-	**78**	0	0.7	1	15.5	-
79	0	0.8	1	10.5	-	**79**	0	0.6	1	10.5	-
80	0	0.3	1	11.6	0.25	**80**	0	0.3	1	5.3	0.25
81	0	0.8	1	16	-	**81**	0	0.5	1	2.3	-
82	0	0.9	1	13.5	-	**82**	0	0.3	1	8.5	-
83	0	0.8	1	9.6	-	**83**	0	0.5	1	9.3	-
84	0	0.7	1	5.6	-	**84**	0	0.6	1	5.1	-
85	0	0.8	1	10.3	-	**85**	0	0.5	1	5.5	-
86	0	0.6	1	8.5	-	**86**	0	0.6	1	7.5	-
87	0	0.8	1	6.5	-	**87**	0	0.6	1	6.3	-
88	0	0.6	1	6.3	-	**88**	0	0.5	1	6.2	-
89	0	0.8	1	5.6	-	**89**	0	0.6	1	7.5	-
90	0	0.9	1	6.8	0.25	**90**	0	0.3	1	6.5	0.25
91	0	0.8	1	21	-	**91**	0	0.6	1	7.5	-
92	0	0.6	1	7.3	-	**92**	0	0.6	1	12.1	-
93	0	0.4	1	24	-	**93**	0	0.3	1	12.5	-
94	0	0.5	1	6.6	-	**94**	0	0.5	1	12.5	-
95	0	0.5	1	10.1	-	**95**	0	0.5	1	6.5	-
96	0	0.5	1	27	-	**96**	0	0.3	1	5.2	-
97	0	0.6	1	9.5	-	**97**	0	0.2	1	8.5	-
98	0	0.3	1	6.5	-	**98**	0	0.3	1	4.6	-
99	0	0.5	1	5.3	-	**99**	0	0	0	5.1	-
100	0	0.3	1	6.2	0.5	**100**	0	0.7	1	13.3	0.25
Average Cic, Cip and Embed. =	**0.04**	**0.48**	**0.90**	**8.5**	**0.43**	**Average Cic, Cip and Embed. =**	**0.02**	**0.39**	**0.86**	**7.9**	**0.38**
Old Calcite Index (CI) =		**0.94**				**Old Calcite Index (CI) =**		**0.88**			
New Calcite Index (CI) =		**0.52**				**New Calcite Index (CI) =**		**0.41**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DC4-1						LC_DC4-2					
12-Sep-22						12-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0.4	1	11	-	**1**	0	0	0	8.5	-
2	0	0.1	1	16	-	**2**	0	0	0	7.9	-
3	0	0	0	10	-	**3**	0	0	0	7.5	-
4	0	0.6	1	11.5	-	**4**	0	0	0	10	-
5	0	0	0	11.2	-	**5**	0	0	0	9.8	-
6	0	0.3	1	10	-	**6**	0	0	0	5.9	-
7	0	0.5	1	16.3	-	**7**	0	0.3	1	12	-
8	0	0	0	4.5	-	**8**	0	0	0	14	-
9	0	0.1	1	6	-	**9**	0	0	0	12	-
10	0	0	0	7.5	0.5	**10**	0	0.1	1	10	0.5
11	0	0.5	1	12.5	-	**11**	0	0.3	1	12.1	-
12	0	0	0	2	-	**12**	0	0	0	11	-
13	0	0	0	6.6	-	**13**	0	0	0	6	-
14	0	0.4	1	9	-	**14**	0	0	0	6.1	-
15	0	0.3	1	5.5	-	**15**	0	0	0	8	-
16	0	0.7	1	12.2	-	**16**	0	0	0	7	-
17	0	0	0	18.5	-	**17**	0	0	0	11.9	-
18	0	0	0	12.1	-	**18**	0	0	0	5.2	-
19	0	0	0	4.1	-	**19**	0	0.5	1	15.5	-
20	0	0	0	14	0.25	**20**	0	0	0	4.1	0.5
21	0	0	0	8	-	**21**	0	0	0	8.5	-
22	0	0	0	7	-	**22**	0	0	0	5	-
23	0	0.5	1	12.3	-	**23**	0	0	0	12.9	-
24	0	0	0	7	-	**24**	0	0.1	1	2.1	-
25	0	0	0	7	-	**25**	0	0	0	4	-
26	0	0	0	5	-	**26**	0	0.1	1	12.1	-
27	0	0	0	16	-	**27**	0	0	0	4.5	-
28	0	0	0	8	-	**28**	0	0	0	2.5	-
29	0	0	0	16	-	**29**	0	0	0	4.6	-
30	0	0	0	12.5	0.25	**30**	0	0	0	13	0.5
31	0	0	0	17	-	**31**	0	0	0	12.5	-
32	0	0	0	14.5	-	**32**	0	0.3	1	12.5	-
33	0	0	0	6.1	-	**33**	0	0.1	1	4.1	-
34	0	0	0	5	-	**34**	0	0	0	4.6	-
35	0	0	0	8	-	**35**	0	0.3	1	11.3	-
36	0	0.1	1	7	-	**36**	0	0	0	6.1	-
37	0	0	0	5.5	-	**37**	0	0	0	8.5	-
38	0	0.1	1	7.3	-	**38**	0	0.2	1	10.6	-
39	0	0	0	8.5	-	**39**	0	0	0	7.5	-
40	0	0.3	1	13.5	0	**40**	0	0.1	1	13	0.5
41	0	0	0	10.6	-	**41**	0	0	0	4.5	-
42	0	0	0	9.3	-	**42**	0	0	0	18.5	-
43	0	0	0	8.9	-	**43**	0	0	0	7	-
44	0	0.2	1	14.5	-	**44**	0	0.1	1	12.5	-
45	0	0	0	16.9	-	**45**	0	0	0	5	-
46	0	0	0	10	-	**46**	0	0	0	9.2	-
47	0	0	0	9	-	**47**	0	0	0	10.5	-
48	0	0	0	12.5	-	**48**	0	0.1	1	5	-
49	0	0	0	5.6	-	**49**	0	0	0	5.2	-
50	0	0	0	11	0.5	**50**	0	0	0	10.6	0.75
51	0	0	0	3.5	-	**51**	0	0	0	8.8	-
52	0	0	0	4.5	-	**52**	0	0	0	3.9	-
53	0	0	0	5.8	-	**53**	0	0.2	1	5.3	-
54	0	0.1	1	9.8	-	**54**	0	0	0	2.9	-
55	0	0	0	9.1	-	**55**	0	0	0	8.7	-
56	0	0.5	1	8.6	-	**56**	0	0	0	5.2	-
57	0	0	0	7.3	-	**57**	0	0.1	1	12.1	-
58	0	0	0	10.5	-	**58**	0	0.1	1	4.5	-
59	0	0	0	5.3	-	**59**	0	0	0	3.2	-
60	0	0	0	4.6	0	**60**	0	0	0	8.5	0.75
61	0	0	0	9.8	-	**61**	0	0.1	1	5.5	-
62	0	0	0	4.5	-	**62**	0	0	0	5.4	-
63	0	0	0	9.9	-	**63**	0	0	0	8.5	-
64	0	0	0	16.5	-	**64**	0	0	0	10.2	-
65	0	0.5	1	8.1	-	**65**	0	0.1	1	5.3	-
66	0	0	0	14.5	-	**66**	0	0	0	5.6	-
67	0	0	0	10.2	-	**67**	0	0	0	4.5	-
68	0	0	0	4.5	-	**68**	0	0.1	1	7.3	-
69	0	0.3	1	7.6	-	**69**	0	0.1	1	6.4	-
70	0	0.3	1	10.2	0.75	**70**	0	0	0	4.8	0.25
71	0	0	0	9.5	-	**71**	0	0	0	11.3	-
72	0	0.2	1	5.8	-	**72**	0	0	0	8.5	-
73	0	0	0	12.3	-	**73**	0	0	0	4.4	-
74	0	0	0	5.4	-	**74**	0	0	0	5.8	-
75	0	0.1	1	8.5	-	**75**	0	0	0	10.5	-
76	0	0	0	1.9	-	**76**	0	0.3	1	11.1	-
77	0	0.3	1	11.2	-	**77**	0	0	0	12.4	-
78	0	0	0	15.5	-	**78**	0	0.2	1	10.5	-
79	0	0	0	5.2	-	**79**	0	0	0	7.5	-
80	0	0	0	9.2	0.5	**80**	0	0.2	1	6.6	0.5
81	0	0.1	1	6.7	-	**81**	0	0	0	8.5	-
82	0	0	0	1.8	-	**82**	0	0	0	5.4	-
83	0	0.3	1	10.3	-	**83**	0	0	0	9.8	-
84	0	0	0	6.5	-	**84**	0	0.1	1	7.2	-
85	0	0	0	8.8	-	**85**	0	0	0	8.4	-
86	0	0.1	1	4.3	-	**86**	0	0.1	1	6.5	-
87	0	0	0	4.6	-	**87**	0	0	0	5.2	-
88	0	0.8	1	11.5	-	**88**	0	0.1	1	13.5	-
89	0	0	0	7.9	-	**89**	0	0	0	4.1	-
90	0	0	0	8.1	0.5	**90**	0	0	0	2.2	0
91	0	0	0	4.5	-	**91**	0	0	0	15.6	-
92	0	0	0	7.5	-	**92**	0	0	0	4	-
93	0	0.1	1	3.2	-	**93**	0	0	0	13.5	-
94	0	0	0	7.4	-	**94**	0	0	0	9.8	-
95	0	0	0	15.2	-	**95**	0	0.1	1	9.5	-
96	0	0	0	14.1	-	**96**	0	0	0	3.6	-
97	0	0	0	5.3	-	**97**	0	0.1	1	9.7	-
98	0	0	0	8.6	-	**98**	0	0	0	4.7	-
99	0	0.2	1	4.4	-	**99**	0	0	0	8.2	-
100	0	0	0	4.8	0.25	**100**	0	0.3	1	14.5	0.5
Average Cic, Cip and Embed. =	**0**	**0.09**	**0.29**	**8.9**	**0.35**	**Average Cic, Cip and Embed. =**	**0**	**0.05**	**0.29**	**8.1**	**0.48**
Old Calcite Index (CI) =		**0.29**				**Old Calcite Index (CI) =**		**0.29**			
New Calcite Index (CI) =		**0.09**				**New Calcite Index (CI) =**		**0.05**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DC4-3						LC_DCDS-1			LC_DCDS-2		
12-Sep-22						13-Sep-22			13-Sep-22		
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)
1	0	0	0	8.4	-	**1**	8	-	**1**	4.7	-
2	0	0	0	7.6	-	**2**	10.1	-	**2**	4.1	-
3	0	0	0	9	-	**3**	13.2	-	**3**	5	-
4	0	0.1	1	8	-	**4**	7.1	-	**4**	3	-
5	0	0	0	7	-	**5**	5.5	-	**5**	22	-
6	0	0	0	11.3	-	**6**	7.6	-	**6**	13	-
7	0	0	0	11.5	-	**7**	6.7	-	**7**	5.6	-
8	0	0	0	7.6	-	**8**	9.5	-	**8**	5.7	-
9	0	0	0	12.6	-	**9**	6.5	-	**9**	5.4	-
10	0	0	0	4	0	**10**	10	0.75	**10**	6	0.5
11	0	0.1	1	7.1	-	**11**	7	-	**11**	5.6	-
12	0	0	0	11	-	**12**	9	-	**12**	7.3	-
13	0	0.1	1	13	-	**13**	11	-	**13**	4.3	-
14	0	0	0	3.6	-	**14**	17	-	**14**	5	-
15	0	0	0	11.5	-	**15**	2.5	-	**15**	4	-
16	0	0	0	7	-	**16**	3	-	**16**	15	-
17	0	0	0	6.2	-	**17**	4.5	-	**17**	20	-
18	0	0	0	13.5	-	**18**	9	-	**18**	11.5	-
19	0	0	0	7	-	**19**	6	-	**19**	8	-
20	0	0	0	7	0.25	**20**	5.5	0.5	**20**	13	0.25
21	0	0	0	6.1	-	**21**	6.7	-	**21**	21	-
22	0	0	0	10.6	-	**22**	7	-	**22**	21.5	-
23	0	0.1	1	11	-	**23**	5	-	**23**	14	-
24	0	0	0	6.5	-	**24**	5.6	-	**24**	11	-
25	0	0	0	3.5	-	**25**	10	-	**25**	7.1	-
26	0	0	0	4.2	-	**26**	3.1	-	**26**	8	-
27	0	0.5	1	16	-	**27**	4	-	**27**	11	-
28	0	0.3	1	10.9	-	**28**	9.1	-	**28**	6.2	-
29	0	0	0	8.4	-	**29**	16	-	**29**	1.5	-
30	0	0	0	6	0.5	**30**	11.5	0.25	**30**	7	0.5
31	0	0	0	6.1	-	**31**	5.7	-	**31**	8.5	-
32	0	0	0	11.5	-	**32**	6	-	**32**	8.5	-
33	0	0	0	8	-	**33**	8.7	-	**33**	13	-
34	0	0	0	12	-	**34**	4.5	-	**34**	7	-
35	0	0	0	8	-	**35**	2	-	**35**	10	-
36	0	0	0	10	-	**36**	7.3	-	**36**	3	-
37	0	0	0	8.2	-	**37**	6.1	-	**37**	13	-
38	0	0	0	12.5	-	**38**	4.3	-	**38**	5.6	-
39	0	0	0	11.6	-	**39**	2	-	**39**	9.6	-
40	0	0	0	16	0.5	**40**	10.5	0.5	**40**	13.1	0.5
41	0	0	0	9	-	**41**	11.5	-	**41**	10.6	-
42	0	0	0	5	-	**42**	6	-	**42**	10	-
43	0	0	0	10.3	-	**43**	9.3	-	**43**	7.2	-
44	0	0	0	9	-	**44**	14	-	**44**	13.3	-
45	0	0	0	13	-	**45**	19	-	**45**	15.5	-
46	0	0	0	9	-	**46**	5.2	-	**46**	8	-
47	0	0	0	6	-	**47**	13.3	-	**47**	8.2	-
48	0	0	0	12.3	-	**48**	4.6	-	**48**	7	-
49	0	0	0	7	-	**49**	5.5	-	**49**	10	-
50	0	0	0	18.9	0.25	**50**	8	0.25	**50**	10.5	0.75
51	0	0	0	7.5	-	**51**	10.3	-	**51**	9.1	-
52	0	0	0	13	-	**52**	7.8	-	**52**	7.3	-
53	0	0.6	1	13	-	**53**	11.2	-	**53**	3.9	-
54	0	0	0	4.3	-	**54**	4.1	-	**54**	4.6	-
55	0	0	0	11.5	-	**55**	6.5	-	**55**	3.8	-
56	0	0	0	16	-	**56**	2.4	-	**56**	6.5	-
57	0	0	0	5.3	-	**57**	8.9	-	**57**	1.4	-
58	0	0	0	4	-	**58**	7.4	-	**58**	9.8	-
59	0	0.5	1	8	-	**59**	1	-	**59**	35.6	-
60	0	0	0	5	0.25	**60**	7	0.25	**60**	2.5	0.5
61	0	0.1	1	4.4	-	**61**	22	-	**61**	3.2	-
62	0	0	0	6.3	-	**62**	21	-	**62**	2.1	-
63	0	0.2	1	4.2	-	**63**	6.1	-	**63**	7.6	-
64	0	0.2	1	8.8	-	**64**	5.4	-	**64**	6.3	-
65	0	0	0	5.8	-	**65**	6.8	-	**65**	8.5	-
66	0	0.1	1	9.4	-	**66**	4.3	-	**66**	7.4	-
67	0	0	0	6.7	-	**67**	4.2	-	**67**	18	-
68	0	0	0	7.2	-	**68**	4.6	-	**68**	6.8	-
69	0	0	0	6.5	-	**69**	3.5	-	**69**	13.5	-
70	0	0.2	1	7.3	0.5	**70**	5.1	0.75	**70**	7.5	0.75
71	0	0	0	13	-	**71**	0.9	-	**71**	8.5	-
72	0	0	0	10.4	-	**72**	8.2	-	**72**	6.9	-
73	0	0	0	6.3	-	**73**	8.4	-	**73**	5.5	-
74	0	0	0	8.5	-	**74**	10.1	-	**74**	7.4	-
75	0	0	0	6.4	-	**75**	9.8	-	**75**	10.5	-
76	0	0	0	12.1	-	**76**	10	-	**76**	14.6	-
77	0	0	0	4.5	-	**77**	14	-	**77**	8.5	-
78	0	0	0	1.8	-	**78**	3.5	-	**78**	6.3	-
79	0	0	0	11.7	-	**79**	2	-	**79**	7.8	-
80	0	0	0	5.5	0.5	**80**	5.3	0.5	**80**	6.3	0.5
81	0	0	0	6.7	-	**81**	9.1	-	**81**	2.4	-
82	0	0	0	3.2	-	**82**	4.5	-	**82**	13.5	-
83	0	0	0	2.4	-	**83**	6.5	-	**83**	3.4	-
84	0	0.2	1	18.3	-	**84**	19	-	**84**	5.1	-
85	0	0.2	1	8.6	-	**85**	4.1	-	**85**	7.2	-
86	0	0	0	7.5	-	**86**	6.2	-	**86**	4.8	-
87	0	0.1	1	11	-	**87**	13.5	-	**87**	5.9	-
88	0	0	0	1.7	-	**88**	16.1	-	**88**	10	-
89	0	0	0	12.4	-	**89**	13.2	-	**89**	10.8	-
90	0	0	0	7.6	0.75	**90**	19	0.5	**90**	7.3	0.75
91	0	0	0	7.7	-	**91**	5.3	-	**91**	6.8	-
92	0	0	0	5.6	-	**92**	6.2	-	**92**	9	-
93	0	0	0	6.4	-	**93**	7	-	**93**	4.7	-
94	0	0	0	9.5	-	**94**	4.5	-	**94**	5.1	-
95	0	0	0	8.3	-	**95**	6.3	-	**95**	4.3	-
96	0	0	0	4.8	-	**96**	4	-	**96**	9.2	-
97	0	0	0	7.5	-	**97**	2.1	-	**97**	7.4	-
98	0	0.1	1	13	-	**98**	3	-	**98**	8.3	-
99	0	0	0	5.5	-	**99**	24	-	**99**	4	-
100	0	0	0	5	0.25	**100**	10.3	0.75	**100**	12	0.5
Average Cic, Cip and Embed. =	**0**	**0.04**	**0.17**	**8.5**	**0.38**	**Average Cic, Cip and Embed. =**	**8.0**	**0.50**	**Average Cic, Cip and Embed. =**	**8.6**	**0.55**
Old Calcite Index (CI) =		**0.17**									
New Calcite Index (CI) =		**0.04**									

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DCDS-3						LC_DCDS-4					
13-Sep-22						13-Sep-22					
Pebble	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**	**Pebble**	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**
1	0	0.1	1	55	-	**1**	0	0	0	9	-
2	0	0.4	1	7.7	-	**2**	0	0.5	1	7.5	-
3	0	0	0	5	-	**3**	0	0.2	1	6.9	-
4	0	0.4	1	7.5	-	**4**	0	0.6	1	10.3	-
5	0	0.9	1	8.5	-	**5**	0	0.4	1	8.5	-
6	0	0.2	1	13.5	-	**6**	0	0.1	1	12.2	-
7	0	0.5	1	17	-	**7**	0	0.3	1	4.7	-
8	0	0.3	1	17.6	-	**8**	0	0.2	1	12	-
9	0	0.4	1	17.6	-	**9**	0	0.3	1	2.9	-
10	0	0.2	1	12	0.25	**10**	0	0.3	1	9.5	0.5
11	0	0	0	4.3	-	**11**	0	0.1	1	4.1	-
12	0	0.2	1	12.3	-	**12**	0	0.3	1	7.5	-
13	0	0.9	1	17	-	**13**	0	0.1	1	9.5	-
14	0	0	0	4	-	**14**	0	0.1	1	7.1	-
15	0	0	0	7.2	-	**15**	0	0.5	1	7.6	-
16	0	0.5	1	11.3	-	**16**	0	0.9	1	21.5	-
17	0	0	0	3	-	**17**	0	0.5	1	12	-
18	0	0	0	1	-	**18**	0	0.6	1	16	-
19	0	0.1	1	5.2	-	**19**	0	0.7	1	12	-
20	0	0.2	1	5.4	0.75	**20**	0	0.5	1	14.5	0.25
21	0	0.5	1	7.6	-	**21**	0	0.7	1	10	-
22	0	0.5	1	6	-	**22**	0	0	0	4.1	-
23	0	0	0	3.2	-	**23**	0	0.5	1	10.5	-
24	0	0	0	2.7	-	**24**	0	0.7	1	16	-
25	0	0.6	1	7.2	-	**25**	0	0.7	1	12.5	-
26	0	0.7	1	16	-	**26**	0	0.7	1	19	-
27	0	0.4	1	16.5	-	**27**	0	0.8	1	6	-
28	0	0.5	1	5.6	-	**28**	0	0.9	1	9	-
29	0	0.7	1	6.7	-	**29**	0	0.7	1	9.1	-
30	0	0.8	1	9.7	0.75	**30**	0	0.4	1	10.3	0.75
31	0	0.5	1	15	-	**31**	0	1	1	8.6	-
32	0	0.5	1	14.1	-	**32**	0	1	1	25.5	-
33	0	0	0	4	-	**33**	0	0.5	1	13	-
34	0	0.2	1	5.3	-	**34**	0	0.7	1	18.3	-
35	0	0.7	1	7.6	-	**35**	0	0.2	1	7.1	-
36	0	0.8	1	4.9	-	**36**	0	0.9	1	21	-
37	0	0.7	1	4.7	-	**37**	0	0.1	1	7	-
38	0	0.4	1	4	-	**38**	0	0.3	1	8	-
39	0	0	0	3	-	**39**	0	0.7	1	12	-
40	0	0.3	1	14.4	0.5	**40**	0	0	0	8	0.5
41	0	0.9	1	10	-	**41**	0	0.5	1	10.5	-
42	0	0	0	2.9	-	**42**	0	0.3	1	10	-
43	0	0.5	1	9	-	**43**	0	0.7	1	19.5	-
44	0	0.7	1	5	-	**44**	0	0.4	1	9	-
45	0	0.5	1	10	-	**45**	0	0	0	13	-
46	0	0.9	1	21	-	**46**	0	0.3	1	11.3	-
47	0	0.7	1	7	-	**47**	0	0	0	8	-
48	0	0.5	1	7.1	-	**48**	0	0.5	1	15.3	-
49	0	0.5	1	10.3	-	**49**	0	0.4	1	7.9	-
50	0	0.4	1	6.5	0.25	**50**	0	0	0	5	0.5
51	0	0.5	1	12.3	-	**51**	0	0.8	1	16.5	-
52	0	0.2	1	14	-	**52**	0	0.5	1	7.5	-
53	0	0.5	1	22	-	**53**	0	0.5	1	4.5	-
54	0	0.7	1	15	-	**54**	0	0.6	1	17.5	-
55	0	0	0	8.2	-	**55**	0	0	0	6.5	-
56	0	0.7	1	10.5	-	**56**	0	0.8	1	7.8	-
57	0	8	1	18	-	**57**	0	0	0	2.8	-
58	0	0	0	4.5	-	**58**	0	0	0	2.2	-
59	0	0.7	1	16.5	-	**59**	0	0.8	1	9.5	-
60	0	0.4	1	8.5	0.5	**60**	0	0.6	1	5.5	0.75
61	0	0	0	3.3	-	**61**	0	0	0	3.5	-
62	0	0.5	1	14	-	**62**	0	0	0	4.1	-
63	0	0.3	1	10.5	-	**63**	0	0	0	3	-
64	0	0.1	1	3.5	-	**64**	0	0.8	1	12.5	-
65	0	0.4	1	11.5	-	**65**	0	0.9	1	19.5	-
66	0	0.5	1	21	-	**66**	0	0.8	1	34.5	-
67	0	0	0	5	-	**67**	0	0.6	1	20.5	-
68	0	0.2	1	10.3	-	**68**	0	0	0	5.5	-
69	0	0	0	4.5	-	**69**	0	0.8	1	5.8	-
70	0	0	0	6.5	0.25	**70**	0	0	0	2.5	0
71	0	0	0	3.6	-	**71**	0	0	0	5.5	-
72	0	0.5	1	10.2	-	**72**	0	0.7	1	8.5	-
73	0	0	0	8.1	-	**73**	0	0.5	1	17.5	-
74	0	0	0	5.2	-	**74**	0	1	1	15.6	-
75	0	0.1	1	5.3	-	**75**	0	0.5	1	4.8	-
76	0	0.5	1	8.4	-	**76**	0	0	0	3.2	-
77	0	0	0	7.4	-	**77**	0	0	0	4.1	-
78	0	0.5	1	8.3	-	**78**	0	0.5	1	7.3	-
79	0	0.5	1	4.1	-	**79**	0	1	1	10.4	-
80	0	0	0	7.3	0.5	**80**	0	0	0	4.5	0.25
81	0	0	0	5.7	-	**81**	0	0.5	1	9.8	-
82	0	0	0	10.3	-	**82**	0	0.6	1	7.6	-
83	0	0.3	1	8.6	-	**83**	0	0.5	1	10.5	-
84	0	0.6	1	12.5	-	**84**	0	0.5	1	11	-
85	0	0.3	1	10.2	-	**85**	0	0.6	1	12	-
86	0	0	0	2.4	-	**86**	0	0	0	9.2	-
87	0	0.3	1	9.3	-	**87**	0	0.3	1	8.3	-
88	0	0.1	1	3.4	-	**88**	0	0.3	1	11.1	-
89	0	0.4	1	8.3	-	**89**	0	0.5	1	16.2	-
90	0	0.2	1	9.1	0.75	**90**	0	0.5	1	9.3	0.25
91	0	0	0	5.3	-	**91**	0	0	0	0.1	-
92	0	0.5	1	8.1	-	**92**	0	0.5	1	19	-
93	0	0	0	8.4	-	**93**	0	0.5	1	14.5	-
94	0	0.3	1	9.5	-	**94**	0	0	0	2.5	-
95	0	0.3	1	7.8	-	**95**	0	0.5	1	16.3	-
96	0	0	0	3.8	-	**96**	0	0.2	1	10.1	-
97	0	0.1	1	5.5	-	**97**	0	0.1	1	11	-
98	0	0.5	1	18.2	-	**98**	0	0.4	1	7.2	-
99	0	0.6	1	12.3	-	**99**	0	0.3	1	16	-
100	0	0	0	4.6	0.75	**100**	0	0.1	1	3.8	0.25
Average Cic, Cip and Embed. =	**0**	**0.40**	**0.71**	**9.3**	**0.53**	**Average Cic, Cip and Embed. =**	**0**	**0.41**	**0.79**	**10.2**	**0.40**
Old Calcite Index (CI) =		**0.71**				**Old Calcite Index (CI) =**		**0.79**			
New Calcite Index (CI) =		**0.40**				**New Calcite Index (CI) =**		**0.41**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DCDS-5						LC_DCEF-1					
13-Sep-22						13-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0	0	9.5	-	**1**	0	0	0	20	-
2	0	0	0	8.2	-	**2**	0	0	0	3	-
3	0	0	0	9.3	-	**3**	0	0	0	4	-
4	0	0.3	1	9.4	-	**4**	0	0	0	4	-
5	0	0	0	8.5	-	**5**	0	0	0	2	-
6	0	0	0	5.2	-	**6**	0	0	0	2.5	-
7	0	0.3	1	10.1	-	**7**	0	0	0	14	-
8	0	0.2	1	3.3	-	**8**	0	0	0	3.1	-
9	0	0.3	1	13	-	**9**	0	0	0	10.5	-
10	0	0	0	5.1	0.25	**10**	0	0	0	18.5	0.5
11	0	0	0	4.2	-	**11**	0	0	0	30	-
12	0	0.3	1	15.5	-	**12**	0	0	0	2.6	-
13	0	0	0	4.5	-	**13**	0	0	0	3	-
14	0	0.3	1	10.1	-	**14**	0	0	0	1	-
15	0	0.5	1	16.5	-	**15**	0	0	0	8	-
16	0	0	0	9.5	-	**16**	0	0	0	6	-
17	0	0	0	12.3	-	**17**	0	0	0	7.9	-
18	0	0.2	1	9.5	-	**18**	0	0	0	4	-
19	0	0	0	10.5	-	**19**	0	0	0	17.5	-
20	0	0	0	11.3	0.25	**20**	0	0	0	6	0.5
21	0	0.3	1	8.1	-	**21**	0	0	0	5.2	-
22	0	0.6	1	8.5	-	**22**	0	0	0	6	-
23	0	0.2	1	11.2	-	**23**	0	0	0	23.5	-
24	0	0.1	1	4.2	-	**24**	0	0	0	9	-
25	0	0.5	1	6.5	-	**25**	0	0	0	6.5	-
26	0	0.5	1	13.5	-	**26**	0	0	0	8	-
27	0	0	0	9	-	**27**	0	0	0	14.2	-
28	0	0.3	1	6.5	-	**28**	0	0	0	11	-
29	0	0	0	8.3	-	**29**	0	0	0	5.5	-
30	0	0.1	1	6.5	0.5	**30**	0	0	0	2.4	0.25
31	0	0.3	1	12.5	-	**31**	0	0	0	5.6	-
32	0	0	0	5.1	-	**32**	0	0	0	7.1	-
33	0	0	0	8.5	-	**33**	0	0	0	9.3	-
34	0	0.3	1	7.5	-	**34**	0	0	0	6	-
35	0	0	0	6.5	-	**35**	0	0	0	3.4	-
36	0	0.3	1	13.5	-	**36**	0	0	0	3.2	-
37	0	0.5	1	6.5	-	**37**	0	0	0	2	-
38	0	0.5	1	10.5	-	**38**	0	0	0	1.2	-
39	0	0	0	1.3	-	**39**	0	0	0	2.2	-
40	0	0	0	6.8	0.75	**40**	0	0	0	1.9	0.5
41	0	0	0	7.2	-	**41**	0	0	0	3	-
42	0	0	0	11.3	-	**42**	0	0	0	2.8	-
43	0	0.1	1	5.2	-	**43**	0	0	0	2	-
44	0	0.5	1	11.3	-	**44**	0	0	0	1.4	-
45	0	1	1	10.5	-	**45**	0	0	0	7	-
46	0	0	0	5.5	-	**46**	0	0	0	4.9	-
47	0	0.4	1	12.5	-	**47**	0	0	0	23	-
48	0	0	0	5.8	-	**48**	0	0	0	4	-
49	0	0	0	6.5	-	**49**	0	0	0	22.3	-
50	0	0	0	6.8	0.25	**50**	0	0	0	5	0.75
51	0	0.7	1	8.5	-	**51**	0	0	0	5.1	-
52	0	0	0	5	-	**52**	0	0	0	3	-
53	0	0.6	1	10.5	-	**53**	0	0	0	1.4	-
54	0	0	0	3.4	-	**54**	0	0	0	6.3	-
55	0	0.1	1	4	-	**55**	0	0	0	16.5	-
56	0	0	0	3.9	-	**56**	0	0	0	4	-
57	0	0	0	2.5	-	**57**	0	0	0	5.1	-
58	0	0	0	4.5	-	**58**	0	0	0	20	-
59	0	0	0	2.9	-	**59**	0	0	0	5	-
60	0	0.7	1	21.1	0.75	**60**	0	0	0	4.5	0.25
61	0	0	0	6.5	-	**61**	0	0	0	4.5	-
62	0	0.5	1	17	-	**62**	0	0	0	2.8	-
63	0	0.5	1	12.5	-	**63**	0	0	0	1.6	-
64	0	0	0	12.2	-	**64**	0	0	0	5.5	-
65	0	0	0	3	-	**65**	0	0	0	23.5	-
66	0	0.3	1	12.9	-	**66**	0	0	0	7.5	-
67	0	0.1	1	7	-	**67**	0	0	0	13	-
68	0	0.5	1	19.5	-	**68**	0	0	0	10.4	-
69	0	0	0	0.5	-	**69**	0	0	0	10	-
70	0	0.3	1	8.5	0.25	**70**	0	0	0	4.6	0.75
71	0	0.7	1	12.3	-	**71**	0	0	0	4.1	-
72	0	0.5	1	29	-	**72**	0	0	0	5	-
73	0	0	0	9	-	**73**	0	0	0	3.5	-
74	0	0.1	1	3	-	**74**	0	0	0	7.5	-
75	0	0	0	10	-	**75**	0	0	0	9	-
76	0	0.5	1	16.5	-	**76**	0	0	0	1.5	-
77	0	0.5	1	2.6	-	**77**	0	0	0	16.2	-
78	0	0.4	1	1	-	**78**	0	0	0	2	-
79	0	0.7	1	5.1	-	**79**	0	0	0	15	-
80	0	0	0	15	0.5	**80**	0	0	0	25	0.75
81	0	0.5	1	12.3	-	**81**	0	0	0	11	-
82	0	0.5	1	29	-	**82**	0	0	0	2.6	-
83	0	0.6	1	9	-	**83**	0	0	0	7	-
84	0	0	0	3	-	**84**	0	0	0	7.1	-
85	0	0.5	1	10	-	**85**	0	0	0	4	-
86	0	0.5	1	16.5	-	**86**	0	0	0	0.7	-
87	0	0	0	2.6	-	**87**	0	0	0	9.5	-
88	0	0	0	1	-	**88**	0	0	0	25.2	-
89	0	0.1	1	5.1	-	**89**	0	0	0	12.2	-
90	0	0.6	1	15	0.5	**90**	0	0	0	8	0.5
91	0	0.7	1	11.2	-	**91**	0	0	0	2.2	-
92	0	0.1	1	5	-	**92**	0	0	0	5	-
93	0	0	0	5.5	-	**93**	0	0	0	4.6	-
94	0	2	1	7.6	-	**94**	0	0	0	4.8	-
95	0	0.5	1	10.5	-	**95**	0	0	0	2.5	-
96	0	0.7	1	10	-	**96**	0	0	0	4	-
97	0	0.2	1	6	-	**97**	0	0	0	3	-
98	0	0.5	1	6.5	-	**98**	0	0	0	7	-
99	0	0.7	1	16	-	**99**	0	0	0	25	-
100	0	0.5	1	7	0.5	**100**	0	0	0	1.4	0
Average Cic, Cip and Embed. =	**0**	**0.26**	**0.58**	**8.9**	**0.45**	**Average Cic, Cip and Embed. =**	**0**	**0**	**0**	**7.7**	**0.48**
Old Calcite Index (CI) =		**0.58**				**Old Calcite Index (CI) =**		**0.00**			
New Calcite Index (CI) =		**0.26**				**New Calcite Index (CI) =**		**0.00**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_DCEF-2						LC_DCEF-3					
13-Sep-22						13-Sep-22					
Pebble	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**	**Pebble**	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**
1	0	0	0	5.5	-	**1**	0	0	0	6	-
2	0	0	0	7.5	-	**2**	0	0	0	8	-
3	0	0	0	7.3	-	**3**	0	0	0	23.5	-
4	0	0	0	10.1	-	**4**	0	0	0	8	-
5	0	0	0	4.6	-	**5**	0	0	0	5	-
6	0	0	0	19	-	**6**	0	0	0	8.2	-
7	0	0	0	11.5	-	**7**	0	0	0	6	-
8	0	0	0	8.5	-	**8**	0	0	0	5.4	-
9	0	0	0	13.1	-	**9**	0	0	0	4	-
10	0	0	0	3.5	0.75	**10**	0	0	0	6	0.75
11	0	0	0	8.3	-	**11**	0	0	0	9	-
12	0	0	0	14	-	**12**	0	0	0	2.1	-
13	0	0	0	7.4	-	**13**	0	0	0	7.1	-
14	0	0	0	10.3	-	**14**	0	0	0	9.5	-
15	0	0	0	20.9	-	**15**	0	0	0	5.5	-
16	0	0	0	15.5	-	**16**	0	0	0	12	-
17	0	0	0	8	-	**17**	0	0	0	23	-
18	0	0	0	16.3	-	**18**	0	0	0	5.6	-
19	0	0	0	2.1	-	**19**	0	0	0	8	-
20	0	0	0	1.6	0.75	**20**	0	0	0	3.6	0.5
21	0	0	0	12.4	-	**21**	0	0	0	7	-
22	0	0	0	14.3	-	**22**	0	0	0	4	-
23	0	0	0	14.6	-	**23**	0	0	0	1.8	-
24	0	0	0	6.3	-	**24**	0	0	0	1.5	-
25	0	0	0	9.5	-	**25**	0	0	0	4	-
26	0	0	0	7	-	**26**	0	0	0	3	-
27	0	0	0	8.2	-	**27**	0	0	0	7	-
28	0	0	0	4	-	**28**	0	0	0	10.5	-
29	0	0	0	3.4	-	**29**	0	0	0	6.2	-
30	0	0	0	20	0.25	**30**	0	0	0	8.5	0.75
31	0	0	0	3.6	-	**31**	0	0	0	2.5	-
32	0	0	0	4.1	-	**32**	0	0	0	3.2	-
33	0	0	0	9.2	-	**33**	0	0	0	6.7	-
34	0	0	0	6.6	-	**34**	0	0	0	4.6	-
35	0	0	0	2.5	-	**35**	0	0	0	7	-
36	0	0	0	6.4	-	**36**	0	0	0	9	-
37	0	0	0	4.5	-	**37**	0	0	0	9.2	-
38	0	0	0	6.4	-	**38**	0	0	0	8	-
39	0	0	0	1.7	-	**39**	0	0	0	8.9	-
40	0	0	0	10	0.5	**40**	0	0	0	6.7	0.25
41	0	0	0	15.6	-	**41**	0	0	0	5.5	-
42	0	0	0	17	-	**42**	0	0	0	12	-
43	0	0	0	24.2	-	**43**	0	0	0	6.2	-
44	0	0	0	4.6	-	**44**	0	0	0	10.3	-
45	0	0	0	8	-	**45**	0	0	0	7.5	-
46	0	0	0	3.1	-	**46**	0	0	0	2.2	-
47	0	0	0	6.6	-	**47**	0	0	0	1.8	-
48	0	0	0	5.9	-	**48**	0	0	0	1	-
49	0	0	0	4.9	-	**49**	0	0	0	1.6	-
50	0	0	0	4	0.75	**50**	0	0	0	3.2	0
51	0	0	0	2.2	-	**51**	0	0	0	6	-
52	0	0	0	4.5	-	**52**	0	0	0	15	-
53	0	0	0	5	-	**53**	0	0	0	8	-
54	0	0	0	2.2	-	**54**	0	0	0	1.6	-
55	0	0	0	6.1	-	**55**	0	0	0	1.2	-
56	0	0	0	2.6	-	**56**	0	0	0	3.4	-
57	0	0	0	7.2	-	**57**	0	0	0	4.6	-
58	0	0	0	4.7	-	**58**	0	0	0	2.7	-
59	0	0	0	4.1	-	**59**	0	0	0	2.2	-
60	0	0	0	1.6	0	**60**	0	0	0	20	0.75
61	0	0	0	13	-	**61**	0	0	0	13	-
62	0	0	0	4.8	-	**62**	0	0	0	16	-
63	0	0	0	4.1	-	**63**	0	0	0	17	-
64	0	0	0	5	-	**64**	0	0	0	3.4	-
65	0	0	0	5	-	**65**	0	0	0	3.2	-
66	0	0	0	2.8	-	**66**	0	0	0	4.5	-
67	0	0	0	14.5	-	**67**	0	0	0	11.6	-
68	0	0	0	7.8	-	**68**	0	0	0	6.6	-
69	0	0	0	6	-	**69**	0	0	0	2.6	-
70	0	0	0	3.6	0.5	**70**	0	0	0	7	0.25
71	0	0	0	4.5	-	**71**	0	0	0	6.6	-
72	0	0	0	2.3	-	**72**	0	0	0	4.2	-
73	0	0	0	11.5	-	**73**	0	0	0	3	-
74	0	0	0	14.5	-	**74**	0	0	0	7	-
75	0	0	0	11	-	**75**	0	0	0	8.9	-
76	0	0	0	8.3	-	**76**	0	0	0	5.6	-
77	0	0	0	3.5	-	**77**	0	0	0	7.1	-
78	0	0	0	5.5	-	**78**	0	0	0	4	-
79	0	0	0	2.3	-	**79**	0	0	0	25	-
80	0	0	0	3.9	0.75	**80**	0	0	0	4	0.75
81	0	0	0	14	-	**81**	0	0	0	3.6	-
82	0	0	0	5.3	-	**82**	0	0	0	9.6	-
83	0	0	0	5.6	-	**83**	0	0	0	13	-
84	0	0	0	7.5	-	**84**	0	0	0	48	-
85	0	0	0	6.3	-	**85**	0	0	0	3.6	-
86	0	0	0	11	-	**86**	0	0	0	3	-
87	0	0	0	4.5	-	**87**	0	0	0	7	-
88	0	0	0	1.6	-	**88**	0	0	0	2.5	-
89	0	0	0	9.5	-	**89**	0	0	0	2.8	-
90	0	0	0	9.5	0.5	**90**	0	0	0	8.6	0.75
91	0	0	0	10.5	-	**91**	0	0	0	4.2	-
92	0	0	0	7.3	-	**92**	0	0	0	9	-
93	0	0	0	10.5	-	**93**	0	0	0	10.2	-
94	0	0	0	3.9	-	**94**	0	0	0	5.4	-
95	0	0	0	12	-	**95**	0	0	0	4	-
96	0	0	0	4.8	-	**96**	0	0	0	6.5	-
97	0	0	0	6.3	-	**97**	0	0	0	3	-
98	0	0	0	4.2	-	**98**	0	0	0	4	-
99	0	0	0	5.5	-	**99**	0	0	0	6.5	-
100	0	0	0	4.5	0.5	**100**	0	0	0	5.6	0.25
Average Cic, Cip and Embed. =	**0**	**0**	**0**	**7.6**	**0.53**	**Average Cic, Cip and Embed. =**	**0**	**0**	**0**	**7.2**	**0.50**
Old Calcite Index (CI) =		**0.00**				**Old Calcite Index (CI) =**		**0.00**			
New Calcite Index (CI) =		**0.00**				**New Calcite Index (CI) =**		**0.00**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_FRB-1						LC_FRB-2					
10-Sep-22						10-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0.4	1	13	-	**1**	0	0.4	1	13	-
2	0	0.1	1	4	-	**2**	0	0.1	1	4	-
3	0	0.5	1	17	-	**3**	0	0.5	1	17	-
4	0	0	0	2	-	**4**	0	0	0	2	-
5	0	0	0	6.5	-	**5**	0	0	0	6.5	-
6	0	0	0	1.5	-	**6**	0	0	0	1.5	-
7	0	0	0	3	-	**7**	0	0	0	3	-
8	0	0.3	1	11	-	**8**	0	0.3	1	11	-
9	0	0	0	1.5	-	**9**	0	0	0	1.5	-
10	0	0	0	3	0	**10**	0	0	0	3	0
11	0	0	0	7	-	**11**	0	0	0	7	-
12	0	0.7	1	22	-	**12**	1	0.7	1	22	-
13	0	0	0	4	-	**13**	0	0	0	4	-
14	0	0.8	1	13	-	**14**	1	0.8	1	13	-
15	0	0	0	3	-	**15**	0	0	0	3	-
16	0	0.8	1	18	-	**16**	0	0.8	1	17	-
17	0	0	0	4	-	**17**	0	0	0	4	-
18	0	0	0	3.5	-	**18**	0	0	0	3.5	-
19	0	0	0	5	-	**19**	0	0	0	5	-
20	0	0	0	4	0.25	**20**	0	0	0	4	0.25
21	0	0.5	1	16	-	**21**	1	0.5	1	16	-
22	0	0	0	3.4	-	**22**	0	0	0	3.4	-
23	0	0	0	5	-	**23**	0	0	0	5	-
24	0	0	0	5	-	**24**	0	0	0	5	-
25	0	0.8	1	20	-	**25**	1	0.8	1	20	-
26	0	0	0	1.2	-	**26**	0	0	0	1.2	-
27	0	0.1	1	14	-	**27**	0	0.1	1	14	-
28	0	0	0	5	-	**28**	0	0	0	5	-
29	0	0.8	1	19	-	**29**	0	0.8	1	19	-
30	0	0	0	5	0	**30**	0	0	0	5	0
31	0	0	0	5	-	**31**	0	0	0	5	-
32	0	0	0	7	-	**32**	0	0	0	7	-
33	0	0.1	1	5.2	-	**33**	0	0.1	1	5.2	-
34	0	0	0	14	-	**34**	0	0	0	14	-
35	0	0	0	18	-	**35**	0	0	0	18	-
36	0	0.3	1	8	-	**36**	0	0.3	1	8	-
37	0	0	0	3.8	-	**37**	0	0	0	3.8	-
38	0	0	0	3	-	**38**	0	0	0	3	-
39	0	0	0	2.8	-	**39**	0	0	0	2.8	-
40	0	0.5	1	20	0.5	**40**	0	0.5	1	20	0.5
41	0	0	0	4	-	**41**	0	0	0	4	-
42	0	0	0	5	-	**42**	0	0	0	5	-
43	0	0.2	1	16.5	-	**43**	0	0.2	1	16.5	-
44	0	0	0	3.2	-	**44**	0	0	0	3.2	-
45	0	0	0	1	-	**45**	0	0	0	1	-
46	0	0.3	1	18.5	-	**46**	0	0.3	1	18.5	-
47	0	0.6	1	20.1	-	**47**	1	0.6	1	20.1	-
48	0	0.3	1	8	-	**48**	0	0.3	1	8	-
49	0	0.2	1	8	-	**49**	0	0.2	1	8	-
50	0	0.7	1	26	0.5	**50**	1	0.7	1	29	0.5
51	0	0.6	1	20	-	**51**	1	0.6	1	20	-
52	0	0.3	1	7.5	-	**52**	0	0.3	1	7.5	-
53	0	0.5	1	14.5	-	**53**	1	0.5	1	14.5	-
54	0	0.5	1	7.1	-	**54**	0	0.5	1	7.1	-
55	0	0	0	3.3	-	**55**	0	0	0	3.3	-
56	0	0.6	1	14	-	**56**	0	0.6	1	14	-
57	0	0.3	1	5	-	**57**	0	0.3	1	5	-
58	0	0.5	1	6.7	-	**58**	0	0.5	1	6.7	-
59	0	0.6	1	12.3	-	**59**	0	0.6	1	12.3	-
60	0	0.3	1	5.2	0.5	**60**	0	0.3	1	5.2	0.25
61	0	0.8	1	6	-	**61**	1	0.8	1	6	-
62	0	0.5	1	17.5	-	**62**	1	0.5	1	17.5	-
63	0	0.3	1	3.5	-	**63**	0	0.3	1	9.5	-
64	0	0.8	1	12.3	-	**64**	0	0.8	1	12.3	-
65	0	0.6	1	12.2	-	**65**	0	0.6	1	12.2	-
66	0	0.1	1	4.8	-	**66**	0	0.1	1	4.8	-
67	0	0.4	1	7	-	**67**	1	0.4	1	7	-
68	0	0.5	1	10.5	-	**68**	0	0.5	1	10.5	-
69	0	0.6	1	17.5	-	**69**	1	0.6	1	17.5	-
70	0	0.5	1	13	0.25	**70**	0	0.5	1	13	0.25
71	0	0.8	1	10.5	-	**71**	0	0.8	1	10.5	-
72	0	0.5	1	15	-	**72**	1	0.5	1	15	-
73	0	0.5	1	7.5	-	**73**	0	0.5	1	7.5	-
74	0	0.5	1	4.5	-	**74**	0	0.5	1	4.5	-
75	0	0.4	1	7.3	-	**75**	0	0.4	1	7.3	-
76	0	0.2	1	8.2	-	**76**	0	0.2	1	8.2	-
77	0	0.5	1	12.1	-	**77**	0	0.5	1	12.1	-
78	0	0.5	1	13	-	**78**	1	0.5	1	13	-
79	0	0.5	1	26	-	**79**	0	0.5	1	26	-
80	0	0.5	1	20	0.25	**80**	0	0.5	1	20	0.25
81	0	0.8	1	7.5	-	**81**	0	0.8	1	7.5	-
82	0	0.3	1	8.2	-	**82**	0	0.3	1	8.2	-
83	0	0.4	1	4.2	-	**83**	0	0.4	1	4.2	-
84	0	0.5	1	10	-	**84**	0	0.5	1	10	-
85	0	0.3	1	8	-	**85**	0	0.3	1	8	-
86	0	0	0	2	-	**86**	0	0	0	2	-
87	0	0.5	1	6.5	-	**87**	0	0.5	1	6.5	-
88	0	0.3	1	7.5	-	**88**	0	0.3	1	7.5	-
89	0	0.1	1	4.5	-	**89**	0	0.1	1	4.5	-
90	0	0.6	1	13	0.25	**90**	0	0.6	1	13	0.25
91	0	0.4	1	7.5	-	**91**	0	0.4	1	7.5	-
92	0	0.8	1	18	-	**92**	0	0.8	1	18	-
93	0	0.7	1	13.4	-	**93**	0	0.7	1	13.4	-
94	0	0.6	1	22	-	**94**	0	0.6	1	22	-
95	0	0.3	1	7.5	-	**95**	0	0.3	1	7.5	-
96	0	0.8	1	7.8	-	**96**	0	0.8	1	7.8	-
97	0	0.1	1	7.2	-	**97**	0	0.1	1	7.2	-
98	0	0.6	1	16	-	**98**	1	0.6	1	16	-
99	0	0.2	1	5.5	-	**99**	0	0.2	1	5.5	-
100	0	0.1	1	3.8	0.25	**100**	0	0.1	1	3.8	0.25
Average Cic, Cip and Embed. =	**0**	**0.32**	**0.68**	**9.4**	**0.28**	**Average Cic, Cip and Embed. =**	**0.15**	**0.32**	**0.68**	**9.5**	**0.25**
Old Calcite Index (CI) =		**0.68**				**Old Calcite Index (CI) =**		**0.83**			
New Calcite Index (CI) =		**0.32**				**New Calcite Index (CI) =**		**0.47**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_FRB-3						LC_FRUS-1					
10-Sep-22						10-Sep-22					
Pebble	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**	**Pebble**	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**
1	0	0.1	1	18	-	**1**	0	0	0	8	-
2	0	0.1	1	5	-	**2**	0	0	0	11	-
3	0	0	0	2	-	**3**	0	0	0	6.5	-
4	0	0.1	1	3	-	**4**	0	0.5	1	10.8	-
5	0	0.3	1	11	-	**5**	0	0	0	8	-
6	0	0.2	1	7.5	-	**6**	0	0.4	1	9.5	-
7	0	0.3	1	13.9	-	**7**	1	0.6	1	14	-
8	0	0.2	1	6	-	**8**	0	0.6	1	9.6	-
9	0	0.1	1	6.3	-	**9**	0	0.7	1	10	-
10	0	0.1	1	12	0.25	**10**	0	0.7	1	12.5	0.75
11	0	0.1	1	5.9	-	**11**	0	0.8	1	7	-
12	0	0.1	1	7.5	-	**12**	0	0	0	9	-
13	0	0.2	1	16	-	**13**	0	0.8	1	14	-
14	0	0.5	1	20.7	-	**14**	0	0.7	1	12	-
15	0	0.2	1	5	-	**15**	0	0.9	1	10.5	-
16	0	0.5	1	3.5	-	**16**	0	0.5	1	13.5	-
17	0	0.1	1	2	-	**17**	1	0.7	1	20	-
18	0	0.4	1	5	-	**18**	1	0.7	1	35	-
19	0	0.2	1	5.5	-	**19**	0	0.6	1	10	-
20	0	0.4	1	3.2	0.5	**20**	0	0.6	1	9.5	0.25
21	0	0	0	5	-	**21**	0	0.6	1	11.5	-
22	0	0.3	1	5	-	**22**	0	0.8	1	11.5	-
23	0	0.5	1	19	-	**23**	0	0.7	1	18	-
24	0	0.2	1	4	-	**24**	1	0	0	3	-
25	0	0.6	1	5.2	-	**25**	0	0.8	1	7.5	-
26	0	0.5	1	13.5	-	**26**	0	0	0	9.5	-
27	0	0.3	1	4	-	**27**	0	0	0	6	-
28	0	0	0	5.5	-	**28**	0	0	0	8.5	-
29	0	0.3	1	7.3	-	**29**	0	0	0	3.2	-
30	0	0.2	1	3.5	0.25	**30**	1	0.8	1	17.5	0.25
31	0	0.4	1	5.5	-	**31**	0	0	0	1.8	-
32	1	0.5	1	17.5	-	**32**	1	0.7	1	22	-
33	0	0.4	1	5.6	-	**33**	0	0.5	1	17	-
34	0	0	0	4	-	**34**	0	0.6	1	18	-
35	1	0.4	1	23.5	-	**35**	0	0	0	10	-
36	0	0.7	1	11	-	**36**	0	0.6	1	10	-
37	0	0.2	1	8.5	-	**37**	0	0	0	10.6	-
38	0	0.2	1	5	-	**38**	0	0.6	1	11.3	-
39	0	0.1	1	6.6	-	**39**	0	0.7	1	26	-
40	0	0.1	1	7.4	0	**40**	0	0	0	8	0.5
41	0	0	0	5.4	-	**41**	0	0.6	1	17	-
42	0	0.3	1	20.5	-	**42**	0	0.7	1	15.4	-
43	0	0.3	1	15	-	**43**	1	0.8	1	23	-
44	0	0.4	1	15.5	-	**44**	0	0.8	1	10	-
45	0	0	0	4.8	-	**45**	0	0.8	1	12	-
46	0	0.3	1	6	-	**46**	0	0.6	1	14	-
47	0	0.6	1	7	-	**47**	0	0	0	6	-
48	0	0.4	1	5	-	**48**	0	0.5	1	10.5	-
49	0	0.7	1	24.5	-	**49**	1	0.8	1	29	-
50	1	0.6	1	10.2	0.25	**50**	0	0.5	1	4	0.5
51	0	0.1	1	4.5	-	**51**	0	0.5	1	7.5	-
52	0	0.3	1	8.5	-	**52**	0	0.6	1	8	-
53	0	0	0	2.8	-	**53**	0	0.1	1	4.5	-
54	0	0	0	4.5	-	**54**	0	0.6	1	5.5	-
55	0	0.3	1	5.3	-	**55**	0	0.8	1	7	-
56	0	0.2	1	5.1	-	**56**	0	0.7	1	22	-
57	0	0.1	1	5.1	-	**57**	0	0	0	4	-
58	0	0	0	4	-	**58**	0	0.9	1	7	-
59	0	0.3	1	6.5	-	**59**	0	0.6	1	11	-
60	0	0.5	1	7.3	0.25	**60**	0	0.6	1	10	0.75
61	0	0.5	1	5.1	-	**61**	0	0.9	1	8.5	-
62	0	0	0	7.5	-	**62**	0	0.5	1	13.5	-
63	0	0.3	1	14	-	**63**	0	0.6	1	7.5	-
64	1	0.5	1	25.5	-	**64**	0	0.8	1	19	-
65	0	0.1	1	4.5	-	**65**	0	0.9	1	13.5	-
66	0	0	0	7	-	**66**	0	0.1	1	7	-
67	0	0.1	1	12	-	**67**	0	0.5	1	9	-
68	1	0.5	1	18	-	**68**	0	0.7	1	11	-
69	0	0.1	1	7.5	-	**69**	0	0.6	1	8	-
70	0	0.2	1	7.5	0.5	**70**	0	0.8	1	14	0.5
71	0	0.1	1	6.5	-	**71**	0	0.5	1	5.5	-
72	1	0.3	1	4.5	-	**72**	0	0.7	1	10	-
73	0	0	0	3.5	-	**73**	0	1	1	7.5	-
74	1	0.5	1	11	-	**74**	0	0.2	1	7	-
75	0	0.3	1	13.5	-	**75**	0	0	0	2	-
76	1	0.5	1	14	-	**76**	0	0.1	1	6	-
77	0	0.1	1	17	-	**77**	0	0.8	1	15	-
78	0	0.3	1	10	-	**78**	0	0.2	1	8	-
79	0	0.5	1	8.5	-	**79**	0	0.3	1	5	-
80	0	0	0	4.5	0.75	**80**	0	0.6	1	14	0.5
81	0	0	0	11	-	**81**	0	0.5	1	15	-
82	0	0.5	1	29	-	**82**	0	0.7	1	16	-
83	0	0.1	1	12.5	-	**83**	0	1	1	10	-
84	0	0.2	1	9.8	-	**84**	0	0.8	1	19	-
85	0	0.1	1	10.4	-	**85**	0	0.6	1	8	-
86	0	0	0	7.5	-	**86**	0	0	0	6	-
87	0	0.5	1	17	-	**87**	0	0.1	1	5	-
88	0	0.5	1	19	-	**88**	0	0.3	1	13	-
89	0	0.4	1	21	-	**89**	0	0.7	1	14	-
90	0	0.3	1	29	0.25	**90**	0	0.6	1	10	0.5
91	0	0	0	9	-	**91**	0	0.5	1	20	-
92	0	0.3	1	8	-	**92**	0	0.3	1	9	-
93	0	0.5	1	22	-	**93**	0	0.4	1	10	-
94	0	0.4	1	7.5	-	**94**	1	0.8	1	11	-
95	0	0	0	2	-	**95**	0	0.5	1	15	-
96	0	0	0	3.5	-	**96**	0	0.7	1	11	-
97	0	0	0	7	-	**97**	0	0.3	1	4.8	-
98	0	0.1	1	5.1	-	**98**	0	0.8	1	19.8	-
99	0	0	0	4.6	-	**99**	0	0.6	1	17.4	-
100	0	0.2	1	5.9	0.5	**100**	0	0.2	1	6	0
Average Cic, Cip and Embed. =	**0.08**	**0.25**	**0.80**	**9.4**	**0.35**	**Average Cic, Cip and Embed. =**	**0.09**	**0.50**	**0.82**	**11.3**	**0.45**
Old Calcite Index (CI) =		**0.88**				**Old Calcite Index (CI) =**		**0.91**			
New Calcite Index (CI) =		**0.33**				**New Calcite Index (CI) =**		**0.59**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_FRUS-2						LC_FRUS-3					
10-Sep-22						10-Sep-22					
Pebble	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**	**Pebble**	**Concreted Status**	**Calcite Proportion**	**Calcite Presence**	**Intermediate Axis (cm)**	**Embeddedness (%)**
1	0	0	0	10	-	**1**	0	0.8	1	10.5	-
2	0	0	0	10.5	-	**2**	0	0.6	1	16	-
3	0	0	0	12	-	**3**	0	0.5	1	7.5	-
4	0	0	0	11	-	**4**	0	0.8	1	8.5	-
5	0	0	0	15	-	**5**	0	0.5	1	5.5	-
6	0	0	0	2	-	**6**	0	0.6	1	15.3	-
7	0	0.7	1	9	-	**7**	0	0.7	1	15.5	-
8	0	0.7	1	10.5	-	**8**	0	0.9	1	10.5	-
9	0	0	0	9	-	**9**	0	0.7	1	9.5	-
10	0	0.3	1	7	0.5	**10**	0	0.8	1	7.5	0.75
11	0	0	0	6	-	**11**	0	0.7	1	7.5	-
12	0	0	0	5.3	-	**12**	0	0.6	1	5.6	-
13	0	0.7	1	9	-	**13**	0	1	1	9.3	-
14	0	0	0	7.5	-	**14**	0	0.5	1	11.4	-
15	0	0	0	6	-	**15**	0	0.5	1	6.5	-
16	0	0.4	1	5.7	-	**16**	0	0.6	1	6.8	-
17	0	0.6	1	5.5	-	**17**	0	1	1	7.5	-
18	0	0.7	1	11.5	-	**18**	0	0.8	1	6.8	-
19	0	0	0	3	-	**19**	0	0.9	1	8.9	-
20	0	0	0	1.2	0.25	**20**	0	0.5	1	13	0.75
21	0	0.4	1	7.3	-	**21**	0	0.6	1	8.8	-
22	0	0	0	1	-	**22**	0	0.7	1	12	-
23	0	0.4	1	5.6	-	**23**	0	0.8	1	5	-
24	0	0.4	1	7	-	**24**	0	1	1	9.6	-
25	0	0	0	3	-	**25**	0	0.5	1	12.1	-
26	0	0	0	7	-	**26**	0	0.9	1	13.5	-
27	0	0.8	1	23	-	**27**	0	0.6	1	15	-
28	0	0.6	1	8	-	**28**	0	0.7	1	12	-
29	0	0.8	1	21	-	**29**	0	0.5	1	9.3	-
30	0	0.6	1	6.5	0.25	**30**	0	0.7	1	9	0.5
31	0	0.3	1	9.2	-	**31**	0	0.3	1	8.2	-
32	0	0	0	6	-	**32**	0	0.4	1	10.4	-
33	0	0.7	1	9	-	**33**	0	0.6	1	17	-
34	0	0.4	1	9.2	-	**34**	0	0.7	1	14	-
35	0	0.4	1	15	-	**35**	0	0.5	1	7	-
36	0	0.5	1	8	-	**36**	0	0.8	1	8.5	-
37	0	0.5	1	6	-	**37**	0	0.9	1	7.1	-
38	0	0.9	1	12	-	**38**	0	1	1	6.8	-
39	0	0	0	4	-	**39**	0	0.7	1	11	-
40	0	0.3	1	7	0.5	**40**	0	0.5	1	14	0.5
41	0	0.3	1	8.6	-	**41**	0	0.8	1	7.1	-
42	0	0.4	1	3	-	**42**	0	0.5	1	17	-
43	0	0.5	1	8	-	**43**	0	0.5	1	20	-
44	0	0.7	1	16	-	**44**	0	0.9	1	13	-
45	0	0	0	4	-	**45**	0	0.5	1	10.5	-
46	0	0	0	4.5	-	**46**	0	0.8	1	2.6	-
47	0	0.1	1	7	-	**47**	0	0.8	1	3.8	-
48	0	0.1	1	6.6	-	**48**	0	0.8	1	9.2	-
49	0	0	0	6.4	-	**49**	0	0.8	1	7.5	-
50	0	0	0	9	0.5	**50**	0	0.3	1	16	0.75
51	0	0.8	1	5.9	-	**51**	0	0	0	9	-
52	0	0	0	1.9	-	**52**	0	0.7	1	4.5	-
53	0	0	0	2.8	-	**53**	0	0.4	1	8	-
54	0	0.1	1	3.8	-	**54**	0	0.8	1	7	-
55	0	0.3	1	4.8	-	**55**	0	0.6	1	5	-
56	0	1	1	8.7	-	**56**	0	0.9	1	6.7	-
57	0	0.4	1	5.3	-	**57**	0	0.5	1	9.5	-
58	0	0.3	1	7.1	-	**58**	0	0.6	1	11.1	-
59	0	0	0	7.5	-	**59**	0	0.5	1	15	-
60	0	0.5	1	8.7	0.75	**60**	0	0.5	1	11	0.5
61	0	0.1	1	5.2	-	**61**	0	0.3	1	7.6	-
62	0	0	0	6.1	-	**62**	0	1	1	6.2	-
63	0	0	0	7.6	-	**63**	0	0.8	1	4.4	-
64	0	0.1	1	8.5	-	**64**	0	0.6	1	13.5	-
65	0	0.1	1	9.5	-	**65**	0	0.6	1	10	-
66	0	0	0	3.5	-	**66**	0	0.5	1	25	-
67	0	0.1	1	4.2	-	**67**	0	0.7	1	10.5	-
68	0	0	0	3	-	**68**	0	0.9	1	18	-
69	0	0.2	1	8.5	-	**69**	0	0.5	1	7	-
70	0	0.1	1	9.5	0	**70**	0	0.6	1	6.5	0.5
71	0	0.1	1	5.5	-	**71**	0	0.8	1	7	-
72	0	0.3	1	4.5	-	**72**	0	0.9	1	6.8	-
73	0	0.1	1	8.5	-	**73**	0	0.8	1	19.5	-
74	0	0.3	1	7.6	-	**74**	0	0.7	1	8.1	-
75	0	0.4	1	6.8	-	**75**	0	0.9	1	9.8	-
76	0	0.4	1	5.8	-	**76**	0	0.6	1	8.5	-
77	0	0	0	3.6	-	**77**	0	0.5	1	7.9	-
78	0	0.3	1	7.2	-	**78**	0	0.1	1	5	-
79	0	0.3	1	6.1	-	**79**	0	0.6	1	4	-
80	0	0.1	1	3.5	0	**80**	0	1	1	12	0.5
81	0	0.4	1	5.8	-	**81**	0	0.9	1	19	-
82	0	0	0	4.5	-	**82**	1	0.8	1	34	-
83	0	0.5	1	14.5	-	**83**	0	0.6	1	17.5	-
84	0	0	0	4.5	-	**84**	0	0.4	1	13.5	-
85	0	0.1	1	4.3	-	**85**	0	0.8	1	12.5	-
86	0	0	0	3	-	**86**	0	0.5	1	3.6	-
87	0	0.3	1	12	-	**87**	0	0.6	1	7.5	-
88	0	0.2	1	4.3	-	**88**	0	0.8	1	7.9	-
89	0	0	0	4.5	-	**89**	0	0.9	1	12	-
90	0	0.8	1	7.2	0.75	**90**	0	0.9	1	7.5	0.5
91	0	1	1	4.5	-	**91**	0	1	1	5.6	-
92	0	0.8	1	6.5	-	**92**	1	0.7	1	5.2	-
93	0	0.8	1	5.8	-	**93**	0	0.7	1	7	-
94	0	0.7	1	4.5	-	**94**	0	0.7	1	8	-
95	0	0	0	4.5	-	**95**	0	0.7	1	9.9	-
96	0	0	0	2.8	-	**96**	0	0.6	1	15.2	-
97	0	0.1	1	4.5	-	**97**	0	0.7	1	16	-
98	0	0.3	1	9.5	-	**98**	0	0.6	1	7	-
99	0	0.5	1	7	-	**99**	0	0.4	1	10.1	-
100	0	0.8	1	6.5	0.5	**100**	0	0.4	1	8	0.25
Average Cic, Cip and Embed. =	**0**	**0.28**	**0.64**	**7.1**	**0.40**	**Average Cic, Cip and Embed. =**	**0.02**	**0.67**	**0.99**	**10.2**	**0.55**
Old Calcite Index (CI) =		**0.64**				**Old Calcite Index (CI) =**		**1.01**			
New Calcite Index (CI) =		**0.28**				**New Calcite Index (CI) =**		**0.69**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_GRCK-1						LC_GRCK-2					
14-Sep-22						14-Sep-22					
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)
1	0	0	0	11	-	**1**	0	0	0	9.7	-
2	0	0	0	8.2	-	**2**	0	0	0	8.8	-
3	0	0	0	8.4	-	**3**	0	0	0	10	-
4	0	0	0	6	-	**4**	0	0	0	7.3	-
5	0	0	0	6.3	-	**5**	0	0	0	7.2	-
6	0	0	0	8.2	-	**6**	0	0	0	5.4	-
7	0	0	0	9.5	-	**7**	0	0	0	4.5	-
8	0	0	0	5.5	-	**8**	0	0	0	2.2	-
9	0	0	0	5.6	-	**9**	0	0	0	4.3	-
10	0	0	0	13	0.5	**10**	0	0	0	3.7	0
11	0	0	0	5.3	-	**11**	0	0	0	6.7	-
12	0	0	0	8.1	-	**12**	0	0	0	3.6	-
13	0	0	0	14.5	-	**13**	0	0	0	5	-
14	0	0	0	5.1	-	**14**	0	0	0	9	-
15	0	0	0	24.9	-	**15**	0	0	0	7.1	-
16	0	0	0	3.5	-	**16**	0	0	0	9	-
17	0	0	0	2	-	**17**	0	0	0	3.7	-
18	0	0	0	4	-	**18**	0	0	0	3.3	-
19	0	0	0	10	-	**19**	0	0	0	8.5	-
20	0	0	0	3.5	0.75	**20**	0	0	0	5	0.75
21	0	0	0	6.2	-	**21**	0	0	0	8	-
22	0	0	0	10	-	**22**	0	0	0	7	-
23	0	0	0	6.7	-	**23**	0	0	0	3.6	-
24	0	0	0	4.5	-	**24**	0	0	0	9	-
25	0	0	0	7	-	**25**	0	0	0	3.2	-
26	0	0	0	7.5	-	**26**	0	0	0	11	-
27	0	0	0	5.5	-	**27**	0	0	0	10	-
28	0	0	0	4	-	**28**	0	0	0	15	-
29	0	0	0	8.5	-	**29**	0	0	0	5.6	-
30	0	0	0	3.1	0.5	**30**	0	0	0	7.1	0.75
31	0	0	0	5.3	-	**31**	0	0	0	5	-
32	0	0	0	7	-	**32**	0	0	0	32	-
33	0	0	0	5.1	-	**33**	0	0	0	16	-
34	0	0	0	4.4	-	**34**	0	0	0	2	-
35	0	0	0	8.1	-	**35**	0	0	0	2.5	-
36	0	0	0	2.3	-	**36**	0	0	0	4.7	-
37	0	0	0	8	-	**37**	0	0	0	3	-
38	0	0	0	5	-	**38**	0	0	0	4	-
39	0	0	0	5.5	-	**39**	0	0	0	4.3	-
40	0	0	0	8	0.75	**40**	0	0	0	16	0.75
41	0	0.2	1	6	-	**41**	0	0	0	6	-
42	0	0	0	3.4	-	**42**	0	0	0	8	-
43	0	0	0	10	-	**43**	0	0	0	4.5	-
44	0	0	0	8.5	-	**44**	0	0	0	3.1	-
45	0	0	0	16	-	**45**	0	0	0	2	-
46	0	0	0	5.3	-	**46**	0	0	0	3	-
47	0	0	0	13	-	**47**	0	0	0	17.5	-
48	0	0	0	10	-	**48**	0	0	0	3.5	-
49	0	0	0	8	-	**49**	0	0	0	4	-
50	0	0	0	8.7	0.25	**50**	0	0	0	4	0.5
51	0	0	0	8.2	-	**51**	0	0	0	3.6	-
52	0	0	0	9.3	-	**52**	0	0	0	9.8	-
53	0	0	0	4.5	-	**53**	0	0	0	7.5	-
54	0	0	0	6.2	-	**54**	0	0	0	5.1	-
55	0	0	0	8.4	-	**55**	0	0	0	7.8	-
56	0	0	0	17	-	**56**	0	0	0	7	-
57	0	0	0	14.5	-	**57**	0	0	0	4	-
58	0	0	0	10.1	-	**58**	0	0	0	10	-
59	0	0	0	9.6	-	**59**	0	0	0	7.2	-
60	0	0	0	3.6	0.5	**60**	0	0	0	6.5	0.5
61	0	0	0	3.9	-	**61**	0	0	0	4.5	-
62	0	0	0	4.1	-	**62**	0	0	0	5.6	-
63	0	0	0	11.4	-	**63**	0	0	0	4.1	-
64	0	0	0	7.4	-	**64**	0	0	0	3	-
65	0	0	0	8.1	-	**65**	0	0	0	18	-
66	0	0	0	12	-	**66**	0	0	0	11	-
67	0	0	0	7.1	-	**67**	0	0	0	15	-
68	0	0	0	7.3	-	**68**	0	0	0	7.1	-
69	0	0	0	9.5	-	**69**	0	0	0	3.5	-
70	0	0	0	9.1	0.75	**70**	0	0	0	4.3	0.75
71	0	0	0	6.8	-	**71**	0	0	0	7.5	-
72	0	0	0	6.2	-	**72**	0	0	0	7.6	-
73	0	0	0	11.3	-	**73**	0	0	0	3.5	-
74	0	0	0	9.8	-	**74**	0	0	0	7	-
75	0	0	0	8.4	-	**75**	0	0	0	3	-
76	0	0	0	9	-	**76**	0	0	0	2.6	-
77	0	0	0	13.6	-	**77**	0	0	0	7.8	-
78	0	0	0	8.1	-	**78**	0	0	0	11	-
79	0	0	0	11	-	**79**	0	0	0	11.5	-
80	0	0	0	5.3	0.5	**80**	0	0	0	16	0.75
81	0	0	0	11	-	**81**	0	0	0	12	-
82	0	0	0	6.4	-	**82**	0	0	0	7.6	-
83	0	0	0	6.2	-	**83**	0	0	0	7.2	-
84	0	0	0	3.1	-	**84**	0	0	0	5.9	-
85	0	0	0	3.1	-	**85**	0	0	0	17	-
86	0	0	0	2.6	-	**86**	0	0	0	3.2	-
87	0	0	0	5.1	-	**87**	0	0	0	11	-
88	0	0	0	4.7	-	**88**	0	0	0	4.3	-
89	0	0	0	3.2	-	**89**	0	0	0	7.5	-
90	0	0	0	15	0.5	**90**	0	0	0	6.4	0.5
91	0	0	0	8.5	-	**91**	0	0	0	11.6	-
92	0	0	0	6.3	-	**92**	0	0	0	8.1	-
93	0	0	0	21	-	**93**	0	0	0	7.5	-
94	0	0	0	4.9	-	**94**	0	0	0	3.2	-
95	0	0	0	5.3	-	**95**	0	0	0	6.4	-
96	0	0	0	5.9	-	**96**	0	0	0	2.5	-
97	0	0	0	5.2	-	**97**	0	0	0	4.6	-
98	0	0	0	4.5	-	**98**	0	0	0	7.5	-
99	0	0	0	4.8	-	**99**	0	0	0	5.5	-
100	0	0	0	8.5	0.25	**100**	0	0	0	3.7	0.5
Average Cic, Cip and Embed. =	**0**	**0.00**	**0.01**	**7.7**	**0.53**	**Average Cic, Cip and Embed. =**	**0**	**0**	**0**	**7.1**	**0.58**
Old Calcite Index (CI) =		**0.01**				**Old Calcite Index (CI) =**		**0.00**			
New Calcite Index (CI) =		**0.00**				**New Calcite Index (CI) =**		**0.00**			

Table I.4: Pebble Counts and Calcite Measurements at Benthic Invertebrate Sampling Locations in Dry Creek, Fording River, and Grace Creek, 2022

LC_GRCK-3						LC_DCDS-1			LC_DCDS-2		
14-Sep-22						30-Nov-22			30-Nov-22		
Pebble	Concreted Status	Calcite Proportion	Calcite Presence	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)	Pebble	Intermediate Axis (cm)	Embeddedness (%)
1	0	0	0	6	-	**1**	12.5	-	**1**	9	-
2	0	0	0	16	-	**2**	7.5	-	**2**	17	-
3	0	0	0	5	-	**3**	15	-	**3**	16.5	-
4	0	0	0	8.5	-	**4**	10.5	-	**4**	17.5	-
5	0	0	0	6.6	-	**5**	4.5	-	**5**	7	-
6	0	0.4	1	14	-	**6**	9	-	**6**	9	-
7	0	0.1	1	10.5	-	**7**	8	-	**7**	16	-
8	0	0	0	5.6	-	**8**	17		**8**	4.5	-
9	0	0.1	1	10	-	**9**	12	-	**9**	13	-
10	0	0.3	1	7.8	0.25	**10**	4	0.5	**10**	13	0.75
11	0	0	0	7.3	-	**11**	5	-	**11**	8	-
12	0	0	0	5.3	-	**12**	8	-	**12**	21	-
13	0	0	0	6.1	-	**13**	5	-	**13**	15	-
14	0	0.3	1	6	-	**14**	3	-	**14**	9	-
15	0	0.1	1	7.1	-	**15**	4.5	-	**15**	7.5	-
16	0	0	0	4.2	-	**16**	4	-	**16**	9.5	-
17	0	0.2	1	6.1	-	**17**	5.5	-	**17**	15	-
18	0	0	0	7.6	-	**18**	4.5	-	**18**	8	-
19	0	0	0	3	-	**19**	9	-	**19**	12.5	-
20	0	0	0	7.6	0.5	**20**	5	0.25	**20**	10.5	0.5
21	0	0	0	11.1	-	**21**	8	-	**21**	6	-
22	0	0.1	1	11.5	-	**22**	6	-	**22**	7.5	-
23	0	0.5	1	20.3	-	**23**	14	-	**23**	7.5	-
24	0	0.5	1	9	-	**24**	14	-	**24**	4	-
25	0	0.1	1	14	-	**25**	8.5	-	**25**	4	-
26	0	0.5	1	17	-	**26**	4	-	**26**	5.5	-
27	0	0.3	1	8	-	**27**	12.5	-	**27**	11.5	-
28	0	0	0	7	-	**28**	4	-	**28**	3	-
29	0	0	0	3	-	**29**	9	-	**29**	9	-
30	0	0	0	2	0.5	**30**	9.5	0.5	**30**	11.5	0
31	0	0	0	5	-	**31**	11	-	**31**	8	-
32	0	0	0	4	-	**32**	7	-	**32**	6	-
33	0	0	0	12	-	**33**	7.5	-	**33**	6	-
34	0	0	0	6	-	**34**	7.5	-	**34**	10.5	-
35	0	0	0	14	-	**35**	14	-	**35**	8.5	-
36	0	0.4	1	5	-	**36**	4	-	**36**	6.5	-
37	0	0	0	9	-	**37**	5.5	-	**37**	20	-
38	0	0	0	5	-	**38**	8	-	**38**	13	-
39	0	0.4	1	10.6	-	**39**	14	-	**39**	5	-
40	0	0	0	5	0.25	**40**	10	0	**40**	9	0.75
41	0	0	0	9.3	-	**41**	9	-	**41**	9.5	-
42	0	0	0	5	-	**42**	8.5	-	**42**	10	-
43	0	0.1	1	11	-	**43**	8	-	**43**	13	-
44	0	0	0	6.1	-	**44**	5.5	-	**44**	4	-
45	0	0.3	1	10	-	**45**	4	-	**45**	11	-
46	0	0.4	1	8	-	**46**	11	-	**46**	4.5	-
47	0	0.1	1	5	-	**47**	4.5	-	**47**	6.5	-
48	0	0	0	6.6	-	**48**	22	-	**48**	13	-
49	0	0	0	7.3	-	**49**	7.5	-	**49**	10	-
50	0	0	0	4	0.25	**50**	10	0.75	**50**	11	0.75
51	0	0	0	7.6	-	**51**	15	-	**51**	8.5	-
52	0	0	0	4.1	-	**52**	7.5	-	**52**	6	-
53	0	0	0	3	-	**53**	5	-	**53**	10.5	-
54	0	0	0	5.2	-	**54**	6	-	**54**	7	-
55	0	0	0	3.9	-	**55**	5.5	-	**55**	7	-
56	0	0	0	5.5	-	**56**	4	-	**56**	9	-
57	0	0	0	7.5	-	**57**	1	-	**57**	16	-
58	0	0	0	4.9	-	**58**	6	-	**58**	11	-
59	0	0	0	9.5	-	**59**	5.5	-	**59**	5.5	-
60	0	0	0	8.5	0.5	**60**	8	0.25	**60**	7	0.5
61	0	0	0	5.6	-	**61**	18	-	**61**	6	-
62	0	0	0	5.5	-	**62**	15	-	**62**	4	-
63	0	0	0	4.8	-	**63**	9	-	**63**	6.5	-
64	0	0	0	12	-	**64**	7.5	-	**64**	12	-
65	0	0	0	4.1	-	**65**	8	-	**65**	5.5	-
66	0	0	0	3.9	-	**66**	10	-	**66**	10	-
67	0	0	0	3.5	-	**67**	8.5	-	**67**	8	-
68	0	0	0	4	-	**68**	14	-	**68**	8	-
69	0	0	0	10	-	**69**	7	-	**69**	7.5	-
70	0	0	0	3	0.5	**70**	5.5	0.25	**70**	16	0.25
71	0	0	0	11.5	-	**71**	5	-	**71**	13	-
72	0	0	0	10.5	-	**72**	6	-	**72**	10	-
73	0	0	0	7	-	**73**	9	-	**73**	9.5	-
74	0	0	0	11	-	**74**	7	-	**74**	9.5	-
75	0	0	0	5.6	-	**75**	10	-	**75**	8	-
76	0	0	0	12.3	-	**76**	8	-	**76**	12	-
77	0	0	0	10	-	**77**	9	-	**77**	5	-
78	0	0	0	7.5	-	**78**	9	-	**78**	7.5	-
79	0	0	0	7.8	-	**79**	7.5	-	**79**	6	-
80	0	0	0	3.2	0	**80**	5.5	0.25	**80**	12	0.5
81	0	0	0	3.8	-	**81**	6	-	**81**	5	-
82	0	0	0	6	-	**82**	5.5	-	**82**	6.5	-
83	0	0	0	4.5	-	**83**	4.5	-	**83**	10	-
84	0	0	0	5	-	**84**	3	-	**84**	4.5	-
85	0	0	0	13.1	-	**85**	5	-	**85**	12.5	-
86	0	0	0	10.2	-	**86**	8	-	**86**	8	-
87	0	0	0	9.8	-	**87**	6	-	**87**	4	-
88	0	0	0	7.5	-	**88**	7.5	-	**88**	4.5	-
89	0	0	0	8	-	**89**	12	-	**89**	7	-
90	0	0	0	8.9	0.25	**90**	7	0.25	**90**	5.5	0.75
91	0	0	0	16	-	**91**	5	-	**91**	14	-
92	0	0	0	6.8	-	**92**	3.5	-	**92**	4.5	-
93	0	0	0	4	-	**93**	9	-	**93**	9	-
94	0	0	0	2.3	-	**94**	4.5	-	**94**	12.5	-
95	0	0	0	13	-	**95**	8	-	**95**	9.5	-
96	0	0	0	10	-	**96**	1	-	**96**	8	-
97	0	0	0	10.1	-	**97**	19	-	**97**	2	-
98	0	0	0	3.5	-	**98**	8	-	**98**	2	-
99	0	0	0	3.3	-	**99**	5.5	-	**99**	3	-
100	0	0	0	11	0.5	**100**	2.5	0.25	**100**	2.5	0.75
Average Cic, Cip and Embed. =	**0**	**0.05**	**0.19**	**7.6**	**0.35**	**Average Cic, Cip and Embed. =**	**7.9**	**0.33**	**Average Cic, Cip and Embed. =**	**8.9**	**0.55**
Old Calcite Index (CI) =		**0.19**									
New Calcite Index (CI) =		**0.05**									

APPENDIX J

LABORATORY REPORTS

WATER CHEMISTRY

ALS Laboratory Report CG2205677
(Finalized 23-May-22)

CERTIFICATE OF ANALYSIS

Work Order	: **CG2205677**	Page	: 1 of 7
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Mike Pope	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 12-May-2022 09:20
PO	: VPO00816101	Date Analysis Commenced	: 13-May-2022
C-O-C number	: LCO_Dry Creek LAEMP_ALS	Issue Date	: 23-May-2022 11:00
Sampler	: ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
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General Comments

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

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

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

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

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

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

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

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_FRUS_WS_LAEMP_DRY_2022-05_N	LC_GRCK_WS_LAEMP_DRY_2022-05_N	----	----	----
				Client sampling date / time	11-May-2022 10:30	11-May-2022 12:45	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2205677-001	CG2205677-002	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	188	159	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	229	194	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	7.0	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	4.2	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	188	166	----	----	----
conductivity	----	E100	2.0	µS/cm	796	365	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	430	193	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	510	518	----	----	----
pH	----	E108	0.10	pH units	8.24	8.37	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	535	257	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	9.0	3.7	----	----	----
turbidity	----	E121	0.10	NTU	2.53	1.06	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	3.19	0.19	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.122	0.098	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	1.36 DLM	<0.050 DLM	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	13.6	0.0453	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0040	<0.0010	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	0.0019	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0076	0.0055	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	207	42.6	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.31	1.23	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.45	1.09	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	LC_FRUS_WS_LAEMP_DRY_2022-05_N	LC_GRCK_WS_LAEMP_DRY_2022-05_N	----	----	----
				Client sampling date / time	11-May-2022 10:30	11-May-2022 12:45	----	----	----
					CG2205677-001	CG2205677-002	--------	--------	--------
					Result	Result	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	9.13	4.22	----	----	----
cation sum	----	EC101	0.10	meq/L	8.76	4.01	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	95.9	95.0	----	----	----
ion balance (APHA)	----	EC101	0.010	%	2.07	2.55	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0485	0.0110	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00017	<0.00010	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00019	0.00016	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0823	0.0601	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	0.016	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0561	0.0082	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	103	47.4	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00034	0.00033	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	0.11	<0.10	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00097	<0.00050	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.072	0.024	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000352	<0.000050	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0314	0.0070	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	44.5	17.6	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0133	0.00307	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00138	0.00136	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00268	<0.00050	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.49	0.699	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	51.5	1.66	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	1.97	2.72	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	0.00146	<0.000010	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.93	2.92	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	LC_FRUS_WS_LAEMP_DRY_2022-05_N	LC_GRCK_WS_LAEMP_DRY_2022-05_N	----	----	----
				Client sampling date / time	11-May-2022 10:30	11-May-2022 12:45	----	----	----
					CG2205677-001	CG2205677-002	--------	--------	--------
					Result	Result	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.147	0.180	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	72.2	14.5	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00140	<0.00030	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00258	0.000948	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00062	<0.00050	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0055	<0.0030	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00013	<0.00010	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0828	0.0596	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	0.015	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0372	<0.0050	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	97.8	47.1	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00012	0.00016	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	<0.10	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00026	<0.00020	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	0.010	<0.010	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0291	0.0065	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	45.2	18.4	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00312	0.00044	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00137	0.00137	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00236	<0.00050	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.38	0.658	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_FRUS_WS_LAEMP_DRY_2022-05_N	LC_GRCK_WS_LAEMP_DRY_2022-05_N	----	----	----
				Client sampling date / time	11-May-2022 10:30	11-May-2022 12:45	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2205677-001	CG2205677-002	--------	--------	--------
					Result	Result	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	60.8	2.23	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.84	2.64	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.81	2.92	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.142	0.175	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	75.8	16.2	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00249	0.000962	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0015	<0.0010	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	----	----	----

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

ALS Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2205677**	Page	: 1 of 16
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Mike Pope	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 12-May-2022 09:20
PO	: VPO00816101	Issue Date	: 23-May-2022 11:00
C-O-C number	: LCO_Dry Creek LAEMP_ALS		
Sampler	: ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

Key

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

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E298	11-May-2022	14-May-2022	----	----		14-May-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E298	11-May-2022	14-May-2022	----	----		14-May-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E235.Br-L	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E235.Br-L	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E235.Cl-L	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E235.Cl-L	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E378-U	11-May-2022	----	----	----		13-May-2022	3 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E378-U	11-May-2022	----	----	----		13-May-2022	3 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E235.F	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E235.F	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E235.NO3-L	11-May-2022	----	----	----		13-May-2022	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E235.NO3-L	11-May-2022	----	----	----		13-May-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E235.NO2-L	11-May-2022	----	----	----		13-May-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E235.NO2-L	11-May-2022	----	----	----		13-May-2022	3 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E235.SO4	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E235.SO4	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E318	11-May-2022	17-May-2022	----	----		17-May-2022	28 days	6 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E318	11-May-2022	17-May-2022	----	----		17-May-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E372-U	11-May-2022	17-May-2022	----	----		17-May-2022	28 days	6 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E372-U	11-May-2022	17-May-2022	----	----		17-May-2022	28 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E421.Cr-L	11-May-2022	17-May-2022	----	----		18-May-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E421.Cr-L	11-May-2022	17-May-2022	----	----		18-May-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E509	11-May-2022	16-May-2022	----	----		16-May-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E509	11-May-2022	16-May-2022	----	----		16-May-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E421	11-May-2022	17-May-2022	----	----		18-May-2022	180 days	6 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E421	11-May-2022	17-May-2022	----	----		18-May-2022	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E358-L	11-May-2022	18-May-2022	----	----		19-May-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E358-L	11-May-2022	18-May-2022	----	----		19-May-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E355-L	11-May-2022	18-May-2022	----	----		19-May-2022	28 days	8 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E355-L	11-May-2022	18-May-2022	----	----		19-May-2022	28 days	8 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E283	11-May-2022	----	----	----		13-May-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E283	11-May-2022	----	----	----		13-May-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E290	11-May-2022	----	----	----		13-May-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E290	11-May-2022	----	----	----		13-May-2022	14 days	2 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E100	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E100	11-May-2022	----	----	----		13-May-2022	28 days	2 days	✓
Physical Tests : ORP by Electrode										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E125	11-May-2022	----	----	----		18-May-2022	0.25 hrs	169 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E125	11-May-2022	----	----	----		18-May-2022	0.25 hrs	171 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E108	11-May-2022	----	----	----		13-May-2022	0.25 hrs	49 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E108	11-May-2022	----	----	----		13-May-2022	0.25 hrs	51 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E162	11-May-2022	----	----	----		17-May-2022	7 days	6 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E162	11-May-2022	----	----	----		17-May-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E160-L	11-May-2022	----	----	----		17-May-2022	7 days	6 days	✓

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E160-L	11-May-2022	----	----	----		17-May-2022	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-05_N	E121	11-May-2022	----	----	----		14-May-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-05_N	E121	11-May-2022	----	----	----		14-May-2022	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E420.Cr-L	11-May-2022	----	----	----		19-May-2022	180 days	8 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E420.Cr-L	11-May-2022	----	----	----		19-May-2022	180 days	9 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E508	11-May-2022	----	----	----		17-May-2022	28 days	6 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E508	11-May-2022	----	----	----		17-May-2022	28 days	6 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-05_N	E420	11-May-2022	----	----	----		19-May-2022	180 days	8 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-05_N	E420	11-May-2022	----	----	----		19-May-2022	180 days	9 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	487130	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	487140	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	488266	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	487065	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	487066	1	20	5.0	5.0	✓
Conductivity in Water	E100	487138	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	490470	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	489577	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	490471	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	492103	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	486949	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	487069	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	487067	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	487068	1	20	5.0	5.0	✓
ORP by Electrode	E125	492076	1	20	5.0	5.0	✓
pH by Meter	E108	487139	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	487064	1	20	5.0	5.0	✓
TDS by Gravimetry	E162	489470	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	489088	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	489194	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	490000	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	489089	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	492104	1	8	12.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	488387	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	487508	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	487130	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	487140	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	488266	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	487065	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	487066	1	20	5.0	5.0	✓
Conductivity in Water	E100	487138	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	490470	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	489577	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	490471	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	492103	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	486949	1	20	5.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	487069	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	487067	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	487068	1	20	5.0	5.0	✓
ORP by Electrode	E125	492076	1	20	5.0	5.0	✓
pH by Meter	E108	487139	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	487064	1	20	5.0	5.0	✓
TDS by Gravimetry	E162	489470	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	489088	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	489194	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	490000	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	489089	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	492104	1	8	12.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	488387	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	489463	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	487508	1	20	5.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	487130	1	20	5.0	5.0	✓
Alkalinity Species by Titration	E290	487140	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	488266	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	487065	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	487066	1	20	5.0	5.0	✓
Conductivity in Water	E100	487138	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	490470	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	489577	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	490471	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	492103	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	486949	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	487069	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	487067	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	487068	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	487064	1	20	5.0	5.0	✓
TDS by Gravimetry	E162	489470	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	489088	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	489194	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	490000	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	489089	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	492104	1	8	12.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	488387	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	489463	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	487508	1	20	5.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	488266	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	487065	1	20	5.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	487066	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	490470	1	10	10.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	489577	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	490471	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	492103	1	8	12.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	486949	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	487069	1	20	5.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	487067	1	20	5.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	487068	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	487064	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	489088	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	489194	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	490000	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	489089	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	492104	1	8	12.5	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	488387	1	20	5.0	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	J. Environ. Monit., 2005, 7, 37-42 (mod)	Ammonia in water is analyzed by flow-injection analysis with fluorescence detection after reaction with orthophthaldialdehyde (OPA).
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Total Kjeldahl Nitrogen is determined using block digestion followed by flow-injection analysis with fluorescence detection.
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Vancouver - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Vancouver - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Vancouver - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested using block digestion with Copper Sulfate Digestion Reagent.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
	Vancouver - Environmental			

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2205677**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Mike Pope	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 12-May-2022 09:20
PO	: VPO00816101	Date Analysis Commenced	: 13-May-2022
C-O-C number	: LCO_Dry Creek LAEMP_ALS	Issue Date	: 23-May-2022 11:00
Sampler	: ----		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
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Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Shirley Li		Calgary Inorganics, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Physical Tests (QC Lot: 487130)											
CG2205638-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	5.0	7.0	2.0	Diff <2x LOR	----
Physical Tests (QC Lot: 487138)											
CG2205638-001	Anonymous	conductivity	----	E100	2.0	µS/cm	502	495	1.40%	10%	----
Physical Tests (QC Lot: 487139)											
CG2205638-001	Anonymous	pH	----	E108	0.10	pH units	7.97	8.01	0.501%	4%	----
Physical Tests (QC Lot: 487140)											
CG2205638-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	2.0	mg/L	267	258	3.69%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	267	258	3.69%	20%	----
Physical Tests (QC Lot: 487508)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	turbidity	----	E121	0.10	NTU	2.53	2.58	1.80%	15%	----
Physical Tests (QC Lot: 489470)											
CG2205639-001	Anonymous	solids, total dissolved [TDS]	----	E162	10	mg/L	<10	<10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 492076)											
CG2205658-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	540	535	0.874%	15%	----
Anions and Nutrients (QC Lot: 486949)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 487064)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	207	208	0.731%	20%	----
Anions and Nutrients (QC Lot: 487065)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 487066)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	3.19	3.15	1.17%	20%	----
Anions and Nutrients (QC Lot: 487067)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	13.6	13.8	0.924%	20%	----
Anions and Nutrients (QC Lot: 487068)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0040	0.0041	0.0001	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 487069)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	fluoride	16984-48-8	E235.F	0.020	mg/L	0.122	0.123	0.0007	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 488266)											
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 488387)											
CG2205636-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 489194)											
CG2205658-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	2.59	2.53	0.066	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 492103)											
CG2205658-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.14	2.21	0.08	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 492104)											
CG2205658-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.68	1.63	0.04	Diff <2x LOR	----
Total Metals (QC Lot: 489088)											
CG2205658-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	0.00016	0.00004	Diff <2x LOR	----
Total Metals (QC Lot: 489089)											
CG2205658-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0035	0.0048	0.0013	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00262	0.00266	1.28%	20%	----
		barium, total	7440-39-3	E420	0.00010	mg/L	4.24	4.39	3.40%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.025	0.025	0.0002	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000100	mg/L	<0.0100 µg/L	<0.0000100	0	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	60.3	59.2	1.74%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	0.42 µg/L	0.00043	0.000008	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	2.98	2.99	0.355%	20%	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.608	0.614	0.928%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	37.0	37.1	0.469%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.0227	0.0232	2.08%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.0221	0.0216	2.62%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	25.2	26.1	3.66%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	<0.050 µg/L	<0.000050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 489089) - continued											
CG2205658-001	Anonymous	silicon, total	7440-21-3	E420	0.10	mg/L	3.04	2.96	2.47%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	35.6	35.9	0.999%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.246	0.240	2.16%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000094	0.000092	0.000002	Diff <2x LOR	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 490000)											
CG2205635-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 489577)											
CG2205633-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 490470)											
CG2205658-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 490471)											
CG2205658-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0016	0.0013	0.0003	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00020	0.00010	0.00010	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00297	0.00280	5.84%	20%	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	4.19	4.23	0.901%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.027	0.028	0.0006	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	61.0	63.3	3.72%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	0.42 µg/L	0.00043	0.00001	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	2.82	2.91	2.97%	20%	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.651	0.688	5.50%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	35.4	35.8	1.09%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.0227	0.0233	2.80%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.0224	0.0226	0.939%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 490471) - continued											
CG2205658-001	Anonymous	nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	24.7	25.6	3.73%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	<0.050 µg/L	<0.000050	0	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.76	2.78	0.671%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	34.2	35.0	2.27%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.239	0.245	2.14%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000090	0.000090	0.0000008	Diff <2x LOR	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0021	0.0021	0.00003	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 487130)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 487138)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 487140)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 487508)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 489463)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 489470)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 486949)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 487064)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 487065)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 487066)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 487067)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 487068)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 487069)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 488266)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 488387)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 489194)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 489194) - continued						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Organic / Inorganic Carbon (QCLot: 492103)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 492104)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 489088)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 489089)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 489089) - continued						
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 490000)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 489577)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 490470)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 490471)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 490471) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 487130)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	110	85.0	115	----
Physical Tests (QCLot: 487138)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	97.8	90.0	110	----
Physical Tests (QCLot: 487139)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 487140)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	105	85.0	115	----
Physical Tests (QCLot: 487508)									
turbidity	----	E121	0.1	NTU	200 NTU	104	85.0	115	----
Physical Tests (QCLot: 489463)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	106	85.0	115	----
Physical Tests (QCLot: 489470)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	97.8	85.0	115	----
Physical Tests (QCLot: 492076)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	103	95.4	104	----
Anions and Nutrients (QCLot: 486949)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	98.5	80.0	120	----
Anions and Nutrients (QCLot: 487064)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 487065)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	100	85.0	115	----
Anions and Nutrients (QCLot: 487066)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	99.1	90.0	110	----
Anions and Nutrients (QCLot: 487067)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 487068)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 487069)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	98.4	90.0	110	----
Anions and Nutrients (QCLot: 488266)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	97.4	85.0	115	----
Anions and Nutrients (QCLot: 488387)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Anions and Nutrients (QCLot: 488387) - continued									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.02 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 489194)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	105	75.0	125	----
Organic / Inorganic Carbon (QCLot: 492103)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	96.7	80.0	120	----
Organic / Inorganic Carbon (QCLot: 492104)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	99.8	80.0	120	----
Total Metals (QCLot: 489088)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	99.4	80.0	120	----
Total Metals (QCLot: 489089)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	105	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	103	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	99.2	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	99.2	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	106	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	92.0	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	101	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	100	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	99.2	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	99.8	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	99.8	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	103	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	105	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	97.1	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	98.8	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	105	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	100	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	109	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	102	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	101	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	92.6	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	106	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	103	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	91.3	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 489089) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	102	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	102	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	99.1	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	105	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	94.0	80.0	120	----
Total Metals (QCLot: 490000)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	105	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 490470)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.3	80.0	120	----
Dissolved Metals (QCLot: 490471)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	98.3	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	107	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	102	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	98.1	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	112	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	105	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	97.2	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	96.7	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	97.0	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	112	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	105	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	110	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	98.0	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	97.2	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	105	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	97.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	89.1	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	100	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	91.8	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	98.4	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 490471) - continued									
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	97.3	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	104	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.7	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	95.9	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	101	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.2	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	102	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 486949)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0510 mg/L	0.05 mg/L	102	70.0	130	----
Anions and Nutrients (QCLot: 487064)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	sulfate (as SO4)	14808-79-8	E235.SO4	89.0 mg/L	100 mg/L	89.0	75.0	125	----
Anions and Nutrients (QCLot: 487065)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	bromide	24959-67-9	E235.Br-L	0.472 mg/L	0.5 mg/L	94.4	75.0	125	----
Anions and Nutrients (QCLot: 487066)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	chloride	16887-00-6	E235.Cl-L	91.1 mg/L	100 mg/L	91.1	75.0	125	----
Anions and Nutrients (QCLot: 487067)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	nitrate (as N)	14797-55-8	E235.NO3-L	2.29 mg/L	2.5 mg/L	91.6	75.0	125	----
Anions and Nutrients (QCLot: 487068)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.470 mg/L	0.5 mg/L	94.0	75.0	125	----
Anions and Nutrients (QCLot: 487069)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	fluoride	16984-48-8	E235.F	0.920 mg/L	1 mg/L	92.0	75.0	125	----
Anions and Nutrients (QCLot: 488266)										
CG2205677-002	LC_GRCK_WS_LAEMP_DRY_2022-05_N	ammonia, total (as N)	7664-41-7	E298	0.0986 mg/L	0.1 mg/L	98.6	75.0	125	----
Anions and Nutrients (QCLot: 488387)										
CG2205636-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0507 mg/L	0.0676 mg/L	75.1	70.0	130	----
Anions and Nutrients (QCLot: 489194)										
CG2205658-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.98 mg/L	2.5 mg/L	119	70.0	130	----
Organic / Inorganic Carbon (QCLot: 492103)										
CG2205658-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	4.82 mg/L	5 mg/L	96.4	70.0	130	----
Organic / Inorganic Carbon (QCLot: 492104)										
CG2205658-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.13 mg/L	5 mg/L	103	70.0	130	----
Total Metals (QCLot: 489088)										
CG2205658-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0398 mg/L	0.04 mg/L	99.6	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 489089)										
CG2205658-002	Anonymous	aluminum, total	7429-90-5	E420	0.205 mg/L	0.2 mg/L	103	70.0	130	----
		antimony, total	7440-36-0	E420	0.0203 mg/L	0.02 mg/L	102	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0208 mg/L	0.02 mg/L	104	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0410 mg/L	0.04 mg/L	103	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00981 mg/L	0.01 mg/L	98.1	70.0	130	----
		boron, total	7440-42-8	E420	0.097 mg/L	0.1 mg/L	97.5	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00386 mg/L	0.004 mg/L	96.6	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0194 mg/L	0.02 mg/L	96.9	70.0	130	----
		copper, total	7440-50-8	E420	0.0191 mg/L	0.02 mg/L	95.6	70.0	130	----
		iron, total	7439-89-6	E420	1.91 mg/L	2 mg/L	95.4	70.0	130	----
		lead, total	7439-92-1	E420	0.0200 mg/L	0.02 mg/L	100	70.0	130	----
		lithium, total	7439-93-2	E420	0.104 mg/L	0.1 mg/L	104	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0209 mg/L	0.02 mg/L	104	70.0	130	----
		nickel, total	7440-02-0	E420	0.0380 mg/L	0.04 mg/L	95.1	70.0	130	----
		potassium, total	7440-09-7	E420	4.30 mg/L	4 mg/L	108	70.0	130	----
		selenium, total	7782-49-2	E420	0.0384 mg/L	0.04 mg/L	95.9	70.0	130	----
		silicon, total	7440-21-3	E420	9.40 mg/L	10 mg/L	94.0	70.0	130	----
		silver, total	7440-22-4	E420	0.00415 mg/L	0.004 mg/L	104	70.0	130	----
		sodium, total	7440-23-5	E420	2.11 mg/L	2 mg/L	105	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	19.5 mg/L	20 mg/L	97.5	70.0	130	----
		thallium, total	7440-28-0	E420	0.00386 mg/L	0.004 mg/L	96.5	70.0	130	----
		tin, total	7440-31-5	E420	0.0198 mg/L	0.02 mg/L	98.8	70.0	130	----
		titanium, total	7440-32-6	E420	0.0398 mg/L	0.04 mg/L	99.4	70.0	130	----
		uranium, total	7440-61-1	E420	0.00406 mg/L	0.004 mg/L	101	70.0	130	----
		vanadium, total	7440-62-2	E420	0.100 mg/L	0.1 mg/L	100	70.0	130	----
		zinc, total	7440-66-6	E420	0.373 mg/L	0.4 mg/L	93.3	70.0	130	----
Total Metals (QCLot: 490000)										
CG2205635-002	Anonymous	mercury, total	7439-97-6	E508	0.000102 mg/L	0.0001 mg/L	102	70.0	130	----
Dissolved Metals (QCLot: 489577)										
CG2205677-001	LC_FRUS_WS_LAEMP_DRY_2022-05_N	mercury, dissolved	7439-97-6	E509	0.0000972 mg/L	0.0001 mg/L	97.2	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 490470)										
CG2205658-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0398 mg/L	0.04 mg/L	99.6	70.0	130	----
Dissolved Metals (QCLot: 490471)										
CG2205658-002	Anonymous	aluminum, dissolved	7429-90-5	E421	0.199 mg/L	0.2 mg/L	99.5	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0199 mg/L	0.02 mg/L	99.6	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0398 mg/L	0.04 mg/L	99.4	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00899 mg/L	0.01 mg/L	89.9	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.097 mg/L	0.1 mg/L	97.5	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00403 mg/L	0.004 mg/L	101	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0192 mg/L	0.02 mg/L	96.0	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0189 mg/L	0.02 mg/L	94.4	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.80 mg/L	2 mg/L	90.0	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0190 mg/L	0.02 mg/L	95.1	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0954 mg/L	0.1 mg/L	95.4	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0203 mg/L	0.02 mg/L	101	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0382 mg/L	0.04 mg/L	95.5	70.0	130	----
		potassium, dissolved	7440-09-7	E421	4.00 mg/L	4 mg/L	100.0	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0437 mg/L	0.04 mg/L	109	70.0	130	----
		silicon, dissolved	7440-21-3	E421	8.95 mg/L	10 mg/L	89.5	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00402 mg/L	0.004 mg/L	100	70.0	130	----
		sodium, dissolved	7440-23-5	E421	1.98 mg/L	2 mg/L	99.2	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	20.9 mg/L	20 mg/L	105	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00373 mg/L	0.004 mg/L	93.2	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0190 mg/L	0.02 mg/L	95.3	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0382 mg/L	0.04 mg/L	95.5	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00381 mg/L	0.004 mg/L	95.2	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.102 mg/L	0.1 mg/L	102	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.392 mg/L	0.4 mg/L	98.1	70.0	130	----

Teck

COC ID: LCO_Dry Creek LAEMP_ALS | TURNAROUND TIME: Regular | RUSH: N/A

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	ALS Calgary			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Mike Pope			Lab Contact	Lyudmyla Shvets			Email 1:	AquaSciLab@Teck.com	X	X	X
Email	[illegible]			Email	Lyudmyla.Shvets@ALSGlobal.com			Email 2:	teckcoal@equisonline.com			X
Address	RR1 HWY 3			Address	2559 29 Street NE			Email 3:	Teck.Lab.Results@teck.com	X	X	X
								Email 4:	[illegible]	X	X	X
City	Sparwood	Province	BC	City	Calgary	Province	AB	Email 5:	[illegible]	X	X	X
Postal Code	V0B 2G1	Country	Canada	Postal Code	T1Y 7B5	Country	Canada	PO number	VPO00816101			
Phone Number	250-425-8137			Phone Number	403 407 1794							

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-D-CVAF-VA	HG-T-U-CVAF-VA	TECKCOAL-MET-D-VA	TECKCOAL-METNHG-T-CL	TECKCOAL-ROUTINE-VA		
FILT.								F	N	F	N	F	N	N	N	N
PRESERV.								H2SO4	H2SO4	HCL	NONE	HNO3	HNO3	NONE	NONE	NONE
LC_FRUS_WS_LAEMP_DRY_2022-05_N	LC_FRUS	WS	n	11-May-22	10:30	G	7	1	1	1	1	1	1	1		
LC_GRCK_WS_LAEMP_DRY_2022-05_N	LC_GRCK	WS	n	11-May-22	12:45	G	7	1	1	1	1	1	1	1		

Environmental Division
Calgary
Work Order Reference
CG2205677

Telephone : +1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Robin Valleau	May 11, 2021		5/11/22 12:11

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Priority (2-3 business days) - 50% surcharge		Sampler's Signature		Date/Time	May 11, 2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

WATER CHEMISTRY

ALS Laboratory Report CG2208042
(Finalized 07-July-22)

CERTIFICATE OF ANALYSIS

Work Order	: **CG2208042**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 23-Jun-2022 09:30
PO	: VPO00816101	Date Analysis Commenced	: 23-Jun-2022
C-O-C number	: LCO_Dry Creek LAEMP_ALS	Issue Date	: 07-Jul-2022 17:09
Sampler	: ROBIN VALLEAU		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Metals, Burnaby, British Columbia
Ann Joby	Lab Assistant	Metals, Burnaby, British Columbia
Anthony Calero	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Benjamin Oke	Lab Assistant	Metals, Burnaby, British Columbia
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Metals, Burnaby, British Columbia
Owen Cheng		Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shirley Li		Inorganics, Calgary, Alberta
Woochan Song	Lab Analyst	Metals, Burnaby, British Columbia

General Comments

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

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

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

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

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

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

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

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

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

Sample Comments

Sample	*Client Id*	*Comment*
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	004 - hg vial submitted

Qualifiers

Qualifier	*Description*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*
RRV	*Reported result verified by repeat analysis.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**
(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	LC_FRUS_WS_LAEMP_DRY_2022-06_N	LC_CC1_WS_LAEMP_DRY_2022-06_N	LC_MT1_WS_LAEMP_DRY_2022-06_N	LC_RD1_WS_LAEMP_DRY_2022-06_N	----
Client sampling date / time					21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	----
					CG2208042-001	CG2208042-002	CG2208042-003	CG2208042-004	--------
					Result	Result	Result	Result	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	<2.0	<2.0	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	153	<1.0	151	<1.0	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	187	<1.0	184	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	2.0	<1.0	4.4	<1.0	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	1.2	<1.0	2.6	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	<1.0	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	155	<1.0	155	<1.0	----
conductivity	----	E100	2.0	µS/cm	487	<2.0	483	<2.0	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	256	<0.50	251	<0.50	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	315	306	499	502	----
pH	----	E108	0.10	pH units	8.18	5.41	8.23	5.17	----
solids, total dissolved [TDS]	----	E162	10	mg/L	323	<10	320	<10	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	29.0	<1.0	27.9	<1.0	----
turbidity	----	E121	0.10	NTU	5.26	<0.10	8.25	<0.10	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	<0.0050	0.0074 RRV	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	<0.050	<0.050	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	1.27	<0.10	1.13	<0.10	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.136	<0.020	0.136	<0.020	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.638	<0.050	0.394 TKNI	<0.050	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	6.21	<0.0050 HTD	6.20	<0.0050	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0035	<0.0010	0.0042	<0.0010	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0.0011	<0.0010	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0218	<0.0020	0.0219	<0.0020	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	77.0	<0.30	76.8	<0.30	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	2.02	<0.50	2.02	<0.50	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.94	<0.50	1.98	<0.50	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_FRUS_WS_LAEMP_DRY_2022-06_N	LC_CC1_WS_LAEMP_DRY_2022-06_N	LC_MT1_WS_LAEMP_DRY_2022-06_N	LC_RD1_WS_LAEMP_DRY_2022-06_N	----
				Client sampling date / time	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2208042-001	CG2208042-002	CG2208042-003	CG2208042-004	--------
					Result	Result	Result	Result	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	5.19	<0.10	5.18	<0.10	----
cation sum	----	EC101	0.10	meq/L	5.22	<0.10	5.11	<0.10	----
ion balance (cations/anions)	----	EC101	0.010	%	100	100	98.6	100 RRV	----
ion balance (APHA)	----	EC101	0.010	%	0.288	<0.010	0.680	<0.010	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.136	<0.0030	0.168	<0.0030	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00014	<0.00010	0.00014	<0.00010	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00021	<0.00010	0.00021	<0.00010	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0549	<0.00010	0.0545	<0.00010	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	<0.020	<0.020	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0535	<0.0050	0.0588	<0.0050	----
calcium, total	7440-70-2	E420	0.050	mg/L	61.2	<0.050	60.6	<0.050	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00040	<0.00010	0.00034	<0.00010	----
cobalt, total	7440-48-4	E420	0.10	µg/L	0.12	<0.10	0.13	<0.10	----
copper, total	7440-50-8	E420	0.00050	mg/L	0.00050	<0.00050	0.00050	<0.00050	----
iron, total	7439-89-6	E420	0.010	mg/L	0.185	<0.010	0.202	<0.010	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000155	<0.000050	0.000160	<0.000050	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0166	<0.0010	0.0165	<0.0010	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	24.1	<0.0050	24.5	<0.0050	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.0106	<0.00010	0.0110	<0.00010	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00133	<0.000050	0.000988	<0.000050	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00185	<0.00050	0.00191	<0.00050	----
potassium, total	7440-09-7	E420	0.050	mg/L	0.958	<0.050	0.971	<0.050	----
selenium, total	7782-49-2	E420	0.050	µg/L	25.5	<0.050	25.6	<0.050	----
silicon, total	7440-21-3	E420	0.10	mg/L	2.21	<0.10	2.29	<0.10	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, total	7440-23-5	E420	0.050	mg/L	1.60	<0.050	1.60	<0.050	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	LC_FRUS_WS_LAEMP_DRY_2022-06_N	LC_CC1_WS_LAEMP_DRY_2022-06_N	LC_MT1_WS_LAEMP_DRY_2022-06_N	LC_RD1_WS_LAEMP_DRY_2022-06_N	----
				Client sampling date / time	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	----
					CG2208042-001	CG2208042-002	CG2208042-003	CG2208042-004	--------
					Result	Result	Result	Result	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.0880	<0.00020	0.0878	<0.00020	----
sulfur, total	7704-34-9	E420	0.50	mg/L	27.5	<0.50	27.6	<0.50	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00202	<0.00030	0.00399	<0.00030	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00148	<0.000010	0.00146	<0.000010	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00075	<0.00050	0.00088	<0.00050	----
zinc, total	7440-66-6	E420	0.0030	mg/L	0.0039	<0.0030	0.0032	<0.0030	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0021	<0.0010	0.0024	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00012	<0.00010	0.00012	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00011	<0.00010	0.00011	<0.00010	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0499	<0.00010	0.0503	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.020	μg/L	<0.020	<0.020	<0.020	<0.020	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.0050	μg/L	0.0216	<0.0050	0.0240	<0.0050	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	62.5	<0.050	61.0	<0.050	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00011	<0.00010	<0.00010	<0.00010	----
cobalt, dissolved	7440-48-4	E421	0.10	μg/L	<0.10	<0.10	<0.10	<0.10	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	<0.00020	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0164	<0.0010	0.0168	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	24.4	<0.0050	24.0	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00169	<0.00010	0.00164	<0.00010	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00110	<0.000050	0.00112	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00135	<0.00050	0.00137	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.954	<0.050	0.960	<0.050	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_FRUS_WS_LAEMP_DRY_2022-06_N	LC_CC1_WS_LAEMP_DRY_2022-06_N	LC_MT1_WS_LAEMP_DRY_2022-06_N	LC_RD1_WS_LAEMP_DRY_2022-06_N	----
				Client sampling date / time	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	21-Jun-2022 14:15	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2208042-001	CG2208042-002	CG2208042-003	CG2208042-004	--------
					Result	Result	Result	Result	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	24.2	<0.050	24.3	<0.050	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	1.96	<0.050	2.10	<0.050	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.53	<0.050	1.54	<0.050	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0932	<0.00020	0.0937	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	26.8	<0.50	28.3	<0.50	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00150	<0.000010	0.00151	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0012	<0.0010	0.0013	<0.0010	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	Field	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	Field	----

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

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2208042**	Page	: 1 of 21
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 23-Jun-2022 09:30
PO	: VPO00816101	Issue Date	: 07-Jul-2022 17:10
C-O-C number	: LCO_Dry Creek LAEMP_ALS		
Sampler	: ROBIN VALLEAU		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E298	21-Jun-2022	26-Jun-2022	----	----		26-Jun-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E298	21-Jun-2022	26-Jun-2022	----	----		26-Jun-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E298	21-Jun-2022	26-Jun-2022	----	----		26-Jun-2022	28 days	5 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E298	21-Jun-2022	26-Jun-2022	----	----		26-Jun-2022	28 days	5 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E235.Br-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E235.Br-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E235.Br-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E235.Br-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E235.Cl-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E235.Cl-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E235.Cl-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E235.Cl-L	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E378-U	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E378-U	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E378-U	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E378-U	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E235.F	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E235.F	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E235.F	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E235.F	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E235.NO3-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E235.NO3-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E235.NO3-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E235.NO3-L	21-Jun-2022	----	----	----		26-Jun-2022	3 days	5 days	× EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E235.NO2-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E235.NO2-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E235.NO2-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E235.NO2-L	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E235.SO4	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E235.SO4	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E235.SO4	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E235.SO4	21-Jun-2022	----	----	----		23-Jun-2022	28 days	2 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E318	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E318	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E318	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E318	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E372-U	21-Jun-2022	28-Jun-2022	----	----		28-Jun-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E372-U	21-Jun-2022	28-Jun-2022	----	----		28-Jun-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E372-U	21-Jun-2022	28-Jun-2022	----	----		28-Jun-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E372-U	21-Jun-2022	28-Jun-2022	----	----		28-Jun-2022	28 days	7 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E421.Cr-L	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E421.Cr-L	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E421.Cr-L	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E421.Cr-L	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E509	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E509	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E509	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E509	21-Jun-2022	30-Jun-2022	----	----		30-Jun-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E421	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E421	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E421	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E421	21-Jun-2022	27-Jun-2022	----	----		28-Jun-2022	180 days	7 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E358-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E358-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E358-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E358-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E355-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E355-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E355-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E355-L	21-Jun-2022	29-Jun-2022	----	----		06-Jul-2022	28 days	15 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E283	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Acidity by Titration										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E283	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E283	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E283	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E290	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E290	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E290	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E290	21-Jun-2022	----	----	----		28-Jun-2022	14 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E100	21-Jun-2022	----	----	----		28-Jun-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E100	21-Jun-2022	----	----	----		28-Jun-2022	28 days	7 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Conductivity in Water										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E100	21-Jun-2022	----	----	----		28-Jun-2022	28 days	7 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E100	21-Jun-2022	----	----	----		28-Jun-2022	28 days	7 days	✓
Physical Tests : ORP by Electrode										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E125	21-Jun-2022	----	----	----		04-Jul-2022	0.25 hrs	313 hrs	✗ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E125	21-Jun-2022	----	----	----		04-Jul-2022	0.25 hrs	313 hrs	✗ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E125	21-Jun-2022	----	----	----		04-Jul-2022	0.25 hrs	313 hrs	✗ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E125	21-Jun-2022	----	----	----		04-Jul-2022	0.25 hrs	313 hrs	✗ EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E108	21-Jun-2022	----	----	----		28-Jun-2022	0.25 hrs	165 hrs	✗ EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E108	21-Jun-2022	----	----	----		28-Jun-2022	0.25 hrs	165 hrs	✗ EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E108	21-Jun-2022	----	----	----		28-Jun-2022	0.25 hrs	165 hrs	✗ EHTR-FM

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : pH by Meter										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E108	21-Jun-2022	----	----	----		28-Jun-2022	0.25 hrs	165 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E162	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E162	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E162	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E162	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E160-L	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E160-L	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E160-L	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E160-L	21-Jun-2022	----	----	----		28-Jun-2022	7 days	7 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : Turbidity by Nephelometry										
HDPE LC_CC1_WS_LAEMP_DRY_2022-06_N	E121	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-06_N	E121	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_MT1_WS_LAEMP_DRY_2022-06_N	E121	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_RD1_WS_LAEMP_DRY_2022-06_N	E121	21-Jun-2022	----	----	----		23-Jun-2022	3 days	2 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E420.Cr-L	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_FRUS_WS_LAEMP_DRY_2022-06_N	E420.Cr-L	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-06_N	E420.Cr-L	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_RD1_WS_LAEMP_DRY_2022-06_N	E420.Cr-L	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_CC1_WS_LAEMP_DRY_2022-06_N	E508	21-Jun-2022	----	----	----		30-Jun-2022	28 days	9 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid)										
LC_FRUS_WS_LAEMP_DRY_2022-06_N	E508	21-Jun-2022	----	----	----		30-Jun-2022	28 days	9 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid)										
LC_MT1_WS_LAEMP_DRY_2022-06_N	E508	21-Jun-2022	----	----	----		30-Jun-2022	28 days	9 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid)										
LC_RD1_WS_LAEMP_DRY_2022-06_N	E508	21-Jun-2022	----	----	----		30-Jun-2022	28 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
LC_CC1_WS_LAEMP_DRY_2022-06_N	E420	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
LC_FRUS_WS_LAEMP_DRY_2022-06_N	E420	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
LC_MT1_WS_LAEMP_DRY_2022-06_N	E420	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
LC_RD1_WS_LAEMP_DRY_2022-06_N	E420	21-Jun-2022	----	----	----		28-Jun-2022	180 days	7 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	541834	1	19	5.2	5.0	✓
Alkalinity Species by Titration	E290	541448	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	539290	2	40	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	536408	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	536409	1	9	11.1	5.0	✓
Conductivity in Water	E100	541447	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	539105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	544103	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	539104	2	20	10.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	543248	1	18	5.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	536138	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	536407	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	536410	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	536411	1	9	11.1	5.0	✓
ORP by Electrode	E125	546132	1	20	5.0	5.0	✓
pH by Meter	E108	541446	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	536412	1	9	11.1	5.0	✓
TDS by Gravimetry	E162	540104	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	539402	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	543342	2	32	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	544092	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	539401	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	543249	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	536291	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	536333	1	15	6.6	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	541834	1	19	5.2	5.0	✓
Alkalinity Species by Titration	E290	541448	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	539290	2	40	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	536408	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	536409	1	9	11.1	5.0	✓
Conductivity in Water	E100	541447	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	539105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	544103	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	539104	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	543248	1	18	5.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	536138	1	8	12.5	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	536407	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	536410	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	536411	1	9	11.1	5.0	✓
ORP by Electrode	E125	546132	1	20	5.0	5.0	✓
pH by Meter	E108	541446	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	536412	1	9	11.1	5.0	✓
TDS by Gravimetry	E162	540104	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	539402	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	543342	2	32	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	544092	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	539401	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	543249	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	536291	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	540097	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	536333	1	15	6.6	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	541834	1	19	5.2	5.0	✓
Alkalinity Species by Titration	E290	541448	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	539290	2	40	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	536408	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	536409	1	9	11.1	5.0	✓
Conductivity in Water	E100	541447	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	539105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	544103	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	539104	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	543248	1	18	5.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	536138	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	536407	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	536410	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	536411	1	9	11.1	5.0	✓
Sulfate in Water by IC	E235.SO4	536412	1	9	11.1	5.0	✓
TDS by Gravimetry	E162	540104	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	539402	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	543342	2	32	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	544092	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	539401	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	543249	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	536291	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	540097	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	536333	1	15	6.6	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	539290	2	40	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	536408	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	536409	1	9	11.1	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	539105	1	20	5.0	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	544103	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	539104	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	543248	1	18	5.5	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	536138	1	8	12.5	5.0	✓
Fluoride in Water by IC	E235.F	536407	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	536410	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	536411	1	9	11.1	5.0	✓
Sulfate in Water by IC	E235.SO4	536412	1	9	11.1	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	539402	1	19	5.2	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	543342	2	32	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	544092	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	539401	1	19	5.2	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	543249	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	536291	1	20	5.0	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Vancouver - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Vancouver - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Vancouver - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Vancouver - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Vancouver - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Vancouver - Environmental	Water	APHA 2340B	"Hardness (as $CaCO_3$), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in $CaCO_3$ equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO_3.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Mercury Water Filtration	EP509 Vancouver - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2208042**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 23-Jun-2022 09:30
PO	: VPO00816101	Date Analysis Commenced	: 23-Jun-2022
C-O-C number	: LCO_Dry Creek LAEMP_ALS	Issue Date	: 07-Jul-2022 17:10
Sampler	: ROBIN VALLEAU		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 4		
No. of samples analysed	: 4		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Angela Ren	Team Leader - Metals	Vancouver Metals, Burnaby, British Columbia
Ann Joby	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Anthony Calero	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Benjamin Oke	Lab Assistant	Vancouver Metals, Burnaby, British Columbia
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Kevin Duarte	Supervisor - Metals ICP Instrumentation	Vancouver Metals, Burnaby, British Columbia
Owen Cheng		Vancouver Metals, Burnaby, British Columbia
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Shirley Li		Calgary Inorganics, Calgary, Alberta
Woochan Song	Lab Analyst	Vancouver Metals, Burnaby, British Columbia

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Physical Tests (QC Lot: 536333)											
CG2207929-002	Anonymous	turbidity	----	E121	0.10	NTU	<0.10	<0.10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 540104)											
CG2208014-005	Anonymous	solids, total dissolved [TDS]	----	E162	40	mg/L	2720	2620	3.64%	20%	----
Physical Tests (QC Lot: 541446)											
CG2208042-001	LC_FRUS_WS_LAEMP_DRY_2022-06_N	pH	----	E108	0.10	pH units	8.18	8.23	0.609%	4%	----
Physical Tests (QC Lot: 541447)											
CG2208042-001	LC_FRUS_WS_LAEMP_DRY_2022-06_N	conductivity	----	E100	2.0	µS/cm	487	485	0.412%	10%	----
Physical Tests (QC Lot: 541448)											
CG2208042-001	LC_FRUS_WS_LAEMP_DRY_2022-06_N	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	153	152	0.720%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	2.0	<1.0	1.0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	155	152	2.01%	20%	----
Physical Tests (QC Lot: 541834)											
CG2208041-006	Anonymous	acidity (as CaCO3)	----	E283	10.0	mg/L	28.8	19.9	8.9	Diff <2x LOR	----
Physical Tests (QC Lot: 546132)											
CG2208034-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	381	386	1.43%	15%	----
Anions and Nutrients (QC Lot: 536138)											
CG2208040-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0017	0.0017	0.00004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 536291)											
CG2208041-003	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 536407)											
CG2208023-004	Anonymous	fluoride	16984-48-8	E235.F	0.400	mg/L	<0.400	<0.400	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 536408)											
CG2208023-004	Anonymous	bromide	24959-67-9	E235.Br-L	1.00	mg/L	<1.00	<1.00	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 536409)											
CG2208023-004	Anonymous	chloride	16887-00-6	E235.Cl-L	2.00	mg/L	52.0	49.9	4.03%	20%	----
Anions and Nutrients (QC Lot: 536410)											
CG2208023-004	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.100	mg/L	36.4	35.2	3.41%	20%	----
Anions and Nutrients (QC Lot: 536411)											
CG2208023-004	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0200	mg/L	20.9	20.4	2.44%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 536412)											
CG2208023-004	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	6.00	mg/L	1130	1090	3.35%	20%	----
Anions and Nutrients (QC Lot: 539290)											
CG2207996-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.125	mg/L	2.39	2.38	0.528%	20%	----
Anions and Nutrients (QC Lot: 539291)											
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	0.0074	0.0067	0.0007	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 543342)											
CG2208014-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 543343)											
CG2208042-002	LC_CC1_WS_LAEMP_DRY_2022-06_N	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 543248)											
CG2208041-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 543249)											
CG2208041-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 539401)											
CG2208029-002	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0117	0.0095	0.0022	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00036	0.00037	0.00001	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00016	0.00016	0.0000004	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0254	0.0258	1.26%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.012	0.013	0.0004	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.504 µg/L	0.000524	3.87%	20%	----
		calcium, total	7440-70-2	E420	0.050	mg/L	73.9	76.0	2.79%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	0.26 µg/L	0.00027	0.00001	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	0.00075	0.00073	0.00002	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.013	0.013	0.0002	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0342	0.0360	5.18%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	38.7	39.4	1.71%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00222	0.00200	10.4%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00184	0.00188	1.70%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00993	0.00985	0.768%	20%	----
		potassium, total	7440-09-7	E420	0.050	mg/L	1.37	1.38	0.568%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	40.6 µg/L	0.0409	0.661%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 539401) - continued											
CG2208029-002	Anonymous	silicon, total	7440-21-3	E420	0.10	mg/L	1.84	1.82	0.832%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	4.78	4.69	1.82%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.139	0.138	0.681%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	57.9	56.8	1.83%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	0.000017	0.000017	0.0000001	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00284	0.00287	1.08%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	0.0228	0.0227	0.0001	Diff <2x LOR	----
Total Metals (QC Lot: 539402)											
CG2208029-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	0.00010	0.00002	Diff <2x LOR	----
Total Metals (QC Lot: 544092)											
CG2208029-002	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 539104)											
CG2208029-004	Anonymous	nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00154	0.00157	0.00003	Diff <2x LOR	----
CG2208029-004	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0024	0.0017	0.0006	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00014	0.00014	0.000002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00013	0.00011	0.00002	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0502	0.0513	2.20%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0201 µg/L	0.0000216	0.0000014	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	58.8	60.2	2.42%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0161	0.0164	1.84%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	23.0	23.7	3.03%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00084	0.00092	0.00008	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00115	0.00114	0.749%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.938	0.975	3.89%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Dissolved Metals (QC Lot: 539104) - continued											
CG2208029-004	Anonymous	selenium, dissolved	7782-49-2	E421	0.000050	mg/L	21.5 µg/L	0.0211	1.86%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.10	2.07	1.56%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	1.89	1.95	3.00%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.102	0.104	1.78%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	28.8	28.3	1.72%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00150	0.00155	3.20%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0018	0.0018	0.00004	Diff <2x LOR	----
Dissolved Metals (QC Lot: 539105)											
CG2208029-004	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 544103)											
CG2208029-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 536333)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 540097)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 540104)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 541447)						
conductivity	----	E100	1	µS/cm	1.7	----
Physical Tests (QCLot: 541448)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 541834)						
acidity (as CaCO3)	----	E283	2	mg/L	2.2	----
Anions and Nutrients (QCLot: 536138)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 536291)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 536407)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 536408)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 536409)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 536410)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 536411)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 536412)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 539290)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 539291)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 539291) - continued						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 543342)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 543343)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Organic / Inorganic Carbon (QCLot: 543248)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 543249)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 539401)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 539401) - continued						
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 539402)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 544092)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 539104)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 539104) - continued						
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 539105)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 544103)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	*Recovery (%)*	*Recovery Limits (%)*		
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	*Concentration*	*LCS*	*Low*	*High*	*Qualifier*
Physical Tests (QCLot: 536333)									
turbidity	----	E121	0.1	NTU	200 NTU	102	85.0	115	----
Physical Tests (QCLot: 540097)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	92.9	85.0	115	----
Physical Tests (QCLot: 540104)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	101	85.0	115	----
Physical Tests (QCLot: 541446)									
pH	----	E108	----	pH units	7 pH units	99.0	98.6	101	----
Physical Tests (QCLot: 541447)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	105	90.0	110	----
Physical Tests (QCLot: 541448)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	103	85.0	115	----
Physical Tests (QCLot: 541834)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	104	85.0	115	----
Physical Tests (QCLot: 546132)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	97.0	95.4	104	----
Anions and Nutrients (QCLot: 536138)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.02 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 536291)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	8.02 mg/L	114	80.0	120	----
Anions and Nutrients (QCLot: 536407)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	96.3	90.0	110	----
Anions and Nutrients (QCLot: 536408)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	91.2	85.0	115	----
Anions and Nutrients (QCLot: 536409)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	97.7	90.0	110	----
Anions and Nutrients (QCLot: 536410)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 536411)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	96.0	90.0	110	----
Anions and Nutrients (QCLot: 536412)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	99.1	90.0	110	----
Anions and Nutrients (QCLot: 539290)									

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 539290) - continued									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 539291)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	112	85.0	115	----
Anions and Nutrients (QCLot: 543342)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 543343)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	100	75.0	125	----
Organic / Inorganic Carbon (QCLot: 543248)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	104	80.0	120	----
Organic / Inorganic Carbon (QCLot: 543249)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	96.7	80.0	120	----
Total Metals (QCLot: 539401)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	102	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	105	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	99.5	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	104	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	100	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	96.4	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	99.2	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	102	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	95.9	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	97.0	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	98.8	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	98.0	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	103	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	98.6	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	95.6	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	98.5	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	101	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	106	80.0	120	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	96.9	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	99.6	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 539401) - continued									
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	96.7	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	98.1	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	105	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	97.9	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	93.5	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	102	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	99.3	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	93.1	80.0	120	----
Total Metals (QCLot: 539402)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	95.9	80.0	120	----
Total Metals (QCLot: 544092)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	108	80.0	120	----
Dissolved Metals (QCLot: 539104)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	95.3	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	96.8	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	99.6	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.3	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	93.1	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	104	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	90.5	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	97.9	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	96.3	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	95.0	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	95.9	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	97.5	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	99.1	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	92.4	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	95.7	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	100.0	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	100	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	97.4	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	97.4	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	91.4	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	102	80.0	120	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	93.6	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	96.5	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 539104) - continued									
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	96.7	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	89.8	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	100	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.0	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	96.4	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	103	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	97.2	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	98.7	80.0	120	----
Dissolved Metals (QCLot: 539105)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	95.2	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	99.2	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 536138)										
CG2208040-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0495 mg/L	0.05 mg/L	99.0	70.0	130	----
Anions and Nutrients (QCLot: 536291)										
CG2208041-004	Anonymous	phosphorus, total	7723-14-0	E372-U	ND mg/L	0.0676 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 536407)										
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	fluoride	16984-48-8	E235.F	0.865 mg/L	1 mg/L	86.5	75.0	125	----
Anions and Nutrients (QCLot: 536408)										
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	bromide	24959-67-9	E235.Br-L	0.436 mg/L	0.5 mg/L	87.1	75.0	125	----
Anions and Nutrients (QCLot: 536409)										
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	chloride	16887-00-6	E235.Cl-L	90.2 mg/L	100 mg/L	90.2	75.0	125	----
Anions and Nutrients (QCLot: 536410)										
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	nitrate (as N)	14797-55-8	E235.NO3-L	2.37 mg/L	2.5 mg/L	94.8	75.0	125	----
Anions and Nutrients (QCLot: 536411)										
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.444 mg/L	0.5 mg/L	88.8	75.0	125	----
Anions and Nutrients (QCLot: 536412)										
CG2208042-004	LC_RD1_WS_LAEMP_DRY_2022-06_N	sulfate (as SO4)	14808-79-8	E235.SO4	92.3 mg/L	100 mg/L	92.3	75.0	125	----
Anions and Nutrients (QCLot: 539290)										
CG2207996-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 539291)										
CG2208046-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 543342)										
CG2208014-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	ND mg/L	2.5 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 543343)										
CG2208042-003	LC_MT1_WS_LAEMP_DRY_2022-06_N	Kjeldahl nitrogen, total [TKN]	----	E318	2.51 mg/L	2.5 mg/L	100	70.0	130	----
Organic / Inorganic Carbon (QCLot: 543248)										
CG2208041-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	4.44 mg/L	5 mg/L	88.7	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Organic / Inorganic Carbon (QCLot: 543249)										
CG2208041-001	Anonymous	carbon, total organic [TOC]	----	E355-L	4.61 mg/L	5 mg/L	92.1	70.0	130	----
Total Metals (QCLot: 539401)										
CG2208029-003	Anonymous	aluminum, total	7429-90-5	E420	0.190 mg/L	0.2 mg/L	95.0	70.0	130	----
		antimony, total	7440-36-0	E420	0.0198 mg/L	0.02 mg/L	99.2	70.0	130	----
		arsenic, total	7440-38-2	E420	0.0193 mg/L	0.02 mg/L	96.6	70.0	130	----
		barium, total	7440-39-3	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, total	7440-41-7	E420	0.0392 mg/L	0.04 mg/L	97.9	70.0	130	----
		bismuth, total	7440-69-9	E420	0.00944 mg/L	0.01 mg/L	94.4	70.0	130	----
		boron, total	7440-42-8	E420	0.098 mg/L	0.1 mg/L	98.2	70.0	130	----
		cadmium, total	7440-43-9	E420	0.00392 mg/L	0.004 mg/L	98.1	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	4 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.0185 mg/L	0.02 mg/L	92.4	70.0	130	----
		copper, total	7440-50-8	E420	0.0190 mg/L	0.02 mg/L	94.8	70.0	130	----
		iron, total	7439-89-6	E420	1.90 mg/L	2 mg/L	95.2	70.0	130	----
		lead, total	7439-92-1	E420	0.0190 mg/L	0.02 mg/L	94.8	70.0	130	----
		lithium, total	7439-93-2	E420	0.0941 mg/L	0.1 mg/L	94.1	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.0186 mg/L	0.02 mg/L	92.8	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.0207 mg/L	0.02 mg/L	104	70.0	130	----
		nickel, total	7440-02-0	E420	0.0365 mg/L	0.04 mg/L	91.3	70.0	130	----
		potassium, total	7440-09-7	E420	3.67 mg/L	4 mg/L	91.7	70.0	130	----
		selenium, total	7782-49-2	E420	0.0417 mg/L	0.04 mg/L	104	70.0	130	----
		silicon, total	7440-21-3	E420	9.21 mg/L	10 mg/L	92.1	70.0	130	----
		silver, total	7440-22-4	E420	0.00390 mg/L	0.004 mg/L	97.4	70.0	130	----
		sodium, total	7440-23-5	E420	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, total	7440-24-6	E420	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, total	7704-34-9	E420	ND mg/L	20 mg/L	ND	70.0	130	----
		thallium, total	7440-28-0	E420	0.00377 mg/L	0.004 mg/L	94.3	70.0	130	----
		tin, total	7440-31-5	E420	0.0194 mg/L	0.02 mg/L	96.8	70.0	130	----
		titanium, total	7440-32-6	E420	0.0365 mg/L	0.04 mg/L	91.2	70.0	130	----
		uranium, total	7440-61-1	E420	0.00390 mg/L	0.004 mg/L	97.4	70.0	130	----
		vanadium, total	7440-62-2	E420	0.0962 mg/L	0.1 mg/L	96.2	70.0	130	----
		zinc, total	7440-66-6	E420	0.377 mg/L	0.4 mg/L	94.3	70.0	130	----
Total Metals (QCLot: 539402)										
CG2208029-003	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.0386 mg/L	0.04 mg/L	96.4	70.0	130	----
Total Metals (QCLot: 544092)										

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 544092) - continued										
CG2208029-003	Anonymous	mercury, total	7439-97-6	E508	0.000101 mg/L	0.0001 mg/L	101	70.0	130	----
Dissolved Metals (QCLot: 539104)										
CG2208029-005	Anonymous	aluminum, dissolved	7429-90-5	E421	0.192 mg/L	0.2 mg/L	96.3	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.0198 mg/L	0.02 mg/L	99.2	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.0195 mg/L	0.02 mg/L	97.6	70.0	130	----
		barium, dissolved	7440-39-3	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.0379 mg/L	0.04 mg/L	94.7	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.00905 mg/L	0.01 mg/L	90.5	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.092 mg/L	0.1 mg/L	91.7	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.00390 mg/L	0.004 mg/L	97.4	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	4 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.0185 mg/L	0.02 mg/L	92.7	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.0186 mg/L	0.02 mg/L	92.9	70.0	130	----
		iron, dissolved	7439-89-6	E421	1.93 mg/L	2 mg/L	96.4	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.0195 mg/L	0.02 mg/L	97.4	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.0925 mg/L	0.1 mg/L	92.5	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	1 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.0194 mg/L	0.02 mg/L	97.2	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.0205 mg/L	0.02 mg/L	102	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.0377 mg/L	0.04 mg/L	94.3	70.0	130	----
		potassium, dissolved	7440-09-7	E421	3.79 mg/L	4 mg/L	94.8	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.0368 mg/L	0.04 mg/L	92.0	70.0	130	----
		silicon, dissolved	7440-21-3	E421	9.11 mg/L	10 mg/L	91.1	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.00383 mg/L	0.004 mg/L	95.7	70.0	130	----
		sodium, dissolved	7440-23-5	E421	ND mg/L	2 mg/L	ND	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.02 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	ND mg/L	20 mg/L	ND	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.00390 mg/L	0.004 mg/L	97.4	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.0197 mg/L	0.02 mg/L	98.3	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.0386 mg/L	0.04 mg/L	96.5	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.00392 mg/L	0.004 mg/L	98.0	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.0954 mg/L	0.1 mg/L	95.4	70.0	130	----
		zinc, dissolved	7440-66-6	E421	0.393 mg/L	0.4 mg/L	98.2	70.0	130	----
Dissolved Metals (QCLot: 539105)										
CG2208029-005	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.0384 mg/L	0.04 mg/L	96.0	70.0	130	----
Dissolved Metals (QCLot: 544103)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 544103) - continued										
CG2208029-003	Anonymous	mercury, dissolved	7439-97-6	E509	0.000103 mg/L	0.0001 mg/L	103	70.0	130	----

Teck

COC ID: LCO_Dry Creek LAEMP_ALS | **TURNAROUND TIME:** Regular | **RUSH:** N/A

Environmental Division
Calgary
Work Order Reference
CG2208042

Telephone : + 1 403 407 1800

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	ALS Calgary			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Nicole Zathey			Lab Contact	Lyudmyla Shvets			Email 1:	AquaSciLab@Teck.com	X	X	X
Email	Nicole.Zathey@Teck.com			Email	Lyudmyla.Shvets@ALSGlobal.com			Email 2:	teckcoal@equisonline.com			X
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								Email 4:	Nicole.Zathey@teck.com	X	X	X
City	Sparwood	Province	BC	City	Calgary	Province	AB	Email 5:	robin.valleau@minnow.ca	X	X	X
	V0B 2G1	Country	Canada	Postal Code	T1Y 7B5	Country	Canada	PO number	VPO00816101			
	25-8137			Phone Number	403 407 1794							

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	ALS_Package-DOC	ALS_Package-TKN/TOC	HG-D-CVAF-VA	HG-T-U-CVAF-VA	TECKCOAL-MET-D-VA	TECKCOAL-METNHG-T-CL	TECKCOAL-ROUTINE-VA					
Filtered								F	N	F	N	F	N	N	N	N			
Preserved								H2SO4	H2SO4	HCL	NONE	HNO3	HNO3	NONE	NONE	NONE			
LC_FRUS_WS_LAEMP_DRY_2022-06_N	LC_FRUS	WS	n	21-Jun-22	14:15	G	7	1	1	1	1	1	1	1					
LC_CC1_WS_LAEMP_DRY_2022-06_N	LC_CC1	WS	n	21-Jun-22	14:15	G	7	1	1	1	1	1	1	1					
LC_MT1_WS_LAEMP_DRY_2022-06_N	LC_MT1	WS	n	21-Jun-22	14:15	G	7	1	1	1	1	1	1	1					
LC_RD1_WS_LAEMP_DRY_2022-06_N	LC_RD1	WS	n	21-Jun-22	14:15	G	7		1		1		1	1					

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Robin Valleau	June 22/2022	MU	6/23 9:30

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	June 22/2022
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

8c

WATER CHEMISTRY

ALS Laboratory Report CG2212407
(Finalized 26-Sept-22)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212407**	Page	: 1 of 6
Amendment	: **1**		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 13-Sep-2022 09:11
PO	: VPO00817033	Date Analysis Commenced	: 13-Sep-2022
C-O-C number	: REP_LAEMP_DRY_2022-09_ALS	Issue Date	: 26-Sep-2022 08:57
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Elke Tabora		Inorganics, Calgary, Alberta
Kevin Baxter		Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Sara Niroomand		Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Inorganics, Calgary, Alberta

General Comments

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

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

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

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

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

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
HTA	*Analytical holding time was exceeded.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	**LC_FRB_WS_LAEMP_DRY_2022-09_N**	**LC_FRUS_WS_LAEMP_DRY_2022-09_N**	----	----	----
				Client sampling date / time	10-Sep-2022 14:00	10-Sep-2022 09:00	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212407-001**	**CG2212407-002**	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	202	201	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	247	246	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	7.8	4.2	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	4.7	2.5	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	210	206	----	----	----
conductivity	----	E100	2.0	µS/cm	769	742	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	410	395	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	327	328	----	----	----
pH	----	E108	0.10	pH units	8.38	8.30	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	590	569	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	<1.0	<1.0	----	----	----
turbidity	----	E121	0.10	NTU	0.17 HTA	0.23 HTA	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	2.89	2.49	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.171	0.176	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.546 TKNI	0.782 TKNI	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	12.4	11.7	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0079	0.0041	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0017	0.0021	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0026	0.0024	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	197	194	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	0.62	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	0.53	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	LC_FRB_WS_LAEMP_DRY_2022-09_N	LC_FRUS_WS_LAEMP_DRY_2022-09_N	----	----	----
				Client sampling date / time	10-Sep-2022 14:00	10-Sep-2022 09:00	----	----	----
					CG2212407-001	CG2212407-002	--------	--------	--------
					Result	Result	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	9.27	9.07	----	----	----
cation sum	----	EC101	0.10	meq/L	8.36	8.05	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	90.2	88.8	----	----	----
ion balance (APHA)	----	EC101	0.010	%	5.16	5.96	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0046	0.0062	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00011	<0.00010	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	0.00012	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.109	0.101	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.011	<0.010	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0284	0.0217	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	97.2	78.6	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	0.00013	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.10	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	<0.010	0.010	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0322	0.0250	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	45.2	45.6	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00160	0.00178	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00128	0.000998	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	0.00096	0.00087	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.30	1.24	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	50.0	45.0	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	2.17	2.21	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	0.000013	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.80	2.77	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	LC_FRB_WS_LAEMP_DRY_2022-09_N	LC_FRUS_WS_LAEMP_DRY_2022-09_N	----	----	----
				Client sampling date / time	10-Sep-2022 14:00	10-Sep-2022 09:00	----	----	----
					CG2212407-001	CG2212407-002	--------	--------	--------
					Result	Result	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.145	0.122	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	68.2	67.6	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00220	0.00185	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00011	<0.00010	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0951	0.0868	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0277	0.0208	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	94.4	91.4	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00010	<0.00010	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	<0.10	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0264	0.0260	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	42.4	40.6	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00121	0.00137	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00126	0.00110	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00086	0.00082	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.34	1.25	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: Water)

				Client sample ID	LC_FRB_WS_LAEMP_DRY_2022-09_N	LC_FRUS_WS_LAEMP_DRY_2022-09_N	----	----	----
				Client sampling date / time	10-Sep-2022 14:00	10-Sep-2022 09:00	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2212407-001	CG2212407-002	--------	--------	--------
					Result	Result	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	46.8	51.1	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.20	2.25	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.91	2.71	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.153	0.146	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	63.8	66.2	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00235	0.00222	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	0.0027	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	----	----	----

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

Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212407**	Page	: 1 of 15
Amendment	: 1		
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 13-Sep-2022 09:11
PO	: VPO00817033	Issue Date	: 26-Sep-2022 08:57
C-O-C number	: REP_LAEMP_DRY_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-09_N	E298	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E298	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E235.Br-L	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E235.Br-L	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E235.Cl-L	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E235.Cl-L	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E378-U	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	3 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E378-U	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E235.F	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E235.F	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E235.NO3-L	10-Sep-2022	13-Sep-2022	3 days	3 days	✓	13-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E235.NO3-L	10-Sep-2022	13-Sep-2022	3 days	3 days	✓	13-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E235.NO2-L	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E235.NO2-L	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E235.SO4	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E235.SO4	10-Sep-2022	13-Sep-2022	----	----		13-Sep-2022	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-09_N	E318	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E318	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-09_N	E372-U	10-Sep-2022	14-Sep-2022	----	----		15-Sep-2022	28 days	5 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E372-U	10-Sep-2022	14-Sep-2022	----	----		15-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-09_N	E421.Cr-L	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E421.Cr-L	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_FRB_WS_LAEMP_DRY_2022-09_N	E509	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E509	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-09_N	E421	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved)										
LC_FRUS_WS_LAEMP_DRY_2022-09_N	E421	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
LC_FRB_WS_LAEMP_DRY_2022-09_N	E358-L	10-Sep-2022	13-Sep-2022	----	----		14-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid)										
LC_FRUS_WS_LAEMP_DRY_2022-09_N	E358-L	10-Sep-2022	13-Sep-2022	----	----		14-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
LC_FRB_WS_LAEMP_DRY_2022-09_N	E355-L	10-Sep-2022	13-Sep-2022	----	----		14-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid)										
LC_FRUS_WS_LAEMP_DRY_2022-09_N	E355-L	10-Sep-2022	13-Sep-2022	----	----		14-Sep-2022	28 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE										
LC_FRB_WS_LAEMP_DRY_2022-09_N	E283	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	14 days	4 days	✓
Physical Tests : Acidity by Titration										
HDPE										
LC_FRUS_WS_LAEMP_DRY_2022-09_N	E283	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
LC_FRB_WS_LAEMP_DRY_2022-09_N	E290	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	14 days	4 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE										
LC_FRUS_WS_LAEMP_DRY_2022-09_N	E290	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	14 days	4 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E100	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E100	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Physical Tests : ORP by Electrode										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E125	10-Sep-2022	----	----	----		14-Sep-2022	0.25 hrs	93 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E125	10-Sep-2022	----	----	----		14-Sep-2022	0.25 hrs	98 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E108	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E108	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E162	10-Sep-2022	----	----	----		14-Sep-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E162	10-Sep-2022	----	----	----		14-Sep-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E160-L	10-Sep-2022	----	----	----		14-Sep-2022	7 days	4 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E160-L	10-Sep-2022	----	----	----		14-Sep-2022	7 days	4 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_FRB_WS_LAEMP_DRY_2022-09_N	E121	10-Sep-2022	----	----	----		13-Sep-2022	3 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-09_N	E121	10-Sep-2022	----	----	----		13-Sep-2022	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-09_N	E420.Cr-L	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E420.Cr-L	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_FRB_WS_LAEMP_DRY_2022-09_N	E508	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	4 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E508	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	28 days	5 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-09_N	E420	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-09_N	E420	10-Sep-2022	14-Sep-2022	----	----		14-Sep-2022	180 days	4 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	646040	1	9	11.1	5.0	✓
Alkalinity Species by Titration	E290	646035	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645371	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645372	1	4	25.0	5.0	✓
Conductivity in Water	E100	646037	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645355	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	645370	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645373	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645374	1	4	25.0	5.0	✓
ORP by Electrode	E125	646219	1	9	11.1	5.0	✓
pH by Meter	E108	646036	1	5	20.0	5.0	✓
Sulfate in Water by IC	E235.SO4	645375	1	4	25.0	5.0	✓
TDS by Gravimetry	E162	647154	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓
Turbidity by Nephelometry	E121	645376	1	6	16.6	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	646040	1	9	11.1	5.0	✓
Alkalinity Species by Titration	E290	646035	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645371	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645372	1	4	25.0	5.0	✓
Conductivity in Water	E100	646037	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645355	1	20	5.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	645370	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645373	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645374	1	4	25.0	5.0	✓
ORP by Electrode	E125	646219	1	9	11.1	5.0	✓
pH by Meter	E108	646036	1	5	20.0	5.0	✓
Sulfate in Water by IC	E235.SO4	645375	1	4	25.0	5.0	✓
TDS by Gravimetry	E162	647154	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	647137	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	645376	1	6	16.6	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	646040	1	9	11.1	5.0	✓
Alkalinity Species by Titration	E290	646035	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645371	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645372	1	4	25.0	5.0	✓
Conductivity in Water	E100	646037	1	5	20.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645355	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	645370	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645373	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645374	1	4	25.0	5.0	✓
Sulfate in Water by IC	E235.SO4	645375	1	4	25.0	5.0	✓
TDS by Gravimetry	E162	647154	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	647137	1	17	5.8	5.0	✓
Turbidity by Nephelometry	E121	645376	1	6	16.6	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	645526	1	9	11.1	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	645371	1	4	25.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	645372	1	4	25.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	646741	1	18	5.5	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	647532	1	13	7.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	646742	1	18	5.5	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	645441	1	9	11.1	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	645355	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	645370	1	4	25.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	645373	1	4	25.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	645374	1	4	25.0	5.0	✓
Sulfate in Water by IC	E235.SO4	645375	1	4	25.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	646084	1	5	20.0	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	645448	1	9	11.1	5.0	✓
Total Mercury in Water by CVAAS	E508	647531	1	13	7.6	5.0	✓
Total Metals in Water by CRC ICPMS	E420	646083	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	645442	1	9	11.1	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	646476	1	9	11.1	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2212407**	Page	: 1 of 18
Amendment	: **1**		
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 13-Sep-2022 09:11
PO	: VPO00817033	Date Analysis Commenced	: 13-Sep-2022
C-O-C number	: REP_LAEMP_DRY_2022-09_ALS	Issue Date	: 26-Sep-2022 08:57
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 2		
No. of samples analysed	: 2		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Kevin Baxter		Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Vladka Stamenova	Analyst	Calgary Inorganics, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 645376)											
CG2212395-001	Anonymous	turbidity	----	E121	0.10	NTU	0.48	0.47	0.02	Diff <2x LOR	----
Physical Tests (QC Lot: 646035)											
CG2212400-003	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	575	594	3.33%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	575	594	3.33%	20%	----
Physical Tests (QC Lot: 646036)											
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	pH	----	E108	0.10	pH units	8.38	8.38	0.00%	4%	----
Physical Tests (QC Lot: 646037)											
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	conductivity	----	E100	2.0	µS/cm	769	762	0.914%	10%	----
Physical Tests (QC Lot: 646040)											
CG2212395-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 646219)											
CG2212395-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	313	315	0.541%	15%	----
Physical Tests (QC Lot: 647154)											
CG2212395-001	Anonymous	solids, total dissolved [TDS]	----	E162	40	mg/L	529	542	2.43%	20%	----
Anions and Nutrients (QC Lot: 645355)											
CG2212395-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0042	0.0042	0.00003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645370)											
CG2212405-001	Anonymous	fluoride	16984-48-8	E235.F	0.100	mg/L	0.101	0.102	0.0005	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645371)											
CG2212405-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.250	mg/L	<0.250	<0.250	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645372)											
CG2212405-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.50	mg/L	11.8	11.8	0.634%	20%	----
Anions and Nutrients (QC Lot: 645373)											
CG2212405-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0250	mg/L	13.8	13.7	0.681%	20%	----
Anions and Nutrients (QC Lot: 645374)											
CG2212405-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645375)											
CG2212405-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	1.50	mg/L	1070	1060	0.940%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 645448)											
CG2212395-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	<0.500	<0.500	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 645526)											
CG2212395-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 646476)											
CG2212395-001	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0071	0.0072	0.00009	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 645441)											
CG2212395-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 645442)											
CG2212395-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 646083)											
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0046	0.0048	0.0002	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	0.00011	0.00010	0.000007	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	0.00012	0.00002	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.109	0.108	1.48%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.011	0.010	0.0001	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0284 µg/L	0.0000292	0.0000008	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	97.2	98.5	1.30%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0322	0.0312	3.20%	20%	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	45.2	44.6	1.36%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00160	0.00147	8.14%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00128	0.00128	0.270%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00096	0.00088	0.00008	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	1.30	1.28	1.35%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	50.0 µg/L	0.0474	5.39%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.17	2.15	0.874%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	2.80	2.79	0.0809%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.145	0.145	0.295%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	68.2	68.4	0.334%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report							
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Total Metals (QC Lot: 646083) - continued											
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00220	0.00216	2.03%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 646084)											
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	0.00016	0.00003	Diff <2x LOR	----
Total Metals (QC Lot: 647531)											
CG2212395-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 646741)											
CG2212207-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 646742)											
CG2212207-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00065	0.00067	0.00002	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00010	<0.00010	0.000003	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0502	0.0508	1.31%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.031	0.032	0.0007	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0869 µg/L	0.0000969	10.9%	20%	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	223	228	2.24%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.306	0.305	0.501%	20%	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	125	128	2.52%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00044	0.00048	0.00005	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00269	0.00280	3.97%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	0.00659	0.00652	1.04%	20%	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	6.59	6.77	2.82%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	128 µg/L	0.135	5.63%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.60	2.66	2.27%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 646742) - continued											
CG2212207-001	Anonymous	silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	10.8	11.1	2.46%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.381	0.392	2.84%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	179	188	4.75%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.0113	0.0116	2.59%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0031	0.0032	0.00007	Diff <2x LOR	----
Dissolved Metals (QC Lot: 647532)											
CG2212395-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 645376)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 646035)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 646037)						
conductivity	----	E100	1	µS/cm	1.2	----
Physical Tests (QCLot: 646040)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 647137)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 647154)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 645355)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 645370)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 645371)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 645372)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 645373)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 645374)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 645375)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 645448)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 645526)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 646476)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 646476) - continued						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 645441)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 645442)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 646083)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 646083) - continued						
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 646084)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 647531)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 646741)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 646742)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 646742) - continued						
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 647532)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 645376)									
turbidity	----	E121	0.1	NTU	200 NTU	104	85.0	115	----
Physical Tests (QCLot: 646035)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	104	85.0	115	----
Physical Tests (QCLot: 646036)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 646037)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.9	90.0	110	----
Physical Tests (QCLot: 646040)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	104	85.0	115	----
Physical Tests (QCLot: 646219)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	102	95.4	104	----
Physical Tests (QCLot: 647137)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	99.8	85.0	115	----
Physical Tests (QCLot: 647154)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	99.0	85.0	115	----
Anions and Nutrients (QCLot: 645355)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	96.4	80.0	120	----
Anions and Nutrients (QCLot: 645370)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 645371)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 645372)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 645373)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 645374)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 645375)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 645448)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	99.6	75.0	125	----
Anions and Nutrients (QCLot: 645526)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 645526) - continued									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	98.4	85.0	115	----
Anions and Nutrients (QCLot: 646476)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	94.4	80.0	120	----
Organic / Inorganic Carbon (QCLot: 645441)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	103	80.0	120	----
Organic / Inorganic Carbon (QCLot: 645442)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	105	80.0	120	----
Total Metals (QCLot: 646083)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	98.5	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	95.8	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	93.0	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	96.0	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	95.5	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	102	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	92.3	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	94.6	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	93.0	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	93.9	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	93.0	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	104	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	102	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	102	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	96.2	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	96.5	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	93.9	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	97.2	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	90.8	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	103	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	83.2	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	98.3	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	95.7	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	93.9	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	97.8	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	96.1	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 646083) - continued									
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	91.7	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	91.5	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	94.1	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	91.0	80.0	120	----
Total Metals (QCLot: 646084)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	95.9	80.0	120	----
Total Metals (QCLot: 647531)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	100	80.0	120	----
Dissolved Metals (QCLot: 646741)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	99.0	80.0	120	----
Dissolved Metals (QCLot: 646742)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	103	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	99.1	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	99.7	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	106	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	98.2	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	98.6	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	98.8	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	95.4	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	96.0	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	96.5	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	108	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	98.7	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	91.7	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	94.9	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	96.4	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	99.5	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	94.7	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	99.2	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	90.2	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	100	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	89.0	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	99.7	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	99.0	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 646742) - continued									
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	99.4	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.2	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	98.8	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	96.2	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	99.8	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	103	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	104	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 645355)										
CG2212395-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0473 mg/L	0.05 mg/L	94.5	70.0	130	----
Anions and Nutrients (QCLot: 645370)										
CG2212405-002	Anonymous	fluoride	16984-48-8	E235.F	0.816 mg/L	1 mg/L	81.6	75.0	125	----
Anions and Nutrients (QCLot: 645371)										
CG2212405-002	Anonymous	bromide	24959-67-9	E235.Br-L	0.497 mg/L	0.5 mg/L	99.4	75.0	125	----
Anions and Nutrients (QCLot: 645372)										
CG2212405-002	Anonymous	chloride	16887-00-6	E235.Cl-L	97.7 mg/L	100 mg/L	97.7	75.0	125	----
Anions and Nutrients (QCLot: 645373)										
CG2212405-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	ND mg/L	2.5 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 645374)										
CG2212405-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.492 mg/L	0.5 mg/L	98.4	75.0	125	----
Anions and Nutrients (QCLot: 645375)										
CG2212405-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	ND mg/L	100 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 645448)										
CG2212395-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.54 mg/L	2.5 mg/L	101	70.0	130	----
Anions and Nutrients (QCLot: 645526)										
CG2212395-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.109 mg/L	0.1 mg/L	109	75.0	125	----
Anions and Nutrients (QCLot: 646476)										
CG2212395-002	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0472 mg/L	0.05 mg/L	94.4	70.0	130	----
Organic / Inorganic Carbon (QCLot: 645441)										
CG2212395-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.72 mg/L	5 mg/L	114	70.0	130	----
Organic / Inorganic Carbon (QCLot: 645442)										
CG2212395-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.80 mg/L	5 mg/L	116	70.0	130	----
Total Metals (QCLot: 646083)										
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	aluminum, total	7429-90-5	E420	1.92 mg/L	2 mg/L	96.3	70.0	130	----
		antimony, total	7440-36-0	E420	0.186 mg/L	0.2 mg/L	93.2	70.0	130	----
		arsenic, total	7440-38-2	E420	0.190 mg/L	0.2 mg/L	94.8	70.0	130	----
		barium, total	7440-39-3	E420	0.178 mg/L	0.2 mg/L	88.8	70.0	130	----
		beryllium, total	7440-41-7	E420	0.373 mg/L	0.4 mg/L	93.2	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 646083) - continued										
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	bismuth, total	7440-69-9	E420	0.0998 mg/L	0.1 mg/L	99.8	70.0	130	----
		boron, total	7440-42-8	E420	0.899 mg/L	1 mg/L	89.9	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.192 mg/L	0.2 mg/L	95.8	70.0	130	----
		copper, total	7440-50-8	E420	0.194 mg/L	0.2 mg/L	97.0	70.0	130	----
		iron, total	7439-89-6	E420	19.1 mg/L	20 mg/L	95.4	70.0	130	----
		lead, total	7439-92-1	E420	0.203 mg/L	0.2 mg/L	102	70.0	130	----
		lithium, total	7439-93-2	E420	0.934 mg/L	1 mg/L	93.4	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.194 mg/L	0.2 mg/L	96.9	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.199 mg/L	0.2 mg/L	99.5	70.0	130	----
		nickel, total	7440-02-0	E420	0.384 mg/L	0.4 mg/L	96.0	70.0	130	----
		potassium, total	7440-09-7	E420	38.3 mg/L	40 mg/L	95.8	70.0	130	----
		selenium, total	7782-49-2	E420	0.388 mg/L	0.4 mg/L	97.0	70.0	130	----
		silicon, total	7440-21-3	E420	102 mg/L	100 mg/L	102	70.0	130	----
		silver, total	7440-22-4	E420	0.0384 mg/L	0.04 mg/L	96.1	70.0	130	----
		sodium, total	7440-23-5	E420	19.6 mg/L	20 mg/L	97.9	70.0	130	----
		strontium, total	7440-24-6	E420	0.197 mg/L	0.2 mg/L	98.5	70.0	130	----
		sulfur, total	7704-34-9	E420	174 mg/L	200 mg/L	87.0	70.0	130	----
		thallium, total	7440-28-0	E420	0.0361 mg/L	0.04 mg/L	90.2	70.0	130	----
		tin, total	7440-31-5	E420	0.184 mg/L	0.2 mg/L	91.9	70.0	130	----
		titanium, total	7440-32-6	E420	0.378 mg/L	0.4 mg/L	94.4	70.0	130	----
		uranium, total	7440-61-1	E420	0.0373 mg/L	0.04 mg/L	93.3	70.0	130	----
		vanadium, total	7440-62-2	E420	0.954 mg/L	1 mg/L	95.4	70.0	130	----
		zinc, total	7440-66-6	E420	3.84 mg/L	4 mg/L	95.9	70.0	130	----
Total Metals (QCLot: 646084)										
CG2212407-001	LC_FRB_WS_LAEMP_DRY_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.392 mg/L	0.4 mg/L	98.1	70.0	130	----
Total Metals (QCLot: 647531)										
CG2212395-002	Anonymous	mercury, total	7439-97-6	E508	0.000103 mg/L	0.0001 mg/L	103	70.0	130	----
Dissolved Metals (QCLot: 646741)										
CG2212207-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.451 mg/L	0.4 mg/L	113	70.0	130	----
Dissolved Metals (QCLot: 646742)										
CG2212207-002	Anonymous	aluminum, dissolved	7429-90-5	E421	2.29 mg/L	2 mg/L	114	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.219 mg/L	0.2 mg/L	109	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 646742) - continued										
CG2212207-002	Anonymous	arsenic, dissolved	7440-38-2	E421	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.148 mg/L	0.2 mg/L	74.3	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.439 mg/L	0.4 mg/L	110	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.111 mg/L	0.1 mg/L	111	70.0	130	----
		boron, dissolved	7440-42-8	E421	1.05 mg/L	1 mg/L	105	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0445 mg/L	0.04 mg/L	111	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.216 mg/L	0.2 mg/L	108	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.220 mg/L	0.2 mg/L	110	70.0	130	----
		iron, dissolved	7439-89-6	E421	21.2 mg/L	20 mg/L	106	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.225 mg/L	0.2 mg/L	112	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.956 mg/L	1 mg/L	95.6	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.217 mg/L	0.2 mg/L	108	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.433 mg/L	0.4 mg/L	108	70.0	130	----
		potassium, dissolved	7440-09-7	E421	40.9 mg/L	40 mg/L	102	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.362 mg/L	0.4 mg/L	90.6	70.0	130	----
		silicon, dissolved	7440-21-3	E421	82.1 mg/L	100 mg/L	82.1	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0463 mg/L	0.04 mg/L	116	70.0	130	----
		sodium, dissolved	7440-23-5	E421	20.3 mg/L	20 mg/L	101	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.238 mg/L	0.2 mg/L	119	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	141 mg/L	200 mg/L	70.4	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0425 mg/L	0.04 mg/L	106	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.222 mg/L	0.2 mg/L	111	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.451 mg/L	0.4 mg/L	113	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	1.08 mg/L	1 mg/L	108	70.0	130	----
		zinc, dissolved	7440-66-6	E421	4.76 mg/L	4 mg/L	119	70.0	130	----
Dissolved Metals (QCLot: 647532)										
CG2212395-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.000100 mg/L	0.0001 mg/L	100	70.0	130	----

Page 1 of 1

Teck

COC ID:	REP_LAEMP_DRY_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priority

PROJECT/CLIENT INFO		LABORATORY		OTHER INFO			
Facility Name / Job#	Regional Effects Program	Lab Name	ALS Calgary	Report Format / Distribution	Excel	PDF	EDD
Project Manager	Nicole Zathey	Lab Contact	Lyudmyla Shvets	Email 1: [illegible]	X	X	X
Email	Nicole.Zathey@Teck.com	Email	Lyudmyla.Shvets@ALSGlobal.com	Email 2: teckcoal@equisonline.com			X
Address	421 Pine Avenue	Address	2559 29 Street NE	Email 3: Teck.Lab.Results@tec	X	X	X
				Email 4: Lisa.Bowron@minnow.ca	X	X	X
City	Sparwood, Province BC	City	Calgary, Province AB	Email 5: Robin.Valleau@minnow.ca	X	X	X
Postal Code	V0B 2G1, Country Canada	Postal Code	T1Y 7B5, Country Canada	Email 5: Jessica.Ritz@Teck.com	X	X	X
Phone Number	1-250-865-3048	Phone Number	403 407 1794	PO number	VPO00817033		

Environmental Division
Calgary
Work Order Reference
CG2212407

Telephone : +1 403 407 1800

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC (F, H2SO4)	Mercury_Dissolved (F, HCL)	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT (N, H2SO4)
LC_FRB_WS_LAEMP_DRY_2022-09_N	LC_FRB	WS		2022/09/10	14:00	G	7	1	1	1	1	1	1	1
LC_FRUS_WS_LAEMP_DRY_2022-09_N	LC_FRUS	WS		2022/09/10	9:00	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Dissolved metals were field filtered and to be lab preserved Total metals to be lab preserved	Jennifer Ings/Minnow	12-Sep	NC	13/09/22 09h

SERVICE REQUEST (rush - subject to availability)	
Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	Mobile #	5195003444
Sampler's Signature		Date/Time	September 12, 2022

10°C

WATER CHEMISTRY

ALS Laboratory Report CG2212551
(Finalized 16-Sept-22)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212551**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 14-Sep-2022 09:00
PO	: VPO00817033	Date Analysis Commenced	: 15-Sep-2022
C-O-C number	: LCO_LAEMP_DRY_2022-09_ALS	Issue Date	: 16-Sep-2022 18:23
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta
Shirley Li		Metals, Calgary, Alberta

General Comments

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

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

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

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

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

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

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

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	LC_DCEF_WS_LAEMP_DRY_2022-09_N	----	----	----	----
				Client sampling date / time	12-Sep-2022 14:30	----	----	----	----
					CG2212551-001	--------	--------	--------	--------
					Result	----	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	----	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	149	----	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	181	----	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	----	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	149	----	----	----	----
conductivity	----	E100	2.0	μS/cm	265	----	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	140	----	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	307	----	----	----	----
pH	----	E108	0.10	pH units	8.07	----	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	158	----	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	22.7	----	----	----	----
turbidity	----	E121	0.10	NTU	5.63	----	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	----	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	----	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	0.24	----	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.108	----	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.500 DLM	----	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0866	----	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	----	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	0.0038	----	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0117	----	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	6.85	----	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	1.00	----	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	1.11	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_DCEF_WS_LAEMP_DRY_2022-09_N	----	----	----	----
				Client sampling date / time	12-Sep-2022 14:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212551-001**	--------	--------	--------	--------
					Result	----	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	3.14	----	----	----	----
cation sum	----	EC101	0.10	meq/L	2.91	----	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	92.7	----	----	----	----
ion balance (APHA)	----	EC101	0.010	%	3.80	----	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0312	----	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	0.00014	----	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00022	----	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.249	----	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	----	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	----	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.010	----	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0676	----	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	33.3	----	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00012	----	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	----	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	----	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.046	----	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	0.000060	----	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0163	----	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	14.1	----	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00307	----	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00111	----	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	----	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.00	----	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	1.66	----	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	3.00	----	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	----	----	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.30	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_DCEF_WS_LAEMP_DRY_2022-09_N	----	----	----	----
				Client sampling date / time	12-Sep-2022 14:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2212551-001	--------	--------	--------	--------
					Result	----	----	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.0525	----	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	2.90	----	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	----	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	----	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	0.00066	----	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.000357	----	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00090	----	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	----	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0011	----	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	0.00013	----	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00016	----	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.254	----	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	----	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	----	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.011	----	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0397	----	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	33.3	----	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	----	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	----	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00024	----	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	----	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	----	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0181	----	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	13.7	----	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00017	----	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	----	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00111	----	----	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	----	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.993	----	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_DCEF_WS_LAEMP_DRY_2022-09_N	----	----	----	----
				Client sampling date / time	12-Sep-2022 14:30	----	----	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2212551-001	--------	--------	--------	--------
					Result	----	----	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	1.94	----	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	3.03	----	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	----	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.28	----	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.0497	----	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	3.12	----	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	----	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	----	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	----	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000299	----	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	0.00055	----	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	----	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	----	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	----	----	----	----

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

ALS Environmental

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212551**	Page	:
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 14-Sep-2022 09:00
PO	: VPO00817033	Issue Date	: 16-Sep-2022 18:23
C-O-C number	: LCO_LAEMP_DRY_2022-09_ALS		
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E298	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E235.Br-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E235.Cl-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E378-U	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	3 days	3 days	✗ EHT
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E235.F	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E235.NO3-L	12-Sep-2022	15-Sep-2022	3 days	3 days	✓	15-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E235.NO2-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	3 days	3 days	✗ EHT

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E235.SO4	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E318	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E372-U	12-Sep-2022	15-Sep-2022	----	----		16-Sep-2022	28 days	3 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E421.Cr-L	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E509	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E421	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E358-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E355-L	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E283	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	14 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E290	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E100	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	28 days	3 days	✓
Physical Tests : ORP by Electrode										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E125	12-Sep-2022	----	----	----		16-Sep-2022	0.25 hrs	93 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E108	12-Sep-2022	15-Sep-2022	----	----		15-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E162	12-Sep-2022	----	----	----		15-Sep-2022	7 days	3 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E160-L	12-Sep-2022	----	----	----		15-Sep-2022	7 days	3 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-09_N	E121	12-Sep-2022	----	----	----		15-Sep-2022	3 days	3 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E420.Cr-L	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_DCEF_WS_LAEMP_DRY_2022-09_N	E508	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	4 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid)										
LC_DCEF_WS_LAEMP_DRY_2022-09_N	E420	12-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	180 days	4 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	649325	1	4	25.0	5.0	✓
Alkalinity Species by Titration	E290	649329	1	6	16.6	5.0	✓
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649483	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	649484	1	16	6.2	5.0	✓
Conductivity in Water	E100	649328	1	6	16.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650008	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650160	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650009	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	649482	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	649485	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649486	1	19	5.2	5.0	✓
ORP by Electrode	E125	650422	1	10	10.0	5.0	✓
pH by Meter	E108	649327	1	8	12.5	5.0	✓
Sulfate in Water by IC	E235.SO4	649487	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	649536	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	649992	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	649378	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	650164	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	649993	1	8	12.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓
Turbidity by Nephelometry	E121	649414	1	4	25.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	649325	1	4	25.0	5.0	✓
Alkalinity Species by Titration	E290	649329	1	6	16.6	5.0	✓
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649483	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	649484	1	16	6.2	5.0	✓
Conductivity in Water	E100	649328	1	6	16.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650008	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650160	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650009	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	649482	1	16	6.2	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type / Analytical Methods	Method	QC Lot #	Count QC	Count Regular	Frequency (%) Actual	Frequency (%) Expected	Evaluation
Laboratory Control Samples (LCS) - Continued							
Nitrate in Water by IC (Low Level)	E235.NO3-L	649485	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649486	1	19	5.2	5.0	✓
ORP by Electrode	E125	650422	1	10	10.0	5.0	✓
pH by Meter	E108	649327	1	8	12.5	5.0	✓
Sulfate in Water by IC	E235.SO4	649487	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	649536	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	649992	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	649378	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	650164	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	649993	1	8	12.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	649523	1	12	8.3	5.0	✓
Turbidity by Nephelometry	E121	649414	1	4	25.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	649325	1	4	25.0	5.0	✓
Alkalinity Species by Titration	E290	649329	1	6	16.6	5.0	✓
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649483	1	16	6.2	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	649484	1	16	6.2	5.0	✓
Conductivity in Water	E100	649328	1	6	16.6	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650008	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650160	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650009	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	649482	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	649485	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649486	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	649487	1	16	6.2	5.0	✓
TDS by Gravimetry	E162	649536	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	649992	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	649378	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	650164	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	649993	1	8	12.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	649523	1	12	8.3	5.0	✓
Turbidity by Nephelometry	E121	649414	1	4	25.0	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	649577	1	17	5.8	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	649483	1	16	6.2	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS) - Continued							
Chloride in Water by IC (Low Level)	E235.Cl-L	649484	1	16	6.2	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	650008	1	15	6.6	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	650160	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	650009	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	649550	1	17	5.8	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	649627	1	20	5.0	5.0	✓
Fluoride in Water by IC	E235.F	649482	1	16	6.2	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	649485	1	19	5.2	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	649486	1	19	5.2	5.0	✓
Sulfate in Water by IC	E235.SO4	649487	1	16	6.2	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	649992	1	8	12.5	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	649378	1	4	25.0	5.0	✓
Total Mercury in Water by CVAAS	E508	650164	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	649993	1	8	12.5	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	649551	1	18	5.5	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	*Method / Lab*	*Matrix*	*Method Reference*	*Method Descriptions*
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **CG2212551**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 14-Sep-2022 09:00
PO	: VPO00817033	Date Analysis Commenced	: 15-Sep-2022
C-O-C number	: LCO_LAEMP_DRY_2022-09_ALS	Issue Date	: 16-Sep-2022 18:23
Sampler	: Jennifer Ings/Minnow		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Dwayne Bennett	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Mackenzie Lamoureux	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta
Shirley Li		Calgary Metals, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 649325)											
CG2212550-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 649327)											
CG2212457-001	Anonymous	pH	----	E108	0.10	pH units	8.06	8.06	0.00%	4%	----
Physical Tests (QC Lot: 649328)											
CG2212462-001	Anonymous	conductivity	----	E100	2.0	µS/cm	68.5	67.3	1.77%	10%	----
Physical Tests (QC Lot: 649329)											
CG2212462-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	47.0	44.0	6.59%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	2.0	mg/L	47.0	44.0	6.59%	20%	----
Physical Tests (QC Lot: 649414)											
CG2212550-001	Anonymous	turbidity	----	E121	0.10	NTU	0.37	0.40	0.03	Diff <2x LOR	----
Physical Tests (QC Lot: 649536)											
CG2212460-001	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	1540	1550	0.453%	20%	----
Physical Tests (QC Lot: 650422)											
CG2212550-001	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	302	299	0.765%	15%	----
Anions and Nutrients (QC Lot: 649378)											
CG2212550-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.500	mg/L	<0.500	<0.500	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649482)											
CG2212545-001	Anonymous	fluoride	16984-48-8	E235.F	0.400	mg/L	<0.400	<0.400	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649483)											
CG2212545-001	Anonymous	bromide	24959-67-9	E235.Br-L	1.00	mg/L	<1.00	<1.00	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649484)											
CG2212545-001	Anonymous	chloride	16887-00-6	E235.Cl-L	2.00	mg/L	10.7	10.7	0.01	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649485)											
CG2212545-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.100	mg/L	209	208	0.299%	20%	----
Anions and Nutrients (QC Lot: 649486)											
CG2212545-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0200	mg/L	0.611	0.616	0.880%	20%	----
Anions and Nutrients (QC Lot: 649487)											
CG2212545-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	6.00	mg/L	1430	1430	0.266%	20%	----
Anions and Nutrients (QC Lot: 649577)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Anions and Nutrients (QC Lot: 649577) - continued											
CG2212550-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 649627)											
CG2212545-001	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 649550)											
CG2212550-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 649551)											
CG2212550-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 649992)											
CG2212550-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00037	0.00024	0.00013	Diff <2x LOR	----
Total Metals (QC Lot: 649993)											
CG2212550-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0069	0.0098	0.0029	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00018	0.00018	0.000006	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0536	0.0552	2.97%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0138 µg/L	0.0000175	0.0000037	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	71.0	71.6	0.777%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	0.014	0.004	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0066	0.0066	0.00002	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	41.7	43.4	3.84%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00090	0.00086	0.00004	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000912	0.000917	0.596%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	0.00069	0.00068	0.00001	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.807	0.828	2.61%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	36.3 µg/L	0.0365	0.568%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	2.22	2.24	0.816%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	0.000013	<0.000010	0.000003	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	1.38	1.41	1.88%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.116	0.117	0.562%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	65.7	65.4	0.479%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 649993) - continued											
CG2212550-001	Anonymous	thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00232	0.00234	1.02%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 650164)											
CG2212515-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 650008)											
CG2212268-001	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 650009)											
CG2212268-001	Anonymous	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	0.0041	0.0040	0.0001	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	0.00011	0.00010	0.000010	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0412	0.0419	1.78%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.000020	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0000342	0.0000278	0.0000064	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	51.4	52.3	1.68%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0033	0.0034	0.00008	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	25.4	25.4	0.0305%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00149	0.00149	0.0188%	20%	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00122	0.00126	3.23%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.790	0.797	0.821%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	0.00182	0.00182	0.348%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.61	2.66	1.84%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	0.910	0.904	0.640%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.116	0.118	1.69%	20%	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 650009) - continued											
CG2212268-001	Anonymous	sulfur, dissolved	7704-34-9	E421	0.50	mg/L	22.1	22.6	2.39%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	0.000013	0.000012	0.0000008	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00032	0.00032	0.000004	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00285	0.00296	3.68%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	0.0030	0.0028	0.0001	Diff <2x LOR	----
Dissolved Metals (QC Lot: 650160)											
CG2212336-001	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 649325)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 649328)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 649329)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 649414)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 649523)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 649536)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 649378)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 649482)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 649483)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 649484)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 649485)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 649486)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 649487)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 649577)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 649627)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Organic / Inorganic Carbon (QCLot: 649550)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Organic / Inorganic Carbon (QCLot: 649550) - continued						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 649551)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 649992)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 649993)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 649993) - continued						
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 650164)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 650008)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 650009)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 650009) - continued						
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 650160)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 649325)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	104	85.0	115	----
Physical Tests (QCLot: 649327)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 649328)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	100	90.0	110	----
Physical Tests (QCLot: 649329)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	101	85.0	115	----
Physical Tests (QCLot: 649414)									
turbidity	----	E121	0.1	NTU	200 NTU	109	85.0	115	----
Physical Tests (QCLot: 649523)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	95.7	85.0	115	----
Physical Tests (QCLot: 649536)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	95.0	85.0	115	----
Physical Tests (QCLot: 650422)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	101	95.4	104	----
Anions and Nutrients (QCLot: 649378)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 649482)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 649483)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	95.0	85.0	115	----
Anions and Nutrients (QCLot: 649484)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 649485)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 649486)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 649487)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 649577)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	99.2	85.0	115	----
Anions and Nutrients (QCLot: 649627)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
Anions and Nutrients (QCLot: 649627) - continued									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	102	80.0	120	----
Organic / Inorganic Carbon (QCLot: 649550)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	90.6	80.0	120	----
Organic / Inorganic Carbon (QCLot: 649551)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	97.1	80.0	120	----
Total Metals (QCLot: 649992)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
Total Metals (QCLot: 649993)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	101	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	107	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	100	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	99.5	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	97.9	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	94.4	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	101	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	97.0	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	101	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	115	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	100	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	94.7	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	103	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	99.8	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	104	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	103	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	99.0	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	106	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	97.7	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	106	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	104	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	111	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	101	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	104	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 649993) - continued									
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	104	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	103	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	104	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	104	80.0	120	----
Total Metals (QCLot: 650164)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	101	80.0	120	----
Dissolved Metals (QCLot: 650008)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	95.8	80.0	120	----
Dissolved Metals (QCLot: 650009)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	98.2	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	101	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	96.9	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	95.4	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	95.9	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	97.9	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	102	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	96.6	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.2	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	97.9	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	94.6	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	109	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	96.5	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	94.5	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	97.6	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	97.9	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	97.4	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	95.6	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	98.3	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	96.2	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	102	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	88.6	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	96.6	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	94.4	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	117	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	97.1	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	96.2	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 650009) - continued									
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	100	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	93.1	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	95.8	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	94.3	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	99.9	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 649378)										
CG2212550-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.82 mg/L	2.5 mg/L	113	70.0	130	----
Anions and Nutrients (QCLot: 649482)										
CG2212545-004	Anonymous	fluoride	16984-48-8	E235.F	1.05 mg/L	1 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 649483)										
CG2212545-004	Anonymous	bromide	24959-67-9	E235.Br-L	0.448 mg/L	0.5 mg/L	89.6	75.0	125	----
Anions and Nutrients (QCLot: 649484)										
CG2212545-004	Anonymous	chloride	16887-00-6	E235.Cl-L	101 mg/L	100 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 649485)										
CG2212545-004	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.72 mg/L	2.5 mg/L	109	75.0	125	----
Anions and Nutrients (QCLot: 649486)										
CG2212545-004	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.509 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 649487)										
CG2212545-004	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	105 mg/L	100 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 649577)										
CG2212550-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.102 mg/L	0.1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 649627)										
CG2212545-002	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0468 mg/L	0.05 mg/L	93.6	70.0	130	----
Organic / Inorganic Carbon (QCLot: 649550)										
CG2212550-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.18 mg/L	5 mg/L	104	70.0	130	----
Organic / Inorganic Carbon (QCLot: 649551)										
CG2212550-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.41 mg/L	5 mg/L	108	70.0	130	----
Total Metals (QCLot: 649992)										
CG2212550-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.374 mg/L	0.4 mg/L	93.5	70.0	130	----
Total Metals (QCLot: 649993)										
CG2212550-002	Anonymous	aluminum, total	7429-90-5	E420	1.82 mg/L	2 mg/L	90.9	70.0	130	----
		antimony, total	7440-36-0	E420	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		arsenic, total	7440-38-2	E420	0.178 mg/L	0.2 mg/L	88.8	70.0	130	----
		barium, total	7440-39-3	E420	0.178 mg/L	0.2 mg/L	88.8	70.0	130	----
		beryllium, total	7440-41-7	E420	0.352 mg/L	0.4 mg/L	88.1	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report: Spike Concentration	Spike Target	Recovery (%) MS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 649993) - continued										
CG2212550-002	Anonymous	bismuth, total	7440-69-9	E420	0.0936 mg/L	0.1 mg/L	93.6	70.0	130	----
		boron, total	7440-42-8	E420	0.872 mg/L	1 mg/L	87.2	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0377 mg/L	0.04 mg/L	94.3	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.184 mg/L	0.2 mg/L	91.8	70.0	130	----
		copper, total	7440-50-8	E420	0.189 mg/L	0.2 mg/L	94.4	70.0	130	----
		iron, total	7439-89-6	E420	18.6 mg/L	20 mg/L	93.1	70.0	130	----
		lead, total	7439-92-1	E420	0.185 mg/L	0.2 mg/L	92.6	70.0	130	----
		lithium, total	7439-93-2	E420	0.808 mg/L	1 mg/L	80.8	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.177 mg/L	0.2 mg/L	88.7	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.188 mg/L	0.2 mg/L	94.2	70.0	130	----
		nickel, total	7440-02-0	E420	0.384 mg/L	0.4 mg/L	96.1	70.0	130	----
		potassium, total	7440-09-7	E420	36.2 mg/L	40 mg/L	90.5	70.0	130	----
		selenium, total	7782-49-2	E420	0.386 mg/L	0.4 mg/L	96.6	70.0	130	----
		silicon, total	7440-21-3	E420	89.8 mg/L	100 mg/L	89.8	70.0	130	----
		silver, total	7440-22-4	E420	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		sodium, total	7440-23-5	E420	18.0 mg/L	20 mg/L	90.2	70.0	130	----
		strontium, total	7440-24-6	E420	0.178 mg/L	0.2 mg/L	89.0	70.0	130	----
		sulfur, total	7704-34-9	E420	176 mg/L	200 mg/L	88.1	70.0	130	----
		thallium, total	7440-28-0	E420	0.0374 mg/L	0.04 mg/L	93.4	70.0	130	----
		tin, total	7440-31-5	E420	0.191 mg/L	0.2 mg/L	95.5	70.0	130	----
		titanium, total	7440-32-6	E420	0.386 mg/L	0.4 mg/L	96.4	70.0	130	----
		uranium, total	7440-61-1	E420	0.0384 mg/L	0.04 mg/L	96.0	70.0	130	----
		vanadium, total	7440-62-2	E420	0.926 mg/L	1 mg/L	92.6	70.0	130	----
		zinc, total	7440-66-6	E420	3.88 mg/L	4 mg/L	97.1	70.0	130	----
Total Metals (QCLot: 650164)										
CG2212515-002	Anonymous	mercury, total	7439-97-6	E508	0.0000968 mg/L	0.0001 mg/L	96.8	70.0	130	----
Dissolved Metals (QCLot: 650008)										
CG2212268-002	Anonymous	chromium, dissolved	7440-47-3	E421.Cr-L	0.385 mg/L	0.4 mg/L	96.3	70.0	130	----
Dissolved Metals (QCLot: 650009)										
CG2212268-002	Anonymous	aluminum, dissolved	7429-90-5	E421	1.90 mg/L	2 mg/L	95.1	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.195 mg/L	0.2 mg/L	97.7	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.189 mg/L	0.2 mg/L	94.6	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.186 mg/L	0.2 mg/L	93.2	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.380 mg/L	0.4 mg/L	94.9	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 650009) - continued										
CG2212268-002	Anonymous	bismuth, dissolved	7440-69-9	E421	0.0910 mg/L	0.1 mg/L	91.0	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.974 mg/L	1 mg/L	97.4	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0388 mg/L	0.04 mg/L	97.0	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.192 mg/L	0.2 mg/L	95.8	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.189 mg/L	0.2 mg/L	94.4	70.0	130	----
		iron, dissolved	7439-89-6	E421	19.1 mg/L	20 mg/L	95.5	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.185 mg/L	0.2 mg/L	92.6	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.944 mg/L	1 mg/L	94.4	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.192 mg/L	0.2 mg/L	96.2	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.191 mg/L	0.2 mg/L	95.6	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.382 mg/L	0.4 mg/L	95.6	70.0	130	----
		potassium, dissolved	7440-09-7	E421	37.7 mg/L	40 mg/L	94.4	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.392 mg/L	0.4 mg/L	98.0	70.0	130	----
		silicon, dissolved	7440-21-3	E421	97.6 mg/L	100 mg/L	97.6	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0393 mg/L	0.04 mg/L	98.2	70.0	130	----
		sodium, dissolved	7440-23-5	E421	19.0 mg/L	20 mg/L	95.2	70.0	130	----
		strontium, dissolved	7440-24-6	E421	ND mg/L	0.2 mg/L	ND	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	206 mg/L	200 mg/L	103	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0363 mg/L	0.04 mg/L	90.7	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.189 mg/L	0.2 mg/L	94.7	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.346 mg/L	0.4 mg/L	86.6	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0362 mg/L	0.04 mg/L	90.5	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.939 mg/L	1 mg/L	93.9	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.79 mg/L	4 mg/L	94.9	70.0	130	----
Dissolved Metals (QCLot: 650160)										
CG2212336-002	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000785 mg/L	0.0001 mg/L	78.5	70.0	130	----

Teck

COC ID:	LCO_LAEMP_DRY_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priority

PROJECT/CLIENT INFO

Facility Name / Job#	Line Creek Operations		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@Teck.com		
Address	421 Pine Avenune		
City	Sparwood	Province	BC
Postal Code	V0B 2G1	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY

Lab Name	ALS Calgary		
Lab Contact	Lyudmyla Shvets		
Email	Lyudmyla.Shvets@ALSGlobal.com		
Address	2559 29 Street NE		
City	Calgary	Province	AB
Postal Code	T1Y 7B5	Country	Canada
Phone Number	403 407 1794		

OTHER INFO

Report Format / Distribution		Excel	PDF	ED
Email 1:	[illegible]	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@tec	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00817033			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: N

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
Filt.								F	F		F			N
Preserv.								H2SO4	HCL		NO3	NO3		H2SO4
LC_DCEF_WS_LAEMP_DRY_2022-09_N	LC_DCEF	WS		2022/09/12	14:30	G	7	1	1	1	1	1	1	1

Environmental Division
Calgary
Work Order Reference
CG2212551

Telephone : + 1 403 407 1800

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	13-Sep		9/14 9:00

SERVICE REQUEST (rush - subject to availability)	
Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	Mobile #	5195003444
Sampler's Signature		Date/Time	September 13, 2022

11c

WATER CHEMISTRY

ALS Laboratory Report CG2212647
(Finalized 26-Sept-22)

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **CG2212647**	Page	: 1 of 6
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 16-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: LCO_LAEMP_DRY_2022-09_ALS	Issue Date	: 26-Sep-2022 17:38
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Metals, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Millicent Brentnall	Laboratory Analyst	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Sara Niroomand		Inorganics, Calgary, Alberta

General Comments

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

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

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

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

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

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent
µg/L	micrograms per litre
µS/cm	Microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
DLB	*Detection Limit Raised. Analyte detected at comparable level in Method Blank.*
HTD	*Hold time exceeded for re-analysis or dilution, but initial testing was conducted within hold time.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_MT1_WS_LAEMP_DRY_2022-09_N	LC_CC1_WS_LAEMP_DRY_2022-09_N	----	----
				Client sampling date / time	14-Sep-2022 13:30	14-Sep-2022 13:30	14-Sep-2022 13:30	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2212647-001	CG2212647-002	CG2212647-003	--------	--------
					Result	Result	Result	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	<2.0	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	161	<1.0	170	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	196	<1.0	207	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	6.6	<1.0	5.6	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	4.0	<1.0	3.4	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	<1.0	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	<1.0	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	167	<1.0	175	----	----
conductivity	----	E100	2.0	µS/cm	374	<2.0	374	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	214	<0.50	215	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	294	519	282	----	----
pH	----	E108	0.10	pH units	8.33	5.21	8.31	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	237	<10	248	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.4	<1.0	1.4	----	----
turbidity	----	E121	0.10	NTU	0.60	<0.10	0.75	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	<0.0050	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	<0.050	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	0.17	<0.10	0.18	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.144	<0.020	0.146	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	<0.050	<0.050	<0.050	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0455	<0.0050 HTD	0.0434	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	0.0054	<0.0020	0.0048	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	46.8	<0.30	47.0	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	<0.50	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	<0.50	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

Analyte	CAS Number	Method	LOR	Unit	CG2212647-001	CG2212647-002	CG2212647-003	--------	--------
				Client sample ID	LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_MT1_WS_LAEMP_DRY_2022-09_N	LC_CC1_WS_LAEMP_DRY_2022-09_N	----	----
				Client sampling date / time	14-Sep-2022 13:30	14-Sep-2022 13:30	14-Sep-2022 13:30	----	----
					Result	Result	Result	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	4.33	<0.10	4.49	----	----
cation sum	----	EC101	0.10	meq/L	4.41	<0.10	4.44	----	----
ion balance (cations/anions)	----	EC101	0.010	%	102	100	98.9	----	----
ion balance (APHA)	----	EC101	0.010	%	0.915	<0.010	0.560	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0150 DLB	<0.0030	<0.0150 DLB	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00015	<0.00010	0.00017	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.0634	<0.00010	0.0625	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	<0.020	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
boron, total	7440-42-8	E420	0.010	mg/L	0.016	<0.010	0.017	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0061	<0.0050	0.0063	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	49.2	<0.050	49.3	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00022	<0.00010	0.00023	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.10	<0.10	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.017	<0.010	0.017	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0073	<0.0010	0.0072	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	18.1	<0.0050	17.7	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00378	<0.00010	0.00357	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00134	<0.000050	0.00139	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	0.653	<0.050	0.642	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	1.82	<0.050	1.86	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	2.88	<0.10	2.81	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
sodium, total	7440-23-5	E420	0.050	mg/L	2.56	<0.050	2.53	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_MT1_WS_LAEMP_DRY_2022-09_N	LC_CC1_WS_LAEMP_DRY_2022-09_N	----	----
				Client sampling date / time	14-Sep-2022 13:30	14-Sep-2022 13:30	14-Sep-2022 13:30	----	----
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	**CG2212647-001**	**CG2212647-002**	**CG2212647-003**	--------	--------
					Result	Result	Result	----	----
Total Metals									
strontium, total	7440-24-6	E420	0.00020	mg/L	0.189	<0.00020	0.190	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	15.5	<0.50	15.4	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	<0.00030	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.000918	<0.000010	0.000943	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00068	<0.00050	0.00069	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0.0015	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0748	<0.00010	0.0761	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	<0.020	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	0.016	<0.010	0.015	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0060	<0.0050	0.0058	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	51.0	<0.050	51.6	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00025	<0.00010	0.00020	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	<0.10	<0.10	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	<0.00020	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	<0.010	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	<0.000050	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0071	<0.0010	0.0070	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	21.0	<0.0050	21.0	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00084	<0.00010	0.00072	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00149	<0.000050	0.00143	----	----
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.649	<0.050	0.654	----	----

Analytical Results

Sub-Matrix: Water

(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_MT1_WS_LAEMP_DRY_2022-09_N	LC_CC1_WS_LAEMP_DRY_2022-09_N	----	----
Client sampling date / time					14-Sep-2022 13:30	14-Sep-2022 13:30	14-Sep-2022 13:30	----	----
					CG2212647-001	CG2212647-002	CG2212647-003	--------	--------
					Result	Result	Result	----	----
Dissolved Metals									
selenium, dissolved	7782-49-2	E421	0.050	µg/L	2.43	<0.050	2.35	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.92	<0.050	2.97	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.80	<0.050	2.80	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.186	<0.00020	0.189	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	16.8	<0.50	16.3	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	<0.000010	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	<0.00010	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	<0.00030	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000902	<0.000010	0.000898	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	<0.00050	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	<0.0010	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	Field	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	Field	----	----

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

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **CG2212647**	Page	: 1 of 18
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 16-Sep-2022 08:50
PO	: VPO00816101	Issue Date	: 26-Sep-2022 17:39
C-O-C number	: LCO_LAEMP_DRY_2022-09_ALS		
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

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

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Water**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Method Blank (MB) Values								
Total Metals	QC-MRG2-660261001	----	aluminum, total	7429-90-5	E420	0.0034 mg/L MB-LOR	0.003 mg/L	Blank result exceeds permitted value

Result Qualifiers

Qualifier	*Description*
MB-LOR	*Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.*

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E298	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E298	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E298	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E235.Br-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E235.Br-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E235.Br-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E235.Cl-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E235.Cl-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E235.Cl-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E378-U	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E378-U	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E378-U	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	3 days	3 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E235.F	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E235.F	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E235.F	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E235.NO3-L	14-Sep-2022	16-Sep-2022	3 days	2 days	✓	16-Sep-2022	3 days	0 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E235.NO3-L	14-Sep-2022	16-Sep-2022	3 days	2 days	✓	16-Sep-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E235.NO3-L	14-Sep-2022	16-Sep-2022	3 days	2 days	✓	26-Sep-2022	3 days	10 days	✗ EHT
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E235.NO2-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E235.NO2-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E235.NO2-L	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	3 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E235.SO4	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E235.SO4	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E235.SO4	14-Sep-2022	16-Sep-2022	----	----		16-Sep-2022	28 days	2 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E318	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	28 days	4 days	✓

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E318	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E318	14-Sep-2022	18-Sep-2022	----	----		18-Sep-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E372-U	14-Sep-2022	21-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E372-U	14-Sep-2022	21-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E372-U	14-Sep-2022	21-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E421.Cr-L	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E421.Cr-L	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE dissolved (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E421.Cr-L	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E509	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E509	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E509	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E421	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E421	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE dissolved (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E421	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E358-L	14-Sep-2022	17-Sep-2022	----	----		19-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E358-L	14-Sep-2022	17-Sep-2022	----	----		19-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E358-L	14-Sep-2022	17-Sep-2022	----	----		19-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E355-L	14-Sep-2022	17-Sep-2022	----	----		19-Sep-2022	28 days	5 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E355-L	14-Sep-2022	17-Sep-2022	----	----		19-Sep-2022	28 days	5 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E355-L	14-Sep-2022	17-Sep-2022	----	----		19-Sep-2022	28 days	5 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E283	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E283	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E283	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E290	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E290	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E290	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E100	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E100	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E100	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	28 days	3 days	✓
Physical Tests : ORP by Electrode										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E125	14-Sep-2022	----	----	----		23-Sep-2022	0.25 hrs	219 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E125	14-Sep-2022	----	----	----		23-Sep-2022	0.25 hrs	219 hrs	× EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E125	14-Sep-2022	----	----	----		23-Sep-2022	0.25 hrs	219 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E108	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E108	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E108	14-Sep-2022	17-Sep-2022	----	----		17-Sep-2022	0.25 hrs	0.25 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E162	14-Sep-2022	----	----	----		19-Sep-2022	7 days	5 days	✓

Matrix: **Water**

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

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : TDS by Gravimetry										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E162	14-Sep-2022	----	----	----		19-Sep-2022	7 days	5 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E162	14-Sep-2022	----	----	----		19-Sep-2022	7 days	5 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E160-L	14-Sep-2022	----	----	----		20-Sep-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E160-L	14-Sep-2022	----	----	----		20-Sep-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E160-L	14-Sep-2022	----	----	----		20-Sep-2022	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_CC1_WS_LAEMP_DRY_2022-09_N	E121	14-Sep-2022	----	----	----		16-Sep-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-09_N	E121	14-Sep-2022	----	----	----		16-Sep-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_MT1_WS_LAEMP_DRY_2022-09_N	E121	14-Sep-2022	----	----	----		16-Sep-2022	3 days	2 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E420.Cr-L	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E420.Cr-L	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E420.Cr-L	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E508	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E508	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E508	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	28 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) LC_CC1_WS_LAEMP_DRY_2022-09_N	E420	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) LC_GRCK_WS_LAEMP_DRY_2022-09_N	E420	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓
Total Metals : Total Metals in Water by CRC ICPMS										
HDPE total (nitric acid) LC_MT1_WS_LAEMP_DRY_2022-09_N	E420	14-Sep-2022	23-Sep-2022	----	----		23-Sep-2022	180 days	9 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

EHT: Exceeded ALS recommended hold time prior to analysis.

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	652501	1	11	9.0	5.0	✓
Alkalinity Species by Titration	E290	652505	1	11	9.0	5.0	✓
Ammonia by Fluorescence	E298	652189	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Conductivity in Water	E100	652504	1	11	9.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	659978	1	17	5.8	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	661779	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	659979	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	652465	1	11	9.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651930	1	9	11.1	5.0	✓
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
ORP by Electrode	E125	660632	1	20	5.0	5.0	✓
pH by Meter	E108	652503	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
TDS by Gravimetry	E162	652307	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	660261	1	3	33.3	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	661783	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	660262	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	652469	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	657682	1	20	5.0	5.0	✓
Turbidity by Nephelometry	E121	651627	1	20	5.0	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	652501	1	11	9.0	5.0	✓
Alkalinity Species by Titration	E290	652505	1	11	9.0	5.0	✓
Ammonia by Fluorescence	E298	652189	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Conductivity in Water	E100	652504	1	11	9.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	659978	1	17	5.8	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	661779	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	659979	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	652465	1	11	9.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651930	1	9	11.1	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Control Samples (LCS) - Continued							
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
ORP by Electrode	E125	660632	1	20	5.0	5.0	✓
pH by Meter	E108	652503	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
TDS by Gravimetry	E162	652307	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	660261	1	3	33.3	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	661783	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	660262	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	652469	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	657682	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	652301	1	15	6.6	5.0	✓
Turbidity by Nephelometry	E121	651627	1	20	5.0	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	652501	1	11	9.0	5.0	✓
Alkalinity Species by Titration	E290	652505	1	11	9.0	5.0	✓
Ammonia by Fluorescence	E298	652189	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Conductivity in Water	E100	652504	1	11	9.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	659978	1	17	5.8	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	661779	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	659979	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	652465	1	11	9.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651930	1	9	11.1	5.0	✓
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
TDS by Gravimetry	E162	652307	1	20	5.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	660261	1	3	33.3	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	661783	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	660262	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	652469	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	657682	1	20	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	652301	1	15	6.6	5.0	✓
Turbidity by Nephelometry	E121	651627	1	20	5.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	652189	1	19	5.2	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	651629	1	11	9.0	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	651630	1	11	9.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	659978	1	17	5.8	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	661779	1	20	5.0	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	659979	1	19	5.2	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	652465	1	11	9.0	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	651930	1	9	11.1	5.0	✓
Fluoride in Water by IC	E235.F	651628	1	11	9.0	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	651631	1	11	9.0	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	651632	1	11	9.0	5.0	✓
Sulfate in Water by IC	E235.SO4	651633	1	11	9.0	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	660261	1	3	33.3	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	652134	1	20	5.0	5.0	✓
Total Mercury in Water by CVAAS	E508	661783	1	20	5.0	5.0	✓
Total Metals in Water by CRC ICPMS	E420	660262	1	6	16.6	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	652469	1	12	8.3	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	657682	1	20	5.0	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO 2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total Metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **CG2212647**	Page	: 1 of 18
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: Line Creek Operations PO BOX 2003 15km North Hwy 43 Sparwood BC Canada V0B 2G0	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATIONS	Date Samples Received	: 16-Sep-2022 08:50
PO	: VPO00816101	Date Analysis Commenced	: 16-Sep-2022
C-O-C number	: LCO_LAEMP_DRY_2022-09_ALS	Issue Date	: 26-Sep-2022 17:38
Sampler	: Jennifer Ings		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 3		
No. of samples analysed	: 3		

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Anthony Calero	Supervisor - Inorganic	Calgary Metals, Calgary, Alberta
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Millicent Brentnall	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Inorganics, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Sara Niroomand		Calgary Inorganics, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 651627)											
CG2212619-005	Anonymous	turbidity	----	E121	0.10	NTU	<0.10	<0.10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 652307)											
CG2212633-002	Anonymous	solids, total dissolved [TDS]	----	E162	40	mg/L	2050	2260	10.0%	20%	----
Physical Tests (QC Lot: 652501)											
CG2212637-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	3.8	3.9	0.08	Diff <2x LOR	----
Physical Tests (QC Lot: 652503)											
CG2212637-001	Anonymous	pH	----	E108	0.10	pH units	8.06	8.10	0.495%	4%	----
Physical Tests (QC Lot: 652504)											
CG2212637-001	Anonymous	conductivity	----	E100	2.0	µS/cm	1060	1060	0.755%	10%	----
Physical Tests (QC Lot: 652505)											
CG2212637-001	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	246	240	2.72%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	246	240	2.72%	20%	----
Physical Tests (QC Lot: 660632)											
CG2212631-009	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	289	286	1.01%	15%	----
Anions and Nutrients (QC Lot: 651628)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	fluoride	16984-48-8	E235.F	0.020	mg/L	0.144	0.144	0.0003	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651629)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651630)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	0.17	0.18	0.009	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651631)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.0455	0.0466	0.0011	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651632)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 651633)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	46.8	46.7	0.379%	20%	----
Anions and Nutrients (QC Lot: 651930)											

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 651930) - continued											
CG2212636-004	Anonymous	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 652134)											
CG2212616-001	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.770	0.768	0.260%	20%	----
Anions and Nutrients (QC Lot: 652189)											
CG2212631-007	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.125	mg/L	5.21	5.11	1.97%	20%	----
Anions and Nutrients (QC Lot: 657682)											
CG2212633-005	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 652465)											
CG2212626-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	0.53	0.03	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 652469)											
CG2212626-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	0.55	0.05	Diff <2x LOR	----
Total Metals (QC Lot: 660261)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00022	0.00019	0.00004	Diff <2x LOR	----
Total Metals (QC Lot: 660262)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0150	0.0095	0.0055	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00015	0.00018	0.00003	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0634	0.0621	1.96%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	0.016	0.016	0.0002	Diff <2x LOR	----
		cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0061 µg/L	0.0000088	0.0000027	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	49.2	49.0	0.500%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	0.017	0.018	0.0006	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0073	0.0072	0.00003	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	18.1	17.6	2.80%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	0.00378	0.00370	2.33%	20%	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00134	0.00136	0.949%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.653	0.628	3.92%	20%	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	1.82 µg/L	0.00190	4.25%	20%	----

Sub-Matrix: **Water**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Total Metals (QC Lot: 660262) - continued											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	silicon, total	7440-21-3	E420	0.10	mg/L	2.88	2.82	2.04%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	2.56	2.48	2.95%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.189	0.187	0.901%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	15.5	15.3	1.22%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.000918	0.000909	0.998%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	0.00068	0.00068	0.000003	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Total Metals (QC Lot: 661783)											
CG2212590-001	Anonymous	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 659978)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00025	0.00023	0.00003	Diff <2x LOR	----
Dissolved Metals (QC Lot: 659979)											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.0748	0.0759	1.40%	20%	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, dissolved	7440-42-8	E421	0.010	mg/L	0.016	0.016	0.0002	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	0.0060 µg/L	0.0000073	0.0000013	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	51.0	51.4	0.665%	20%	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0071	0.0070	0.0001	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	21.0	21.1	0.134%	20%	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00084	0.00085	0.00001	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.00149	0.00147	1.11%	20%	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 659979) - continued											
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	potassium, dissolved	7440-09-7	E421	0.050	mg/L	0.649	0.657	1.29%	20%	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	2.43 µg/L	0.00235	3.47%	20%	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.92	2.92	0.0760%	20%	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.80	2.79	0.336%	20%	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.186	0.185	0.616%	20%	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	16.8	16.5	1.95%	20%	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.000902	0.000894	0.900%	20%	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 661779)											
CG2212615-008	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	0.0000081	0.0000062	0.0000019	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 651627)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 652301)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 652307)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 652501)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 652504)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 652505)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Anions and Nutrients (QCLot: 651628)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 651629)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 651630)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 651631)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 651632)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 651633)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 651930)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 652134)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Anions and Nutrients (QCLot: 652189)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 657682)						

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 657682) - continued						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Organic / Inorganic Carbon (QCLot: 652465)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 652469)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 660261)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 660262)						
aluminum, total	7429-90-5	E420	0.003	mg/L	# 0.0034	MB-LOR
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 660262) - continued						
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Total Metals (QCLot: 661783)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 659978)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----
Dissolved Metals (QCLot: 659979)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 659979) - continued						
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 661779)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----

Qualifiers

Qualifier	*Description*
MB-LOR	*Method Blank exceeds ALS DQO. Limits of Reporting have been adjusted for samples with positive hits below 5x blank level.*

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 651627)									
turbidity	----	E121	0.1	NTU	200 NTU	113	85.0	115	----
Physical Tests (QCLot: 652301)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	91.4	85.0	115	----
Physical Tests (QCLot: 652307)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	100	85.0	115	----
Physical Tests (QCLot: 652501)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	108	85.0	115	----
Physical Tests (QCLot: 652503)									
pH	----	E108	----	pH units	7 pH units	100	98.6	101	----
Physical Tests (QCLot: 652504)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	96.5	90.0	110	----
Physical Tests (QCLot: 652505)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	101	85.0	115	----
Physical Tests (QCLot: 660632)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	99.2	95.4	104	----
Anions and Nutrients (QCLot: 651628)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	103	90.0	110	----
Anions and Nutrients (QCLot: 651629)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 651630)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 651631)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 651632)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	99.7	90.0	110	----
Anions and Nutrients (QCLot: 651633)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	104	90.0	110	----
Anions and Nutrients (QCLot: 651930)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	93.0	80.0	120	----
Anions and Nutrients (QCLot: 652134)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	95.2	75.0	125	----
Anions and Nutrients (QCLot: 652189)									

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 652189) - continued									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	102	85.0	115	----
Anions and Nutrients (QCLot: 657682)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	98.2	80.0	120	----
Organic / Inorganic Carbon (QCLot: 652465)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	118	80.0	120	----
Organic / Inorganic Carbon (QCLot: 652469)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	110	80.0	120	----
Total Metals (QCLot: 660261)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	94.1	80.0	120	----
Total Metals (QCLot: 660262)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	96.2	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	94.3	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	96.0	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	90.9	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	96.4	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	84.8	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	94.0	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	89.6	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	94.7	80.0	120	----
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	93.0	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	106	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	96.1	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	96.4	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	89.6	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	95.7	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	99.9	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	93.8	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	95.1	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	88.2	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	95.9	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	88.7	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	94.9	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	97.7	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	89.0	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Total Metals (QCLot: 660262) - continued									
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	96.4	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	99.1	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	94.2	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	92.5	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	97.1	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	88.0	80.0	120	----
Total Metals (QCLot: 661783)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	101	80.0	120	----
Dissolved Metals (QCLot: 659978)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	95.6	80.0	120	----
Dissolved Metals (QCLot: 659979)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	101	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	97.2	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	95.4	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	97.9	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	99.3	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	93.6	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	101	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	93.5	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	97.1	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	94.3	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	93.8	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	97.9	80.0	120	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	99.2	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	102	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	105	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	94.0	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	98.5	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	93.6	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	99.6	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	95.0	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	103	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	84.0	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	95.4	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	92.4	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Dissolved Metals (QCLot: 659979) - continued									
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	97.8	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	97.7	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	96.2	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	89.0	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	97.2	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	92.6	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	103	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 651628)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	fluoride	16984-48-8	E235.F	1.02 mg/L	1 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651629)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	bromide	24959-67-9	E235.Br-L	0.510 mg/L	0.5 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651630)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	chloride	16887-00-6	E235.Cl-L	100 mg/L	100 mg/L	100	75.0	125	----
Anions and Nutrients (QCLot: 651631)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	nitrate (as N)	14797-55-8	E235.NO3-L	2.53 mg/L	2.5 mg/L	101	75.0	125	----
Anions and Nutrients (QCLot: 651632)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	nitrite (as N)	14797-65-0	E235.NO2-L	0.515 mg/L	0.5 mg/L	103	75.0	125	----
Anions and Nutrients (QCLot: 651633)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	sulfate (as SO4)	14808-79-8	E235.SO4	102 mg/L	100 mg/L	102	75.0	125	----
Anions and Nutrients (QCLot: 651930)										
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0497 mg/L	0.05 mg/L	99.4	70.0	130	----
Anions and Nutrients (QCLot: 652134)										
CG2212647-001	LC_GRCK_WS_LAEMP_DRY_2022-09_N	Kjeldahl nitrogen, total [TKN]	----	E318	2.47 mg/L	2.5 mg/L	98.8	70.0	130	----
Anions and Nutrients (QCLot: 652189)										
CG2212631-008	Anonymous	ammonia, total (as N)	7664-41-7	E298	ND mg/L	0.1 mg/L	ND	75.0	125	----
Anions and Nutrients (QCLot: 657682)										
CG2212633-006	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0455 mg/L	0.05 mg/L	91.1	70.0	130	----
Organic / Inorganic Carbon (QCLot: 652465)										
CG2212626-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.84 mg/L	5 mg/L	117	70.0	130	----
Organic / Inorganic Carbon (QCLot: 652469)										
CG2212626-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.91 mg/L	5 mg/L	118	70.0	130	----
Total Metals (QCLot: 660261)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	chromium, total	7440-47-3	E420.Cr-L	0.480 mg/L	0.4 mg/L	120	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*Concentration*	*Target*	*MS*	*Low*	*High*	*Qualifier*
Total Metals (QCLot: 660262)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY _2022-09_N	aluminum, total	7429-90-5	E420	2.37 mg/L	2 mg/L	118	70.0	130	----
		antimony, total	7440-36-0	E420	0.228 mg/L	0.2 mg/L	114	70.0	130	----
		arsenic, total	7440-38-2	E420	0.230 mg/L	0.2 mg/L	115	70.0	130	----
		barium, total	7440-39-3	E420	0.234 mg/L	0.2 mg/L	117	70.0	130	----
		beryllium, total	7440-41-7	E420	0.482 mg/L	0.4 mg/L	120	70.0	130	----
		bismuth, total	7440-69-9	E420	0.115 mg/L	0.1 mg/L	115	70.0	130	----
		boron, total	7440-42-8	E420	1.09 mg/L	1 mg/L	109	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0485 mg/L	0.04 mg/L	121	70.0	130	----
		calcium, total	7440-70-2	E420	46.8 mg/L	40 mg/L	117	70.0	130	----
		cobalt, total	7440-48-4	E420	0.242 mg/L	0.2 mg/L	121	70.0	130	----
		copper, total	7440-50-8	E420	0.245 mg/L	0.2 mg/L	122	70.0	130	----
		iron, total	7439-89-6	E420	23.8 mg/L	20 mg/L	119	70.0	130	----
		lead, total	7439-92-1	E420	0.240 mg/L	0.2 mg/L	120	70.0	130	----
		lithium, total	7439-93-2	E420	1.21 mg/L	1 mg/L	121	70.0	130	----
		magnesium, total	7439-95-4	E420	11.3 mg/L	10 mg/L	113	70.0	130	----
		manganese, total	7439-96-5	E420	0.240 mg/L	0.2 mg/L	120	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.226 mg/L	0.2 mg/L	113	70.0	130	----
		nickel, total	7440-02-0	E420	0.484 mg/L	0.4 mg/L	121	70.0	130	----
		potassium, total	7440-09-7	E420	46.4 mg/L	40 mg/L	116	70.0	130	----
		selenium, total	7782-49-2	E420	0.468 mg/L	0.4 mg/L	117	70.0	130	----
		silicon, total	7440-21-3	E420	89.6 mg/L	100 mg/L	89.6	70.0	130	----
		silver, total	7440-22-4	E420	0.0495 mg/L	0.04 mg/L	124	70.0	130	----
		sodium, total	7440-23-5	E420	24.1 mg/L	20 mg/L	120	70.0	130	----
		strontium, total	7440-24-6	E420	0.239 mg/L	0.2 mg/L	119	70.0	130	----
		sulfur, total	7704-34-9	E420	216 mg/L	200 mg/L	108	70.0	130	----
		thallium, total	7440-28-0	E420	0.0454 mg/L	0.04 mg/L	114	70.0	130	----
		tin, total	7440-31-5	E420	0.228 mg/L	0.2 mg/L	114	70.0	130	----
		titanium, total	7440-32-6	E420	0.440 mg/L	0.4 mg/L	110	70.0	130	----
		uranium, total	7440-61-1	E420	0.0468 mg/L	0.04 mg/L	117	70.0	130	----
		vanadium, total	7440-62-2	E420	1.20 mg/L	1 mg/L	120	70.0	130	----
		zinc, total	7440-66-6	E420	4.62 mg/L	4 mg/L	116	70.0	130	----
Total Metals (QCLot: 661783)										
CG2212615-008	Anonymous	mercury, total	7439-97-6	E508	0.0001000 mg/L	0.0001 mg/L	100.0	70.0	130	----
Dissolved Metals (QCLot: 659978)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY _2022-09_N	chromium, dissolved	7440-47-3	E421.Cr-L	0.378 mg/L	0.4 mg/L	94.4	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 659979)										
CG2212647-002	LC_MT1_WS_LAEMP_DRY_2022-09_N	aluminum, dissolved	7429-90-5	E421	1.92 mg/L	2 mg/L	96.3	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.179 mg/L	0.2 mg/L	89.4	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.188 mg/L	0.2 mg/L	94.2	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.192 mg/L	0.2 mg/L	95.8	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.388 mg/L	0.4 mg/L	97.0	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0936 mg/L	0.1 mg/L	93.6	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.986 mg/L	1 mg/L	98.6	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0390 mg/L	0.04 mg/L	97.4	70.0	130	----
		calcium, dissolved	7440-70-2	E421	39.6 mg/L	40 mg/L	99.1	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.190 mg/L	0.2 mg/L	94.8	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.190 mg/L	0.2 mg/L	94.9	70.0	130	----
		iron, dissolved	7439-89-6	E421	19.0 mg/L	20 mg/L	95.0	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.198 mg/L	0.2 mg/L	99.1	70.0	130	----
		lithium, dissolved	7439-93-2	E421	0.973 mg/L	1 mg/L	97.3	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	9.66 mg/L	10 mg/L	96.6	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.188 mg/L	0.2 mg/L	94.0	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.192 mg/L	0.2 mg/L	96.2	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.380 mg/L	0.4 mg/L	94.9	70.0	130	----
		potassium, dissolved	7440-09-7	E421	38.5 mg/L	40 mg/L	96.3	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.387 mg/L	0.4 mg/L	96.7	70.0	130	----
		silicon, dissolved	7440-21-3	E421	101 mg/L	100 mg/L	101	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0377 mg/L	0.04 mg/L	94.3	70.0	130	----
		sodium, dissolved	7440-23-5	E421	20.0 mg/L	20 mg/L	99.9	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.193 mg/L	0.2 mg/L	96.7	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	178 mg/L	200 mg/L	89.2	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0349 mg/L	0.04 mg/L	87.4	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.176 mg/L	0.2 mg/L	88.1	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.368 mg/L	0.4 mg/L	92.1	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0352 mg/L	0.04 mg/L	88.0	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	0.946 mg/L	1 mg/L	94.6	70.0	130	----
		zinc, dissolved	7440-66-6	E421	3.80 mg/L	4 mg/L	94.9	70.0	130	----
Dissolved Metals (QCLot: 661779)										
CG2212615-009	Anonymous	mercury, dissolved	7439-97-6	E509	0.0000877 mg/L	0.0001 mg/L	87.7	70.0	130	----

Teck

COC ID:	LCO_LAEMP_DRY_2022-09_ALS	TURNAROUND TIME:	2-3 Business Days	RUSH:	Priority

PROJECT/CLIENT INFO

Facility Name / Job#	Line Creek Operations		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@Teck.com		
Address	421 Pine Avenune		
City	Sparwood	Province	BC
Postal Code	V0B 2G1	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY

Lab Name	ALS Calgary		
Lab Contact	Lyudmyla Shvets		
Email	Lyudmyla.Shvets@ALSGlobal.com		
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OTHER INFO

Report Format / Distribution		Excel	PDF	EI
Email 1:	[illegible]@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@tec	X	X	X
Email 4:	Lisa.Bowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	
PO number	VPO00816101			

Environmental Division
Calgary
Work Order Reference
CG2212647

Telephone : + 1 403 407 1800

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNHG_D	TECKCOAL_METNHG_T	TECKCOAL_ROUTINE	TOC_TKN_PT
FIlt.								F	F		F			N
PRESERV.								H2SO4	HCL		NO3	NO3		H2SO4
LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_GRCK	WS		2022/09/14	13:30	G	7	1	1	1	1	1	1	1
LC_MT1_WS_LAEMP_DRY_2022-09_N	LC_MT1	WS		2022/09/14	13:30	G	7	1	1	1	1	1	1	1
LC_CC1_WS_LAEMP_DRY_2022-09_N	LC_CC1	WS		2022/09/14	13:30	G	7	1	1	1	1	1	1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	15-Sep		9/16 850

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	X
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Jennifer Ings	Mobile #	5195003444
Sampler's Signature		Date/Time	September 15, 2022

Environmental Division
Calgary
Work Order Reference
CG2212647

WATER CHEMISTRY

ALS Laboratory Report CG2216696
(Finalized 01-Dec-22)

CERTIFICATE OF ANALYSIS

Work Order	: **CG2216696**	Page	: 1 of 10
Client	: **Teck Coal Limited**	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G1	Address	: 2559 29th Street NE Calgary AB Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 01-Dec-2022 09:00
PO	: VPO00816101	Date Analysis Commenced	: 01-Dec-2022
C-O-C number	: LAEMP_DRY_2022-11_ALS	Issue Date	: 07-Dec-2022 17:54
Sampler	: , Robin Valleau		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 7		
No. of samples analysed	: 7		

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Inorganics, Calgary, Alberta
Elke Tabora		Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Metals, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Metals, Calgary, Alberta
Ruifang Zheng	Analyst	Inorganics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Inorganics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Metals, Calgary, Alberta

General Comments

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

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

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

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

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

Unit	*Description*
-	no units
%	percent
µg/L	micrograms per litre
µS/cm	microsiemens per centimetre
meq/L	milliequivalents per litre
mg/L	milligrams per litre
mV	millivolts
NTU	nephelometric turbidity units
pH units	pH units

<: less than.

>: greater than.

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

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

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

Qualifiers

Qualifier	*Description*
DLM	*Detection Limit Adjusted due to sample matrix effects (e.g. chemical interference, colour, turbidity).*
RRV	*Reported result verified by repeat analysis.*
TKNI	*TKN result may be biased low due to Nitrate interference. Nitrate-N is > 10x TKN.*

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

					Client sample ID	LC_RD1_WS_LAEMP_DRY_2022-11_NP	LC_MT1_WS_LAEMP_DRY_2022-11_NP	LC_CC1_WS_LAEMP_DRY_2022-11_NP	LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_GRCK_WS_LAEMP_DRY_2022-11_N
					Client sampling date / time	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*		CG2216696-001	CG2216696-002	CG2216696-003	CG2216696-004	CG2216696-005
						Result	Result	Result	Result	Result
Physical Tests										
acidity (as CaCO3)	----	E283	2.0	mg/L		<2.0 RRV	<2.0 RRV	<2.0	<2.0	<2.0
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L		<1.0	2.2	199	195	159
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L		<1.0	2.7	243	238	194
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L		<1.0	<1.0	12.2	16.4	13.0
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L		<1.0	<1.0	7.3	9.8	7.8
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	<1.0
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L		<1.0	2.2	211	211	172
conductivity	----	E100	2.0	µS/cm		<2.0	3.4	856	862	377
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L		<0.50	<0.50	545	541	225
oxidation-reduction potential [ORP]	----	E125	0.10	mV		535	543	352	374	403
pH	----	E108	0.10	pH units		5.59	6.27	8.38	8.40	8.44
solids, total dissolved [TDS]	----	E162	10	mg/L		<10	<10	597	596	223
solids, total suspended [TSS]	----	E160-L	1.0	mg/L		<1.0	<1.0	<1.0	<1.0	2.9
turbidity	----	E121	0.10	NTU		<0.10	<0.10	0.36	0.34	0.28
Anions and Nutrients										
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L		<0.0050	<0.0050	0.0062	<0.0050	<0.0050
bromide	24959-67-9	E235.Br-L	0.050	mg/L		<0.050	<0.050	<0.050	<0.050	<0.050
chloride	16887-00-6	E235.Cl-L	0.10	mg/L		<0.10	<0.10	5.22	5.40	0.17
fluoride	16984-48-8	E235.F	0.020	mg/L		<0.020	<0.020	0.162	0.168	0.139
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L		<0.050	<0.050	0.987 TKNI	0.745 TKNI	<0.500 DLM
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L		<0.0050	<0.0050	14.4	14.3	0.0771
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L		<0.0010	<0.0010	0.0033	0.0035	<0.0010
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L		<0.0010	<0.0010	<0.0010	<0.0010	0.0019
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L		<0.0020	<0.0020	<0.0020	<0.0020	0.0026
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L		<0.30	<0.30	234	232	50.1
Organic / Inorganic Carbon										
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L		----	<0.50	0.68	0.64	<0.50

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_RD1_WS_LAEMP_DRY_2022-11_NP	LC_MT1_WS_LAEMP_DRY_2022-11_NP	LC_CC1_WS_LAEMP_DRY_2022-11_NP	LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_GRCK_WS_LAEMP_DRY_2022-11_N
				Client sampling date / time	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30
Analyte	*CAS Number*	*Method*	*LOR*	*Unit*	CG2216696-001	CG2216696-002	CG2216696-003	CG2216696-004	CG2216696-005
					Result	Result	Result	Result	Result
Organic / Inorganic Carbon									
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0.71	<0.50	<0.50
Ion Balance									
anion sum	----	EC101	0.10	meq/L	<0.10	<0.10	10.3	10.2	4.50
cation sum	----	EC101	0.10	meq/L	<0.10	<0.10	11.1	11.0	4.62
ion balance (cations/anions)	----	EC101	0.010	%	100	100	108	108	103
ion balance (APHA)	----	EC101	0.01	%	<0.01	<0.01	3.74	3.77	1.32
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	<0.0030	<0.0030	0.0037	0.0054	0.0048
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
barium, total	7440-39-3	E420	0.00010	mg/L	<0.00010	0.00090 RRV	0.124	0.123	0.0607
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	<0.020	<0.020	<0.020
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	0.012
cadmium, total	7440-43-9	E420	0.0050	µg/L	<0.0050	<0.0050	0.0255	0.0200	<0.0050
calcium, total	7440-70-2	E420	0.050	mg/L	<0.050	0.106 RRV	112	113	50.2
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0.00016	0.00014	0.00014
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.10	<0.10	<0.10	<0.10
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	0.00056 RRV	<0.00050	<0.00050	<0.00050
iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	<0.010	<0.010	0.012
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050
lithium, total	7439-93-2	E420	0.0010	mg/L	<0.0010	<0.0010	0.0290	0.0289	0.0064
magnesium, total	7439-95-4	E420	0.0050	mg/L	<0.0050	0.0067 RRV	49.6	48.0	19.4
manganese, total	7439-96-5	E420	0.00010	mg/L	<0.00010	0.00015 RRV	0.00151	0.00164	0.00185
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, total	7439-98-7	E420	0.000050	mg/L	<0.000050	<0.000050	0.000844	0.000806	0.00150
nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	0.00066	<0.00050	<0.00050
potassium, total	7440-09-7	E420	0.050	mg/L	<0.050	<0.050	1.51	1.40	0.666
selenium, total	7782-49-2	E420	0.050	µg/L	<0.050	<0.050	55.8	55.8	2.54

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	LC_RD1_WS_LAEMP_DRY_2022-11_NP	LC_MT1_WS_LAEMP_DRY_2022-11_NP	LC_CC1_WS_LAEMP_DRY_2022-11_NP	LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_GRCK_WS_LAEMP_DRY_2022-11_N
				Client sampling date / time	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30
					CG2216696-001	CG2216696-002	CG2216696-003	CG2216696-004	CG2216696-005
					Result	Result	Result	Result	Result
Total Metals									
silicon, total	7440-21-3	E420	0.10	mg/L	<0.10	0.35 RRV	2.62	2.67	2.96
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
sodium, total	7440-23-5	E420	0.050	mg/L	<0.050	0.511 RRV	3.47	3.40	2.49
strontium, total	7440-24-6	E420	0.00020	mg/L	<0.00020	0.00062 RRV	0.158	0.161	0.180
sulfur, total	7704-34-9	E420	0.50	mg/L	<0.50	<0.50	85.9	86.2	20.2
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
uranium, total	7440-61-1	E420	0.000010	mg/L	<0.000010	<0.000010	0.00260	0.00255	0.00117
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	----	<0.0010	<0.0010	<0.0010	<0.0010
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	----	<0.00010	0.00011	<0.00010	<0.00010
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	----	<0.00010	<0.00010	<0.00010	<0.00010
barium, dissolved	7440-39-3	E421	0.00010	mg/L	----	0.00038 RRV	0.128	0.124	0.0596
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	----	<0.020	<0.020	<0.020	<0.020
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	----	<0.000050	<0.000050	<0.000050	<0.000050
boron, dissolved	7440-42-8	E421	0.010	mg/L	----	<0.010	<0.010	<0.010	0.012
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	----	<0.0050	0.0291	0.0186	0.0053
calcium, dissolved	7440-70-2	E421	0.050	mg/L	<0.050	<0.050	131	127	55.6
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	----	<0.00010	0.00017	0.00017	0.00017
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	----	<0.10	<0.10	<0.10	<0.10
copper, dissolved	7440-50-8	E421	0.00020	mg/L	----	0.00051 RRV	0.00038	0.00025	<0.00020
iron, dissolved	7439-89-6	E421	0.010	mg/L	----	<0.010	<0.010	<0.010	<0.010
lead, dissolved	7439-92-1	E421	0.000050	mg/L	----	<0.000050	<0.000050	<0.000050	<0.000050
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	----	<0.0010	0.0312	0.0307	0.0061
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	<0.0050	0.0079 RRV	52.9	54.4	20.9
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	----	0.00015 RRV	0.00127	0.00129	0.00056

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	LC_RD1_WS_LAEMP_DRY_2022-11_NP	LC_MT1_WS_LAEMP_DRY_2022-11_NP	LC_CC1_WS_LAEMP_DRY_2022-11_NP	LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_GRCK_WS_LAEMP_DRY_2022-11_N
				Client sampling date / time	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30	30-Nov-2022 10:30
					CG2216696-001	CG2216696-002	CG2216696-003	CG2216696-004	CG2216696-005
					Result	Result	Result	Result	Result
Dissolved Metals									
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	----	<0.0000050	<0.0000050	<0.0000050	<0.0000050
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	----	<0.000050	0.000887	0.000890	0.00156
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	----	<0.00050	<0.00050	<0.00050	<0.00050
potassium, dissolved	7440-09-7	E421	0.050	mg/L	<0.050	<0.050	1.45	1.48	0.616
selenium, dissolved	7782-49-2	E421	0.050	µg/L	----	<0.050	59.6	60.9	2.84
silicon, dissolved	7440-21-3	E421	0.050	mg/L	----	<0.050	2.40	2.42	2.63
silver, dissolved	7440-22-4	E421	0.000010	mg/L	----	<0.000010	<0.000010	<0.000010	<0.000010
sodium, dissolved	7440-23-5	E421	0.050	mg/L	<0.050	0.284 RRV	3.35	3.52	2.48
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	----	<0.00020	0.172	0.176	0.193
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	----	<0.50	85.4	87.4	19.2
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	----	<0.000010	<0.000010	<0.000010	<0.000010
tin, dissolved	7440-31-5	E421	0.00010	mg/L	----	0.00025 RRV	<0.00010	<0.00010	<0.00010
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	----	<0.00030	<0.00030	<0.00030	<0.00030
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	----	<0.000010	0.00256	0.00256	0.00117
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	----	<0.00050	<0.00050	<0.00050	<0.00050
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	----	<0.0010	0.0013	0.0013	<0.0010
dissolved mercury filtration location	----	EP509	-	-	----	Field	Field	Field	Field
dissolved metals filtration location	----	EP421	-	-	Laboratory	Field	Field	Field	Field

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

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	LC_FRUS_WS_LAEMP_DRY_2022-11_N	LC_DCEF_WS_LAEMP_DRY_2022-11_N	----	----	----
				Client sampling date / time	29-Nov-2022 10:30	29-Nov-2022 10:30	----	----	----
					CG2216696-006	CG2216696-007	--------	--------	--------
					Result	Result	----	----	----
Physical Tests									
acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	----	----	----
alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	201	147	----	----	----
alkalinity, bicarbonate (as HCO3)	71-52-3	E290	1.0	mg/L	245	179	----	----	----
alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	16.6	9.0	----	----	----
alkalinity, carbonate (as CO3)	3812-32-6	E290	1.0	mg/L	10.0	5.4	----	----	----
alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, hydroxide (as OH)	14280-30-9	E290	1.0	mg/L	<1.0	<1.0	----	----	----
alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	218	156	----	----	----
conductivity	----	E100	2.0	µS/cm	792	269	----	----	----
hardness (as CaCO3), dissolved	----	EC100	0.50	mg/L	485	164	----	----	----
oxidation-reduction potential [ORP]	----	E125	0.10	mV	413	384	----	----	----
pH	----	E108	0.10	pH units	8.43	8.39	----	----	----
solids, total dissolved [TDS]	----	E162	10	mg/L	576	179	----	----	----
solids, total suspended [TSS]	----	E160-L	1.0	mg/L	1.1	<1.0	----	----	----
turbidity	----	E121	0.10	NTU	0.24	0.12	----	----	----
Anions and Nutrients									
ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	----	----	----
bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	----	----	----
chloride	16887-00-6	E235.Cl-L	0.10	mg/L	4.15	0.30	----	----	----
fluoride	16984-48-8	E235.F	0.020	mg/L	0.162	0.110	----	----	----
Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	0.876 TKNI	<0.500 DLM	----	----	----
nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	11.8	0.130	----	----	----
nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	0.0025	<0.0010	----	----	----
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	0.0135	----	----	----
phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	0.0132 DLM	----	----	----
sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	204	6.93	----	----	----
Organic / Inorganic Carbon									
carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	0.77	----	----	----
carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	0.90	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

				Client sample ID	LC_FRUS_WS_LAEMP_DRY_2022-11_N	LC_DCEF_WS_LAEMP_DRY_2022-11_N	----	----	----
				Client sampling date / time	29-Nov-2022 10:30	29-Nov-2022 10:30	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2216696-006	CG2216696-007	--------	--------	--------
					Result	Result	----	----	----
Ion Balance									
anion sum	----	EC101	0.10	meq/L	9.57	3.28	----	----	----
cation sum	----	EC101	0.10	meq/L	9.84	3.41	----	----	----
ion balance (cations/anions)	----	EC101	0.010	%	103	104	----	----	----
ion balance (APHA)	----	EC101	0.01	%	1.39	1.94	----	----	----
Total Metals									
aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0060	0.0035	----	----	----
antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	0.00015	----	----	----
arsenic, total	7440-38-2	E420	0.00010	mg/L	<0.00010	0.00018	----	----	----
barium, total	7440-39-3	E420	0.00010	mg/L	0.106	0.249	----	----	----
beryllium, total	7440-41-7	E420	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, total	7440-42-8	E420	0.010	mg/L	<0.010	0.011	----	----	----
cadmium, total	7440-43-9	E420	0.0050	µg/L	0.0238	0.0347	----	----	----
calcium, total	7440-70-2	E420	0.050	mg/L	102	35.2	----	----	----
chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00013	0.00013	----	----	----
cobalt, total	7440-48-4	E420	0.10	µg/L	<0.10	<0.10	----	----	----
copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	----	----	----
iron, total	7439-89-6	E420	0.010	mg/L	0.013	<0.010	----	----	----
lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, total	7439-93-2	E420	0.0010	mg/L	0.0252	0.0189	----	----	----
magnesium, total	7439-95-4	E420	0.0050	mg/L	43.5	14.5	----	----	----
manganese, total	7439-96-5	E420	0.00010	mg/L	0.00187	<0.00010	----	----	----
mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.000788	0.00114	----	----	----
nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	<0.00050	----	----	----
potassium, total	7440-09-7	E420	0.050	mg/L	1.19	1.09	----	----	----
selenium, total	7782-49-2	E420	0.050	µg/L	50.9	1.51	----	----	----
silicon, total	7440-21-3	E420	0.10	mg/L	2.71	3.32	----	----	----
silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----

Analytical Results

Sub-Matrix: Water
(Matrix: Water)

Analyte	CAS Number	Method	LOR	Unit	LC_FRUS_WS_LAEMP_DRY_2022-11_N	LC_DCEF_WS_LAEMP_DRY_2022-11_N	----	----	----
				Client sampling date / time	29-Nov-2022 10:30	29-Nov-2022 10:30	----	----	----
					CG2216696-006	CG2216696-007	--------	--------	--------
					Result	Result	----	----	----
Total Metals									
sodium, total	7440-23-5	E420	0.050	mg/L	3.07	2.59	----	----	----
strontium, total	7440-24-6	E420	0.00020	mg/L	0.153	0.0506	----	----	----
sulfur, total	7704-34-9	E420	0.50	mg/L	86.2	3.63	----	----	----
thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, total	7440-61-1	E420	0.000010	mg/L	0.00230	0.000424	----	----	----
vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	0.00054	----	----	----
zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	----	----	----
Dissolved Metals									
aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	----	----	----
antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	0.00014	----	----	----
arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	0.00018	----	----	----
barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.104	0.261	----	----	----
beryllium, dissolved	7440-41-7	E421	0.020	µg/L	<0.020	<0.020	----	----	----
bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	0.010	----	----	----
cadmium, dissolved	7440-43-9	E421	0.0050	µg/L	0.0196	0.0373	----	----	----
calcium, dissolved	7440-70-2	E421	0.050	mg/L	117	41.3	----	----	----
chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	0.00016	0.00011	----	----	----
cobalt, dissolved	7440-48-4	E421	0.10	µg/L	<0.10	<0.10	----	----	----
copper, dissolved	7440-50-8	E421	0.00020	mg/L	<0.00020	<0.00020	----	----	----
iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	----	----	----
lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	----	----	----
lithium, dissolved	7439-93-2	E421	0.0010	mg/L	0.0280	0.0199	----	----	----
magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	46.8	14.8	----	----	----
manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00165	<0.00010	----	----	----
mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	----	----	----
molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	0.000856	0.00125	----	----	----

Analytical Results

Sub-Matrix: **Water**

(Matrix: **Water**)

				Client sample ID	LC_FRUS_WS_LAEMP_DRY_2022-11_N	LC_DCEF_WS_LAEMP_DRY_2022-11_N	----	----	----
				Client sampling date / time	29-Nov-2022 10:30	29-Nov-2022 10:30	----	----	----
Analyte	CAS Number	Method	LOR	Unit	CG2216696-006	CG2216696-007	--------	--------	--------
					Result	Result	----	----	----
Dissolved Metals									
nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	----	----	----
potassium, dissolved	7440-09-7	E421	0.050	mg/L	1.19	1.00	----	----	----
selenium, dissolved	7782-49-2	E421	0.050	µg/L	52.0	1.70	----	----	----
silicon, dissolved	7440-21-3	E421	0.050	mg/L	2.35	2.86	----	----	----
silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
sodium, dissolved	7440-23-5	E421	0.050	mg/L	2.84	2.36	----	----	----
strontium, dissolved	7440-24-6	E421	0.00020	mg/L	0.165	0.0557	----	----	----
sulfur, dissolved	7704-34-9	E421	0.50	mg/L	78.6	2.65	----	----	----
thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	----	----	----
tin, dissolved	7440-31-5	E421	0.00010	mg/L	<0.00010	<0.00010	----	----	----
titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	----	----	----
uranium, dissolved	7440-61-1	E421	0.000010	mg/L	0.00236	0.000425	----	----	----
vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	----	----	----
zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	----	----	----
dissolved mercury filtration location	----	EP509	-	-	Field	Field	----	----	----
dissolved metals filtration location	----	EP421	-	-	Field	Field	----	----	----

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

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: CG2216696	Page	: 1 of 30
Client	: Teck Coal Limited	Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey	Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G1	Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	: ----	Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION	Date Samples Received	: 01-Dec-2022 09:00
PO	: VPO00816101	Issue Date	: 07-Dec-2022 17:55
C-O-C number	: LAEMP_DRY_2022-11_ALS		
Sampler	: , Robin Valleau		
Site	: ----		
Quote number	: Teck Coal Master Quote		
No. of samples received	: 7		
No. of samples analysed	: 7		

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

Key

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

Workorder Comments

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

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Matrix Spike outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

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

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

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

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

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

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

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E298	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E298	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E298	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E298	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E298	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E298	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Ammonia by Fluorescence										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E298	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E235.Br-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E235.Br-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E235.Br-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E235.Br-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E235.Br-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E235.Br-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Bromide in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E235.Br-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E235.Cl-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E235.Cl-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E235.Cl-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E235.Cl-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E235.Cl-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E235.Cl-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Chloride in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E235.Cl-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E378-U	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E378-U	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E378-U	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E378-U	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E378-U	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E378-U	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	2 days	✓
Anions and Nutrients : Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E378-U	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E235.F	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E235.F	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E235.F	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E235.F	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation* Preparation Date	Holding Times Rec	Holding Times Actual	Eval	*Analysis* Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E235.F	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E235.F	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Fluoride in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E235.F	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E235.NO3-L	30-Nov-2022	01-Dec-2022	3 days	1 days	✓	01-Dec-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E235.NO3-L	30-Nov-2022	01-Dec-2022	3 days	1 days	✓	01-Dec-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E235.NO3-L	30-Nov-2022	01-Dec-2022	3 days	1 days	✓	01-Dec-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E235.NO3-L	30-Nov-2022	01-Dec-2022	3 days	1 days	✓	01-Dec-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E235.NO3-L	30-Nov-2022	01-Dec-2022	3 days	1 days	✓	01-Dec-2022	3 days	0 days	✓
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E235.NO3-L	29-Nov-2022	01-Dec-2022	3 days	2 days	✓	01-Dec-2022	3 days	0 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Anions and Nutrients : Nitrate in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E235.NO3-L	29-Nov-2022	01-Dec-2022	3 days	2 days	✓	01-Dec-2022	3 days	0 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E235.NO2-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E235.NO2-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E235.NO2-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E235.NO2-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E235.NO2-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	1 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E235.NO2-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	2 days	✓
Anions and Nutrients : Nitrite in Water by IC (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E235.NO2-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	3 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E235.SO4	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E235.SO4	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E235.SO4	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E235.SO4	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E235.SO4	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E235.SO4	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Sulfate in Water by IC										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E235.SO4	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E318	30-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E318	30-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E318	30-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E318	30-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E318	30-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	3 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E318	29-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	4 days	✓
Anions and Nutrients : Total Kjeldahl Nitrogen by Fluorescence (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E318	29-Nov-2022	03-Dec-2022	----	----		03-Dec-2022	28 days	4 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E372-U	30-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E372-U	30-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E372-U	30-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E372-U	30-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	7 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E372-U	30-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	7 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E372-U	29-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	8 days	✓
Anions and Nutrients : Total Phosphorus by Colourimetry (0.002 mg/L)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E372-U	29-Nov-2022	02-Dec-2022	----	----		07-Dec-2022	28 days	8 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E421.Cr-L	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-11_N	E421.Cr-L	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E421.Cr-L	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E421.Cr-L	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E421.Cr-L	29-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Chromium in Water by CRC ICPMS (Low Level)										
HDPE - dissolved (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E421.Cr-L	29-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E509	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓

Work Order : CG2216696
Client : Teck Coal Limited
Project : LINE CREEK OPERATION

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E509	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E509	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E509	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E509	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Dissolved Metals : Dissolved Mercury in Water by CVAAS										
Glass vial dissolved (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E509	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E421	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-11_N	E421	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E421	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E421	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E421	30-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	5 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E421	29-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	6 days	✓
Dissolved Metals : Dissolved Metals in Water by CRC ICPMS										
HDPE - dissolved (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E421	29-Nov-2022	05-Dec-2022	----	----		05-Dec-2022	180 days	6 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E358-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E358-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E358-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E358-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E358-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Organic / Inorganic Carbon : Dissolved Organic Carbon by Combustion (Low Level)										
Amber glass dissolved (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E358-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E355-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E355-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E355-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E355-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E355-L	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E355-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Organic / Inorganic Carbon : Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)										
Amber glass total (sulfuric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E355-L	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E283	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E283	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	*Method*	*Sampling Date*	*Extraction / Preparation* Preparation Date	Holding Times Rec	Holding Times Actual	Eval	*Analysis* Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Acidity by Titration										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E283	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E283	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E283	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E283	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	3 days	✓
Physical Tests : Acidity by Titration										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E283	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E290	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E290	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E290	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E290	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : Alkalinity Species by Titration										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E290	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	2 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E290	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	3 days	✓
Physical Tests : Alkalinity Species by Titration										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E290	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	14 days	3 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E100	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E100	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E100	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E100	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E100	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	2 days	✓
Physical Tests : Conductivity in Water										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E100	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	3 days	✓

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Physical Tests : Conductivity in Water										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E100	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	28 days	3 days	✓
Physical Tests : ORP by Electrode										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E125	29-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	100 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E125	29-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	100 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E125	30-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	76 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E125	30-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	76 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E125	30-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	76 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E125	30-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	76 hrs	✘ EHTR-FM
Physical Tests : ORP by Electrode										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E125	30-Nov-2022	----	----	----		03-Dec-2022	0.25 hrs	76 hrs	✘ EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E108	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	✘ EHTR-FM

Matrix: **Water**

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

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : pH by Meter										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E108	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E108	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E108	29-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E108	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E108	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : pH by Meter										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E108	30-Nov-2022	02-Dec-2022	----	----		02-Dec-2022	0.25 hrs	0.26 hrs	× EHTR-FM
Physical Tests : TDS by Gravimetry										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E162	30-Nov-2022	----	----	----		03-Dec-2022	7 days	3 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E162	30-Nov-2022	----	----	----		03-Dec-2022	7 days	3 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E162	30-Nov-2022	----	----	----		03-Dec-2022	7 days	3 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Physical Tests : TDS by Gravimetry										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E162	30-Nov-2022	----	----	----		03-Dec-2022	7 days	3 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E162	30-Nov-2022	----	----	----		03-Dec-2022	7 days	3 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E162	29-Nov-2022	----	----	----		03-Dec-2022	7 days	4 days	✓
Physical Tests : TDS by Gravimetry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E162	29-Nov-2022	----	----	----		03-Dec-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E160-L	29-Nov-2022	----	----	----		03-Dec-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E160-L	29-Nov-2022	----	----	----		03-Dec-2022	7 days	4 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E160-L	30-Nov-2022	----	----	----		06-Dec-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E160-L	30-Nov-2022	----	----	----		06-Dec-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E160-L	30-Nov-2022	----	----	----		06-Dec-2022	7 days	6 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times: Rec	Holding Times: Actual	Eval	Analysis: Analysis Date	Holding Times: Rec	Holding Times: Actual	Eval
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E160-L	30-Nov-2022	----	----	----		06-Dec-2022	7 days	6 days	✓
Physical Tests : TSS by Gravimetry (Low Level)										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E160-L	30-Nov-2022	----	----	----		06-Dec-2022	7 days	6 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_CC1_WS_LAEMP_DRY_2022-11_NP	E121	30-Nov-2022	----	----	----		02-Dec-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_DCEF_WS_LAEMP_DRY_2022-11_N	E121	29-Nov-2022	----	----	----		01-Dec-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_FRB_WS_LAEMP_DRY_2022-11_N	E121	30-Nov-2022	----	----	----		02-Dec-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_FRUS_WS_LAEMP_DRY_2022-11_N	E121	29-Nov-2022	----	----	----		01-Dec-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_GRCK_WS_LAEMP_DRY_2022-11_N	E121	30-Nov-2022	----	----	----		02-Dec-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_MT1_WS_LAEMP_DRY_2022-11_NP	E121	30-Nov-2022	----	----	----		02-Dec-2022	3 days	2 days	✓
Physical Tests : Turbidity by Nephelometry										
HDPE LC_RD1_WS_LAEMP_DRY_2022-11_NP	E121	30-Nov-2022	----	----	----		02-Dec-2022	3 days	2 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E420.Cr-L	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-11_N	E420.Cr-L	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E420.Cr-L	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E420.Cr-L	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE total (nitric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E420.Cr-L	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E420.Cr-L	29-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	5 days	✓
Total Metals : Total Chromium in Water by CRC ICPMS (Low Level)										
HDPE - total (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E420.Cr-L	29-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	5 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E508	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_FRB_WS_LAEMP_DRY_2022-11_N	E508	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis: Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E508	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E508	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E508	30-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	1 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E508	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Total Metals : Total Mercury in Water by CVAAS										
Glass vial total (hydrochloric acid) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E508	29-Nov-2022	01-Dec-2022	----	----		01-Dec-2022	28 days	2 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_CC1_WS_LAEMP_DRY_2022-11_NP	E420	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_FRB_WS_LAEMP_DRY_2022-11_N	E420	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_GRCK_WS_LAEMP_DRY_2022-11_N	E420	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_MT1_WS_LAEMP_DRY_2022-11_NP	E420	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓

Matrix: **Water**

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

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation: Preparation Date	Extraction / Preparation: Holding Times Rec	Extraction / Preparation: Holding Times Actual	Extraction / Preparation: Eval	Analysis: Analysis Date	Analysis: Holding Times Rec	Analysis: Holding Times Actual	Analysis: Eval
Total Metals : Total metals in Water by CRC ICPMS										
HDPE total (nitric acid) LC_RD1_WS_LAEMP_DRY_2022-11_NP	E420	30-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	4 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_DCEF_WS_LAEMP_DRY_2022-11_N	E420	29-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	5 days	✓
Total Metals : Total metals in Water by CRC ICPMS										
HDPE - total (lab preserved) LC_FRUS_WS_LAEMP_DRY_2022-11_N	E420	29-Nov-2022	04-Dec-2022	----	----		04-Dec-2022	180 days	5 days	✓

Legend & Qualifier Definitions

EHTR-FM: Exceeded ALS recommended hold time prior to sample receipt. Field Measurement recommended

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

Quality Control Parameter Frequency Compliance

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

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Acidity by Titration	E283	765406	2	37	5.4	5.0	✓
Alkalinity Species by Titration	E290	765590	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	764773	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	764810	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	764811	1	9	11.1	5.0	✓
Conductivity in Water	E100	765588	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	767115	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	764834	1	6	16.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	767114	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	764778	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	764740	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	764809	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	764812	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	764813	1	9	11.1	5.0	✓
ORP by Electrode	E125	764762	1	20	5.0	5.0	✓
pH by Meter	E108	765589	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	764814	1	9	11.1	5.0	✓
TDS by Gravimetry	E162	765146	2	39	5.1	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	766892	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	765499	1	16	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	764833	1	7	14.2	5.0	✓
Total metals in Water by CRC ICPMS	E420	766893	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	764779	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	765467	2	40	5.0	5.0	✓
Turbidity by Nephelometry	E121	764765	3	41	7.3	5.0	✓
Laboratory Control Samples (LCS)							
Acidity by Titration	E283	765406	2	37	5.4	5.0	✓
Alkalinity Species by Titration	E290	765590	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	764773	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	764810	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	764811	1	9	11.1	5.0	✓
Conductivity in Water	E100	765588	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	767115	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	764834	1	6	16.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	767114	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	764778	1	19	5.2	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Laboratory Control Samples (LCS) - Continued							
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	764740	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	764809	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	764812	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	764813	1	9	11.1	5.0	✓
ORP by Electrode	E125	764762	1	20	5.0	5.0	✓
pH by Meter	E108	765589	1	20	5.0	5.0	✓
Sulfate in Water by IC	E235.SO4	764814	1	9	11.1	5.0	✓
TDS by Gravimetry	E162	765146	2	39	5.1	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	766892	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	765499	1	16	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	764833	1	7	14.2	5.0	✓
Total metals in Water by CRC ICPMS	E420	766893	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	764779	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	765467	2	40	5.0	5.0	✓
TSS by Gravimetry (Low Level)	E160-L	765142	2	36	5.5	5.0	✓
Turbidity by Nephelometry	E121	764765	3	41	7.3	5.0	✓
Method Blanks (MB)							
Acidity by Titration	E283	765406	2	37	5.4	5.0	✓
Alkalinity Species by Titration	E290	765590	1	20	5.0	5.0	✓
Ammonia by Fluorescence	E298	764773	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	764810	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	764811	1	9	11.1	5.0	✓
Conductivity in Water	E100	765588	1	20	5.0	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	767115	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	764834	1	6	16.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	767114	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	764778	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	764740	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	764809	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	764812	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	764813	1	9	11.1	5.0	✓
Sulfate in Water by IC	E235.SO4	764814	1	9	11.1	5.0	✓
TDS by Gravimetry	E162	765146	2	39	5.1	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	766892	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	765499	1	16	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	764833	1	7	14.2	5.0	✓
Total metals in Water by CRC ICPMS	E420	766893	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	764779	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	765467	2	40	5.0	5.0	✓

Matrix: **Water**

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

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Method Blanks (MB) - Continued							
TSS by Gravimetry (Low Level)	E160-L	765142	2	36	5.5	5.0	✓
Turbidity by Nephelometry	E121	764765	3	41	7.3	5.0	✓
Matrix Spikes (MS)							
Ammonia by Fluorescence	E298	764773	1	20	5.0	5.0	✓
Bromide in Water by IC (Low Level)	E235.Br-L	764810	1	9	11.1	5.0	✓
Chloride in Water by IC (Low Level)	E235.Cl-L	764811	1	9	11.1	5.0	✓
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L	767115	1	19	5.2	5.0	✓
Dissolved Mercury in Water by CVAAS	E509	764834	1	6	16.6	5.0	✓
Dissolved Metals in Water by CRC ICPMS	E421	767114	1	20	5.0	5.0	✓
Dissolved Organic Carbon by Combustion (Low Level)	E358-L	764778	1	19	5.2	5.0	✓
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U	764740	1	18	5.5	5.0	✓
Fluoride in Water by IC	E235.F	764809	1	9	11.1	5.0	✓
Nitrate in Water by IC (Low Level)	E235.NO3-L	764812	1	9	11.1	5.0	✓
Nitrite in Water by IC (Low Level)	E235.NO2-L	764813	1	9	11.1	5.0	✓
Sulfate in Water by IC	E235.SO4	764814	1	9	11.1	5.0	✓
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L	766892	1	17	5.8	5.0	✓
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318	765499	1	16	6.2	5.0	✓
Total Mercury in Water by CVAAS	E508	764833	1	7	14.2	5.0	✓
Total metals in Water by CRC ICPMS	E420	766893	1	20	5.0	5.0	✓
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L	764779	1	20	5.0	5.0	✓
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U	765467	2	40	5.0	5.0	✓

Methodology References and Summaries

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

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Water	E100 Calgary - Environmental	Water	APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a water sample. Conductivity measurements are temperature-compensated to 25°C.
pH by Meter	E108 Calgary - Environmental	Water	APHA 4500-H (mod)	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C). For high accuracy test results, pH should be measured in the field within the recommended 15 minute hold time.
Turbidity by Nephelometry	E121 Calgary - Environmental	Water	APHA 2130 B (mod)	Turbidity is measured by the nephelometric method, by measuring the intensity of light scatter under defined conditions.
ORP by Electrode	E125 Calgary - Environmental	Water	ASTM D1498 (mod)	Oxidation redution potential is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed, measured in mV. For high accuracy test results, it is recommended that this analysis be conducted in the field.
TSS by Gravimetry (Low Level)	E160-L Calgary - Environmental	Water	APHA 2540 D (mod)	Total Suspended Solids (TSS) are determined by filtering a sample through a glass fibre filter, following by drying of the filter at 104 ± 1°C, with gravimetric measurement of the filtered solids. Samples containing very high dissolved solid content (i.e. seawaters, brackish waters) may produce a positive bias by this method. Alternate analysis methods are available for these types of samples.
TDS by Gravimetry	E162 Calgary - Environmental	Water	APHA 2540 C (mod)	Total Dissolved Solids (TDS) are determined by filtering a sample through a glass fibre filter, with evaporation of the filtrate at 180 ± 2°C for 16 hours or to constant weight, with gravimetric measurement of the residue.
Bromide in Water by IC (Low Level)	E235.Br-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Chloride in Water by IC (Low Level)	E235.Cl-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Fluoride in Water by IC	E235.F Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrite in Water by IC (Low Level)	E235.NO2-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Nitrate in Water by IC (Low Level)	E235.NO3-L Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.
Sulfate in Water by IC	E235.SO4 Calgary - Environmental	Water	EPA 300.1 (mod)	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Acidity by Titration	E283 Calgary - Environmental	Water	APHA 2310 B (mod)	Acidity is determined by potentiometric titration to pH endpoint of 8.3
Alkalinity Species by Titration	E290 Calgary - Environmental	Water	APHA 2320 B (mod)	Total alkalinity is determined by potentiometric titration to a pH 4.5 endpoint. Bicarbonate, carbonate and hydroxide alkalinity are calculated from phenolphthalein alkalinity and total alkalinity values.
Ammonia by Fluorescence	E298 Calgary - Environmental	Water	Method Fialab 100, 2018	Ammonia in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021)
Total Kjeldahl Nitrogen by Fluorescence (Low Level)	E318 Calgary - Environmental	Water	Method Fialab 100, 2018	TKN in water is determined by automated continuous flow analysis with membrane diffusion and fluorescence detection, after reaction with OPA (ortho-phthalaldehyde). This method is approved under US EPA 40 CFR Part 136 (May 2021).
Total Organic Carbon (Non-Purgeable) by Combustion (Low Level)	E355-L Calgary - Environmental	Water	APHA 5310 B (mod)	Total Organic Carbon (Non-Purgeable), also known as NPOC (total), is a direct measurement of TOC after an acidified sample has been purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of total carbon (TC) is comprised of IC (which is common), this method is more accurate and more reliable than the TOC by subtraction method (i.e. TC minus TIC).
Dissolved Organic Carbon by Combustion (Low Level)	E358-L Calgary - Environmental	Water	APHA 5310 B (mod)	Dissolved Organic Carbon (Non-Purgeable), also known as NPOC (dissolved), is a direct measurement of DOC after a filtered (0.45 micron) sample has been acidified and purged to remove inorganic carbon (IC). Analysis is by high temperature combustion with infrared detection of CO_2. NPOC does not include volatile organic species that are purged off with IC. For samples where the majority of DC (dissolved carbon) is comprised of IC (which is common), this method is more accurate and more reliable than the DOC by subtraction method (i.e. DC minus DIC).
Total Phosphorus by Colourimetry (0.002 mg/L)	E372-U Calgary - Environmental	Water	APHA 4500-P E (mod).	Total Phosphorus is determined colourimetrically using a discrete analyzer after heated persulfate digestion of the sample.
Dissolved Orthophosphate by Colourimetry (Ultra Trace Level 0.001 mg/L)	E378-U Calgary - Environmental	Water	APHA 4500-P F (mod)	Dissolved Orthophosphate is determined colourimetrically on a sample that has been lab or field filtered through a 0.45 micron membrane filter. Field filtration is recommended to ensure test results represent conditions at time of sampling.
Total metals in Water by CRC ICPMS	E420 Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Total Chromium in Water by CRC ICPMS (Low Level)	E420.Cr-L Calgary - Environmental	Water	EPA 200.2/6020B (mod)	Water samples are digested with nitric and hydrochloric acids, and analyzed by Collision/Reaction Cell ICPMS.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Metals in Water by CRC ICPMS	E421 Calgary - Environmental	Water	APHA 3030B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS. Method Limitation (re: Sulfur): Sulfide and volatile sulfur species may not be recovered by this method.
Dissolved Chromium in Water by CRC ICPMS (Low Level)	E421.Cr-L Calgary - Environmental	Water	APHA 3030 B/EPA 6020B (mod)	Water samples are filtered (0.45 um), preserved with nitric acid, and analyzed by Collision/Reaction Cell ICPMS
Total Mercury in Water by CVAAS	E508 Calgary - Environmental	Water	EPA 1631E (mod)	Water samples undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS
Dissolved Mercury in Water by CVAAS	E509 Calgary - Environmental	Water	APHA 3030B/EPA 1631E (mod)	Water samples are filtered (0.45 um), preserved with HCl, then undergo a cold-oxidation using bromine monochloride prior to reduction with stannous chloride, and analyzed by CVAAS.
Dissolved Hardness (Calculated)	EC100 Calgary - Environmental	Water	APHA 2340B	"Hardness (as CaCO3), dissolved" is calculated from the sum of dissolved Calcium and Magnesium concentrations, expressed in CaCO3 equivalents. "Total Hardness" refers to the sum of Calcium and Magnesium Hardness. Hardness is normally or preferentially calculated from dissolved Calcium and Magnesium concentrations, because it is a property of water due to dissolved divalent cations.
Ion Balance using Dissolved Metals	EC101 Calgary - Environmental	Water	APHA 1030E	Cation Sum, Anion Sum, and Ion Balance are calculated based on guidance from APHA Standard Methods (1030E Checking Correctness of Analysis). Dissolved species are used where available. Minor ions are included where data is present. Ion Balance cannot be calculated accurately for waters with very low electrical conductivity (EC).

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Preparation for Ammonia	EP298 Calgary - Environmental	Water		Sample preparation for Preserved Nutrients Water Quality Analysis.
Digestion for TKN in water	EP318 Calgary - Environmental	Water	APHA 4500-Norg D (mod)	Samples are digested at high temperature using Sulfuric Acid with Copper catalyst, which converts organic nitrogen sources to Ammonia, which is then quantified by the analytical method as TKN. This method is unsuitable for samples containing high levels of nitrate. If nitrate exceeds TKN concentration by ten times or more, results may be biased low.
Preparation for Total Organic Carbon by Combustion	EP355 Calgary - Environmental	Water		Preparation for Total Organic Carbon by Combustion
Preparation for Dissolved Organic Carbon for Combustion	EP358 Calgary - Environmental	Water	APHA 5310 B (mod)	Preparation for Dissolved Organic Carbon
Digestion for Total Phosphorus in water	EP372 Calgary - Environmental	Water	APHA 4500-P E (mod).	Samples are heated with a persulfate digestion reagent.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dissolved Metals Water Filtration	EP421 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HNO3.
Dissolved Mercury Water Filtration	EP509 Calgary - Environmental	Water	APHA 3030B	Water samples are filtered (0.45 um), and preserved with HCl.

QUALITY CONTROL REPORT

Work Order	: **CG2216696**		Page	: 1 of 18
Client	: Teck Coal Limited		Laboratory	: Calgary - Environmental
Contact	: Nicole Zathey		Account Manager	: Lyudmyla Shvets
Address	: 421 Pine Avenue Sparwood BC Canada V0B 2G1		Address	: 2559 29th Street NE Calgary, Alberta Canada T1Y 7B5
Telephone	:		Telephone	: +1 403 407 1800
Project	: LINE CREEK OPERATION		Date Samples Received	: 01-Dec-2022 09:00
PO	: VPO00816101		Date Analysis Commenced	: 01-Dec-2022
C-O-C number	: LAEMP_DRY_2022-11_ALS		Issue Date	: 07-Dec-2022 17:54
Sampler	: , Robin Valleau ----			
Site	: ----			
Quote number	: Teck Coal Master Quote			
No. of samples received	: 7			
No. of samples analysed	: 7			

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

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

Signatories	*Position*	*Laboratory Department*
Anthony Calero	Supervisor - Inorganic	Calgary Inorganics, Calgary, Alberta
Elke Tabora		Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Harpreet Chawla	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Kevin Baxter	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Parker Sgarbossa	Laboratory Analyst	Calgary Metals, Calgary, Alberta
Ruifang Zheng	Analyst	Calgary Inorganics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Calgary Inorganics, Calgary, Alberta
Shirley Li	Team Leader - Inorganics	Calgary Metals, Calgary, Alberta
Sonthuong Bui	Laboratory Analyst	Calgary Metals, Calgary, Alberta

General Comments

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

Key :

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

Workorder Comments

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

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 764762)											
CG2216691-003	Anonymous	oxidation-reduction potential [ORP]	----	E125	0.10	mV	297	306	2.92%	15%	----
Physical Tests (QC Lot: 764765)											
CG2216657-001	Anonymous	turbidity	----	E121	0.10	NTU	<0.10	<0.10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 765146)											
CG2216669-002	Anonymous	solids, total dissolved [TDS]	----	E162	20	mg/L	244	244	0.00%	20%	----
Physical Tests (QC Lot: 765401)											
CG2216663-001	Anonymous	turbidity	----	E121	0.10	NTU	1.82	1.85	1.74%	15%	----
Physical Tests (QC Lot: 765402)											
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	turbidity	----	E121	0.10	NTU	<0.10	<0.10	0	Diff <2x LOR	----
Physical Tests (QC Lot: 765406)											
CG2216683-001	Anonymous	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 765407)											
CG2216696-007	LC_DCEF_WS_LAEMP_DRY_2022-11_N	acidity (as CaCO3)	----	E283	2.0	mg/L	<2.0	<2.0	0	Diff <2x LOR	----
Physical Tests (QC Lot: 765588)											
CG2216681-002	Anonymous	conductivity	----	E100	2.0	μS/cm	1550	1580	1.60%	10%	----
Physical Tests (QC Lot: 765589)											
CG2216681-002	Anonymous	pH	----	E108	0.10	pH units	7.76	7.74	0.258%	4%	----
Physical Tests (QC Lot: 765590)											
CG2216681-002	Anonymous	alkalinity, bicarbonate (as CaCO3)	----	E290	1.0	mg/L	446	460	3.13%	20%	----
		alkalinity, carbonate (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, hydroxide (as CaCO3)	----	E290	1.0	mg/L	<1.0	<1.0	0	Diff <2x LOR	----
		alkalinity, total (as CaCO3)	----	E290	1.0	mg/L	446	460	3.13%	20%	----
Physical Tests (QC Lot: 766414)											
CG2216688-001	Anonymous	solids, total dissolved [TDS]	----	E162	40	mg/L	2420	2520	4.17%	20%	----
Anions and Nutrients (QC Lot: 764740)											
CG2216696-001	LC_RD1_WS_LAEMP_DRY_2022-11_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 764773)											
CG2216689-001	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.0050	mg/L	<0.0050	<0.0050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Laboratory Duplicate (DUP) Report						
					LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Anions and Nutrients (QC Lot: 764809)											
CG2216689-001	Anonymous	fluoride	16984-48-8	E235.F	0.020	mg/L	0.401	0.396	1.38%	20%	----
Anions and Nutrients (QC Lot: 764810)											
CG2216689-001	Anonymous	bromide	24959-67-9	E235.Br-L	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 764811)											
CG2216689-001	Anonymous	chloride	16887-00-6	E235.Cl-L	0.10	mg/L	0.35	0.34	0.004	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 764812)											
CG2216689-001	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	0.0050	mg/L	0.251	0.252	0.159%	20%	----
Anions and Nutrients (QC Lot: 764813)											
CG2216689-001	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 764814)											
CG2216689-001	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	0.30	mg/L	85.3	84.8	0.593%	20%	----
Anions and Nutrients (QC Lot: 765467)											
CG2216679-004	Anonymous	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	<0.0020	0	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 765468)											
CG2216696-004	LC_FRB_WS_LAEMP_DRY_2022-11_N	phosphorus, total	7723-14-0	E372-U	0.0020	mg/L	<0.0020	0.0028	0.0008	Diff <2x LOR	----
Anions and Nutrients (QC Lot: 765499)											
CG2216695-002	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	0.050	mg/L	1.42	1.45	1.43%	20%	----
Organic / Inorganic Carbon (QC Lot: 764778)											
CG2216689-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Organic / Inorganic Carbon (QC Lot: 764779)											
CG2216689-001	Anonymous	carbon, total organic [TOC]	----	E355-L	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
Total Metals (QC Lot: 764833)											
CG2216696-001	LC_RD1_WS_LAEMP_DRY_2022-11_NP	mercury, total	7439-97-6	E508	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Total Metals (QC Lot: 766892)											
CG2216689-001	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.00010	mg/L	0.00021	0.00029	0.00007	Diff <2x LOR	----
Total Metals (QC Lot: 766893)											
CG2216689-001	Anonymous	aluminum, total	7429-90-5	E420	0.0030	mg/L	0.0033	0.0061	0.0028	Diff <2x LOR	----
		antimony, total	7440-36-0	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, total	7440-38-2	E420	0.00010	mg/L	0.00021	0.00013	0.00007	Diff <2x LOR	----
		barium, total	7440-39-3	E420	0.00010	mg/L	0.0470	0.0477	1.53%	20%	----
		beryllium, total	7440-41-7	E420	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, total	7440-69-9	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		boron, total	7440-42-8	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Total Metals (QC Lot: 766893) - continued											
CG2216689-001	Anonymous	cadmium, total	7440-43-9	E420	0.0000050	mg/L	0.0088 µg/L	<0.0000050	0.0000038	Diff <2x LOR	----
		calcium, total	7440-70-2	E420	0.050	mg/L	51.0	53.1	4.00%	20%	----
		cobalt, total	7440-48-4	E420	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, total	7440-50-8	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		iron, total	7439-89-6	E420	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, total	7439-92-1	E420	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, total	7439-93-2	E420	0.0010	mg/L	0.0044	0.0041	0.0003	Diff <2x LOR	----
		magnesium, total	7439-95-4	E420	0.0050	mg/L	14.9	15.6	4.47%	20%	----
		manganese, total	7439-96-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		molybdenum, total	7439-98-7	E420	0.000050	mg/L	0.00108	0.00108	0.0389%	20%	----
		nickel, total	7440-02-0	E420	0.00050	mg/L	<0.00050	0.00051	0.00001	Diff <2x LOR	----
		potassium, total	7440-09-7	E420	0.050	mg/L	0.311	0.307	0.004	Diff <2x LOR	----
		selenium, total	7782-49-2	E420	0.000050	mg/L	3.91 µg/L	0.00379	2.99%	20%	----
		silicon, total	7440-21-3	E420	0.10	mg/L	1.96	1.96	0.0285%	20%	----
		silver, total	7440-22-4	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, total	7440-23-5	E420	0.050	mg/L	1.42	1.48	3.96%	20%	----
		strontium, total	7440-24-6	E420	0.00020	mg/L	0.199	0.203	1.84%	20%	----
		sulfur, total	7704-34-9	E420	0.50	mg/L	31.8	31.5	1.11%	20%	----
		thallium, total	7440-28-0	E420	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, total	7440-31-5	E420	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		titanium, total	7440-32-6	E420	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, total	7440-61-1	E420	0.000010	mg/L	0.00184	0.00189	2.44%	20%	----
		vanadium, total	7440-62-2	E420	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, total	7440-66-6	E420	0.0030	mg/L	<0.0030	<0.0030	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 764834)											
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	mercury, dissolved	7439-97-6	E509	0.0000050	mg/L	<0.0000050	<0.0000050	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 767114)											
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	aluminum, dissolved	7429-90-5	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		antimony, dissolved	7440-36-0	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		arsenic, dissolved	7440-38-2	E421	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----
		barium, dissolved	7440-39-3	E421	0.00010	mg/L	0.00038	0.00040	0.00002	Diff <2x LOR	----
		beryllium, dissolved	7440-41-7	E421	0.000020	mg/L	<0.020 µg/L	<0.000020	0	Diff <2x LOR	----
		bismuth, dissolved	7440-69-9	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
					Laboratory Duplicate (DUP) Report						
Dissolved Metals (QC Lot: 767114) - continued											
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	boron, dissolved	7440-42-8	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		cadmium, dissolved	7440-43-9	E421	0.0000050	mg/L	<0.0050 µg/L	<0.0000050	0	Diff <2x LOR	----
		calcium, dissolved	7440-70-2	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		cobalt, dissolved	7440-48-4	E421	0.00010	mg/L	<0.10 µg/L	<0.00010	0	Diff <2x LOR	----
		copper, dissolved	7440-50-8	E421	0.00020	mg/L	0.00051	0.00051	0.000006	Diff <2x LOR	----
		iron, dissolved	7439-89-6	E421	0.010	mg/L	<0.010	<0.010	0	Diff <2x LOR	----
		lead, dissolved	7439-92-1	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		lithium, dissolved	7439-93-2	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
		magnesium, dissolved	7439-95-4	E421	0.0050	mg/L	0.0079	0.0075	0.0004	Diff <2x LOR	----
		manganese, dissolved	7439-96-5	E421	0.00010	mg/L	0.00015	<0.00010	0.00005	Diff <2x LOR	----
		molybdenum, dissolved	7439-98-7	E421	0.000050	mg/L	<0.000050	<0.000050	0	Diff <2x LOR	----
		nickel, dissolved	7440-02-0	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		potassium, dissolved	7440-09-7	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		selenium, dissolved	7782-49-2	E421	0.000050	mg/L	<0.050 µg/L	<0.000050	0	Diff <2x LOR	----
		silicon, dissolved	7440-21-3	E421	0.050	mg/L	<0.050	<0.050	0	Diff <2x LOR	----
		silver, dissolved	7440-22-4	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		sodium, dissolved	7440-23-5	E421	0.050	mg/L	0.284	0.277	0.007	Diff <2x LOR	----
		strontium, dissolved	7440-24-6	E421	0.00020	mg/L	<0.00020	<0.00020	0	Diff <2x LOR	----
		sulfur, dissolved	7704-34-9	E421	0.50	mg/L	<0.50	<0.50	0	Diff <2x LOR	----
		thallium, dissolved	7440-28-0	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		tin, dissolved	7440-31-5	E421	0.00010	mg/L	0.00025	0.00025	0.000003	Diff <2x LOR	----
		titanium, dissolved	7440-32-6	E421	0.00030	mg/L	<0.00030	<0.00030	0	Diff <2x LOR	----
		uranium, dissolved	7440-61-1	E421	0.000010	mg/L	<0.000010	<0.000010	0	Diff <2x LOR	----
		vanadium, dissolved	7440-62-2	E421	0.00050	mg/L	<0.00050	<0.00050	0	Diff <2x LOR	----
		zinc, dissolved	7440-66-6	E421	0.0010	mg/L	<0.0010	<0.0010	0	Diff <2x LOR	----
Dissolved Metals (QC Lot: 767115)											
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	chromium, dissolved	7440-47-3	E421.Cr-L	0.00010	mg/L	<0.00010	<0.00010	0	Diff <2x LOR	----

Method Blank (MB) Report

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

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 764765)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 765142)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 765146)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Physical Tests (QCLot: 765401)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 765402)						
turbidity	----	E121	0.1	NTU	<0.10	----
Physical Tests (QCLot: 765406)						
acidity (as CaCO3)	----	E283	2	mg/L	2.2	----
Physical Tests (QCLot: 765407)						
acidity (as CaCO3)	----	E283	2	mg/L	<2.0	----
Physical Tests (QCLot: 765588)						
conductivity	----	E100	1	µS/cm	<1.0	----
Physical Tests (QCLot: 765590)						
alkalinity, bicarbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, carbonate (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, hydroxide (as CaCO3)	----	E290	1	mg/L	<1.0	----
alkalinity, total (as CaCO3)	----	E290	1	mg/L	<1.0	----
Physical Tests (QCLot: 766409)						
solids, total suspended [TSS]	----	E160-L	1	mg/L	<1.0	----
Physical Tests (QCLot: 766414)						
solids, total dissolved [TDS]	----	E162	10	mg/L	<10	----
Anions and Nutrients (QCLot: 764740)						
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 764773)						
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 764809)						
fluoride	16984-48-8	E235.F	0.02	mg/L	<0.020	----
Anions and Nutrients (QCLot: 764810)						
bromide	24959-67-9	E235.Br-L	0.05	mg/L	<0.050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Anions and Nutrients (QCLot: 764811)						
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	<0.10	----
Anions and Nutrients (QCLot: 764812)						
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	<0.0050	----
Anions and Nutrients (QCLot: 764813)						
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	<0.0010	----
Anions and Nutrients (QCLot: 764814)						
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	<0.30	----
Anions and Nutrients (QCLot: 765467)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 765468)						
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	<0.0020	----
Anions and Nutrients (QCLot: 765499)						
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	<0.050	----
Organic / Inorganic Carbon (QCLot: 764778)						
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	<0.50	----
Organic / Inorganic Carbon (QCLot: 764779)						
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	<0.50	----
Total Metals (QCLot: 764833)						
mercury, total	7439-97-6	E508	0.000005	mg/L	<0.0000050	----
Total Metals (QCLot: 766892)						
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	<0.00010	----
Total Metals (QCLot: 766893)						
aluminum, total	7429-90-5	E420	0.003	mg/L	<0.0030	----
antimony, total	7440-36-0	E420	0.0001	mg/L	<0.00010	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	<0.00010	----
barium, total	7440-39-3	E420	0.0001	mg/L	<0.00010	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	<0.000020	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	<0.000050	----
boron, total	7440-42-8	E420	0.01	mg/L	<0.010	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	<0.0000050	----
calcium, total	7440-70-2	E420	0.05	mg/L	<0.050	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	<0.00010	----
copper, total	7440-50-8	E420	0.0005	mg/L	<0.00050	----
iron, total	7439-89-6	E420	0.01	mg/L	<0.010	----
lead, total	7439-92-1	E420	0.00005	mg/L	<0.000050	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Total Metals (QCLot: 766893) - continued						
lithium, total	7439-93-2	E420	0.001	mg/L	<0.0010	----
magnesium, total	7439-95-4	E420	0.005	mg/L	<0.0050	----
manganese, total	7439-96-5	E420	0.0001	mg/L	<0.00010	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	<0.000050	----
nickel, total	7440-02-0	E420	0.0005	mg/L	<0.00050	----
potassium, total	7440-09-7	E420	0.05	mg/L	<0.050	----
selenium, total	7782-49-2	E420	0.00005	mg/L	<0.000050	----
silicon, total	7440-21-3	E420	0.1	mg/L	<0.10	----
silver, total	7440-22-4	E420	0.00001	mg/L	<0.000010	----
sodium, total	7440-23-5	E420	0.05	mg/L	<0.050	----
strontium, total	7440-24-6	E420	0.0002	mg/L	<0.00020	----
sulfur, total	7704-34-9	E420	0.5	mg/L	<0.50	----
thallium, total	7440-28-0	E420	0.00001	mg/L	<0.000010	----
tin, total	7440-31-5	E420	0.0001	mg/L	<0.00010	----
titanium, total	7440-32-6	E420	0.0003	mg/L	<0.00030	----
uranium, total	7440-61-1	E420	0.00001	mg/L	<0.000010	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	<0.00050	----
zinc, total	7440-66-6	E420	0.003	mg/L	<0.0030	----
Dissolved Metals (QCLot: 764834)						
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	<0.0000050	----
Dissolved Metals (QCLot: 767114)						
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	<0.0010	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	<0.00010	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	<0.00010	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	<0.00010	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	<0.000020	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	<0.000050	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	<0.010	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	<0.0000050	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	<0.050	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	<0.00010	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	<0.00020	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	<0.010	----
lead, dissolved	7439-92-1	E421	0.00005	mg/L	<0.000050	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	<0.0010	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Dissolved Metals (QCLot: 767114) - continued						
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	<0.0050	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	<0.00010	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	<0.000050	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	<0.00050	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	<0.050	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	<0.000050	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	<0.050	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	<0.000010	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	<0.050	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	<0.00020	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	<0.50	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	<0.000010	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	<0.00010	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	<0.00030	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	<0.000010	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	<0.00050	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	<0.0010	----
Dissolved Metals (QCLot: 767115)						
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	<0.00010	----

Laboratory Control Sample (LCS) Report

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

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 764762)									
oxidation-reduction potential [ORP]	----	E125	----	mV	220 mV	99.8	95.4	104	----
Physical Tests (QCLot: 764765)									
turbidity	----	E121	0.1	NTU	200 NTU	100.0	85.0	115	----
Physical Tests (QCLot: 765142)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	94.8	85.0	115	----
Physical Tests (QCLot: 765146)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	97.0	85.0	115	----
Physical Tests (QCLot: 765401)									
turbidity	----	E121	0.1	NTU	200 NTU	102	85.0	115	----
Physical Tests (QCLot: 765402)									
turbidity	----	E121	0.1	NTU	200 NTU	103	85.0	115	----
Physical Tests (QCLot: 765406)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	107	85.0	115	----
Physical Tests (QCLot: 765407)									
acidity (as CaCO3)	----	E283	2	mg/L	50 mg/L	107	85.0	115	----
Physical Tests (QCLot: 765588)									
conductivity	----	E100	1	µS/cm	146.9 µS/cm	99.7	90.0	110	----
Physical Tests (QCLot: 765589)									
pH	----	E108	----	pH units	7 pH units	101	98.6	101	----
Physical Tests (QCLot: 765590)									
alkalinity, total (as CaCO3)	----	E290	1	mg/L	500 mg/L	104	85.0	115	----
Physical Tests (QCLot: 766409)									
solids, total suspended [TSS]	----	E160-L	1	mg/L	150 mg/L	98.2	85.0	115	----
Physical Tests (QCLot: 766414)									
solids, total dissolved [TDS]	----	E162	10	mg/L	1000 mg/L	94.4	85.0	115	----
Anions and Nutrients (QCLot: 764740)									
phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.001	mg/L	0.03 mg/L	98.1	80.0	120	----
Anions and Nutrients (QCLot: 764773)									
ammonia, total (as N)	7664-41-7	E298	0.005	mg/L	0.2 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 764809)									
fluoride	16984-48-8	E235.F	0.02	mg/L	1 mg/L	102	90.0	110	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Laboratory Control Sample (LCS) Report: Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Anions and Nutrients (QCLot: 764810)									
bromide	24959-67-9	E235.Br-L	0.05	mg/L	0.5 mg/L	101	85.0	115	----
Anions and Nutrients (QCLot: 764811)									
chloride	16887-00-6	E235.Cl-L	0.1	mg/L	100 mg/L	100	90.0	110	----
Anions and Nutrients (QCLot: 764812)									
nitrate (as N)	14797-55-8	E235.NO3-L	0.005	mg/L	2.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 764813)									
nitrite (as N)	14797-65-0	E235.NO2-L	0.001	mg/L	0.5 mg/L	101	90.0	110	----
Anions and Nutrients (QCLot: 764814)									
sulfate (as SO4)	14808-79-8	E235.SO4	0.3	mg/L	100 mg/L	102	90.0	110	----
Anions and Nutrients (QCLot: 765467)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	102	80.0	120	----
Anions and Nutrients (QCLot: 765468)									
phosphorus, total	7723-14-0	E372-U	0.002	mg/L	0.03 mg/L	97.2	80.0	120	----
Anions and Nutrients (QCLot: 765499)									
Kjeldahl nitrogen, total [TKN]	----	E318	0.05	mg/L	4 mg/L	99.3	75.0	125	----
Organic / Inorganic Carbon (QCLot: 764778)									
carbon, dissolved organic [DOC]	----	E358-L	0.5	mg/L	8.57 mg/L	97.7	80.0	120	----
Organic / Inorganic Carbon (QCLot: 764779)									
carbon, total organic [TOC]	----	E355-L	0.5	mg/L	8.57 mg/L	104	80.0	120	----
Total Metals (QCLot: 764833)									
mercury, total	7439-97-6	E508	0.000005	mg/L	0.0001 mg/L	93.9	80.0	120	----
Total Metals (QCLot: 766892)									
chromium, total	7440-47-3	E420.Cr-L	0.0001	mg/L	0.25 mg/L	101	80.0	120	----
Total Metals (QCLot: 766893)									
aluminum, total	7429-90-5	E420	0.003	mg/L	2 mg/L	106	80.0	120	----
antimony, total	7440-36-0	E420	0.0001	mg/L	1 mg/L	100	80.0	120	----
arsenic, total	7440-38-2	E420	0.0001	mg/L	1 mg/L	98.4	80.0	120	----
barium, total	7440-39-3	E420	0.0001	mg/L	0.25 mg/L	102	80.0	120	----
beryllium, total	7440-41-7	E420	0.00002	mg/L	0.1 mg/L	97.5	80.0	120	----
bismuth, total	7440-69-9	E420	0.00005	mg/L	1 mg/L	100	80.0	120	----
boron, total	7440-42-8	E420	0.01	mg/L	1 mg/L	91.1	80.0	120	----
cadmium, total	7440-43-9	E420	0.000005	mg/L	0.1 mg/L	99.9	80.0	120	----
calcium, total	7440-70-2	E420	0.05	mg/L	50 mg/L	97.2	80.0	120	----
cobalt, total	7440-48-4	E420	0.0001	mg/L	0.25 mg/L	97.4	80.0	120	----

Sub-Matrix: **Water**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Total Metals (QCLot: 766893) - continued									
copper, total	7440-50-8	E420	0.0005	mg/L	0.25 mg/L	100	80.0	120	----
iron, total	7439-89-6	E420	0.01	mg/L	1 mg/L	106	80.0	120	----
lead, total	7439-92-1	E420	0.00005	mg/L	0.5 mg/L	105	80.0	120	----
lithium, total	7439-93-2	E420	0.001	mg/L	0.25 mg/L	101	80.0	120	----
magnesium, total	7439-95-4	E420	0.005	mg/L	50 mg/L	99.5	80.0	120	----
manganese, total	7439-96-5	E420	0.0001	mg/L	0.25 mg/L	113	80.0	120	----
molybdenum, total	7439-98-7	E420	0.00005	mg/L	0.25 mg/L	99.4	80.0	120	----
nickel, total	7440-02-0	E420	0.0005	mg/L	0.5 mg/L	98.0	80.0	120	----
potassium, total	7440-09-7	E420	0.05	mg/L	50 mg/L	105	80.0	120	----
selenium, total	7782-49-2	E420	0.00005	mg/L	1 mg/L	94.7	80.0	120	----
silicon, total	7440-21-3	E420	0.1	mg/L	10 mg/L	102	60.0	140	----
silver, total	7440-22-4	E420	0.00001	mg/L	0.1 mg/L	95.2	80.0	120	----
sodium, total	7440-23-5	E420	0.05	mg/L	50 mg/L	101	80.0	120	----
strontium, total	7440-24-6	E420	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
sulfur, total	7704-34-9	E420	0.5	mg/L	50 mg/L	107	80.0	120	----
thallium, total	7440-28-0	E420	0.00001	mg/L	1 mg/L	102	80.0	120	----
tin, total	7440-31-5	E420	0.0001	mg/L	0.5 mg/L	101	80.0	120	----
titanium, total	7440-32-6	E420	0.0003	mg/L	0.25 mg/L	97.8	80.0	120	----
uranium, total	7440-61-1	E420	0.00001	mg/L	0.005 mg/L	104	80.0	120	----
vanadium, total	7440-62-2	E420	0.0005	mg/L	0.5 mg/L	103	80.0	120	----
zinc, total	7440-66-6	E420	0.003	mg/L	0.5 mg/L	91.4	80.0	120	----
mercury, dissolved	7439-97-6	E509	0.000005	mg/L	0.0001 mg/L	92.2	80.0	120	----
Dissolved Metals (QCLot: 767114)									
aluminum, dissolved	7429-90-5	E421	0.001	mg/L	2 mg/L	109	80.0	120	----
antimony, dissolved	7440-36-0	E421	0.0001	mg/L	1 mg/L	104	80.0	120	----
arsenic, dissolved	7440-38-2	E421	0.0001	mg/L	1 mg/L	103	80.0	120	----
barium, dissolved	7440-39-3	E421	0.0001	mg/L	0.25 mg/L	105	80.0	120	----
beryllium, dissolved	7440-41-7	E421	0.00002	mg/L	0.1 mg/L	105	80.0	120	----
bismuth, dissolved	7440-69-9	E421	0.00005	mg/L	1 mg/L	96.6	80.0	120	----
boron, dissolved	7440-42-8	E421	0.01	mg/L	1 mg/L	96.3	80.0	120	----
cadmium, dissolved	7440-43-9	E421	0.000005	mg/L	0.1 mg/L	101	80.0	120	----
calcium, dissolved	7440-70-2	E421	0.05	mg/L	50 mg/L	102	80.0	120	----
cobalt, dissolved	7440-48-4	E421	0.0001	mg/L	0.25 mg/L	103	80.0	120	----
copper, dissolved	7440-50-8	E421	0.0002	mg/L	0.25 mg/L	101	80.0	120	----
iron, dissolved	7439-89-6	E421	0.01	mg/L	1 mg/L	102	80.0	120	----

Sub-Matrix: **Water**

Analyte	CAS Number	Method	LOR	Unit	Spike Concentration	Recovery (%) LCS	Recovery Limits (%) Low	Recovery Limits (%) High	Qualifier
Dissolved Metals (QCLot: 767114) - continued									
lead, dissolved	7439-92-1	E421	0.00005	mg/L	0.5 mg/L	99.0	80.0	120	----
lithium, dissolved	7439-93-2	E421	0.001	mg/L	0.25 mg/L	108	80.0	120	----
magnesium, dissolved	7439-95-4	E421	0.005	mg/L	50 mg/L	114	80.0	120	----
manganese, dissolved	7439-96-5	E421	0.0001	mg/L	0.25 mg/L	106	80.0	120	----
molybdenum, dissolved	7439-98-7	E421	0.00005	mg/L	0.25 mg/L	101	80.0	120	----
nickel, dissolved	7440-02-0	E421	0.0005	mg/L	0.5 mg/L	102	80.0	120	----
potassium, dissolved	7440-09-7	E421	0.05	mg/L	50 mg/L	106	80.0	120	----
selenium, dissolved	7782-49-2	E421	0.00005	mg/L	1 mg/L	98.7	80.0	120	----
silicon, dissolved	7440-21-3	E421	0.05	mg/L	10 mg/L	103	60.0	140	----
silver, dissolved	7440-22-4	E421	0.00001	mg/L	0.1 mg/L	95.5	80.0	120	----
sodium, dissolved	7440-23-5	E421	0.05	mg/L	50 mg/L	104	80.0	120	----
strontium, dissolved	7440-24-6	E421	0.0002	mg/L	0.25 mg/L	105	80.0	120	----
sulfur, dissolved	7704-34-9	E421	0.5	mg/L	50 mg/L	104	80.0	120	----
thallium, dissolved	7440-28-0	E421	0.00001	mg/L	1 mg/L	95.9	80.0	120	----
tin, dissolved	7440-31-5	E421	0.0001	mg/L	0.5 mg/L	105	80.0	120	----
titanium, dissolved	7440-32-6	E421	0.0003	mg/L	0.25 mg/L	101	80.0	120	----
uranium, dissolved	7440-61-1	E421	0.00001	mg/L	0.005 mg/L	106	80.0	120	----
vanadium, dissolved	7440-62-2	E421	0.0005	mg/L	0.5 mg/L	107	80.0	120	----
zinc, dissolved	7440-66-6	E421	0.001	mg/L	0.5 mg/L	98.8	80.0	120	----
Dissolved Metals (QCLot: 767115)									
chromium, dissolved	7440-47-3	E421.Cr-L	0.0001	mg/L	0.25 mg/L	105	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Anions and Nutrients (QCLot: 764740)										
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	phosphate, ortho-, dissolved (as P)	14265-44-2	E378-U	0.0520 mg/L	0.05 mg/L	104	70.0	130	----
Anions and Nutrients (QCLot: 764773)										
CG2216689-002	Anonymous	ammonia, total (as N)	7664-41-7	E298	0.105 mg/L	0.1 mg/L	105	75.0	125	----
Anions and Nutrients (QCLot: 764809)										
CG2216689-002	Anonymous	fluoride	16984-48-8	E235.F	0.970 mg/L	1 mg/L	97.0	75.0	125	----
Anions and Nutrients (QCLot: 764810)										
CG2216689-002	Anonymous	bromide	24959-67-9	E235.Br-L	0.479 mg/L	0.5 mg/L	95.8	75.0	125	----
Anions and Nutrients (QCLot: 764811)										
CG2216689-002	Anonymous	chloride	16887-00-6	E235.Cl-L	96.3 mg/L	100 mg/L	96.3	75.0	125	----
Anions and Nutrients (QCLot: 764812)										
CG2216689-002	Anonymous	nitrate (as N)	14797-55-8	E235.NO3-L	2.42 mg/L	2.5 mg/L	96.7	75.0	125	----
Anions and Nutrients (QCLot: 764813)										
CG2216689-002	Anonymous	nitrite (as N)	14797-65-0	E235.NO2-L	0.488 mg/L	0.5 mg/L	97.7	75.0	125	----
Anions and Nutrients (QCLot: 764814)										
CG2216689-002	Anonymous	sulfate (as SO4)	14808-79-8	E235.SO4	94.5 mg/L	100 mg/L	94.5	75.0	125	----
Anions and Nutrients (QCLot: 765467)										
CG2216681-001	Anonymous	phosphorus, total	7723-14-0	E372-U	ND mg/L	0.05 mg/L	ND	70.0	130	----
Anions and Nutrients (QCLot: 765468)										
CG2216696-005	LC_GRCK_WS_LAEMP_DRY_2022-11_N	phosphorus, total	7723-14-0	E372-U	0.0466 mg/L	0.05 mg/L	93.1	70.0	130	----
Anions and Nutrients (QCLot: 765499)										
CG2216695-003	Anonymous	Kjeldahl nitrogen, total [TKN]	----	E318	2.64 mg/L	2.5 mg/L	106	70.0	130	----
Organic / Inorganic Carbon (QCLot: 764778)										
CG2216689-001	Anonymous	carbon, dissolved organic [DOC]	----	E358-L	5.43 mg/L	5 mg/L	108	70.0	130	----
Organic / Inorganic Carbon (QCLot: 764779)										
CG2216689-001	Anonymous	carbon, total organic [TOC]	----	E355-L	5.51 mg/L	5 mg/L	110	70.0	130	----
Total Metals (QCLot: 764833)										

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 764833) - continued										
CG2216696-002	LC_MT1_WS_LAEMP_DRY_2022-11_NP	mercury, total	7439-97-6	E508	0.0000977 mg/L	0.0001 mg/L	97.7	70.0	130	----
Total Metals (QCLot: 766892)										
CG2216689-002	Anonymous	chromium, total	7440-47-3	E420.Cr-L	0.388 mg/L	0.4 mg/L	96.9	70.0	130	----
Total Metals (QCLot: 766893)										
CG2216689-002	Anonymous	aluminum, total	7429-90-5	E420	2.27 mg/L	2 mg/L	113	70.0	130	----
		antimony, total	7440-36-0	E420	0.199 mg/L	0.2 mg/L	99.6	70.0	130	----
		arsenic, total	7440-38-2	E420	0.190 mg/L	0.2 mg/L	95.0	70.0	130	----
		barium, total	7440-39-3	E420	0.198 mg/L	0.2 mg/L	98.8	70.0	130	----
		beryllium, total	7440-41-7	E420	0.394 mg/L	0.4 mg/L	98.6	70.0	130	----
		bismuth, total	7440-69-9	E420	0.108 mg/L	0.1 mg/L	108	70.0	130	----
		boron, total	7440-42-8	E420	0.904 mg/L	1 mg/L	90.4	70.0	130	----
		cadmium, total	7440-43-9	E420	0.0404 mg/L	0.04 mg/L	101	70.0	130	----
		calcium, total	7440-70-2	E420	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, total	7440-48-4	E420	0.186 mg/L	0.2 mg/L	92.8	70.0	130	----
		copper, total	7440-50-8	E420	0.199 mg/L	0.2 mg/L	99.7	70.0	130	----
		iron, total	7439-89-6	E420	20.0 mg/L	20 mg/L	100	70.0	130	----
		lead, total	7439-92-1	E420	0.199 mg/L	0.2 mg/L	99.6	70.0	130	----
		lithium, total	7439-93-2	E420	0.923 mg/L	1 mg/L	92.3	70.0	130	----
		magnesium, total	7439-95-4	E420	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, total	7439-96-5	E420	0.204 mg/L	0.2 mg/L	102	70.0	130	----
		molybdenum, total	7439-98-7	E420	0.195 mg/L	0.2 mg/L	97.7	70.0	130	----
		nickel, total	7440-02-0	E420	0.373 mg/L	0.4 mg/L	93.2	70.0	130	----
		potassium, total	7440-09-7	E420	40.3 mg/L	40 mg/L	101	70.0	130	----
		selenium, total	7782-49-2	E420	0.399 mg/L	0.4 mg/L	99.7	70.0	130	----
		silicon, total	7440-21-3	E420	101 mg/L	100 mg/L	101	70.0	130	----
		silver, total	7440-22-4	E420	0.0436 mg/L	0.04 mg/L	109	70.0	130	----
		sodium, total	7440-23-5	E420	18.6 mg/L	20 mg/L	93.0	70.0	130	----
		strontium, total	7440-24-6	E420	0.196 mg/L	0.2 mg/L	98.0	70.0	130	----
		sulfur, total	7704-34-9	E420	188 mg/L	200 mg/L	94.0	70.0	130	----
		thallium, total	7440-28-0	E420	0.0410 mg/L	0.04 mg/L	102	70.0	130	----
		tin, total	7440-31-5	E420	0.197 mg/L	0.2 mg/L	98.7	70.0	130	----
		titanium, total	7440-32-6	E420	0.382 mg/L	0.4 mg/L	95.5	70.0	130	----
		uranium, total	7440-61-1	E420	0.0419 mg/L	0.04 mg/L	105	70.0	130	----
		vanadium, total	7440-62-2	E420	0.958 mg/L	1 mg/L	95.8	70.0	130	----

Sub-Matrix: **Water**

Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
					Concentration	Target	MS	Low	High	Qualifier
Total Metals (QCLot: 766893) - continued										
CG2216689-002	Anonymous	zinc, total	7440-66-6	E420	3.53 mg/L	4 mg/L	88.4	70.0	130	----
Dissolved Metals (QCLot: 764834)										
CG2216696-003	LC_CC1_WS_LAEMP_DRY_2022-11_NP	mercury, dissolved	7439-97-6	E509	0.0000968 mg/L	0.0001 mg/L	96.8	70.0	130	----
Dissolved Metals (QCLot: 767114)										
CG2216696-003	LC_CC1_WS_LAEMP_DRY_2022-11_NP	aluminum, dissolved	7429-90-5	E421	2.09 mg/L	2 mg/L	104	70.0	130	----
		antimony, dissolved	7440-36-0	E421	0.196 mg/L	0.2 mg/L	97.8	70.0	130	----
		arsenic, dissolved	7440-38-2	E421	0.202 mg/L	0.2 mg/L	101	70.0	130	----
		barium, dissolved	7440-39-3	E421	0.198 mg/L	0.2 mg/L	98.9	70.0	130	----
		beryllium, dissolved	7440-41-7	E421	0.432 mg/L	0.4 mg/L	108	70.0	130	----
		bismuth, dissolved	7440-69-9	E421	0.0957 mg/L	0.1 mg/L	95.7	70.0	130	----
		boron, dissolved	7440-42-8	E421	0.962 mg/L	1 mg/L	96.2	70.0	130	----
		cadmium, dissolved	7440-43-9	E421	0.0398 mg/L	0.04 mg/L	99.6	70.0	130	----
		calcium, dissolved	7440-70-2	E421	ND mg/L	40 mg/L	ND	70.0	130	----
		cobalt, dissolved	7440-48-4	E421	0.201 mg/L	0.2 mg/L	100	70.0	130	----
		copper, dissolved	7440-50-8	E421	0.201 mg/L	0.2 mg/L	100	70.0	130	----
		iron, dissolved	7439-89-6	E421	19.3 mg/L	20 mg/L	96.7	70.0	130	----
		lead, dissolved	7439-92-1	E421	0.195 mg/L	0.2 mg/L	97.5	70.0	130	----
		lithium, dissolved	7439-93-2	E421	1.08 mg/L	1 mg/L	108	70.0	130	----
		magnesium, dissolved	7439-95-4	E421	ND mg/L	10 mg/L	ND	70.0	130	----
		manganese, dissolved	7439-96-5	E421	0.206 mg/L	0.2 mg/L	103	70.0	130	----
		molybdenum, dissolved	7439-98-7	E421	0.212 mg/L	0.2 mg/L	106	70.0	130	----
		nickel, dissolved	7440-02-0	E421	0.400 mg/L	0.4 mg/L	100	70.0	130	----
		potassium, dissolved	7440-09-7	E421	40.7 mg/L	40 mg/L	102	70.0	130	----
		selenium, dissolved	7782-49-2	E421	0.394 mg/L	0.4 mg/L	98.6	70.0	130	----
		silicon, dissolved	7440-21-3	E421	96.8 mg/L	100 mg/L	96.8	70.0	130	----
		silver, dissolved	7440-22-4	E421	0.0408 mg/L	0.04 mg/L	102	70.0	130	----
		sodium, dissolved	7440-23-5	E421	21.5 mg/L	20 mg/L	108	70.0	130	----
		strontium, dissolved	7440-24-6	E421	0.213 mg/L	0.2 mg/L	106	70.0	130	----
		sulfur, dissolved	7704-34-9	E421	195 mg/L	200 mg/L	97.5	70.0	130	----
		thallium, dissolved	7440-28-0	E421	0.0378 mg/L	0.04 mg/L	94.6	70.0	130	----
		tin, dissolved	7440-31-5	E421	0.195 mg/L	0.2 mg/L	97.7	70.0	130	----
		titanium, dissolved	7440-32-6	E421	0.371 mg/L	0.4 mg/L	92.7	70.0	130	----
		uranium, dissolved	7440-61-1	E421	0.0428 mg/L	0.04 mg/L	107	70.0	130	----
		vanadium, dissolved	7440-62-2	E421	1.02 mg/L	1 mg/L	102	70.0	130	----

Sub-Matrix: **Water**

					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Dissolved Metals (QCLot: 767114) - continued										
CG2216696-003	LC_CC1_WS_LAEMP_DRY_2022-11_NP	zinc, dissolved	7440-66-6	E421	3.84 mg/L	4 mg/L	96.0	70.0	130	----
Dissolved Metals (QCLot: 767115)										
CG2216696-003	LC_CC1_WS_LAEMP_DRY_2022-11_NP	chromium, dissolved	7440-47-3	E421.Cr-L	0.407 mg/L	0.4 mg/L	102	70.0	130	----

Teck

COC ID:	LAEMP_DRY_2022-11_ALS	TURNAROUND TIME:	Regular	RUSH:	N/A

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO		
Facility Name / Job#	Line Creek Operation			Lab Name	ALS			Report Format / Distribution		Excel
Project Manager	Nicole Zathey			Lab Contact	Lyudmyla Shvets			Email 1:	[illegible]@minnow.ca	X
Email	[illegible]			Email	Lyudmyla.Shvets@ALSGlobal.com			Email 2:	teckcoal@equisonline.com	
Address	Box 2003			Address	2559 29 Street NE			Email 3:	Teck.Lab.Results@teck.com	X
	15km North Hwy 43							Email 4:	Hannah.Penner@teck.co	X
City	Sparwood	Province	BC	City	Calgary	Province	AB	Email 5:	aquascilab@teck.com	X
	V0B 2G0	Country	Canada	Postal Code	T1Y 7B5	Country	Canada	Email 6:	lborwon@minnow.ca	X
	-425-8478			Phone Number	1-403-407-1781			PO number	VPO00816101	

Environmental Division
Calgary
Work Order Reference
CG2216696

Telephone : +1 403 407 1800

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab)

	Sample ID	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	DOC	Mercury_Dissolved	Mercury_Total	TECKCOAL_METNH G_D	TECKCOAL_METNH G_T	TECKCOAL_ROUTIN E	TOC_TKN_NH3_TP
Filt.											N		N	N	N
PRESERV.									H2SO4	HCL	HCL	HNO3	HNO3	NONE	H2SO4
1	LC_RD1_WS_LAEMP_DRY_2022-11_NP	LC_RD1	WS		2022/11/~~01~~ 30	~~00:00~~ 10:30	G	#NAME? 7			1		1	1	1
2	LC-MTI-WS-LAEMP-DRY-2022-11-NP	LC-MTI	WS		2022/11/~~29~~ 30	10:30	G	#NAME? 7	X	X	X	X	X	X	X
3	LC-CCI-WS-LAEMP-DRY-2022-11-NP	LC CCI	WS		2022/11/~~29~~ 30	10:30	G	#NAME? 7	X	X	X	X	X	X	X
4	LC-FRB-WS-LAEMP-DRY-2022-11-N	LC FRB	WS		2022/11/~~29~~ 30	10:30	G	#NAME? 7	X	X	X	X	X	X	X
5	LC-GRCK-WS-LAEMP-DRY-2022-11-N	LC-GRCK	WS		2022/11/~~29~~ 30	10:30	G	#NAME? 7	X	X	X	X	X	X	X
6	LC-FRUS-WS-LAEMP-DRY-2022-11-N	LC-FRUS	WS		2022/11/~~28~~ 29	13:30	G	#NAME? 7	X	X	X	X	X	X	X
7	LC-DCEF-WS-LAEMP-DRY-2022-11-N	LC-DCEF	WS		2022/11/29	10:30	G	#NAME? 7	X	X	X	X	X	X	X
								#NAME?							
								#NAME?							
								#NAME?							

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	ROBIN VALLEAU / minnow	NOV 30/2022	[signature]	12/1 9:00

SERVICE REQUEST (rush - subject to availability)	
Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	RValleau	Mobile #	416 970-7535
Sampler's Signature		Date/Time	NOV/30/2022

6C

Environmental Division
Calgary
Work Order Reference
CG2216696

SELENIUM SPECIATION

BAL Final Report 2205247
(Finalized 02-June-22)

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

June 2, 2022

Teck Resources Limited - Vancouver
Mike Pope
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
mike.pope@teck.com

Re: Line creek operations

Dear Mike Pope,

On May 19, 2022, Brooks Applied Labs (BAL) received four (4) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable Se and Dissolved Se
Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation
Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [$SeSO_3$], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H Holding time and/or preservation requirements not met. Please see narrative for explanation.
J Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1 Estimated value. A full explanation is presented in the narrative.
M Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R Rejected, unusable value. A full explanation is presented in the narrative.
U Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	**Matrix**	**ISO and Non-Gov. TNI Accredited Analyte(s)**
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP	2205247-01	WS	Sample	05/11/2022	05/19/2022
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP	2205247-02	WS	Sample	05/11/2022	05/19/2022
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP	2205247-03	WS	Sample	05/11/2022	05/19/2022
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP	2205247-04	WS	Sample	05/11/2022	05/19/2022
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP	2205247-05	WS	Sample	05/11/2022	05/19/2022
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP	2205247-06	WS	Sample	05/11/2022	05/19/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
MeSe(IV)	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
MeSe(VI)	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
Se	Water	EPA 1638 Mod	05/20/2022	05/23/2022	B221118	S220564
Se(IV)	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
Se(VI)	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
SeCN	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
SeMet	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
SeSO3	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553
Unk Se Sp	Water	SOP BAL-4201	05/19/2022	05/20/2022	B221103	S220553

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP										
2205247-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-01	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-01	Se(IV)	WS	D	0.175		0.010	0.075	µg/L	B221103	S220553
2205247-01	Se(VI)	WS	D	52.7		0.010	0.055	µg/L	B221103	S220553
2205247-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B221103	S220553
2205247-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B221103	S220553
2205247-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B221103	S220553
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP										
2205247-02	Se	WS	D	49.0		0.165	0.528	µg/L	B221118	S220564
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP										
2205247-03	Se	WS	TR	49.4		0.165	0.528	µg/L	B221118	S220564
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP										
2205247-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-04	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-04	Se(IV)	WS	D	0.033	J	0.010	0.075	µg/L	B221103	S220553
2205247-04	Se(VI)	WS	D	1.52		0.010	0.055	µg/L	B221103	S220553
2205247-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B221103	S220553
2205247-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221103	S220553
2205247-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B221103	S220553
2205247-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B221103	S220553
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP										
2205247-05	Se	WS	D	1.68		0.165	0.528	µg/L	B221118	S220564
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP										
2205247-06	Se	WS	TR	1.79		0.165	0.528	µg/L	B221118	S220564

Accuracy & Precision Summary

Batch: B221103
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B221103-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.515	µg/L	108%	75-125		
	Se(IV)		5.000	4.996	µg/L	100%	75-125		
	Se(VI)		5.000	4.875	µg/L	98%	75-125		
	SeCN		5.015	4.810	µg/L	96%	75-125		
	SeMet		4.932	4.935	µg/L	100%	75-125		
B221103-DUP4	**Duplicate, (2205247-04)**								
	DMSeO	ND		ND	µg/L			N/C	25
	MeSe(IV)	ND		ND	µg/L			N/C	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.033		0.027	µg/L			22%	25
	Se(VI)	1.520		1.490	µg/L			2%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B221103-MS4	**Matrix Spike, (2205247-04)**								
	Se(IV)	0.033	4.900	4.741	µg/L	96%	75-125		
	Se(VI)	1.520	5.100	6.358	µg/L	95%	75-125		
	SeCN	ND	1.962	1.703	µg/L	87%	75-125		
	SeMet	ND	1.977	1.835	µg/L	93%	75-125		
B221103-MSD4	**Matrix Spike Duplicate, (2205247-04)**								
	Se(IV)	0.033	4.900	4.693	µg/L	95%	75-125	1%	25
	Se(VI)	1.520	5.100	6.366	µg/L	95%	75-125	0.1%	25
	SeCN	ND	1.962	1.725	µg/L	88%	75-125	1%	25
	SeMet	ND	1.977	1.824	µg/L	92%	75-125	0.6%	25

Accuracy & Precision Summary

Batch: B221118
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B221118-BS1	**Blank Spike, (2128022)**								
	Se		200.0	195.1	µg/L	98%	75-125		
B221118-BS2	**Blank Spike, (2128022)**								
	Se		200.0	195.9	µg/L	98%	75-125		
B221118-BS3	**Blank Spike, (2128022)**								
	Se		200.0	197.9	µg/L	99%	75-125		
B221118-SRM1	**Reference Material (2145011, TMDA 51.5 Reference Standard - Bottle 10 - SRM)**								
	Se		14.30	13.87	µg/L	97%	75-125		
B221118-SRM2	**Reference Material (2145011, TMDA 51.5 Reference Standard - Bottle 10 - SRM)**								
	Se		14.30	14.08	µg/L	98%	75-125		
B221118-SRM3	**Reference Material (2145011, TMDA 51.5 Reference Standard - Bottle 10 - SRM)**								
	Se		14.30	13.91	µg/L	97%	75-125		
B221118-DUP3	**Duplicate, (2205247-06)**								
	Se	1.793		1.721	µg/L			4%	20
B221118-MS3	**Matrix Spike, (2205247-06)**								
	Se	1.793	220.0	216.5	µg/L	98%	75-125		
B221118-MSD3	**Matrix Spike Duplicate, (2205247-06)**								
	Se	1.793	220.0	221.6	µg/L	100%	75-125	2%	20

Method Blanks & Reporting Limits

Batch: B221103
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B221103-BLK1	0.00	µg/L
B221103-BLK2	0.00	µg/L
B221103-BLK3	0.00	µg/L
B221103-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B221118
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B221118-BLK1	0.097	µg/L
B221118-BLK2	0.071	µg/L
B221118-BLK3	0.083	µg/L
B221118-BLK4	0.028	µg/L

Average: 0.070
Limit: 0.480

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2205247-01
Sample: LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 05/11/2022
Received: 05/19/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 5 - 2205247
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 5 - 2205247
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 5 - 2205247

Lab ID: 2205247-02
Sample: LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 05/11/2022
Received: 05/19/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2152004	<2	Cooler 5 - 2205247

Lab ID: 2205247-03
Sample: LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 05/11/2022
Received: 05/19/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2152004	<2	Cooler 5 - 2205247

Lab ID: 2205247-04
Sample: LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 05/11/2022
Received: 05/19/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 5 - 2205247
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 5 - 2205247
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 5 - 2205247

Sample Containers

Lab ID: 2205247-05
Sample: LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 05/11/2022
Received: 05/19/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2152004	<2	Cooler 5 - 2205247

Lab ID: 2205247-06
Sample: LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 05/11/2022
Received: 05/19/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2152004	<2	Cooler 5 - 2205247

Shipping Containers

Cooler 5 - 2205247

Received: May 19, 2022 7:00
Tracking No: PAPS#RWHV99228 via Courier
Coolant Type: Ice
Temperature: 1.8 °C

Description: Large Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#33

Custody seals present? No
Custody seals intact? No
COC present? Yes

Teck

COC ID:	LCO Dry LAEMP_2022_MAY_Brooks	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO

Facility Name / Job#	Line creek operations		
Project Manager	Mike Pope		
Email	Mike.Pope@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8202		

LABORATORY

Lab Name	Brooks Applied Labs		
Lab Contact	Ben Wozniak		
Email	Ben@brooksapplied.com		
Address	18804 North Creek Parkway		
	Suite 100		
City	Bothell	Province	WA
Postal Code	98011	Country	United S
Phone Number	(206) 753-6158		

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:		X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	lbowron@minnow.ca	X	X	X
Email 6:	Robin.valleau@minnow.c	X	X	X
PO number	748540			

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation	Brooks_Se_D	Brooks_Se_T
Filtered								F	F	N
Preserved								N	N	N
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP	LC_FRUS	WS	No	11-May-22	10:30	G	1	1		
LC_FRUS_WS_LAEMP_LCO_DRY_2022-05_NP	LC_FRUS	WS	No	11-May-22	10:30	G	2		1	1
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP	LC_GRCK	WS	No	11-May-22	13:30	G	1	1		
LC_GRCK_WS_LAEMP_LCO_DRY_2022-05_NP	LC_GRCK	WS	No	11-May-22	13:30	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Valleau	May 13 2022	UW1 BAL	5/19/22 1100

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	RV	Date/Time	May 13 2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 92280

Sparwood, BC
Terrace, BC
Red Deer, AB

Vancouver, BC
Calgary, AB
Montreal, QC

Prince George, BC
Edmonton, AB
Spokane, WA

Elkford, BC
Ft. McMurray, AB
Shelby, MT

Tumbler Ridge, BC
Hinton, AB
Gillette, WY

INVOICE TO

DATE

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM)

CONSIGNEE (TO)

STREET

STREET

CITY/PROVINCE

POSTAL CODE

CITY/PROVINCE

POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
		52 lbs

FREIGHT CHARGES
SHIPPER TO CHECK

☐ PREPAID ☐ COLLECT

If not indicated, shipping will automatically move collect.

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise.
$

DRIVER'S SIGNATURE - PICK UP BY

PICK UP TIME

DRIVER'S SIGNATURE - DELIVERY BY

FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice thereof setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading, in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT

CONSIGNEE PRINT

DATE 5/18/22

SHIPPER SIGN

CONSIGNEE SIGN

TIME

2

NUMBER OF PIECES RECEIVED

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper

GST # 864540398RT0001

AMIGOS PRINTING

Cooler ID: Cooler 5 **COC (Y/N)** **Temperature:** 1.8 **IR:** 33

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations: LC EV KC7 sedimenta

Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	125mL Plastic	60mL plastic		60mL plastic		Plastic bag				

125mL plastic

40mL glass

Opened By: WW **Date:** 5/19/22

COPY

2205247

Effective 7/29/20

Revision 004

SELENIUM SPECIATION

BAL Final Report 2206435
(Finalized 22-July-22)

BROOKS APPLIED LABS
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

July 22, 2022

Teck Resources Limited - Vancouver
Nicole Zathey
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
nicole.zathey@teck.com

Re: Line creek operations

Dear Nicole Zathey,

On June 30, 2022, Brooks Applied Labs (BAL) received four (4) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

The client sample *LC_CC1_WS_LAEMP_DRY_2022-06_NP* was listed on the COC form, but there were no containers with this description included in the sample shipment. Brooks Applied Labs (BAL) did receive an extra set of samples. The information on the container labels is provided in in the table below.

Extra Samples Received with the Sample Shipment

Sample ID (on container label)	Analysis
LC_MTI_WS_2022-06-NP	Se Speciation
LC_MTI_WS_2022-06-NP_NAL	Dissolved Recoverable Se
LC_MTI_WS_2022-06-NP_NAL	Total Recoverable Se

The client was informed, and BAL was advised that the *LC_MTI* samples were the missing *LC_CC1* samples present on the COC form. For reporting, the *LC_MTI* samples were renamed to reflect the *LC_CC1* samples described on the COC form. A summary of the **Sample ID** designations is provided in the table below.

Samples ID Cross Reference Table

Laboratory ID	Sample ID (on COC form)	Sample ID (on container label)	Analysis
2206435-07	LC_CC1_WS_LAEMP_DRY_2022-06_NP	LC_MTI_WS_2022-06-NP	Se Speciation
2206435-08	LC_CC1_WS_LAEMP_DRY_2022-06_NP	LC_MTI_WS_2022-06-NP_NAL	Dissolved Se
2206435-09	LC_CC1_WS_LAEMP_DRY_2022-06_NP	LC_MTI_WS_2022-06-NP_NAL	Total Recoverable Se

For samples 2206435-07, 2206435-08, and 2206435-09, the **Sample ID** values provided on the COC form (*column two in the table above*) were used for reporting.

Date/Time Collected values listed on the chain-of-custody (COC) form did not exactly match the corresponding **Date/Time Collected** values on the container labels for 2206435-02 and 2206435-03. The discrepancies are described in the table below.

Date/Time Collected Discrepancies

Laboratory ID	Sample ID	Date/Time Collected (on COC form)	Date/Time Collected (on container label)
2206435-02	LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	06/22/2022 12:00	06/21/2022 12:00
2206435-03	LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	06/22/2022 12:00	06/21/2022 12:00

2206435-02 and 2206435-03 were logged in and reported using the **Date/Time Collected** values listed on the COC form (column 3 in the table above).

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable Se and Dissolved Se

Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

In the trace metals digest (Batch B221452), the four method blank samples (B221452-BLK1, B221452-BLK2, B221452-BLK3, and B221452-BLK4) produced selenium results greater than the associated method reporting limits (MRL). Associated client sample results are greater than ten times the value of the elevated results in the method blanks. The potential the impact of the of the elevated selenium in (B221452-BLK1, B221452-BLK2, B221452-BLK3, and B221452-BLK4) is minimal for these samples. No corrective actions were needed, and no data were qualified based on the elevated selenium in the Batch B221452 method blanks.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [$SeSO_3$], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	2206435-01	WS	Sample	06/22/2022	06/30/2022
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	2206435-02	WS	Sample	06/22/2022	06/30/2022
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	2206435-03	WS	Sample	06/22/2022	06/30/2022
Sample does not exist	2206435-04	WS	Sample	06/22/2022	06/30/2022
Sample does not exist	2206435-05	WS	Sample	06/22/2022	06/30/2022
Sample does not exist	2206435-06	WS	Sample	06/22/2022	06/30/2022
LC_CC1_WS_LAEMP_DRY_2022-06_NP	2206435-07	WS	Sample	unknown	06/30/2022
LC_CC1_WS_LAEMP_DRY_2022-06_NP	2206435-08	WS	Sample	unknown	06/30/2022
LC_CC1_WS_LAEMP_DRY_2022-06_NP	2206435-09	WS	Sample	unknown	06/30/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
MeSe(IV)	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
MeSe(VI)	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
Se	Water	EPA 1638 Mod	07/01/2022	07/08/2022	B221452	S220697
Se(IV)	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
Se(VI)	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
SeCN	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
SeMet	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
SeSO3	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685
Unk Se Sp	Water	SOP BAL-4201	06/29/2022	07/01/2022	B221439	S220685

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP										
2206435-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-01	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-01	Se(IV)	WS	D	0.079		0.010	0.075	µg/L	B221439	S220685
2206435-01	Se(VI)	WS	D	21.3		0.010	0.055	µg/L	B221439	S220685
2206435-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B221439	S220685
2206435-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B221439	S220685
2206435-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B221439	S220685
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP										
2206435-02	Se	WS	D	23.7		0.165	0.528	µg/L	B221452	S220697
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP										
2206435-03	Se	WS	TR	23.4		0.165	0.528	µg/L	B221452	S220697
LC_CC1_WS_LAEMP_DRY_2022-06_NP										
2206435-07	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-07	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-07	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-07	Se(IV)	WS	D	0.080		0.010	0.075	µg/L	B221439	S220685
2206435-07	Se(VI)	WS	D	21.2		0.010	0.055	µg/L	B221439	S220685
2206435-07	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B221439	S220685
2206435-07	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B221439	S220685
2206435-07	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B221439	S220685
2206435-07	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B221439	S220685
LC_CC1_WS_LAEMP_DRY_2022-06_NP										
2206435-08	Se	WS	D	23.4		0.165	0.528	µg/L	B221452	S220697
LC_CC1_WS_LAEMP_DRY_2022-06_NP										
2206435-09	Se	WS	TR	24.2		0.165	0.528	µg/L	B221452	S220697

Accuracy & Precision Summary

Batch: B221439
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	REC Limits	RPD	RPD Limits
B221439-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.761	µg/L	113%	75-125		
	Se(IV)		5.000	4.815	µg/L	96%	75-125		
	Se(VI)		5.000	4.567	µg/L	91%	75-125		
	SeCN		5.015	4.982	µg/L	99%	75-125		
	SeMet		4.932	4.865	µg/L	99%	75-125		
B221439-DUP4	**Duplicate, (2206434-07)**								
	DMSeO	0.020		0.019	µg/L			8%	25
	MeSe(IV)	0.042		0.044	µg/L			4%	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.523		0.525	µg/L			0.4%	25
	Se(VI)	2.104		2.081	µg/L			1%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B221439-MS4	**Matrix Spike, (2206434-07)**								
	Se(IV)	0.523	4.900	4.942	µg/L	90%	75-125		
	Se(VI)	2.104	5.100	6.583	µg/L	88%	75-125		
	SeCN	ND	1.962	1.783	µg/L	91%	75-125		
	SeMet	ND	1.977	1.901	µg/L	96%	75-125		
B221439-MSD4	**Matrix Spike Duplicate, (2206434-07)**								
	Se(IV)	0.523	4.900	4.932	µg/L	90%	75-125	0.2%	25
	Se(VI)	2.104	5.100	6.535	µg/L	87%	75-125	0.7%	25
	SeCN	ND	1.962	1.774	µg/L	90%	75-125	0.5%	25
	SeMet	ND	1.977	1.894	µg/L	96%	75-125	0.4%	25

Accuracy & Precision Summary

Batch: B221452
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC	REC Limits	RPD	RPD Limits
B221452-BS1	**Blank Spike, (2137005)**								
	Se		200.0	186.3	µg/L	93%	75-125		
B221452-BS2	**Blank Spike, (2137005)**								
	Se		200.0	195.5	µg/L	98%	75-125		
B221452-SRM1	**Reference Material (2214010, TMDA 51.5 Reference Standard - Bottle 2 - SRM)**								
	Se		14.30	14.34	µg/L	100%	75-125		
B221452-SRM2	**Reference Material (2214010, TMDA 51.5 Reference Standard - Bottle 2 - SRM)**								
	Se		14.30	13.38	µg/L	94%	75-125		
B221452-DUP2	**Duplicate, (2206435-03)**								
	Se	23.43		23.32	µg/L			0.5%	20
B221452-MS2	**Matrix Spike, (2206435-03)**								
	Se	23.43	220.0	235.2	µg/L	96%	75-125		
B221452-MSD2	**Matrix Spike Duplicate, (2206435-03)**								
	Se	23.43	220.0	230.2	µg/L	94%	75-125	2%	20

Method Blanks & Reporting Limits

Batch: B221439
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B221439-BLK1	0.00	µg/L
B221439-BLK2	0.00	µg/L
B221439-BLK3	0.00	µg/L
B221439-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B221452
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B221452-BLK1	0.626	µg/L
B221452-BLK2	0.566	µg/L
B221452-BLK3	0.574	µg/L
B221452-BLK4	0.521	µg/L
Average:	*0.572*	
Limit:	0.480	

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2206435-01 **Report Matrix:** WS **Collected:** 06/22/2022
Sample: LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2206435
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2206435
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2206435

Lab ID: 2206435-02 **Report Matrix:** WS **Collected:** 06/22/2022
Sample: LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2218038	<2	Cooler 6 - 2206435

Lab ID: 2206435-03 **Report Matrix:** WS **Collected:** 06/22/2022
Sample: LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2218038	<2	Cooler 6 - 2206435

Lab ID: 2206435-04 **Report Matrix:** WS **Collected:** 06/22/2022
Sample: Sample does not exist **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2206435
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2206435
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2206435

Sample Containers

Lab ID: 2206435-05 **Report Matrix:** WS **Collected:** 06/22/2022
Sample: Sample does not exist **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2218038	<2	Cooler 6 - 2206435

Lab ID: 2206435-06 **Report Matrix:** WS **Collected:** 06/22/2022
Sample: Sample does not exist **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2218038	<2	Cooler 6 - 2206435

Lab ID: 2206435-07 **Report Matrix:** WS **Collected:** unknown
Sample: LC_CC1_WS_LAEMP_DRY_2022-06_NP **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2206435
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2206435
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2206435

Lab ID: 2206435-08 **Report Matrix:** WS **Collected:** unknown
Sample: LC_CC1_WS_LAEMP_DRY_2022-06_NP **Sample Type:** Sample + Sum **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2218038	<2	Cooler 6 - 2206435

Lab ID: 2206435-09 **Report Matrix:** WS **Collected:** unknown
Sample: LC_CC1_WS_LAEMP_DRY_2022-06_NP **Sample Type:** Sample **Received:** 06/30/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2218038	<2	Cooler 6 - 2206435

Shipping Containers

Cooler 6 - 2206435

Received: June 30, 2022 7:00
Tracking No: PAPS#RWHV55065 via Courier
Coolant Type: Ice
Temperature: -1.8 °C

Description: stryrofoam cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:33

Custody seals present? No
Custody seals intact? No
COC present? Yes

Confidential **Teck**

COC ID:	LCO Dry LAEMP_2022_June_Brooks	TURNAROUND TIME:		RUSH:	

PROJECT/CLIENT INFO

Facility Name / Job#	Line creek operations		
Project Manager	Nicole Zathey		
Email	nicole.zathey@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8202		

LABORATORY

Lab Name	Brooks Applied Labs		
Lab Contact	Ben Wozniak		
Email	Ben@brooksapplied.com		
Address	18804 North Creek Parkway		
	Suite 100		
City	Bothell	Province	WA
Postal Code	98011	Country	United S
Phone Number	(206) 753-6158		

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	[illegible]	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	TeckLabResults@teck.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	lbowron@minnow.ca	X	X	X
Email 6:	Robin.valleau@minnow.c	X	X	X
PO number	PO 817033			

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered : F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation	Brooks_Se_D	Brooks_Se_T
Filtered								F	F	N
Preserved								N	N	N
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	LC_FRUS	WS	No	22-Jun-22	12:00	G	1	1		
LC_FRUS_WS_LAEMP_LCO_DRY_2022-06_NP	LC_FRUS	WS	No	22-Jun-22	12:00	G	2		1	1
LC_CC1_WS_LAEMP_DRY_2022-06_NP	LC_CC1	WS	No	22-Jun-22	12:00	G	1	1		
LC_CC1_WS_LAEMP_DRY_2022-06_NP	LC-CC1	WS	No	22-Jun-22	12:00	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Robin Valleau	June 22, 2022	[signature] (BAL)	6/30/22 07:00

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Robin Valleau		416-970-7535
Sampler's Signature		Date/Time	June 22, 2022

RW Hot Shot Service Inc.

24 Hour Hot Shot Service

P.O. BOX 276, SPARWOOD, BC V0B 2G0
PHONE: (250) 425-7447
FAX: (250) 425-7450

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

55065

INVOICE TO	DATE June 28-22
BILL OF LADING #	PURCHASE ORDER NUMBER
SHIPPER (FROM) Teck Coal Ltd	CONSIGNEE (TO) Brooks Applied Labs
STREET West Line Creek Treatment	STREET 13751 Lake City Way NE (Ste 108)
CITY/PROVINCE Sparwood BC / POSTAL CODE	CITY/PROVINCE Seattle, WA / POSTAL CODE 98125
INTERLINE CARRIER	WAY BILL #
SPECIAL INSTRUCTIONS Tracking# 2206A6163	

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
4	Coolers - Water Samples	149 LBS
	PAPS# RWHV55065	

FREIGHT CHARGES

SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated shipping will automatically move collect

WAITING
XPU
CHARGES
FSC
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK WRITE ORD HERE

UNIT # 113
PERMIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise $

DRIVER'S SIGNATURE - PICK UP BY Barbee
DRIVER'S SIGNATURE - DELIVERY BY Barbee

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods or in the case of failure to make delivery within nine (9) months from the date of shipment (b)The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill RECEIVED at the point of origin on the date specified from the consignor mentioned herein the property herein described in apparent good order except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading in power at the date of issuing which are hereto agreed by the consignor and accepted for himself and his assigns Printed or written including conditions set aside by the standard Bill of Lading in power at the date of issuing which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions

SHIPPER PRINT
SHIPPER SIGN
CONSIGNEE PRINT Slava
CONSIGNEE SIGN [signature]
DATE June 29
TIME 8:08 am
NUMBER OF PIECES RECEIVED 4
PST

WHITE Office YELLOW Carrier PINK Consignee GOLDENROD Shipper

GST # 864540398RT0001

Cooler ID: Cooler V **COC(Y/N)** Y **Temperature:** -1.8 **IR:** 33

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	EV		LC		RG		GH			
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40mL Glass	125mL ~~Glass~~ (1) plastic	40mL Glass	125mL ~~Gl~~ (1) Plastic		60mL Plastic	40mL Glass	60mL plastic		

Opened By: ERL **Date:** 6/30/22

(1) EE ERL 6/30/22

Effective 7/29/20
Revision 004

SELENIUM SPECIATION

BAL Final Report 2209181
(Finalized 21-Sept-22)

BrooksAppliedLabs
18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

September 21, 2022

Teck Resources Limited - Vancouver
Nicole Zathey
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
nicole.zathey@teck.com

Re: Line Creek Operation

Dear Nicole Zathey,

On September 15, 2022, Brooks Applied Labs (BAL) received four (4) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

Sample ID values listed on the chain-of-custody (COC) form did not exactly match the corresponding **Sample ID** values listed on container labels for samples 2209181-01, 2209181-02, 2209181-03, 2209181-05, and 2209181-06. The discrepancies are described in the table below.

Sample ID Agreement Issues

Laboratory ID	**Sample ID** ***(From COC)***	**Sample ID** **(*From Container Label*)**
2209181-01	LC_FRB_LAEMP_DRY_2022-09_N	LC_FRB_LAEMP_DRY_2022-09_N
2209181-02	LC_FRB_LAEMP_DRY_2022-09_NP-NAL	LC_FRB_LAEMP_DRY_2022-09_NP-NAL
2209181-03	LC_FRB_LAEMP_DRY_2022-09_NP-NAL	LC_FRB_LAEMP_DRY_2022-09_NP-NAL
2209181-05	LC_FRUS_LAEMP_DRY_2022-09_NP-NAL	LC_FRUS_LAEMP_DRY_2022-09_NP-NAL
2209181-06	LC_FRUS_LAEMP_DRY_2022-09_NP-NAL	LC_FRUS_LAEMP_DRY_2022-09_NP-NAL

2209181-01, 2209181-02, 2209181-03, 2209181-05, and 2209181-06 were logged in and reported using the **Sample ID** values listed on the COC form.

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable Se and Dissolved Se

Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [$SeSO_3$], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
LC_FRB_LAEMP_DRY_2022-09_N	2209181-01	WS	Sample	09/10/2022	09/15/2022
LC_FRB_LAEMP_DRY_2022-09_NP-NAL	2209181-02	WS	Sample	09/10/2022	09/15/2022
LC_FRB_LAEMP_DRY_2022-09_NP-NAL	2209181-03	WS	Sample	09/10/2022	09/15/2022
LC_FRUS_LAEMP_DRY_2022-09_N	2209181-04	WS	Sample	09/10/2022	09/15/2022
LC_FRUS_LAEMP_DRY_2022-09_NP-NAL	2209181-05	WS	Sample	09/10/2022	09/15/2022
LC_FRUS_LAEMP_DRY_2022-09_NP-NAL	2209181-06	WS	Sample	09/10/2022	09/15/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
MeSe(IV)	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
MeSe(VI)	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
Se	Water	EPA 1638 Mod	09/16/2022	09/20/2022	B222134	S220972
Se(IV)	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
Se(VI)	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
SeCN	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
SeMet	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
SeSO3	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953
Unk Se Sp	Water	SOP BAL-4201	09/14/2022	09/15/2022	B222056	S220953

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_FRB_LAEMP_DRY_2022-09_N										
2209181-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209181-01	MeSe(IV)	WS	D	0.012	J	0.010	0.025	µg/L	B222056	S220953
2209181-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209181-01	Se(IV)	WS	D	0.168		0.020	0.075	µg/L	B222056	S220953
2209181-01	Se(VI)	WS	D	34.7		0.010	0.055	µg/L	B222056	S220953
2209181-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222056	S220953
2209181-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209181-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222056	S220953
2209181-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222056	S220953
LC_FRB_LAEMP_DRY_2022-09_NP-NAL										
2209181-02	Se	WS	TR	39.9		0.165	0.528	µg/L	B222134	S220972
LC_FRB_LAEMP_DRY_2022-09_NP-NAL										
2209181-03	Se	WS	D	36.9		0.165	0.528	µg/L	B222134	S220972
LC_FRUS_LAEMP_DRY_2022-09_N										
2209181-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209181-04	MeSe(IV)	WS	D	0.013	J	0.010	0.025	µg/L	B222056	S220953
2209181-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209181-04	Se(IV)	WS	D	0.169		0.020	0.075	µg/L	B222056	S220953
2209181-04	Se(VI)	WS	D	42.2		0.010	0.055	µg/L	B222056	S220953
2209181-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222056	S220953
2209181-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222056	S220953
2209181-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222056	S220953
2209181-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222056	S220953
LC_FRUS_LAEMP_DRY_2022-09_NP-NAL										
2209181-05	Se	WS	TR	37.5		0.165	0.528	µg/L	B222134	S220972
LC_FRUS_LAEMP_DRY_2022-09_NP-NAL										
2209181-06	Se	WS	D	41.4		0.165	0.528	µg/L	B222134	S220972

Accuracy & Precision Summary

Batch: B222056
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	REC Limits	RPD	RPD Limits
B222056-BS1	**Blank Spike, (2124033)**								
	MeSe(IV)		5.095	5.504	µg/L	108%	75-125		
	Se(IV)		5.000	4.917	µg/L	98%	75-125		
	Se(VI)		5.000	4.657	µg/L	93%	75-125		
	SeCN		5.015	4.709	µg/L	94%	75-125		
	SeMet		4.932	4.821	µg/L	98%	75-125		
B222056-DUP5	**Duplicate, (2209181-04)**								
	DMSeO	ND		ND	µg/L			N/C	25
	MeSe(IV)	0.013		ND	µg/L			N/C	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.169		0.172	µg/L			2%	25
	Se(VI)	42.16		42.48	µg/L			0.7%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B222056-MS5	**Matrix Spike, (2209181-04)**								
	Se(IV)	0.169	4.900	5.007	µg/L	99%	75-125		
	Se(VI)	42.16	5.100	47.46	µg/L	NR	75-125		
	SeCN	ND	1.962	1.850	µg/L	94%	75-125		
	SeMet	ND	1.977	1.892	µg/L	96%	75-125		
B222056-MSD5	**Matrix Spike Duplicate, (2209181-04)**								
	Se(IV)	0.169	4.900	4.903	µg/L	97%	75-125	2%	25
	Se(VI)	42.16	5.100	46.96	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.816	µg/L	93%	75-125	2%	25
	SeMet	ND	1.977	1.909	µg/L	97%	75-125	0.9%	25

Accuracy & Precision Summary

Batch: B222134
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222134-BS1	**Blank Spike, (2128023)**								
	Se		200.0	163.3	µg/L	82%	75-125		
B222134-BS2	**Blank Spike, (2128023)**								
	Se		200.0	159.2	µg/L	80%	75-125		
B222134-BS3	**Blank Spike, (2128023)**								
	Se		200.0	160.1	µg/L	80%	75-125		
B222134-SRM1	**Reference Material (2214014, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	11.78	µg/L	82%	75-125		
B222134-SRM2	**Reference Material (2214014, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	12.50	µg/L	87%	75-125		
B222134-SRM3	**Reference Material (2214014, TMDA 51.5 Reference Standard - Bottle 6 - SRM)**								
	Se		14.30	11.52	µg/L	81%	75-125		
B222134-DUP1	**Duplicate, (2209182-02)**								
	Se	64.23		68.25	µg/L			6%	20
B222134-MS1	**Matrix Spike, (2209182-02)**								
	Se	64.23	220.0	268.3	µg/L	93%	75-125		
B222134-MSD1	**Matrix Spike Duplicate, (2209182-02)**								
	Se	64.23	220.0	242.4	µg/L	81%	75-125	10%	20

Method Blanks & Reporting Limits

Batch: B222056
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.004
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B222056-BLK1	0.00	µg/L
B222056-BLK2	0.00	µg/L
B222056-BLK3	0.00	µg/L
B222056-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B222134
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B222134-BLK1	0.023	µg/L
B222134-BLK2	0.073	µg/L
B222134-BLK3	0.041	µg/L
B222134-BLK4	-0.013	µg/L

Average: 0.031
Limit: 0.480

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2209181-01 **Report Matrix:** WS **Collected:** 09/10/2022
Sample: LC_FRB_LAEMP_DRY_2022-09_N **Sample Type:** Sample + Sum **Received:** 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209181
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209181
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209181

Lab ID: 2209181-02 **Report Matrix:** WS **Collected:** 09/10/2022
Sample: LC_FRB_LAEMP_DRY_2022-09_NP-NAL **Sample Type:** Sample + Sum **Received:** 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209181

Lab ID: 2209181-03 **Report Matrix:** WS **Collected:** 09/10/2022
Sample: LC_FRB_LAEMP_DRY_2022-09_NP-NAL **Sample Type:** Sample + Sum **Received:** 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209181

Lab ID: 2209181-04 **Report Matrix:** WS **Collected:** 09/10/2022
Sample: LC_FRUS_LAEMP_DRY_2022-09_N **Sample Type:** Sample + Sum **Received:** 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 4 - 2209181
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 4 - 2209181
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 4 - 2209181

Sample Containers

Lab ID: 2209181-05
Sample: LC_FRUS_LAEMP_DRY_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/10/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209181

Lab ID: 2209181-06
Sample: LC_FRUS_LAEMP_DRY_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/10/2022
Received: 09/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 2 - 2209181

Shipping Containers

Cooler 2 - 2209181

Received: September 15, 2022 7:10
Tracking No: RWHV95580 via Courier
Coolant Type: Ice
Temperature: 5.3 °C
Description: Styrofoam cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:1
Custody seals present? No
Custody seals intact? No
COC present? Yes

Cooler 4 - 2209181

Received: September 15, 2022 7:10
Tracking No: RWHV95580 via Courier
Coolant Type: Ice
Temperature: 2.4 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:2
Custody seals present? No
Custody seals intact? No
COC present? Yes

Cooler 4 - 2209181

Received: September 15, 2022 7:43
Tracking No: RWHV95580 via Courier
Coolant Type: Ice
Temperature: 2.4 °C
Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:2
Custody seals present? No
Custody seals intact? No
COC present? Yes

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BAL Final Report 2209181

COC ID:	REP_LAEMP_DRY_2022-09_BROOKS	TURNAROUND TIME:	Regular	RUSH:	NA

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO	
Facility Name / Job#	Line Creek Operation			Lab Name	Brooks Applied Labs			Email 1:	AquaSciLab@Teck.com X X X
Project Manager	Nicole Zathey			Lab Contact	Ben Wozniak			Email 2:	teckcoal@equisonline.com X
Email	Nicole.Zathey@Teck.com			Email	Ben@brooksapplied.com			Email 3:	Teck.Lab.Results@teck.com X X X
Address	421 Prine Avenue			Address	13751 Lake City Way			Email 4:	Lisa.Bowron@minnow.ca X X X
					Suite 108			Email 5:	Robin.Valleau@minnow.ca X X X
City	Sparwood	Province	BC	City	Seattle	Province	WA	Email 5:	Jessica.Ritz@Teck.com X X X
Postal Code	V0B 2G0	Country	Canada	Postal Code	98125	Country	United S	PO number	VPO00817033
Phone Number	1-250-425-8478			Phone Number	(206) 753-6158				

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (F)	Brooks_Se_T (N)
LC_FRB_WS_LAEMP_DRY_2022-09_N	LC_FRB	WS		2022/09/10	14:00	G	1	1		
LC_FRB_WS_LAEMP_DRY_2022-09_NP-NAL	LC_FRB	WS		2022/09/10	14:00	G	2		1	1
LC_FRUS_WS_LAEMP_DRY_2022-09_N	LC_FRUS	WS		2022/09/10	9:00	G	1	1		
LC_FRUS_WS_LAEMP_DRY_2022-09_NP-NAL	LC_FRUS	WS		2022/09/10	9:00	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Jennifer Ings/Minnow	##############	ww / BAL	9/15/22 7:10

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge	X				
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	September 12, 2022
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 95580

Confidential

BAL Final Report 2209181

Sparwood, BC
Terrace, BC
Red Deer, AB

Vancouver, BC
Calgary, AB
Montreal, QC

Prince George, BC
Edmonton, AB
Spokane, WA

Elkford, BC
Ft. McMurray, AB
Shelby, MT

Tumbler Ridge, BC
Hinton, AB
Gillette, WY

INVOICE TO

DATE

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM)

CONSIGNEE (TO)

STREET

STREET

CITY/PROVINCE

POSTAL CODE

CITY/PROVINCE

POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
	RWHV95580	

FREIGHT CHARGES
SHIPPER TO CHECK
☐ PREPAID ☐ COLLECT
If not indicated, shipping will automatically move collect

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY

PICK UP TIME

DRIVER'S SIGNATURE - DELIVERY BY

FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below which the carrier agrees to carry and to deliver to the consignee at the said destination subject to the rates and classification in effect on the date of shipment. It is mutually agreed as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading in power at the date of issuing which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT

CONSIGNEE PRINT

DATE

SHIPPER SIGN

CONSIGNEE SIGN

TIME

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

GST # 864540398RT0001

NUMBER OF PIECES RECEIVED

Cooler ID: Cooler 2 COC (Y/N) Temperature: 5.3 IR: 7

Coolant Type: Ice Blue Ice Ambient

Notes:

	EV		LC		RG					
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	125mL glass	125mL plastic	125mL plastic		125mL glass					

Sampling Locations: EV, LC, RG

Opened By: ERL

Date: 4/15/22

Revision 004

Effective 7/29/20

COPY

2209181

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

250-425-7447
24 Hour Hot Shot Service

No. 95580

Confidential

BAL Final Report 2209181

Sparwood, BC
Terrace, BC
Red Deer, AB

Vancouver, BC
Calgary, AB
Montreal, QC

Prince George, BC
Edmonton, AB
Spokane, WA

Elkford, BC
Ft. McMurray, AB
Shelby, MT

Tumbler Ridge, BC
Hinton, AB
Gillette, WY

INVOICE TO

DATE

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM)

CONSIGNEE (TO)

STREET

STREET

CITY/PROVINCE

POSTAL CODE

CITY/PROVINCE

POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
3	Coolers Water Samples	
	RWHV95580	

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY

PICK UP TIME

DRIVER'S SIGNATURE - DELIVERY BY

FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT

CONSIGNEE PRINT

SHIPPER SIGN

CONSIGNEE SIGN

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated shipping will automatically move collect

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK WRITE ORD HERE
DATE
TIME
NUMBER OF PIECES RECEIVED

GST # 864540398RT0001

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper

AMIGOS PRINTING

Cooler ID: Cooler 4

COC (Y/N)

Temperature: 2.4 °C

IR: 2

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	WL		EV		LC		RG			
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40 mL Glass	125 mL Plastic		60 mL Plastic, 60 ml Plastic, 125 mL Plastic		125 mL Plastic, 60 mL Plastic		60 mL Plastic		

Opened By: AM

Date: 9/15/22

Effective 7/29/20

COPY

Revision 004

SELENIUM SPECIATION

BAL Final Report 2209283
(Finalized Oct-12-22)

BrooksAppliedLabs

18804 North Creek Parkway, Ste 100, Bothell, WA 98011 • USA • T: 206 632 6206 F: 206 632 6017 • info@brooksapplied.com

October 12, 2022

Teck Resources Limited - Vancouver
Nicole Zathey
421 Pine Avenue
Sparwood, B.C. CANADA V0B2G0
nicole.zathey@teck.com

Re: Line Creek Operation

Dear Nicole Zathey,

On September 22, 2022, Brooks Applied Labs (BAL) received eight (8) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) form.

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. All sample fractions for total recoverable Se and dissolved Se were preserved within the (14 calendar day) preservation holding time.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

Total Recoverable Se and Dissolved Se

Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [*$SeSO_3$*], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified on the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL, an accredited laboratory, certifies that the reported results of all analyses for which BAL is NELAP accredited meet all NELAP requirements. For more information, please see the *Report Information* page.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

Laboratory Accreditation

BAL is accredited by the *National Environmental Laboratory Accreditation Program* (NELAP) through the State of Florida Department of Health, Bureau of Laboratories (E87982) and is certified to perform many environmental analyses. BAL is also certified by many other states to perform environmental analyses. For a current list of our accreditations/certifications, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/> or review Tables 1 and 2 in our Accreditation Information. Results reported relate only to the samples listed in the report.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

(Effective 3/23/2020)

E An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H Holding time and/or preservation requirements not met. Please see narrative for explanation.
J Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1 Estimated value. A full explanation is presented in the narrative.
M Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R Rejected, unusable value. A full explanation is presented in the narrative.
U Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

These qualifiers are based on those previously utilized by Brooks Applied Labs, those found in the EPA SOW ILM03.0, Exhibit B, Section III, pg. B-18, and the USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review; USEPA; January 2010. These supersede all previous qualifiers ever employed by BAL.

Accreditation Information

Table 1. Accredited method/matrix/analytes for TNI

Issued by: State of Florida Dept. of Health (The NELAC Institute 2016 Standard)
Issued on: July 1, 2021; Valid to: June 30, 2022
Certificate Number: E87982-37

Method	Matrix	TNI Accredited Analyte(s)
EPA 1638	Non-Potable Waters	Ag, Cd, Cu, Ni, Pb, Sb, Se, Tl, Zn
EPA 200.8	Non-Potable Waters	Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
EPA 6020	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Tl, V, Zn
BAL-5000	Non-Potable Waters	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn, Hardness
	Solids/Chemicals	Ag, As, B, Be, Cd, Co, Cr, Cu, Pb, Mo, Ni, Sb, Se, Sn, Sr, Tl, V, Zn
	Biological	Ag, Al, As, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Tl, V, Zn
EPA 1640	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn
EPA 1631E	Non-Potable Waters, Solids/Chemicals & Biological	Total Mercury
EPA 1630	Non-Potable Waters	Methyl Mercury
BAL-3200	Solids/Chemicals & Biological	Methyl Mercury
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
BAL-4201	Non-Potable Waters	Se(IV), Se(VI)
BAL-4300	Non-Potable Waters Solid/Chemicals	Cr(VI)
SM2340B	Non-Potable Waters	Hardness

Accreditation Information

Table 2. Accredited method/matrix/analytes for ISO (1), Non-Governmental TNI (2)

Issued by: ANAB

Issued on: September 21, 2021; Valid to: March 30, 2024

Method	Matrix	ISO and Non-Gov. TNI Accredited Analyte(s)
EPA 1638 Mod EPA 200.8 Mod EPA 6020 Mod BAL-5000	Non-Potable Waters	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, U, V, Zn
	Solids/Chemicals & Biological	Ag, Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, Mo, Ni, Pb, Sb, Se, Sn, Sr, Tl, V, Zn Hg (Biological Only)
EPA 1640 Mod	Non-Potable Waters	Cd, Cu, Pb, Ni, Zn Ag, As, Cr, Co, Se, Tl, V (ISO Only)
EPA 1631E Mod BAL-3100	Non-Potable Waters, Solids/Chemicals & Biological/Food	Total Mercury
EPA 1630 Mod BAL-3200	Non-Potable Waters, Solids/Chemicals Biological	Methyl Mercury
EPA 1632A Mod BAL-3300	Non-Potable Waters	Inorganic Arsenic (ISO Only)
	Biological/Food Solids/Chemicals	Inorganic Arsenic (ISO Only)
AOAC 2015.01 Mod BAL-5000	Food	As, Cd, Hg, Pb
BAL-4100	Non-Potable Waters	As(III), As(V), DMAs, MMAs
	Biological by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4101	Food by BAL-4117	Inorganic Arsenic, DMAs, MMAs (ISO Only)
BAL-4201	Non-Potable Waters	Se(IV), Se(VI), SeCN, SeMet
BAL-4300	Non-Potable Waters, Solid/Chemicals	Cr(VI)
SM 3500-Fe BAL-4500	Non-Potable Waters	Fe, Fe(II) (ISO Only)
SM2340B	Non-Potable Waters	Hardness
SM 2540G BAL-0501	Solids/Chemicals & Biological	% Dry Weight

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
LC_DCEF_WS_LAEMP_DRY_2022-09_N	2209283-01	WS	Sample	09/12/2022	09/22/2022
LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL	2209283-02	WS	Sample	09/12/2022	09/22/2022
LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL	2209283-03	WS	Sample	09/12/2022	09/22/2022
LC_GRCK_WS_LAEMP_DRY_2022-09_N	2209283-04	WS	Sample	09/14/2022	09/22/2022
LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL	2209283-05	WS	Sample	09/14/2022	09/22/2022
LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL	2209283-06	WS	Sample	09/14/2022	09/22/2022
LC_MT1_WS_LAEMP_DRY_2022-09_N	2209283-07	WS	Sample	09/14/2022	09/22/2022
LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL	2209283-08	WS	Sample	09/14/2022	09/22/2022
LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL	2209283-09	WS	Sample	09/14/2022	09/22/2022
LC_CC1_WS_LAEMP_DRY_2022-09_N	2209283-10	WS	Sample	09/14/2022	09/22/2022
LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL	2209283-11	WS	Sample	09/14/2022	09/22/2022
LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL	2209283-12	WS	Sample	09/14/2022	09/22/2022

Batch Summary

Analyte	Lab Matrix	Method	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
DMSeO	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
MeSe(IV)	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
MeSe(IV)	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
MeSe(VI)	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
MeSe(VI)	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
Se	Water	EPA 1638 Mod	09/23/2022	09/26/2022	B222203	S221000
Se(IV)	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
Se(IV)	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
Se(VI)	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
Se(VI)	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
SeCN	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
SeCN	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
SeMet	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
SeMet	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
SeSO3	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
SeSO3	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017
Unk Se Sp	Water	SOP BAL-4201	09/27/2022	09/27/2022	B222236	S221003
Unk Se Sp	Water	SOP BAL-4201	09/29/2022	10/01/2022	B222236	S221017

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_DCEF_WS_LAEMP_DRY_2022-09_N										
2209283-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-01	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-01	Se(IV)	WS	D	≤ 0.020	U	0.020	0.075	µg/L	B222236	S221003
2209283-01	Se(VI)	WS	D	1.49		0.010	0.055	µg/L	B222236	S221003
2209283-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222236	S221003
2209283-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222236	S221003
2209283-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222236	S221003
LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL										
2209283-02	Se	WS	D	1.56		0.165	0.528	µg/L	B222203	S221000
LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL										
2209283-03	Se	WS	TR	1.44		0.165	0.528	µg/L	B222203	S221000
LC_GRCK_WS_LAEMP_DRY_2022-09_N										
2209283-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-04	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-04	Se(IV)	WS	D	0.035	J	0.020	0.075	µg/L	B222236	S221003
2209283-04	Se(VI)	WS	D	1.85		0.010	0.055	µg/L	B222236	S221003
2209283-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222236	S221003
2209283-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222236	S221003
2209283-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222236	S221003
LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL										
2209283-05	Se	WS	D	1.69		0.165	0.528	µg/L	B222203	S221000
LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL										
2209283-06	Se	WS	TR	1.83		0.165	0.528	µg/L	B222203	S221000

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_MT1_WS_LAEMP_DRY_2022-09_N										
2209283-07	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-07	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-07	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-07	Se(IV)	WS	D	≤ 0.020	U	0.020	0.075	µg/L	B222236	S221003
2209283-07	Se(VI)	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222236	S221003
2209283-07	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222236	S221003
2209283-07	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221003
2209283-07	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222236	S221003
2209283-07	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222236	S221003
LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL										
2209283-08	Se	WS	D	0.208	J	0.165	0.528	µg/L	B222203	S221000
LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL										
2209283-09	Se	WS	TR	≤ 0.165	U	0.165	0.528	µg/L	B222203	S221000
LC_CC1_WS_LAEMP_DRY_2022-09_N										
2209283-10	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221017
2209283-10	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221017
2209283-10	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221017
2209283-10	Se(IV)	WS	D	0.032	J	0.020	0.075	µg/L	B222236	S221017
2209283-10	Se(VI)	WS	D	1.53		0.010	0.055	µg/L	B222236	S221017
2209283-10	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B222236	S221017
2209283-10	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B222236	S221017
2209283-10	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B222236	S221017
2209283-10	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B222236	S221017
LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL										
2209283-11	Se	WS	D	1.87		0.165	0.528	µg/L	B222203	S221000
LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL										
2209283-12	Se	WS	TR	1.81		0.165	0.528	µg/L	B222203	S221000

Accuracy & Precision Summary

Batch: B222203
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222203-BS1	**Blank Spike, (2128023)**								
	Se		200.0	174.3	µg/L	87%	75-125		
B222203-BS2	**Blank Spike, (2128023)**								
	Se		200.0	178.8	µg/L	89%	75-125		
B222203-BS3	**Blank Spike, (2128023)**								
	Se		200.0	179.9	µg/L	90%	75-125		
B222203-BS4	**Blank Spike, (2128023)**								
	Se		200.0	173.4	µg/L	87%	75-125		
B222203-BS5	**Blank Spike, (2128023)**								
	Se		200.0	182.9	µg/L	91%	75-125		
B222203-SRM1	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	12.81	µg/L	90%	75-125		
B222203-SRM2	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.33	µg/L	93%	75-125		
B222203-SRM3	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.09	µg/L	92%	75-125		
B222203-SRM4	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.25	µg/L	93%	75-125		
B222203-SRM5	**Reference Material (2214016, TMDA 51.5 Reference Standard - Bottle 8 - SRM)**								
	Se		14.30	13.11	µg/L	92%	75-125		
B222203-DUP1	**Duplicate, (2209283-06)**								
	Se	1.829		1.882	µg/L			3%	20

Accuracy & Precision Summary

Batch: B222203
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B222203-MS1	**Matrix Spike, (2209283-06)**								
	Se	1.829	220.0	198.2	µg/L	89%	75-125		
B222203-MSD1	**Matrix Spike Duplicate, (2209283-06)**								
	Se	1.829	220.0	202.7	µg/L	91%	75-125	2%	20

Accuracy & Precision Summary

Batch: B222236
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	Limits	RPD	Limits
B222236-BS1	**Blank Spike, (2236035)**								
	MeSe(IV)		5.095	5.336	µg/L	105%	75-125		
	Se(IV)		5.000	5.147	µg/L	103%	75-125		
	Se(VI)		5.000	4.836	µg/L	97%	75-125		
	SeCN		5.015	4.828	µg/L	96%	75-125		
	SeMet		4.982	4.782	µg/L	96%	75-125		
B222236-DUP1	**Duplicate, (2209289-06)**								
	DMSeO	0.013		ND	µg/L			N/C	25
	MeSe(IV)	0.013		0.015	µg/L			9%	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.219		0.223	µg/L			2%	25
	Se(VI)	20.72		20.98	µg/L			1%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B222236-MS1	**Matrix Spike, (2209289-06)**								
	Se(IV)	0.219	4.900	5.274	µg/L	103%	75-125		
	Se(VI)	20.72	5.100	26.18	µg/L	NR	75-125		
	SeCN	ND	1.962	1.977	µg/L	101%	75-125		
	SeMet	ND	1.977	2.015	µg/L	102%	75-125		
B222236-MSD1	**Matrix Spike Duplicate, (2209289-06)**								
	Se(IV)	0.219	4.900	5.335	µg/L	104%	75-125	1%	25
	Se(VI)	20.72	5.100	26.45	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.970	µg/L	100%	75-125	0.4%	25
	SeMet	ND	1.977	2.010	µg/L	102%	75-125	0.2%	25

Method Blanks & Reporting Limits

Batch: B222203
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B222203-BLK1	-0.026	µg/L
B222203-BLK2	-0.076	µg/L
B222203-BLK3	-0.031	µg/L
B222203-BLK4	-0.040	µg/L
B222203-BLK5	-0.054	µg/L

Average: -0.045 **MDL:** 0.150
Limit: 0.480 **MRL:** 0.480

Method Blanks & Reporting Limits

Batch: B222236
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B222236-BLK1	0.0009	µg/L
B222236-BLK2	0.0005	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.004
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B222236-BLK1	0.001	µg/L
B222236-BLK2	0.0007	µg/L
B222236-BLK3	0.0005	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.001 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B222236-BLK1	0.00	µg/L
B222236-BLK2	0.00	µg/L
B222236-BLK3	0.00	µg/L
B222236-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Sample Containers

Lab ID: 2209283-01
Sample: LC_DCEF_WS_LAEMP_DRY_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 7 - 2209283
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 7 - 2209283
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 7 - 2209283

Lab ID: 2209283-02
Sample: LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Lab ID: 2209283-03
Sample: LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/12/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Lab ID: 2209283-04
Sample: LC_GRCK_WS_LAEMP_DRY_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 7 - 2209283
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 7 - 2209283
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 7 - 2209283

Sample Containers

Lab ID: 2209283-05
Sample: LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Lab ID: 2209283-06
Sample: LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Lab ID: 2209283-07
Sample: LC_MT1_WS_LAEMP_DRY_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 7 - 2209283
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 7 - 2209283
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 7 - 2209283

Lab ID: 2209283-08
Sample: LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Lab ID: 2209283-09
Sample: LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Sample Containers

Lab ID: 2209283-10
Sample: LC_CC1_WS_LAEMP_DRY_2022-09_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube 15mL Se-Sp	15 mL	na	none	na	na	Cooler 7 - 2209283
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 7 - 2209283
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 7 - 2209283

Lab ID: 2209283-11
Sample: LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Lab ID: 2209283-12
Sample: LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 09/14/2022
Received: 09/22/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Client-Provided - TM	40 mL	na	10% HNO3 (BAL)	2230023	<2	Cooler 6 - 2209283

Shipping Containers

Cooler 6 - 2209283

Received: September 22, 2022 7:37
Tracking No: RWHV95583 via Courier
Coolant Type: Blue Ice
Temperature: 12.5 °C

Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:1

Custody seals present? No
Custody seals intact? No
COC present? Yes

Cooler 7 - 2209283

Received: September 22, 2022 7:37
Tracking No: RWHV95583 via Courier
Coolant Type: Blue Ice
Temperature: -0.8 °C

Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: IR#:1

Custody seals present? No
Custody seals intact? No
COC present? Yes

COC ID:	REP_LAEMP_DRY_2022-09_BROOKS	TURNAROUND TIME:	Regular	RUSH:	NA

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Brooks Applied Labs			Email 1:	AquaSciLab@Teck.com	X	X	X
Project Manager	Nicole Zathey			Lab Contact	Ben Wozniak			Email 2:	teckcoal@equisonline.com			X
Email	Nicole.Zathey@Teck.com			Email	Ben@brooksapplied.com			Email 3:	Teck.Lab.Results@teck.com	X	X	X
Address	421 Prine Avenue			Address	13751 Lake City Way			Email 4:	Lisa.Bowron@minnow.ca	X	X	X
					Suite 108			Email 5:	Robin.Valleau@minnow.ca	X	X	X
City	Sparwood	Province	BC	City	Seattle	Province	WA	Email 5:	Jessica.Ritz@Teck.com	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	98125	Country	United S	PO number	VPO00817033			
Phone Number	1-250-425-8478			Phone Number	(206) 753-6158							

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (F)	Brooks_Se_T (N)
LC_DCEF_WS_LAEMP_DRY_2022-09_N	LC_DCEF	WS		2022/09/12	14:30	G	1	1		
LC_DCEF_WS_LAEMP_DRY_2022-09_NP-NAL	LC_DCEF	WS		2022/09/12	14:30	G	2		1	1
LC_GRCK_WS_LAEMP_DRY_2022-09_N	LC_GRCK	WS		2022/09/14	13:30	G	1	1		
LC_GRCK_WS_LAEMP_DRY_2022-09_NP-NAL	LC_GRCK	WS		2022/09/14	13:30	G	2		1	1
LC_MT1_WS_LAEMP_DRY_2022-09_N	LC_MT1	WS		2022/09/14	13:30	G	1	1		
LC_MT1_WS_LAEMP_DRY_2022-09_N-NAL	LC_MT1	WS		2022/09/14	13:30	G	2		1	1
LC_CC1_WS_LAEMP_DRY_2022-09_N	LC_CC1	WS		2022/09/14	13:30	G	1	1		
LC_CC1_WS_LAEMP_DRY_2022-09_N-NAL	LC_CC1	WS		2022/09/14	13:30	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Jennifer Ings/Minnow	##############	WW / BAL	9/22/22 7:37

SERVICE REQUEST (rush - subject to availability)

Regular (default)		Sampler's Name	Jennifer Ings	Mobile #	519-500-3444
Priority (2-3 business days) - 50% surcharge	X	Sampler's Signature		Date/Time	September 19, 2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Confidential

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 95583

BAL Final Report 2209283

Sparwood, BC	Vancouver, BC	Prince George, BC	Elkford, BC	Tumbler Ridge, BC
Terrace, BC	Calgary, AB	Edmonton, AB	Ft. McMurray, AB	Hinton, AB
Red Deer, AB	Montreal, QC	Spokane, WA	Shelby, MT	Gillette, WY

INVOICE TO: Cap 22098 4270

DATE: Sept 20/22

BILL OF LADING #

PURCHASE ORDER NUMBER

SHIPPER (FROM): [illegible] Limited

CONSIGNEE (TO): Brooks Applied Labs

STREET: [illegible] Creeks

STREET: 13751 Lake City Way NE

CITY/PROVINCE: Sparwood B.C.

POSTAL CODE

CITY/PROVINCE: Seattle WA

POSTAL CODE

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
7	Coolers - water samples	266 lbs
	RWHV95583	

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated, shipping will automatically move collect

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY | PICK UP TIME | DRIVER'S SIGNATURE - DELIVERY BY | FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, thereof setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written including conditions set aside by the standard Bill of Lading in power at the state of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT | CONSIGNEE PRINT | DATE

SHIPPER SIGN | CONSIGNEE SIGN | TIME

NUMBER OF PIECES RECEIVED: 7

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper

GST # 864540398RT0001

Cooler ID: Cooler 6 **COC (Y/N)** Y **Temperature:** 12.5 **IR:** 2

Coolant Type: Ice **Blue Ice** Ambient

Notes:

Sampling Locations:	GH	volatiles	LC		R6					
Sample Types:	T/D	~~SP~~	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	125mL glass	40mL glass	125mL Plastic		40mL glass					

Opened By: ERL **Date:** 9/22/22

2209283

Effective 7/29/20

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Revision 004

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STRAIGHT BILL OF LADING
NOT NEGOTIABLE

RW HOT SHOT SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

BAL Final Report 2209283

No. 95583

Sparwood, BC	Vancouver, BC	Prince George, BC	Elkford, BC	Tumbler Ridge, BC
Terrace, BC	Calgary, AB	Edmonton, AB	Ft. McMurray, AB	Hinton, AB
Red Deer, AB	Montreal, QC	Spokane, WA	Shelby, MT	Gillette, WY

INVOICE TO: Cap 220994270
DATE: Sept 20/22
BILL OF LADING #:
PURCHASE ORDER NUMBER:
SHIPPER (FROM): [illegible] Coal Limited
CONSIGNEE (TO): Brooks Applied Labs
STREET: [illegible] Line Creek
STREET: 18951 [illegible] NE
CITY/PROVINCE: Sparwood B.C.
POSTAL CODE:
CITY/PROVINCE: Seattle WA
POSTAL CODE:
SPECIAL INSTRUCTIONS:

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
7	Coolers - water samples	266 lbs
	RWHV95583	

FREIGHT CHARGES
SHIPPER TO CHECK
☐PREPAID ☐COLLECT
If not indicated, shipping will automatically move collect

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise. $

DRIVER'S SIGNATURE - PICK UP BY | PICK UP TIME | DRIVER'S SIGNATURE - DELIVERY BY | FINISH TIME

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice, thereof setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, on the case of failure to make delivery within nine (9) months from the date of shipment (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below which the carrier agrees to carry and to deliver to the consigned at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of issuing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading, in power at the date of issuing, which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT | CONSIGNEE PRINT | DATE
SHIPPER SIGN | CONSIGNEE SIGN | TIME
NUMBER OF PIECES RECEIVED: 7

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROAD: Shipper GST # 864540398RT0001

Cooler ID: Cooler 7 **COC** (Y/N): Y **Temperature:** -0.8 **IR:** 2

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	RG		LC		GH					
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:		60mL Plastic, 125mL Plastic		125mL plastic		60mL Plastic				

Opened By: ERL **Date:** 9/22/22

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Effective 7/29/20 Revision 004

SELENIUM SPECIATION

BAL Final Report 2212302

(Finalized 13-Jan-23)

BROOKS APPLIED LABS
13751 Lake City Way NE, Ste 108, Seattle, WA 98125 • USA • T:206-632-6206 • info@brooksapplied.com

January 13, 2023

Teck Resources Limited - Vancouver
Nicole Zathey
Box 2003
15km North Hwy 43
Sparwood, B.C. CANADA V0B2G0
nicole.zathey@teck.com

Re: Line Creek Operation

Dear Nicole Zathey,

On December 15, 2022, Brooks Applied Labs (BAL) received twelve (12) aqueous samples. The samples were logged-in for total recoverable selenium [*Se*], dissolved Se [*Se*], and Se speciation analyses, according to the chain-of-custody (COC) forms.

The total recoverable Se fraction for *LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL* (Laboratory ID = 2212302-16) arrived in a broken container and most of the volume was lost during shipment. Enough volume was remaining to undergo an acid digest and subsequent analysis for selenium. Since it is unknown if contamination occurred during shipment/storage, the total recoverable Se result for 2212302-16 is qualified as estimated (**J-1**) due to a broken container/leaking during shipment.

The dissolved Se fraction for *LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL* (laboratory ID 2212302-17) also arrived at BAL in a broken container with no volume remaining for quantitation. Volume from the corresponding field filtered selenium speciation fraction (laboratory ID 2212302-06) was poured off into a new container to support the dissolved Se analysis. This new dissolved Se fraction (2212302-17) was preserved (pH < 2) upon receipt at BAL.

The sample fractions for total recoverable Se and dissolved Se were not preserved in the field. The samples were preserved (pH < 2) upon receipt at BAL. The preservation took place beyond the (14-calander day) preservation holding time. Consequently, all total recoverable Se and dissolved Se results are qualified (**H**) for preservation time violations.

The sample fractions logged in for Se speciation and dissolved Se had been field-filtered prior to receipt at BAL. All samples were stored according to BAL SOPs.

__Total Recoverable Se and Dissolved Se__

Each aqueous sample fraction for dissolved Se was digested in a closed vessel (bomb) with nitric and hydrochloric acids. The resulting digests were analyzed for Se content via inductively coupled plasma triple quadrupole mass spectrometry (ICP-QQQ-MS). The ICP-QQQ-MS instrumentation uses advanced interference removal techniques to ensure accuracy of the sample results. For more information, please visit the *Interference Reduction Technology* section on our website, brooksapplied.com.

The total recoverable Se result for 2212302-16 is qualified as estimated (**J-1**) due to a broken container/leaking during shipment. All total recoverable Se and dissolved Se results are qualified (**H**) for preservation time violations.

Selenium Speciation

Each aqueous sample was analyzed for selenium speciation using ion chromatography inductively coupled plasma collision reaction cell mass spectrometry (IC-ICP-CRC-MS). Selenium species are chromatographically separated on an ion exchange column and then quantified using inductively coupled plasma collision reaction cell mass spectrometry (ICP-CRC-MS); for more information on this determinative technique, please visit the *Interference Reduction Technology* section on our website. The chromatographic method applied for the analyses provides greater retention of methylseleninic acid and selenomethionine, allowing for more definitive quantitation of these species.

In accordance with the quotation issued for this project, selenium speciation was defined as dissolved selenite [*Se(IV)*], selenate [*Se(VI)*], selenocyanate [*SeCN*], methylseleninic acid [*MeSe(IV)*], methaneselenonic acid [*MeSe(VI)*], selenomethionine [*SeMet*], selenosulfate [$SeSO_3$], and dimethylselenoxide [*DMSeO*]. Unknown Se species was defined as the total concentration of all unknown Se species observed during the analysis. This item is identified in the report as [*Unk Se Sp*].

DMSeO elutes early in the chromatographic run due to the nature of the molecule and the applied chromatographic separation method. Since this species elutes near the dead volume, additional selenium species may coelute. Alternate methods can be applied, upon client request, to increase the separation of DMSeO from potentially co-eluting selenium species.

The results were not method blank corrected, as described in the calculations section of the relevant BAL SOPs and were evaluated using reporting limits adjusted to account for sample aliquot size. Please refer to the *Sample Results* page for sample-specific MDLs, MRLs, and other details.

In instances where a matrix spike/matrix spike duplicate (MS/MSD) set was spiked at a level less than the native sample concentration, the recoveries and the relative percent difference (RPD) are not considered valid indicators of data quality. In such instances, the recoveries of the laboratory fortified blanks (BS) and/or standard reference materials (SRM) demonstrate the accuracy of the applied methods. When the spiking level was less than 25% of the native sample concentration, the spike recovery was not reported (**NR**) and the relative percent difference (RPD) of the MS/MSD set was not calculated (**N/C**).

In cases when either the native sample concentration was non-detectable (reported as less than or equal to the MDL) and/or the corresponding DUP result was also non-detectable, the RPD between the two values was not calculated (**N/C**).

Except for concentration qualifiers and items noted above, all data were reported without qualification. All associated quality control sample results met the acceptance criteria.

BAL verifies that the reported results of all analyses for which the laboratory is accredited meet the requirements of the accrediting body, unless otherwise noted in the report narrative. For more information regarding accreditations please see the *Report Information* and *Batch Summary* pages. This report must be used in its entirety for interpretation of results.

Please feel free to contact us if you have any questions regarding this report.

Sincerely,

Jeremy Maute
Senior Project Manager
Jeremy@brooksapplied.com

Report Information

General Disclaimers

Test results are based solely upon the sample submitted to Brooks Applied Labs in the condition it was received . This report shall not be reproduced or copied, except in full, without written approval of the laboratory. Brooks Applied Labs is not responsible for the consequences arising from the use of a partial report.

Laboratory Accreditation

BAL maintains accreditation with various state and national agencies for select test methods. For a current list of BAL accreditations, please visit our website at <http://www.brooksapplied.com/resources/certificates-permits/>. The reported analyte/matrix/method combination shall be considered outside BAL's scopes of accreditation unless otherwise identified as ISO, TNI, or ISO,TNI in the tables. It is the responsibility of the client to verify whether a specific accreditation is required for the intended data use.

ISO: ISO/IEC 17025:2017 accredited test method. Issued by ANSI National Accreditation Board (ANAB), #ADE-1447.02

TNI: NELAP accredited test method. Issued by the State of Florida Department of Health, #E87982.

ISO,TNI: Test method is accredited under both the ISO/IEC 17025:2017 and NELAP accreditations referenced above.

Field Quality Control Samples

Please be notified that certain EPA methods require the collection of field quality control samples of an appropriate type and frequency; failure to do so is considered a deviation from some methods and for compliance purposes should only be done with the approval of regulatory authorities. Please see the specific EPA methods for details regarding required field quality control samples.

Common Abbreviations

AR	as received	**MS**	matrix spike
BAL	Brooks Applied Labs	**MSD**	matrix spike duplicate
BLK	method blank	**ND**	non-detect
BS	blank spike	**NR**	non-reportable
CAL	calibration standard	**N/C**	not calculated
CCB	continuing calibration blank	**PS**	post preparation spike
CCV	continuing calibration verification	**REC**	percent recovery
COC	chain of custody record	**RPD**	relative percent difference
D	dissolved fraction	**SCV**	secondary calibration verification
DUP	duplicate	**SOP**	standard operating procedure
IBL	instrument blank	**SRM**	reference material
ICV	initial calibration verification	**T**	total fraction
MDL	method detection limit	**TR**	total recoverable fraction
MRL	method reporting limit		

Definition of Data Qualifiers

E	An estimated value due to the presence of interferences. A full explanation is presented in the narrative.
H	Holding time and/or preservation requirements not met. Please see narrative for explanation.
J	Detected by the instrument, the result is > the MDL but ≤ the MRL. Result is reported and considered an estimate.
J-1	Estimated value. A full explanation is presented in the narrative.
M	Duplicate precision (RPD) was not within acceptance criteria. Please see narrative for explanation.
N	Spike recovery was not within acceptance criteria. Please see narrative for explanation.
R	Rejected, unusable value. A full explanation is presented in the narrative.
U	Result is ≤ the MDL or client requested reporting limit (CRRL). Result reported as the MDL or CRRL.
X	Result is not BLK-corrected and is within 10x the absolute value of the highest detectable BLK in the batch. Result is estimated.
Z	Holding time and/or preservation requirements not established for this method; however, BAL recommendations for holding time were not followed. Please see narrative for explanation.

Sample Information

Sample	Lab ID	Report Matrix	Type	Sampled	Received
LC_FRB_WS_LAEMP_DRY_2022-11_N	2212302-01	WS	Sample	11/30/2022	12/15/2022
LC_FRUS_WS_LAEMP_DRY_2022-11_N	2212302-02	WS	Sample	11/29/2022	12/15/2022
LC_GRCK_WS_LAEMP_DRY_2022-11_N	2212302-03	WS	Sample	11/30/2022	12/15/2022
LC_MT1_WS_LAEMP_DRY_2022-11_NP	2212302-04	WS	Sample	11/30/2022	12/15/2022
LC_DCEF_WS_LAEMP_DRY_2022-11_N	2212302-05	WS	Sample	11/29/2022	12/15/2022
LC_CC1_WS_LAEMP_DRY_2022-11_NP	2212302-06	WS	Sample	11/30/2022	12/15/2022
LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-07	WS	Sample	11/30/2022	12/15/2022
LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-08	WS	Sample	11/30/2022	12/15/2022
LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-09	WS	Sample	11/29/2022	12/15/2022
LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-10	WS	Sample	11/29/2022	12/15/2022
LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-11	WS	Sample	11/30/2022	12/15/2022
LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-12	WS	Sample	11/30/2022	12/15/2022
LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-13	WS	Sample	11/30/2022	12/15/2022
LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-14	WS	Sample	11/30/2022	12/15/2022
LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-15	WS	Sample	11/29/2022	12/15/2022
LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-16	WS	Sample	11/29/2022	12/15/2022
LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-17	WS	Sample	11/30/2022	12/15/2022
LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL	2212302-18	WS	Sample	11/30/2022	12/15/2022

Batch Summary

Analyte	Lab Matrix	Method	Accred.	Prepared	Analyzed	Batch	Sequence
DMSeO	Water	SOP BAL-4201		12/15/22	12/18/22	B223068	S221316
MeSe(IV)	Water	SOP BAL-4201		12/15/22	12/18/22	B223068	S221316
MeSe(VI)	Water	SOP BAL-4201		12/15/22	12/18/22	B223068	S221316
Se	Water	EPA 1638 Mod		12/21/22	12/22/22	B223142	S221342
Se(IV)	Water	SOP BAL-4201	ISO,TNI	12/15/22	12/18/22	B223068	S221316
Se(VI)	Water	SOP BAL-4201	ISO,TNI	12/15/22	12/18/22	B223068	S221316
SeCN	Water	SOP BAL-4201	ISO	12/15/22	12/18/22	B223068	S221316
SeMet	Water	SOP BAL-4201	ISO	12/15/22	12/18/22	B223068	S221316
SeSO3	Water	SOP BAL-4201		12/15/22	12/18/22	B223068	S221316
Unk Se Sp	Water	SOP BAL-4201		12/15/22	12/18/22	B223068	S221316

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_FRB_WS_LAEMP_DRY_2022-11_N										
2212302-01	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-01	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-01	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-01	Se(IV)	WS	D	0.191		0.020	0.075	µg/L	B223068	S221316
2212302-01	Se(VI)	WS	D	50.6		0.010	0.055	µg/L	B223068	S221316
2212302-01	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B223068	S221316
2212302-01	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-01	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-01	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B223068	S221316
LC_FRUS_WS_LAEMP_DRY_2022-11_N										
2212302-02	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-02	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-02	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-02	Se(IV)	WS	D	0.137		0.020	0.075	µg/L	B223068	S221316
2212302-02	Se(VI)	WS	D	42.6		0.010	0.055	µg/L	B223068	S221316
2212302-02	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B223068	S221316
2212302-02	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-02	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-02	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B223068	S221316
LC_GRCK_WS_LAEMP_DRY_2022-11_N										
2212302-03	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-03	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-03	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-03	Se(IV)	WS	D	0.031	J	0.020	0.075	µg/L	B223068	S221316
2212302-03	Se(VI)	WS	D	2.28		0.010	0.055	µg/L	B223068	S221316
2212302-03	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B223068	S221316
2212302-03	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-03	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-03	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B223068	S221316

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_MT1_WS_LAEMP_DRY_2022-11_NP										
2212302-04	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-04	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-04	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-04	Se(IV)	WS	D	≤ 0.020	U	0.020	0.075	µg/L	B223068	S221316
2212302-04	Se(VI)	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-04	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B223068	S221316
2212302-04	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-04	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-04	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B223068	S221316
LC_DCEF_WS_LAEMP_DRY_2022-11_N										
2212302-05	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-05	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-05	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-05	Se(IV)	WS	D	≤ 0.020	U	0.020	0.075	µg/L	B223068	S221316
2212302-05	Se(VI)	WS	D	1.39		0.010	0.055	µg/L	B223068	S221316
2212302-05	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B223068	S221316
2212302-05	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-05	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-05	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B223068	S221316
LC_CC1_WS_LAEMP_DRY_2022-11_NP										
2212302-06	DMSeO	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-06	MeSe(IV)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-06	MeSe(VI)	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-06	Se(IV)	WS	D	0.176		0.020	0.075	µg/L	B223068	S221316
2212302-06	Se(VI)	WS	D	48.2		0.010	0.055	µg/L	B223068	S221316
2212302-06	SeCN	WS	D	≤ 0.010	U	0.010	0.050	µg/L	B223068	S221316
2212302-06	SeMet	WS	D	≤ 0.010	U	0.010	0.025	µg/L	B223068	S221316
2212302-06	SeSO3	WS	D	≤ 0.010	U	0.010	0.055	µg/L	B223068	S221316
2212302-06	Unk Se Sp	WS	D	≤ 0.010	U	0.010	0.075	µg/L	B223068	S221316
LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-07	Se	WS	D	46.1	H	0.165	0.528	µg/L	B223142	S221342
LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-08	Se	WS	TR	45.6	H	0.165	0.528	µg/L	B223142	S221342

Sample Results

Sample	Analyte	Report Matrix	Basis	Result	Qualifier	MDL	MRL	Unit	Batch	Sequence
LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-09	Se	WS	D	41.9	H	0.165	0.528	µg/L	B223142	S221342
LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-10	Se	WS	TR	39.5	H	0.165	0.528	µg/L	B223142	S221342
LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-11	Se	WS	D	2.43	H	0.165	0.528	µg/L	B223142	S221342
LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-12	Se	WS	TR	2.04	H	0.165	0.528	µg/L	B223142	S221342
LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-13	Se	WS	D	≤ 0.165	H U	0.165	0.528	µg/L	B223142	S221342
LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-14	Se	WS	TR	≤ 0.165	H U	0.165	0.528	µg/L	B223142	S221342
LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-15	Se	WS	D	1.23	H	0.165	0.528	µg/L	B223142	S221342
LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-16	Se	WS	TR	1.39	H J-1	0.165	0.528	µg/L	B223142	S221342
LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-17	Se	WS	D	45.8	H	0.165	0.528	µg/L	B223142	S221342
LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL										
2212302-18	Se	WS	TR	47.4	H	0.165	0.528	µg/L	B223142	S221342

Accuracy & Precision Summary

Batch: B223068
Lab Matrix: Water
Method: SOP BAL-4201

Sample	Analyte	Native	Spike	Result	Units	REC	REC Limits	RPD	RPD Limits
B223068-BS1	**Blank Spike, (2236035)**								
	MeSe(IV)		5.095	5.608	µg/L	110%	75-125		
	Se(IV)		5.000	4.946	µg/L	99%	75-125		
	Se(VI)		5.000	4.638	µg/L	93%	75-125		
	SeCN		5.015	4.822	µg/L	96%	75-125		
	SeMet		4.982	5.088	µg/L	102%	75-125		
B223068-DUP8	**Duplicate, (2212302-01)**								
	DMSeO	ND		ND	µg/L			N/C	25
	MeSe(IV)	ND		ND	µg/L			N/C	25
	MeSe(VI)	ND		ND	µg/L			N/C	25
	Se(IV)	0.191		0.194	µg/L			2%	25
	Se(VI)	50.57		49.65	µg/L			2%	25
	SeCN	ND		ND	µg/L			N/C	25
	SeMet	ND		ND	µg/L			N/C	25
	SeSO3	ND		ND	µg/L			N/C	25
	Unk Se Sp	ND		ND	µg/L			N/C	25
B223068-MS8	**Matrix Spike, (2212302-01)**								
	Se(IV)	0.191	4.900	5.224	µg/L	103%	75-125		
	Se(VI)	50.57	5.100	55.91	µg/L	NR	75-125		
	SeCN	ND	1.962	1.952	µg/L	100%	75-125		
	SeMet	ND	1.977	2.070	µg/L	105%	75-125		
B223068-MSD8	**Matrix Spike Duplicate, (2212302-01)**								
	Se(IV)	0.191	4.900	5.215	µg/L	103%	75-125	0.2%	25
	Se(VI)	50.57	5.100	55.59	µg/L	NR	75-125	N/C	25
	SeCN	ND	1.962	1.922	µg/L	98%	75-125	2%	25
	SeMet	ND	1.977	2.023	µg/L	102%	75-125	2%	25

Accuracy & Precision Summary

Batch: B223142
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B223142-BS1	**Blank Spike, (2137006)**								
	Se		200.0	179.2	µg/L	90%	75-125		
B223142-BS2	**Blank Spike, (2137006)**								
	Se		200.0	181.7	µg/L	91%	75-125		
B223142-BS3	**Blank Spike, (2137006)**								
	Se		200.0	177.3	µg/L	89%	75-125		
B223142-SRM1	**Reference Material (2128019, T221)**								
	Se		3.800	3.405	µg/L	90%	75-125		
B223142-SRM2	**Reference Material (2128019, T221)**								
	Se		3.800	3.355	µg/L	88%	75-125		
B223142-SRM3	**Reference Material (2128019, T221)**								
	Se		3.800	3.288	µg/L	87%	75-125		
B223142-DUP5	**Duplicate, (2212302-08)**								
	Se	45.60		45.64	µg/L			0.08%	20
B223142-MS5	**Matrix Spike, (2212302-08)**								
	Se	45.60	220.0	239.2	µg/L	88%	75-125		
B223142-MSD5	**Matrix Spike Duplicate, (2212302-08)**								
	Se	45.60	220.0	250.7	µg/L	93%	75-125	5%	20
B223142-DUP6	**Duplicate, (2212302-18)**								
	Se	47.45		46.65	µg/L			2%	20
B223142-MS6	**Matrix Spike, (2212302-18)**								
	Se	47.45	220.0	242.5	µg/L	89%	75-125		

Accuracy & Precision Summary

Batch: B223142
Lab Matrix: Water
Method: EPA 1638 Mod

Sample	Analyte	Native	Spike	Result	Units	REC & Limits		RPD & Limits	
B223142-MSD6	**Matrix Spike Duplicate, (2212302-18)**								
	Se	47.45	220.0	236.6	µg/L	86%	75-125	2%	20

Method Blanks & Reporting Limits

Batch: B223068
Matrix: Water
Method: SOP BAL-4201
Analyte: DMSeO

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(IV)

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Analyte: MeSe(VI)

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: Se(IV)

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.004
Limit: 0.015 **MRL:** 0.015

Analyte: Se(VI)

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: SeCN

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.010 **MRL:** 0.010

Analyte: SeMet

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.005 **MRL:** 0.005

Method Blanks & Reporting Limits

Analyte: SeSO3

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.011 **MRL:** 0.011

Analyte: Unk Se Sp

Sample	Result	Units
B223068-BLK1	0.00	µg/L
B223068-BLK2	0.00	µg/L
B223068-BLK3	0.00	µg/L
B223068-BLK4	0.00	µg/L

Average: 0.000 **MDL:** 0.002
Limit: 0.015 **MRL:** 0.015

Method Blanks & Reporting Limits

Batch: B223142
Matrix: Water
Method: EPA 1638 Mod
Analyte: Se

Sample	Result	Units
B223142-BLK1	0.041	µg/L
B223142-BLK2	0.039	µg/L
B223142-BLK3	0.070	µg/L
B223142-BLK4	0.011	µg/L

Average: 0.040
Limit: 0.480

MDL: 0.150
MRL: 0.480

Sample Containers

Lab ID: 2212302-01
Sample: LC_FRB_WS_LAEMP_DRY_2022-11_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2212302
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2212302
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2212302

Lab ID: 2212302-02
Sample: LC_FRUS_WS_LAEMP_DRY_2022-11_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/29/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2212302
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2212302
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2212302

Lab ID: 2212302-03
Sample: LC_GRCK_WS_LAEMP_DRY_2022-11_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2212302
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2212302
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2212302

Sample Containers

Lab ID: 2212302-04
Sample: LC_MT1_WS_LAEMP_DRY_2022-11_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2212302
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2212302
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2212302

Lab ID: 2212302-05
Sample: LC_DCEF_WS_LAEMP_DRY_2022-11_N
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/29/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2212302
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2212302
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2212302

Lab ID: 2212302-06
Sample: LC_CC1_WS_LAEMP_DRY_2022-11_NP
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	Cent Tube Se-Sp	15 mL	na	none	na	na	Cooler 6 - 2212302
B	XTRA_VOL	15 mL	na	none	na	na	Cooler 6 - 2212302
C	XTRA_VOL	125 mL	na	none	na	na	Cooler 6 - 2212302

Lab ID: 2212302-07
Sample: LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Sample Containers

Lab ID: 2212302-08
Sample: LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-09
Sample: LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/29/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-10
Sample: LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/29/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-11
Sample: LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-12
Sample: LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Sample Containers

Lab ID: 2212302-13
Sample: LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-14
Sample: LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-15
Sample: LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/29/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-16
Sample: LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/29/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Lab ID: 2212302-17
Sample: LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL
Report Matrix: WS
Sample Type: Sample + Sum
Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Sample Containers

Lab ID: 2212302-18
Sample: LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL

Report Matrix: WS
Sample Type: Sample + Sum

Collected: 11/30/2022
Received: 12/15/2022

Des	Container	Size	Lot	Preservation	P-Lot	pH	Ship. Cont.
A	zClient-Provided - TM	40 mL	na	10 % HNO3 (BAL)	2244016	<2	Cooler 6 - 2212302

Shipping Containers

Cooler 6 - 2212302

Received: December 15, 2022 7:08
Tracking No: RWHV 97355 via Courier
Coolant Type: Blue Ice
Temperature: -2.5 °C

Description: Styrofoam Cooler
Damaged in transit? No
Returned to client? No
Comments: R-IR-2

Custody seals present? No
Custody seals intact? No
COC present? Yes

COC ID:	LAEMP_DRY_2022-11_BROOKS	TURNAROUND TIME:	Regular	RUSH:	N/A

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Brooks Applied Labs			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Nicole Zathey			Lab Contact	Ben Wozniak			Email 1:	[illegible]	X	X	X
Email	Nicole.Zathey@teck.com			Email	Ben@brooksapplied.com			Email 2:	teckcoal@equisonline.com			X
Address	Box 2003			Address	18804 North Creek Parkway			Email 3:	Teck.Lab.Results@teck.com	X	X	X
	15km North Hwy 43				Suite 100			Email 4:	[illegible]@teck.com	X	X	X
City	Sparwood	Province	BC	City	Bothell	Province	WA	Email 5:	[illegible]@teck.com	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	98011	Country	United S	PO number	VPO00817033		
Phone Number	1-250-425-8478			Phone Number	(206) 753-6158						

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (F)	Brooks_Se_D (N)	Brooks_Se_T (N)
LC_DCEF_WS_LAEMP_DRY_2022-11_NP-NAL	LC_DCEF	WS		2022/11/29	10:30	G	2		1	1
LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_FRB	WS		2022/11/30	10:30	G	1	1		
LC_FRB_WS_LAEMP_DRY_2022-11_NP-NAL	LC_FRB	WS		2022/11/30	10:30	G	2		1	1
LC_FRUS_WS_LAEMP_DRY_2022-11_N	LC_FRUS	WS		2022/11/29	13:30	G	1	1		
LC_FRUS_WS_LAEMP_DRY_2022-11_NP-NAL	LC_FRUS	WS		2022/11/29	13:30	G	2		1	1
LC_GRCK_WS_LAEMP_DRY_2022-11_N	LC_GRCK	WS		2022/11/30	9:20	G	1	1		
LC_GRCK_WS_LAEMP_DRY_2022-11_NP-NAL	LC_GRCK	WS		2022/11/30	9:20	G	2		1	1
LC_MT1_WS_LAEMP_DRY_2022-11_NP	LC_MT1	WS		2022/11/30	10:30	G	1	1		
LC_MT1_WS_LAEMP_DRY_2022-11_NP-NAL	LC_MT1	WS		2022/11/30	10:30	G	2		1	1
LC_CC1_WS_LAEMP_DRY_2022-11_NP	LC_CC1	WS		2022/11/30	10:30	G	1	1		
LC_CC1_WS_LAEMP_DRY_2022-11_NP-NAL	LC_CC1	WS		2022/11/30	10:30	G	2		1	1

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
	Alex McClymont	6-Dec	ERL / BAL	12/15/22 7:08

SERVICE REQUEST (rush - subject to availability)					
Regular (default)	X	Sampler's Name	Alex McClymont	Mobile #	780-293-6750
Priority (2-3 business days) - 50% surcharge		Sampler's Signature	[signature]	Date/Time	6-Dec-2022
Emergency (1 Business Day) - 100% surcharge					
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Confidential

Teck

COC ID:	LAEMP_DRY_2022-11_BROOKS	TURNAROUND TIME:	Regular	RUSH:	N/A

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operation			Lab Name	Brooks Applied Labs			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Nicole Zathey			Lab Contact	Ben Wozniak			Email 1: [illegible]	X	X	X
Email	Nicole.Zathey@teck.com			Email	Ben@brooksapplied.com			Email 2: teckcoal@equisonline.com			X
Address	Box 2003			Address	18804 North Creek Parkway			Email 3: Teck.Lab.Results@teck.com	X	X	X
	15km North Hwy 43				Suite 100			Email 4: Hannah.Parmer@teck.com	X	X	X
City	Sparwood	Province	BC	City	Bothell	Province	WA	Email 5: equisclab@teck.com	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	98011	Country	United S	PO number	VPO00817033		
Phone Number	1-250-425-8478			Phone Number	(206) 753-6158						

SAMPLE DETAILS / **ANALYSIS REQUESTED** — Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation (Filt.: F)	Brooks_Se_D (Filt.: N)	Brooks_Se_T (Filt.: N)
LC_DCEF_WS_LAEMP_DRY_2022-11_N	LC_DCEF	WS		2022/11/29	10:30	G	1	1		

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
			ERL/BAL	12/1/5/22 7:08

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X	Sampler's Name		Mobile #	
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge		Sampler's Signature		Date/Time	
For Emergency <1 Day, ASAP or Weekend - Contact ALS					

Confidential

COC ID:	LAEMP_DRY_2022-11_BROOKS	TURNAROUND TIME:	Regular	RUSH:	N/A

PROJECT/CLIENT INFO			
Facility Name / Job#	Line Creek Operation		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@teck.com		
Address	Box 2003		
	15km North Hwy 43		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-425-8478		

LABORATORY			
Lab Name	Brooks Applied Labs		
Lab Contact	Ben Wozniak		
Email	Ben@brooksapplied.com		
Address	18804 North Creek Parkway		
	Suite 100		
City	Bothell	Province	WA
Postal Code	98011	Country	US
Phone Number	(206) 753-6158		

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	[illegible]	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	[illegible]	X	X	X
Email 5:	[illegible]	X	X	X
PO number	VPO00817033			

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	G=Grab C=Comp	# Of Cont.	Brooks_Se_Speciation	Brooks_Se_D	Brooks_Se_T
FIL.								F	N	N
PRESERV.										
LC_FRB_WS_LAEMP_DRY_2022-11_N	LC_FRB	WS	n	2022/11/30	10:30	G	1	1		
LC_FRUS_WS_LAEMP_DRY_2022-11_N	LC_FRUS	WS	n	2022/11/29	13:30	G	1	1		
LC_GRCK_WS_LAEMP_DRY_2022-11_N	LC_GRCK	WS	n	2022/11/30	9:20	G	1	1		
LC_MT1_WS_LAEMP_DRY_2022-11_NP	LC_MT1	WS	n	2022/11/30	10:30	G	1	1		
LC_DCEF_WS_LAEMP_DRY_2022-11_N	LC_DCEF	WS	n	2022/11/29	10:30	G	1	1		
LC_CC1_WS_LAEMP_DRY_2022-11_NP	LC_CC1	WS	n	2022/11/30	10:30	G	1	1		

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS

RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
Alex McClymont	December 9, 2022	AM / BAL	12/15/22 07:04

SERVICE REQUEST (rush - subject to availability)

Regular (default)	X
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	
For Emergency <1 Day, ASAP or Weekend - Contact ALS	

Sampler's Name	Alex McClymont	Mobile #	780-293-6750
Sampler's Signature	[signature]	Date/Time	December 9, 2022

STRAIGHT BILL OF LADING
NOT NEGOTIABLE

Confidential

SERVICE INC.
250-425-7447
24 Hour Hot Shot Service

No. 97355

BAL Final Report 2212302

Sparwood, BC | Terrace, BC | Red Deer, AB
Vancouver, BC | Calgary, AB | Montreal, QC
Prince George, BC | Edmonton, AB | Spokane, WA
Elkford, BC | Ft. McMurray, AB | Shelby, MT
Tumbler Ridge, BC | Hinton, AB | Gillette, WY

INVOICE TO: AL Teck
DATE: Dec 13/22

BILL OF LADING #:
PURCHASE ORDER NUMBER:

SHIPPER (FROM): Teck Coal
CONSIGNEE (TO): Brooks Applied Labs

STREET: Line Creek Water Treatment
STREET: 13751 Lake City Way NE

CITY/PROVINCE: Sparwood, BC
POSTAL CODE:
CITY/PROVINCE: Seattle WA
POSTAL CODE:

SPECIAL INSTRUCTIONS

PACKAGES	DESCRIPTION OF ARTICLES AND SPECIAL MARKS	WEIGHT (Subject to Correction)
3	Coolers Water Samples	70 lbs

FREIGHT CHARGES
SHIPPER TO CHECK
☐ PREPAID ☐ COLLECT
If not indicated, shipping will automatically move collect

FEE
WAITING
XPU
CHARGES
FSC
US
SUB TOTAL
GST
TOTAL $
IF AT OWNER'S RISK, WRITE ORD HERE

UNIT #

DECLARED VALUATION: Maximum liability of carrier is $2.00 per lb. ($4.41 per kilogram) unless declared valuation states otherwise $

DRIVER'S SIGNATURE - PICK UP BY
PICK UP TIME
DRIVER'S SIGNATURE - DELIVERY BY: Shayn
FINISH TIME: 8:36 pm

NOTICE OF CLAIM: (a) No carrier is liable for loss, damage or delay of any goods under the Bill of Lading unless notice therefor setting out particulars of the origin, destination and date of shipment of the goods and the estimated amount claimed in respect of such loss, damage or delay is given in writing to the originating carrier or the delivering carrier within sixty (60) days after the delivery of the goods, or in the case of failure to make delivery within nine (9) months from the date of shipment. (b) The final statement of the claim must be filed within nine (9) months from the date of shipment together with a copy of the paid freight bill. RECEIVED at the point of origin on the date specified from the consignor mentioned herein, the property herein described, in apparent good order, except as noted (contents and condition of contents of package unknown) marked, consigned and destined as indicated below, which the carrier agrees to carry and to deliver to the consignee at the said destination, subject to the rates and classification in effect on the date of shipment. It is mutually agreed, as to each carrier of all or any of the goods over all or any portion of the route to destination, and as to each party of any time interested in all or any of the goods, that every service to be performed hereunder shall be subject to all the conditions standard Bill of Lading, in power at the date of signing, which are hereto agreed by the consignor and accepted for himself and his assigns. Printed or written, including conditions set aside by the standard Bill of Lading, in power at the date of issuing which are hereby agreed by the consignor and accepted for himself and his assigns. The Contract for the carriage of the goods listed in the Bill of Lading is governed by regulation in force in the jurisdiction at the time and place of shipment and is subject to the conditions set out in such conditions.

SHIPPER PRINT
CONSIGNEE PRINT
DATE: Dec 14/22

SHIPPER SIGN
CONSIGNEE SIGN
TIME: 8:30 pm

NUMBER OF PIECES RECEIVED: 2

WHITE: Office YELLOW: Carrier PINK: Consignee GOLDENROD: Shipper

GST # 864540398RT0001

Cooler ID: Cooler 6 COC (Y/N) Temperature: -2.5 IR: R-IR-2

Coolant Type: Ice Blue Ice Ambient

Notes:

Sampling Locations:	EV		LC		R6					
Sample Types:	T/D	SP	T/D	SP	T/D	SP	T/D	SP	T/D	SP
Container Types:	40mL glass	125mL plastic	40mL glass	125mL plastic		125mL plastic				

Opened By: ERL Date: 12/15/22

Effective 7/29/20

COPY

Revision 004

BENTHIC COMMUNITY

Cordillera Report 220144

Project: 22-19 (LCO Dry Creek LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022		2022		2022	
Sample:	LC_DCDS_BIC-01_2022-05_NP		LC_DCDS_BIC-02_2022-05_NP		LC_DCDS_BIC-03_2022-05_NP		LC_DCDS_BIC-04_2022-05_NP		LC_DCDS_BIC-05_2022-05_NP	
Sample Collection Date:	10-May-22		10-May-22		10-May-22		10-May-22		10-May-22	
CC#:	CC230046		CC230047		CC230048		CC230049		CC230050	
Sieve Size:	400		400		400		400		400	
Subsample %:	5		6		11		5		5	
Phylum: Arthropoda	0		0		0		0		0	
Subphylum: Hexapoda	0		0		0		0		0	
| Class: Insecta	0		0		0		0		0	
| Order: Ephemeroptera	0		0		0		0		0	
| Family: Ameletidae	0		0		0		0		0	
Ameletus	0		2		2		0		2	
| Family: Baetidae	0		0		0		0		0	
Baetis	4	ND	4		1	ND	6	ND	8	
Baetis rhodani group	2		0		1		3		2	
Baetis bicaudatus	0		0		1		0		0	
| Family: Caenidae	0		0		0		0		0	
Caenis	0		0		1		0		0	
| Family: Ephemerellidae	14		23		19	ND	11	ND	18	
Drunella	0		0		2		1		6	
Drunella doddsii	0		0		2		0		2	
Ephemerella	1		3		0		0		0	
| Family: Heptageniidae	26		18		45		68		67	
| Order: Plecoptera	1		0		0		0		0	
| Family: Chloroperlidae	0		0		6		0		0	
Sweltsa	8		3		2		5		6	
| Family: Nemouridae	6		4		4		4		2	
Zapada	193		97		89	ND	91	ND	52	ND
Zapada oregonensis group	2		2		10		3		4	
Zapada cinctipes	1		0		0		1		0	
| Family: Peltoperlidae	0		0		0		0		0	
Yoraperla	1		0		0		0		0	
| Family: Perlodidae	0		5		5	ND	6	ND	6	ND
Isoperla	5		0		0		0		1	
Kogotus	1		0		2		1		1	
Megarcys	5		1		1		1		3	
| Family: Taeniopterygidae	0		0		0		0		0	
Taenionema	1		4		3		0		3	
| Order: Trichoptera	0		0		0		0		0	
| Family: Glossosomatidae	0		0		0		0		0	
Glossosoma	0		2		0		0		1	
| Family: Hydropsychidae	6		0		0		0		0	
Arctopsyche	20		10		15		7		20	
| Family: Limnephilidae	0		0		0		0		0	
Ecclisomyia	0		2		0		5		1	
| Family: Rhyacophilidae	0		0		0		0		0	
Rhyacophila	42		40		30	ND	39		50	
Rhyacophila betteni group	1		0		1		0		0	
Rhyacophila brunnea/vemna group	2		1		1		1		1	
Rhyacophila hyalinata group	5		0		0		0		0	
Rhyacophila vofixa group	2		3		2		0		0	
Rhyacophila narvae	2		2		3		0		1	
| Family: Thremmatidae	0		0		0		0		0	
Oligophlebodes	9		7		5		4		5	
| Family: Uenoidae	0		0		0		0		0	
Neothremma	0		2		0		0		0	
| Order: Coleoptera	0		0		0		0		0	
| Family: Staphylinidae	0		0		0		1		0	
| Order: Diptera	0		0		0		0		0	
| Family: Chironomidae	4	ND	11	ND	4	ND	17		16	
| Subfamily: Chironominae	0		0		0		0		0	
| Tribe: Chironomini	0		0		0		0		0	
Polypedilum	0		0		0		0		1	
| Tribe: Tanytarsini	1		4		22		8		9	ND
Micropsectra	0		0		3		2		4	
| Subfamily: Diamesinae	0		0		0		0		0	
| Tribe: Diamesini	0		0		0		0		0	
Diamesa	0		0		0		1		0	
Pagastia	4		33		5		2		5	
| Subfamily: Orthocladiinae	0		0		0		0		0	
Brillia	2		2		3		0		5	
Cricotopus (Nostococladius)	3		1		0		0		0	
Eukiefferiella	17		52		17		15		26	
Krenosmittia	0		0		0		1		0	
Limnophyes	0		1		1		0		0	
Orthocladius complex	30		0		43		55		17	
Rheocricotopus	0		0		1		0		0	
Tvetenia	4		1		2		2		2	
| Family: Empididae	0		0		0		0		0	
Chelifera/ Metachela	5		6		1		0		0	
| Family: Psychodidae	0		0		0		0		0	
Pericoma/Telmatoscopus	3		5		5		0		2	
| Family: Simuliidae	0		0		0		1		2	
Simulium	0		3		0		0		0	
| Family: Tipulidae	0		0		0		0		0	
Dicranota	2		1		0		2		0	

Project: 22-19 (LCO Dry Creek LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022	2022
Sample:	LC_DCDS_BIC-01_2022-05_NP	LC_DCDS_BIC-02_2022-05_NP	LC_DCDS_BIC-03_2022-05_NP	LC_DCDS_BIC-04_2022-05_NP	LC_DCDS_BIC-05_2022-05_NP
Sample Collection Date:	10-May-22	10-May-22	10-May-22	10-May-22	10-May-22
CC#:	CC230046	CC230047	CC230048	CC230049	CC230050
Sieve Size:	400	400	400	400	400
Subsample %:	5	6	11	5	5
Phylum: Mollusca	0	0	0	0	0
| Class: Gastropoda	0	0	0	0	0
| Order: Basommatophora	0	0	0	0	0
| Family: Lymnaeidae	0	1	0	0	0
Phylum: Annelida	0	0	0	0	0
Subphylum: Clitellata	0	0	0	0	0
| Class: Oligochaeta	0	0	0	0	0
| Order: Tubificida	0	0	0	0	0
| Family: Enchytraeidae	0	0	0	0	0
Enchytraeus	0	0	1	0	0
Totals:	**435**	**356**	**361**	**364**	**351**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0	0
Subphylum: Crustacea	0	0	0	0	0
| Class: Ostracoda	1	1	1	1	1
| Class: Branchiopoda	0	0	0	0	0
| Order: Cladocera	1	0	0	0	0
Phylum: Platyhelminthes	0	0	0	0	0
| Class: Turbellaria	1	1	1	1	1
Totals:	**3**	**2**	**2**	**2**	**2**

ND designation of a taxa represents a non-distinct taxa. This adjusts where the associated taxa fall in the metrics for this sample because the individuals are likely represented by Genus or Species level identifications.

Methods and QC Report 2022

Project ID: LCO Dry Creek (22-19)

Client: Minnow Environmental

Prepared by:
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Summerland, BC

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Sample Reception

On May 20, 2022, Cordillera Consulting received 5 benthic samples from Minnow Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Sample	CC#	Date	Size	# of Jars
LC_DCDS_BIC-01_2022-05_NP	CC230046	5/10/2022	400µM	2
LC_DCDS_BIC-02_2022-05_NP	CC230047	5/10/2022	400µM	1
LC_DCDS_BIC-03_2022-05_NP	CC230048	5/10/2022	400µM	1
LC_DCDS_BIC-04_2022-05_NP	CC230049	5/10/2022	400µM	1
LC_DCDS_BIC-05_2022-05_NP	CC230050	5/10/2022	400µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.

- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	400 micron fraction	
			% Sampled	# Invertebrates
LC_DCDS_BIC-01_2022-05_NP	10-May-22	CC230046	5%	435
LC_DCDS_BIC-02_2022-05_NP	10-May-22	CC230047	6%	356
LC_DCDS_BIC-03_2022-05_NP	10-May-22	CC230048	11%	361
LC_DCDS_BIC-04_2022-05_NP	10-May-22	CC230049	5%	364
LC_DCDS_BIC-05_2022-05_NP	10-May-22	CC230050	5%	351

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3 Summary of sorting efficiency

		Total from Sample	Percent Efficiency
Site - QC, Sample - QC 1, CC# - CC220750, Percent sampled = 100%, Sieve size = 250			
Plecoptera	2		
Trichoptera	1		
Chironomidae	3		
Total:	**6**	**147**	**96%**
Site - QC, Sample - QC 2, CC# - CC220753, Percent sampled = 100%, Sieve size = 250			
Oligochaeta	1		
Trombidiformes	1		
Total:	**2**	**180**	**99%**
Site - QC, Sample - QC 3, CC# - CC220765, Percent sampled = 100%, Sieve size = 250			
Trombidiformes	15		
Oligochaeta	2		
Chironomidae	1		
Total:	**18**	**343**	**95%**

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of error would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4 Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																				Sorter		Actual Total	Precision		Accuracy	
CC#	Sample Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	By	Time		Percent Range		Min	Max
230050	LC_DCDS_BIC05_2022-05_NP	349	300	314	300	301	317	302	300	308	290	290	308	301	302	314	298	333	328	327	330	MP	960	6212	0.00	16.91	0.84	12.36

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae
Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 5 Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - 2022, Sample - LC_DCDS_BIC-03_2022-05_NP, CC# - CC230048, Percent sampled = 11%, Sieve size = 400	362	0.00	0.13831259	0.55248619	0.00414938

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - 2022, Sample - LC_DCDS_BIC-03_2022-05_NP, CC# - CC230048, Percent sampled = 11%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Ameletus	2	2						
Arctopsyche	15	14	No			X		
Baetis	1	1						
Baetis bicaudatus	1	1						
Baetis rhodani group	1	1						
Brillia	3	3						
Caenis	1	1						

Chelifera/ Metachela	1	1						
Chironomidae	4	4						
Chloroperlidae	6	6						
Drunella	2	2						
Drunella doddsii	2	2						
Enchytraeus	1	1						
Ephemerellidae	19	19						
Eukiefferiella	17	17						
Heptageniidae	45	45						
Kogotus	2	2						
Limnophyes	1	1						
Megarcys	1	1						
Micropsectra	3	3						
Nemouridae	4	4						
Oligophlebodes	5	5						
Orthocladius complex	43	44	No			X		
Pagastia	5	5						
Pericoma/Telmatoscopus	5	5						
Perlodidae	5	5						
Rheocricotopus	1	1						
Rhyacophila	30	30						
Rhyacophila betteni group	1	1						
Rhyacophila brunnea/vemna group	1	1						
Rhyacophila narvae	3	3						
Rhyacophila vofixa group	2	2						
Sweltsa	2	2						
Taenionema	3	3						
Tanytarsini	22	22						
Tvetenia	2	2						
Zapada	89	90	No			X		
Zapada oregonensis group	10	10						
Total:	**361**	**362**						
					0	3	0	
% Total Misidentification Rate =	misidentifications	x100	0.00	**Pass**				
	total number	=						

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[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015).
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BENTHIC COMMUNITY

Cordillera Report 230020

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022		2022	
Sample:	LC_DC1_BIC-1_2022-09-12_N		LC_DC1_BIC-2_2022-09-12_N		LC_DC1_BIC-3_2022-09-12_N		LC_DC2_BIC-1_2022-09-14_N	
Sample Collection Date:	12-Sep-22		12-Sep-22		12-Sep-22		14-Sep-22	
CC#:	CC231037		CC231038		CC231039		CC231040	
Sieve Size:	400		400		400		400	
Subsample %:	5		10		5		14	
Phylum: Arthropoda	0		0		0		0	
| Order: Collembola	0		0		0		0	
Subphylum: Hexapoda	0		0		0		0	
| Class: Insecta	0		0		0		0	
| Order: Ephemeroptera	0		0		0		0	
| Family: Ameletidae	0		0		0		0	
Ameletus	0		1		0		0	
| Family: Baetidae	9	ND	5	ND	5	ND	0	
Baetis	1	ND	2		3		0	
Baetis fuscatus gr.	0		0		0		0	
Baetis rhodani group	29		28		26		4	
Baetis bicaudatus	2		0		0		0	
| Family: Ephemerellidae	15		15		17		18	
Drunella	0		0		0		0	
Drunella grandis group	0		0		0		0	
Drunella coloradensis	0		0		0		0	
Drunella doddsii	16		12		11		6	
| Family: Heptageniidae	21		15		14		3	
Cinygmula	22		27		27		5	
Epeorus	0		0		1		0	
Rhithrogena	0		0		0		0	
| Family: Siphlonuridae	0		0		0		0	
Siphlonurus	0		0		0		0	
| Order: Plecoptera	9	ND	2	ND	2	ND	1	ND
| Family: Capniidae	0		0		0		0	
Mesocapnia	0		0		0		0	
| Family: Chloroperlidae	0		0		0		3	
Haploperla	0		0		0		0	
Plumiperla	0		0		0		0	
Sweltsa	3		0		3		2	
Utaperla	0		0		0		0	
| Family: Leuctridae	0		0		0		0	
Paraleuctra	0		0		0		0	
| Family: Nemouridae	2	ND	1	ND	1	ND	1	ND
Malenka	0		0		0		0	
Visoka cataractae	1		0		0		0	
Zapada	30	ND	11	ND	21		31	
Zapada oregonensis group	67		42		61		25	
Zapada cinctipes	4		2		0		0	
Zapada columbiana	18		7		12		15	
| Family: Peltoperlidae	0		0		0		0	
Yoraperla	0		0		0		1	
| Family: Perlidae	0		0		0		0	
Hesperoperla	0		0		0		0	
| Family: Perlodidae	1		4		1		2	
Isoperla	0		0		0		0	
Kogotus	3		1		1		0	
Megarcys	3		0		3		1	
Setvena	0		0		0		0	
| Family: Taeniopterygidae	4		4		4		3	
| Order: Trichoptera	33	ND	12		38		20	ND
| Family: Brachycentridae	0		0		0		0	
Brachycentrus	0		0		0		0	
Micrasema	0		0		0		0	
| Family: Glossosomatidae	0		0		0		1	
Glossosoma	0		0		0		0	
| Family: Hydropsychidae	7		3		4		23	
Parapsyche	0		0		0		0	
Parapsyche elsis	6		1		2		3	
| Family: Leptoceridae	0		0		0		0	
| Family: Limnephilidae	2		1		0		4	
Clostoeca disjuncta	0		0		0		0	
Dicosmoecus	0		0		0		0	
Ecclisomyia	0		0		0		1	
| Family: Rhyacophilidae	0		0		0		0	
Rhyacophila	0		0		1	ND	4	
Rhyacophila betteni group	0		0		0		6	
Rhyacophila brunnea/vemna group	2		1		4		0	
Rhyacophila hyalinata group	0		1		1		0	
Rhyacophila vetina complex	0		0		0		0	
Rhyacophila vofixa group	0		0		0		1	
Rhyacophila atrata complex	0		0		0		0	
Rhyacophila narvae	3		1		4		0	
| Family: Thremmatidae	0		0		0		0	
Oligophlebodes	5		0		3		36	
| Family: Uenoidae	0		0		0		0	
Neothremma	0		0		0		0	
| Order: Coleoptera	0		0		0		0	
| Family: Elmidae	0		0		0		1	ND

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022		2022	
Sample:	LC_DC1_BIC-1_2022-09-12_N		LC_DC1_BIC-2_2022-09-12_N		LC_DC1_BIC-3_2022-09-12_N		LC_DC2_BIC-1_2022-09-14_N	
Sample Collection Date:	12-Sep-22		12-Sep-22		12-Sep-22		14-Sep-22	
CC#:	CC231037		CC231038		CC231039		CC231040	
Sieve Size:	400		400		400		400	
Subsample %:	5		10		5		14	
Heterlimnius	0		0		1		1	
| Family: Staphylinidae	0		0		0		1	
| Order: Diptera	0		0		0		0	
| Family: Ceratopogonidae	0		0		0		0	
Mallochohelea	0		0		0		0	
| Family: Chironomidae	25	ND	13	ND	40	ND	19	ND
| Subfamily: Chironominae	0		0		0		0	
| Tribe: Tanytarsini	0		2		1		0	
Micropsectra	0		1		1		1	
Stempellinella	0		0		0		0	
| Subfamily: Diamesinae	0		0		0		0	
| Tribe: Diamesini	0		0		0		0	
Diamesa	29		9		33		4	
Pagastia	38		19		35		4	
Pseudodiamesa	1		1		0		2	
| Subfamily: Orthocladiinae	1		0		0		0	
Brillia	0		0		0		0	
Corynoneura	0		0		0		0	
Cricotopus (Nostococladius)	0		0		1		0	
Diplocladius cultriger	0		0		0		0	
Eukiefferiella	35		4		45		5	
Hydrobaenus	10		20		7		19	
Limnophyes	0		0		0		0	
Metriocnemus	0		0		0		0	
Orthocladius complex	60		26		44		7	
Parametriocnemus	0		0		0		0	
Parorthocladius	2		1		2		0	
Rheocricotopus	2		5		5		1	
Tvetenia	14		10		9		4	
| Subfamily: Tanypodinae	0		0		0		0	
Krenopelopia	0		1		0		0	
| Tribe: Pentaneurini	0		0		0		0	
Telmatopelopia	0		0		0		0	
Thienemannimyia group	0		0		0		0	
| Family: Empididae	1		1		0		0	
Chelifera/ Metachela	1		0		0		3	
Clinocerinae Unknown Genus A	0		0		0		0	
Neoplasta	0		1		1		3	
Oreogeton	0		0		0		0	
Trichoclinocera	0		0		0		0	
| Family: Pelecorhynchidae	0		0		0		0	
Glutops	0		0		0		0	
| Family: Psychodidae	0		0		0		0	
Pericoma/Telmatoscopus	77		25		15		27	
| Family: Simuliidae	0		0		0		0	
Prosimulium	0		0		0		0	
Prosimulium/Helodon	0		0		0		1	
Simulium	0		0		2		1	
| Family: Tipulidae	0		0		0		0	
Antocha	0		0		0		0	
Dicranota	0		0		0		0	
Molophilus	0		0		0		0	
Pedicia	0		0		0		0	
Tricyphona	1		0		0		0	
Subphylum: Chelicerata	0		0		0		0	
| Class: Arachnida	0		0		0		0	
| Order: Trombidiformes	0		0		0		0	
| Family: Feltriidae	0		0		0		0	
Feltria	0		0		1		0	
| Family: Hydryphantidae	0		0		0		0	
Albertathyas	0		0		0		0	
| Family: Hygrobatidae	0		0		0		0	
Atractides	0		0		0		0	
Hygrobates	0		0		0		0	
| Family: Lebertiidae	0		0		0		0	
Lebertia	0		0		0		0	
| Family: Sperchontidae	0		0		0		0	
Sperchon	1		0		0		0	
| Family: Torrenticolidae	0		0		0		0	
Testudacarus	0		0		0		0	
| Order: Sarcoptiformes	0		0		0		0	
| Order: Oribatida	0		0		0		0	
| Family: Hydrozetidae	1		0		0		0	
Phylum: Mollusca	0		0		0		0	
| Class: Gastropoda	0		0		0		1	
Phylum: Annelida	0		0		0		0	
Subphylum: Clitellata	0		0		0		0	
| Class: Oligochaeta	0		0		0		0	
| Order: Lumbriculida	0		0		0		0	
| Family: Lumbriculidae	0		0		0		0	
Rhynchelmis	0		0		0		0	
| Order: Tubificida	0		0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2022	2022	2022	2022
Sample:	LC_DC1_BIC-1_2022-09-12_N	LC_DC1_BIC-2_2022-09-12_N	LC_DC1_BIC-3_2022-09-12_N	LC_DC2_BIC-1_2022-09-14_N
Sample Collection Date:	12-Sep-22	12-Sep-22	12-Sep-22	14-Sep-22
CC#:	CC231037	CC231038	CC231039	CC231040
Sieve Size:	400	400	400	400
Subsample %:	5	10	5	14
| Family: Enchytraeidae	0	1	0	3
| Family: Naididae	0	0	0	0
Nais	0	0	0	0
Stylaria lacustris	0	0	0	1
| Subfamily: Tubificinae with hair chaeta	0	0	0	0
Totals:	**617**	**339**	**513**	**329**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0
Subphylum: Hexapoda	0	0	0	0
| Class: Insecta	0	0	0	0
| Order: Diptera	0	0	0	0
| Family: Cecidomyiidae	0	1	0	0
| Order: Homoptera	0	0	0	0
| Family: Cicadellidae	0	0	0	0
| Order: Psocodea	0	0	0	0
Subphylum: Crustacea	0	0	0	0
| Class: Ostracoda	1	1	1	1
Phylum: Annelida	0	0	0	0
Subphylum: Clitellata	0	0	0	0
| Class: Oligochaeta	0	0	0	0
| Order: Tubificida	0	0	0	0
| Family: Lumbricidae	0	0	0	0
Phylum: Nemata	1	1	1	1
Phylum: Platyhelminthes	0	0	0	0
| Class: Turbellaria	1	1	1	1
Totals:	**3**	**4**	**3**	**3**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
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250-494-7553

Site:	2022		2022		2022		2022	
Sample:	LC_DC2_BIC-2_2022-09-14_N		LC_DC2_BIC-3_2022-09-14_N		LC_DC3_BIC-1_2022-09-13_N		LC_DC3_BIC-2_2022-09-13_N	
Sample Collection Date:	14-Sep-22		14-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231041		CC231042		CC231043		CC231044	
Sieve Size:	400		400		400		400	
Subsample %:	15		8		5		8	
Phylum: Arthropoda	0		0		0		0	
| Order: Collembola	0		0		1		0	
Subphylum: Hexapoda	0		0		0		0	
| Class: Insecta	0		0		0		0	
| Order: Ephemeroptera	0		0		0		0	
| Family: Ameletidae	0		0		0		0	
Ameletus	0		0		0		0	
| Family: Baetidae	3		0		0		0	
Baetis	0		0		0		0	
Baetis fuscatus gr.	0		0		0		0	
Baetis rhodani group	12		4		0		0	
Baetis bicaudatus	0		0		0		0	
| Family: Ephemerellidae	27		17		0		0	
Drunella	0		0		0		0	
Drunella grandis group	0		0		0		0	
Drunella coloradensis	0		0		0		0	
Drunella doddsii	5		3		0		0	
| Family: Heptageniidae	10		4		0		0	
Cinygmula	6		7		7		0	
Epeorus	0		2		0		0	
Rhithrogena	0		0		0		0	
| Family: Siphlonuridae	0		0		0		0	
Siphlonurus	0		0		0		0	
| Order: Plecoptera	2	ND	4	ND	0		0	
| Family: Capniidae	0		0		8		3	
Mesocapnia	0		0		0		0	
| Family: Chloroperlidae	2		5		2		3	
Haploperla	0		0		0		0	
Plumiperla	0		0		0		0	
Sweltsa	2		4		1		1	
Utaperla	0		0		0		0	
| Family: Leuctridae	0		0		1		0	
Paraleuctra	0		0		0		0	
| Family: Nemouridae	3	ND	4	ND	0		0	
Malenka	0		0		0		0	
Visoka cataractae	0		0		0		0	
Zapada	21	ND	27	ND	1	ND	1	
Zapada oregonensis group	34		21		19		15	
Zapada cinctipes	3		2		0		0	
Zapada columbiana	17		20		30		43	
| Family: Peltoperlidae	0		0		0		0	
Yoraperla	0		0		1		3	
| Family: Perlidae	0		0		0		0	
Hesperoperla	0		0		0		0	
| Family: Perlodidae	5		1		0		1	
Isoperla	0		0		0		0	
Kogotus	0		3		0		0	
Megarcys	1		5		2		5	
Setvena	0		0		0		0	
| Family: Taeniopterygidae	2		3		0		0	
| Order: Trichoptera	11		2	ND	1	ND	1	ND
| Family: Brachycentridae	0		0		0		0	
Brachycentrus	0		0		0		0	
Micrasema	0		0		0		0	
| Family: Glossosomatidae	0		0		0		0	
Glossosoma	0		1		0		0	
| Family: Hydropsychidae	45		71		0		0	
Parapsyche	0		0		0		0	
Parapsyche elsis	2		7		0		0	
| Family: Leptoceridae	0		0		0		0	
| Family: Limnephilidae	0		1		2		0	
Clostoeca disjuncta	0		0		0		0	
Dicosmoecus	0		0		0		0	
Ecclisomyia	1		0		2		1	
| Family: Rhyacophilidae	0		0		0		0	
Rhyacophila	1		1		2		5	
Rhyacophila betteni group	5		7		0		0	
Rhyacophila brunnea/vemna group	1		2		6		3	
Rhyacophila hyalinata group	1		2		0		1	
Rhyacophila vetina complex	0		0		0		0	
Rhyacophila vofixa group	0		0		0		3	
Rhyacophila atrata complex	0		0		0		0	
Rhyacophila narvae	0		2		0		1	
| Family: Thremmatidae	0		0		0		0	
Oligophlebodes	45		7		0		0	
| Family: Uenoidae	0		0		0		0	
Neothremma	0		0		0		0	
| Order: Coleoptera	0		0		0		0	
| Family: Elmidae	0		0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2022		2022		2022		2022	
Sample:	LC_DC2_BIC-2_2022-09-14_N		LC_DC2_BIC-3_2022-09-14_N		LC_DC3_BIC-1_2022-09-13_N		LC_DC3_BIC-2_2022-09-13_N	
Sample Collection Date:	14-Sep-22		14-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231041		CC231042		CC231043		CC231044	
Sieve Size:	400		400		400		400	
Subsample %:	15		8		5		8	
Heterlimnius	0		0		0		0	
| Family: Staphylinidae	0		0		0		0	
| Order: Diptera	0		0		0		0	
| Family: Ceratopogonidae	0		0		0		0	
Mallochohelea	0		0		0		0	
| Family: Chironomidae	17	ND	11	ND	38	ND	17	ND
| Subfamily: Chironominae	0		0		0		0	
| Tribe: Tanytarsini	0		0		0		0	
Micropsectra	1		1		0		0	
Stempellinella	0		0		0		0	
| Subfamily: Diamesinae	0		0		0		0	
| Tribe: Diamesini	0		0		0		0	
Diamesa	1		9		2		1	
Pagastia	3		2		64		61	
Pseudodiamesa	2		0		52		10	
| Subfamily: Orthocladiinae	0		0		0		0	
Brillia	0		0		0		0	
Corynoneura	0		0		0		0	
Cricotopus (Nostococladius)	0		0		0		0	
Diplocladius cultriger	0		0		0		0	
Eukiefferiella	6		8		95		38	
Hydrobaenus	0		12		26		3	
Limnophyes	0		0		0		1	
Metriocnemus	0		0		0		0	
Orthocladius complex	16		17		199		96	
Parametriocnemus	0		0		0		0	
Parorthocladius	3		3		12		7	
Rheocricotopus	0		0		0		0	
Tvetenia	0		2		2		2	
| Subfamily: Tanypodinae	0		0		0		0	
Krenopelopia	0		0		0		0	
| Tribe: Pentaneurini	0		0		0		0	
Telmatopelopia	0		0		0		0	
Thienemannimyia group	0		0		0		0	
| Family: Empididae	0		0		2		0	
Chelifera/ Metachela	1		2		0		0	
Clinocerinae Unknown Genus A	0		0		0		0	
Neoplasta	1		4		0		0	
Oreogeton	0		0		2		0	
Trichoclinocera	0		0		5		2	
| Family: Pelecorhynchidae	0		0		0		0	
Glutops	0		0		0		0	
| Family: Psychodidae	0		0		0		0	
Pericoma/Telmatoscopus	14		19		19		4	
| Family: Simuliidae	0		0		0		0	
Prosimulium	0		0		0		0	
Prosimulium/Helodon	0		3		0		0	
Simulium	0		0		0		0	
| Family: Tipulidae	0		0		0		0	
Antocha	0		0		0		0	
Dicranota	0		1		3		2	
Molophilus	0		0		0		0	
Pedicia	0		0		0		0	
Tricyphona	0		0		0		0	
Subphylum: Chelicerata	0		0		0		0	
| Class: Arachnida	0		0		0		0	
| Order: Trombidiformes	0		0		0		0	
| Family: Feltriidae	0		0		0		0	
Feltria	0		0		2		0	
| Family: Hydryphantidae	0		0		0		0	
Albertathyas	0		0		0		2	
| Family: Hygrobatidae	0		0		0		0	
Atractides	0		0		1		0	
Hygrobates	0		0		0		0	
| Family: Lebertiidae	0		0		0		0	
Lebertia	1		0		10		7	
| Family: Sperchontidae	0		0		0		0	
Sperchon	0		0		0		0	
| Family: Torrenticolidae	0		0		0		0	
Testudacarus	0		0		0		0	
| Order: Sarcoptiformes	0		0		0		0	
| Order: Oribatida	0		0		1		0	
| Family: Hydrozetidae	0		0		0		0	
Phylum: Mollusca	0		0		0		0	
| Class: Gastropoda	0		0		0		0	
Phylum: Annelida	0		0		0		0	
Subphylum: Clitellata	0		0		0		0	
| Class: Oligochaeta	0		0		0		0	
| Order: Lumbriculida	0		0		0		0	
| Family: Lumbriculidae	0		0		0		0	
Rhynchelmis	0		0		0		0	
| Order: Tubificida	0		0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022	2022
Sample:	LC_DC2_BIC-2_2022-09-14_N	LC_DC2_BIC-3_2022-09-14_N	LC_DC3_BIC-1_2022-09-13_N	LC_DC3_BIC-2_2022-09-13_N
Sample Collection Date:	14-Sep-22	14-Sep-22	13-Sep-22	13-Sep-22
CC#:	CC231041	CC231042	CC231043	CC231044
Sieve Size:	400	400	400	400
Subsample %:	15	8	5	8
| Family: Enchytraeidae	2	2	1	0
| Family: Naididae	0	0	0	0
Nais	0	0	0	0
Stylaria lacustris	0	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0	0
Totals:	**335**	**335**	**622**	**343**

Taxa present but not included:

Phylum: Arthropoda	0	0	0	0
Subphylum: Hexapoda	0	0	0	0
| Class: Insecta	0	0	0	0
| Order: Diptera	0	0	0	0
| Family: Cecidomyiidae	0	0	0	0
| Order: Homoptera	0	0	0	0
| Family: Cicadellidae	0	0	0	1
| Order: Psocodea	0	0	0	0
Subphylum: Crustacea	0	0	0	0
| Class: Ostracoda	1	1	1	1
Phylum: Annelida	0	0	0	0
Subphylum: Clitellata	0	0	0	0
| Class: Oligochaeta	0	0	0	0
| Order: Tubificida	0	0	0	0
| Family: Lumbricidae	0	1	0	0
Phylum: Nemata	1	1	0	1
Phylum: Platyhelminthes	0	0	0	0
| Class: Turbellaria	1	1	1	1
Totals:	**3**	**4**	**2**	**4**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DC3_BIC-3_2022-09-13_N		LC_DC4_BIC-1_2022-09-12_N		LC_DC4_BIC-2_2022-09-12_N	
Sample Collection Date:	13-Sep-22		12-Sep-22		12-Sep-22	
CC#:	CC231045		CC231046		CC231047	
Sieve Size:	400		400		400	
Subsample %:	5		7		5	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	0		0		0	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Ephemeroptera	0		0		0	
| Family: Ameletidae	0		0		0	
Ameletus	0		2		2	
| Family: Baetidae	0		2		0	
Baetis	0		0		2	ND
Baetis fuscatus gr.	0		0		0	
Baetis rhodani group	0		12		28	
Baetis bicaudatus	0		0		0	
| Family: Ephemerellidae	1		24		17	
Drunella	0		0		0	
Drunella grandis group	0		0		0	
Drunella coloradensis	0		1		0	
Drunella doddsii	0		11		11	
| Family: Heptageniidae	0		45		26	
Cinygmula	0		12		33	
Epeorus	0		0		0	
Rhithrogena	0		0		0	
| Family: Siphlonuridae	0		0		0	
Siphlonurus	0		0		0	
| Order: Plecoptera	0		1	ND	3	
| Family: Capniidae	31		0		1	
Mesocapnia	0		0		0	
| Family: Chloroperlidae	4		6		2	
Haploperla	0		0		0	
Plumiperla	1		0		0	
Sweltsa	1		4		7	
Utaperla	0		0		0	
| Family: Leuctridae	0		0		0	
Paraleuctra	0		0		0	
| Family: Nemouridae	1	ND	1	ND	1	ND
Malenka	1		0		0	
Visoka cataractae	0		0		0	
Zapada	2	ND	4		2	ND
Zapada oregonensis group	11		51		69	
Zapada cinctipes	0		0		1	
Zapada columbiana	72		8		25	
| Family: Peltoperlidae	0		0		0	
Yoraperla	0		0		2	
| Family: Perlidae	0		0		0	
Hesperoperla	0		0		0	
| Family: Perlodidae	0		3		5	
Isoperla	0		0		0	
Kogotus	0		3		2	
Megarcys	7		5		15	
Setvena	0		0		0	
| Family: Taeniopterygidae	0		3		0	
| Order: Trichoptera	0		14		14	ND
| Family: Brachycentridae	0		0		0	
Brachycentrus	0		0		0	
Micrasema	0		0		0	
| Family: Glossosomatidae	0		0		0	
Glossosoma	0		1		0	
| Family: Hydropsychidae	0		4		0	
Parapsyche	0		1	ND	0	
Parapsyche elsis	0		9		3	
| Family: Leptoceridae	0		0		0	
| Family: Limnephilidae	2		8		13	
Clostoeca disjuncta	0		0		0	
Dicosmoecus	0		1		0	
Ecclisomyia	0		0		1	
| Family: Rhyacophilidae	0		0		0	
Rhyacophila	3		1		0	
Rhyacophila betteni group	0		0		1	
Rhyacophila brunnea/vemna group	2		2		1	
Rhyacophila hyalinata group	0		1		2	
Rhyacophila vetina complex	0		0		0	
Rhyacophila vofixa group	1		1		2	
Rhyacophila atrata complex	0		1		1	
Rhyacophila narvae	0		5		11	
| Family: Thremmatidae	0		0		0	
Oligophlebodes	0		0		2	
| Family: Uenoidae	0		0		0	
Neothremma	0		0		0	
| Order: Coleoptera	0		0		0	
| Family: Elmidae	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DC3_BIC-3_2022-09-13_N		LC_DC4_BIC-1_2022-09-12_N		LC_DC4_BIC-2_2022-09-12_N	
Sample Collection Date:	13-Sep-22		12-Sep-22		12-Sep-22	
CC#:	CC231045		CC231046		CC231047	
Sieve Size:	400		400		400	
Subsample %:	5		7		5	
Heterlimnius	0		0		0	
| Family: Staphylinidae	0		0		0	
| Order: Diptera	0		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	0		0		0	
| Family: Chironomidae	12	ND	16	ND	14	ND
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		1		0	
Micropsectra	0		0		0	
Stempellinella	0		0		0	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	2		1		0	
Pagastia	28		25		12	
Pseudodiamesa	33		0		1	
| Subfamily: Orthocladiinae	0		0		0	
Brillia	1		0		0	
Corynoneura	0		0		0	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		0		0	
Eukiefferiella	22		7		3	
Hydrobaenus	6		2		2	
Limnophyes	1		0		0	
Metriocnemus	0		0		0	
Orthocladius complex	84		12		7	
Parametriocnemus	0		0		0	
Parorthocladius	9		1		0	
Rheocricotopus	0		4		6	
Tvetenia	5		1		5	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		0	
Thienemannimyia group	0		0		0	
| Family: Empididae	0		0		1	
Chelifera/ Metachela	0		1		0	
Clinocerinae Unknown Genus A	0		2		0	
Neoplasta	0		2		0	
Oreogeton	1		0		0	
Trichoclinocera	5		0		0	
| Family: Pelecorhynchidae	0		0		0	
Glutops	0		4		1	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	12		7		0	
| Family: Simuliidae	0		0		0	
Prosimulium	1		0		0	
Prosimulium/Helodon	0		0		0	
Simulium	0		0		2	
| Family: Tipulidae	0		0		0	
Antocha	0		0		0	
Dicranota	5		0		1	
Molophilus	1		0		0	
Pedicia	0		0		0	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		0		0	
| Family: Feltriidae	0		0		0	
Feltria	0		0		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	3		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		0		0	
Hygrobates	0		0		0	
| Family: Lebertiidae	0		0		0	
Lebertia	4		0		0	
| Family: Sperchontidae	0		0		0	
Sperchon	0		0		0	
| Family: Torrenticolidae	0		0		0	
Testudacarus	0		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	1		0		0	
| Family: Hydrozetidae	0		0		0	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		0		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		0	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
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250-494-7553

Site:	2022	2022	2022
Sample:	LC_DC3_BIC-3_2022-09-13_N	LC_DC4_BIC-1_2022-09-12_N	LC_DC4_BIC-2_2022-09-12_N
Sample Collection Date:	13-Sep-22	12-Sep-22	12-Sep-22
CC#:	CC231045	CC231046	CC231047
Sieve Size:	400	400	400
Subsample %:	5	7	5
| Family: Enchytraeidae	0	1	0
| Family: Naididae	0	0	0
Nais	0	0	0
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0
Totals:	**376**	**334**	**360**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	0	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	1	1	0
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	1	1
Totals:	**3**	**3**	**2**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DC4_BIC-3_2022-09-12_N		LC_DCDS_BIC-1_2022-09-13_N		LC_DCDS_BIC-2_2022-09-13_N	
Sample Collection Date:	12-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231048		CC231049		CC231050	
Sieve Size:	400		400		400	
Subsample %:	13		15		8	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	0		0		0	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Ephemeroptera	0		0		0	
| Family: Ameletidae	0		0		0	
Ameletus	0		0		0	
| Family: Baetidae	1	ND	1		0	
Baetis	1	ND	0		0	
Baetis fuscatus gr.	0		0		0	
Baetis rhodani group	19		2		3	
Baetis bicaudatus	1		0		0	
| Family: Ephemerellidae	22		16		19	
Drunella	0		0		0	
Drunella grandis group	0		0		0	
Drunella coloradensis	1		1		1	
Drunella doddsii	4		5		1	
| Family: Heptageniidae	19		2		0	
Cinygmula	18		6		3	
Epeorus	0		0		1	
Rhithrogena	0		0		0	
| Family: Siphlonuridae	0		0		0	
Siphlonurus	0		0		0	
| Order: Plecoptera	0		0		1	ND
| Family: Capniidae	0		2		0	
Mesocapnia	0		0		0	
| Family: Chloroperlidae	1		0		0	
Haploperla	0		0		0	
Plumiperla	0		0		0	
Sweltsa	6		2		2	
Utaperla	1		0		0	
| Family: Leuctridae	0		0		0	
Paraleuctra	0		0		0	
| Family: Nemouridae	1		1	ND	0	
Malenka	0		0		0	
Visoka cataractae	0		1		0	
Zapada	0		4		4	
Zapada oregonensis group	64		41		24	
Zapada cinctipes	0		0		0	
Zapada columbiana	5		47		40	
| Family: Peltoperlidae	0		0		0	
Yoraperla	1		0		1	
| Family: Perlidae	0		0		0	
Hesperoperla	0		0		0	
| Family: Perlodidae	5		7		9	
Isoperla	0		0		0	
Kogotus	3		0		0	
Megarcys	19		5		10	
Setvena	0		0		0	
| Family: Taeniopterygidae	1		1		1	
| Order: Trichoptera	20		0		14	ND
| Family: Brachycentridae	0		0		0	
Brachycentrus	0		0		0	
Micrasema	0		0		0	
| Family: Glossosomatidae	0		0		0	
Glossosoma	0		0		0	
| Family: Hydropsychidae	0		20		21	
Parapsyche	0		0		0	
Parapsyche elsis	3		6		0	
| Family: Leptoceridae	0		0		0	
| Family: Limnephilidae	13		3		5	
Clostoeca disjuncta	0		0		0	
Dicosmoecus	0		0		0	
Ecclisomyia	1		0		3	
| Family: Rhyacophilidae	0		0		0	
Rhyacophila	0		9		2	
Rhyacophila betteni group	1		3		4	
Rhyacophila brunnea/vemna group	2		6		2	
Rhyacophila hyalinata group	1		1		0	
Rhyacophila vetina complex	0		0		0	
Rhyacophila vofixa group	1		3		1	
Rhyacophila atrata complex	1		0		0	
Rhyacophila narvae	5		10		6	
| Family: Thremmatidae	0		0		0	
Oligophlebodes	0		6		16	
| Family: Uenoidae	0		0		0	
Neothremma	0		0		0	
| Order: Coleoptera	0		0		0	
| Family: Elmidae	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DC4_BIC-3_2022-09-12_N		LC_DCDS_BIC-1_2022-09-13_N		LC_DCDS_BIC-2_2022-09-13_N	
Sample Collection Date:	12-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231048		CC231049		CC231050	
Sieve Size:	400		400		400	
Subsample %:	13		15		8	
Heterlimnius	0		0		0	
| Family: Staphylinidae	0		0		0	
| Order: Diptera	0		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	0		0		0	
| Family: Chironomidae	11	ND	15	ND	18	ND
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		0		0	
Micropsectra	0		0		1	
Stempellinella	1		0		0	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	2		16		6	
Pagastia	41		7		6	
Pseudodiamesa	0		8		9	
| Subfamily: Orthocladiinae	0		0		0	
Brillia	0		0		0	
Corynoneura	0		0		1	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		0		0	
Eukiefferiella	10		5		8	
Hydrobaenus	28		2		8	
Limnophyes	0		0		0	
Metriocnemus	0		0		0	
Orthocladius complex	25		40		48	
Parametriocnemus	0		0		0	
Parorthocladius	8		3		2	
Rheocricotopus	1		1		1	
Tvetenia	1		3		8	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		0	
Thienemannimyia group	0		0		0	
| Family: Empididae	2		0		0	
Chelifera/ Metachela	3		10		0	
Clinocerinae Unknown Genus A	1		0		0	
Neoplasta	1		1		1	
Oreogeton	0		0		1	
Trichoclinocera	1		0		0	
| Family: Pelecorhynchidae	0		0		0	
Glutops	1		0		0	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	6		5		4	
| Family: Simuliidae	1		0		0	
Prosimulium	0		0		0	
Prosimulium/Helodon	0		0		0	
Simulium	0		1		2	
| Family: Tipulidae	0		0		0	
Antocha	0		0		0	
Dicranota	0		2		2	
Molophilus	0		0		0	
Pedicia	0		0		0	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		0		0	
| Family: Feltriidae	0		0		0	
Feltria	0		1		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	0		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		0		0	
Hygrobates	0		0		0	
| Family: Lebertiidae	0		0		0	
Lebertia	0		0		0	
| Family: Sperchontidae	0		0		0	
Sperchon	0		0		0	
| Family: Torrenticolidae	0		0		0	
Testudacarus	0		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	0		0		0	
| Family: Hydrozetidae	0		0		0	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		1		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		0	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022
Sample:	LC_DC4_BIC-3_2022-09-12_N	LC_DCDS_BIC-1_2022-09-13_N	LC_DCDS_BIC-2_2022-09-13_N
Sample Collection Date:	12-Sep-22	13-Sep-22	13-Sep-22
CC#:	CC231048	CC231049	CC231050
Sieve Size:	400	400	400
Subsample %:	13	15	8
| Family: Enchytraeidae	0	0	0
| Family: Naididae	0	0	0
Nais	0	0	0
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0
Totals:	**385**	**332**	**320**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	0	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	1	1	1
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	1	1
Totals:	**3**	**3**	**3**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DCDS_BIC-3_2022-09-13_N		LC_DCDS_BIC-4_2022-09-13_N		LC_DCDS_BIC-5_2022-09-13_N	
Sample Collection Date:	13-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231051		CC231052		CC231053	
Sieve Size:	400		400		400	
Subsample %:	16		8		12	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	0		1		0	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Ephemeroptera	0		0		0	
| Family: Ameletidae	0		0		0	
Ameletus	0		0		0	
| Family: Baetidae	0		2	ND	0	
Baetis	1		2		1	
Baetis fuscatus gr.	0		0		0	
Baetis rhodani group	1		2		2	
Baetis bicaudatus	0		0		0	
| Family: Ephemerellidae	40		31		58	
Drunella	0		0		0	
Drunella grandis group	0		0		0	
Drunella coloradensis	0		0		0	
Drunella doddsii	7		4		3	
| Family: Heptageniidae	3		2		2	
Cinygmula	4		5		11	
Epeorus	0		1		0	
Rhithrogena	0		0		0	
| Family: Siphlonuridae	0		0		0	
Siphlonurus	0		0		0	
| Order: Plecoptera	1	ND	1	ND	0	
| Family: Capniidae	4		2		3	
Mesocapnia	0		0		0	
| Family: Chloroperlidae	5		4		3	
Haploperla	0		0		0	
Plumiperla	0		0		0	
Sweltsa	5		3		4	
Utaperla	0		0		0	
| Family: Leuctridae	0		0		0	
Paraleuctra	0		0		0	
| Family: Nemouridae	2	ND	1	ND	0	
Malenka	0		0		0	
Visoka cataractae	1		0		0	
Zapada	1		7	ND	1	ND
Zapada oregonensis group	16		14		9	
Zapada cinctipes	0		1		0	
Zapada columbiana	30		28		16	
| Family: Peltoperlidae	0		0		0	
Yoraperla	0		0		0	
| Family: Perlidae	0		0		0	
Hesperoperla	0		0		0	
| Family: Perlodidae	18		16		6	
Isoperla	0		0		0	
Kogotus	0		2		2	
Megarcys	6		5		4	
Setvena	0		0		0	
| Family: Taeniopterygidae	1		3		0	
| Order: Trichoptera	7	ND	19	ND	8	ND
| Family: Brachycentridae	0		0		0	
Brachycentrus	0		0		0	
Micrasema	0		0		0	
| Family: Glossosomatidae	0		1		0	
Glossosoma	0		0		0	
| Family: Hydropsychidae	20		31		13	
Parapsyche	0		0		0	
Parapsyche elsis	1		0		0	
| Family: Leptoceridae	1		0		0	
| Family: Limnephilidae	1		1		4	
Clostoeca disjuncta	0		0		1	
Dicosmoecus	0		0		0	
Ecclisomyia	0		1		1	
| Family: Rhyacophilidae	0		0		0	
Rhyacophila	0		1		3	
Rhyacophila betteni group	2		3		4	
Rhyacophila brunnea/vemna group	3		1		1	
Rhyacophila hyalinata group	2		0		0	
Rhyacophila vetina complex	0		0		0	
Rhyacophila vofixa group	2		2		2	
Rhyacophila atrata complex	0		0		0	
Rhyacophila narvae	8		1		8	
| Family: Thremmatidae	0		0		0	
Oligophlebodes	11		19		3	
| Family: Uenoidae	0		0		0	
Neothremma	0		0		0	
| Order: Coleoptera	0		0		0	
| Family: Elmidae	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DCDS_BIC-3_2022-09-13_N		LC_DCDS_BIC-4_2022-09-13_N		LC_DCDS_BIC-5_2022-09-13_N	
Sample Collection Date:	13-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231051		CC231052		CC231053	
Sieve Size:	400		400		400	
Subsample %:	16		8		12	
Heterlimnius	0		0		0	
| Family: Staphylinidae	1		0		0	
| Order: Diptera	0		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	0		0		0	
| Family: Chironomidae	16	ND	15	ND	9	
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		2		0	
Micropsectra	2		3		7	
Stempellinella	0		0		0	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	6		4		0	
Pagastia	7		7		7	
Pseudodiamesa	10		21		44	
| Subfamily: Orthocladiinae	0		0		1	
Brillia	0		0		0	
Corynoneura	0		1		0	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		0		0	
Eukiefferiella	9		12		1	
Hydrobaenus	7		4		18	
Limnophyes	0		0		0	
Metriocnemus	0		0		0	
Orthocladius complex	38		48		54	
Parametriocnemus	0		0		0	
Parorthocladius	3		2		6	
Rheocricotopus	1		0		0	
Tvetenia	2		4		0	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		0	
Thienemannimyia group	0		0		0	
| Family: Empididae	0		0		0	
Chelifera/ Metachela	5		0		1	
Clinocerinae Unknown Genus A	0		0		0	
Neoplasta	4		1		3	
Oreogeton	0		0		2	
Trichoclinocera	0		0		0	
| Family: Pelecorhynchidae	0		0		0	
Glutops	0		0		0	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	2		2		1	
| Family: Simuliidae	0		0		0	
Prosimulium	0		0		0	
Prosimulium/Helodon	0		0		0	
Simulium	0		0		0	
| Family: Tipulidae	0		0		0	
Antocha	0		0		0	
Dicranota	1		1		0	
Molophilus	0		0		0	
Pedicia	0		0		0	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		0		0	
| Family: Feltriidae	0		0		0	
Feltria	0		0		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	0		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		0		0	
Hygrobates	0		0		0	
| Family: Lebertiidae	0		0		0	
Lebertia	1		0		0	
| Family: Sperchontidae	0		0		0	
Sperchon	0		0		0	
| Family: Torrenticolidae	0		0		0	
Testudacarus	0		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	0		0		0	
| Family: Hydrozetidae	0		0		0	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		0		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		0	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022
Sample:	LC_DCDS_BIC-3_2022-09-13_N	LC_DCDS_BIC-4_2022-09-13_N	LC_DCDS_BIC-5_2022-09-13_N
Sample Collection Date:	13-Sep-22	13-Sep-22	13-Sep-22
CC#:	CC231051	CC231052	CC231053
Sieve Size:	400	400	400
Subsample %:	16	8	12
| Family: Enchytraeidae	0	2	0
| Family: Naididae	0	0	0
Nais	0	0	0
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0
Totals:	**319**	**346**	**327**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	1	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	1	0	1
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	1	1
Totals:	**3**	**3**	**3**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022
Sample:	LC_DCEF_BIC-1_2022-09-13_N		LC_DCEF_BIC-2_2022-09-13_N		LC_DCEF_BIC-3_2022-09-13_N
Sample Collection Date:	13-Sep-22		13-Sep-22		13-Sep-22
CC#:	CC231054		CC231055		CC231056
Sieve Size:	400		400		400
Subsample %:	12		15		12
Phylum: Arthropoda	0		0		0
| Order: Collembola	0		0		0
Subphylum: Hexapoda	0		0		0
| Class: Insecta	0		0		0
| Order: Ephemeroptera	0		0		0
| Family: Ameletidae	0		0		0
Ameletus	4		9		9
| Family: Baetidae	3	ND	0		0
Baetis	1		0		0
Baetis fuscatus gr.	0		0		0
Baetis rhodani group	4		2		0
Baetis bicaudatus	0		0		0
| Family: Ephemerellidae	41		28		37
Drunella	0		0		0
Drunella grandis group	0		0		0
Drunella coloradensis	0		0		0
Drunella doddsii	3		6		2
| Family: Heptageniidae	48		41		93
Cinygmula	57		50		59
Epeorus	6		4		5
Rhithrogena	1		6		2
| Family: Siphlonuridae	0		0		0
Siphlonurus	0		0		0
| Order: Plecoptera	0		0		0
| Family: Capniidae	3		2		6
Mesocapnia	0		0		0
| Family: Chloroperlidae	8		15		19
Haploperla	0		0		0
Plumiperla	0		0		0
Sweltsa	14		22		15
Utaperla	0		0		0
| Family: Leuctridae	0		0		1
Paraleuctra	0		0		0
| Family: Nemouridae	0		0		0
Malenka	0		1		0
Visoka cataractae	0		3		4
Zapada	0		1	ND	3
Zapada oregonensis group	1		2		0
Zapada cinctipes	0		0		0
Zapada columbiana	18		7		0
| Family: Peltoperlidae	0		0		0
Yoraperla	1		2		3
| Family: Perlidae	0		0		0
Hesperoperla	0		0		0
| Family: Perlodidae	9		6		4
Isoperla	0		0		0
Kogotus	0		1		0
Megarcys	3		8		5
Setvena	11		2		0
| Family: Taeniopterygidae	0		0		0
| Order: Trichoptera	14		7		6
| Family: Brachycentridae	0		0		0
Brachycentrus	0		0		0
Micrasema	0		0		0
| Family: Glossosomatidae	0		0		0
Glossosoma	0		0		0
| Family: Hydropsychidae	0		0		0
Parapsyche	0		0		0
Parapsyche elsis	0		0		0
| Family: Leptoceridae	0		0		0
| Family: Limnephilidae	5		1		2
Clostoeca disjuncta	1		2		1
Dicosmoecus	0		0		0
Ecclisomyia	1		1		0
| Family: Rhyacophilidae	0		0		0
Rhyacophila	5		8		3
Rhyacophila betteni group	0		0		1
Rhyacophila brunnea/vemna group	2		0		1
Rhyacophila hyalinata group	0		0		0
Rhyacophila vetina complex	1		0		0
Rhyacophila vofixa group	0		0		0
Rhyacophila atrata complex	0		0		0
Rhyacophila narvae	0		0		2
| Family: Thremmatidae	0		0		0
Oligophlebodes	0		0		0
| Family: Uenoidae	0		0		0
Neothremma	0		0		0
| Order: Coleoptera	0		0		0
| Family: Elmidae	0		0		0

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_DCEF_BIC-1_2022-09-13_N		LC_DCEF_BIC-2_2022-09-13_N		LC_DCEF_BIC-3_2022-09-13_N	
Sample Collection Date:	13-Sep-22		13-Sep-22		13-Sep-22	
CC#:	CC231054		CC231055		CC231056	
Sieve Size:	400		400		400	
Subsample %:	12		15		12	
Heterlimnius	0		0		0	
| Family: Staphylinidae	1		0		0	
| Order: Diptera	1		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	0		0		0	
| Family: Chironomidae	14	ND	9	ND	5	ND
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		0		0	
Micropsectra	0		1		0	
Stempellinella	0		1		0	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	1		3		11	
Pagastia	3		10		4	
Pseudodiamesa	8		8		0	
| Subfamily: Orthocladiinae	0		0		0	
Brillia	4		1		0	
Corynoneura	0		0		0	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		0		0	
Eukiefferiella	1		3		6	
Hydrobaenus	1		11		0	
Limnophyes	0		0		1	
Metriocnemus	0		1		0	
Orthocladius complex	5		18		15	
Parametriocnemus	0		1		0	
Parorthocladius	6		4		4	
Rheocricotopus	2		2		1	
Tvetenia	8		6		6	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		0	
Thienemannimyia group	0		0		0	
| Family: Empididae	1		0		0	
Chelifera/ Metachela	0		0		0	
Clinocerinae Unknown Genus A	1		0		0	
Neoplasta	0		0		0	
Oreogeton	1		1		0	
Trichoclinocera	0		0		0	
| Family: Pelecorhynchidae	0		0		0	
Glutops	0		0		0	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	5		4		0	
| Family: Simuliidae	0		0		0	
Prosimulium	0		0		0	
Prosimulium/Helodon	0		0		0	
Simulium	0		0		0	
| Family: Tipulidae	0		0		0	
Antocha	0		0		0	
Dicranota	0		1		0	
Molophilus	0		0		0	
Pedicia	0		0		1	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		0		1	
| Family: Feltriidae	0		0		0	
Feltria	0		0		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	0		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		0		0	
Hygrobates	0		0		0	
| Family: Lebertiidae	0		0		0	
Lebertia	6		8		3	
| Family: Sperchontidae	0		0		0	
Sperchon	0		0		0	
| Family: Torrenticolidae	0		0		0	
Testudacarus	0		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	0		0		0	
| Family: Hydrozetidae	0		3		1	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		0		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		0	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022
Sample:	LC_DCEF_BIC-1_2022-09-13_N	LC_DCEF_BIC-2_2022-09-13_N	LC_DCEF_BIC-3_2022-09-13_N
Sample Collection Date:	13-Sep-22	13-Sep-22	13-Sep-22
CC#:	CC231054	CC231055	CC231056
Sieve Size:	400	400	400
Subsample %:	12	15	12
| Family: Enchytraeidae	0	0	0
| Family: Naididae	0	0	0
Nais	0	0	0
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0
Totals:	**334**	**333**	**342**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	0	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	1	0	0
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	0	0	1
Totals:	**2**	**1**	**2**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_FRB_BIC-1_2022-09-10_N		LC_FRB_BIC-2_2022-09-10_N		LC_FRB_BIC-3_2022-09-10_N	
Sample Collection Date:	10-Sep-22		10-Sep-22		10-Sep-22	
CC#:	CC231057		CC231058		CC231059	
Sieve Size:	400		400		400	
Subsample %:	5		5		5	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	0		0		0	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Ephemeroptera	0		0		0	
| Family: Ameletidae	0		0		0	
Ameletus	1		1		1	
| Family: Baetidae	2	ND	15	ND	10	ND
Baetis	1		2		1	
Baetis fuscatus gr.	0		0		0	
Baetis rhodani group	28		23		25	
Baetis bicaudatus	0		0		0	
| Family: Ephemerellidae	13		3		0	
Drunella	0		0		0	
Drunella grandis group	1		2		3	
Drunella coloradensis	0		0		0	
Drunella doddsii	2		0		0	
| Family: Heptageniidae	0		5		0	
Cinygmula	152		94		65	
Epeorus	12		4		2	
Rhithrogena	6		1		1	
| Family: Siphlonuridae	0		0		0	
Siphlonurus	0		0		0	
| Order: Plecoptera	0		0		0	
| Family: Capniidae	23		8		5	
Mesocapnia	0		0		0	
| Family: Chloroperlidae	1		1		0	
Haploperla	3		0		0	
Plumiperla	0		0		0	
Sweltsa	1		3		0	
Utaperla	0		0		0	
| Family: Leuctridae	0		0		0	
Paraleuctra	0		0		0	
| Family: Nemouridae	0		0		0	
Malenka	0		0		0	
Visoka cataractae	0		0		0	
Zapada	16		7	ND	1	
Zapada oregonensis group	3		4		2	
Zapada cinctipes	2		1		2	
Zapada columbiana	0		1		0	
| Family: Peltoperlidae	0		0		0	
Yoraperla	0		0		0	
| Family: Perlidae	0		0		0	
Hesperoperla	0		0		0	
| Family: Perlodidae	12		4		10	
Isoperla	2		5		7	
Kogotus	2		2		3	
Megarcys	2		2		2	
Setvena	0		0		0	
| Family: Taeniopterygidae	16		7		2	
| Order: Trichoptera	0		0		0	
| Family: Brachycentridae	0		0		0	
Brachycentrus	0		0		0	
Micrasema	0		0		0	
| Family: Glossosomatidae	1		0		0	
Glossosoma	1		0		0	
| Family: Hydropsychidae	7		2		1	
Parapsyche	1		0		0	
Parapsyche elsis	0		0		1	
| Family: Leptoceridae	0		0		0	
| Family: Limnephilidae	0		0		1	
Clostoeca disjuncta	0		0		0	
Dicosmoecus	0		0		0	
Ecclisomyia	0		0		0	
| Family: Rhyacophilidae	0		0		0	
Rhyacophila	0		1		1	
Rhyacophila betteni group	0		1		0	
Rhyacophila brunnea/vemna group	5		5		1	
Rhyacophila hyalinata group	0		0		0	
Rhyacophila vetina complex	0		0		0	
Rhyacophila vofixa group	0		0		0	
Rhyacophila atrata complex	3		1		0	
Rhyacophila narvae	0		0		0	
| Family: Thremmatidae	0		0		0	
Oligophlebodes	1		0		0	
| Family: Uenoidae	0		0		0	
Neothremma	0		0		0	
| Order: Coleoptera	0		0		0	
| Family: Elmidae	1	ND	1	ND	1	ND

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_FRB_BIC-1_2022-09-10_N		LC_FRB_BIC-2_2022-09-10_N		LC_FRB_BIC-3_2022-09-10_N	
Sample Collection Date:	10-Sep-22		10-Sep-22		10-Sep-22	
CC#:	CC231057		CC231058		CC231059	
Sieve Size:	400		400		400	
Subsample %:	5		5		5	
Heterlimnius	3		3		1	
| Family: Staphylinidae	0		0		0	
| Order: Diptera	0		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	0		0		0	
| Family: Chironomidae	18	ND	15	ND	17	ND
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		0		0	
Micropsectra	2		0		2	
Stempellinella	0		0		1	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	2		5		7	
Pagastia	3		4		4	
Pseudodiamesa	0		0		0	
| Subfamily: Orthocladiinae	0		1	ND	0	
Brillia	0		0		0	
Corynoneura	0		0		0	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		1		0	
Eukiefferiella	2		7		14	
Hydrobaenus	1		0		0	
Limnophyes	0		0		0	
Metriocnemus	0		0		0	
Orthocladius complex	57		145		144	
Parametriocnemus	0		0		0	
Parorthocladius	0		1		1	
Rheocricotopus	0		1		0	
Tvetenia	10		8		2	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		2	
Thienemannimyia group	1		0		0	
| Family: Empididae	0		0		0	
Chelifera/ Metachela	0		0		0	
Clinocerinae Unknown Genus A	0		0		0	
Neoplasta	1		0		0	
Oreogeton	0		0		0	
Trichoclinocera	0		0		0	
| Family: Pelecorhynchidae	0		0		0	
Glutops	0		0		0	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	85		30		37	
| Family: Simuliidae	2		0		0	
Prosimulium	0		0		0	
Prosimulium/Helodon	0		0		0	
Simulium	1		6		4	
| Family: Tipulidae	0		0		0	
Antocha	0		0		0	
Dicranota	0		0		0	
Molophilus	0		0		0	
Pedicia	0		0		0	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		0		0	
| Family: Feltriidae	0		0		0	
Feltria	0		0		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	0		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		0		0	
Hygrobates	0		1		0	
| Family: Lebertiidae	0		0		0	
Lebertia	3		5		2	
| Family: Sperchontidae	0		0		0	
Sperchon	1		1		0	
| Family: Torrenticolidae	0		0		0	
Testudacarus	0		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	0		0		1	
| Family: Hydrozetidae	0		0		0	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		0		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		0	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022
Sample:	LC_FRB_BIC-1_2022-09-10_N	LC_FRB_BIC-2_2022-09-10_N	LC_FRB_BIC-3_2022-09-10_N
Sample Collection Date:	10-Sep-22	10-Sep-22	10-Sep-22
CC#:	CC231057	CC231058	CC231059
Sieve Size:	400	400	400
Subsample %:	5	5	5
| Family: Enchytraeidae	0	0	0
| Family: Naididae	0	0	0
Nais	2	3	5
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0
Totals:	**515**	**443**	**392**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	0	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	0	0	0
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	1	1
Totals:	**2**	**2**	**2**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_FRUS_BIC-1_2022-09-10_N		LC_FRUS_BIC-2_2022-09-10_N		LC_FRUS_BIC-3_2022-09-10_N	
Sample Collection Date:	10-Sep-22		10-Sep-22		10-Sep-22	
CC#:	CC231060		CC231061		CC231062	
Sieve Size:	400		400		400	
Subsample %:	7		10		14	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	0		0		0	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Ephemeroptera	1	ND	0		0	
| Family: Ameletidae	0		0		0	
Ameletus	0		0		42	
| Family: Baetidae	6	ND	1	ND	1	ND
Baetis	1		1		2	ND
Baetis fuscatus gr.	0		0		1	
Baetis rhodani group	31		14		5	
Baetis bicaudatus	0		0		0	
| Family: Ephemerellidae	6		14		1	
Drunella	0		0		0	
Drunella grandis group	1		0		2	
Drunella coloradensis	0		1		0	
Drunella doddsii	1		2		0	
| Family: Heptageniidae	3		4	ND	9	
Cinygmula	97		132		124	
Epeorus	0		1		0	
Rhithrogena	0		0		0	
| Family: Siphlonuridae	0		0		0	
Siphlonurus	0		0		1	
| Order: Plecoptera	0		0		0	
| Family: Capniidae	1		1		3	
Mesocapnia	0		0		1	
| Family: Chloroperlidae	3		4		0	
Haploperla	0		1		0	
Plumiperla	0		0		0	
Sweltsa	0		3		0	
Utaperla	0		0		0	
| Family: Leuctridae	0		0		0	
Paraleuctra	0		0		0	
| Family: Nemouridae	0		0		0	
Malenka	0		0		0	
Visoka cataractae	0		0		0	
Zapada	5	ND	3		0	
Zapada oregonensis group	10		3		12	
Zapada cinctipes	3		0		0	
Zapada columbiana	1		0		0	
| Family: Peltoperlidae	0		0		0	
Yoraperla	0		0		0	
| Family: Perlidae	0		0		3	
Hesperoperla	1		0		1	
| Family: Perlodidae	20		7		24	
Isoperla	27		19		36	
Kogotus	10		8		14	
Megarcys	4		5		1	
Setvena	0		0		0	
| Family: Taeniopterygidae	4		14		0	
| Order: Trichoptera	0		1	ND	0	
| Family: Brachycentridae	0		0		0	
Brachycentrus	1		0		0	
Micrasema	3		0		0	
| Family: Glossosomatidae	0		0		0	
Glossosoma	0		0		0	
| Family: Hydropsychidae	5		5		1	
Parapsyche	1	ND	0		0	
Parapsyche elsis	2		0		1	
| Family: Leptoceridae	0		0		0	
| Family: Limnephilidae	0		0		0	
Clostoeca disjuncta	0		0		0	
Dicosmoecus	0		0		0	
Ecclisomyia	0		0		0	
| Family: Rhyacophilidae	0		0		0	
Rhyacophila	1	ND	3		0	
Rhyacophila betteni group	0		2		0	
Rhyacophila brunnea/vemna group	6		3		3	
Rhyacophila hyalinata group	0		1		0	
Rhyacophila vetina complex	0		0		0	
Rhyacophila vofixa group	0		0		0	
Rhyacophila atrata complex	1		4		0	
Rhyacophila narvae	1		9		2	
| Family: Thremmatidae	0		0		0	
Oligophlebodes	0		0		0	
| Family: Uenoidae	0		0		0	
Neothremma	0		0		0	
| Order: Coleoptera	0		0		0	
| Family: Elmidae	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_FRUS_BIC-1_2022-09-10_N		LC_FRUS_BIC-2_2022-09-10_N		LC_FRUS_BIC-3_2022-09-10_N	
Sample Collection Date:	10-Sep-22		10-Sep-22		10-Sep-22	
CC#:	CC231060		CC231061		CC231062	
Sieve Size:	400		400		400	
Subsample %:	7		10		14	
Heterlimnius	11		23		4	
| Family: Staphylinidae	0		0		0	
| Order: Diptera	0		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	1		1		0	
| Family: Chironomidae	9	ND	4	ND	5	ND
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		0		0	
Micropsectra	0		1		0	
Stempellinella	0		0		0	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	7		0		0	
Pagastia	0		0		2	
Pseudodiamesa	0		0		0	
| Subfamily: Orthocladiinae	0		0		0	
Brillia	0		0		0	
Corynoneura	0		0		0	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		0		0	
Eukiefferiella	5		0		0	
Hydrobaenus	0		0		5	
Limnophyes	0		1		0	
Metriocnemus	0		0		0	
Orthocladius complex	46		7		10	
Parametriocnemus	0		0		0	
Parorthocladius	0		0		1	
Rheocricotopus	0		0		2	
Tvetenia	0		1		5	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		0	
Thienemannimyia group	0		0		0	
| Family: Empididae	0		1		0	
Chelifera/ Metachela	1		2		1	
Clinocerinae Unknown Genus A	0		0		0	
Neoplasta	3		6		8	
Oreogeton	0		0		0	
Trichoclinocera	0		0		1	
| Family: Pelecorhynchidae	0		0		0	
Glutops	0		0		0	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	4		7		4	
| Family: Simuliidae	0		0		0	
Prosimulium	0		0		0	
Prosimulium/Helodon	0		0		0	
Simulium	6		0		0	
| Family: Tipulidae	0		1	ND	0	
Antocha	0		0		3	
Dicranota	0		1		0	
Molophilus	0		0		0	
Pedicia	0		0		0	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		1	ND	0	
| Family: Feltriidae	0		0		0	
Feltria	0		0		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	0		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		0		0	
Hygrobates	0		0		0	
| Family: Lebertiidae	0		0		0	
Lebertia	2		3		5	
| Family: Sperchontidae	0		0		0	
Sperchon	0		0		2	
| Family: Torrenticolidae	0		0		0	
Testudacarus	1		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	0		0		0	
| Family: Hydrozetidae	0		0		0	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		0		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		0	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022
Sample:	LC_FRUS_BIC-1_2022-09-10_N	LC_FRUS_BIC-2_2022-09-10_N	LC_FRUS_BIC-3_2022-09-10_N
Sample Collection Date:	10-Sep-22	10-Sep-22	10-Sep-22
CC#:	CC231060	CC231061	CC231062
Sieve Size:	400	400	400
Subsample %:	7	10	14
| Family: Enchytraeidae	0	0	0
| Family: Naididae	0	0	0
Nais	0	3	0
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	0
Totals:	**353**	**329**	**348**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	0	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	0	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	1	1	1
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	1	1	1
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	1	1
Totals:	**3**	**3**	**3**

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_GRCK_BIC-1_2022-09-14_N		LC_GRCK_BIC-2_2022-09-14_N		LC_GRCK_BIC-3_2022-09-14_N	
Sample Collection Date:	14-Sep-22		14-Sep-22		14-Sep-22	
CC#:	CC231063		CC231064		CC231065	
Sieve Size:	400		400		400	
Subsample %:	14		50		12	
Phylum: Arthropoda	0		0		0	
| Order: Collembola	0		0		0	
Subphylum: Hexapoda	0		0		0	
| Class: Insecta	0		0		0	
| Order: Ephemeroptera	0		0		0	
| Family: Ameletidae	0		0		0	
Ameletus	1		8		1	
| Family: Baetidae	23	ND	4	ND	9	ND
Baetis	2		1		1	
Baetis fuscatus gr.	0		0		0	
Baetis rhodani group	7		11		6	
Baetis bicaudatus	0		0		0	
| Family: Ephemerellidae	0		2		2	
Drunella	0		0		0	
Drunella grandis group	0		0		0	
Drunella coloradensis	0		0		0	
Drunella doddsii	3		7		3	
| Family: Heptageniidae	2		2		0	
Cinygmula	17		53		20	
Epeorus	51		27		47	
Rhithrogena	12		14		11	
| Family: Siphlonuridae	0		0		0	
Siphlonurus	0		0		0	
| Order: Plecoptera	1	ND	0		0	
| Family: Capniidae	11		24		13	
Mesocapnia	0		0		0	
| Family: Chloroperlidae	1		1		0	
Haploperla	0		0		0	
Plumiperla	0		0		0	
Sweltsa	3		11		11	
Utaperla	0		0		0	
| Family: Leuctridae	1		0		0	
Paraleuctra	0		1		2	
| Family: Nemouridae	3	ND	1	ND	3	ND
Malenka	0		0		0	
Visoka cataractae	18		56		36	
Zapada	5		2		7	
Zapada oregonensis group	5		10		3	
Zapada cinctipes	0		0		0	
Zapada columbiana	49		56		39	
| Family: Peltoperlidae	0		0		0	
Yoraperla	4		9		4	
| Family: Perlidae	0		0		0	
Hesperoperla	0		0		0	
| Family: Perlodidae	6		5		9	
Isoperla	0		0		0	
Kogotus	0		0		0	
Megarcys	0		3		2	
Setvena	1		5		3	
| Family: Taeniopterygidae	7		5		9	
| Order: Trichoptera	0		3		0	
| Family: Brachycentridae	0		0		0	
Brachycentrus	0		0		0	
Micrasema	0		0		0	
| Family: Glossosomatidae	0		0		0	
Glossosoma	0		0		0	
| Family: Hydropsychidae	12		4		3	
Parapsyche	0		0		0	
Parapsyche elsis	0		0		0	
| Family: Leptoceridae	0		0		0	
| Family: Limnephilidae	1		2		1	
Clostoeca disjuncta	1		0		1	
Dicosmoecus	0		0		0	
Ecclisomyia	0		3		0	
| Family: Rhyacophilidae	0		0		0	
Rhyacophila	18		11		7	
Rhyacophila betteni group	0		0		1	
Rhyacophila brunnea/vemna group	6		2		1	
Rhyacophila hyalinata group	0		0		1	
Rhyacophila vetina complex	0		0		0	
Rhyacophila vofixa group	2		5		6	
Rhyacophila atrata complex	0		0		0	
Rhyacophila narvae	12		16		9	
| Family: Thremmatidae	0		0		0	
Oligophlebodes	0		0		0	
| Family: Uenoidae	0		0		0	
Neothremma	11		20		22	
| Order: Coleoptera	0		0		0	
| Family: Elmidae	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022		2022		2022	
Sample:	LC_GRCK_BIC-1_2022-09-14_N		LC_GRCK_BIC-2_2022-09-14_N		LC_GRCK_BIC-3_2022-09-14_N	
Sample Collection Date:	14-Sep-22		14-Sep-22		14-Sep-22	
CC#:	CC231063		CC231064		CC231065	
Sieve Size:	400		400		400	
Subsample %:	14		50		12	
Heterlimnius	0		0		2	
| Family: Staphylinidae	0		0		0	
| Order: Diptera	0		0		0	
| Family: Ceratopogonidae	0		0		0	
Mallochohelea	0		0		0	
| Family: Chironomidae	1	ND	7	ND	4	
| Subfamily: Chironominae	0		0		0	
| Tribe: Tanytarsini	0		0		0	
Micropsectra	6		0		0	
Stempellinella	0		0		0	
| Subfamily: Diamesinae	0		0		0	
| Tribe: Diamesini	0		0		0	
Diamesa	0		0		0	
Pagastia	0		1		0	
Pseudodiamesa	0		1		0	
| Subfamily: Orthocladiinae	0		0		0	
Brillia	2		2		0	
Corynoneura	0		0		0	
Cricotopus (Nostococladius)	0		0		0	
Diplocladius cultriger	0		0		0	
Eukiefferiella	0		1		0	
Hydrobaenus	0		0		0	
Limnophyes	0		1		0	
Metriocnemus	0		0		0	
Orthocladius complex	0		0		0	
Parametriocnemus	1		1		0	
Parorthocladius	0		1		0	
Rheocricotopus	0		0		0	
Tvetenia	0		0		0	
| Subfamily: Tanypodinae	0		0		0	
Krenopelopia	0		0		0	
| Tribe: Pentaneurini	0		0		0	
Telmatopelopia	0		0		0	
Thienemannimyia group	0		0		0	
| Family: Empididae	0		0		0	
Chelifera/ Metachela	1		2		1	
Clinocerinae Unknown Genus A	0		0		0	
Neoplasta	0		1		0	
Oreogeton	0		0		0	
Trichoclinocera	0		0		0	
| Family: Pelecorhynchidae	0		0		0	
Glutops	0		1		4	
| Family: Psychodidae	0		0		0	
Pericoma/Telmatoscopus	2		0		1	
| Family: Simuliidae	0		5		2	
Prosimulium	0		0		0	
Prosimulium/Helodon	0		0		1	
Simulium	0		0		0	
| Family: Tipulidae	0		0		0	
Antocha	0		0		0	
Dicranota	1		0		0	
Molophilus	0		0		0	
Pedicia	0		0		0	
Tricyphona	0		0		0	
Subphylum: Chelicerata	0		0		0	
| Class: Arachnida	0		0		0	
| Order: Trombidiformes	0		0		0	
| Family: Feltriidae	0		0		0	
Feltria	0		0		0	
| Family: Hydryphantidae	0		0		0	
Albertathyas	0		0		0	
| Family: Hygrobatidae	0		0		0	
Atractides	0		3		0	
Hygrobates	0		0		0	
| Family: Lebertiidae	0		0		0	
Lebertia	0		0		0	
| Family: Sperchontidae	0		0		0	
Sperchon	0		0		0	
| Family: Torrenticolidae	0		0		0	
Testudacarus	0		0		0	
| Order: Sarcoptiformes	0		0		0	
| Order: Oribatida	0		0		0	
| Family: Hydrozetidae	0		0		0	
Phylum: Mollusca	0		0		0	
| Class: Gastropoda	0		0		0	
Phylum: Annelida	0		0		0	
Subphylum: Clitellata	0		0		0	
| Class: Oligochaeta	0		0		0	
| Order: Lumbriculida	0		0		0	
| Family: Lumbriculidae	0		0		0	
Rhynchelmis	0		0		1	
| Order: Tubificida	0		0		0	

Project: 22-19 (LCO Dry LAEMP)
Minnow Environmental (BC)
Taxonomist: Scott Finlayson
scottfinlayson@cordilleraconsulting.ca
250-494-7553

Site:	2022	2022	2022
Sample:	LC_GRCK_BIC-1_2022-09-14_N	LC_GRCK_BIC-2_2022-09-14_N	LC_GRCK_BIC-3_2022-09-14_N
Sample Collection Date:	14-Sep-22	14-Sep-22	14-Sep-22
CC#:	CC231063	CC231064	CC231065
Sieve Size:	400	400	400
Subsample %:	14	50	12
| Family: Enchytraeidae	0	0	0
| Family: Naididae	0	0	0
Nais	0	0	0
Stylaria lacustris	0	0	0
| Subfamily: Tubificinae with hair chaeta	0	0	18
Totals:	**310**	**411**	**327**

Taxa present but not included:

Phylum: Arthropoda	0	0	0
Subphylum: Hexapoda	0	0	0
| Class: Insecta	0	0	0
| Order: Diptera	0	0	0
| Family: Cecidomyiidae	0	0	0
| Order: Homoptera	0	0	0
| Family: Cicadellidae	0	0	0
| Order: Psocodea	0	3	0
Subphylum: Crustacea	0	0	0
| Class: Ostracoda	0	1	0
Phylum: Annelida	0	0	0
Subphylum: Clitellata	0	0	0
| Class: Oligochaeta	0	0	0
| Order: Tubificida	0	0	0
| Family: Lumbricidae	0	0	0
Phylum: Nemata	1	1	1
Phylum: Platyhelminthes	0	0	0
| Class: Turbellaria	1	1	1
Totals:	**2**	**6**	**2**

Methods and QC Report 2022

Project ID: LCO Dry (22-19)

Client: Minnow Environmental

Prepared by:
Cordillera Consulting Inc.
Summerland, BC

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Sample Reception

On September 26, 2022, Cordillera Consulting received 29 benthic samples from Minnow Environmental. When samples arrived to Cordillera Consulting, exterior packaging was initially inspected for damage or wet spots that would have indicated damage to the interior containers.

Samples were logged into a proprietary software database (INSTAR1) where the clients assigned sample name was recorded along with a Cordillera Consulting (CC) number for cross-reference. Each sample was checked to ensure that all sites and replicates recorded on field sheets or packing lists were delivered intact and with adequate preservative. Any missing, mislabelled or extra samples were reported to the client immediately to confirm the total numbers and correct names on the sample jars. The client representative was notified of the arrival of the shipment and provided a sample inventory once intake was completed.
See table below for sample inventory:

Table 1: Summary of sample information including Cordillera Consulting (CC) number

Sample	CC#	Date	Size	# of Jars
LC_DC1_BIC-1_2022-09-12_N	CC231037	9/12/2022	400µM	1
LC_DC1_BIC-2_2022-09-12_N	CC231038	9/12/2022	400µM	1
LC_DC1_BIC-3_2022-09-12_N	CC231039	9/12/2022	400µM	1
LC_DC2_BIC-1_2022-09-14_N	CC231040	9/14/2022	400µM	1
LC_DC2_BIC-2_2022-09-14_N	CC231041	9/14/2022	400µM	1
LC_DC2_BIC-3_2022-09-14_N	CC231042	9/14/2022	400µM	1
LC_DC3_BIC-1_2022-09-13_N	CC231043	9/13/2022	400µM	1
LC_DC3_BIC-2_2022-09-13_N	CC231044	9/13/2022	400µM	1
LC_DC3_BIC-3_2022-09-13_N	CC231045	9/13/2022	400µM	1
LC_DC4_BIC-1_2022-09-12_N	CC231046	9/12/2022	400µM	1
LC_DC4_BIC-2_2022-09-12_N	CC231047	9/12/2022	400µM	1
LC_DC4_BIC-3_2022-09-12_N	CC231048	9/12/2022	400µM	1
LC_DCDS_BIC-1_2022-09-13_N	CC231049	9/13/2022	400µM	1
LC_DCDS_BIC-2_2022-09-13_N	CC231050	9/13/2022	400µM	1
LC_DCDS_BIC-3_2022-09-13_N	CC231051	9/13/2022	400µM	1
LC_DCDS_BIC-4_2022-09-13_N	CC231052	9/13/2022	400µM	1
LC_DCDS_BIC-5_2022-09-13_N	CC231053	9/13/2022	400µM	1
LC_DCEF_BIC-1_2022-09-13_N	CC231054	9/13/2022	400µM	1
LC_DCEF_BIC-2_2022-09-13_N	CC231055	9/13/2022	400µM	1
LC_DCEF_BIC-3_2022-09-13_N	CC231056	9/13/2022	400µM	1
LC_FRB_BIC-1_2022-09-10_N	CC231057	9/10/2022	400µM	1
LC_FRB_BIC-2_2022-09-10_N	CC231058	9/10/2022	400µM	1
LC_FRB_BIC-3_2022-09-10_N	CC231059	9/10/2022	400µM	1
LC_FRUS_BIC-1_2022-09-10_N	CC231060	9/10/2022	400µM	1
LC_FRUS_BIC-2_2022-09-10_N	CC231061	9/10/2022	400µM	1
LC_FRUS_BIC-3_2022-09-10_N	CC231062	9/10/2022	400µM	1
LC_GRCK_BIC-1_2022-09-14_N	CC231063	9/14/2022	400µM	1

LC_GRCK_BIC-2_2022-09-14_N	CC231064	9/14/2022	400µM	1
LC_GRCK_BIC-3_2022-09-14_N	CC231065	9/14/2022	400µM	1

Sample Sorting

- Using a gridded Petri dish, fine forceps and a low power stereo-microscope (Olympus, Nikon, Leica) the sorting technicians removed the invertebrates and sorted them into family/orders.
- The sorting technician kept a running tally of total numbers excluding organisms from Porifera, Nemata, Platyhelminthes, Ostracoda, Copepoda, Cladocera and terrestrial drop-ins such as aphids. These organisms were marked for their presence (given a value of 1) only and left in the sample. They were not included towards the 300-organism subsample count.
- Where specimens are broken or damaged, only heads were counted.
- Subsampling was conducted with the use of a Marchant Box.
- When using the Marchant box, cells were extracted at the same time in the order indicated by a random number table. If the 300th organism was found part way into sorting a cell then the balance of that cell was sorted. If the organism count had not reached 300 by the 50th cell then the entire sample was sorted.
- The total number of cells sorted and the number of organisms removed were recorded manually on a bench sheet and then recorded into INSTAR1
- Organisms were stored in vials containing 80% ethanol and an interior label indicating the site names, date of sampling, site code numbers and portion subsampled. This information was also recorded on the laboratory bench sheet and on INSTAR1.
- The sorted portion of the debris was preserved and labeled separately from the unsorted portion and was tested for sorting efficiency (Sorting Quality Control – Sorting Efficiency). The unsorted portion was also labeled and preserved in separate jars.

Percent sub-sampled and total countable invertebrates pulled from the samples were summarized in the table below.

Table 2: Percent sub-sample and invertebrate count for each sample

Sample	Date	CC#	400 micron fraction	
			% Sampled	# Invertebrates
LC_DC1_BIC-1_2022-09-12_N	12-Sep-22	CC231037	5%	617
LC_DC1_BIC-2_2022-09-12_N	12-Sep-22	CC231038	10%	339
LC_DC1_BIC-3_2022-09-12_N	12-Sep-22	CC231039	5%	513
LC_DC2_BIC-1_2022-09-14_N	14-Sep-22	CC231040	14%	329
LC_DC2_BIC-2_2022-09-14_N	14-Sep-22	CC231041	15%	335
LC_DC2_BIC-3_2022-09-14_N	14-Sep-22	CC231042	8%	335

LC_DC3_BIC-1_2022-09-13_N	13-Sep-22	CC231043	5%	622
LC_DC3_BIC-2_2022-09-13_N	13-Sep-22	CC231044	8%	343
LC_DC3_BIC-3_2022-09-13_N	13-Sep-22	CC231045	5%	376
LC_DC4_BIC-1_2022-09-12_N	12-Sep-22	CC231046	7%	334
LC_DC4_BIC-2_2022-09-12_N	12-Sep-22	CC231047	5%	360
LC_DC4_BIC-3_2022-09-12_N	12-Sep-22	CC231048	13%	385
LC_DCDS_BIC-1_2022-09-13_N	13-Sep-22	CC231049	15%	332
LC_DCDS_BIC-2_2022-09-13_N	13-Sep-22	CC231050	8%	320
LC_DCDS_BIC-3_2022-09-13_N	13-Sep-22	CC231051	16%	319
LC_DCDS_BIC-4_2022-09-13_N	13-Sep-22	CC231052	8%	346
LC_DCDS_BIC-5_2022-09-13_N	13-Sep-22	CC231053	12%	327
LC_DCEF_BIC-1_2022-09-13_N	13-Sep-22	CC231054	12%	334
LC_DCEF_BIC-2_2022-09-13_N	13-Sep-22	CC231055	15%	333
LC_DCEF_BIC-3_2022-09-13_N	13-Sep-22	CC231056	12%	342
LC_FRB_BIC-1_2022-09-10_N	10-Sep-22	CC231057	5%	515
LC_FRB_BIC-2_2022-09-10_N	10-Sep-22	CC231058	5%	443
LC_FRB_BIC-3_2022-09-10_N	10-Sep-22	CC231059	5%	392
LC_FRUS_BIC-1_2022-09-10_N	10-Sep-22	CC231060	7%	353
LC_FRUS_BIC-2_2022-09-10_N	10-Sep-22	CC231061	10%	329
LC_FRUS_BIC-3_2022-09-10_N	10-Sep-22	CC231062	14%	348
LC_GRCK_BIC-1_2022-09-14_N	14-Sep-22	CC231063	14%	310
LC_GRCK_BIC-2_2022-09-14_N	14-Sep-22	CC231064	50%	411
LC_GRCK_BIC-3_2022-09-14_N	14-Sep-22	CC231065	12%	327

Sorting Quality Control - Sorting Efficiency

As a part of Cordillera's laboratory policy, all projects undergo sorting efficiency checks.

- As sorting progresses, 10% of samples were randomly chosen by senior members of the sorting team for resorting.
- All sorters working on a project had at least 1 sample resorted by another sorter.
- An efficiency of 90 % was expected (95% for CABIN samples).
- If 90/95% efficiency was not met, samples from that sorter were resorted.
- To calculated sorting efficiency the following formula was used:

$$\frac{\#OrganismsMissed}{TotalOrganismsFound} * 100 = \%OM$$

Table 3 Summary of sorting efficiency

		Total from Sample	Percent Efficiency
Site - QC, Sample - QC3, CC# - CC231042, Percent sampled = 8%, Sieve size = 400			
Chironomidae	1		
Lepidoptera	3		
Total:	**4**	**335**	**99%**
Site - QC, Sample - QC2, CC# - CC231044, Percent sampled = 8%, Sieve size = 400			
Plecoptera	3		
Chironomidae	3		
Total:	**6**	**343**	**98%**
Site - QC, Sample - QC1, CC# - CC231062, Percent sampled = 14%, Sieve size = 400			
Chironomidae	1		
Heptageniidae	1		
Plecoptera	1		
Total:	**3**	**348**	**99%**

Sorting Quality Control - Sub-Sampling QC

Certain Provincial and Mining projects require additional sorting checks in the form of sub-sampling QC, (Environmental Effects Monitoring (EEM) protocol). This ensured that any fraction of the total sample that was examined was actually an accurate representation of the number of total organisms. Organisms from the additional sub-samples were not identified; rather total organism count only was compared.

Sub-Sampling efficiency was measured on 10% of the number of sub-sampled samples in the project. Ex. In a project where 50 of 100 total samples were processed through subsampling using a Marchant box, then 10% of 50; or 5 samples were used for sub sampling efficiency.

Sub-Sampling efficiency was performed by fractioning the entire sample into sub-sample percentages. On each sub-sampled portion, a total organism count was recorded and compared to the rest of the sub-samples. In order to pass, all fractions were required to be within 20% of total organism count.

Example: If 300 organisms are found in 10% of the sample, the sorter will continue to sample in 10% fractions until the entire sample is separated. They will then count the total number of organisms in each of the 10 fractions of 10% and compare the organism count.

When divergence is >20% the sorting manager examines for the source of the problem and takes steps to correct it. With the Marchant box, the problem typically rested with how the box is flipped back to the upright position. For this reason, subsampling was performed by experienced employees only. Another common source of error would be the type of debris in the sample. Samples with algae or heavy with periphyton have a higher incident of failure due to clumping than clear samples.

Table 4 Summary of Sub Sample efficiency

Station ID		Organisms in Subsample																				Sorter		Actual Total	Precision		Accuracy	
CC#	Sample Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	By	Time		Percent Range		Min	Max
230050	LC_DCDS_BIC05_2022-05_NP	349	300	314	300	301	317	302	300	308	290	290	308	301	302	314	298	333	328	327	330	MP	960	6212	0.00	16.91	0.84	12.36

Taxonomic Effort

The next procedure was the identification to genus-species level where possible of all the organisms in the sample.

- Identifications were made at the genus/species level for all insect organisms found including Chironomidae (Based on CABIN protocol).
- Non-insect organisms (except those not included in CABIN count) were identified to genus/species where possible and to a minimum of family level with intact and mature specimens.
- The Standard Taxonomic Effort lists compiled by the CABIN manual[1], SAFIT[2] , and PNAMP[3] were used as a guide line for what level of identification to achieve where the condition and maturity of the organism enabled.
- Organisms from the same families/order were kept in separate vials with 80% ethanol and an interior label of printed laser paper.
- Chironomidae was identified to genus/species level where possible and was aided by slide mounts. CMC-10 was used to clear and mount the slide.
- Oligochaetes was identified to family/genus level with the aid of slide mounts. CMC-10 was used to clear and mount the slide.
- Other Annelida (leeches, polychaetes) were identified to the family/genus/species level with undamaged, mature specimens.
- Mollusca was identified to family and genus/species where possible
- Decapoda, Amphipoda and Isopoda were identified at family/genus/species level where possible.
- Bryozoans and Nemata remained at the phylum level
- Hydrachnidae and Cnidaria were identified at the family/genus level where possible.
- When requested, reference collections were made containing at least one individual from each taxa listed. Organisms represented will have been identified to the lowest practical level.
- Reference collection specimens were stored in 55 mm glass vials with screw-cap lids with polyseal inserts (museum quality). They were labeled with taxa name, site code, date identified and taxonomist name. The same information was applied to labels on the slide mounts.

Taxonomists

The taxonomists for this project were certified by the Society of Freshwater Science (SFS) Taxonomic Certification Program at level 2 which is the required certification for CABIN projects:

Scott Finlayson: Group 1 General Arthropods (East/West); Group 2 EPT (East/West);
Group 3 Chironomidae (East/West); Group 4 Oligochaeta

Adam Bliss: Group 1 General Arthropods (East/West); Group 2 EPT (East/West); Group 3 Chironomidae

Rita Avery: Group 1 General Arthropods (East/West); Group 2 EPT (East/West)

Taxonomic QC

Taxonomic QC was performed in house by someone other than the original taxonomist.

- Quality control protocol involved complete, blind re-identification and re-enumeration of at least 10% of samples by a second SFS-certified taxonomist.
- Samples for taxonomic quality control were randomly selected and quality control procedures were conducted as the project progresses through the laboratories.

- The second (QC) taxonomist will calculate and record four types of errors:
    1. Misidentification error
    2. Enumeration error
    3. Questionable taxonomic resolution error
    4. Insufficient taxonomic resolution error

The QC coordinator then calculates the following estimates of taxonomic precision.

1. The percent total identification error rate is calculated as:

$$\frac{Sum\ of\ incorrect\ identifications}{total\ organisms\ counted\ in\ audit} * (100)$$

The average total identification error rate of audited samples did not exceed 5%. All samples that exceed a 5% error rate were re-evaluated to determine whether repeated errors or patterns in error contributed.

2. The percent difference in enumeration (PDE) to quantify the consistency of specimen counts.

$$PDE = \frac{|n_1 - n_2|}{n_1 + n_2} x100$$

3. The percent taxonomic disagreement (PTD) to quantify the shared precision between two sets of identifications.

$$PTD = \left(1 - \left[\frac{a}{N}\right]\right) x100$$

4. Bray Curtis dissimilarity Index to quantify the differences in identifications.

$$BC_{ij} = 1 - \frac{2C_{ij}}{S_j + S_i}$$

Error Summary

All samples report errors within the acceptable limits for CABIN Laboratory methods (less than 5% error).

Table 5 Summary of taxonomic error following QC

Site	Taxa Identified	% Error	PDE	PTD	Bray - Curtis Dissimilarity index
Site - 2022, Sample - LC_DC1_BIC-2_2022-09-12_N, CC# - CC231038, Percent sampled = 10%, Sieve size = 400	339	0.00	0	0.29498525	0.00294985
Site - 2022, Sample - LC_DC3_BIC-3_2022-09-13_N, CC# - CC231045, Percent sampled = 5%, Sieve size = 400	379	0.00	0.39735099	0.79155673	0.00397351
Site - 2022, Sample - LC_DCEF_BIC-3_2022-09-13_N, CC# - CC231056, Percent sampled = 12%, Sieve size = 400	341	0.00	0.14641288	1.4619883	0.01317716

There will always be disagreements between taxonomists regarding the degree of taxonomic resolution in immature specimens and when laboratories make use of different keys for certain groups (Mollusks is an especially disputed group). It is always possible that some taxa found by the original taxonomist were overlooked in QC.

All of the Taxonomic QC samples that were observed passed testing according to the CABIN misidentification protocols. See the tables below for results from taxonomic QC audit.

Error Rationale

Site - 2022, Sample - LC_DC1_BIC-2_2022-09-12_N, CC# - CC231038, Percent sampled = 10%, Sieve size = 400	Laboratory Count	QC Audit Count	Agreement	Misidentification	Questionable Taxonomic Resolution	Enumeration	Insufficient Taxonomic Resolution	Comments
Ameletus	1	1						
Baetidae	5	5						

Baetis	2	2							
Baetis rhodani group	28	29	No			X			
Chironomidae	13	13							
Cinygmula	27	27							
Diamesa	9	9							
Drunella doddsii	12	12							
Empididae	1	1							
Enchytraeidae	1	1							
Ephemerellidae	15	15							
Eukiefferiella	4	4							
Heptageniidae	15	15							
Hydrobaenus	20	20							
Hydropsychidae	3	3							
Kogotus	1	1							
Krenopelopia	1	1							
Limnephilidae	1	1							
Micropsectra	1	1							
Nemouridae	1	1							
Neoplasta	1	1							
Orthocladius complex	26	26							
Pagastia	19	19							
Parapsyche elsis	1	1							
Parorthocladius	1	1							
Pericoma/Telmatoscopus	25	25							
Perlodidae	4	4							
Plecoptera	2	2							
Pseudodiamesa	1	1							
Rheocricotopus	5	5							
Rhyacophila brunnea/vemna group	1	1							
Rhyacophila hyalinata group	1	1							
Rhyacophila narvae	1	1							
Taeniopterygidae	4	4							
Tanytarsini	2	2							
Trichoptera	12	11	No			X			
Tvetenia	10	10							
Zapada	11	11							
Zapada cinctipes	2	2							
Zapada columbiana	7	7							
Zapada oregonensis group	42	42							

Total:	**339**	**339**						
					0	**2**	**0**	
% Total Misidentification Rate =	misidentifications	x100	0.00	**Pass**				
	total number	=						
Site - 2022, Sample - LC_DC3_BIC-3_2022-09-13_N, CC# - CC231045, Percent sampled = 5%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficient Taxonomic Resolution**	**Comments**
Albertathyas	3	3						
Brillia	1	1						
Capniidae	31	32	No			X		
Chironomidae	12	12						
Chloroperlidae	4	4						
Diamesa	2	2						
Dicranota	5	5						
Ephemerellidae	1	1						
Eukiefferiella	22	22						
Hydrobaenus	6	6						
Lebertia	4	4						
Limnephilidae	2	2						
Limnophyes	1	1						
Malenka	1	1						
Megarcys	7	7						
Molophilus	1	1						
Nemouridae	1	1						
Oreogeton	1	1						
Oribatida	1	1						
Orthocladius complex	84	84						
Pagastia	28	29	No			X		
Parorthocladius	9	9						
Pericoma/Telmatoscopus	12	12						
Plumiperla	1	1						
Prosimulium	1	1						
Pseudodiamesa	33	33						
Rhyacophila	3	3						
Rhyacophila brunnea/vemna group	2	2						
Rhyacophila vofixa group	1	1						

Sweltsa	1	1						
Trichoclinocera	5	5						
Tvetenia	5	5						
Zapada	2	2						
Zapada columbiana	72	73	No			X		
Zapada oregonensis group	11	11						
Total:	**376**	**379**						
					0	**3**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				

Site - 2022, Sample - LC_DCEF_BIC-3_2022-09-13_N, CC# - CC231056, Percent sampled = 12%, Sieve size = 400	**Laboratory Count**	**QC Audit Count**	**Agreement**	**Misidentification**	**Questionable Taxonomic Resolution**	**Enumeration**	**Insufficient Taxonomic Resolution**	**Comments**
Ameletus	9	9						
Capniidae	6	6						
Chironomidae	5	5						
Chloroperlidae	19	18	No			X		
Cinygmula	59	55	No			X		
Clostoeca disjuncta	1	1						
Diamesa	11	11						
Drunella doddsii	2	2						
Epeorus	5	5						
Ephemerellidae	37	37						
Eukiefferiella	6	6						
Heptageniidae	93	97	No			X		
Hydrozetidae	1	1						
Lebertia	3	3						
Leuctridae	1	1						
Limnephilidae	2	2						
Limnophyes	1	1						
Megarcys	5	5						
Orthocladius complex	15	15						
Pagastia	4	4						
Parorthocladius	4	4						
Pedicia	1	1						
Perlodidae	4	4						

Rheocricotopus	1	1						
Rhithrogena	2	2						
Rhyacophila	3	3						
Rhyacophila betteni group	1	1						
Rhyacophila brunnea/vemna group	1	1						
Rhyacophila narvae	2	2						
Sweltsa	15	15						
Trichoptera	6	6						
Trombidiformes	1	1						
Tvetenia	6	6						
Visoka cataractae	4	4						
Yoraperla	3	3						
Zapada	3	3						
Total:	**342**	**341**						
					0	**3**	**0**	
% Total Misidentification Rate =	misidentifications / total number	x100 =	0.00	**Pass**				

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[3] Pacific Northwest Aquatic Monitoring Partnership (Accessed 2015). www.pnamp.org

Taxonomic Keys

Below is a reference list of taxonomic keys utilized by taxonomists at Cordillera Consulting. Cordillera taxonomists routinely seek out new literature to ensure the most accurate identification keys are being utilized. This is not reflective of the exhaustive list of resources that we use for identification. A more complete list of taxonomic resources can be found at Southwest Association of Freshwater Invertebrate Taxonomists. (2015). http://www.safit.org/Docs/SAFIT_Taxonomic_Literature_Database_1_March_2011.enl

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BENTHIC TISSUE CHEMISTRY

TrichAnalytics Laboratory Report 2022-334
(Finalized 26-May-22)

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client: Mike Pope
Project Manager
Teck Coal Limited
Phone: (250) 425-8449
Email: mike.pope@teck.com; jessica.ritz@teck.com;
teckcoal@equisonline.com; aquascilab@teck.com; robin.valleau@minnow.com

Date Received:	16 May 2022
Date of Analysis:	22 May 2022
Final Report Date:	26 May 2022
Project No.:	2022-334
Method No.:	MET-002.06

Client Project: LCO_LAEMP (PO 818999)

Analytical Request: Composite Benthic Invertebrate Tissue Microchemistry (total metals & moisture) - 45 samples. See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg)
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.
Client specific DQO for Selenium accuracy is 90-110% of the certified value; result achieved 102% (ranging from 97-106%).

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

26 May 2022
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA Testing Accreditation No. A4196

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_FRB_INV-1_2022-05_NP	LC_FRB_INV-2_2022-05_NP	LC_FRB_INV-3_2022-05_NP	LC_FRB_INV-4_2022-05_NP	LC_FRB_INV-5_2022-05_NP
		Lab ID	317	318	319	320	321
		Wet Weight (g)	0.2734	0.2554	0.5036	0.3749	0.2703
		Dry Weight (g)	0.0628	0.0588	0.1181	0.0733	0.0777
		Moisture (%)	77.0	77.0	76.5	80.4	71.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	6.8	1.3	1.3	1.3	1.5
11B	0.067	0.223	11	2.4	2.4	2.9	4.2
23Na	2.6	8.7	3,651	3,101	3,575	2,958	3,246
24Mg	0.065	0.217	2,055	1,689	1,681	1,637	1,551
27Al	0.036	0.120	7,956	1,858	1,763	2,312	2,610
31P	67	223	11,849	12,441	12,719	11,040	10,674
39K	2.4	8.0	12,459	11,910	10,313	9,195	11,037
44Ca	7.6	25	3,373	3,500	4,083	3,539	3,627
49Ti	0.224	0.747	787	153	179	153	245
51V	0.035	0.117	23	3.7	4.3	4.9	7.4
52Cr	0.094	0.313	76	21	27	27	48
55Mn	0.006	0.020	127	62	80	86	59
57Fe	0.956	3.2	2,635	1,066	1,111	1,470	1,314
59Co	0.011	0.037	4.8	1.7	3.2	3.4	2.5
60Ni	0.001	0.003	162	37	41	48	61
63Cu	0.013	0.043	25	21	24	20	21
66Zn	0.242	0.807	289	262	373	290	228
75As	0.417	1.4	1.2	0.843	0.813	0.783	0.873
77Se	0.374	1.2	9.7	9.4	8.5	9.0	7.7
88Sr	0.001	0.003	16	6.9	5.9	5.8	8.0
95Mo	0.001	0.003	0.631	0.702	0.365	0.449	0.365
107Ag	0.001	0.003	0.168	0.165	0.199	0.151	0.151
111Cd	0.066	0.220	2.9	4.0	3.0	3.3	1.4
118Sn	0.037	0.123	0.456	0.782	0.571	0.274	0.281
121Sb	0.003	0.010	0.160	0.061	0.075	0.081	0.094
137Ba	0.001	0.003	152	57	60	61	78
202Hg	0.022	0.073	0.078	0.065	0.065	0.049	0.049
205Tl	0.001	0.003	0.129	0.041	0.051	0.060	0.063
208Pb	0.003	0.010	1.3	0.502	0.620	0.712	0.684
238U	0.001	0.003	0.257	0.088	0.086	0.125	0.134

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_FRUS_INV-1_2022-05_NP	LC_FRUS_INV-2_2022-05_NP	LC_FRUS_INV-3_2022-05_NP	LC_FRUS_INV-4_2022-05_NP	LC_FRUS_INV-5_2022-05_NP
		Lab ID	322	323	324	325	326
		Wet Weight (g)	0.2878	0.5570	0.2929	0.4102	0.4014
		Dry Weight (g)	0.0553	0.1456	0.0716	0.1087	0.1039
		Moisture (%)	80.8	73.9	75.6	73.5	74.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	2.2	2.7	2.4	0.928	1.4
11B	0.067	0.223	5.5	5.1	4.5	2.0	2.7
23Na	2.6	8.7	3,247	3,178	3,300	2,845	3,528
24Mg	0.065	0.217	1,461	2,144	1,803	1,746	1,703
27Al	0.036	0.120	4,031	3,923	4,048	1,497	2,554
31P	67	223	10,946	10,668	11,367	12,472	11,908
39K	2.4	8.0	10,275	11,070	12,267	9,419	11,183
44Ca	7.6	25	4,399	8,435	4,742	4,335	3,245
49Ti	0.224	0.747	269	363	338	106	194
51V	0.035	0.117	8.6	8.2	9.4	3.2	5.0
52Cr	0.094	0.313	25	39	51	25	30
55Mn	0.006	0.020	60	78	74	47	49
57Fe	0.956	3.2	2,193	2,039	2,891	1,057	1,629
59Co	0.011	0.037	1.0	3.1	3.4	2.1	2.3
60Ni	0.001	0.003	42	56	79	37	42
63Cu	0.013	0.043	27	19	24	24	24
66Zn	0.242	0.807	229	176	245	285	242
75As	0.417	1.4	0.693	0.964	0.994	0.663	0.723
77Se	0.374	1.2	9.2	7.1	10	9.0	11
88Sr	0.001	0.003	7.4	12	9.5	7.7	6.8
95Mo	0.001	0.003	0.730	0.533	0.561	0.281	0.477
107Ag	0.001	0.003	0.206	0.158	0.165	0.160	0.165
111Cd	0.066	0.220	1.1	1.3	3.9	2.5	4.0
118Sn	0.037	0.123	0.998	0.312	0.690	0.427	0.886
121Sb	0.003	0.010	0.091	0.151	0.097	0.053	0.074
137Ba	0.001	0.003	80	131	112	55	75
202Hg	0.022	0.073	0.072	0.065	0.068	0.078	0.065
205Tl	0.001	0.003	0.064	0.083	0.078	0.038	0.046
208Pb	0.003	0.010	1.2	1.5	1.1	0.529	0.614
238U	0.001	0.003	0.128	0.144	0.173	0.075	0.101

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited

Tissue Analysis Results

Parameter	DL (ppm)	LOQ (ppm)	LC_DC4_INV-1_2022-05_NP	LC_DC4_INV-2_2022-05_NP	LC_DC4_INV-3_2022-05_NP	LC_DC4_INV-4_2022-05_NP	LC_DC4_INV-5_2022-05_NP
		Lab ID	327	328	329	330	331
		Wet Weight (g)	0.3353	0.6203	0.4071	0.3858	0.4998
		Dry Weight (g)	0.0547	0.1493	0.0882	0.0780	0.1143
		Moisture (%)	83.7	75.9	78.3	79.8	77.1
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	0.826	0.664	1.7	0.941	1.2
11B	0.067	0.223	2.3	1.3	5.0	2.8	3.3
23Na	2.6	8.7	3,693	3,700	4,118	3,106	3,003
24Mg	0.065	0.217	1,753	1,139	1,685	1,542	1,889
27Al	0.036	0.120	1,197	796	2,871	1,914	2,185
31P	67	223	14,032	13,564	14,041	12,343	11,796
39K	2.4	8.0	11,466	11,646	12,070	10,449	10,583
44Ca	7.6	25	3,943	2,422	5,713	4,015	4,389
49Ti	0.224	0.747	130	56	276	166	205
51V	0.035	0.117	3.9	3.7	9.8	8.0	8.3
52Cr	0.094	0.313	12	21	45	34	24
55Mn	0.006	0.020	45	59	72	67	83
57Fe	0.956	3.2	763	735	1,832	1,607	1,393
59Co	0.011	0.037	0.761	1.5	1.4	2.4	2.0
60Ni	0.001	0.003	25	45	80	62	46
63Cu	0.013	0.043	15	13	18	16	17
66Zn	0.242	0.807	200	198	246	236	224
75As	0.417	1.4	1.5	1.7	2.0	1.7	1.8
77Se	0.374	1.2	10	9.9	9.0	8.6	8.3
88Sr	0.001	0.003	6.6	3.6	8.9	6.9	7.4
95Mo	0.001	0.003	1.1	0.856	1.3	0.898	0.646
107Ag	0.001	0.003	0.131	0.103	0.155	0.137	0.220
111Cd	0.066	0.220	2.7	1.2	2.0	3.8	1.8
118Sn	0.037	0.123	0.723	0.323	0.612	0.479	0.311
121Sb	0.003	0.010	0.112	0.077	0.194	0.157	0.165
137Ba	0.001	0.003	109	114	175	168	180
202Hg	0.022	0.073	0.072	0.059	0.091	0.065	0.098
205Tl	0.001	0.003	0.055	0.032	0.089	0.078	0.094
208Pb	0.003	0.010	0.523	0.386	0.912	0.881	0.990
238U	0.001	0.003	0.104	0.080	0.193	0.162	0.198

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DC1_INV-1_2022-05_NP	LC_DC1_INV-2_2022-05_NP	LC_DC1_INV-3_2022-05_NP	LC_DC1_INV-4_2022-05_NP	LC_DC1_INV-5_2022-05_NP
		Lab ID	332	333	334	335	336
		Wet Weight (g)	0.7797	0.4728	0.4700	0.5640	0.5795
		Dry Weight (g)	0.1849	0.0902	0.1253	0.1047	0.1263
		Moisture (%)	76.3	80.9	73.3	81.4	78.2
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	0.448	0.733	1.0	0.853	1.8
11B	0.067	0.223	1.0	2.1	1.9	2.1	5.6
23Na	2.6	8.7	2,714	3,245	4,253	3,651	3,310
24Mg	0.065	0.217	1,364	1,839	1,526	1,835	1,532
27Al	0.036	0.120	342	1,432	1,259	1,464	4,363
31P	67	223	10,512	13,965	14,721	13,000	11,011
39K	2.4	8.0	8,380	11,722	12,565	11,501	12,086
44Ca	7.6	25	3,755	3,067	2,395	3,319	2,722
49Ti	0.224	0.747	33	67	75	87	282
51V	0.035	0.117	1.5	4.2	4.0	4.2	11
52Cr	0.094	0.313	9.4	16	27	18	60
55Mn	0.006	0.020	56	63	95	67	88
57Fe	0.956	3.2	435	856	1,153	972	2,398
59Co	0.011	0.037	0.952	1.1	2.0	1.7	2.3
60Ni	0.001	0.003	25	32	63	41	87
63Cu	0.013	0.043	11	19	16	16	13
66Zn	0.242	0.807	184	269	316	365	193
75As	0.417	1.4	0.964	0.911	1.2	1.5	1.6
77Se	0.374	1.2	7.3	14	12	9.6	10
88Sr	0.001	0.003	3.9	6.4	5.0	5.4	9.7
95Mo	0.001	0.003	0.407	0.638	0.667	0.580	1.3
107Ag	0.001	0.003	0.069	0.132	0.136	0.129	0.136
111Cd	0.066	0.220	4.9	2.5	5.2	9.8	4.0
118Sn	0.037	0.123	0.123	0.553	0.336	1.1	0.524
121Sb	0.003	0.010	0.076	0.116	0.119	0.110	0.303
137Ba	0.001	0.003	57	123	155	110	204
202Hg	0.022	0.073	0.059	0.071	0.098	0.102	0.078
205Tl	0.001	0.003	0.041	0.061	0.061	0.075	0.115
208Pb	0.003	0.010	0.140	0.408	0.477	0.444	1.1
238U	0.001	0.003	0.054	0.095	0.096	0.112	0.128

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_GRCK_INV-1_2022-05_NP	LC_GRCK_INV-2_2022-05_NP	LC_GRCK_INV-3_2022-05_NP	LC_GRCK_INV-4_2022-05_NP	LC_GRCK_INV-5_2022-05_NP
		Lab ID	337	338	339	340	341
		Wet Weight (g)	0.5422	0.5966	0.5969	0.4255	0.4614
		Dry Weight (g)	0.1177	0.1229	0.1240	0.0768	0.0906
		Moisture (%)	78.3	79.4	79.2	82.0	80.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	1.2	1.0	1.2	1.5	1.8
11B	0.067	0.223	5.0	4.7	6.3	4.3	8.7
23Na	2.6	8.7	3,852	3,158	4,389	3,755	3,422
24Mg	0.065	0.217	2,100	1,914	1,552	1,325	2,075
27Al	0.036	0.120	2,252	1,853	2,884	1,885	3,786
31P	67	223	12,420	12,395	9,187	10,522	10,920
39K	2.4	8.0	13,208	12,077	12,048	10,376	12,099
44Ca	7.6	25	4,257	3,250	2,207	3,078	5,844
49Ti	0.224	0.747	242	150	184	108	269
51V	0.035	0.117	3.4	4.2	4.5	3.3	7.3
52Cr	0.094	0.313	21	18	17	17	34
55Mn	0.006	0.020	145	158	84	81	173
57Fe	0.956	3.2	1,543	1,740	1,556	1,240	2,378
59Co	0.011	0.037	2.4	2.4	1.4	1.3	2.8
60Ni	0.001	0.003	32	30	29	26	52
63Cu	0.013	0.043	23	20	14	19	19
66Zn	0.242	0.807	205	244	112	156	206
75As	0.417	1.4	1.6	1.7	2.5	0.829	1.8
77Se	0.374	1.2	7.9	7.9	6.8	6.0	5.6
88Sr	0.001	0.003	16	10	8.6	10	19
95Mo	0.001	0.003	0.986	0.914	1.7	0.551	0.812
107Ag	0.001	0.003	0.106	0.083	0.053	0.068	0.091
111Cd	0.066	0.220	3.4	3.6	1.9	1.3	3.3
118Sn	0.037	0.123	0.913	0.607	0.365	0.532	0.906
121Sb	0.003	0.010	0.089	0.077	0.111	0.053	0.105
137Ba	0.001	0.003	157	72	75	90	138
202Hg	0.022	0.073	0.081	0.075	0.051	0.047	0.068
205Tl	0.001	0.003	0.094	0.093	0.094	0.067	0.094
208Pb	0.003	0.010	0.775	0.646	0.794	0.557	1.3
238U	0.001	0.003	0.220	0.175	0.268	0.119	0.348

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DC2_INV-1_2022-05_NP	LC_DC2_INV-2_2022-05_NP	LC_DC2_INV-3_2022-05_NP	LC_DC2_INV-4_2022-05_NP	LC_DC2_INV-5_2022-05_NP
		Lab ID	342	343	344	345	346
		Wet Weight (g)	0.5495	0.3888	0.3497	0.2357	0.3307
		Dry Weight (g)	0.1571	0.0844	0.0786	0.0666	0.0730
		Moisture (%)	71.4	78.3	77.5	71.7	77.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	1.3	0.874	0.733	2.2	1.3
11B	0.067	0.223	2.8	1.3	1.5	8.3	2.8
23Na	2.6	8.7	3,116	4,259	3,263	2,897	2,945
24Mg	0.065	0.217	1,093	1,379	1,733	2,127	1,762
27Al	0.036	0.120	2,466	1,537	1,117	6,646	2,541
31P	67	223	10,647	12,962	12,131	11,898	12,033
39K	2.4	8.0	10,731	12,480	10,839	12,714	9,599
44Ca	7.6	25	2,059	1,767	2,696	4,034	4,260
49Ti	0.224	0.747	255	99	104	486	209
51V	0.035	0.117	6.2	3.0	4.3	22	7.4
52Cr	0.094	0.313	23	22	33	140	40
55Mn	0.006	0.020	123	67	92	84	87
57Fe	0.956	3.2	1,447	869	1,094	4,198	1,407
59Co	0.011	0.037	1.9	1.0	2.5	7.1	2.3
60Ni	0.001	0.003	53	44	67	223	66
63Cu	0.013	0.043	15	17	20	24	18
66Zn	0.242	0.807	193	218	388	262	232
75As	0.417	1.4	0.976	0.781	0.667	1.4	0.716
77Se	0.374	1.2	11	11	13	13	11
88Sr	0.001	0.003	5.1	4.3	7.7	14	8.9
95Mo	0.001	0.003	0.812	0.957	0.972	1.5	0.725
107Ag	0.001	0.003	0.159	0.159	0.204	0.242	0.174
111Cd	0.066	0.220	1.3	2.4	3.1	1.4	1.9
118Sn	0.037	0.123	0.197	0.465	0.609	0.662	0.489
121Sb	0.003	0.010	0.132	0.101	0.118	0.389	0.167
137Ba	0.001	0.003	124	98	131	197	136
202Hg	0.022	0.073	0.088	0.081	0.109	0.105	0.081
205Tl	0.001	0.003	0.062	0.046	0.057	0.134	0.081
208Pb	0.003	0.010	0.741	0.443	0.452	1.5	0.680
238U	0.001	0.003	0.156	0.085	0.095	0.368	0.184

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DCEF_INV-1_2022-05_NP	LC_DCEF_INV-2_2022-05_NP	LC_DCEF_INV-3_2022-05_NP	LC_DCEF_INV-4_2022-05_NP	LC_DCEF_INV-5_2022-05_NP
		Lab ID	347	348	349	350	351
		Wet Weight (g)	0.3833	0.2707	0.2837	0.2546	0.2696
		Dry Weight (g)	0.0810	0.0479	0.0557	0.0520	0.0553
		Moisture (%)	78.9	82.3	80.4	79.6	79.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	0.479	0.546	0.620	0.497	0.424
11B	0.067	0.223	0.940	1.1	1.4	0.819	2.1
23Na	2.6	8.7	2,682	3,558	4,026	3,097	4,076
24Mg	0.065	0.217	1,594	1,138	1,468	1,295	1,578
27Al	0.036	0.120	187	307	402	416	422
31P	67	223	13,674	11,815	11,871	11,076	11,722
39K	2.4	8.0	9,077	10,494	11,723	10,052	12,026
44Ca	7.6	25	4,115	1,935	2,704	1,707	2,716
49Ti	0.224	0.747	10	17	37	25	29
51V	0.035	0.117	0.986	1.1	1.9	1.3	2.1
52Cr	0.094	0.313	8.3	8.0	21	13	11
55Mn	0.006	0.020	28	22	27	25	41
57Fe	0.956	3.2	398	380	576	423	532
59Co	0.011	0.037	0.268	0.651	1.1	0.505	0.866
60Ni	0.001	0.003	11	11	32	21	19
63Cu	0.013	0.043	20	16	22	19	20
66Zn	0.242	0.807	261	197	207	217	223
75As	0.417	1.4	1.2	1.3	2.2	1.3	2.4
77Se	0.374	1.2	6.0	6.0	7.4	7.0	7.5
88Sr	0.001	0.003	4.4	3.0	3.4	2.8	3.3
95Mo	0.001	0.003	0.522	0.377	0.377	0.609	0.365
107Ag	0.001	0.003	0.121	0.068	0.106	0.083	0.060
111Cd	0.066	0.220	5.2	10	7.9	8.7	9.6
118Sn	0.037	0.123	0.184	0.834	0.701	0.403	0.267
121Sb	0.003	0.010	0.056	0.051	0.061	0.056	0.053
137Ba	0.001	0.003	109	84	88	72	118
202Hg	0.022	0.073	0.068	0.047	0.061	0.061	0.064
205Tl	0.001	0.003	0.019	0.024	0.028	0.024	0.046
208Pb	0.003	0.010	0.102	0.159	0.179	0.229	0.252
238U	0.001	0.003	0.048	0.054	0.070	0.051	0.069

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

		Client ID	LC_DCDS_INV-1_2022-05_NP	LC_DCDS_INV-2_2022-05_NP	LC_DCDS_INV-3_2022-05_NP	LC_DCDS_INV-4_2022-05_NP	LC_DCDS_INV-5_2022-05_NP
		Lab ID	352	353	354	355	356
		Wet Weight (g)	0.4702	0.1976	0.2825	0.5246	0.4669
		Dry Weight (g)	0.0985	0.0480	0.0604	0.1073	0.1082
		Moisture (%)	79.1	75.7	78.6	79.5	76.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	0.598	1.8	1.3	0.820	0.692
11B	0.067	0.223	1.7	6.4	3.1	2.5	1.7
23Na	2.6	8.7	3,704	3,190	2,675	3,480	3,494
24Mg	0.065	0.217	1,144	1,506	1,579	1,263	1,367
27Al	0.036	0.120	993	5,858	2,968	1,530	902
31P	67	223	13,608	12,692	11,153	13,264	13,341
39K	2.4	8.0	11,112	10,548	9,439	10,565	9,959
44Ca	7.6	25	2,095	3,605	2,989	2,416	3,105
49Ti	0.224	0.747	61	571	233	109	65
51V	0.035	0.117	3.0	13	7.3	4.4	2.9
52Cr	0.094	0.313	22	95	39	27	16
55Mn	0.006	0.020	84	112	104	90	75
57Fe	0.956	3.2	716	2,715	1,549	884	569
59Co	0.011	0.037	2.2	5.4	1.5	2.4	1.4
60Ni	0.001	0.003	50	161	79	50	31
63Cu	0.013	0.043	13	20	16	13	11
66Zn	0.242	0.807	203	277	263	200	205
75As	0.417	1.4	0.706	1.1	1.0	0.723	0.538
77Se	0.374	1.2	11	12	9.9	10	8.1
88Sr	0.001	0.003	5.1	13	8.6	5.0	5.5
95Mo	0.001	0.003	0.814	1.3	1.1	0.617	0.449
107Ag	0.001	0.003	0.121	0.174	0.174	0.121	0.151
111Cd	0.066	0.220	1.6	4.4	4.9	2.6	3.7
118Sn	0.037	0.123	0.345	0.858	0.590	0.353	0.249
121Sb	0.003	0.010	0.091	0.237	0.180	0.119	0.093
137Ba	0.001	0.003	105	156	162	96	224
202Hg	0.022	0.073	0.064	0.078	0.078	0.064	0.071
205Tl	0.001	0.003	0.055	0.163	0.097	0.081	0.047
208Pb	0.003	0.010	0.388	1.3	0.820	0.545	0.326
238U	0.001	0.003	0.123	0.225	0.208	0.103	0.111

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DC3_INV-1_2022-05_NP	LC_DC3_INV-2_2022-05_NP	LC_DC3_INV-3_2022-05_NP	LC_DC3_INV-4_2022-05_NP	LC_DC3_INV-5_2022-05_NP
		Lab ID	357	358	359	360	361
		Wet Weight (g)	0.2991	0.2610	0.3314	0.2074	0.2462
		Dry Weight (g)	0.0693	0.0716	0.0839	0.0462	0.0570
		Moisture (%)	76.8	72.6	74.7	77.7	76.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.010	0.033	1.4	0.445	0.174	0.643	0.215
11B	0.067	0.223	5.3	1.2	0.414	2.6	0.518
23Na	2.6	8.7	3,181	2,935	2,588	3,509	2,766
24Mg	0.065	0.217	1,429	1,639	1,162	1,031	1,036
27Al	0.036	0.120	3,965	815	154	1,888	296
31P	67	223	10,106	14,161	10,777	12,201	10,341
39K	2.4	8.0	8,895	7,367	8,294	10,196	7,107
44Ca	7.6	25	2,695	4,004	979	1,510	1,232
49Ti	0.224	0.747	348	67	9.3	120	21
51V	0.035	0.117	8.9	2.5	0.606	4.9	0.953
52Cr	0.094	0.313	57	33	11	33	17
55Mn	0.006	0.020	61	40	39	39	33
57Fe	0.956	3.2	2,067	866	267	2,091	437
59Co	0.011	0.037	1.9	2.2	0.747	2.3	0.583
60Ni	0.001	0.003	98	64	19	60	31
63Cu	0.013	0.043	17	15	12	23	16
66Zn	0.242	0.807	163	145	156	162	168
75As	0.417	1.4	0.639	0.605	<0.417	0.470	<0.417
77Se	0.374	1.2	7.2	4.7	7.6	8.2	5.7
88Sr	0.001	0.003	7.1	5.7	2.3	4.6	2.4
95Mo	0.001	0.003	0.940	0.225	0.253	0.393	0.449
107Ag	0.001	0.003	0.113	0.147	0.083	0.344	0.140
111Cd	0.066	0.220	1.0	0.725	0.690	0.846	0.690
118Sn	0.037	0.123	0.329	0.123	0.133	0.285	0.188
121Sb	0.003	0.010	0.159	0.069	0.036	0.178	0.049
137Ba	0.001	0.003	95	39	32	42	35
202Hg	0.022	0.073	0.067	0.028	0.050	0.057	0.057
205Tl	0.001	0.003	0.139	0.061	0.026	0.096	0.031
208Pb	0.003	0.010	1.3	0.504	0.138	0.486	0.148
238U	0.001	0.003	0.143	0.047	0.031	0.093	0.028

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

	Client ID	LC_FRB_INV-5_2022-05_NP			LC_FRUS_INV-4_2022-05_NP			LC_DC1_INV-2_2022-05_NP		
	Lab ID	321			325			333		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.010	1.5	1.7	13	0.928	1.3	33	0.733	0.684	6.9
11B	0.067	4.2	4.6	9.1	2.0	2.7	30	2.1	2.0	4.9
23Na	2.6	3,246	2,908	11	2,845	2,674	6.2	3,245	3,503	7.6
24Mg	0.065	1,551	1,516	2.3	1,746	2,081	18	1,839	1,808	1.7
27Al	0.036	2,610	3,745	36	1,497	2,122	35	1,432	1,122	24
31P	67	10,674	10,403	2.6	12,472	12,688	1.7	13,965	14,469	3.5
39K	2.4	11,037	9,685	13	9,419	9,307	1.2	11,722	11,668	0.5
44Ca	7.6	3,627	3,595	0.9	4,335	6,330	37	3,067	2,823	8.3
49Ti	0.224	245	323	28	106	146	32	67	64	4.6
51V	0.035	7.4	8.3	12	3.2	4.4	32	4.2	3.3	24
52Cr	0.094	48	48	0.0	25	18	33	16	20	22
55Mn	0.006	59	63	6.6	47	49	4.2	63	57	10
57Fe	0.956	1,314	1,462	11	1,057	1,168	10	856	818	4.5
59Co	0.011	2.5	2.8	11	2.1	2.0	4.9	1.1	1.2	8.7
60Ni	0.001	61	69	12	37	29	24	32	36	12
63Cu	0.013	21	17	21	24	22	8.7	19	16	17
66Zn	0.242	228	174	27	285	273	4.3	269	292	8.2
75As	0.417	0.873	0.753	-	0.663	0.843	-	0.911	1.1	-
77Se	0.374	7.7	7.3	5.3	9.0	8.0	12	14	12	15
88Sr	0.001	8.0	5.9	30	7.7	11	35	6.4	6.7	4.6
95Mo	0.001	0.365	0.351	3.9	0.281	0.365	26	0.638	0.609	4.7
107Ag	0.001	0.151	0.131	14	0.160	0.223	33	0.132	0.113	16
111Cd	0.066	1.4	1.3	7.4	2.5	2.4	4.1	2.5	2.9	15
118Sn	0.037	0.281	0.202	-	0.427	0.415	2.9	0.553	0.730	28
121Sb	0.003	0.094	0.080	16	0.053	0.079	39	0.116	0.094	21
137Ba	0.001	78	64	20	55	69	23	123	100	21
202Hg	0.022	0.049	0.065	-	0.078	0.072	-	0.071	0.068	-
205Tl	0.001	0.063	0.060	4.9	0.038	0.046	19	0.061	0.055	10
208Pb	0.003	0.684	0.692	1.2	0.529	0.648	20	0.408	0.462	12
238U	0.001	0.134	0.136	1.5	0.075	0.072	4.1	0.095	0.082	15

Notes:

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL

Tissue QA/QC Relative Percent Difference Results

Client ID		LC_DCDS_INV-1_2022-05_NP			LC_DCDS_INV-4_2022-05_NP		
Lab ID		352			355		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.010	0.598	0.803	29	0.820	0.966	16
11B	0.067	1.7	2.5	38	2.5	3.2	25
23Na	2.6	3,704	4,056	9.1	3,480	4,370	23
24Mg	0.065	1,144	1,298	13	1,263	1,345	6.3
27Al	0.036	993	1,482	40	1,530	1,991	26
31P	67	13,608	11,552	16	13,264	14,022	5.6
39K	2.4	11,112	11,528	3.7	10,565	12,657	18
44Ca	7.6	2,095	2,461	16	2,416	2,451	1.4
49Ti	0.224	61	82	29	109	132	19
51V	0.035	3.0	4.3	36	4.4	5.5	22
52Cr	0.094	22	28	24	27	20	30
55Mn	0.006	84	84	0.0	90	131	37
57Fe	0.956	716	895	22	884	1,062	18
59Co	0.011	2.2	2.7	20	2.4	2.4	0.0
60Ni	0.001	50	55	9.5	50	46	8.3
63Cu	0.013	13	13	0.0	13	12	8.0
66Zn	0.242	203	202	0.5	200	211	5.4
75As	0.417	0.706	0.739	-	0.723	0.941	-
77Se	0.374	11	9.1	19	10	11	9.5
88Sr	0.001	5.1	5.2	1.9	5.0	6.1	20
95Mo	0.001	0.814	0.702	15	0.617	0.674	8.8
107Ag	0.001	0.121	0.106	13	0.121	0.117	3.4
111Cd	0.066	1.6	1.7	6.1	2.6	3.0	14
118Sn	0.037	0.345	0.456	-	0.353	0.487	-
121Sb	0.003	0.091	0.098	7.4	0.119	0.143	18
137Ba	0.001	105	113	7.3	96	129	29
202Hg	0.022	0.064	0.064	-	0.064	0.078	-
205Tl	0.001	0.055	0.075	31	0.081	0.092	13
208Pb	0.003	0.388	0.536	32	0.545	0.655	18
238U	0.001	0.123	0.113	8.5	0.103	0.152	38

Notes:
ppm = parts per million
RPD = relative percent difference
DL = detection limit
< = less than detection limit
% = percent

Data Quality Objectives:
Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%
Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

		Sample Group ID	01			02		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.010	1.21	1.3	109	12	1.3	107	5.4
11B	0.067	4.5	4.5	100	2.4	4.6	103	1.2
23Na	2.6	14,000	16,217	116	4.1	14,069	100	5.8
24Mg	0.065	910	1,045	115	6.5	929	102	5.1
27Al	0.036	197.2	180	92	9.3	183	93	4.6
31P	67	8,000	8,976	112	4.9	7,670	96	5.6
39K	2.4	15,500	16,754	108	6.0	15,789	102	3.6
44Ca	7.6	2,360	2,571	109	4.7	2,372	100	2.2
49Ti	0.224	12.24	13	105	17	10	86	9.7
51V	0.035	1.57	1.7	111	6.6	1.5	96	16
52Cr	0.094	1.87	2.2	116	5.3	2.0	105	7.7
55Mn	0.006	3.17	3.6	113	6.1	3.1	98	5.1
57Fe	0.956	343	375	109	3.2	346	101	6.8
59Co	0.011	0.25	0.289	116	8.6	0.250	100	6.5
60Ni	0.001	1.34	1.5	112	6.7	1.5	112	9.4
63Cu	0.013	15.7	18	115	5.6	17	106	6.9
66Zn	0.242	51.6	58	112	4.0	51	99	5.0
75As	0.417	6.87	7.4	108	3.3	6.8	98	5.2
77Se	0.374	3.45	3.6	106	8.8	3.3	97	6.2
88Sr	0.001	10.1	11	105	5.2	10	99	6.2
95Mo	0.001	0.29	0.348	120	4.4	0.293	101	2.3
107Ag	0.001	0.0252	0.028	113	11	0.027	105	15
111Cd	0.066	0.299	0.303	102	9.0	0.316	106	9.5
118Sn	0.037	0.061	0.058	95	14	0.078	128	18
121Sb	0.003	0.011	0.013	115	16	0.011	104	19
137Ba	0.001	8.6	8.2	95	2.9	7.8	91	3.2
202Hg	0.022	0.412	0.473	115	6.1	0.429	104	7.2
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.003	0.404	0.386	95	11	0.356	88	13
238U	0.001	0.05	0.050	100	11	0.050	100	10

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.
Accuracy: DQO of 90 - 110% of the certified values for Se.
Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.
Precision: DQO of ≤20% for all elements.
DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.
Tl certified concentration from NIST-2976.
Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Tissue QA/QC Accuracy and Precision Results

Sample Group ID: 03

Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.010	1.21	1.2	98	7.1
11B	0.067	4.5	4.4	97	2.6
23Na	2.6	14,000	13,693	98	3.0
24Mg	0.065	910	893	98	5.7
27Al	0.036	197.2	194	98	4.8
31P	67	8,000	7,872	98	1.4
39K	2.4	15,500	14,714	95	3.1
44Ca	7.6	2,360	2,343	99	2.5
49Ti	0.224	12.24	11	87	13
51V	0.035	1.57	1.7	106	8.1
52Cr	0.094	1.87	1.9	104	5.9
55Mn	0.006	3.17	3.2	101	4.4
57Fe	0.956	343	351	102	3.0
59Co	0.011	0.25	0.272	109	5.3
60Ni	0.001	1.34	1.3	100	6.7
63Cu	0.013	15.7	16	103	5.2
66Zn	0.242	51.6	52	101	1.9
75As	0.417	6.87	7.0	102	2.3
77Se	0.374	3.45	3.6	103	5.5
88Sr	0.001	10.1	10	99	0.9
95Mo	0.001	0.29	0.292	101	5.2
107Ag	0.001	0.0252	0.027	105	15
111Cd	0.066	0.299	0.314	105	15
118Sn	0.037	0.061	0.069	113	19
121Sb	0.003	0.011	0.011	103	5.1
137Ba	0.001	8.6	8.2	95	5.5
202Hg	0.022	0.412	0.429	104	3.7
205Tl	0.001	0.0013	-	-	-
208Pb	0.003	0.404	0.363	90	12
238U	0.001	0.05	0.049	99	4.2

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.
Accuracy: DQO of 90 - 110% of the certified values for Se.
Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.
Precision: DQO of ≤20% for all elements.
DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.
Tl certified concentration from NIST-2976.
Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_FRB_INV-1_2022-05_NP	317	22 May 2022
	LC_FRB_INV-2_2022-05_NP	318	
	LC_FRB_INV-3_2022-05_NP	319	
	LC_FRB_INV-4_2022-05_NP	320	
	LC_FRB_INV-5_2022-05_NP	321	
	LC_FRUS_INV-1_2022-05_NP	322	
	LC_FRUS_INV-2_2022-05_NP	323	
	LC_FRUS_INV-3_2022-05_NP	324	
	LC_FRUS_INV-4_2022-05_NP	325	
	LC_FRUS_INV-5_2022-05_NP	326	
	LC_DC4_INV-1_2022-05_NP	327	
	LC_DC4_INV-2_2022-05_NP	328	
	LC_DC4_INV-3_2022-05_NP	329	
	LC_DC4_INV-4_2022-05_NP	330	
	LC_DC4_INV-5_2022-05_NP	331	
	LC_DC1_INV-1_2022-05_NP	332	
02	LC_DC1_INV-2_2022-05_NP	333	22 May 2022
	LC_DC1_INV-3_2022-05_NP	334	
	LC_DC1_INV-4_2022-05_NP	335	
	LC_DC1_INV-5_2022-05_NP	336	
	LC_GRCK_INV-1_2022-05_NP	337	
	LC_GRCK_INV-2_2022-05_NP	338	
	LC_GRCK_INV-3_2022-05_NP	339	
	LC_GRCK_INV-4_2022-05_NP	340	
	LC_GRCK_INV-5_2022-05_NP	341	
	LC_DC2_INV-1_2022-05_NP	342	
	LC_DC2_INV-2_2022-05_NP	343	
	LC_DC2_INV-3_2022-05_NP	344	
	LC_DC2_INV-4_2022-05_NP	345	
	LC_DC2_INV-5_2022-05_NP	346	
	LC_DCEF_INV-1_2022-05_NP	347	
	LC_DCEF_INV-2_2022-05_NP	348	
	LC_DCEF_INV-3_2022-05_NP	349	
	LC_DCEF_INV-4_2022-05_NP	350	
03	LC_DCEF_INV-5_2022-05_NP	351	22 May 2022
	LC_DCDS_INV-1_2022-05_NP	352	
	LC_DCDS_INV-2_2022-05_NP	353	
	LC_DCDS_INV-3_2022-05_NP	354	
	LC_DCDS_INV-4_2022-05_NP	355	
	LC_DCDS_INV-5_2022-05_NP	356	

Teck Coal Limited

Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
03	LC_DC3_INV-1_2022-05_NP	357	22 May 2022
	LC_DC3_INV-2_2022-05_NP	358	
	LC_DC3_INV-3_2022-05_NP	359	
	LC_DC3_INV-4_2022-05_NP	360	
	LC_DC3_INV-5_2022-05_NP	361	

Teck

COC ID:	LCO_LAEMP	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO

Facility Name / Job#	Line Creek Operations		
Project Manager	Mike Pope		
Email	Mike.pope@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8449		

LABORATORY

Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code	V8M 0B3	Country	Canada
Phone Number			

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
Email 1:	mike.pope@teck.com	X	X	X
Email 2:	jessica.Ritz@teck.com	X	X	X
Email 3:	teckcoal@equisonline.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	Robin.valleau@minnow.ca	X	X	X
PO number	818999			

SAMPLE DETAILS / **ANALYSIS REQUESTED**

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Species	Sample Type	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
317	LC_FRB_INV-1_2022-05_NP ✓	LC_FRB	TA	N	11-May-22 ✓	11:15	BIT	Composite	1	X	X	X
318	LC_FRB_INV-2_2022-05_NP ✓	LC_FRB	TA	N	11-May-22 ✓	11:20	BIT	Composite	1	X	X	X
319	LC_FRB_INV-3_2022-05_NP ✓	LC_FRB	TA	N	11-May-22 ✓	11:25	BIT	Composite	1	X	X	X
320	LC_FRB_INV-4_2022-05_NP ✓	LC_FRB	TA	N	11-May-22 ✓	11:30	BIT	Composite	1	X	X	X
321	LC_FRB_INV-5_2022-05_NP ✓	LC_FRB	TA	N	11-May-22 ✓	11:35	BIT	Composite	1	X	X	X
322	LC_FRUS_INV-1_2022-05_NP ✓	LC_FRUS	TA	N	11-May-22 ✓	10:30	BIT	Composite	1	X	X	X
323	LC_FRUS_INV-2_2022-05_NP ✓	LC_FRUS	TA	N	11-May-22 ✓	10:35	BIT	Composite	1	X	X	X
324	LC_FRUS_INV-3_2022-05_NP ✓	LC_FRUS	TA	N	11-May-22 ✓	10:40	BIT	Composite	1	X	X	X
325	LC_FRUS_INV-4_2022-05_NP ✓	LC_FRUS	TA	N	11-May-22 ✓	10:45	BIT	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	May 15, 2022		

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	X
For Emergency <1 Day, ASAP or Weekend	

Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Sampler's Signature		Date/Time	May 15, 2022

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Received by: Alex Wade
17 May 2022

Project #: 2022-334

Teck

COC ID:	LCO_LAEMP	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operations			Lab Name	TrichAnalytics Inc.			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Mike Pope			Lab Contact	Jennie Christensen			Email 1: mike.pope@teck.com	X	X	X
Email	Mike.pope@teck.com			Email	jennie.christensen@trichanalytics			Email 2: jessica.Ritz@teck.com	X	X	X
Address	421 Pine Ave			Address	207-1753 Sean Heights			Email 3: teckcoal@equisonline.com	X	X	X
								Email 4: AquaSciLab@teck.com	X	X	X
City	Sparwood	Province	BC	City	Saanichton	Province	BC	Email 5: Robin.valleau@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	V8M 0B3	Country	Canada				
Phone Number	250-425-8449			Phone Number				PO number	818999		

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Tich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Species	Sample Type	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
326	LC_FRUS_INV-5_2022-05_NP ✓	LC_FRUS	TA	N	11-May-22 ✓	10:50	BIT	Composite	1	X	X	X
327	LC_DC4_INV-1_2022-05_NP ✓	LC_DC4	TA	N	11-May-22 ✓	8:45	BIT	Composite	1	X	X	X
328	LC_DC4_INV-2_2022-05_NP ✓	LC_DC4	TA	N	11-May-22 ✓	8:50	BIT	Composite	1	X	X	X
329	LC_DC4_INV-3_2022-05_NP ✓	LC_DC4	TA	N	11-May-22 ✓	8:55	BIT	Composite	1	X	X	X
330	LC_DC4_INV-4_2022-05_NP ✓	LC_DC4	TA	N	11-May-22 ✓	9:00	BIT	Composite	1	X	X	X
331	LC_DC4_INV-5_2022-05_NP ✓	LC_DC4	TA	N	11-May-22 ✓	9:05	BIT	Composite	1	X	X	X
332	LC_DC1_INV-1_2022-05_NP ✓	LC_DC1	TA	N	11-May-22 ✓	9:30	BIT	Composite	1	X	X	X
333	LC_DC1_INV-2_2022-05_NP ✓	LC_DC1	TA	N	11-May-22 ✓	9:35	BIT	Composite	1	X	X	X
334	LC_DC1_INV-3_2022-05_NP ✓	LC_DC1	TA	N	11-May-22 ✓	9:40	BIT	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	May 15, 2022		

SERVICE REQUEST (rush - subject to availability)

Regular (default)	
Priority (2-3 business days) - 50% surcharge	
Emergency (1 Business Day) - 100% surcharge	X
For Emergency <1 Day, ASAP or Weekend	

Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Sampler's Signature		Date/Time	May 15, 2022

Received by: Alex Wade

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Project #: 2022-334

17 May 2022

Teck

COC ID:	LCO_LAEMP	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operations			Lab Name	TrichAnalytics Inc.			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Mike Pope			Lab Contact	Jennie Christensen			Email 1: mike.pope@teck.com	X	X	X
Email	Mike.pope@teck.com			Email	jennie.christensen@trichanalytics			Email 2: jessica.Ritz@teck.com	X	X	X
Address	421 Pine Ave			Address	207-1753 Sean Heights			Email 3: teckcoal@equisonline.com	X	X	X
								Email 4: AquaSciLab@teck.com	X	X	X
City	Sparwood	Province	BC	City	Saanichton	Province	BC	Email 5: Robin.valleau@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	V8M 0B3	Country	Canada				
Phone Number	250-425-8449			Phone Number				PO number	818999		

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Sch ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Species	Sample Type	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
335	LC_DC1_INV-4_2022-05_NP ✓	LC_DC1	TA	N	11-May-22 ✓	9:45	BIT	Composite	1	X	X	X
336	LC_DC1_INV-5_2022-05_NP ✓	LC_DC1	TA	N	11-May-22 ✓	9:50	BIT	Composite	1	X	X	X
337	LC_GRCK_INV-1_2022-05_NP ✓	LC_GRCK	TA	N	11-May-22 ✓	13:30	BIT	Composite	1	X	X	X
338	LC_GRCK_INV-2_2022-05_NP ✓	LC_GRCK	TA	N	11-May-22 ✓	13:35	BIT	Composite	1	X	X	X
339	LC_GRCK_INV-3_2022-05_NP ✓	LC_GRCK	TA	N	11-May-22 ✓	13:40	BIT	Composite	1	X	X	X
340	LC_GRCK_INV-4_2022-05_NP ✓	LC_GRCK	TA	N	11-May-22 ✓	13:45	BIT	Composite	1	X	X	X
341	LC_GRCK_INV-5_2022-05_NP ✓	LC_GRCK	TA	N	11-May-22 ✓	13:50	BIT	Composite	1	X	X	X
342	LC_DC2_INV-1_2022-05_NP ✓	LC_DC2	TA	N	10-May-22 ✓	15:30	BIT	Composite	1	X	X	X
343	LC_DC2_INV-2_2022-05_NP ✓	LC_DC2	TA	N	10-May-22 ✓	15:35	BIT	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	May 15, 2022		

SERVICE REQUEST (rush - subject to availability)

Regular (default)					
Priority (2-3 business days) - 50% surcharge		Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Emergency (1 Business Day) - 100% surcharge	X	Sampler's Signature		Date/Time	May 15, 2022
For Emergency <1 Day, ASAP or Weekend					

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Received by: Alex Wade
17 May 2022

Project #: 2022 - 334

Teck

COC ID:	LCO_LAEMP	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Line Creek Operations		
Project Manager	Mike Pope		
Email	Mike.pope@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	250-425-8449		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code	V8M 0B3	Country	Canada
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	mike.pope@teck.com	X	X	X
Email 2:	jessica.Ritz@teck.com	X	X	X
Email 3:	teckcoal@equisonline.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	Robin.valleau@minnow.ca	X	X	X
PO number	818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Tech ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Species	Sample Type	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
344	LC_DC2_INV-3_2022-05_NP ✓	LC_DC2	TA	N	10-May-22✓	15:40	BIT	Composite	1	X	X	X
345	LC_DC2_INV-4_2022-05_NP ✓	LC_DC2	TA	N	10-May-22 ✓	15:45	BIT	Composite	1	X	X	X
346	LC_DC2_INV-5_2022-05_NP ✓	LC_DC2	TA	N	10-May-22 ✓	15:50	BIT	Composite	1	X	X	X
347	LC_DCEF_INV-1_2022-05_NP ✓	LC_DCEF	TA	N	10-May-22 ✓	11:00	BIT	Composite	1	X	X	X
348	LC_DCEF_INV-2_2022-05_NP ✓	LC_DCEF	TA	N	10-May-22✓	11:05	BIT	Composite	1	X	X	X
349	LC_DCEF_INV-3_2022-05_NP ✓	LC_DCEF	TA	N	10-May-22 ✓	11:10	BIT	Composite	1	X	X	X
350	LC_DCEF_INV-4_2022-05_NP ✓	LC_DCEF	TA	N	10-May-22 ✓	11:15	BIT	Composite	1	X	X	X
351	LC_DCEF_INV-5_2022-05_NP ✓	LC_DCEF	TA	N	10-May-22 ✓	11:20	BIT	Composite	1	X	X	X
352	LC_DCDS_INV-1_2022-05_NP ✓	LC_DCDS	TA	N	10-May-22 ✓	12:30	BIT	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	May 15, 2022		

SERVICE REQUEST (rush - subject to availability)					
Regular (default)		Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Priority (2-3 business days) - 50% surcharge					
Emergency (1 Business Day) - 100% surcharge	X	Sampler's Signature		Date/Time	May 15, 2022
For Emergency <1 Day, ASAP or Weekend					

Page 4 of 5

Received by: Alex Wade
17 May 2022

Project #: 2022-334

Teck

COC ID:	LCO_LAEMP	TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO			
Facility Name / Job#	Line Creek Operations			Lab Name	TrichAnalytics Inc.			Report Format / Distribution	Excel	PDF	EDD
Project Manager	Mike Pope			Lab Contact	Jennie Christensen			Email 1: mike.pope@teck.com	X	X	X
Email	Mike.pope@teck.com			Email	jennie.christensen@trichanalytics			Email 2: jessica.Ritz@teck.com	X	X	X
Address	421 Pine Ave			Address	207-1753 Sean Heights			Email 3: teckcoal@equisonline.com	X	X	X
								Email 4: AquaSciLab@teck.com	X	X	X
City	Sparwood	Province	BC	City	Saanichton	Province	BC	Email 5: Robin.valleau@minnow.ca	X	X	X
Postal Code	V0B 2G0	Country	Canada	Postal Code	V8M 0B3	Country	Canada				
Phone Number	250-425-8449			Phone Number				PO number: 818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Species	Sample Type	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
353	LC_DCDS_INV-2_2022-05_NP ✓	LC_DCDS	TA	N	10-May-22 ✓	12:35	BIT	Composite	1	X	X	X
354	LC_DCDS_INV-3_2022-05_NP ✓	LC_DCDS	TA	N	10-May-22 ✓	12:40	BIT	Composite	1	X	X	X
355	LC_DCDS_INV-4_2022-05_NP ✓	LC_DCDS	TA	N	10-May-22 ✓	12:45	BIT	Composite	1	X	X	X
356	LC_DCDS_INV-5_2022-05_NP ✓	LC_DCDS	TA	N	10-May-22 ✓	12:50	BIT	Composite	1	X	X	X
357	LC_DC3_INV-1_2022-05_NP ✓	LC_DC3	TA	N	10-May-22 ✓	10:00	BIT	Composite	1	X	X	X
358	LC_DC3_INV-2_2022-05_NP ✓	LC_DC3	TA	N	10-May-22 ✓	10:05	BIT	Composite	1	X	X	X
359	LC_DC3_INV-3_2022-05_NP ✓	LC_DC3	TA	N	10-May-22 ✓	10:10	BIT	Composite	1	X	X	X
360	LC_DC3_INV-4_2022-05_NP ✓	LC_DC3	TA	N	10-May-22 ✓	10:15	BIT	Composite	1	X	X	X
361	LC_DC3_INV-5_2022-05_NP ✓	LC_DC3	TA	N	10-May-22 ✓	10:20	BIT	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	May 15, 2022		

SERVICE REQUEST (rush - subject to availability)

Regular (default)				
Priority (2-3 business days) - 50% surcharge		Sampler's Name: Robin Valleau	Mobile #	416-970-7535
Emergency (1 Business Day) - 100% surcharge	X	Sampler's Signature	Date/Time	May 15, 2022
For Emergency <1 Day, ASAP or Weekend				

Received by: Alex Wade
17 May 2022
Project #: 2022-334

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BENTHIC TISSUE CHEMISTRY

TrichAnalytics Laboratory Report 2022-393
(Finalized 13-Oct-22)

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Nicole Zathey Project Manager Teck Coal Ltd	Date Received:	29 Sep 2022
		Date of Analysis:	05 Oct 2022
		Final Report Date:	13 Oct 2022
Phone:	(250) 865-3048	Project No.:	2022-393
Email:	nicole.zathey@teck.com; aquascilab@teck.com; jessica.ritz@teck.com; teck.lab.results@teck.com; lbowron@minnow.ca; robin.valleau@minnow.ca; teckcoal@equisonline.com	Method No.:	MET-002.06

Client Project: LCO_LAEMP_DRY_2022-09 Line Creek Operation (PO 818999)

Analytical Request: Composite Benthic Invertebrate Tissue Microchemistry (total metals & moisture) - 48 samples. See chain of custody form provided for sample identification numbers.

Notes:

Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg).
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.
Client specific DQO for Selenium accuracy is 90-110% of the certified value; result achieved 108% (ranging from 107-109%).

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

13 Oct 2022
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA Testing Accreditation No. A4196

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DC1_INV-1_2022-09-12_N	LC_DC1_INV-2_2022-09-12_N	LC_DC1_INV-3_2022-09-12_N	LC_DC1_INV-4_2022-09-12_N	LC_DC1_INV-5_2022-09-12_N
		Lab ID	419	420	421	422	423
		Wet Weight (g)	0.4333	0.4106	0.2347	0.3648	0.6957
		Dry Weight (g)	0.1164	0.0972	0.0559	0.0816	0.1592
		Moisture (%)	73.1	76.3	76.2	77.6	77.1
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	2.5	1.8	1.7	0.991	1.3
11B	0.074	0.247	5.3	3.6	3.6	0.969	2.7
23Na	3.2	11	3,778	2,583	3,081	5,014	2,755
24Mg	0.050	0.167	1,660	1,476	1,404	1,330	1,166
27Al	0.053	0.177	4,628	3,567	2,849	602	2,585
31P	63	210	12,991	8,878	10,247	16,025	9,709
39K	3.1	10	17,444	11,043	11,537	18,017	10,636
44Ca	13	43	4,911	8,654	8,303	3,462	4,561
49Ti	0.001	0.003	350	258	202	43	172
51V	0.025	0.083	13	8.9	7.1	1.8	7.0
52Cr	0.153	0.510	27	8.1	36	10	19
55Mn	0.006	0.020	67	69	58	24	56
57Fe	1.5	5.0	2,396	1,657	2,231	548	1,548
59Co	0.009	0.030	1.8	0.974	0.986	0.397	0.943
60Ni	0.030	0.100	63	29	62	18	38
63Cu	0.149	0.497	18	14	14	11	14
66Zn	0.335	1.1	155	122	116	123	182
75As	0.453	1.5	1.4	1.2	1.1	0.604	0.893
77Se	0.381	1.3	8.3	7.2	8.3	8.3	9.6
88Sr	0.001	0.003	10	17	12	3.7	8.1
95Mo	0.014	0.047	0.776	0.662	0.799	0.480	0.662
107Ag	0.001	0.003	0.132	0.111	0.102	0.072	0.126
111Cd	0.036	0.120	1.9	2.4	2.2	0.908	2.2
118Sn	0.019	0.063	0.400	0.646	0.625	0.090	0.357
121Sb	0.004	0.013	0.165	0.122	0.125	0.030	0.113
137Ba	0.001	0.003	167	287	199	44	185
202Hg	0.025	0.083	0.056	0.051	0.056	0.031	0.074
205Tl	0.001	0.003	0.063	0.056	0.045	0.016	0.040
208Pb	0.002	0.007	0.861	0.695	0.668	0.137	0.488
238U	0.001	0.003	0.221	0.177	0.132	0.031	0.147

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DC2_INV-1_2022-09-14_N	LC_DC2_INV-2_2022-09-14_N	LC_DC2_INV-3_2022-09-14_N	LC_DC2_INV-4_2022-09-14_N	LC_DC2_INV-5_2022-09-14_N
		Lab ID	424	425	426	427	428
		Wet Weight (g)	0.4722	0.1764	0.3899	0.6971	0.5792
		Dry Weight (g)	0.0916	0.0399	0.0820	0.1530	0.1424
		Moisture (%)	80.6	77.4	79.0	78.1	75.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	0.522	1.7	1.1	2.1	0.631
11B	0.074	0.247	0.345	4.1	1.7	4.2	0.942
23Na	3.2	11	2,712	2,387	2,842	2,684	1,522
24Mg	0.050	0.167	207	650	453	773	428
27Al	0.053	0.177	86	3,347	1,652	3,706	926
31P	63	210	11,301	9,368	10,186	9,601	7,217
39K	3.1	10	7,771	9,438	10,283	11,072	4,298
44Ca	13	43	467	2,357	1,253	2,779	1,629
49Ti	0.001	0.003	4.8	227	107	239	54
51V	0.025	0.083	0.343	8.9	3.9	10	2.3
52Cr	0.153	0.510	3.6	63	8.5	43	12
55Mn	0.006	0.020	10	48	25	64	42
57Fe	1.5	5.0	114	1,747	756	1,726	459
59Co	0.009	0.030	0.274	1.4	0.695	2.4	0.662
60Ni	0.030	0.100	11	117	22	86	22
63Cu	0.149	0.497	8.8	16	10	18	10
66Zn	0.335	1.1	93	135	114	247	100
75As	0.453	1.5	<0.453	0.704	0.553	1.2	<0.453
77Se	0.381	1.3	7.4	7.9	6.6	8.9	6.1
88Sr	0.001	0.003	0.712	6.6	3.2	8.8	3.4
95Mo	0.014	0.047	0.240	1.1	0.343	0.959	0.365
107Ag	0.001	0.003	0.078	0.156	0.114	0.132	0.093
111Cd	0.036	0.120	0.942	1.8	1.1	3.5	1.2
118Sn	0.019	0.063	0.032	0.436	1.1	0.513	0.197
121Sb	0.004	0.013	0.030	0.125	0.086	0.187	0.043
137Ba	0.001	0.003	31	115	72	145	54
202Hg	0.025	0.083	0.072	0.092	0.072	0.107	0.087
205Tl	0.001	0.003	0.010	0.061	0.031	0.077	0.018
208Pb	0.002	0.007	0.047	0.582	0.304	0.893	0.224
238U	0.001	0.003	0.021	0.202	0.083	0.219	0.058

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited
Tissue Analysis Results

Parameter	DL (ppm)	LOQ (ppm)	LC_DC3_INV-1_2022-09-13_N	LC_DC3_INV-2_2022-09-13_N	LC_DC3_INV-3_2022-09-13_N	LC_DC3_INV-4_2022-09-13_N	LC_DC3_INV-5_2022-09-13_N
		Lab ID	429	430	431	432	433
		Wet Weight (g)	0.2440	0.2556	0.3614	0.2269	0.4485
		Dry Weight (g)	0.0465	0.0514	0.0921	0.0604	0.0884
		Moisture (%)	80.9	79.9	74.5	73.4	80.3
			(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	1.5	2.2	1.8	0.841	1.4
11B	0.074	0.247	2.5	4.4	4.1	1.2	0.983
23Na	3.2	11	3,487	3,307	2,969	3,472	7,549
24Mg	0.050	0.167	1,511	1,668	1,829	1,601	1,003
27Al	0.053	0.177	2,097	3,661	2,838	797	676
31P	63	210	12,545	12,116	12,977	14,308	10,744
39K	3.1	10	11,037	12,351	15,186	14,627	11,501
44Ca	13	43	6,321	8,202	7,314	3,020	1,431
49Ti	0.001	0.003	129	262	206	59	46
51V	0.025	0.083	5.5	11	9.8	2.5	1.9
52Cr	0.153	0.510	9.2	48	13	10	5.0
55Mn	0.006	0.020	46	65	58	32	16
57Fe	1.5	5.0	794	2,220	1,526	556	152
59Co	0.009	0.030	1.0	3.1	2.0	1.1	0.302
60Ni	0.030	0.100	35	88	49	30	11
63Cu	0.149	0.497	16	18	21	21	6.1
66Zn	0.335	1.1	144	167	170	156	66
75As	0.453	1.5	0.578	0.931	0.905	0.616	<0.453
77Se	0.381	1.3	7.7	9.4	9.9	8.8	10
88Sr	0.001	0.003	12	16	11	3.9	2.7
95Mo	0.014	0.047	0.548	0.685	0.708	0.411	0.367
107Ag	0.001	0.003	0.090	0.132	0.207	0.162	0.036
111Cd	0.036	0.120	1.4	1.8	2.1	1.3	0.266
118Sn	0.019	0.063	0.979	0.837	0.678	0.625	0.131
121Sb	0.004	0.013	0.111	0.155	0.148	0.055	0.037
137Ba	0.001	0.003	139	169	126	35	8.1
202Hg	0.025	0.083	0.074	0.079	0.092	0.056	0.038
205Tl	0.001	0.003	0.056	0.071	0.067	0.031	0.013
208Pb	0.002	0.007	0.501	0.868	0.686	0.252	0.061
238U	0.001	0.003	0.161	0.262	0.224	0.060	0.038

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Tissue Analysis Results

		Client ID	LC_DC4_COMPNOLI-1_2022-09-12_N	LC_DC4_INV-2_2022-09-12_N	LC_DC4_INV-3_2022-09-12_N	LC_DC4_INV-4_2022-09-12_N	LC_DC4_INV-5_2022-09-12_N
		Lab ID	434	435	436	437	438
		Wet Weight (g)	0.2631	0.3397	0.5776	0.7787	0.6136
		Dry Weight (g)	0.0464	0.0735	0.1233	0.1881	0.1446
		Moisture (%)	82.4	78.4	78.7	75.8	76.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	1.3	1.1	0.615	0.552	0.646
11B	0.074	0.247	2.4	2.4	0.940	0.812	0.841
23Na	3.2	11	3,077	4,059	3,132	3,094	2,816
24Mg	0.050	0.167	1,345	1,025	875	817	1,253
27Al	0.053	0.177	2,109	1,717	491	549	599
31P	63	210	10,186	13,418	12,601	11,302	10,466
39K	3.1	10	11,603	13,304	10,591	9,695	11,057
44Ca	13	43	3,494	3,245	1,522	869	1,816
49Ti	0.001	0.003	119	116	34	39	41
51V	0.025	0.083	5.8	5.3	1.8	1.8	1.9
52Cr	0.153	0.510	45	20	10	9.0	11
55Mn	0.006	0.020	37	52	24	37	22
57Fe	1.5	5.0	1,562	955	335	410	463
59Co	0.009	0.030	2.1	1.0	0.573	0.418	1.2
60Ni	0.030	0.100	72	44	19	26	22
63Cu	0.149	0.497	15	12	9.9	13	10
66Zn	0.335	1.1	138	155	107	118	199
75As	0.453	1.5	1.0	1.1	0.785	0.606	0.799
77Se	0.381	1.3	7.0	10	9.1	8.8	7.7
88Sr	0.001	0.003	5.4	5.3	2.3	1.4	1.9
95Mo	0.014	0.047	0.480	0.502	0.343	0.580	0.316
107Ag	0.001	0.003	0.108	0.120	0.093	0.082	0.076
111Cd	0.036	0.120	2.0	2.7	0.984	0.846	2.0
118Sn	0.019	0.063	0.647	0.431	0.142	0.141	0.189
121Sb	0.004	0.013	0.091	0.101	0.048	0.050	0.046
137Ba	0.001	0.003	93	190	55	60	42
202Hg	0.025	0.083	0.054	0.097	0.066	0.042	0.084
205Tl	0.001	0.003	0.039	0.034	0.018	0.018	0.026
208Pb	0.002	0.007	0.440	0.525	0.137	0.180	0.200
238U	0.001	0.003	0.138	0.171	0.053	0.050	0.049

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Tissue Analysis Results

		Client ID	LC_DCDS_INV-1_2022-09-13_N	LC_DCDS_INV-2_2022-09-13_N	LC_DCDS_INV-3_2022-09-13_N	LC_DCDS_INV-4_2022-09-13_N	LC_DCDS_INV-5_2022-09-13_N
		Lab ID	439	440	441	442	443
		Wet Weight (g)	0.1824	0.6907	0.5320	0.6808	0.3517
		Dry Weight (g)	0.0472	0.1456	0.1195	0.1702	0.0850
		Moisture (%)	74.1	78.9	77.5	75.0	75.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	4.5	2.2	1.5	0.359	1.9
11B	0.074	0.247	9.7	3.7	2.4	0.798	3.5
23Na	3.2	11	2,375	2,978	3,941	1,697	3,020
24Mg	0.050	0.167	1,521	1,237	1,538	614	1,328
27Al	0.053	0.177	6,410	2,937	1,243	299	2,875
31P	63	210	10,526	10,989	14,586	5,860	11,307
39K	3.1	10	11,080	10,475	14,385	5,611	11,725
44Ca	13	43	5,706	3,686	3,733	1,237	3,334
49Ti	0.001	0.003	691	240	100	19	228
51V	0.025	0.083	26	9.0	4.0	1.1	8.3
52Cr	0.153	0.510	37	25	12	5.3	25
55Mn	0.006	0.020	100	89	75	38	94
57Fe	1.5	5.0	3,069	1,541	706	216	1,495
59Co	0.009	0.030	3.1	2.3	1.2	0.745	1.9
60Ni	0.030	0.100	94	84	50	18	68
63Cu	0.149	0.497	20	15	16	7.5	16
66Zn	0.335	1.1	249	199	179	83	251
75As	0.453	1.5	1.7	1.6	0.854	0.468	0.909
77Se	0.381	1.3	15	10	12	8.3	15
88Sr	0.001	0.003	18	9.3	7.5	2.0	7.7
95Mo	0.014	0.047	1.1	0.659	0.685	0.264	0.765
107Ag	0.001	0.003	0.275	0.223	0.254	0.062	0.223
111Cd	0.036	0.120	2.7	1.9	2.1	0.804	2.5
118Sn	0.019	0.063	0.413	0.331	0.344	0.050	0.398
121Sb	0.004	0.013	0.498	0.229	0.124	0.046	0.207
137Ba	0.001	0.003	298	168	121	30	144
202Hg	0.025	0.083	0.163	0.114	0.120	0.060	0.154
205Tl	0.001	0.003	0.196	0.072	0.048	0.023	0.074
208Pb	0.002	0.007	1.7	0.808	0.486	0.112	0.753
238U	0.001	0.003	0.407	0.226	0.131	0.031	0.188

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DCEF_INV-1_2022-09-12_N	LC_DCEF_INV-2_2022-09-13_N	LC_DCEF_INV-3_2022-09-13_N	LC_DCEF_INV-4_2022-09-13_N	LC_DCEF_INV-5_2022-09-13_N
		Lab ID	444	445	446	447	448
		Wet Weight (g)	0.3793	0.2747	0.2072	0.2528	0.3388
		Dry Weight (g)	0.0822	0.0645	0.0411	0.0498	0.0669
		Moisture (%)	78.3	76.5	80.2	80.3	80.3
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	0.574	0.574	0.929	0.516	1.0
11B	0.074	0.247	2.1	0.641	2.3	1.1	2.4
23Na	3.2	11	2,928	2,784	3,197	1,986	3,052
24Mg	0.050	0.167	1,278	1,364	1,460	932	1,349
27Al	0.053	0.177	138	181	939	340	1,434
31P	63	210	12,378	12,221	12,332	9,679	9,809
39K	3.1	10	11,775	10,396	10,235	8,039	11,559
44Ca	13	43	2,755	2,838	2,944	1,528	3,462
49Ti	0.001	0.003	10	11	74	20	117
51V	0.025	0.083	1.3	1.1	4.1	1.7	5.3
52Cr	0.153	0.510	8.7	7.1	15	6.8	17
55Mn	0.006	0.020	28	15	28	14	31
57Fe	1.5	5.0	237	230	664	247	817
59Co	0.009	0.030	0.453	0.321	0.836	0.445	1.1
60Ni	0.030	0.100	11	10	24	11	24
63Cu	0.149	0.497	22	20	16	12	16
66Zn	0.335	1.1	263	179	136	107	144
75As	0.453	1.5	0.744	0.702	2.6	1.3	2.3
77Se	0.381	1.3	5.9	5.9	5.4	5.4	5.7
88Sr	0.001	0.003	2.7	3.1	4.2	2.1	5.4
95Mo	0.014	0.047	0.448	0.475	0.422	0.264	0.525
107Ag	0.001	0.003	0.124	0.137	0.103	0.117	0.117
111Cd	0.036	0.120	1.9	2.1	2.4	1.6	3.9
118Sn	0.019	0.063	0.356	0.379	0.556	0.171	0.699
121Sb	0.004	0.013	0.058	0.044	0.097	0.045	0.120
137Ba	0.001	0.003	247	51	106	39	129
202Hg	0.025	0.083	0.084	0.084	0.084	0.096	0.066
205Tl	0.001	0.003	0.007	0.009	0.024	0.012	0.031
208Pb	0.002	0.007	0.080	0.098	0.334	0.121	0.388
238U	0.001	0.003	0.115	0.069	0.090	0.033	0.118

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited
Tissue Analysis Results

Parameter	DL (ppm)	LOQ (ppm)	LC_FRB_INV-1_2022-09-10_N	LC_FRB_INV-2_2022-09-10_N	LC_FRB_INV-3_2022-09-10_N	LC_FRB_INV-4_2022-09-10_N	LC_FRB_INV-5_2022-09-10_N
		Lab ID	449	450	451	452	453
		Wet Weight (g)	0.4700	0.1917	0.3821	0.4954	0.4292
		Dry Weight (g)	0.0914	0.0398	0.0691	0.0998	0.1115
		Moisture (%)	80.6	79.2	81.9	79.9	74.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	1.2	1.3	0.857	1.2	1.2
11B	0.074	0.247	0.826	1.5	0.513	1.4	2.2
23Na	3.2	11	2,622	2,193	2,340	2,823	3,144
24Mg	0.050	0.167	1,246	1,442	1,136	1,396	1,983
27Al	0.053	0.177	381	845	229	715	1,312
31P	63	210	9,117	9,106	10,035	10,008	12,894
39K	3.1	10	8,675	9,462	8,936	10,758	13,257
44Ca	13	43	3,279	4,851	2,440	5,016	5,617
49Ti	0.001	0.003	25	167	15	50	96
51V	0.025	0.083	1.0	4.0	0.648	2.0	3.2
52Cr	0.153	0.510	12	48	4.8	7.5	14
55Mn	0.006	0.020	64	54	34	51	54
57Fe	1.5	5.0	532	1,405	252	654	1,026
59Co	0.009	0.030	0.900	2.8	0.729	1.3	2.1
60Ni	0.030	0.100	19	78	8.7	16	28
63Cu	0.149	0.497	17	16	11	18	19
66Zn	0.335	1.1	173	171	158	158	286
75As	0.453	1.5	0.482	0.716	0.523	0.551	1.0
77Se	0.381	1.3	12	11	9.6	9.7	13
88Sr	0.001	0.003	3.7	6.1	2.6	5.6	7.9
95Mo	0.014	0.047	0.593	0.554	0.422	0.409	0.814
107Ag	0.001	0.003	0.131	0.158	0.096	0.210	0.157
111Cd	0.036	0.120	2.0	2.8	2.3	2.1	3.5
118Sn	0.019	0.063	0.257	0.632	0.387	0.537	0.695
121Sb	0.004	0.013	0.027	0.059	0.020	0.053	0.055
137Ba	0.001	0.003	36	39	18	41	55
202Hg	0.025	0.083	0.060	0.054	0.060	0.063	0.039
205Tl	0.001	0.003	0.013	0.026	0.010	0.019	0.028
208Pb	0.002	0.007	0.214	0.398	0.096	0.357	0.371
238U	0.001	0.003	0.058	0.074	0.036	0.067	0.099

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_FRUS_INV-1_2022-09-10_N	LC_FRUS_INV-2_2022-09-10_N	LC_FRUS_INV-3_2022-09-10_N	LC_FRUS_INV-4_2022-09-10_N	LC_FRUS_INV-5_2022-09-10_N
		Lab ID	454	455	456	457	458
		Wet Weight (g)	0.6246	0.2170	0.2562	0.5051	0.5845
		Dry Weight (g)	0.1330	0.0463	0.0538	0.1283	0.1305
		Moisture (%)	78.7	78.7	79.0	74.6	77.7
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	1.3	1.0	1.1	1.1	0.938
11B	0.074	0.247	3.2	2.8	2.4	1.9	1.7
23Na	3.2	11	2,488	2,681	1,888	2,251	2,430
24Mg	0.050	0.167	1,745	1,509	1,333	1,360	1,334
27Al	0.053	0.177	1,482	981	1,404	1,047	1,044
31P	63	210	9,361	10,340	7,464	9,551	8,705
39K	3.1	10	10,269	11,806	8,498	10,051	9,465
44Ca	13	43	6,032	6,222	4,485	5,067	3,913
49Ti	0.001	0.003	84	80	111	30	72
51V	0.025	0.083	3.6	2.6	3.4	1.1	2.3
52Cr	0.153	0.510	11	15	17	5.7	10
55Mn	0.006	0.020	64	51	47	67	61
57Fe	1.5	5.0	1,082	849	1,145	427	746
59Co	0.009	0.030	2.3	2.0	2.5	1.1	1.8
60Ni	0.030	0.100	21	24	31	10	18
63Cu	0.149	0.497	18	18	17	18	17
66Zn	0.335	1.1	194	235	215	203	284
75As	0.453	1.5	0.854	0.569	0.840	0.527	0.683
77Se	0.381	1.3	11	9.6	8.0	10	9.9
88Sr	0.001	0.003	14	9.3	6.7	5.9	4.8
95Mo	0.014	0.047	0.575	0.589	0.533	0.449	0.631
107Ag	0.001	0.003	0.103	0.097	0.073	0.091	0.103
111Cd	0.036	0.120	4.3	2.8	3.8	2.0	3.5
118Sn	0.019	0.063	0.460	0.959	1.0	0.188	0.476
121Sb	0.004	0.013	0.055	0.051	0.044	0.028	0.035
137Ba	0.001	0.003	60	53	44	59	48
202Hg	0.025	0.083	0.050	0.033	0.028	0.044	0.072
205Tl	0.001	0.003	0.031	0.019	0.025	0.016	0.022
208Pb	0.002	0.007	0.436	0.327	0.369	0.200	0.309
238U	0.001	0.003	0.179	0.149	0.095	0.131	0.102

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_GRCK_COMPNOLI-1_2022-09-14_N	LC_GRCK_COMPNOLI-2_2022-09-14_N	LC_GRCK_INV-3_2022-09-14_N	LC_GRCK_INV-4_2022-09-14_N	LC_GRCK_INV-5_2022-09-14_N
		Lab ID	459	460	461	462	463
		Wet Weight (g)	0.1929	0.1823	0.0342	0.0735	0.2062
		Dry Weight (g)	0.0431	0.0413	0.0089	0.0133	0.0458
		Moisture (%)	77.7	77.3	74.0	81.9	77.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	1.7	3.8	1.4	3.2	1.2
11B	0.074	0.247	5.5	12	5.7	11	5.1
23Na	3.2	11	2,401	2,564	1,857	2,254	2,455
24Mg	0.050	0.167	1,542	1,825	823	1,973	1,876
27Al	0.053	0.177	3,281	7,085	2,937	6,575	2,671
31P	63	210	9,460	9,265	5,753	7,509	8,721
39K	3.1	10	9,721	12,525	7,500	11,558	9,187
44Ca	13	43	2,835	4,426	3,426	4,903	3,114
49Ti	0.001	0.003	296	705	182	689	216
51V	0.025	0.083	6.0	13	4.5	12	5.6
52Cr	0.153	0.510	28	56	31	50	32
55Mn	0.006	0.020	68	117	40	101	93
57Fe	1.5	5.0	2,243	4,576	1,988	4,255	1,857
59Co	0.009	0.030	2.2	4.0	1.8	2.8	2.3
60Ni	0.030	0.100	45	94	45	79	51
63Cu	0.149	0.497	21	23	15	19	15
66Zn	0.335	1.1	198	216	149	169	155
75As	0.453	1.5	1.2	1.7	0.683	1.7	1.1
77Se	0.381	1.3	7.3	7.8	4.8	8.7	7.3
88Sr	0.001	0.003	8.8	16	11	13	8.9
95Mo	0.014	0.047	0.646	1.1	0.519	1.6	0.758
107Ag	0.001	0.003	0.085	0.079	0.085	0.048	0.054
111Cd	0.036	0.120	1.7	1.8	1.3	4.2	1.4
118Sn	0.019	0.063	0.726	0.577	0.941	0.837	0.983
121Sb	0.004	0.013	0.063	0.111	0.074	0.089	0.050
137Ba	0.001	0.003	65	125	56	104	72
202Hg	0.025	0.083	0.106	0.081	0.056	0.072	0.067
205Tl	0.001	0.003	0.055	0.099	0.045	0.081	0.053
208Pb	0.002	0.007	0.839	1.6	0.667	1.4	0.713
238U	0.001	0.003	0.134	0.276	0.120	0.257	0.120

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_GRCK_INVOLI-1_2022-09-14_N	LC_GRCK_INVOLI-2_2022-09-14_N	LC_DC4_INVOLI-1_2022-09-12_N
		Lab ID	464	465	466
		Wet Weight (g)	0.0038	0.0057	0.0341
		Dry Weight (g)	0.0018	0.0011	0.0137
		Moisture (%)	52.6	80.7	59.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)
7Li	0.025	0.083	0.099	0.046	0.625
11B	0.074	0.247	<0.074	0.097	<0.074
23Na	3.2	11	3,185	1,647	2,116
24Mg	0.050	0.167	596	670	872
27Al	0.053	0.177	2.2	16	17
31P	63	210	5,919	3,944	5,058
39K	3.1	10	5,555	2,533	3,361
44Ca	13	43	1,361	2,358	3,022
49Ti	0.001	0.003	0.408	0.816	0.816
51V	0.025	0.083	<0.025	0.036	0.138
52Cr	0.153	0.510	1.2	3.3	6.0
55Mn	0.006	0.020	2.0	3.8	4.6
57Fe	1.5	5.0	22	57	97
59Co	0.009	0.030	0.035	0.052	0.198
60Ni	0.030	0.100	0.073	2.4	6.8
63Cu	0.149	0.497	7.3	4.8	9.1
66Zn	0.335	1.1	95	100	64
75As	0.453	1.5	<0.453	<0.453	<0.453
77Se	0.381	1.3	6.6	3.6	7.5
88Sr	0.001	0.003	4.2	9.9	4.2
95Mo	0.014	0.047	0.112	0.112	0.196
107Ag	0.001	0.003	0.091	0.042	0.079
111Cd	0.036	0.120	3.4	1.6	2.1
118Sn	0.019	0.063	0.080	0.097	0.037
121Sb	0.004	0.013	<0.004	0.005	0.007
137Ba	0.001	0.003	3.3	55	36
202Hg	0.025	0.083	0.078	0.056	0.067
205Tl	0.001	0.003	0.003	0.003	0.004
208Pb	0.002	0.007	0.006	0.013	0.010
238U	0.001	0.003	0.001	0.002	0.002

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Tissue QA/QC Relative Percent Difference Results

Client ID		LC_DC1_INV-1_2022-09-12_N			LC_DC2_INV-4_2022-09-14_N			LC_DCEF_INV-1_2022-09-12_N		
Lab ID		419			427			444		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.025	2.5	2.0	22	2.1	1.9	8.2	0.574	0.529	8.2
11B	0.074	5.3	4.2	23	4.2	4.7	10	2.1	1.7	21
23Na	3.2	3,778	3,577	5.5	2,684	2,761	2.8	2,928	2,454	18
24Mg	0.050	1,660	1,662	0.1	773	856	10	1,278	1,097	15
27Al	0.053	4,628	3,476	28	3,706	4,909	28	138	196	35
31P	63	12,991	14,744	13	9,601	9,605	0.0	12,378	9,767	24
39K	3.1	17,444	15,010	15	11,072	10,555	4.8	11,775	10,416	12
44Ca	13	4,911	4,206	16	2,779	3,026	8.5	2,755	3,176	14
49Ti	0.001	350	238	38	239	282	17	10	13	26
51V	0.025	13	10	26	10	13	23	1.3	1.3	0.0
52Cr	0.153	27	35	26	43	63	38	8.7	7.5	15
55Mn	0.006	67	51	27	64	64	0.4	28	27	3.6
57Fe	1.5	2,396	1,757	31	1,726	2,116	20	237	264	11
59Co	0.009	1.8	1.8	0.0	2.4	3.1	27	0.453	0.412	9.5
60Ni	0.030	63	63	0.0	86	116	29	11	10	9.5
63Cu	0.149	18	15	18	18	16	12	22	19	15
66Zn	0.335	155	166	6.9	247	217	13	263	206	24
75As	0.453	1.4	1.2	-	1.2	1.1	7.2	0.744	0.689	-
77Se	0.381	8.3	8.4	1.2	8.9	9.8	10	5.9	5.1	15
88Sr	0.001	10	7.9	24	8.8	8.9	1.5	2.7	2.8	3.6
95Mo	0.014	0.776	0.617	23	0.959	0.891	7.4	0.448	0.448	0.0
107Ag	0.001	0.132	0.108	20	0.132	0.168	24	0.124	0.103	19
111Cd	0.036	1.9	1.7	11	3.5	3.1	11	1.9	2.0	5.1
118Sn	0.019	0.400	0.322	22	0.513	0.539	4.8	0.356	0.470	28
121Sb	0.004	0.165	0.162	1.8	0.187	0.179	4.6	0.058	0.060	3.4
137Ba	0.001	167	124	30	145	150	3.3	247	223	10
202Hg	0.025	0.056	0.056	-	0.107	0.153	35	0.084	0.090	-
205Tl	0.001	0.063	0.055	14	0.077	0.073	5.9	0.007	0.009	-
208Pb	0.002	0.861	0.779	10	0.893	0.814	9.2	0.080	0.106	28
238U	0.001	0.221	0.152	37	0.219	0.251	14	0.115	0.112	2.6

Notes:

ppm = parts per million
RPD = relative percent difference
DL = detection limit
< = less than detection limit
% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%
Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

	Client ID	LC_FRB_INV-5_2022-09-10_N			LC_GRCK_INV-5_2022-09-14_N		
	Lab ID	453			463		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.025	1.2	1.2	0.0	1.2	1.2	0.0
11B	0.074	2.2	1.8	20	5.1	4.7	8.2
23Na	3.2	3,144	2,825	11	2,455	2,808	13
24Mg	0.050	1,983	2,162	8.6	1,876	1,557	19
27Al	0.053	1,312	1,149	13	2,671	2,723	1.9
31P	63	12,894	13,380	3.7	8,721	9,412	7.6
39K	3.1	13,257	12,826	3.3	9,187	10,921	17
44Ca	13	5,617	5,961	5.9	3,114	3,123	0.3
49Ti	0.001	96	106	9.9	216	230	6.3
51V	0.025	3.2	3.0	6.5	5.6	5.6	0.0
52Cr	0.153	14	13	7.4	32	35	9.0
55Mn	0.006	54	51	5.7	93	86	7.8
57Fe	1.5	1,026	845	19	1,857	2,067	11
59Co	0.009	2.1	1.9	10	2.3	2.5	8.3
60Ni	0.030	28	24	15	51	60	16
63Cu	0.149	19	21	10	15	19	24
66Zn	0.335	286	301	5.1	155	174	12
75As	0.453	1.0	0.797	-	1.1	1.2	-
77Se	0.381	13	14	7.4	7.3	8.0	9.2
88Sr	0.001	7.9	8.0	1.3	8.9	10	12
95Mo	0.014	0.814	0.730	11	0.758	0.870	14
107Ag	0.001	0.157	0.206	27	0.054	0.067	22
111Cd	0.036	3.5	3.6	2.8	1.4	1.8	25
118Sn	0.019	0.695	0.600	15	0.983	0.907	8.0
121Sb	0.004	0.055	0.054	1.8	0.050	0.057	13
137Ba	0.001	55	46	18	72	74	2.7
202Hg	0.025	0.039	0.072	-	0.067	0.069	-
205Tl	0.001	0.028	0.025	11	0.053	0.057	7.3
208Pb	0.002	0.371	0.331	11	0.713	0.796	11
238U	0.001	0.099	0.106	6.8	0.120	0.153	24

Notes:

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

Sample Group ID			01			02		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.025	1.21	1.3	111	11	1.3	111	8.5
11B	0.074	4.5	4.8	107	1.5	4.8	107	4.4
23Na	3.2	14,000	14,409	103	5.6	16,153	115	7.4
24Mg	0.050	910	1,012	111	5.7	996	110	8.2
27Al	0.053	197.2	193	98	6.1	198	100	3.5
31P	63	8,000	8,232	103	5.9	9,153	114	6.8
39K	3.1	15,500	16,308	105	3.7	17,459	113	12
44Ca	13	2,360	2,462	104	6.7	2,610	111	5.6
49Ti	0.001	12.24	13	105	10	14	116	10
51V	0.025	1.57	1.6	101	2.8	1.9	120	10
52Cr	0.153	1.87	2.0	105	6.8	2.1	112	5.8
55Mn	0.006	3.17	3.4	108	5.3	3.4	107	4.2
57Fe	1.5	343	356	104	5.8	384	112	4.3
59Co	0.009	0.25	0.299	120	6.3	0.293	117	2.8
60Ni	0.030	1.34	1.4	103	6.1	1.5	113	5.5
63Cu	0.149	15.7	18	117	4.9	18	112	5.1
66Zn	0.335	51.6	55	106	8.5	58	113	7.8
75As	0.453	6.87	7.4	108	5.7	7.7	113	7.2
77Se	0.381	3.45	3.8	109	8.1	3.7	107	3.0
88Sr	0.001	10.1	11	106	5.0	12	117	7.1
95Mo	0.014	0.29	0.302	104	3.4	0.335	116	3.6
107Ag	0.001	0.0252	0.031	124	16	0.028	113	11
111Cd	0.036	0.299	0.338	113	12	0.285	95	16
118Sn	0.019	0.061	0.065	107	9.1	0.066	108	14
121Sb	0.004	0.011	0.010	89	8.5	0.014	127	8.7
137Ba	0.001	8.6	8.8	102	4.6	9.5	111	6.5
202Hg	0.025	0.412	0.447	108	5.8	0.492	119	6.6
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.002	0.404	0.407	101	4.9	0.511	126	17
238U	0.001	0.05	0.050	100	14	0.054	108	9.4

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.
Accuracy: DQO of 90 - 110% of the certified values for Se.
Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.
Precision: DQO of ≤20% for all elements.
DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.
Tl certified concentration from NIST-2976.
Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Tissue QA/QC Accuracy and Precision Results

Sample Group ID: 03

Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.025	1.21	1.3	107	7.7
11B	0.074	4.5	5.0	110	5.4
23Na	3.2	14,000	16,427	117	2.4
24Mg	0.050	910	1,043	115	3.4
27Al	0.053	197.2	204	103	5.2
31P	63	8,000	9,253	116	2.0
39K	3.1	15,500	18,539	120	5.4
44Ca	13	2,360	2,806	119	5.3
49Ti	0.001	12.24	15	124	11
51V	0.025	1.57	1.9	124	10
52Cr	0.153	1.87	2.2	116	4.1
55Mn	0.006	3.17	3.7	116	3.5
57Fe	1.5	343	409	119	4.1
59Co	0.009	0.25	0.291	116	9.0
60Ni	0.030	1.34	1.5	113	5.5
63Cu	0.149	15.7	19	122	4.4
66Zn	0.335	51.6	60	116	3.5
75As	0.453	6.87	8.2	119	2.7
77Se	0.381	3.45	3.7	107	2.7
88Sr	0.001	10.1	12	119	5.9
95Mo	0.014	0.29	0.359	124	8.5
107Ag	0.001	0.0252	0.026	105	12
111Cd	0.036	0.299	0.337	113	12
118Sn	0.019	0.061	0.070	115	16
121Sb	0.004	0.011	0.009	84	18
137Ba	0.001	8.6	9.8	114	2.2
202Hg	0.025	0.412	0.456	111	4.7
205Tl	0.001	0.0013	-	-	-
208Pb	0.002	0.404	0.481	119	2.5
238U	0.001	0.05	0.057	113	8.8

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.
Accuracy: DQO of 90 - 110% of the certified values for Se.
Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.
Precision: DQO of ≤20% for all elements.
DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.
Tl certified concentration from NIST-2976.
Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_DC1_INV-1_2022-09-12_N	419	05 Oct 2022
	LC_DC1_INV-2_2022-09-12_N	420	
	LC_DC1_INV-3_2022-09-12_N	421	
	LC_DC1_INV-4_2022-09-12_N	422	
	LC_DC1_INV-5_2022-09-12_N	423	
	LC_DC2_INV-1_2022-09-14_N	424	
	LC_DC2_INV-2_2022-09-14_N	425	
	LC_DC2_INV-3_2022-09-14_N	426	
	LC_DC2_INV-4_2022-09-14_N	427	
	LC_DC2_INV-5_2022-09-14_N	428	
	LC_DC3_INV-1_2022-09-13_N	429	
	LC_DC3_INV-2_2022-09-13_N	430	
	LC_DC3_INV-3_2022-09-13_N	431	
	LC_DC3_INV-4_2022-09-13_N	432	
	LC_DC3_INV-5_2022-09-13_N	433	
	LC_DC4_COMPNOLI-1_2022-09-12_N	434	
	LC_DC4_INV-2_2022-09-12_N	435	
02	LC_DC4_INV-3_2022-09-12_N	436	05 Oct 2022
	LC_DC4_INV-4_2022-09-12_N	437	
	LC_DC4_INV-5_2022-09-12_N	438	
	LC_DCDS_INV-1_2022-09-13_N	439	
	LC_DCDS_INV-2_2022-09-13_N	440	
	LC_DCDS_INV-3_2022-09-13_N	441	
	LC_DCDS_INV-4_2022-09-13_N	442	
	LC_DCDS_INV-5_2022-09-13_N	443	
	LC_DCEF_INV-1_2022-09-12_N	444	
	LC_DCEF_INV-2_2022-09-13_N	445	
	LC_DCEF_INV-3_2022-09-13_N	446	
	LC_DCEF_INV-4_2022-09-13_N	447	
	LC_DCEF_INV-5_2022-09-13_N	448	
	LC_FRB_INV-1_2022-09-10_N	449	
	LC_FRB_INV-2_2022-09-10_N	450	
	LC_FRB_INV-3_2022-09-10_N	451	
	LC_FRB_INV-4_2022-09-10_N	452	
03	LC_FRB_INV-5_2022-09-10_N	453	05 Oct 2022
	LC_FRUS_INV-1_2022-09-10_N	454	
	LC_FRUS_INV-2_2022-09-10_N	455	
	LC_FRUS_INV-3_2022-09-10_N	456	
	LC_FRUS_INV-4_2022-09-10_N	457	
	LC_FRUS_INV-5_2022-09-10_N	458	

Teck Coal Limited
Sample Group Information

Sample Group ID	Client ID	Lab ID	Date of Analysis
03	LC_GRCK_COMPNOLI-1_2022-09-14_N	459	05 Oct 2022
	LC_GRCK_COMPNOLI-2_2022-09-14_N	460	
	LC_GRCK_INV-3_2022-09-14_N	461	
	LC_GRCK_INV-4_2022-09-14_N	462	
	LC_GRCK_INV-5_2022-09-14_N	463	
	LC_GRCK_INVOLI-1_2022-09-14_N	464	
	LC_GRCK_INVOLI-2_2022-09-14_N	465	
	LC_DC4_INVOLI-1_2022-09-12_N	466	

Teck

COC ID: **LCO_LAEMP_DRY_2022-09_TRICH** | TURNAROUND TIME: | RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Line Creek Operation		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
119	LC_DC1_INV-1_2022-09-12_N ✓	LC_DC1	TA		12-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
120	LC_DC1_INV-2_2022-09-12_N ✓	LC_DC1	TA		12-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
121	LC_DC1_INV-3_2022-09-12_N ✓	LC_DC1	TA		12-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
122	LC_DC1_INV-4_2022-09-12_N ✓	LC_DC1	TA		12-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
123	LC_DC1_INV-5_2022-09-12_N ✓	LC_DC1	TA		12-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
124	LC_DC2_INV-1_2022-09-14_N ✓	LC_DC2	TA		14-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
125	LC_DC2_INV-2_2022-09-14_N ✓	LC_DC2	TA		14-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
126	LC_DC2_INV-3_2022-09-14_N ✓	LC_DC2	TA		14-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
127	LC_DC2_INV-4_2022-09-14_N ✓	LC_DC2	TA		14-Sep-22	12:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Gerlene LaBine	29 Sep 2022 / 08:40
			(Project # 2022-393)	

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

(COC Rec'd: 29Sep2022)

Teck

COC ID: **LCO_LAEMP_DRY_2022-09_TRICH**

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Line Creek Operation		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
128	LC_DC2_INV-5_2022-09-14_N ✓	LC_DC2	TA		14-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
129	LC_DC3_INV-1_2022-09-13_N ✓	LC_DC3	TA		13-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
130	LC_DC3_INV-2_2022-09-13_N ✓	LC_DC3	TA		13-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
131	LC_DC3_INV-3_2022-09-13_N ✓	LC_DC3	TA		13-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
132	LC_DC3_INV-4_2022-09-13_N ✓	LC_DC3	TA		13-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
133	LC_DC3_INV-5_2022-09-13_N ✓	LC_DC3	TA		13-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
134	LC_DC4_COMPNOLI-1_2022-09-12_N ✓	LC_DC4	TA		12-Sep-22	9:00	INV	compnoli	Composite	1	X	X	X
135	LC_DC4_INV-2_2022-09-12_N ✓	LC_DC4	TA		12-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
136	LC_DC4_INV-3_2022-09-12_N ✓	LC_DC4	TA		12-Sep-22	11:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Genene LaBine	29Sep2022 / 08:40
Rcvd: LC				
				(Project #2022-393)

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

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COC ID: **LCO_LAEMP_DRY_2022-09_TRICH**

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO			
Facility Name / Job#	Line Creek Operation		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
137	LC_DC4_INV-4_2022-09-12_N ✓	LC_DC4	TA		12-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
138	LC_DC4_INV-5_2022-09-12_N ✓	LC_DC4	TA		12-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
139	LC_DCDS_INV-1_2022-09-13_N ✓	LC_DCDS	TA		13-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
140	LC_DCDS_INV-2_2022-09-13_N ✓	LC_DCDS	TA		13-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
141	LC_DCDS_INV-3_2022-09-13_N ✓	LC_DCDS	TA		13-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
142	LC_DCDS_INV-4_2022-09-13_N ✓	LC_DCDS	TA		13-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
143	LC_DCDS_INV-5_2022-09-13_N ✓	LC_DCDS	TA		13-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
144	LC_DCEF_INV-1_2022-09-12_N ✓	LC_DCEF	TA		12-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
145	LC_DCEF_INV-2_2022-09-13_N ✓	LC_DCEF	TA		13-Sep-22	10:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	##############	Genene LaBrie	29 Sep 2022 / 08:40
			Genene LaB	
				(Project # 2022-393)

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	Jennifer Ings	Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

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COC ID: LCO_LAEMP_DRY_2022-09_TRICH | **TURNAROUND TIME:** | **RUSH:**

PROJECT/CLIENT INFO			
Facility Name / Job#	Line Creek Operation		
Project Manager	Nicole Zathey		
Email	Nicole.Zathey@teck.com		
Address	421 Pine Ave		
City	Sparwood	Province	BC
Postal Code	V0B 2G0	Country	Canada
Phone Number	1-250-865-3048		

LABORATORY			
Lab Name	TrichAnalytics Inc.		
Lab Contact	Jennie Christensen		
Email	jennie.christensen@trichanalytics		
Address	207-1753 Sean Heights		
City	Saanichton	Province	BC
Postal Code			
Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Trich ID	Sample ID		Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
140	LC_DCEF_INV-3_2022-09-13_N	✓	LC_DCEF	TA		13-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
147	LC_DCEF_INV-4_2022-09-13_N	✓	LC_DCEF	TA		13-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
148	LC_DCEF_INV-5_2022-09-13_N	✓	LC_DCEF	TA		13-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
149	LC_FRB_INV-1_2022-09-10_N	✓	LC_FRB	TA		10-Sep-22	9:00	INV	Composite	Composite	1	X	X	X
150	LC_FRB_INV-2_2022-09-10_N	✓	LC_FRB	TA		10-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
151	LC_FRB_INV-3_2022-09-10_N	✓	LC_FRB	TA		10-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
152	LC_FRB_INV-4_2022-09-10_N	✓	LC_FRB	TA		10-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
153	LC_FRB_INV-5_2022-09-10_N	✓	LC_FRB	TA		10-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
154	LC_FRUS_INV-1_2022-09-10_N	✓	LC_FRUS	TA		10-Sep-22	9:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	##############	Cevriene LaBine	29 Sep 2022 / 08:40
				(Project # 2022-393)

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

Teck

COC ID: **LCO_LAEMP_DRY_2022-09_TRICH**

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO	
Facility Name / Job#	Line Creek Operation
Project Manager	Nicole Zathey
Email	Nicole.Zathey@teck.com
Address	421 Pine Ave
City	Sparwood — Province: BC
Postal Code	V0B 2G0 — Country: Canada
Phone Number	1-250-865-3048

LABORATORY	
Lab Name	TrichAnalytics Inc.
Lab Contact	Jennie Christensen
Email	jennie.christensen@trichanalytics
Address	207-1753 Sean Heights
City	Saanichton — Province: BC
Postal Code	
Phone Number	

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
455	LC_FRUS_INV-2_2022-09-10_N ✓	LC_FRUS	TA		10-Sep-22	10:00	INV	Composite	Composite	1	X	X	X
456	LC_FRUS_INV-3_2022-09-10_N ✓	LC_FRUS	TA		10-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
457	LC_FRUS_INV-4_2022-09-10_N ✓	LC_FRUS	TA		10-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
458	LC_FRUS_INV-5_2022-09-10_N ✓	LC_FRUS	TA		10-Sep-22	13:00	INV	Composite	Composite	1	X	X	X
459	LC_GRCK_COMPNOLI-1_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	9:00	INV	compnoli	Composite	1	X	X	X
460	LC_GRCK_COMPNOLI-2_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	10:00	INV	compnoli	Composite	1	X	X	X
461	LC_GRCK_INV-3_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	11:00	INV	Composite	Composite	1	X	X	X
462	LC_GRCK_INV-4_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	12:00	INV	Composite	Composite	1	X	X	X
463	LC_GRCK_INV-5_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	13:00	INV	Composite	Composite	1	X	X	X

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Gerene LaBree	29 Sep 2022 / 08:40
				(Project # 2022-393)

SERVICE REQUEST (rush - subject to availability)

Regular (default) Priority (2-3 business days) - 50% surcharge	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Emergency (1 Business Day) - 100% surcharge For Emergency <1 Day, ASAP or Weekend	Sampler's Signature		Date/Time	September 19, 2022

Teck

COC ID: LCO_LAEMP_DRY_2022-09_TRICH

TURNAROUND TIME:

RUSH:

PROJECT/CLIENT INFO				LABORATORY			
Facility Name / Job#	Line Creek Operation			Lab Name	TrichAnalytics Inc.		
Project Manager	Nicole Zathey			Lab Contact	Jennie Christensen		
Email	Nicole.Zathey@teck.com			Email	jennie.christensen@trichanalytics		
Address	421 Pine Ave			Address	207-1753 Sean Heights		
City	Sparwood	Province	BC	City	Saanichton	Province	BC
Postal Code	V0B 2G0	Country	Canada	Postal Code			
Phone Number	1-250-865-3048			Phone Number			

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	AquaSciLab@Teck.com	X	X	X
Email 2:	teckcoal@equisonline.com			X
Email 3:	Teck.Lab.Results@teck.com	X	X	X
Email 4:	lbowron@minnow.ca	X	X	X
Email 5:	Robin.Valleau@minnow.ca	X	X	X
Email 5:	Jessica.Ritz@Teck.com	X	X	X
PO number	VPO00818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

incl P

	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
164	LC_GRCK_INVOLI-1_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	9:01	INV	INVOLI	Composite	1	X	X	X
65	LC_GRCK_INVOLI-2_2022-09-14_N ✓	LC_GRCK	TA		14-Sep-22	10:01	INV	INVOLI	Composite	1	X	X	X
166	LC_DC4_INVOLI-1_2022-09-12_N ✓	LC_DC4	TA		12-Sep-22	9:01	INV	INVOLI	Composite	1	X	X	x

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Jennifer Ings	###############	Gerriene LaBrie	29Sep2022/08:40
			Gerriene LB	
				(Project #: 2022-393)

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Jennifer Ings	Mobile #	5195003444
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature	Jennifer Ings	Date/Time	September 19, 2022
For Emergency <1 Day, ASAP or Weekend				

BENTHIC TISSUE CHEMISTRY

TrichAnalytics Laboratory Report 2022-445
(Finalized 12-Dec-22)

TrichAnalytics Inc.

Tissue Microchemistry Analysis Report

Client:	Nicole Zathey Project Manager Teck Coal Limited	**Date Received:**	06 Dec 2022
Phone:	250-425-8449	**Date of Analysis:**	09 Dec 2022
Email:	nicole.zathey@teck.com; mike.pope@teck.com; jessica.ritz@teck.com; teckcoal@equisonline.com; aquascilab@teck.com; robin.valleau@minnow.ca	**Final Report Date:**	12 Dec 2022
		Project No.:	2022-445
		Method No.:	MET-002.06

Client Project: Line Creek Operation (PO 818999)

Analytical Request: Composite Benthic Invertebrate Tissue Microchemistry (total metals & moisture) - 35 samples. See chain of custody form provided for sample identification numbers.

Notes:
Analytical results are expressed in parts per million (ppm) dry weight (equivalent to mg/kg).
Samples quantified using DORM-4, NIST-1566b, and NIST-2976 certified reference standards.
Aluminum concentrations above 1,000 ppm are outside linear range of the calibration curve.
RPD values calculated according to the British Columbia Environmental Laboratory Manual (2020) criteria.
Client specific DQO for Selenium accuracy is 90-110% of the certified value; result achieved 100% (ranging from 97-102%).

This report provides the analytical results only for tissue samples noted above as received from the Client.

Reviewed and Approved by Jennie Christensen, PhD, RPBio

12 Dec 2022
Date

TrichAnalytics Inc.
207-1753 Sean Heights
Saanichton, BC V8M 0B3
www.trichanalytics.com

CALA Testing Accreditation No. A4196

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_FRB_INV-1_2022-11_N	LC_FRB_INV-2_2022-11_N	LC_FRB_INV-3_2022-11_N	LC_FRB_INV-4_2022-11_N	LC_FRB_INV-5_2022-11_N
		Lab ID	047	048	049	050	051
		Wet Weight (g)	0.0964	0.2839	0.5065	0.4348	0.4411
		Dry Weight (g)	0.0258	0.0646	0.1114	0.0996	0.0975
		Moisture (%)	73.2	77.2	78.0	77.1	77.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	1.8	1.2	1.0	1.4	1.1
11B	0.107	0.357	4.3	1.2	1.6	1.8	2.1
23Na	2.7	9.0	5,444	8,433	5,368	6,452	5,250
24Mg	0.089	0.297	2,179	1,763	1,439	1,636	1,778
27Al	0.142	0.473	2,940	561	501	1,318	1,369
31P	73	243	19,115	18,018	14,910	15,405	13,895
39K	4.3	14	16,836	15,257	9,496	12,035	10,374
44Ca	53	177	6,921	3,971	2,093	3,027	6,469
49Ti	0.001	0.003	140	39	40	78	100
51V	0.033	0.110	5.5	1.8	1.9	3.1	3.8
52Cr	0.174	0.580	29	13	5.6	12	29
55Mn	0.007	0.023	59	43	81	57	69
57Fe	0.872	2.9	1,690	661	568	602	1,155
59Co	0.017	0.057	0.925	0.790	0.713	0.655	1.7
60Ni	0.086	0.287	41	19	8.0	15	43
63Cu	0.018	0.060	34	20	13	24	15
66Zn	0.313	1.0	248	233	150	227	243
75As	0.327	1.1	0.951	0.533	0.533	0.457	0.723
77Se	0.448	1.5	11	8.9	10	9.3	7.9
88Sr	0.001	0.003	9.7	5.1	4.3	5.3	9.7
95Mo	0.001	0.003	0.832	0.340	0.303	0.378	0.303
107Ag	0.001	0.003	0.302	0.248	0.108	0.194	0.151
111Cd	0.106	0.353	1.5	2.1	1.2	1.7	2.6
118Sn	0.022	0.073	1.7	0.695	0.339	0.244	0.430
121Sb	0.004	0.013	0.102	0.038	0.056	0.050	0.062
137Ba	0.001	0.003	75	33	38	67	69
202Hg	0.023	0.077	0.049	0.030	0.030	0.036	0.042
205Tl	0.001	0.003	0.051	0.020	0.028	0.031	0.033
208Pb	0.002	0.007	0.973	0.305	0.303	0.343	0.467
238U	0.001	0.003	0.147	0.048	0.062	0.076	0.090

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DC3_INV-1_2022-11_N	LC_DC3_INV-2_2022-11_N	LC_DC3_INV-3_2022-11_N	LC_DC3_INV-4_2022-11_N	LC_DC3_INV-5_2022-11_N
		Lab ID	052	053	054	055	056
		Wet Weight (g)	0.0988	0.7005	0.2121	0.3413	0.0788
		Dry Weight (g)	0.0176	0.1870	0.0463	0.0679	0.0138
		Moisture (%)	82.2	73.3	78.2	80.1	82.5
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	1.1	0.932	1.4	1.4	0.800
11B	0.107	0.357	2.9	3.6	5.4	4.2	2.0
23Na	2.7	9.0	2,971	3,090	2,330	4,669	3,848
24Mg	0.089	0.297	1,344	1,424	1,383	1,770	1,636
27Al	0.142	0.473	1,690	2,285	3,307	2,266	1,047
31P	73	243	10,598	11,270	9,356	13,686	12,104
39K	4.3	14	7,447	8,829	6,875	11,369	8,490
44Ca	53	177	4,515	3,668	4,025	3,131	3,326
49Ti	0.001	0.003	120	147	335	171	78
51V	0.033	0.110	5.3	5.6	9.6	7.3	3.1
52Cr	0.174	0.580	27	17	34	21	20
55Mn	0.007	0.023	39	37	33	44	34
57Fe	0.872	2.9	968	938	1,267	1,126	596
59Co	0.017	0.057	1.1	1.8	1.7	1.6	0.824
60Ni	0.086	0.287	54	55	65	46	36
63Cu	0.018	0.060	24	14	11	14	16
66Zn	0.313	1.0	185	179	141	216	172
75As	0.327	1.1	0.609	1.0	1.0	0.951	0.457
77Se	0.448	1.5	6.9	5.3	4.4	8.5	7.1
88Sr	0.001	0.003	8.2	5.9	10	8.9	6.2
95Mo	0.001	0.003	0.757	0.340	0.416	0.378	0.567
107Ag	0.001	0.003	0.140	0.130	0.130	0.130	0.108
111Cd	0.106	0.353	2.5	2.4	1.5	1.2	1.1
118Sn	0.022	0.073	1.7	0.355	0.326	0.434	0.800
121Sb	0.004	0.013	0.114	0.102	0.141	0.158	0.071
137Ba	0.001	0.003	75	90	89	97	50
202Hg	0.023	0.077	0.061	0.058	0.042	0.079	0.055
205Tl	0.001	0.003	0.072	0.082	0.099	0.097	0.046
208Pb	0.002	0.007	0.637	0.546	0.852	0.911	0.323
238U	0.001	0.003	0.264	0.116	0.162	0.183	0.106

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited
Tissue Analysis Results

		Client ID	LC_DC4_INV-1_2022-11_N	LC_DC4_INV-2_2022-11_N	LC_DC4_INV-3_2022-11_N	LC_DC4_INV-4_2022-11_N	LC_DC4_INV-5_2022-11_N
		Lab ID	057	058	059	060	061
		Wet Weight (g)	0.0313	0.7176	0.8149	0.5904	0.2990
		Dry Weight (g)	0.0080	0.1846	0.1888	0.1248	0.0693
		Moisture (%)	74.4	74.3	76.8	78.9	76.8
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	0.335	0.445	0.460	0.402	0.603
11B	0.107	0.357	0.911	0.781	1.0	0.933	1.3
23Na	2.7	9.0	1,453	3,451	4,073	3,026	3,353
24Mg	0.089	0.297	633	939	1,026	801	1,230
27Al	0.142	0.473	442	483	689	566	614
31P	73	243	4,872	14,631	14,515	11,268	11,452
39K	4.3	14	3,740	8,466	10,121	6,486	9,076
44Ca	53	177	1,625	1,282	2,429	1,267	2,979
49Ti	0.001	0.003	29	26	40	40	59
51V	0.033	0.110	1.6	1.7	1.9	2.1	2.9
52Cr	0.174	0.580	6.2	9.9	8.5	11	17
55Mn	0.007	0.023	7.7	20	16	20	21
57Fe	0.872	2.9	558	590	614	539	827
59Co	0.017	0.057	0.323	0.434	0.453	0.438	0.443
60Ni	0.086	0.287	9.6	15	18	17	29
63Cu	0.018	0.060	5.7	12	11	8.8	11
66Zn	0.313	1.0	113	148	137	83	148
75As	0.327	1.1	0.628	0.647	1.0	0.647	0.932
77Se	0.448	1.5	3.1	7.6	6.9	5.5	5.7
88Sr	0.001	0.003	2.2	2.1	2.7	2.7	3.8
95Mo	0.001	0.003	0.378	0.567	0.416	0.303	0.530
107Ag	0.001	0.003	0.043	0.076	0.097	0.076	0.108
111Cd	0.106	0.353	1.9	1.1	1.7	1.0	1.6
118Sn	0.022	0.073	0.411	0.310	0.193	0.160	0.734
121Sb	0.004	0.013	0.038	0.037	0.049	0.044	0.074
137Ba	0.001	0.003	35	54	72	64	64
202Hg	0.023	0.077	<0.023	0.036	0.042	0.036	0.030
205Tl	0.001	0.003	0.028	0.018	0.022	0.024	0.042
208Pb	0.002	0.007	0.189	0.178	0.246	0.234	0.404
238U	0.001	0.003	0.045	0.054	0.071	0.053	0.065

Notes:
ppm = parts per million
DL = detection limit
LOQ = limit of quantitation
< = less than detection limit
g = grams
% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_GRCK_INV-1_2022-11_N	LC_GRCK_INV-2_2022-11_N	LC_GRCK_INV-3_2022-11_N	LC_GRCK_INV-4_2022-11_N	LC_GRCK_INV-5_2022-11_N
		Lab ID	062	063	064	065	066
		Wet Weight (g)	0.0367	0.1443	0.0873	0.1051	0.1457
		Dry Weight (g)	0.0085	0.0367	0.0189	0.0243	0.0306
		Moisture (%)	76.8	74.6	78.4	76.9	79.0
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	1.2	0.254	0.557	0.660	1.0
11B	0.107	0.357	5.3	1.1	2.5	4.9	6.2
23Na	2.7	9.0	2,479	3,530	2,862	5,246	5,565
24Mg	0.089	0.297	1,106	1,549	1,968	2,303	1,966
27Al	0.142	0.473	1,033	242	875	1,176	1,507
31P	73	243	6,476	13,342	12,333	16,133	16,463
39K	4.3	14	6,938	10,484	8,738	14,398	15,856
44Ca	53	177	3,312	2,008	4,165	4,057	3,410
49Ti	0.001	0.003	170	11	65	77	150
51V	0.033	0.110	4.1	0.521	2.1	2.1	3.7
52Cr	0.174	0.580	25	6.6	11	11	13
55Mn	0.007	0.023	101	59	68	78	94
57Fe	0.872	2.9	1,486	304	643	823	1,204
59Co	0.017	0.057	2.1	1.5	1.3	2.0	1.5
60Ni	0.086	0.287	32	9.7	15	17	18
63Cu	0.018	0.060	8.2	24	15	23	22
66Zn	0.313	1.0	140	582	269	414	234
75As	0.327	1.1	1.7	0.602	1.0	2.0	1.8
77Se	0.448	1.5	5.3	8.9	7.8	9.6	6.9
88Sr	0.001	0.003	10	5.1	8.2	10	11
95Mo	0.001	0.003	0.454	0.532	0.580	0.725	0.580
107Ag	0.001	0.003	0.032	0.076	0.022	0.119	0.108
111Cd	0.106	0.353	3.2	6.9	3.6	8.3	2.6
118Sn	0.022	0.073	0.977	0.355	0.839	0.289	0.505
121Sb	0.004	0.013	0.056	0.023	0.040	0.052	0.113
137Ba	0.001	0.003	60	16	31	40	56
202Hg	0.023	0.077	<0.023	0.085	0.043	0.050	0.057
205Tl	0.001	0.003	0.059	0.046	0.049	0.070	0.060
208Pb	0.002	0.007	1.0	0.110	0.315	0.457	0.711
238U	0.001	0.003	0.139	0.056	0.121	0.164	0.196

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_DCEF_INV-1_2022-11_N	LC_DCEF_INV-2_2022-11_N	LC_DCEF_INV-3_2022-11_N	LC_DCEF_INV-4_2022-11_N	LC_DCEF_INV-5_2022-11_N
		Lab ID	067	068	069	070	071
		Wet Weight (g)	0.0654	0.1022	0.1046	0.1467	0.0343
		Dry Weight (g)	0.0107	0.0235	0.0246	0.0275	0.0068
		Moisture (%)	83.6	77.0	76.5	81.3	80.2
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	0.422	0.660	0.465	0.957	0.379
11B	0.107	0.357	0.385	1.8	1.0	4.3	1.2
23Na	2.7	9.0	4,011	4,196	2,541	3,842	1,731
24Mg	0.089	0.297	935	1,171	1,480	1,280	597
27Al	0.142	0.473	84	746	429	1,276	591
31P	73	243	11,484	12,854	13,189	13,418	5,424
39K	4.3	14	8,326	10,851	7,777	10,922	6,200
44Ca	53	177	2,919	2,639	5,571	2,762	1,416
49Ti	0.001	0.003	7.3	65	23	94	43
51V	0.033	0.110	0.413	3.6	1.5	5.5	2.5
52Cr	0.174	0.580	8.1	19	18	36	10
55Mn	0.007	0.023	13	22	20	23	31
57Fe	0.872	2.9	169	703	484	1,279	453
59Co	0.017	0.057	0.267	0.918	0.534	1.6	0.564
60Ni	0.086	0.287	9.8	29	26	53	15
63Cu	0.018	0.060	12	18	17	15	7.4
66Zn	0.313	1.0	108	116	163	109	84
75As	0.327	1.1	0.387	1.9	1.1	2.6	0.752
77Se	0.448	1.5	2.5	3.8	3.5	3.8	3.3
88Sr	0.001	0.003	3.1	3.9	6.9	6.5	2.4
95Mo	0.001	0.003	0.242	0.532	0.628	0.483	0.387
107Ag	0.001	0.003	0.054	0.097	0.076	0.065	0.032
111Cd	0.106	0.353	1.2	2.4	4.0	2.4	3.1
118Sn	0.022	0.073	0.662	0.332	0.682	0.731	0.478
121Sb	0.004	0.013	0.035	0.215	0.086	0.231	0.154
137Ba	0.001	0.003	49	110	127	118	163
202Hg	0.023	0.077	<0.023	0.043	0.036	0.043	<0.023
205Tl	0.001	0.003	0.006	0.025	0.020	0.050	0.024
208Pb	0.002	0.007	0.082	0.366	0.154	0.591	0.240
238U	0.001	0.003	0.022	0.122	0.071	0.163	0.131

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited
Tissue Analysis Results

Parameter	DL (ppm)	LOQ (ppm)	LC_DCDS_INV-1_2022-11_N	LC_DCDS_INV-2_2022-11_N	LC_DCDS_INV-3_2022-11_N	LC_DCDS_INV-4_2022-11_N	LC_DCDS_INV-5_2022-11_N
		Client ID	LC_DCDS_INV-1_2022-11_N	LC_DCDS_INV-2_2022-11_N	LC_DCDS_INV-3_2022-11_N	LC_DCDS_INV-4_2022-11_N	LC_DCDS_INV-5_2022-11_N
		Lab ID	072	073	074	075	076
		Wet Weight (g)	0.1058	0.2908	0.1429	0.4021	0.1961
		Dry Weight (g)	0.0243	0.0521	0.0250	0.0756	0.0414
		Moisture (%)	77.0	82.1	82.5	81.2	78.9
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	1.3	1.7	1.6	1.4	0.920
11B	0.107	0.357	4.9	5.3	26	3.2	2.1
23Na	2.7	9.0	3,892	5,586	4,309	5,287	5,661
24Mg	0.089	0.297	1,851	1,655	1,511	1,551	1,203
27Al	0.142	0.473	2,953	3,481	3,281	2,227	1,153
31P	73	243	13,686	15,529	12,066	14,199	15,815
39K	4.3	14	11,049	14,371	10,486	11,565	11,976
44Ca	53	177	4,888	5,157	4,997	4,016	2,604
49Ti	0.001	0.003	244	260	256	179	82
51V	0.033	0.110	7.9	10	9.8	6.5	3.8
52Cr	0.174	0.580	25	30	30	15	11
55Mn	0.007	0.023	116	91	105	93	102
57Fe	0.872	2.9	1,429	1,616	2,012	1,063	644
59Co	0.017	0.057	2.4	1.8	2.6	1.7	1.2
60Ni	0.086	0.287	78	78	92	55	37
63Cu	0.018	0.060	16	24	18	16	13
66Zn	0.313	1.0	284	216	152	206	197
75As	0.327	1.1	0.795	1.2	0.860	0.989	0.602
77Se	0.448	1.5	15	12	12	10	12
88Sr	0.001	0.003	15	12	12	8.5	5.0
95Mo	0.001	0.003	0.773	0.918	0.822	0.628	0.773
107Ag	0.001	0.003	0.151	0.454	0.205	0.259	0.194
111Cd	0.106	0.353	6.3	3.3	2.5	2.5	1.9
118Sn	0.022	0.073	0.830	0.947	0.689	0.319	0.363
121Sb	0.004	0.013	0.303	0.255	0.223	0.205	0.132
137Ba	0.001	0.003	332	134	130	105	84
202Hg	0.023	0.077	0.089	0.107	0.085	0.100	0.071
205Tl	0.001	0.003	0.189	0.138	0.104	0.083	0.051
208Pb	0.002	0.007	0.916	1.2	1.1	0.766	0.453
238U	0.001	0.003	0.260	0.197	0.215	0.140	0.111

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue Analysis Results

		Client ID	LC_FRUS_INV-1_2022-11_N	LC_FRUS_INV-2_2022-11_N	LC_FRUS_INV-3_2022-11_N	LC_FRUS_INV-4_2022-11_N	LC_FRUS_INV-5_2022-11_N
		Lab ID	077	078	079	080	081
		Wet Weight (g)	0.1366	0.3863	0.3766	0.6683	0.3434
		Dry Weight (g)	0.0294	0.0624	0.0745	0.1765	0.0707
		Moisture (%)	78.5	83.8	80.2	73.6	79.4
Parameter	DL (ppm)	LOQ (ppm)	(ppm)	(ppm)	(ppm)	(ppm)	(ppm)
7Li	0.023	0.077	3.1	1.8	1.2	1.2	1.1
11B	0.107	0.357	11	4.7	2.7	2.0	3.7
23Na	2.7	9.0	3,133	4,460	3,697	4,148	2,548
24Mg	0.089	0.297	2,091	1,759	1,711	1,196	1,403
27Al	0.142	0.473	4,133	2,008	1,538	1,365	1,474
31P	73	243	11,161	12,466	12,280	13,364	10,682
39K	4.3	14	11,172	9,670	10,251	10,463	7,561
44Ca	53	177	4,207	6,984	4,978	1,872	4,484
49Ti	0.001	0.003	604	181	118	93	107
51V	0.033	0.110	20	5.2	3.5	2.9	3.3
52Cr	0.174	0.580	61	20	15	8.8	15
55Mn	0.007	0.023	99	58	58	97	43
57Fe	0.872	2.9	4,247	1,531	994	871	944
59Co	0.017	0.057	2.6	1.2	1.5	0.848	0.639
60Ni	0.086	0.287	103	30	24	14	22
63Cu	0.018	0.060	17	21	16	15	13
66Zn	0.313	1.0	177	136	205	123	140
75As	0.327	1.1	1.5	0.903	0.946	0.602	0.774
77Se	0.448	1.5	7.6	6.9	8.9	8.9	5.6
88Sr	0.001	0.003	14	8.8	6.8	3.3	6.2
95Mo	0.001	0.003	1.3	0.387	0.387	0.580	0.435
107Ag	0.001	0.003	0.097	0.130	0.108	0.130	0.097
111Cd	0.106	0.353	3.2	1.1	2.4	1.1	1.3
118Sn	0.022	0.073	0.703	0.617	0.411	0.176	0.326
121Sb	0.004	0.013	0.256	0.093	0.081	0.063	0.083
137Ba	0.001	0.003	132	70	62	58	50
202Hg	0.023	0.077	0.064	0.028	0.043	0.036	0.046
205Tl	0.001	0.003	0.112	0.051	0.039	0.030	0.034
208Pb	0.002	0.007	1.8	0.724	0.575	0.551	0.507
238U	0.001	0.003	0.299	0.144	0.113	0.068	0.095

Notes:

ppm = parts per million

DL = detection limit

LOQ = limit of quantitation

< = less than detection limit

g = grams

% = percent

Teck Coal Limited

Tissue QA/QC Relative Percent Difference Results

	Client ID	LC_FRB_INV-4_2022-11_N			LC_DC3_INV-2_2022-11_N			LC_DC3_INV-4_2022-11_N		
	Lab ID	050			053			055		
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.023	1.4	1.7	19	0.932	1.2	25	1.4	1.2	15
11B	0.107	1.8	2.5	33	3.6	4.3	18	4.2	3.7	13
23Na	2.7	6,452	8,920	32	3,090	3,325	7.3	4,669	4,383	6.3
24Mg	0.089	1,636	1,780	8.4	1,424	1,535	7.5	1,770	2,166	20
27Al	0.142	1,318	1,293	1.9	2,285	2,279	0.3	2,266	1,894	18
31P	73	15,405	16,128	4.6	11,270	13,192	16	13,686	14,427	5.3
39K	4.3	12,035	13,089	8.4	8,829	9,929	12	11,369	10,382	9.1
44Ca	53	3,027	3,668	19	3,668	4,576	22	3,131	3,228	3.1
49Ti	0.001	78	95	20	147	150	2.0	171	131	27
51V	0.033	3.1	3.5	12	5.6	6.9	21	7.3	5.9	21
52Cr	0.174	12	15	22	17	18	5.7	21	26	21
55Mn	0.007	57	51	11	37	46	22	44	47	6.6
57Fe	0.872	602	665	9.9	938	1,073	13	1,126	1,033	8.6
59Co	0.017	0.655	0.814	22	1.8	1.9	5.4	1.6	1.9	17
60Ni	0.086	15	19	24	55	62	12	46	54	16
63Cu	0.018	24	17	34	14	17	19	14	13	7.4
66Zn	0.313	227	202	12	179	187	4.4	216	190	13
75As	0.327	0.457	0.533	-	1.0	1.4	-	0.951	1.1	-
77Se	0.448	9.3	11	17	5.3	6.1	14	8.5	7.5	13
88Sr	0.001	5.3	6.2	16	5.9	9.8	50	8.9	8.7	2.3
95Mo	0.001	0.378	0.303	22	0.340	0.378	11	0.378	0.340	11
107Ag	0.001	0.194	0.194	0.0	0.130	0.151	15	0.130	0.119	8.8
111Cd	0.106	1.7	1.5	13	2.4	2.1	13	1.2	1.2	0.0
118Sn	0.022	0.244	0.332	31	0.355	0.362	2.0	0.434	0.410	5.7
121Sb	0.004	0.050	0.047	6.2	0.102	0.141	32	0.158	0.162	2.5
137Ba	0.001	67	62	7.8	90	98	8.5	97	109	12
202Hg	0.023	0.036	0.036	-	0.058	0.055	-	0.079	0.079	-
205Tl	0.001	0.031	0.038	20	0.082	0.102	22	0.097	0.086	12
208Pb	0.002	0.343	0.386	12	0.546	0.727	28	0.911	0.630	37
238U	0.001	0.076	0.063	19	0.116	0.151	26	0.183	0.142	25

Notes:

ppm = parts per million
RPD = relative percent difference
DL = detection limit
< = less than detection limit
% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%
Minimum DQOs apply to individual samples at concentrations above 10x DL

Tissue QA/QC Relative Percent Difference Results

		Client ID	LC_GRCK_INV-2_2022-11_N	
		Lab ID	063	
Parameter	DL (ppm)	Sample (ppm)	Sample Duplicate (ppm)	RPD (%)
7Li	0.023	0.254	0.368	37
11B	0.107	1.1	1.6	37
23Na	2.7	3,530	3,860	8.9
24Mg	0.089	1,549	1,686	8.5
27Al	0.142	242	348	36
31P	73	13,342	15,313	14
39K	4.3	10,484	12,138	15
44Ca	53	2,008	2,520	23
49Ti	0.001	11	12	8.7
51V	0.033	0.521	0.492	5.7
52Cr	0.174	6.6	8.7	28
55Mn	0.007	59	69	16
57Fe	0.872	304	403	28
59Co	0.017	1.5	1.6	6.5
60Ni	0.086	9.7	11	13
63Cu	0.018	24	29	19
66Zn	0.313	582	604	3.7
75As	0.327	0.602	0.602	-
77Se	0.448	8.9	9.6	7.6
88Sr	0.001	5.1	6.4	23
95Mo	0.001	0.532	0.580	8.6
107Ag	0.001	0.076	0.101	28
111Cd	0.106	6.9	6.4	7.5
118Sn	0.022	0.355	0.440	21
121Sb	0.004	0.023	0.030	-
137Ba	0.001	16	22	32
202Hg	0.023	0.085	0.085	-
205Tl	0.001	0.046	0.047	2.2
208Pb	0.002	0.110	0.159	36
238U	0.001	0.056	0.078	33

Notes:

ppm = parts per million

RPD = relative percent difference

DL = detection limit

< = less than detection limit

% = percent

Data Quality Objectives:

Laboratory Duplicates - RPD ≤40% for all elements, except Ca and Sr, which are ≤60%

Minimum DQOs apply to individual samples at concentrations above 10x DL

Teck Coal Limited

Tissue QA/QC Accuracy and Precision Results

		Sample Group ID	01			02		
Parameter	DL (ppm)	Certified Conc. (ppm)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)	Mean Estimated Conc. (ppm)	Accuracy (%)	Precision RSD (%)
7Li	0.023	1.21	1.2	96	9.8	1.2	96	10
11B	0.107	4.5	4.1	92	3.2	4.3	96	2.5
23Na	2.7	14,000	14,074	100	4.0	12,422	89	5.6
24Mg	0.089	910	920	101	8.1	838	92	4.7
27Al	0.142	197.2	186	94	2.2	193	98	4.9
31P	73	8,000	7,970	100	6.3	7,163	90	5.2
39K	4.3	15,500	16,154	104	7.1	14,521	94	7.0
44Ca	53	2,360	2,350	100	4.9	2,262	96	4.1
49Ti	0.001	12.24	12	95	12	11	88	12
51V	0.033	1.57	1.5	96	9.4	1.4	90	14
52Cr	0.174	1.87	2.0	106	5.5	1.8	96	7.9
55Mn	0.007	3.17	3.2	102	8.3	3.2	100	5.7
57Fe	0.872	343	349	102	6.7	338	98	5.7
59Co	0.017	0.25	0.264	106	5.8	0.247	99	2.7
60Ni	0.086	1.34	1.5	109	3.8	1.3	98	11
63Cu	0.018	15.7	18	112	6.5	15	96	6.7
66Zn	0.313	51.6	49	95	4.4	47	92	6.9
75As	0.327	6.87	6.9	100	3.7	6.3	92	4.6
77Se	0.448	3.45	3.4	97	2.7	3.5	102	2.4
88Sr	0.001	10.1	10	102	5.9	9.5	94	3.8
95Mo	0.001	0.29	0.295	102	11	0.314	108	7.6
107Ag	0.001	0.0252	0.026	103	20	0.024	95	19
111Cd	0.106	0.299	0.359	120	18	0.269	90	11
118Sn	0.022	0.061	0.078	128	16	0.049	80	15
121Sb	0.004	0.011	0.013	114	16	0.015	136	14
137Ba	0.001	8.6	7.7	90	3.4	7.8	91	2.6
202Hg	0.023	0.412	0.416	101	7.5	0.427	104	3.2
205Tl	0.001	0.0013	-	-	-	-	-	-
208Pb	0.002	0.404	0.369	91	18	0.425	105	13
238U	0.001	0.05	0.046	92	10	0.045	90	13

Notes:

ppm = parts per million; % = percent; DL = detection limit; RSD = relative standard deviation

Data Quality Objectives:

Accuracy: DQO of 60 - 140% of the certified values for B, Ti, Ag, Sn, Sb, and Ba.

Accuracy: DQO of 90 - 110% of the certified values for Se.

Accuracy: DQO of 70 - 130% of the certified values for all other elements provided.

Precision: DQO of ≤20% for all elements.

DORM-4 used for all parameters except B, Ti, Sb, Ba, and Al where NIST-1566b was used.

Tl certified concentration from NIST-2976.

Accuracy and precision for Tl are not reported as the certified concentration is too close to the reportable detection limit.

Sample Group ID	Client ID	Lab ID	Date of Analysis
01	LC_FRB_INV-1_2022-11_N	047	09 Dec 2022
	LC_FRB_INV-2_2022-11_N	048	
	LC_FRB_INV-3_2022-11_N	049	
	LC_FRB_INV-4_2022-11_N	050	
	LC_FRB_INV-5_2022-11_N	051	
	LC_DC3_INV-1_2022-11_N	052	
	LC_DC3_INV-2_2022-11_N	053	
	LC_DC3_INV-3_2022-11_N	054	
	LC_DC3_INV-4_2022-11_N	055	
	LC_DC3_INV-5_2022-11_N	056	
	LC_DC4_INV-1_2022-11_N	057	
	LC_DC4_INV-2_2022-11_N	058	
	LC_DC4_INV-3_2022-11_N	059	
	LC_DC4_INV-4_2022-11_N	060	
	LC_DC4_INV-5_2022-11_N	061	
	LC_GRCK_INV-1_2022-11_N	062	
02	LC_GRCK_INV-2_2022-11_N	063	09 Dec 2022
	LC_GRCK_INV-3_2022-11_N	064	
	LC_GRCK_INV-4_2022-11_N	065	
	LC_GRCK_INV-5_2022-11_N	066	
	LC_DCEF_INV-1_2022-11_N	067	
	LC_DCEF_INV-2_2022-11_N	068	
	LC_DCEF_INV-3_2022-11_N	069	
	LC_DCEF_INV-4_2022-11_N	070	
	LC_DCEF_INV-5_2022-11_N	071	
	LC_DCDS_INV-1_2022-11_N	072	
	LC_DCDS_INV-2_2022-11_N	073	
	LC_DCDS_INV-3_2022-11_N	074	
	LC_DCDS_INV-4_2022-11_N	075	
	LC_DCDS_INV-5_2022-11_N	076	
	LC_FRUS_INV-1_2022-11_N	077	
	LC_FRUS_INV-2_2022-11_N	078	
	LC_FRUS_INV-3_2022-11_N	079	
	LC_FRUS_INV-4_2022-11_N	080	
	LC_FRUS_INV-5_2022-11_N	081	

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COC ID:	TURNAROUND TIME:	RUSH:

PROJECT/CLIENT INFO

Facility Name / Job#	Line Creek Operation
Project Manager	Nicole Zathey
Email	nicole.zathey@teck.com
Address	421 Pine Ave
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Phone Number	250-425-8449

LABORATORY

Lab Name	TrichAnalytics Inc.
Lab Contact	Jennie Christensen
Email	jennie.christensen@trichanalytics
Address	207-1753 Sean Heights
City	Saanichton
Province	BC
Postal Code	
Phone Number	

OTHER INFO

Report Format / Distribution		Excel	PDF	EDD
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Email 2:	jessica.Ritz@teck.com	X	X	X
Email 3:	teckcoal@equisonline.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	Robin.valleau@minnow.ca	X	X	X
PO number	818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Trich ID	Sample ID	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
047	LC_FRB_INV-1_2022-11_N	LC_FRB	TA	N	29-Nov-22	10:30	INV	Composite	Composite	1	x	x	x
048	LC_FRB_INV-2_2022-11_N	LC_FRB	TA	N	29-Nov-22	10:35	INV	Composite	Composite	1	x	x	x
049	LC_FRB_INV-3_2022-11_N	LC_FRB	TA	N	29-Nov-22	10:40	INV	Composite	Composite	1	x	x	x
050	LC_FRB_INV-4_2022-11_N	LC_FRB	TA	N	29-Nov-22	10:45	INV	Composite	Composite	1	x	x	x
051	LC_FRB_INV-5_2022-11_N	LC_FRB	TA	N	29-Nov-22	10:50	INV	Composite	Composite	1	x	x	x
052	LC_DC3_INV-1_2022-11_N	LC_DC3	TA	N	29-Nov-22	10:00	INV	Composite	Composite	1	x	x	x
053	LC_DC3_INV-2_2022-11_N	LC_DC3	TA	N	29-Nov-22	10:05	INV	Composite	Composite	1	x	x	x
054	LC_DC3_INV-3_2022-11_N	LC_DC3	TA	N	29-Nov-22	10:10	INV	Composite	Composite	1	x	x	x
055	LC_DC3_INV-4_2022-11_N	LC_DC3	TA	N	29-Nov-22	10:15	INV	Composite	Composite	1	x	x	x

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	December 2, 2022	Alex Wade	07Dec2022 / 11:00
			(Project #: 2022-445)	

SERVICE REQUEST (rush - subject to availability)

Regular (default) Priority (2-3 business days) - 50% surcharge	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Emergency (1 Business Day) - 100% surcharge For Emergency <1 Day, ASAP or Weekend	Sampler's Signature		Date/Time	December 1, 2022

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G02 06Dec2022

COC ID:	TURNAROUND TIME:	RUSH:

PROJECT/CLIENT INFO	
Facility Name / Job#	Line Creek Operation
Project Manager	Nicole Zathey
Email	nicole.zathey@teck.com
Address	421 Pine Ave
City	Sparwood
Province	BC
Postal Code	V0B 2G0
Phone Number	250-425-8449

LABORATORY	
Lab Name	TrichAnalytics Inc.
Lab Contact	Jennie Christensen
Email	jennie.christensen@trichanalytics
Address	207-1753 Sean Heights
City	Saanichton
Province	BC
Postal Code	
Phone Number	

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	mike.pope@teck.com	X	X	X
Email 2:	jessica.Ritz@teck.com	X	X	X
Email 3:	teckcoal@equisonline.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	Robin.valleau@minnow.ca	X	X	X
PO number	818999			

SAMPLE DETAILS / ANALYSIS REQUESTED

Filtered - F: Field, L: Lab, FL: Field & Lab, N: None

Trich ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
056	LC_DC3_INV-5_2022-11_N	LC_DC3	TA	N	29-Nov-22	10:20	INV	Composite	Composite	1	x	x	x
057	LC_DC4_INV-1_2022-11_N	LC_DC4	TA	N	29-Nov-22	12:30	INV	Composite	Composite	1	x	x	x
058	LC_DC4_INV-2_2022-11_N	LC_DC4	TA	N	29-Nov-22	12:35	INV	Composite	Composite	1	x	x	x
059	LC_DC4_INV-3_2022-11_N	LC_DC4	TA	N	29-Nov-22	12:40	INV	Composite	Composite	1	x	x	x
060	LC_DC4_INV-4_2022-11_N	LC_DC4	TA	N	29-Nov-22	12:45	INV	Composite	Composite	1	x	x	x
061	LC_DC4_INV-5_2022-11_N	LC_DC4	TA	N	29-Nov-22	12:50	INV	Composite	Composite	1	x	x	x
062	LC_GRCK_INV-1_2022-11_N	LC_GRCK	TA	N	30-Nov-22	9:30	INV	Composite	Composite	1	x	x	x
063	LC_GRCK_INV-2_2022-11_N	LC_GRCK	TA	N	1-Dec-22	9:35	INV	Composite	Composite	1	x	x	x
064	LC_GRCK_INV-3_2022-11_N	LC_GRCK	TA	N	2-Dec-22	9:40	INV	Composite	Composite	1	x	x	x

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	December 1, 2022	Alex Wade	07Dec2022 / 11:00
			(Project #: 2022-445)	

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	December 1, 2022
For Emergency <1 Day, ASAP or Weekend				

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GoL 06Dec2022

COC ID:	TURNAROUND TIME:	RUSH:

PROJECT/CLIENT INFO		LABORATORY	
Facility Name / Job#	Line Creek Operation	Lab Name	TrichAnalytics Inc.
Project Manager	Nicole Zathey	Lab Contact	Jennie Christensen
Email	nicole.zathey@teck.com	Email	jennie.christensen@trichanalytics
Address	421 Pine Ave	Address	207-1753 Sean Heights
City	Sparwood, Province BC	City	Saanichton, Province BC
Postal Code	V0B 2G0	Postal Code	
Phone Number	250-425-8449	Phone Number	

OTHER INFO				
Report Format / Distribution		Excel	PDF	EDD
Email 1:	mike.pope@teck.com	X	X	X
Email 2:	jessica.Ritz@teck.com	X	X	X
Email 3:	teckcoal@equisonline.com	X	X	X
Email 4:	AquaSciLab@teck.com	X	X	X
Email 5:	Robin.valleau@minnow.ca	X	X	X
PO number	818999			

SAMPLE DETAILS / **ANALYSIS REQUESTED** (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

ncL ID	Sample ID	Sample Location (sys_loc_code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
365	LC_GRCK_INV-4_2022-11_N	LC_GRCK	TA	N	30-Nov-22	9:45	INV	Composite	Composite	1	x	x	x
366	LC_GRCK_INV-5_2022-11_N	LC_GRCK	TA	N	30-Nov-22	9:50	INV	Composite	Composite	1	x	x	x
367	LC_DCEF_INV-1_2022-11_N	LC_DCEF	TA	N	29-Nov-22	10:30	INV	Composite	Composite	1	x	x	x
368	LC_DCEF_INV-2_2022-11_N	LC_DCEF	TA	N	29-Nov-22	10:35	INV	Composite	Composite	1	x	x	x
369	LC_DCEF_INV-3_2022-11_N	LC_DCEF	TA	N	29-Nov-22	10:40	INV	Composite	Composite	1	x	x	x
370	LC_DCEF_INV-4_2022-11_N	LC_DCEF	TA	N	29-Nov-22	10:45	INV	Composite	Composite	1	x	x	x
371	LC_DCEF_INV-5_2022-11_N	LC_DCEF	TA	N	29-Nov-22	10:50	INV	Composite	Composite	1	x	x	x
372	LC_DCDS_INV-1_2022-11_N	LC_DCDS	TA	N	30-Nov-22	12:00	INV	Composite	Composite	1	x	x	x
373	LC_DCDS_INV-2_2022-11_N	LC_DCDS	TA	N	30-Nov-22	12:05	INV	Composite	Composite	1	x	x	x

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	December 1, 2022	Alex Wade	07 Dec 2022 / 11:00
			(Project #: 2022-445)	

SERVICE REQUEST (rush - subject to availability)				
Regular (default) / Priority (2-3 business days) - 50% surcharge	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Emergency (1 Business Day) - 100% surcharge / For Emergency <1 Day, ASAP or Weekend	Sampler's Signature		Date/Time	December 1, 2022

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COC ID:		TURNAROUND TIME:		RUSH:

PROJECT/CLIENT INFO				LABORATORY				OTHER INFO				
Facility Name / Job#	Line Creek Operation			Lab Name	TrichAnalytics Inc.			Report Format / Distribution		Excel	PDF	EDD
Project Manager	Nicole Zathey			Lab Contact	Jennie Christensen			Email 1:	mike.pope@teck.com	X	X	X
Email	nicole.zathey@teck.com			Email	jennie.christensen@trichanalytics			Email 2:	jessica.Ritz@teck.com	X	X	X
Address	421 Pine Ave			Address	207-1753 Sean Heights			Email 3:	teckcoal@equisonline.com	X	X	X
								Email 4:	AquaSciLab@teck.com	X	X	X
City	Sparwood	Province	BC	City	Saanichton	Province	BC	Email 5:	Robin.valleau@minnow.ca	X	X	X
Postal Code	V0B 2G0			Postal Code								
Phone Number	250-425-8449			Phone Number				PO number	818999			

SAMPLE DETAILS / ANALYSIS REQUESTED (Filtered - F: Field, L: Lab, FL: Field & Lab, N: None)

Trich ID	Sample ID	Sample Location (sys loc code)	Field Matrix	Hazardous Material (Yes/No)	Date	Time (24hr)	Tissue type	Tissue Species	Sample Structure	Number of Containers	Metals in Biota by CRC ICPMS (wet and dry)	Mercury in Biota by CVAAS (wet, dry & routine)	Moisture Content by Gravimetry
374	LC_DCDS_INV-3_2022-11_N	LC_DCDS	TA	N	30-Nov-22	12:10	INV	Composite	Composite	1	x	x	x
375	LC_DCDS_INV-4_2022-11_N	LC_DCDS	TA	N	30-Nov-22	12:15	INV	Composite	Composite	1	x	x	x
376	LC_DCDS_INV-5_2022-11_N	LC_DCDS	TA	N	30-Nov-22	12:20	INV	Composite	Composite	1	x	x	x
377	LC_FRUS_INV-1_2022-11_N	LC_FRUS	TA	N	29-Nov-22	13:30	INV	Composite	Composite	1	x	x	x
378	LC_FRUS_INV-2_2022-11_N	LC_FRUS	TA	N	29-Nov-22	13:35	INV	Composite	Composite	1	x	x	x
379	LC_FRUS_INV-3_2022-11_N	LC_FRUS	TA	N	29-Nov-22	13:40	INV	Composite	Composite	1	x	x	x
380	LC_FRUS_INV-4_2022-11_N	LC_FRUS	TA	N	29-Nov-22	13:45	INV	Composite	Composite	1	x	x	x
381	LC_FRUS_INV-5_2022-11_N	LC_FRUS	TA	N	29-Nov-22	13:50	INV	Composite	Composite	1	x	x	x

ADDITIONAL COMMENTS/SPECIAL INSTRUCTIONS	RELINQUISHED BY/AFFILIATION	DATE/TIME	ACCEPTED BY/AFFILIATION	DATE/TIME
PO 818999	Robin Valleau	December 1, 2022	Alex Wade	07 Dec 2022 / 11:00
			(Project #: 2022-445)	

SERVICE REQUEST (rush - subject to availability)				
Regular (default)	Sampler's Name	Robin Valleau	Mobile #	416-970-7535
Priority (2-3 business days) - 50% surcharge				
Emergency (1 Business Day) - 100% surcharge	Sampler's Signature		Date/Time	December 1, 2022
For Emergency <1 Day, ASAP or Weekend				